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Abstract Excellent source rocks are found within the Upper Jurassic Nesna formation with potential for gas-condensate. The formation is within the oil window. Scattered good shales are also found within the Upper Jurassic Engelvær formation and in the thin coals of the Tomma sand. Leka shales are fair to good, and terrestrial organic matter is mature and gas condensate generating on structure. Some good interbeds source rocks and rich coals are found within the Aldra and Hitra formations, whereas shales are generally poor to fair.

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STATOIL

**GEOCHEMICAL EVALUATION OF
THE 6506/12-5 WELL**

6

September 1986



GEOCHEMICAL EVALUATION OF THE STATOIL
6506/12-5 WELL

EXECUTIVE SUMMARY

Claystones and shales from the Sklinna, Skomvaer and Flatoey groups have, with very few exceptions, a poor potential for gas and associated liquids. They are, furthermore, immature or effectively so, on structure.

The Nesna (3779-3824 metres) silty claystones are within the maturation oil window and have an excellent potential for gas-condensate.

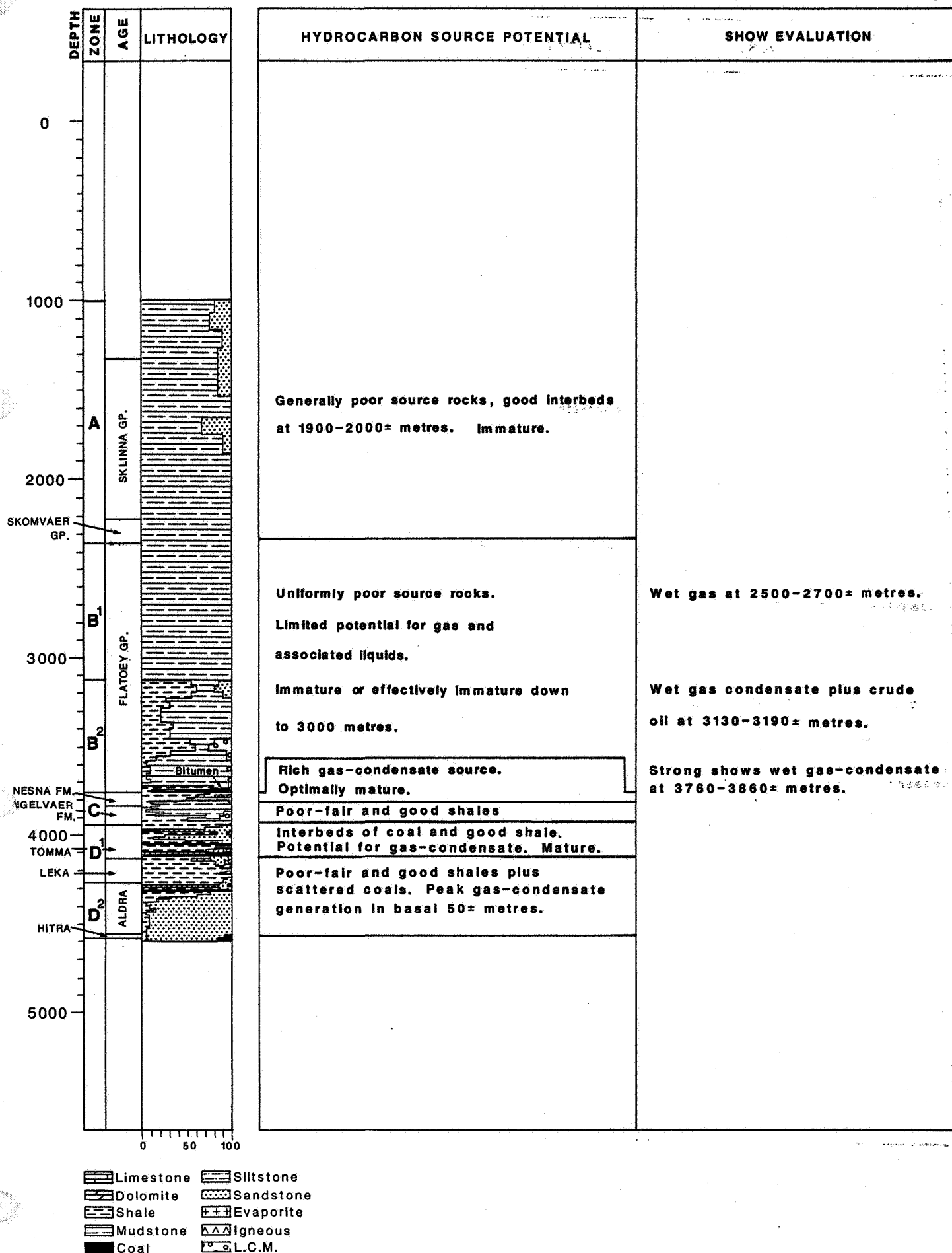
Scattered good shales occur in the Engelvær and, with thin coals, in the Tomma sands, whilst the Leka shales are fair with good interbeds. Throughout this interval the organic matter is composed of land plant debris which is effectively mature (significant gas condensate generation) on structure.

Good shales and thin coals occur intermittently in the Aldra and Hitra formations (below 4275 metres) although this interval lacks effective source-rocks. Optimum maturity for gas-condensate generation commences in the basal 50± metres of this section.

Shows of migrated crude oil resembling the DST # 4 and DST # 2 tests are discussed in more detail in the text of this report.

M.J. SAUER

SUMMARY CHART



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INTRODUCTION

This report presents a geochemical evaluation of the section between 1000 metres and 4587 metres (TD) in the 6506/12-5 well drilled by Statoil in the Norwegian Sea.

The analytical format in this study, specified by E. Mydland-Carlsen, was designed to:

- a) investigate the hydrocarbon potential of the section in terms of richness, maturity and potential for oil or gas.
- b) detect and characterise shows of migrated hydrocarbons.

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

This project was authorised by E Mydland-Carlsen, Statoil, Stavanger.

ANALYTICAL

A total of two hundred and fifty-two (252) canned, twenty two (22) wet bagged ditch cuttings and thirteen (13) core samples were received and assigned Geochem job number 1335.

Geochem were initially requested to select 114 canned ditch cuttings samples for analysis but were subsequently instructed to include bagged samples at 5 metres intervals from the 3770-3824 metre interval to give a total of 114 samples (Telefax 16/5/86).

Geochem were advised of the following depths (RKB)

Formation Tops

Water depth 330

Sklinna GRP 1338m

Skomvaer GRP 2217m

Flatoy GRP 2349m

GRIP GRP Nesna FM 3779m

Engelvaer FM 3824m

Halten grp, Tomma fm 3948m

Leka fm 4138m

Aldra fm 4275m

Hitra fm 4560m

TD 4587m

Sampling interval canned cuttings

1000-2217m every 90m 1217m 14 bx

2217-3150m every 60m 993m 15 bx

3150-3740m every 30m 590m 20 bx

3749-3824m every 5m 75m 50 bx

3824-4587m every 15m 763m 50 bx

114 bx

First coals should appear at 4530m. O/W contacts

Turbodrilling: 3189-3740m. 4011m.

Lignite used last 350m. 3178.5m

CSG shoes : 30" 392m 4070m

: 20" 1055m (4230)?m

: 13 3/8" 2280m

: 9 5/8" 3883m

: 7" 4178m

Traces of grease were observed whilst washing the samples below 3760 metres.

The total number of analyses performed in this study are as follows:

ANALYSIS	NUMBER OF ANALYSES
Headspace and cuttings gas	115
Sample preparation	130
Total organic carbon	146
Pyrolysis	126
Vitrinite reflectance	41
Kerogen type and spore colouration	40
C ₁₅₊ extraction and chromatography	19
Capillary GC - paraffin-naphthenes	19
Capillary GC - aromatics	19
Pyrolysis-GC	31
Carbon isotopes - extract fractions	88
Carbon isotopes - kerogen	18
GC-MS biomarker analysis	18

The data are listed in Tables 1 to 12 and presented graphically in figures 1 to 22. A brief description of analytical techniques employed in this study is included in the back of this report.

GENERAL INFORMATION

Ten (10) copies of this report have been forwarded to E. Myland Carlsen at Statoil, together with kerogen slides. A copy of the data has been retained by Geochem for future consultation with authorised Statoil personnel.

The remaining sample material will be handled as directed.

All of the results of this study are proprietary to Statoil A.S.

CONCLUSIONS

A total of six zones are recognised between 1000 metres and 4587 metres in the 6506/12-5 well.

Zone A (100-2349 metres) covers the SKLINNA and (at 1338-2217 metres) SKOMVAER Groups. Interbeds of sand are present above 1750 metres but light olive-grey claystones and silty claystones predominate. Organic carbon contents improve from 0.39% up to 2.93% (at 1900-1950 metres) but the pyrolysate yields are poor (less than 1.18 mg/g) and only exceed this value in the richest sample (4.37 mg/g). The reason for this poor potential is the type of organic matter, largely woody and inertinitic, in the claystones. Zone A therefore has minor good intervals but overall has a poor potential for gas and associated liquids and, furthermore, is immature.

Zone B¹ (2349-3130± metres) is composed of medium-light claystones from the upper half of the FLATOEY Group. Below average (0.17 - 1.14% organic carbon) contents of inertinite and wood result in less than 1.45 mg/g pyrolysate yields and, therefore, a minimal potential for gas and light liquids. The Zone B¹ claystones are lean immature and have a poor hydrocarbon potential.

Zone B² (3130-3779 metres) corresponds to the lower part of the FLATOEY Group, which is composed of medium dark grey shales and silty mudstones. Although they have marginally better carbon contents (0.71-1.72%) the Zone B¹ sediments these shales and mudstones also have a poor potential (below 1.57 mg/g pyrolysate for gas-condensate). Minor hydrocarbon generation has commenced on structure.

Zone C (3779-3948 metres) is equivalent to the NESNA and, below 3824 metres, ENGELVAER formations. Dark brownish grey (silty) claystones are abundant in the NESNA and have very good contents of amorphous and algal - with lesser amounts of woody and inertinitic - organic matter. Pyrolysate yields of 18.9-28.2 mg/g indicate that these claystones are rich and, from the pyrolysis-GC traces, have a potential for gas-condensate. They are within the oil window. The NESNA claystones, therefore, are a rich and mature gas condensate source - they should make associated reservoirs highly, prospective.

3824-3948

The ENGELVAER (3948-4275 metres) brownish grey claystones and medium dark grey shales have variable contents (0.97 - 2.11%, organic carbon, up to 3.14% at 3946 metres) of a mixed assemblage of inertinitic, woody and herbaceous organic matter. Claystones above 3860 metres and shales in the basal 10 metres generated 2.94 - 4.98mg/g pyrolysate and are good source rocks for gas-condensate. With these exceptions the Engelvaer has a poor hydrocarbon potential.

Zone D' (3948-4275 metres) includes the TOMMA and, below 3948 metres LEKA formations from the HALTEN Group. Dark grey shales are interbedded with sands and thin coals above 3950± metres. The TOMMA shales generally have good (1.16-4.59% organic carbon) contents of terrestrial organic matter; improving in richness (13.5-29.5% organic carbon) and kerogen quality (amorphous woody and herbaceous) at 4068-4072± metres. Scattered coals within this interval have organic carbon contents of 54.8-73.4%, dropping to 12.9-17.6% at 4106-4112 metres. Above 4100± metres the shales are good source rocks, with rich interbeds - for gas and condensate - but the underlying sediments have a fair potential. Oil prone kerogen would be at peak maturity within this zone but these sediments are not oil prone and are effectively, mature (significant hydrocarbon generation). Per unit volume the shales within the Tomma sands are good, mature, source rocks for gas-condensate whilst the thin coals are rich.

Organic carbon contents of 0.86-3.36% suggest that the LEKA shales are generally good source rocks but their organic matter, a mixture of inertinitic, woody and herbaceous debris, is of poor quality, so that, apart from a few good interbeds the shales are poor to fair. They have a potential for gas condensate but are effectively mature and do not quite achieve the necessary maturity for peak hydrocarbon generation. Thus, the LEKA is rated as a fair, with good interbeds, source for gas and associated liquids.

Zone D² (4275-4587 metres, T.D.) covers the Aldra and top 30± metres of the Hitra formations. Interbedded brownish grey shales (silty), sands and minor coals are present in this zone. Organic carbon contents range from 1.62-3.45% (14.7% at 4312.5 metres) in the shales to 59.7-73.1% in the coals but with few exceptions the sediments are poor source rocks. Within this zone the kerogen, consisting largely of woody, inertinitic and herbaceous material achieves optimum maturity for gas-condensate generation. Shales within the ALDRA and HITRA formations are poor to fair, with good interbeds source rocks whereas the coals are rich. The sediments are optimally mature for gas-condensate generation in the basal 50± metres.

Traces of dry gas were detected in Zone A (down to 2349 metres) but the gases in Zone B¹ (2349-3130 metres) are marginally wet to wet and fairly abundant.

Within the FLATOEY Group (Zone B²) a fairly strong 'show' of wet gas and liquid hydrocarbons was detected at 3130-3190 metres (in a sequence of claystones, shales and sands). The heavier hydrocarbons are largely drilling introduced contaminants but significant traces of oil resembling that tested in DST # 4 are also present. A stronger show of this oil with associated wet gas/gasolines, was also detected in the basal 20± metres of the FLATOEY.

The NESNA (3779-3824 metres) claystones are rich in wet gas condensate and also contain shows of the DST # 4 type crude oil. The lighter hydrocarbons are partly due to generation by the host sediments, which are rich and 'oil window' mature, but a significant migration of crude oil from down dip is also occurring.

Fairly strong shows of wet gas-condensate were detected in the ENGELVAER (3824-3948 metres) claystones and shales; plus traces of a more waxy oil, similar to the DST # 2 sample, at 3915-3946± metres.

Zone D¹ (3948-4275 metres) includes the TOMMA and LEKA formations. Shows of moderately wet to wet gas, peaking at 4060-4070± metres and at 4110-4120± metres were detected in this sequence of sands and shales. Some drilling introduced contamination is present but weak shows of the DST # 2 crude oil are indicated at 4068± metres and at 4220-4230± metres.

Good 'shows' of marginally wet to wet gas strongest in the HITRA (coals) were detected in Zone D².

Mass fragmentograms of the steranes and triterpanes correlate the shows at 3150-3190± metres and at 3760-3770± metres with the DST # 4 crude. There is a similar relationship between this oil and the shows in the Nesna. Traces of waxy oil at 3915-3946 metres in the Engelvær and at 4220-4230± metres in the Leka also correlate with the DST # 4 crude but are closer to the DST # 2 oil.

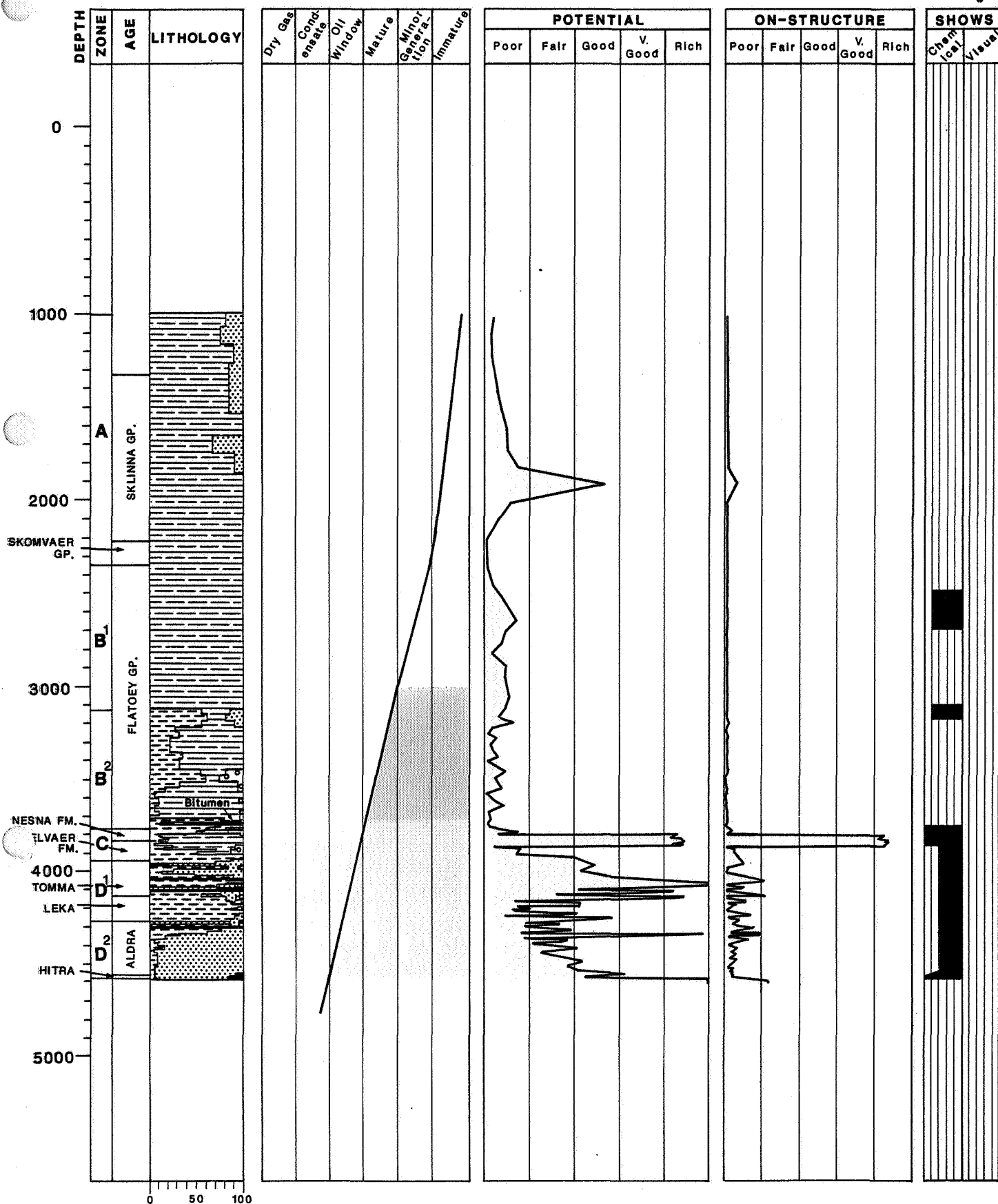
Carbon isotope ratios of the source rock kerogens are, with one exception, heavier (by over 3‰) than the tested crudes and do not therefore constitute a potential source.

RATING DIAGRAM



MATURITY

SOURCE RICHNESS



- Limestone
- Dolomite
- Shale
- Mudstone
- Coal
- Siltstone
- Sandstone
- Evaporite
- Igneous
- L.C.M.

THIS WELL

OIL-PRONE FACIES

- MATURE
- OIL-WINDOW

- GAS
- WET GAS/CONDENSATE
- OIL+GAS
- OIL

ZONATION

This zonation is based upon the formation tops listed in the introduction and variations in the geochemical parameters - a total of six (6) zones are recognised :

Zone A (1000-2349 metres) includes sediments from the SKLINNA (at 1338-2217 metres) and SKOMVAER groups. They are dominantly light olive grey claystones and silty claystones, with sands above 1750± metres.

Zone B¹ (2349-3130± metres) corresponds to the upper part of the FLATOEY GROUP and is composed of light grey claystones.

Zone B² (3130-3779 metres) which is equivalent to the basal FLATOEY GROUP, chiefly consists of medium-dark grey shales with (silty) claystones.

Zone C (3779-3948 metres) covers the NESNA and ENGELVAER (top picked at 3824 metres) formations. Dark brownish grey silty claystones predominate above 3820 metres - the medium-dark grey shales appear to be caved - but below this depth the medium-dark grey shales are believed to be in place; and the richer mudstones caved from the NESNA.

Zone D¹ (3948-4275 metres) comprises the HALTEN GROUP TOMMA (at 3948-4138 metres) and LEKA formations. The former is a sequence of dark grey shales (silty), sands and thin coals whereas the latter chiefly consists of dark brownish grey silty shales; with scattered sandy interbeds. The cuttings samples within the HALTEN Group are generally fine grained and this has hindered their interpretation. The cores from this interval suggest that the problem is not too serious however,

Zone D² (4275-4587 metres T.D.) includes the ALDRA and top 30± metres of the HITRA formations. The sediments are a interbedded brownish grey silty shales, sands (dominant below 4330± metres) and minor coals.

ORGANIC FACIES AND SOURCE RICHNESS

The amount of organic matter within a sediment is measured by its organic carbon content. Average shales contain approximately one percent organic carbon.

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. Pyrolysis-derived hydrogen indices increase with organic matter quality.

Hydrocarbon source richness has been evaluated from the yields of pyrolysate (S2) in association with the total organic carbon (TOC) contents. The following rating scheme has been employed:

	S2 ppm (mg/g)	TOC (%)
POOR SOURCE	below 2000 (2 mg/g)	below 0.5
FAIR SOURCE	2000-3000 (2-3 mg/g)	0.5-1.0
GOOD SOURCE	3000-5000 (3-5 mg/g)	1 - 3
VERY GOOD	5000-10,000 (5-10 mg/g)	3 - 5
RICH SOURCE	over 10,000 (10 mg/g)	over 5

The type of product (oil, gas) has been determined from the gas chromatograms of the pyrolysate (S2) fractions for which the gas-oil indices have also been calculated. Oil-prone sediments have indices of less than 20%, 20-35% indicates a mixed potential for oil and gas, 35-50% for condensate and values in excess of 50% are indicative of dry gas.

The solvent extractable C_{15+} hydrocarbons are commonly enhanced by non-indigenous species (Show Detection Section) and hence are of limited value in evaluating source richness in this well.

The Zone A claystones have organic carbon contents which increase, with depth from 0.39% up to 2.93% (at 1900-1950± metres) but apart from the richest of these, which yielded 4.37 mg/g pyrolysate, they are poor source rocks (less than 1.18 mg/g pyrolysate). This poor hydrocarbon potential is due to the largely woody and inertinitic nature of the organic matter in the sediments. With few exceptions the sediments within the analysed section are lean and, organic contaminants preassembly from the system are common.

Organic carbon values are generally below average (0.17, 0.45-1.14%) above 3130± metres in the Flatoey group claystones. Their organic matter, consisting of inertinite and wood with traces of herbaceous kerogen, has a negligible potential (less than 1.47 mg/g pyrolysate) for gas and associated light liquids. Dark grey shales and lighter coloured mudstones below 1330± metres in the Flatoey Group are somewhat richer at 0.71-1.72% organic carbon although the organic matter is still inertinitic and woody in character and the resulting hydrocarbon potential minimal (less than 1.57 mg/g pyrolysate); for gas and condensate.

Dark brownish grey mudstones from the Nesna contrast strongly with those in the overlying interval in that they have very good (6.85-7.55% organic carbon) contents of organic matter which is largely composed of amorphous and algal material. Wood and inertinite are minor and only traces of herbaceous kerogen were observed. Pyrolysate yields of 18.9-28.2 mg/g confirm that these mudstones have an excellent potential for gas-condensate. Dark grey shales are also present in the samples from this interval but they are believed to be caved from the Flatoey Group.

