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# GEOCHEMICAL SERVICE REPORT

Prepared for

STATOIL

GEOCHEMICAL EVALUATION OF STATOIL'S 6406/3-1

HALTENBANKEN WELL

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SUMMARY

The interval between 350 metres and 4900 metres has been examined in this study.

The section above the top of the Jurassic at 3662± metres consists almost exclusively of poor, uninteresting source rocks which are further limited by immaturity. An exception is provided by the mudstones between 1675-2110± metres which have a poor or fair potential (but very good at 1800-1850± metres) for gas and associated light liquids.

In contrast, Jurassic shales from 3664-3680± metres represent a rich or occasionally a very good source for condensate/light oil gas or at best, for light oil and gas. Furthermore, minor to significant or significant hydrocarbon generation has already been initiated on-structure. In this well, however, these shales are too limited in thickness to generate economically significant volumes of hydrocarbons.

Similarly, coals of Lower Jurassic and Triassic age between 4490± metres and 4740± metres (at least) are extremely rich source rocks for gas and condensate. Moreover, on-structure they are mature (significant hydrocarbon generation) while below approximately 4550± metres they lie within the oil window of peak hydrocarbon generation and are therefore optimally mature. Further scattered very good and rich interbedded shales occur below 4825± metres.

Migrated hydrocarbons were frequently detected below 1650± metres. The strongest shows occur chiefly as wet gas/condensate or 'young' oil between 2405-2585± metres and as wet to extremely wet gas at 3665-3785± metres. Good shows of wet or marginally wet gas are associated with the coals within the Lower Jurassic and Trias but it is probable that these at least in part reflect the source potential of the sediments. Further minor shows are discussed in detail in Section E of the report.



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## INTRODUCTION

This report presents a geochemical evaluation of the interval between 350 metres and 4900 metres in Statoil's 6406/3-1 Haltenbanken well.

The analytical format was specified by the client and was designed to investigate the hydrocarbon source potential of the sediments in terms of richness, maturity and organic matter type and to detect and characterise shows of migrated hydrocarbons.

This project was authorised by Dr. H. Irwin, Statoil, Stavanger.

### A. ANALYTICAL

Three hundred and seventeen (317) canned cuttings samples composited over 50 metre intervals between 350-2050 metres and over 10 metres below this depth, were received from the interval 350-4900 metres in 6406/3-1. In addition, twenty nine (29) sidewall cores were submitted from 3600-4843 metres. The samples were assigned the Geochem job number 951.

The sediments were screened using the light hydrocarbon ( $C_1-C_7$ ), organic carbon and Rockeval pyrolysis analyses. Samples for further analysis were based on the screen results. A total of one hundred and seventy seven light hydrocarbon analyses, one hundred and forty Rockeval pyrolysis analyses, two hundred and fifty eight organic carbon determinations, eighteen extractions with chromatography, eighteen high resolution paraffin-naphthene analyses, sixty visual kerogen analyses, forty three vitrinite reflectance determinations, eighteen pyrolysis-GC analyses, twelve carbon isotope determinations, nine 7-ion and two 4-ion mass fragmentograms was performed in this study.

The data are presented in tables 1. through 11 and graphically in figures 1 through 12. A brief description of the analytical techniques is included at the back of this report.

### B. GENERAL INFORMATION

Ten (10) copies of this report together with the kerogen slides prepared for this study and an IBM magnetic tape of the data have been forwarded to Dr. H. Irwin in Stavanger. A copy of the data have been retained by Geochem for future consultation with authorised Statoil personnel.

The remaining sample material will be returned to Statoil.

The results of this study are proprietary to Statoil.

## RESULTS AND INTERPRETATION

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

Formation tops were supplied by the client.

### A. ZONATION

This zonation is based primarily on the biostratigraphy but also takes into account the lithological variations. Eight (8) zones are recognised.

Zone A lies between 350 metres and the top of the Cretaceous at 2410± metres. Mudstones frequently light or medium olive grey in colour dominate the interval above 1975± metres with the underlying section consisting of interbedded mixed shales and mudstones, very light olive grey to yellowish grey claystones and olive grey shaly mudstones. Sands form a major component of the samples above approximately 650± metres while significant proportions of basaltic material are intermittently present above 1850± metres. Isobutane to normal butane ratios range between 0.31 and 10.0.

No fluorescence was detected in the sands.

The gaseous hydrocarbons of this zone are commonly of fair abundance, although an improvement is evident between 1800-2185± metres (9734-24754(70084) ppm) and below 2365± metres (10670-14968 ppm). The gases are generally dry or extremely dry (2.6-26.1% C<sub>2+</sub> hydrocarbons) above 2245± metres and marginally wet ((15.6)33.8-49.7% C<sub>2+</sub>) below this depth. Artificial enhancement of gas wetness by loss of methane from poorly sealed or damaged cans is suggested by scattered values of 31.8-89.2% C<sub>2+</sub> hydrocarbons above 2120± metres. Gasoline range hydrocarbons rarely exceed 600 ppm above 2000± metres but improve to 918-14917 ppm at greater depth.

Zone B 2410± metres to 3662± metres is essentially a thick interval of medium grey Cretaceous mudstones and shales.

The  $C_1$ - $C_4$  gases are generally of good abundance ((3077)12109-20530 ppm) above 2565± metres, but apart from scattered minor 'kicks' are commonly poor or fair below this depth at 280-9647 ppm. Gasoline range hydrocarbons exhibit an irregular decrease with depth. Hence they lie within the limits of 176-1159 ppm below 3345± metres, are of fair abundance overall in the overlying sediments up to 2565± metres, and frequently exceed 13000 ppm at the top of this zone. The gases are variously marginally wet, wet or very wet above 3000± metres (38.4-79.7%  $C_{2+}$  hydrocarbons) but are consistently very wet or extremely wet (61.2-92.1%  $C_{2+}$ ) below this depth with the exception of the sample at 3110-3120± metres (30.6%  $C_{2+}$  hydrocarbons). Butane ratios commonly fall within the range 0.25-0.60.

Zone C 3662-3782± metres includes the Heather Formation and is a sequence of Jurassic age consisting of medium dark grey and medium grey to medium dark grey shales and interbedded brownish grey mudstones and shaly mudstones.

The gases in the uppermost sample of this zone achieve 97200 ppm (due in large part to an anomalously high concentration of propane) but fall to 3089 ppm in the underlying sample. The remaining section is characterised by good (10172-15310 ppm) or very good (27602 ppm) gas abundances. The gases are consistently very wet or extremely wet at 74.0-94.3%  $C_{2+}$  hydrocarbons and their butane ratios low (0.15-0.26). The heavier  $C_5$ - $C_7$  hydrocarbons range between 902-3653 ppm.

Zone D extends from 3782± metres to the top of the Dunlin at 4012± metres and is dominated by sands although a medium dark grey shale was recovered from the sidewall cores between 3917.7-3930.6± metres. Further thin shales and mudstones were noted at 3845-3885± metres. Lignite is present in a number of the samples.

No fluorescence was observed in the sands.

$C_1$ - $C_4$  gases lie within the limits of (455)1449-5937 ppm but are enhanced at 3830-3840± metres (18608 ppm). Wetness values of 7.9-36.8%  $C_{2+}$  hydrocarbons apply to the interval above 3925±

metres but they range between 31.9-80.2% in the underlying sediments. The gasoline fraction is generally poor at 381-1057(1865) ppm. Butane ratios remain low (0.19-0.42).

Zone E 4012± metres to 4177± metres comprises sandstones chiefly with interbedded medium grey to medium brownish grey silty mudstones.

No fluorescence was detected in the sandstones.

These sediments contain 437-7049(11333) ppm of very wet or extremely wet gas ((57.5)73.1-95.0%  $C_{2+}$  hydrocarbons). The heavier  $C_5$ - $C_7$  hydrocarbons are of poor abundance above approximately 4045± metres (586-611 ppm) but improve to 3967-5221 ppm between 4045-4125± metres and increase still further (7355-14884 ppm) below this depth. Isobutane to normal butane ratios exhibit little variation at 0.22-0.27.

Zone F 4177-4380± metres is essentially a sandstone unit of Lower Jurassic age. Thin medium grey to medium brownish grey silty shales (possibly caved) are occasionally present.

No fluorescence was observed in the sandstones.

The  $C_1$ - $C_4$  and  $C_5$ - $C_7$  hydrocarbon abundances are generally fair at 2898-12562 ppm and 1998-9362 ppm respectively and the gases are very wet ((51.5)61.3-82.6%  $C_{2+}$  hydrocarbons). Butane ratios are low (0.21-0.43).

Zone G 4380-4659± metres (Lower Jurassic) is dominated by sandstones and coals although sidewall cores at 4473.2± metres and 4598± metres yielded a dusky brown mudstone and a medium grey shale respectively.

No fluorescence was noted.

The richest intervals within this zone occur between 4485-4540± metres (34968-54122 ppm of  $C_1$ - $C_4$  gases) and below 4585± metres (53688-77424 ppm) and are clearly associated with the coals. Above 4485± metres the gases increase with depth from 1812-11134 ppm and represent a diffusion halo from the shows in the

underlying sediments, while abundances range between 5096-10313 ppm at 4540-4585± metres. The gases are consistently very wet (63.4-79.4%  $C_{2+}$  hydrocarbons) between 4505-85± metres but are otherwise commonly marginally wet or wet at 35.1-53.8(64.4)%  $C_{2+}$  hydrocarbons. These sediments typically contain fair abundances of gasoline range hydrocarbons (1032-5567 ppm) although they fall to 546-834 ppm between 4465-4505± metres and are enhanced at 4505-4520± metres (12931 ppm). Butane ratios (0.41-0.94) are somewhat higher than those of the overlying zones.

Zone H extends from 4659± metres to the deepest sample at 4900± metres and is Triassic in age. The interval above approximately 4725± metres is lithologically varied and comprises interbedded sandstones, coals and medium dark grey (to brownish grey) shales. The remaining sediments are dominated by shales ranging in colour from dark grey through medium grey to medium olive grey. Significant sandstone interbeds were noted between 4765-4845± metres.

No fluorescence was observed in the sandstones.

This zone is characterised by generally good or very good (12953-40463 ppm) or occasionally fair (5719-7735 ppm) abundances of marginally wet or wet gas (34.6-60.8%  $C_{2+}$  hydrocarbons). Values of 624-2689 ppm apply to the  $C_5$ - $C_7$  hydrocarbons while isobutane to normal butane ratios fall within the limits 0.51-0.92.

## B. AMOUNT AND TYPE OF ORGANIC MATTER

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

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

Within Zone A the olive grey mudstones and shaly mudstones from the interval 1675-2110± metres contain good abundances (1.28-1.94% organic carbon) of mixed algal-woody-herbaceous-amorphous organic matter, although the sample at 1800-1850± metres is both richer at 3.13% organic carbon and is characterised by an organic assemblage comprising amorphous and algal debris together with significant wood. Above 1675± metres the medium and light olive grey mudstones are consistently poor (0.25-0.56% organic carbon) and this leanness is further compounded by the nature of their organic matter which is dominantly woody with significant herbaceous material and inertinite. The remaining sediments within this zone are comparable in terms of richness (0.16-0.71% organic carbon though rarely exceeding 0.5%), but their organic matter is of better quality being mixed algal-herbaceous-woody in type or chiefly herbaceous with significant algal debris and wood.

Only minor variations in richness and organic matter type are apparent in the Cretaceous mudstones and shales of Zone B. Organic carbon values chiefly fall within the range 0.63-1.10% while the organic matter in these sediments is woody-inertinitic or dominantly woody with significant inertinite. Herbaceous material and occasionally algal debris are present in significant amounts above approximately 2730± metres.

At 3.16-10.5% organic carbon, the medium dark grey to brownish grey and (medium) dark grey shales above 3680± metres in Zone C represent the richest sediments of the analysed section to date. Moreover, they are characterised by organic assemblages that are either dominantly algal (including material undergoing sapropelisation) with significant amorphous and woody material and minor or significant inertinite and herbaceous debris or mixed algal-inertinitic-

herbaceous-woody in type with significant or minor amorphous material. The remaining shales and mudstones resemble those of Zone B in richness (0.60-1.12% organic carbon) and organic matter type, although the mudstone interbeds below 3750± metres are enhanced at 1.87-1.97% organic carbon. The sidewall core from 3774± metres yielded a rich shale containing 7.98% of amorphous-algal organic matter together with significant wood and inertinite.

The Zone D shales and mudstones vary between 0.87-5.13% organic carbon. Their organic matter is largely woody with significant inertinitic and herbaceous fractions or mixed woody-herbaceous-inertinitic. Similar organic assemblages were recovered from the silty mudstones of Zone E although their organic carbon values exhibit less variation at (0.58)1.03-1.66%. The very minor silty shales of Zone F contain 1.03-1.63% of organic matter that is woody-herbaceous with significant inertinite.

The coals of Zones G and H are rich (34.3-64.6% organic carbon) and consist almost exclusively of vitrinite (wood) with minor or significant inertinite.

The minor mudstones and shales of Zone G, the shales of Zone H above 4753± metres and the interbeds of dark grey shales below this depth are frequently of above-average richness at 0.94-2.83% organic carbon, while organic carbon values reach 6.98-11.20% in the coaly shales. In contrast, the medium grey shales that dominate the interval below 4753± metres are consistently poor (0.14-0.34% organic carbon) while the pale brown shales at the base of the analysed section are even leaner at 0.07-0.09% organic carbon. The richer sediments of Zones G and H are comparable to the coals in terms of organic matter type.

### C. LEVEL OF THERMAL MATURATION

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

The spore colouration method suggests that a thermal index of 2- is achieved at a depth close to  $2870\pm$  metres while values of 2 and 2 to 2+ are reached at  $3670\pm$  metres and  $3900\pm$  metres respectively. A thermal index of 2+ applies to the sediments below approximately  $4550\pm$  metres.

All organic matter with a thermal index of less than 2- is immature. Amorphous, herbaceous±algal debris become marginally mature (minor hydrocarbon generation) at 2- and mature (significant generation, not oil window) at 2 whilst the top of the oil window of peak hydrocarbon generation lies at 2 to 2+. The corresponding values for woody and inertinitic organic matter are 2, 2 to 2+ and 2+ respectively.

In this well, therefore, the sediments are immature or effectively immature down to the base of the Cretaceous. Minor to significant or significant generation is anticipated from the rich shales at the top of Zone C although the underlying section down to approximately  $3900\pm$  metres is only marginally mature (minor hydrocarbon generation) due to the overall character of the organic matter. Significant generation will have commenced from the sediments between  $3900\pm$  metres and  $4550\pm$  metres and peak generation can be expected below this depth. However, sediments containing good quality (as opposed to woody and inertinitic) organic matter would lie within the oil window of peak hydrocarbon generation below approximately  $3900\pm$  metres.

Confirmation of these maturation levels was sought from the vitrinite reflectance data. These clearly indicate extensive reworking of the organic matter resulting in a considerable scatter of individual readings and multiple vitrinite populations, particularly above approximately  $4000\pm$  metres. Below this depth difficulties arising from reworking and occasionally of differentiating vitrinite from other organic debris exist, although overall the data are of better quality. In particular, the coals present below approximately  $4490\pm$  metres yielded one very dominant vitrinite population with a mean value of 0.94-1.06% Ro, while similar values were obtained from the rich shales between 4830-4860± metres. Such reflectivities are compatible with the spore colouration indices of 2+ below  $4550\pm$  metres. The preferred vitrinite trend honours the coal reflectivities and takes in the values of 0.69% Ro and 0.52% Ro at 4130-4140± metres and 3673±

metres respectively. This trend reaches a reflectivity of 0.53% (corresponding to the top of the zone of significant hydrocarbon generation and a thermal index of 2) at approximately  $3700\pm$  metres. There is therefore very good agreement between the two methods at 2 and 2+ although the correlation is less good for the top of the oil window of peak hydrocarbon generation (i.e. 2 to 2+ equivalent to 0.72% Ro). Unfortunately, this trend does not appear to apply to the section above  $3700\pm$  metres since not only does it suggest the onset of minor hydrocarbon generation at approximately  $3400\pm$  metres as opposed to the depth of  $2870\pm$  metres indicated by the visual kerogen method, but in addition, the line by projection intercepts the surface at an anomalously low value of approximately 0.05% Ro. Consequently the spore colouration data are preferred over the interval above  $3700\pm$  metres. Despite this lack of correlation between the two methods at shallower depth, values of 0.37-0.40% Ro between  $1800\pm$  metres and  $2240\pm$  metres do lend some support to the spore colour indices.

Overall, levels of thermal maturity defined by the spore colouration indices are believed to be more reliable and these will be adopted in this study.

#### D. SOURCE RICHNESS

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

The light hydrocarbon data suggest that Zone C has a generally good source potential although very good or rich interbeds are also present, while Zone G comprises intervals which are variously fair, rich, very good and occasionally good. Zone H is good or very good. In contrast, the remaining zones are fair overall, although good interbeds occur in Zone A and at the top of Zone B. However, as migrated hydrocarbons are suspected throughout Zones B through H, the light hydrocarbon abundances cannot reliably be used to assess source richness for this part of the section.

Organic carbon contents indicate that Zone A is a generally poor source but contains good interbeds, while Zone B is fair overall. A similar rating applies to much of Zone C, although rich shales dominate the section above 3685± metres. Zones D through F comprise sandstones chiefly with occasional good interbeds. The Triassic sediments of Zone H are poor with good to rich interbeds below 4725± metres but fair and good shales are interbedded with coals above this depth. Zone G contains good thicknesses of rich coals. However, the abundance of woody and inertinitic organic matter in these sediments means that assessments based on organic carbon values are likely to be optimistic.

Upon extraction the shales and mudstones of Zone B commonly yielded 91-182 ppm  $C_{15+}$  hydrocarbons, indicating a poor potential, although values of 394 ppm for the silty mudstone from 2550-2560± metres and of 866 ppm for the mudstone at 3310-3320± metres suggest that these sediments are respectively good and very good source rocks. However, hydrocarbon to total extract ratios of 58.17-63.33 indicate enhancement by non indigenous species. Examination of the paraffin-naphthene chromatograms suggests that a (relatively light) crude is present at 3310-3320± metres whereas a weak show of "young" oil is suspected at 2550-2560± metres. Within Zone C,  $C_{15+}$  hydrocarbon abundances are compatible with the very good or rich rating for the (medium) dark grey shales above 3680± metres, but indicate a poor one for the mudstones and shales at 3750-3760± metres. Although their chromatograms are dominated by source indigenous hydrocarbons, possible traces of oil may be present in the (medium) dark shales, particularly at 3669± metres. The sandstones of Zones D and F

yielded 104-372 ppm  $C_{15+}$  hydrocarbons and 1848 ppm at 3850-3860± metres. The paraffin-naphthene traces of this latter sample are dominated by an unresolved hump between approximately  $nC_{25}$  and  $nC_{35}$ , and does not resemble a crude oil despite the abundance of  $C_{15+}$  hydrocarbons and the high hydrocarbon to total extract ratio (74.55). The two alternatives are a drilling introduced contaminant or a 'dead' stain. For the remaining sandstones, traces of condensate/light oil are suggested at 4350-4360± metres and possible insignificantly minor traces of a crude at 4270-4280± metres, while the hydrocarbons from 3930-3940± metres are interpreted as a mixture of drilling introduced contamination and hydrocarbons extracted from a lignite. Source indigenous species and drilling introduced contamination dominate the extracts of the sediments from Zones G and H. Mention, however, must be made of the coal at 4650-4660± metres which yielded 11248 ppm  $C_{15+}$  hydrocarbons with classic immature characteristics (as might be expected of a lignite), yet subsequent analysis indicates that the coal is mature. These data are therefore clearly incompatible and the hydrocarbons are believed to be associated with a lignite. In conclusion, it is evident that in view of the presence of shows and drilling introduced contamination, the abundances of extracted  $C_{15+}$  hydrocarbons are frequently not related to source richness in this well.

Hydrocarbon potential at optimum maturity is measured using the pyrolysis technique. With the exception of the mudstones and shaly mudstones from 1675-2115± metres which at 1.55-2.45 mg/g S<sub>2</sub> (pyrolysate) are poor or fair source rocks but very good (5.56 mg/g) at 1800-1850± metres, the sediments of Zones A and B (i.e. the entire analysed section to the top of the Jurassic) are consistently poor with 0.11-1.16 mg/g S<sub>2</sub>. In contrast, the Zone C (medium) dark grey to brownish grey shales above 3685± metres and at 3774± metres are potentially rich or occasionally very good source rocks yielding 7.90-33.28 mg/g S<sub>2</sub>, although the remaining sediments of this zone constitute a poor source. Within Zone D the shale interbed at 3850-3860± metres is a potentially good source rock (3.60 mg/g) while the medium dark grey shales at 3928.8-3930.6± metres are variously rich or fair. Further fair or good interbeds (2.47-3.24 mg/g) occur at 4110-65± metres and 4350-4360± metres. With pyrolysate values of 80.72-87.54 mg/g, the coals of Zones G and H are clearly extremely rich source rocks. Zone H (Trias) is otherwise characterised by poor sediments, although the dark grey shales from 4805-4840± metres vary between a fair (2.33 mg/g) and a very good (6.72 mg/g) rating. The dark grey shale at 4870-4880± metres represents a rich potential source (17.57 mg/g S<sub>2</sub>).

Chromatograms of the S<sub>2</sub> (pyrolysate) fraction define whether a mature source

rock will yield oil, gas or condensate. Oil-prone source rocks are characterised by chromatograms with a well-defined series of normal alkene-alkane doublets which extend out to the heavy ends. If the doublets are restricted to the front ends a potential for condensate is indicated whilst in gas-prone sediments the doublets are (essentially) absent. In this well, a number of the analysed sediments, i.e. the coals of Zones G and H, the silty mudstones of Zone E and the medium grey shale at 4130-4140± metres, generated chromatograms consisting of methane followed by a well developed series of aromatic compounds restricted chiefly to the C<sub>20</sub>- and occasionally the C<sub>15</sub>- fraction and with a distinct front end bias. Such sediments have a potential essentially for gas and condensate. The most oil-prone facies within this section is represented by the (medium) dark grey to brownish grey shales of Zone C above 3685± metres and at 3774± metres. These shales yielded 'pyrograms' containing alkane-alkene doublets out to nC<sub>20</sub> and occasionally to nC<sub>25</sub>. Nevertheless, these are not classically oil-prone sediments and their primary potential is for condensate /light oil and gas or at best, for light oil and gas. The richer mudstones and shaly mudstones of Zone A would if mature, yield gas with associated light liquids. Although the chromatograms were generated by pyrolysis of kerogen concentrates as opposed to whole rock samples wherever possible, the presence of drilling introduced contamination is occasionally apparent (as at 4690-4700± metres).

In summary therefore:

- Zones A and B: consistently poor source apart from the fair mudstones (very good at 1800-1850± metres) for gas and associated light liquids between 1675-2115± metres.
- Zone C: rich or occasionally very good shales above 3680± metres and at 3774± metres. Potential for condensate/light oil and gas or at best, for light oil and gas.
- Zone D: essentially a poor sequence of little significance as a source. Good interbed at 3850-3860± metres with a potential similar to that of the Zone C shales; further rich and fair shales at 3928.8± metres and 3930.6± metres respectively.
- Zone E: poor potential overall but with interbedded fair or good silty mudstones between 4110-4165± metres. Potential for gas with associated condensate.

- Zone F: dominated by sandstones and therefore of minimal interest - minor fair shale at 4350-4360± metres.
- Zone G: the coals represent an extremely rich source for gas and condensate.
- Zone H: generally poor source although the coal interbeds have an excellent potential for gas and condensate. Thin very good and rich shale interbeds at 4830-4840± metres and 4870-4880± metres respectively.

## E. MIGRATED HYDROCARBONS

Potential reservoir facies are represented by the sands at the top of Zone A and by the thick sandstone units of Zones D through H.

No fluorescence was detected in the sandstones.

Gaseous hydrocarbons between 350-1650± metres are commonly dry and of fair abundance, although artificial enhancement of gas wetness by loss of methane from poorly sealed and damaged cans is indicated. The presence of migrated hydrocarbons is not suspected within this interval. Moderate shows essentially of dry gas (with minor associated light liquids) are suggested by the improved  $C_1$ - $C_4$  abundances at 1800-2185± metres with traces extending up to 1650± metres. These shows may reflect at least in part a change in source facies.

Gas wetness values of 54.9-71.8%  $C_{2+}$  hydrocarbons strongly suggest that migrated hydrocarbons are present above 2625± metres in Zone B (Cretaceous). The abundance and composition of the light hydrocarbons indicates that shows or moderate shows of at least wet gas/condensate and possibly of oil occur between 2405± metres and 2585± metres with further traces apparent down to 2625± metres and up into Zone A to a depth of 2365± metres. A yield of 394  $C_{15+}$  hydrocarbons by the silty mudstone at 2550-2560± metres together with a hydrocarbon to total extract ratio of 58.17 indicates a strong contribution from migrated hydrocarbons - the paraffin-naphthene chromatogram suggesting that these out of place hydrocarbons are present as a 'young' oil. In contrast, the paraffin-naphthenes extracted from the shale at 2450-2460± metres are dominated by a mixture of immature source indigenous hydrocarbons and a highly naphthenic drilling introduced contaminant. The moderate show at this depth, therefore, is likely to be wet gas/condensate in type. Additional traces of wet gas and light liquids were observed at 2685-2725± metres with weaker traces down to 2765± metres. Traces of very wet or extremely wet gas ± minor light liquids are present throughout most of the section between 2905± metres and 3385± metres at least, and intermittently down to the base of Zone B, although a 'kick' of very wet gas is apparent at 3445-3505± metres and a show of (relatively light) crude was detected at 3310-3320± metres.

Within Zone C a strong show of extremely wet gas is indicated at 3670-3680± metres (the  $C_{15+}$  paraffin-naphthenes in the shales at 3669± metres and 3670-3680± metres suggest that traces of oil may also be involved), while shows of very wet and extremely wet gas are apparent throughout the Heather. The

only show of note in Zone D is the 'kick' of dry gas at 3830-3840± metres.

Gas wetness values of (57.5)73.1-95.0%  $C_{2+}$  hydrocarbons for Zone E resemble those of the Heather Formation although the  $C_1$ - $C_4$  gas and gasoline range hydrocarbons are only occasionally of good abundance and are commonly fair. A combination of light hydrocarbon and heavy  $C_{15+}$  hydrocarbon data suggests that traces of a crude may be present between 4125-4165± metres together with insignificantly minor traces elsewhere in this zone. Traces or weak shows of very wet gas and associated liquids occur within the Lower Jurassic sandstones of Zone F while minor traces of a condensate/light oil were extracted from the sandstone at 4350-4360± metres.

Good shows of wet gas are apparent at 4485-4540± metres and below 4585± metres in Zone G. A considerable proportion of these gases is indigenous and may be attributed to the coals of this zone. However, gas wetness values in excess of 60%  $C_{2+}$  hydrocarbons suggest that out of place hydrocarbons are also present. If the sandstone intervals without coals are assumed to represent the probable level of migrated hydrocarbons, then only weak or at best, moderate shows could be involved, and it is likely that hydrocarbons are essentially wet or marginally wet gas in type. A possible show of condensate/light oil is suggested at 4510-4520± metres.

Fairly strong shows of marginally wet or wet gas are associated with the coals above 4785± metres in Zone H. Further shows or weak shows are apparent to the base of this zone.

Mass fragmentograms were prepared to characterise the various shows discussed above. A number of the traces, however, are rather poor as a result of the small amount of material available for analysis. Furthermore, detailed consideration of the fragmentograms does not indicate any distinct clearcut groupings. Nevertheless, the following observations are made. Turning to the m/z 191 traces, that at 3669± metres most clearly resembles a good oil-prone source, while at 3670-3680± metres the presence either of an early oil or of contamination is suggested. The presence of significant contamination is indicated in a number of the samples, notably at 3930-3940± metres. The triterpane configuration at 4510-4520± metres differs from that of all the other samples and is characteristic of a coal. The full range of triterpanes present in the extract from the sandstone at 3850-3860± metres indicates the presence of a crude (as opposed to drilling introduced contamination) at this depth, but the light hydrocarbon data and  $C_{15+}$  paraffin-naphthene chromatogram suggest a

'dead' stain. The  $m/z$  218 (sterane) fragmentograms offer little support for a detailed correlation although they suggest that an essentially marine organic input applies to the (medium) dark grey shale at  $3669 \pm$  metres, whereas the proportions of the  $C_{27}$ ,  $C_{28}$  and  $C_{29}$  steranes indicate that a mixed organic input is more likely for the samples at  $2550-2560 \pm$  metres,  $3310-3320 \pm$  metres and  $4130-4140 \pm$  metres. Unfortunately, on this basis, a mixed input is also suggested for the coal at  $4510-4520 \pm$  metres!

Correlations based on the carbon isotope values of the  $C_{15+}$  extracted hydrocarbons and a suite of kerogens are somewhat inconclusive. Kerogens isolated from the Lower Jurassic and Triassic coals gave similar values of  $-25.64^{\circ}/\text{oo}$  to  $-25.88^{\circ}/\text{oo}$  whereas the (medium) dark grey shales at the top of Zone C produced values ranging between  $-24.56^{\circ}/\text{oo}$  and  $-26.20^{\circ}/\text{oo}$ . On the basis of carbon isotope values of the  $C_{15+}$  saturate hydrocarbon fractions, a correlation is suggested for the oil shows at  $2550-2560 \pm$  metres and  $3310-3320 \pm$  metres. The hydrocarbons extracted from the sandstone at  $4350-4360 \pm$  metres gave values of  $-31.52^{\circ}/\text{oo}$  and  $-27.71^{\circ}/\text{oo}$  for the saturate and aromatic fractions respectively, but these data must be treated with caution since the amount of sample available for analysis was very small. A similar observation applies to the sample from  $3850-3860 \pm$  metres in which the extract is dominated by an unresolved hump between  $nC_{25}$  and  $nC_{35}$  of uncertain origin, the alternatives being a drilling introduced contaminant or a 'dead' stain. This sample gave identical carbon isotope values ( $-25.08^{\circ}/\text{oo}$ ) for both the saturate and aromatic hydrocarbons. At  $-27.56^{\circ}/\text{oo}$  for the saturates, the crude at  $4130-4140 \pm$  metres does not appear to correlate with the other shows.

To summarise:-

- moderate shows essentially of dry gas with minor associated light liquids are present between  $1800-2185 \pm$  metres in Zone A with further traces up to  $1650 \pm$  metres.
- shows and moderate shows of wet gas/condensate or of a 'young' oil occur between  $2405 \pm$  metres and  $2585 \pm$  metres with further traces extending down to  $2625 \pm$  metres and up into Zone A to  $2365 \pm$  metres.
- traces of wet gas or wet gas and light liquids were observed at  $2685-2725 \pm$  metres with weaker traces down to  $2765 \pm$  metres.

- traces of very wet or extremely wet gas  $\pm$  minor light liquids are present throughout the interval 2905-3385 $\pm$  metres at least, and intermittently down to the base of Zone B. A 'kick' of very wet gas is apparent at 3445-3505 $\pm$  metres while a show of (relatively light) crude was detected at 3310-3320 $\pm$  metres.
- strong show of extremely wet gas together with possible traces of oil at 3669-3680 $\pm$  metres. Shows of very wet and extremely wet gas are apparent throughout the Heather Formation.
- a 'kick' of dry gas was detected at 3830-3840 $\pm$  metres.
- traces of a crude are suggested at 4125-4165 $\pm$  metres in Zone E. Insignificantly minor traces may be present elsewhere within this zone.
- traces or weak shows of very wet gas and associated light liquids are present within the Lower Jurassic sandstones of Zone F. Minor traces of a condensate/light oil were extracted from the sandstone at 4350-4360 $\pm$  metres.
- good shows of wet gas at 4485-4540 $\pm$  metres and below 4585 $\pm$  metres in Zone G associated with the coals. Weak or at best, moderate shows of wet or marginally wet gas elsewhere in this zone. A possible show of condensate/light oil is suspected at 4510-4520 $\pm$  metres.
- fairly strong shows of marginally wet or wet gas are associated with the coals above 4785 $\pm$  metres in Zone H. Further shows or moderate shows are apparent to the base of this zone.

## F. CONCLUSIONS

Eight (8) zones are recognised in the interval between 350 metres and 4900 metres in the 6406/3-1 well.

Zone A lies between 350 metres and the top of the Cretaceous at 2410± metres. Mudstones dominate the interval above 1975± metres with the underlying section consisting of mixed shales, mudstones, shaly mudstones and claystones. Sands form a major component of the samples above approximately 650± metres, while significant proportions of basaltic material are intermittently present above 1850± metres. The mudstones and shaly mudstones from 1675-2110± metres contain good abundances (1.28-1.94% organic carbon) of mixed algal-woody-herbaceous-amorphous organic matter although the sample at 1800-1850± metres is richer (3.13% organic carbon) and is characterised by an organic assemblage comprising amorphous and algal debris with significant wood. These mudstones are immature, but even if mature, they would only be poor or fair source rocks (very good at 1800-1850± metres) for gas and associated light liquids. Above 1675± metres the mudstones are consistently poor (0.25-0.56% organic carbon) and this leanness is further emphasised by the nature of the organic matter which is dominantly woody with significant herbaceous material and inertinite. The remaining sediments of this zone are comparable in terms of richness (0.16-0.71% organic carbon), although they are mixed algal-herbaceous-woody in organic matter type or chiefly herbaceous with significant algal debris and wood. These sediments are lean and uninteresting source rocks which are further limited by immaturity. Moderate shows essentially of dry gas ± minor associated light liquids are present between 1800-2185± metres with further traces up to 1650± metres.

Zone B 2410± metres to 3662± metres is essentially a thick interval of Cretaceous mudstones and shales. Organic carbon values of 0.63-1.10% apply to these sediments while their organic matter is woody-inertinitic or dominantly woody with significant inertinite. These sediments are poor, immature or effectively immature source rocks.

Shows and moderate shows of wet gas/condensate or of a 'young' oil occur between 2405± metres and 2585± metres with further traces extending down to 2625± metres and up into Zone A to 2365± metres. Traces of wet gas or wet gas and light liquids were observed at 2685-2725± metres with weaker traces down to 2765± metres, while traces of very wet or extremely wet gas ± minor light liquids are present throughout the interval 2905-3385± metres at least, and

intermittently down to the base of Zone B. A 'kick' of very wet gas is apparent at 3445-3505± metres and a show of (relatively light) crude was detected at 3310-3320± metres.

Zone C 3662-3782± metres includes the Heather Formation and is a sequence of Jurassic age consisting of medium (dark) grey shales and interbedded mudstones and shaly mudstones. At 3.16-10.50% organic carbon, the shales above 3680± metres are the richest sediments of the analysed section to date, and moreover, they are characterised by organic assemblages that are either dominantly algal (including material undergoing sapropelisation) with significant amorphous and woody material ± inertinite and herbaceous debris or mixed algal-inertinitic-herbaceous-woody in type. The sidewall core at 3774± metres yielded a shale containing 7.98% of amorphous-algal organic matter together with significant wood and inertinite. These rich shales represent a rich (or occasionally a very good) source for condensate/light oil and gas, or at best, for light oil and gas, and furthermore, minor to significant or significant hydrocarbon generation has already been initiated on-structure. Unfortunately, within this well, they are too limited in thickness to generate economically significant volumes of hydrocarbons. The remaining shales and mudstones contain fair or good abundances (0.60-1.97% organic carbon) of organic matter that is mainly woody with significant or major inertinite and minor or significant herbaceous debris. These sediments are consistently poor, marginally mature source rocks. Shows of very wet and extremely wet gas are apparent throughout the Heather Formation, while a strong show of extremely wet gas together with possible traces of oil was detected at 3669-3680± metres.

Zone D extends from 3782± metres to the top of the Dunlin at 4012± metres and is dominated by sands, although shales were recovered from the sidewall cores between 3917.7-3930.6± metres and further thin shales and mudstones were noted at 3845-3885± metres. Lignite is present in a number of the samples. The sediments of this zone vary between 0.87-5.13% organic carbon and their organic matter is either woody with significant inertinitic and herbaceous fractions or mixed woody-herbaceous-inertinitic. Overall, this is a zone of little exploration significance, although the shale interbed at 3850-3860± metres is per unit volume a good, marginally mature source for condensate and gas, while significant generation can also be anticipated from the rich and fair shales at 3928.8± metres and 3930.6± metres respectively. A 'kick' of dry gas was observed at 3830-3840± metres.

Zone E 4012± metres to 4177± metres comprises sandstones chiefly with

interbedded silty mudstones. The mudstones are of above-average richness at (0.58)1.03-1.66% organic carbon and their kerogens are dominantly woody with significant inertinite and herbaceous material or chiefly herbaceous with significant wood and inertinite. These silty mudstones are mature (significant hydrocarbon generation) but they are frequently only poor source rocks, although the interbeds at 4110-4165± metres have a fair or occasionally a good potential for gas with associated condensate. Traces of a crude may be present at 4125-4165± metres within this zone.

Zone F 4177-4380± metres is essentially a sandstone unit of Lower Jurassic age. Occasional thin silty shales containing good abundances (1.03-1.63% organic carbon) of woody-herbaceous organic matter and significant inertinite are also present. However, further analysis indicates that these are only poor source rocks (although the shale at 4350-4360± metres is fair), and consequently this zone is of minimal interest. Traces or weak shows of very wet gas and associated light liquids are present within this interval together with minor traces of a condensate/light oil at 4350-4360± metres.

Zone G 4380-4659± metres is almost exclusively a sequence of sandstones and coals. The coals are rich at 34.3-64.6% organic carbon and dominantly woody in type. These coals are extremely rich source rocks for gas and condensate and moreover, on-structure significant generation has already commenced, while below approximately 4550± metres they lie within the oil window of peak hydrocarbon generation. Good shows of wet gas at 4485-4540± metres and below 4585± metres are associated with the coals, while weak or at best, moderate shows of wet or marginally wet gas are present elsewhere in this zone. A possible show of condensate/light oil is suspected at 4510-4520± metres.

Zone H extends from 4659± metres to the deepest sample at 4900 metres and is Triassic in age. The interval above approximately 4725± metres is lithologically varied and comprises interbedded sandstones coals and shales. The remaining section is dominated by mixed shales together with sandstone interbeds between 4765-4845± metres. The shales above approximately 4735± metres and the interbeds of dark grey shale below this depth are frequently of above-average richness at 0.94-2.83% organic carbon, with values reaching 6.98-11.2% for the minor coaly shales below 4830± metres and 37.6-58.2% in the case of the coals. In contrast, the medium grey ± pale brown shales that dominate the section below 4755± metres are consistently poor at 0.07-0.34% organic carbon. The coals and richer sediments are characterised by organic assemblages that are very dominantly woody. Although the sediments of this zone lie within the oil

window of peak hydrocarbon generation and are therefore optimally mature,  
overall they are only poor source rocks. Exceptions, however, are provided by  
the interbeds of coal at the top of this zone which represent a rich and fully  
mature source for gas and condensate and by the thin but very good/rich shale  
interbeds at 4830-4840± metres and 4870-4880± metres respectively. Fairly  
strong shows of marginally wet or wet gas are associated with the coals above  
4785± metres with further shows or moderate shows to the base of this zone.

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                                                                                                                         | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-002                     | 400-450m   | A 70% Sand, coarse grained, poorly sorted<br>but quartz most abundant, white<br>B 25% Igneous, basalt, blocky, hard, non-<br>calc., minor caving, greenish grey<br>C 5% Shelly debris, mainly bivalves and<br>forams<br>Minor acid igenous, schist and mud-<br>stone | N9<br>5G6/1             |                                            |
| 951-004                     | 500-550m   | A 60% Sand, as 951-002A<br>B 30% Mudstone, often silty, blocky, soft,<br>calc. cement, minor caving, greenish<br>grey<br>C 10% Igneous, as 951-002B, sig. caving<br>Minor schist, meta-quartzite, acid<br>igneous, limestone, shelly debris                          | N9<br>5Y6/1<br>5G6/1    | 0.27                                       |
| 951-006                     | 600-650m   | A 50% Sand, as 951-002A<br>B 50% Mudstone, as 951-004B, sig. caving<br>Minor metamorphics, shelly debris,<br>limestone                                                                                                                                               | N9<br>5Y6/1             | 0.25                                       |
| 951-008                     | 700-750m   | A 90% Mudstone, as 951-004B, sig. caving<br>B 10% Sand, as 951-002A<br>Minor limestone, metamorphic, igneous                                                                                                                                                         | 5Y6/1<br>N9             | 0.29                                       |
| 951-010                     | 800-850m   | A 90% Mudstone, as 951-004B, sig. caving<br>B 10% Sand, as 951-002A<br>Minor limestone, shelly debris,<br>igneous                                                                                                                                                    | 5Y6/1<br>N9             | 0.30                                       |
| 951-012                     | 900-950m   | A 95% Mudstone, as 951-004B, sig. caving<br>B 5% Sand, as 951-002A<br>Minor limestone, igneous                                                                                                                                                                       | 5Y6/1<br>N9             | 0.37, 0.36                                 |
| 951-014                     | 1000-1050m | A 90% Mudstone, as 951-004B, sig. caving<br>B 10% Igneous, basalt, blocky, hard, non-<br>calc., abundant caving, dark grey<br>Minor limestone, sand                                                                                                                  | 5Y6/1<br>N3             | 0.37                                       |
| 951-016                     | 1100-1150m | A 65% Mudstone, blocky, soft, calc. cement,<br>sig. caving, medium olive grey<br>B 35% Igneous, basalt, blocky, hard, non-<br>calc., sig. caving, dark grey<br>Minor sand, shelly debris                                                                             | 5Y5/1<br>N3             | 0.40                                       |
| 951-018                     | 1200-1250m | A 90% Mudstone, as 951-016A, sig. caving<br>B 10% Igneous, as 951-016B, minor caving<br>Minor limestone                                                                                                                                                              | 5Y5/1<br>N3             | 0.39                                       |
| 951-020                     | 1300-1350m | A 80% Mudstone, as 951-016A, sig. caving<br>B 20% Sand, medium grained, poorly sorted,<br>sub-angular, quartz most abundant,<br>white<br>Minor igneous                                                                                                               | 5Y5/1<br>N9             | 0.40                                       |
| 951-022                     | 1400-1450m | A 90% Mudstone, as 951-016A, sig. caving<br>B 10% Igneous, as 951-016B, sig. caving<br>Minor sand                                                                                                                                                                    | 5Y5/1<br>N3             | 0.36, 0.33                                 |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                     | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-024                     | 1500-1550m | A 98% Mudstone, blocky, soft, calc. cement, sig. caving, medium olive grey<br>Minor basalt, sand                                                 | 5Y5/1                   | 0.56                                       |
| 951-026                     | 1600-1650m | A 80% Mudstone, as 951-024A, sig. caving<br>B 10% Igneous, basalt, blocky, hard, non-calc., sig. caving, dark grey<br>C 10% LCM - walnut shell   | 5Y5/1<br>N3             | 0.42                                       |
| 951-028                     | 1700-1750m | A 80% Mudstone, as 951-024A, sig. caving<br>B 20% Igneous, as 951-026B, sig. caving                                                              | 5Y5/1<br>N3             | 1.31                                       |
| 951-030                     | 1800-1850m | A 90% Mudstone, as 951-024A, sig. caving<br>B 10% Igneous, as 951-026B, sig. caving<br>Minor other mudstone                                      | 5Y5/1<br>N3             | 3.13                                       |
| 951-032                     | 1900-1950m | A 98% Mudstone, often silty, blocky, mod. soft, non-calc., sig. caving, yellowish grey<br>Minor other mudstone                                   | 5Y8/1                   | 1.28                                       |
| 951-034                     | 2000-2050m | A 80% Shaly mudstone, silty in part, platy, mod. hard, non-calc., olive grey<br>B 20% Mudstone, as 951-032A, dominant caving                     | 5Y4/1<br>5Y8/1          | 1.89, 1.94                                 |
| 951-035                     | 2050-2060m | A 90% Shaly mudstone, as 951-034A, sig. caving<br>B 10% Siltstone, blocky, soft, sl. calc., dominant caving, yellowish grey                      | 5Y4/1<br>5Y8/1          | 1.43                                       |
| 951-038                     | 2080-2090m | A 50% Shaly mudstone, as 951-034A, sig. caving<br>B 50% Shale, platy, mod. hard, soft, non-calc., minor caving, greenish grey<br>Minor siltstone | 5Y4/1<br>5GY6/1         | 1.53<br>0.34                               |
| 951-040                     | 2100-2110m | A 60% Shaly mudstone, as 951-034A, abundant caving<br>B 40% Shale, as 951-038B, sig. caving                                                      | 5Y4/1<br>5GY6/1         | 1.71, 1.73<br>0.44                         |
| 951-042                     | 2120-2130m | A 65% Shale, as 951-038B, sig. caving<br>B 35% Shaly mudstone, as 951-034A, dominant caving                                                      | 5GY6/1<br>5Y4/1         | 0.33                                       |
| 951-044                     | 2140-2150m | A 80% Shale, as 951-038B, minor caving<br>B 10% Shaly mudstone, as 951-034A, dominant caving<br>C 10% LCM - walnut shell                         | 5GY6/1<br>5Y4/1         | 0.32                                       |
| 951-046                     | 2170-2180m | A 60% Shale, as 951-038B, sig. caving<br>B 40% Shaly mudstone, as 951-034A, dominant caving<br>Minor LCM - walnut shell                          | 5GY6/1<br>5Y4/1         | 0.36                                       |
| 951-048                     | 2190-2200m | A 90% Shale, as 951-038B, minor caving<br>B 10% LCM - cement                                                                                     | 5GY6/1                  | 0.28, 0.29                                 |

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Lost Circulation Material, moderately, occasionally, slightly, very

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-050                     | 2210-2220m | A 80% Claystone, blocky, soft, non-calc.,<br>minor cavings, very light olive grey<br>to yellowish grey                                      | 5Y7/1-<br>5Y8/1         | 0.19                                       |
|                             |            | B 20% Shale, platy, soft to mod. hard,<br>non-calc., minor cavings, greenish<br>grey<br>Minor other mudstone<br>LCM - cement                | 5GY6/1                  | 0.21                                       |
| 951-052                     | 2230-2240m | A 90% Claystone, as 951-050A, minor to sig.<br>cavings                                                                                      | 5Y7/1-<br>5Y8/1         | 0.40                                       |
|                             |            | B 10% Shale, as 951-050B<br>Minor cement                                                                                                    | 5GY6/1                  | 0.17                                       |
| 951-054                     | 2250-2260m | A 85% Claystone, as 951-050A, minor cavings                                                                                                 | 5Y7/1-<br>5Y8/1         | 0.42, 0.42                                 |
|                             |            | B 15% Shale, as 951-050B<br>Minor pyrites and glauconite                                                                                    | 5GY6/1                  | 0.40                                       |
| 951-056                     | 2270-2280m | A 70% Claystone, as 951-050A, minor cavings                                                                                                 | 5Y7/1-<br>5Y8/1         | 0.41                                       |
|                             |            | B 30% Shale, as 951-050B<br>Minor pyrites                                                                                                   | 5GY6/1                  | 0.20                                       |
| 951-058                     | 2290-2300m | A 70% Mudstone, blocky, soft, calc. in<br>part, minor cavings, very light<br>grey to yellowish grey                                         | N8-5Y8/1                | 0.34                                       |
|                             |            | B 20% Shale, subfissile, mod. hard, non-<br>calc., medium grey                                                                              | N5                      | 0.51, 0.52                                 |
|                             |            | C 10% Chert, blocky, hard, medium grey<br>Minor pyrites and limestone                                                                       | N5                      |                                            |
| 951-060                     | 2310-2320m | A 65% Mudstone, grading to claystone,<br>blocky, soft, non-calc., minor<br>cavings, very light olive grey to<br>yellowish grey              | 5Y7/1-<br>5Y8/1         | 0.33                                       |
|                             |            | B 35% Limestone, blocky, sl. silty, soft to<br>mod. hard, medium light grey to light<br>grey<br>Minor shale, pyrites and glauconite         | N6-7                    | 0.33                                       |
| 951-062                     | 2330-2340m | A 50% Mudstone, as 951-060A, minor to sig.<br>cavings                                                                                       | 5Y7/1-<br>5Y8/1         | 0.23                                       |
|                             |            | B 30% Mudstone, blocky, soft. non-calc.,<br>medium light grey                                                                               | N6                      | 0.71                                       |
|                             |            | C 20% Shale, platy to subfissile, soft to<br>mod. hard, non-calc., minor to sig.<br>cavings, medium olive grey<br>Minor limestone and chert | 5Y5/1                   | 0.22, 0.22                                 |
| 951-064                     | 2350-2360m | A 50% Mudstone, as 951-060A, minor to sig.<br>cavings                                                                                       | 5Y7/1-<br>5Y8/1         | 0.27                                       |
|                             |            | B 40% Mudstone, as 951-062B                                                                                                                 | N6                      | 0.34                                       |
|                             |            | C 10% Shale, as 951-062C, sig. cavings                                                                                                      | 5Y5/1                   | 0.16                                       |

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                   | G S A<br>Colour<br>Code     | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------|
| 951-066                     | 2370-2380m | A 60% Shale, subfissile, soft to mod. hard,<br>non-calc., sig. cavings, yellowish<br>grey to very light olive grey                                             | 5Y8/1-<br>5Y7/1             | 0.24                                       |
|                             |            | B 40% Mudstone, blocky, soft, non-calc.,<br>medium grey to medium olive grey<br>Minor pyrites                                                                  | N5-5Y5/1                    | 0.68, 0.68                                 |
| 951-068                     | 2390-2400m | A 50% Shale, as 951-066A, sig. cavings                                                                                                                         | 5Y8/1-<br>5Y7/1             | 0.31                                       |
|                             |            | B 50% Mudstone, as 951-066B, minor caving<br>Minor pyrites                                                                                                     | N5-5Y5/1                    | 0.69                                       |
| 951-070                     | 2410-2420m | A 70% Mudstone, blocky, shaly in part,<br>soft to mod. hard, non-calc., minor<br>caving, medium grey to medium olive<br>grey                                   | N5-5Y5/1                    | 0.85                                       |
|                             |            | B 30% Shale, as 951-066A, sig. caving<br>Minor pyrites                                                                                                         | 5Y8/1-<br>5Y7/1             | 0.45                                       |
| 951-072                     | 2430-2440m | A 80% Mudstone, as 951-070A, minor caving<br>B 20% Shale, as 951-066A, sig. caving<br>Minor pyrites                                                            | N5-5Y5/1<br>5Y8/1-<br>5Y7/1 | 1.10<br>0.39                               |
| 951-074                     | 2450-2460m | A 98% Mudstone, blocky, soft, non-calc.,<br>minor caving, medium grey to medium<br>light grey<br>Minor shale (caved) and pyrites                               | N5-6                        | 0.77                                       |
| 951-076                     | 2470-2480m | A 98% Mudstone, as 951-074A, minor cavings<br>Minor shale and pyrites                                                                                          | N5-6                        | 0.74, 0.74                                 |
| 951-078                     | 2490-2500m | A 98% Mudstone, as 951-074A, minor to sig.<br>cavings<br>Minor pyrites and caved shale                                                                         | N5-6                        | 0.77                                       |
| 951-080                     | 2510-2520m | A 98% Mudstone, as 951-074A, minor caving<br>Minor pyrites and caved shale                                                                                     | N5-6                        | 0.89                                       |
| 951-082                     | 2530-2540m | A 98% Silty mudstone, blocky, soft, v. sl.<br>calc. to non-calc., minor cavings,<br>medium light grey to light olive<br>grey<br>Minor caved shale and mudstone | N6-5Y6/1                    | 0.90                                       |
| 951-084                     | 2550-2560m | A 98% Silty mudstone, as 951-082A, minor<br>caving<br>Minor pyrites and other mudstone                                                                         | N6-5Y6/1                    | 0.92                                       |
| 951-086                     | 2570-2580m | A 98% Silty mudstone, as 951-082A, minor to<br>sig. cavings<br>Minor pyrites and other mudstone                                                                | N6-5Y6/1                    | 0.84, 0.84                                 |
| 951-088                     | 2590-2600m | A 98% Silty mudstone, as 951-082A, minor to<br>sig. cavings<br>Minor pyrites and other mudstone                                                                | N6-5Y6/1                    | 0.85                                       |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      |                | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                   | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-090                     | 2610-2620m | A 98%          | Silty mudstone, blocky, shaly in part, soft, v. sl. calc., sig. cavings, medium light grey<br>Minor other mudstone and pyrite                                  | N6                      | 0.95                                       |
| 951-092                     | 2630-2640m | A 98%          | Silty mudstone, as 951-090A, sig. cavings<br>Minor pyrites and other mudstone                                                                                  | N6                      | 0.87                                       |
| 951-094                     | 2650-2660m | A 98%          | Silty mudstone, as 951-090A, sig. cavings<br>Minor other mudstone                                                                                              | N6                      | 0.87                                       |
| 951-096                     | 2670-2680m | A 98%          | Mudstone, blocky, soft, sl. silty, non-calc. to v. sl. calc., sig. cavings, medium grey to medium light grey<br>Minor mudstone                                 | N5-6                    | 0.81,0.80                                  |
| 951-098                     | 2690-2700m | A 98%          | Mudstone, as 951-096A, sig. cavings<br>Minor other mudstone                                                                                                    | N5-6                    | 0.83                                       |
| 951-100                     | 2710-2720m | A 65%<br>B 35% | Mudstone, as 951-096A, sig. cavings<br>Shale, subfissile, soft to mod. hard, non-calc., caved, very light olive grey                                           | N5-6<br>5Y7/1           | 0.80                                       |
| 951-102                     | 2730-2740m | A 90%<br>B 10% | Mudstone, blocky, soft, sl. calc., minor to sig. cavings, medium grey to light medium grey<br>Shale, as 951-100B, caved                                        | N5-6<br>5Y7/1           | 0.93                                       |
| 951-104                     | 2750-2760m | A 95%<br>B 5%  | Mudstone, as 951-102A, sig. cavings<br>Shale, as 951-100B, caved                                                                                               | N5-6<br>5Y7/1           | 0.87                                       |
| 951-106                     | 2770-2780m | A 98%          | Mudstone, as 951-102A, minor to sig. cavings<br>Minor caved mudstone and siltstone                                                                             | N5-6                    | 0.90,0.90                                  |
| 951-108                     | 2790-2800m | A 98%          | Mudstone, as 951-102A, minor to sig. cavings<br>Minor sand, siltstone and caved mudstone                                                                       | N5-6                    | 0.93                                       |
| 951-110                     | 2810-2820m | A 98%          | Mudstone, blocky, soft, v. sl. calc. to non-calc., minor cavings, medium grey to medium light grey<br>Minor siltstone and caved mudstone<br>Minor LCM - cement | N5-6                    | 0.94                                       |
| 951-112                     | 2830-2840m | A 98%          | Mudstone, as 951-110A, minor to sig. cavings<br>Minor siltstone and caved mudstone                                                                             | N5-6                    | 1.00                                       |
| 951-114                     | 2850-2860m | A 50%<br>B 50% | Mudstone, as 951-110A, sig. cavings<br>Siltstone, blocky, soft, non-calc., grades to fine sandstone, light grey<br>Minor lignite and caved mudstone            | N5-6<br>N7              | 1.03<br>0.57                               |

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

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                             | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-116                     | 2870-2880m | A 98% Mudstone, blocky, soft, v. sl. calc. to non-calc., minor to sig. cavings, medium grey to medium light grey<br>Minor lignite and siltstone                          | N5-6                    | 0.92,0.92                                  |
| 951-118                     | 2890-2900m | A 98% Mudstone, blocky, soft, non-calc., minor to sig. cavings, medium grey<br>Minor pyrites and lignite                                                                 | N5                      | 1.04                                       |
| 951-120                     | 2910-2920m | A 98% Mudstone, as 951-118A, minor to sig. cavings<br>Minor lignite                                                                                                      | N5                      | 1.01                                       |
| 951-122                     | 2930-2940m | A 98% Shale, grading to shaly mudstone, subfissile, soft, non-calc., dominant cavings, medium light grey to light olive grey<br>Minor lignite                            | N6-5Y6/1                | 0.77                                       |
| 951-124                     | 2950-2960m | A 55% Shale, as 951-122A, dominant cavings<br>B 45% Mudstone, blocky, soft, non-calc., minor cavings, medium dark grey to medium grey<br>Minor lignite                   | N6-5Y6/1<br>N4-5        | 0.82<br>0.89,0.90                          |
| 951-126                     | 2970-2980m | A 85% Mudstone, as 951-124B, minor cavings<br>B 15% Shale, as 951-122A, dominant cavings<br>Minor lignite                                                                | N4-5<br>N6-5Y6/1        | 0.84                                       |
| 951-128                     | 2990-3000m | A 95% Mudstone, as 951-124B, minor cavings<br>B 5% Shale, as 951-122A, dominant cavings<br>Minor pyrites                                                                 | N4-5<br>N6-5Y6/1        | 0.85                                       |
| 951-130                     | 3010-3020m | A 95% Mudstone, as 951-124B, minor cavings<br>B 5% Shale, as 951-122A, caved                                                                                             | N4-5<br>N6-5Y6/1        | 0.81                                       |
| 951-132                     | 3030-3040m | A 90% Mudstone, blocky, soft, non-calc., minor cavings, medium light grey<br>B 10% Shale, platy to subfissile, mod. hard, non-calc., abundant cavings, medium light grey | N6<br>N6                | 0.80<br>0.78,0.78                          |
| 951-134                     | 3050-3060m | A 90% Mudstone, as 951-132A, minor cavings<br>B 10% Shale, as 951-132B, abundant caving<br>Minor other mudstone                                                          | N6<br>N6                | 0.81<br>0.77                               |
| 951-136                     | 3070-3080m | A 95% Mudstone, as 951-132A, minor cavings<br>B 5% Shale, platy, mod. hard, non-calc., sig. cavings, medium light grey                                                   | N6<br>N6                | 0.86<br>0.74                               |
| 951-138                     | 3090-3100m | A 85% Mudstone, as 951-132A, minor cavings<br>B 15% Shale, as 951-136B, sig. to abundant cavings<br>Minor caved mudstone                                                 | N6<br>N6                | 0.91,0.91<br>0.90                          |
| 951-140                     | 3110-3120m | A 95% Mudstone, as 951-132A, minor cavings<br>B 5% Shale, as 951-136B, abundant cavings                                                                                  | N6<br>N6                | 0.91                                       |
| 951-142                     | 3130-3140m | A 90% Mudstone, as 951-132A, minor cavings<br>B 10% Shale, as 951-136B, abundant cavings                                                                                 | N6<br>N6                | 0.95                                       |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                           | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|--------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-144                     | 3150-3160m | A 90% Mudstone, blocky, soft, non-calc.,<br>minor cavings, medium grey                                 | N5                      | 0.96                                       |
|                             |            | B 10% Shale, platy, mod. hard, non-calc.,<br>abundant cavings, medium light grey                       | N6                      |                                            |
| 951-146                     | 3170-3180m | A 98% Mudstone, as 951-144A, minor cavings<br>Minor shale and sand                                     | N5                      | 0.93,0.94                                  |
| 951-148                     | 3190-3200m | A 98% Mudstone, as 951-144A, minor cavings<br>Minor shale                                              | N5                      | 0.96                                       |
| 951-150                     | 3210-3220m | A 60% Mudstone, blocky, soft, non-calc.,<br>minor to sig. cavings, medium grey                         | N5                      | 0.76                                       |
|                             |            | B 30% Sand, unconsolidated, medium<br>grained, subrounded to subangular,<br>well sorted, clear, white  | N9                      |                                            |
|                             |            | C 10% Shale, platy, mod. hard, non-calc.,<br>sig. cavings, medium light grey                           | N6                      | 0.93                                       |
| 951-152                     | 3230-3240m | A 95% Mudstone, as 951-150A, minor to sig.<br>cavings                                                  | N5                      | 0.69                                       |
|                             |            | B 5% Shale, as 951-150C, sig. cavings<br>Minor other mudstone                                          | N6                      |                                            |
| 951-154                     | 3250-3260m | A 98% Mudstone, as 951-150A, minor to sig.<br>cavings<br>Minor shale and other mudstone                | N5                      | 0.93,0.90                                  |
| 951-156                     | 3270-3280m | A 55% Shale, platy, mod. hard, non-calc.,<br>sig. to abundant cavings, medium<br>grey                  | N5                      | 0.69                                       |
|                             |            | B 30% Mudstone, blocky, soft, non-calc.,<br>minor to sig. cavings, medium grey                         | N5                      | 0.84                                       |
|                             |            | C 15% Shale, subfissile to platy, soft,<br>non-calc., abundant to dominant<br>cavings<br>Minor pyrites | 5GY7/1                  | 0.25                                       |
| 951-158                     | 3290-3300m | A 85% Mudstone, as 951-156B, minor cavings                                                             | N5                      | 0.79                                       |
|                             |            | B 15% Shale, as 951-156A, sig. to abundant<br>cavings<br>Minor other shale and pyrites                 | N5                      | 0.82,0.82                                  |
| 951-160                     | 3310-3320m | A 90% Mudstone, a 951-156B, minor cavings                                                              | N5                      | 0.92                                       |
|                             |            | B 10% Shale, as 951-156A, abundant cavings                                                             | N5                      |                                            |
| 951-162                     | 3330-3340m | A 85% Mudstone, blocky, soft, non-calc.,<br>minor cavings, medium grey to medium<br>brownish grey      | N5-5YR5/1               | 0.88                                       |
|                             |            | B 15% Shale, platy, mod. hard, non-calc.,<br>sig. to abundant cavings, medium dark<br>grey             | N4                      | 0.99                                       |
| 951-164                     | 3350-3360m | A 85% Mudstone, as 951-162A, minor cavings                                                             | N5-5YR5/1               | 0.65                                       |
|                             |            | B 15% Shale, as 951-162B, sig. to abundant<br>cavings<br>Minor other mudstone                          | N4                      | 0.75                                       |
| 951-166                     | 3370-3380m | A 80% Mudstone, as 951-162A, minor cavings                                                             | N505YR5/1               | 0.79,0.80                                  |

