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GEOCHEMICAL SERVICE REPORT

Prepared for
NORSK HYDRO

**GEOCHEMICAL EVALUATION OF NORSK HYDRO'S 33/5-1 WELL,
NORWEGIAN NORTH SEA**

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COMPANY PROPRIETARY

GEOCHEMICAL EVALUATION OF NORSK HYDRO'S 33/5-1

WELL, NORWEGIAN NORTH SEA

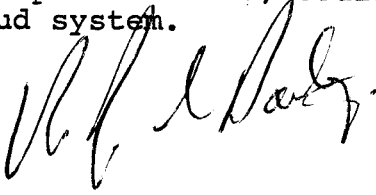
SUMMARY

Eight (8) zones are recognised between 1400 metres and 3822 metres (TD).

Zones A through E¹ represent the shale section above 2680± metres. Zone A (1400-1640± metres) is a poor and immature source whilst Zone E¹ (2560-2680± metres) is also poor and effectively immature. The others are somewhat more interesting. Thus Zones B (1640-2040± metres) and C (2040-2220± metres) are generally fair source rocks within which minor hydrocarbon generation is occurring on-structure; some intervals are potentially good source rocks for oil and gas. Zone D (2220-2560± metres) is only a fair source.

On-structure maturation is limiting but no source intervals capable of generating major oil (even if mature) were detected. Nevertheless, good shows of medium gravity crude oil were detected in Zones B through D (particularly B and D) and minor shows extend downwards through Zone E¹ to approximately 2700± metres. It is believed that this oil was generated in the off-structure lateral equivalents of the Zone B, C and D shales buried to below 3300± metres and then migrated laterally through the interbedded limestones and siltstones.

Zones E² through F² have only a nominal source potential. Traces of crude oil were detected down to 2950± metres (insignificantly minor traces 2950-3210± metres) but these, particularly in the deeper interval, could well have been introduced from the mud system.



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INTRODUCTION

This report presents a geochemical evaluation of the section between 1400 metres and 3822 metres (TD) in Norsk Hydro's 33/5-1 well.

The study was designed to:

- investigate the hydrocarbon source potential of the shales in terms of richness, maturity and organic matter type
- detect migrated hydrocarbons within the section
- characterise the migrated hydrocarbons and relate them to their probable parent source rocks.

This project was authorised by Mr. Svein I. Leivestad, Norsk Hydro.

A. ANALYTICAL

A total of one hundred and twenty one (121) canned samples were received from between 1400 metres and 3822 metres, each sample being a twenty metres composite. They were assigned the Geochem job number 377 and sequential sample numbers.

During the sample preparation steps, a slight fleck was observed down to 1900 metres and below 2460 metres, whilst the samples smelled of oil down to 3420 metres and of "detergent" below this depth.

The samples were screened with the light hydrocarbon (C_1-C_7) and organic carbon analyses. Samples for further analysis were selected on the basis of the screen results. A total of one hundred and twenty one light hydrocarbon analyses, one hundred and sixty seven organic carbon analyses, eight detailed gasoline range analyses, thirty three visual kerogens, seventeen vitrinite reflectance determinations, nineteen pyrolysis analyses, thirty four extractions with chromatography and thirty four high resolution paraffin-naphthene analyses were performed in this study.

The data are presented in tables 1 through 9 and graphically in figures 1 through 6. A brief description of the analytical techniques is included in the back of the report.

B. GENERAL INFORMATION

Ten (10) copies of this report have been forwarded to Mr. S.I. Leivestad, Norsk Hydro, together with the kerogen slides

prepared for this study. A copy of the data has been retained by Geochem for future consultation with authorised Norsk Hydro personnel.

The remaining sample material will be handled as instructed.

All of the results and interpretations related to this study are regarded as highly confidential and are proprietary to Norsk Hydro.

RESULTS AND INTERPRETATION

Each of the parameters relevant to the geochemical evaluation of the section between 1400 metres and 3822 metres (T.D.) in 33/5-1 will be discussed in turn and then synthesised to form the "Conclusions".

No well logs were available for this study. Sample recoveries were frequently poor within the gross interval 2020-2740 metres and high proportions of lost circulation material were present at 1540-1720 metres, 1760-2160 metres, 2600-2800 metres, 2880-3040 $\pm$ metres and below 3740 metres.

A. ZONATION

This zonation is based upon the light hydrocarbon (C₁-C₇) data. A total of eight (8) zones are recognised.

Zone A 1400 metres to 1640 $\pm$ metres, is grossly composed of light brownish grey and medium light grey shales above and below 1540 $\pm$ metres respectively. Minor limestones are present and these display weak yellow fluorescence at 1500-1520 $\pm$ metres and below 1620 $\pm$ metres.

The C₁-C₄ gaseous hydrocarbons within this interval vary between 556 ppm and 13694 ppm (peaking at 1500-1520 metres and 1580-1600 metres) but generally exceed 2000 ppm. They are very dry (1.0-5.0% C₂+ in total C₁-C₄) and this is reflected in the relative sparseness of the heavier C₅-C₇ hydrocarbons (25-82(165) ppm).

Zone B extends from 1640 $\pm$ metres down to 2040 $\pm$ metres. This interval is dominated by medium light grey shales and mudstones, the proportion of shale increasing with depth. Minor sands occur at 1680-1760 $\pm$ metres, whilst minor argillaceous limestones are present in the samples from above 1780 $\pm$ metres.

The limestones exhibit patchy yellow fluorescence.

Zone B is richer and wetter than Zone A. The gases range from (4213)10284 ppm up to 23298 ppm and tend to show a slight increase with depth. Isobutane to normal butane ratios are in the range 0.5-0.6, but the gases become marginally wet at 1660 $\pm$ metres and then, below 1720 $\pm$ metres, lie within the limits of (37.6)43.8-58.5% C₂+. This trend is reflected in the C₅-C₇ fraction which jumps from

924 ppm above 1660 metres, to 2094-5585 ppm at 1660-1720 metres and then falls within the limits of 4415-12236 ppm, the better values tending to correlate with the wetter gases at 1760-1780 metres and 1880-1920 metres.

Zone C lies between 2040 $\pm$ metres and 2220 $\pm$ metres and consists of medium grey to medium light grey shales with interbedded medium dark grey to medium grey shales.

This interval is somewhat leaner than Zone B. The gases drop from approximately 10,000 ppm at the top of the zone to the general range of 3144-6266 ppm below 2080 $\pm$ metres, but they are wet (54.8-60.0% C₂₊) down to 2160 $\pm$ metres, becoming marginally wet (43.0-51.6% C₂₊) below this depth. The heavier C₅-C₇ hydrocarbons display an erratic decrease with depth from approximately 5000 ppm to 1500 ppm.

Zone D 2220 $\pm$ metres to 2560 $\pm$ metres, is lithologically similar to Zone C, being composed of medium grey to medium light grey shales. These are occasionally silty and minor limestones are present below 2320 $\pm$ metres (sparse above this depth).

The gaseous hydrocarbons range in abundance from 5472 ppm up to 15556 ppm but generally approximate 10,000 ppm whilst the C₅-C₇ fraction decreases from over 8000 ppm at the top of the zone to less than 3000 ppm at the base. The gases are generally 47-56% wet.

Zone E¹ 2560 $\pm$ metres to 2680 $\pm$ metres, is also dominated by medium grey to medium light grey shales. Relatively minor interbedded silts and argillaceous limestones are present. A coal (? , small sample, finely divided) is present within the interval 2660-2680 $\pm$ metres.

Geochemically, Zone E¹ is transitional between Zones D and E². The C₁-C₄ gases decrease, below 2600 $\pm$ metres, to the range 3801-4321(5544) ppm and are generally only 43.7-49.9% wet, although the samples from 2600-2620 metres and 2640-2660 metres are improved at 59.1% and 64.9% respectively. A similar depletion is evident in the C₅-C₇ hydrocarbons, which generally fall within the limits 1090-1951 ppm but rise to 3000 ppm at the bottom of the zone.

Zone E² extends from 2680± metres down to 3000± metres. It consists of a massive sand unit. The minor medium grey shales present in the samples are dominantly (perhaps entirely) caved. Minor coals are present above 2720± metres.

Pale yellow fluorescence was detected in the sands at 2700-2720 metres, 2820-2940 metres and 2980-3000 metres.

The gaseous hydrocarbons fall within the narrow limits of 1037-1842(2842) ppm and are now only (13.1)24.4-46.5(54.2)% wet. There is a slight increase in their isobutane to normal butane ratios. This drop in hydrocarbon abundances is also reflected in the C₅-C₇ fraction (914-2044 ppm).

Zone F¹ 3000± metres to 3180± metres, is a continuation of the massive sand unit.

This is a lean, dry interval. The C₁-C₄ and C₅-C₇ fractions lie within the limits of 126-530 ppm and 71-884 ppm respectively, whilst the gases are only 8.3-32.3% wet.

Zone F² extends from 3180± metres down to 3822± metres (TD). The massive sand of Zones E² and F¹ continues down to the base of the well. Minor amounts of "coal" were observed at 3200-3240 metres and more particularly at 3480-3520± metres. The greyish red shale below 3800± metres is probably in-situ but the minor medium grey shales which are present throughout this zone are probably caved.

Zone F² is lean, with none of the samples exceeding 720 ppm of the C₁-C₄ gases. These gases are also very dry (generally less than 11% C₂+). The heavier C₅-C₇ hydrocarbons range from 289 ppm up to 1885 ppm, values in excess of 1000 ppm only applying to the section above 3480± metres. These hydrocarbons were probably entrained in the mud system.

In summary:

- Zone A generally has fair contents of dry gas
- Zone B is good and passes from marginally wet to just wet
- Zone C is fair and generally wet
- Zone D is fair to good and just wet
- Zone E¹ has fair contents of marginally wet gas
- although leaner, Zone E² is still fair but drier
- Zones F¹ and F² are poor and dry.

B. AMOUNT AND TYPE OF ORGANIC MATTER

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

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

The Zone A shales contain 0.38-0.67(0.77)% organic carbon, whilst the mudstones and limestones are leaner at (0.16)0.29-0.48% and 0.21-0.23(0.33)% organic carbon respectively. Wood is generally the major constituent of the organic matter in the shales. Significant proportions of algal debris are present but the herbaceous and amorphous fractions are rather minor although an atypical, degraded form of amorphous material is occasionally relatively abundant. This atypical amorphous material is dominant in the argillaceous limestones whilst in some of the mudstones algal debris is dominant and wood is reduced to a significant role.

A similar richness pattern is evident in Zone B where the shales contain 0.56-0.80% organic carbon and the mudstones and limestones are again leaner at 0.27-0.39% and 0.18-0.24(0.45)% organic carbon. However, the minor mudstone (caved?) from 1680-1700 metres is significantly enhanced at 0.93% organic carbon. These shales are variously dominated by amorphous kerogen (accompanied by significant proportions of wood) and by wood (with significant amorphous[±]algal debris). Significant proportions of algal material are generally present but herbaceous debris is only a minor constituent. The amorphous fraction, as in Zone A, is dark, degraded and atypical and would be expected to be less oil-prone than the typical amorphous species.

Analysis of the bulk, extracted samples suggests that richer interbeds containing in excess of one per cent organic carbon are also present.

Minor colour variations are evident in the Zone C shales but they all fall within the limits of 0.59-0.83(0.96)% organic carbon. Woody material is generally dominant and is accompanied by significant proportions of algal [±] inertinitic (coaly) debris, although these occasionally share the major role. Amorphous kerogen (atypical) is minor to significant whilst herbaceous material is, again, only minor.

The Zone D shales are of similar richness at 0.53-0.83(0.98)% organic carbon but some interbeds containing more than one per cent carbon may be present. This is certainly true of the medium grey mudstones which contain (0.84)1.08-1.31% organic carbon. Their organic matter is variously woody and amorphous in type, with significant proportions of algal kerogen but only minor herbaceous debris. Again, the amorphous fraction is largely atypical. The limestones are lean (0.13-0.35%).

Similar values of 0.66-0.73(0.84)% organic carbon apply to the shales of Zone E¹. However, woody material is now very dominant and, although significant proportions of inertinitic debris are present, amorphous kerogen is essentially absent. The algal and herbaceous fractions are minor. The minor siltstones are relatively enhanced at 0.87-1.19% organic carbon and their organic matter is woody-algal in type, with fairly significant proportions of inertinitic and atypical amorphous material.

The minor medium grey shales within Zones E², F¹ and F² contain 0.47-0.90%, 0.66-0.90% and 0.74-0.91% organic carbon. Wood is dominant throughout, although the inertinitic and algal fractions tend to be fairly significant. Similar organic matter is present in the sparse moderate reddish brown shales within Zone F², but these are very lean (0.05-0.09% organic carbon). In contrast, the (thin) coal beds are rich at 24.8-43.1% organic carbon. Their organic matter is very dominantly woody in type, sometimes with fairly significant proportions of inertinitic or herbaceous debris.

Throughout the analysed section, the shales generally contain between 0.5% and 1.0% organic carbon. The mudstones of Zones A and B fall below this range whilst those of Zone D and the siltstones of Zone E¹ are slightly enhanced and are comparable to the worldwide average shale. Wood tends to be dominant but significant proportions of algal debris are commonly present. Amorphous kerogen is sometimes dominant, particularly at the base of Zone A and in Zone B, but is an atypical, degraded and probably less oil-prone species. Below Zone D it is only a minor constituent.

C. LEVEL OF THERMAL MATURATION

Thermal maturity has been evaluated with the spore colouration and vitrinite reflectance techniques.

Due to the general sparsity of herbaceous organic matter, measurements employing the spore colouration method were sometimes difficult to achieve. However, a thermal index of 2- is reached at approximately 1920[±] metres but apparently does not pass to 2 within this well section. However, the shales within Zones E² through F² are probably caved and, as noted below, the "coals" are believed to be lignitic material used in drilling. As a

result, it would be more accurate to state that an index of 2 is not reached at the base of Zone E¹.

The sediments above 1920[±] metres are immature. Between this depth and at least to the base of Zone E¹, the amorphous, herbaceous and algal fractions of the total organic matter are marginally mature (minor hydrocarbon generation) but wood is still immature. Hence, in view of the character of their organic matter, the shales at the base of Zone B and those of Zones C and D must be regarded as transitional between the immature and marginally mature states whilst the dominant shales of Zone E¹ are effectively immature.

It is likely that such shales as are indigenous to Zone E² and F¹ will also be effectively immature whilst those of Zone F² could be marginally mature. However, shales are insignificant within Zones E² through F².

With the exception of the three "coals", all of the samples selected for vitrinite reflectance measurements gave a wide spread of values within which several data populations can be recognised. As a result, there is no obvious depth-related trend. It is believed that the scatter is dominantly due to the presence of reworked organic matter (which was also observed in the kerogen populations) and this is supported when a best-fit line is drawn through the data points representing the most abundant vitrinite populations. This trend line suggests reflectivities of 0.40% Ro and 0.53% Ro at depths of approximately 1600[±] metres and 3300[±] metres respectively. A reflectivity of 0.53% Ro should correlate with a thermal index of 2 and hence these data lend qualitative support to the conclusions derived above and confirm that significant hydrocarbon generation cannot be anticipated above Zone F² but that minor generation is occurring from suitable organic matter below approximately 2000[±] metres.

The three "coals" all gave reflectivities of 0.28% Ro and not only do not fit the trend but also are less reflective than any of the other samples. For this reason it is believed that these are in fact not coals but rather, are particles of lignite added to the mud system. It was not possible to examine them further due to the fact that the particles were small and very sparse.

The C₁₅+ paraffin-naphthene chromatograms suggest relative immaturity throughout.

Significant hydrocarbon generation is not achieved on-structure within the shale section.

D. SOURCE RICHNESS

Assessments of present and potential source richness can be obtained from the light hydrocarbon (C₁-C₇) and organic carbon

abundances. Within Zone B through D the light hydrocarbons are masked by non-indigenous species and hence cannot be used to measure source richness but Zones A and E¹ are generally of fair richness.

Organic carbon data suggest that the shales of Zone A are potentially poor to fair and fair source rocks whilst those of Zones B through E¹ (and any of the underlying medium grey shales which are indigenous) are fair. A few intervals within Zones B and D are good.

C₁₅+ hydrocarbon abundances of 266-708 ppm suggest good and very good source ratings for Zone A. However, the hydrocarbons constitute 47-56% of the total extract and these values are suspiciously high for immature sediments. The high background envelopes of the paraffin-naphthene chromatograms indicate the presence of drilling-introduced contamination and hence the measured hydrocarbon abundances do not reflect the indigenous source richness.

The problem is more pronounced in Zones B through D and, above 2620[±] metres, in Zone E¹. Over this entire interval the C₁₅+ hydrocarbons lie within the limits of 1184-2705 ppm and constitute an anomalously high (54.4)80.4-89.4% of the total extract. Not only are these values too high but the hydrocarbon to organic carbon ratios are also high, thus indicating the presence of non-indigenous hydrocarbon species - in this case, crude oil. As a result, the hydrocarbon abundances do not provide a measure of source richness.

The C₁₅+ hydrocarbons drop in abundance to 168-564 ppm between 2620[±] metres and 2970[±] metres, suggesting fair to very good source potentials regardless of lithology. Again however, contamination by crude oil is present (although much less abundantly) and it is unlikely that any of the Zone E² samples exceed 100 ppm, thus resembling the poor source rocks which characterise Zones F¹ and F².

In order to overcome this problem of non-indigenous hydrocarbons, the pyrolysate technique has been employed. This method provides a laboratory simulation of the maturation process which allows us to measure source richness under optimum conditions of maturity. The Zone A samples yielded 438-957 ppm pyrolysate and are classified as poor source rocks. Somewhat better values of 1219-1754 (2821) ppm pyrolysate were returned by the shales of Zone B, which are assigned a generally fair rating, although some good source interbeds are present. Zone C (1628-3993 ppm) also consists of a mixture of fair and good source rocks. The Zone D shales yielded 404-1923 ppm pyrolysate and are classified as mixed poor and fair source rocks, whilst all of the analysed samples from Zone E were poor (206-659 ppm).

The ratings based upon the pyrolysate technique are preferred and will be used in this study.

E. MIGRATED HYDROCARBONS

Apart from the massive sandstone unit of Zones E², F¹ and F², potential reservoir facies are represented by the minor limestones above 1780± metres in Zones A and B and within Zones D and E¹. Minor sand interbeds are apparently present at 1680-1760± metres in Zone B and in Zone E¹ (silts) whilst the Zone D shales are occasionally silty.

Weak yellow fluorescence was detected within the limestone of Zones A and B and in some of the Zone E sands.

The zonation of this well is based upon the light hydrocarbon (C₁-C₇) data, which indicate some dramatic breaks which are unrelated to changes in the source character of the sediments. For example, the top of Zone B is defined by a dramatic improvement in gas wetness and in the abundance of the C₅-C₇ hydrocarbons. Although the gases are not exceptionally wet, the presence of migrated liquid hydrocarbons is indicated and these apparently extend down to the base of Zone D and, less abundantly, to the bottom of Zone E¹. The cuttings gas is wetter and, after a transitional interval above 1700± metres in Zone A, contains 62.2-90.5 (generally 67-84)% of C₂+ in the total C₁-C₄ down to 2660± metres. Less abundant migrated liquid hydrocarbons are indicated at 2660-2700± metres and trace amounts are suggested to 2950± metres. Scattered, insignificantly minor traces are suggested down to 3200± metres.

The best values apply to Zones B and D, and it is interesting to note the relative depletion in Zone C which could be related to the apparent lack of reservoir/microreservoir facies within this interval.

The very high proportion of the heavy C₁₅+ hydrocarbons (generally 80-89%) within the total extracts obtained from the Zone B, C and D samples clearly indicate the presence of non-indigenous material. This conclusion is supported by the relatively high abundances of these hydrocarbons, which vary from 2006-2705 ppm in Zone B, to 1396-1739 ppm in Zone C and (1299)1697-2482 ppm in Zone D. The paraffin-naphthene chromatograms indicate the presence of a medium gravity crude oil derived from a mature source rock. It is interesting to note that Zone C is "depleted" relative to Zones B and D. Hydrocarbon abundances and hydrocarbon to total extract ratios decrease across a transitional zone extending down to 2750± metres, but traces (168-305 ppm) were detected down to 2970± metres and insignificantly minor traces are suggested as deep as 3210± metres.

Combining these different sets of data, we derive the following picture:

- shows of mature, medium gravity crude oil throughout Zones B, C and D. The best shows are in Zone B and also in Zone D and could reflect the apparent sparsity of reservoir and microreservoir facies within Zone C.
- minor shows within Zone E¹, becoming weaker with depth.
- traces of oil down to 2950[±] metres and insignificantly minor traces as deep as 3210[±] metres. At these abundance levels, the hydrocarbons detected in the samples (particularly below 2950[±] metres) could easily have been introduced from the mud system.

It would appear that the same crude oil is present throughout. This crude was derived from mature parent source rocks and hence, is incompatible with its host sediments on-structure. However, some of the shales within Zones B and D contain a favourable type of organic matter which should, if buried to below at least 3300[±] metres, start to realise a significant proportion of its potential for oil.

F. CONCLUSIONS

Eight (8) zones are recognised between 1400 metres and 3822 metres (TD) in 33/5-1.

Zone A (1400-1640[±] metres) consists of light brownish grey and medium light grey shales and mudstones with minor limestones. The mudstones and limestones have relatively low values of (0.16) 0.29-0.48% and 0.21-0.23(0.33)% organic carbon respectively. However, the shales are slightly improved at 0.38-0.67(0.77)% organic carbon. Their organic matter is dominantly woody in type but significant proportions of algal debris are also present and indeed, in some of the limestones, is dominant. An atypical form of degraded amorphous kerogen is generally only a minor constituent but is occasionally (and particularly in the limestones) relatively abundant. These sediments are immature, but even in a mature state would only be poor source rocks with a negligible potential for hydrocarbons.

Zone B (1640-2040[±] metres) is composed of medium light grey shales and mudstones with, above 1780[±] metres, minor interbedded sands and argillaceous limestones. The Zone A pattern of leaner mudstones and "richer" shales continues into this interval. Thus, whilst the limestones approximate 0.2% organic carbon, the mudstones and shales generally contain 0.27-0.39% and 0.56-0.80% organic carbon respectively. Richer shales, with up to 1.15% organic carbon are however, also present. The organic

matter in the shales is variously amorphous (with significant proportions of wood) and woody (with significant amorphous[±] algal) in type. As in Zone A, the amorphous kerogen is an atypical, degraded form which is probably less oil-prone than the normal amorphous material. The mudstones, which become less abundant with depth, are poor source rocks but the shales are generally potentially fair sources for oil and gas with some interbeds which are classified as good. On-structure however, Zone B is immature above approximately 1920[±] metres, whilst below this depth it is transitional between the immature and marginally mature state and only minor hydrocarbon generation is occurring.