At the top (above 3860± metres) of the Engelvaer the brownish grey claystones have good (1.91-2.00%) organic carbon contents whereas the underlying dark grey shales improve from 0.97 up to 2.11% reaching 3.14% at 3946 ± metres. The organic matter consists of a mixed assemblage of inertinitic, woody and herbaceous debris. "Amorphous" material at 3880-3890± metres is finely dispersed and resembles an organic contaminant. Claystones above 3860± metres and shales in the basal 10± metres generated 2.94 - 4.98 mg/g pyrolysate and are good source rocks for gas and light liquids. Between these limits the mudstones and shales have a poor to fair (0.29-2.00 mg/g pyrolysate) hydrocarbon potential.

Shales within the Tomma sands commonly have organic carbon contents of 1.16-4.59% but there are significantly richer interbeds of dark grey silty shale (13.5-29.5% organic carbon) at 4068-4072± metres and coals with values of 54.8-73.4%, dropping to 12.9-17.6% at 4106-4112± metres. The richest of the silty shales contains a mixed assemblage of amorphous, woody, herbaceous and inertinitic kerogen but land plant debris is present in the remaining shales and the coals. The dark grey shales, are good source rocks (3.24-4.32 mg/g pyrolysate down to 4100± metres, and then fair, whilst the richer silty shales and coals generated (8.96) 18.97-213.84 mg/g pyrolysate; and are rich source rocks for gas and condensate.

Organic carbon values (0.80-3.36% are generally above average within the Leka Formation shales. Their organic matter, a mixture of inertinitic, woody and herbaceous kerogen commonly results in poor or fair source rocks; but with good intervals at 4150-4170± metres, 4207± metres, and at 4220-4230± metres, these richer shales have a potential for gas and associated light liquids.

Interbeds of shale from the Aldra Formation (4275-4560 metres) also have good (1.62-3.49%) and very good (14.7% at 4312.5 metres) organic carbon contents. Dominantly woody, organic matter is present in the latter but the other shales contain land plant debris. Finely disseminated amorphous organic matter in the silty shales below 4400± metres appears to be degraded. With this exception they organically resemble the overlying shales, but are somewhat richer; yielding 3.05 to 5.28 mg/g pyrolysate as opposed to 1.58-2.83 mg/g. Despite these variations in richness the shales are generating gas and condensate.

The Hitra Formation coals at 4570-4587 metres are rich (59.7-73.1% organic carbon) in woody and inertinitic organic matter and are realising their potential for gas and associated light liquids.

To summarise:

Zone A - generally poor source rocks with minor good interbeds - for gas and condensate.

Zone B¹ - and B² (FLATOEY) - claystones and shales poor overall potential for gas and associated liquids.

Zone C - (NESNA) rich gas condensate source
- (ENGELVAER) some good shales/claystones but generally poor.

Zone D - (TOMMA) scattered very good shales and coals.

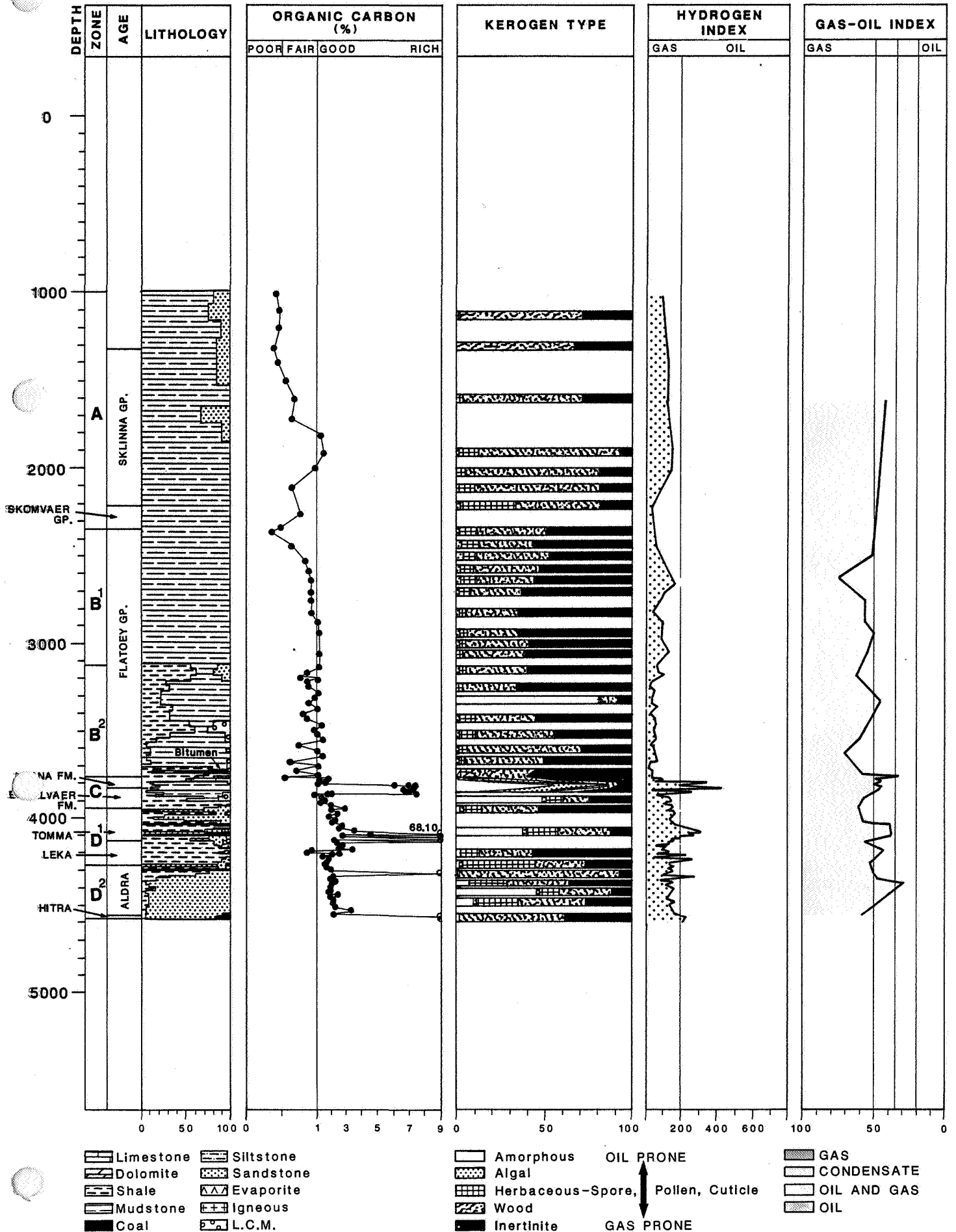
- (LEKA) as Tomma but more shaly.

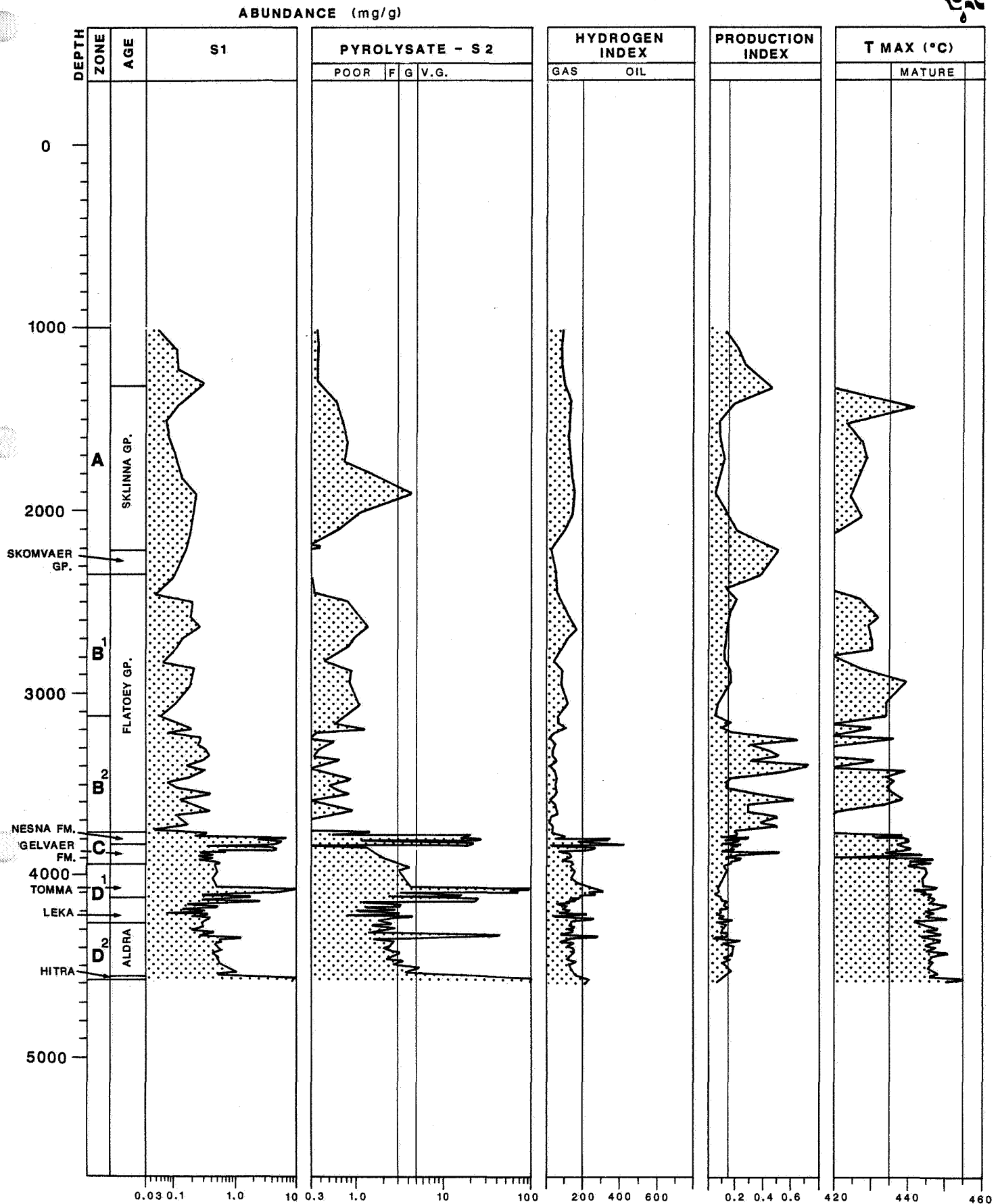
Zone D² - ALDRA good interbed of shale plus coaly shale, potential for gas-condensate.

- HITRA rich coals.

FIGURE 3
WELL 6506/12-5

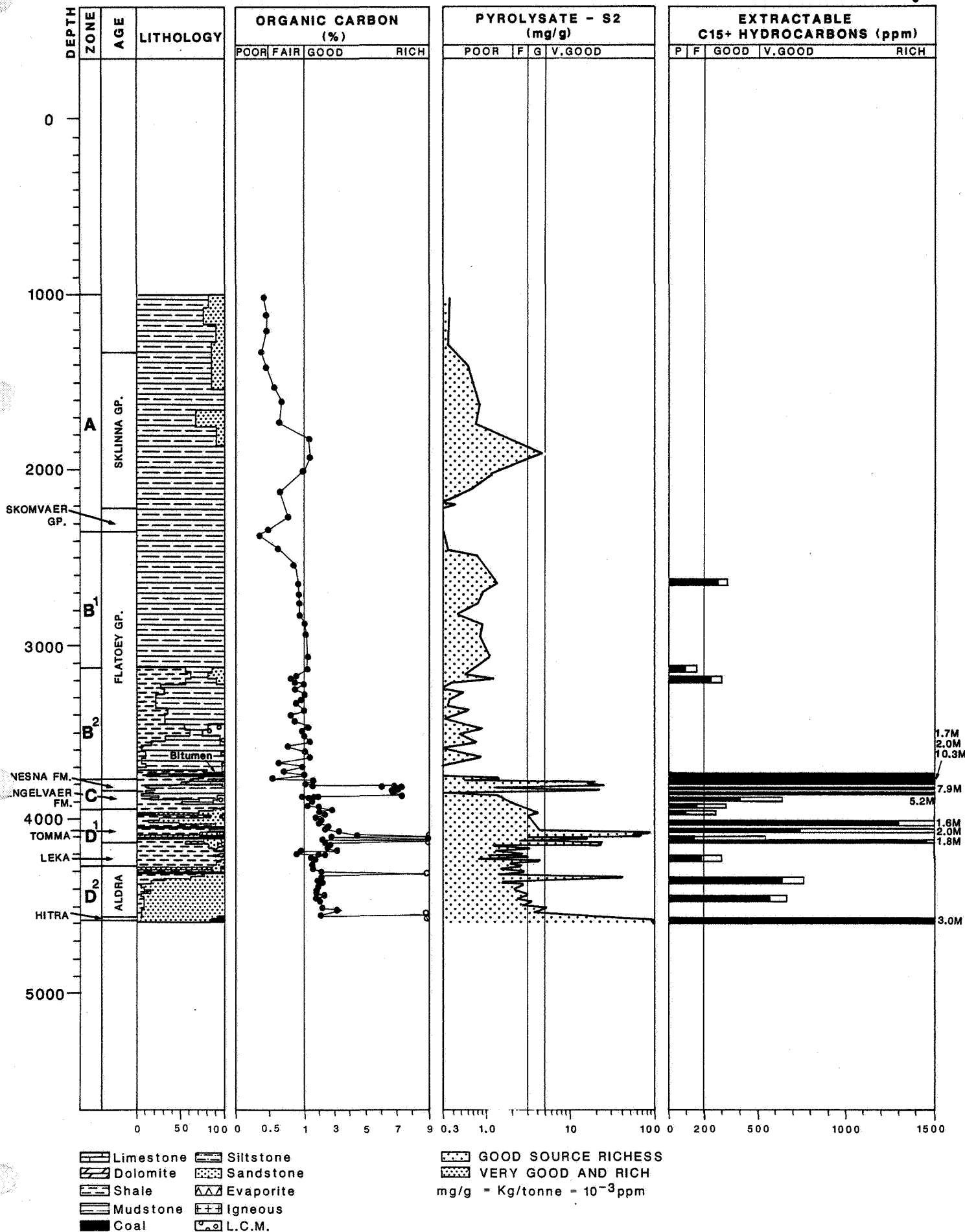
SOURCE FACIES





$$\text{HYDROGEN INDEX} = \frac{S2}{\text{TOC}}$$

$$\text{PRODUCTION INDEX} = \frac{S1}{S1 + S2}$$



THERMAL MATURATION

Thermal maturity has been evaluated with the spore colouration and vitrinite reflectance techniques. Pyrolysis Tmax data are also available but the methyphenanthrene indices cannot be employed as a maturity parameter due to the presence of non-indigenous hydrocarbons in most of the analysed samples.

The correlation between spore colouration and vitrinite reflectance is shown in the following table, in which the maturation interpretations refer to oil-prone organic matter and the spore colouration and vitrinite reflectance values define the top of the relevant maturation zone. Spore colouration is reported both as thermal alteration indices (TAI) and on the equivalent 1-10 scale.

MATURATION STATE	SPORE COLOURATION		VITRINITE REFLECTANCE (% Ro)
	TAI	1-10	
IMMATURE	less than 2-	below 3	less than 0.45
MARGINALLY MATURE	2-	3	0.45
MATURE	2	4	0.55
OIL WINDOW	2 to 2+	5	0.72
GAS CONDENSATE	3	8	1.3
DRY GAS	3+	9	2.0

By definition, thermal hydrocarbon generation does not occur in immature sediments. Minor, non-economic generation is initiated with marginal maturity but significant hydrocarbon generation requires mature sediments. Peak oil generation is achieved within the oil window. The character of the hydrocarbon product changes with increasing maturity from young condensates and oils in marginally mature sediments to conventional crudes in mature sediments. With more advanced maturity, oil generation ceases and is replaced by gas condensate and then by dry gas. Gas-prone organic facies mature more slowly than oil-prone facies and peak gas generation is only initiated in the lower half of the oil window.

The post Nesna sediments are lean, appear to be contaminated and the maturation indices, which are based upon the sparse herbaceous kerogen, commonly exhibit a high degree of uncertainty. Tentatively, they indicate a maturity of 2- at 2350± metres 2 at possibly 3530± metres and a maximum value of 2 to 2+ starting at 3780± metres.

When plotted, vitrinite reflectance data display a clearly defined trend against depth which increases from 0.45% at 2400± metres to 0.55% at 3000± metres, 0.72% at 3750± metres and 0.9% at TD. Multiple vitrinite reflectance populations, due to reworking occur in most of the samples and a limited number of readings, from caved material fall below the preferred trend.

The coals below 4250± metres appear to be oxidised and this may account for low readings obtained from them. It is doubtful if they are based upon drilling introduced lignite although traces of this material may be present.

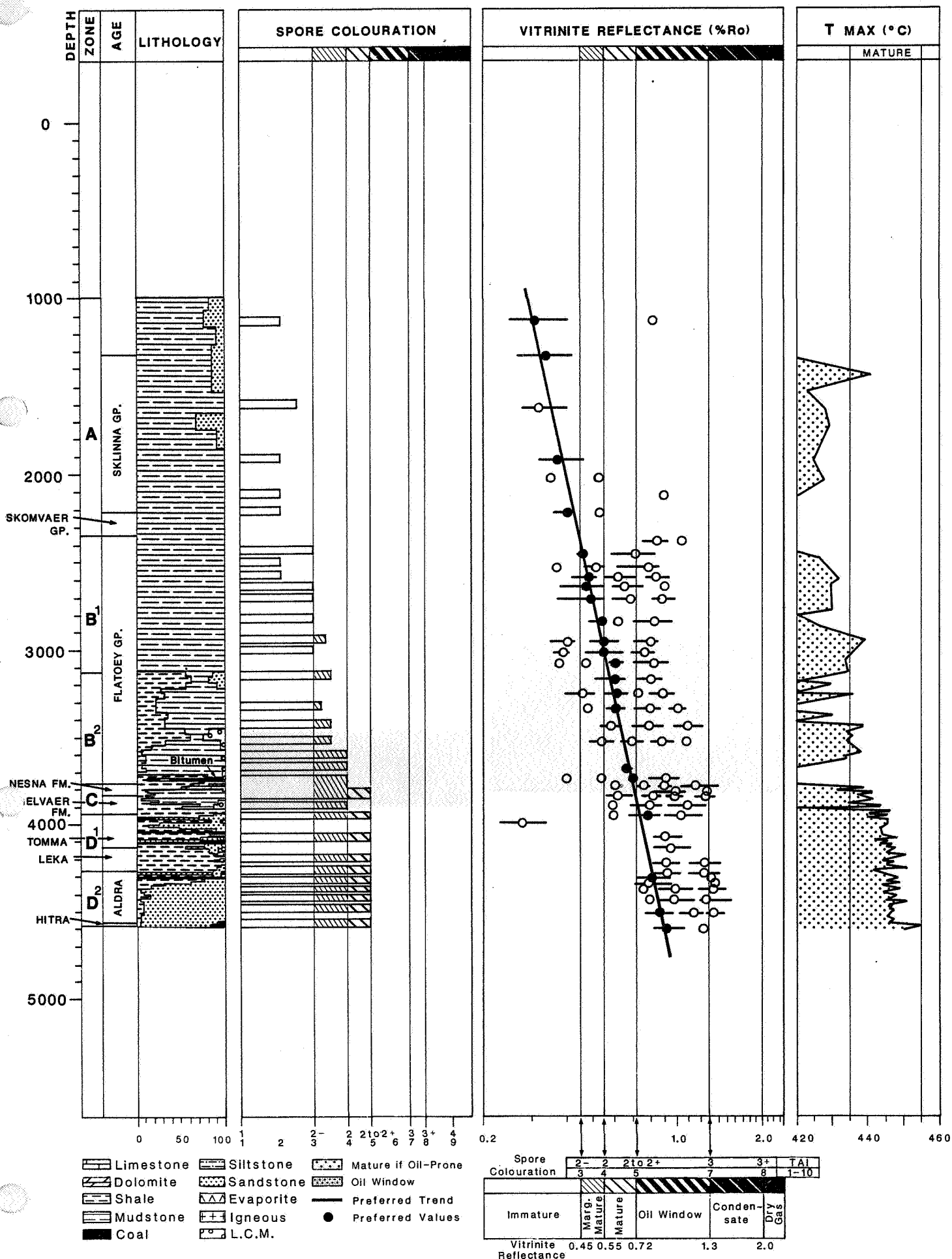
The thermal maturation data may be summarised as follows:

ZONE	SPORE COLOURATION	VITRINITE REFLECTANCE	PREFERRED DEPTH
MARGINALLY MATURE	2350	2400	2400
MATURE	3530	3000	3000
OIL WINDOW	3780	3750	3750

Although the depths at which the onset of marginal maturity and the top of the oil window are similar for both methods the vitrinite reflectance data due to the nature of the organic matter are believed to be more reliable, and will be adopted in this study.

Were the sediments oil prone then the above depths would be valid for the various stages of hydrocarbon generation. The post Nesna sediments are not oil prone and are effectively immature down to 3000± metres and marginally mature below this depth. Better quality organic matter is present in the Nesna claystones and they are within the oil window. With few exceptions organic matter in the underlying sediments chiefly consist of wood and inertinite; which is effectively, mature and only just reaches peak maturity at the base of the analysed section. Interbeds of richer shale, at for example 4070± metres, contain a substantial proportion of amorphous kerogen and are at 'oil window' maturity.

SOURCE ROCK MATURITY



SHOW DETECTION

Shows of migrated wet gas, condensate and crude oil are most effectively detected with the light C_1 - C_7 hydrocarbons. Mature liquid hydrocarbons are characterised by high gas wetnesses and by low isobutane to normal butane ratios. Preliminary assessments of the character of the hydrocarbons in the shows can also be obtained from the light hydrocarbons but must be confirmed with the heavy C_{15+} hydrocarbon analyses, whilst the abundances of both fractions are used to determine the strength of the shows. The pyrolysis S1 parameter also detects shows but is severely affected by drilling-introduced contamination.

The C_1 - C_4 gases in Zone A (down to 2349 metres) diminish from 11207 $\mu\text{l/Kg}$ at 1000 metres to 315 $\mu\text{l/Kg}$ at 2200 $\pm$ metres and, with one anomalous exception (63.5% at 2100 $\pm$ metres), are dry to marginally wet. These data, in conjunction with the sparse (less than 1169 $\mu\text{l/Kg}$) C_5 - C_7 hydrocarbons, suggest that there are no shows of migrated liquid hydrocarbons within this zone.

Gas abundances rise sharply to (4393) 11070-58563 $\mu\text{l/Kg}$ below 2520 $\pm$ metres in Zone B' (2349-3130 $\pm$ metres). Wet gas (55.2-57.1%) is present at 2520-2640 $\pm$ metres but the gasolines are relatively poor at 857-3773 $\mu\text{l/Kg}$ and a weak show is suspected. Apart from a kick at 3120-3130 $\pm$ metres gas in the remaining sediments, although abundant, is dry. The C_{15+} hydrocarbons (165-331ppm) are largely composed of indigenous species (odd carbon paraffin preference); plus contamination at 2640 $\pm$ metres.