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Lost Circulation Material, moderately, occasionally, slightly, very

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                 | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|--------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-166                     | 3370-3380m | B 20% Shale, platy, mod. hard, non-calc.,<br>sig. to abundant cavings, medium dark<br>grey                   | N4                      | 0.73                                       |
| 951-168                     | 3390-3400m | A 85% Mudstone, blocky, soft, non-calc.,<br>minor cavings, medium grey to medium<br>brownish grey            | N5-5YR5/1               | 0.79                                       |
|                             |            | B 15% Shale, as 951-166B, abundant cavings<br>Minor other mudstone<br>Minor LCM                              | N4                      | 0.78                                       |
| 951-170                     | 3410-3420m | A 70% Mudstone, blocky, soft, non-calc.,<br>minor cavings, medium grey to medium<br>brownish grey            | N5-5YR5/1               | 0.78, 0.77                                 |
|                             |            | B 30% Shale, platy, mod. hard, non-calc.,<br>sig. to abundant cavings, medium grey<br>occ. medium dark grey  | N5 occ. N4              | 0.81                                       |
| 951-172                     | 3430-3440m | A 65% Mudstone, as 951-170A, minor cavings                                                                   | N5-5YR5/1               | 0.82                                       |
|                             |            | B 35% Shale, as 951-170B, sig. to abundant<br>cavings                                                        | N5 occ. N4              | 0.80                                       |
| 951-174                     | 3450-3460m | A 60% Shale, as 951-170B, sig. cavings                                                                       | N5 occ. N4              | 0.75                                       |
|                             |            | B 40% Mudstone, as 951-170A, minor cavings                                                                   | N5-5YR5/1               | 0.99, 1.00                                 |
| 951-176                     | 3470-3480m | A 60% Shale, platy, mod. hard, non-calc.,<br>abundant cavings, medium dark grey to<br>medium grey            | N4-5                    | 0.76                                       |
|                             |            | B 40% Mudstone, as 951-170A, minor to sig.<br>cavings                                                        | N5-5YR5/1               | 0.86                                       |
| 951-178                     | 3490-3500m | A 60% Shale, as 951-176A, abundant cavings                                                                   | N4-5                    | 0.83                                       |
|                             |            | B 40% Mudstone, as 951-170A, minor to sig.<br>cavings                                                        | N5-5YR5/1               | 0.78, 0.77                                 |
| 951-180                     | 3510-3520m | A 50% Shale, as 951-176A, abundant cavings                                                                   | N4-5                    | 0.77                                       |
|                             |            | B 50% Mudstone, as 951-170A, minor to sig.<br>cavings                                                        | N5-5YR5/1               | 0.66                                       |
| 951-182                     | 3530-3540m | A 65% Shale, platy to thinly fissile, mod.<br>hard, non-calc., sig. to abundant<br>cavings, medium dark grey | N4                      | 0.70                                       |
|                             |            | B 35% Mudstone, as 951-170A, minor to sig.<br>cavings                                                        | N5-5YR5/1               | 0.77                                       |
| 951-184                     | 3550-3560m | A 70% Shale, as 951-182A, sig. to abundant<br>cavings                                                        | N4                      | 0.81, 0.81                                 |
|                             |            | B 30% Mudstone, blocky, soft, non-calc.,<br>minor cavings, medium grey to medium<br>brownish grey            | N5-5YR5/1               | 0.63, 0.65                                 |
| 951-186                     | 3570-3580m | A 55% Shale, as 951-182A, sig. cavings                                                                       | N4                      | 0.77                                       |
|                             |            | B 45% Mudstone, as 951-184B, minor cavings<br>Minor other mudstone                                           | N5-5YR5/1               | 0.70, 0.70                                 |
| 951-188                     | 3590-3600m | A 60% Shale, as 951-182A, sig. to abundant<br>cavings                                                        | N4                      | 0.67                                       |
|                             |            | B 40% Mudstone, as 951-184B, minor cavings<br>Minor caved mudstone                                           | N5-5YR5/1               | 0.74, 0.76                                 |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | GROSS LITHOLOGIC DESCRIPTION                                                                            | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|-------------|---------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-190                     | 3610-3620m  | A 55% Shale, platy to thinly fissile, mod. hard, non-calc., sig. to abundant cavings, medium dark grey  | N4                      | 0.79                                       |
|                             |             | B 45% Mudstone, blocky, soft, non-calc., minor cavings, medium grey to medium brownish grey             | N5-5YR5/1               | 0.72                                       |
| 951-192                     | 3630-3640m  | A 60% Shale, platy, mod. hard, non-calc., sig. to abundant cavings, medium dark grey to medium grey     | N4-5                    | 0.69                                       |
|                             |             | B 40% Mudstone, blocky, soft, sl. calc., minor cavings, medium grey to medium brownish grey             | N5-5YR5/1               | 0.66                                       |
| 951-194                     | 3650-3660m  | A 75% Shale, as 951-192A, sig. cavings                                                                  | N4-5                    | 0.71                                       |
|                             |             | B 25% Mudstone, blocky, soft, calc. in part, minor cavings, moderate brown Minor other mudstone         | 5YR4/4                  | 0.20,0.20                                  |
| 951-196                     | 3600m SWC   | A 98% Shale, subfissile to platy, soft to mod. hard, non-calc., medium dark grey to medium grey         | N4-5                    | 0.23                                       |
| 951-197                     | 3663m SWC   | A 98% Shale, subfissile, mod. hard, non-calc., medium dark grey                                         | N4                      | 0.23                                       |
| 951-198                     | 3664m SWC   | A 98% Shale, subfissile to platy, mod. hard, non-calc., medium dark grey                                | N4                      | 5.46                                       |
| 951-199                     | 3666m SWC   | A 98% Shale, subfissile, soft to mod. hard, sl. silty, non-calc., medium dark grey to dark grey         | N4-3                    | 6.25                                       |
| 951-200                     | 3667m SWC   | A 98% Shale, silty, subfissile, soft to mod. hard, non-calc., medium dark grey to brownish grey         | N4-5YR4/1               | 5.69                                       |
| 951-201                     | 3668m SWC   | A 98% Shale, as 951-200A<br>Minor calcite                                                               | N4-5YR4/1               | 3.16                                       |
| 951-202                     | 3669m SWC   | A 98% Shale, as 951-200A                                                                                | N4-5YR4/1               | 9.55                                       |
| 951-203                     | 3670m SWC   | A 98% Shale, subfissile, soft to mod. hard, sl. silty, non-calc., medium dark grey                      | N4                      | 9.12                                       |
| 951-204                     | 3671m SWC   | A 98% Shale, subfissile to blocky, mod. hard, non-calc., medium dark grey to dark grey<br>Minor calcite | N4-3                    | 8.57                                       |
| 951-205                     | 3671.5m SWC | A 98% Shale, subfissile to platy, soft to mod. hard, non-calc., dark grey to medium dark grey           | N3-4                    | 10.5,10.5                                  |
| 951-206                     | 3672.5m SWC | A 70% Shale, blocky to subfissile, mod. hard, non-calc., medium dark grey                               | N4                      | 6.47                                       |
|                             |             | B 30% Shale, blocky, mod. hard, non-calc., pale greyish brown                                           | 5YR4/2                  | 0.08                                       |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                                                                               | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-207                     | 3673m SWC  | A 98% Shaly mudstone, blocky, soft to mod. hard, non-calc., medium dark grey to brownish grey                                                                                                                              | N4-5YR4/1               | 7.79                                       |
| 951-208                     | 3670-3680m | A 80% Shale, platy, mod. hard, non-calc., sig. cavings, medium dark grey<br>B 20% Mudstone, blocky, soft, v. sl. calc., brownish grey<br>Minor other mudstone                                                              | N4<br>5YR4/1            | 0.77<br>5.41, 5.40                         |
| 951-210                     | 3690-3700m | A 60% Shale, as 951-208A, sig. to abundant cavings<br>B 40% Mudstone, as 951-208B, minor cavings<br>Minor other mudstone                                                                                                   | N4<br>5YR4/1            | 0.64<br>1.12                               |
| 951-212                     | 3717m SWC  | A 98% Shale, platy, mod. hard, non-calc., medium dark grey                                                                                                                                                                 | N4                      | 0.93                                       |
| 951-213                     | 3710-3720m | A 55% Shale, platy, mod. hard, non-calc., sig. to abundant cavings, medium grey to medium dark grey<br>B 45% Mudstone, blocky, soft, non-calc., minor cavings, medium grey to medium brownish grey<br>Minor other mudstone | N5-4<br>N5-5YR5/1       | 0.76<br>1.00, 1.03                         |
| 951-214                     | 3725m SWC  | A 75% Shale, subfissile, mod. hard, non-calc., medium dark grey<br>B 25% Shaly mudstone, blocky, soft, non-calc., brownish grey                                                                                            | N4<br>5YR4/1            | 0.60<br>0.83                               |
| 951-216                     | 3730-3740m | A 65% Shale, as 951-213A, sig. cavings<br>B 35% Mudstone, as 951-213B, minor cavings<br>Minor other mudstone                                                                                                               | N5-4<br>N5-5YR5/1       | 0.81<br>0.85                               |
| 951-217                     | 3742m SWC  | A 98% Shale, platy, mod. hard, non-calc., medium grey to medium brownish grey                                                                                                                                              | N5-5YR5/1               | 0.96                                       |
| 951-219                     | 3750-3760m | A 50% Shale, as 951-213A, sig. to abundant cavings<br>B 50% Mudstone, as 951-213B, minor cavings<br>Minor other mudstone and shale                                                                                         | N5-4<br>N5-5YR5/1       | 0.89, 0.89<br>1.97                         |
| 951-221                     | 3774m SWC  | A 98% Shale, subfissile, soft to mod. hard, non-calc., medium dark grey to brownish grey                                                                                                                                   | N4-5YR4/1               | 7.98                                       |
| 951-222                     | 3770-3780m | A 50% Mudstone, blocky, soft, non-calc., minor cavings, brownish grey<br>B 50% Shale, platy, mod. hard, non-calc., abundant cavings, medium dark grey<br>Minor other shale                                                 | 5YR4/1<br>N4            | 1.87<br>0.82                               |
| 951-224                     | 3790-3800m | A 85% Sand, unconsolidated, medium grained, subangular, fairly well sorted, clear, white<br>B 15% LCM - cement<br>Minor shale                                                                                              |                         |                                            |
| 951-226                     | 3810-3820m | A 90% Sand, as 951-224A                                                                                                                                                                                                    | N9                      |                                            |

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

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                                                         | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-226                     | 3810-3820m  | B 10% LCM - cement<br>Minor shale                                                                                                                                                                    |                         |                                            |
| 951-228                     | 3820-3840m  | A 60% LCM - cement<br>B 40% Sand, unconsolidated, medium grained, N9<br>subangular, fairly well sorted,<br>clear, white<br>Minor shale                                                               |                         |                                            |
| 951-230                     | 3850-3860m  | A 70% Sand, as 951-228B<br>B 15% Shale, subfissile, soft, sl. silty,<br>non-calc., minor to sig. cavings,<br>dark grey to dark brownish grey<br>C 15% LCM - cement                                   | N9<br>N3-5YR3/1         | 3.40, 3.43                                 |
| 951-232                     | 3870-3880m  | A 95% Sand, as 951-228B<br>B 5% Lignite, blocky, soft, dark brownish<br>grey                                                                                                                         | N9<br>5YR3/1            | 24.1                                       |
| 951-234                     | 3890-3900m  | A 70% Sand, unconsolidated, medium grained, N9<br>subangular, fairly well sorted,<br>clear, white<br>B 25% Mudstone, blocky, soft, sl. silty,<br>non-calc., medium grey<br>C 5% Lignite, as 951-232B | N5<br>5YR3/1            | 0.87                                       |
| 951-236                     | 3917.7m SWC | A 98% Shale, platy to subfissile, mod.<br>hard, non-calc., medium dark grey to<br>medium grey                                                                                                        | N4-5                    | 1.00                                       |
| 951-237                     | 3910-3920m  | A 80% Lignite, as 951-232B<br>B 20% Shaly mudstone, blocky to subfissile,<br>soft, non-calc., medium dark grey to<br>medium grey<br>Minor sand                                                       | 5YR3/1<br>N4-5          | 33.0<br>1.49                               |
| 951-238                     | 3928.8m SWC | A 98% Shale, blocky to subfissile, mod.<br>hard, non-calc., medium dark grey                                                                                                                         | N4                      | 5.13                                       |
| 951-240                     | 3930.6m SWC | A 98% Shale, as 951-238A                                                                                                                                                                             | N4                      | 1.70, 1.73                                 |
| 951-241                     | 3930-3940m  | A 90% Sandstone, mostly unconsolidated,<br>medium grained, subangular, fairly<br>well sorted, non-calc. matrix, v.<br>pale milky cut, very light grey to<br>white<br>B 10% Lignite, as 951-232B      | N8-9<br>5YR3/1          | 35.7                                       |
| 951-243                     | 3950-3960m  | A 90% Sandstone, as 951-241A, v. pale<br>milky cut<br>B 10% Lignite, as 951-232B                                                                                                                     | N8-9<br>5YR3/1          | 35.7<br>37.8                               |
| 951-245                     | 3970-3980m  | A 95% Sandstone, as 951-241A, v. pale<br>milky cut<br>B 5% Lignite, as 951-232B                                                                                                                      | N8-9<br>5YR3/1          |                                            |
| 951-247                     | 3990-4000m  | A 85% Sandstone, as 951-241A, v. pale<br>milky cut<br>B 15% Lignite, as 951-232B                                                                                                                     | N8-9<br>5YR3/1          | 25.4                                       |

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

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                                                                                                                                                                                | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-249                     | 4010-4020m | A 95% Sandstone, mostly unconsolidated,<br>medium grained, subangular, fairly<br>well sorted, non-calc. matrix, v.<br>pale milky cut, very light grey to<br>white<br>B 5% LCM - lignite                                                                                                                                     | N8-9                    |                                            |
| 951-251                     | 4030-4040m | A 80% LCM - cement and lignite<br>B 20% Sandstone, as 951-249A, v. pale<br>milky cut<br>Minor caved shale                                                                                                                                                                                                                   | N8-9                    |                                            |
| 951-253                     | 4050-4060m | A 60% Sandstone, mostly unconsolidated,<br>medium grained, subangular, fairly<br>well sorted, non-calc. matrix, v.<br>pale milky cut, very light grey to<br>light grey<br>B 25% LCM - lignite, cement and metal<br>C 15% Silty mudstone, blocky, soft, non-<br>calc., sig.? cavings, medium grey<br>to medium brownish grey | N8-7<br><br>N5-5YR5/1   | <br><br>1.21                               |
| 951-255                     | 4070-4080m | A 60% Sandstone, as 951-253A, v. pale<br>milky cut<br>B 20% LCM - lignite, cement and wood<br>C 20% Silty mudstone, as 951-253C, sig.?<br>cavings                                                                                                                                                                           | N8-7<br><br>N5-5YR5/1   | <br><br>1.13                               |
| 951-257                     | 4090-4100m | A 75% Sandstone, mostly unconsolidated,<br>medium grained, subangular, fairly<br>well sorted, sl. micaceous, non-<br>calc. matrix, v. pale milky cut,<br>very light grey<br>B 25% Siltstone, blocky, soft, non-calc.,<br>medium grey to medium brownish grey<br>Minor LCM                                                   | N8<br><br>N5-5YR5/1     | <br><br>1.05                               |
| 951-258                     | 4106m SWC  | A 98% Siltstone, blocky, soft, grades to<br>fine sandstone, non-calc., medium<br>brownish grey                                                                                                                                                                                                                              | 5YR5/1                  | 0.58,0.58                                  |
| 951-260                     | 4110-4120m | A 70% Sandstone, as 951-257A, minor<br>cavings, v. pale milky cut<br>B 30% Silty mudstone, grading to siltstone,<br>blocky, soft, non-calc., medium grey<br>to medium brownish grey<br>Minor caved shale                                                                                                                    | N8<br><br>N5-5YR5/1     | <br><br>1.56                               |
| 951-262                     | 4130-4140m | A 55% Silty mudstone, as 951-260B, minor<br>sig. cavings<br>B 45% Sandstone, as 951-257A, minor<br>cavings, v. pale milky cut                                                                                                                                                                                               | N5-5YR5/1<br><br>N8     | <br><br>1.66                               |
| 951-264                     | 4150-4160m | A 70% Silty mudstone, as 951-260B, sig.<br>cavings<br>B 30% Sandstone, as 951-257A, v. pale milky<br>cut<br>Minor caved shale                                                                                                                                                                                               | N5-5YR5/1<br><br>N8     | <br><br>1.38                               |

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

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                                                  | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-266                     | 4170-4180m | A 65% Silty mudstone, grading to siltstone, blocky, soft, non-calc., medium grey to medium brownish grey                                                                                      | N5-5YR5/1               | 1.06                                       |
|                             |            | B 35% Sandstone, mostly unconsolidated, medium grained, subangular, fairly well sorted, sl. micaceous, non-calc. matrix, pale milky cut, very light grey<br>Minor caved shale<br>LCM - cement | N8                      |                                            |
| 951-268                     | 4190-4200m | A 90% Sandstone, mostly unconsolidated, medium grained, subangular to sub-rounded, fairly well sorted, non-calc. matrix, very light grey to pinkish grey                                      | N8-5YR8/1               |                                            |
|                             |            | B 10% Silty shale, subfissile, soft, non-calc., minor cavings, medium light grey to medium grey                                                                                               | N6-5                    | 1.03, 1.04                                 |
| 951-270                     | 4210-4220m | A 98% Sandstone, as 951-268A<br>Minor shale and siltstone                                                                                                                                     | N8-5YR8/1               |                                            |
| 951-272                     | 4230-4240m | A 98% Sandstone, as 951-268A<br>Minor shale and siltstone                                                                                                                                     | N8-5YR8/1               |                                            |
| 951-274                     | 4250-4260m | A 98% Sandstone, as 951-268A<br>Minor shale and siltstone                                                                                                                                     | N8-5YR8/1               |                                            |
| 951-276                     | 4270-4280m | A 98% Sandstone, as 951-268A<br>Minor shale and siltstone                                                                                                                                     | N8-5YR8/1               |                                            |
| 951-278                     | 4290-4300m | A 90% Sandstone, as 951-268A, pale milky cut                                                                                                                                                  | N8-5YR8/1               |                                            |
|                             |            | B 10% Silty shale, blocky, soft, non-calc., sig. cavings, medium grey to medium brownish grey                                                                                                 | N5-5YR5/1               | 1.47                                       |
| 951-280                     | 4310-4320m | A 98% Sandstone, as 951-268A<br>Minor shale                                                                                                                                                   | N8-5YR8/1               |                                            |
| 951-282                     | 4330-4340m | A 95% Sandstone, mostly unconsolidated, medium grained, subangular to sub-rounded, fairly well sorted, non-calc. matrix, very light grey to pinkish grey                                      | N8-5YR8/1               |                                            |
|                             |            | B 5% Silty shale, as 951-278B, sig. caving                                                                                                                                                    | N5-5YR5/1               | 1.33                                       |
| 951-284                     | 4350-4360m | A 95% Sandstone, as 951-282A                                                                                                                                                                  | N8-5YR8/1               |                                            |
|                             |            | B 5% Silty shale, blocky to platy, soft, non-calc., sig. cavings, medium grey to medium brownish grey                                                                                         | N5-5YR5/1               | 1.63                                       |
| 951-286                     | 4370-4380m | A 98% Sand, unconsolidated, medium grained, subangular to subrounded, well sorted, clear, white<br>Minor shale                                                                                | N9                      |                                            |

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

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                                                            | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-288                     | 4390-4400m  | A 98% Sand, unconsolidated, medium grained, N9<br>subangular to subrounded, well<br>sorted, clear, white<br>Minor shale                                                                                 |                         |                                            |
| 951-290                     | 4410-4420m  | A 98% Sandstone, mostly unconsolidated,<br>medium grained, subangular to sub-<br>rounded, fairly well sorted, non-<br>calc. matrix, very light grey to<br>pinkish grey<br>Minor shale                   | N8-5YR8/1               |                                            |
| 951-292                     | 4430-4440m  | A 90% Sandstone, as 951-290A<br>B 10% Lignite, blocky, soft, dark brownish<br>grey<br>Minor shale .                                                                                                     | N8-5YR8/1<br>5YR3/1     | 32.2                                       |
| 951-294                     | 4450-4460m  | A 98% Sandstone, as 951-290A<br>Minor shale, rare lignite                                                                                                                                               | N8-5YR8/1               |                                            |
| 951-296                     | 4473.2m SWC | A 98% Mudstone, blocky, soft, v. sl. calc.,<br>dusky brown                                                                                                                                              | 5YR2/2                  | 1.11                                       |
| 951-297                     | 4470-4480m  | A 95% Sandstone, as 951-290A<br>B 5% Lignite, blocky, soft, dark brownish<br>grey<br>Minor mudstone, shale and coal?                                                                                    | N8-5YR8/1<br>5YR3/1     | 40.8                                       |
| 951-298                     | 4486.5m SWC | A 98% Sandstone, blocky, medium grained,<br>subangular, micaceous, fairly well<br>sorted, non-calc. matrix, pinkish<br>grey                                                                             | 5YR8/1                  |                                            |
| 951-300                     | 4490-4500m  | A 75% Sandstone, blocky, unconsolidated in<br>part, medium grained, subangular,<br>micaceous, fairly well sorted, non-<br>calc. matrix, pinkish grey<br>B 25% Coal, blocky, soft, dark brownish<br>grey | 5YR8/1<br>5YR3/1        | 64.6                                       |
| 951-302                     | 4510-4520m  | A 85% Coal, as 951-300B<br>B 15% Sandstone, as 951-300A                                                                                                                                                 | 5YR3/1<br>5YR8/1        | 35.9                                       |
| 951-304                     | 4530-4540m  | A 80% Coal, as 951-300B<br>B 15% LCM - cement and paint<br>C <5% Sandstone, as 951-300A                                                                                                                 | 5YR3/1<br>5YR8/1        | 40.1                                       |
| 951-305                     | 4540-4560m  | A 85% Coal, as 951-300B<br>B 15% LCM - cement                                                                                                                                                           | 5YR3/1                  | 50.1, 50.1                                 |
| 951-307                     | 4570-4580m  | A 90% Sand, unconsolidated, medium grained, N9<br>subangular, fairly well sorted,<br>clear, v. pale milky cut, white<br>B 10% Coal, blocky, soft to mod. hard,<br>greyish black to dark brownish grey   | N2-5YR3/1               | 35.2                                       |
| 951-309                     | 4598m SWC   | A 98% Shale, silty, subfissile to blocky,<br>soft, non-calc., medium grey                                                                                                                               | N5                      | 2.16                                       |
| 951-310                     | 4590-4600m  | A 98% Coal, as 951-307B<br>Minor sand and shale                                                                                                                                                         | N2-5YR3/1               | 50.5                                       |

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1  
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | GROSS LITHOLOGIC DESCRIPTION                                                                                                                                          | GSA<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------|
| 951-312                     | 4610-4620m  | A 75% Sandstone, blocky, unconsolidated in part, medium grained, subangular, fairly well sorted, non-calc. matrix, v. pale milky cut, very light grey to pinkish grey | N8-5YR8/1             |                                            |
|                             |             | B 25% Coal, blocky, soft to mod. hard, greyish black to dark brownish grey<br>Minor shale                                                                             | N2-5YR3/1             | 34.5, 34.3                                 |
| 951-314                     | 4630-4640m  | A 70% Sandstone, as 951-312A, v. pale milky cut                                                                                                                       | N8-5YR8/1             |                                            |
|                             |             | B 30% Coal, as 951-312B<br>Minor shale                                                                                                                                | N2-5YR3/1             | 54.7                                       |
| 951-316                     | 4650-4660m  | A 55% Coal, as 951-312B                                                                                                                                               | N2-5YR3/1             | 55.3, 57.2                                 |
|                             |             | B 35% Sandstone, as 951-312A                                                                                                                                          | N8-5YR8/1             |                                            |
|                             |             | C 10% Shale, subfissile to blocky, soft, non-calc., sl. silty, medium grey to medium dark grey                                                                        | N5-4                  | 1.07                                       |
| 951-318                     | 4670-4680m  | A 75% Sandstone, as 951-312A                                                                                                                                          | N8-5YR8/1             |                                            |
|                             |             | B 20% Coal, as 951-312B                                                                                                                                               | N2-5YR3/1             | 28.0                                       |
|                             |             | C 5% Shale, as 951-316C, minor cavings                                                                                                                                | N5-4                  | 1.23                                       |
| 951-320                     | 4695m SWC   | A 98% Shale, blocky to subfissile, mod. hard, sl. silty, non-calc., medium dark grey                                                                                  | N4                    | 1.77, 1.77                                 |
| 951-321                     | 4690-4700m  | A 45% Coal, blocky, soft, dark brownish grey                                                                                                                          | 5YR3/1                | 58.4, 58.2                                 |
|                             |             | B 40% Sandstone, blocky, fine-medium grained, subangular, well sorted, quartzite, non-calc. matrix, v. pale milky cut, very light grey to white                       | N8-9                  |                                            |
|                             |             | C 15% Shale, platy to subfissile, mod. hard, non-calc., sl. silty, medium dark grey to brownish grey                                                                  | N4-5YR4/1             | 0.53                                       |
| 951-323                     | 4710-4720m  | A 45% Sandstone, as 951-321B                                                                                                                                          | N8-9                  |                                            |
|                             |             | B 35% Coal, as 951-321A                                                                                                                                               | 5YR3/1                | 56.0                                       |
|                             |             | C 20% Shale, as 951-321C, minor cavings                                                                                                                               | N4-5YR4/1             | 0.94                                       |
| 951-325                     | 4730-4740m  | A 75% Shale, subfissile to platy, mod. hard, non-calc., minor cavings, brownish grey                                                                                  | 5YR4/1                | 0.41                                       |
|                             |             | B 15% Sandstone, as 951-321B                                                                                                                                          | N8-9                  |                                            |
|                             |             | C 10% Coal, as 951-321A                                                                                                                                               | 5YR3/1                | 37.6                                       |
| 951-327                     | 4753m SWC   | A 98% Shale, subfissile to blocky, mod. hard, non-calc., medium grey to medium dark grey                                                                              | N4-3                  | 1.91                                       |
| 951-328                     | 4755.6m SWC | A 98% Shale, as 951-327A                                                                                                                                              | N4-3                  | 0.26, 0.25                                 |
| 951-329                     | 4750-4760m  | A 40% Shale, subfissile to platy, mod. hard, sl. silty, non-calc., minor caving, medium grey to medium brownish grey                                                  | N5-5YR5/1             | 0.26                                       |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | GROSS LITHOLOGIC DESCRIPTION                                                                                                                | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-329                     | 4750-4760m  | B 35% Shale, subfissile to platy, mod. hard, non-calc., dark grey to dark brownish grey                                                     | N3-5YR3/1               | 2.16                                       |
|                             |             | C 15% Sandstone, mostly unconsolidated, fine-medium grained, subangular, well sorted, non-calc., very light grey                            | N8                      |                                            |
|                             |             | D 10% Coal, blocky, soft, dark brownish grey                                                                                                | 5YR3/1                  |                                            |
| 951-331                     | 4770-4780m  | A 35% Shale, subfissile to platy, mod. hard, sl. silty, non-calc., minor caving, medium grey to medium brownish grey                        | N5-5YR5/1               | 0.34                                       |
|                             |             | B 30% Shale, as 951-329B, minor caving                                                                                                      | N3-5YR3/1               | 1.66                                       |
|                             |             | C 30% Sandstone, as 951-329C                                                                                                                | N8                      |                                            |
|                             |             | D 5% Coal, as 951-329D                                                                                                                      | 5YR3/1                  |                                            |
| 951-333                     | 4794.5m SWC | A 98% Shale, subfissile, mod. hard, non-calc., medium grey to medium brownish grey                                                          | N5-occ.<br>5YR5/1       | 0.17                                       |
| 951-334                     | 4790-4800m  | A 70% Shale, platy to subfissile, mod. hard, non-calc., minor cavings, medium grey to medium olive grey                                     | N5-5Y5/1                | 0.14, 0.14                                 |
|                             |             | B 20% Sandstone, as 951-329C                                                                                                                | N8                      |                                            |
|                             |             | C 10% Shale, as 951-329B, sig. cavings<br>Minor lignite                                                                                     | N3-5YR3/1               | 1.52                                       |
| 951-336                     | 4810-4820m  | A 80% Shale, as 951-334A, minor to sig. cavings                                                                                             | N5-5Y5/1                | 0.14                                       |
|                             |             | B 15% Shale, as 951-329B, sig. cavings                                                                                                      | N3-5YR3/1               | 2.83                                       |
|                             |             | C 5% Sandstone, as 951-329C                                                                                                                 | N8                      |                                            |
| 951-338                     | 4830-4840m  | A 70% Shale, platy to subfissile, mod. hard, non-calc., medium grey to medium olive grey                                                    | N5-5Y5/1                | 0.14                                       |
|                             |             | B 15% Shale, platy, mod. hard, non-calc., sig. cavings, dark grey                                                                           | N3                      | 6.98, 6.93                                 |
|                             |             | C 15% Sandstone, blocky, medium grained, subangular, poorly sorted, non-calc. matrix, quartzitic, very light grey to white<br>LCM - lignite | N8-9                    |                                            |
| 951-339                     | 4841m SWC   | A 98% Shale, subfissile, mod. hard, sl. silty, non-calc., medium grey to medium olive grey                                                  | N5-5Y5/1                | 0.17                                       |
| 951-340                     | 4843m SWC   | A 98% Shale, subfissile, mod. hard, sl. silty, non-calc., medium grey to medium dark grey                                                   | N5-4                    | 0.19                                       |
| 951-342                     | 4850-4860m  | A 50% Shale, subfissile, mod. hard, sl. silty, non-calc., minor to sig. cavings, medium grey to medium olive grey                           | N5-5Y5/1                | 0.15                                       |

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

**TABLE 1**  
**ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | GROSS LITHOLOGIC DESCRIPTION                                                                                               | G S A<br>Colour<br>Code | TOTAL ORGANIC<br>CARBON<br>(Wt. % of Rock) |
|-----------------------------|------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|
| 951-342                     | 4850-4860m | B 40% Shale, subfissile, mod. hard, sl.<br>silty, non-calc., minor cavings,<br>pale brown                                  | 5YR5/2                  | 0.09                                       |
|                             |            | C 10% Shale, platy to subfissile, mod.<br>hard, non-calc., dark grey to medium<br>dark grey<br>Minor sandstone             | N3-4                    | 1.91,1.92                                  |
| 951-344                     | 4870-4880m | A 50% Shale, subfissile, mod. hard, sl.<br>silty, non-calc., minor to sig.<br>cavings, medium grey to medium<br>olive grey | N5-5Y5/1                | 0.14                                       |
|                             |            | B 40% Shale, as 951-342B                                                                                                   | 5YR5/2                  | 0.07                                       |
|                             |            | C 10% Shale, as 951-342C, sig. cavings<br>Minor sandstone and lignite                                                      | N3-4                    | 11.2                                       |
| 951-346                     | 4890-4900m | A 85% Shale, as 951-342B                                                                                                   | 5YR5/2                  | 0.09                                       |
|                             |            | B 15% Shale, as 951-344A, minor cavings<br>Minor sandstone and other shale                                                 | N5-5Y5/1                | 0.14,0.15                                  |

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

**TABLE 2A**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN AIR SPACE GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-001                     | 350-400   | 39                        | 37                       | 35                        | 17                           | 36                        | 165                                      | 126                                      | 76.3                | 59                                       | 0.47                |
| 951-002                     | 400-450   | 3109                      | 80                       | 45                        | 51                           | 153                       | 3438                                     | 329                                      | 9.6                 | 49                                       | 0.33                |
| 951-003                     | 450-500   | 3370                      | 95                       | 20                        | 27                           | 20                        | 3533                                     | 163                                      | 4.6                 | 98                                       | 1.33                |
| 951-004                     | 500-550   | 3396                      | 104                      | 9                         | 13                           | 30                        | 3553                                     | 157                                      | 4.4                 | 306                                      | 0.44                |
| 951-005                     | 550-600   | 3240                      | 102                      | 39                        | 62                           | 107                       | 3551                                     | 311                                      | 8.8                 | 345                                      | 0.58                |
| 951-006                     | 600-650   | 4352                      | 143                      | 20                        | 28                           | 11                        | 4554                                     | 202                                      | 4.4                 | 227                                      | 2.48                |
| 951-007                     | 650-700   | 2662                      | 76                       | 10                        | 29                           | 16                        | 2792                                     | 130                                      | 4.7                 | 247                                      | 1.81                |
| 951-008                     | 700-750   | 118                       | 18                       | 9                         | 4                            | 6                         | 156                                      | 38                                       | 24.3                | 14                                       | 0.78                |
| 951-009                     | 750-800   | 2022                      | 61                       | 25                        | 14                           | 24                        | 2145                                     | 123                                      | 5.7                 | 19                                       | 0.58                |
| 951-010                     | 800-850   | 3126                      | 114                      | 29                        | 25                           | 18                        | 3311                                     | 185                                      | 5.6                 | 22                                       | 1.43                |
| 951-011                     | 850-900   | 2394                      | 87                       | 26                        | 32                           | 14                        | 2553                                     | 160                                      | 6.3                 | 20                                       | 2.27                |
| 951-012                     | 900-950   | 3470                      | 125                      | 29                        | 20                           | 28                        | 3672                                     | 202                                      | 5.5                 | 16                                       | 0.74                |
| 951-013                     | 950-1000  | 132                       | 33                       | 26                        | 52                           | 163                       | 405                                      | 274                                      | 67.5                | 235                                      | 0.32                |
| 951-014                     | 1000-1050 | 5                         | 16                       | 4                         | 25                           | 16                        | 65                                       | 61                                       | 92.8                | 136                                      | 1.55                |
| 951-015                     | 1050-1100 | 98                        | 8                        | 4                         | 7                            | 2                         | 119                                      | 21                                       | 17.3                | 18                                       | 4.40                |
| 951-016                     | 1100-1150 | 2124                      | 103                      | 36                        | 29                           | 22                        | 2314                                     | 190                                      | 8.2                 | 83                                       | 1.30                |
| 951-017                     | 1150-1200 | 1737                      | 81                       | 22                        | 30                           | 13                        | 1884                                     | 146                                      | 7.8                 | 827                                      | 2.36                |
| 951-018                     | 1200-1250 | 1669                      | 70                       | 18                        | 16                           | 11                        | 1784                                     | 114                                      | 6.4                 | 55                                       | 1.46                |
| 951-019                     | 1250-1300 | 1353                      | 59                       | 14                        | 6                            | 7                         | 1440                                     | 87                                       | 6.0                 | 24                                       | 0.91                |
| 951-020                     | 1300-1350 | 1760                      | 71                       | 15                        | 17                           | 24                        | 1886                                     | 126                                      | 6.7                 | 4                                        | 0.69                |
| 951-021                     | 1350-1400 | 1535                      | 78                       | 21                        | 22                           | 8                         | 1664                                     | 129                                      | 7.8                 | 12                                       | 2.70                |
| 951-022                     | 1400-1450 | 442                       | 38                       | 13                        | 30                           | 13                        | 536                                      | 94                                       | 17.5                | 5                                        | 2.32                |
| 951-023                     | 1450-1500 | 3042                      | 170                      | 73                        | 104                          | 26                        | 3415                                     | 373                                      | 10.9                | 174                                      | 4.03                |
| 951-024                     | 1500-1550 | 26                        | 88                       | 187                       | 172                          | 240                       | 714                                      | 688                                      | 96.3                | 189                                      | 0.72                |
| 951-025                     | 1550-1600 | 3498                      | 359                      | 186                       | 261                          | 75                        | 4378                                     | 880                                      | 20.1                | 96                                       | 3.48                |
| 951-026                     | 1600-1650 | 2834                      | 186                      | 60                        | 68                           | 27                        | 3175                                     | 341                                      | 10.7                | 45                                       | 2.48                |
| 951-027                     | 1650-1700 | 2850                      | 52                       | 24                        | 16                           | 4                         | 2946                                     | 96                                       | 3.3                 | 35                                       | 3.61                |
| 951-028                     | 1700-1750 | 3696                      | 266                      | 59                        | 34                           | 7                         | 4061                                     | 365                                      | 9.0                 | 29                                       | 4.70                |
| 951-029                     | 1750-1800 | 1510                      | 150                      | 33                        | 19                           | 4                         | 1716                                     | 207                                      | 12.0                | 16                                       | 4.63                |
| 951-030                     | 1800-1850 | 1486                      | 253                      | 41                        | 36                           | 4                         | 1820                                     | 334                                      | 18.3                | 19                                       | 8.10                |

TABLE 2A  
CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN AIR SPACE GAS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-031                     | 1850-1900 | 1197                      | 239                      | 31                        | 37                           | 3                         | 1506                                     | 309                                      | 20.5                | 15                                       | *. **               |
| 951-032                     | 1900-1950 | 3709                      | 647                      | 76                        | 114                          | 11                        | 4557                                     | 848                                      | 18.6                | 55                                       | *. **               |
| 951-033                     | 1950-2000 | 7330                      | 640                      | 69                        | 229                          | 18                        | 8286                                     | 956                                      | 11.5                | 249                                      | *. **               |
| 951-034                     | 2000-2050 | 9408                      | 924                      | 114                       | 394                          | 40                        | 10881                                    | 1472                                     | 13.5                | 513                                      | 9.86                |
| 951-035                     | 2050-2060 | 11494                     | 774                      | 105                       | 407                          | 57                        | 12836                                    | 1343                                     | 10.5                | 693                                      | 7.14                |
| 951-038                     | 2080-2090 | 16510                     | 978                      | 117                       | 387                          | 106                       | 18097                                    | 1587                                     | 8.8                 | 2154                                     | 3.66                |
| 951-040                     | 2100-2110 | 15533                     | 2187                     | 204                       | 684                          | 115                       | 18723                                    | 3190                                     | 17.0                | 2038                                     | 5.95                |
| 951-041                     | 2110-2120 | 54                        | 16                       | 8                         | 24                           | 9                         | 110                                      | 57                                       | 51.4                | 299                                      | 2.78                |
| 951-042                     | 2120-2130 | 19801                     | 2795                     | 221                       | 877                          | 153                       | 23847                                    | 4046                                     | 17.0                | 4655                                     | 5.71                |
| 951-044                     | 2140-2150 | 58946                     | 7705                     | 547                       | 1906                         | 349                       | 69454                                    | 10508                                    | 15.1                | 7850                                     | 5.46                |
| 951-046                     | 2170-2180 | 8130                      | 1749                     | 149                       | 488                          | 88                        | 10604                                    | 2474                                     | 23.3                | 1439                                     | 5.51                |
| 951-048                     | 2190-2200 | 476                       | 37                       | 3                         | 10                           | 2                         | 529                                      | 53                                       | 10.0                | 95                                       | 5.40                |
| 951-050                     | 2210-2220 | 1177                      | 86                       | 10                        | 25                           | 7                         | 1306                                     | 128                                      | 9.8                 | 142                                      | 3.32                |
| 951-052                     | 2230-2240 | 3000                      | 730                      | 82                        | 75                           | 69                        | 3956                                     | 957                                      | 24.2                | 268                                      | 1.08                |
| 951-054                     | 2250-2260 | 4736                      | 1967                     | 346                       | 344                          | 380                       | 7773                                     | 3037                                     | 39.1                | 1351                                     | 0.90                |
| 951-056                     | 2270-2280 | 4018                      | 1211                     | 340                       | 449                          | 428                       | 6446                                     | 2428                                     | 37.7                | 2053                                     | 1.05                |
| 951-058                     | 2290-2300 | 614                       | 132                      | 36                        | 38                           | 28                        | 847                                      | 233                                      | 27.5                | 470                                      | 1.34                |
| 951-060                     | 2310-2320 | 33                        | 10                       | 5                         | 8                            | 6                         | 62                                       | 29                                       | 47.2                | 130                                      | 1.28                |
| 951-062                     | 2330-2340 | 5297                      | 1723                     | 455                       | 289                          | 225                       | 7989                                     | 2692                                     | 33.7                | 853                                      | 1.28                |
| 951-064                     | 2350-2360 | 1083                      | 88                       | 23                        | 19                           | 17                        | 1230                                     | 147                                      | 11.9                | 281                                      | 1.12                |
| 951-066                     | 2370-2380 | 5025                      | 1749                     | 835                       | 445                          | 693                       | 8745                                     | 3721                                     | 42.5                | 780                                      | 0.64                |
| 951-068                     | 2390-2400 | 5480                      | 2242                     | 1627                      | 705                          | 1298                      | 11351                                    | 5871                                     | 51.7                | 3961                                     | 0.54                |
| 951-070                     | 2410-2420 | 382                       | 84                       | 204                       | 212                          | 368                       | 1250                                     | 868                                      | 69.4                | 1440                                     | 0.57                |
| 951-072                     | 2430-2440 | 7031                      | 2613                     | 2727                      | 1115                         | 2243                      | 15730                                    | 8699                                     | 55.3                | 5727                                     | 0.50                |
| 951-074                     | 2450-2460 | 5234                      | 2433                     | 2422                      | 1325                         | 2747                      | 14161                                    | 8927                                     | 63.0                | 7105                                     | 0.48                |
| 951-076                     | 2470-2480 | 3493                      | 1737                     | 1738                      | 1469                         | 2312                      | 10748                                    | 7256                                     | 67.5                | 7201                                     | 0.64                |
| 951-078                     | 2490-2500 | 3944                      | 1755                     | 1697                      | 644                          | 1381                      | 9422                                     | 5478                                     | 58.1                | 3610                                     | 0.47                |
| 951-080                     | 2510-2520 | 5065                      | 2247                     | 2148                      | 941                          | 1891                      | 12291                                    | 7226                                     | 58.8                | 4905                                     | 0.50                |
| 951-082                     | 2530-2540 | 4968                      | 2598                     | 2658                      | 1514                         | 3116                      | 14854                                    | 9886                                     | 66.6                | 7505                                     | 0.49                |
| 951-084                     | 2550-2560 | 6407                      | 3188                     | 3256                      | 1582                         | 3700                      | 18133                                    | 11726                                    | 64.7                | 9972                                     | 0.43                |

**TABLE 2A**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN AIR SPACE GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-086                     | 2570-2580 | 298                       | 84                       | 152                       | 73                           | 147                       | 753                                      | 455                                      | 60.5                | 703                                      | 0.49                |
| 951-088                     | 2590-2600 | 48                        | 20                       | 45                        | 20                           | 65                        | 199                                      | 151                                      | 75.8                | 867                                      | 0.31                |
| 951-090                     | 2610-2620 | 731                       | 183                      | 273                       | 113                          | 251                       | 1551                                     | 820                                      | 52.9                | 1075                                     | 0.45                |
| 951-092                     | 2630-2640 | 8                         | 4                        | 8                         | 5                            | 11                        | 36                                       | 27                                       | 76.2                | 165                                      | 0.42                |
| 951-094                     | 2650-2660 | 3                         | 2                        | 3                         | 2                            | 5                         | 15                                       | 11                                       | 76.7                | 9                                        | 0.38                |
| 951-096                     | 2670-2680 | 142                       | 45                       | 79                        | 36                           | 76                        | 377                                      | 235                                      | 62.3                | 388                                      | 0.48                |
| 951-098                     | 2690-2700 | 3615                      | 910                      | 816                       | 323                          | 492                       | 6156                                     | 2541                                     | 41.3                | 5707                                     | 0.66                |
| 951-100                     | 2710-2720 | 6059                      | 2508                     | 2431                      | 934                          | 1608                      | 13540                                    | 7481                                     | 55.3                | 4155                                     | 0.58                |
| 951-102                     | 2730-2740 | 4994                      | 1054                     | 905                       | 298                          | 470                       | 7721                                     | 2727                                     | 35.3                | 1397                                     | 0.64                |
| 951-104                     | 2750-2760 | 4431                      | 1241                     | 1084                      | 371                          | 548                       | 7675                                     | 3244                                     | 42.3                | 1385                                     | 0.68                |
| 951-106                     | 2770-2780 | 2077                      | 383                      | 376                       | 143                          | 202                       | 3181                                     | 1104                                     | 34.7                | 792                                      | 0.70                |
| 951-108                     | 2790-2800 | 1696                      | 403                      | 327                       | 134                          | 177                       | 2736                                     | 1040                                     | 38.0                | 503                                      | 0.76                |
| 951-110                     | 2810-2820 | 202                       | 36                       | 47                        | 32                           | 21                        | 338                                      | 137                                      | 40.4                | 178                                      | 1.48                |
| 951-112                     | 2830-2840 | 208                       | 40                       | 61                        | 32                           | 45                        | 386                                      | 178                                      | 46.1                | 258                                      | 0.70                |
| 951-114                     | 2850-2860 | 10                        | 3                        | 22                        | 33                           | 73                        | 142                                      | 132                                      | 92.8                | 1147                                     | 0.44                |
| 951-116                     | 2870-2880 | 811                       | 155                      | 189                       | 90                           | 122                       | 1367                                     | 556                                      | 40.7                | 405                                      | 0.74                |
| 951-118                     | 2890-2900 | 449                       | 75                       | 74                        | 34                           | 41                        | 673                                      | 225                                      | 33.4                | 173                                      | 0.85                |
| 951-120                     | 2910-2920 | 80                        | 14                       | 17                        | 9                            | 9                         | 128                                      | 48                                       | 37.5                | 86                                       | 0.97                |
| 951-122                     | 2930-2940 | 103                       | 34                       | 54                        | 28                           | 45                        | 264                                      | 161                                      | 61.0                | 164                                      | 0.61                |
| 951-124                     | 2950-2960 | 54                        | 25                       | 70                        | 49                           | 79                        | 278                                      | 224                                      | 80.6                | 37                                       | 0.63                |
| 951-126                     | 2970-2980 | 34                        | 7                        | 12                        | 7                            | 10                        | 70                                       | 37                                       | 52.3                | 88                                       | 0.68                |
| 951-128                     | 2990-3000 | 35                        | 9                        | 21                        | 13                           | 15                        | 94                                       | 59                                       | 62.5                | 106                                      | 0.86                |
| 951-130                     | 3010-3020 | 95                        | 209                      | 440                       | 28                           | 33                        | 805                                      | 709                                      | 88.1                | 167                                      | 0.85                |
| 951-132                     | 3030-3040 | 478                       | 1042                     | 1957                      | 105                          | 129                       | 3711                                     | 3233                                     | 87.1                | 361                                      | 0.81                |
| 951-134                     | 3050-3060 | 57                        | 115                      | 178                       | 10                           | 10                        | 370                                      | 313                                      | 84.6                | 44                                       | 0.93                |
| 951-136                     | 3070-3080 | 279                       | 47                       | 589                       | 31                           | 32                        | 978                                      | 698                                      | 71.4                | 96                                       | 0.96                |
| 951-138                     | 3090-3100 | 100                       | 18                       | 243                       | 13                           | 14                        | 388                                      | 288                                      | 74.3                | 60                                       | 0.92                |
| 951-140                     | 3110-3120 | 15722                     | 261                      | 3233                      | 158                          | 169                       | 19543                                    | 3822                                     | 19.6                | 404                                      | 0.94                |
| 951-142                     | 3130-3140 | 1048                      | 246                      | 3822                      | 175                          | 240                       | 5530                                     | 4482                                     | 81.1                | 613                                      | 0.73                |

TABLE 2A  
CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN AIR SPACE GAS

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-144                     | 3150-3160 | 52                        | 13                       | 207                       | 10                           | 11                        | 293                                      | 241                                      | 82.3                | 74                                       | 0.87                |
| 951-146                     | 3170-3180 | 539                       | 93                       | 1701                      | 79                           | 120                       | 2531                                     | 1992                                     | 78.7                | 365                                      | 0.66                |
| 951-148                     | 3190-3200 | 547                       | 103                      | 1241                      | 55                           | 63                        | 2010                                     | 1462                                     | 72.8                | 119                                      | 0.86                |
| 951-150                     | 3210-3220 | 308                       | 78                       | 1783                      | 101                          | 179                       | 2449                                     | 2141                                     | 87.4                | 722                                      | 0.56                |
| 951-152                     | 3230-3240 | 238                       | 49                       | 917                       | 40                           | 80                        | 1324                                     | 1086                                     | 82.0                | 217                                      | 0.51                |
| 951-154                     | 3250-3260 | 1370                      | 196                      | 2327                      | 107                          | 178                       | 4178                                     | 2808                                     | 67.2                | 388                                      | 0.60                |
| 951-156                     | 3270-3280 | 150                       | 85                       | 1522                      | 83                           | 132                       | 1971                                     | 1821                                     | 92.4                | 364                                      | 0.63                |
| 951-158                     | 3290-3300 | 1262                      | 166                      | 2452                      | 134                          | 220                       | 4234                                     | 2972                                     | 70.2                | 640                                      | 0.61                |
| 951-160                     | 3310-3320 | 129                       | 21                       | 412                       | 23                           | 43                        | 629                                      | 499                                      | 79.4                | 185                                      | 0.54                |
| 951-162                     | 3330-3340 | 23                        | 5                        | 86                        | 4                            | 8                         | 127                                      | 104                                      | 81.8                | 42                                       | 0.57                |
| 951-164                     | 3350-3360 | 771                       | 117                      | 1665                      | 84                           | 123                       | 2760                                     | 1989                                     | 72.1                | 311                                      | 0.68                |
| 951-166                     | 3370-3380 | 1365                      | 275                      | 3118                      | 137                          | 134                       | 5028                                     | 3663                                     | 72.9                | 87                                       | 1.03                |
| 951-168                     | 3390-3400 | 23                        | 7                        | 45                        | 2                            | 4                         | 80                                       | 58                                       | 71.9                | 145                                      | 0.55                |
| 951-170                     | 3410-3420 | 1164                      | 219                      | 2650                      | 116                          | 124                       | 4274                                     | 3110                                     | 72.8                | 190                                      | 0.93                |
| 951-172                     | 3430-3440 | 142                       | 45                       | 1172                      | 69                           | 100                       | 1528                                     | 1386                                     | 90.7                | 197                                      | 0.69                |
| 951-174                     | 3450-3460 | 3576                      | 335                      | 4872                      | 263                          | 298                       | 9344                                     | 5768                                     | 61.7                | 547                                      | 0.89                |
| 951-176                     | 3470-3480 | 1509                      | 528                      | 3435                      | 146                          | 108                       | 5727                                     | 4218                                     | 73.7                | 148                                      | 1.35                |
| 951-178                     | 3490-3500 | 3718                      | 486                      | 3534                      | 140                          | 127                       | 8006                                     | 4288                                     | 53.6                | 228                                      | 1.10                |
| 951-180                     | 3510-3520 | 32                        | 7                        | 107                       | 7                            | 10                        | 163                                      | 131                                      | 80.2                | 41                                       | 0.70                |
| 951-182                     | 3530-3540 | 194                       | 66                       | 703                       | 24                           | 28                        | 1015                                     | 821                                      | 80.9                | 102                                      | 0.84                |
| 951-184                     | 3550-3560 | 129                       | 84                       | 1079                      | 35                           | 45                        | 1372                                     | 1243                                     | 90.6                | 86                                       | 0.78                |
| 951-186                     | 3570-3580 | 32                        | 12                       | 169                       | 5                            | 9                         | 226                                      | 194                                      | 85.8                | 30                                       | 0.60                |
| 951-188                     | 3590-3600 | 81                        | 40                       | 442                       | 10                           | 15                        | 589                                      | 507                                      | 86.2                | 69                                       | 0.65                |
| 951-190                     | 3610-3620 | 59                        | 16                       | 127                       | 2                            | 4                         | 208                                      | 149                                      | 71.7                | 22                                       | 0.62                |
| 951-192                     | 3630-3640 | 2037                      | 379                      | 1898                      | 30                           | 53                        | 4396                                     | 2360                                     | 53.7                | 54                                       | 0.56                |
| 951-194                     | 3650-3660 | 1588                      | 407                      | 2931                      | 61                           | 107                       | 5095                                     | 3507                                     | 68.8                | 201                                      | 0.57                |
| 951-208                     | 3670-3680 | 10212                     | 3295                     | 29862                     | 371                          | 1340                      | 45081                                    | 34868                                    | 77.3                | 1126                                     | 0.28                |
| 951-210                     | 3690-3700 | 186                       | 27                       | 288                       | 5                            | 21                        | 527                                      | 341                                      | 64.7                | 104                                      | 0.24                |

**TABLE 2A**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN AIR SPACE GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | iC <sub>4</sub><br>nC <sub>4</sub> |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|------------------------------------|
| 951-213                     | 3710-3720 | 2152                      | 484                      | 4468                      | 88                           | 287                       | 7479                                     | 5328                                     | 71.2                | 564                                      | 0.31                               |
| 951-216                     | 3730-3740 | 2083                      | 553                      | 5112                      | 105                          | 317                       | 8170                                     | 6087                                     | 74.5                | 556                                      | 0.33                               |
| 951-219                     | 3750-3760 | 811                       | 343                      | 3962                      | 64                           | 174                       | 5355                                     | 4544                                     | 84.9                | 196                                      | 0.37                               |
| 951-222                     | 3770-3780 | 2015                      | 319                      | 2413                      | 37                           | 94                        | 4878                                     | 2863                                     | 58.7                | 120                                      | 0.39                               |
| 951-226                     | 3810-3820 | 229                       | 19                       | 21                        | 6                            | 17                        | 292                                      | 63                                       | 21.6                | 142                                      | 0.39                               |
| 951-228                     | 3830-3840 | 15672                     | 1110                     | 653                       | 115                          | 311                       | 17861                                    | 2190                                     | 12.3                | 1394                                     | 0.37                               |
| 951-230                     | 3850-3860 | 2101                      | 482                      | 344                       | 44                           | 109                       | 3080                                     | 979                                      | 31.8                | 221                                      | 0.41                               |
| 951-232                     | 3870-3880 | 3454                      | 338                      | 311                       | 71                           | 156                       | 4330                                     | 876                                      | 20.2                | 390                                      | 0.46                               |
| 951-234                     | 3890-3900 | 1481                      | 195                      | 158                       | 18                           | 47                        | 1899                                     | 417                                      | 22.0                | 80                                       | 0.38                               |
| 951-237                     | 3910-3920 | 2532                      | 66                       | 154                       | 28                           | 89                        | 2869                                     | 337                                      | 11.7                | 218                                      | 0.31                               |
| 951-241                     | 3930-3940 | 1091                      | 332                      | 414                       | 60                           | 170                       | 2068                                     | 976                                      | 47.2                | 57                                       | 0.36                               |
| 951-243                     | 3950-3960 | 73                        | 28                       | 32                        | 4                            | 15                        | 152                                      | 79                                       | 51.9                | 39                                       | 0.30                               |
| 951-245                     | 3970-3980 | 2032                      | 247                      | 316                       | 45                           | 158                       | 2797                                     | 765                                      | 27.4                | 241                                      | 0.28                               |
| 951-247                     | 3990-4000 | 48                        | 33                       | 72                        | 10                           | 42                        | 205                                      | 157                                      | 76.4                | 216                                      | 0.25                               |
| 951-249                     | 4010-4020 | 54                        | 18                       | 51                        | 14                           | 39                        | 176                                      | 122                                      | 69.5                | 245                                      | 0.35                               |
| 951-251                     | 4030-4040 | 317                       | 161                      | 279                       | 43                           | 154                       | 955                                      | 638                                      | 66.8                | 170                                      | 0.28                               |
| 951-253                     | 4050-4060 | 148                       | 314                      | 1395                      | 354                          | 1065                      | 3277                                     | 3129                                     | 95.5                | 1609                                     | 0.33                               |
| 951-255                     | 4070-4080 | 107                       | 141                      | 544                       | 163                          | 515                       | 1469                                     | 1363                                     | 92.7                | 1129                                     | 0.32                               |
| 951-257                     | 4090-4100 | 208                       | 162                      | 445                       | 134                          | 402                       | 1350                                     | 1143                                     | 84.6                | 235                                      | 0.33                               |
| 951-260                     | 4110-4120 | 71                        | 32                       | 89                        | 29                           | 81                        | 301                                      | 230                                      | 76.4                | 230                                      | 0.35                               |
| 951-262                     | 4130-4140 | 2174                      | 1436                     | 2209                      | 936                          | 2813                      | 9568                                     | 7394                                     | 77.3                | 3529                                     | 0.33                               |
| 951-264                     | 4150-4160 | 371                       | 510                      | 1640                      | 437                          | 1419                      | 4377                                     | 4007                                     | 91.5                | 1820                                     | 0.31                               |
| 951-266                     | 4170-4180 | 21                        | 19                       | 65                        | 19                           | 58                        | 182                                      | 161                                      | 88.6                | 150                                      | 0.32                               |
| 951-268                     | 4190-4200 | 1441                      | 796                      | 1540                      | 447                          | 1181                      | 5405                                     | 3964                                     | 73.3                | 2286                                     | 0.38                               |
| 951-270                     | 4210-4220 | 1773                      | 1                        | 1566                      | 310                          | 929                       | 4579                                     | 2806                                     | 61.3                | 1840                                     | 0.33                               |
| 951-272                     | 4230-4240 | 311                       | 217                      | 341                       | 66                           | 179                       | 1114                                     | 803                                      | 72.0                | 79                                       | 0.37                               |
| 951-274                     | 4250-4260 | 3141                      | 1740                     | 1798                      | 307                          | 639                       | 7626                                     | 4485                                     | 58.8                | 1170                                     | 0.48                               |
| 951-276                     | 4270-4280 | 1595                      | 1239                     | 959                       | 113                          | 212                       | 4119                                     | 2524                                     | 61.3                | 333                                      | 0.53                               |
| 951-278                     | 4290-4300 | 1575                      | 954                      | 1251                      | 430                          | 907                       | 5116                                     | 3542                                     | 69.2                | 1643                                     | 0.47                               |