Zones C (2040-2220[±] metres) and D (2220-2560[±] metres) both consist of medium grey to medium light grey shales, although those of Zone D are occasionally silty and, particularly below 2320[±] metres, contain minor interbedded limestones. In both zones, the shales fall within the general range of 0.53-0.83(0.98)% organic carbon, but with occasional richer interbeds (up to 1.25%). However, their organic matter varies in character. Thus in Zone C wood is dominant and, although significant proportions of algae [±]inertinite (coaly) are present, amorphous kerogen is only minor to significant. In contrast, the organic matter in the Zone D shales is dominantly woody or amorphous with algal debris as a significant constituent. The amorphous fraction, again, is degraded and atypical. Medium grey mudstones are present within Zone D and these are richer than the shales at (0.84)1.08-1.31% organic carbon. Both zones are transitional between the immature and marginally mature states, resulting in only minor hydrocarbon generation on-structure but, in a mature state off-structure, the shales would generally be fair source rocks for oil and gas. Zone C contains some intervals with good source potential but surprisingly, none were detected in Zone D where indeed, some intervals are poor.

Shows of migrated crude oil were detected throughout Zones B, C and D, the best shows being in Zones B and D. The crude was derived from mature source rocks and hence could not have been generated from the associated shales on-structure. However, the mature off-structure lateral equivalents of the more "amorphous rich" shales within Zones B (and D) could have sourced the oil. This would necessitate burial to below at least 3300[±] metres followed by up-dip migration through the interbedded limestones and silts. These facies are apparently sparse or absent within Zone C which probably explains why the shows are weaker within this interval.

Minor shows of the same crude (becoming weaker with depth) extend down to 2700[±] metres whilst traces were detected to 2950[±] metres and insignificantly minor traces occur as deep as 3210[±] metres. However it is likely that, below 2950[±] metres and perhaps below

2700 $\pm$ metres, these traces were introduced from the mud system during the drilling of the well.

Zone E¹ (2560-2680 $\pm$ metres) like Zone D, is composed of medium grey to medium light grey shales with relatively minor interbedded silts and argillaceous limestones. The shales are comparable in richness with 0.66-0.73(0.84)% organic carbon but woody material is now very dominant, amorphous kerogen is essentially absent and even the algal and herbaceous fractions are only minor. Siltstones are relatively sparse but are not only richer at 0.87-1.19% organic carbon but also contain somewhat better quality organic matter (woody-algal with significant inertinite and amorphous). Due to the change in the character of the organic matter in the shales they are effectively immature, but even if mature, Zone E¹ would only be a poor source interval.

Minor "coals" are present within Zones E¹, E² and F². It is believed however that these are lignites which were added to the mud system and not indigenous to the section.

Zones E² (2680-3000 $\pm$ metres), F¹ (3000-3180 $\pm$ metres) and F² (3180-3822 $\pm$ metres) constitute a massive sand unit. Minor medium grey shales are present which contain 0.47-0.91% organic matter which is dominantly woody in type but these are dominantly, if not entirely, caved. Sparse, very lean (0.05-0.09% organic carbon) moderate reddish brown shales are present within Zone F². This entire interval effectively lacks source potential although shales, if present, would become mature below approximately 3300 $\pm$ metres.

No rich source rocks capable of generating major oil were detected within the analysed section but it would appear that the off-structure lateral equivalents of the shales from Zones B through D are starting to realise their potential for oil. A definitive oil to parent source rock correlation was not attempted as part of this study.

The distribution of the oil shows suggests that migration was dominantly lateral and that effective source rocks are not in contact with the massive sand reservoir of Zones E² through F². It is assumed of course, that these sands were not "flushed" in drilling.

TABLE 1A

CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C ₁ Methane	C ₂ Ethane	C ₃ Propane	iC ₄ Isobutane	nC ₄ Butane	TOTAL C ₁ - C ₄	TOTAL C ₂ - C ₄	% GAS WETNESS	TOTAL C ₅ - C ₇	$\frac{iC_4}{nC_4}$
377-001	1400-420m	261	3	1	0	0	264	4	1.4	0	0.00
377-002	1420-440	3253	31	1	0	0	3285	32	1.0	4	0.54
377-003	1440-460	7200	57	2	0	0	7259	60	0.8	5	0.59
377-004	1460-480	151	1	0	0	0	152	1	0.9	2	0.00
377-005	1480-500	4105	29	1	0	1	4136	31	0.8	6	0.89
377-006	1500-520	13072	91	6	2	2	13173	101	0.8	21	0.91
377-007	1520-540	590	9	1	0	0	599	9	1.6	12	0.00
377-008	1540-560	2179	44	3	1	1	2227	48	2.2	22	0.92
377-009	1560-580	5541	84	3	1	1	5629	88	1.6	60	0.86
377-010	1580-600	7951	96	2	0	0	8049	98	1.2	14	0.84
377-011	1600-620	1845	15	5	0	0	1865	20	1.1	13	0.90
377-012	1620-640	4019	42	3	2	2	4068	49	1.2	5	0.99
377-013	1640-660	9831	232	158	88	152	10461	629	6.0	474	0.58
377-014	1660-680	6148	337	398	153	269	7306	1157	15.8	465	0.57
377-015	1680-700	3031	138	239	150	318	3876	845	21.8	1136	0.47
377-016	1700-720	6754	449	825	409	853	9291	2536	27.3	2638	0.48
377-017	1720-740	1427	125	214	91	177	2035	608	29.9	370	0.51
377-018	1740-760	4995	976	1560	625	1106	9261	4266	46.1	2228	0.57
377-019	1760-780	6794	1123	2229	971	1885	13002	6208	47.7	6089	0.52
377-020	1780-800	7541	871	1321	478	869	11080	3539	31.9	2440	0.55
377-021	1800-820	9211	815	1271	504	937	12737	3527	27.7	2878	0.54
377-022	1820-840	5972	674	1130	490	859	9126	3153	34.6	2458	0.57
377-023	1840-860	7899	1248	1828	672	1177	12823	4924	38.4	3034	0.57
377-024	1860-880	9015	1547	2384	903	1638	15486	6472	41.8	5020	0.55
377-025	1880-900	8718	1655	2584	1023	1800	15780	7062	44.8	5471	0.57
377-026	1900-920	6593	1408	2409	938	1669	13018	6424	49.3	4929	0.56
377-027	1920-940	9515	2021	3129	1074	1929	17668	8153	46.1	5111	0.56
377-028	1940-960	10368	1809	2285	790	1275	16527	6159	37.3	2529	0.62
377-029	1960-980	9946	1374	1958	782	1309	15369	5423	35.3	3682	0.60
377-030	1980-2000	8763	1202	1811	775	1267	13818	5055	36.6	3382	0.61

TABLE 1A

CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C ₁ Methane	C ₂ Ethane	C ₃ Propane	iC ₄ Isobutane	nC ₄ Butane	TOTAL C ₁ - C ₄	TOTAL C ₂ - C ₄	% GAS WETNESS	TOTAL C ₅ - C ₇	$\frac{iC_4}{nC_4}$
377-031	2000-020	11170	1523	2199	876	1604	17372	6202	35.7	2922	0.55
377-032	2020-040	7452	1240	1599	557	989	11837	4384	37.0	1897	0.56
377-033	2040-060	3702	638	898	342	548	6128	2426	39.6	1212	0.62
377-034	2060-080	3588	601	863	343	562	5957	2369	39.8	1186	0.61
377-035	2080-100	2174	486	742	277	464	4143	1969	47.5	1161	0.60
377-036	2100-120	1812	377	513	191	331	3224	1412	43.8	915	0.58
377-037	2120-140	1784	390	560	204	371	3309	1525	46.1	1561	0.55
377-038	2140-160	910	184	222	71	121	1508	598	39.7	265	0.59
377-039	2160-180	5615	1161	1462	489	849	9575	3961	41.4	1637	0.58
377-040	2180-200	1607	326	150	76	145	2304	697	30.3	342	0.52
377-041	2200-220	1961	434	512	156	266	3329	1368	41.1	503	0.59
377-042	2220-240	1496	330	394	114	193	2528	1032	40.8	472	0.59
377-043	2240-260	6132	1340	2039	740	1381	11632	5500	47.3	4305	0.54
377-044	2260-280	2899	568	750	239	515	4971	2072	41.7	1064	0.46
377-045	2280-300	5475	1387	1801	517	1007	10187	4712	46.3	2439	0.51
377-046	2300-320	4333	1142	1519	461	838	8293	3961	47.8	2393	0.55
377-047	2320-340	3391	630	830	278	512	5641	2251	39.9	1669	0.54
377-048	2340-360	4078	774	1057	347	665	6921	2843	41.1	3160	0.52
377-049	2360-380	584	109	232	62	95	1082	498	46.0	761	0.66
377-050	2380-400	2539	467	541	176	318	4040	1502	37.2	1195	0.55
377-051	2400-420	4360	724	835	276	492	6686	2326	34.8	1270	0.56
377-052	2420-440	3440	679	850	270	470	5708	2269	39.7	942	0.57
377-053	2440-460	4922	741	823	234	459	7180	2257	31.4	884	0.51
377-054	2460-480	3162	617	765	232	416	5192	2030	39.1	895	0.56
377-055	2480-500	4106	648	686	205	356	6001	1895	31.6	1125	0.58
377-056	2500-520	5874	1063	977	265	464	8643	2769	32.0	1578	0.57
377-057	2520-540	680	104	105	30	52	972	292	30.0	91	0.59
377-058	2540-560	3502	472	454	127	226	4781	1279	26.8	543	0.56
377-059	2560-580	4070	540	497	133	235	5474	1404	25.6	454	0.57
377-060	2580-600	2585	353	358	99	187	3583	998	27.9	473	0.53

TABLE 1A

CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C ₁ Methane	C ₂ Ethane	C ₃ Propane	iC ₄ Isobutane	nC ₄ Butane	TOTAL C ₁ - C ₄	TOTAL C ₂ - C ₄	% GAS WETNESS	TOTAL C ₅ - C ₇	$\frac{iC_4}{nC_4}$
377-061	2600-620	1126	268	288	77	138	1897	771	40.6	316	0.56
377-062	2620-640	1300	321	322	75	134	2153	853	39.6	256	0.56
377-063	2640-660	1300	412	364	90	166	2333	1033	44.3	593	0.54
377-064	2660-680	1948	404	514	142	288	3297	1348	40.9	2365	0.49
377-065	2680-700	475	74	108	38	71	765	290	37.9	402	0.53
377-066	2700-720	469	78	107	42	76	771	302	39.2	403	0.55
377-067	2720-740	551	70	81	27	54	783	232	29.6	710	0.50
377-068	2740-760	831	72	71	24	47	1044	214	20.5	534	0.50
377-069	2760-780	783	42	44	16	32	917	134	14.6	313	0.51
377-070	2780-800	480	35	47	24	41	626	146	23.4	515	0.58
377-071	2800-820	209	22	20	12	19	283	73	25.9	317	0.63
377-072	2820-840	468	42	42	27	41	620	152	24.5	585	0.65
377-073	2840-860	362	39	45	30	44	520	159	30.5	523	0.69
377-074	2860-880	255	34	41	32	48	411	156	37.9	477	0.68
377-075	2880-900	270	43	44	23	34	414	144	34.8	310	0.68
377-076	2900-920	345	38	44	29	42	498	153	30.7	282	0.69
377-077	2920-940	389	43	46	36	50	564	175	31.1	292	0.72
377-078	2940-960	1013	99	96	64	104	1375	362	26.3	396	0.62
377-079	2960-980	439	24	22	10	20	516	77	14.9	480	0.50
377-080	2980-3000	397	14	8	2	5	427	30	7.0	457	0.41
377-081	3000-020	175	17	12	2	5	210	36	17.0	153	0.37
377-082	3020-040	111	5	4	1	2	124	12	9.8	118	0.33
377-083	3040-060	306	16	6	1	1	330	24	7.2	504	0.71
377-084	3060-080	263	25	20	10	13	331	68	20.6	269	0.76
377-085	3080-100	60	6	5	1	4	76	17	21.7	117	0.32
377-086	3100-120	41	3	2	0	1	47	6	12.6	46	0.28
377-087	3120-140	47	2	2	0	0	51	4	8.4	25	0.31
377-088	3140-160	43	1	0	0	0	44	1	2.9	36	0.37
377-089	3160-180	172	17	16	1	3	209	37	17.9	170	0.36
377-090	3108-200	259	5	3	0	1	269	9	3.5	179	0.29

TABLE 1A

CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C ₁ Methane	C ₂ Ethane	C ₃ Propane	iC ₄ Isobutane	nC ₄ Butane	TOTAL C ₁ - C ₄	TOTAL C ₂ - C ₄	% GAS WETNESS	TOTAL C ₅ - C ₇	$\frac{iC_4}{nC_4}$
377-091	3200-220	348	8	5	1	3	365	17	4.7	449	0.38
377-092	3220-240	282	9	7	1	5	305	23	7.4	423	0.26
377-093	3240-260	218	9	7	1	3	237	20	8.2	411	0.32
377-094	3260-280	175	5	5	1	2	188	13	7.1	658	0.38
377-095	3280-300	335	11	5	1	3	355	20	5.6	773	0.21
377-096	3300-320	165	14	5	1	4	189	24	12.7	465	0.22
377-097	3320-340	241	7	4	1	3	256	15	5.9	580	0.33
377-098	3340-360	206	14	6	1	3	230	24	10.4	229	0.22
377-099	3360-380	124	5	3	0	1	134	9	7.0	204	0.24
377-100	3380-400	184	5	3	1	2	193	10	5.0	283	0.39
377-101	3400-420	144	3	2	0	1	150	6	4.0	447	0.31
377-102	3420-440	150	7	6	0	1	163	14	8.3	446	0.24
377-103	3440-460	205	6	3	0	1	215	10	4.9	304	0.42
377-104	3460-480	153	3	1	0	0	157	4	2.6	385	0.26
377-105	3480-500	231	4	0	0	0	235	4	1.8	274	0.45
377-106	3500-520	132	1	0	0	0	133	2	1.2	241	0.00
377-107	3520-540	107	2	0	0	0	109	2	1.9	294	0.00
377-108	3540-560	183	11	5	0	1	199	16	8.1	78	0.80
377-109	3560-580	103	1	0	0	0	105	2	1.5	221	0.00
377-110	3580-600	84	0	0	0	0	85	0	0.5	336	0.00
377-111	3600-620	8	1	0	0	0	9	1	13.4	29	0.00
377-112	3620-640	24	1	0	0	0	25	1	3.9	63	0.00
377-113	3640-660	65	1	1	0	0	66	1	2.0	106	0.00
377-114	3660-680	84	2	1	0	0	88	4	4.5	100	0.38
377-115	3680-700	184	5	2	0	1	191	7	3.9	183	0.35
377-116	3700-720	143	27	4	1	2	178	34	19.4	119	0.37
377-117	3720-740	111	11	8	0	1	131	20	15.0	73	0.34
377-118	3740-760	224	8	2	0	0	236	11	4.8	102	0.39
377-119	3760-780	91	1	1	0	1	94	3	3.3	92	0.43
377-120	3780-800	49	1	1	0	1	53	3	6.1	50	0.50
377-121	3800-822	67	2	2	1	1	73	6	8.0	73	0.46

TABLE 1B
CONCENTRATION (VOL. PPM OF 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	$\frac{iC_4}{nC_4}$
377-001	1400-420m	285	5	2	0	0	292	7	2.4	25	0.00
377-002	1420-440	3943	37	6	3	5	3994	51	1.3	78	0.60
377-003	1440-460	1489	22	5	2	3	1522	33	2.1	62	0.57
377-004	1460-480	744	8	2	0	0	755	10	1.3	46	0.00
377-005	1480-500	1434	15	1	2	5	1456	23	1.5	25	0.32
377-006	1500-520	487	16	11	3	4	521	34	6.5	13	0.81
377-007	1520-540	409	20	11	6	6	452	43	9.6	153	0.98
377-008	1540-560	172	23	16	2	2	215	43	20.2	48	0.77
377-009	1560-580	331	28	13	2	4	377	47	12.3	52	0.65
377-010	1580-600	3171	65	5	2	3	3247	76	2.3	68	0.78
377-011	1600-620	818	15	2	1	1	837	19	2.3	24	0.90
377-012	1620-640	1002	13	5	1	1	1022	21	2.0	76	1.08
377-013	1640-660	671	50	56	29	39	845	174	20.6	450	0.74
377-014	1660-680	1608	171	371	290	538	2979	1370	46.0	1629	0.54
377-015	1680-700	469	66	108	103	220	966	497	51.5	2488	0.47
377-016	1700-720	441	93	242	214	414	1404	962	68.6	2947	0.52
377-017	1720-740	377	705	388	248	460	2178	1801	82.7	4251	0.54
377-018	1740-760	2811	652	2013	1368	2320	9164	6353	69.3	6234	0.59
377-019	1760-780	648	185	816	831	1454	3934	3286	83.5	6147	0.57
377-020	1780-800	708	174	426	306	517	2131	1423	66.8	2244	0.59
377-021	1800-820	933	221	701	637	1080	3571	2639	73.9	4000	0.59
377-022	1820-840	694	191	603	555	915	2958	2264	76.5	3415	0.61
377-023	1840-860	933	351	1134	847	1382	4647	3714	79.9	4586	0.61
377-024	1860-880	397	146	483	440	751	2218	1821	82.1	2537	0.59
377-025	1880-900	423	202	762	700	1226	3313	2889	87.2	4781	0.57
377-026	1900-920	351	202	850	839	1458	3699	3349	90.5	6342	0.58
377-027	1920-940	218	86	378	363	700	1745	1526	87.5	2980	0.52
377-028	1940-960	1759	525	1498	1032	1957	6771	5012	74.0	6868	0.53
377-029	1960-980	959	321	1048	792	1435	4554	3595	78.9	5419	0.55
377-030	1980-2000	840	238	883	634	1131	3725	2885	77.5	4271	0.56

TABLE 1B
CONCENTRATION (VOL. PPM OF 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	$\frac{iC_4}{nC_4}$
377-031	2000-020	1012	253	874	794	1362	4294	3282	76.4	5072	0.58
377-032	2020-040	1099	263	697	485	874	3418	2319	67.8	2517	0.56
377-033	2040-060	734	239	842	666	1209	3691	2956	80.1	3207	0.55
377-034	2060-080	1031	302	997	738	1330	4398	3367	76.6	4196	0.56
377-035	2080-100	409	154	506	365	689	2123	1714	80.8	2029	0.53
377-036	2100-120	370	134	394	268	523	1688	1319	78.1	1624	0.51
377-037	2120-140	331	126	460	358	700	1975	1645	83.3	2167	0.51
377-038	2140-160	375	134	387	247	492	1636	1261	77.1	1403	0.50
377-039	2160-180	102	36	101	69	143	451	349	77.3	582	0.48
377-040	2180-200	637	241	548	305	600	2332	1694	72.7	549	0.51
377-041	2200-220	399	111	310	182	371	1373	974	70.9	1070	0.49
377-042	2220-240	913	414	1170	740	1400	4637	3724	80.3	4129	0.53
377-043	2240-260	1038	646	1949	1018	2069	6720	5683	84.6	8344	0.49
377-044	2260-280	422	219	965	738	1437	3781	3359	88.8	3953	0.51
377-045	2280-300	957	436	1257	779	1469	4898	3941	80.5	5850	0.53
377-046	2300-320	929	445	1195	709	1328	4606	3677	79.8	5218	0.53
377-047	2320-340	878	288	710	523	999	3398	2519	74.1	6337	0.52
377-048	2340-360	867	293	737	540	1015	3452	2585	74.9	5423	0.53
377-049	2360-380	1852	395	725	499	919	4390	2538	57.8	4743	0.54
377-050	2380-400	2252	671	1376	748	1309	6356	4104	64.6	4743	0.57
377-051	2400-420	1988	629	1307	894	1469	6286	4298	68.4	5297	0.61
377-052	2420-440	1160	436	1001	678	1141	4417	3257	73.7	4269	0.59
377-053	2440-460	1599	460	1048	678	1242	5027	3428	68.2	3953	0.55
377-054	2460-480	1120	431	1128	700	1154	4532	3412	75.3	3367	0.61
377-055	2480-500	1458	512	1031	567	960	4529	3071	67.8	2846	0.59
377-056	2500-520	2337	969	1744	740	1123	6913	4576	66.2	2751	0.66
377-057	2520-540	1481	526	1158	607	953	4724	3244	68.7	2428	0.64
377-058	2540-560	1689	521	991	484	784	4469	2780	62.2	2293	0.62
377-059	2560-580	1374	405	737	586	1087	4188	2815	67.2	791	0.54
377-060	2580-600	968	317	621	320	547	2773	1805	65.1	1478	0.59

TABLE 1B
CONCENTRATION (VOL. PPM OF 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	$\frac{iC_4}{nC_4}$
377-061	2600-620	602	302	584	319	522	2330	1728	74.1	1508	0.61
377-062	2620-640	602	205	372	164	304	1648	1045	63.4	833	0.54
377-063	2640-660	648	500	902	443	719	3211	2564	79.8	1905	0.62
377-064	2660-680	293	143	276	114	199	1024	732	71.4	794	0.57
377-065	2680-700	372	74	196	167	270	1077	706	65.5	1270	0.62
377-066	2700-720	332	76	126	76	116	727	395	54.3	754	0.66
377-067	2720-740	208	62	105	60	100	535	327	61.1	793	0.60
377-068	2740-760	383	55	89	54	89	669	286	42.8	830	0.60
377-069	2760-780	552	67	102	63	101	885	333	37.7	794	0.62
377-070	2780-800	225	50	71	55	90	491	265	54.1	1190	0.61
377-071	2800-820	743	64	81	63	93	1045	302	28.9	1037	0.68
377-072	2820-840	439	86	99	71	98	793	354	44.6	1144	0.73
377-073	2840-860	248	62	75	62	80	527	279	53.0	713	0.78
377-074	2860-880	276	69	107	126	171	749	473	63.2	1292	0.74
377-075	2880-900	372	81	89	43	63	647	276	42.6	648	0.68
377-076	2900-920	343	79	119	58	107	706	363	51.4	632	0.55
377-077	2920-940	304	74	102	101	131	713	409	57.3	928	0.77
377-078	2940-960	858	75	142	143	249	1467	609	41.5	1577	0.57
377-079	2960-980	466	61	63	33	58	682	215	31.6	741	0.57
377-080	2980-3000	504	31	32	12	31	610	107	17.5	1587	0.39
377-081	3000-020	80	9	11	4	12	115	35	30.6	305	0.33
377-082	3020-040	53	12	10	2	7	85	31	37.1	149	0.36
377-083	3040-060	144	8	3	1	4	161	17	10.5	379	0.26
377-084	3060-080	187	5	3	1	4	200	13	6.4	459	0.30
377-085	3080-100	142	6	4	1	4	157	15	9.3	277	0.30
377-086	3100-120	72	4	1	1	2	79	7	9.1	95	0.33
377-087	3120-140	110	17	31	6	16	180	70	39.1	47	0.36
377-088	3140-160	133	18	16	2	5	174	41	23.5	461	0.41
377-089	3160-180	113	31	34	0	1	179	66	36.8	518	0.34
377-090	3108-200	108	25	27	0	0	161	52	32.5	1005	0.00