At 3130-3190 $\pm$ metres (in Zone B²) the interbedded claystones, shales and sands yielded 10762-14590 $\mu\text{l/Kg}$ wet gas (65.0-65.8% C_2 hydrocarbons) and traces (738-1067 $\mu\text{l/Kg}$) of gasolines. The C_{15+} hydrocarbons (292 ppm) at 3180-3190 $\pm$ metres, amounting to 55.4% of the total extract, are largely out of place. Their paraffin-naphthene chromatogram has a massive baseline hump of unresolved naphthenes; which could be due to water washing and biodegradation of the crude oil in the reservoir. The very close similarity between this chromatogram and those at for example 4020 $\pm$ metres - where the association with lignite based mud additives is clearer - strongly suggests that the 'show' is in fact contamination from the mud system. Traces of the oil tested at 3174-3177 metres were detected in this sample but they are believed to be entrained material from the mud system.

Gas abundance increases to 23395-341062 $\mu\text{l/Kg}$ and wetness to (27.7) 61.4-75.5% in the basal $20\pm$ metres of Zone B². The gasolines peak at more than 20000 $\mu\text{l/Kg}$ within this interval whilst the C₁₅₊ hydrocarbons, 1741-2001 ppm (72.8-77.7% of the total extract) are clearly out of place migrated species. The show in this sequence of shales/claystones and limestones is of a medium gravity crude oil which resembles that occurring in the Nesna (see below).

The Nesna (3779-3824 metres) silty claystones are rich (383815-1209623 $\mu\text{l/Kg}$) in gas of variable wetness. Gases from the canned ditch cuttings are very wet (66.5-77.5%) whereas those from the bagged samples are drier at 29.2-43.1% wetness. Preferential loss of methane from the latter should result in enhanced gas wetness but these gases are relatively dry due, it is speculated, to the biogenic formation of methane during storage. The low (less than 0.43) butane ratios and abundant gasolines however, indicate strong shows of migrated liquid hydrocarbons within this zone. They contain abundant (5255-10316 ppm) C₁₅₊ hydrocarbons which, from the saturates chromatogram are a mixture of indigenous species and of a light-medium gravity crude oil.

Strong shows of wet gas (1534650-27740 $\mu\text{l/Kg}$) and gasolines (133325-3029 $\mu\text{l/Kg}$) were detected in the Engelvær claystones and shales. They have low isobutane to normal butane ratios (less than 0.46), suggesting a mature source, but the C₁₅₊ hydrocarbons are comparatively sparse 261-648 ppm. The shows are therefore, primarily of wet gas-condensate although the saturates chromatograms indicate traces of a waxy oil are also present.

Shows of moderately wet to wet (39.4-76.5% wetness) gas, peaking at 4060-4070 $\pm$ metres and at 4110-4120 $\pm$ metres, were detected in the sequence of sands and shales in the Tomma Formation (3948-4138 metres). The sands at 4020-4030 $\pm$ metres yielded (1575 ppm of what appears to be a biodegraded crude oil residue but the strong odd carbon paraffin preference is incompatible with a source at peak maturity. These hydrocarbons and the substantial naphthene baseline hump are believed to be derived from drilling introduced lignite which, due to the finely divided state of the samples, is impossible to eliminate. Identical traces were obtained at 4340 $\pm$ metres and at 4450 $\pm$ metres. The C₁₅₊ hydrocarbons extracted from the rich silty shale at 4068 $\pm$ metres are largely indigenous (32.4% hydrocarbon to total extract ratio) and the same is true of those from the coaly shale at 4106 $\pm$ metres. Traces of the crude oil tested at 4004.0-4009.5 metres are also suspected in the latter. At 4110-4120 $\pm$ metres, however, more drilling introduced contamination is suspected.

The Leka (4138-4275 metres) shales and sands contain moderate concentrations (32679-99186 $\mu\text{l/Kg}$) of marginally wet to wet (36.9-57.9%) gas and lower contents of the gasolines (2031-5457 $\mu\text{l/Kg}$). The richest sample at 4220-4230 metres yielded 312 ppm C_{15+} hydrocarbons - consisting of indigenous species (slight odd carbon paraffin preference) and traces of crude oil. The oil is moderately waxy and is similar to that found in the Engelvær Formation.

$\text{C}_1\text{-C}_4$ gases although abundant (8240-4009311 $\mu\text{l/Kg}$) in Zone D² (4275-4587 metres) are marginally wet to wet and only traces (less than 10460 $\mu\text{l/Kg}$) of $\text{C}_5\text{-C}_7$ hydrocarbons are present. The heavier C_{15+} hydrocarbons represented by the samples at 4340 $\pm$ metres and at 4450 $\pm$ metres appear to be largely composed of drilling introduced contaminants; whilst those at 4580 $\pm$ metres are undoubtedly associated with the coals in this interval. The basal 10 $\pm$ metres of this section yielded 2997 ppm C_{15+} hydrocarbons but the low hydrocarbon to total extract ratio (27.6%) suggests that they are associated with the coaly facies in this interval.

To summarise:

Zone A - mainly dry gas

Zone B¹ - wet gas-condensate below 2520 $\pm$ metres

Zone B - shows oil above 3190 metres and in basal 20 metres.

Zone C - (NESNA) strong shows wet gas - condensate plus crude oil.

- (ENGELVÆR) shows mainly of wet gas-condensate plus traces of oil.

Zone D¹ - shows wetgas-condensate above 4120 metres and, intermittently of crude oil.

Zone D² -marginally wet gas - associated with coals.

C₁-C₇ HYDROCARBONS

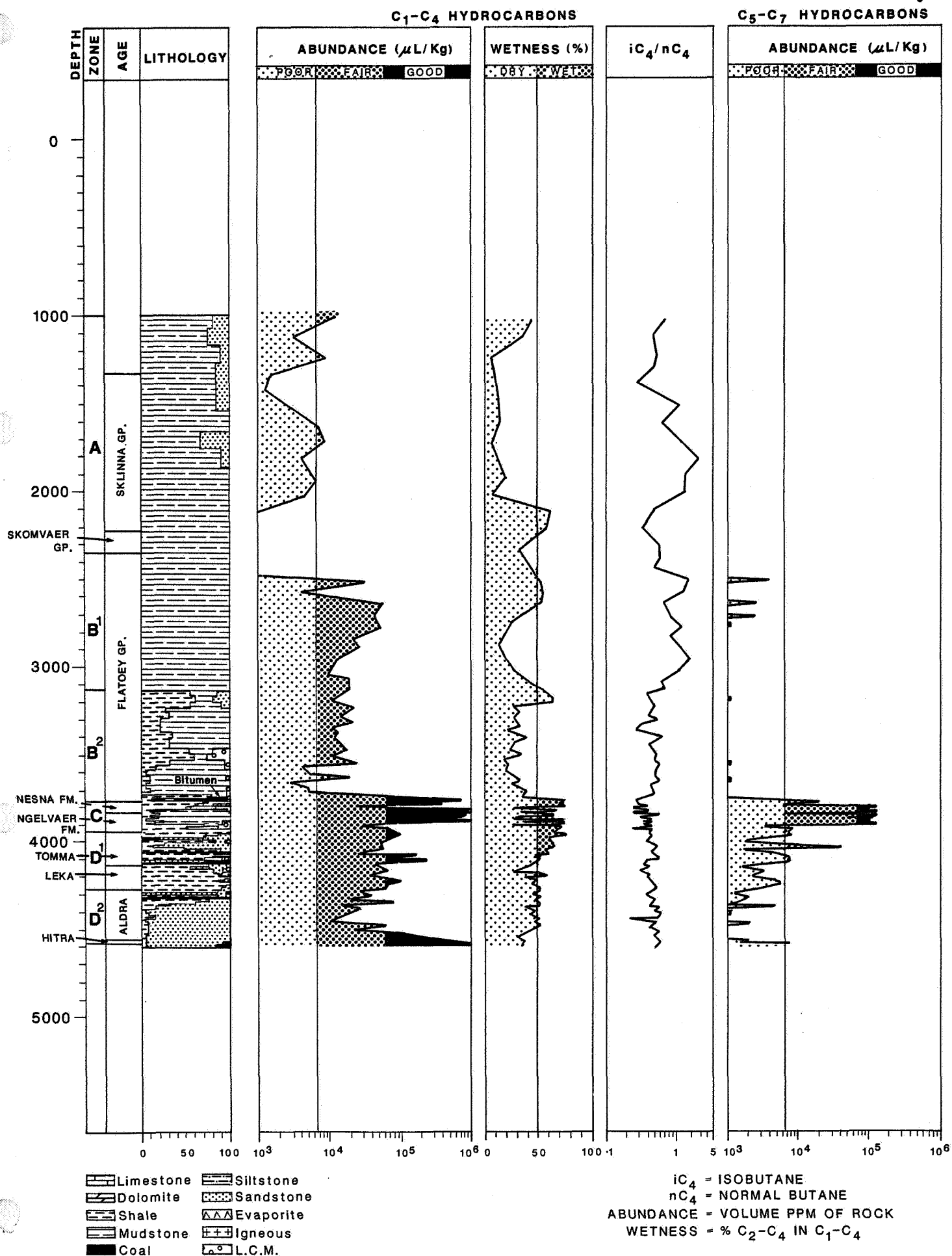
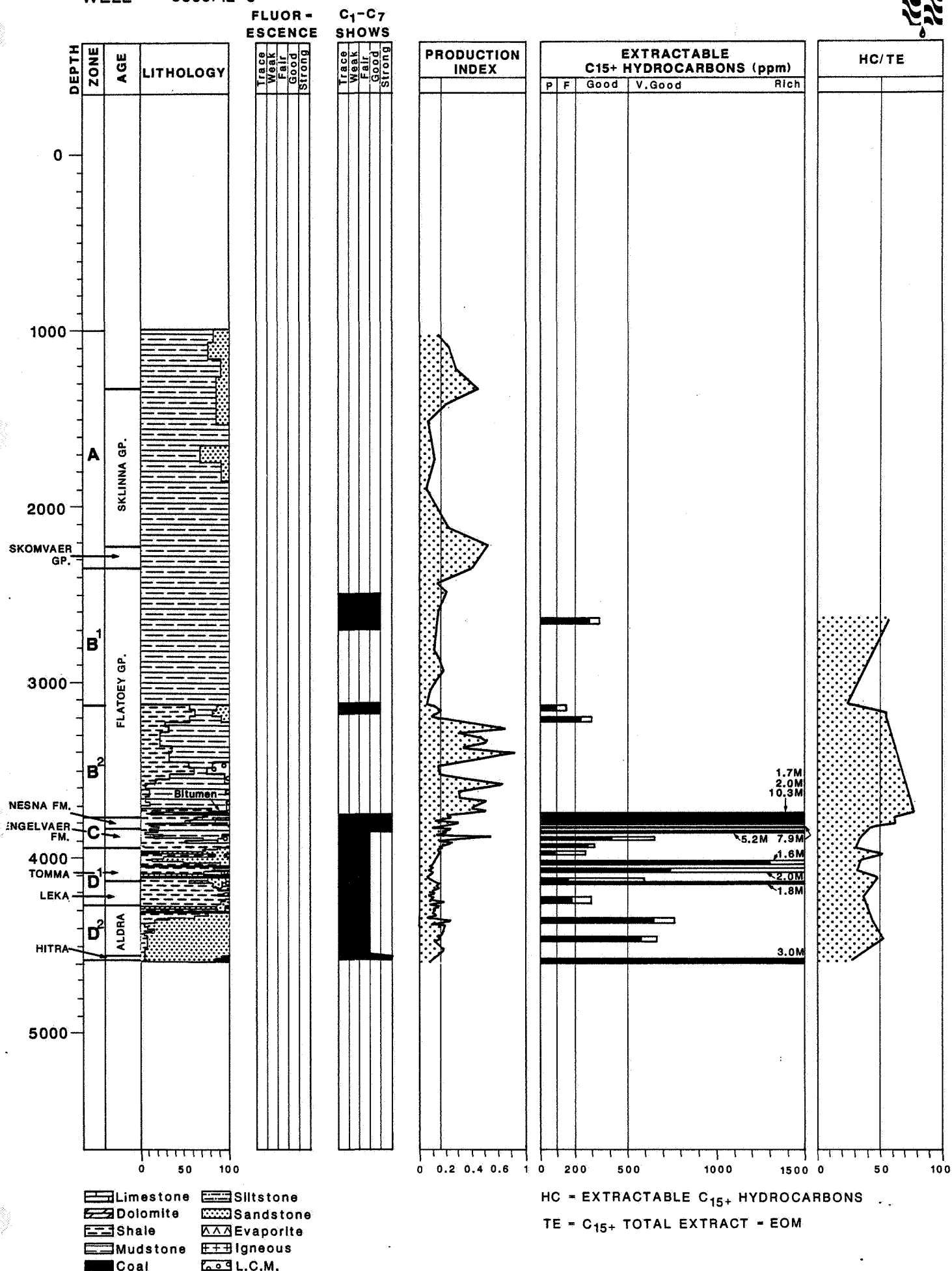


FIGURE 8

WELL 6506/12-5

SHOW DETECTION



SHOW CHARACTERISATION AND CORRELATION

From the preceeding section it is evident that shows of migrated hydrocarbons occur widely within the analysed section, and that they largely mask the indigenous species. The relationships between these shows have been investigated by means of GC-MS and carbon isotope ratio measurements.

The claystones at 3120-3130± metres yielded a full range of steranes (m/z 217) although the greater abundance of C₂₉ components at m/z 218 suggests a greater proportion of land plant debris in the kerogen. C₃₀ hopane dominates the triterpane fragmentogram (m/z = 191) but the C₃₁ hopanes (G, H) and C₂₉ norhopene (C) are all moderately strong peaks. The maturity parameters are not unambiguous but overall they suggest a relatively immature source.

Below 3130± metres the Flatoey Group shales are represented by samples at 3180-3190± metres, 3670±metres and at 3770± metres. Their saturates chromatograms have an 'oily' appearance which the steranes fragmentograms at m/z 217 and 218 identify with the DST # 4 crude oil. These fragmentograms show strong peaks for the C₂₇ and C₂₉ dia-steranes (see also m/z 259) plus a complete range of the remaining C₂₇-C₂₉ components. The steranes (m/z 218) are roughly of equal abundance - suggesting a mixture of marine and terrestrial organic matter in the source. Apart from the top sample where contamination is suspected the triterpane fragmentograms (m/z 191), which display strong C₃₀ hopane, C₂₉ norhopane and C₃₁ hopane peaks, also confirm the shows of DST # 4 type oil at 3180-3190± metres and at 3760-3770± metres.

Further strong shows of crude oil, which closely resemble that present in the basal Flatoey, were detected in the silty claystones of the Nesna Formation (3779-3824± metres). These hydrocarbons, with the possible exception of the sample at 3820-3830± metres, have steranes and triterpanes mass-fragmentograms that closely resemble those in the overlying sediments. It is unlikely that these oil shows are the result of in situ generation (the Nesna is within the oil window) because the host sediments have a potential for gas-condensate. The source of these hydrocarbons must therefore lie off structure; and that presupposes a change in organic facies to a more oil prone kerogen. Again the m/z 191 fragmentograms, with the apparent exception of the trace at 3820± metres (where peak H is enhanced by the co-elution of suspected gammacerane), confirm the identity of these shows of oil.

Weaker shows of a more waxy oil were detected at 3850-3915± metres in the Engelvaer shales. It is doubtful if they were generated by the analysed sediments since they have a potential for gas condensate and not crude oil. A localised movement of hydrocarbons is suspected. It is difficult to distinguish the mass fragmentograms of the Engelvaer extracts from those associated with the DST # 4 oil, the Flatoey and the Nesna shows. Close inspection of the GC-MS data reveals few systematic differences between the two sets of traces although the more waxy nature of the Engelvaer shows suggests that they more closely resemble the DST # 2 crude (tested at 4004.0-4009.6 metres).

Contamination from the mud system is suspected at 4020± metres and at 4110 metres in the Tomma but the hydrocarbons at 4068.09 metres and at 4106.36-4106.41 metres are believed to be indigenous to the coals and shales within this formation. The steranes are very sparse, and their fragmentograms uninformative, although a predominance of C₂₉ steranes at m/z 218 confirms the, largely terrestrial nature of their organic matter. Traces of triterpanes were extracted from the latter two sediments. Their fragmentograms apart from the relative abundances of trisnorneohopane and trisnorhopane are similar to those of the tested crudes. It is, however, doubtful if these coaly facies are the source of the tested oils since the crudes have an inferred source which contains both land plant and marine debris.

Traces of waxy oil at 4220-4230± metres in the Leka Formation have almost identical chromatograms and fragmentograms to the shows in the Engelvaer.

Contamination by mud additives is suspected at 4340-4350± metres and at 4450-4460± metres in the Aldra Formation. Saturates chromatograms and fragmentograms of the triterpanes and steranes all closely resemble those at 4020-4030± metres.

The Hitra coals are generating a paraffinic crude oil but have a primary potential for gas-condensate. Minimal steranes, consisting mainly of the C₂₉ components, were detected whilst the m/z 191 fragmentogram is dominated by (it is suspected) gammacerane. These observations are consistent with the land plant type source organic matter and, like the Tomma coals, do not represent a potential source for the tested crudes.

- 19 -

Carbon isotope ratios of the source rock kerogen are normally heavier (by up to $1^{\circ}/\text{oo}$) than the associated hydrocarbons. The tested crude oils have whole oil isotopic ratios of -29.4 and $-29.5^{\circ}/\text{oo}$ and are, therefore, more than $3^{\circ}/\text{oo}$ lighter (more negative) than the kerogen extracted from the Flatoey Group, Engeltaer Formation and Halten Group sediments. There is no evidence of an oil to source rock correlation on the basis of these data. Isotopically the Nesna Formation claystones are either lighter ($-30.05^{\circ}/\text{oo}$ at 3780-3790 metres) or significantly heavier ($-27.48^{\circ}/\text{oo}$ at 3281-3820 metres and $-27.17^{\circ}/\text{oo}$ at 3820-3830 metres). They too are not, apparently, the source of the tested crudes.

FIGURE 9

WELL 6506/12-5

SHOW CHARACTERISATION

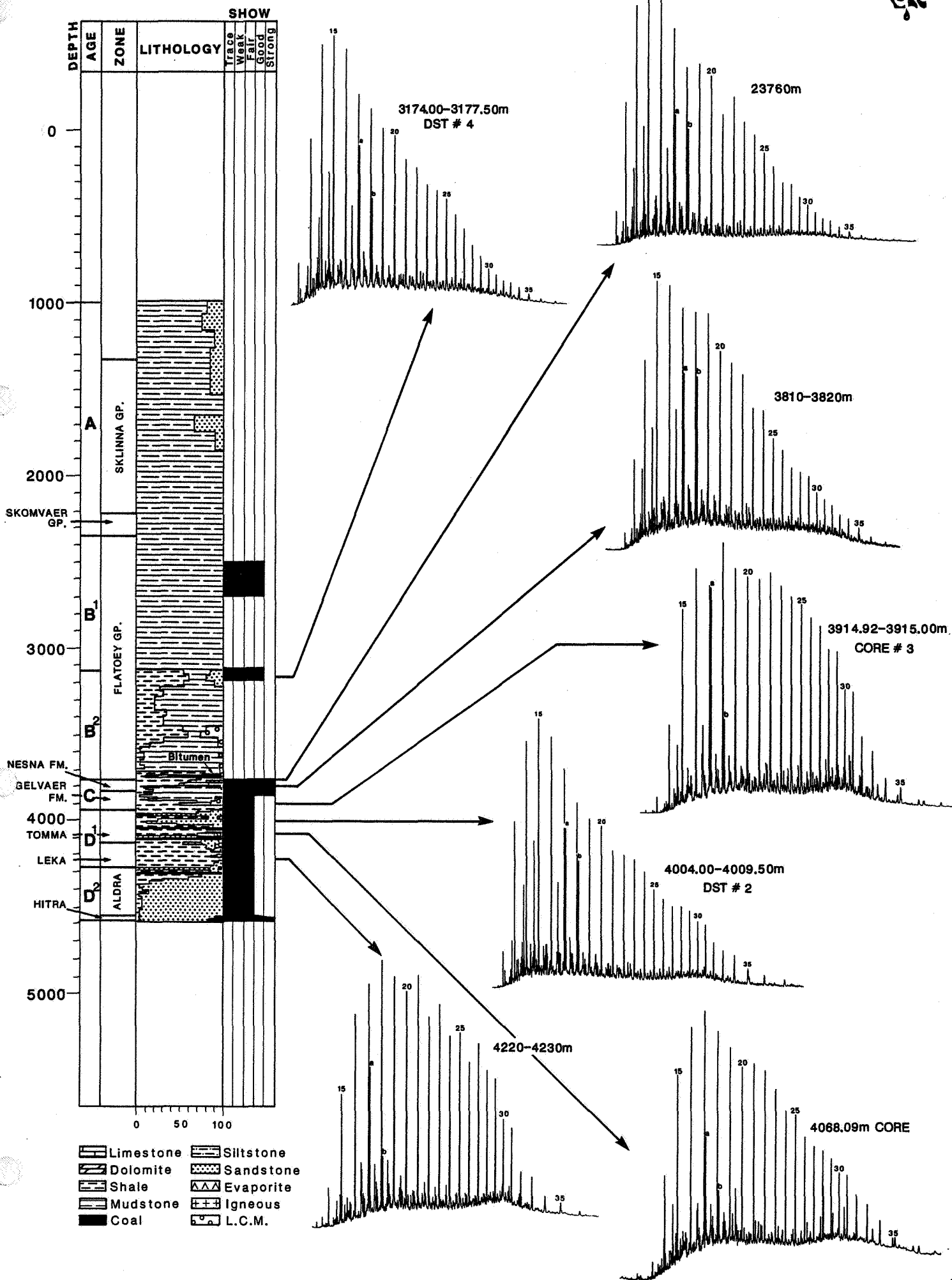


FIGURE 10

WELL 6506/12-5

GALIMOV CARBON ISOTOPE PLOT (‰, PDB)



1	2640	11	3945.91-3946.00 CORE 6
2	3120-30	12	4020-30
3	3180-90	13	4086.09
4	3760	14	4106.36-41
5	3810-20	15	4110-20
6	3780-90	16	4220-30
7	3770	17	4340-50
8	3820-30	18	4450-60
9	3850-60	19	4580-4587.5
10	3914.92-00 CORE 3		