**TABLE 2A**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN AIR SPACE GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-280                     | 4310-4320 | 112                       | 159                      | 292                       | 70                           | 158                       | 791                                      | 679                                      | 85.9                | 366                                      | 0.45                |
| 951-282                     | 4330-4340 | 645                       | 479                      | 776                       | 14                           | 434                       | 2347                                     | 1702                                     | 72.5                | 1                                        | 0.03                |
| 951-284                     | 4350-4360 | 255                       | 179                      | 444                       | 182                          | 387                       | 1447                                     | 1193                                     | 82.4                | 1325                                     | 0.47                |
| 951-286                     | 4370-4380 | 244                       | 78                       | 150                       | 50                           | 106                       | 627                                      | 383                                      | 61.1                | 285                                      | 0.47                |
| 951-288                     | 4390-4400 | 315                       | 109                      | 187                       | 52                           | 114                       | 777                                      | 462                                      | 59.5                | 360                                      | 0.45                |
| 951-290                     | 4410-4420 | 1015                      | 646                      | 676                       | 157                          | 232                       | 2727                                     | 1712                                     | 62.8                | 191                                      | 0.68                |
| 951-292                     | 4430-4440 | 1833                      | 491                      | 439                       | 99                           | 162                       | 3024                                     | 1191                                     | 39.4                | 246                                      | 0.61                |
| 951-294                     | 4450-4460 | 2101                      | 1137                     | 544                       | 73                           | 100                       | 3955                                     | 1854                                     | 46.9                | 201                                      | 0.73                |
| 951-297                     | 4470-4480 | 1486                      | 912                      | 661                       | 106                          | 134                       | 3299                                     | 1814                                     | 55.0                | 206                                      | 0.79                |
| 951-300                     | 4490-4500 | 6286                      | 3165                     | 1745                      | 161                          | 201                       | 11558                                    | 5272                                     | 45.6                | 212                                      | 0.80                |
| 951-302                     | 4510-4520 | 6110                      | 7473                     | 5942                      | 548                          | 1299                      | 21372                                    | 15262                                    | 71.4                | 10096                                    | 0.42                |
| 951-304                     | 4530-4540 | 9265                      | 5767                     | 4057                      | 774                          | 605                       | 20468                                    | 11203                                    | 54.7                | 804                                      | 1.28                |
| 951-305                     | 4540-4560 | 933                       | 2053                     | 1228                      | 140                          | 226                       | 4580                                     | 3647                                     | 79.6                | 1470                                     | 0.62                |
| 951-307                     | 4570-4580 | 1424                      | 909                      | 414                       | 56                           | 78                        | 2881                                     | 1457                                     | 50.6                | 621                                      | 0.72                |
| 951-310                     | 4590-4600 | 13008                     | 6846                     | 3038                      | 317                          | 259                       | 23468                                    | 10460                                    | 44.6                | 557                                      | 1.22                |
| 951-312                     | 4610-4620 | 26304                     | 14425                    | 5648                      | 535                          | 676                       | 47588                                    | 21284                                    | 44.7                | 1994                                     | 0.79                |
| 951-314                     | 4630-4640 | 14958                     | 8162                     | 4141                      | 384                          | 429                       | 28073                                    | 13115                                    | 46.7                | 1036                                     | 0.89                |
| 951-316                     | 4650-4660 | 32629                     | 17585                    | 5155                      | 404                          | 504                       | 56277                                    | 23648                                    | 42.0                | 2682                                     | 0.80                |
| 951-318                     | 4670-4680 | 2258                      | 1287                     | 788                       | 103                          | 94                        | 4530                                     | 2272                                     | 50.1                | 172                                      | 1.09                |
| 951-321                     | 4690-4700 | 5404                      | 2529                     | 778                       | 76                           | 76                        | 8864                                     | 3460                                     | 39.0                | 185                                      | 1.01                |
| 951-323                     | 4710-4720 | 14943                     | 7400                     | 2028                      | 185                          | 253                       | 24809                                    | 9866                                     | 39.8                | 1064                                     | 0.73                |
| 951-325                     | 4730-4740 | 1980                      | 1176                     | 401                       | 36                           | 48                        | 3641                                     | 1661                                     | 45.6                | 135                                      | 0.75                |
| 951-329                     | 4750-4760 | 9734                      | 4607                     | 949                       | 100                          | 102                       | 15491                                    | 5758                                     | 37.2                | 477                                      | 0.98                |
| 951-331                     | 4770-4780 | 7962                      | 4091                     | 2329                      | 197                          | 244                       | 14822                                    | 6861                                     | 46.3                | 350                                      | 0.81                |
| 951-334                     | 4790-4800 | 7185                      | 2962                     | 468                       | 42                           | 54                        | 10711                                    | 3526                                     | 32.9                | 661                                      | 0.77                |
| 951-336                     | 4810-4820 | 2545                      | 1119                     | 166                       | 13                           | 19                        | 3862                                     | 1318                                     | 34.1                | 110                                      | 0.67                |
| 951-338                     | 4830-4840 | 3324                      | 1927                     | 302                       | 33                           | 25                        | 5612                                     | 2288                                     | 40.8                | 159                                      | 1.31                |
| 951-342                     | 4850-4860 | 8772                      | 2602                     | 412                       | 39                           | 54                        | 11879                                    | 3107                                     | 26.2                | 442                                      | 0.71                |
| 951-344                     | 4870-4880 | 4145                      | 1826                     | 275                       | 26                           | 26                        | 6298                                     | 2153                                     | 34.2                | 112                                      | 0.98                |
| 951-346                     | 4890-4900 | 2320                      | 1104                     | 161                       | 12                           | 13                        | 3610                                     | 1290                                     | 35.7                | 73                                       | 0.93                |

**TABLE 2B**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN CUTTING GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-001                     | 350-400   | 503                       | 128                      | 86                        | 26                           | 88                        | 831                                      | 328                                      | 39.4                | 131                                      | 0.29                |
| 951-002                     | 400-450   | 294                       | 216                      | 153                       | 36                           | 132                       | 832                                      | 538                                      | 64.7                | 719                                      | 0.27                |
| 951-003                     | 450-500   | 2706                      | 202                      | 88                        | 150                          | 112                       | 3259                                     | 552                                      | 16.9                | 881                                      | 1.34                |
| 951-004                     | 500-550   | 771                       | 108                      | 21                        | 62                           | 64                        | 1026                                     | 255                                      | 24.9                | 131                                      | 0.97                |
| 951-005                     | 550-600   | 129                       | 123                      | 35                        | 16                           | 12                        | 314                                      | 185                                      | 59.0                | 6415                                     | 1.30                |
| 951-006                     | 600-650   | 302                       | 79                       | 49                        | 10                           | 4                         | 443                                      | 142                                      | 32.0                | 24                                       | 2.59                |
| 951-007                     | 650-700   | 381                       | 118                      | 32                        | 16                           | 36                        | 583                                      | 202                                      | 34.7                | 107                                      | 0.43                |
| 951-008                     | 700-750   | 172                       | 172                      | 60                        | 67                           | 60                        | 532                                      | 360                                      | 67.7                | 14                                       | 1.12                |
| 951-009                     | 750-800   | 202                       | 157                      | 56                        | 67                           | 48                        | 530                                      | 328                                      | 61.9                | 59                                       | 1.40                |
| 951-010                     | 800-850   | 353                       | 123                      | 81                        | 145                          | 24                        | 727                                      | 373                                      | 51.4                | 100                                      | 6.05                |
| 951-011                     | 850-900   | 142                       | 93                       | 28                        | 93                           | 36                        | 393                                      | 251                                      | 63.8                | 332                                      | 2.59                |
| 951-012                     | 900-950   | 337                       | 187                      | 32                        | 52                           | 88                        | 696                                      | 359                                      | 51.6                | 114                                      | 0.59                |
| 951-013                     | 950-1000  | 239                       | 148                      | 26                        | 57                           | 52                        | 521                                      | 282                                      | 54.2                | 266                                      | 1.10                |
| 951-014                     | 1000-1050 | 73                        | 74                       | 14                        | 41                           | 4                         | 206                                      | 133                                      | 64.6                | 117                                      | *.**                |
| 951-015                     | 1050-1100 | 149                       | 84                       | 14                        | 10                           | 8                         | 265                                      | 116                                      | 43.7                | 138                                      | 1.30                |
| 951-016                     | 1100-1150 | 173                       | 79                       | 14                        | 16                           | 24                        | 305                                      | 132                                      | 43.4                | 45                                       | 0.65                |
| 951-017                     | 1150-1200 | 257                       | 59                       | 37                        | 47                           | 32                        | 432                                      | 175                                      | 40.5                | 256                                      | 1.46                |
| 951-018                     | 1200-1250 | 331                       | 118                      | 30                        | 16                           | 12                        | 507                                      | 176                                      | 34.7                | 166                                      | 1.30                |
| 951-019                     | 1250-1300 | 202                       | 84                       | 19                        | 10                           | 8                         | 322                                      | 121                                      | 37.4                | 211                                      | 1.30                |
| 951-020                     | 1300-1350 | 207                       | 84                       | 16                        | 5                            | 4                         | 316                                      | 109                                      | 34.5                | 41                                       | 1.30                |
| 951-021                     | 1350-1400 | 215                       | 108                      | 128                       | 124                          | 36                        | 611                                      | 396                                      | 64.8                | 52                                       | 3.45                |
| 951-022                     | 1400-1450 | 205                       | 79                       | 49                        | 36                           | 44                        | 413                                      | 208                                      | 50.3                | 111                                      | 0.82                |
| 951-023                     | 1450-1500 | 206                       | 128                      | 32                        | 31                           | 28                        | 426                                      | 219                                      | 51.6                | 31                                       | 1.11                |
| 951-024                     | 1500-1550 | 97                        | 157                      | 44                        | 78                           | 56                        | 432                                      | 335                                      | 77.5                | 14                                       | 1.39                |
| 951-025                     | 1550-1600 | 264                       | 226                      | 102                       | 67                           | 52                        | 712                                      | 448                                      | 62.9                | 31                                       | 1.30                |
| 951-026                     | 1600-1650 | 142                       | 84                       | 32                        | 31                           | 24                        | 314                                      | 171                                      | 54.6                | 24                                       | 1.30                |
| 951-027                     | 1650-1700 | 6274                      | 94                       | 26                        | 19                           | 7                         | 6420                                     | 146                                      | 2.3                 | 101                                      | 2.97                |
| 951-028                     | 1700-1750 | 4273                      | 71                       | 29                        | 15                           | 10                        | 4399                                     | 126                                      | 2.9                 | 151                                      | 1.49                |
| 951-029                     | 1750-1800 | 5776                      | 110                      | 41                        | 24                           | 12                        | 5964                                     | 188                                      | 3.1                 | 124                                      | 1.99                |
| 951-030                     | 1800-1850 | 8256                      | 253                      | 92                        | 97                           | 39                        | 8738                                     | 482                                      | 5.5                 | 228                                      | 2.47                |

**TABLE 2B**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN CUTTING GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-031                     | 1850-1900 | 10323                     | 384                      | 98                        | 158                          | 26                        | 10989                                    | 666                                      | 6.1                 | 186                                      | 6.00                |
| 951-032                     | 1900-1950 | 7459                      | 224                      | 54                        | 118                          | 18                        | 7873                                     | 414                                      | 5.3                 | 170                                      | 6.47                |
| 951-033                     | 1950-2000 | 1205                      | 95                       | 25                        | 108                          | 16                        | 1449                                     | 243                                      | 16.8                | 342                                      | 6.72                |
| 951-034                     | 2000-2050 | 592                       | 71                       | 29                        | 125                          | 29                        | 845                                      | 253                                      | 30.0                | 1004                                     | 4.24                |
| 951-035                     | 2050-2060 | 414                       | 40                       | 12                        | 41                           | 12                        | 518                                      | 104                                      | 20.1                | 546                                      | 3.44                |
| 951-038                     | 2080-2090 | 253                       | 36                       | 12                        | 27                           | 17                        | 345                                      | 92                                       | 26.6                | 1387                                     | 1.58                |
| 951-040                     | 2100-2110 | 1497                      | 132                      | 21                        | 21                           | 66                        | 1737                                     | 240                                      | 13.8                | 1709                                     | 0.32                |
| 951-041                     | 2110-2120 | 395                       | 74                       | 27                        | 120                          | 48                        | 662                                      | 268                                      | 40.4                | 4359                                     | 2.49                |
| 951-042                     | 2120-2130 | 722                       | 94                       | 18                        | 52                           | 21                        | 906                                      | 184                                      | 20.3                | 2040                                     | 2.51                |
| 951-044                     | 2140-2150 | 459                       | 75                       | 15                        | 63                           | 18                        | 630                                      | 171                                      | 27.1                | 1944                                     | 3.52                |
| 951-046                     | 2170-2180 | 948                       | 243                      | 64                        | 297                          | 88                        | 1642                                     | 693                                      | 42.2                | 4200                                     | 3.37                |
| 951-048                     | 2190-2200 | 473                       | 49                       | 10                        | 19                           | 14                        | 565                                      | 91                                       | 16.2                | 823                                      | 1.43                |
| 951-050                     | 2210-2220 | 3904                      | 334                      | 46                        | 99                           | 45                        | 4429                                     | 525                                      | 11.9                | 2139                                     | 2.18                |
| 951-052                     | 2230-2240 | 3242                      | 437                      | 78                        | 94                           | 106                       | 3957                                     | 715                                      | 18.1                | 1304                                     | 0.89                |
| 951-054                     | 2250-2260 | 2737                      | 1075                     | 308                       | 476                          | 716                       | 5312                                     | 2575                                     | 48.5                | 7305                                     | 0.66                |
| 951-056                     | 2270-2280 | 2052                      | 356                      | 135                       | 191                          | 277                       | 3011                                     | 959                                      | 31.9                | 4535                                     | 0.69                |
| 951-058                     | 2290-2300 | 1216                      | 316                      | 123                       | 151                          | 155                       | 1961                                     | 746                                      | 38.0                | 2002                                     | 0.97                |
| 951-060                     | 2310-2320 | 377                       | 78                       | 60                        | 110                          | 127                       | 752                                      | 375                                      | 49.8                | 2859                                     | 0.86                |
| 951-062                     | 2330-2340 | 798                       | 159                      | 78                        | 76                           | 103                       | 1214                                     | 416                                      | 34.3                | 2005                                     | 0.74                |
| 951-064                     | 2350-2360 | 192                       | 44                       | 16                        | 11                           | 18                        | 281                                      | 89                                       | 31.8                | 1873                                     | 0.60                |
| 951-066                     | 2370-2380 | 1429                      | 196                      | 121                       | 59                           | 120                       | 1925                                     | 496                                      | 25.8                | 3997                                     | 0.49                |
| 951-068                     | 2390-2400 | 2047                      | 423                      | 367                       | 217                          | 562                       | 3617                                     | 1570                                     | 43.4                | 10956                                    | 0.39                |
| 951-070                     | 2410-2420 | 485                       | 130                      | 225                       | 276                          | 711                       | 1827                                     | 1342                                     | 73.5                | 18430                                    | 0.39                |
| 951-072                     | 2430-2440 | 917                       | 297                      | 380                       | 271                          | 730                       | 2594                                     | 1678                                     | 64.7                | 12739                                    | 0.37                |
| 951-074                     | 2450-2460 | 2268                      | 454                      | 486                       | 201                          | 538                       | 3947                                     | 1679                                     | 42.5                | 6631                                     | 0.37                |
| 951-076                     | 2470-2480 | 1301                      | 353                      | 515                       | 248                          | 768                       | 3186                                     | 1884                                     | 59.2                | 8282                                     | 0.32                |
| 951-078                     | 2490-2500 | 1523                      | 296                      | 341                       | 129                          | 399                       | 2687                                     | 1164                                     | 43.3                | 492                                      | 0.32                |
| 951-080                     | 2510-2520 | 750                       | 167                      | 188                       | 82                           | 259                       | 1446                                     | 697                                      | 48.2                | 419                                      | 0.32                |
| 951-082                     | 2530-2540 | 1848                      | 556                      | 938                       | 436                          | 1419                      | 5197                                     | 3349                                     | 64.4                | 14820                                    | 0.31                |
| 951-084                     | 2550-2560 | 714                       | 248                      | 441                       | 220                          | 774                       | 2397                                     | 1683                                     | 70.2                | 11988                                    | 0.29                |

**TABLE 2B**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN CUTTING GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-086                     | 2570-2580 | 337                       | 114                      | 248                       | 170                          | 570                       | 1438                                     | 1101                                     | 76.5                | 9980                                     | 0.30                |
| 951-088                     | 2590-2600 | 217                       | 46                       | 67                        | 40                           | 193                       | 564                                      | 346                                      | 61.4                | 3757                                     | 0.21                |
| 951-090                     | 2610-2620 | 240                       | 98                       | 305                       | 174                          | 634                       | 1450                                     | 1210                                     | 83.4                | 6177                                     | 0.27                |
| 951-092                     | 2630-2640 | 300                       | 67                       | 61                        | 26                           | 76                        | 530                                      | 231                                      | 43.5                | 1650                                     | 0.34                |
| 951-094                     | 2650-2660 | 402                       | 133                      | 206                       | 253                          | 76                        | 1070                                     | 668                                      | 62.5                | 2841                                     | 3.35                |
| 951-096                     | 2670-2680 | 766                       | 202                      | 312                       | 136                          | 387                       | 1801                                     | 1035                                     | 57.5                | 3814                                     | 0.35                |
| 951-098                     | 2690-2700 | 1017                      | 279                      | 503                       | 305                          | 671                       | 2774                                     | 1757                                     | 63.3                | 9646                                     | 0.45                |
| 951-100                     | 2710-2720 | 1070                      | 279                      | 370                       | 137                          | 351                       | 2207                                     | 1137                                     | 51.5                | 3594                                     | 0.39                |
| 951-102                     | 2730-2740 | 649                       | 169                      | 244                       | 104                          | 273                       | 1438                                     | 789                                      | 54.9                | 3197                                     | 0.38                |
| 951-104                     | 2750-2760 | 908                       | 289                      | 329                       | 125                          | 321                       | 1972                                     | 1065                                     | 54.0                | 4639                                     | 0.39                |
| 951-106                     | 2770-2780 | 947                       | 317                      | 568                       | 233                          | 491                       | 2555                                     | 1608                                     | 62.9                | 3291                                     | 0.48                |
| 951-108                     | 2790-2800 | 859                       | 166                      | 184                       | 81                           | 193                       | 1483                                     | 624                                      | 42.1                | 2292                                     | 0.42                |
| 951-110                     | 2810-2820 | 278                       | 83                       | 131                       | 65                           | 178                       | 735                                      | 457                                      | 62.1                | 2563                                     | 0.37                |
| 951-112                     | 2830-2840 | 157                       | 51                       | 100                       | 50                           | 139                       | 497                                      | 340                                      | 68.3                | 1949                                     | 0.36                |
| 951-114                     | 2850-2860 | 86                        | 22                       | 21                        | 142                          | 47                        | 317                                      | 231                                      | 72.7                | 12233                                    | 3.02                |
| 951-116                     | 2870-2880 | 732                       | 236                      | 451                       | 281                          | 498                       | 2197                                     | 1465                                     | 66.7                | 4908                                     | 0.56                |
| 951-118                     | 2890-2900 | 206                       | 76                       | 129                       | 157                          | 63                        | 631                                      | 426                                      | 67.4                | 1888                                     | 2.49                |
| 951-120                     | 2910-2920 | 461                       | 165                      | 289                       | 137                          | 285                       | 1337                                     | 876                                      | 65.5                | 1566                                     | 0.48                |
| 951-122                     | 2930-2940 | 281                       | 185                      | 404                       | 224                          | 537                       | 1632                                     | 1351                                     | 82.8                | 2373                                     | 0.42                |
| 951-124                     | 2950-2960 | 200                       | 67                       | 133                       | 76                           | 167                       | 644                                      | 443                                      | 68.9                | 1462                                     | 0.45                |
| 951-126                     | 2970-2980 | 527                       | 121                      | 232                       | 126                          | 236                       | 1242                                     | 715                                      | 57.6                | 1697                                     | 0.53                |
| 951-128                     | 2990-3000 | 232                       | 74                       | 180                       | 115                          | 218                       | 818                                      | 586                                      | 71.7                | 1521                                     | 0.53                |
| 951-130                     | 3010-3020 | 68                        | 206                      | 576                       | 85                           | 32                        | 966                                      | 899                                      | 93.0                | 1002                                     | 2.67                |
| 951-132                     | 3030-3040 | 150                       | 450                      | 881                       | 63                           | 124                       | 1666                                     | 1516                                     | 91.0                | 823                                      | 0.51                |
| 951-134                     | 3050-3060 | 142                       | 430                      | 834                       | 39                           | 86                        | 1533                                     | 1390                                     | 90.7                | 729                                      | 0.46                |
| 951-136                     | 3070-3080 | 234                       | 61                       | 1563                      | 103                          | 236                       | 2196                                     | 1962                                     | 89.4                | 1580                                     | 0.43                |
| 951-138                     | 3090-3100 | 192                       | 56                       | 1157                      | 60                           | 147                       | 1611                                     | 1419                                     | 88.1                | 944                                      | 0.41                |
| 951-140                     | 3110-3120 | 647                       | 155                      | 2797                      | 131                          | 309                       | 4038                                     | 3391                                     | 84.0                | 1942                                     | 0.42                |
| 951-142                     | 3130-3140 | 532                       | 61                       | 1563                      | 66                           | 203                       | 2425                                     | 1894                                     | 78.1                | 1060                                     | 0.33                |

**TABLE 2B**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN CUTTING GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-144                     | 3150-3160 | 334                       | 95                       | 1886                      | 98                           | 287                       | 2700                                     | 2366                                     | 87.6                | 1998                                     | 0.34                |
| 951-146                     | 3170-3180 | 109                       | 35                       | 1085                      | 52                           | 183                       | 1465                                     | 1356                                     | 92.5                | 1286                                     | 0.29                |
| 951-148                     | 3190-3200 | 555                       | 146                      | 2647                      | 102                          | 262                       | 3712                                     | 3157                                     | 85.0                | 1625                                     | 0.39                |
| 951-150                     | 3210-3220 | 310                       | 60                       | 1185                      | 76                           | 248                       | 1879                                     | 1569                                     | 83.5                | 3920                                     | 0.31                |
| 951-152                     | 3230-3240 | 357                       | 68                       | 1409                      | 69                           | 218                       | 2121                                     | 1764                                     | 83.2                | 1186                                     | 0.32                |
| 951-154                     | 3250-3260 | 247                       | 54                       | 918                       | 44                           | 142                       | 1405                                     | 1158                                     | 82.4                | 1161                                     | 0.31                |
| 951-156                     | 3270-3280 | 61                        | 21                       | 490                       | 28                           | 94                        | 695                                      | 635                                      | 91.2                | 618                                      | 0.30                |
| 951-158                     | 3290-3300 | 175                       | 52                       | 1127                      | 63                           | 211                       | 1628                                     | 1453                                     | 89.3                | 1723                                     | 0.30                |
| 951-160                     | 3310-3320 | 298                       | 219                      | 2121                      | 166                          | 527                       | 3332                                     | 3034                                     | 91.0                | 9845                                     | 0.32                |
| 951-162                     | 3330-3340 | 116                       | 56                       | 1397                      | 71                           | 262                       | 1901                                     | 1785                                     | 93.9                | 1624                                     | 0.27                |
| 951-164                     | 3350-3360 | 493                       | 84                       | 1431                      | 60                           | 144                       | 2211                                     | 1718                                     | 77.7                | 505                                      | 0.41                |
| 951-166                     | 3370-3380 | 286                       | 78                       | 1679                      | 69                           | 179                       | 2290                                     | 2005                                     | 87.5                | 574                                      | 0.38                |
| 951-168                     | 3390-3400 | 69                        | 15                       | 100                       | 11                           | 5                         | 200                                      | 131                                      | 65.4                | 142                                      | 2.34                |
| 951-170                     | 3410-3420 | 143                       | 35                       | 843                       | 37                           | 103                       | 1161                                     | 1018                                     | 87.7                | 466                                      | 0.36                |
| 951-172                     | 3430-3440 | 121                       | 20                       | 350                       | 18                           | 54                        | 562                                      | 441                                      | 78.5                | 220                                      | 0.33                |
| 951-174                     | 3450-3460 | 126                       | 28                       | 598                       | 38                           | 111                       | 902                                      | 775                                      | 86.0                | 611                                      | 0.34                |
| 951-176                     | 3470-3480 | 1477                      | 275                      | 3427                      | 133                          | 240                       | 5552                                     | 4075                                     | 73.4                | 593                                      | 0.55                |
| 951-178                     | 3490-3500 | 579                       | 120                      | 2083                      | 93                           | 191                       | 3066                                     | 2487                                     | 81.1                | 606                                      | 0.49                |
| 951-180                     | 3510-3520 | 127                       | 18                       | 291                       | 47                           | 17                        | 500                                      | 372                                      | 74.5                | 190                                      | 2.75                |
| 951-182                     | 3530-3540 | 89                        | 29                       | 649                       | 21                           | 56                        | 843                                      | 754                                      | 89.5                | 200                                      | 0.37                |
| 951-184                     | 3550-3560 | 240                       | 78                       | 1281                      | 28                           | 81                        | 1707                                     | 1467                                     | 85.9                | 202                                      | 0.35                |
| 951-186                     | 3570-3580 | 87                        | 18                       | 311                       | 11                           | 40                        | 468                                      | 380                                      | 81.3                | 252                                      | 0.28                |
| 951-188                     | 3590-3600 | 147                       | 75                       | 1561                      | 34                           | 122                       | 1938                                     | 1791                                     | 92.4                | 773                                      | 0.28                |
| 951-190                     | 3610-3620 | 120                       | 68                       | 1205                      | 17                           | 71                        | 1480                                     | 1360                                     | 91.9                | 153                                      | 0.23                |
| 951-192                     | 3630-3640 | 351                       | 121                      | 1391                      | 23                           | 83                        | 1969                                     | 1618                                     | 82.2                | 162                                      | 0.28                |
| 951-194                     | 3650-3660 | 150                       | 58                       | 783                       | 20                           | 72                        | 1082                                     | 933                                      | 86.2                | 466                                      | 0.27                |
| 951-208                     | 3670-3680 | 2831                      | 1861                     | 43454                     | 3111                         | 862                       | 52119                                    | 49288                                    | 94.6                | 2527                                     | 3.61                |
| 951-210                     | 3690-3700 | 185                       | 74                       | 1910                      | 51                           | 342                       | 2562                                     | 2377                                     | 92.8                | 1224                                     | 0.15                |

**TABLE 2B**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN CUTTING GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-213                     | 3710-3720 | 489                       | 128                      | 1817                      | 42                           | 217                       | 2693                                     | 2204                                     | 81.8                | 1084                                     | 0.19                |
| 951-216                     | 3730-3740 | 409                       | 143                      | 2694                      | 57                           | 309                       | 3612                                     | 3203                                     | 88.7                | 1190                                     | 0.18                |
| 951-219                     | 3750-3760 | 760                       | 867                      | 19253                     | 268                          | 1100                      | 22247                                    | 21488                                    | 96.6                | 1025                                     | 0.24                |
| 951-222                     | 3770-3780 | 646                       | 400                      | 8535                      | 159                          | 692                       | 10432                                    | 9786                                     | 93.8                | 782                                      | 0.23                |
| 951-224                     | 3790-3800 | 916                       | 86                       | 136                       | 80                           | 231                       | 1449                                     | 533                                      | 36.8                | 1057                                     | 0.35                |
| 951-226                     | 3810-3820 | 4005                      | 136                      | 80                        | 21                           | 64                        | 4307                                     | 302                                      | 7.0                 | 877                                      | 0.34                |
| 951-228                     | 3830-3840 | 586                       | 71                       | 52                        | 10                           | 29                        | 747                                      | 161                                      | 21.6                | 471                                      | 0.34                |
| 951-230                     | 3850-3860 | 1865                      | 311                      | 393                       | 65                           | 223                       | 2857                                     | 992                                      | 34.7                | 663                                      | 0.29                |
| 951-232                     | 3870-3880 | 712                       | 103                      | 129                       | 37                           | 102                       | 1083                                     | 371                                      | 34.3                | 643                                      | 0.36                |
| 951-234                     | 3890-3900 | 478                       | 136                      | 189                       | 31                           | 116                       | 950                                      | 472                                      | 49.7                | 400                                      | 0.26                |
| 951-237                     | 3910-3920 | 569                       | 73                       | 220                       | 60                           | 254                       | 1177                                     | 607                                      | 51.6                | 518                                      | 0.24                |
| 951-241                     | 3930-3940 | 425                       | 192                      | 325                       | 54                           | 265                       | 1262                                     | 837                                      | 66.3                | 324                                      | 0.20                |
| 951-243                     | 3950-3960 | 278                       | 309                      | 626                       | 63                           | 345                       | 1620                                     | 1342                                     | 82.9                | 429                                      | 0.18                |
| 951-245                     | 3970-3980 | 379                       | 66                       | 129                       | 30                           | 141                       | 745                                      | 366                                      | 49.1                | 548                                      | 0.21                |
| 951-247                     | 3990-4000 | 118                       | 21                       | 42                        | 12                           | 56                        | 249                                      | 131                                      | 52.6                | 257                                      | 0.22                |
| 951-249                     | 4010-4020 | 132                       | 28                       | 31                        | 11                           | 59                        | 261                                      | 129                                      | 49.4                | 365                                      | 0.18                |
| 951-251                     | 4030-4040 | 89                        | 46                       | 157                       | 56                           | 209                       | 557                                      | 467                                      | 83.9                | 416                                      | 0.27                |
| 951-253                     | 4050-4060 | 103                       | 58                       | 457                       | 182                          | 907                       | 1708                                     | 1605                                     | 94.0                | 2667                                     | 0.20                |
| 951-255                     | 4070-4080 | 155                       | 91                       | 415                       | 183                          | 837                       | 1681                                     | 1527                                     | 90.8                | 2838                                     | 0.22                |
| 951-257                     | 4090-4100 | 542                       | 211                      | 441                       | 132                          | 776                       | 2102                                     | 1560                                     | 74.2                | 4985                                     | 0.17                |
| 951-260                     | 4110-4120 | 449                       | 197                      | 534                       | 167                          | 755                       | 2103                                     | 1654                                     | 78.6                | 4061                                     | 0.22                |
| 951-262                     | 4130-4140 | 392                       | 230                      | 1094                      | 409                          | 2206                      | 4331                                     | 3939                                     | 91.0                | 11354                                    | 0.19                |
| 951-264                     | 4150-4160 | 271                       | 151                      | 854                       | 364                          | 1674                      | 3314                                     | 3043                                     | 91.8                | 8835                                     | 0.22                |
| 951-266                     | 4170-4180 | 309                       | 85                       | 240                       | 135                          | 655                       | 1424                                     | 1115                                     | 78.3                | 7204                                     | 0.21                |
| 951-268                     | 4190-4200 | 648                       | 154                      | 348                       | 129                          | 549                       | 1828                                     | 1180                                     | 64.5                | 5089                                     | 0.23                |
| 951-270                     | 4210-4220 | 535                       | 122                      | 312                       | 82                           | 330                       | 1381                                     | 846                                      | 61.2                | 2509                                     | 0.25                |
| 951-272                     | 4230-4240 | 442                       | 127                      | 166                       | 36                           | 145                       | 917                                      | 475                                      | 51.8                | 2485                                     | 0.25                |
| 951-274                     | 4250-4260 | 324                       | 208                      | 474                       | 101                          | 438                       | 1545                                     | 1221                                     | 79.1                | 2306                                     | 0.23                |
| 951-276                     | 4270-4280 | 837                       | 1965                     | 3680                      | 390                          | 1572                      | 8444                                     | 7607                                     | 90.1                | 1665                                     | 0.25                |
| 951-278                     | 4290-4300 | 947                       | 391                      | 795                       | 253                          | 949                       | 3336                                     | 2389                                     | 71.6                | 2194                                     | 0.27                |

**TABLE 2B**  
**CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS IN CUTTING GAS**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | iC <sub>4</sub><br>nC <sub>4</sub> |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|------------------------------------|
| 951-280                     | 4310-4320 | 615                       | 328                      | 668                       | 206                          | 672                       | 2489                                     | 1874                                     | 75.3                | 2557                                     | 0.31                               |
| 951-282                     | 4330-4340 | 583                       | 279                      | 703                       | 265                          | 871                       | 2701                                     | 2118                                     | 78.4                | 4523                                     | 0.30                               |
| 951-284                     | 4350-4360 | 594                       | 227                      | 863                       | 466                          | 1276                      | 3426                                     | 2832                                     | 82.7                | 8037                                     | 0.37                               |
| 951-286                     | 4370-4380 | 1163                      | 216                      | 396                       | 147                          | 350                       | 2271                                     | 1108                                     | 48.8                | 2587                                     | 0.42                               |
| 951-288                     | 4390-4400 | 734                       | 82                       | 101                       | 31                           | 87                        | 1036                                     | 302                                      | 29.1                | 1017                                     | 0.36                               |
| 951-290                     | 4410-4420 | 445                       | 262                      | 344                       | 89                           | 234                       | 1374                                     | 929                                      | 67.6                | 841                                      | 0.38                               |
| 951-292                     | 4430-4440 | 3157                      | 1208                     | 919                       | 177                          | 397                       | 5859                                     | 2702                                     | 46.1                | 1883                                     | 0.45                               |
| 951-294                     | 4450-4460 | 3157                      | 1208                     | 919                       | 177                          | 397                       | 5858                                     | 2701                                     | 46.1                | 1883                                     | 0.45                               |
| 951-297                     | 4470-4480 | 5743                      | 1331                     | 551                       | 72                           | 136                       | 7835                                     | 2091                                     | 26.7                | 340                                      | 0.53                               |
| 951-300                     | 4490-4500 | 12200                     | 8506                     | 6184                      | 448                          | 1125                      | 28464                                    | 16263                                    | 57.1                | 622                                      | 0.40                               |
| 951-302                     | 4510-4520 | 1949                      | 2349                     | 5823                      | 1158                         | 2318                      | 13596                                    | 11648                                    | 85.7                | 2835                                     | 0.50                               |
| 951-304                     | 4530-4540 | 10564                     | 9323                     | 8000                      | 2327                         | 3440                      | 33654                                    | 23089                                    | 68.6                | 4763                                     | 0.68                               |
| 951-305                     | 4540-4560 | 118                       | 168                      | 165                       | 21                           | 44                        | 516                                      | 398                                      | 77.2                | 797                                      | 0.48                               |
| 951-307                     | 4570-4580 | 1943                      | 2687                     | 2034                      | 277                          | 490                       | 7432                                     | 5488                                     | 73.8                | 1534                                     | 0.56                               |
| 951-310                     | 4590-4600 | 18890                     | 11845                    | 8225                      | 1662                         | 1851                      | 42474                                    | 23584                                    | 55.5                | 2430                                     | 0.90                               |
| 951-312                     | 4610-4620 | 8973                      | 7552                     | 5379                      | 618                          | 1094                      | 23617                                    | 14644                                    | 62.0                | 2490                                     | 0.56                               |
| 951-314                     | 4630-4640 | 10200                     | 8172                     | 5670                      | 626                          | 946                       | 25614                                    | 15414                                    | 60.2                | 1701                                     | 0.66                               |
| 951-316                     | 4650-4660 | 8270                      | 7453                     | 4317                      | 422                          | 684                       | 21147                                    | 12877                                    | 60.9                | 1291                                     | 0.62                               |
| 951-318                     | 4670-4680 | 9694                      | 6545                     | 2891                      | 366                          | 556                       | 20052                                    | 10358                                    | 51.7                | 1517                                     | 0.66                               |
| 951-321                     | 4690-4700 | 13355                     | 8670                     | 4552                      | 530                          | 583                       | 27689                                    | 14334                                    | 51.8                | 1239                                     | 0.91                               |
| 951-323                     | 4710-4720 | 6144                      | 4226                     | 1826                      | 244                          | 402                       | 12842                                    | 6698                                     | 52.2                | 1625                                     | 0.61                               |
| 951-325                     | 4730-4740 | 4586                      | 5398                     | 2392                      | 276                          | 470                       | 13122                                    | 8536                                     | 65.1                | 1470                                     | 0.59                               |
| 951-329                     | 4750-4760 | 10559                     | 7874                     | 5025                      | 469                          | 891                       | 24818                                    | 14259                                    | 57.5                | 1403                                     | 0.53                               |
| 951-331                     | 4770-4780 | 11418                     | 8000                     | 4977                      | 414                          | 833                       | 25641                                    | 14223                                    | 55.5                | 274                                      | 0.50                               |
| 951-334                     | 4790-4800 | 2641                      | 3018                     | 928                       | 103                          | 185                       | 6874                                     | 4234                                     | 61.6                | 854                                      | 0.56                               |
| 951-336                     | 4810-4820 | 737                       | 1984                     | 856                       | 98                           | 198                       | 3873                                     | 3136                                     | 81.0                | 582                                      | 0.50                               |
| 951-338                     | 4830-4840 | 7026                      | 4536                     | 905                       | 99                           | 151                       | 12717                                    | 5691                                     | 44.8                | 954                                      | 0.66                               |
| 951-342                     | 4850-4860 | 897                       | 1240                     | 567                       | 61                           | 133                       | 2898                                     | 2001                                     | 69.0                | 531                                      | 0.46                               |
| 951-344                     | 4870-4880 | 3541                      | 2400                     | 559                       | 53                           | 102                       | 6655                                     | 3114                                     | 46.8                | 605                                      | 0.52                               |
| 951-346                     | 4890-4900 | 1012                      | 775                      | 245                       | 24                           | 53                        | 2110                                     | 1097                                     | 52.0                | 690                                      | 0.45                               |

**TABLE 2 C**  
**TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS (2A + 2B)**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-001                     | 350-400   | 543                       | 165                      | 121                       | 43                           | 124                       | 996                                      | 454                                      | 45.5                | 190                                      | 0.35                |
| 951-002                     | 400-450   | 3403                      | 297                      | 198                       | 87                           | 285                       | 4270                                     | 866                                      | 20.3                | 767                                      | 0.31                |
| 951-003                     | 450-500   | 6076                      | 297                      | 108                       | 177                          | 132                       | 6792                                     | 715                                      | 10.5                | 979                                      | 1.34                |
| 951-004                     | 500-550   | 4166                      | 212                      | 30                        | 76                           | 94                        | 4579                                     | 412                                      | 9.0                 | 437                                      | 0.80                |
| 951-005                     | 550-600   | 3369                      | 225                      | 73                        | 78                           | 119                       | 3865                                     | 496                                      | 12.8                | 6761                                     | 0.65                |
| 951-006                     | 600-650   | 4653                      | 222                      | 68                        | 39                           | 15                        | 4997                                     | 344                                      | 6.9                 | 251                                      | 2.51                |
| 951-007                     | 650-700   | 3043                      | 194                      | 42                        | 44                           | 52                        | 3376                                     | 333                                      | 9.9                 | 354                                      | 0.85                |
| 951-008                     | 700-750   | 290                       | 191                      | 70                        | 72                           | 66                        | 688                                      | 398                                      | 57.9                | 28                                       | 1.09                |
| 951-009                     | 750-800   | 2224                      | 218                      | 80                        | 81                           | 72                        | 2675                                     | 451                                      | 16.9                | 78                                       | 1.13                |
| 951-010                     | 800-850   | 3480                      | 237                      | 110                       | 170                          | 42                        | 4038                                     | 558                                      | 13.8                | 123                                      | 4.10                |
| 951-011                     | 850-900   | 2536                      | 181                      | 54                        | 126                          | 50                        | 2946                                     | 410                                      | 13.9                | 352                                      | 2.50                |
| 951-012                     | 900-950   | 3807                      | 312                      | 62                        | 72                           | 116                       | 4368                                     | 561                                      | 12.8                | 130                                      | 0.62                |
| 951-013                     | 950-1000  | 371                       | 180                      | 52                        | 109                          | 215                       | 926                                      | 556                                      | 60.0                | 501                                      | 0.51                |
| 951-014                     | 1000-1050 | 78                        | 90                       | 18                        | 66                           | 20                        | 271                                      | 194                                      | 71.4                | 253                                      | 3.31                |
| 951-015                     | 1050-1100 | 247                       | 92                       | 18                        | 17                           | 10                        | 384                                      | 137                                      | 35.6                | 156                                      | 1.81                |
| 951-016                     | 1100-1150 | 2296                      | 182                      | 50                        | 44                           | 46                        | 2619                                     | 322                                      | 12.3                | 128                                      | 0.96                |
| 951-017                     | 1150-1200 | 1995                      | 140                      | 59                        | 77                           | 45                        | 2316                                     | 321                                      | 13.9                | 1082                                     | 1.72                |
| 951-018                     | 1200-1250 | 2000                      | 188                      | 48                        | 31                           | 23                        | 2290                                     | 290                                      | 12.7                | 221                                      | 1.37                |
| 951-019                     | 1250-1300 | 1555                      | 143                      | 33                        | 17                           | 15                        | 1763                                     | 207                                      | 11.8                | 235                                      | 1.11                |
| 951-020                     | 1300-1350 | 1967                      | 154                      | 31                        | 22                           | 28                        | 2202                                     | 235                                      | 10.7                | 46                                       | 0.78                |
| 951-021                     | 1350-1400 | 1750                      | 186                      | 149                       | 146                          | 44                        | 2276                                     | 525                                      | 23.1                | 64                                       | 3.31                |
| 951-022                     | 1400-1450 | 647                       | 116                      | 62                        | 66                           | 57                        | 949                                      | 301                                      | 31.8                | 115                                      | 1.16                |
| 951-023                     | 1450-1500 | 3248                      | 298                      | 106                       | 135                          | 54                        | 3840                                     | 593                                      | 15.4                | 205                                      | 2.51                |
| 951-024                     | 1500-1550 | 123                       | 246                      | 231                       | 250                          | 296                       | 1146                                     | 1023                                     | 89.2                | 203                                      | 0.84                |
| 951-025                     | 1550-1600 | 3762                      | 585                      | 288                       | 328                          | 127                       | 5090                                     | 1328                                     | 26.1                | 127                                      | 2.59                |
| 951-026                     | 1600-1650 | 2977                      | 269                      | 92                        | 99                           | 51                        | 3489                                     | 512                                      | 14.7                | 70                                       | 1.93                |
| 951-027                     | 1650-1700 | 9124                      | 145                      | 51                        | 35                           | 11                        | 9366                                     | 242                                      | 2.6                 | 136                                      | 3.23                |
| 951-028                     | 1700-1750 | 7969                      | 337                      | 88                        | 49                           | 17                        | 8460                                     | 491                                      | 5.8                 | 180                                      | 2.83                |
| 951-029                     | 1750-1800 | 7286                      | 261                      | 74                        | 44                           | 16                        | 7680                                     | 394                                      | 5.1                 | 140                                      | 2.66                |
| 951-030                     | 1800-1850 | 9743                      | 506                      | 133                       | 133                          | 44                        | 10558                                    | 815                                      | 7.7                 | 247                                      | 3.04                |

**TABLE 2 C**  
**TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS (2A + 2B)**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-031                     | 1850-1900 | 11519                     | 623                      | 129                       | 194                          | 30                        | 12495                                    | 976                                      | 7.8                 | 202                                      | 6.59                |
| 951-032                     | 1900-1950 | 11168                     | 871                      | 131                       | 232                          | 29                        | 12430                                    | 1263                                     | 10.2                | 224                                      | 8.01                |
| 951-033                     | 1950-2000 | 8535                      | 735                      | 93                        | 338                          | 34                        | 9734                                     | 1199                                     | 12.3                | 591                                      | *.**                |
| 951-034                     | 2000-2050 | 10000                     | 994                      | 143                       | 519                          | 69                        | 11726                                    | 1726                                     | 14.7                | 1517                                     | 7.47                |
| 951-035                     | 2050-2060 | 11907                     | 813                      | 117                       | 448                          | 69                        | 13354                                    | 1447                                     | 10.8                | 1239                                     | 6.51                |
| 951-038                     | 2080-2090 | 16764                     | 1014                     | 129                       | 413                          | 123                       | 18443                                    | 1679                                     | 9.1                 | 3541                                     | 3.37                |
| 951-040                     | 2100-2110 | 17030                     | 2320                     | 225                       | 705                          | 181                       | 20460                                    | 3430                                     | 16.8                | 3747                                     | 3.90                |
| 951-041                     | 2110-2120 | 448                       | 90                       | 34                        | 144                          | 57                        | 773                                      | 324                                      | 42.0                | 4657                                     | 2.53                |
| 951-042                     | 2120-2130 | 20523                     | 2889                     | 239                       | 929                          | 174                       | 24754                                    | 4230                                     | 17.1                | 6695                                     | 5.33                |
| 951-044                     | 2140-2150 | 59405                     | 7780                     | 562                       | 1969                         | 367                       | 70084                                    | 10679                                    | 15.2                | 9795                                     | 5.36                |
| 951-046                     | 2170-2180 | 9078                      | 1992                     | 213                       | 785                          | 177                       | 12246                                    | 3168                                     | 25.9                | 5639                                     | 4.44                |
| 951-048                     | 2190-2200 | 949                       | 86                       | 13                        | 30                           | 15                        | 1094                                     | 144                                      | 13.2                | 918                                      | 1.93                |
| 951-050                     | 2210-2220 | 5082                      | 421                      | 56                        | 124                          | 53                        | 5735                                     | 653                                      | 11.4                | 2281                                     | 2.34                |
| 951-052                     | 2230-2240 | 6242                      | 1167                     | 160                       | 169                          | 176                       | 7913                                     | 1672                                     | 21.1                | 1571                                     | 0.96                |
| 951-054                     | 2250-2260 | 7473                      | 3042                     | 654                       | 820                          | 1097                      | 13085                                    | 5612                                     | 42.9                | 8656                                     | 0.75                |
| 951-056                     | 2270-2280 | 6070                      | 1567                     | 474                       | 640                          | 705                       | 9458                                     | 3387                                     | 35.8                | 6589                                     | 0.91                |
| 951-058                     | 2290-2300 | 1830                      | 448                      | 159                       | 189                          | 183                       | 2808                                     | 979                                      | 34.9                | 2472                                     | 1.03                |
| 951-060                     | 2310-2320 | 410                       | 87                       | 65                        | 118                          | 134                       | 815                                      | 404                                      | 49.6                | 2990                                     | 0.88                |
| 951-062                     | 2330-2340 | 6095                      | 1882                     | 533                       | 365                          | 328                       | 9203                                     | 3108                                     | 33.8                | 2859                                     | 1.11                |
| 951-064                     | 2350-2360 | 1275                      | 133                      | 39                        | 29                           | 35                        | 1511                                     | 236                                      | 15.6                | 2154                                     | 0.85                |
| 951-066                     | 2370-2380 | 6454                      | 1945                     | 956                       | 504                          | 812                       | 10670                                    | 4217                                     | 39.5                | 4776                                     | 0.62                |
| 951-068                     | 2390-2400 | 7527                      | 2664                     | 1994                      | 923                          | 1860                      | 14968                                    | 7441                                     | 49.7                | 14917                                    | 0.50                |
| 951-070                     | 2410-2420 | 867                       | 215                      | 429                       | 488                          | 1079                      | 3077                                     | 2210                                     | 71.8                | 19870                                    | 0.45                |
| 951-072                     | 2430-2440 | 7948                      | 2911                     | 3107                      | 1386                         | 2973                      | 18324                                    | 10376                                    | 56.6                | 18466                                    | 0.47                |
| 951-074                     | 2450-2460 | 7502                      | 2888                     | 2907                      | 1526                         | 3285                      | 18108                                    | 10606                                    | 58.6                | 13737                                    | 0.46                |
| 951-076                     | 2470-2480 | 4794                      | 2090                     | 2253                      | 1717                         | 3080                      | 13934                                    | 9140                                     | 65.6                | 15482                                    | 0.56                |
| 951-078                     | 2490-2500 | 5467                      | 2050                     | 2039                      | 773                          | 1780                      | 12109                                    | 6642                                     | 54.9                | 4102                                     | 0.43                |
| 951-080                     | 2510-2520 | 5815                      | 2413                     | 2336                      | 1024                         | 2150                      | 13737                                    | 7923                                     | 57.7                | 5323                                     | 0.48                |
| 951-082                     | 2530-2540 | 6816                      | 3154                     | 3596                      | 1950                         | 4535                      | 20051                                    | 13235                                    | 66.0                | 22325                                    | 0.43                |
| 951-084                     | 2550-2560 | 7121                      | 3435                     | 3698                      | 1802                         | 4473                      | 20530                                    | 13409                                    | 65.3                | 21960                                    | 0.40                |

TABLE 2 C  
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS (2A + 2B)

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-086                     | 2570-2580 | 635                       | 198                      | 399                       | 242                          | 717                       | 2191                                     | 1556                                     | 71.0                | 10683                                    | 0.34                |
| 951-088                     | 2590-2600 | 265                       | 67                       | 112                       | 61                           | 258                       | 762                                      | 497                                      | 65.2                | 4624                                     | 0.23                |
| 951-090                     | 2610-2620 | 971                       | 281                      | 578                       | 286                          | 885                       | 3001                                     | 2030                                     | 67.6                | 7252                                     | 0.32                |
| 951-092                     | 2630-2640 | 308                       | 71                       | 69                        | 30                           | 87                        | 566                                      | 258                                      | 45.6                | 1815                                     | 0.35                |
| 951-094                     | 2650-2660 | 405                       | 135                      | 209                       | 255                          | 80                        | 1084                                     | 679                                      | 62.6                | 2849                                     | 3.18                |
| 951-096                     | 2670-2680 | 908                       | 246                      | 390                       | 172                          | 462                       | 2179                                     | 1271                                     | 58.3                | 4203                                     | 0.37                |
| 951-098                     | 2690-2700 | 4632                      | 1189                     | 1318                      | 628                          | 1163                      | 8931                                     | 4298                                     | 48.1                | 15353                                    | 0.54                |
| 951-100                     | 2710-2720 | 7129                      | 2788                     | 2801                      | 1071                         | 1959                      | 15747                                    | 8618                                     | 54.7                | 7749                                     | 0.55                |
| 951-102                     | 2730-2740 | 5643                      | 1223                     | 1149                      | 402                          | 742                       | 9160                                     | 3516                                     | 38.4                | 4594                                     | 0.54                |
| 951-104                     | 2750-2760 | 5338                      | 1530                     | 1413                      | 496                          | 869                       | 9647                                     | 4309                                     | 44.7                | 6024                                     | 0.57                |
| 951-106                     | 2770-2780 | 3024                      | 700                      | 943                       | 376                          | 693                       | 5736                                     | 2712                                     | 47.3                | 4083                                     | 0.54                |
| 951-108                     | 2790-2800 | 2554                      | 569                      | 511                       | 215                          | 370                       | 4219                                     | 1665                                     | 39.5                | 2795                                     | 0.58                |
| 951-110                     | 2810-2820 | 480                       | 119                      | 178                       | 97                           | 199                       | 1074                                     | 593                                      | 55.3                | 2741                                     | 0.49                |
| 951-112                     | 2830-2840 | 366                       | 91                       | 161                       | 82                           | 184                       | 883                                      | 518                                      | 58.6                | 2207                                     | 0.45                |
| 951-114                     | 2850-2860 | 97                        | 25                       | 43                        | 174                          | 120                       | 459                                      | 363                                      | 79.0                | 13380                                    | 1.45                |
| 951-116                     | 2870-2880 | 1543                      | 391                      | 640                       | 370                          | 620                       | 3564                                     | 2021                                     | 56.7                | 5313                                     | 0.60                |
| 951-118                     | 2890-2900 | 654                       | 151                      | 204                       | 192                          | 104                       | 1304                                     | 650                                      | 49.8                | 2061                                     | 1.84                |
| 951-120                     | 2910-2920 | 541                       | 179                      | 306                       | 146                          | 294                       | 1465                                     | 924                                      | 63.1                | 1652                                     | 0.50                |
| 951-122                     | 2930-2940 | 384                       | 219                      | 458                       | 252                          | 583                       | 1896                                     | 1512                                     | 79.7                | 2538                                     | 0.43                |
| 951-124                     | 2950-2960 | 254                       | 92                       | 203                       | 125                          | 246                       | 921                                      | 667                                      | 72.4                | 1499                                     | 0.51                |
| 951-126                     | 2970-2980 | 560                       | 128                      | 244                       | 133                          | 246                       | 1312                                     | 752                                      | 57.3                | 1785                                     | 0.54                |
| 951-128                     | 2990-3000 | 267                       | 83                       | 200                       | 128                          | 233                       | 912                                      | 645                                      | 70.7                | 1627                                     | 0.55                |
| 951-130                     | 3010-3020 | 163                       | 415                      | 1016                      | 113                          | 64                        | 1771                                     | 1608                                     | 90.8                | 1169                                     | 1.75                |
| 951-132                     | 3030-3040 | 628                       | 1492                     | 2838                      | 167                          | 252                       | 5377                                     | 4749                                     | 88.3                | 1184                                     | 0.66                |
| 951-134                     | 3050-3060 | 199                       | 545                      | 1013                      | 49                           | 96                        | 1902                                     | 1703                                     | 89.5                | 774                                      | 0.51                |
| 951-136                     | 3070-3080 | 513                       | 107                      | 2152                      | 133                          | 268                       | 3174                                     | 2661                                     | 83.8                | 1676                                     | 0.50                |
| 951-138                     | 3090-3100 | 292                       | 74                       | 1399                      | 73                           | 161                       | 1999                                     | 1707                                     | 85.4                | 1005                                     | 0.45                |
| 951-140                     | 3110-3120 | 16369                     | 416                      | 6030                      | 289                          | 477                       | 23581                                    | 7212                                     | 30.6                | 2347                                     | 0.61                |
| 951-142                     | 3130-3140 | 1580                      | 307                      | 5385                      | 241                          | 442                       | 7955                                     | 6376                                     | 80.1                | 1673                                     | 0.55                |

TABLE 2 C  
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS (2A + 2B)

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-144                     | 3150-3160 | 386                       | 108                      | 2092                      | 108                          | 299                       | 2993                                     | 2607                                     | 87.1                | 2072                                     | 0.36                |
| 951-146                     | 3170-3180 | 648                       | 128                      | 2786                      | 131                          | 303                       | 3996                                     | 3348                                     | 83.8                | 1651                                     | 0.43                |
| 951-148                     | 3190-3200 | 1102                      | 250                      | 3889                      | 156                          | 325                       | 5722                                     | 4620                                     | 80.7                | 1744                                     | 0.48                |
| 951-150                     | 3210-3220 | 618                       | 138                      | 2968                      | 177                          | 427                       | 4328                                     | 3710                                     | 85.7                | 4641                                     | 0.42                |
| 951-152                     | 3230-3240 | 595                       | 117                      | 2326                      | 110                          | 297                       | 3445                                     | 2850                                     | 82.7                | 1404                                     | 0.37                |
| 951-154                     | 3250-3260 | 1617                      | 250                      | 3244                      | 151                          | 320                       | 5583                                     | 3966                                     | 71.0                | 1549                                     | 0.47                |
| 951-156                     | 3270-3280 | 211                       | 107                      | 2012                      | 111                          | 226                       | 2666                                     | 2456                                     | 92.1                | 982                                      | 0.49                |
| 951-158                     | 3290-3300 | 1436                      | 218                      | 3578                      | 197                          | 431                       | 5861                                     | 4425                                     | 75.5                | 2362                                     | 0.46                |
| 951-160                     | 3310-3320 | 428                       | 240                      | 2534                      | 189                          | 570                       | 3961                                     | 3533                                     | 89.2                | 10030                                    | 0.33                |
| 951-162                     | 3330-3340 | 139                       | 61                       | 1483                      | 76                           | 269                       | 2027                                     | 1889                                     | 93.2                | 1666                                     | 0.28                |
| 951-164                     | 3350-3360 | 1264                      | 201                      | 3096                      | 143                          | 267                       | 4971                                     | 3707                                     | 74.6                | 816                                      | 0.54                |
| 951-166                     | 3370-3380 | 1650                      | 353                      | 4797                      | 205                          | 312                       | 7318                                     | 5668                                     | 77.4                | 661                                      | 0.66                |
| 951-168                     | 3390-3400 | 92                        | 22                       | 145                       | 13                           | 9                         | 280                                      | 189                                      | 67.2                | 287                                      | 1.53                |
| 951-170                     | 3410-3420 | 1307                      | 254                      | 3493                      | 153                          | 228                       | 5435                                     | 4128                                     | 76.0                | 656                                      | 0.67                |
| 951-172                     | 3430-3440 | 262                       | 64                       | 1522                      | 87                           | 154                       | 2090                                     | 1827                                     | 87.4                | 417                                      | 0.56                |
| 951-174                     | 3450-3460 | 3703                      | 363                      | 5470                      | 301                          | 409                       | 10246                                    | 6543                                     | 63.9                | 1159                                     | 0.74                |
| 951-176                     | 3470-3480 | 2986                      | 803                      | 6863                      | 280                          | 348                       | 11279                                    | 8294                                     | 73.5                | 742                                      | 0.80                |
| 951-178                     | 3490-3500 | 4297                      | 606                      | 5618                      | 232                          | 318                       | 11072                                    | 6775                                     | 61.2                | 834                                      | 0.73                |
| 951-180                     | 3510-3520 | 160                       | 25                       | 398                       | 54                           | 27                        | 662                                      | 503                                      | 75.9                | 231                                      | 2.00                |
| 951-182                     | 3530-3540 | 283                       | 95                       | 1352                      | 44                           | 84                        | 1858                                     | 1575                                     | 84.8                | 301                                      | 0.53                |
| 951-184                     | 3550-3560 | 369                       | 161                      | 2359                      | 64                           | 126                       | 3080                                     | 2710                                     | 88.0                | 287                                      | 0.50                |
| 951-186                     | 3570-3580 | 120                       | 29                       | 480                       | 17                           | 49                        | 694                                      | 575                                      | 82.8                | 282                                      | 0.34                |
| 951-188                     | 3590-3600 | 228                       | 115                      | 2003                      | 44                           | 137                       | 2526                                     | 2298                                     | 91.0                | 842                                      | 0.32                |
| 951-190                     | 3610-3620 | 179                       | 84                       | 1332                      | 19                           | 74                        | 1688                                     | 1509                                     | 89.4                | 176                                      | 0.25                |
| 951-192                     | 3630-3640 | 2388                      | 500                      | 3288                      | 53                           | 136                       | 6365                                     | 3977                                     | 62.5                | 216                                      | 0.39                |
| 951-194                     | 3650-3660 | 1738                      | 466                      | 3715                      | 80                           | 179                       | 6177                                     | 4439                                     | 71.9                | 667                                      | 0.45                |
| 951-208                     | 3670-3680 | 13044                     | 5156                     | 73316                     | 3482                         | 2202                      | 97200                                    | 84156                                    | 86.6                | 3653                                     | 1.58                |
| 951-210                     | 3690-3700 | 371                       | 101                      | 2198                      | 56                           | 362                       | 3089                                     | 2718                                     | 88.0                | 1327                                     | 0.15                |

TABLE 2 C  
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS (2A + 2B)

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | $\frac{iC_4}{nC_4}$ |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|---------------------|
| 951-213                     | 3710-3720 | 2641                      | 612                      | 6285                      | 130                          | 505                       | 10172                                    | 7532                                     | 74.0                | 1647                                     | 0.26                |
| 951-216                     | 3730-3740 | 2492                      | 696                      | 7806                      | 162                          | 626                       | 11782                                    | 9290                                     | 78.8                | 1745                                     | 0.26                |
| 951-219                     | 3750-3760 | 1571                      | 1210                     | 23215                     | 333                          | 1274                      | 27602                                    | 26032                                    | 94.3                | 1221                                     | 0.26                |
| 951-222                     | 3770-3780 | 2661                      | 718                      | 10947                     | 196                          | 787                       | 15310                                    | 12649                                    | 82.6                | 902                                      | 0.25                |
| 951-224                     | 3790-3800 | 916                       | 86                       | 136                       | 80                           | 231                       | 1449                                     | 533                                      | 36.8                | 1057                                     | 0.35                |
| 951-226                     | 3810-3820 | 4234                      | 155                      | 101                       | 28                           | 80                        | 4599                                     | 365                                      | 7.9                 | 1019                                     | 0.35                |
| 951-228                     | 3830-3840 | 16257                     | 1181                     | 705                       | 125                          | 340                       | 18608                                    | 2351                                     | 12.6                | 1865                                     | 0.37                |
| 951-230                     | 3850-3860 | 3966                      | 794                      | 737                       | 109                          | 331                       | 5937                                     | 1971                                     | 33.2                | 884                                      | 0.33                |
| 951-232                     | 3870-3880 | 4165                      | 441                      | 440                       | 108                          | 258                       | 5412                                     | 1247                                     | 23.0                | 1033                                     | 0.42                |
| 951-234                     | 3890-3900 | 1959                      | 331                      | 347                       | 48                           | 163                       | 2849                                     | 890                                      | 31.2                | 480                                      | 0.30                |
| 951-237                     | 3910-3920 | 3101                      | 139                      | 373                       | 88                           | 343                       | 4046                                     | 944                                      | 23.3                | 736                                      | 0.26                |
| 951-241                     | 3930-3940 | 1517                      | 525                      | 739                       | 115                          | 435                       | 3329                                     | 1813                                     | 54.4                | 381                                      | 0.26                |
| 951-243                     | 3950-3960 | 351                       | 337                      | 658                       | 67                           | 359                       | 1772                                     | 1421                                     | 80.2                | 468                                      | 0.19                |
| 951-245                     | 3970-3980 | 2410                      | 313                      | 445                       | 74                           | 299                       | 3542                                     | 1131                                     | 31.9                | 790                                      | 0.25                |
| 951-247                     | 3990-4000 | 166                       | 54                       | 114                       | 22                           | 98                        | 455                                      | 288                                      | 63.4                | 472                                      | 0.23                |
| 951-249                     | 4010-4020 | 186                       | 46                       | 82                        | 25                           | 98                        | 437                                      | 251                                      | 57.5                | 611                                      | 0.25                |
| 951-251                     | 4030-4040 | 406                       | 207                      | 436                       | 99                           | 363                       | 1511                                     | 1105                                     | 73.1                | 586                                      | 0.27                |
| 951-253                     | 4050-4060 | 251                       | 372                      | 1852                      | 537                          | 1973                      | 4985                                     | 4734                                     | 95.0                | 4276                                     | 0.27                |
| 951-255                     | 4070-4080 | 261                       | 233                      | 959                       | 346                          | 1352                      | 3151                                     | 2889                                     | 91.7                | 3967                                     | 0.26                |
| 951-257                     | 4090-4100 | 750                       | 373                      | 886                       | 266                          | 1178                      | 3453                                     | 2702                                     | 78.3                | 5221                                     | 0.23                |
| 951-260                     | 4110-4120 | 520                       | 229                      | 624                       | 195                          | 836                       | 2404                                     | 1884                                     | 78.4                | 4291                                     | 0.23                |
| 951-262                     | 4130-4140 | 2566                      | 1666                     | 3303                      | 1345                         | 5019                      | 13899                                    | 11333                                    | 81.5                | 14884                                    | 0.27                |
| 951-264                     | 4150-4160 | 642                       | 661                      | 2494                      | 802                          | 3092                      | 7691                                     | 7049                                     | 91.7                | 10654                                    | 0.26                |
| 951-266                     | 4170-4180 | 330                       | 104                      | 305                       | 154                          | 713                       | 1606                                     | 1276                                     | 79.5                | 7355                                     | 0.22                |
| 951-268                     | 4190-4200 | 2089                      | 950                      | 1888                      | 576                          | 1730                      | 7232                                     | 5143                                     | 71.1                | 7376                                     | 0.33                |
| 951-270                     | 4210-4220 | 2308                      | 123                      | 1878                      | 392                          | 1259                      | 5960                                     | 3652                                     | 61.3                | 4348                                     | 0.31                |
| 951-272                     | 4230-4240 | 754                       | 345                      | 507                       | 102                          | 324                       | 2031                                     | 1277                                     | 62.9                | 2565                                     | 0.31                |
| 951-274                     | 4250-4260 | 3465                      | 1949                     | 2272                      | 408                          | 1078                      | 9171                                     | 5706                                     | 62.2                | 3477                                     | 0.38                |
| 951-276                     | 4270-4280 | 2432                      | 3204                     | 4640                      | 503                          | 1784                      | 12562                                    | 10131                                    | 80.6                | 1998                                     | 0.28                |
| 951-278                     | 4290-4300 | 2521                      | 1345                     | 2046                      | 683                          | 1856                      | 8452                                     | 5931                                     | 70.2                | 3837                                     | 0.37                |