TABLE 1B
CONCENTRATION (VOL. PPM OF 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	$\frac{iC_4}{nC_4}$
377-091	3200-220	264	57	27	1	2	351	88	24.9	822	0.28
377-092	3220-240	319	19	11	1	5	355	36	10.1	1461	0.30
377-093	3240-260	236	13	10	3	7	268	32	12.0	1279	0.37
377-094	3260-280	181	6	5	0	1	192	12	6.1	895	0.30
377-095	3280-300	142	9	3	0	1	154	13	8.2	924	0.22
377-096	3300-320	201	29	16	2	4	252	51	20.2	671	0.39
377-097	3320-340	104	5	4	1	4	118	14	11.7	274	0.30
377-098	3340-360	111	3	2	0	0	117	6	4.8	116	0.30
377-099	3360-380	153	19	16	1	6	195	43	21.8	457	0.24
377-100	3380-400	86	13	8	1	2	110	24	21.5	462	0.28
377-101	3400-420	83	9	4	0	1	98	15	14.9	634	0.36
377-102	3420-440	153	14	5	1	4	176	23	13.2	903	0.28
377-103	3440-460	229	10	6	2	5	252	23	9.0	918	0.36
377-104	3460-480	160	3	2	0	1	166	6	3.6	731	0.26
377-105	3480-500	187	4	1	0	0	193	5	2.8	365	0.00
377-106	3500-520	222	2	1	0	0	225	3	1.3	359	0.00
377-107	3520-540	208	4	1	0	0	214	5	2.5	228	0.00
377-108	3540-560	194	3	1	0	0	199	4	2.1	293	0.00
377-109	3560-580	139	3	1	0	0	143	4	2.5	731	0.00
377-110	3580-600	104	1	0	0	0	105	1	1.1	594	0.00
377-111	3600-620	105	9	8	3	7	131	26	20.2	305	0.37
377-112	3620-640	83	10	8	0	1	102	19	18.4	225	0.23
377-113	3640-660	159	6	2	0	0	168	9	5.3	604	0.00
377-114	3660-680	72	1	0	0	0	74	2	2.3	339	0.00
377-115	3680-700	145	7	2	0	0	154	9	6.1	544	0.00
377-116	3700-720	45	6	4	1	3	59	14	24.1	515	0.37
377-117	3720-740	116	4	4	2	4	129	13	10.4	842	0.45
377-118	3740-760	159	6	2	1	3	171	12	7.0	509	0.50
377-119	3760-780	130	1	0	0	0	132	2	1.3	316	0.00
377-120	3780-800	137	4	3	3	8	155	18	11.6	508	0.41
377-121	3800-822	217	10	6	2	5	239	23	9.4	533	0.49

TABLE 1C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
377-001	1400-420m	546	7	3	0	0	556	11	1.9	25	0.00
377-002	1420-440	7196	67	7	3	5	7279	83	1.1	82	0.60
377-003	1440-460	8689	79	7	2	4	8781	92	1.1	68	0.57
377-004	1460-480	895	9	2	0	0	907	11	1.3	48	0.00
377-005	1480-500	5538	44	3	2	5	5592	54	1.0	31	0.38
377-006	1500-520	13559	107	17	5	6	13694	135	1.0	34	0.85
377-007	1520-540	999	29	12	6	6	1051	53	5.0	165	0.98
377-008	1540-560	2351	67	19	3	3	2443	92	3.8	71	0.81
377-009	1560-580	5872	112	16	3	4	6006	135	2.2	113	0.68
377-010	1580-600	11122	161	7	3	4	11296	174	1.5	81	0.78
377-011	1600-620	2663	30	7	1	1	2703	40	1.5	38	0.90
377-012	1620-640	5021	56	7	3	3	5091	70	1.4	81	1.02
377-013	1640-660	10502	282	214	117	191	11306	803	7.1	924	0.61
377-014	1660-680	7757	508	770	443	806	10284	2528	24.6	2094	0.55
377-015	1680-700	3500	204	347	253	539	4842	1342	27.7	3624	0.47
377-016	1700-720	7195	542	1067	623	1267	10694	3499	32.7	5585	0.49
377-017	1720-740	1804	830	602	339	637	4213	2409	57.2	4621	0.53
377-018	1740-760	7805	1628	3572	1993	3426	18425	10619	57.6	8462	0.58
377-019	1760-780	7443	1308	3045	1802	3339	16936	9494	56.1	12236	0.54
377-020	1780-800	8249	1045	1747	784	1386	13211	4962	37.6	4684	0.57
377-021	1800-820	10143	1036	1973	1140	2017	16309	6166	37.8	6878	0.57
377-022	1820-840	6667	865	1733	1044	1775	12084	5417	44.8	5873	0.59
377-023	1840-860	8831	1599	2962	1519	2558	17470	8638	49.4	7619	0.59
377-024	1860-880	9412	1693	2867	1344	2390	17705	8293	46.8	7557	0.56
377-025	1880-900	9141	1857	3346	1723	3026	19092	9951	52.1	10251	0.57
377-026	1900-920	6944	1610	3259	1777	3127	16717	9773	58.5	11271	0.57
377-027	1920-940	9733	2106	3506	1437	2629	19412	9679	49.9	8091	0.55
377-028	1940-960	12128	2334	3784	1821	3232	23298	11171	47.9	9397	0.56
377-029	1960-980	10905	1695	3006	1573	2744	19923	9018	45.3	9101	0.57
377-030	1980-2000	9603	1440	2695	1408	2398	17543	7940	45.3	7653	0.59

TABLE 1C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
377-031	2000-020	12182	1775	3073	1670	2966	21666	9484	43.8	7994	0.56
377-032	2020-040	8551	1503	2296	1042	1862	15255	6703	43.9	4415	0.56
377-033	2040-060	4437	877	1740	1008	1758	9819	5382	54.8	4418	0.57
377-034	2060-080	4619	903	1860	1081	1892	10355	5736	55.4	5382	0.57
377-035	2080-100	2582	640	1248	642	1153	6266	3684	58.8	3189	0.56
377-036	2100-120	2181	512	907	459	854	4912	2731	55.6	2540	0.54
377-037	2120-140	2115	516	1020	562	1072	5285	3170	60.0	3728	0.52
377-038	2140-160	1285	319	609	319	613	3144	1859	59.1	1668	0.52
377-039	2160-180	5717	1197	1563	557	992	10026	4309	43.0	2219	0.56
377-040	2180-200	2244	567	698	381	746	4636	2392	51.6	891	0.51
377-041	2200-220	2360	545	822	338	637	4702	2342	49.8	1573	0.53
377-042	2220-240	2409	744	1564	855	1593	7165	4756	66.4	4600	0.54
377-043	2240-260	7170	1986	3987	1758	3450	18352	11183	60.9	12649	0.51
377-044	2260-280	3322	787	1715	977	1952	8752	5430	62.0	5017	0.50
377-045	2280-300	6433	1823	3058	1296	2476	15085	8653	57.4	8289	0.52
377-046	2300-320	5262	1587	2714	1171	2166	12900	7638	59.2	7611	0.54
377-047	2320-340	4269	918	1540	801	1511	9039	4770	52.8	8006	0.53
377-048	2340-360	4945	1067	1793	887	1680	10372	5427	52.3	8583	0.53
377-049	2360-380	2436	504	957	562	1014	5472	3036	55.5	5505	0.55
377-050	2380-400	4791	1138	1917	924	1627	10397	5606	53.9	5938	0.57
377-051	2400-420	6348	1352	2141	1170	1961	12972	6625	51.1	6567	0.60
377-052	2420-440	4599	1114	1852	948	1611	10125	5525	54.6	5211	0.59
377-053	2440-460	6521	1201	1871	912	1701	12207	5685	46.6	4837	0.54
377-054	2460-480	4283	1048	1892	932	1570	9725	5442	56.0	4262	0.59
377-055	2480-500	5565	1160	1717	772	1316	10530	4965	47.2	3971	0.59
377-056	2500-520	8211	2032	2721	1005	1587	15556	7345	47.2	4329	0.63
377-057	2520-540	2161	631	1263	637	1004	5697	3535	62.1	2519	0.63
377-058	2540-560	5191	993	1445	611	1010	9250	4059	43.9	2836	0.60
377-059	2560-580	5444	945	1233	719	1322	9663	4219	43.7	1245	0.54
377-060	2580-600	3553	670	979	419	734	6356	2803	44.1	1951	0.57

TABLE 1C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
377-061	2600-620	1729	570	872	396	661	4227	2499	59.1	1824	0.60
377-062	2620-640	1903	526	694	240	438	3801	1898	49.9	1090	0.55
377-063	2640-660	1947	912	1266	533	885	5544	3597	64.9	2498	0.60
377-064	2660-680	2241	547	790	256	487	4321	2080	48.1	3158	0.53
377-065	2680-700	846	148	303	204	340	1842	996	54.1	1672	0.60
377-066	2700-720	801	154	234	118	191	1498	697	46.5	1157	0.61
377-067	2720-740	759	132	186	87	154	1318	559	42.4	1503	0.56
377-068	2740-760	1214	127	160	77	136	1713	500	29.2	1364	0.57
377-069	2760-780	1334	108	146	80	133	1802	468	25.9	1107	0.60
377-070	2780-800	705	85	118	78	130	1117	412	36.9	1704	0.60
377-071	2800-820	953	86	102	75	112	1328	375	28.2	1355	0.67
377-072	2820-840	907	128	141	98	139	1413	506	35.8	1729	0.71
377-073	2840-860	610	101	121	92	123	1047	437	41.8	1236	0.75
377-074	2860-880	531	103	148	159	219	1160	629	54.2	1769	0.73
377-075	2880-900	642	124	133	66	97	1061	420	39.5	958	0.68
377-076	2900-920	689	117	163	87	148	1204	515	42.8	914	0.59
377-077	2920-940	693	117	148	137	182	1277	584	45.7	1220	0.75
377-078	2940-960	1871	174	238	207	352	2842	971	34.2	1973	0.59
377-079	2960-980	906	85	85	43	78	1198	292	24.4	1221	0.55
377-080	2980-3000	901	45	41	14	36	1037	136	13.1	2044	0.39
377-081	3000-020	254	26	23	6	16	325	71	21.8	458	0.34
377-082	3020-040	165	17	14	3	9	208	43	20.9	267	0.35
377-083	3040-060	450	24	9	2	5	491	41	8.3	884	0.38
377-084	3060-080	450	30	23	11	17	530	81	15.3	728	0.66
377-085	3080-100	202	12	9	3	8	233	31	13.4	395	0.31
377-086	3100-120	113	6	4	1	2	126	13	10.4	141	0.32
377-087	3120-140	157	19	33	6	17	232	75	32.3	71	0.36
377-088	3140-160	176	19	16	2	5	218	42	19.4	497	0.41
377-089	3160-180	285	48	49	2	5	388	103	26.6	688	0.36
377-090	3108-200	368	30	30	0	1	429	62	14.4	1184	0.29

TABLE 1C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
377-091	3200-220	611	65	33	2	5	716	105	14.6	1271	0.33
377-092	3220-240	602	28	18	3	10	660	59	8.9	1885	0.28
377-093	3240-260	454	21	16	4	11	505	52	10.2	1689	0.36
377-094	3260-280	356	11	9	1	3	381	25	6.6	1553	0.36
377-095	3280-300	477	19	8	1	4	509	32	6.4	1697	0.22
377-096	3300-320	366	43	21	3	8	441	75	17.0	1136	0.31
377-097	3320-340	345	12	8	2	6	374	29	7.7	854	0.31
377-098	3340-360	317	17	8	1	3	346	29	8.5	345	0.24
377-099	3360-380	277	24	19	2	7	329	52	15.8	661	0.24
377-100	3380-400	270	17	11	1	4	303	33	11.0	745	0.32
377-101	3400-420	227	12	6	1	2	248	21	8.3	1081	0.34
377-102	3420-440	302	21	10	1	5	339	37	10.8	1350	0.27
377-103	3440-460	434	16	9	2	5	467	33	7.1	1221	0.37
377-104	3460-480	312	6	3	0	1	323	10	3.1	1116	0.26
377-105	3480-500	418	8	1	0	0	428	10	2.2	639	1.11
377-106	3500-520	354	3	1	0	0	358	4	1.2	600	0.00
377-107	3520-540	315	6	2	0	0	323	7	2.3	522	0.00
377-108	3540-560	378	14	6	0	1	398	20	5.1	371	0.80
377-109	3560-580	242	4	1	0	0	247	5	2.1	952	0.00
377-110	3580-600	188	1	0	0	0	190	2	0.8	930	0.00
377-111	3600-620	113	10	8	3	7	140	28	19.7	334	0.37
377-112	3620-640	107	11	8	0	1	127	20	15.6	289	0.23
377-113	3640-660	224	7	3	0	0	234	10	4.3	710	0.00
377-114	3660-680	156	3	2	0	0	162	6	3.5	439	0.38
377-115	3680-700	328	12	4	0	1	345	17	4.9	728	0.35
377-116	3700-720	188	33	8	2	5	237	49	20.5	634	0.37
377-117	3720-740	227	15	12	2	4	260	33	12.7	915	0.43
377-118	3740-760	383	15	4	1	3	406	23	5.7	611	0.49
377-119	3760-780	221	3	1	0	1	226	5	2.1	408	0.43
377-120	3780-800	187	5	4	4	9	208	21	10.2	559	0.42
377-121	3800-822	284	12	8	3	6	312	28	9.1	606	0.48

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-001	1400-420m	A 95% Mudstone, grading to soft shale, blocky, soft, non calcareous, occasionally silty, light grey to light brownish grey, minor fossils	N7-5YR6/1	0.42
		B 5% Limestone, blocky, hard, very fine grained with thinly interbedded shales, very light grey to greenish grey, no fluorescence Minor free pyrites	N8-5G6/1	0.33
377-002	1420-440m	A 85% Shale, platy, brittle, soft, non calcareous, occasionally pyritic and rare fossils, light brownish grey to brownish grey	5YR6/1- 5Y4/1	0.37,0.39
		B 15% Mudstone, as 377-001A, and pyrite	N7-5YR6/1	0.30
		C Minor limestone, as 377-001B Minor igneous, free pyrites, other mudstone	N8-5G6/1	
377-003	1440-460m	A 90% Shale, platy, brittle, soft, non calcareous, pyritic, light brownish grey to olive grey	5YR6/1- 5Y4/1	0.77
		B 10% Mudstone, as 377-001A Minor limestone	N7-5YR6/1	0.48
377-004	1460-480m	A 95% Shale, as 377-003A	5YR6/1- 5Y4/1	0.47
		B 5% Limestone, as 377-001B, no fluorescence Minor mudstone, pyrites, other shale	N8-5G6/1	0.16,0.16
377-005	1480-500m	A 80% Shale, as 377-003A, minor cavings	5YR6/1- 5Y4/1	0.52
		B 20% Mudstone, as 377-001A, abundant cavings Minor limestone, pyrites, igneous, other shale	N7-5YR6/1	0.45
377-006	1500-520m	A 85% Shale, as 377-003A, pyritic	5YR6/1- 5Y4/1	0.55
		B 10% Mudstone, as 377-001A, abundant cavings	N7-5YR6/1	0.29
		C 5% Limestone, blocky, hard, argillaceous, fossiliferous, patchy yellow fluorescence, light grey to greenish grey Free pyrite, other mudstone	N7-5G6/1	0.23,0.23

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-007	1520-540m	A 70% Shale, platy, brittle, soft, non calcareous, pyritic, minor cavings, light brownish grey to olive grey	5YR6/1- 5Y4/1	0.73
		B 30% Mudstone, blocky, soft, non cal- careous, pyritic, abundant cavings, light grey to light brownish grey Minor limestone free pyrite	N7-5YR6/1	0.37
377-008	1540-560m	A 60% Lost circulation material - cement, metal		
		B 30% Shale, soft, blocky, silty in parts, non calcareous, medium grey to olive grey	N5-N4	0.39
		C 5% Shale, blocky, hard, silty, cal- careous, medium dark grey	N4	0.01
		D 5% Free quartz, conchoidal fracture, coarse grains		
		E Minor limestone, blocky, soft, chalky, rare fossils, white	N9	
377-009	1560-580m	A 75% Shale, blocky, soft, brittle, non calcareous, silty in parts, occasionally pyritic, medium grey to medium light grey	N5-N6	0.64,0.67
		B 20% Lost circulation material - cement, metal, paint		
		C 3% Limestone, as 377-008E	N9	
		D 2% Calcite, crystalline, reddish- pink Minor other shale, free pyrite		
377-010	1580-600m	A 85% Shale, blocky, soft to hard, brittle, non calcareous, silty and pyritic in parts, minor cavings, medium light grey	N6	0.56
		B 15% Lost circulation material - cement, metal, paint Minor pyrite, other shale		
377-011	1600-620m	A Shale, as 377-010A	N6	0.51
		B 10% Limestone, argillaceous, blocky, hard, calcite veins, greenish grey	5G6/1	0.21

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-011	1600-620m	C 5% Pyrite, framboidal and cubic D 5% Lost circulation material, cement, metal Minor other shale		
377-012	1620-640m	A 80% Shale, blocky, soft to hard, brittle, non calcareous, silty and pyritic in parts, medium light grey B 10% Argillaceous limestone, blocky, hard, rare pyrite fragments, patchy blue/yellow fluorescence, greenish grey to light grey, iron stained C 5% Lost circulation material - metal, paint D 5% Free pyrite	N6 5G6/1-N7	0.74
377-013	1640-660m	A 65% Shale, as 377-012A B 10% Shale, blocky, soft, silty, calcareous, medium light grey C 10% Limestone, argillaceous, as 377-012B, patchy yellow fluor- escence D 10% Sand, unconsolidated, very fine to fine grained, subrounded, colourless to white E 5% Pyrites, framboidal, and cubic F 5% Lost circulation material - metal turnings Minor other shale	N6 N6 5G6/1-N7 N9	0.56, 0.56 0.23 0.24
377-014	1660-680m	A 80% Shale, as 377-012A, minor cavings B 10% Argillaceous limestone, as 377-012B, blue/yellow fluorescence C 10% Lost circulation material, metal D Pyrite, minor Minor other shale	N6 5G6/1-N7	0.38
377-015	1680-700m	A 65% Shale, as 377-012A B 10% Mudstone, blocky, soft, rare fossils, non calcareous, medium light grey to medium bluish grey C 10% Sand, as 377-013D D 10% Lost circulation material - metal E 5% Argillaceous limestone, as 377-012B, patchy blue/yellow fluorescence Minor pyrites, calcite, other shale Small sample	N6 N6-5B5/1 N9 5G6/1-N7	0.27 0.94, 0.92 0.18

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-016	1700-720m	A 70% Mudstone, blocky, soft, non calcareous, slightly silty in parts, medium light grey to light grey	N6-N7	0.39
		B 10% Shale, blocky, soft to hard, brittle, non calcareous, silty and pyritic in parts, medium light grey	N6	0.66
		C 10% Lost circulation material - metal		
		D 10% Sand, unconsolidated, very fine to fine grained, subrounded, colourless to white Minor limestone, pyrites Very small sample	N9	
377-017	1720-740m	A 35% Mudstone, as 377-016A, mostly caved	N6-N7	0.37
		B 25% Shale, as 377-016B	N6	0.79
		C 20% Argillaceous limestone, blocky, hard, rare pyrite fragments, patchy blue/yellow fluorescence, greenish grey to light grey	5G6/1-N7	0.44,0.47
		D 15% Sand, as 377-016D	N9	
		E 5% Lost circulation material - metal Minor other shale, pyrite		
377-018	1740-760m	A 50% Shale, as 377-016B	N6	0.78
		B 30% Mudstone, as 377-016A	N6-N7	0.39
		C 10% Argillaceous limestone, as 377-017C, patchy yellow fluorescence	5G6/1-N7	
		D 10% Sand, as 377-016D Minor other shale, pyrite, calcite	N9	
377-019	1760-780m	A 75% Shale, blocky, soft to hard, slightly calcareous to non calcareous, light grey to medium light grey	N7-N6	0.79
		B 20% Lost circulation material - cement and metal		
		C 5% Argillaceous limestone, as 377-017C, patchy blue/yellow fluorescence Minor pyrite, other shale	5G6/1-N7	0.19

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-020	1780-800m	A 60% Shale, blocky, soft to hard, slightly calcareous to non calcareous, light grey to medium light grey B 40% Lost circulation material - cement Minor limestone, other shale, pyrite	N7-N6	0.72,0.72
377-021	1800-820m	A 55% Lost circulation material - cement, metal B 45% Shale, blocky, soft to hard, non calcareous, medium grey to medium light grey Minor pyrites, mudstone	N5-N6	0.67
377-022	1820-840m	A 65% Shale, as 377-021B B 35% Lost circulation material - cement, metal	N5-N6	0.74
377-023	1840-860m	A 75% Shale, as 377-021B B 25% Lost circulation material - cement Minor pyrites, mudstone	N5-N6	0.76
377-024	1860-880m	A 85% Shale, as 377-021B, minor cavings B 15% Lost circulation material - cement, metal Minor pyrites, mudstone	N5-N6	0.80
377-025	1880-900m	A 90% Shale, as 377-021B, minor cavings B 10% Lost circulation material - cement, metal Minor pyrites, mudstone, limestone	N5-N6	0.78,0.78
377-026	1900-920m	A 95% Shale, as 377-021B, minor cavings B 5% Lost circulation material - cement, metal Minor pyrites, mudstone	N5-N6	0.74
377-027	1920-940m	A 80% Shale, as 377-021B, minor cavings B 20% Lost circulation material - cement, metal Minor pyrites, mudstone	N5-N6	0.72

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-028	1940-960m	A 90% Shale, blocky to platy, soft to hard, brittle, non calcareous, occasionally pyritic, medium grey to medium light grey B 10% Lost circulation material - cement, metal Minor pyrites	N5-N6	0.63
377-029	1960-980m	A 95% Shale, as 377-028A B 5% Lost circulation material - cement, metal Minor limestone, pyrites Small sample	N5-N6	0.60
377-030	1980-2000	A 90% Shale, as 377-028A B 10% Lost circulation material - cement, metal Minor mudstone	N5-N6	0.65
377-031	2000-020m	A 98% Shale, blocky, soft, brittle, silty in parts, non calcareous, medium dark grey to medium grey Minor limestone, mudstone	N4-N5	0.58
377-032	2020-040m	A 80% Shale, as 377-028A B 10% Shale, as 377-031A C 10% Lost circulation material - cement Minor mudstone Small sample	N5-N6 N4-N5	0.70,0.70 0.64
377-033	2040-060m	A 90% Shale, blocky, soft becoming hard, brittle, non calcareous, occasionally silty, occasionally pyritic, minor cavings, medium dark grey to medium grey B 10% Lost circulation material - cement Minor mudstone, other shale, pyrites	N4-N5	0.66
377-034	2060-080m	A 50% Shale, blocky, platy, brittle, non calcareous, thinly inter-bedded with medium dark grey shale, minor cavings, medium grey to medium light grey B 20% Shale, as 377-033A C 20% Mudstone, blocky, flaky, soft, non calcareous, minor cavings, medium light grey	N5-N6 N4-N5 N6	0.78 0.59 0.70,0.70