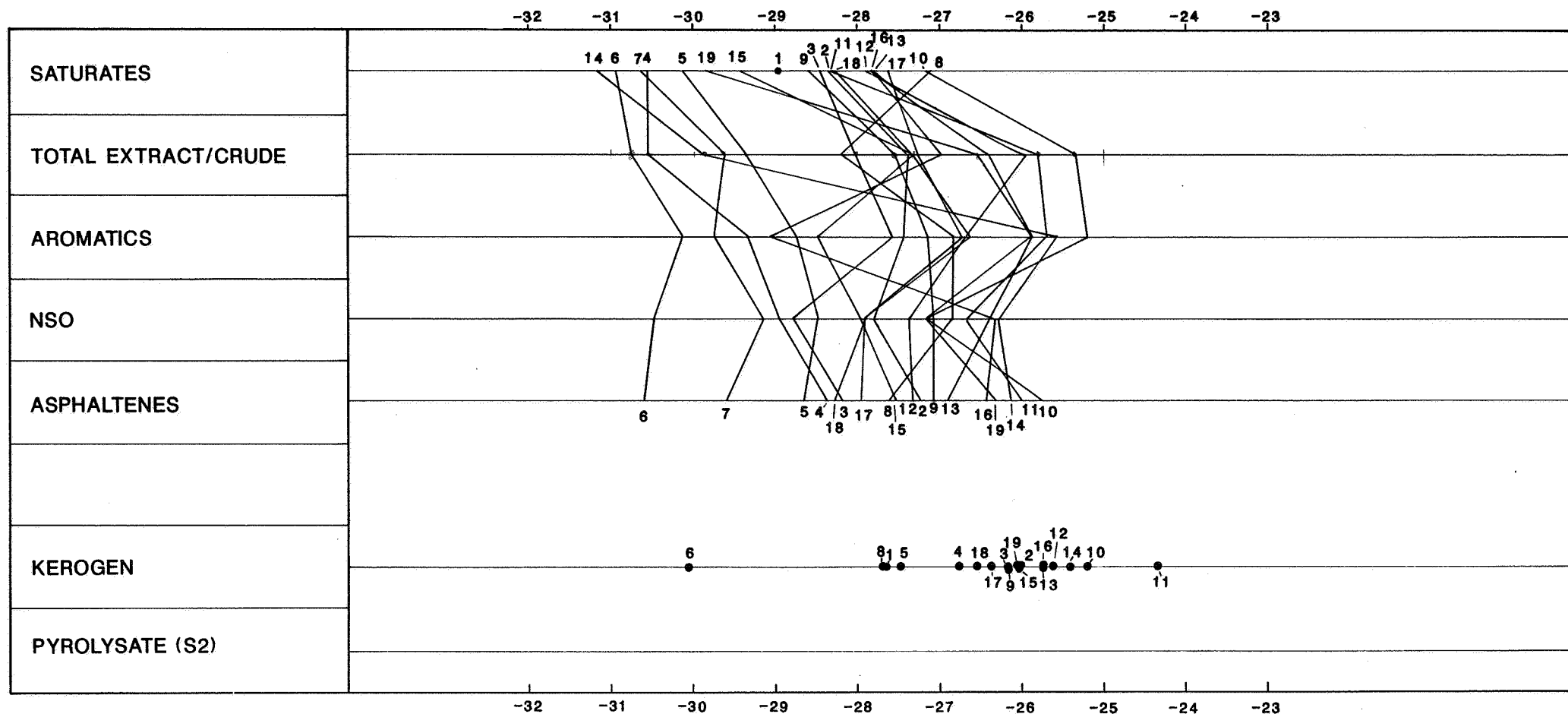


TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1335-013	1000-050m	A 80% Claystone, blocky, soft, sandy, non-calc., medium light grey to greenish grey B 20% Sand, unconsolidated, medium grained, N9 subrounded to subangular, poorly sorted, white	N6- 5G6/1	0.39
1335-015	1090-150m	A 75% Claystone, as 1335-013A, minor cavings B 25% Sand, as 1335-013B Minor shell fragments	N6- 5G6/1 N9	0.43
1335-017	1200-250m	A 90% Claystone, blocky, soft, sandy, non-calc., medium grey to medium greenish grey B 10% Sand, as 1335-013B Minor shell fragments	N5- 5G5/1 N9	0.42, 0.42
1335-019	1300-350m	A 85% Claystone, as 1335-017A B 15% Sand, as 1335-013B	N5- 5G5/1 N9	0.38
1335-021	1400-450m	A 85% Claystone, blocky, soft, silty, sl. calc., medium light grey to light olive grey B 15% Sand, unconsolidated, medium grained, N9 subangular to subrounded, poorly sorted, white	N6- 5Y6/1	0.42
1335-023	1500-550m	A 85% Claystone, as 1335-021A, minor cavings B 15% Sand, as 1335-021B	N6- 5Y6/1 N9	0.57
1335-025	1600-650m	A 98% Silty claystone, blocky, soft, sl. calc., light olive grey Minor sand	5Y6/1	0.70
1335-027	1700-750m	A 65% Silty claystone, as 1335-025A B 35% Sandstone, mostly unconsolidated, fine to medium grained, subangular, poorly sorted, sl. glauconitic, v. light grey to white Minor limestone	5Y6/1 N8-9	0.63
1335-029	1800-850m	A 90% Claystone, blocky, soft, non-calc., minor cavings, light olive grey B 10% Sandstone, as 1335-027B Minor igneous?	5Y6/1 N8-9	1.22, 1.18
1335-031	1900-950m	A 60% Claystone, blocky to subfissile, soft, non-calc., minor cavings, yellowish grey B 40% Claystone, as 1335-029A, minor to sig. cavings	5Y8/1 5Y6/1	1.38 2.93

TABLE 1
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GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1335-033	2000-050m	A 50% Shaly claystone, subfissile, soft to mod. hard, non-calc., minor cavings, medium grey to medium olive grey	N5- 5Y5/1	0.98
		B 35% Claystone, blocky to subfissile, soft, non-calc., minor cavings, yellowish grey	5Y8/1	0.97
		C 15% Claystone, blocky, soft, non-calc., minor cavings, light olive grey	5Y6/1	2.60, 2.62
1335-035	2100-150m	A 50% Shaly claystone, as 1335-033A, minor cavings	N5- 5Y5/1	0.68
		B 30% Shaly claystone, platy to subfissile, soft to mod. hard, non-calc., yellowish grey to light greenish grey	5Y8/1- 5GY8/1	0.40
		C 20% Claystone, blocky, soft, non-calc., light olive grey	5Y6/1	1.37
1335-037	2200-250m	A 60% Claystone, subfissile to platy, soft to mod. hard, non-calc., greyish red	5R4/2	0.17
		B 40% Claystone, subfissile to platy, soft to mod. hard, non-calc., sig. cavings, light olive grey Minor other claystone	5Y6/1	0.77
1335-039	2300m	A 98% Claystone, platy to subfissile, soft to mod. hard, non-calc., minor to sig. cavings, light grey to v. light olive grey Minor other claystone Minor LCM - cement	N7- 5Y7/1	0.46, 0.45
1335-040	2350-400m	A 98% Claystone, as 1335-039A, sig. cavings Minor Pyrites	N7- 5Y7/1	0.35
1335-046	2460m	A 98% Claystone, blocky, soft, non-calc., minor cavings, medium grey Minor caved claystone	N5	0.63
1335-052	2520m	A 98% Claystone, as 1335-046A, minor cavings Minor caved claystone	N5	0.84
1335-058	2580m	A 98% Claystone, as 1335-046A, minor to sig. cavings Minor caved claystone	N5	0.86
1335-064	2640m	A 98% Claystone, as 1335-046A, minor to sig. cavings Minor caved claystone	N5	0.90, 0.89
1335-070	2700m	A 60% Claystone, blocky, soft, non-calc., minor to sig. cavings, medium light grey	N6	0.91
		B 40% Shaly claystone, platy to subfissile, mod. hard, non-calc., sig. cavings, light grey	N7	0.81

TABLE 1
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GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1335-076	2760m	A 70% Claystone, blocky, soft, non-calc., minor to sig. cavings, medium light grey	N6	0.92
		B 30% Shaly claystone, platy to subfissile, mod. hard, non-calc., sig. to abundant cavings, light grey	N7	0.89
1335-082	2820m	A 75% Claystone, blocky, soft, non-calc., minor to sig. cavings, medium grey to medium light grey	N5-6	0.90
		B 25% Shaly claystone, as 1335-076B, abundant cavings Minor other claystone	N7	0.86, 0.82
1335-089	2880-890m	A 90% Claystone, as 1335-082A, minor to sig. cavings	N5-6	1.08
		B 10% Shaly claystone, as 1335-076B, abundant cavings	N7	
1335-095	2940-950m	A 95% Claystone, as 1335-082A, minor cavings	N5-6	1.05
		B 5% Shaly claystone, as 1335-076B, abundant cavings	N7	
1335-101	3000-010m	A 95% Claystone, as 1335-082A, minor cavings	N5-6	
		B 5% Shaly claystone, as 1335-076B, abundant cavings	N7	
1335-107	3060-070m	A 98% Claystone, blocky, soft, non-calc., minor cavings, medium grey to medium light grey Minor other claystone	N5-6	1.14
1335-112	3120-130m	A 98% Claystone, as 1335-107A, minor cavings Minor other claystone	N5-6	1.12, 1.13
1335-115	3150-160m	A 55% Shale, platy, mod. hard, non-calc., abundant cavings, medium dark grey	N4	0.87
		B 30% Claystone, blocky, soft to mod. hard, non-calc., abundant cavings, medium grey	N5	0.78
		C 15% Sand, unconsolidated, fine to medium grained, well sorted, white	N9	
1335-118	3180-190m	A 60% Shale, as 1335-115A, abundant cavings	N4	1.04
		B 20% Claystone, as 1335-115B, abundant cavings	N5	1.09
		C 20% Sand, as 1335-115C	N9	

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)
1335-120	3210-220m	A 55% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	0.86
		B 35% Silty mudstone, blocky, mod. hard, non-calc., medium dark grey	N4	0.97,0.96
		C 10% Claystone, blocky, soft, non-calc., sig. cavings, medium light grey	N6	0.83
1335-123	3240-250m	A 55% Silty mudstone, blocky, mod. hard, non-calc., medium dark grey to medium grey	N4-5	0.88
		B 25% Shale, as 1335-120A, sig. cavings	N4	1.12
		C 20% Claystone, as 1335-120C, sig. cavings	N6	1.02
1335-126	3270-280m	A 70% Silty mudstone, as 1335-123A, minor cavings	N4-5	1.08,1.07
		B 30% Shale, platy to thinly fissile, mod. hard, non-calc., sig. to abundant cavings, medium dark grey to medium grey Minor other mudstone	N4-5	1.00
1335-129	3300-310m	A 65% Silty mudstone, as 1335-123A, minor cavings	N4-5	0.99
		B 20% Shale, as 1335-126B, sig. cavings	N4-5	1.14
		C 15% Claystone, blocky, soft, non-calc., medium grey to medium brownish grey Minor cavings	N5- 5YR5/1	0.94,0.94
1335-132	3330-340m	A 75% Silty mudstone, as 1335-123A, minor cavings	N4-5	0.87
		B 20% Shale, as 1335-126B, sig. cavings	N4-5	0.97
		C 5% Claystone, as 1335-129C, minor cavings	N5- 5YR5/1	0.88
1335-135	3360-370m	A 80% Silty mudstone, blocky, mod. hard, non-calc., minor cavings, medium dark grey	N4	1.05
		B 20% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey Minor other mudstone	N4	0.99
1335-138	3390-400m	A 55% Silty mudstone, as 1335-135A, minor cavings	N4	0.93
		B 35% Shale, as 1335-135B, sig. cavings	N4	0.93
		C 10% Claystone, blocky, soft to mod. hard, non-calc., minor cavings, medium grey Minor other claystone	N5	0.83
1335-140	3420-430m	A 55% Silty mudstone, as 1335-135A, minor cavings	N4	0.85
		B 30% Shale, as 1335-135B, sig. cavings	N4	0.88
		C 15% Claystone, as 1335-138C, minor cavings Minor other claystone	N5	0.91,0.93

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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)
1335-143	3450-460m	A 50% Silty mudstone, blocky, mod. hard, non-calc., minor cavings, medium dark grey	N4	1.49
		B 30% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	0.95
		C 20% Claystone, blocky, soft to mod. hard, non-calc., minor cavings, medium grey Minor other claystone	N5	0.99
1335-146	3480-490m	A 55% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	0.97
		B 25% Claystone, blocky, soft to mod. hard, non-calc., sig. cavings, light grey to v. light olive grey	N7- 5Y7/1	0.89
		C 20% LCM - lignite Minor other claystone		
1335-149	3510-520m	A 60% Shale, as 1335-146A, sig. to abundant cavings	N4	1.04,1.05
		B 25% LCM - lignite		
		C 15% Claystone, as 1335-146B, abundant cavings Minor other claystone	N7- 5Y7/1	1.24
1335-152	3540-550m	A 55% Silty mudstone, blocky, mod. hard, non-calc., minor cavings, medium dark grey	N4	1.52
		B 30% Shale, as 1335-146A, sig. to abundant cavings	N4	1.05
		C 10% Claystone, as 1335-146B, abundant cavings	N7- 5Y7/1	0.96
		D 5% LCM - lignite		
1335-155	3570-580m	A 80% Silty mudstone, as 1335-152A, minor cavings	N4	0.77,0.75
		B 15% Shale, as 1335-146A, sig. cavings	N4	0.94
		C 5% LCM - lignite Minor claystone		
1335-158	3600-610m	A 95% Silty mudstone, as 1335-152A, minor cavings	N4	1.13
		B 5% Shale, as 1335-146A, sig. to abundant cavings Minor claystone Minor LCM - lignite	N4	0.85
1335-161	3630-640m	A 85% Silty mudstone, as 1335-152A, minor cavings	N4	1.42
		B 10% Shale, as 1335-146A, sig. to abundant cavings	N4	0.90
		C 5% LCM - lignite		

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)
1335-164	3660-670m	A 95% Silty mudstone, blocky, mod. hard, non-calc., minor cavings, medium dark grey	N4	0.62,0.58
		B 5% Shale, platy to thinly fissile, mod. hard, non-calc., abundant cavings, medium dark grey Minor red claystone Minor LCM	N4	0.75
1335-167	3690-700m	A 85% Silty mudstone, as 1335-164A, minor cavings	N4	1.19
		B 10% Shale, as 1335-164B, abundant cavings	N4	0.87
		C 5% LCM - lignite		
1335-169	3720-730m	A 95% Silty mudstone, as 1335-164A, minor cavings	N4	0.71
		B 5% LCM - lignite Minor shale and claystone		
1335-171	3740-740m	A 75% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	0.82,0.83
		B 15% Claystone, subfissile, mod. hard, non-calc., minor to sig. cavings, medium light grey	N6	0.92
		C 5% Shale, platy to subfissile, mod. hard, non-calc., minor cavings, greyish red	5R4/2	0.30
		D 5% LCM - lignite		
1335-172	3760m	A 40% Shale, as 1335-171A, sig. cavings	N4	1.25
		B 35% Shale, as 1335-171C, minor to sig. cavings	5R4/2	0.46
		C 20% Bitumen?, soft, greyish black	N2	
		D 5% LCM - lignite		
1335-173	3762.5m	A 60% Bitumen?, as 1335-172C	N2	
		B 25% Claystone, subfissile to blocky, shaly, soft, non-calc., greyish red	5R4/2	0.52
		C 10% Shale, as 1335-171A, sig. cavings	N4	1.14,1.13
		D 5% LCM - lignite		
1335-174	3760-770m	A 60% Shale, as 1335-171A, sig. cavings	N4	1.72
		B 25% Limestone, blocky, soft, v. light grey	N8	0.35
		C 10% Claystone, as 1335-173B	5R4/2	0.29
		D 5% Bitumen, as 1335-172C	N2	
1335-266	3770m	A 65% Shale, as 1335-171A, sig. cavings	N4	1.53
		B 20% LCM - lignite		
		C 15% Limestone, as 1335-174B	N8	0.44
1335-175	3770-780m	A 60% Shale, as 1335-171A, sig. cavings	N4	1.02
		B 40% Limestone, as 1335-174B Minor claystone and bitumen	N8	0.49

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)
1335-268	3775m	A 50% Shale, platy to thinly fissile, mod. hard, non-calc., sig. to abundant cavings, medium dark grey	N4	1.04
		B 50% Limestone, blocky, soft, chalky, v. light grey to white Minor claystone LCM - lignite	N8-9	0.62
1335-270	3780m	A 85% Silty claystone, blocky to subfissile, soft, non-calc., minor cavings, dark brownish grey	5YR3/1	6.83, 6.88
		B 10% Shale, as 1335-268A, sig. cavings	N4	2.99
		C 5% Limestone, as 1335-268B	N8-9	
1335-177	3780-790m	A 90% Silty claystone, as 1335-270A, minor cavings	5YR3/1	7.41
		B 10% Shale, as 1335-268A, sig. cavings Minor limestone, rare lignite	N4	1.08
1335-272	3785m	A 90% Silty claystone, blocky to subfissile, soft, non-calc., minor cavings, dark brownish grey	5YR3/1	6.90, 6.92
		B 10% Shale, platy, mod. hard, non-calc., minor to sig. cavings, dark grey to medium dark grey Minor limestone	N3-4	2.39
1335-274	3790m	A 85% Silty claystone, as 1335-272A, minor cavings	5YR3/1	7.53
		B 15% Shale, as 1335-272B, sig. cavings Minor limestone and other shale	N3-4	2.86
1335-178	3790-800m	A 85% Silty claystone, as 1335-272A, minor cavings	5YR3/1	6.84
		B 15% Shale, as 1335-272B, sig. cavings Minor limestone and other shale	N3-4	2.86
1335-276	3795m	A 80% Silty claystone, blocky to subfissile, soft to mod. hard, non-calc., minor to sig. cavings, dark brownish grey	5YR3/1	7.12, 7.09
		B 20% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey Minor limestone and other shale	N4	1.49
1335-278	3800m	A 90% Silty claystone, as 1335-276A, minor cavings	5YR3/1	6.65
		B 10% Shale, as 1335-276B, sig. cavings Minor other shale	N4	3.46
1335-280	3805m	A 80% Silty claystone, as 1335-276A, sig. cavings.	5YR3/1	7.51, 7.65
		B 20% Shale, as 1335-276B, sig. to abundant cavings Minor other shale LCM lignite	N4	1.69

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)
1335-282	3810m	A 85% Silty claystone, blocky to subfissile, soft to mod. hard, non-calc., minor cavings, dark brownish grey	5YR3/1	7.25
		B 15% Shale, platy to thinly fissile, mod. hard, non-calc., sig. to abundant cavings, medium dark grey Minor other shale	N4	1.66
1335-180	3810-820m	A 95% Silty claystone, as 1335-282A, minor cavings	5YR3/1	7.21
		B 5% Shale, as 1335-282B, sig. to abundant cavings Minor other shale	N4	1.93
1335-284	3815m	A 90% Silty claystone, blocky to subfissile, soft to mod. hard, non-calc., minor cavings, dark brownish grey	5YR3/1	7.05
		B 10% Shale, platy, mod. hard, non-calc., sig. cavings, medium dark grey Minor other shale Minor lignite	N4	2.63, 2.59
1335-286	3820m	A 90% Silty claystone, as 1335-284A, minor cavings	5YR3/1	7.19
		B 10% Shale, as 1335-284B, sig. cavings Minor other shale	N4	1.75
1335-181	3820-830m	A 90% Silty claystone, as 1335-284A, minor cavings	5YR3/1	6.90
		B 10% Shale, as 1335-284B, sig. cavings Minor other shale LCM - lignite	N4	2.76
1335-287	3822.5m	A 95% Silty claystone, as 1335-284A, minor cavings	5YR3/1	7.39, 7.32
		B 5% Shale, as 1335-284B, sig. cavings Minor other shale	N4	2.57, 2.52
1335-183	3840-850m	A 50% Claystone, blocky, soft to mod. hard, non-calc., minor cavings, brownish grey	5YR4/1	2.00
		B 25% Shale, as 1335-284B, sig. cavings	N4	0.96
		C 15% Silty claystone, as 1335-284A, sig. to abundant cavings	5YR3/1	3.20
		D 10% LCM - lignite Minor other shale		
1335-184	3850-860m	A 65% Claystone, as 1335-183A, minor cavings	5YR4/1	1.91
		B 15% Shale, as 1335-284B, sig. cavings	N4	1.00
		C 10% Silty claystone, as 1335-284A, sig. to abundant cavings	5YR3/1	2.41, 2.45
		D 10% LCM - lignite Minor other shale		

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)
1335-186	3870-880m	A 45% Shale, platy to thinly fissile, mod. hard, non-calc., sig. to abundant cavings, medium dark grey	N4	0.97
		B 20% Silty mudstone, blocky, soft to mod. hard, non-calc., minor to sig. cavings, light grey	N7	0.83
		C 15% Shale, platy, mod. hard, non-calc., minor cavings, medium light grey	N6	0.84
		D 10% Shale, platy, mod. hard, non-calc., sig. cavings, greyish red	5R4/2	0.33
		E 10% LCM - lignite Minor limestone and other shale		
1335-187	3880-890m	A 50% Shale, as 1335-186A, sig. cavings	N4	1.25, 1.25
		B 35% Silty claystone, blocky to subfissile, soft to mod. hard, non-calc., minor cavings, brownish grey to medium brownish grey	5YR4/1- 5YR5/1	0.87
		C 15% LCM - lignite Minor other shale		
1335-189	3910-920m	A 95% Silty shale, subfissile, soft to mod. hard, non-calc., sl. micaceous, medium grey to medium dark grey	N5-4	1.19
		B 5% Shale, platy, mod. hard, non-calc., medium dark grey	N4	1.17
1335-190 CORE #3	3914.92m	A 98% Shale, subfissile, mod. hard, non-calc., sl. micaceous, medium dark grey	N4	1.70
1335-191	3920-930m	A 60% Shale, platy, mod. hard, sl. micaceous, non-calc., medium dark grey to dark grey	N4-3	1.46
		B 40% Silty shale, as 1335-189A, minor cavings Minor LCM	N5-4	1.13, 1.15
1335-193	3940-950m	A 65% Silty shale, as 1335-189A, minor cavings	N5-4	1.11
		B 35% Shale, as 1335-191A, minor cavings Minor sand Minor LCM	N4-3	2.11
1335-194 CORE #6	3945.91- 3946.00m	A 98% Shale, subfissile, mod. hard, sl. micaceous, non-calc., medium dark grey	N4	3.14