TABLE 2 C  
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C<sub>1</sub> - C<sub>7</sub> HYDROCARBONS (2A + 2B)

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | C <sub>1</sub><br>Methane | C <sub>2</sub><br>Ethane | C <sub>3</sub><br>Propane | iC <sub>4</sub><br>Isobutane | nC <sub>4</sub><br>Butane | TOTAL<br>C <sub>1</sub> - C <sub>4</sub> | TOTAL<br>C <sub>2</sub> - C <sub>4</sub> | %<br>GAS<br>WETNESS | TOTAL<br>C <sub>5</sub> - C <sub>7</sub> | iC <sub>4</sub><br>nC <sub>4</sub> |
|-----------------------------|-----------|---------------------------|--------------------------|---------------------------|------------------------------|---------------------------|------------------------------------------|------------------------------------------|---------------------|------------------------------------------|------------------------------------|
| 951-280                     | 4310-4320 | 727                       | 488                      | 959                       | 276                          | 830                       | 3280                                     | 2553                                     | 77.8                | 2923                                     | 0.33                               |
| 951-282                     | 4330-4340 | 1228                      | 758                      | 1479                      | 278                          | 1305                      | 5049                                     | 3821                                     | 75.7                | 4524                                     | 0.21                               |
| 951-284                     | 4350-4360 | 849                       | 407                      | 1307                      | 648                          | 1663                      | 4874                                     | 4024                                     | 82.6                | 9362                                     | 0.39                               |
| 951-286                     | 4370-4380 | 1407                      | 294                      | 546                       | 196                          | 455                       | 2898                                     | 1491                                     | 51.5                | 2872                                     | 0.43                               |
| 951-288                     | 4390-4400 | 1049                      | 191                      | 288                       | 83                           | 201                       | 1812                                     | 763                                      | 42.1                | 1378                                     | 0.41                               |
| 951-290                     | 4410-4420 | 1460                      | 909                      | 1020                      | 246                          | 466                       | 4101                                     | 2641                                     | 64.4                | 1032                                     | 0.53                               |
| 951-292                     | 4430-4440 | 4991                      | 1699                     | 1358                      | 276                          | 559                       | 8883                                     | 3893                                     | 43.8                | 2129                                     | 0.49                               |
| 951-294                     | 4450-4460 | 5258                      | 2345                     | 1463                      | 250                          | 497                       | 9813                                     | 4555                                     | 46.4                | 2084                                     | 0.50                               |
| 951-297                     | 4470-4480 | 7229                      | 2243                     | 1213                      | 179                          | 271                       | 11134                                    | 3905                                     | 35.1                | 546                                      | 0.66                               |
| 951-300                     | 4490-4500 | 18486                     | 11671                    | 7929                      | 609                          | 1326                      | 40021                                    | 21535                                    | 53.8                | 834                                      | 0.46                               |
| 951-302                     | 4510-4520 | 8058                      | 9822                     | 11766                     | 1706                         | 3616                      | 34968                                    | 26910                                    | 77.0                | 12931                                    | 0.47                               |
| 951-304                     | 4530-4540 | 19829                     | 15090                    | 12057                     | 3102                         | 4044                      | 54122                                    | 34293                                    | 63.4                | 5567                                     | 0.77                               |
| 951-305                     | 4540-4560 | 1051                      | 2220                     | 1394                      | 161                          | 270                       | 5096                                     | 4045                                     | 79.4                | 2267                                     | 0.60                               |
| 951-307                     | 4570-4580 | 3368                      | 3596                     | 2448                      | 333                          | 568                       | 10313                                    | 6945                                     | 67.3                | 2155                                     | 0.59                               |
| 951-310                     | 4590-4600 | 31898                     | 18691                    | 11262                     | 1979                         | 2111                      | 65942                                    | 34043                                    | 51.6                | 2987                                     | 0.94                               |
| 951-312                     | 4610-4620 | 35278                     | 21977                    | 11027                     | 1153                         | 1771                      | 71205                                    | 35928                                    | 50.5                | 4484                                     | 0.65                               |
| 951-314                     | 4630-4640 | 25158                     | 16333                    | 9811                      | 1010                         | 1375                      | 53688                                    | 28529                                    | 53.1                | 2737                                     | 0.73                               |
| 951-316                     | 4650-4660 | 40899                     | 25038                    | 9472                      | 826                          | 1189                      | 77424                                    | 36525                                    | 47.2                | 3973                                     | 0.69                               |
| 951-318                     | 4670-4680 | 11952                     | 7832                     | 3679                      | 469                          | 650                       | 24582                                    | 12630                                    | 51.4                | 1689                                     | 0.72                               |
| 951-321                     | 4690-4700 | 18759                     | 11200                    | 5330                      | 606                          | 658                       | 36553                                    | 17794                                    | 48.7                | 1424                                     | 0.92                               |
| 951-323                     | 4710-4720 | 21087                     | 11625                    | 3854                      | 430                          | 655                       | 37651                                    | 16564                                    | 44.0                | 2689                                     | 0.66                               |
| 951-325                     | 4730-4740 | 6566                      | 6574                     | 2793                      | 312                          | 517                       | 16762                                    | 10197                                    | 60.8                | 1605                                     | 0.60                               |
| 951-329                     | 4750-4760 | 20292                     | 12480                    | 5974                      | 569                          | 993                       | 40309                                    | 20016                                    | 49.7                | 1880                                     | 0.57                               |
| 951-331                     | 4770-4780 | 19380                     | 12090                    | 7306                      | 611                          | 1076                      | 40463                                    | 21084                                    | 52.1                | 624                                      | 0.57                               |
| 951-334                     | 4790-4800 | 9826                      | 5980                     | 1396                      | 145                          | 240                       | 17585                                    | 7760                                     | 44.1                | 1515                                     | 0.60                               |
| 951-336                     | 4810-4820 | 3282                      | 3103                     | 1022                      | 111                          | 217                       | 7735                                     | 4453                                     | 57.6                | 693                                      | 0.51                               |
| 951-338                     | 4830-4840 | 10350                     | 6463                     | 1208                      | 132                          | 176                       | 18329                                    | 7979                                     | 43.5                | 1113                                     | 0.75                               |
| 951-342                     | 4850-4860 | 9669                      | 3843                     | 979                       | 100                          | 187                       | 14777                                    | 5108                                     | 34.6                | 973                                      | 0.53                               |
| 951-344                     | 4870-4880 | 7686                      | 4226                     | 835                       | 78                           | 128                       | 12953                                    | 5266                                     | 40.7                | 717                                      | 0.61                               |
| 951-346                     | 4890-4900 | 3333                      | 1879                     | 406                       | 36                           | 66                        | 5719                                     | 2387                                     | 41.7                | 763                                      | 0.54                               |

TABLE 3  
KEROGEN TYPE AND MATURATION

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | ORGANIC MATTER DESCRIPTION |                                                                                |                      |                  |                   | THERMAL<br>MATURATION |                 |
|-----------------------------|------------|----------------------------|--------------------------------------------------------------------------------|----------------------|------------------|-------------------|-----------------------|-----------------|
|                             |            | TYPES<br>40%; 10-40%; 10%  | REMARKS                                                                        | RE-<br>WORKED<br>(%) | PARTICLE<br>SIZE | PRESERV-<br>ATION | INDEX                 | 1 - 10<br>SCALE |
| 951-012A                    | 900-950m   | W;H-I;Al                   | abundant Am-like contamination                                                 | 15                   | F-C              | F                 | 1+                    |                 |
| 951-020A                    | 1300-1350m | W;H-I;Al                   |                                                                                | 25                   | F-M              | F                 | 1+                    |                 |
| 951-030A                    | 1800-1850m | Am**-Al**;W;H-I            | **includes Al passing to Am                                                    | -                    | F-C              | F-G               | 1+                    |                 |
| 951-034A                    | 2000-2050m | -,Al**-W-H**-Am*;I         | **includes material passing to Am<br>*includes incompletely developed material | -                    | F-M              | F-G               | 1+                    |                 |
| 951-038A                    | 2080-2090m | -,Al**-W-H**-Am*;I         | **<br>* as 034A                                                                | -                    | F-M              | F-G               | 1+                    |                 |
| 951-046A                    | 2170-2180m | -,H-Al-W;I-Am              | contamination. **includes material passing to Am                               | 10                   | F-M              | F                 | 1+                    |                 |
| 951-052A                    | 2230-2240m | -,Al-H-W;I-Am              | abundant Am-like contamination                                                 |                      | F-M              | P-F               | 1+                    |                 |
| 951-062B                    | 2330-2340m | H;Al-W;Am-I                | contamination                                                                  | 15                   | F-M              | F-G               | 1+                    |                 |
| 951-070A                    | 2410-2420m | W-I;Al-H;Am                | Am-like contamination                                                          | 80                   | F-M              | F                 | 1+ to 2-              |                 |
| 951-078A                    | 2490-2500m | I-W;H;Al-Am                | H at 2-                                                                        | 80                   | F-M              | F-G               | 1+ to 2-              |                 |
| 951-084A                    | 2550-2560m | W;I-H;Al-Am                | H at 2- through 2                                                              | 80                   | F-M              | F-G               | 1+ to 2-              |                 |
| 951-090A                    | 2610-2620m | W-I;Al-H;-                 |                                                                                | 70                   | M                | G                 | 1+ to 2-              |                 |
| 951-098A                    | 2690-2700m | W-I;H;Al                   |                                                                                | 80                   | M                | F-G               | 1+ to 2-              |                 |
| 951-106A                    | 2770-2780m | W;I;H-Al                   | contamination. H at 2-                                                         | 90                   | F-M              | F                 | 1+ to 2-              |                 |
| 951-112A                    | 2830-2840m | W-I;-;H-Al                 | trace of H at 1+ to 2-                                                         | 90                   | F-M              | F                 | 1+ to 2-/2-           |                 |
| 951-118A                    | 2890-2900m | W-I;-;H-Al                 | trace of H at 1+ to 2-                                                         | 90                   | F-M              | F                 | 2-                    |                 |
| 951-126A                    | 2970-2980m | W-I;-;H-Al                 | contamination                                                                  | 85                   | F-M              | F                 | 2-                    |                 |
| 951-134A                    | 3050-3060m | W-I;-;H-Al                 | contamination. H from 2- to 2 through 2 to 2+                                  | 90                   | F-M              | F                 | 2-(?)                 |                 |

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

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

Dominant, Major, Significant, Minor

TABLE 3

## KEROGEN TYPE AND MATURATION

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | ORGANIC MATTER DESCRIPTION |                                                                                                                |                      |                  |                   | THERMAL<br>MATURATION |                 |
|-----------------------------|-------------|----------------------------|----------------------------------------------------------------------------------------------------------------|----------------------|------------------|-------------------|-----------------------|-----------------|
|                             |             | TYPES<br>40%; 10-40%; 10%  | REMARKS                                                                                                        | RE-<br>WORKED<br>(%) | PARTICLE<br>SIZE | PRESERV-<br>ATION | INDEX                 | 1 - 10<br>SCALE |
| 951-142A                    | 3130-3140m  | W;I;H-Al-Am                | disseminated contamination<br>H at 1+ to 2- (caved?)                                                           | 80                   | F-M              | F                 | 2-(?)                 |                 |
| 951-150A                    | 3210-3220m  | W-I;-;H-Al                 | contamination. H at 2- to 2 and 2                                                                              | 80                   | M                | F                 | 2-                    |                 |
| 951-158A                    | 3290-3300m  | W-I;-;H-Al                 | abundant contamination                                                                                         | 90                   | F-M              | F                 | 2-                    |                 |
| 951-162B                    | 3330-3340m  | W;I;H-Al                   | H at 2                                                                                                         | 90                   | F-M              | F-G               | 2- to 2(?)            |                 |
| 951-168A                    | 3390-3400m  | W;I;H-Al                   | good H at 2. Contamination                                                                                     | 95                   | F-M              | F                 | 2- to 2               |                 |
| 951-172A                    | 3430-3440m  | W-I;-;H-Al                 | abundant contamination                                                                                         | 95                   | F-M              | F                 | 2- to 2               |                 |
| 951-176A                    | 3470-3480m  | W-I;-;H-Al                 | H at 2, cavings                                                                                                | 90                   | F-M              | G                 | 2- to 2               |                 |
| 951-182B                    | 3530-3540m  | W-I;-;H-Al                 | contamination                                                                                                  | 90                   | F-M              | F                 | 2- to 2               |                 |
| 951-186A                    | 3570-3580m  | W-I;-;H-Al                 | minor H at 2                                                                                                   | 90                   | F-M              | G                 | 2- to 2               |                 |
| 951-194A                    | 3650-3660m  | W;I;H-Al                   |                                                                                                                | 90                   | F-C              | G                 | 2- to 2               |                 |
| 951-198A                    | 3664m SWC   | -,Al**-I-H**-W-Am*,-       | differentiation extremely difficult<br>**includes material passing to Am<br>*frequently incompletely developed | 40                   | F-C              | F-G               | 2- to 2/2             |                 |
| 951-200A                    | 3667m SWC   | Al**;Am*-W;I-H             | **<br>* as 198A                                                                                                | 15                   | F-C              | F-G               | 2- to 2(?)            |                 |
| 951-203A                    | 3670m SWC   | Al**;Am*-H-W;I             | H at 2 **<br>* as 198A                                                                                         | 20                   | F-C              | F-G               | 2- to 2/2             |                 |
| 951-205A                    | 3671.5m SWC | Al**;Am*-W-I;H             | **<br>* as 198A                                                                                                | 20                   | F-C              | F-G               | 2 max                 |                 |
| 951-207A                    | 3673m SWC   | -,I-Al**-W-H**,Am          | differentiation extremely difficult<br>**as 198A                                                               | 55                   | F-C              | F-G               | 2 max                 |                 |
| 951-210B                    | 3690-3700m  | W;I-H;Al                   | abundant finely disseminated Am-like<br>contamination. Good H at 2                                             | 70                   | F-M              | F                 | 2- to 2(?)            |                 |
| 951-212A                    | 3717m SWC   | W;I;Al-H                   | contamination                                                                                                  | 75                   | F-M/C            | F                 | 2                     |                 |

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

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Dominant, Major, Significant, Minor

TABLE 3

## KEROGEN TYPE AND MATURATION

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | ORGANIC MATTER DESCRIPTION |                                                                                                                   |                      |                  |                   | THERMAL<br>MATURATION |                 |
|-----------------------------|-------------|----------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------|------------------|-------------------|-----------------------|-----------------|
|                             |             | TYPES<br>40%; 10-40%; 10%  | REMARKS                                                                                                           | RE-<br>WORKED<br>(%) | PARTICLE<br>SIZE | PRESERV-<br>ATION | INDEX                 | 1 - 10<br>SCALE |
| 951-216A                    | 3730-3740m  | W-I;-;H-Al                 | H at 2 to 2+ and 2+                                                                                               | 95                   | F-C              | G                 | 2                     |                 |
| 951-221A                    | 3774m SWC   | Am**-Al*;W-I;H             | H at 2 to 2+ **includes incompletely developed material, not typically oil-prone *includes material passing to Am | 20                   | F-C              | F                 | 2                     |                 |
| 951-222A                    | 3770-3780m  | W;I;H-Al-Am                | material at 2- to 2 and 2 to 2+                                                                                   | 90                   | F-M              | F                 | 2(?)                  |                 |
| 951-230B                    | 3850-3860m  | W;I-H;Am-Al                | H at 2                                                                                                            | 80                   | F-C              | F-G               | 2 to 2+               |                 |
| 951-236A                    | 3917.7m SWC | W;H-I;Al                   |                                                                                                                   | 60                   | M-C              | G                 | 2 to 2+               |                 |
| 951-238A                    | 3928.8m SWC | -;W-H-I;Am-Al              |                                                                                                                   | 40                   | F-C              | F-G               | 2 to 2+               |                 |
| 951-240A                    | 3930.6m SWC | -;W-H-I;Al-Am              | sapropelisation                                                                                                   | 45                   | M-C              | F-G               | 2 to 2+               |                 |
| 951-253C                    | 4050-4060m  | I-W;Am**-H;Al              | **not prime quality                                                                                               | 70                   | F-M/C            | F                 | 2 to 2+               |                 |
| 951-257B                    | 4090-4100m  | W;I-H;Al-Am                | caving                                                                                                            | 35                   | F-C              | F-G               | 2 to 2+(?)            |                 |
| 951-262A                    | 4130-4140m  | H;W-I;Am-Al                |                                                                                                                   | 40                   | F-C              | F-G               | 2 to 2+               |                 |
| 951-266A                    | 4170-4180m  | W;H-I;Am-Al                |                                                                                                                   | 55                   | M-C              | G                 | 2 to 2+               |                 |
| 951-278B                    | 4290-4300m  | W-H;I;Am-Al                |                                                                                                                   | 25                   | M-C              | G                 | 2 to 2+               |                 |
| 951-284B                    | 4350-4360m  | W-H;I;Am-Al                | sapropelisation                                                                                                   | 25                   | M                | F-G               | 2 to 2+               |                 |
| 951-292B                    | 4430-4440m  | W;-;H-I                    |                                                                                                                   |                      | F-VC             | G                 | 1+                    |                 |
| 951-296A                    | 4473.2m SWC | W;I;H                      | contains H of anomalously low maturity, possibly contaminant                                                      |                      | F-C              | F-G               | 2 to 2+(?)            |                 |
| 951-302A                    | 4510-4520m  | W;-;I-Am-H                 |                                                                                                                   |                      | F-C              | F-G               | 2 to 2+               |                 |
| 951-309A                    | 4598m SWC   | W;H-I;Am-Al                |                                                                                                                   |                      | F-C              | F                 | 2+                    |                 |
| 951-310A                    | 4590-4600m  | W;I;H                      |                                                                                                                   |                      | F-C              | G                 | 2 to 2+(?)            |                 |
| 951-316A                    | 4650-4660m  | W;I;H-Am                   |                                                                                                                   |                      | F-VC             | G                 | 2+ max                |                 |
| 951-316C                    | 4650-4660m  | -;Am**-H-W;I-Al            | **frequently incompletely developed<br>*frequently passing to Am                                                  |                      | F-VC             | G                 | 2 to 2+               |                 |

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

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

Dominant, Major, Significant, Minor

TABLE 3

## KEROGEN TYPE AND MATURATION

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH      | ORGANIC MATTER DESCRIPTION |                     |                      |                  | THERMAL<br>MATURATION |                          |
|-----------------------------|------------|----------------------------|---------------------|----------------------|------------------|-----------------------|--------------------------|
|                             |            | TYPES<br>40%; 10-40%; 10%  | REMARKS             | RE-<br>WORKED<br>(%) | PARTICLE<br>SIZE | PRESERV-<br>ATION     | INDEX<br>1 - 10<br>SCALE |
| 951-320A                    | 4695m SWC  | W-I; -; H-Am-Al            |                     |                      | M                | G                     | 2+                       |
| 951-321A                    | 4690-4700m | W; I; H                    |                     |                      | F-C              | G                     | 2+                       |
| 951-327A                    | 4753m SWC  | W; I; H-Am-Al              |                     |                      | F-M              | G                     | 2+                       |
| 951-338B                    | 4830-4840m | W; Am**; I-H-Al            | **not prime quality |                      | F-C              | F-G                   | 2+                       |
| 951-342C                    | 4850-4860m | W; Am**-I; H-Al            | **as 338B           |                      | F-C              | F-G                   | 2+                       |

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

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

Dominant, Major, Significant, Minor

**TABLE 4**  
**VITRINITE REFLECTANCE DATA**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | SAMPLE<br>TYPE | AVERAGE REFLECTIVITY Ro (%),<br>(NUMBER OF PARTICLES) |                       |           | REMARKS |
|-----------------------------|-------------|----------------|-------------------------------------------------------|-----------------------|-----------|---------|
|                             |             |                | 1                                                     | 2                     | 3         |         |
| 951-030A                    | 1800-1850m  | KC             | 0.37 (25)                                             | 0.51 (1)              | -         |         |
| 951-034A                    | 2000-2050m  | WR             | 0.37 (12)                                             | 0.75 (8)              | -         |         |
| 951-038A                    | 2080-2090m  | WR             | NO DETERMINATIONS POSSIBLE                            |                       |           |         |
| 951-046A                    | 2170-2180m  | WR             | 0.37 (5)                                              | 0.63 (1)              | -         |         |
| 951-052A                    | 2230-2240m  | WR             | 0.40 (3)                                              | 0.91 (2)              | -         |         |
| 951-062B                    | 2330-2340m  | WR             | 0.30 (3)                                              | 0.64 (2)              | 0.88 (11) |         |
| 951-070A                    | 2410-2420m  | WR             | 0.52 (4)                                              | 0.73 (4)              | 0.98 (12) |         |
| 951-078A                    | 2490-2500m  | WR             | 0.51 (10)                                             | 0.75 (11)             | 1.01 (5)  |         |
| 951-084A                    | 2550-2560m  | WR             | 0.37 (7)                                              | 0.55 (11)             | 0.75 (2)  |         |
| 951-090A                    | 2610-2620m  | WR             | 0.56 (13)                                             | 0.94 (11)             | -         |         |
| 951-098A                    | 2690-2700m  | WR             | 0.36 (2)<br>1.05 (6)                                  | 0.64 (21)             | 0.83 (7)  |         |
| 951-106A                    | 2770-2780m  | WR             | 0.68 (20)                                             | 0.99 (3)              | 1.26 (7)  |         |
| 951-112A                    | 2830-2840m  | WR             | 0.67 (8)                                              | 1.00 (13)             | 1.29 (9)  |         |
| 951-118A                    | 2890-2900m  | WR             | 0.55 (6)<br>1.24 (1)                                  | 0.73 (12)             | 0.95 (11) |         |
| 951-126A                    | 2970-2980m  | WR             | 0.39 (3)<br>1.03 (4)                                  | 0.62 (9)<br>1.38 (1)  | 0.82 (10) |         |
| 951-134A                    | 3050-3060m  | WR             | 0.33 (1)<br>1.40 (6)                                  | 0.66 (4)              | 0.86 (10) |         |
| 951-142A                    | 3130-3140m  | WR             | 0.55 (18)                                             | 0.81 (15)             | 1.20 (3)  |         |
| 951-150A                    | 3210-3220m  | WR             | 0.57 (11)                                             | 0.83 (15)             | 1.16 (5)  |         |
| 951-158A                    | 3290-3300m  | WR             | 0.66 (8)                                              | 0.98 (12)             | 1.28 (8)  |         |
| 951-168A                    | 3390-3400m  | WR             | 0.62 (4)                                              | 0.88 (21)             | 1.24 (5)  |         |
| 951-176A                    | 3470-3480m  | WR             | 0.75 (2)                                              | 0.96 (11)             | 1.29 (17) |         |
| 951-186A                    | 3570-3580m  | WR             | 0.40 (1)<br>1.25 (21)                                 | 0.80 (19)             | 1.02 (19) |         |
| 951-194A                    | 3650-3660m  | WR             | 0.86 (8)                                              | 1.17 (40)             | 1.45 (11) |         |
| 951-198A                    | 3664m SWC   | KC             | 0.46 (9)<br>1.29 (5)                                  | 0.72 (7)              | 1.05 (9)  |         |
| 951-207A                    | 3673m SWC   | KC             | 0.52 (19)                                             | 0.77 (7)              | 1.03 (6)  |         |
| 951-221A                    | 3774m SWC   | WR             | 0.49 (8)                                              | 0.65 (7)              | 0.92 (12) |         |
| 951-230B                    | 3850-3860m  | KC             | 0.86 (6)                                              | 1.26 (29)             | 1.63 (5)  |         |
| 951-236A                    | 3917.7m SWC | WR             | 0.75 (1)<br>1.46 (8)                                  | 0.91 (8)              | 1.12 (13) |         |
| 951-240A                    | 3930.6m SWC | KC             | 0.66 (3)                                              | 0.91 (3)              | 1.19 (24) |         |
| 951-262A                    | 4130-4140m  | KC             | 0.37 (2)<br>1.00 (4)                                  | 0.54 (18)             | 0.69 (18) |         |
| 951-278B                    | 4290-4300m  | KC             | 0.67 (26)                                             | 0.85 (6)              | -         |         |
| 951-284B                    | 4350-4360m  | WR             | 0.38 (1)<br>1.12 (21)                                 | 0.59 (23)<br>1.42 (6) | 0.83 (14) |         |

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

Colours — spore fluorescence.

\* Reworked

**TABLE 4**  
**VITRINITE REFLECTANCE DATA**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH       | SAMPLE<br>TYPE | AVERAGE REFLECTIVITY R <sub>o</sub> (%),<br>(NUMBER OF PARTICLES) |           |           | REMARKS |
|-----------------------------|-------------|----------------|-------------------------------------------------------------------|-----------|-----------|---------|
|                             |             |                | 1                                                                 | 2         | 3         |         |
| 951-292B                    | 4430-4440m  | KC             | 0.26 (38)                                                         | 0.78 (2)  | -         | lignite |
| 951-296A                    | 4473.2m SWC | KC             | 0.50 (1)                                                          | 0.84 (37) | -         |         |
| 951-302A                    | 4510-4520m  | KC             | 0.44 (1)                                                          | 0.94 (36) | 1.23 (1)  | coal    |
| 951-309A                    | 4598m SWC   | KC             | 1.11 (44)                                                         | 1.51 (1)  | -         |         |
| 951-310A                    | 4590-4600m  | WR             | 0.98 (50)                                                         | -         | -         | coal    |
| 951-316A                    | 4650-4660m  | WR             | 0.96 (32)                                                         | -         | -         | coal    |
| 951-320A                    | 4695m SWC   | KC             | 0.91 (1)                                                          | 1.45 (40) | -         |         |
| 951-321A                    | 4690-4700m  | WR             | 1.06 (50)                                                         | -         | -         | coal    |
| 951-327A                    | 4753m SWC   | KC             | 0.95 (1)                                                          | 1.30 (4)  | 1.57 (35) |         |
| 951-338B                    | 4830-4840m  | WR             | 0.99 (50)                                                         | -         | -         |         |
| 951-342C                    | 4850-4860m  | WR             | 1.03 (49)                                                         | -         | -         |         |

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

Colours — spore fluorescence.

\*Reworked

TABLE 5a  
CONCENTRATION (PPM) OF EXTRACTED C<sub>15+</sub> MATERIAL IN ROCK

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | TOTAL<br>EXTRACT | HYDROCARBONS            |           |       | NON HYDROCARBONS        |                 |                     |         |
|-----------------------------|-----------|------------------|-------------------------|-----------|-------|-------------------------|-----------------|---------------------|---------|
|                             |           |                  | Paraffin-<br>Naphthenes | Aromatics | TOTAL | Precipd-<br>Asphaltenes | Eluted<br>NSO's | Non-eluted<br>NSO's | Sulphur |
| 951-074                     | 2450-2460 | 262              | 68                      | 24        | 91    | 116                     | 31              | 25                  | 0       |
| 951-084                     | 2550-2560 | 678              | 254                     | 141       | 394   | 186                     | 65              | 32                  | 0       |
| 951-100A                    | 2710-2720 | 518              | 100                     | 57        | 156   | 275                     | 58              | 26                  | 4       |
| 951-140                     | 3110-3120 | 259              | 78                      | 32        | 110   | 113                     | 24              | 12                  | 0       |
| 951-150                     | 3210-3220 | 501              | 115                     | 66        | 182   | 245                     | 47              | 23                  | 3       |
| 951-160A                    | 3310-3320 | 1367             | 465                     | 401       | 866   | 344                     | 95              | 52                  | 10      |
| 951-202A                    | 3669      | 5692             | 1427                    | 1422      | 2849  | 1958                    | (628            | 243)                | 14      |
| 951-208                     | 3670-3680 | 2270             | 261                     | 391       | 652   | 1367                    | (166            | 82)                 | 4       |
| 951-219                     | 3750-3760 | 381              | 58                      | 71        | 129   | 172                     | (66             | 12)                 | 2       |
| 951-230                     | 3850-3860 | 2478             | 1470                    | 377       | 1848  | 389                     | 183             | 59                  | 0       |
| 951-241A                    | 3930-3940 | 1313             | 272                     | 99        | 372   | 687                     | 188             | 66                  | 0       |
| 951-262                     | 4130-4140 | 1230             | 372                     | 326       | 698   | 312                     | (161            | 58)                 | 0       |
| 951-276                     | 4270-4280 | 302              | 62                      | 41        | 104   | 175                     | 16              | 7                   | 1       |
| 951-284A                    | 4350-4360 | 599              | 131                     | 119       | 250   | 284                     | 45              | 20                  | 0       |
| 951-296A                    | 4473.2    | 991              | 178                     | 150       | 328   | 576                     | (74             | 7)                  | 6       |
| 951-302                     | 4510-4520 | 19982            | 6979                    | 4269      | 11248 | 6959                    | (1205           | 553)                | 18      |
| 951-316                     | 4650-4660 | 8966             | 1008                    | 921       | 1929  | 6241                    | 474             | 315                 | 7       |
| 951-327A                    | 4753      | 1881             | 346                     | 470       | 816   | 879                     | (115            | 72)                 | 0       |

**TABLE 5b**  
**COMPOSITION (NORMALISED %) OF C<sub>15</sub>+ MATERIAL EXTRACTED FROM ROCK**

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | HYDROCARBONS             |           | NON HYDROCARBONS          |                 |                     |         |
|-----------------------------|-----------|--------------------------|-----------|---------------------------|-----------------|---------------------|---------|
|                             |           | Paraffin –<br>Naphthenes | Aromatics | Precipitd.<br>Asphaltenes | Eluted<br>NSO's | Non eluted<br>NSO's | Sulphur |
| 951-074                     | 2450-2460 | 25.75                    | 8.97      | 44.14                     | 11.72           | 9.43                | 0.00    |
| 951-084                     | 2550-2560 | 37.43                    | 20.74     | 27.46                     | 9.62            | 4.75                | 0.00    |
| 951-100A                    | 2710-2720 | 19.22                    | 10.91     | 52.99                     | 11.17           | 4.94                | 0.78    |
| 951-140                     | 3110-3120 | 30.05                    | 12.26     | 43.75                     | 9.13            | 4.81                | 0.00    |
| 951-150                     | 3210-3220 | 23.04                    | 13.25     | 48.96                     | 9.45            | 4.61                | 0.69    |
| 951-160A                    | 3310-3320 | 33.98                    | 29.35     | 25.19                     | 6.94            | 3.80                | 0.74    |
| 951-202A                    | 3669      | 25.06                    | 24.99     | 34.40                     | 11.03           | 4.28                | 0.24    |
| 951-208                     | 3670-3680 | 11.48                    | 17.23     | 60.21                     | 7.32            | 3.59                | 0.17    |
| 951-219                     | 3750-3760 | 15.15                    | 18.70     | 45.29                     | 17.31           | 3.09                | 0.46    |
| 951-230                     | 3850-3860 | 59.32                    | 15.23     | 15.70                     | 7.37            | 2.38                | 0.00    |
| 951-241A                    | 3930-3940 | 20.74                    | 7.56      | 52.33                     | 14.34           | 5.04                | 0.00    |
| 951-262                     | 4130-4140 | 30.24                    | 26.53     | 25.40                     | 13.08           | 4.75                | 0.00    |
| 951-276                     | 4270-4280 | 20.69                    | 13.66     | 57.82                     | 5.17            | 2.39                | 0.27    |
| 951-284A                    | 4350-4360 | 21.80                    | 19.92     | 47.37                     | 7.52            | 3.38                | 0.00    |
| 951-296A                    | 4473.2    | 17.94                    | 15.15     | 58.09                     | 7.50            | 0.74                | 0.59    |
| 951-302                     | 4510-4520 | 34.92                    | 21.36     | 34.83                     | 6.03            | 2.77                | 0.09    |
| 951-316                     | 4650-4660 | 11.24                    | 10.27     | 69.61                     | 5.29            | 3.51                | 0.08    |
| 951-327A                    | 4753      | 18.37                    | 25.00     | 46.74                     | 6.09            | 3.80                | 0.00    |

TABLE 6  
SIGNIFICANT RATIOS (%) OF C<sub>15</sub>+ FRACTIONS AND ORGANIC CARBON

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH     | ORGANIC<br>CARBON<br>(wt. %) | HYDROCARBONS  | HYDROCARBONS | TOTAL EXTRACT | P-NAPHTHENES |
|-----------------------------|-----------|------------------------------|---------------|--------------|---------------|--------------|
|                             |           |                              | TOTAL EXTRACT | ORG. CARBON  | ORG. CARBON   | AROMATICS    |
| 951-074                     | 2450-2460 | 0.65                         | 34.71         | 1.40         | 4.04          | 2.87         |
| 951-084                     | 2550-2560 | 0.70                         | 58.17         | 5.63         | 9.68          | 1.80         |
| 951-100A                    | 2710-2720 | 0.79                         | 30.13         | 1.98         | 6.56          | 1.76         |
| 951-140                     | 3110-3120 | 0.83                         | 42.31         | 1.32         | 3.12          | 2.45         |
| 951-150                     | 3210-3220 | 0.48                         | 36.29         | 3.79         | 10.43         | 1.74         |
| 951-160A                    | 3310-3320 | 0.81                         | 63.33         | 10.69        | 16.88         | 1.16         |
| 951-202A                    | 3669      | 5.72                         | 50.05         | 4.98         | 9.95          | 1.00         |
| 951-208                     | 3670-3680 | 2.30                         | 28.71         | 2.83         | 9.87          | 0.67         |
| 951-219                     | 3750-3760 | 0.92                         | 33.85         | 1.40         | 4.14          | 0.81         |
| 951-230                     | 3850-3860 | 1.02                         | 74.55         | 18.11        | 24.30         | 3.90         |
| 951-241A                    | 3930-3940 | 0.56                         | 28.29         | 6.63         | 23.45         | 2.74         |
| 951-262                     | 4130-4140 | 1.20                         | 56.77         | 5.82         | 10.25         | 1.14         |
| 951-276                     | 4270-4280 | 0.38                         | 34.35         | 2.73         | 7.95          | 1.51         |
| 951-284A                    | 4350-4360 | 0.12                         | 41.73         | 20.83        | 49.92         | 1.09         |
| 951-296A                    | 4473.2    | 1.04                         | 33.09         | 3.15         | 9.53          | 1.18         |
| 951-302                     | 4510-4520 | 17.30                        | 56.29         | 6.50         | 11.55         | 1.63         |
| 951-316                     | 4650-4660 | 21.20                        | 21.52         | 0.91         | 4.23          | 1.09         |
| 951-327A                    | 4753      | 1.91                         | 43.37         | 4.27         | 9.85          | 0.73         |

TABLE 7

ROCKEVAL PYROLYSIS

| GEOCHEM<br>SAMPLE<br>DEPTH | DEPTH      | S1<br>(mg/g) | S2<br>(mg/g) | S3<br>(mg/g) | HYDROGEN<br>INDEX | PRODUCTION<br>INDEX | Tmax<br>(°C) |
|----------------------------|------------|--------------|--------------|--------------|-------------------|---------------------|--------------|
| 951-012A                   | 900-950m   | 0.03         | 0.27         | 0.74         | 73.5              | 0.09                | 419          |
| 951-016A                   | 1000-1050m | 0.03         | 0.29         | 1.00         | 71.7              | 0.10                | 417          |
| 951-020A                   | 1300-1350m | 0.03         | 0.35         | 0.85         | 88.0              | 0.08                | 420          |
| 951-024A                   | 1500-1550m | 0.03         | 0.51         | 1.00         | 91.4              | 0.05                | 420          |
| 951-028A                   | 1700-1750m | 0.05         | 1.95         | 1.30         | 149.0             | 0.02                | 426          |
| 951-030A                   | 1800-1850m | 0.08         | 5.56         | 1.86         | 177.7             | 0.01                | 423          |
| 951-032A                   | 1900-1950m | 0.08         | 2.45         | 0.83         | 191.7             | 0.03                | 418          |
| 951-034A                   | 2000-2050m | 0.07         | 2.10         | 1.77         | 108.3             | 0.03                | 429          |
| 951-035A                   | 2050-2060m | 0.05         | 1.55         | 1.37         | 108.5             | 0.03                | 427          |
| 951-038A                   | 2080-2090m | 0.08         | 2.26         | 1.44         | 147.0             | 0.03                | 427          |
| 951-040B                   | 2100-2110m | 0.06         | 0.38         | 1.05         | 86.4              | 0.14                | 420          |
| 951-052A                   | 2230-2240m | 0.04         | 0.36         | 2.06         | 90.6              | 0.10                | 429          |
| 951-054B                   | 2250-2260m | 0.04         | 0.25         | 2.39         | 62.6              | 0.14                | 424          |
| 951-056A                   | 2270-2280m | 0.05         | 0.34         | 2.08         | 82.9              | 0.13                | 424          |
| 951-058B                   | 2290-2300m | 0.07         | 0.39         | 1.58         | 75.8              | 0.15                | 433          |
| 951-062B                   | 2330-2340m | 0.13         | 1.33         | 1.07         | 187.1             | 0.09                | 432          |
| 951-066B                   | 2370-2380m | 0.06         | 0.43         | 0.71         | 62.8              | 0.12                | 390          |
| 951-068B                   | 2390-2400m | 0.03         | 0.24         | 0.86         | 34.3              | 0.12                | 424          |
| 951-070A                   | 2410-2420m | 0.03         | 0.27         | 1.18         | 31.5              | 0.10                | 423          |
| 951-072A                   | 2430-2440m | 0.04         | 0.44         | 1.37         | 39.9              | 0.09                | 423          |
| 951-074A                   | 2450-2460m | 0.04         | 0.39         | 1.12         | 50.6              | 0.08                | 425          |
| 951-076A                   | 2470-2480m | 0.05         | 0.41         | 1.11         | 55.0              | 0.10                | 424          |
| 951-078A                   | 2490-2500m | 0.03         | 0.35         | 1.18         | 44.9              | 0.09                | 424          |
| 951-080A                   | 2510-2520m | 0.06         | 0.55         | 0.96         | 61.6              | 0.10                | 425          |
| 951-082A                   | 2530-2540m | 0.09         | 0.91         | 0.93         | 100.7             | 0.09                | 429          |
| 951-084A                   | 2550-2560m | 0.08         | 0.71         | 0.87         | 77.0              | 0.10                | 427          |
| 951-086A                   | 2570-2580m | 0.08         | 0.83         | 0.80         | 98.3              | 0.09                | 430          |
| 951-088A                   | 2590-2600m | 0.07         | 0.82         | 0.81         | 95.9              | 0.08                | 429          |
| 951-090A                   | 2610-2620m | 0.10         | 1.16         | 0.77         | 122.0             | 0.08                | 431          |
| 951-092A                   | 2630-2640m | 0.07         | 0.64         | 0.82         | 73.9              | 0.09                | 431          |
| 951-094A                   | 2650-2660m | 0.06         | 0.60         | 1.06         | 68.6              | 0.09                | 429          |
| 951-096A                   | 2670-2680m | 0.04         | 0.42         | 0.90         | 51.8              | 0.09                | 428          |
| 951-098A                   | 2690-2700m | 0.07         | 0.66         | 0.83         | 80.1              | 0.10                | 431          |
| 951-100A                   | 2710-2720m | 0.05         | 0.41         | 0.74         | 51.8              | 0.10                | 425          |
| 951-102A                   | 2730-2740m | 0.06         | 0.81         | 0.89         | 86.8              | 0.07                | 432          |
| 951-104A                   | 2750-2760m | 0.04         | 0.49         | 0.97         | 56.6              | 0.08                | 428          |
| 951-106A                   | 2770-2780m | 0.06         | 0.64         | 0.80         | 71.3              | 0.09                | 430          |
| 951-108A                   | 2790-2800m | 0.06         | 0.70         | 1.09         | 75.8              | 0.08                | 429          |
| 951-110A                   | 2810-2820m | 0.04         | 0.51         | 0.95         | 54.1              | 0.08                | 429          |
| 951-112A                   | 2830-2840m | 0.07         | 0.77         | 0.92         | 77.1              | 0.08                | 432          |
| 951-114B                   | 2850-2860m | 0.15         | 0.90         | 0.68         | 157.9             | 0.14                | 431          |
| 951-116A                   | 2870-2880m | 0.09         | 0.73         | 0.78         | 79.8              | 0.10                | 432          |
| 951-118A                   | 2890-2900m | 0.06         | 0.69         | 0.82         | 66.7              | 0.07                | 433          |
| 951-120A                   | 2910-2920m | 0.05         | 0.59         | 0.75         | 58.7              | 0.07                | 430          |
| 951-122A                   | 2930-2940m | 0.04         | 0.39         | 0.48         | 50.8              | 0.09                | 424          |
| 951-124B                   | 2950-2960m | 0.07         | 0.48         | 0.60         | 52.8              | 0.13                | 427          |
| 951-126A                   | 2970-2980m | 0.07         | 0.41         | 0.78         | 49.1              | 0.15                | 428          |
| 951-128A                   | 2990-3000m | 0.07         | 0.56         | 0.57         | 66.4              | 0.11                | 435          |
| 951-130A                   | 3010-3020m | 0.10         | 0.59         | 0.51         | 72.7              | 0.15                | 430          |
| 951-132A                   | 3030-3040m | 0.06         | 0.54         | 0.60         | 67.8              | 0.10                | 432          |

TABLE 7

ROCKEVAL PYROLYSIS

| GEOCHEM<br>SAMPLE<br>DEPTH | DEPTH       | S1<br>(mg/g) | S2<br>(mg/g) | S3<br>(mg/g) | HYDROGEN<br>INDEX | PRODUCTION<br>INDEX | Tmax<br>(°C) |
|----------------------------|-------------|--------------|--------------|--------------|-------------------|---------------------|--------------|
| 951-134A                   | 3050-3060m  | 0.07         | 0.59         | 0.64         | 72.4              | 0.11                | 431          |
| 951-136A                   | 3070-3080m  | 0.07         | 0.76         | 0.54         | 88.1              | 0.08                | 432          |
| 951-138A                   | 3090-3100m  | 0.07         | 0.81         | 0.56         | 89.5              | 0.08                | 434          |
| 951-140A                   | 3110-3120m  | 0.08         | 0.80         | 0.58         | 87.5              | 0.09                | 433          |
| 951-142A                   | 3130-3140m  | 0.08         | 0.78         | 0.49         | 82.4              | 0.09                | 434          |
| 951-144A                   | 3150-3160m  | 0.06         | 0.58         | 0.51         | 60.4              | 0.10                | 433          |
| 951-146A                   | 3170-3180m  | 0.07         | 0.69         | 0.61         | 73.7              | 0.09                | 432          |
| 951-148A                   | 3190-3200m  | 0.09         | 0.77         | 0.62         | 80.1              | 0.10                | 434          |
| 951-150A                   | 3210-3220m  | 0.09         | 0.56         | 0.43         | 73.8              | 0.14                | 432          |
| 951-152A                   | 3230-3240m  | 0.07         | 0.34         | 0.60         | 49.2              | 0.16                | 431          |
| 951-154A                   | 3250-3260m  | 0.09         | 0.68         | 0.39         | 73.5              | 0.12                | 433          |
| 951-156A                   | 3270-3280m  | 0.06         | 0.42         | 0.42         | 60.8              | 0.12                | 427          |
| 951-158A                   | 3290-3300m  | 0.08         | 0.33         | 0.67         | 41.1              | 0.20                | 429          |
| 951-160A                   | 3310-3320m  | 0.17         | 0.64         | 0.55         | 70.0              | 0.21                | 433          |
| 951-162B                   | 3330-3340m  | 0.09         | 0.42         | 0.33         | 42.8              | 0.17                | 435          |
| 951-164A                   | 3350-3360m  | 0.04         | 0.16         | 0.65         | 24.8              | 0.21                | 424          |
| 951-166A                   | 3370-3380m  | 0.04         | 0.32         | 0.51         | 40.4              | 0.12                | 432          |
| 951-168A                   | 3390-3400m  | 0.05         | 0.26         | 0.74         | 32.4              | 0.15                | 432          |
| 951-170A                   | 3410-3420m  | 0.04         | 0.27         | 0.52         | 35.2              | 0.14                | 433          |
| 951-172A                   | 3430-3440m  | 0.04         | 0.21         | 0.73         | 25.1              | 0.17                | 426          |
| 951-174B                   | 3450-3460m  | 0.08         | 0.62         | 0.61         | 62.1              | 0.12                | 435          |
| 951-176A                   | 3470-3480m  | 0.04         | 0.25         | 0.32         | 33.5              | 0.13                | 434          |
| 951-178A                   | 3490-3500m  | 0.05         | 0.28         | 0.47         | 36.2              | 0.15                | 433          |
| 951-180A                   | 3510-3520m  | 0.05         | 0.35         | 0.30         | 44.8              | 0.14                | 433          |
| 951-182B                   | 3530-3540m  | 0.05         | 0.19         | 0.53         | 24.7              | 0.20                | 429          |
| 951-184A                   | 3550-3560m  | 0.02         | 0.20         | 0.39         | 25.3              | 0.11                | 435          |
| 951-186A                   | 3570-3580m  | 0.05         | 0.37         | 0.32         | 48.6              | 0.11                | 434          |
| 951-188B                   | 3590-3600m  | 0.04         | 0.16         | 0.59         | 21.3              | 0.22                | 430          |
| 951-190A                   | 3610-3620m  | 0.03         | 0.15         | 0.31         | 19.2              | 0.17                | 427          |
| 951-192A                   | 3630-3640m  | 0.03         | 0.19         | 0.24         | 27.5              | 0.15                | 434          |
| 951-192B                   | 3630-3640m  | 0.03         | 0.11         | 0.53         | 16.8              | 0.24                | -            |
| 951-194A                   | 3650-3660m  | 0.04         | 0.21         | 0.38         | 29.6              | 0.17                | 436          |
| 951-198A                   | 3664m SWC   | 1.38         | 12.24        | 0.21         | 224.1             | 0.10                | 434          |
| 951-199A                   | 3666m SWC   | 1.80         | 13.41        | 0.30         | 214.5             | 0.12                | 432          |
| 951-200A                   | 3667m SWC   | 3.09         | 20.02        | 0.17         | 214.8             | 0.13                | 430          |
| 951-201A                   | 3668m SWC   | 1.04         | 7.90         | 0.53         | 250.1             | 0.12                | 432          |
| 951-202A                   | 3669m SWC   | 2.87         | 24.26        | 0.22         | 254.0             | 0.11                | 434          |
| 951-203A                   | 3670m SWC   | 3.05         | 20.33        | 0.13         | 222.9             | 0.13                | 429          |
| 951-204A                   | 3671m SWC   | 2.47         | 20.58        | 0.17         | 240.1             | 0.11                | 433          |
| 951-205A                   | 3671.5m SWC | 2.53         | 33.28        | 0.16         | 317.0             | 0.07                | 433          |
| 951-206A                   | 3672.5m SWC | 1.71         | 15.64        | 0.22         | 241.7             | 0.10                | 435          |
| 951-207A                   | 3673m SWC   | 1.97         | 17.05        | 0.18         | 218.9             | 0.10                | 430          |
| 951-208A                   | 3670-3680m  | 0.07         | 0.17         | 0.30         | 22.0              | 0.29                | 437          |
| 951-208B                   | 3670-3680m  | 0.99         | 9.06         | 0.57         | 167.0             | 0.10                | 433          |
| 951-210B                   | 3690-3700m  | 0.12         | 0.93         | 0.69         | 83.0              | 0.11                | 439          |
| 951-212A                   | 3717m SWC   | 0.05         | 0.40         | 0.24         | 43.0              | 0.11                | 433          |
| 951-213B                   | 3710-3720m  | 0.12         | 1.03         | 1.09         | 100.0             | 0.10                | 439          |
| 951-214A                   | 3725m SWC   | 0.03         | 0.07         | 0.29         | 12.0              | 0.30                | -            |
| 951-216A                   | 3730-3740m  | 0.05         | 0.18         | 0.37         | 22.0              | 0.22                | 436          |
| 951-216B                   | 3730-3740m  | 0.08         | 0.69         | 0.58         | 81.0              | 0.10                | 438          |

TABLE 7

ROCKEVAL PYROLYSIS

| GEOCHEM<br>SAMPLE<br>DEPTH | DEPTH       | S1<br>(mg/g) | S2<br>(mg/g) | S3<br>(mg/g) | HYDROGEN<br>INDEX | PRODUCTION<br>INDEX | Tmax<br>(°C) |
|----------------------------|-------------|--------------|--------------|--------------|-------------------|---------------------|--------------|
| 951-217A                   | 3742m SWC   | 0.06         | 0.66         | 0.85         | 69.1              | 0.09                | 432          |
| 951-219A                   | 3750-3760m  | 0.05         | 0.22         | 0.46         | 25.1              | 0.18                | 439          |
| 951-219B                   | 3750-3760m  | 0.23         | 1.96         | 0.49         | 99.3              | 0.10                | 442          |
| 951-221A                   | 3774m SWC   | 2.42         | 19.16        | 0.07         | 240.1             | 0.11                | 434          |
| 951-222A                   | 3770-3780m  | 0.18         | 1.50         | 0.38         | 80.2              | 0.11                | 442          |
| 951-230B                   | 3850-3860m  | 0.46         | 3.60         | 0.13         | 104.9             | 0.11                | 443          |
| 951-234B                   | 3890-3900m  | 0.13         | 0.41         | 0.33         | 47.6              | 0.24                | 434          |
| 951-236A                   | 3917.5m SWC | 0.12         | 1.03         | 0.28         | 102.5             | 0.10                | 445          |
| 951-237B                   | 3910-3920m  | 0.20         | 1.34         | 0.48         | 89.8              | 0.13                | 443          |
| 951-238A                   | 3928.8m SWC | 0.97         | 30.04        | 0.20         | 585.5             | 0.03                | 449          |
| 951-240A                   | 3930.6m SWC | 0.32         | 2.75         | 0.10         | 159.2             | 0.10                | 445          |
| 951-253C                   | 4050-4060m  | 0.25         | 1.13         | 0.48         | 93.7              | 0.18                | 443          |
| 951-255C                   | 4070-4080m  | 0.31         | 1.50         | 0.36         | 132.3             | 0.17                | 443          |
| 951-257B                   | 4090-4100m  | 0.17         | 0.88         | 0.65         | 83.7              | 0.16                | 447          |
| 951-258A                   | 4106m SWC   | 0.10         | 0.24         | 0.38         | 42.2              | 0.29                | 444          |
| 951-260B                   | 4110-4120m  | 0.41         | 2.54         | 0.47         | 162.8             | 0.14                | 447          |
| 951-262A                   | 4130-4140m  | 0.59         | 3.24         | 0.55         | 195.5             | 0.15                | 444          |
| 951-264A                   | 4150-4160m  | 0.52         | 2.64         | 0.39         | 191.1             | 0.16                | 445          |
| 951-266A                   | 4170-4180m  | 0.30         | 1.73         | 0.26         | 163.5             | 0.15                | 447          |
| 951-268B                   | 4190-4200m  | 0.31         | 1.76         | 0.17         | 169.5             | 0.15                | 446          |
| 951-278B                   | 4290-4300m  | 0.35         | 1.97         | 0.60         | 134.2             | 0.15                | 451          |
| 951-282B                   | 4330-4340m  | 0.32         | 1.71         | 0.32         | 128.7             | 0.16                | 451          |
| 951-284B                   | 4350-4360m  | 0.37         | 2.47         | 0.21         | 151.4             | 0.13                | 449          |
| 951-292B                   | 4430-4440m  | 0.76         | 34.03        | 38.78        | 34.0              | 0.02                | 420          |
| 951-296A                   | 4473.2m SWC | 0.16         | 1.85         | 5.69         | 166.4             | 0.08                | 332          |
| 951-302A                   | 4510-4520m  | 8.04         | 80.72        | 1.22         | 80.7              | 0.09                | 460          |
| 951-309A                   | 4598m SWC   | 0.43         | 2.16         | 0.12         | 100.2             | 0.17                | 462          |
| 951-316A                   | 4650-4660m  | 8.63         | 87.54        | 0.89         | 87.5              | 0.09                | 445          |
| 951-316C                   | 4650-4660m  | 0.22         | 1.40         | 0.18         | 130.5             | 0.14                | 550          |
| 951-318C                   | 4670-4680m  | 0.22         | 1.22         | 0.13         | 99.1              | 0.15                | 466          |
| 951-320A                   | 4695m SWC   | 0.15         | 0.89         | 0.12         | 50.5              | 0.14                | 468          |
| 951-323C                   | 4710-4720m  | 0.18         | 0.57         | 0.14         | 61.2              | 0.23                | 445          |
| 951-327A                   | 4753m SWC   | 0.13         | 0.95         | 0.14         | 49.7              | 0.12                | 472          |
| 951-329B                   | 4750-4760m  | 0.14         | 1.08         | 0.11         | 50.0              | 0.12                | 473          |
| 951-331B                   | 4770-4780m  | 0.13         | 0.94         | 0.12         | 56.7              | 0.12                | 468          |
| 951-334C                   | 4790-4800m  | 0.10         | 0.68         | 0.12         | 44.4              | 0.13                | 471          |
| 951-336B                   | 4810-4820m  | 0.22         | 2.33         | 0.11         | 82.2              | 0.09                | 466          |
| 951-338B                   | 4830-4840m  | 0.53         | 6.72         | 0.15         | 96.2              | 0.07                | 469          |
| 951-342C                   | 4850-4860m  | 0.14         | 1.25         | 0.13         | 65.1              | 0.10                | 466          |
| 951-344C                   | 4870-4880m  | 0.96         | 17.57        | 0.12         | 156.9             | 0.05                | 464          |

**TABLE 8**  
**COMPOSITION (NORMALISED %) OF C<sub>15</sub>+ PARAFFIN – NAPHTHENE HYDROCARBONS**

| GEOCHEM SAMPLE NUMBER     | 074           | 084           | 100A          | 140           | 150           | 160A          | 202A         | 208           |
|---------------------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|---------------|
| DEPTH                     | 2450-<br>2460 | 2550-<br>2560 | 2710-<br>2720 | 3110-<br>3120 | 3210-<br>3220 | 3310-<br>3320 | 3669-<br>SWC | 3670-<br>3680 |
| SAMPLE TYPE               |               |               |               |               |               |               |              |               |
| nC <sub>15</sub>          | 1.38          | 3.89          | 0.25          | 3.14          | 1.70          | 2.58          | 9.60         | 9.09          |
| nC <sub>16</sub>          | 5.15          | 6.59          | 2.06          | 7.43          | 4.77          | 7.01          | 9.50         | 9.95          |
| nC <sub>17</sub>          | 7.91          | 7.98          | 5.59          | 12.60         | 7.45          | 10.62         | 7.92         | 9.37          |
| nC <sub>18</sub>          | 10.92         | 8.48          | 10.13         | 11.22         | 9.93          | 11.61         | 7.65         | 8.97          |
| nC <sub>19</sub>          | 6.50          | 7.45          | 10.13         | 14.36         | 7.90          | 11.44         | 5.94         | 8.95          |
| nC <sub>20</sub>          | 9.71          | 8.95          | 11.83         | 9.56          | 10.75         | 10.41         | 6.98         | 6.83          |
| nC <sub>21</sub>          | 6.74          | 7.99          | 12.27         | 5.95          | 8.72          | 7.44          | 6.23         | 5.80          |
| nC <sub>22</sub>          | 8.81          | 7.84          | 5.71          | 7.49          | 8.91          | 6.93          | 5.96         | 6.22          |
| nC <sub>23</sub>          | 7.53          | 6.88          | 7.33          | 4.98          | 3.92          | 5.62          | 5.47         | 4.74          |
| nC <sub>24</sub>          | 5.94          | 6.40          | 4.48          | 4.11          | 7.22          | 6.45          | 4.99         | 3.97          |
| nC <sub>25</sub>          | 7.53          | 6.58          | 5.71          | 4.15          | 5.66          | 5.18          | 4.90         | 4.40          |
| nC <sub>26</sub>          | 4.63          | 4.52          | 4.03          | 2.63          | 5.07          | 3.15          | 4.31         | 3.80          |
| nC <sub>27</sub>          | 5.84          | 4.04          | 7.29          | 3.09          | 2.36          | 2.53          | 4.16         | 3.36          |
| nC <sub>28</sub>          | 1.55          | 3.25          | 2.66          | 1.70          | 3.90          | 2.00          | 3.81         | 3.01          |
| nC <sub>29</sub>          | 1.04          | 2.98          | 3.48          | 1.29          | 4.00          | 1.93          | 3.46         | 3.08          |
| nC <sub>30</sub>          | 2.28          | 1.93          | 1.19          | 1.94          | 2.36          | 1.25          | 2.47         | 1.98          |
| nC <sub>31</sub>          | 2.38          | 1.30          | 2.03          | 1.94          | 1.73          | 1.00          | 1.76         | 2.00          |
| nC <sub>32</sub>          | 2.25          | 0.66          | 1.31          | 0.87          | 0.79          | 0.48          | 0.79         | 1.06          |
| nC <sub>33</sub>          | 1.04          | 0.32          | 0.45          | 0.38          | 1.05          | 0.62          | 1.39         | 1.49          |
| nC <sub>34</sub>          | 0.52          | 1.31          | 1.19          | 0.52          | 1.12          | 0.78          | 1.64         | 1.00          |
| nC <sub>35</sub>          | 0.35          | 0.65          | 0.88          | 0.67          | 0.70          | 0.96          | 1.07         | 0.94          |
| PARAFFIN                  | 34.24         | 41.35         | 10.38         | 58.78         | 44.87         | 15.79         | 59.40        | 22.77         |
| ISOPRENOID                | 4.71          | 4.47          | 1.68          | 11.01         | 4.99          | 2.46          | 13.00        | 4.97          |
| NAPHTHENE                 | 61.05         | 54.17         | 87.94         | 30.21         | 50.15         | 81.75         | 27.60        | 72.26         |
| CPI INDEX A               | 1.14          | 1.04          | 1.59          | 0.95          | 0.73          | 0.95          | 1.01         | 0.98          |
| CPI INDEX B               | 1.37          | 1.18          | 1.76          | 1.24          | 0.94          | 1.19          | 1.09         | 1.15          |
| PRISTANE/PHYTANE          | 1.65          | 1.51          | 0.60          | 2.13          | 1.46          | 1.08          | 2.77         | 3.21          |
| PRISTANE/nC <sub>17</sub> | 1.08          | 0.82          | 1.09          | 1.01          | 0.88          | 0.76          | 2.03         | 1.78          |