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-034	2060-080m	D 10% Lost circulation material - cement Minor other mudstone, pyrite		
377-035	2080-100m	A 75% Shale, blocky to platy, soft to hard, brittle, non calcareous, mostly caved, medium grey to medium light grey	N5-N6	0.96
		B 15% Shale, blocky, soft becoming hard, brittle, non calcareous, occasionally silty, occasionally pyritic, minor cavings, medium dark grey to medium grey	N4-N5	0.83
		C 10% Lost circulation material - cement Very small sample		
377-036	2100-120m	A 85% Shale, as 377-034A, moderate cavings	N5-N6	0.70
		B 15% Lost circulation material - cement Minor pyrite, mudstone Very small sample		
377-037	2120-140m	A 90% Shale, blocky, platy, brittle, non calcareous, thinly inter- bedded with medium dark grey shale, minor cavings, medium grey to medium light grey	N5-N6	0.70
		B 10% Lost circulation material - cement Minor other mudstone Small sample		
377-038	2140-160m	A 95% Shale, as 377-037A, mostly cavings	N5-N6	0.68
		B 5% Lost circulation material - cement Minor pyrite, other shale Very small sample		
377-039	2160-180m	A 98% Shale, as 377-035A, moderate cavings Minor lost circulation material - cement Minor limestone, pyrite	N5-N6	0.67, 0.69

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-040	2180-200m	A 98% Shale, blocky to platy, soft to hard, brittle, non calcareous, significant cavings, medium grey to medium light grey Minor other shale, mudstone	N5-N6	0.70
377-041	2200-220m	A 95% Shale, as 377-040A, significant cavings B 5% Lost circulation material - cement, metal Minor pyrites	N5-N6	0.60
377-042	2220-240m	A 85% Shale, as 377-040A, abundant cavings B 10% Shale, blocky, soft to hard, silty grading to mudstone, medium grey to light brownish grey C 5% Lost circulation material - cement Minor other mudstone, pyrite	N5-N6 N5-5YR6/1	0.59 1.31
377-043	2240-260m	A 98% Shale, as 377-040A, significant cavings Minor other shale, mudstone Lost circulation material Very small sample	N5-N6	0.75,0.73
377-044	2260-280m	A 90% Shale, as 377-040A, abundant cavings B 10% Mudstone, blocky, soft, silty, non calcareous, light grey to medium light grey Minor limestone, other mudstone	N5-N6 N7-N6	0.63 1.09
377-045	2280-300m	A 70% Shale, as 377-040A, abundant cavings B 30% Mudstone, as 377-044B C Minor limestone, platy, brittle, very light grey to white	N5-N6 N7-N6 N8-N9	0.96 0.86 0.52,0.50
377-046	2300-320m	A 95% Shale, as 377-040A, mostly caved B 5% Mudstone, as 377-044B, mostly caved Minor limestone, calcite, free pyrites Very small sample	N5-N6 N7-N6	0.77 0.86

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-047	2320-340m	A 85% Shale, blocky to platy, brittle, silty in parts, non calcareous, medium grey to medium light grey	N5-N6	0.83
		B 10% Mudstone, blocky, rounded, silty in parts, non calcareous, medium grey to light brownish grey	N5-5YR6/1	1.08
		C 5% Limestone, blocky, hard, very fine grained, no fluorescence, very light grey to white Minor other shale, mudstone Very small sample	N8-N9	0.35
377-048	2340-360m	A 85% Shale, as 377-047A	N5-N6	0.78, 0.77
		B 10% Shale, blocky to platy, silty, non calcareous with interbedded mudstone, medium grey to medium light grey	N5-N6	1.10
		C 5% Limestone, as 377-047C, no fluorescence Minor calcareous mudstone, other mudstone, pyrites Very small sample	N8-N9	
377-049	2360-380m	A 95% Shale, as 377-047A, minor cavings	N5-N6	0.71
		B 5% Limestone, as 377-047C, no fluorescence Minor other shale, mudstone	N8-N9	0.19
377-050	2380-400m	A 95% Shale, as 377-047A, moderate cavings	N5-N6	0.66
		B 5% Limestone, as 377-047C, no fluorescence Small sample	N8-N9	
377-051	2400-420m	A 98% Shale, as 377-047A, minor cavings	N5-N6	0.71, 0.74
		B Minor limestone, as 377-047C Very small sample	N8-N9	
377-052	2420-440m	A 95% Shale, as 377-047A, abundant cavings	N5-N6	0.76
		B 5% Limestone, as 377-047C Small sample	N8-N9	0.32
377-053	2440-460m	A 95% Shale, as 377-047A, moderate cavings	N5-N6	0.81
		B 5% Limestone, as 377-047C, no fluorescence Minor other shale	N8-N9	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-054	2460-480m	A 95% Shale, blocky to platy, brittle, silty in parts, non calcareous, moderate cavings	N5-N6	0.71
		B 5% Limestone, blocky, hard, very fine grained, no fluorescence, very light grey to white Minor other shale, mudstone Very small sample	N8-N9	0.13,0.13
377-055	2480-500m	A 90% Shale, as 377-054A, moderate cavings	N5-N6	0.98
		B 5% Shale, blocky to platy, silty, non calcareous with interbedded mudstone, medium grey to medium light grey	N5-N6	0.84
		C 5% Limestone, as 377-054B, no fluorescence Very small sample	N8-N9	
377-056	2500-520m	A 98% Shale, as 377-054A, abundant cavings	N5-N6	0.76
		B Minor limestone, as 377-054B Minor other mudstone, shale Very small sample	N8-N9	
377-057	2520-540m	A 98% Shale, as 377-054A, moderate cavings Minor limestone Very small sample	N5-N6	0.71
377-058	2540-560m	A 99% Shale, as 377-054A, abundant cavings Minor limestone, pyrite Very small sample	N5-N6	0.52,0.54
377-059	2560-580m	A 60% Shale, platy, brittle, non calcareous, moderate cavings, medium grey to medium light grey	N5-N6	0.73
		B 20% Mudstone, blocky, silty, soft, non calcareous, medium grey to medium light grey	N5-N6	0.78
		C 10% Limestone, blocky, hard, argillaceous, medium light grey to light grey	N6-N7	0.18
		D 10% Siltstone with finely interbedded sands, blocky, brittle, medium light grey, non calcareous Very small sample Minor lost circulation material - cement	N6	0.87,0.87

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-060	2580-600m	A 80% Shale, platy, brittle, non cal- careous, minor cavings, medium grey to medium light grey	N5-N6	0.66
		B 10% Limestone, blocky, hard, arg- illaceous, medium light grey to light grey	N6-N7	
		C 10% Siltstone with thinly interbedded sands, blocky, brittle, medium light grey, non calcareous Minor sandstone, calcite, free pyrite Very small sample	N6	1.19
377-061	2600-620m	A 45% Shale, platy to blocky, non calcareous, moderate cavings, medium grey to medium light grey	N5-N6	0.67
		B 40% Lost circulation material - cement		
		C 15% Limestone, as 377-060B Minor limestone, mudstone	N6-N7	0.38
377-062	2620-640m	A 50% Shale, as 377-061A, significant cavings	N5-N6	0.70,0.73
		B 35% Lost circulation material - cement, metal		
		C 15% Limestone, as 377-060B Minor mudstone	N6-N7	
377-063	2640-660m	A 80% Shale, as 377-061A, significant cavings	N5-N6	0.84
		B 20% Lost circulation material - cement, metal Minor coal (very small fragments)		
377-064	2660-680m	A 50% Lost circulation material - metal, cement		
		B 35% Shale, as 377-061A	N5-N6	0.80
		C 15% Coal, blocky, vitreous lustre, very fine fragments, black Minor limestone Very small sample	N1	
377-065	2680-700m	A 55% Lost circulation material - metal, cement, rubber		
		B 20% Shale, as 377-061A, minor cavings	N5-N6	0.47
		C 10% Coal, as 377-064C	N1	
		D 10% Sand, unconsolidated, very fine to fine grained, subrounded, colourless to white	N9	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-065	2680-700m	E 5% Limestone, blocky, hard, arg- illaceous, medium light grey to light grey Very small sample	N6-N7	
377-066	2700-720m	A 40% Sandstone, blocky, consolidated to loosely unconsolidated, sub- rounded to subangular, often associated with pyrite, very fine to fine grained, colourless, white to moderate yellow green patchy very pale yellow fluore- scence B 30% Lost circulation material, metal, cement C 20% Shale, platy to blocky, non calcareous, minor cavings, medium grey to medium light grey D 10% Coal, blocky, vitreous lustre, very fine fragments, black Minor limestone, pyrites	N9-5GY7/4 N5-N6 N1	 0.77
377-067	2720-740m	A 60% Sandstone, as 377-066A B 20% Lost circulation material - metal, cement C 20% Shale, as 377-066C, moderate cavings Minor limestone, pyrite Very small sample	N9-5GY7/4 N5-N6	 0.54, 0.54
377-068	2740-760m	A 60% Sand, unconsolidated, very fine to fine grained, subrounded, subangular, colourless to greyish orange, iron stained B 15% Sandstone, as 377-066A C 15% Shale, as 377-066C, moderate cavings D 10% Lost circulation material - metal, cement Minor limestone, pyrite	10YR7/4 N9-5GY7/4 N5-N6	 0.81
377-069	2760-780m	A 40% Sand, as 377-068A B 20% Sandstone, as 377-066A C 20% Shale, as 377-066C, significant cavings D 20% Lost circulation material - metal, cement Minor mudstone, limestone	10YR7/4 N9-5GY7/4 N5-N6	 0.59

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-070	2780-800m	A 40% Sand, unconsolidated, very fine to fine grained, subrounded, subangular, no fluorescence, greyish orange	10YR7/4	0.90
		B 20% Sandstone, blocky, consolidated to loosely unconsolidated, subrounded to subangular, often associated with pyrite, very fine to fine grained, colourless, white to moderate yellow green, no fluorescence	N9-5GY7/4	
		C 20% Shale, platy to blocky, non calcareous, mostly cavings, medium grey to medium light grey	N5-N6	
		D 20% Lost circulation material - metal, cement Minor limestone, pyrite		
377-071	2800-820m	A 65% Sand, as 377-070A, no fluorescence	10YR7/4	0.72
		B 20% Sandstone, as 377-070B, no fluorescence	N9-5GY7/4	
		C 10% Shale, as 377-070C, abundant cavings	N5-N6	
		D 5% Lost circulation material - metal, cement Minor mudstone, free pyrite, limestone		
377-072	2820-840m	A 60% Sand, as 377-070A, no fluorescence	10YR7/4	0.74, 0.75
		B 25% Sandstone, blocky, consolidated, slightly calcareous, cement, patchy yellow fluorescence, very light grey to white	N8-N9	
		C 10% Shale, as 377-070C, mostly cavings	N5-N6	
		D 5% Lost circulation material - metal, cement Minor limestone, coal, pyrite		
377-073	2840-860m	A 70% Sand, as 377-070A, no fluorescence	10YR7/4	0.84
		B 20% Sandstone, as 377-072B, patchy yellow fluorescence	N8-N9	
		C 5% Shale, as 377-070C, mostly cavings	N5-N6	
		D 5% Lost circulation material - metal, cement Minor limestone		

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-074	2860-880m	A 80% Sand, unconsolidated, very fine to fine grained, subrounded, subangular, no fluorescence, colourless to greyish orange	10YR7/4	
		B 10% Sandstone, blocky, consolidated, slightly calcareous, cement, patchy yellow fluorescence, very light grey to white	N8-N9	
		C 5% Shale, platy to blocky, non calcareous, mostly cavings, medium grey to medium light grey	N5-N6	
		D 5% Lost circulation material - metal, cement Minor coal		
377-075	2880-900m	A 40% Sandstone, loosely consolidated, fine to medium, subangular to subrounded, patchy yellow fluorescence, very light grey to white	N8-N9	
		B 30% Sand, unconsolidated, fine to medium, occasionally coarse, subrounded, no fluorescence, colourless to white	N9	
		C 20% Shale, platy, non calcareous, moderate cavings, medium grey	N5	0.86
		D 10% Lost circulation material, metal, cement Minor coal, pyrite, mudstone		
377-076	2900-920m	A 35% Sandstone, as 377-075A, patchy yellow fluorescence	N8-N9.	
		B 30% Sand, as 377-075B, no fluorescence	N9	
		C 25% Shale, as 377-075C, abundant cavings	N5	0.82
		D 10% Lost circulation material - metal, cement Minor pyrite, mudstone, coal		
377-077	2920-940m	A 55% Sand, unconsolidated, medium - occasionally coarse grained, rounded to subrounded, colourless to white, no fluorescence	N9	
		B 20% Sandstone, as 377-075A, patchy yellow fluorescence	N8-N9	
		C 15% Shale, as 377-075C, mostly cavings	N5	
		D 10% Lost circulation material - metal, cement Minor coal, mudstone		

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-078	2940-960m	A 70% Sand, unconsolidated, medium to coarse, occasionally very coarse, angular to subangular to sub-rounded, no fluorescence, colourless to white	N9	0.18
		B 10% Shale, platy, non calcareous, mostly cavings, medium grey	N5	
		C 10% Limestone, blocky, soft, chalky, white	N9	
		D 10% Lost circulation material - metal, cement Minor mudstone, coal		
377-079	2960-980m	A 70% Sand, as 377-078A, no fluorescence, white	N9	0.74
		B 20% Shale, as 377-078B, abundant cavings	N5	
		C 10% Lost circulation material - metal, cement Minor mudstone, sandstone		
377-080	2980-3000	A 60% Sand, as 377-078A, no fluorescence	N9	
		B 20% Sandstone, loosely consolidated, fine to medium, subangular to subrounded, faint patchy yellow fluorescence, very light grey to white	N8-N9	
		C 10% Shale, as 377-078B, mostly cavings	N5	
		D 10% Lost circulation material - metal, cement Minor other shale, limestone, mudstone		
377-081	3000-020m	A 60% Sand, unconsolidated, fine to medium, subrounded, no fluorescence, light greenish grey to very light grey	5GY8/1-N8	0.90
		B 20% Sandstone, consolidated, fine to medium, rounded, no fluorescence, calcareous matrix, very light grey	N8	
		C 10% Shale, blocky to platy, occasionally fissile, soft, non calcareous, moderate cavings, medium grey	N5	
		D 10% Lost circulation material, metal, cement		

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-082	3020-040m	A 90% Sand, unconsolidated, fine to medium, occasionally coarse, subrounded to subangular, no fluorescence, colourless, very light grey to yellowish grey B 5% Shale, blocky to platy, occasionally fissile, soft, non calcareous, caved, medium grey C 5% Lost circulation material - cement, metal Minor limestone	N8-5Y8/1 N5	
377-083	3040-060m	A 98% Sand, as 377-082A, no fluorescence Minor shale Lost circulation material - rubber	N8-5Y8/1	
377-084	3060-080m	A 90% Sand, as 377-082A, no fluorescence B 5% Shale, as 377-082B, mostly caved C 5% Lost circulation material - metal, cement	N8-5Y8/1 N5	0.66
377-085	3080-100m	A 90% Sand, as 377-082A, no fluorescence B 5% Shale, as 377-082B, mostly caved C 5% Lost circulation material - metal, cement	N8-5Y8/1 N5	
377-086	3100-120m	A 98% Sand, as 377-082A, no fluorescence Lost circulation material - metal, cement	N8-5Y8/1	
377-087	3120-140m	A 98% Sand, as 377-082A, no fluorescence Minor lost circulation material - metal, cement Minor limestone	N8-5Y8/1	
377-088	3140-160m	A 98% Sand, unconsolidated, rounded to subangular, fine to medium, often coarse, colourless, very light grey to white Minor lost circulation material - metal, shale Minor shale	N8-N9	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-089	3160-180m	A 98% Sand, unconsolidated, rounded to subangular, medium to coarse, colourless, no fluorescence, very light grey to white Minor lost circulation material - metal, cement	N8-N9	
377-090	3180-200m	A 98% Sand, as 377-089A, no fluorescence Minor lost circulation material - metal, cement, limestone	N8-N9	
377-091	3200-220m	A 95% Sand, as 377-089A, no fluorescence B 3% Lost circulation material, metal, cement C 2% Coal, very finely divided fragments, vitreous lustre, black Minor shale	N8-N9 N1	
377-092	3220-240m	A 90% Sand, unconsolidated, fine to medium, subangular to rounded, no fluorescence, colourless, white to moderate yellowish brown B 5% Coal, as 377-091C C 5% Lost circulation material - metal, cement Minor caved shale	N9-10YR5/4 N1	
377-093	3240-260m	A 95% Sand, unconsolidated, fine to medium, occasionally coarse, subangular to rounded, colourless, no fluorescence, white to moderate reddish orange B 3% Lost circulation material - metal, cement C 2% Shale, blocky to platy, occasionally fissile, soft, non calcareous, caved, medium grey D Minor shale, blocky, silty and micaceous, non calcareous, moderate reddish brown to dark reddish brown	N9-10R6/6 N5 10R4/6- 10R3/4	0.05
377-094	3260-280m	A 98% Sand, unconsolidated, fine, fine to medium, occasionally coarse, rounded, subrounded to subangular, colourless, no fluorescence, white to pale greenish yellow	N9-10Y8/2	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-094	3260-280m	B	Shale, blocky to platy, occasionally fissile, soft, non calcareous, caved, medium grey Minor lost circulation material - metal, cement	N5	
377-095	3280-300m	A 85%	Sand, unconsolidated, fine, fine to medium, occasionally coarse, rounded, subrounded to subangular, colourless, no fluorescence, white to pale greenish yellow	N9-10Y8/2	
		B 10%	Lost circulation material - metal, cement, paint, rubber		
		C 5%	Shale, as 377-094B, caved	N5	
377-096	3300-320m	A 75%	Sand, unconsolidated, fine to medium, subangular to rounded, no fluorescence, white to moderate yellowish brown	N9-10YR5/4	
		B 10%	Shale, as 377-094B, caved	N5	
		C 10%	Sandstone, consolidated, non calcareous matrix, fine to medium grained, no fluorescence, subrounded, very light grey to white	N8-N9	
		D 5%	Lost circulation material - metal, cement		
377-097	3320-340m	A 98%	Sand, as 377-095A, no fluorescence Minor shale, lost circulation material	N9-10Y8/2	
377-098	3340-360m	A 90%	Sand, unconsolidated, very fine to fine, occasionally medium, rounded to subrounded, colourless, no fluorescence, white to pale greenish yellow	N9-10Y8/2	
		B 5%	Sandstone, as 377-096C, no fluorescence	N8-N9	
		C 5%	Shale, as 377-094B, caved Minor lost circulation material - cement, metal	N5	
377-099	3360-380m	A 80%	Sand, as 377-098A, no fluorescence	N9-10Y8/2	
		B 10%	Sandstone, as 377-096C, no fluorescence	N8-N9	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-099	3360-380m	C 10% Shale, blocky to platy, occasionally fissile, soft, non calcareous, caved, medium grey	N5	
		D Minor coal, finely divided fragments, vitreous lustre, black	N1	24.75
377-100	3380-400m	A 75% Sand, unconsolidated, very fine to fine, occasionally medium, rounded to subrounded, colourless, no fluorescence, white to pale greenish yellow	N9-10Y8/2	
		B 15% Shale, as 377-099C, caved	N5	
		C 10% Lost circulation material - metal, cement Minor mudstone, sandstone		
377-101	3400-420m	A 85% Sand, as 377-100A, no fluorescence	N9-10Y8/2	
		B 10% Sandstone, consolidated, non calcareous matrix, fine to medium grained, no fluorescence, very light grey to white	N8-N9	
		C 5% Shale, as 377-099C, caved	N5	
377-102	3420-440m	A 95% Sand, unconsolidated, fine to medium, subrounded to rounded, occasionally angular, colourless, no fluorescence, white to moderate reddish brown	N9-10YR5/4	
		B 5% Shale, as 377-099C, caved	N5	
		C Minor shale, platy, silty, non calcareous, light grey Minor lost circulation material - metal, cement	N7	0.15
377-103	3440-460m	A 60% Sand, as 377-102A, no fluorescence	N9-10YR5/4	
		B 15% Sandstone, as 377-101B, no fluorescence	N8-N9	
		C 15% Lost circulation material - metal, cement, paint, rubber		
		D 5% Shale, as 377-099C, caved	N5	
		E 5% Shale, blocky, non calcareous, medium dark grey to medium grey	N4-N5	0.74
377-104	3460-480m	A 90% Sand, unconsolidated, fine to medium, subrounded to rounded, no fluorescence, colourless, white to greyish orange	N9-10YR7/4	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-104	3460-480m	B 10%	Sandstone, consolidated, non calcareous matrix, fine to medium grained, no fluorescence, very light grey to white	N8-N9	
		C	Minor coal, finely divided particles, vitreous lustre, black Minor lost circulation material - metal, cement	N1	34.62
377-105	3480-500m	A 70%	Sand, unconsolidated, fine to medium, subrounded to rounded, colourless, no fluorescence, white to greyish orange	N9-10YR7/4	
		B 15%	Coal, as 377-104C	N1	37.69
		C 10%	Sandstone, as 377-104B, no fluorescence	N8-N9	
		D 5%	Shale, blocky, non calcareous, medium dark grey to medium grey Minor lost circulation material - metal, cement, rubber	N4-N5	0.85
377-106	3500-520m	A 85%	Sand, unconsolidated, fine to medium, subrounded to subangular, colourless to pale reddish brown	10R5/4	
		B 15%	Coal, as 377-104C Minor sandstone, shale	N1	43.06
377-107	3520-540m	A 98%	Sand, unconsolidated, very fine to fine, subrounded to subangular, no fluorescence, pale reddish brown Minor coal, shale, lost circulation material - metal, cement	10R5/4	
377-108	3540-560m	A 98%	Sand, as 377-107A, no fluorescence Minor shale Lost circulation material - metal, cement	10R5/4	
377-109	3560-580m	A 98%	Sand, 377-107A, no fluorescence Minor shale Lost circulation material - metal, cement	10R5/4	
377-110	3580-600m	A 99%	Sand, as 377-107A, no fluorescence	10R5/4	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-111	3600-620m	A 85% Sand, unconsolidated, very fine to fine, subrounded to subangular, no fluorescence, pale reddish brown B 10% Lost circulation material - metal, rubber, cement C 5% Shale, blocky, non calcareous, moderate cavings, medium grey	10R5/4 N5	 0.89
377-112	3620-640m	A 98% Sand, as 377-111A, no fluores- cence Minor shale Lost circulation material - metal	10R5/4	
377-113	3640-660m	A 98% Sand, unconsolidated, very fine fine, occasionally medium grained, rounded to subrounded, occasionally subangular, colourless, no fluor- escence, white to moderate reddish orange Minor shale Lost circulation material - metal	N9-10R6/6	
377-114	3660-680m	A 98% Sand, as 377-113A, no fluor- escence B Shale, as 377-111C Minor other shale Lost circulation material - metal	N9-10R6/6 N5	 0.84
377-115	3680-700m	A 65% Sand, as 377-113A, no fluor- escence B 20% Lost circulation material - metal, cement, rubber C 15% Shale, as 377-111C, moderate cavings D Minor shale, blocky, non cal- careous, greyish red Minor shale fragments of coal	N9-10R6/6 N5 10R4/2	 0.88
377-116	3700-720m	A 85% Sand, as 377-113A, no fluores- cence B 10% Shale, as 377-111C, moderate cavings C 5% Lost circulation material - metal, paint, cement Minor coal fragments	N9-10R6/6 N5	 0.91
377-117	3720-740m	A 90% Sand, as 377-113A, no fluores- cence	N9-10R6/6	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
377-117	3720-740m	B 5% Shale, blocky, non calcareous, mostly cavings, medium grey	N5	
		C 5% Lost circulation material - metal, cement, rubber		
		D Minor shale, blocky, non cal- careous, greyish red	10R4/2	
377-118	3740-760m	A 70% Sand, unconsolidated, very fine to fine, occasionally medium grained, subrounded to rounded, colourless, no fluorescence, moderate reddish orange to pale reddish brown	10R6/6- 10R5/4	
		B 20% Lost circulation material, metal, paint, cement		
		C 10% Shale, as 377-117B, caved Minor coal fragments	N5	
377-119	3760-780m	A 98% Sand, as 377-118A, no fluor- escence	10R6/6- 10R5/4	
		B Lost circulation material - cement, metal, paint Minor shale		
377-120	3780-800m	A 75% Sand, as 377-118A, no fluores- cence	10R6/6- 10R5/4	
		B 15% Shale, as 377-117B, caved	N5	
		C 10% Lost circulation material - metal, paint, cement		
377-121	3800-822m (TD)	A 45% Sand, as 377-118A, no fluores- cence	10R6/6- 10R5/4	
		B 20% Shale, as 377-117B, caved	N5	
		C 20% Lost circulation material - metal, cement, paint, rubber		
		D 15% Shale, platy, blocky, non cal- careous, silty in parts, greyish red to moderate brown Minor other shale	10R4/2- 5YR3/4	0.09