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)
1335-195	3960-970m	A 45% Silty shale, subfissile, mod. hard, non-calc., sl. micaceous, medium dark grey to medium grey	N4-5	2.01
		B 40% Shale, platy, mod. hard, non-calc., minor cavings, medium dark grey	N4	1.07
		C 15% Sandstone, mostly unconsolidated, fine grained, subangular, well sorted, white to v. light grey	N9-8	
1335-196	3970-980m	A 40% Silty shale, as 1335-195A	N4-5	1.28
		B 30% Sandstone, as 1335-195C	N9-8	
		C 30% Shale, as 1335-195B, minor cavings	N4	2.59
1335-197 CORE #8	3981.55- 3981.66m	A 80% Sandstone, blocky, medium grained, subangular, well sorted, v. light grey	N8	
		B 20% Wood, pyritised?, medium dark grey	N4	22.10
1335-199	3990- 4000m	A 45% Silty shale, subfissile, soft to mod. hard, non-calc., medium grey to medium dark grey	N5-4	1.16
		B 40% Shale, platy, mod. hard, non-calc., minor cavings, medium dark grey	N4	1.99, 1.94
		C 10% Sandstone, as 1335-195C	N9-8	
		D 5% LCM, paint and grease		
1335-200	4000-010m	A 75% Sandstone, as 1335-195C	N9-8	
		B 25% Shale, as 1335-199B, minor cavings Minor other shale	N4	2.58
1335-202	4020-030m	A 85% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, white	N9	
		B 15% Shale, platy, mod. hard, sl. silty, non-calc., minor cavings, medium dark grey Minor other shale	N4	2.13
1335-203	4030-040m	A 60% Sandstone, as 1335-202A	N9	
		B 40% Shale, as 1335-202B, minor cavings	N4	2.93
1335-205	4050-060m	A 90% Shale, subfissile to platy, mod. hard, sl. silty, non-calc., minor cavings, medium dark grey to dark grey	N4-3	2.47, 2.51
		B 10% Sandstone, as 1335-202A Minor other shale	N9	
1335-206	4060-070m	A 90% Shale, as 1335-205A, minor cavings	N4-3	3.77
		B 10% Sandstone, as 1335-202A Minor other shale LCM - paint and grease	N9	

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)
1335-207	4068.09m	A 98% Coal, blocky, brittle, greyish black	N2	68.10
CORES				
1335-207	4068.30m	B 80% Silty shale, subfissile, mod. hard, non-calc., medium dark grey	N4	13.50
		C 20% Coal, blocky, brittle, greyish black	N2	54.80
1335-208	4068.22m	A 98% Silty shale, blocky to subfissile, mod. hard, non-calc., with coal inclusions/laminae, medium dark grey to greyish black	N4-2	26.50
CORE				
1335-209	4071.90- 4071.96m	A 45% Silty sandstone, blocky, fine grained, bioturbated, light grey	N7	
		B 35% Silty shale, blocky, mod. hard, non-calc., coal banding, medium dark grey	N4	29.50, 29.00
		C 20% Coal, blocky, brittle, greyish black	N2	73.40
1335-211	4080-090m	A 70% Silty shale, platy, mod. hard, non-calc., brownish grey to medium dark grey	5YR4/1- N4	4.59
		B 20% Sandstone, mostly unconsolidated, fine grained, subangular, well sorted, v. light grey to white	N8-9	
		C 10% LCM - lignite Rare coal		
1335-212	4090-100m	A 70% Silty shale, as 1335-211A, minor cavings	5YR4/1- N4	2.63
		B 20% Sandstone, as 1335-211B	N8-9	
		C 10% LCM - lignite		
1335-214	4106.36-	A 70% Sandstone, blocky, medium grained, subangular, well sorted, white to v. light grey, with laminae of:-	N9-8	
CORE				
		B 30% Coal, subfissile, dull lustre, dark grey	N3	12.90
1335-215	4112m	A 98% Coal, subfissile to blocky, dull lustre, dark grey to brownish black	N3- 5YR3/1	17.50, 17.60
CORE				
1335-216	4110-120m	A 75% Silty shale, platy, mod. hard, non-calc., medium dark grey to brownish black	N4- 5YR3/1	2.23
		B 20% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, v. light grey	N8	
		C 5% LCM - lignite Rare coal		
1335-217	4120-130m	A 55% Silty shale, as 1335-216A	N4- 5YR3/1	2.24
		B 40% Sandstone, as 1335-216B	N8	
		C 5% LCM - lignite and grease? Rare coal		

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)
1335-219	4140-150m	A 80% Silty shale, platy, mod. hard, non-calc., minor cavings, medium dark grey to brownish black B 10% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, v. light grey C 10% LCM - lignite, paint and grease	N4- 5YR3/1 N8	2.70
1335-220	4150-160m	A 80% Silty shale, as 1335-219A, minor cavings B 20% Sandstone, as 1335-219B Rare coal Minor LCM	N4- 5YR3/1 N8	2.55
1335-221	4160-170m	A 85% Silty shale, as 1335-219A, minor cavings B 15% Sandstone, as 1335-219B Minor LCM	N4- 5YR3/1 N8	3.36
1335-222 CORE	4179.94- 4180.00m	A 98% Shale, subfissile, mod. hard, non-calc., sl. micaceous, occ. coal layers, medium dark grey	N4	0.93, 0.93
1335-223 CORE	4184.72- 4184.84m	A 98% Shale, subfissile, mod. hard, non-calc., sl. micaceous, medium dark grey	N4	0.80
1335-224	4180-90m	A 95% Silty shale, subfissile to platy, mod. hard, non-calc., minor cavings, medium dark grey to brownish grey B 5% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, white	N4- 5YR4/1 N9	2.28
1335-225	4190-200m	A 85% Silty shale, as 1335-224A B 15% Sandstone, as 1335-224B	N4- 5YR4/1 N9	2.35
1335-227 CORE	4207.38- 4207.41m	A 98% Silty shale, subfissile, mod. hard, non-calc., sl. micaceous, medium dark grey	N4	1.50
1335-228	4210-220m	A 95% Silty shale, platy to subfissile, mod. hard, sl. micaceous, non-calc., minor cavings, brownish grey B 5% Sandstone, mostly unconsolidated, fine to medium grained, subangular, well sorted, v. light grey	5YR4/1 N8	1.87, 1.89
1335-229	4220-230m	A 90% Silty shale, as 1335-228A, minor cavings B 10% Sandstone, as 1335-228B	5YR4/1 N8	1.88
1335-231	4240-250m	A 90% Silty shale, as 1335-228A, minor cavings B 10% Sandstone, as 1335-228B	5YR4/1 N8	1.72

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)
1335-232	4250-260m	A 90% Silty shale, platy to subfissile, mod. hard, sl. micaceous, non-calc., minor cavings, brownish grey	5YR4/1	1.62
		B 10% Sandstone, mostly unconsolidated, fine to medium grained, subangular, well sorted, v. light grey	N8	
1335-234	4270-280m	A 95% Silty shale, as 1335-232A, minor cavings	5YR4/1	1.68
		B <5% Sandstone, as 1335-232B	N8	
1335-235 CORE	4277.38m	A 98% Shale, platy to subfissile, mod. hard, non-calc., sl. micaceous, medium dark grey to brownish grey	N4- 5YR4/1	1.62
1335-236	4280-290m	A 85% Silty shale, platy to subfissile, mod. hard, non-calc., minor cavings, brownish grey	5YR4/1	1.74, 1.70
		B 15% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, white Minor LCM - paint and fibre	N9	
1335-237 CORE	4291.70m	A 95% Sandstone, blocky, medium grained, subangular, well sorted, white, within layers of	N9	
		B <5% Coal, blocky, brittle, greyish black	N2	
1335-239	4300-310m	A 85% Silty shale, as 1335-236A, minor cavings	5YR4/1	2.07
		B 15% Sandstone, as 1335-236B Minor LCM - lignite and paint	N9	
1335-240 CORE	4312.15m	A 98% Shaly coal, subfissile to blocky, mod. hard, non-calc., greyish black	N2	14.70
1335-241	4310-320m	A 75% Silty shale, platy, mod. hard, non-calc., minor cavings, brownish grey	5YR4/1	2.05
		B 25% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, v. light grey	N8	
1335-243	4330-340m	A 60% Silty shale, as 1335-241A, minor cavings	5YR4/1	1.91
		B 40% Sandstone, as 1335-241B	N8	
1335-244	4340-350m	A 70% Sandstone, as 1335-241B	N8	
		B 30% Silty shale, as 1335-241A, minor cavings	5YR4/1	2.21, 2.21
1335-246	4360-0370m	A 85% Sandstone, as 1335-241B	N8	
		B 15% Silty shale, as 1335-241A, minor cavings Rare coal	5YR4/1	1.90

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)
1335-247	4370-380m	A 95% Sandstone, mostly unconsolidated, medium grained, subangular, well sorted, v. light grey	N8	
		B 5% Silty shale, platy, mod. hard, non-calc., minor cavings, brownish grey Rare coal	5YR4/1	2.06
1335-249	4290-400m	A 90% Sandstone, mostly unconsolidated, medium grained, subangular, fairly well sorted, white	N9	
		B 10% Silty shale, platy to subfissile, mod. hard, non-calc., minor cavings, medium dark grey to brownish grey	N4- 5YR4/1	1.82
1335-250	4400-410m	A 85% Sandstone, as 1335-249A	N9	
		B 15% Silty shale, as 1335-249B, minor cavings	N4- 5YR4/1	1.84
1335-252	4420-430m	A 95% Sandstone, as 1335-249A	N9	
		B 5% Silty shale, as 1335-249B, minor cavings Minor LCM - lignite	N4- 5YR4/1	1.94
1335-253	4430-440m	A 90% Sandstone, as 1335-249A	N9	
		B 10% Silty shale, as 1335-249B, minor cavings Minor LCM - lignite	N4- 5YR4/1	2.68
1335-255	4450-460m	A 90% Sandstone, as 1335-249A	N9	
		B 10% Silty shale, as 1335-249B, minor cavings Minor LCM - lignite	N4- 5YR4/1	1.81, 1.82
1335-256	4490-500m	A 90% Sandstone, as 1335-249A	N9	
		B 10% Silty shale, as 1335-249B, minor cavings Minor LCM - lignite	N4- 5YR4/1	2.09
1335-258	4510-520m	A 90% Sandstone, mostly unconsolidated, medium grained, subangular, fairly well sorted, v. light grey	N8	
		B 10% Silty shale, platy to subfissile, mod. hard, non-calc., minor cavings, brownish grey LCM - lignite	5YR4/1	2.01
1335-259	4520-530m	A 95% Sandstone, as 1335-258A	N8	
		B 5% Silty shale, as 1335-258B, minor cavings LCM - lignite	5YR4/1	2.27
1335-261	4540-550m	A 95% Sandstone, as 1335-258A	N8	
		B 5% Silty shale, as 1335-258B, minor cavings	5YR4/1	3.44, 3.49

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)
1335-262	4550-560m	A 95% Sandstone, mostly unconsolidated, medium grained, subangular, fairly well sorted, v. light grey	N8	
		B 5% Silty shale, platy to subfissile, mod. hard, non-calc., minor cavings, brownish grey Minor coal	5YR4/1	2.16
1335-264	4570-580m	A 85% Sandstone, as 1335-262A	N8	
		B 10% Coal, subfissile, shaly, mod. hard, greyish black	N2	59.70
		C 5% Silty shale, as 1335-262B	5YR4/1	3.76
1335-265	4580- 4587.5m	A 85% Sandstone, as 1335-262A	N8	
		B 15% Coal, as 1335-264B Minor shale	N2	73.1

TABLE 2A
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN HEAD 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	iC ₄ nC ₄
1335-013	1000-1050	19	0	1	0	0	21	1	6.2	0	0.59
1335-015	1090-1150	17	0	0	0	0	17	0	2.7	0	0.31
1335-017	1200-1250	8172	50	19	1	0	8241	69	0.8	156	4.69
1335-019	1300-1350	1255	5	8	14	13	1294	40	3.1	25	1.09
1335-021	1400-1450	1001	13	25	2	11	1051	50	4.8	40	0.15
1335-023	1500-1550	3070	197	77	35	22	3403	332	9.8	116	1.59
1335-025	1600-1650	5184	122	159	61	56	5583	399	7.1	147	1.09
1335-027	1700-1750	7265	208	292	74	51	7890	625	7.9	111	1.45
1335-029	1800-1850	3421	106	186	158	38	3909	488	12.5	72	4.19
1335-031	1900-1950	4893	253	361	239	54	5799	906	15.6	99	4.41
1335-033	2000-2050	3794	84	127	109	31	4145	351	8.5	52	3.51
1335-035	2100-2150	35	0	0	0	0	36	1	2.0	0	0.45
1335-037	2200-2250	6	0	1	0	1	8	2	24.6	0	0.42
1335-039	2300-2350	17	1	1	0	0	18	2	8.5	0	0.10
1335-040	2350-2400	16	1	1	0	0	18	1	7.9	0	0.33
1335-046	2460	19	1	3	1	2	26	7	26.4	1	0.32
1335-052	2520	94	12	63	26	53	247	153	62.1	14	0.48
1335-058	2580	17	3	8	2	4	35	17	50.4	2	0.51
1335-064	2640	25885	6914	12958	4616	7471	57843	31958	55.2	2462	0.62
1335-070	2700	30286	4492	5162	1615	2324	43879	13593	31.0	2140	0.70
1335-076	2760	45566	6140	3904	1087	934	57632	12066	20.9	681	1.16
1335-082	2820	18551	2023	1353	519	625	23071	4521	19.6	500	0.83
1335-089	2890-2900	24594	2262	836	314	233	28239	3645	12.9	179	1.35
1335-095	2940-2950	11490	1436	806	546	235	14514	3024	20.8	788	2.33
1335-101	3000-3010	8002	1434	860	262	193	10751	2749	25.6	138	1.36
1335-107	3060-3070	12526	4136	2299	593	724	20278	7752	38.2	513	0.82
1335-112	3120-3130	9152	3911	4550	1131	1339	20083	10931	54.4	364	0.84
1335-115	3150-3160	4699	2640	3610	879	1760	13589	8889	65.4	516	0.50
1335-118	3180-3190	2797	1527	2566	604	1353	8847	6051	68.4	673	0.45
1335-120	3210-3220	15984	3195	1994	352	759	22284	6299	28.3	364	0.46

TABLE 2A
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN HEAD 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	$\frac{iC_4}{nC_4}$
1335-123	3240-3250	9698	2058	1910	432	1030	15128	5430	35.9	462	0.42
1335-126	3270-3280	9143	1809	1192	232	544	12920	3777	29.2	169	0.43
1335-129	3300-3310	14618	3056	2074	432	838	21019	6401	30.5	665	0.52
1335-132	3330-3340	5713	1307	1112	306	646	9084	3371	37.1	257	0.47
1335-135	3360-3370	10443	1495	922	209	483	13552	3109	22.9	140	0.43
1335-138	3390-3400	6878	2395	1562	362	610	11806	4928	41.7	227	0.59
1335-140	3420-3430	9107	1875	1495	241	709	13428	4320	32.2	271	0.34
1335-143	3450-3460	10676	2100	1808	207	738	15529	4853	31.3	674	0.28
1335-146	3480-3490	8554	2243	1405	299	431	12932	4378	33.9	667	0.69
1335-149	3510-3520	5984	1030	330	33	78	7455	1472	19.7	72	0.42
1335-152	3540-3565	10365	1812	1307	160	369	14013	3648	26.0	469	0.43
1335-155	3570-3580	1169	294	183	36	50	1732	563	32.5	31	0.73
1335-158	3600-3610	2555	565	389	113	233	3856	1301	33.7	208	0.48
1335-161	3630-3640	3763	2580	1790	444	706	9283	5520	59.5	575	0.63
1335-164	3660-3670	830	333	156	19	48	1387	557	40.1	47	0.40
1335-167	3690-3700	2428	1067	687	16	44	4243	1815	42.8	147	0.37
1335-169	3720-3730	2753	845	302	31	64	3994	1242	31.1	130	0.48
1335-171	3740-3750	12074	9302	6607	621	2049	30653	18579	60.6	413	0.30
1335-172	3760	26930	25128	26311	2745	9812	90926	63996	70.4	2458	0.28
1335-174	3760-3770	18266	10390	28530	7050	27919	92155	73889	80.2	9376	0.25
1335-173	3762.5	62495	57556	84337	12491	46356	263235	200740	76.3	11304	0.27
1335-175	3770-3780	29087	28977	50130	8459	28628	145280	116193	80.0	10246	0.30
1335-177	3780-3790	133762	148298	243997	36018	127548	689622	555861	80.6	49235	0.28
1335-178	3790-3800	69707	64927	141982	27202	97072	400890	331183	82.6	41736	0.28

TABLE 2A
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN HEAD 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	$\frac{iC_4}{nC_4}$
1335-278	3800	0	0	0	0	0	0	0	0.0	0	0.00
1335-180	3810-3820	126861	80961	160013	27290	85786	480911	354050	73.6	37137	0.32
1335-181	3820-3830	51123	32767	60907	10585	32232	187614	136492	72.8	15066	0.33
1335-183	3840-3850	28411	18083	32723	6037	17444	102698	74287	72.3	7565	0.35
1335-184	3850-3860	358484	176880	376128	79755	214904	1206152	847668	70.3	74947	0.37
1335-186	3870-3880	7414	7856	12387	1753	3886	33296	25882	77.7	5234	0.45
1335-187	3880-3890	8070	3546	6986	1801	3944	24347	16277	66.9	2013	0.46
1335-189	3910-3920	3545	1799	4141	955	2386	12826	9281	72.4	1060	0.40
1335-191	3920-3930	4852	4315	8241	1746	4003	23158	18306	79.0	924	0.44
1335-193	3940-3950	6187	6071	7679	1237	2604	23777	17591	74.0	874	0.48
1335-195	3960-3970	7701	9538	10962	1519	3445	33165	25464	76.8	1310	0.44
1335-196	3970-3980	723	861	3541	182	336	5643	4920	87.2	529	0.54
1335-199	3990-4000	11722	10214	10121	1406	3517	36980	25258	68.3	1218	0.40
1335-200	4000-4010	5632	8840	11033	2401	4097	32003	26371	82.4	2169	0.59
1335-202	4020-4030	10917	12139	13186	2251	4132	42625	31708	74.4	36613	0.54
1335-203	4030-4040	6827	4407	2217	300	528	14279	7452	52.2	221	0.57
1335-205	4050-4060	433	631	1060	333	1742	4199	3766	89.7	1373	0.19
1335-206	4060-4070	82496	32762	12088	1626	2567	131538	49043	37.3	996	0.63
1335-211	4080-4090	22308	10454	9116	1897	3742	47516	25209	53.1	2290	0.51
1335-216	4110-4120	84811	34687	26810	3590	10526	160425	75613	47.1	3327	0.34
1335-217	4120-4130	20871	6111	4222	645	1876	33725	12854	38.1	665	0.34
1335-219	4140-4150	236	139	318	33	83	810	574	70.9	86	0.40
1335-220	4150-4160	18908	6868	7031	897	3059	36763	17855	48.6	880	0.29
1335-221	4160-4170	522	443	441	16	37	1459	937	64.2	56	0.44
1335-224	4180-4190	8445	4872	4948	602	1649	20515	12070	58.8	402	0.36

TABLE 2A
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN HEAD 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	$\frac{iC_4}{nC_4}$
1335-225	4190-4200	7911	4108	4386	673	1694	18772	10861	57.9	473	0.40
1335-228	4210-4220	24383	7519	7622	1312	3255	44090	19707	44.7	989	0.40
1335-229	4220-4230	32506	7432	7356	1420	3611	52324	19819	37.9	1167	0.39
1335-231	4240-4250	12731	5267	7830	1788	4051	31667	18936	59.8	1482	0.44
1335-232	4250-4260	11971	4012	4791	1008	2376	24159	12188	50.5	942	0.42
1335-234	4270-4280	8759	4006	6711	1569	3416	24461	15702	64.2	1582	0.46
1335-236	4280-4290	6403	2334	2693	482	1319	13230	6827	51.6	689	0.37
1335-239	4300-4310	5338	2321	2953	637	1397	12645	7307	57.8	621	0.46
1335-241	4310-4320	12173	4317	4034	806	1798	23129	10956	47.4	726	0.45
1335-243	4330-4340	4444	2031	2443	556	1177	10651	6207	58.3	586	0.47
1335-244	4340-4350	19086	6737	12380	2525	6315	47042	27957	59.4	3410	0.40
1335-246	4360-4370	4736	1566	1389	242	628	8562	3826	44.7	311	0.39
1335-247	4370-4380	10989	4964	3353	571	1320	21197	10208	48.2	475	0.43
1335-249	4390-4400	7772	3782	3448	801	1552	17354	9582	55.2	531	0.52
1335-250	4400-4410	104	37	35	7	21	203	99	48.7	14	0.31
1335-252	4420-4430	6135	2798	2869	597	1323	13722	7588	55.3	516	0.45
1335-253	4430-4440	102	35	35	8	30	211	108	51.5	16	0.26
1335-255	4450-4460	27565	10443	9675	2743	4313	54740	27175	49.6	1657	0.64
1335-256	4490-4500	7819	3539	2499	353	834	15045	7225	48.0	276	0.42
1335-258	4510-4520	49989	12984	5348	754	1321	70396	20406	29.0	403	0.57
1335-259	4520-4530	48787	10948	4443	664	1300	66142	17355	26.2	439	0.51
1335-261	4540-4550	81095	11881	4569	728	1419	99692	18597	18.7	454	0.51
1335-262	4550-4560	149215	41299	15608	2047	3313	211481	62266	29.4	1095	0.62
1335-264	4570-4580	284088	89301	27494	2919	4004	407806	123719	30.3	964	0.73
1335-265	4580-4587	2485416	903401	229255	24306	31486	3673863	1188447	32.3	7903	0.77

TABLE 2B
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
1335-013	1000-1050	6542	503	2275	806	1061	11187	4644	41.5	1168	0.76
1335-015	1090-1150	2019	132	427	223	445	3246	1227	37.8	428	0.50
1335-017	1200-1250	444	137	197	107	181	1066	622	58.4	291	0.59
1335-019	1300-1350	267	43	40	14	38	403	136	33.7	107	0.38
1335-021	1400-1450	384	47	29	13	41	514	130	25.2	104	0.31
1335-023	1500-1550	82	16	46	8	18	171	89	51.8	131	0.45
1335-025	1600-1650	612	34	80	160	258	1144	532	46.5	167	0.62
1335-027	1700-1750	260	21	46	7	19	353	93	26.3	239	0.38
1335-029	1800-1850	227	38	80	5	19	368	141	38.4	81	0.28
1335-031	1900-1950	158	59	172	70	136	595	437	73.5	206	0.51
1335-033	2000-2050	572	63	57	21	54	766	195	25.4	157	0.39
1335-035	2100-2150	215	187	178	22	47	649	434	66.8	185	0.48
1335-037	2200-2250	123	32	63	21	68	307	184	60.0	99	0.31
1335-039	2300-2350	491	61	35	45	78	710	219	30.9	357	0.58
1335-040	2350-2400	161	31	20	20	38	271	110	40.5	268	0.54
1335-046	2460	134	45	46	8	18	252	118	46.7	113	0.46
1335-052	2520	15787	3450	7867	5483	3283	35870	20083	56.0	3759	1.67
1335-058	2580	1868	567	1032	517	374	4359	2490	57.1	855	1.38
1335-064	2640	311	69	197	19	67	664	353	53.2	186	0.29
1335-070	2700	1046	401	681	421	346	2896	1850	63.9	452	1.22
1335-076	2760	583	173	50	73	52	931	348	37.4	409	1.38
1335-082	2820	116	48	27	28	29	248	131	53.0	231	0.97
1335-089	2890-2900	218	56	32	41	28	375	156	41.7	170	1.48
1335-095	2940-2950	82	35	45	27	62	251	169	67.5	155	0.44
1335-101	3000-3010	156	26	36	34	68	320	164	51.3	182	0.50
1335-107	3060-3070	456	164	178	129	187	1115	659	59.1	184	0.69
1335-112	3120-3130	88	36	88	69	188	469	380	81.2	176	0.37
1335-115	3150-3160	284	84	205	121	307	1001	717	71.6	222	0.39
1335-118	3180-3190	967	127	501	130	190	1915	948	49.5	394	0.69
1335-120	3210-3220	1774	137	159	50	131	2252	478	21.2	217	0.38