**TABLE 8**  
**COMPOSITION (NORMALISED %) OF C<sub>15</sub>+ PARAFFIN – NAPHTHENE HYDROCARBONS**

| GEOCHEM SAMPLE NUMBER     | 219           | 230           | 241A          | 262           | 276           | 284A          | 296A         | 302           |
|---------------------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|---------------|
| DEPTH                     | 3750–<br>3760 | 3850–<br>3860 | 3930–<br>3940 | 4130–<br>4140 | 4270–<br>4280 | 4350–<br>4360 | 4473–<br>SWC | 4510–<br>4520 |
| SAMPLE TYPE               |               |               |               |               |               |               |              |               |
| nC <sub>15</sub>          | 5.25          | 1.08          | 0.69          | 7.55          | 3.30          | 0.85          | 7.02         | 5.65          |
| nC <sub>16</sub>          | 7.29          | 1.37          | 2.14          | 9.49          | 6.34          | 1.18          | 9.62         | 7.56          |
| nC <sub>17</sub>          | 8.73          | 1.68          | 5.28          | 3.90          | 7.90          | 3.34          | 9.90         | 10.27         |
| nC <sub>18</sub>          | 8.56          | 1.83          | 9.65          | 7.80          | 9.15          | 6.09          | 8.36         | 12.08         |
| nC <sub>19</sub>          | 7.74          | 1.91          | 11.42         | 9.38          | 11.76         | 6.86          | 9.26         | 12.67         |
| nC <sub>20</sub>          | 7.63          | 1.42          | 12.26         | 8.57          | 10.56         | 9.65          | 8.13         | 10.52         |
| nC <sub>21</sub>          | 6.78          | 0.89          | 9.42          | 8.08          | 8.53          | 10.88         | 7.57         | 6.67          |
| nC <sub>22</sub>          | 7.36          | 0.94          | 8.05          | 7.63          | 7.70          | 9.82          | 7.16         | 5.42          |
| nC <sub>23</sub>          | 6.61          | 0.47          | 7.79          | 6.97          | 6.16          | 9.73          | 5.16         | 3.30          |
| nC <sub>24</sub>          | 6.14          | 0.15          | 7.01          | 4.36          | 4.65          | 9.27          | 4.14         | 2.57          |
| nC <sub>25</sub>          | 6.49          | 0.76          | 8.49          | 4.60          | 5.59          | 8.97          | 4.81         | 1.69          |
| nC <sub>26</sub>          | 4.61          | 6.14          | 5.37          | 4.48          | 4.19          | 6.69          | 2.81         | 7.90          |
| nC <sub>27</sub>          | 4.96          | 9.60          | 4.15          | 3.22          | 3.59          | 6.05          | 3.10         | 2.84          |
| nC <sub>28</sub>          | 3.41          | 4.96          | 1.81          | 3.34          | 2.65          | 3.55          | 3.68         | 4.60          |
| nC <sub>29</sub>          | 3.21          | 25.88         | 1.37          | 1.88          | 2.74          | 2.50          | 1.86         | 1.94          |
| nC <sub>30</sub>          | 1.65          | 14.94         | 1.04          | 1.64          | 1.48          | 1.23          | 1.70         | 1.34          |
| nC <sub>31</sub>          | 1.30          | 4.76          | 1.97          | 0.89          | 1.15          | 1.02          | 1.52         | 1.83          |
| nC <sub>32</sub>          | 0.61          | 10.71         | 0.81          | 0.77          | 0.65          | 0.38          | 0.61         | 0.85          |
| nC <sub>33</sub>          | 0.73          | 8.52          | 0.14          | 0.56          | 0.78          | 0.89          | 1.00         | 0.09          |
| nC <sub>34</sub>          | 0.73          | 1.59          | 0.71          | 0.43          | 0.65          | 0.63          | 1.39         | 0.08          |
| nC <sub>35</sub>          | 0.24          | 0.40          | 0.44          | 4.48          | 0.49          | 0.42          | 1.19         | 0.12          |
| PARAFFIN                  | 48.36         | 23.04         | 15.98         | 41.11         | 14.67         | 21.67         | 14.22        | 10.27         |
| ISOPRENOID                | 5.14          | 0.53          | 1.10          | 4.32          | 1.01          | 0.65          | 1.54         | 1.47          |
| NAPHTHENE                 | 46.50         | 76.44         | 82.92         | 54.56         | 84.32         | 77.68         | 84.24        | 88.25         |
| CPI INDEX A               | 1.06          | 1.16          | 1.13          | 1.03          | 1.06          | 1.11          | 1.04         | 0.63          |
| CPI INDEX B               | 1.28          | 1.34          | 1.41          | 0.90          | 1.23          | 1.23          | 1.10         | 0.54          |
| PRISTANE/PHYTANE          | 3.30          | 1.37          | 1.34          | 1.07          | 1.87          | 1.45          | 2.34         | 1.13          |
| PRISTANE/nC <sub>17</sub> | 0.92          | 0.79          | 0.75          | 1.39          | 0.57          | 0.53          | 0.77         | 0.74          |

TABLE 8  
COMPOSITION (NORMALISED %) OF C<sub>15+</sub> PARAFFIN – NAPHTHENE HYDROCARBONS

| GEOCHEM SAMPLE NUMBER     | 316       | 327A     |
|---------------------------|-----------|----------|
| DEPTH                     | 4650-4660 | 4753-SWC |
| SAMPLE TYPE               |           |          |
| nC <sub>15</sub>          | 11.95     | 5.80     |
| nC <sub>16</sub>          | 13.36     | 13.79    |
| nC <sub>17</sub>          | 12.56     | 11.42    |
| nC <sub>18</sub>          | 10.13     | 10.16    |
| nC <sub>19</sub>          | 9.24      | 17.15    |
| nC <sub>20</sub>          | 7.71      | 11.13    |
| nC <sub>21</sub>          | 1.43      | 8.02     |
| nC <sub>22</sub>          | 4.67      | 5.38     |
| nC <sub>23</sub>          | 4.60      | 3.49     |
| nC <sub>24</sub>          | 3.27      | 3.16     |
| nC <sub>25</sub>          | 4.24      | 1.76     |
| nC <sub>26</sub>          | 2.13      | 1.56     |
| nC <sub>27</sub>          | 4.10      | 1.13     |
| nC <sub>28</sub>          | 1.79      | 1.26     |
| nC <sub>29</sub>          | 2.93      | 0.74     |
| nC <sub>30</sub>          | 0.75      | 0.99     |
| nC <sub>31</sub>          | 2.01      | 1.10     |
| nC <sub>32</sub>          | 2.06      | 0.55     |
| nC <sub>33</sub>          | 0.68      | 0.55     |
| nC <sub>34</sub>          | 0.24      | 0.47     |
| nC <sub>35</sub>          | 0.16      | 0.39     |
| PARAFFIN                  | 21.74     | 22.75    |
| ISOPRENOID                | 2.47      | 4.91     |
| NAPHTHENE                 | 75.79     | 72.35    |
| CPI INDEX A               | 1.01      | 0.97     |
| CPI INDEX B               | 1.82      | 0.88     |
| PRISTANE/PHYTANE          | 2.23      | 1.12     |
| PRISTANE/nC <sub>17</sub> | 0.63      | 1.00     |

TABLE 9

METHYL PHENANTHRENE INDEX

| <u>GEOCHEM</u><br><u>SAMPLE</u><br><u>NUMBER</u> | <u>DEPTH</u> | <u>MPI</u><br><u>(HEIGHT)</u> | <u>MPI</u><br><u>(AREA)</u> |
|--------------------------------------------------|--------------|-------------------------------|-----------------------------|
| 951-150                                          | 3210-3220m   | 0.65                          | 0.68                        |
| 951-202                                          | 3669m SWC    | 0.47                          | 0.55                        |
| 951-208                                          | 3670-3680m   | 0.27                          | 0.30                        |
| 951-219                                          | 3750-3760m   | 0.24                          | 0.20                        |
| 951-230                                          | 3850-3860m   | 0.58                          | 0.61                        |
| 951-262                                          | 4130-4140m   | 0.64                          | 0.67                        |
| 951-276                                          | 4270-4280m   | 1.14                          | 1.26                        |
| 951-284                                          | 4350-4360m   | 0.23                          | 0.27                        |
| 951-302                                          | 4510-4520m   | 0.67                          | 0.73                        |
| 951-316                                          | 4650-4660m   | 1.57                          | 1.66                        |
| 951-327                                          | 4753m SWC    | 1.00                          | 1.15                        |

TABLE 10

MOLECULAR MATURATION PARAMETERS

| GEOCHEM<br>SAMPLE NO. | DEPTH       | STERANES M/Z 217 (259)                                      |                                                             |                                                                             |                   | TERPANES M/Z 191                                        |                                                                                            |                                                                                              |                                                                            |        |
|-----------------------|-------------|-------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------|
|                       |             | $\frac{C_{29} \text{ 20S } (\%)}{C_{29} \text{ 20R } (\%)}$ | $\frac{C_{29} \text{ 20R } (\%)}{C_{29} \text{ 20R } (\%)}$ | $\frac{C_{27} \text{ (20S) Diasteranes}}{C_{27} \text{ (20R) Diasteranes}}$ | $\frac{T_m}{T_s}$ | $\frac{C_{30} \text{ Moretane}}{C_{30} \text{ Hopane}}$ | $\frac{C_{29} \text{ normoretane}}{C_{29} \text{ norhopane} + C_{29} \text{ normoretane}}$ | $\frac{\text{Bisnorhopane } (C_{28})}{T_m + \text{Bisnorhopane} + C_{29} \text{ norhopane}}$ | $\frac{C_{31} \text{ (20S)}}{C_{31} \text{ (20S)} + C_{31} \text{ (20R)}}$ | x 100  |
| 951-084               | 2550-2560m  | 0.30                                                        | 0.48                                                        | 1.37                                                                        | 1.01              | 0.08                                                    | 0.27                                                                                       | -                                                                                            |                                                                            | 40%    |
| 951-160               | 3310-3320m  | 0.53                                                        | 0.71                                                        | 1.44                                                                        | 1.13              | 0.17                                                    | 0.16                                                                                       | -                                                                                            |                                                                            | 57%    |
| 951-202               | 3669m SWC   | 0.91                                                        | 0.85                                                        | 1.42                                                                        | 4.62              | 0.09                                                    | 0.05                                                                                       | -                                                                                            |                                                                            | 60%    |
| 951-219               | 3750-3760m  | 0.48                                                        | 0.70                                                        | 1.41                                                                        | 5.59              | 0.19                                                    | 0.14                                                                                       | -                                                                                            |                                                                            | 59%    |
| 951-230               | 3850-3860m  | 0.57                                                        | 0.93                                                        | 1.35                                                                        | 1.89              | 0.16                                                    | 0.18                                                                                       | -                                                                                            |                                                                            | 70%    |
| 951-262               | 4130-4140m  | 0.95                                                        | 1.29                                                        | 1.58                                                                        | 1.11              | 0.05                                                    | 0.08                                                                                       | -                                                                                            |                                                                            | 59%    |
| 951-284               | 4350-4360m  | 0.55                                                        | 0.77                                                        | 1.33                                                                        | 1.81              | 0.11                                                    | 0.16                                                                                       | -                                                                                            |                                                                            | 51%    |
| 951-296               | 4473.2m SWC | 0.61                                                        | 0.80                                                        | 1.25                                                                        | 1.62              | 0.10                                                    | 0.11                                                                                       | -                                                                                            |                                                                            | 42%    |
| 951-302               | 4510-4520m  | 0.69                                                        | 1.01                                                        | 1.47                                                                        | 1.46              | 0.13                                                    | 0.18                                                                                       | -                                                                                            |                                                                            | 21%(?) |
| 951-327               | 4753m SWC   | 0.69                                                        | 0.94                                                        | 1.32                                                                        | 1.64              | 0.09                                                    | 0.14                                                                                       | -                                                                                            |                                                                            | 32%    |

TABLE 11  
CARBON ISOTOPE ( $\delta^{13}\text{C}$ ) RESULTS

| <u>GEOCHEM<br/>SAMPLE<br/>NUMBER</u> | <u>DEPTH</u> | <u>SATURATES</u> | <u>AROMATICS</u> | <u>KEROGEN</u> |
|--------------------------------------|--------------|------------------|------------------|----------------|
| 951-084A                             | 2550-2560m   | -29.65           | -                | -              |
| 951-160A                             | 3310-3320m   | -30.26           | -                | -              |
| 951-198                              | 3664m SWC    | -                | -                | -26.20         |
| 951-205                              | 3671.5m SWC  | -                | -                | -24.56         |
| 951-230                              | 3850-3860m   | -25.08           | -25.08           | -              |
| 951-262                              | 4130-4140m   | -27.56           | -26.91           | -              |
| 951-284                              | 4350-4360m   | -31.52           | -27.71           | -              |
| 951-302                              | 4510-4520m   | -                | -                | -25.88         |
| 951-316                              | 4650-4660m   | -                | -                | -25.64         |

FIGURE 1

## RATING

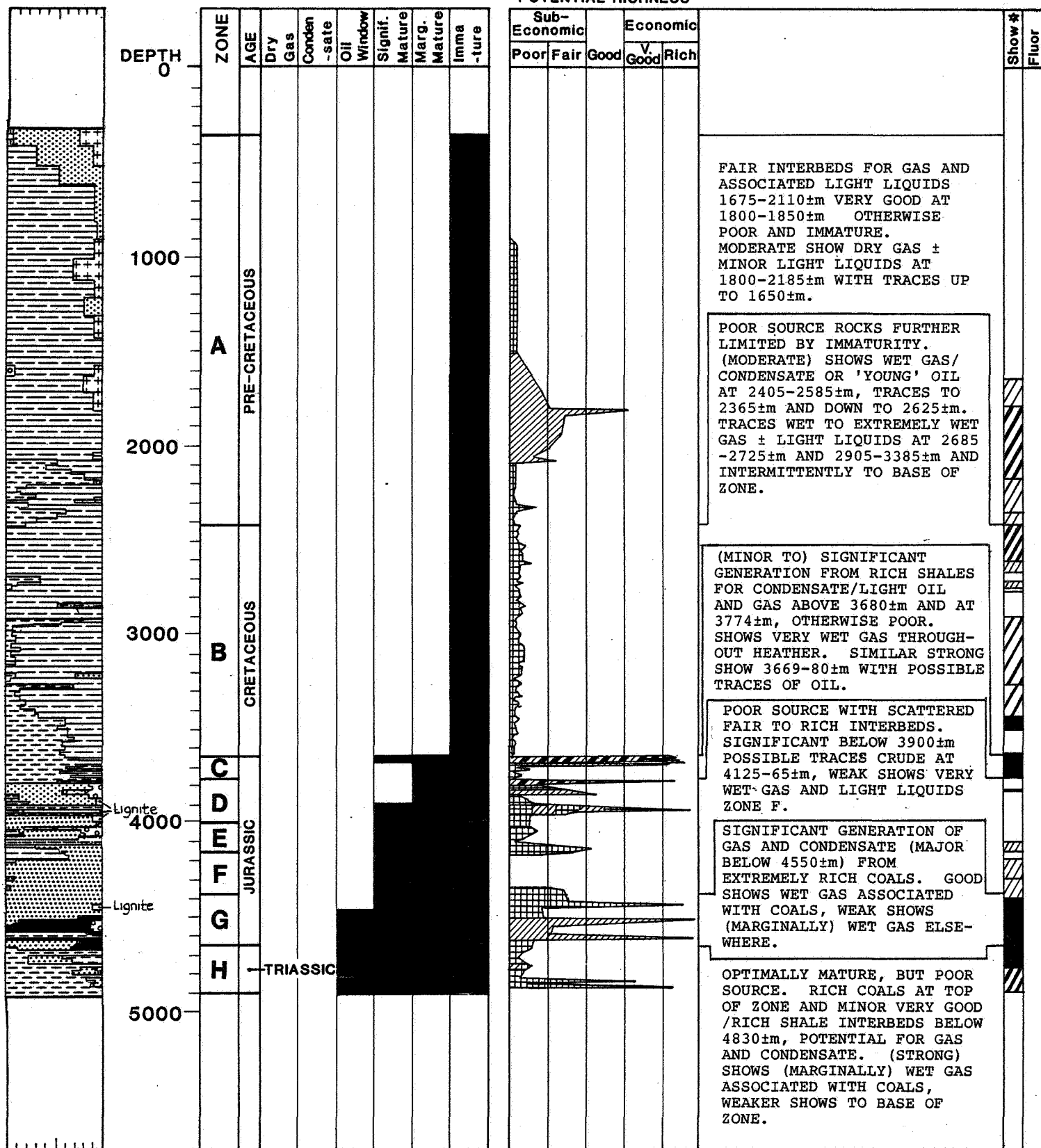
WELL 6406/3-1

## LITHO % LOG

## MATURITY

PRESENT AND  
POTENTIAL RICHNESS

## COMMENTS



Limestone

Dolomite

Shale

Mudstone/Claystone

Coal

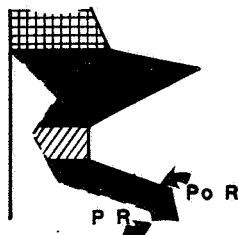
Siltstone

Sandstone

Evaporite

Igneous

L.C.M.



GAS PRONE

GAS AND CONDENSATE

OIL PRONE

Shows Recognised by Analysis

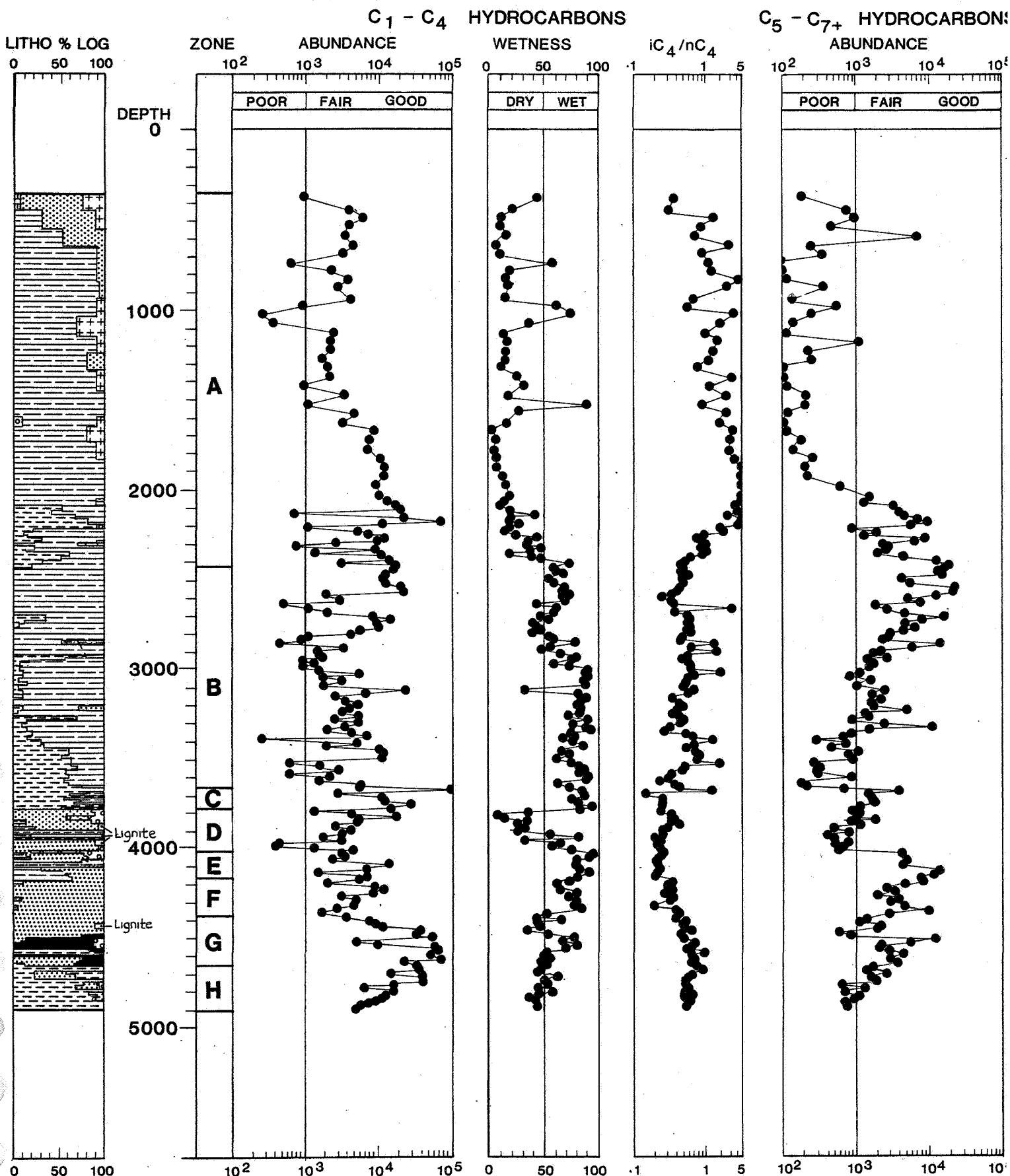
Po R Potential Richness

PR Present Richness

FIGURE 2

# C<sub>1</sub>-C<sub>7</sub> HYDROCARBONS

WELL 6406/3-1



Limestone  
Dolomite  
Shale  
Mudstone/  
Claystone  
Coal

Siltstone  
Sandstone  
Evaporite  
Igneous  
L.C.M.

iC<sub>4</sub> - ISOBUTANE

nC<sub>4</sub> - NORMAL BUTANE

ABUNDANCE - VOLUME PPM OF ROCK

WETNESS - % C<sub>2</sub>-C<sub>4</sub> IN C<sub>1</sub>-C<sub>4</sub>

FIGURE 3

# RICHNESS

WELL 6406/3-1

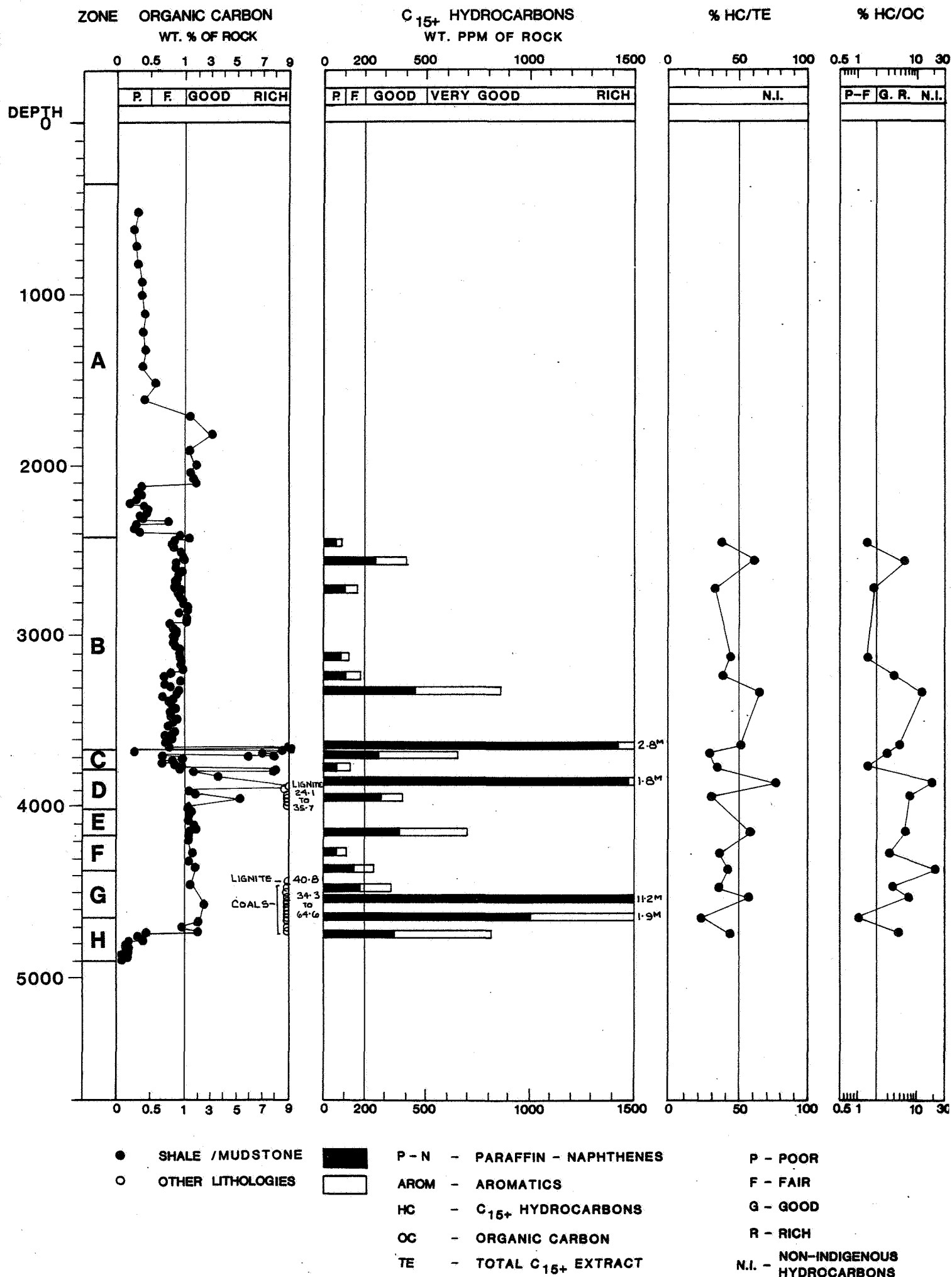
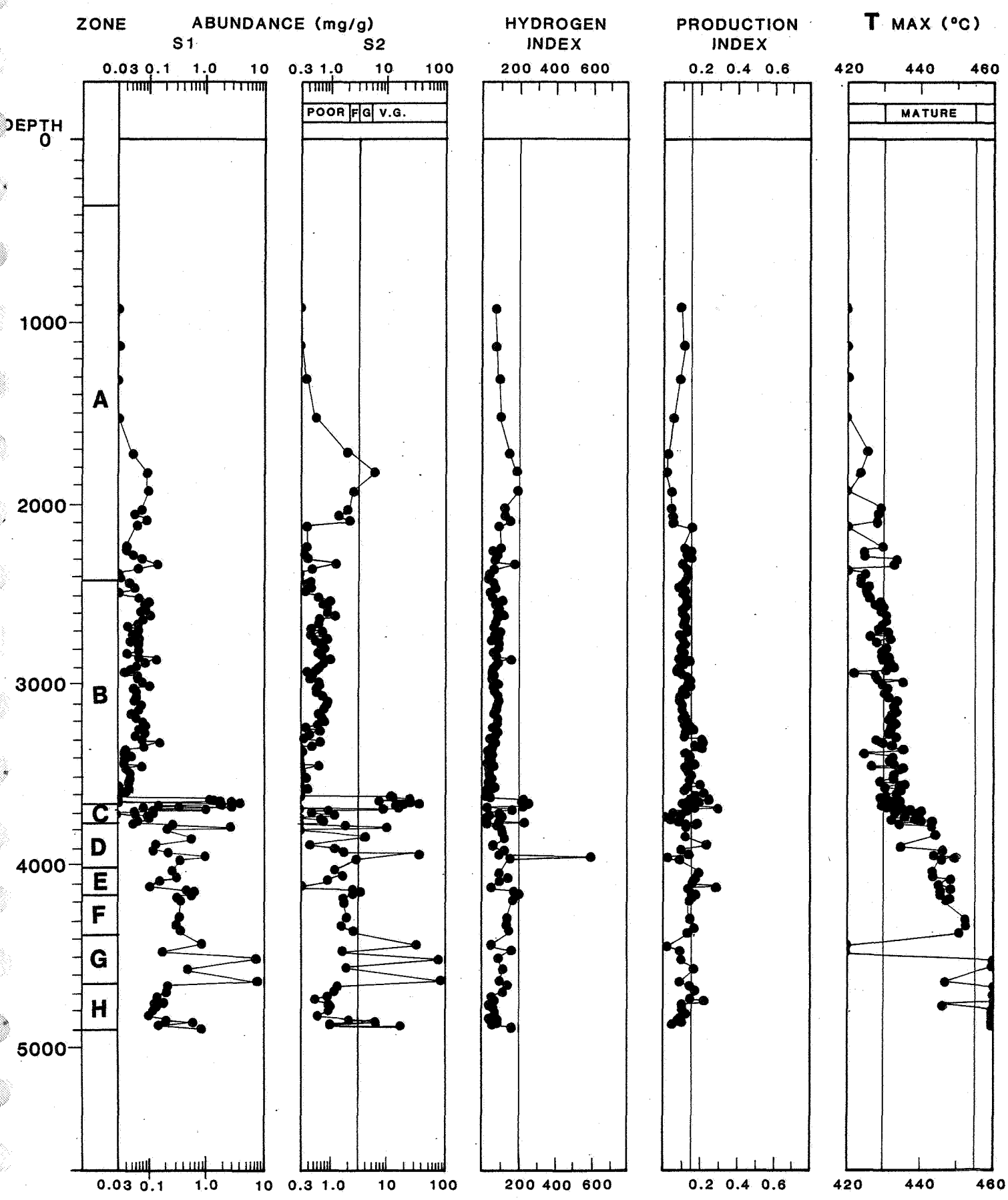
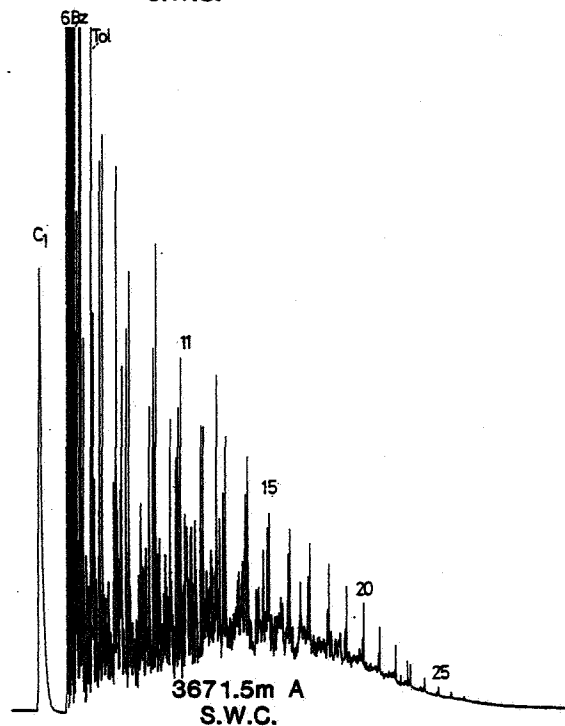
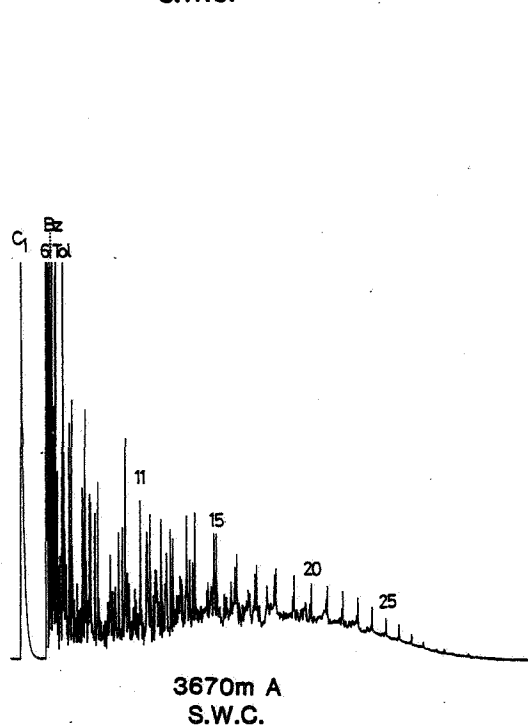
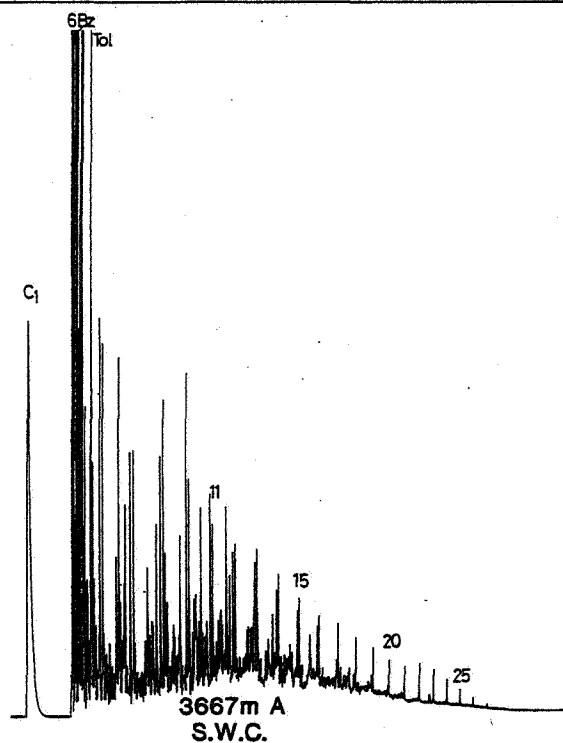
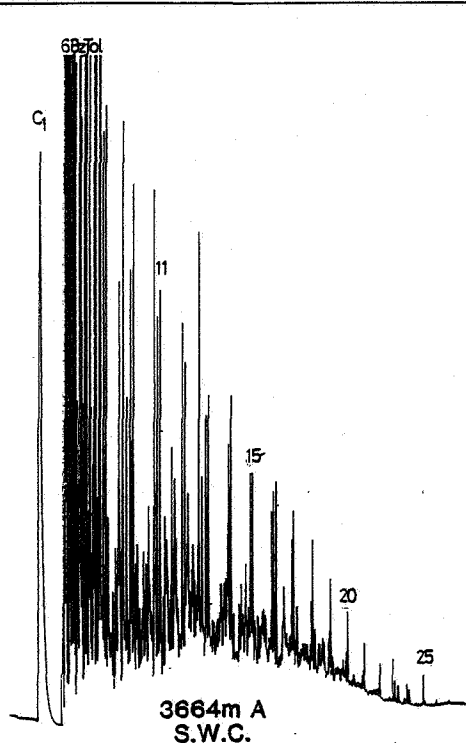
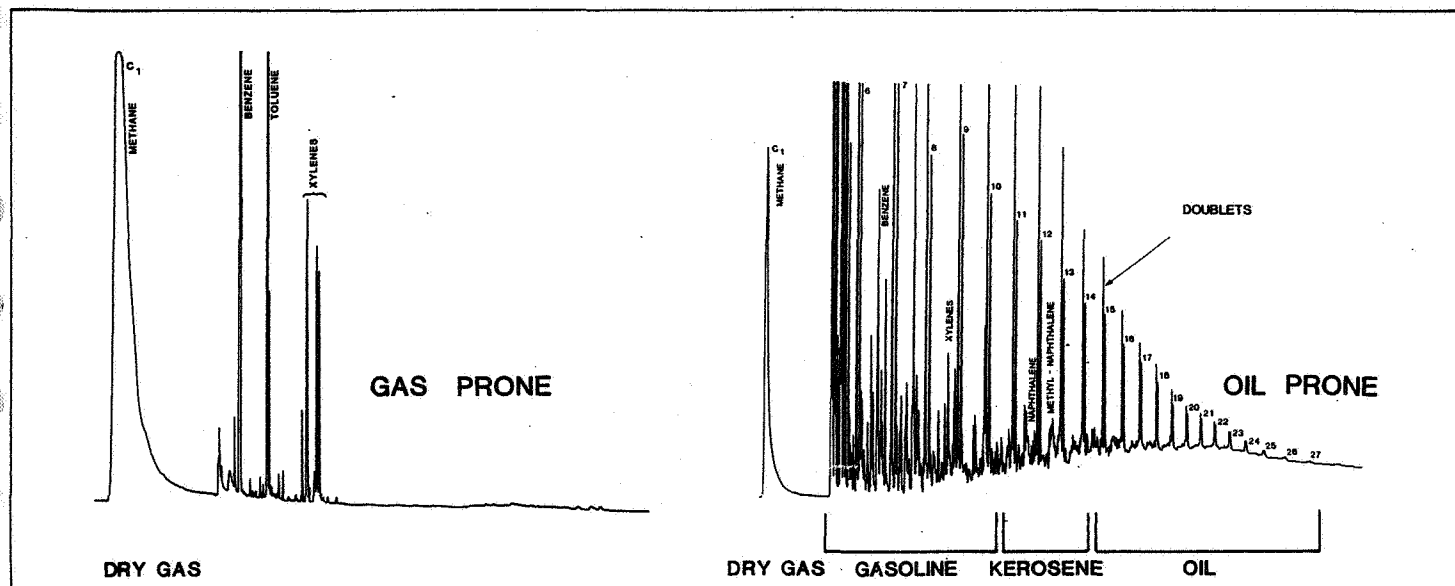


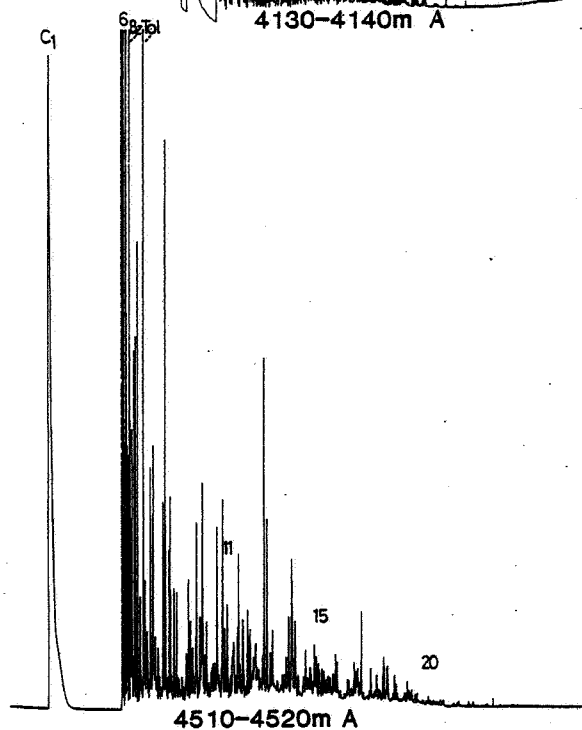
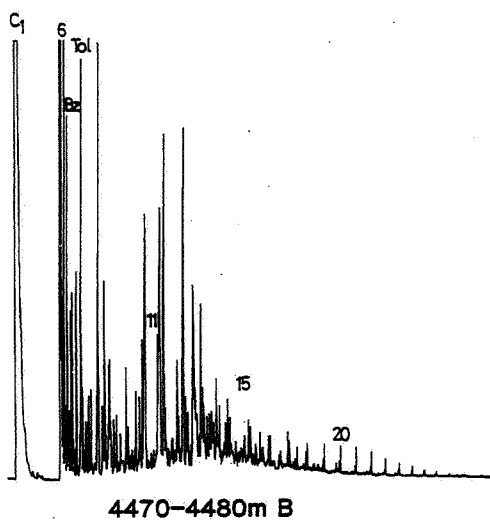
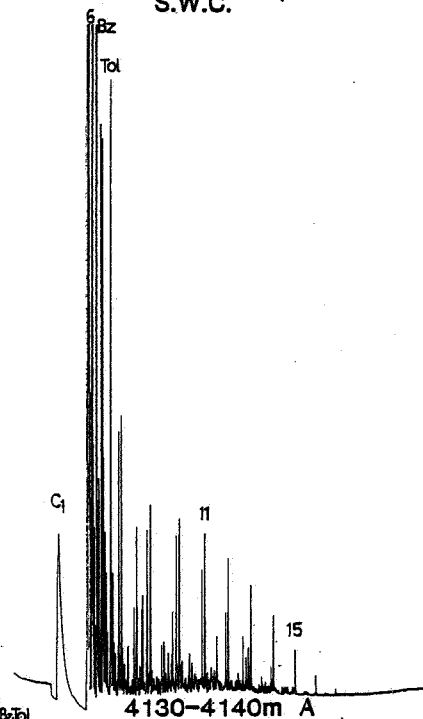
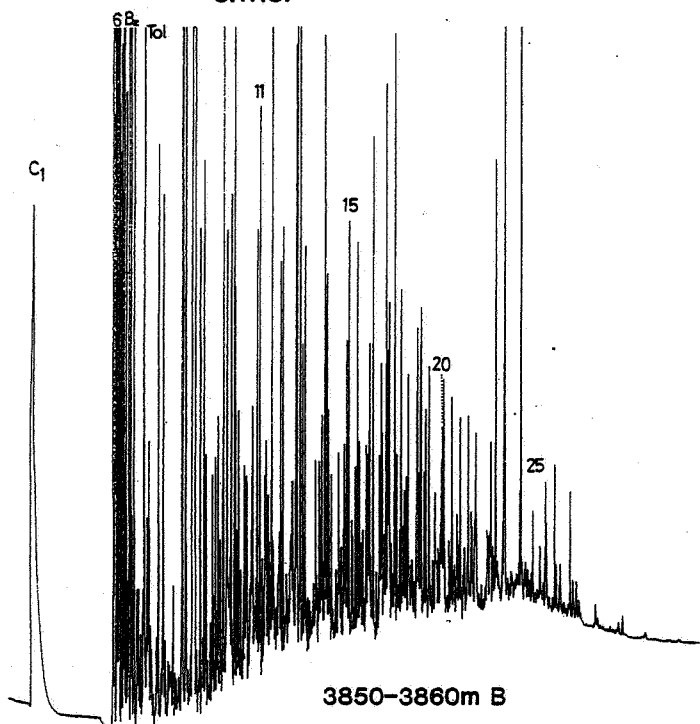
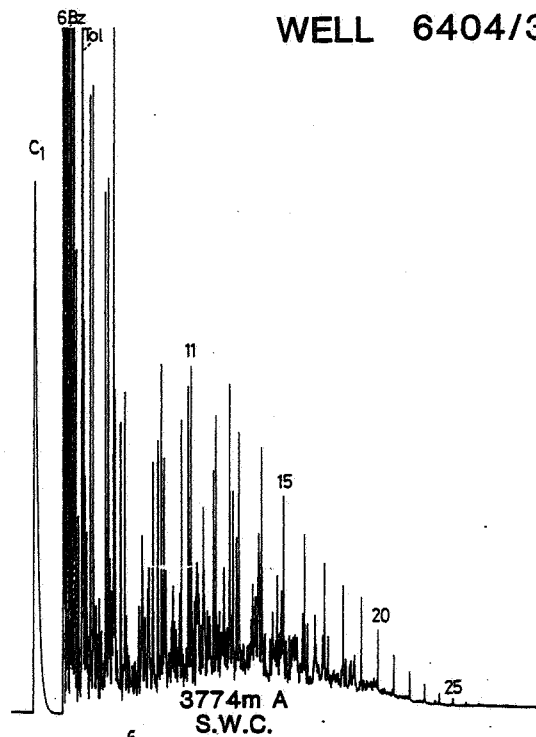
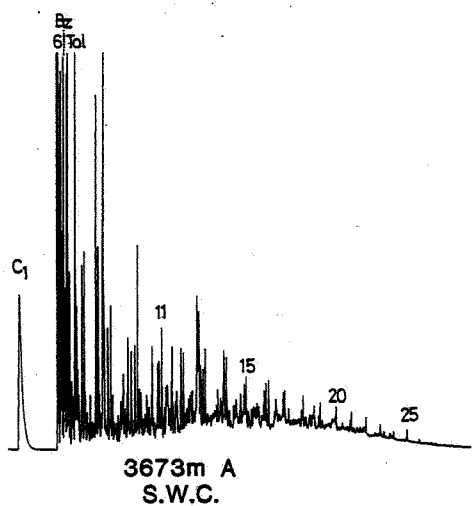
FIGURE 4

ROCKEVAL DATA

WELL 6406/3-1







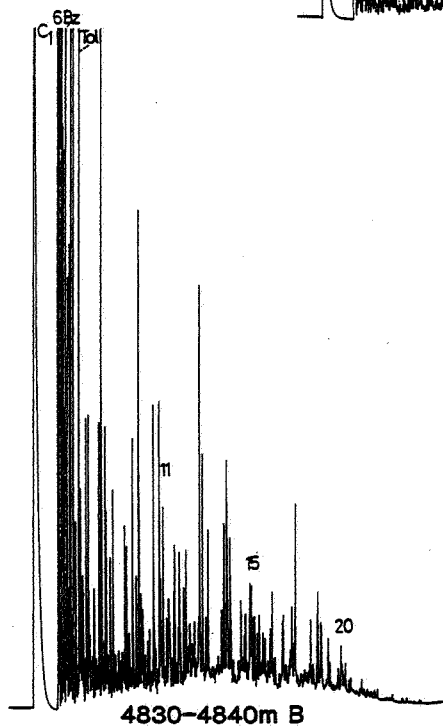
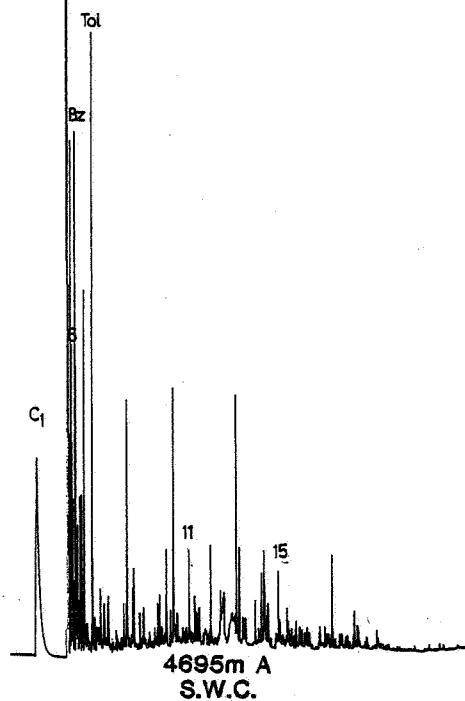
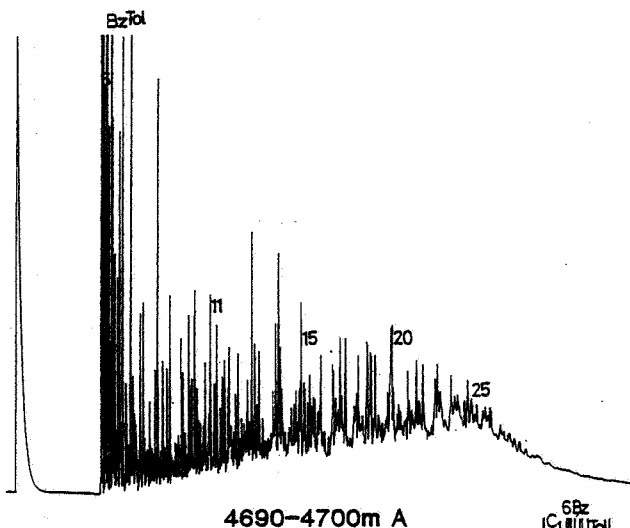
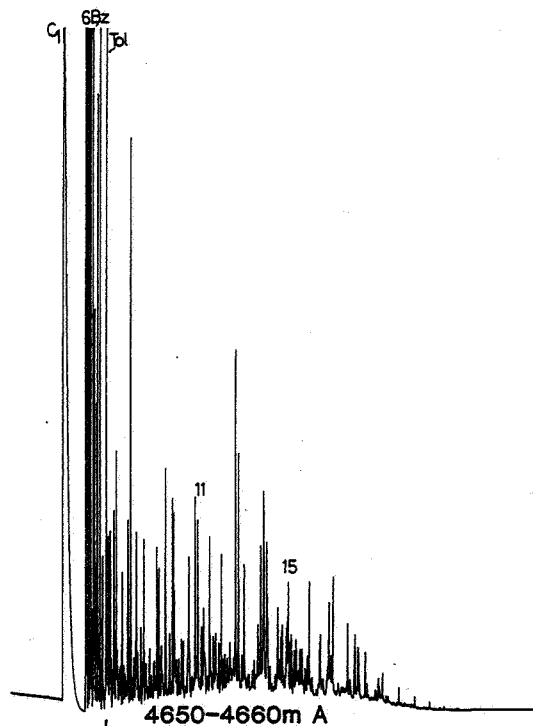
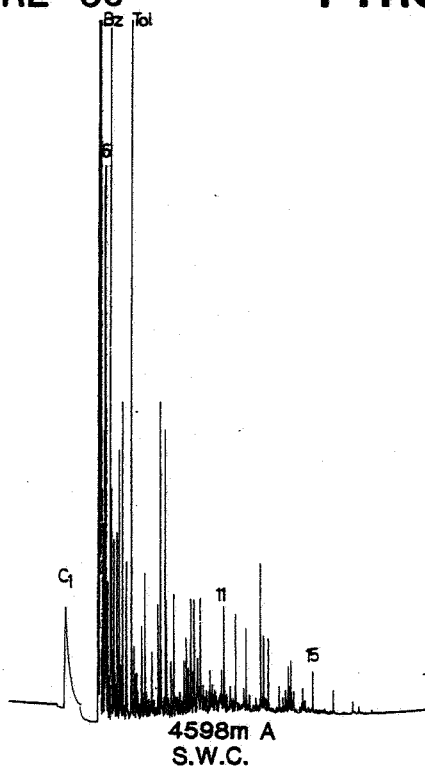
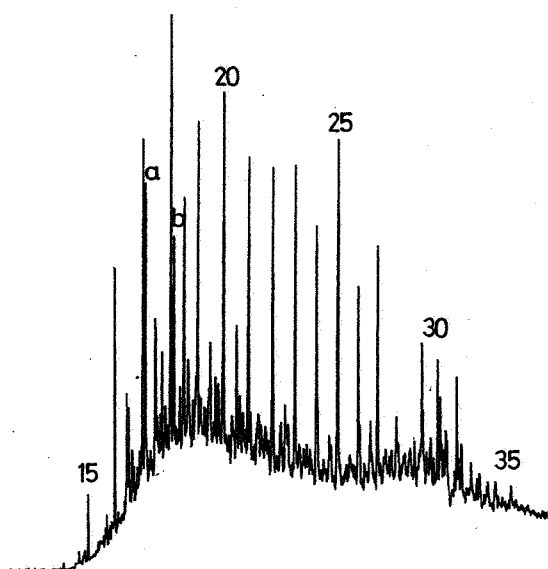
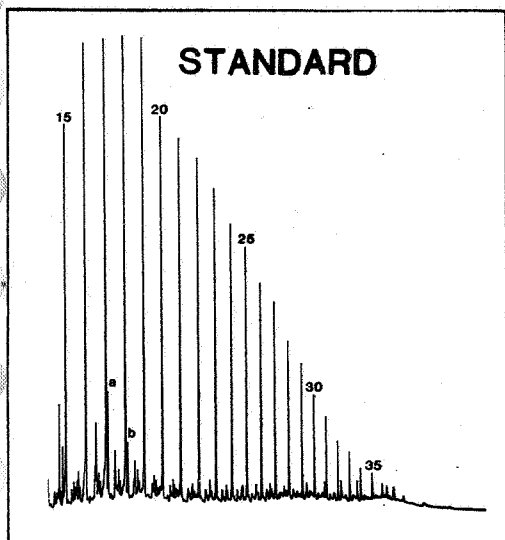


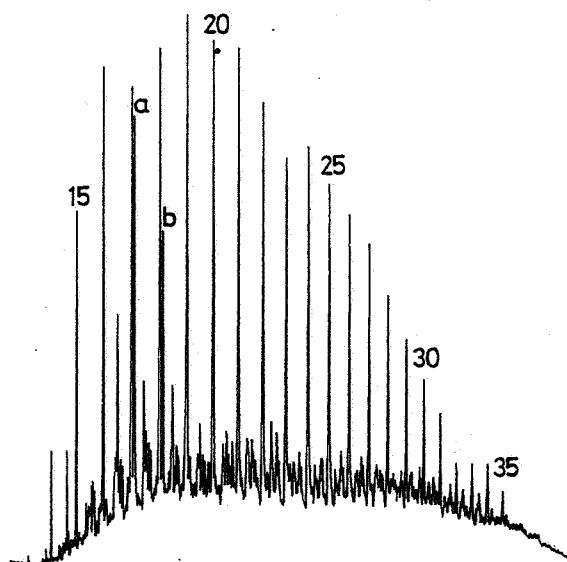
FIGURE 6a

# **C<sub>15+</sub> PARAFFIN - NAPHTHENES**

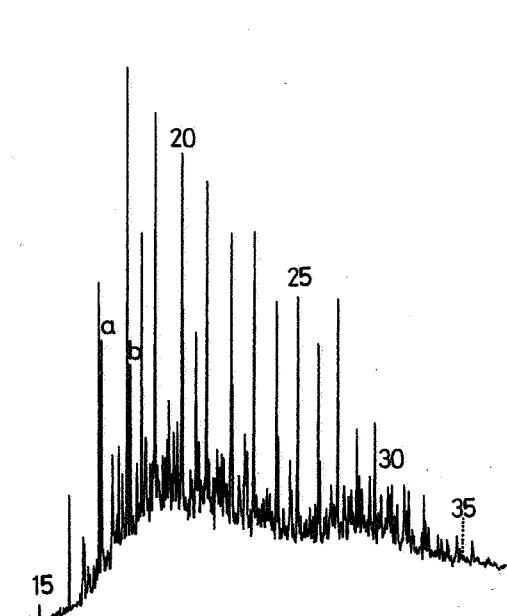
WELL 6406/3-1



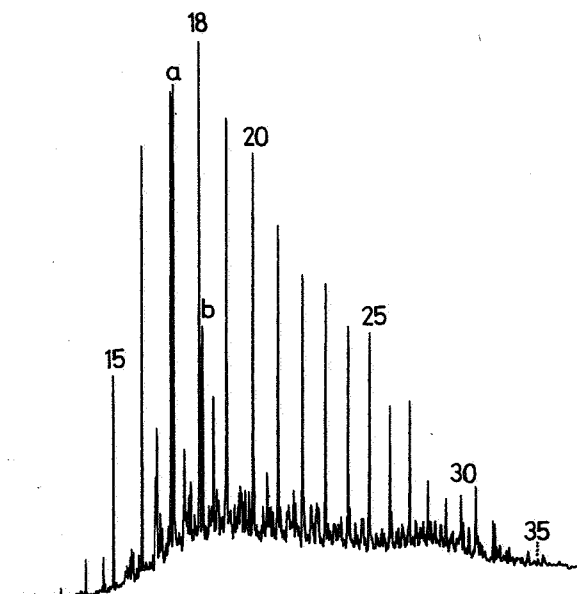
2450-2460m



2550-2560m



2710-2720m A

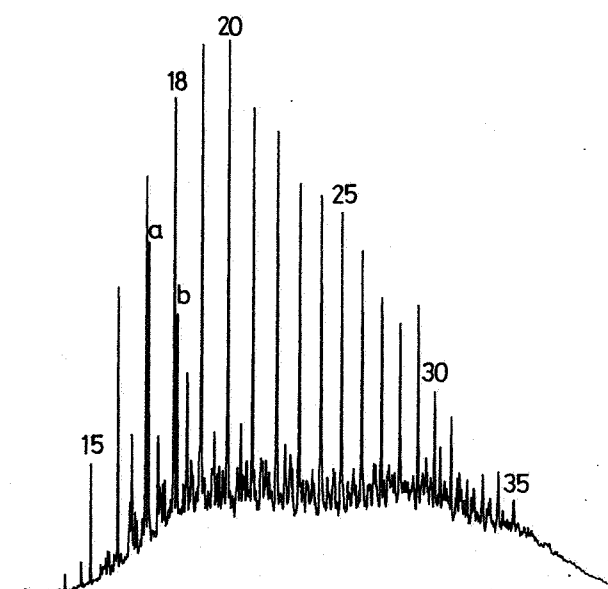


3110-3120m

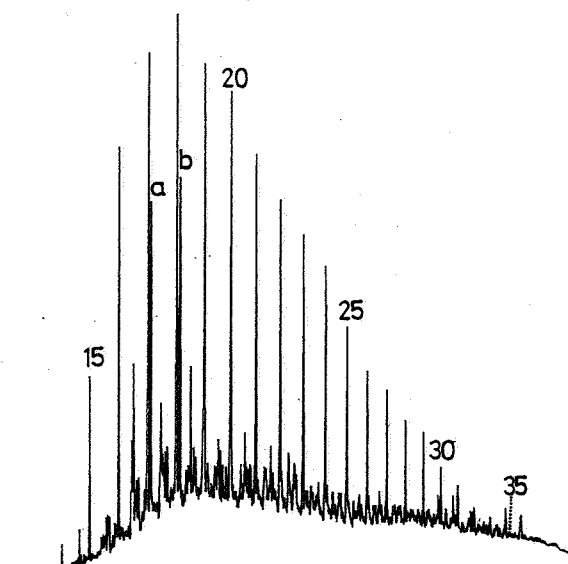
a - PRISTANE  
b - PHYTANE

*red fat unmoderated/moderated/moderated  
materials, kerogen/biohydrogen korb*

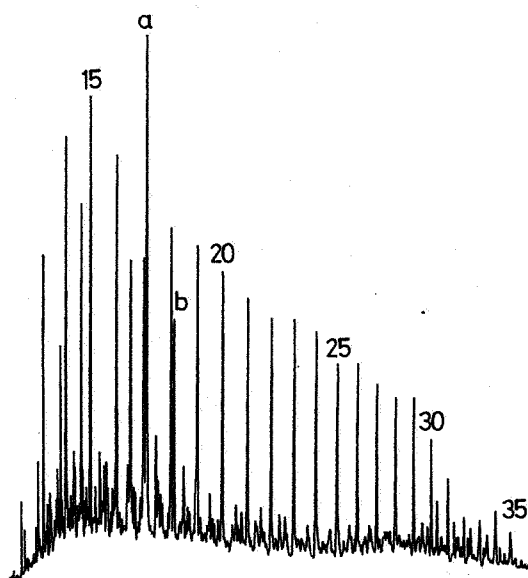
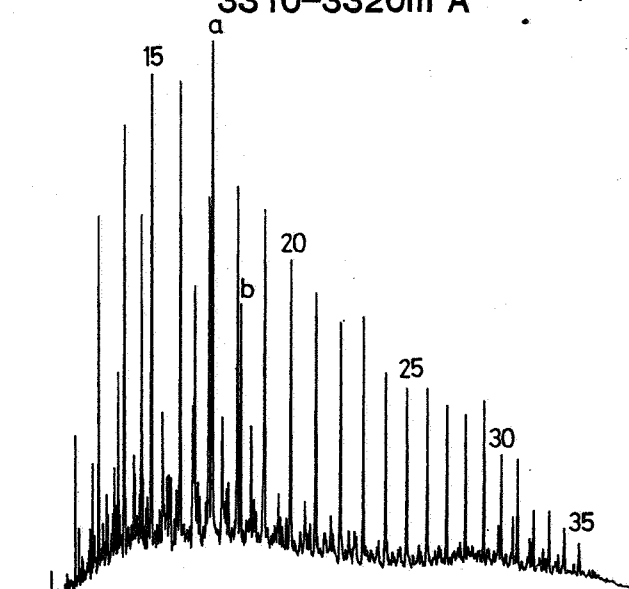
CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC<sub>20</sub>)



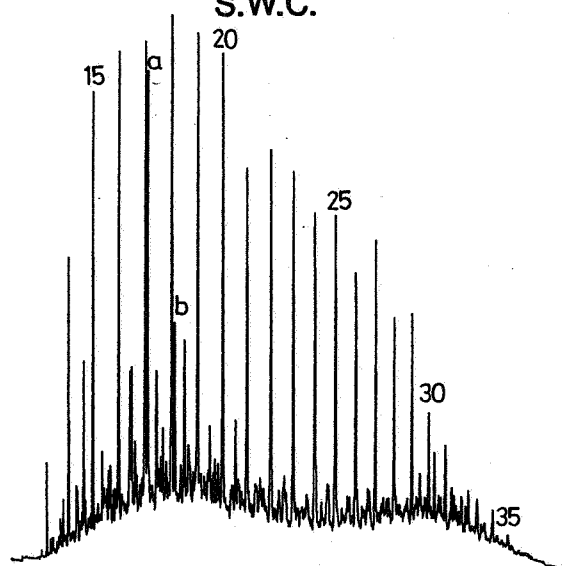
3210-3220m



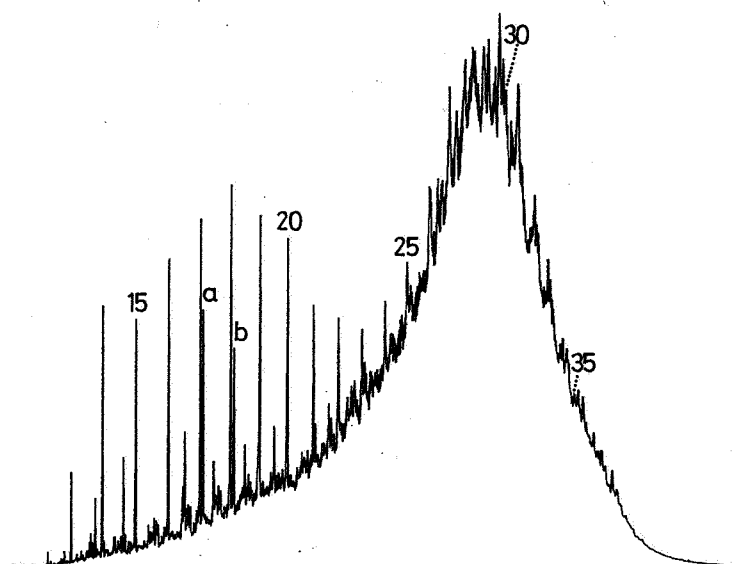
3310-3320m A

3669m A  
S.W.C.