TABLE 3
DETAILED GASOLINE RANGE (C₄ – C₇) ANALYSIS

GEOCHEM SAMPLE NUMBER	-023	-033	-040	-048	-054	-063
DEPTH	1840-860m	2040-060m	2180-200m	2340-360m	2460-480m	2640-660m
isobutane	1.01	0.97	1.02	0.43	1.08	1.50
n - butane (nB)	2.01	2.73	3.25	1.19	2.95	7.55
isopentane	2.23	4.90	3.71	2.50	3.20	6.01
n - pentane (nP)	4.40	7.02	5.45	5.38	5.81	12.07
2,2 - dimethylB	0.32	0.57	0.19	0.24	0.40	0.23
cyclopentane (CP)	0.31	0.61	0.43	0.41	0.43	0.63
2,3 - dimethylB	0.30	0.53	0.63	0.59	0.27	0.45
2 - methylIP	5.19	6.72	5.04	5.10	5.44	4.49
3 - methylIP	3.02	4.17	3.13	3.05	3.24	2.43
n - hexane (nH)	11.66	11.38	11.44	10.32	11.13	9.72
methylCP (MCP)	3.60	4.17	3.41	3.02	3.59	2.34
2,2 - dimethylIP	0.52	0.88	1.29	0.66	0.57	0.67
benzene	6.93	5.74	5.31	6.26	5.40	5.43
2,4 - dimethylIP	0.04	0.04	0.12	0.13	0.06	0.12
2,2,3 - trimethylB	0.96	0.11	0.42	0.80	0.62	0.29
cyclohexane (CH)	7.84	7.28	7.86	8.13	8.27	6.42
3,3 - dimethylIP	0.06	0.08	0.11	0.07	0.10	0.12
1,1 - dimethylIP	0.13	0.21	0.44	0.32	0.39	0.59
2 - methylIH	5.99	5.37	5.92	6.42	6.51	5.47
2,3 - dimethylIP	1.16	1.01	1.44	1.16	1.34	1.52
1,c,3 - dimethylIP	-	-	-	-	-	-
3 - methylIH	1.01	0.87	1.15	0.99	1.17	1.25
1,t,3 - dimethylIP	-	-	-	-	-	-
1,t,2 - dimethylIP	2.20	2.29	4.16	2.53	3.98	2.79
3 - ethylIP	0.30	0.04	0.17	0.17	0.22	0.05
n - heptane	19.65	15.18	17.81	20.17	19.70	11.55
1,c,2 - dimethylIP	1.33	0.53	2.77	1.37	0.60	0.73
methylCH (MCH)	17.08	16.14	12.51	17.53	12.71	13.15
toluene	0.74	0.48	0.84	1.07	0.83	2.46
ABUNDANCE (ppm)	3347	7990	5844	9278	5176	2126
MCP/benzene	0.52	0.73	0.64	0.48	0.66	0.43
MCP/MCH	0.21	0.26	0.27	0.17	0.28	0.18
NC5/NC7	0.22	0.46	0.31	0.27	0.29	1.04
NAP/P	0.86	0.86	0.83	0.90	0.75	0.65
%n - PARAFFINS	37.72	36.31	37.94	37.06	39.60	40.89
% ISOPARAFFINS	22.11	26.23	24.34	22.31	24.22	24.59
% NAPHTHENES	32.50	31.24	31.58	33.30	29.96	26.63
% AROMATICS	7.67	6.22	6.14	7.33	6.22	7.88

TABLE 3
DETAILED GASOLINE RANGE (C₄ - C₇) ANALYSIS

GEOCHEM SAMPLE NUMBER		-072	-080
DEPTH		2820-840m	2980-3000m
NORMALISED COMPOSITION	isobutane	1.52	0.38
	n - butane (nB)	2.76	1.84
	isopentane	3.57	1.53
	n - pentane (nP)	5.85	3.41
	2,2 - dimethylB	0.50	0.15
	cyclopentane (CP)	1.78	0.23
	2,3 - dimethylB	1.29	0.33
	2 - methylP	6.24	3.79
	3 - methylP	2.21	2.37
	n - hexane (nH)	9.38	9.21
	methylCP (MCP)	1.85	2.32
	2,2 - dimethylP	0.97	0.75
	benzene	3.27	5.42
	2,4 - dimethylP	0.25	0.14
	2,2,3 - trimethylB	0.16	0.40
	cyclohexane (CH)	7.63	8.88
	3,3 - dimethylP	0.06	0.08
	1,1 - dimethylCP	0.23	0.25
	2 - methylH	6.35	8.18
	2,3 - dimethylP	0.97	1.81
	1,c,3 - dimethylCP	-	-
	3 - methylH	0.78	0.76
	1,t,3 - dimethylCP	-	-
	1,t,2 - dimethylCP	2.31	3.77
	3 - ethylP	0.03	-
	n - heptane	22.29	21.31
	1,c,2 - dimethylCP	1.95	2.07
	methylCH (MCH)	13.77	19.25
	toluene	2.03	1.33
ABUNDANCE (ppm)		1244	792
MCP/benzene		0.56	0.43
MCP/MCH		0.13	0.12
NC5/NC7		0.26	0.16
NAP/P		0.73	1.03
%n - PARAFFINS		40.28	35.78
% ISOPARAFFINS		24.90	20.69
% NAPHTHENES		29.52	36.77
% AROMATICS		5.30	6.75

TABLE 4
VISUAL KEROGEN DATA

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION				THERMAL MATURATION INDEX
		TYPES	REMARKS	PARTICLE SIZE	PRESERV- ATION	
377-001A	1400-420m	Al*;W-Am ⁺ ;C-H	⁺ dark, degraded, atypical, [*] passing to Am.	F-M/C	P	1+ to 2-
377-003A	1440-460m	W-Al;C;H-Am		F-M	F	1+ to 2-
377-006A	1500-520m	W;Al-H;C-Am		F-M	F	1+ to 2-
377-010A	1580-600m	W-Am ⁺ ;Al-H-C;-	H at 1+ to 2-(trace). ⁺ Dark, degraded, dispersed, atypical (after algae?).	F-M	F-G	1+ to 2-
377-012B	1620-640m	Am ⁺ ;--;Al*-C-W-H	⁺ as above. [*] Passing to Am. Reworked.	VF+ F-M	F	
377-014A	1660-680m	W-Al-Am ⁺ ;C;H	⁺ largely degraded, atypical, includes incompletely developed material.	F-M	P-F	1+ to 2-
377-018A	1740-760m	Am ⁺ -W;Al;H-C	Reworked, fungal spores. ⁺ largely dark, degraded, atypical - includes incomple- tely developed material.	F-M	F	1+ to 2-
377-023A	1840-860m	Am ⁺ ;W;C-Al-H	⁺ as above. Reworked.	F-M	F	1+ to 2-
377-025A	1880-900m	Am ⁺ ;W-Al;H-C	⁺ as 018A (probably after algae). H at 2 to 2+ (trace). Reworked.	F-C	F-G	1+ to 2-
377-028A	1940-960m	W-Am ⁺ ;Al-C;H	⁺ as 018A. Reworked.	F-M	F	2-
377-031A	2000-020m	W;Am ⁺ -Al*-H;C	[*] passing to Am. Reworked. ⁺ as 018A.	F-C	F	2- max.
377-034A	2060-080m	C-W;Al;Am-H	reworked.	F-M	F	2-
377-035B	2080-100m	W;Al-C-Am ⁺ ;H	⁺ fine, dark, atypical (after algae?). Reworked.	F-M	P	1+ to 2-
377-038A	2140-160m	W;Al ⁺ -C-Am;H	⁺ passing to Am. Reworked.	F-M	P-F	2- max(?)

Algal, Amorphous, Coaly, Herbaceous, Stem, Woody.

TABLE 4
VISUAL KEROGEN DATA

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION				THERMAL MATURATION INDEX
		TYPES	REMARKS	PARTICLE SIZE	PRESERV- ATION	
377-040A	2180-200m	Al-C-W; Am ⁺ ; H	Reworked H at 2-. ⁺ Dark, atypical.	F-M	P-F	2-
377-042B	2220-240m	Am ⁺ -W-Al; -; C-H	H at 2- to 2 and 2 to 2+ (trace). Reworked. Sapropelisation.	F-C	F	2-
377-045A	2280-300m	Al-W; C; H-Am	Unreliable - identification difficult.	F-VC	P	2-
377-045B	2280-300m	W; Al-C; H-Am	H at 2- to 2. Reworked.	F-M	P-F	2-
377-047A	2320-340m	W; C; Al-H-Am	Reworked.	F-M	F-G	2-
377-048B	2340-360m	Am ⁺ ; W-Al-C; H	⁺ degraded, dark, includes incompletely developed material (after algae?).	F-M/C	F	2-
377-051A	2400-420m	W; Al-C; Am-H	reworking.	M-C	H	2-(?)
377-055A	2480-500m	W; Al-C; H-Am	reworked.	F-C	F-G	2-
377-057A	2520-540m	Am ⁺ ; W-C-Al*; H	⁺ as 048B. *passing to Am.	F-M	F	2-
377-060C	2580-600m	Al ⁺ -W; C-Am*; H	⁺ passing to Am. *as 048B.	F-C	F	2-
377-061	2600-620m	W; C; Al-H-Am	H at 2 to 2+(trace). Reworked.	M-C	F	2-
377-063A	2640-660m	W; C; Al-H	reworked.	M	F-G	2-
377-066D	2700-720m	W; C; Am		F-VC	G	2-(??)
377-067C	2720-740m	W; C-Al; Am-H	reworked. Sapropelisation.	M	P-F	2-/2- to 2
377-081C	3000-020m	W; C-Al; H-Am	reworked.	M	F	2-
377-092B	3220-240m	W; -; C-H- (Am)		F-C	G	2-(?)
377-105B	3480-500m	W; H; C-Am ⁺ -Al	⁺ fine, unrecognisable.	F-M	G	2-

Algal, Amorphous, Coaly, Herbaceous, Stem, Woody.

TABLE 4
VISUAL KEROGEN DATA

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION				THERMAL MATURATION INDEX
		TYPES	REMARKS	PARTICLE SIZE	PRESERV- ATION	
377-115C	3680-700m	W-Am ⁺ ;Al;H-C	cavings. ⁺ degraded, incom- pletely developed (after algae?).	F-M	F	2-/2- to 2
377-121D	3800-822m	W;C-Al;H		M	F	2- to 2.

Algal, Amorphous, Coaly, Herbaceous, Stem, Woody.

TABLE 5
VITRinite REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%)			NUMBER OF PARTICLES			REMARKS
			1	2	3	1	2	3	
377-001A	1400-420m	CUTTING	0.37	0.51*	0.75*	15	4	1	
377-006A	1500-520m	CUTTING	0.36	0.44	-	11	17	-	
377-010A	1580-600m	CUTTING	0.40	0.49*	0.65*	14	16	1	
377-014A	1660-680m	CUTTING	0.42	0.51*	0.63*	2	5	3	4th population 0.90 (10)*
377-018A	1740-760m	CUTTING	0.41	0.50*	0.60*	7	5	6	4th population 0.71 (2)*
377-025A	1880-900m	CUTTING	0.49	0.64*	0.84*	6	5	1	
377-031A	2000-020m	CUTTING	0.43	0.60*	0.79*	7	6	7	
377-035B	2080-100m	CUTTING	0.40	0.48	0.59*	9	2	3	
377-040A	2180-200m	CUTTING	0.42	0.55*	0.66*	5	12	1	
377-045B	2280-300m	CUTTING	0.43	0.51	0.67*	2	8	3	
377-051A	2400-420m	CUTTING	0.49	0.73*	1.12*	3	2	15	
377-055A	2480-500m	CUTTING	0.46	0.58*	0.96*	13	2	5	
377-066D	2700-720m	CUTTING	0.28	-	-	32	-	-	lignite
377-092B	3220-240m	CUTTING	0.28	-	-	30	-	-	lignite
377-105B	3480-500m	CUTTING	0.28	-	-	30	-	-	lignite
377-115C	3680-700m	CUTTING	0.49	0.59	0.78*	2	7	6	
377-121D	3800-822m	CUTTING	NO DETERMINATION POSSIBLE						

*reworked

TABLE 5B
VITRINITE REFLECTANCE DATA

<u>GEOCHEM SAMPLE NUMBER</u>	<u>DEPTH</u>	<u>READINGS</u>
377-001A	1400-420m	0.40, 0.40, 0.45, 0.39, 0.38, 0.41, 0.39, 0.53, 0.56, 0.40, 0.75, 0.34, 0.38, 0.38, 0.35, 0.35, 0.48, 0.36, 0.34, 0.34.
377-006A	1500-520m	0.44, 0.44, 0.47, 0.43, 0.45, 0.45, 0.37, 0.34, 0.33, 0.39, 0.36, 0.32, 0.43, 0.46, 0.38, 0.37, 0.45, 0.37, 0.37, 0.40, 0.41, 0.44, 0.43, 0.41, 0.41, 0.34, 0.43, 0.45.
377-010A	1580-600m	0.36, 0.37, 0.49, 0.42, 0.48, 0.52, 0.46, 0.44, 0.46, 0.43, 0.43, 0.47, 0.58, 0.41, 0.41, 0.49, 0.48, 0.49, 0.47, 0.49, 0.37, 0.37, 0.32, 0.46, 0.44, 0.47, 0.65, 0.50, 0.53, 0.38, 0.39.
377-014A	1660-680m	0.40, 0.77, 1.16, 0.94, 0.89, 0.52, 1.03, 0.53, 0.51, 0.76, 0.64, 0.49, 0.93, 1.04, 0.44, 0.75, 0.51, 0.75, 0.62, 0.62.
377-018A	1740-760m	0.38, 0.63, 0.38, 0.38, 0.49, 0.42, 0.60, 0.43, 0.57, 0.58, 0.60, 0.51, 0.74, 0.54, 0.47, 0.67, 0.45, 0.42, 0.47, 0.59.
377-025A	1880-900m	0.46, 0.49, 0.50, 0.63, 0.59, 0.68, 0.69, 0.62, 0.54, 0.84, 0.41, 0.51.
377-031A	2000-020m	0.57, 0.45, 1.63, 1.01, 0.44, 0.90, 0.94, 0.61, 0.64, 0.82, 0.83, 0.39, 0.58, 0.40, 0.54, 0.72, 0.41, 0.97, 0.44, 0.49.
377-035B	2080-100m	0.34, 0.48, 0.60, 0.39, 0.37, 0.38, 0.39, 0.47, 0.43, 0.57, 0.40, 0.38, 0.60, 0.39.
377-040A	2180-200m	0.52, 0.66, 0.50, 0.51, 0.59, 0.55, 0.55, 0.43, 0.41, 0.49, 0.52, 0.49, 0.41, 0.54, 0.50, 0.42, 0.47, 0.43.
377-045B	2280-300m	0.65, 0.46, 0.47, 0.52, 0.55, 0.67, 0.68, 0.52, 0.49, 0.42, 0.49, 0.55, 0.43.
377-051A	2400-420m	0.71, 1.18, 0.49, 0.52, 0.47, 1.06, 0.94, 0.74, 1.06, 1.37, 1.12, 1.05, 1.36, 1.25, 0.86, 0.99, 1.26, 1.04, 1.15, 0.97.

TABLE 5B
VITRINITE REFLECTANCE DATA

<u>GEOCHEM SAMPLE NUMBER</u>	<u>DEPTH</u>	<u>READINGS</u>
377-055A	2480-500m	0.60, 0.50, 0.56, 0.42, 0.46, 1.04, 0.98, 0.46, 0.44, 0.43, 0.46, 0.48, 0.89, 0.81, 1.09, 0.44, 0.43, 0.49, 0.45, 0.46.
377-066D	2700-720m	0.24, 0.27, 0.24, 0.23, 0.25, 0.31, 0.25, 0.27, 0.24, 0.23, 0.26, 0.29, 0.20, 0.26, 0.30, 0.33, 0.21, 0.24, 0.22, 0.34, 0.27, 0.26, 0.26, 0.32, 0.34, 0.37, 0.27, 0.33, 0.29, 0.37, 0.30, 0.23.
377-092B	3220-240m	0.28, 0.27, 0.31, 0.27, 0.30, 0.27, 0.26, 0.31, 0.29, 0.25, 0.29, 0.31, 0.24, 0.26, 0.28, 0.25, 0.29, 0.35, 0.25, 0.31, 0.24, 0.25, 0.25, 0.26, 0.23, 0.33, 0.27, 0.24, 0.24, 0.29.
377-105B	3480-500m	0.28, 0.27, 0.32, 0.27, 0.30, 0.27, 0.26, 0.31, 0.29, 0.26, 0.30, 0.31, 0.25, 0.26, 0.28, 0.25, 0.29, 0.35, 0.25, 0.31, 0.24, 0.25, 0.26, 0.26, 0.23, 0.34, 0.27, 0.24, 0.24, 0.29.
377-115C	3680-700m	0.77, 0.55, 0.60, 0.84, 0.62, 0.59, 0.82, 0.60, 0.47, 0.68, 0.64, 0.56, 0.51, 0.71, 0.88.

TABLE 6A
WEIGHT (GRAMMES) OF C₁₅+ EXTRACTS AND CHROMATOGRAPHIC FRACTIONS

GEOCHEM SAMPLE NUMBER	INTERVAL	ROCK EXTRACTED	TOTAL EXTRACT OBTAINED	TOTAL EXTRACT		nC ₅ SOLUBLE FRACTION				
				Preciptd. Asphaltenes	nC ₅ soluble	Paraffin – Naphthenes	Aromatics	Eluted NSO's	Non-eluted NSO's	Sulphur
377-003	1440-1460	36.3700	0.02112	0.00380	0.01732	0.00588	0.00594	0.00550	0.00000	0.00000
377-006	1500-1520	28.8700	0.01644	0.00548	0.01096	0.00407	0.00360	0.00329	0.00000	0.00000
377-010A	1580-1600	10.6400	0.01604	0.00507	0.01097	0.00405	0.00348	0.00344	0.00000	0.00000
377-018	1740-1760	25.6200	0.07237	0.00397	0.06840	0.04540	0.01588	0.00712	0.00000	0.00000
377-023A	1840-1860	33.4900	0.10283	0.00279	0.10004	0.07464	0.01596	0.00944	0.00000	0.00000
377-025	1880-1900	20.0700	0.04626	0.00152	0.04474	0.03262	0.00765	0.00447	0.00000	0.00000
377-028A	1940-1960	30.3000	0.08823	0.00392	0.08431	0.06711	0.01172	0.00548	0.00000	0.00000
377-031A	2000-2020	28.3900	0.07368	0.00761	0.06607	0.05036	0.01036	0.00534	0.00000	0.00000
377-033	2040-2060	21.3500	0.03579	0.00216	0.03363	0.02370	0.00609	0.00383	0.00000	0.00000
377-036A	2100-2120	15.0500	0.02820	0.00160	0.02660	0.01940	0.00437	0.00282	0.00000	0.00000
377-040A	2180-2200	26.5800	0.05508	0.00338	0.05170	0.03581	0.01040	0.00549	0.00000	0.00000
377-043A	2240-2260	21.1100	0.04553	0.00440	0.04113	0.02925	0.00735	0.00452	0.00000	0.00000
377-045	2280-2300	13.9600	0.03944	0.00425	0.03519	0.02619	0.00592	0.00307	0.00000	0.00000
377-048	2340-2360	19.2100	0.05744	0.00472	0.05272	0.04167	0.00601	0.00505	0.00000	0.00000
377-050-	2380-2420	19.4900	0.04105	0.00412	0.03693	0.02732	0.00575	0.00385	0.00000	0.00000
377-054	2460-2480	19.0800	0.07662	0.03197	0.04465	0.03417	0.00753	0.00295	0.00000	0.00000
377-056	2500-2520	31.9000	0.05099	0.00450	0.04649	0.03243	0.00899	0.00507	0.00000	0.00000
377-060	2580-2600	11.1700	0.02015	0.00526	0.01489	0.00974	0.00348	0.00150	0.00017	0.00000
377-063	2640-2660	13.0900	0.00969	0.00287	0.00682	0.00262	0.00171	0.00225	0.00024	0.00000
377-066-	2700-2740	9.8800	0.01065	0.00281	0.00784	0.00382	0.00175	0.00227	0.00000	0.00000
377-069A	2760-2780	17.4700	0.01086	0.00611	0.00475	0.00268	0.00129	0.00078	0.00000	0.00000
377-072	2820-2840	64.3600	0.02900	0.00551	0.02349	0.01453	0.00510	0.00382	0.00004	0.00000
377-075A	2880-2900	33.8400	0.01322	0.00472	0.00850	0.00360	0.00208	0.00282	0.00000	0.00000
377-078	2940-2960	52.9800	0.01644	0.00179	0.01465	0.00714	0.00292	0.00434	0.00025	0.00000
377-080A	2980-3000	42.6300	0.00846	0.00044	0.00802	0.00228	0.00120	0.00425	0.00029	0.00000
377-083	3040-3060	52.4500	0.00435	0.00083	0.00352	0.00072	0.00171	0.00083	0.00026	0.00000
377-090	3180-3200	52.1500	0.00662	0.00244	0.00418	0.00164	0.00148	0.00083	0.00023	0.00000
377-092	3220-3240	56.5600	0.01676	0.01320	0.00356	0.00064	0.00082	0.00179	0.00031	0.00000
377-095	3280-3300	60.8700	0.01346	0.00334	0.01012	0.00645	0.00212	0.00155	0.00000	0.00000
377-099A	3360-3380	55.6200	0.00880	0.00308	0.00572	0.00159	0.00164	0.00216	0.00033	0.00000
377-103A	3440-3460	25.5400	0.00843	0.00390	0.00453	0.00145	0.00093	0.00211	0.00004	0.00000
377-109	3560-3580	48.6900	0.00731	0.00394	0.00337	0.00106	0.00109	0.00108	0.00014	0.00000
377-115	3680-3700	28.7000	0.01833	0.00412	0.01421	0.00667	0.00431	0.00304	0.00020	0.00000
377-117	3720-3740	28.2200	0.00781	0.00330	0.00451	0.00153	0.00161	0.00137	0.00000	0.00000