TABLE 2B
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
1335-123	3240-3250	1430	199	166	68	227	2089	659	31.6	225	0.30
1335-126	3270-3280	1004	106	147	60	123	1441	437	30.3	191	0.49
1335-129	3300-3310	1765	294	447	183	433	3122	1357	43.5	294	0.42
1335-132	3330-3340	534	35	44	7	15	636	102	16.0	93	0.51
1335-135	3360-3370	1027	147	111	18	39	1343	315	23.5	136	0.46
1335-138	3390-3400	518	153	134	23	57	886	368	41.5	147	0.41
1335-140	3420-3430	2496	219	158	37	107	3016	520	17.3	173	0.34
1335-143	3450-3460	2197	64	149	13	25	2449	252	10.3	81	0.51
1335-146	3480-3490	240	77	91	19	44	471	231	49.1	93	0.43
1335-149	3510-3520	2306	79	357	112	243	3097	791	25.5	189	0.46
1335-152	3540-3565	5725	417	630	98	170	7039	1314	18.7	715	0.58
1335-155	3570-3580	2242	131	98	18	45	2534	292	11.5	75	0.41
1335-158	3600-3610	1564	97	174	40	62	1936	373	19.2	214	0.64
1335-161	3630-3640	9552	396	442	110	208	10707	1156	10.8	575	0.53
1335-164	3660-3670	1158	99	86	17	29	1389	231	16.6	126	0.56
1335-167	3690-3700	880	92	134	27	46	1180	299	25.4	121	0.60
1335-169	3720-3730	649	68	178	93	173	1162	512	44.1	206	0.54
1335-171	3740-3750	668	187	498	146	336	1835	1167	63.6	293	0.44
1335-172	3760	17171	6881	37114	5119	22763	89048	71877	80.7	6684	0.22
1335-174	3760-3770	13054	317	5776	1102	4993	25243	12188	48.3	3600	0.22
1335-173	3762.5	24202	1828	22510	4912	24375	77828	53625	68.9	9761	0.20
1335-175	3770-3780	43250	5185	18502	3910	13406	84253	41003	48.7	10221	0.29
1335-266	3770	9022	1335	7315	1467	4257	23395	14374	61.4	5984	0.34
1335-268	3775	55543	2838	9444	2383	6565	76772	21229	27.7	10807	0.36
1335-177	3780-3790	230393	27450	108709	29790	123660	520001	289608	55.7	78571	0.24
1335-270	3780	378608	29939	40390	25983	72916	547835	169228	30.9	97915	0.36
1335-272	3785	260859	20872	42821	17106	42157	383815	122956	32.0	56578	0.41
1335-178	3790-3800	313810	47007	172049	42149	168154	743168	429358	57.8	101619	0.25
1335-274	3790	612655	52551	104105	40416	108214	917941	305286	33.3	137299	0.37
1335-276	3795	349471	28045	63763	17055	28289	486623	137152	28.2	52511	0.60

TABLE 2B
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
1335-278	3800	505821	42010	86988	36591	99651	771061	265240	34.4	116836	0.37
1335-280	3805	536217	29630	40648	39338	119355	765188	228971	29.9	129257	0.33
1335-180	3810-3820	9166	1880	9542	2661	8530	31778	22612	71.2	5657	0.31
1335-282	3810	397118	36081	75681	30661	80566	620107	222988	36.0	91748	0.38
1335-284	3815	376234	32974	73739	31610	92573	607130	230896	38.0	96693	0.34
1335-181	3820-3830	92290	43169	169554	34788	109489	449291	357001	79.5	60155	0.32
1335-286	3820	307663	26213	38789	18544	43595	434803	127140	29.2	67278	0.43
1335-287	3822.5	282667	24271	59729	29694	100584	496945	214277	43.1	92781	0.30
1335-183	3840-3850	137127	31166	130613	35614	116494	451015	313887	69.6	79189	0.31
1335-184	3850-3860	116332	23562	86640	26350	75616	328499	212167	64.6	58379	0.35
1335-186	3870-3880	16771	4044	10492	2724	5904	39935	23164	58.0	5650	0.46
1335-187	3880-3890	12737	1821	8635	630	6293	30117	17379	57.7	5628	0.10
1335-189	3910-3920	3728	1237	5037	1449	3464	14914	11187	75.0	1969	0.42
1335-191	3920-3930	13175	3222	11768	3809	8627	40601	27426	67.5	6402	0.44
1335-193	3940-3950	29087	3871	19511	5271	13103	70844	41757	58.9	8451	0.40
1335-195	3960-3970	12510	3824	19088	5031	12254	52707	40197	76.3	6866	0.41
1335-196	3970-3980	26792	3535	17151	4872	10009	62360	35568	57.0	8252	0.49
1335-199	3990-4000	4637	762	2176	434	1259	9269	4632	50.0	737	0.34
1335-200	4000-4010	12125	1214	3751	1023	2397	20512	8386	40.9	2062	0.43
1335-202	4020-4030	9501	610	2617	1343	2201	16272	6771	41.6	1318	0.61
1335-203	4030-4040	8460	2065	5160	1326	2367	19378	10917	56.3	1555	0.56
1335-205	4050-4060	9824	1271	4702	1961	3269	21026	11202	53.3	1698	0.60
1335-206	4060-4070	12299	12228	15034	3780	6320	49661	37362	75.2	3094	0.60
1335-211	4080-4090	9421	1777	4118	1454	2855	19625	10204	52.0	2100	0.51
1335-216	4110-4120	28260	3293	9872	2628	6741	50793	22534	44.4	4650	0.39
1335-217	4120-4130	4686	513	1649	478	1137	8462	3777	44.6	938	0.42
1335-219	4140-4150	51787	1722	7767	2335	4755	68366	16579	24.3	3135	0.49
1335-220	4150-4160	12121	2474	7154	1494	4644	27887	15766	56.5	2147	0.32
1335-221	4160-4170	14077	2356	7740	2065	4981	31220	17143	54.9	2582	0.41
1335-224	4180-4190	11516	1909	8566	1560	3372	26923	15406	57.2	1629	0.46

TABLE 2B
CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
1335-225	4190-4200	30090	2359	5126	1292	2582	41448	11359	27.4	1563	0.50
1335-228	4210-4220	18091	3720	7497	2524	4852	36684	18594	50.7	3599	0.52
1335-229	4220-4230	24647	4773	9075	3354	5013	46862	22215	47.4	4289	0.67
1335-231	4240-4250	22717	2356	6927	2734	3701	38435	15718	40.9	3531	0.74
1335-232	4250-4260	13665	3315	6744	1743	3821	29289	15623	53.3	2479	0.46
1335-234	4270-4280	11310	1209	3540	644	1960	18665	7355	39.4	1309	0.33
1335-236	4280-4290	4491	626	1154	295	675	7242	2750	38.0	453	0.44
1335-239	4300-4310	10586	2739	5280	1288	2644	22538	11951	53.0	1535	0.49
1335-241	4310-4320	7678	1549	3437	875	1163	14701	7023	47.8	956	0.75
1335-243	4330-4340	3453	378	1221	235	425	5713	2260	39.6	367	0.55
1335-244	4340-4350	24245	2877	7972	1428	3581	40103	15859	39.5	2516	0.40
1335-246	4360-4370	4983	461	1005	336	329	7114	2131	30.0	631	1.02
1335-247	4370-4380	3603	326	527	240	309	5004	1401	28.0	206	0.78
1335-249	4390-4400	7048	936	2144	560	556	11244	4196	37.3	440	1.01
1335-250	4400-4410	9518	1330	3394	930	1406	16578	7060	42.6	1095	0.66
1335-252	4420-4430	3227	354	1013	372	323	5290	2063	39.0	252	1.15
1335-253	4430-4440	4257	2096	292	244	1140	8029	3772	47.0	498	0.21
1335-255	4450-4460	5637	5469	2204	598	797	14706	9069	61.7	472	0.75
1335-256	4490-4500	2125	289	590	79	134	3218	1092	33.9	105	0.59
1335-258	4510-4520	2692	3343	2799	487	824	10144	7452	73.5	261	0.59
1335-259	4520-4530	6319	3478	4135	939	1314	16184	9866	61.0	559	0.71
1335-261	4540-4550	9699	8537	4576	662	1106	24581	14882	60.5	400	0.60
1335-262	4550-4560	6270	13225	10647	1235	2434	33810	27541	81.5	805	0.51
1335-264	4570-4580	8573	26623	12452	910	2136	50694	42121	83.1	504	0.43
1335-265	4580-4587	48501	190603	77723	5414	13206	335448	286947	85.5	2557	0.41

TABLE 2C
TOTAL CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS (A + B)

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	$\frac{iC_4}{nC_4}$
1335-013	1000-1050	6561	503	2275	806	1061	11207	4646	41.5	1169	0.76
1335-015	1090-1150	2036	132	427	223	446	3263	1228	37.6	428	0.50
1335-017	1200-1250	8616	186	215	108	181	9307	691	7.4	448	0.60
1335-019	1300-1350	1522	49	48	28	51	1698	176	10.3	132	0.56
1335-021	1400-1450	1386	59	55	14	52	1565	180	11.5	144	0.28
1335-023	1500-1550	3153	214	123	43	40	3574	421	11.8	246	1.08
1335-025	1600-1650	5797	156	239	221	314	6727	931	13.8	314	0.70
1335-027	1700-1750	7526	229	337	81	70	8243	718	8.7	350	1.16
1335-029	1800-1850	3648	144	266	163	57	4277	630	14.7	153	2.89
1335-031	1900-1950	5051	312	532	309	190	6394	1344	21.0	305	1.62
1335-033	2000-2050	4366	147	184	130	85	4912	546	11.1	209	1.53
1335-035	2100-2150	250	187	178	22	47	685	435	63.5	185	0.48
1335-037	2200-2250	129	33	63	21	69	315	186	59.1	100	0.31
1335-039	2300-2350	508	62	35	45	78	729	221	30.3	357	0.58
1335-040	2350-2400	178	32	21	20	38	289	111	38.5	268	0.54
1335-046	2460	154	46	49	9	20	278	125	44.8	114	0.44
1335-052	2520	15880	3462	7930	5508	3337	36117	20237	56.0	3773	1.65
1335-058	2580	1886	570	1040	519	378	4393	2508	57.1	857	1.37
1335-064	2640	26196	6983	13155	4635	7538	58507	32311	55.2	2648	0.61
1335-070	2700	31332	4894	5843	2037	2669	46775	15443	33.0	2592	0.76
1335-076	2760	46149	6313	3954	1160	986	58563	12414	21.2	1090	1.18
1335-082	2820	18667	2071	1379	547	654	23319	4652	19.9	731	0.84
1335-089	2890-2900	24813	2318	867	355	261	28614	3801	13.3	350	1.36
1335-095	2940-2950	11572	1471	852	573	297	14765	3193	21.6	943	1.93
1335-101	3000-3010	8158	1460	896	296	261	11070	2913	26.3	319	1.14
1335-107	3060-3070	12982	4301	2477	722	911	21393	8411	39.3	696	0.79
1335-112	3120-3130	9240	3947	4637	1200	1527	20552	11312	55.0	540	0.79
1335-115	3150-3160	4983	2725	3815	999	2067	14590	9606	65.8	738	0.48
1335-118	3180-3190	3764	1654	3067	735	1543	10762	6998	65.0	1067	0.48
1335-120	3210-3220	17758	3332	2153	403	890	24535	6777	27.6	581	0.45

TABLE 2C
TOTAL CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS (A + B)

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	iC ₄ nC ₄
1335-123	3240-3250	11128	2257	2076	500	1257	17218	6089	35.4	686	0.40
1335-126	3270-3280	10147	1916	1339	292	668	14361	4214	29.3	360	0.44
1335-129	3300-3310	16383	3351	2521	615	1271	24141	7758	32.1	959	0.48
1335-132	3330-3340	6247	1343	1156	313	661	9719	3472	35.7	350	0.47
1335-135	3360-3370	11470	1643	1034	227	522	14895	3424	23.0	277	0.43
1335-138	3390-3400	7396	2548	1696	385	667	12692	5296	41.7	374	0.58
1335-140	3420-3430	11603	2094	1653	277	816	16444	4841	29.4	443	0.34
1335-143	3450-3460	12873	2165	1958	220	763	17978	5105	28.4	755	0.29
1335-146	3480-3490	8794	2320	1496	318	475	13403	4609	34.4	760	0.67
1335-149	3510-3520	8290	1110	687	145	321	10553	2263	21.4	261	0.45
1335-152	3540-3565	16090	2229	1937	258	539	21052	4962	23.6	1184	0.48
1335-155	3570-3580	3411	424	281	55	95	4266	855	20.0	106	0.58
1335-158	3600-3610	4118	662	563	153	296	5792	1673	28.9	421	0.52
1335-161	3630-3640	13314	2975	2232	554	914	19990	6676	33.4	1151	0.61
1335-164	3660-3670	1988	432	242	36	77	2775	787	28.4	173	0.46
1335-167	3690-3700	3309	1159	822	43	90	5423	2114	39.0	268	0.49
1335-169	3720-3730	3402	914	479	124	237	5156	1754	34.0	336	0.52
1335-171	3740-3750	12742	9489	7106	767	2384	32489	19746	60.8	706	0.32
1335-172	3760	44101	32009	63425	7864	32576	179974	135873	75.5	9142	0.24
1335-174	3760-3770	31321	10707	34306	8152	32911	117398	86077	73.3	12975	0.25
1335-173	3762.5	86697	59384	106847	17403	70730	341062	254365	74.6	21065	0.25
1335-175	3770-3780	72337	34162	68632	12369	42034	229533	157196	68.5	20468	0.29
1335-266	3770	9022	1335	7315	1467	4257	23395	14374	61.4	5984	0.34
1335-268	3775	55543	2838	9444	2383	6565	76772	21229	27.7	10807	0.36
1335-177	3780-3790	364154	175748	352705	65808	251208	1209623	845469	69.9	127806	0.26
1335-270	3780	378608	29939	40390	25983	72916	547835	169228	30.9	97915	0.36
1335-272	3785	260859	20872	42821	17106	42157	383815	122956	32.0	56578	0.41
1335-178	3790-3800	383517	111934	314030	69351	265226	1144058	760541	66.5	143355	0.26
1335-274	3790	612655	52551	104105	40416	108214	917941	305286	33.3	137299	0.37
1335-276	3795	349471	28045	63763	17055	28289	486623	137152	28.2	52511	0.60

TABLE 2C
TOTAL CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS (A + B)

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	$\frac{iC_4}{nC_4}$
1335-278	3800	505821	42010	86988	36591	99651	771061	265240	34.4	116836	0.37
1335-280	3805	536217	29630	40648	39338	119355	765188	228971	29.9	129257	0.33
1335-180	3810-3820	136026	82841	169555	29951	94317	512689	376663	73.5	42794	0.32
1335-282	3810	397118	36081	75681	30661	80566	620107	222988	36.0	91748	0.38
1335-284	3815	376234	32974	73739	31610	92573	607130	230896	38.0	96693	0.34
1335-181	3820-3830	143413	75936	230461	45373	141722	636905	493492	77.5	75221	0.32
1335-286	3820	307663	26213	38789	18544	43595	434803	127140	29.2	67278	0.43
1335-287	3822.5	282667	24271	59729	29694	100584	496945	214277	43.1	92781	0.30
1335-183	3840-3850	165539	49249	163336	41651	133938	553713	388174	70.1	86754	0.31
1335-184	3850-3860	474816	200442	462768	106105	290520	1534650	1059835	69.1	133325	0.37
1335-186	3870-3880	24185	11900	22879	4478	9789	73232	49046	67.0	10884	0.46
1335-187	3880-3890	20808	5367	15621	2431	10238	54464	33657	61.8	7642	0.24
1335-189	3910-3920	7272	3036	9178	2404	5850	27740	20468	73.8	3029	0.41
1335-191	3920-3930	18027	7538	20009	5555	12630	63759	45731	71.7	7326	0.44
1335-193	3940-3950	35274	9942	27190	6508	15707	94621	59347	62.7	9325	0.41
1335-195	3960-3970	20212	13361	30050	6551	15699	85873	65661	76.5	8176	0.42
1335-196	3970-3980	27515	4396	20692	5055	10345	68003	40488	59.5	8781	0.49
1335-199	3990-4000	16359	10976	12297	1840	4777	46249	29890	64.6	1955	0.39
1335-200	4000-4010	17757	10055	14784	3424	6495	52514	34757	66.2	4231	0.53
1335-202	4020-4030	20417	12748	15803	3594	6333	58896	38479	65.3	37931	0.57
1335-203	4030-4040	15287	6471	7377	1626	2894	33657	18369	54.6	1776	0.56
1335-205	4050-4060	10256	1902	5762	2294	5011	25225	14968	59.3	3071	0.46
1335-206	4060-4070	94795	44990	27122	5406	8887	181199	86404	47.7	4089	0.61
1335-211	4080-4090	31729	12231	13234	3351	6597	67142	35413	52.7	4390	0.51
1335-216	4110-4120	113071	37980	36682	6219	17267	211218	98147	46.5	7977	0.36
1335-217	4120-4130	25557	6624	5871	1123	3013	42187	16631	39.4	1603	0.37
1335-219	4140-4150	52022	1862	8085	2369	4838	69176	17153	24.8	3221	0.49
1335-220	4150-4160	31029	9342	14185	2391	7703	64650	33621	52.0	3026	0.31
1335-221	4160-4170	14599	2799	8182	2081	5018	32679	18080	55.3	2638	0.41
1335-224	4180-4190	19961	6781	13513	2162	5021	47438	27477	57.9	2031	0.43



TABLE 2C
TOTAL CONCENTRATION (μ L GAS/KG ROCK) OF C₁ - C₇ HYDROCARBONS (A + B)

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	$\frac{iC_4}{nC_4}$
1335-225	4190-4200	38001	6467	9512	1965	4276	60220	22219	36.9	2036	0.46
1335-228	4210-4220	42474	11239	15119	3835	8107	80774	38301	47.4	4588	0.47
1335-229	4220-4230	57153	12205	16431	4774	8624	99186	42033	42.4	5457	0.55
1335-231	4240-4250	35448	7624	14758	4522	7751	70102	34654	49.4	5013	0.58
1335-232	4250-4260	25636	7327	11535	2752	6198	53448	27812	52.0	3421	0.44
1335-234	4270-4280	20069	5216	10251	2213	5376	43125	23057	53.5	2891	0.41
1335-236	4280-4290	10894	2959	3847	777	1994	20472	9578	46.8	1142	0.39
1335-239	4300-4310	15924	5060	8233	1925	4041	35183	19258	54.7	2157	0.48
1335-241	4310-4320	19851	5866	7471	1681	2961	37830	17979	47.5	1682	0.57
1335-243	4330-4340	7897	2409	3664	791	1602	16364	8467	51.7	953	0.49
1335-244	4340-4350	43330	9614	20352	3953	9897	87146	43815	50.3	5927	0.40
1335-246	4360-4370	9719	2027	2394	578	957	15676	5956	38.0	942	0.60
1335-247	4370-4380	14592	5290	3879	811	1628	26201	11609	44.3	680	0.50
1335-249	4390-4400	14820	4718	5591	1360	2108	28598	13778	48.2	970	0.65
1335-250	4400-4410	9623	1366	3429	937	1427	16781	7159	42.7	1110	0.66
1335-252	4420-4430	9362	3153	3882	969	1646	19012	9650	50.8	768	0.59
1335-253	4430-4440	4359	2131	327	252	1170	8240	3881	47.1	514	0.22
1335-255	4450-4460	33203	15913	11880	3341	5110	69447	36244	52.2	2130	0.65
1335-256	4490-4500	9945	3828	3089	432	968	18262	8318	45.5	382	0.45
1335-258	4510-4520	52681	16326	8147	1241	2144	80540	27859	34.6	664	0.58
1335-259	4520-4530	55105	14427	8578	1603	2614	82327	27221	33.1	998	0.61
1335-261	4540-4550	90794	20418	9145	1390	2525	124273	33479	26.9	854	0.55
1335-262	4550-4560	155485	54523	26255	3282	5746	245291	89807	36.6	1899	0.57
1335-264	4570-4580	292661	115924	39946	3829	6139	458500	165839	36.2	1468	0.62
1335-265	4580-4587	2533917	1094003	306978	29721	44692	4009311	1475394	36.8	10460	0.67

TABLE 3

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	Production INDEX	Hydrogen INDEX	Oxygen INDEX	Tmax (°C)
1335-013A	1000-1050	0.06	0.38	0.82	0.14	97.4	210.3	410
1335-015A	1090-1150	0.11	0.38	0.83	0.22	88.4	193.0	400
1335-017A	1200-1250	0.12	0.36	0.91	0.25	85.7	216.7	392
1335-019A	1300-1350	0.30	0.35	1.15	0.46	92.1	302.6	322
1335-021A	1400-1450	0.13	0.59	0.76	0.18	140.5	181.0	441
1335-023A	1500-1550	0.07	0.67	1.10	0.09	117.5	193.0	423
1335-025A	1600-1650	0.08	0.78	1.20	0.09	111.4	171.4	427
1335-027A	1700-1750	0.11	0.72	1.31	0.13	114.3	207.9	428
1335-029A	1800-1850	0.15	1.44	1.72	0.09	120.0	143.3	426
1335-031B	1900-1950	0.24	4.37	2.46	0.05	149.1	84.0	425
1335-033A	2000-2050	0.21	1.18	1.33	0.15	120.4	135.7	427
1335-035A	2100-2150	0.18	0.68	1.31	0.21	100.0	192.6	417
1335-037A	2200-2250	0.16	0.16	0.78	0.50	20.8	101.3	282
1335-040A	2350-2400	0.11	0.19	0.78	0.37	54.3	222.9	294
1335-046A	2460	0.05	0.32	0.92	0.14	50.8	146.0	412
1335-052A	2520	0.20	0.80	0.89	0.20	95.2	106.0	427
1335-058A	2580	0.19	1.02	0.82	0.16	118.6	95.3	432
1335-064A	2640	0.26	1.47	1.27	0.15	165.2	142.7	429
1335-070B	2700	0.14	0.96	1.06	0.13	118.5	130.9	430
1335-076A	2760	0.12	0.88	0.96	0.12	95.7	104.3	430
1335-082A	2820	0.07	0.47	1.34	0.13	52.2	148.9	365
1335-089A	2880-2890	0.20	0.95	1.05	0.17	88.0	97.2	427
1335-095A	2940-2950	0.19	0.91	1.11	0.17	86.7	105.7	439
1335-107A	3060-3070	0.11	1.29	1.04	0.08	113.2	91.2	434
1335-112A	3120-3130	0.06	0.82	1.04	0.07	73.2	92.9	434
1335-115A	3150-3160	0.12	0.64	0.64	0.16	73.6	73.6	373
1335-118A	3180-3190	0.19	1.35	0.72	0.12	129.8	69.2	431
1335-120A	3210-3220	0.09	0.39	0.48	0.19	45.3	55.8	378
1335-123A	3240-3250	0.29	0.16	0.79	0.64	18.2	89.8	437
1335-126A	3270-3280	0.26	0.59	1.16	0.31	55.1	108.4	415
1335-129A	3300-3310	0.31	0.36	1.09	0.46	36.4	110.1	386
1335-132A	3330-3340	0.32	0.32	0.98	0.50	36.8	112.6	278
1335-135B	3360-3370	0.29	0.68	0.68	0.30	64.8	64.8	432
1335-138A	3390-3400	0.17	0.07	0.53	0.71	9.2	69.7	320
1335-140B	3420-3430	0.30	0.54	0.64	0.36	61.4	72.7	398
1335-143A	3450-3460	0.19	0.97	1.41	0.16	65.1	94.6	434
1335-146A	3480-3490	0.08	0.50	0.55	0.14	51.5	56.7	437
1335-149A	3510-3520	0.11	0.65	0.65	0.14	62.5	62.5	435
1335-152A	3540-3550	0.39	0.84	1.42	0.32	55.3	93.4	436
1335-155A	3570-3580	0.13	0.08	0.51	0.62	10.5	67.1	439
1335-158A	3600-3610	0.19	0.50	0.70	0.28	44.2	61.9	433
1335-161A	3630-3640	0.38	0.97	1.02	0.28	68.3	71.8	419
1335-164A	3660-3670	0.12	0.12	0.46	0.50	20.0	76.7	312
1335-167A	3690-3700	0.14	0.22	0.81	0.39	18.5	68.1	282
1335-169A	3720-3730	0.17	0.17	0.55	0.50	23.9	77.5	282
1335-171A	3740-3750	0.05	0.22	0.47	0.19	26.8	57.3	350
1335-172A	3760	0.13	0.52	0.72	0.20	41.6	57.6	419
1335-174A	3760-3770	0.37	1.57	0.50	0.19	91.3	29.1	438
1335-266A	3770	0.26	1.52	2.21	0.15	99.3	144.4	431
1335-268A	3775	0.24	0.53	0.62	0.31	51.0	59.6	436