3670-3680m



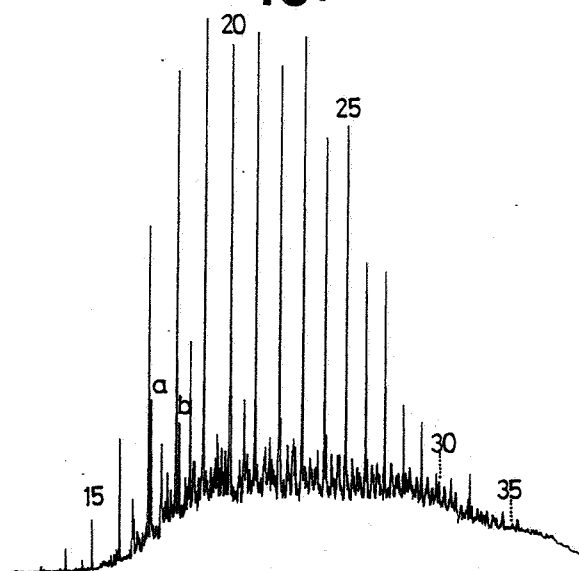
3750-3760m



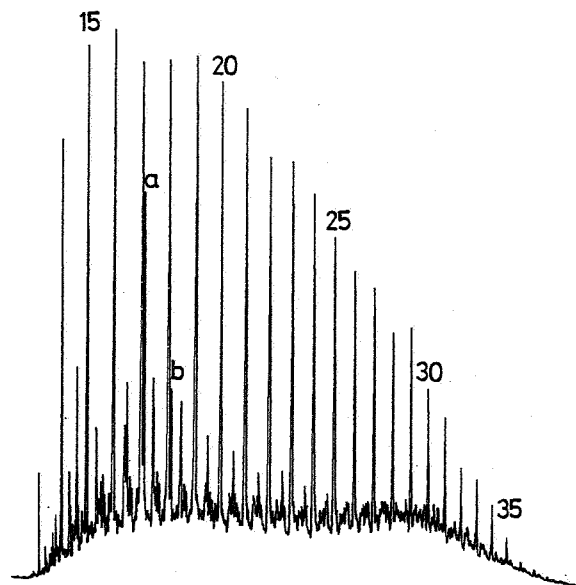
3850-3860m

a - PRISTANE  
b - PHYTANE

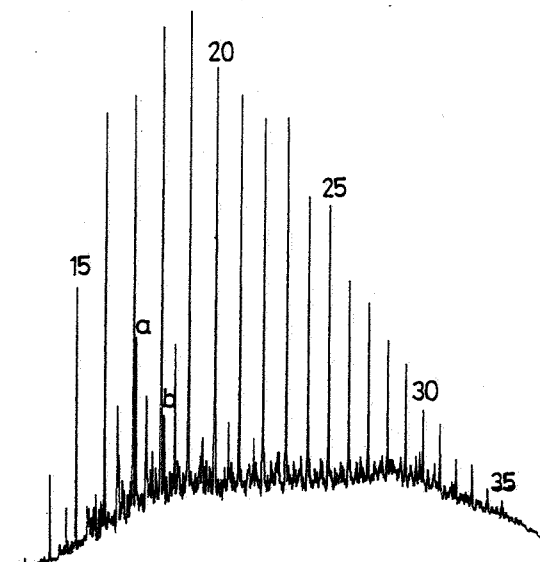
CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC<sub>20</sub>)



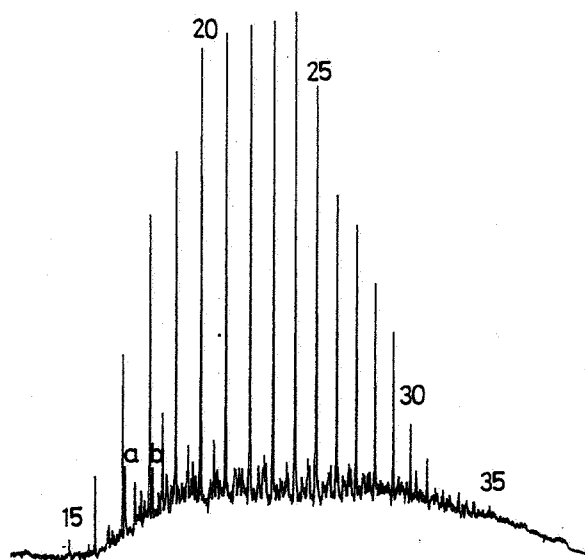
3930-3940m A



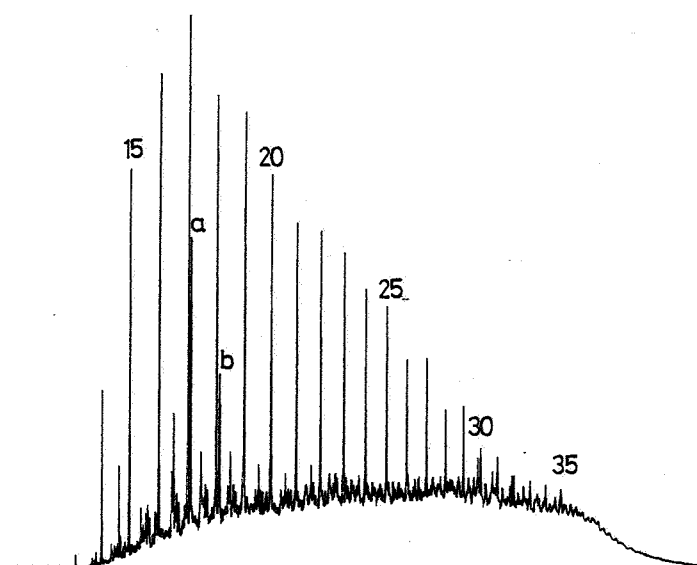
4130-4140m



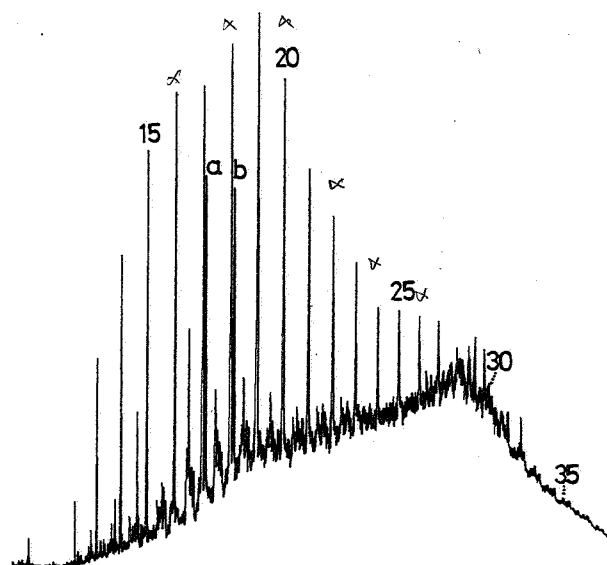
4270-4280m



4350-4360m A



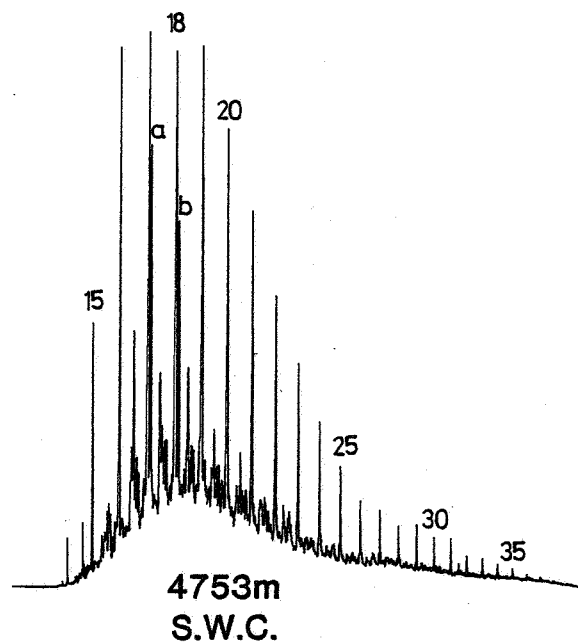
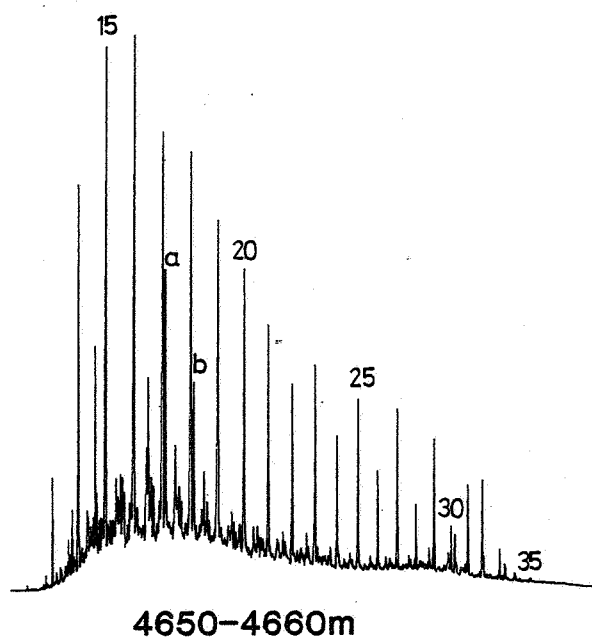
4473.2m A  
S.W.C.



4510-4520m

a - PRISTANE  
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC<sub>20</sub>)



a - PRISTANE  
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC<sub>20</sub>)

FIGURE 7a

# AROMATIC CHROMATOGRAMS

WELL 6406/3-1

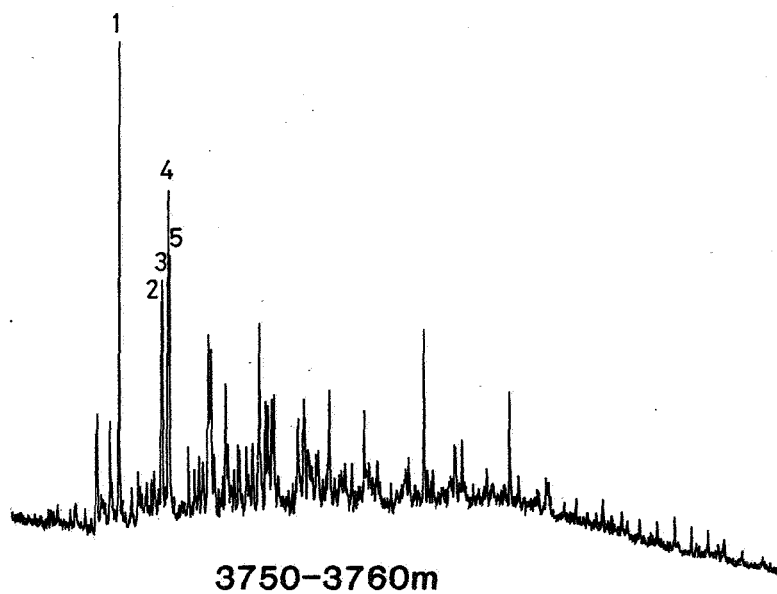
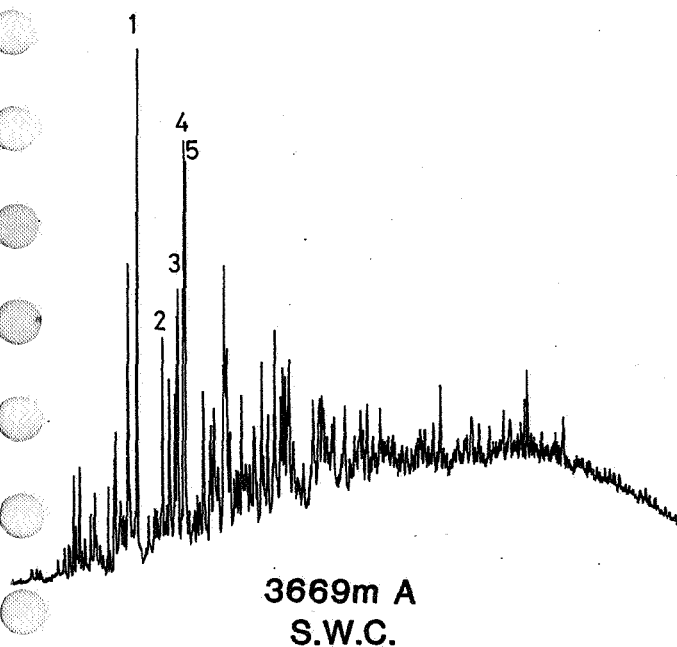
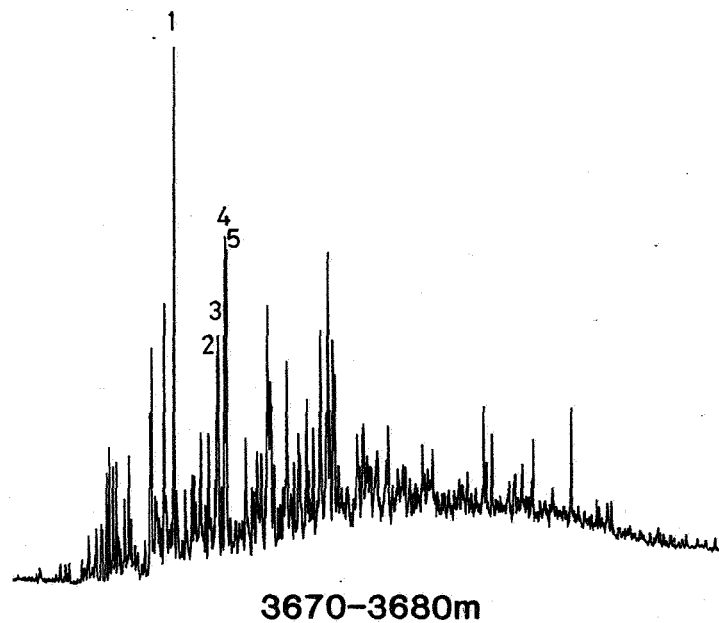
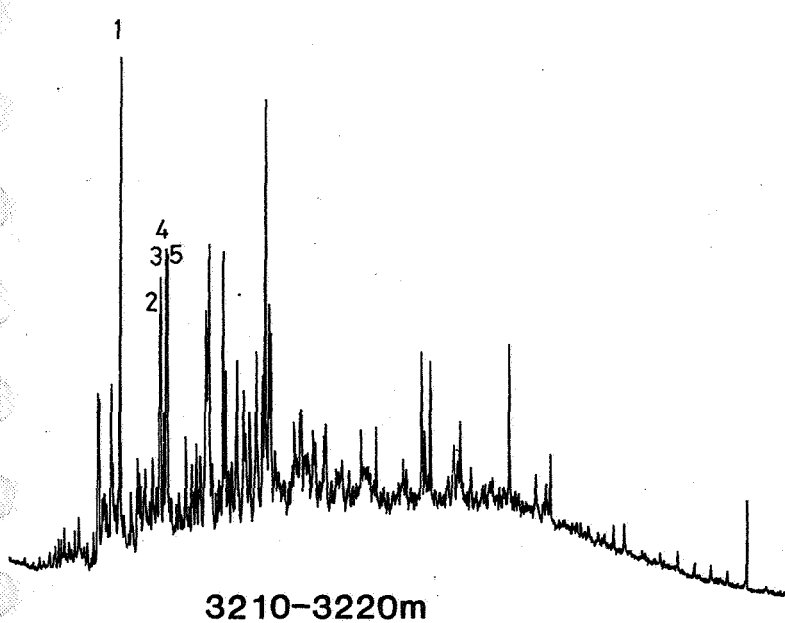
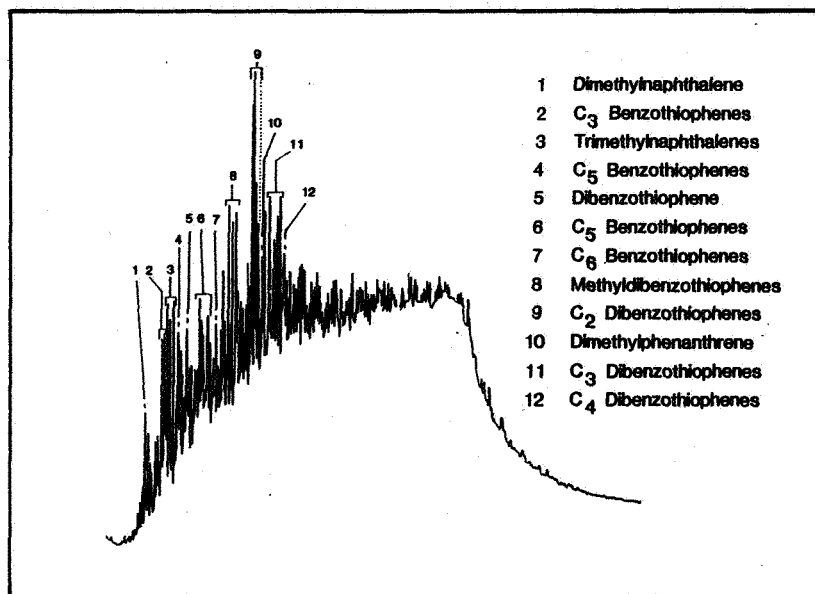
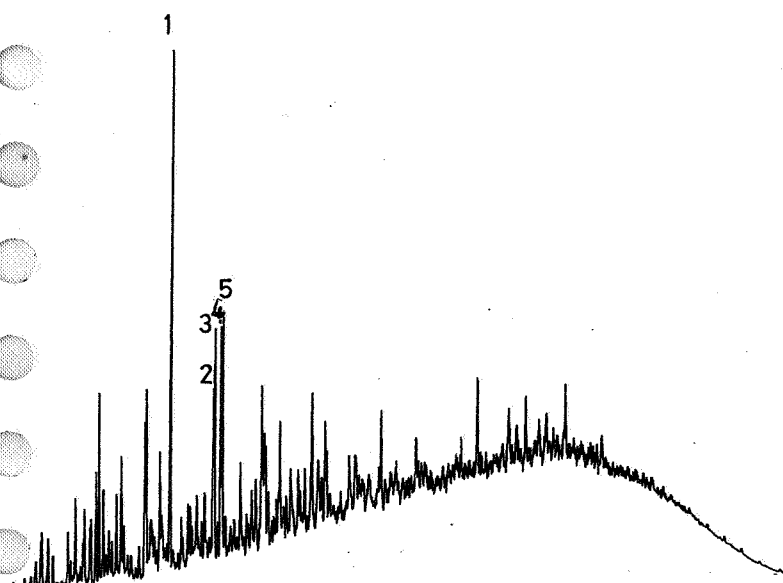
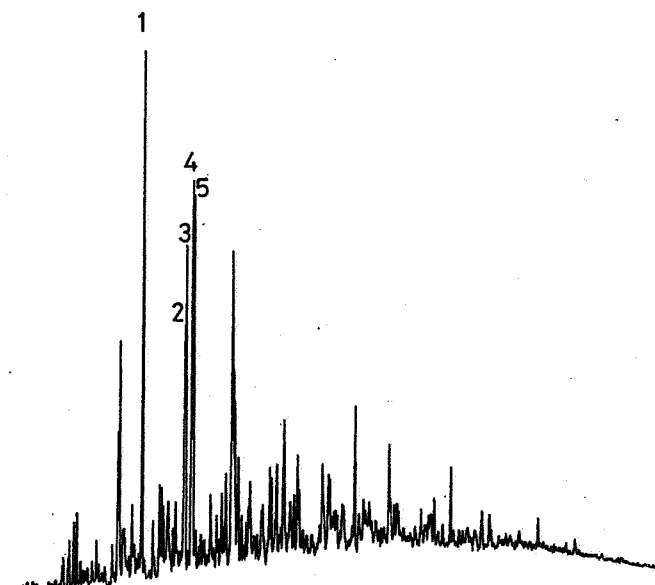


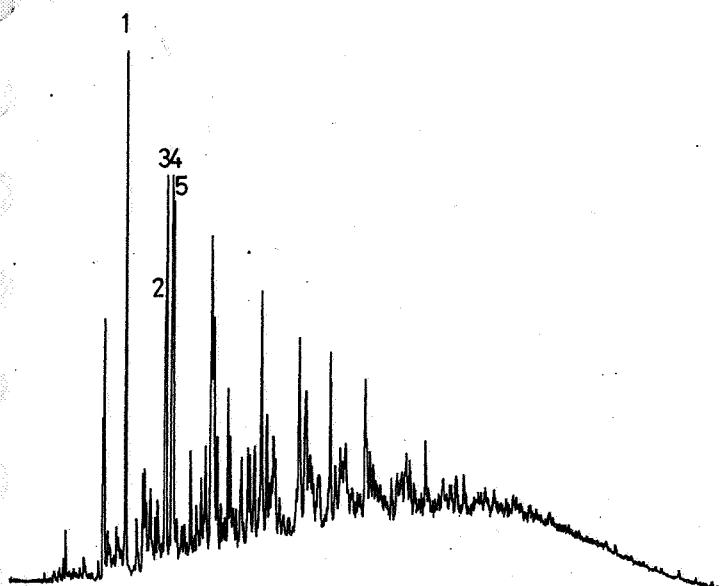
FIGURE 7b AROMATIC CHROMATOGRAMS WELL 6406/3-1



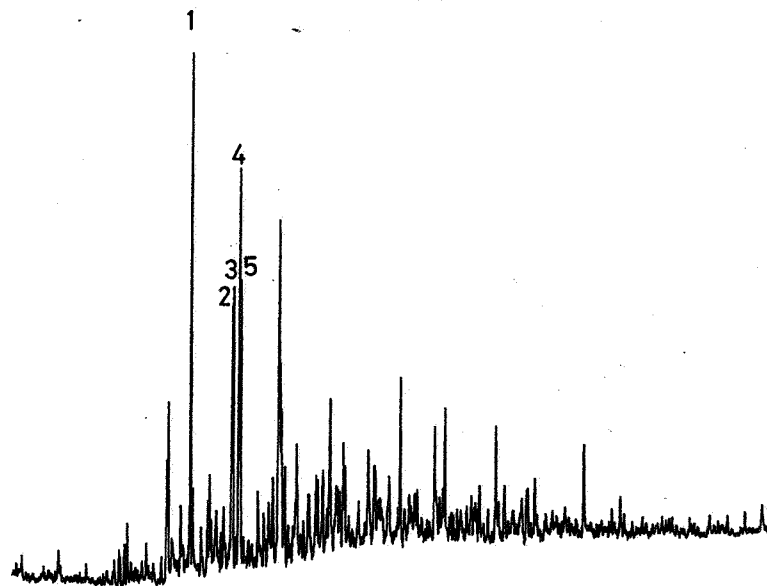
3850-3860m



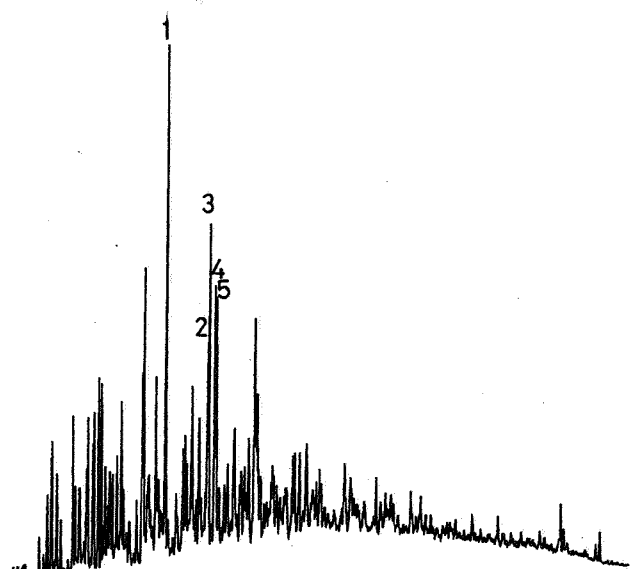
4130-4140m



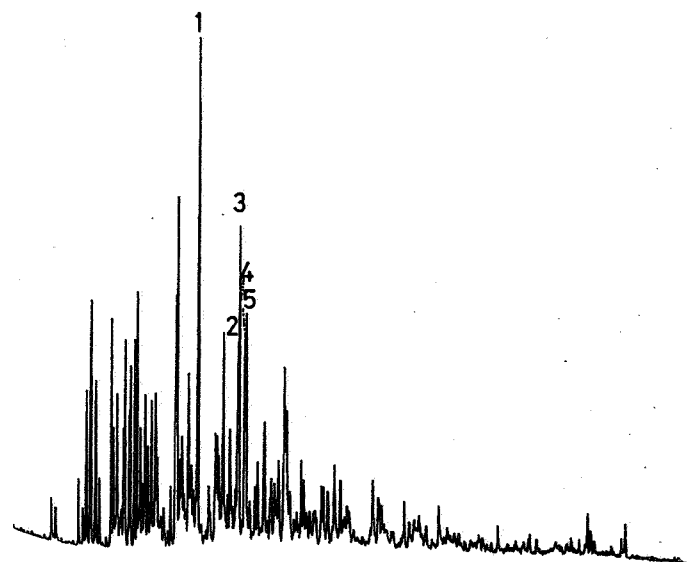
4270-4280m



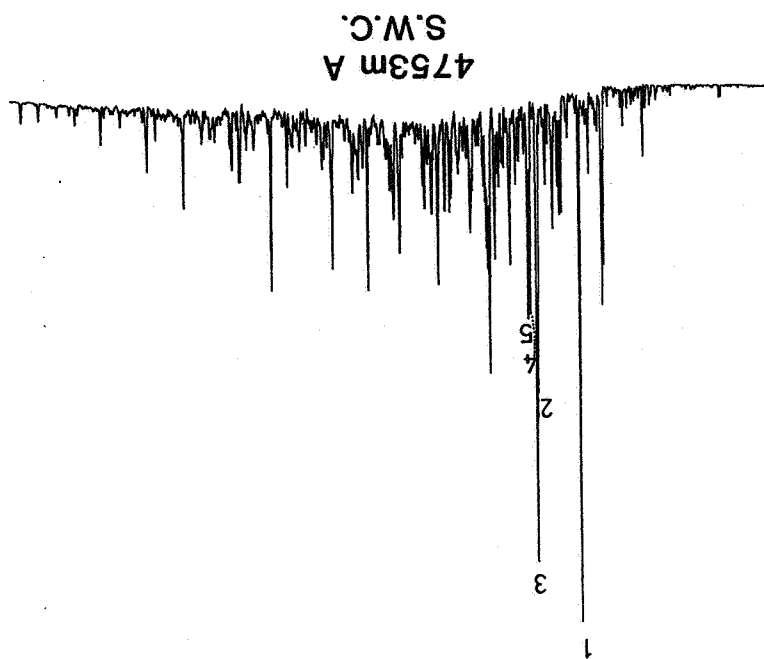
4350-4360m A

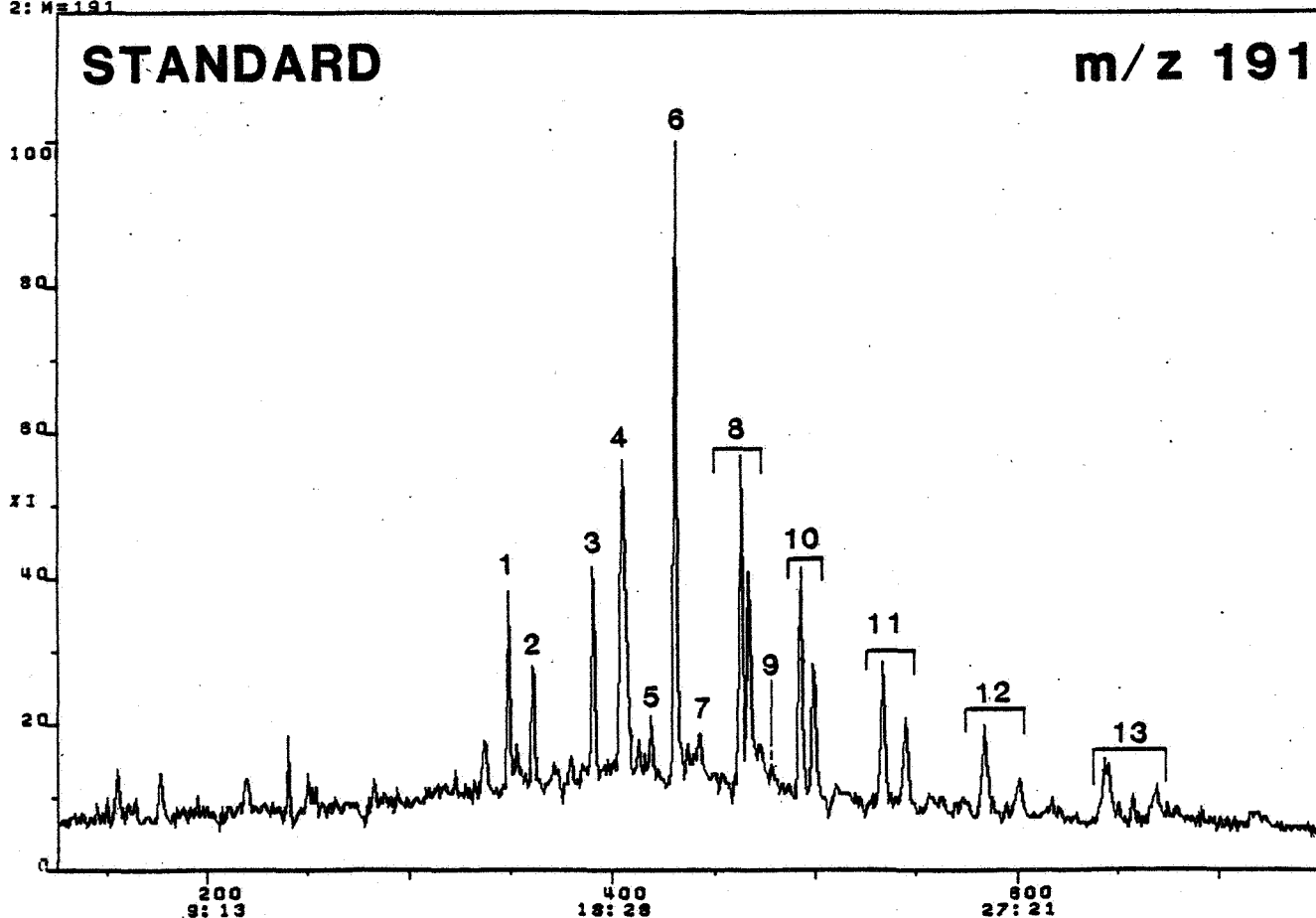


4510-4520m



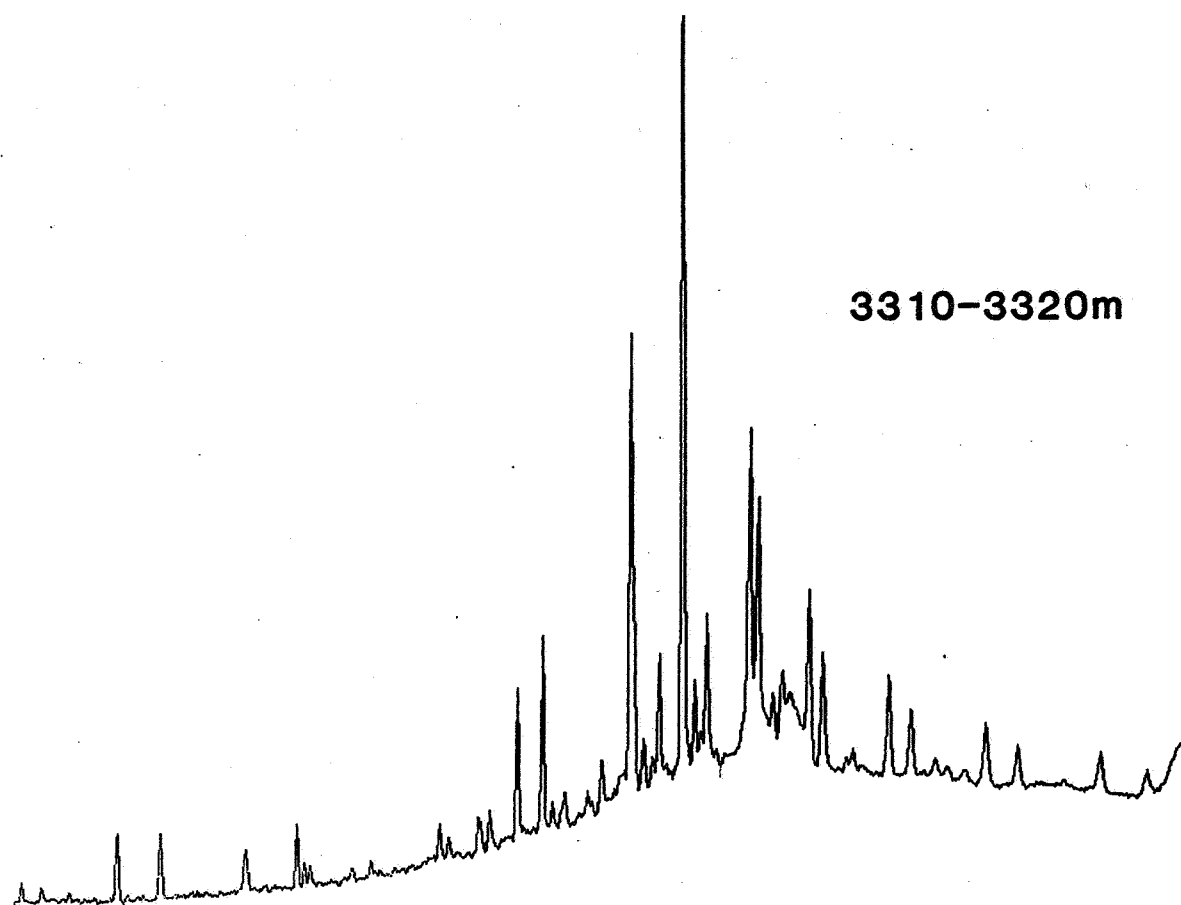
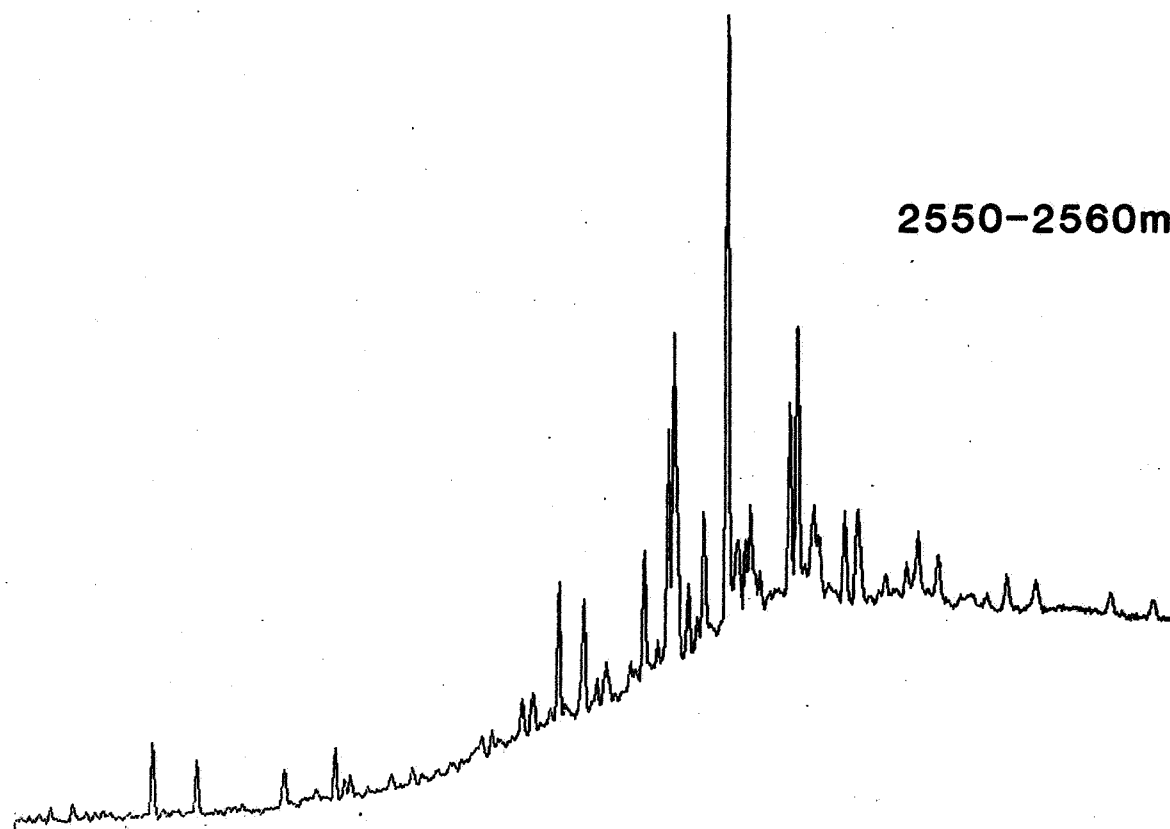
4650-4660m

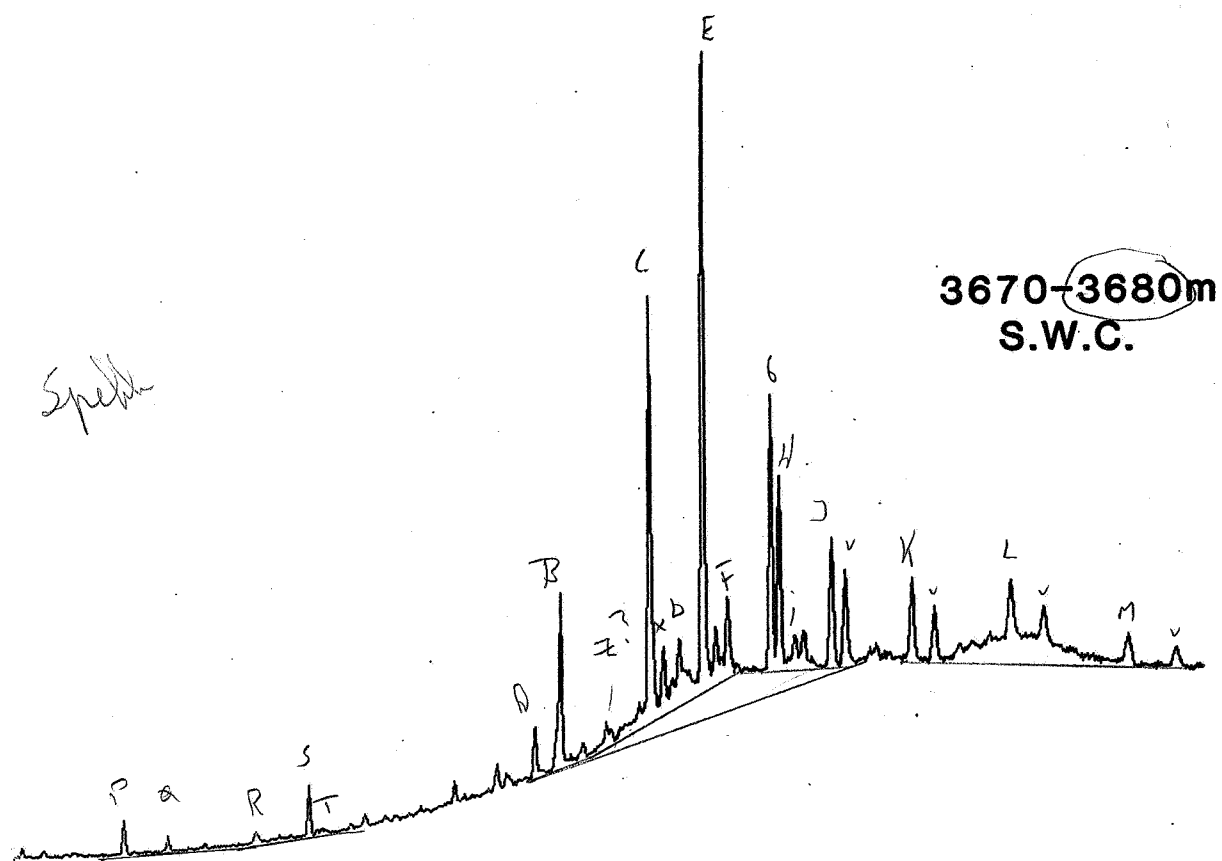
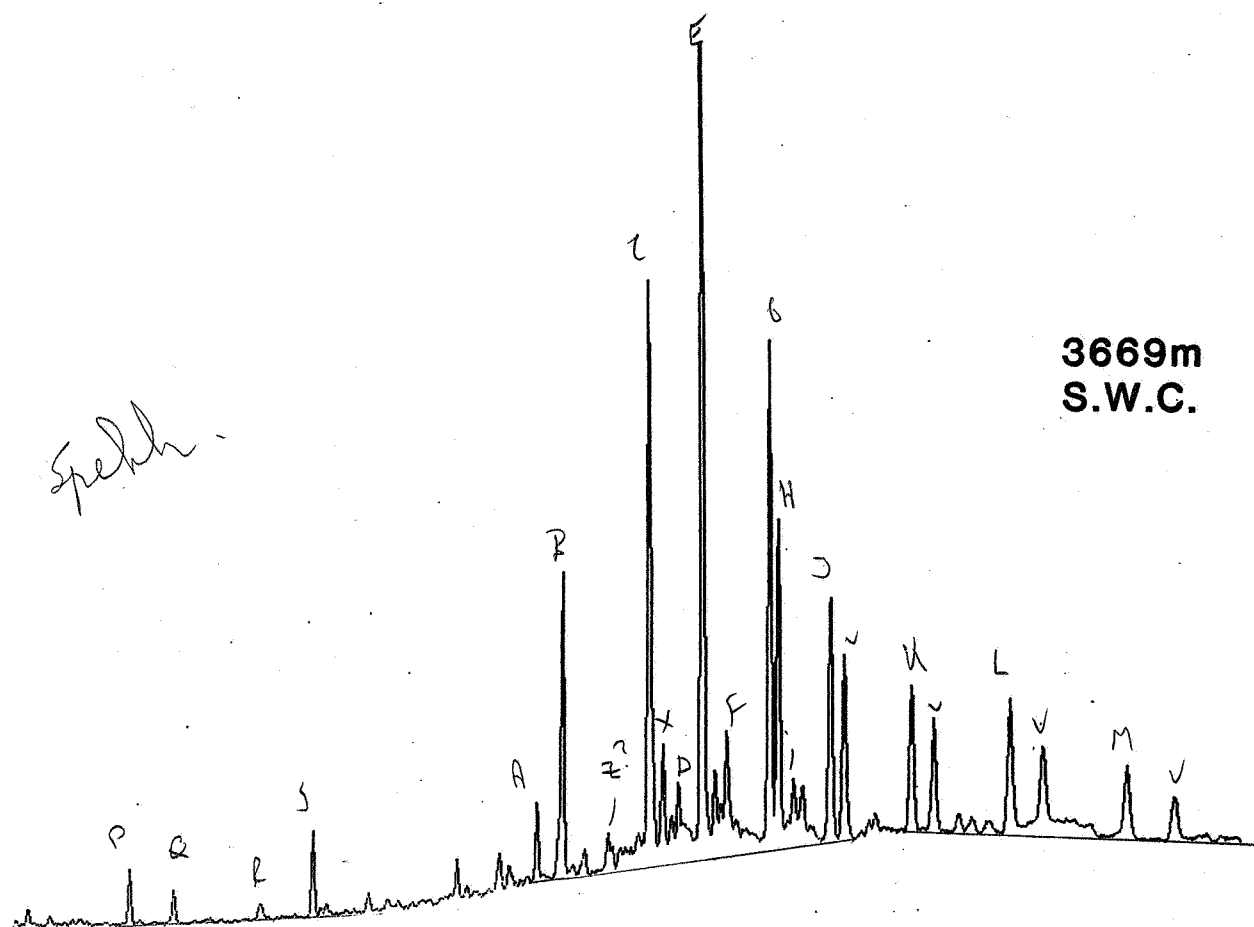




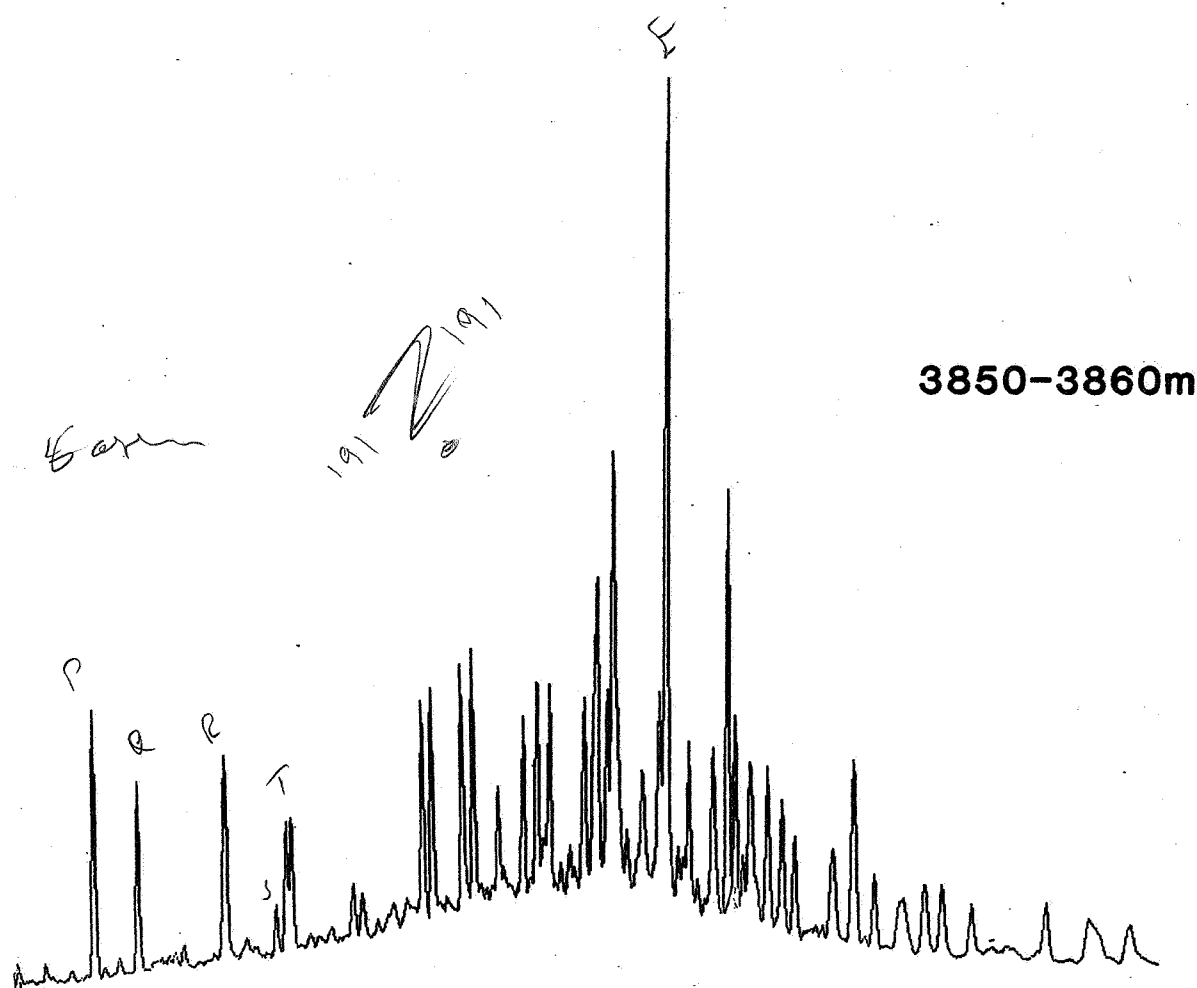
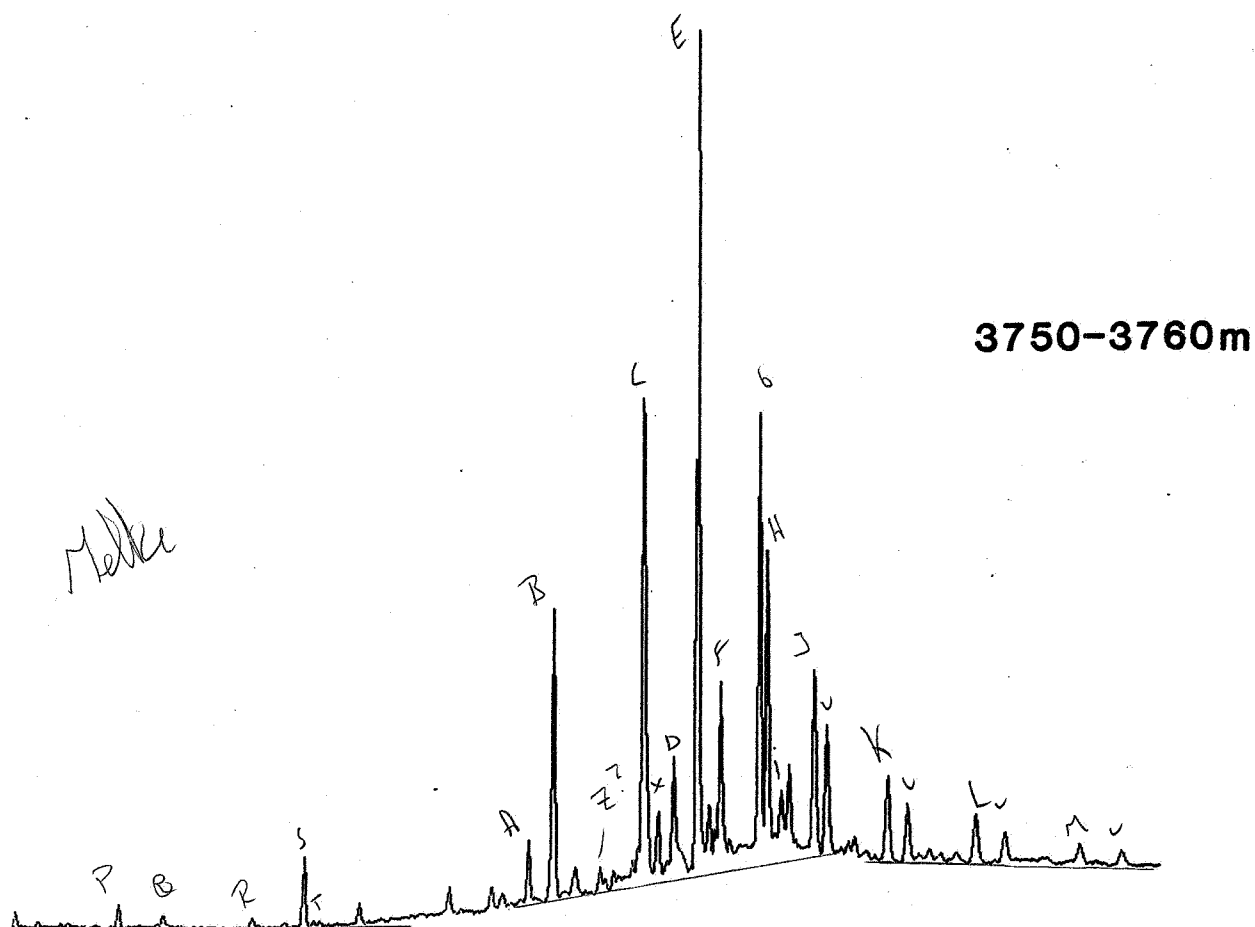
LIST OF IDENTIFIED TRITERPANES

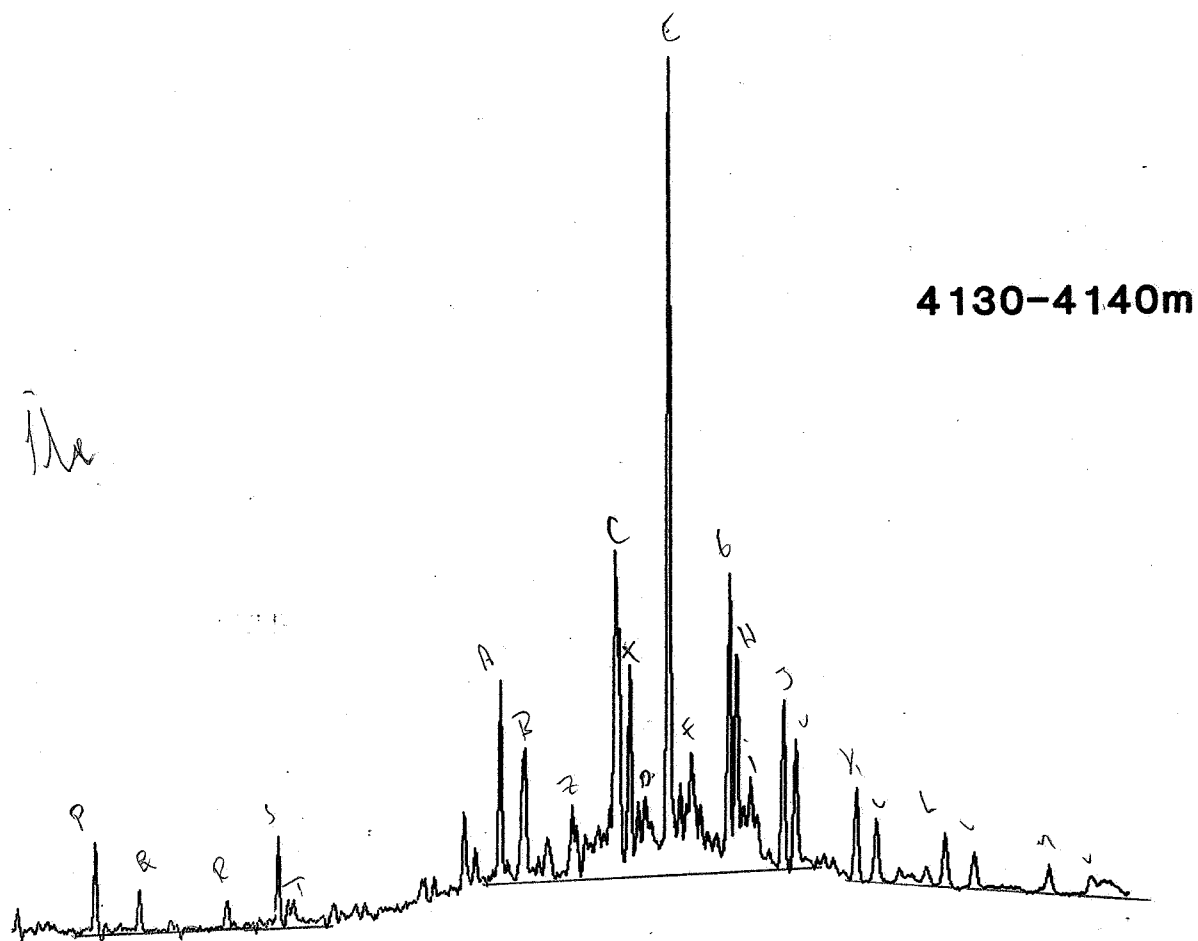
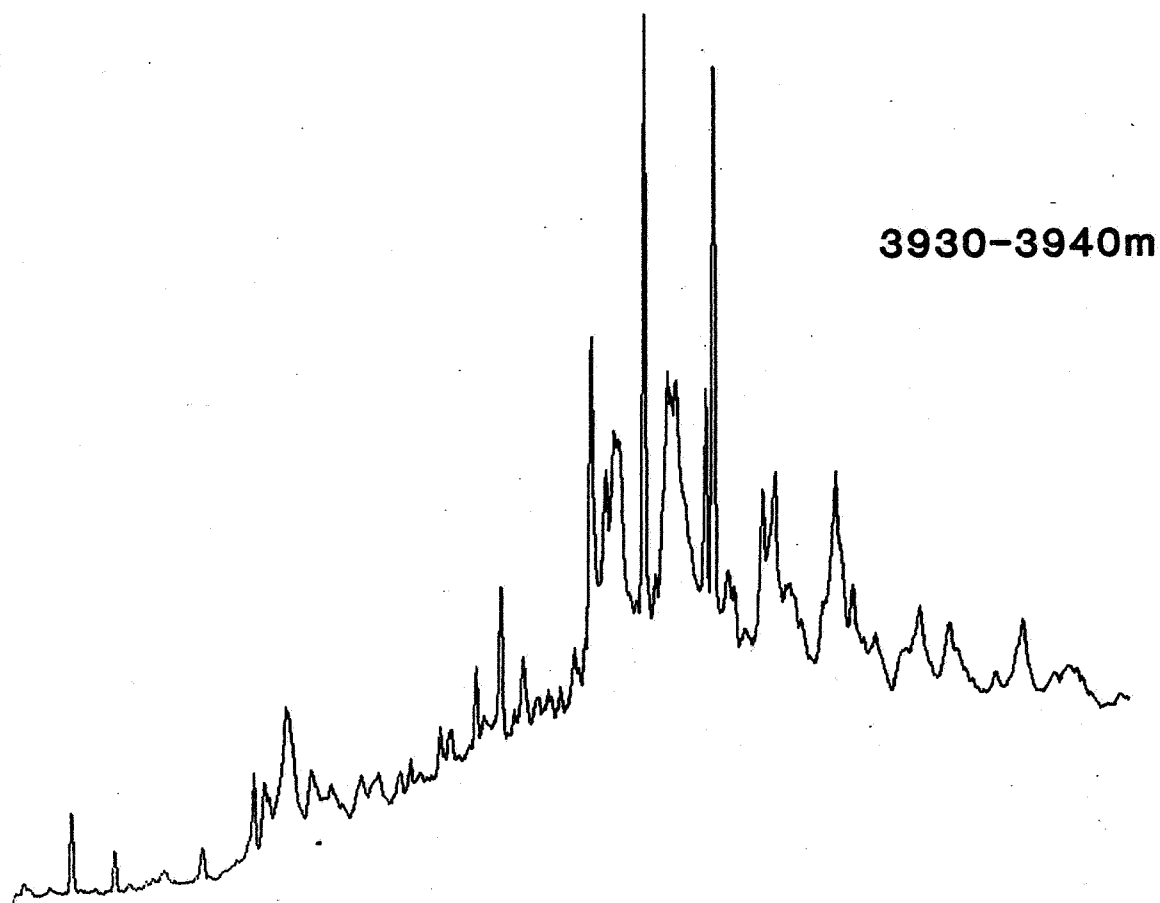
- |                   |                                                |
|-------------------|------------------------------------------------|
| 1                 | 17 $\alpha$ H TRISNORHOPANE (C <sub>27</sub> ) |
| 2                 | 17 $\alpha$ H TRISNORHOPANE (C <sub>27</sub> ) |
| 3                 | BISNORHOPANE (C <sub>28</sub> )                |
| 4                 | 17 $\alpha$ H NORHOPANE (C <sub>29</sub> )     |
| 5                 | NORMORETANE (C <sub>29</sub> )                 |
| 6                 | 17 $\alpha$ H HOPANE (C <sub>30</sub> )        |
| 7                 | 17 $\alpha$ H MORETANE (C <sub>30</sub> )      |
| 8 (22S)<br>(22R)  | 17 $\alpha$ H HOMOHOPANES (C <sub>31</sub> )   |
| 9                 | GAMMACERANE                                    |
| 10 (22S)<br>(22R) | BISHOMOHOPANE (C <sub>32</sub> )               |
| 11 (22S)<br>(22R) | TRISHOMOHOPANES (C <sub>33</sub> )             |
| 12 (22S)<br>(22R) | TETRAHOPANES (C <sub>34</sub> )                |
| 13 (22S)<br>(22R) | HOPANES (C <sub>35</sub> )                     |