TABLE 6B
CONCENTRATION (PPM) OF EXTRACTED C₁₅₊ MATERIAL IN ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS				
			Paraffin – Naphthenes	Aromatics	TOTAL	Precipd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	Sulphur	TOTAL
377-003	1440-1460	581	162	163	325	104	151	0	0	256
377-006	1500-1520	569	141	125	266	190	114	0	0	304
377-010A	1580-1600	1508	381	327	708	477	323	0	0	800
377-018	1740-1760	2825	1772	620	2392	155	278	0	0	433
377-023A	1840-1860	3070	2229	477	2705	83	282	0	0	365
377-025	1880-1900	2305	1625	381	2006	76	223	0	0	298
377-028A	1940-1960	2912	2215	387	2602	129	181	0	0	310
377-031A	2000-2020	2595	1774	365	2139	268	188	0	0	456
377-033	2040-2060	1676	1110	285	1396	101	179	0	0	281
377-036A	2100-2120	1874	1289	291	1580	106	188	0	0	294
377-040A	2180-2200	2072	1347	391	1739	127	207	0	0	334
377-043A	2240-2260	2157	1386	348	1734	208	214	0	0	423
377-045	2280-2300	2825	1876	424	2301	304	220	0	0	525
377-048	2340-2360	2990	2169	313	2482	246	263	0	0	508
377-050-	2380-2420	2106	1402	295	1697	211	198	0	0	409
377-054	2460-2480	4016	1791	395	2186	1676	155	0	0	1830
377-056	2500-2520	1598	1017	282	1299	141	159	0	0	300
377-060	2580-2600	1804	872	312	1184	471	134	15	0	620
377-063	2640-2660	740	200	131	331	219	172	18	0	409
377-066-	2700-2740	1078	387	177	564	284	230	0	0	514
377-069A	2760-2780	622	153	74	227	350	45	0	0	394
377-072	2820-2840	451	226	79	305	86	59	1	0	146
377-075A	2880-2900	391	106	61	168	139	83	0	0	223
377-078	2940-2960	310	135	55	190	34	82	5	0	120
377-080A	2980-3000	198	53	28	82	10	100	7	0	117
377-083	3040-3060	83	14	33	46	16	16	5	0	37
377-090	3180-3200	127	31	28	60	47	16	4	0	67
377-092	3220-3240	296	11	14	26	233	32	5	0	271
377-095	3280-3300	221	106	35	141	55	25	0	0	80
377-099A	3360-3380	158	29	29	58	55	39	6	0	100
377-103A	3440-3460	330	57	36	93	153	83	2	0	237
377-109	3560-3580	150	22	22	44	81	22	3	0	106
377-115	3680-3700	639	232	150	382	144	106	7	0	256
377-117	3720-3740	277	54	57	111	117	49	0	0	165

TABLE 6C

COMPOSITION (NORMALISED %) OF C₁₅+ MATERIAL EXTRACTED FROM ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	HYDROCARBONS			NON HYDROCARBONS					HC NON HC
		Paraffin -- Naphthenes	Aromatics	P - N AROM	Precipitd. Asphaltenes	Eluted NSO's	Non eluted NSO's	ASPH Sulphur	ASPH NSO	
377-003	1440-1460	27.84	28.13	0.99	17.99	26.04	0.00	0.00	0.69	1.27
377-006	1500-1520	24.76	21.90	1.13	33.33	20.01	0.00	0.00	1.67	0.87
377-010A	1580-1600	25.25	21.70	1.16	31.61	21.45	0.00	0.00	1.47	0.88
377-018	1740-1760	62.74	21.94	2.86	5.49	9.83	0.00	0.00	0.56	5.53
377-023A	1840-1860	72.59	15.52	4.68	2.71	9.18	0.00	0.00	0.30	7.41
377-025	1880-1900	70.51	16.54	4.26	3.29	9.66	0.00	0.00	0.34	6.72
377-028A	1940-1960	76.06	13.29	5.73	4.44	6.21	0.00	0.00	0.72	8.39
377-031A	2000-2020	68.35	14.06	4.86	10.33	7.25	0.00	0.00	1.42	4.69
377-033	2040-2060	66.23	17.03	3.89	6.04	10.71	0.00	0.00	0.56	4.97
377-036A	2100-2120	68.80	15.51	4.44	5.67	10.02	0.00	0.00	0.57	5.37
377-040A	2180-2200	65.01	18.89	3.44	6.14	9.97	0.00	0.00	0.62	5.21
377-043A	2240-2260	64.25	16.15	3.98	9.66	9.93	0.00	0.00	0.97	4.10
377-045	2280-2300	66.41	15.02	4.42	10.78	7.80	0.00	0.00	1.38	4.38
377-048	2340-2360	72.54	10.46	6.94	8.22	8.79	0.00	0.00	0.94	4.88
377-050-	2380-2420	66.56	14.02	4.75	10.04	9.39	0.00	0.00	1.07	4.15
377-054	2460-2480	44.60	9.83	4.54	41.73	3.85	0.00	0.00	10.84	1.19
377-056	2500-2520	63.61	17.63	3.61	8.83	9.94	0.00	0.00	0.89	4.33
377-060	2580-2600	48.34	17.27	2.80	26.10	7.44	0.84	0.00	3.15	1.91
377-063	2640-2660	27.04	17.65	1.53	29.62	23.22	2.48	0.00	1.15	0.81
377-066-	2700-2740	35.87	16.43	2.18	26.38	21.31	0.00	0.00	1.24	1.10
377-069A	2760-2780	24.68	11.88	2.08	56.26	7.18	0.00	0.00	7.83	0.58
377-072	2820-2840	50.10	17.59	2.85	19.00	13.17	0.14	0.00	1.43	2.09
377-075A	2880-2900	27.23	15.73	1.73	35.70	21.33	0.00	0.00	1.67	0.75
377-078	2940-2960	43.43	17.76	2.45	10.89	26.40	1.52	0.00	0.39	1.58
377-080A	2980-3000	26.95	14.18	1.90	5.20	50.24	3.43	0.00	0.10	0.70
377-083	3040-3060	16.54	39.34	0.42	19.08	19.00	6.04	0.00	0.76	1.27
377-090	3180-3200	24.77	22.36	1.11	36.86	12.54	3.47	0.00	2.30	0.89
377-092	3220-3240	3.82	4.89	0.78	78.76	10.68	1.85	0.00	6.29	0.10
377-095	3280-3300	47.92	15.75	3.04	24.81	11.52	0.00	0.00	2.15	1.75
377-099A	3360-3380	18.07	18.64	0.97	35.00	24.55	3.75	0.00	1.24	0.58
377-103A	3440-3460	17.20	11.03	1.56	46.26	25.03	0.47	0.00	1.81	0.39
377-109	3560-3580	14.50	14.91	0.97	53.90	14.77	1.92	0.00	3.23	0.42
377-115	3680-3700	36.39	23.50	1.55	22.48	16.56	1.07	0.00	1.27	1.49
377-117	3720-3740	19.59	20.61	0.95	42.25	17.54	0.00	0.00	2.41	0.67

TABLE 7
SIGNIFICANT RATIOS (%) OF C₁₅₊ FRACTIONS AND ORGANIC CARBON

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC CARBON	<u>HYDROCARBONS</u> TOTAL EXTRACT	<u>HYDROCARBONS</u> ORGANIC CARBON	<u>TOTAL EXTRACT</u> ORGANIC CARBON
377-003	1440-1460	0.98	55.97	3.32	5.93
377-006	1500-1520	0.77	46.65	3.45	7.40
377-010A	1580-1600	0.88	46.95	8.04	17.13
377-018	1740-1760	0.55	84.68	43.49	51.36
377-023A	1840-1860	1.01	88.11	26.79	30.40
377-025	1880-1900	1.15	87.05	17.45	20.04
377-028A	1940-1960	0.83	89.35	31.35	35.08
377-031A	2000-2020	0.66	82.42	32.41	39.32
377-033	2040-2060	0.73	83.26	19.12	22.96
377-036A	2100-2120	0.71	84.31	22.25	26.39
377-040A	2180-2200	0.95	83.90	18.30	21.81
377-043A	2240-2260	1.25	80.40	13.87	17.25
377-045	2280-2300	0.78	81.43	29.49	36.22
377-048	2340-2360	0.90	83.00	27.57	33.22
377-050-	2380-2420	0.98	80.58	17.32	21.49
377-054	2460-2480	0.77	54.43	28.38	52.15
377-056	2500-2520	0.82	81.24	15.84	19.49
377-060	2580-2600	0.72	65.61	16.44	25.05
377-063	2640-2660	0.82	44.69	4.03	9.03
377-066-	2700-2740	0.30	52.30	18.79	35.93
377-069A	2760-2780	0.24	36.56	9.47	25.90
377-072	2820-2840	0.32	67.69	9.53	14.08
377-075A	2880-2900	0.52	42.97	3.23	7.51
377-078	2940-2960	0.09	61.19	21.10	34.48
377-080A	2980-3000	0.12	41.13	6.80	16.54
377-083	3040-3060	0.08	55.88	5.79	10.37
377-090	3180-3200	0.07	47.13	8.55	18.13
377-092	3220-3240	0.06	8.71	4.30	49.39
377-095	3280-3300	0.12	63.67	11.73	18.43
377-099A	3360-3380	0.35	36.70	1.66	4.52
377-103A	3440-3460	0.25	28.23	3.73	13.20
377-109	3560-3580	0.10	29.41	4.42	15.01
377-115	3680-3700	1.52	59.89	2.52	4.20
377-117	3720-3740	0.13	40.20	8.56	21.29

TABLE 8
PYROLYSIS ANALYSIS

SAMPLE NUMBER	DEPTH	ORGANIC CARBON	PPM BITUMEN*	PPM PYROLYSATE+	PYROLYSATE ORGANIC CARBON	BITUMEN PYROLYSATE	PEAK PYROL TEMP (°C)
377-003A	1440-1460	0.77	292	438	0.057	0.667	483
377-006A	1500-1520	0.55	460	728	0.132	0.632	485
377-010A	1580-1600	0.56	732	957	0.171	0.765	486
377-018A	1740-1760	0.78	466	1219	0.156	0.382	484
377-023A	1840-1860	0.76	1421	1675	0.220	0.848	487
377-025A	1880-1900	0.78	508	1754	0.225	0.290	486
377-028A	1940-1960	0.63	697	2821	0.448	0.247	487
377-031A	2000-2020	0.58	575	1318	0.227	0.436	486
377-033A	2040-2060	0.66	611	1628	0.247	0.375	482
377-036A	2100-2120	0.70	1294	3993	0.570	0.324	483
377-040A	2180-2200	0.70	608	1801	0.257	0.337	483
377-043A	2240-2260	0.75	850	744	0.099	1.143	487
377-045A	2280-2300	0.96	2404	1923	0.200	1.250	488
377-048A	2340-2360	0.78	1511	1209	0.155	1.250	486
377-050A	2380-2420	0.68	1057	872	0.128	1.212	483
377-054A	2460-2480	0.71	647	1100	0.155	0.588	484
377-056A	2500-2520	0.76	539	404	0.053	1.333	485
377-060A	2580-2600	0.66	549	659	0.100	0.833	483
377-063A	2640-2660	0.84	319	206	0.025	1.548	482

*340°C

+550°C

TABLE 9

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

GEOCHEM SAMPLE NUMBER	-003	-006	-010A	-018	-023A	-025
DEPTH	1440-460m	1500-520m	1580-600m	1740-760m	1840-860m	1880-900m
SAMPLE TYPE						
nC ₁₅	5.6	0.4	5.3	9.8	11.2	3.0
nC ₁₆	8.0	2.2	10.9	13.1	11.8	6.4
nC ₁₇	8.4	6.2	10.8	11.7	11.6	8.9
nC ₁₈	9.1	8.5	10.9	9.8	9.9	9.9
nC ₁₉	8.7	7.8	10.6	9.2	8.8	9.6
nC ₂₀	6.8	6.7	8.9	7.9	8.2	9.1
nC ₂₁	6.4	6.6	7.4	7.0	7.3	8.1
nC ₂₂	6.1	7.0	7.0	6.2	6.3	7.4
nC ₂₃	5.5	6.9	6.1	5.5	5.6	6.6
nC ₂₄	4.3	6.4	4.7	4.7	4.7	5.9
nC ₂₅	4.3	5.8	3.7	3.9	3.9	5.0
nC ₂₆	3.3	5.0	3.0	3.2	3.1	4.3
nC ₂₇	4.2	6.8	2.8	2.6	2.5	3.7
nC ₂₈	3.0	4.3	1.7	1.7	1.8	2.9
nC ₂₉	6.2	6.7	2.9	1.5	1.4	2.8
nC ₃₀	2.2	4.0	1.0	0.8	0.8	2.0
nC ₃₁	4.0	4.3	1.5	0.1	0.5	1.6
nC ₃₂	1.4	1.1	0.2	0.3	0.3	0.9
nC ₃₃	1.7	1.7	0.3	0.2	0.2	0.9
nC ₃₄	0.5	0.6	0.1	0.1	0.1	0.6
nC ₃₅	0.4	1.0	0.1	0.1	0.1	0.3
PARAFFIN	14.8	15.2	15.8	36.8	46.2	43.8
ISOPRENOID	1.6	1.2	1.9	4.6	5.4	4.1
NAPHTHENE	83.6	83.6	82.2	58.6	48.3	52.2
CPI INDEX A	1.11	1.10	1.03	1.03	1.04	1.00
CPI INDEX B	1.68	1.42	1.44	1.14	1.10	1.08
PRISTANE/PHYTANE	1.28	1.00	1.29	1.25	1.81	1.39
PRISTANE/nC ₁₇	0.71	0.63	0.63	0.68	0.66	0.60

TABLE 9
COMPOSITION (NORMALISED %) OF C₁₅+ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-028	-031	-033	-036	-040	-043A	-045
DEPTH	1940-960m	2000-020m	2040-060m	2100-120m	2180-200m	2240-260m	2280-300m
SAMPLE TYPE							
nC ₁₅	5.1	4.8	0.5	8.4	5.0	4.7	2.1
nC ₁₆	8.3	8.7	3.4	12.5	9.0	10.8	6.1
nC ₁₇	9.0	9.7	6.9	11.4	10.6	11.8	8.4
nC ₁₈	8.9	9.8	9.1	10.4	10.2	11.1	9.0
nC ₁₉	8.5	10.0	9.4	9.8	9.0	10.4	8.8
nC ₂₀	7.9	9.2	9.4	8.8	8.2	9.3	8.4
nC ₂₁	7.5	8.4	8.4	7.5	7.1	7.9	7.8
nC ₂₂	7.3	7.7	7.8	6.6	6.5	6.9	7.4
nC ₂₃	6.5	6.7	7.3	5.7	5.8	5.9	6.9
nC ₂₄	5.7	5.5	6.9	4.8	5.2	5.2	6.2
nC ₂₅	4.8	4.7	6.3	3.7	4.1	4.0	5.5
nC ₂₆	4.2	3.8	5.1	3.0	3.8	3.3	4.7
nC ₂₇	3.8	3.3	4.3	2.4	3.8	2.6	4.3
nC ₂₈	3.1	2.5	3.5	1.6	2.8	1.9	3.5
nC ₂₉	2.8	2.1	3.3	1.3	2.6	1.6	3.3
nC ₃₀	2.0	1.4	2.5	0.8	1.9	0.9	2.3
nC ₃₁	1.7	0.9	2.2	0.6	1.4	0.8	1.7
nC ₃₂	1.0	0.5	1.3	0.2	0.9	0.3	1.1
nC ₃₃	0.9	0.4	1.3	0.2	0.7	0.2	1.2
nC ₃₄	0.6	0.2	0.7	0.1	0.5	0.1	0.7
nC ₃₅	0.3	0.1	0.4	0.1	0.4	0.1	0.4
PARAFFIN	52.3	46.3	45.9	44.9	49.5	48.1	48.1
ISOPRENOID	5.0	5.4	3.6	5.7	5.0	6.2	4.3
NAPHTHENE	42.7	48.3	50.5	49.4	45.5	45.7	47.6
CPI INDEX A	1.00	1.03	1.01	1.01	1.02	1.01	1.02
CPI INDEX B	1.06	1.09	1.09	1.11	1.12	1.10	1.08
PRISTANE/PHYTANE	1.46	1.49	1.11	1.76	1.58	1.63	1.36
PRISTANE/nC ₁₇	0.63	0.72	0.60	0.71	0.58	0.67	0.62

TABLE 9
COMPOSITION (NORMALISED %) OF C₁₅+ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-048	-050A/051	-054	-056	-060	-063	-066/-067
DEPTH	2340-360m	2380-420m	2460-480m	2500-520m	2580-600m	2640-660m	2700-740m
SAMPLE TYPE							
nC ₁₅	1.3	3.4	2.1	0.1	0.1	2.9	0.3
nC ₁₆	4.9	8.0	5.2	0.2	0.8	10.1	1.2
nC ₁₇	8.3	10.9	10.0	1.3	4.7	14.7	3.0
nC ₁₈	8.5	11.7	9.3	3.7	8.7	15.0	5.5
nC ₁₉	8.6	10.7	9.0	5.7	10.2	11.5	6.7
nC ₂₀	8.6	9.4	8.7	7.3	10.9	7.9	8.1
nC ₂₁	8.1	8.2	7.4	8.5	10.2	5.9	9.1
nC ₂₂	8.1	7.6	7.5	9.1	9.6	5.0	10.0
nC ₂₃	7.3	6.8	6.6	8.8	8.8	4.4	10.0
nC ₂₄	6.6	5.7	6.1	8.5	7.8	4.1	9.3
nC ₂₅	5.8	4.7	5.4	7.9	6.4	3.6	8.5
nC ₂₆	5.4	3.9	4.7	7.1	5.3	3.2	7.3
nC ₂₇	4.6	2.9	4.2	6.8	4.3	3.0	6.2
nC ₂₈	3.7	2.1	3.5	5.6	3.4	2.2	5.0
nC ₂₉	3.3	1.7	3.2	5.4	2.9	2.4	4.1
nC ₃₀	2.2	1.1	2.3	4.2	1.9	1.4	2.4
nC ₃₁	1.8	0.7	1.7	3.6	1.7	1.3	1.7
nC ₃₂	1.1	0.3	1.2	2.3	0.9	0.6	0.9
nC ₃₃	0.7	0.2	0.9	1.8	0.8	0.5	0.6
nC ₃₄	0.6	0.1	0.6	1.1	0.5	0.2	0.3
nC ₃₅	0.3	0.1	0.4	0.8	0.2	0.1	0.2
PARAFFIN	49.4	45.4	47.0	46.1	43.6	41.1	53.1
ISOPRENOID	4.1	5.3	4.4	1.1	2.5	5.3	1.9
NAPHTHENE	46.5	49.3	48.7	52.8	53.8	53.6	45.0
CPI INDEX A	0.99	1.01	0.98	1.03	1.01	1.00	1.02
CPI INDEX B	1.06	1.07	1.06	1.08	1.08	1.17	1.09
PRISTANE/PHYTANE	1.71	1.56	1.60	0.67	0.89	1.67	0.81
PRISTANE/nC ₁₇	0.63	0.65	0.58	0.69	0.58	0.55	0.53

TABLE 9
COMPOSITION (NORMALISED %) OF C₁₅+ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-069A+B	-072	-075A+B	-078	-080A+B	-083	-090
DEPTH	2760-780m	2820-840m	2880-900m	2940-960m	2980-3000m	3040-060m	3180-200m
SAMPLE TYPE							
nC ₁₅	3.4	3.0	0.3	2.9	0.2	0.2	0.3
nC ₁₆	6.8	4.7	2.0	4.7	0.6	0.2	0.3
nC ₁₇	8.2	6.2	5.8	6.6	3.4	1.5	2.5
nC ₁₈	8.8	7.0	9.0	7.3	8.6	3.7	6.8
nC ₁₉	8.5	7.3	11.3	8.0	14.5	7.6	9.8
nC ₂₀	8.0	7.4	11.0	7.9	14.0	9.1	9.5
nC ₂₁	7.4	7.0	9.9	7.6	11.8	9.1	9.5
nC ₂₂	7.0	7.2	9.0	7.6	10.1	9.1	9.6
nC ₂₃	6.6	6.9	7.7	7.1	7.9	8.7	9.0
nC ₂₄	6.0	6.7	6.6	6.6	6.4	8.7	7.7
nC ₂₅	5.5	6.2	5.6	6.0	5.0	7.3	6.5
nC ₂₆	4.7	5.5	4.6	5.3	3.3	6.5	5.3
nC ₂₇	4.3	5.2	4.1	5.0	3.3	5.9	4.9
nC ₂₈	3.5	4.3	2.9	4.1	2.2	4.8	3.7
nC ₂₉	3.4	4.1	3.2	4.0	2.5	5.4	4.3
nC ₃₀	2.5	3.4	2.0	3.0	1.7	3.3	2.3
nC ₃₁	2.1	2.8	2.0	2.3	1.8	3.4	2.8
nC ₃₂	1.3	2.0	1.1	1.5	0.9	1.8	2.6
nC ₃₃	1.1	1.6	1.0	1.2	0.8	2.1	1.4
nC ₃₄	0.7	1.0	0.5	0.8	0.5	1.2	0.8
nC ₃₅	0.3	0.8	0.4	0.5	0.5	0.6	0.5
PARAFFIN	48.5	56.8	37.4	51.3	31.0	37.0	37.3
ISOPRENOID	4.2	3.2	2.1	3.0	1.7	1.0	1.3
NAPHTHENE	47.3	40.0	60.5	45.7	67.4	62.0	61.5
CPI INDEX A	1.02	1.00	1.02	1.01	1.05	1.00	1.04
CPI INDEX B	1.09	1.06	1.17	1.08	1.24	1.15	1.16
PRISTANE/PHYTANE	1.40	1.33	0.93	1.26	0.50	0.70	0.50
PRISTANE/nC ₁₇	0.61	0.52	0.47	0.49	0.53	0.70	0.45

TABLE 9
COMPOSITION (NORMALISED %) OF C₁₅₊ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-092	-095	-099A+B	-103A+B	-109	-115	-117
DEPTH	3220-240m	3280-300m	3360-380m	3440-460m	3560-580m	3680-700m	3720-740m
SAMPLE TYPE							
nC ₁₅	0.6	0.5	0.2	0.2	0.2	0.1	0.1
nC ₁₆	3.3	4.8	1.0	1.4	2.1	5.9	0.5
nC ₁₇	8.5	12.3	5.9	5.0	7.1	8.1	3.7
nC ₁₈	12.1	14.1	12.0	9.6	12.7	10.6	10.4
nC ₁₉	13.2	13.7	15.0	9.9	12.6	11.4	14.6
nC ₂₀	10.8	12.9	12.5	9.5	10.5	10.5	13.1
nC ₂₁	8.4	9.4	9.4	8.3	8.9	8.6	11.2
nC ₂₂	7.1	7.6	7.9	8.6	7.4	7.3	9.5
nC ₂₃	5.7	5.7	6.3	7.4	5.9	6.3	7.7
nC ₂₄	4.5	4.4	4.8	7.1	4.7	5.1	5.8
nC ₂₅	4.3	3.3	4.1	6.2	4.0	4.3	4.4
nC ₂₆	3.6	2.5	3.0	5.6	3.5	3.4	3.5
nC ₂₇	3.7	2.2	4.0	5.0	3.9	4.4	3.1
nC ₂₈	2.0	1.5	2.1	3.8	2.7	2.4	2.2
nC ₂₉	3.7	1.5	4.3	3.8	4.7	4.2	3.0
nC ₃₀	1.9	0.9	1.7	2.3	2.0	1.9	1.6
nC ₃₁	2.7	0.9	3.1	3.0	3.5	2.2	2.3
nC ₃₂	1.1	0.5	0.8	1.3	1.2	1.3	1.0
nC ₃₃	1.4	0.5	1.1	1.2	1.4	0.9	1.2
nC ₃₄	0.9	0.3	0.4	0.6	0.5	0.4	0.5
nC ₃₅	0.5	0.3	0.3	0.3	0.5	0.5	0.3
PARAFFIN	36.3	42.1	30.9	43.9	34.7	26.1	31.9
ISOPRENOID	2.5	4.2	2.1	2.2	2.3	1.8	1.7
NAPHTHENE	61.2	53.7	67.0	53.9	63.0	72.1	66.5
CPI INDEX A	1.07	1.02	1.09	0.97	1.06	1.09	1.04
CPI INDEX B	1.43	1.14	1.67	1.16	1.47	1.42	1.27
PRISTANE/PHYTANE	0.90	0.94	0.61	0.68	0.69	0.92	0.50
PRISTANE/nC ₁₇	0.39	0.40	0.43	0.41	0.39	0.41	0.47

BRIEF DESCRIPTION OF THE ANALYSES PERFORMED BY GEOCHEM

"Screen Analyses" are described in sections A and C, "Sample Preparation" in section B, "Follow-up Analyses" in sections C through J and "Correlation Studies" in section K. The analyses can be run on either core or cuttings material with the proviso that samples must be canned for the C₁-C₇ analysis and should be canned (or at least wet) for the C₄-C₇ analysis. The other analyses can be run on both canned and bagged samples.