TABLE 3

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	Production INDEX	Hydrogen INDEX	Oxygen INDEX	Tmax (°C)
1335-270A	3780	7.05	22.82	1.78	0.24	333.1	26.0	438
1335-177	3780-3790	2.36	20.63	1.84	0.10	278.4	24.8	441
1335-272A	3785	6.43	18.88	2.44	0.25	273.2	35.3	439
1335-274A	3790	5.35	26.81	1.99	0.17	356.0	26.4	437
1335-178A	3790-3800	5.06	28.19	1.64	0.15	412.1	24.0	437
1335-276A	3795	3.46	25.43	3.24	0.12	358.2	45.6	439
1335-278A	3800	6.24	16.26	1.06	0.28	244.5	15.9	438
1335-280A	3805	4.56	20.38	4.07	0.18	271.4	54.2	437
1335-180A	3810-3820	4.63	21.36	2.77	0.18	296.3	38.4	437
1335-181A	3820-3830	3.96	20.60	0.91	0.16	298.6	13.2	435
1335-287A	3822.5	4.35	19.35	1.66	0.18	266.9	22.9	433
1335-183A	3840-3850	0.57	4.98	0.65	0.10	249.0	32.5	441
1335-184A	3850-3860	0.68	2.94	1.47	0.19	153.9	77.0	444
1335-186B	3870-3880	0.29	0.29	1.31	0.50	34.9	157.8	417
1335-187A	3880-3890	0.43	1.53	1.38	0.22	122.4	110.4	446
1335-189A	3910-3920	0.27	1.60	0.55	0.14	134.5	46.2	440
1335-190A	3914.92	0.43	1.35	0.54	0.24	79.4	31.8	447
1335-191A	3920-3930	0.48	2.00	0.52	0.19	137.0	35.6	440
1335-193B	3940-3950	0.59	2.98	0.40	0.17	141.2	19.0	445
1335-194A	3945-3946	0.50	4.19	0.34	0.11	133.4	10.8	446
1335-199B	3990-4000	0.56	3.24	0.70	0.15	165.3	35.7	445
1335-200B	4000-4010	0.49	3.60	0.36	0.12	139.5	14.0	443
1335-205A	4050-4060	0.52	4.32	0.40	0.11	173.5	16.1	445
1335-207A	4068.09	13.00	213.84	3.49	0.06	314.0	5.1	449
1335-208A	4068.22	6.52	64.41	2.41	0.09	243.1	9.1	442
1335-209B	4071.9-96	4.08	78.26	4.08	0.05	267.6	13.9	445
1335-211A	4080-4090	0.68	8.96	0.68	0.07	195.2	14.8	443
1335-212A	4090-4100	0.32	3.29	1.02	0.09	125.1	38.8	447
1335-214B	4106.3-41	1.94	18.97	1.55	0.09	147.1	12.0	446
1335-216A	4110-4120	0.31	2.57	0.85	0.11	115.2	38.1	445
1335-215A	4112	3.91	27.11	1.85	0.13	154.5	10.5	450
1335-217A	4120-4130	0.35	2.62	1.51	0.12	117.0	67.4	446
1335-219A	4140-4150	0.19	1.21	1.79	0.14	44.8	66.3	452
1335-220A	4150-4160	0.53	3.29	1.31	0.14	129.0	51.4	448
1335-221A	4160-4170	0.32	3.22	2.47	0.09	95.8	73.5	444
1335-222A	4179-4180	0.16	1.24	0.64	0.11	133.3	68.8	446
1335-224A	4180-4190	0.25	1.94	0.69	0.11	85.1	30.3	445
1335-223A	4184.7-84	0.07	1.13	0.39	0.06	141.2	48.7	446
1335-225A	4190-4200	0.30	2.06	1.22	0.13	87.7	51.9	447
1335-227A	4207.3-41	0.34	3.22	0.21	0.10	214.7	14.0	447
1335-228A	4210-4220	0.20	0.80	1.91	0.20	42.6	101.6	451
1335-229A	4220-4230	0.40	4.70	0.40	0.08	250.0	21.3	451
1335-231A	4240-4250	0.40	2.55	0.33	0.14	148.3	19.2	441
1335-232A	4250-4260	0.29	1.98	0.49	0.13	122.2	30.2	444
1335-234A	4270-4280	0.31	2.63	0.33	0.11	156.5	19.6	444
1335-235A	4277.38	0.19	1.67	0.86	0.10	103.1	53.1	446
1335-236A	4280-4290	0.41	2.50	0.38	0.14	145.3	22.1	444
1335-239A	4300-4310	0.47	2.85	0.76	0.14	137.7	36.7	447
1335-241A	4310-4320	0.26	1.58	0.58	0.14	77.1	28.3	450
1335-240A	4312.15	1.59	43.51	1.02	0.04	296.0	6.9	444

TABLE 3

ROCKEVAL PYROLYSIS DATA

GEOCHEM		S1	S2	S3	Production	Hydrogen	Oxygen	Tmax
SAMPLE	DEPTH	(mg/g)	(mg/g)	(mg/g)	INDEX	INDEX	INDEX	(%C)
1335-243A	4330-4340	0.55	2.43	0.79	0.18	127.2	41.4	445
1335-244B	4340-4350	0.50	1.62	0.91	0.24	73.3	41.2	449
1335-246B	4360-4370	0.48	2.77	0.57	0.15	145.8	30.0	446
1335-247B	4370-4380	0.46	2.74	0.44	0.14	133.0	21.4	444
1335-249B	4390-4400	0.50	2.17	0.56	0.19	119.2	30.8	445
1335-250B	4400-4410	0.55	2.43	0.38	0.18	132.1	20.7	446
1335-252B	4420-4430	0.61	3.05	0.56	0.17	157.2	28.9	445
1335-253B	4430-4440	0.37	2.83	1.04	0.12	105.6	38.8	452
1335-255B	4450-4460	0.40	2.25	0.36	0.15	124.3	19.9	444
1335-256B	4490-4500	0.48	3.49	0.30	0.12	167.0	14.4	446
1335-258B	4510-4520	0.49	2.75	0.45	0.15	136.8	22.4	445
1335-259B	4520-4530	0.64	3.02	0.47	0.17	133.0	20.7	445
1335-261B	4540-4550	1.08	5.28	1.01	0.17	152.6	29.2	449
1335-262B	4550-4560	0.59	3.68	0.56	0.14	170.4	25.9	446
1335-264B	4570-4580	10.84	140.59	3.98	0.07	235.5	6.7	455
1335-265B	4580-4587	9.54	178.90	4.45	0.05	244.7	6.1	452

TABLE 4
GAS - OIL INDEX



GEOCHEM SAMPLE NUMBER	DEPTH	DRY GAS	WET GAS	GASOLINES KEROSENES	GAS OIL DISTILLATE	GAS-OIL INDEX
		% C ₁	% C ₂ - C ₅	% C ₆ - C ₁₄	% C ₁₅ +	% $\frac{C_1 - C_5}{TOTAL}$

1335-025A	1600-1650	3.35	37.69	58.05	0.91	41.04
1335-052A	2520	6.97	45.82	46.80	0.42	52.79
1335-064A	2640	9.11	61.88	28.82	0.19	70.99
1335-076A	2760	10.84	44.36	44.53	0.27	55.20
1335-089A	2880-2890	12.44	44.47	42.99	0.09	56.91
1335-095A	2940-2950	5.51	44.82	48.66	1.00	50.33
1335-107A	3060-3070	7.88	46.76	44.60	0.76	54.64
1335-118A	3180-3190	11.42	48.78	39.70	0.10	60.19
1335-143A	3450-3460	5.87	41.84	52.30	0.00	47.70
1335-152A	3540-3550	16.25	43.64	39.60	0.51	59.89
1335-161A	3630-3640	31.08	38.16	30.57	0.19	69.24
1335-174A	3760-3770	16.35	39.98	43.48	0.20	56.33
1335-266A	3770	7.13	26.24	66.07	0.55	33.38
1335-177A	3780-3790	9.90	40.64	48.61	0.86	50.53
1335-276A	3795	12.41	33.81	52.46	1.32	46.22
1335-180A	3810-3820	10.58	40.02	49.06	0.35	50.59
1335-181A	3820-3830	10.25	35.31	53.19	1.25	45.56
1335-184A	3850-3860	9.63	36.25	53.26	0.86	45.88
1335-187A	3880-3890	12.49	45.49	41.50	0.52	57.98
1335-194A	3945.91-3946.00	16.79	44.55	38.26	0.40	61.33
1335-203B	4030-4040	23.97	34.68	40.77	0.57	58.65
1335-208A	4068-22	38.58	12.92	45.53	2.97	51.50
1335-207A	4068.09-.50	32.82	6.50	37.29	23.39	39.32
1335-215A	4112	36.20	21.75	37.57	4.48	57.95
1335-220A	4150-4160	15.74	40.48	43.24	0.54	56.22
1335-227A	4207.38-41	10.73	32.17	55.87	1.23	42.90
1335-235A	4277.38	7.48	44.73	47.22	0.57	52.21
1335-240A	4312.15	38.99	13.06	39.15	8.80	52.05
1335-243A	4330-4340	13.28	36.17	48.67	1.89	49.45
1335-256B	4490-4500	5.89	22.21	69.57	2.33	28.10
1335-265B	4580-87.5	44.72	12.89	37.27	5.12	57.61

TABLE 5
KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES >35%; 10-35%; <10%	REMARKS	RE- WORKED (%)	PARTICLE SIZE	PRESERV- ATION	THERMAL ALTERATION INDEX	1 - 10 SCALE
1335-015A	1090-1150m	(W;I;H)	lean, visible	-	F-M	F	1 ⁺ to 2-(?)	2 (?)
1335-019A	1300-1350m	(W;I;-)	extremely lean, unreliable	-	F	P	-	
1335-025A	1600-1650m	W;I;H	lean	-	F-M	F	1 ⁺ to 2-(?)	2.5(?)
1335-031B	1900-1950m	W;H;I-Al	chiefly contamination H at and 2-	-	F-M	F	1 ⁺ to 2-(?)	2 (?)
1335-033A	2000-2050m	(W;I;H)	lean, chiefly amorphous-like contamination, unreliable. ** unreliable, 2- at best, possibly 1 ⁺ to 2-	-	F-M	F	**	
1335-035A	2100-2150m	W;I-H;-	lean, frequent contamination good H at 2-.	25	F-M	P-F	1 ⁺ to 2-	2
1335-037B	2200-2250m	W;H-I;-	lean, contamination	25	F-M	F	1 ⁺ to 2-(?)	2 (?)
1335-040A	2350-2400m	(I-W;-;H-Al)	lean, unreliable, chiefly contamination		F	P	-	
1335-046A	2460m	I;W;H-Al	lean	70	F	P-F	2- (?)	3 (?)
1335-052A	2520m	I-W;-;H-Al	contamination	70	F-M	P-F	1 ⁺ to 2-(?)	2 (?)
1335-058A	2580m	I-W;-;H-Al		75	F	F	1 ⁺ to 2-(?)	2 (?)
1335-064A	2640m	I;W;H-Al	contamination, minor material 1 ⁺ to 2-	85	F-M	F	2- (?)	3 (?)
1335-070B	2700m	I;W;H-Al	lean	85	F-M	F	2- (?)	3 (?)>
1335-082A	2820m	I;W;H-Al		85	F	F-G	2-	3
1335-095A	2940-2950m	I;W;H-Al		90	F-M	F-G	2-/2- to 2	3.3
1335-101A	3000-3010m	I-W;-;H-Al	lean contamination	80	F-M	P-F	2- (?)	3 (?)
1335-107A	3060-3070m	I;W;H	extremely lean, contamination	80	F	F	-	
1335-115A	3150-3160m	I-W;-;A-Al	lean, contamination	80	F-M	F	2- to 2 (?)	3.5(?)
1335-123A	3240-3250m	(I;W;-H)	virtually barren, unreliable	80	F	F	-	

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

preservation = Poor, Fair, Good size = Fine, Medium, Coarse

TA1 SCALE	1	1+ to 2-	2-	2	2 to 2+	2+ to 3-	3	3+	4	5
1 - 10 SCALE	1	2	3	4	5	6	7	8	9	10



TABLE 5
KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES > 35%; 10-35%; < 10%	REMARKS	RE- WORKED (%)	PARTICLE SIZE	PRESERV- ATION	THERMAL ALTERATION INDEX	1 - 10 SCALE
1335-132A	3330-3340m	Am ⁺ ; -, I-W-H	+poor quality, probably con- tamination, otherwise virtually barren.	15	F	P	2-/2-to2(?)	3.2(?)
1335-140B	3420-3430m	I; W; H-Al		80	F-M	G	2- to 2	3.5
1335-149A	3510-3520m	W-I; -, H-Al		65	F-M	G	2- to 2	3.5
1335-158A	3600-3610m	W; I; H-Al		-	F-M	F	2	4
1335-164A	3660-3370m	I-W; -, H-Al	lean, chiefly contamination	50	F-M	F	2 (?)	4 (?)
1335-169A	3720-3720m	I-W; -H-Al	contamination	75	F-M	F	2	4
1335-172A	3760m	I; W; H		85	F-M	F	2 (?)	4 (?)
1335-266A	3770m	I-W; -, H-Al	significant caving?	70	F-C	F-G	2 (?)	4 (?)
1335-270A	3780m	Am ⁺ ; Al ⁺ ; I-W-H	+ includes material passing to amorphous	10	F-C	F-G	2 to 2 ⁺ max (?)	5 max (?)
1335-278A	3800m	Am ⁺ ; Al ⁺ -I; W-H	differentiation difficult + as 270A	15	F-C	F	2 to 2 ⁺	5
1335-181A	3820-3830m	(-, Al-I-W-Am; H)	differentiation extremely difficult, frequently unrecognisable	15	F-M	F	2 to 2 ⁺	5
1335-187A	3880-3890m	Am ⁺ ; I-W-H; Al	+ degraded, disseminated relatively poor quality	35	F-M	F	2 (?)	4 (?)
1335-194A	3945.91-3946m	I; W-H; Am		65	F-C	F-G	2 to 2 ⁺	5
1335-207B	4068.09-.30m	-, Am ⁺ -W-H ⁺ -I; Al	+ includes material passing to amorphous	-	F-C	F-G	2 to 2 ⁺	5
1335-227A	4207.38-.41m	I; W-H; Am	significant saving?	-	F-M/C	F	2 to 2 ⁺ (?)	5 (?)
1335-235A	4277.38m	H; W-I; Al-Am	fairly lean	-	F-M	F	2 to 2 ⁺	5
1335-240A	4312-4315m	W; -, I-H		-	F-C	G	2 to 2 ⁺ (?)	5 (?)
1335-243A	4330-4340m	W-I; H; Am	caving?	-	F-C	G	2 to 2 ⁺	5

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

preservation = Poor, Fair, Good size = Fine, Medium, Coarse

TA1 SCALE	1	1 + to 2-	2-	2	2 to 2+	2+ to 3-	3	3+	4	5
1 - 10 SCALE	1	2	3	4	5	6	7	8	9	10



TABLE 5
KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES > 35%; 10-35%; < 10%	REMARKS	RE- WORKED (%)	PARTICLE SIZE	PRESERV- ATION	THERMAL ALTERATION INDEX	1 - 10 SCALE
1335-250B	4400-4410m	Am ⁺ ; W-I-H; Al	+ degraded, not prime quality	-	F-M/C	F	2 to 2 ⁺	5
1335-256B	4490-4500m	W; I-H-Am ⁺ , Al	+ fairly disseminated	-	F-M/C	G	2 to 2 ⁺	5
1335-264/5B	4570-4587.5m	W-I; -; H	W/I differentiation difficult	-	F-C	G	2 to 2 ⁺ (?)	5 (?)

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

preservation = Poor, Fair, Good size = Fine, Medium, Coarse

TA1 SCALE	1	1 + to 2-	2-	2	2 to 2+	2+ to 3-	3	3+	4	5
1 - 10 SCALE	1	2	3	4	5	6	7	8	9	10



TABLE 6
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)			REMARKS
			1	2	3	
1335-015A	1090-150m	WR	<u>0.31(19)</u> ;	0.82(1) *		
1335-019A	1300-350m	WR	0.34(8)			
1335-025A	1600-650m	WR	<u>0.34(12)</u>			
1335-031B	1900-950m	WR	0.37(15)			
1335-033A	2000-050m	WR	0.35(2);	0.53(2) *		
1335-035A	2100-150m	WR	0.89(3) *			
1335-037B	2200-250m	WR	<u>0.40(4)</u> ;	0.53(1) *		
1335-040A	2350-400m	WR	0.84(3); *	1.04(3)		
1335-046A	2460m	WR	0.46(6);	0.71(14) *		
1335-052A	2520m	WR	0.37(2);	0.51(5);	0.77(13) *	
1335-058A	2580m	WR	0.48(9);	0.62(15) *	0.83(5) *	
1335-064A	2640m	WR	<u>0.47(16)</u> ;	0.65(11) *	0.90(3) *	
1335-070B	2700m	WR	<u>0.49(13)</u> ;	0.68(13) *	0.88(8) *	
1335-082A	2820m	WR	0.54(6);	0.62(6); *	0.82(16) *	
1335-095A	2940-950m	WR	0.40(6);	0.55(17);	0.79(7) *	
1335-107A	3000-010m	WR	0.39(4);	0.55(15);	0.76(8)	
1335-107A	3060-070m	WR	0.37(1); ; 0.81(16) *	0.47(3);	0.61(9)	
1335-115A	3150-160m	WR	<u>0.60(13)</u> ;	0.79(16) *		
1335-123A	3240-250m	WR	0.46(7); 0.88(9) *	<u>0.61(19)</u> ;	0.73(4); *	
1335-132A	3330-340m	WR	0.48(1); 0.99(6) *	<u>0.61(5)</u> ;	0.79(7); *	
1335-140B	3420-430m	WR	<u>0.58(9)</u> ;	0.77(13) *	1.07(8) *	
1335-149A	3510-520m	WR	<u>0.54(9)</u> ; 1.07(1) *	0.69(12) *	0.87(7); *	
1335-158A	3600-610m	WR	No determinations possible.			
1335-164A	3660-670m	WR	0.66(2)			
1335-169A	3720-730m	WR	0.40(1); 0.90(11) *	0.54(1);	0.70(2);	
1335-172A	3760m	WR	0.60(2); 1.15(13) *	0.75(2);	0.89(7); *	
1335-181A	3820-830m	WR	0.62(10); 1.27(4) *	<u>0.81(9)</u> ;	0.98(6); *	
1335-187A	3880-890m	WR	0.58(1);	<u>0.78(14)</u> ;	1.08(10) *	
1335-194A	3945.91 - 3946.00m	WR	0.59(1);	<u>0.77(19)</u> ;	1.02(19) *	
1335-197B	3981.55- .56m	WR	0.28(20)			
1335-207A	4068.09m/ 4068.50m	WR	<u>0.90(39)</u>			
1335-215A	4112m	WR	<u>0.94(40)</u>			

CT—ditch cuttings; CO—core; WR—whole rock; KC—kerogen concentrate.