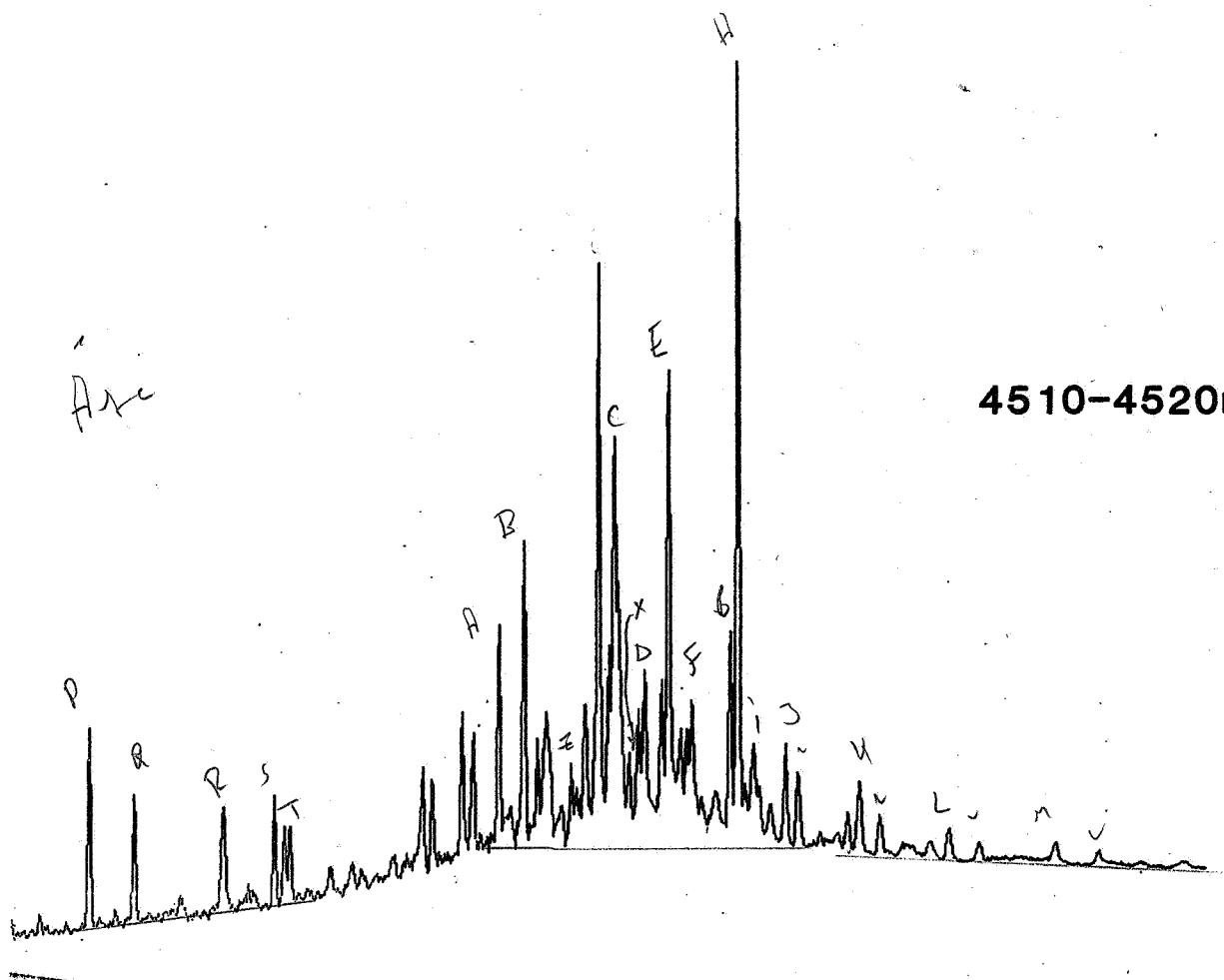
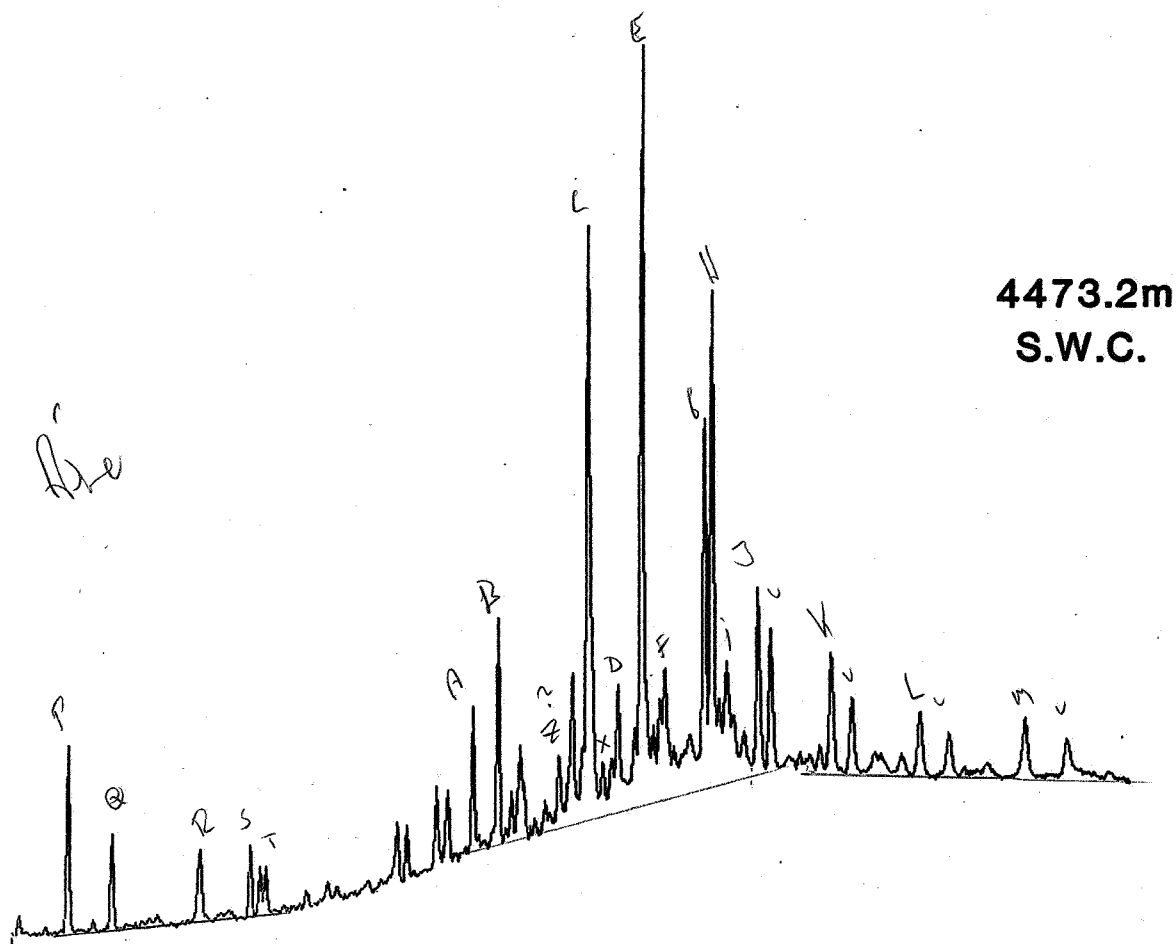
TRITERPANES  $m/z$  191

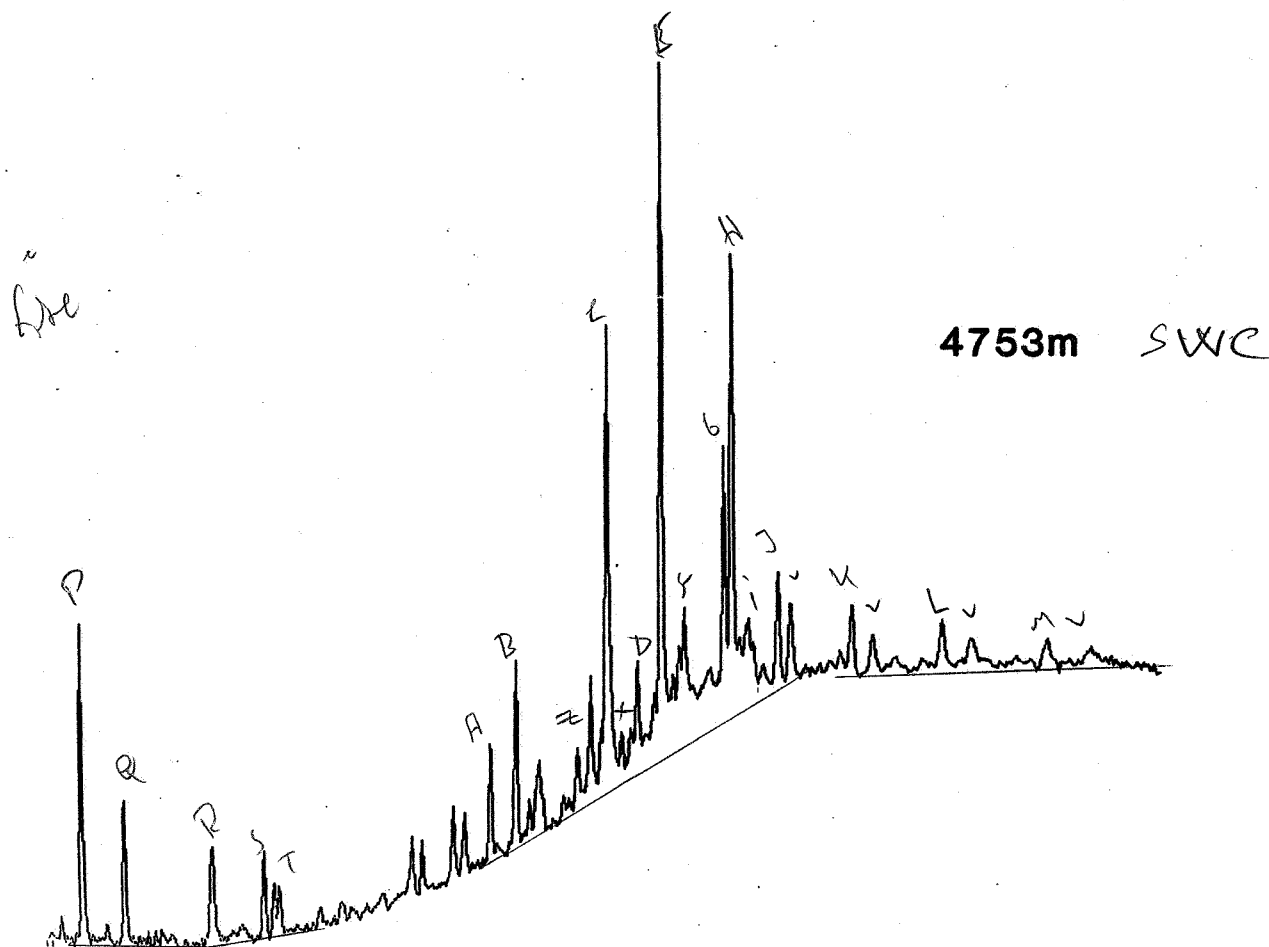
TRITERPANES  $m/z$  191

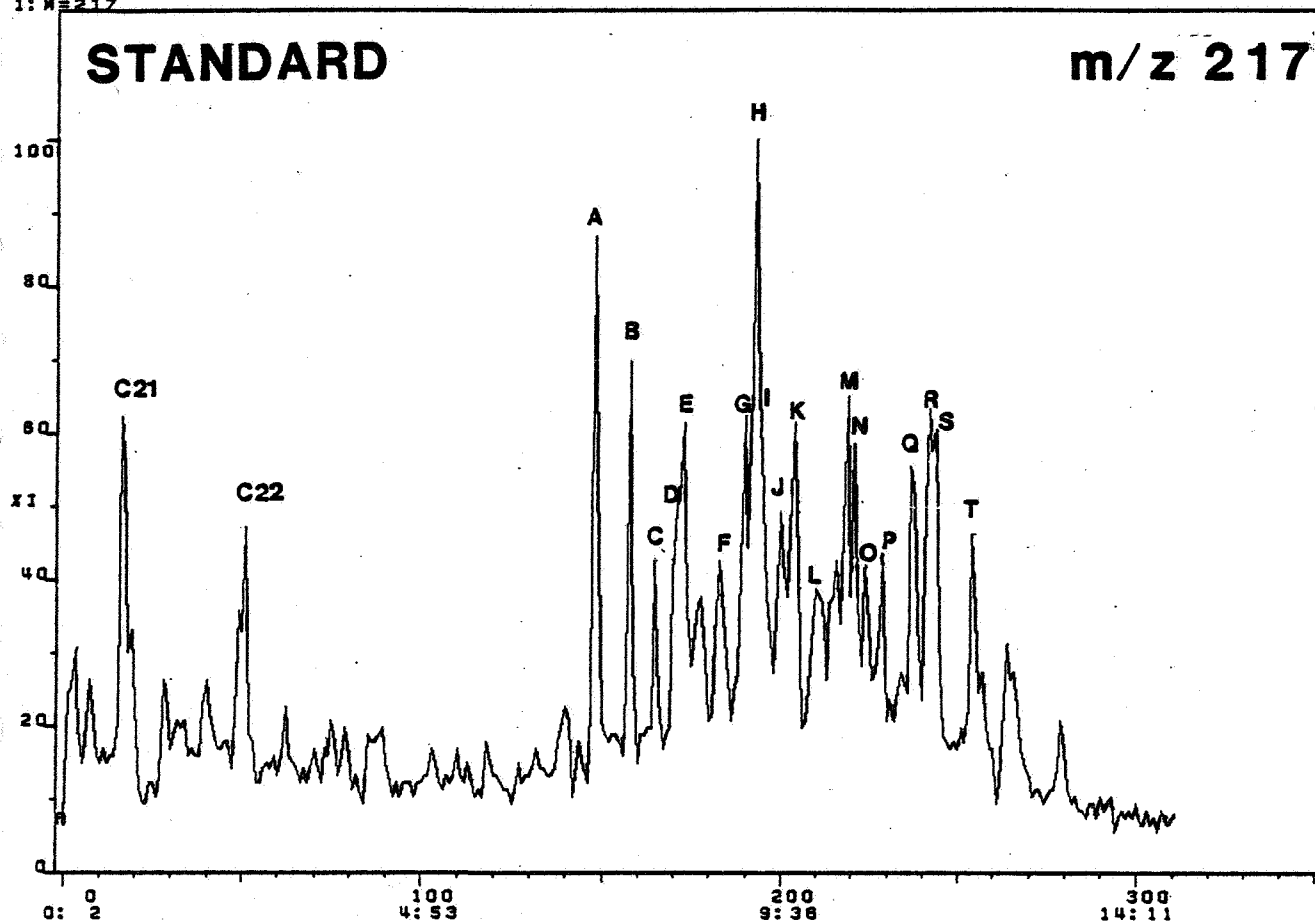
TRITERPANES  $m/z$  191



TRITERPANES  $m/z$  191

TRITERPANES  $m/z$  191

TRITERPANES  $m/z$  191



LIST OF IDENTIFIED STERANES

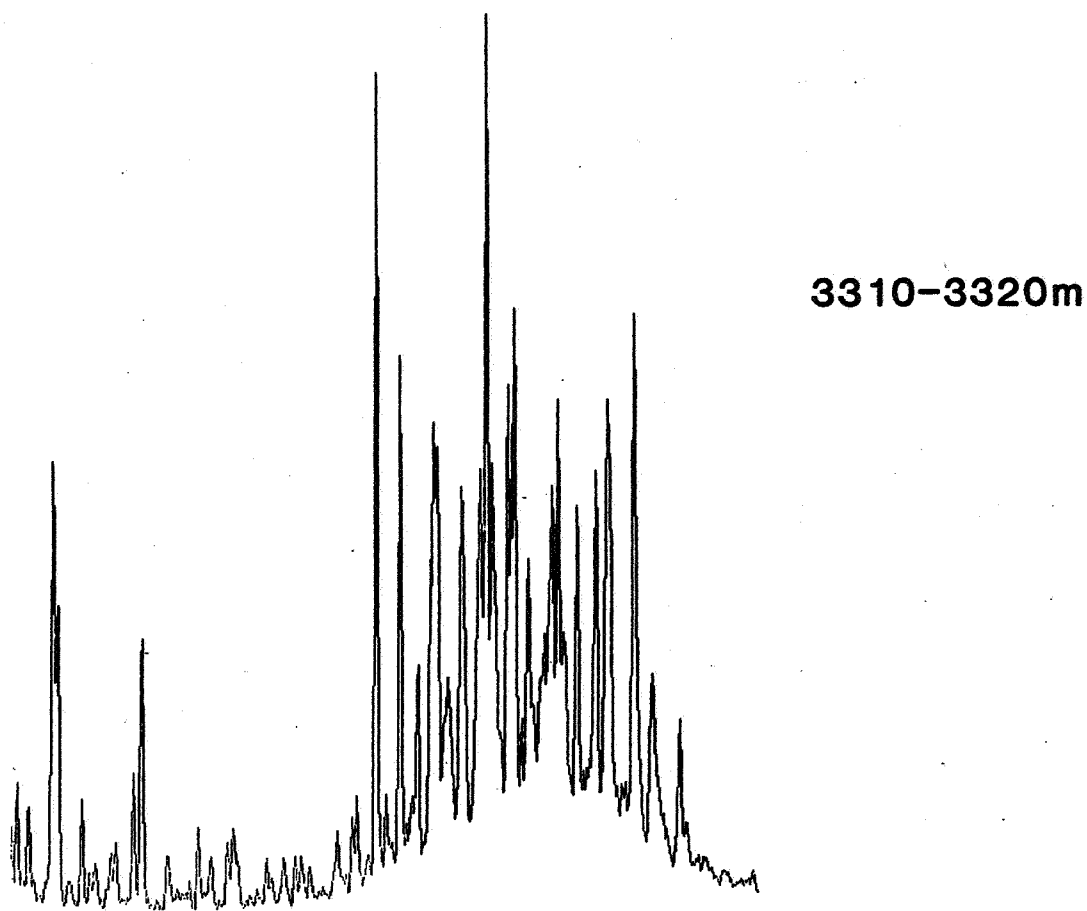
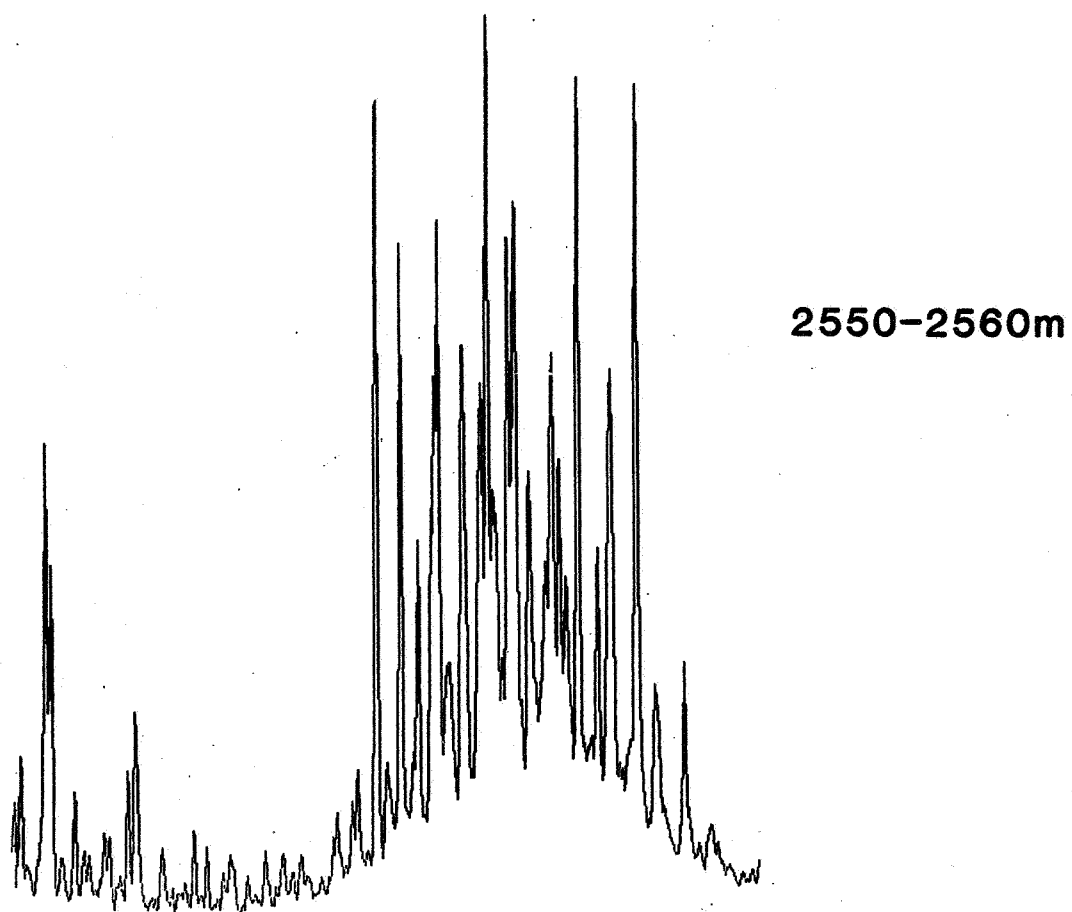
- A C<sub>27</sub> DIACHOLESTANE (20S)
- B C<sub>27</sub> DIACHOLESTANE (20R)
- C C<sub>27</sub> DIACHOLESTANE (20S)
- D C<sub>27</sub> DIACHOLESTANE (20R)
- E C<sub>28</sub> METHYL DIACHOLESTANE (20S)
- F C<sub>28</sub> METHYL DIACHOLESTANE (20R)
- G C<sub>28</sub> METHYL DIACHOLESTANE (20S)
- H C<sub>29</sub> ETHYL DIACHOLESTANE (20S)
- I C<sub>27</sub> CHOLESTANE (20S) & C<sub>28</sub> METHYL DIACHOLESTANE (20R)
- J C<sub>27</sub> CHOLESTANE (20R)
- K C<sub>29</sub> ETHYL DIACHOLESTANE (20R)
- L C<sub>29</sub> ETHYL DIACHOLESTANE (20S)
- M C<sub>28</sub> METHYL CHOLESTANE (20S)
- N C<sub>29</sub> ETHYL DIACHOLESTANE (20R)
- O C<sub>28</sub> METHYL CHOLESTANE (20S)
- P C<sub>28</sub> METHYL CHOLESTANE (20R)
- Q C<sub>29</sub> ETHYL CHOLESTANE (20S) [ $\alpha$   $\alpha$ ]
- R C<sub>29</sub> ETHYL CHOLESTANE (20R) [ $\beta$   $\beta$ ]
- S C<sub>29</sub> ETHYL CHOLESTANE (20S) [ $\beta$   $\beta$ ]
- T C<sub>29</sub> ETHYL CHOLESTANE (20R) [ $\alpha$   $\alpha$ ]

FIGURE 8g

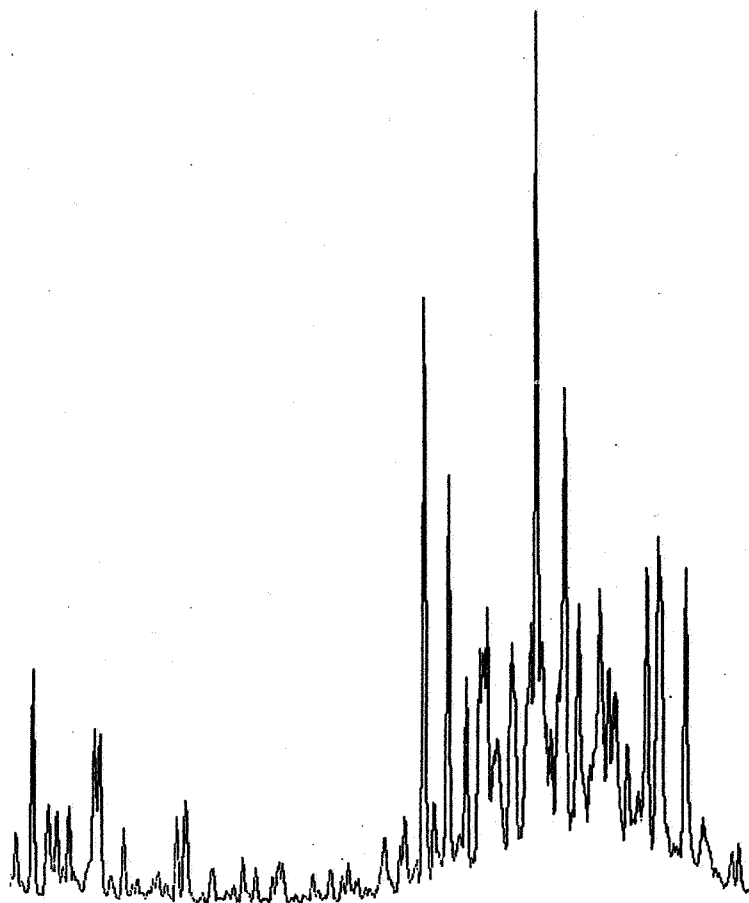
MASS FRAGMENTOGRAMS

WELL 6406/3-1

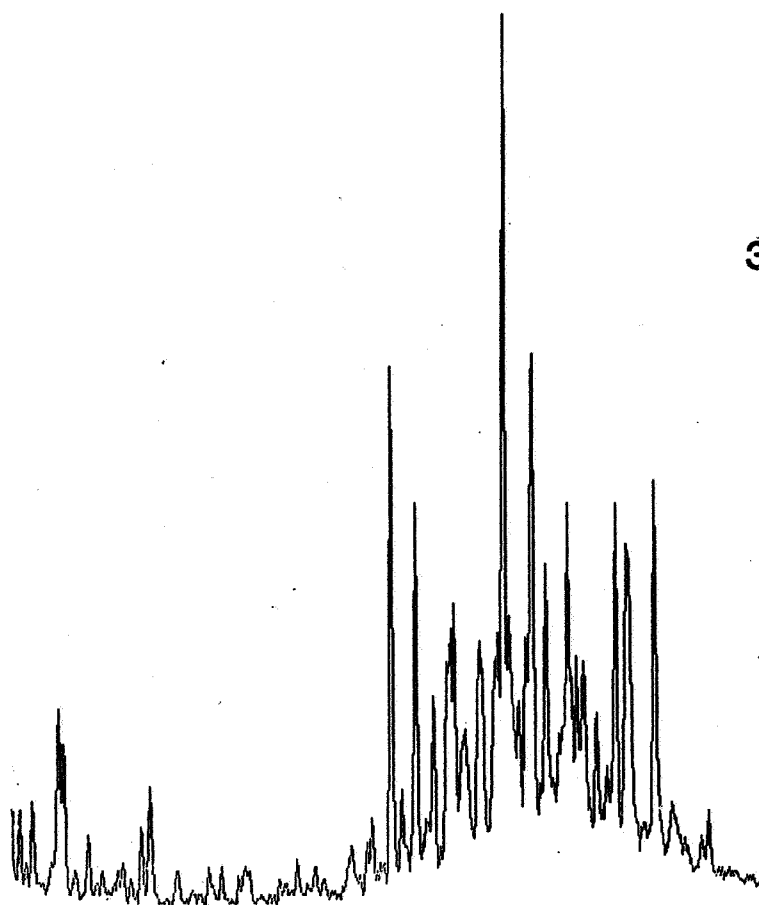
STERANES  $m/z$  217



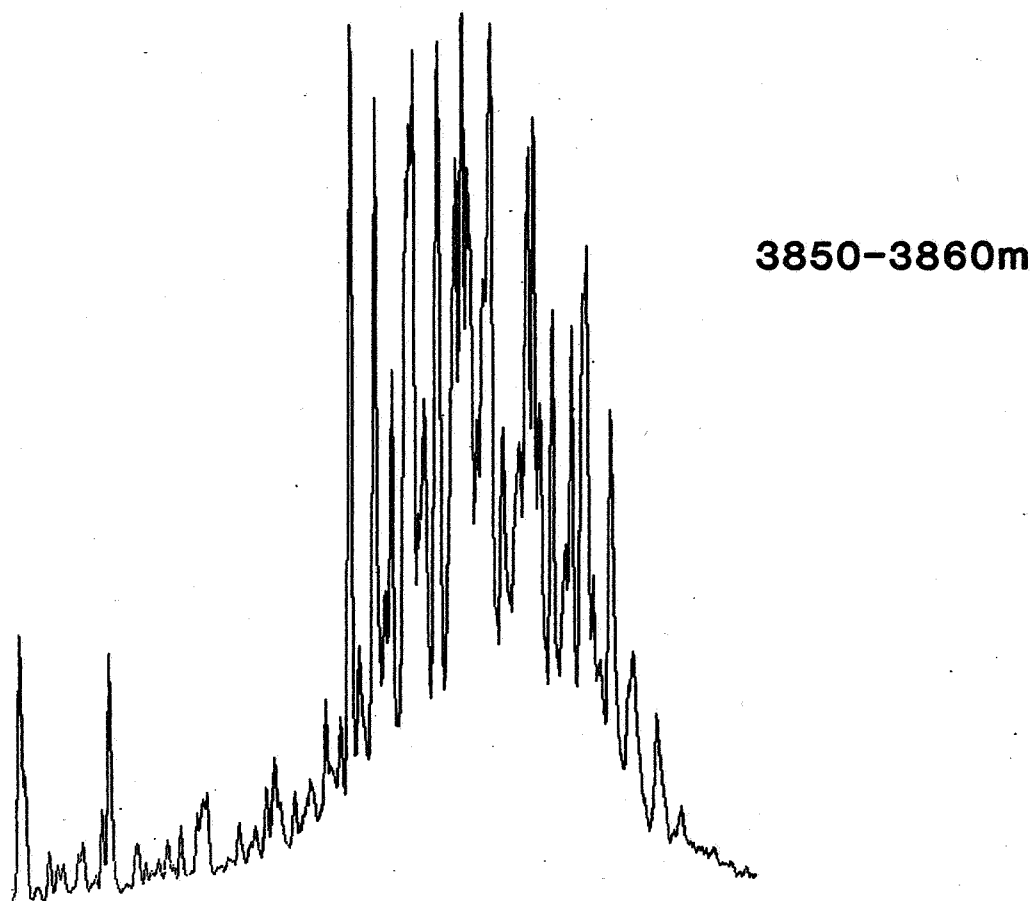
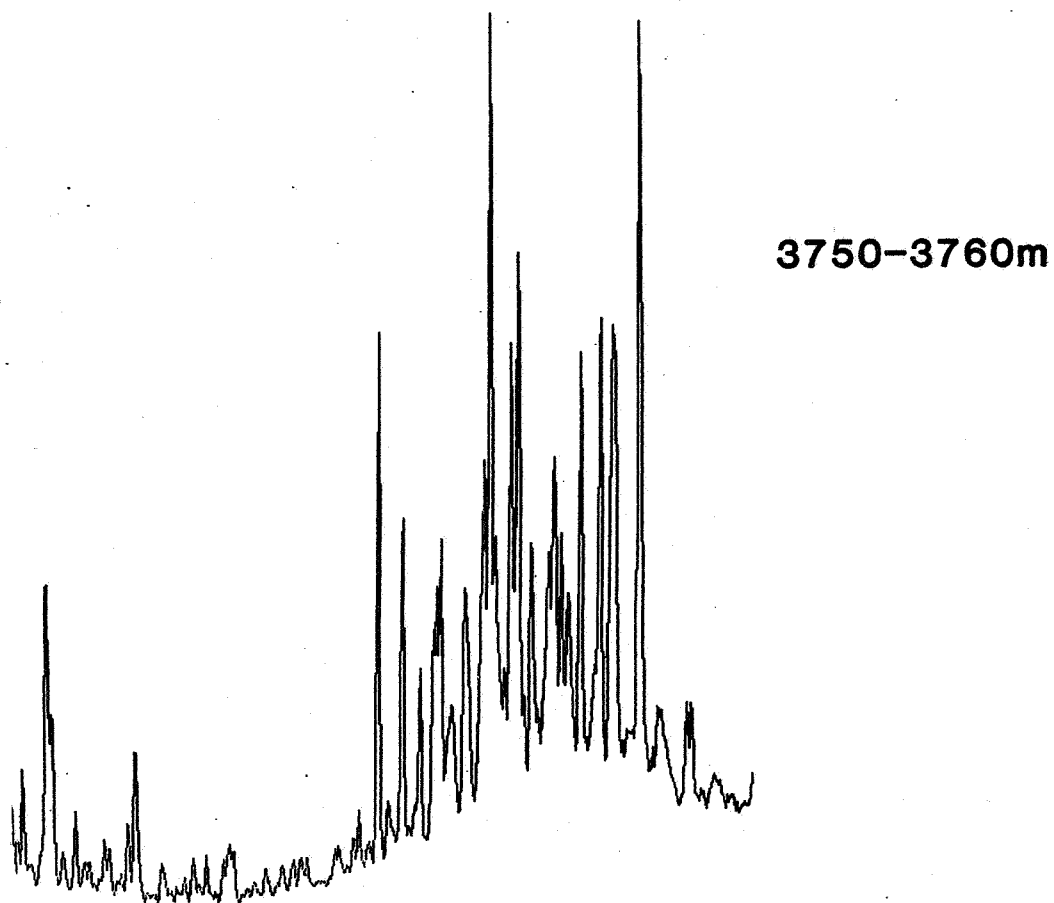
STERANES  $m/z$  217



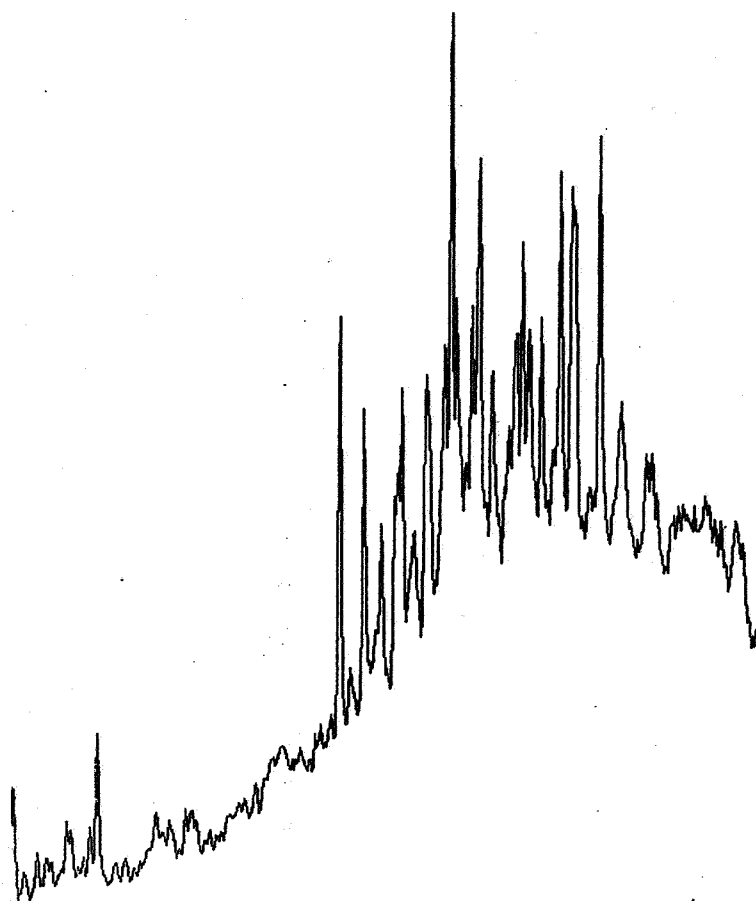
3669m  
S.W.C.



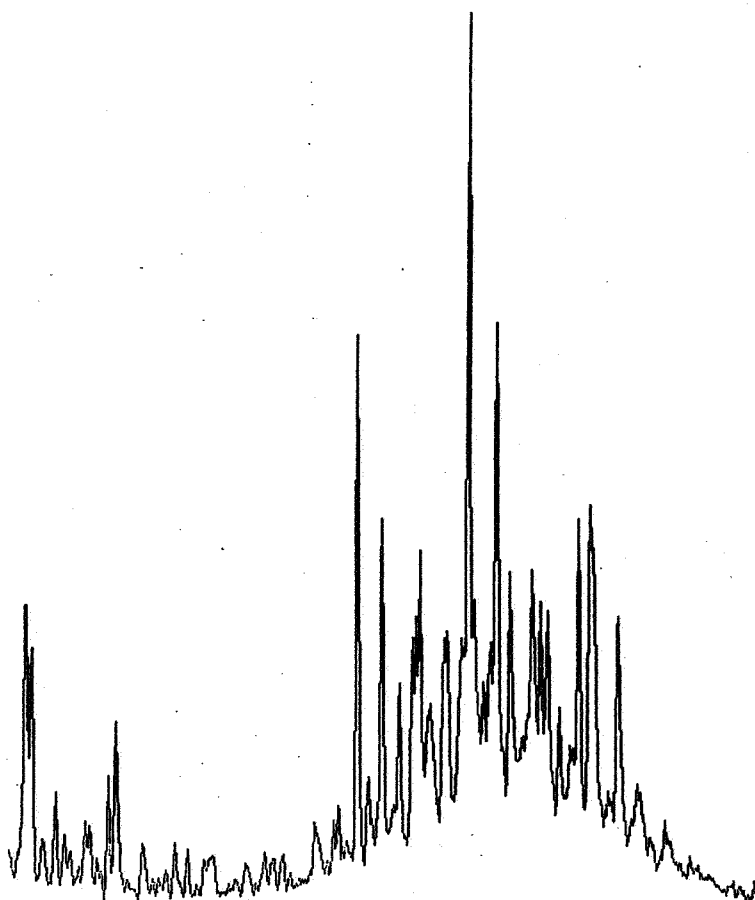
3670-3680m

STERANES  $m/z$  217

STERANES  $m/z$  217

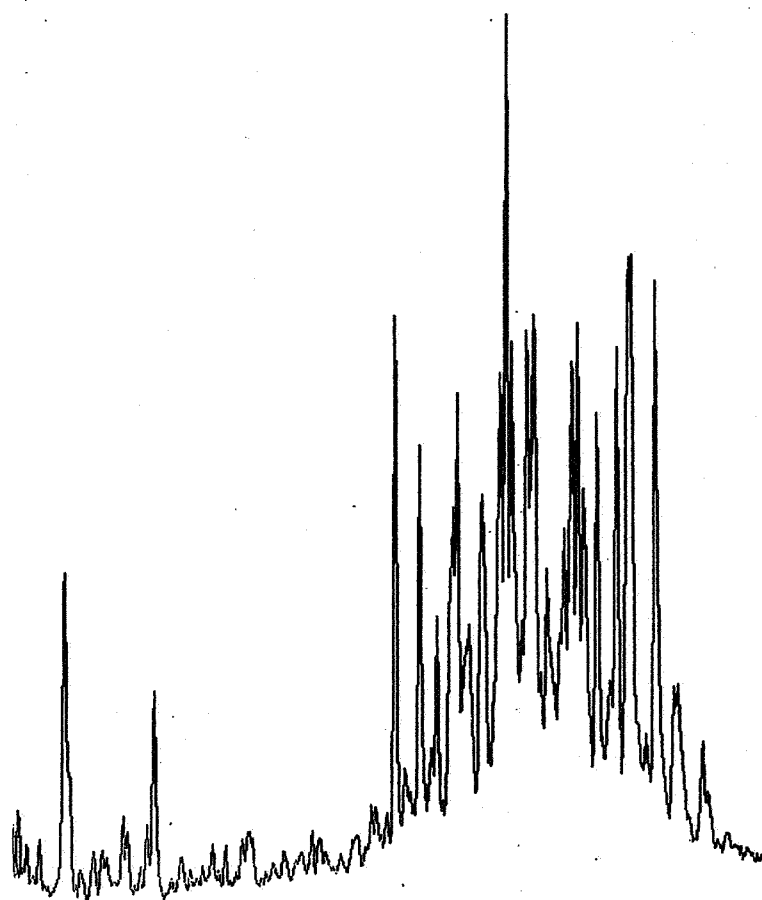


3930-3940m



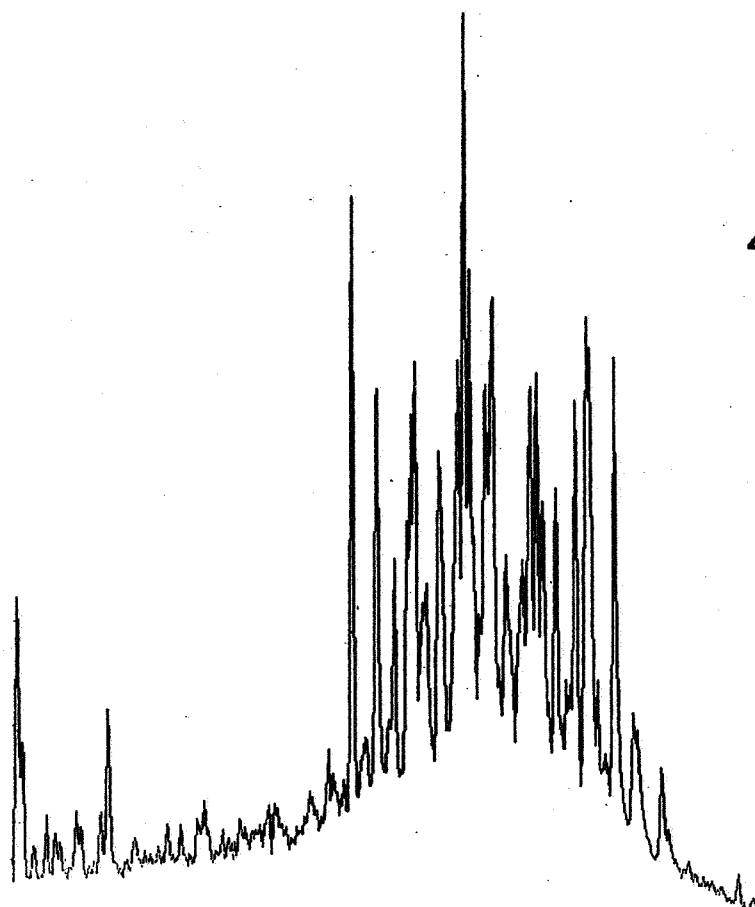
4130-4140m

STERANES  $m/z$  217

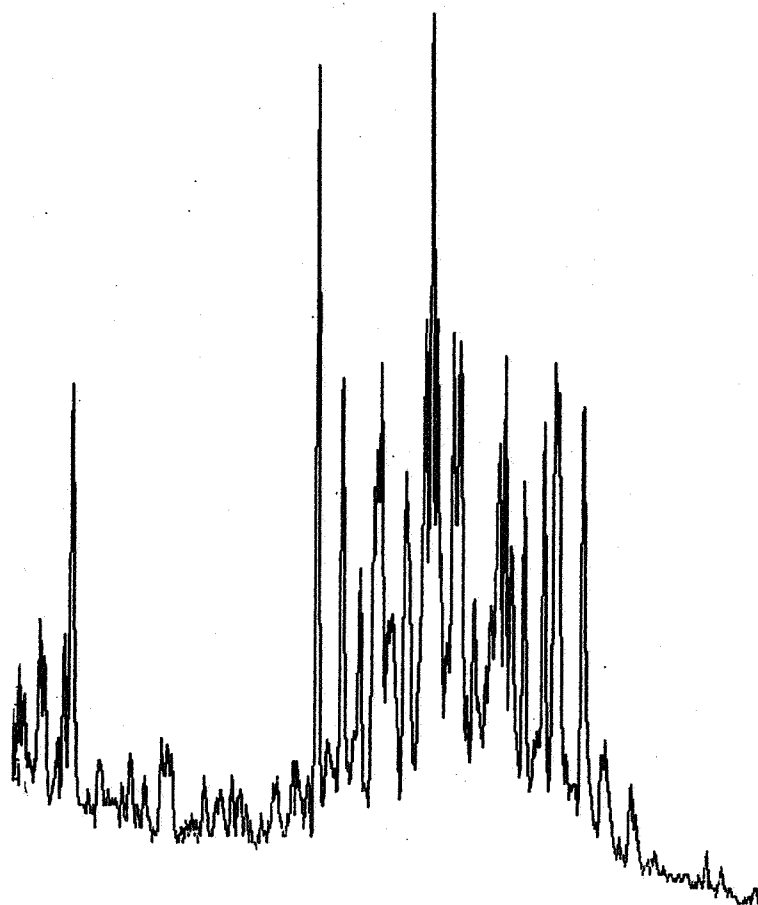


4473.2m

S.W.C.



4510-4520m

STERANES  $m/z$  217

4753m

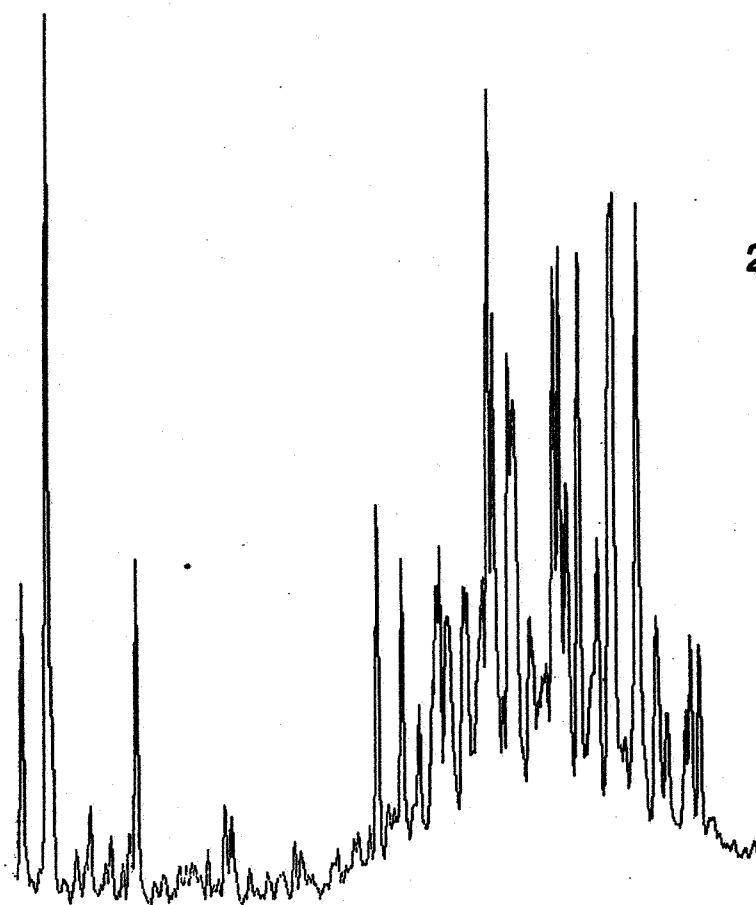
S.W.C.

FIGURE 8m

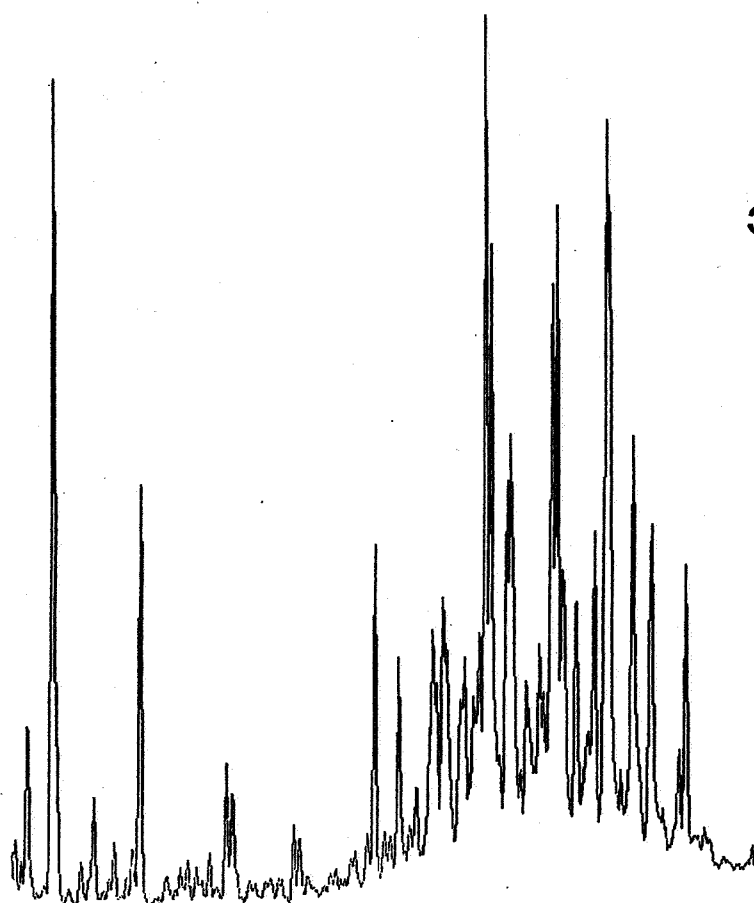
MASS FRAGMENTOGRAMS

WELL 6406/3-1

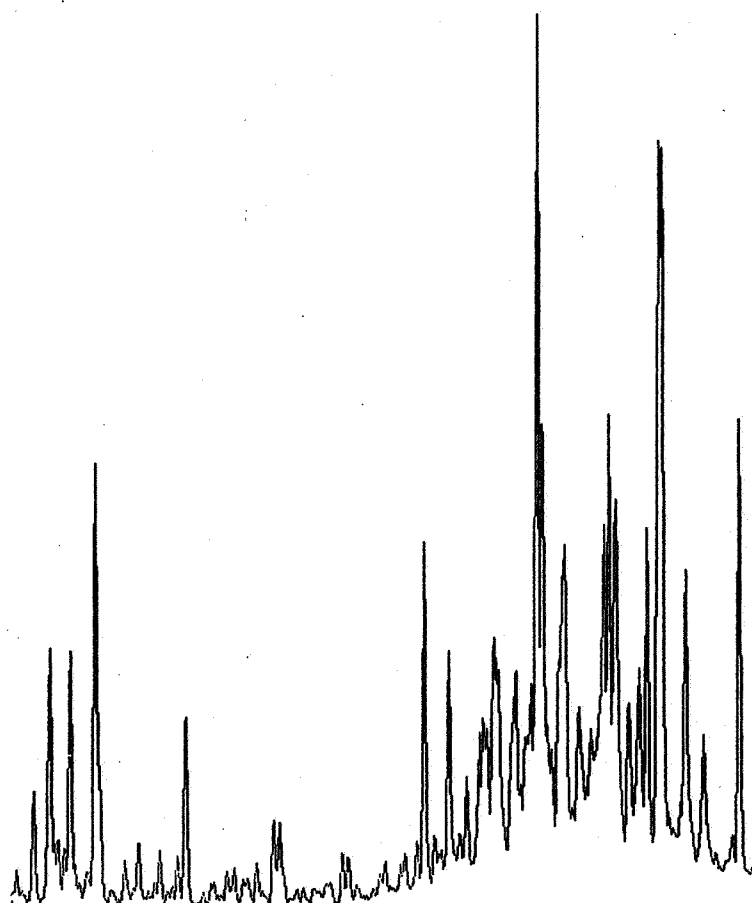
STERANES  $m/z$  218



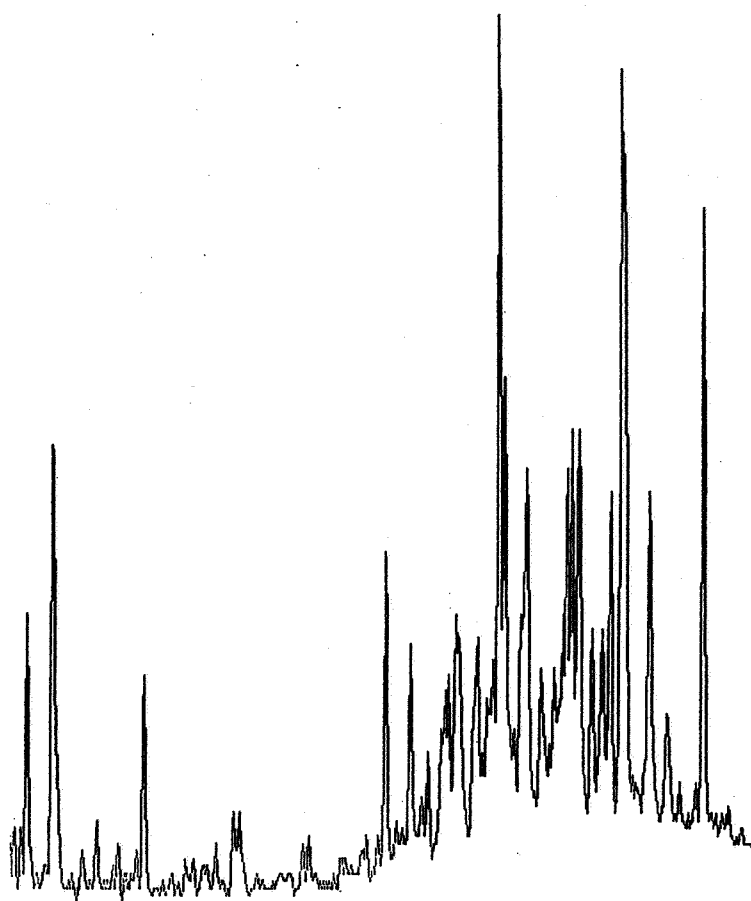
2550-2560m



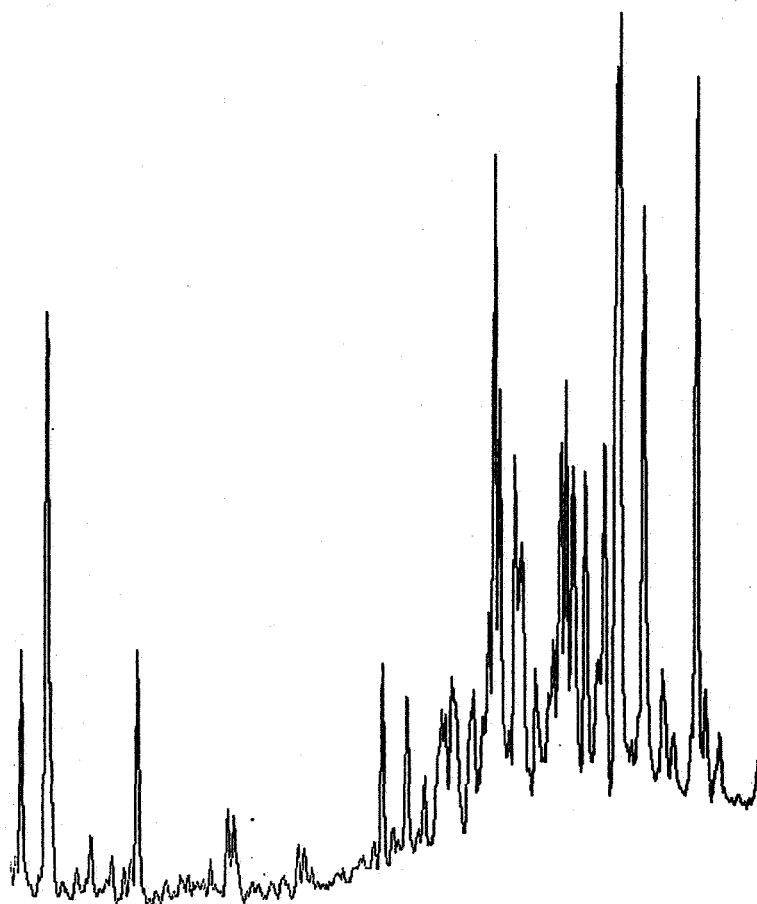
3310-3320m

STERANES  $m/z$  218

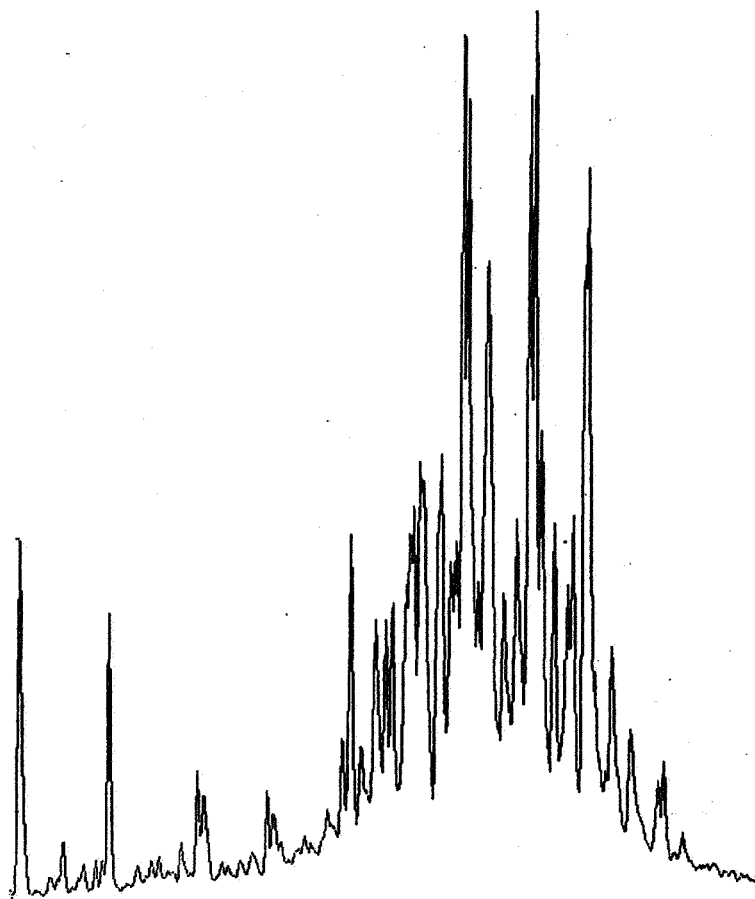
3669 m  
S.W.C.