A) C₁-C₇ LIGHT HYDROCARBON ANALYSIS

The abundance and composition of the C₁-C₇ hydrocarbons in sediments reflects their source richness, maturity and the character of the hydrocarbons they can yield. This analysis provides a very sensitive means for detecting migrated hydrocarbons. As it provides information on most of the critical parameters and is also economical, this analysis is excellent for screening samples to decide which of them merit further analysis.

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

The analysis involves the gas chromatographic separation of the individual C₁-C₄ gaseous hydrocarbons (methane, ethane, propane, isobutane and normal butane) and a partial resolution of the C₅-C₇ gasoline-range hydrocarbons (for their complete resolution see Section D). The ppm abundance of the five gases and of the total C₅-C₇ hydrocarbons are calculated from their electronically integrated peak areas (not from peak height) by comparison with a standard.

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

B) SAMPLE WASHING AND HAND PICKING

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

Cuttings are washed to remove the drilling mud, care being taken not to remove soft clays and fine sand during the washing procedure. Using the C₁-C₇ hydrocarbon data profile of the well, or the organic carbon profile (if this analysis is used for screening), electric logs (if supplied) and the appearance of the cuttings under the binocular microscope, samples are selected to represent the lithological and geochemical zones penetrated by the well. These samples are then carefully hand picked and the lithology of the uncaved material is described. It is these samples which are submitted for further analysis.

The remaining and unused samples (also washed) are dried and packaged in labelled plastic bags for return to the client. Any hand picked sample remaining after analysis can also be returned together with the extracted rock material.

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

C) ORGANIC CARBON ANALYSIS

The organic carbon content of a rock is a measure of its total organic richness. Combined with the visual kerogen, C₁-C₇, C₄-C₇ and C₁₅+ analyses, the organic carbon content is used to evaluate the potential (not necessarily actual) hydrocarbon source richness of the sediment. This analysis is an integral part of a total evaluation and it can also be used as an economical screen analysis for dry samples (when the C₁-C₇ analysis cannot be used).

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

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

D) DETAILED C₄-C₇ HYDROCARBON ANALYSIS

The abundance and composition of the C₄-C₇ gasoline-range hydrocarbons in sediments reflects their source quality, level of thermal maturation and organic facies. In addition, the data also reveal the presence of migrated hydrocarbons and can be used for crude oil-parent source rock correlation studies.

This powerful analysis, performed upon hand picked lithologies, is employed as a follow-up to confirm the potential of samples which have been selected using the initial screen analysis. It is used in conjunction with the organic carbon, visual kerogen and C₁₅+ analyses.

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

Tabulation of the composition and ppm abundance of the total gasoline-range fraction is achieved by comparison with a standard. In the report, the data are also presented graphically

E) KEROGEN TYPE AND MATURATION

Kerogen is the insoluble organic matter in rocks. Visual examination of the kerogen gives a direct measure of thermal maturity and of the composition of the organic matter (organic facies) and indicates the source quality of the sediment - which is confirmed using the organic carbon, light hydrocarbon and C₁₅+ analyses.

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

Kerogen is separated from the inorganic rock matrix by methods which avoid oxidation of the organic matter. It is then mounted on a glass slide and examined under a high power microscope.

This examination gives the following data: the composition of the organic matter by type (amorphous, algal, herbaceous, stem, woody, oxidised etc.), the proportions of these fractions, the colour and hence level of thermal maturation of the organic matter, and its state of preservation.

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

F) VITRINITE REFLECTANCE

Vitrinite reflectance is an alternative/confirmatory method for evaluating thermal maturation which is used in conjunction with the visual kerogen, light and heavy hydrocarbon analyses. The reflectivity of vitrinite macerals increases in response to thermal alteration and is used to define maturation levels and, by projection, to predict maturity at depth.

Measurements are made upon polished whole rock samples in polarised light. The technique is only valid for vitrinite (not the other macerals) which is indigenous to the sediment and hence the experience of the operator is critical. Geochem employs Dr J M Jones for this work.

If possible, twenty measurements are taken per sample and plotted in a histogram. This distinguishes the indigenous vitrinite from possible reworked or caved material. Averages are calculated for each population. Comments upon exinite fluorescence and upon the character of the phyto-clasts are noted on the histograms. The reports contain the tabulated data and the reflectivities plotted against depth; the histograms are included with the reports.

G) C15+ EXTRACTION, DEASPHALTENING AND CHROMATOGRAPHIC SEPARATION

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

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

The techniques involved in this analysis have been designed to give very reproducible results. Hand picked samples are ground and then solvent extracted in a soxhlet apparatus with benzene-methanol or methylene chloride (the solvent system can be adapted to client's specifications). The total extract obtained is then separated by column chromatography into the following fractions: paraffin-naphthene hydrocarbons, aromatic hydrocarbons, eluted NSO's (nitrogen-, sulphur-, and oxygen- containing non-hydrocarbons), non-eluted NSO's and precipitated asphaltenes. Note that the non-hydrocarbons are split into three fractions instead of being reported as a gross value. These fractions can be submitted for further analyses (carbon isotopes, gas chromatography, high mass spectroscopy) which are primarily designed to correlate crude oils to their parent source rocks (but also see section "H").

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

Upon completion of the study, the extracts and extracted powders are available, if required, for further analysis.

H) GC ANALYSIS OF C15+ PARAFFIN-NAPHTHENE HYDROCARBONS

The gas chromatographic configurations of the heavy C15+ paraffin-naphthene hydrocarbons reflect source type, the degree of thermal maturation and the presence and character of migrated hydrocarbons or contamination.

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

The paraffin-naphthene hydrocarbons obtained by column chromatography are introduced into the gas chromatograph. Excellent resolution of the individual normal paraffins and of the significant isoprenoids and other isoparaffins is achieved.

The normal paraffin carbon preference indices (C.P.I.) indicate if odd (values in excess of 1) or even (values less than 1) normal paraffins are dominant. Strong odd preferences ($\pm$ strong pristane peaks) are characteristic of immature land plant organic matter whilst even preferences ($\pm$ strong phytane peaks) suggest a reducing environment of deposition. With increasing maturity, values approach 1.0 and oils are typically close to 1.0. The indices are calculated using the following formulae:

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

2

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

2

Chromatograms are reproduced in the report for use as visual fingerprints and in addition, the following data are tabulated: normalised normal paraffin distributions; proportions of paraffins, isoprenoids and naphthenes in the total paraffin-naphthene fraction; C.P.I_A and C.P.I_B; pristane to phytane ratio; pristane to nC₁₇ ratio.

Very high resolution of the C₁₅₊ paraffin-naphthenes (and aromatics) can be achieved with capillary columns. These chromatograms are used for correlation purposes.

J) PYROLYSIS

The process of thermal maturation can be simulated in the laboratory by pyrolysis, which involves heating the sample under specified conditions and measuring the oil-like material which is freed/generated from the rock. With this analysis, the potential richness of immature sediments can be determined and, by coupling the pyrolysis unit to a gas chromatograph, the liberated material can be characterised. These results are correlated with those obtained from the organic carbon and C₁₅₊ analyses.

Small amounts of powdered sample are heated to release the thermal bitumen (up to 300°C) and pyrolysate (over 300°C). The abundance (ppm of rock) of each fraction and of the generated carbon dioxide is measured. Pyrolysate yields provide a definitive measure of potential source richness which avoids the ambiguities of the organic carbon data and the problem of contamination. The data also evaluate the quality and character of the organic material and the degree to which it has realised its hydrocarbon potential.

The data are reported and presented graphically as ppm thermal bitumen and pyrolysate, the ratio of the two fractions, the ratio of pyrolysate to organic carbon and as the abundance of carbon dioxide and its ratio to organic carbon. The temperature at which peak pyrolysate evolution occurs is also reported.

K) CORRELATION STUDY ANALYSES

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

- detailed C₄-C₇ hydrocarbon (gasoline range) analysis. See section D. Although these hydrocarbons can be affected by migrational/alteration processes, they commonly provide a very useful correlation parameter.
- capillary gas chromatography of the C₁₅+ paraffin-naphthenes. See section H. The branched[±]normal paraffin distributions are used to "fingerprint" the samples.
- capillary gas chromatography of whole oils and of C₁₅+ aromatic hydrocarbons. The detailed resolution achieved in these analyses makes them an ideal fingerprinting tool. Chromatograms are reproduced in our reports.
- mass spectrometric carbon isotope analyses of the C₁₅+ paraffin-naphthene and aromatic hydrocarbons of oils and sediments, and of kerogen separations. A powerful tool for comparing hydrocarbons and correlating hydrocarbons to organic matter. With this technique the problem of source rock contamination can be avoided. The data are recorded on x-y plots.
- mass fragmentograms (mass chromatograms) of fragment ions characteristic of selected hydrocarbon groups such as the steranes and terpanes. The fragmentograms provide a convenient and simple means of presenting detailed mass spectrometric data and are used as a sophisticated fingerprinting technique. This provides the ultimate resolution for correlating hydrocarbons and facilitates the examination of hydrocarbon classes (Masspec).

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

L) ANALYSES FOR SPECIAL CASES

L-1) ELEMENTAL KEROGEN ANALYSIS

This analysis evaluates source quality, whether the sediments are oil or gas prone, the character of the organic matter and its level of thermal maturation. It is the chemical equivalent of the visual kerogen analysis and the data are also integrated with the light hydrocarbon and C₁₅+ results.

The separated kerogen is combusted and the resulting gases converted into molecules which are measured to give the elemental carbon, hydrogen, nitrogen, oxygen and sulphur contents of the organic matter. The data are reported as percentages and ratios.

As a general rule, the pyrolysis analysis is preferred to this technique, both methods providing similar information.

L-2) NORMAL PARAFFIN ANALYSIS

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

L-3) CARBONATE CONTENT

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

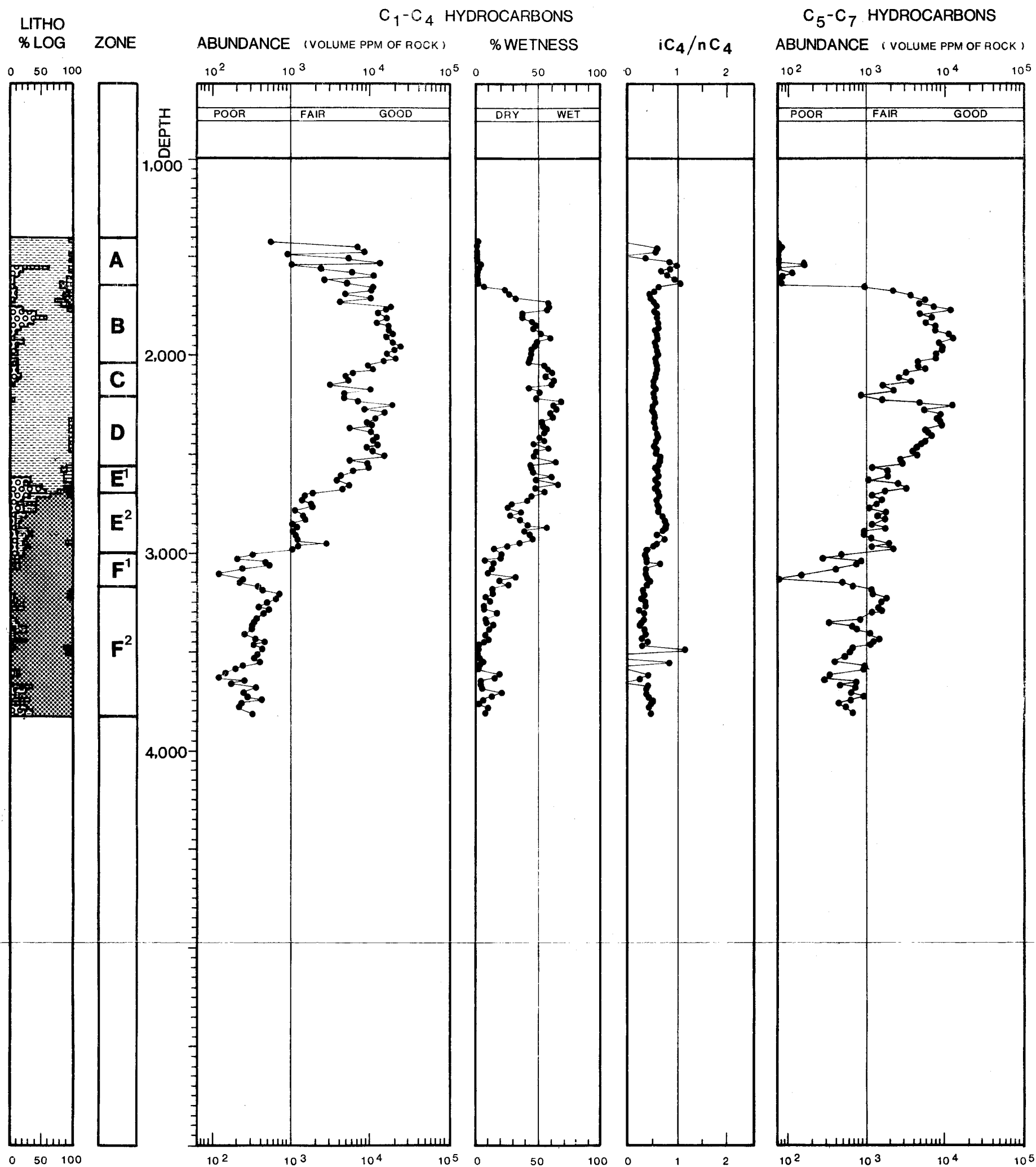
L-4) SOLID BITUMEN EVALUATION

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

The analysis involves the determination of the solubility (in CS₂) of the solid bitumen and of the atomic hydrogen to carbon ratio of the insoluble fraction.

L-5) EXTRACTION WITHOUT CHROMATOGRAPHY

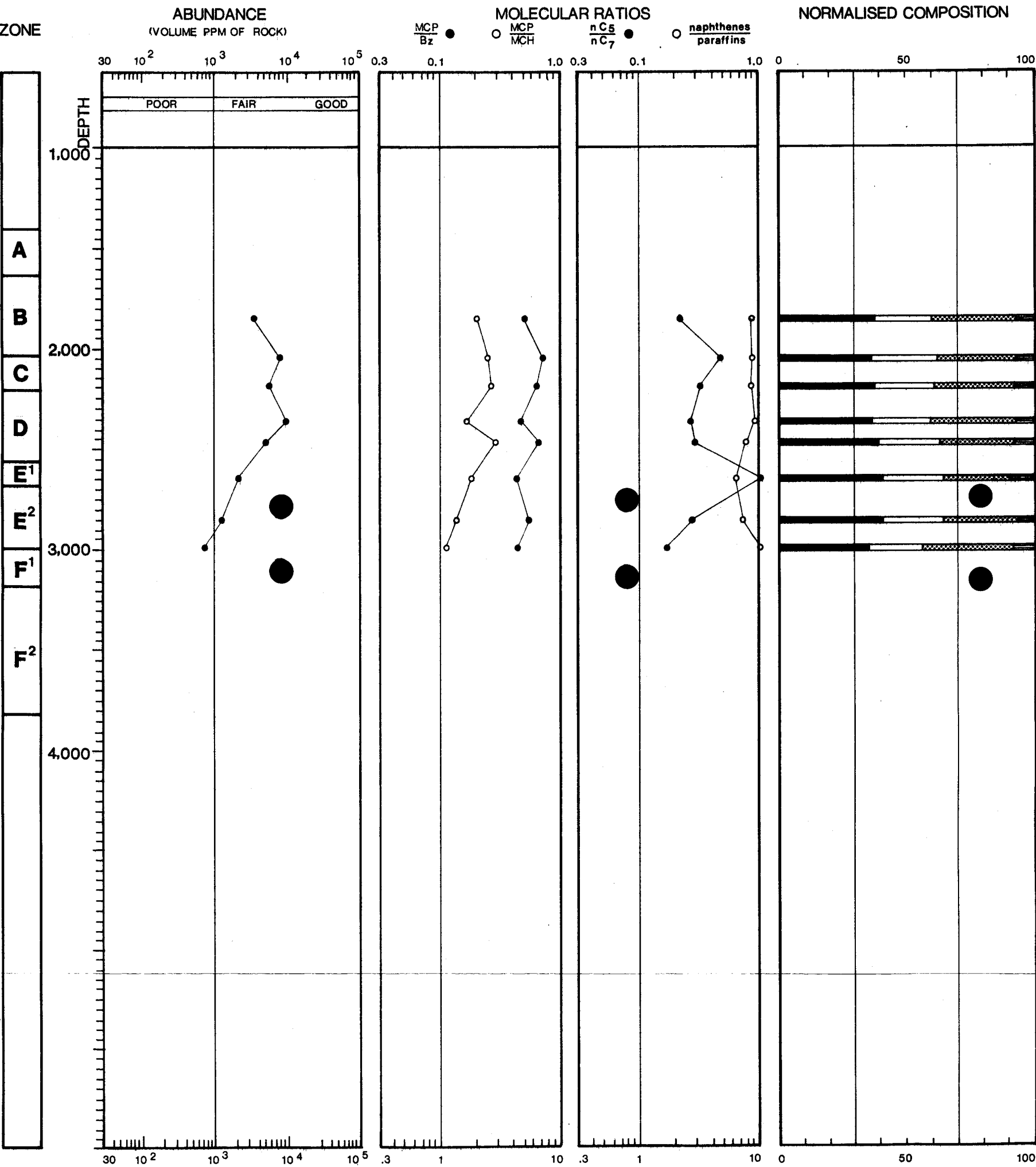
The removal of the soluble C₁₅+ material either to measure its abundance or to prepare the sediment for further analysis.