Preferred values underlined. *Reworked

TABLE 6
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)			REMARKS
			1	2	3	
1335-227A	4207.38-41m	WR	<u>0.91(25);</u>	1.25(10) *		
1335-235A	4277.38m	WR	<u>0.92(11);</u>	1.23(4) *		
1335-237	4291.70m	WR	<u>0.81(58);</u>	1.32(2) *		
1335-240A	4312.15m	WR	<u>0.77(40);</u>	1.35(1) *		
1335-243A	4330-340m	WR	<u>0.75(4);</u>	<u>0.98(29);</u>	1.33(7) *	
1335-250B	4400-410m	WR	<u>0.78(2);</u>	<u>0.97(17);</u>	1.26(11) *	
1335-256B	4490-500m	WR	<u>0.86(20);</u>	1.13(15) *	1.35(5) *	
1335-264A	4570-580m	WR	<u>0.91(40);</u>	1.23(1) *		
1335-270A	3780m	WR	<u>0.99(9);</u>	1.27(1) *		



TABLE 7

METHYL PHENANTHRENE INDEX (1)

SAMPLE NUMBER	DEPTH	% AREA	% HEIGHT
1335-064A	2640	0.73	0.80
1335-112A	3120-30	0.44	0.57
1335-118	3180-90	0.49	0.54
1335-172A	3760	0.47	0.57
1335-266A	3770	0.62	0.58
1335-177A	3780-90	0.51	0.67
1335-180A	3810-20	0.47	0.51
1335-181A	3820-30	0.66	0.53
1335-184	3850-60	0.53	0.69
1335-190A	3914.92	0.56	0.66
1335-194A	3945.91-3	0.47	0.70
1335-202	4020-30	0.62	0.70
1335-207B	4068.09	0.51	0.56
1335-214	4106.36-4	0.58	0.65
1335-216	4110-20	0.52	0.67
1335-229	4220-30	0.57	0.63
1335-244	4340-50	0.55	0.62
1335-255	4450-60	0.64	0.72
1335-265	4580-4587	0.66	0.82

TABLE 8a
CONCENTRATION (PPM) OF EXTRACTED C₁₅₊ MATERIAL IN ROCK

JOB	LITHO	DEPTH	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS			
				Saturates	Aromatics	TOTAL	Precipitd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	TOTAL
1335-064A		2640	575	276	55	331	122	118	5	244
1335-112A		3120-30	619	95	70	165	252	186	16	454
1335-118		3180-90	528	233	59	292	157	74	5	236
1335-172A		3760	2240	1518	223	1741	216	(262 + 20)		499
1335-266A		3770	2756	1704	304	2007	421	(256 + 72)		749
1335-177A		3780-90	17191	7154	3162	10316	3430	(3301	143)	6875
1335-180A		3810-20	13050	5503	2421	7924	2045	(2642	439)	5126
1335-181A		3820-30	11112	3502	1753	5255	3491	(2132	234)	5857
1335-184		3850-60	1616	403	246	648	496	425	47	967
1335-190A		3914.92-	1047	151	178	328	466	238	15	719
1335-194A		3945.91-3	920	96	164	261	436	207	16	659
1335-202A		4020-30	3070	1298	276	1575	624	829	42	1495
1335-207B		4068.09	6226	738	1277	2015	2942	1211	58	4211
1335-214		4106.36-4	1815	141	407	548	931	318	18	1267
1335-216		4110-20	3820	1468	348	1817	865	1104	34	2003
1335-229		4220-30	897	167	133	300	340	250	7	597
1335-244		4340-50	1698	639	116	755	730	193	20	943
1335-255		4450-60	1302	558	102	660	456	161	26	643
1335-265		4580-4587	10847	2452	545	2997	6305	(1497	48)	7850

TABLE 8B
COMPOSITION (NORMALISED %) OF C₁₅₊ MATERIAL

JOB	LITHO	DEPTH	HYDROCARBONS		NON HYDROCARBONS		
GEOCHEM SAMPLE NUMBER			Saturates	Aromatics	Precipd. Asphaltenes	Eluted NSO's	Non eluted NSO's
1335-064A		2640	48.02	9.49	21.25	20.45	0.79
1335-112A		3120-30	15.35	11.26	40.72	30.07	2.60
1335-118		3180-90	44.19	11.16	29.66	14.07	0.92
1335-172A		3760	67.76	9.96	9.66	11.71	0.91
1335-266A		3770	61.81	11.01	15.28	9.29	2.61
1335-177A		3780-90	41.62	18.39	19.95	19.20	0.83
1335-180A		3810-20	42.17	18.55	15.67	20.25	3.37
1335-181A		3820-30	31.52	15.78	31.41	19.19	2.11
1335-184		3850-60	24.93	15.21	30.70	26.29	2.88
1335-190A		3914.92-	14.38	16.98	44.54	22.70	1.39
1335-194A		3945.91-3	10.47	17.88	47.38	22.53	1.74
1335-202A		4020-30	42.29	9.00	20.32	27.01	1.38
1335-207B		4068.09	11.86	20.51	47.25	19.46	0.93
1335-214		4106.36-4	7.79	22.40	51.30	17.53	0.97
1335-216		4110-20	38.44	9.12	22.66	28.89	0.89
1335-229		4220-30	18.59	14.87	37.92	27.88	0.74
1335-244		4340-50	37.63	6.85	42.97	11.38	1.16
1335-255		4450-60	42.82	7.84	34.98	12.34	2.03
1335-265		4580-4587	22.61	5.02	58.13	13.80	0.44



TABLE 9
SIGNIFICANT RATIOS (%) OF C₁₅₊ FRACTIONS AND ORGANIC CARBON

JOB	LITHO	DEPTH	ORGANIC CARBON (wt. %)	HYDROCARBONS TOTAL EXTRACT	HYDROCARBONS ORG. CARBON	TOTAL EXTRACT ORG. CARBON	SATURATES AROMATICS
GEOCHEM SAMPLE NUMBER							
1335-064A		2640	0.82	57.51	4.03	7.01	5.06
1335-112A		3120-30	1.13	26.61	1.46	5.48	1.36
1335-118		3180-90	0.81	55.35	3.61	6.52	3.96
1335-172A		3760	0.98	77.72	17.77	22.86	6.80
1335-266A		3770	1.05	72.82	19.11	26.25	5.61
1335-177A		3780-90	6.27	60.01	16.45	27.42	2.26
1335-180A		3810-20	6.29	60.72	12.60	20.75	2.27
1335-181A		3820-30	7.13	47.29	7.37	15.58	2.00
1335-184		3850-60	2.09	40.14	3.10	7.73	1.64
1335-190A		3914.92-	1.97	31.37	1.67	5.32	0.85
1335-194A		3945.91-3	2.97	28.34	0.88	3.10	0.59
1335-202A		4020-30	2.44	51.29	6.45	12.58	4.70
1335-207B		4068.09	10.70	32.36	1.88	5.82	0.58
1335-214		4106.36-4	1.87	30.19	2.93	9.71	0.35
1335-216		4110-20	4.48	47.56	4.06	8.53	4.21
1335-229		4220-30	1.40	33.46	2.14	6.40	1.25
1335-244		4340-50	0.71	44.48	10.64	23.92	5.49
1335-255		4450-60	1.51	50.65	4.37	8.63	5.46
1335-265		4580-4587	10.40	27.63	2.88	10.43	4.50

TABLE 10
COMPOSITION (NORMALISED %) OF C₁₅+ SATURATE (PARAFFIN – NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	064A	112A	118	172A	177A	266A	180A	181A
DEPTH	2640m	3120-30m	3180-90m	3760m	3780-90m	3770	3810-20m	3820-30m
SAMPLE TYPE								
nC ₁₅	23.21	6.88	9.56	11.04	6.39	11.80	8.78	8.91
nC ₁₆	18.55	7.42	9.06	12.24	8.11	14.51	8.42	9.80
nC ₁₇	12.01	7.20	7.87	10.94	8.90	13.21	8.99	11.66
nC ₁₈	7.37	7.19	6.01	9.46	9.47	10.91	8.54	8.55
nC ₁₉	5.11	7.23	5.15	10.02	8.92	8.45	9.18	9.57
nC ₂₀	4.05	7.13	5.36	7.75	9.04	6.06	8.68	7.86
nC ₂₁	3.07	5.95	3.31	6.38	7.67	4.75	6.27	6.00
nC ₂₂	4.56	5.42	3.48	5.69	6.68	4.55	6.16	5.91
nC ₂₃	2.13	5.90	7.19	5.19	4.98	3.49	5.88	4.59
nC ₂₄	1.73	4.52	3.22	4.19	5.03	3.74	4.57	5.77
nC ₂₅	2.05	5.62	5.70	3.89	4.93	3.36	4.70	4.56
nC ₂₆	1.51	3.86	2.91	3.12	3.18	2.49	3.92	3.05
nC ₂₇	1.61	5.58	6.85	2.17	3.50	1.89	2.25	2.43
nC ₂₈	4.93	3.16	5.51	1.71	2.21	1.85	2.00	2.18
nC ₂₉	2.54	5.48	4.79	1.42	2.50	1.57	3.55	1.98
nC ₃₀	1.73	3.61	5.03	1.08	1.82	1.52	1.86	1.56
nC ₃₁	1.02	2.58	4.85	0.94	0.97	1.13	1.29	1.27
nC ₃₂	0.94	1.13	1.52	0.61	1.26	1.15	1.10	1.87
nC ₃₃	0.68	1.65	0.54	0.57	0.91	0.95	0.90	1.19
nC ₃₄	0.81	1.32	1.81	0.70	1.80	1.31	1.71	1.14
nC ₃₅	0.40	1.18	0.28	0.89	1.74	1.32	1.26	1.17
PARAFFIN	10.51	16.56	6.54	29.28	14.19	26.37	15.25	15.22
ISOPRENOID	1.06	2.46	0.59	3.27	2.09	8.40	2.53	2.49
NAPHTHENE	88.43	80.98	92.86	67.45	83.73	65.22	82.22	82.29
CPI INDEX 1	0.72	1.23	1.53	1.03	1.06	0.93	0.98	0.91
CPI INDEX 2	0.76	1.45	1.41	1.06	1.19	0.98	1.14	1.00
CPI INDEX 3	0.50	1.59	1.63	0.90	1.30	0.87	0.76	0.93
PRISTANE/PHYTANE	2.23	2.56	1.95	1.18	0.82	2.47	1.10	1.28
PRISTANE/nC ₁₇	0.58	1.49	0.76	0.55	0.75	1.72	0.97	0.79
PHYTANE/nC ₁₈	0.30	0.41	0.39	0.66	0.85	0.76	0.69	0.71

$$C.P.I. 1 = \frac{1}{2} \left[\frac{C_{21}+C_{23}+C_{25}+C_{27}}{C_{20}+C_{22}+C_{24}+C_{26}} + \frac{C_{21}+C_{23}+C_{25}+C_{27}}{C_{22}+C_{24}+C_{26}+C_{28}} \right]$$

$$C.P.I. 2 = \frac{1}{2} \left[\frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{24}+C_{26}+C_{28}+C_{30}} + \frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{26}+C_{28}+C_{30}+C_{32}} \right]$$

$$C.P.I. 3 = \frac{2 \times (C_{27})}{C_{26}+C_{28}}$$

TABLE 10
COMPOSITION (NORMALISED %) OF C₁₅+ SATURATE (PARAFFIN – NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	184	190A	194A	202	207B	214	216	229
DEPTH	3850-60m	3914.91-15m	3945.91-3946m	4020-30m	4068.09-.50m	4160.36-.41m	4110-20m	4220-30m
SAMPLE TYPE								
nC ₁₅	8.45	3.96	4.94	5.16	6.01	7.49	5.17	2.60
nC ₁₆	8.16	5.83	5.87	4.68	7.33	7.77	4.27	5.18
nC ₁₇	9.36	7.44	6.62	4.39	9.17	9.08	4.58	7.86
nC ₁₈	7.70	7.57	7.32	3.74	7.73	9.04	4.33	9.01
nC ₁₉	8.57	7.78	7.85	4.13	6.35	7.51	3.48	9.15
nC ₂₀	6.63	6.89	6.79	3.07	6.08	6.08	4.42	7.93
nC ₂₁	6.16	6.50	6.60	3.69	6.64	6.37	3.19	7.57
nC ₂₂	5.49	6.64	6.23	4.63	5.88	5.32	5.93	6.96
nC ₂₃	5.02	6.45	5.79	5.72	5.57	5.32	7.24	6.17
nC ₂₄	5.05	6.57	6.27	3.62	5.36	5.31	6.97	5.58
nC ₂₅	4.78	6.30	5.41	8.52	5.27	4.34	5.87	5.87
nC ₂₆	3.62	4.74	4.71	3.15	3.92	3.71	10.26	4.67
nC ₂₇	4.18	5.14	4.48	8.35	3.76	3.25	3.50	4.76
nC ₂₈	3.00	3.96	3.50	5.32	3.15	4.94	7.94	5.07
nC ₂₉	3.36	3.81	3.48	7.57	3.63	2.92	3.15	3.45
nC ₃₀	2.27	2.58	2.84	7.97	2.39	2.31	5.10	1.70
nC ₃₁	2.70	2.29	2.56	4.27	2.85	2.14	3.42	2.08
nC ₃₂	1.55	1.57	2.37	4.78	3.05	1.70	2.37	1.20
nC ₃₃	1.54	1.97	2.49	2.37	2.30	2.17	2.51	1.57
nC ₃₄	1.28	1.23	2.32	1.36	2.32	1.75	3.07	0.87
nC ₃₅	1.13	0.80	1.57	3.51	1.24	1.49	3.23	0.75
PARAFFIN	23.50	29.86	30.76	6.13	21.43	15.44	5.48	17.59
ISOPRENOID	2.78	2.41	3.39	0.38	1.99	1.40	0.52	1.14
NAPHTHENE	73.72	67.73	65.85	93.49	76.58	83.15	94.00	81.26
CPI INDEX 1	1.07	1.05	1.00	1.69	1.08	0.97	0.68	1.03
CPI INDEX 2	1.26	1.17	1.05	1.39	1.14	0.89	0.57	1.11
CPI INDEX 3	1.26	1.18	1.09	1.97	1.06	0.75	0.38	0.98
PRISTANE/PHYTANE	1.87	3.49	4.00	1.72	1.47	1.87	1.22	2.24
PRISTANE/nC ₁₇	0.82	0.84	1.33	0.88	0.60	0.65	1.14	0.57
PHYTANE/nC ₁₈	0.35	0.30	0.27	0.30	0.24	0.27	0.29	0.21

$$C.P.I. 1 = \frac{1}{2} \left[\frac{C_{21}+C_{23}+C_{25}+C_{27}}{C_{20}+C_{22}+C_{24}+C_{26}} + \frac{C_{21}+C_{23}+C_{25}+C_{27}}{C_{22}+C_{24}+C_{26}+C_{28}} \right]$$

$$C.P.I. 2 = \frac{1}{2} \left[\frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{24}+C_{26}+C_{28}+C_{30}} + \frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{26}+C_{28}+C_{30}+C_{32}} \right]$$

$$C.P.I. 3 = \frac{2 \times (C_{27})}{C_{26}+C_{28}}$$

TABLE 10
COMPOSITION (NORMALISED %) OF C₁₅+ SATURATE (PARAFFIN – NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	244	255	265
DEPTH	4340-50m	4450-60	4580-4587.5
SAMPLE TYPE			
nC ₁₅	2.61	5.25	7.36
nC ₁₆	3.84	5.42	8.67
nC ₁₇	3.65	5.75	9.89
nC ₁₈	4.00	5.17	10.65
nC ₁₉	3.72	6.36	9.63
nC ₂₀	4.00	4.90	8.27
nC ₂₁	2.86	4.59	7.04
nC ₂₂	6.23	4.02	6.46
nC ₂₃	5.99	6.07	5.94
nC ₂₄	17.50	5.39	5.52
nC ₂₅	17.48	7.37	4.84
nC ₂₆	4.48	5.99	3.41
nC ₂₇	8.12	11.80	2.87
nC ₂₈	3.16	2.97	1.82
nC ₂₉	3.95	3.67	1.90
nC ₃₀	3.93	7.28	1.45
nC ₃₁	1.58	2.65	1.13
nC ₃₂	0.64	2.60	0.80
nC ₃₃	1.02	1.29	1.35
nC ₃₄	0.67	0.94	0.63
nC ₃₅	0.55	0.54	0.38
PARAFFIN	10.87	9.99	26.65
ISOPRENOID	0.48	0.47	2.39
NAPHTHENE	88.65	89.54	70.95
CPI INDEX 1	1.08	1.55	1.04
CPI INDEX 2	1.81	1.27	1.16
CPI INDEX 3	2.13	2.63	1.10
PRISTANE/PHYTANE	2.16	1.75	2.86
PRISTANE/nC ₁₇	0.84	0.52	0.67
PHYTANE/nC ₁₈	0.23	0.24	0.18

$$C.P.I. 1 = \frac{1}{2} \left[\frac{C_{21}+C_{23}+C_{25}+C_{27}}{C_{20}+C_{22}+C_{24}+C_{26}} + \frac{C_{21}+C_{23}+C_{25}+C_{27}}{C_{22}+C_{24}+C_{26}+C_{28}} \right]$$

$$C.P.I. 2 = \frac{1}{2} \left[\frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{24}+C_{26}+C_{28}+C_{30}} + \frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{26}+C_{28}+C_{30}+C_{32}} \right]$$

$$C.P.I. 3 = \frac{2 \times (C_{27})}{C_{26}+C_{28}}$$

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TABLE 11
CARBON ISOTOPE COMPOSITIONS (‰, PDB)

GEOCHEM SAMPLE NUMBER	DEPTH	TOTAL EXTRACT WHOLE OIL	SATURATES	AROMATICS	NSO	ASPHALTENES	KEROGEN	PYROLYSATE S2
1335-064A	3660-670m	----	-28.99					-27.65
1335-112A	3120-130m	-27.39	-28.35	-27.44	-27.81	-27.20		-26.01
1335-118	3180-190m	-28.03	-28.45	-27.58	-28.19	-28.19		-26.16
1335-172A	3760m	-30.52	-30.52	-30.54	-29.32	-28.35		-26.75
1335-177A	3780-3790m	-30.72	-30.92	-30.12	-30.12	-30.56		-30.05
1335-181A	3820-3830m	-28.19	-27.06	-26.84	-26.83	-27.6-		-27.17
1335-184	3850-60m	-27.52	-28.64	-27.09	-27.04	-27.04		-26.15
1335-190	3914-92m	-25.33	-27.15	-25.20	-27.11	-25.75		-24.70
1335-194A	3945-91m	-25.77	-28.32	-25.70	-26.65	-26.00		-24.32
1335-202A	4020-30m	-25.92	-27.89	-26.67	-27.39	-27.30		-25.62
1335-207B	4068-09m	-26.41	-27.78	-25.86	-----	-26.88		-25.71
1335-214	4106.36-4m	-29.87	-----	-25.58	-26.29	-26.12		-25.37
1335-216	4110-20m	-27.31	-29.42	-28.48	-27.95	-27.52		-26.06
1335-244	4340-50m	-27.26	-27.63	-26.69	-27.90	-27.98		-26.38
1335-229	4220-30m	-26.96	-27.83	-29	-26.34	-26.43		-25.72
1335-255	4450-60m	-27.37	-28.28	-26.64	-27.89	-28.25		-26.52
1335-265	4580-4587m	-26.52	-----	-25.83	-27.09	-26.23		-26.06
1335-130A	3310-20m	-29.32	-30.10	-28.74	-28.48	-28.63		-27.48
1335-266A	3770m	-29.60	-30.78	-29.72	-29.14	-29.59		-----

TABLE 12
BIOMARKER MOLECULAR RATIOS

GEOCHEM SAMPLE NUMBER	SAMPLE DEPTH/ IDENTITY	SAMPLE TYPE	STERANES (m/z 217, 218)				TERPANES (m/z 191, 177)					
			$C_{29} \frac{\alpha\alpha\alpha \text{ 20S [Q]}}{\alpha\alpha\alpha \text{ 20R [T]}}$	$C_{29} \frac{\alpha\beta\beta \text{ 20R [R]}}{\alpha\alpha\alpha \text{ 20R [T]}}$	$C_{27} \frac{20SDI \text{ [A]}}{20RDI \text{ [B]}}$	$\frac{C_{27} \beta\beta}{C_{29} \beta\beta} \text{ (218)}$	$\frac{Tm [B]}{Ts [A]}$	$\frac{C_{29} 17\alpha\text{-NH [C]}}{[C] + C_{30} 17\alpha\text{-H [E]}}$	$C_{29} \frac{NM [D]}{[D] + NH [C]}$	$\frac{28, 30\text{-BNH [Z]}}{[Z] + C_{29} 17\text{-NH [C]}}$	$\frac{28, 30\text{-BNH [Z]}}{[Z] + 25, 28, 30\text{-TNH [177]}}$	$C_{31} \frac{20S [G]}{[G] + 20R [H]} \%$
1335-112	3120-30m		0.52	0.22	1.27	1.06	5.52	0.35	0.38	0.30	-	50.4
1335-118	3180-90m		0.86	0.32	1.32	0.92	1.07	0.50	0.15	-	-	
1335-172	3760m		0.50	0.85	2.20	0.78	0.89	0.42	0.13	-	-	49.5
1335-266	3770m		0.41	1.95	0.65	1.26	1.30	0.49	0.10	-	-	53.3
1335-177	3780-90m		1.75	1.12	1.54	1.22	0.69	0.15	0.23	-	-	57.5
1335-180	3810-20m		1.58	0.78	1.52	1.39	-	0.13	-	0.77	-	58.2
1335-181	3820-30m		-	0.58	1.10	2.17	1.16	0.09	0.30	-	-	19.1
1335-184	3850-60m		-	0.72	1.38	1.07	2.58	0.39	0.17	-	-	30.4
1335-190	3914-92m		0.62	0.72	1.41	1.05	1.60	0.40	0.13	-	-	57.8
1335-194	3945.91m		0.61	0.50	1.75	0.48	13.4	0.38	0.12	-	-	57.2
1335-202	4020-30m		1.03	0.41	1.25	1.07	1.28	0.51	0.14	-	-	26.1
1335-207	4068-09m		1.00	1.00	-	-	-	0.32	0.07	-	-	59.3
1335-214	4106.36-4m		1.25	1.00	2.00	-	3.00	0.39	0.06	-	-	55.7

[A] etc. REFERS TO IDENTIFICATION ON APPROPRIATE MASS FRAGMENTOGRAM DIAST – DIASTERANES H – HOPANE NH – NORHOPANE BNH – BISNORHOPANE

CT – ditch cuttings CO – core SWC – sidewall core

TNH – TRISNORHOPANE NM – NORMORETANE



TABLE 12
BIOMARKER MOLECULAR RATIOS

GEOCHEM SAMPLE NUMBER	SAMPLE DEPTH/ IDENTITY	SAMPLE TYPE	STERANES (m/z 217, 218)				TERPANES (m/z 191, 177)					
			$C_{29} \frac{\alpha\alpha\alpha \text{ 20S [Q]}}{\alpha\alpha\alpha \text{ 20R [T]}}$	$C_{29} \frac{\alpha\beta\beta \text{ 20R [R]}}{\alpha\alpha\alpha \text{ 20R [T]}}$	$C_{27} \frac{20S \text{ DIAST [A]}}{20R \text{ DIAST [B]}}$	$\frac{C_{27} \beta\beta}{C_{29} \beta\beta} (218)$	$\frac{Tm [B]}{Ts [A]}$	$\frac{C_{29} 17\alpha\text{-NH [C]}}{[C] + C_{30} 17\alpha\text{-H [E]}}$	$C_{29} \frac{NM [D]}{[D] + NH [C]}$	$\frac{28, 30\text{-BNH [Z]}}{[Z] + C_{29} 17\text{-NH [C]}}$	$\frac{28, 30\text{-BNH [Z]}}{[Z] + 25, 28, 30\text{-TNH [177]}}$	$C_{31} \frac{20S [G]}{[G] + 20R [H]} \%$
1335- 216	4110-20m		0.29	1.95	1.58	1.24	1.13	0.36	-	-	-	56.5
1335- 229	4220-30m		1.00	1.00	1.00	-	3.62	0.40	0.12	-	-	42.3
1335-244	4340-50m		-	-	1.40	1.37	1.17	0.51	0.13	-	-	44.7
1335-255	4450-60m		0.14	0.29	1.20	0.82	9.13	0.50	0.15	-	-	25.2
1335-265	4580-4687m		0.84	1.08	0.61	-	-	-	-	-	-	10.7

[A] etc. REFERS TO IDENTIFICATION ON APPROPRIATE MASS FRAGMENTOGRAM DIAST – DIASTERANES H – HOPANE NH – NORHOPANE BNH – BISNORHOPANE

CT – ditch cuttings CO – core SWC – sidewall core

TNH – TRISNORHOPANE NM – NORMORETANE