LITHOLOGIES

	CARBONATE		SANDSTONE / SAND		EVAPORITE
	SHALE / MUDSTONE		COAL		LOST CIRCULATION MATERIAL
	SILTSTONE		IGNEOUS		

iC_4 - ISOBUTANE
 nC_4 - NORMAL BUTANE



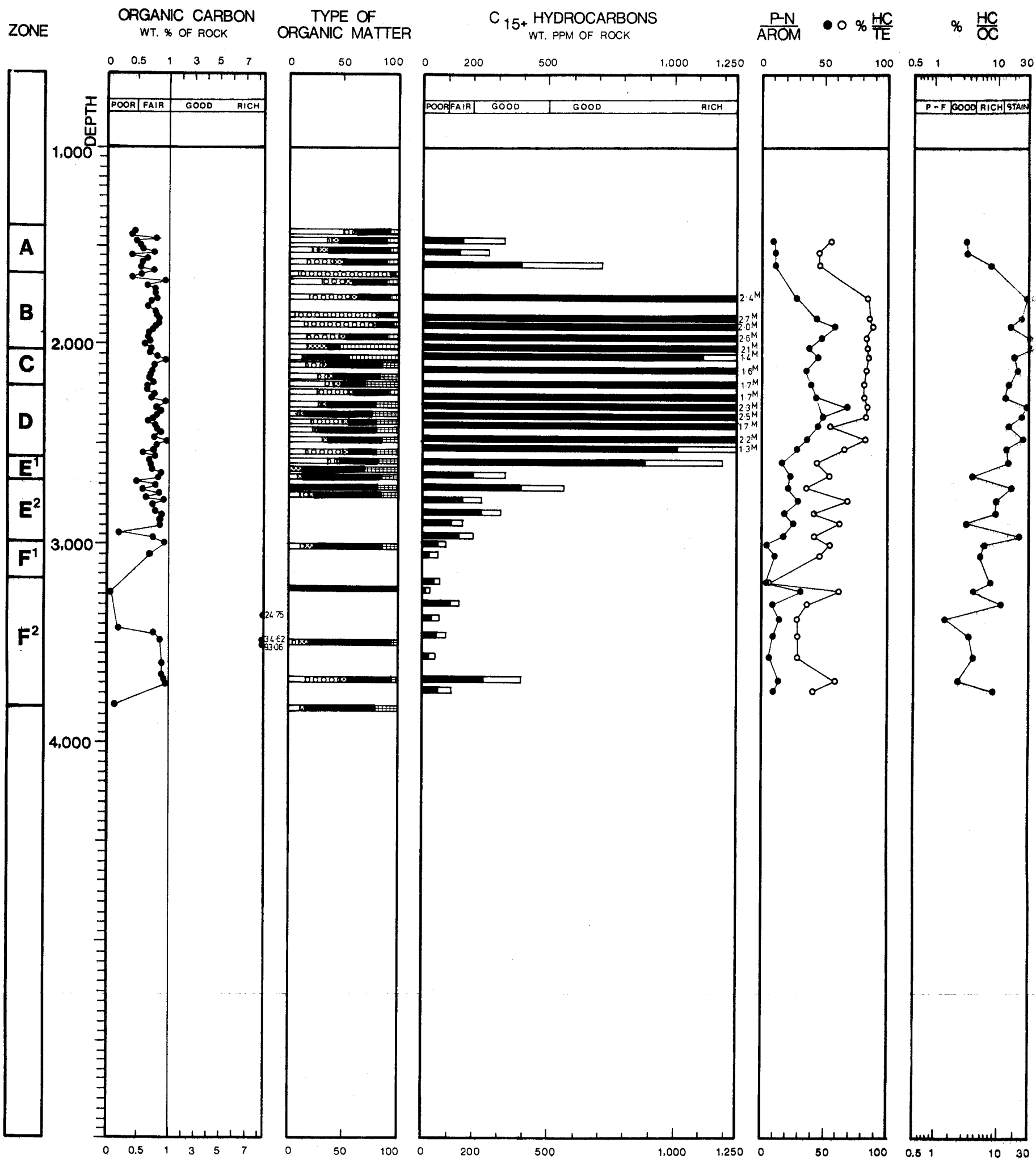
PPM VALUES EXPRESSED AS VOLUMES
OF GAS PER MILLION VOLUMES OF SEDIMENT

MCP = METHYLCYCLOPENTANE
MCH = METHYLCYCLOHEXANE
Bz = BENZENE

nC₅ = NORMAL PENTANE
nC₇ = NORMAL HEPTANE

NORMAL PARAFFINS
ISOPARAFFINS
NAPHTHENES
AROMATICS



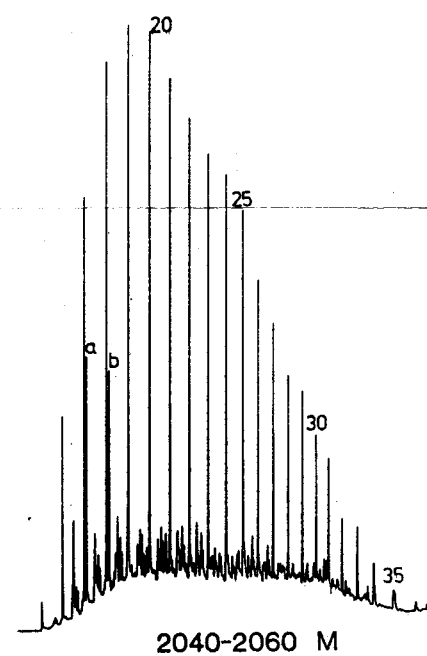
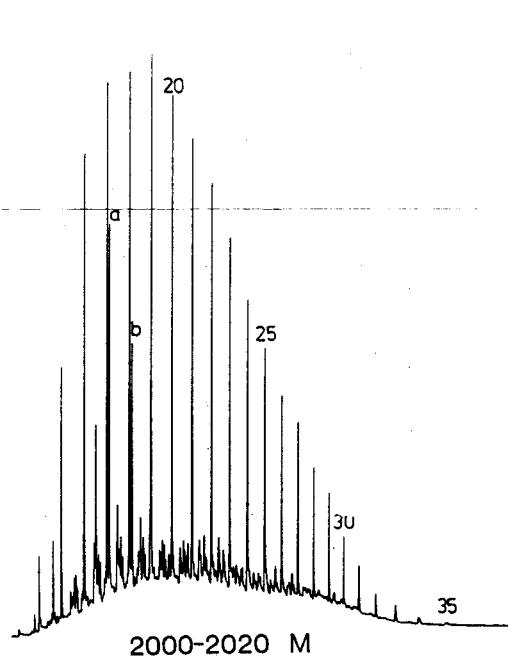
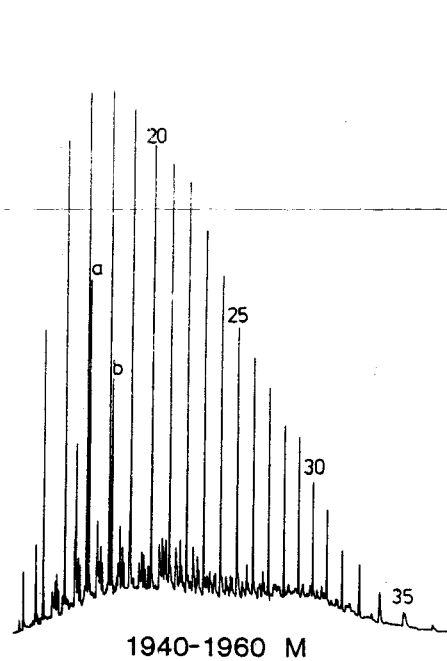
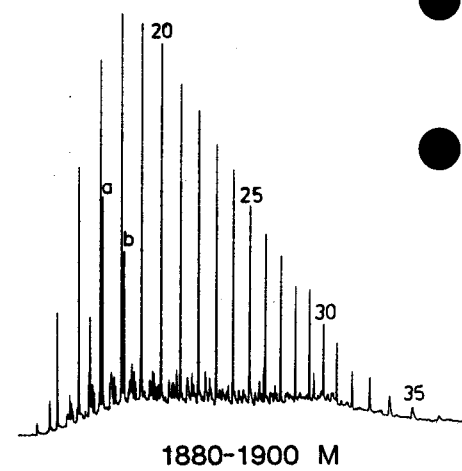
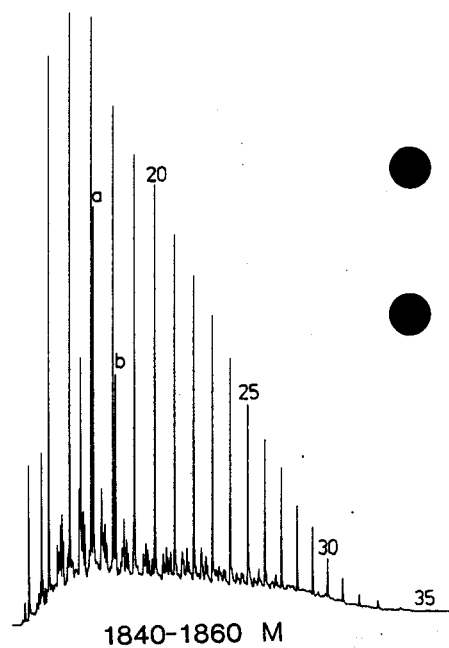
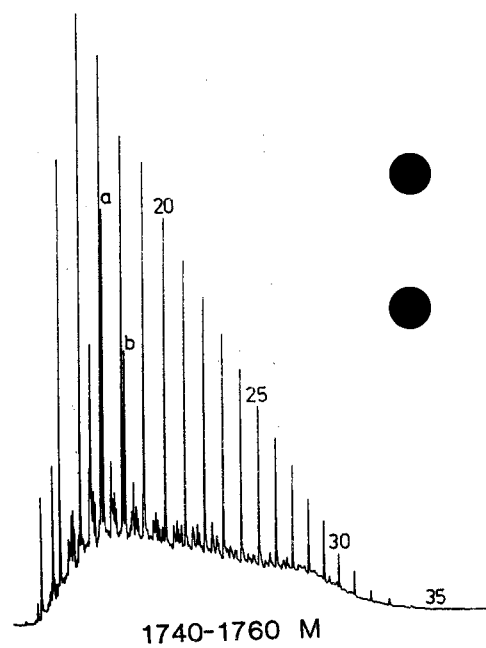
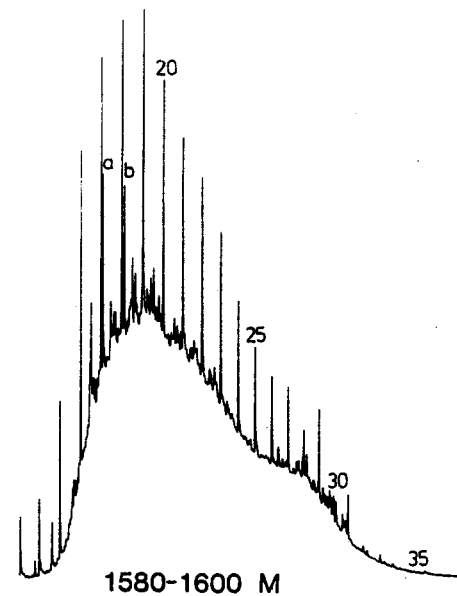
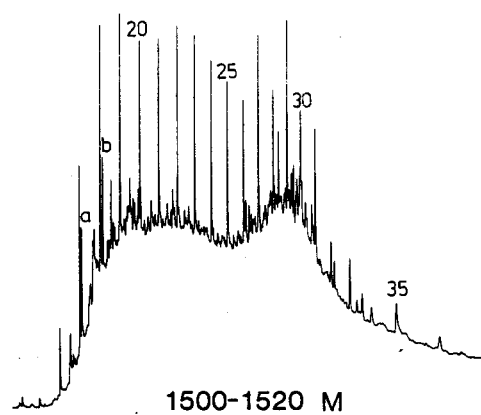
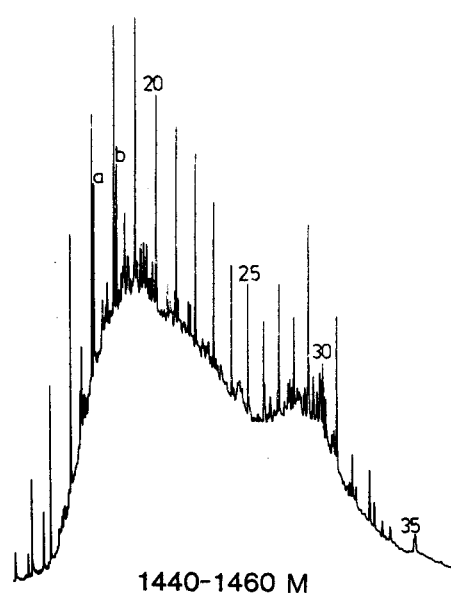


● SHALE
○ OTHER LITHOLOGIES

ALGAL
AMORPHOUS
HERBACEOUS - SPORE, POLLEN, CUTICLE.
STEM
WOODY
COALY (FUSINITE)

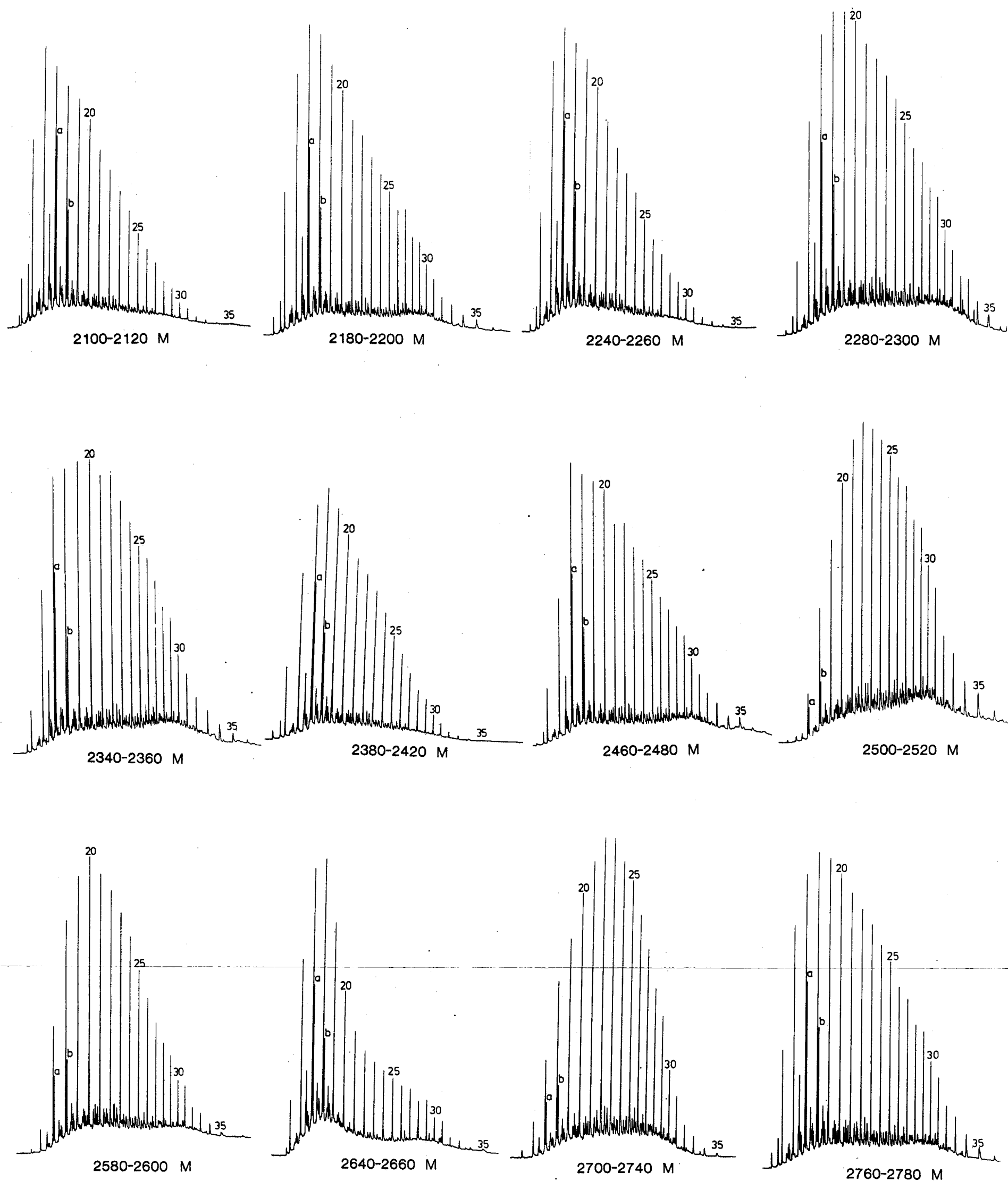
PARAFFIN-NAPHTHENES
AROMATIC HYDROCARBONS
FREE ELEMENTAL SULPHUR
N₂-S-O₂ BEARING COMPOUNDS
ASPHALTENES

P-N
AROM
S
NSO
ASP
HC = C₁₅+ HYDROCARBONS
OC = ORGANIC CARBON
TE = TOTAL EXTRACT



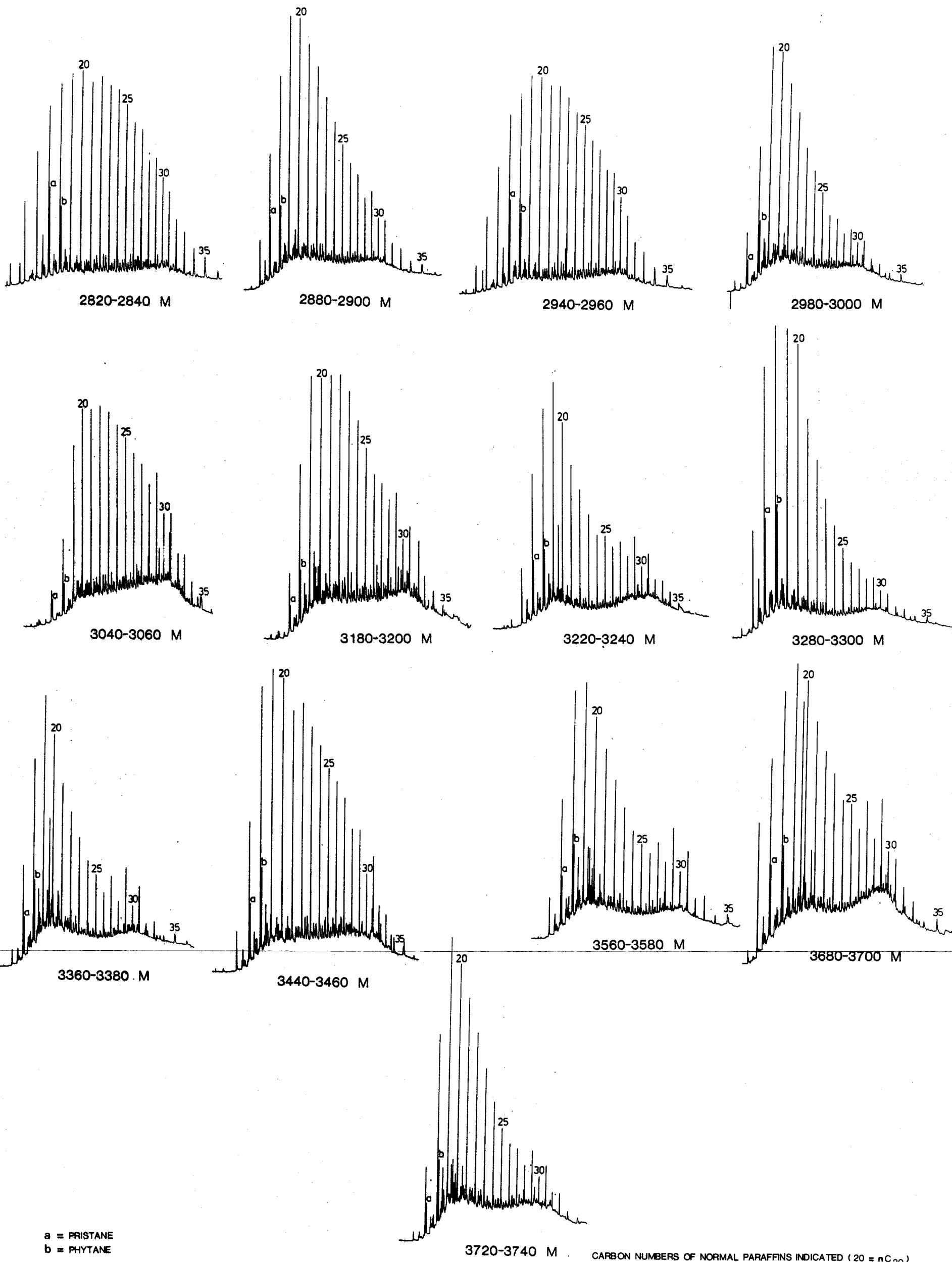
a = PRISTANE
b = PHYTANE

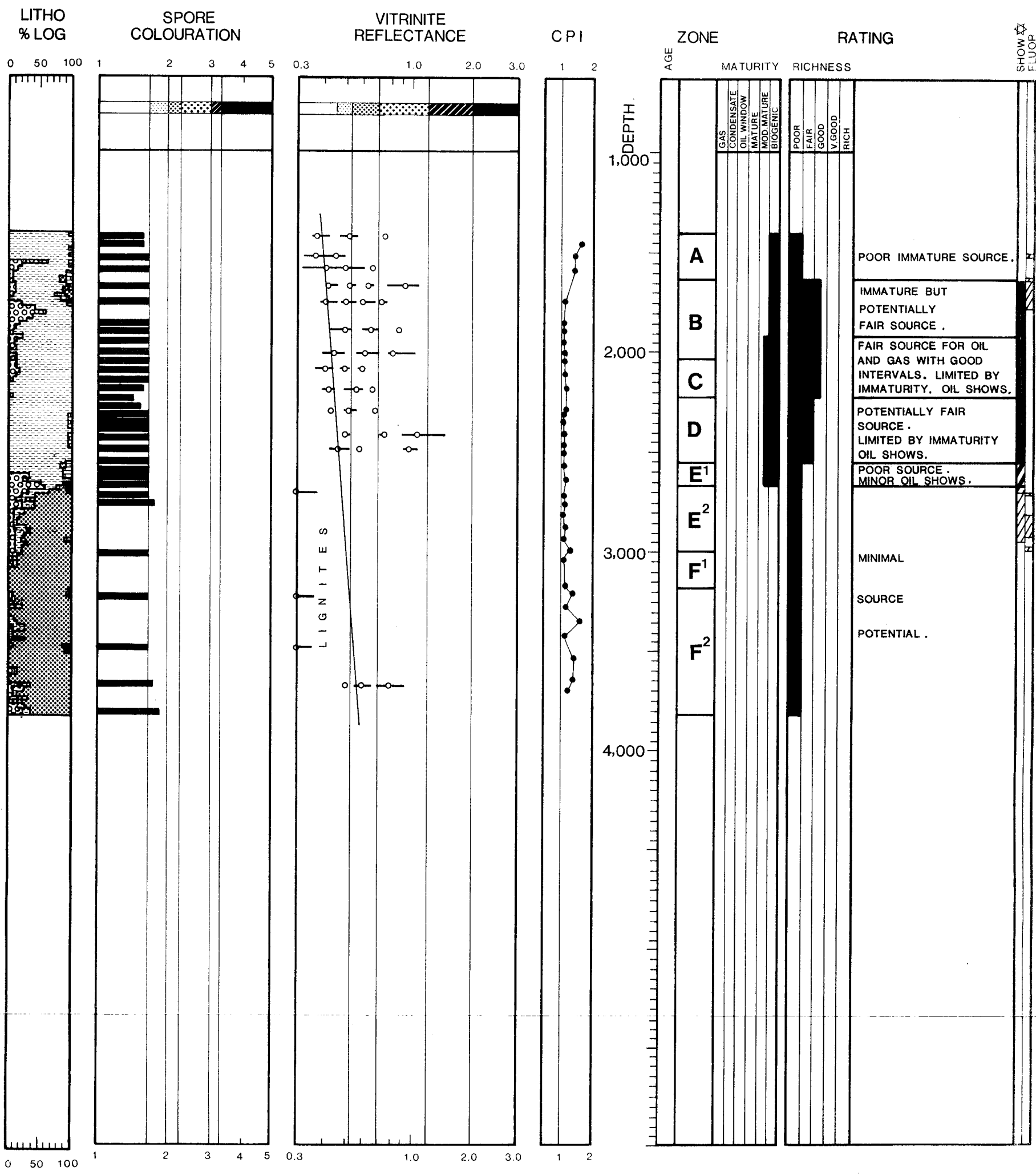
CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 = nC₂₀)



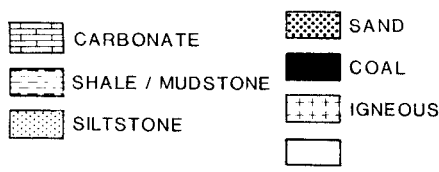
a = PRISTANE
b = PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 = nC₂₀)



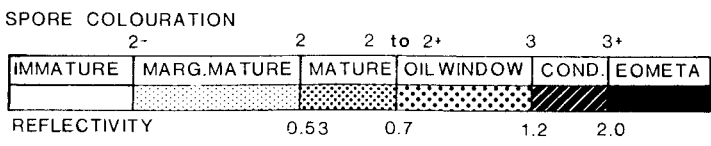


LITHOLOGIES



X RECALCULATED VALUE
● CORE
- PREFERRED TREND

CPI CARBON PREFERENCE INDEX



☆ GEOCHEMICAL