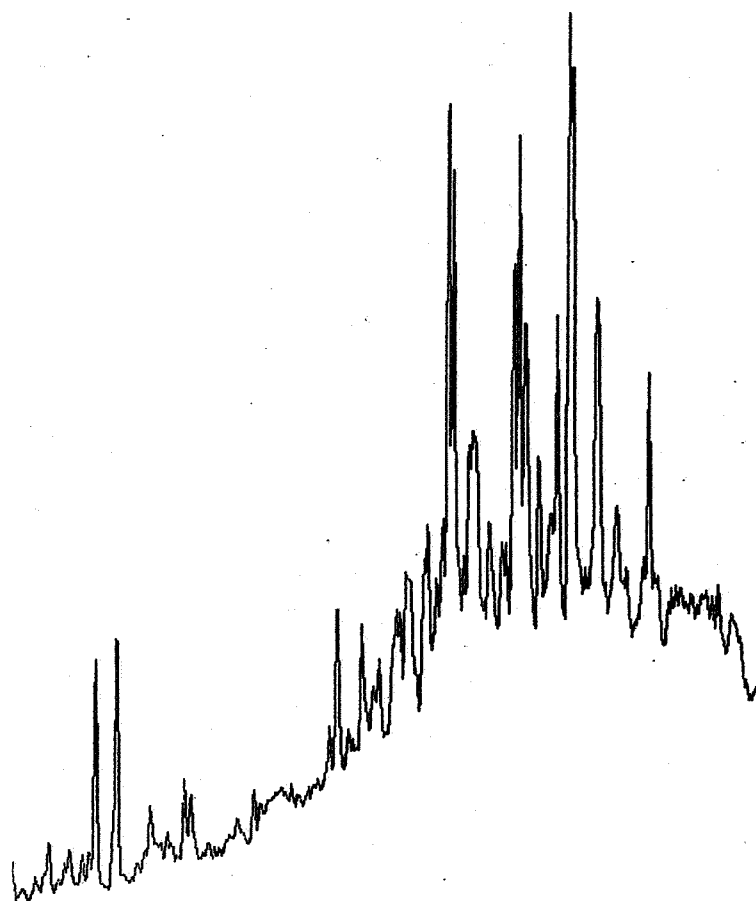
3670-3680m

STERANES  $m/z$  218

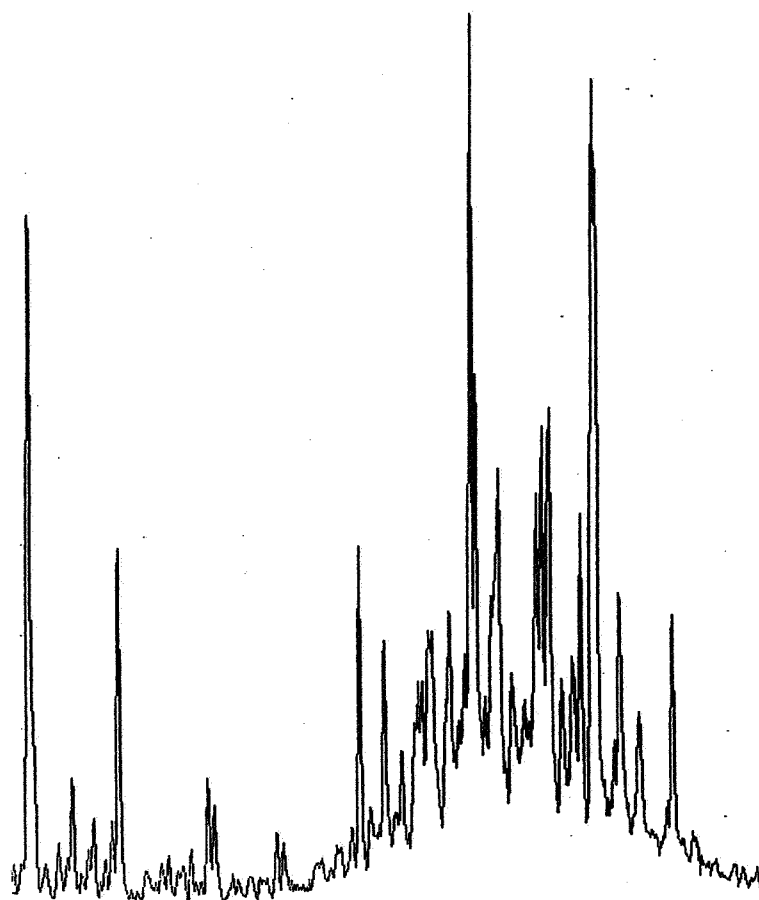
3750-3760m



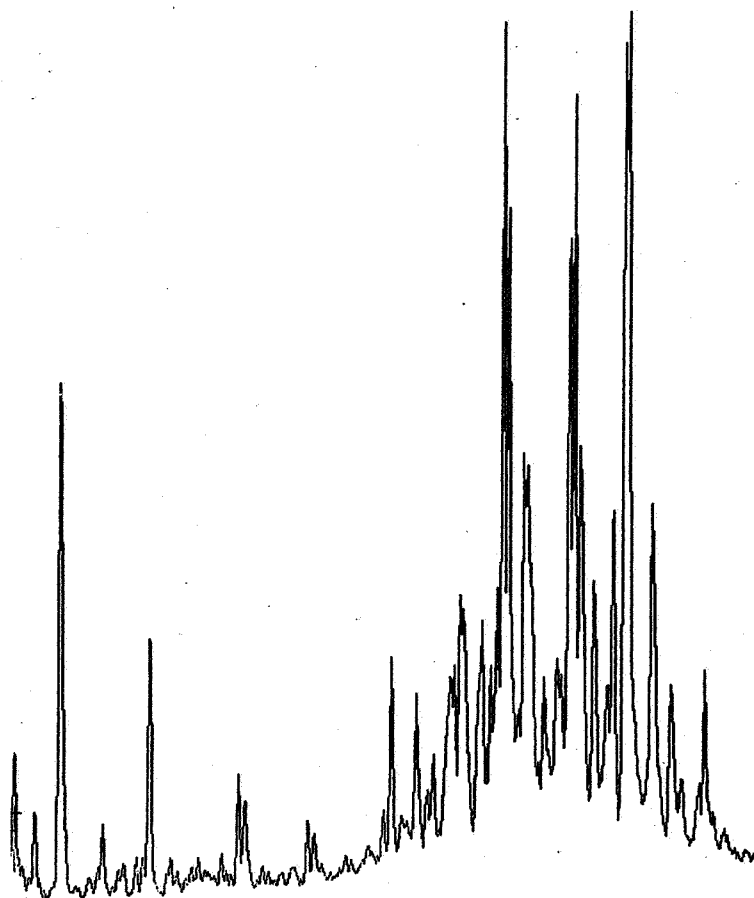
3850-3860m

STERANES  $m/z$  218

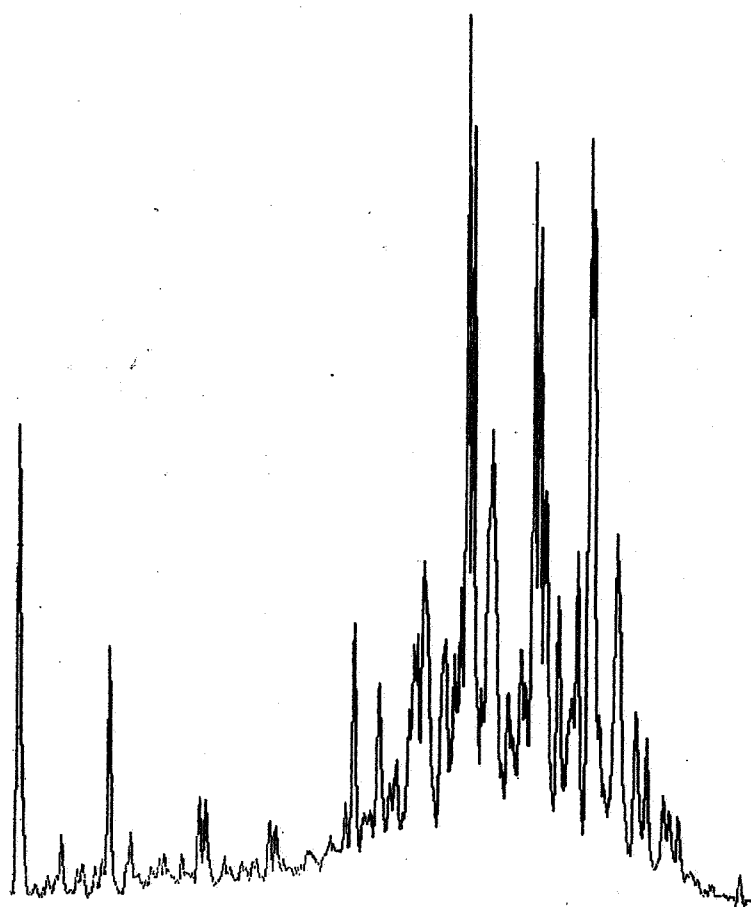
3930-3940m



4130-4140m

STERANES  $m/z$  218

4473.2m  
S.W.C.



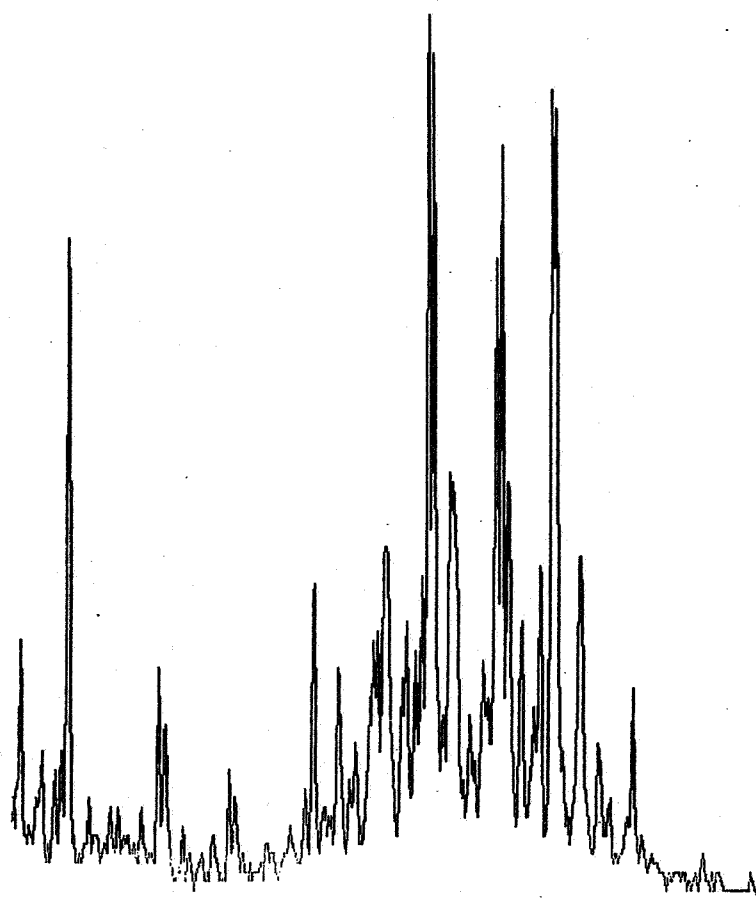
4510-4520m

FIGURE 8r

MASS FRAGMENTOGRAMS

WELL 6406/3-1

STERANES  $m/z$  218



4753m

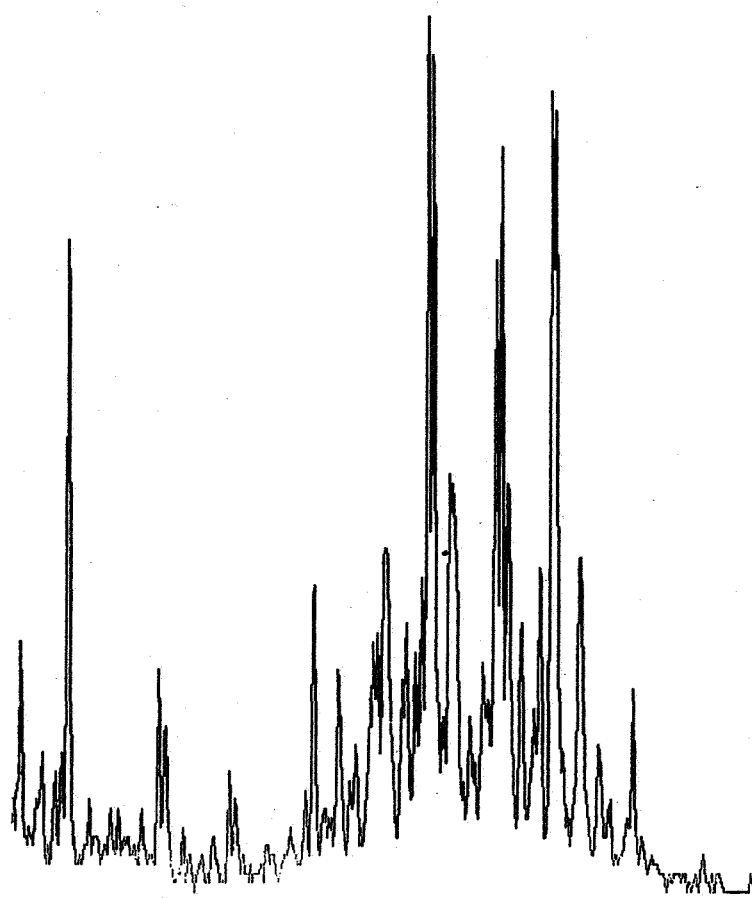
S.W.C.

FIGURE 8r

MASS FRAGMENTOGRAMS

WELL 6406/3-1

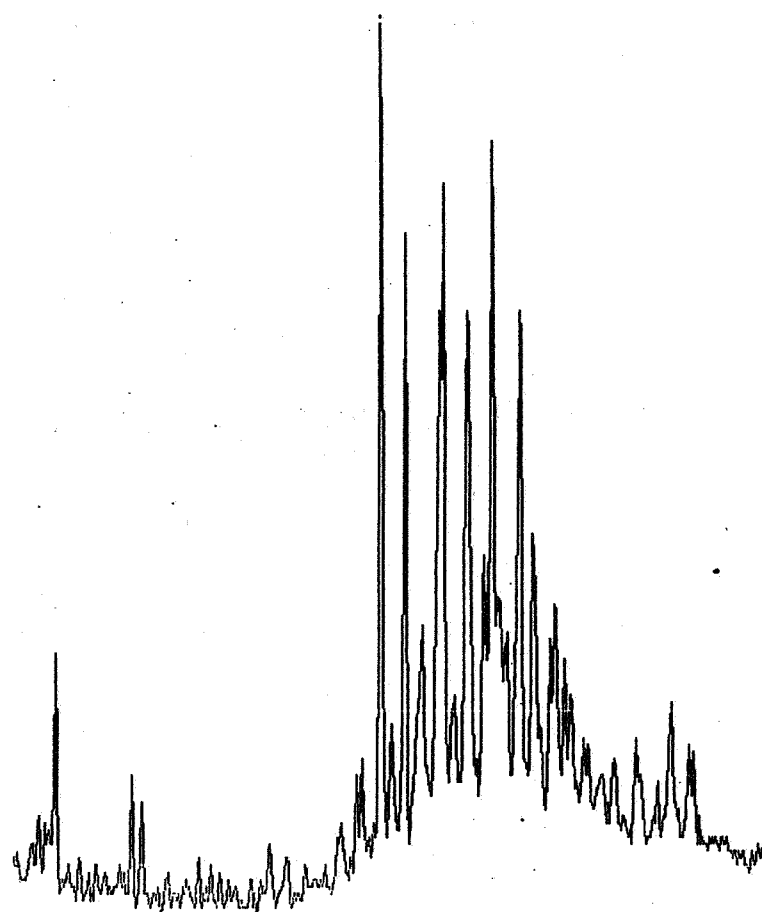
STERANES  $m/z$  218



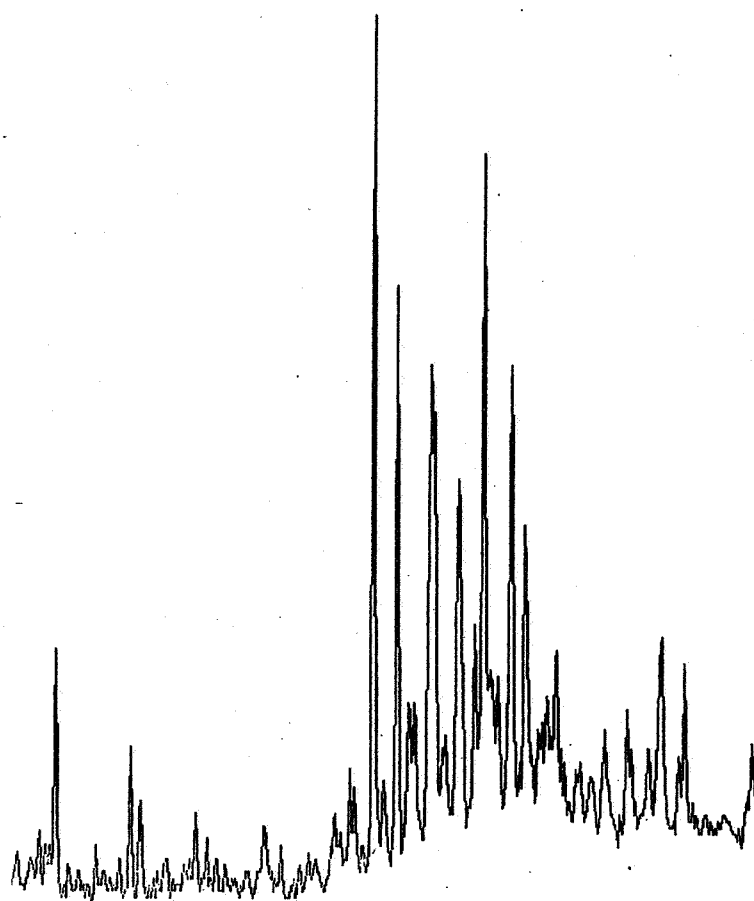
4753m

S.W.C.

REARRANGED STERANES  $m/z$  259

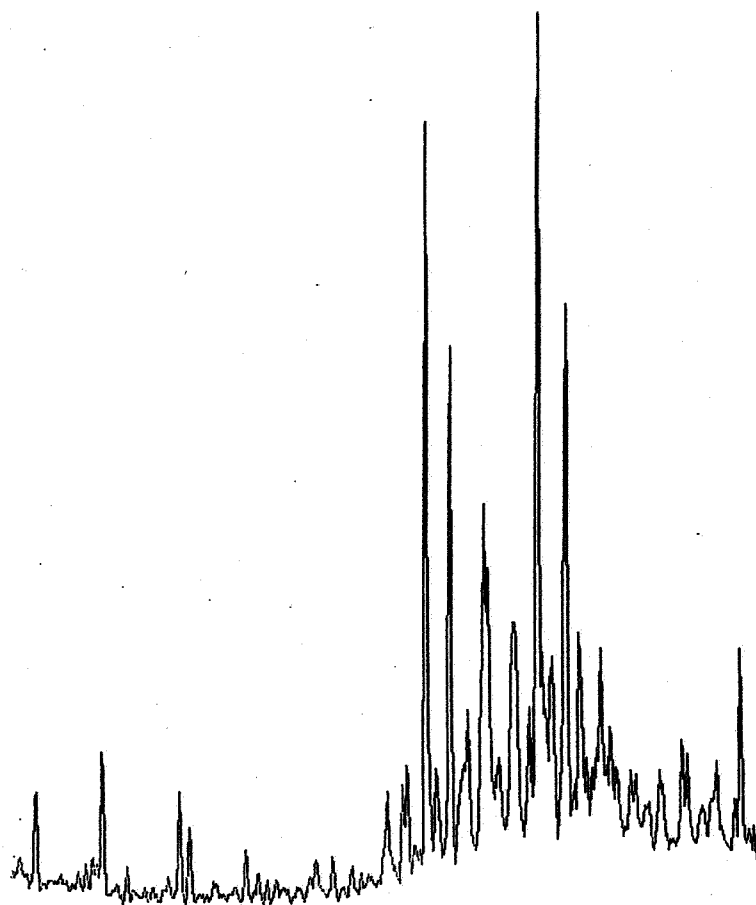


2550-2560m

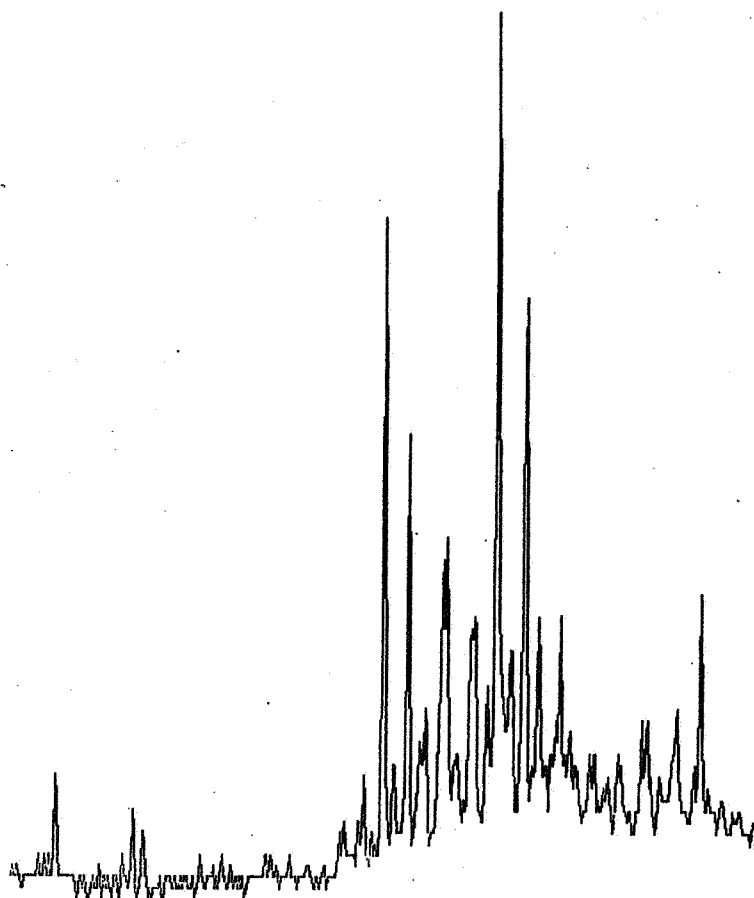


3310-3320m

REARRANGED STERANES  $m/z$  259

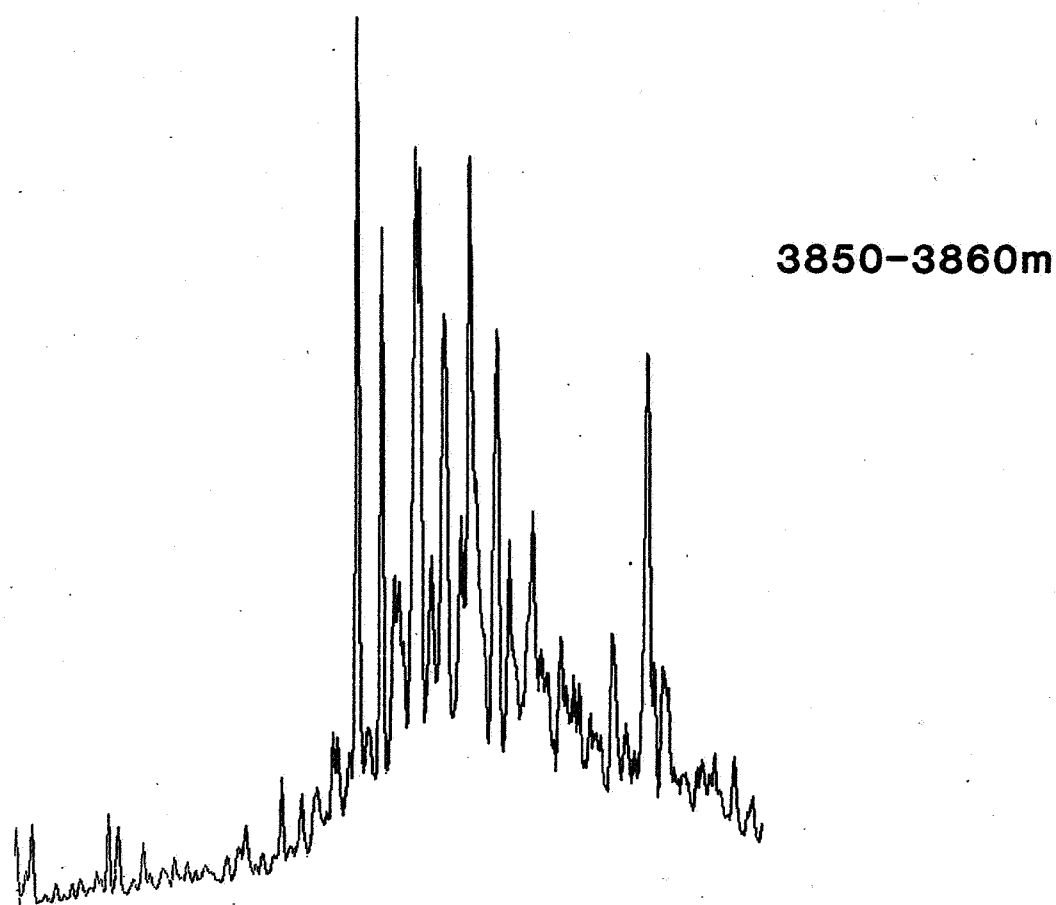
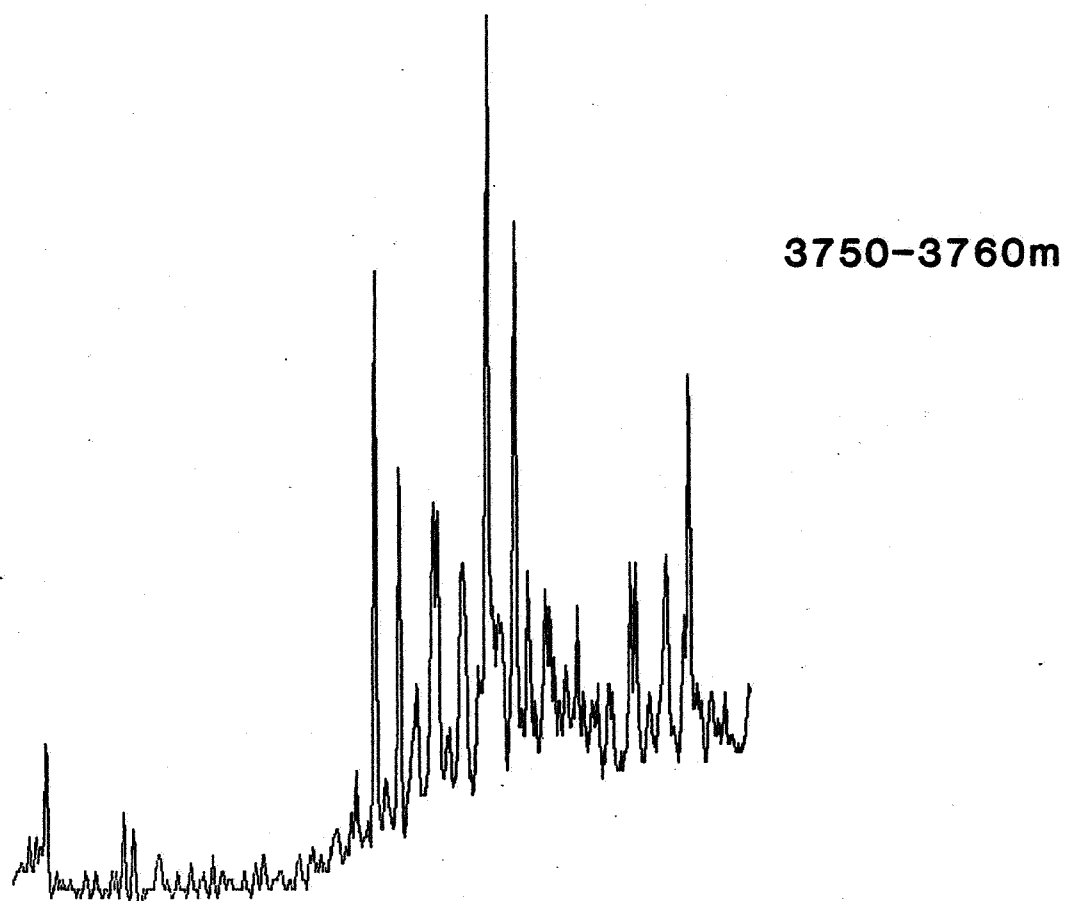


3669m  
S.W.C.

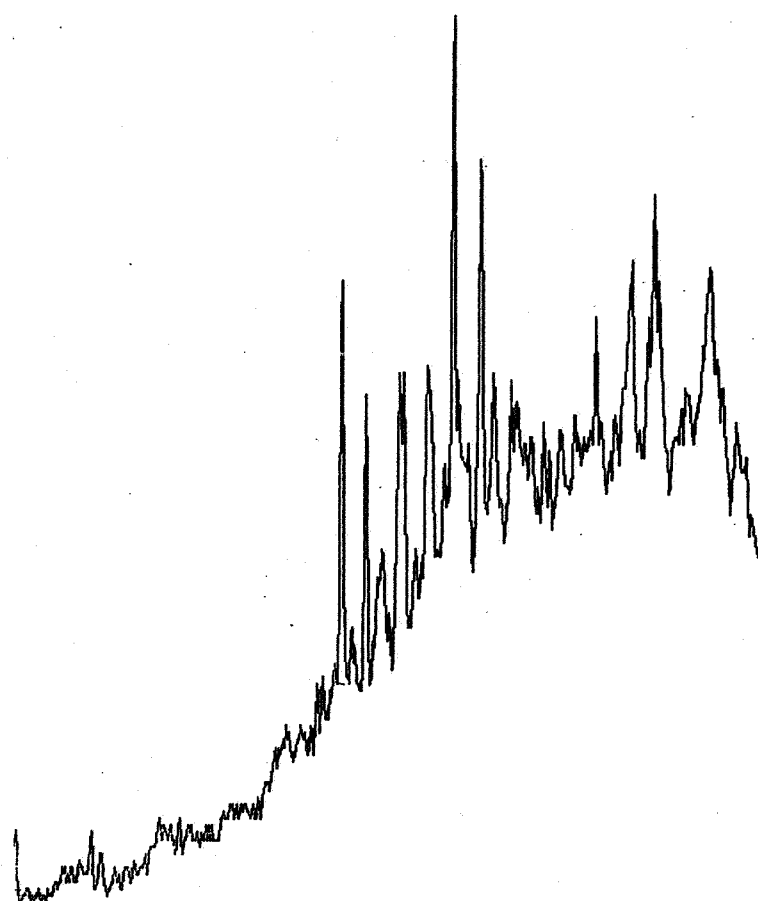


3670-3680m

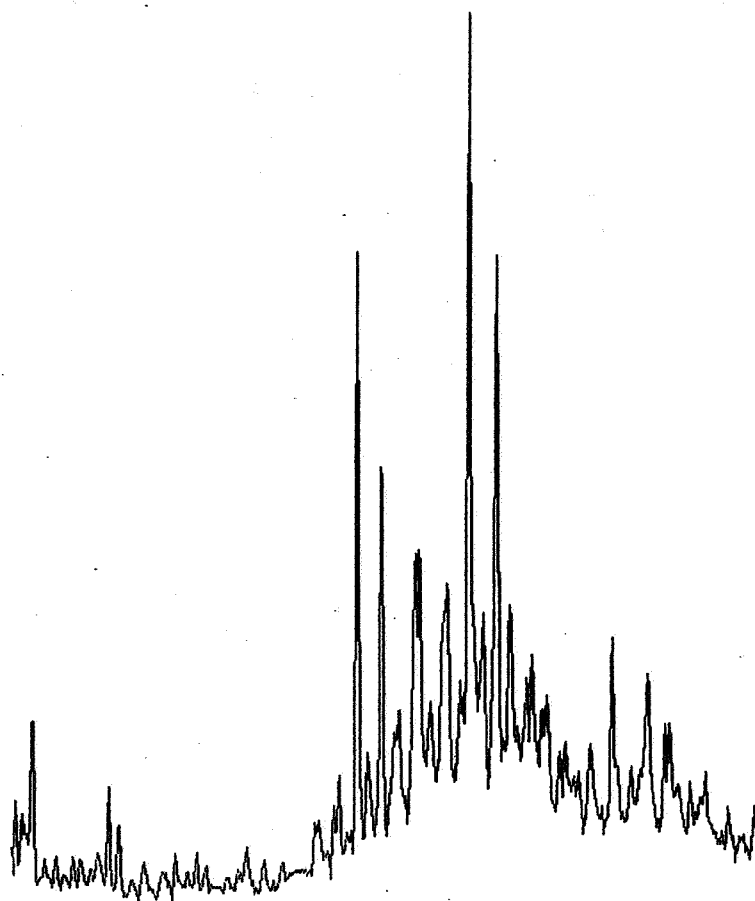
REARRANGED STERANES  $m/z$  259



REARRANGED STERANES  $m/z$  259



3930-3940m



4130-4140m

REARRANGED STERANES  $m/z$  259

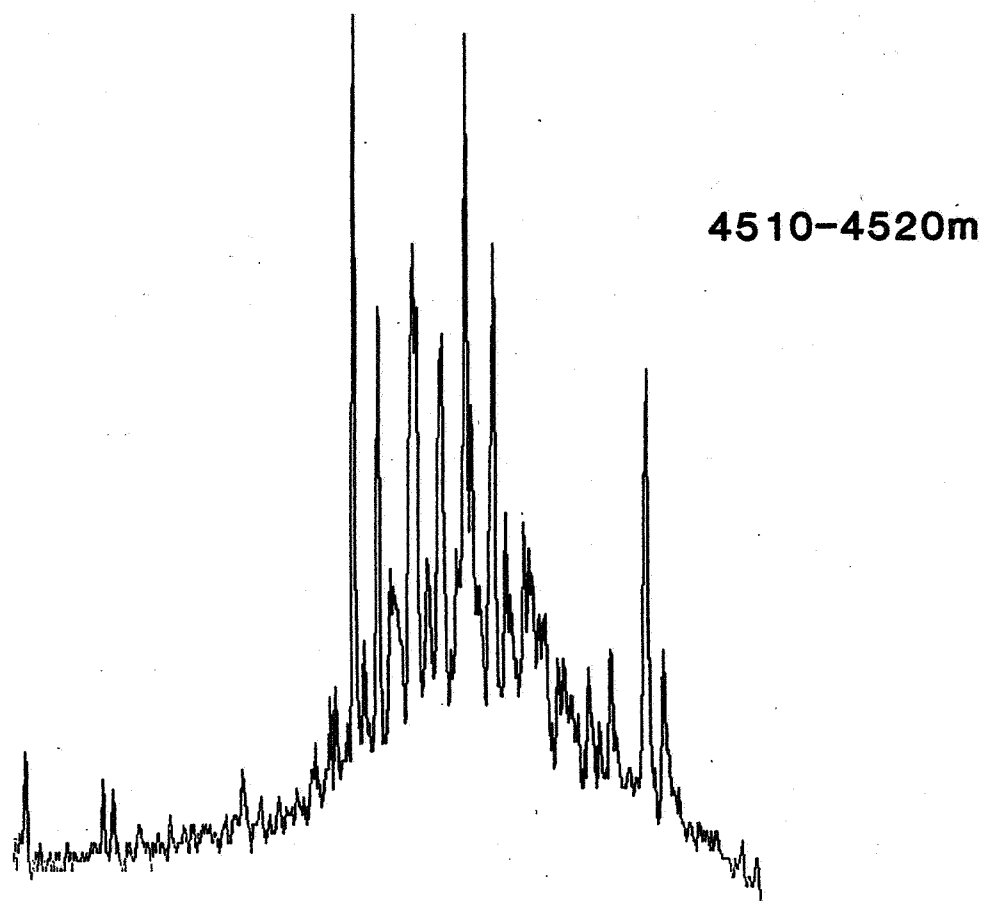
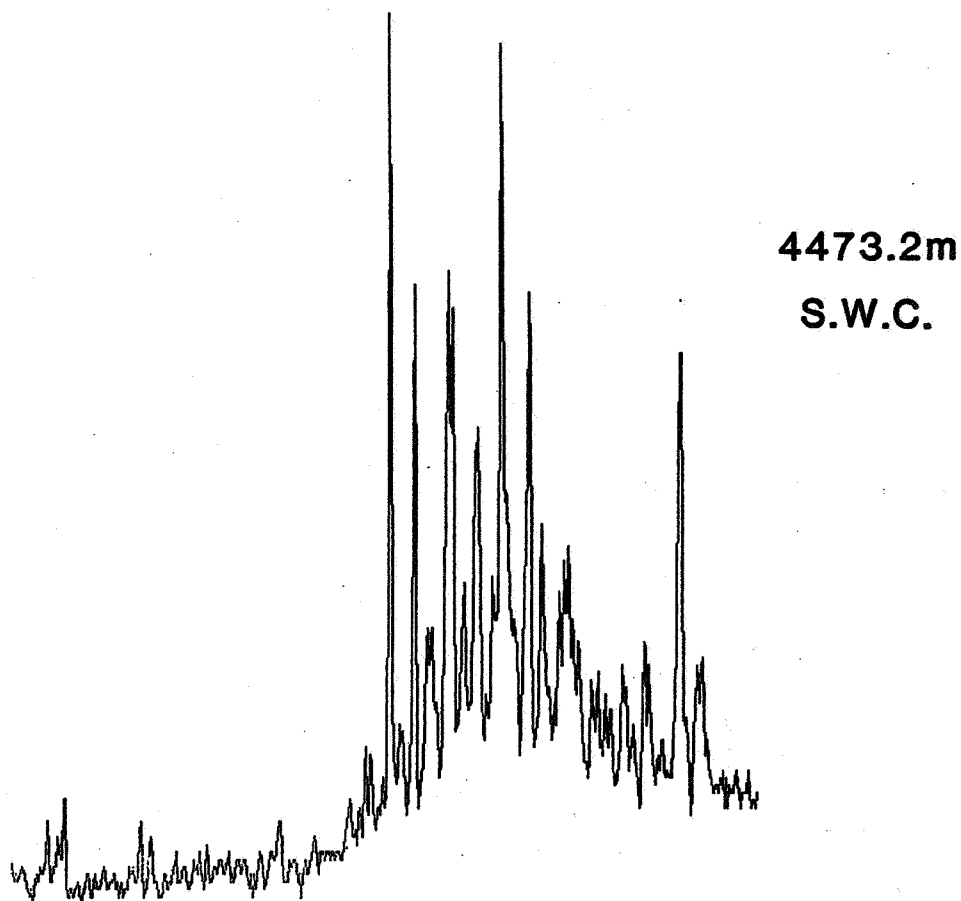
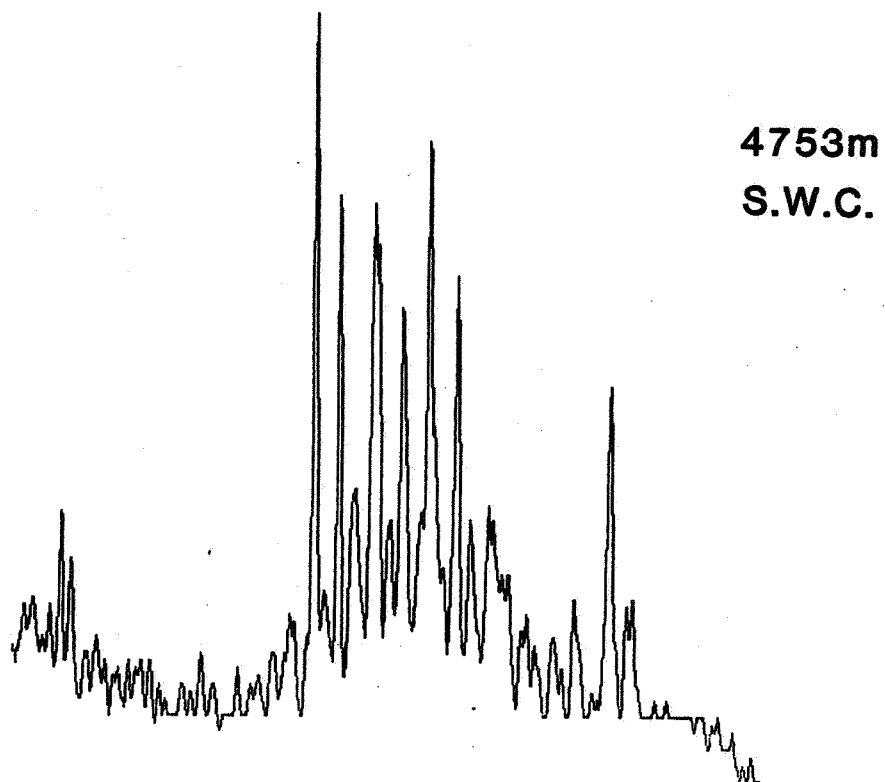


FIGURE 8x

MASS FRAGMENTOGRAMS

WELL 6406/3-1

REARRANGED STERANES  $m/z$  259



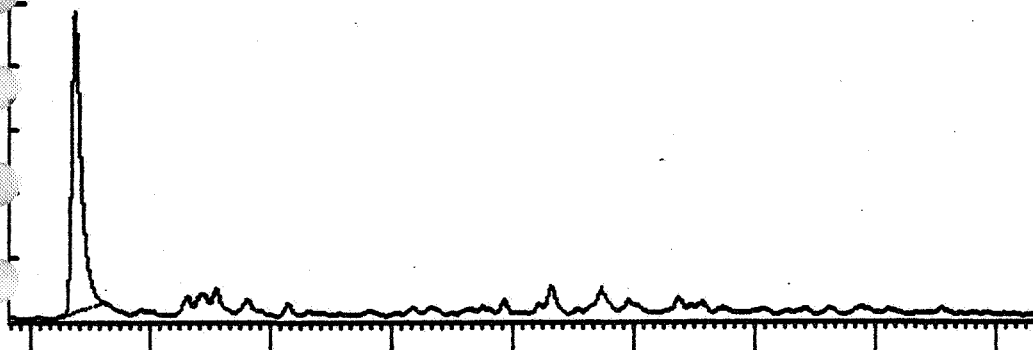
# AROMATIC MASS FRAGMENTOGRAMS

## PHENANTHRENE SERIES

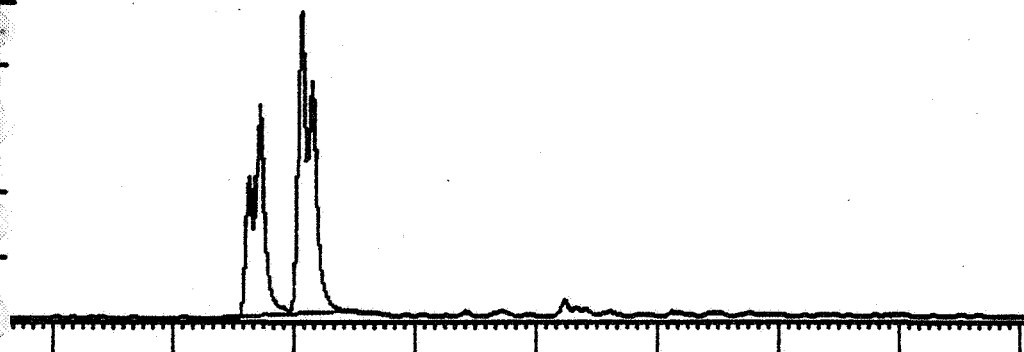
SIR REPORT. FILE - STD..SD RUN - 1

UNCALIBRATED.

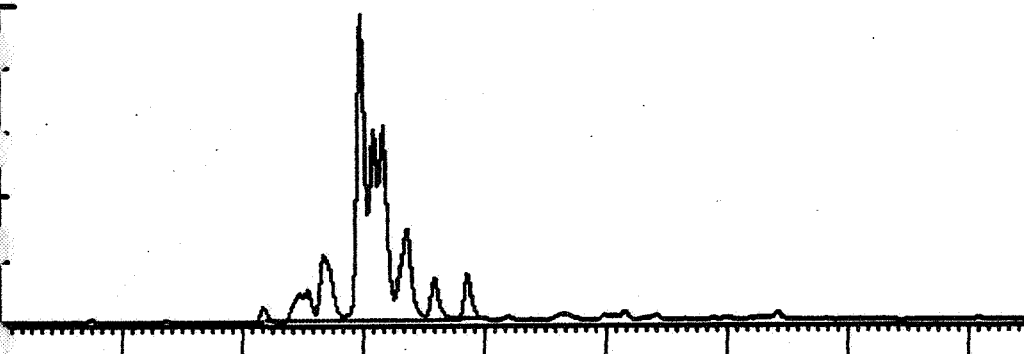
| MASS   | RETENTION TIME        | HEIGHT    | AREA       | CONC. (H) | CONC. (A) |
|--------|-----------------------|-----------|------------|-----------|-----------|
| 178.00 | 0 HRS 12 MINS 17 SECS | 9885.1530 | 52863.6900 | 0.0000    | 0.0000    |



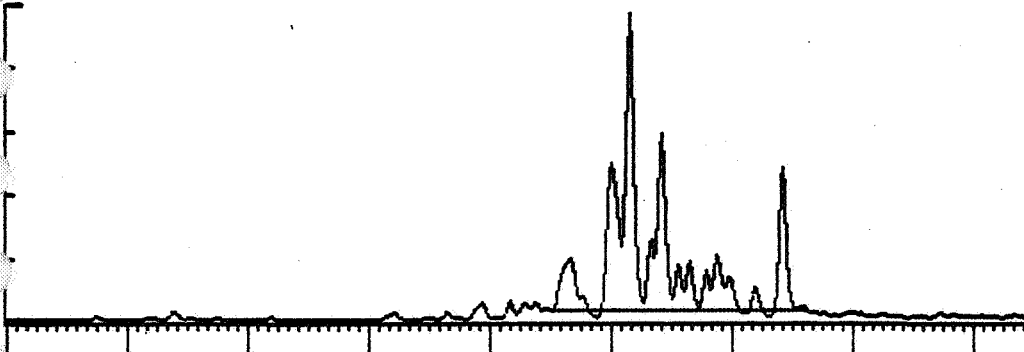
|        |                       |           |             |        |        |
|--------|-----------------------|-----------|-------------|--------|--------|
| 192.00 | 0 HRS 14 MINS 41 SECS | 9491.7360 | 122714.4000 | 0.0000 | 0.0000 |
|--------|-----------------------|-----------|-------------|--------|--------|



|        |                       |           |             |        |        |
|--------|-----------------------|-----------|-------------|--------|--------|
| 206.00 | 0 HRS 16 MINS 31 SECS | 7513.8950 | 112294.6000 | 0.0000 | 0.0000 |
|--------|-----------------------|-----------|-------------|--------|--------|



|        |                       |           |            |        |        |
|--------|-----------------------|-----------|------------|--------|--------|
| 220.00 | 0 HRS 18 MINS 21 SECS | 3435.1420 | 60707.0400 | 0.0000 | 0.0000 |
|--------|-----------------------|-----------|------------|--------|--------|



0 HRS 13 MINS 59 SECS

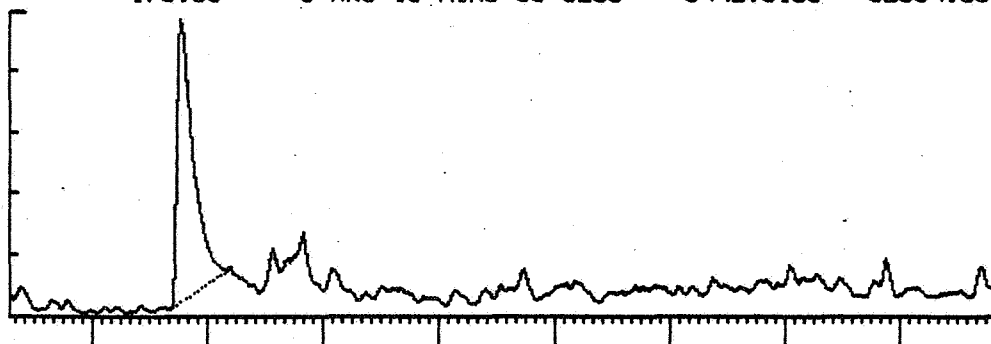
0 HRS 22 MINS 10 SECS

FIGURE 9a AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1  
PHENANTHRENE SERIES

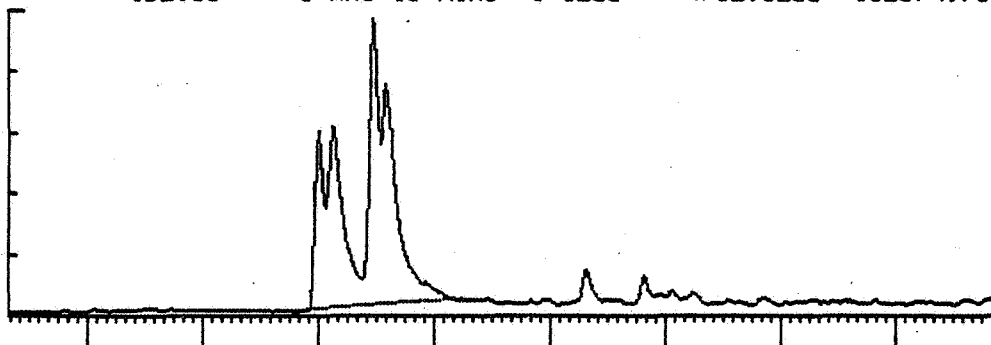
SIR REPORT. FILE - 951084 .SD RUN - 1

UNCALIBRATED.

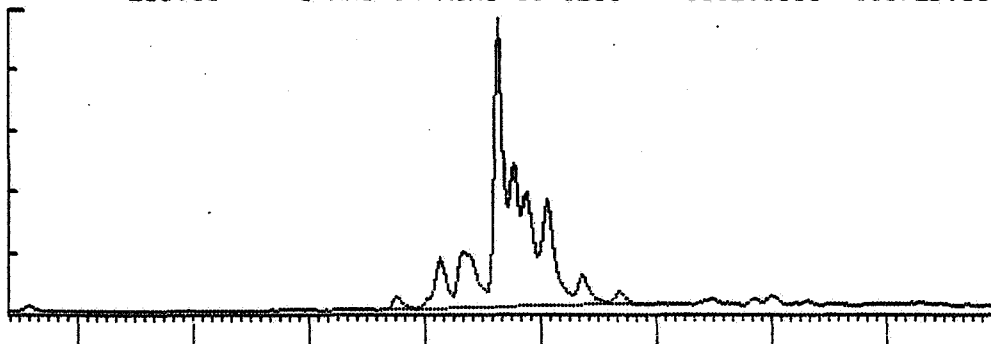
| MASS   | RETENTION TIME        | HEIGHT    | AREA       | CONC.(H) | CONC.(A) |
|--------|-----------------------|-----------|------------|----------|----------|
| 178.00 | 0 HRS 10 MINS 30 SECS | 3442.6160 | 32534.8800 | 0.0000   | 0.0000   |



|        |                      |           |             |        |        |
|--------|----------------------|-----------|-------------|--------|--------|
| 192.00 | 0 HRS 13 MINS 0 SECS | 4782.6260 | 102374.7000 | 0.0000 | 0.0000 |
|--------|----------------------|-----------|-------------|--------|--------|



|        |                       |           |             |        |        |
|--------|-----------------------|-----------|-------------|--------|--------|
| 206.00 | 0 HRS 14 MINS 60 SECS | 6602.0330 | 118729.5000 | 0.0000 | 0.0000 |
|--------|-----------------------|-----------|-------------|--------|--------|



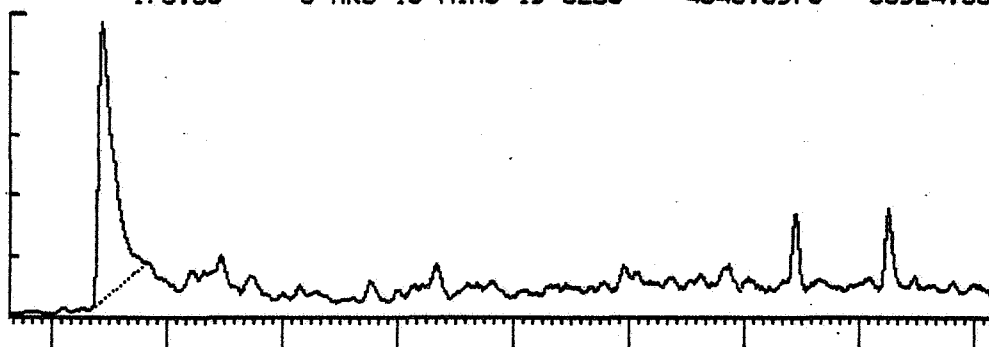
2550-2560m

# FIGURE 9b AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

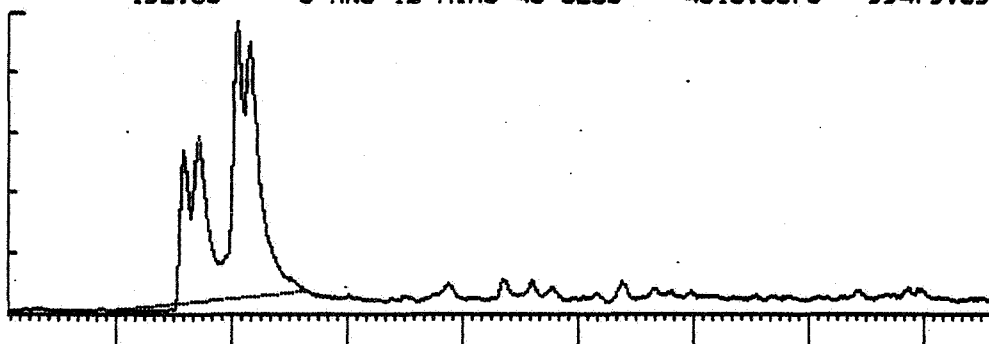
SIR REPORT. FILE - 951160 .SD RUN - 1

UNCALIBRATED.

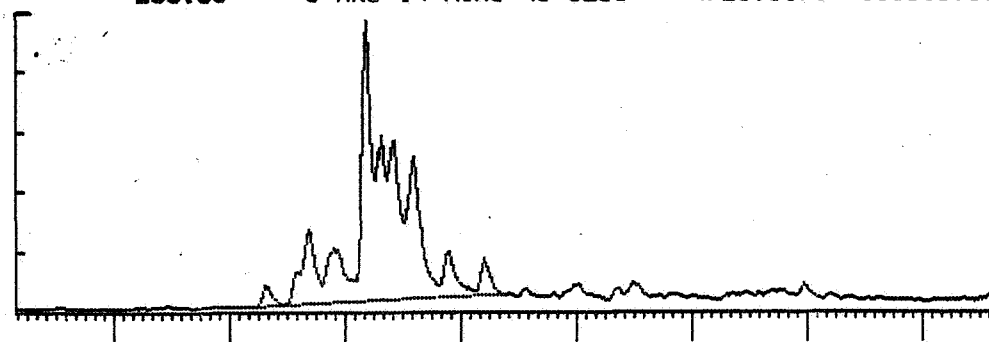
| MASS   | RETENTION TIME        | HEIGHT    | AREA       | CONC. (H) | CONC. (A) |
|--------|-----------------------|-----------|------------|-----------|-----------|
| 178.00 | 0 HRS 10 MINS 19 SECS | 4348.5970 | 38924.8800 | 0.0000    | 0.0000    |



|        |                       |           |            |        |        |
|--------|-----------------------|-----------|------------|--------|--------|
| 192.00 | 0 HRS 12 MINS 46 SECS | 4615.8870 | 99479.5900 | 0.0000 | 0.0000 |
|--------|-----------------------|-----------|------------|--------|--------|



|        |                       |           |             |        |        |
|--------|-----------------------|-----------|-------------|--------|--------|
| 206.00 | 0 HRS 14 MINS 45 SECS | 4728.6170 | 108516.3000 | 0.0000 | 0.0000 |
|--------|-----------------------|-----------|-------------|--------|--------|



0 HRS 12 MINS 9 SECS

0 HRS 20 MINS 21 SECS

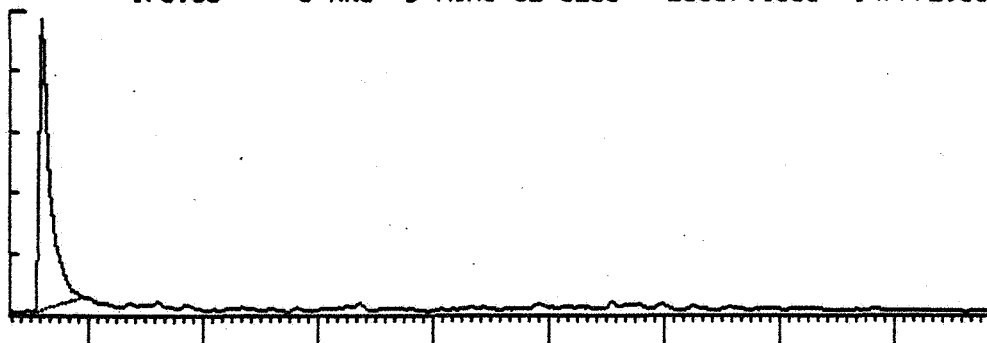
3310-3320m

FIGURE 9c AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1  
PHENANTHRENE SERIES

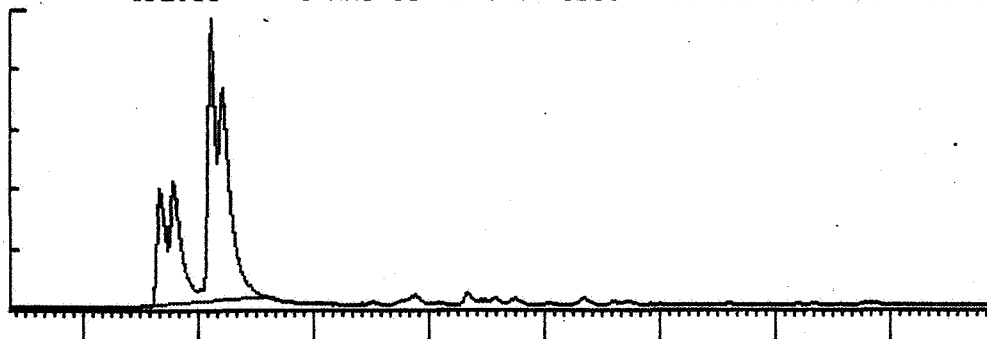
SIR REPORT. FILE - 951202 .SD RUN - 1

UNCALIBRATED.

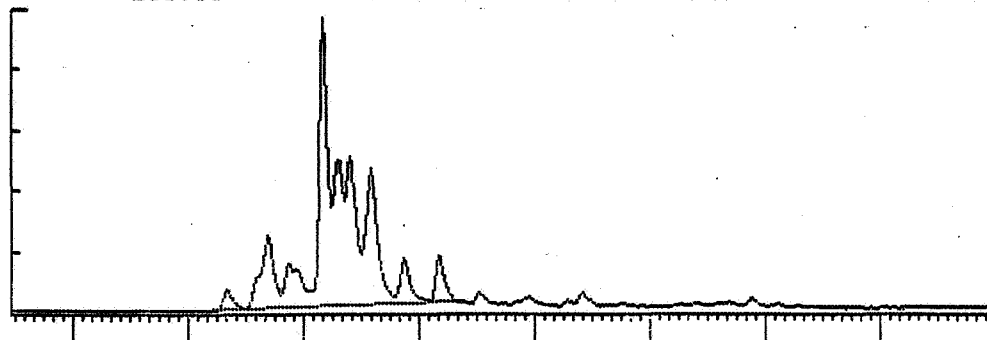
| MASS   | RETENTION TIME       | HEIGHT     | AREA        | CONC. (H) | CONC. (A) |
|--------|----------------------|------------|-------------|-----------|-----------|
| 178.00 | 0 HRS 9 MINS 32 SECS | 23687.1800 | 147772.3000 | 0.0000    | 0.0000    |



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 192.00 | 0 HRS 11 MINS 51 SECS | 19056.7800 | 269419.4000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 206.00 | 0 HRS 13 MINS 44 SECS | 10308.3600 | 200567.3000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



0 HRS 11 MINS 27 SECS

0 HRS 19 MINS 39 SECS

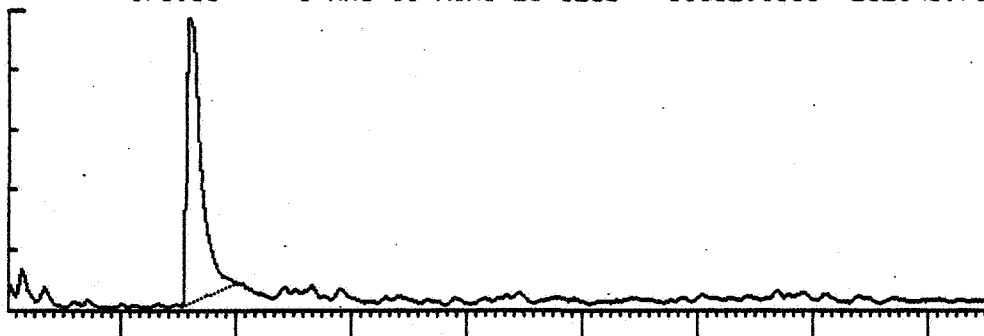
3669m  
S.W.C.

# FIGURE 9d: AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

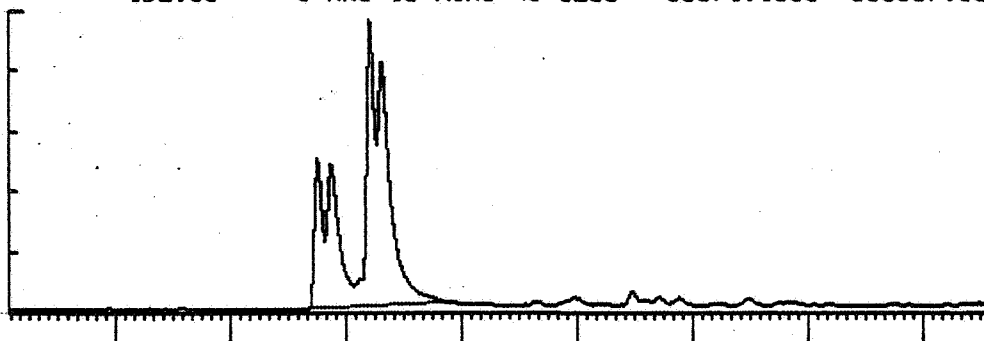
SIR REPORT. FILE - 951200 .SD RUN - 1

UNCALIBRATED.

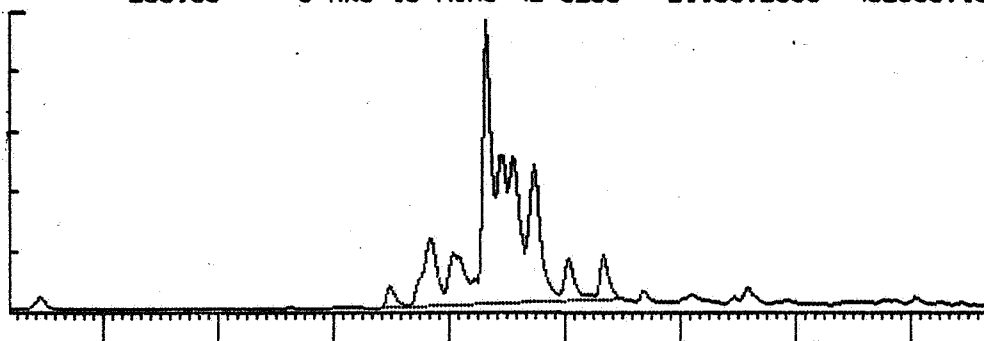
| MASS   | RETENTION TIME        | HEIGHT     | AREA        | CONC. (H) | CONC. (A) |
|--------|-----------------------|------------|-------------|-----------|-----------|
| 178.00 | 0 HRS 11 MINS 20 SECS | 31102.1000 | 262146.7000 | 0.0000    | 0.0000    |



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 192.00 | 0 HRS 13 MINS 45 SECS | 30571.1600 | 533637.0000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 206.00 | 0 HRS 15 MINS 42 SECS | 21156.2500 | 432500.1000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



0 HRS 12 MINS 10 SECS

0 HRS 20 MINS 22 SECS

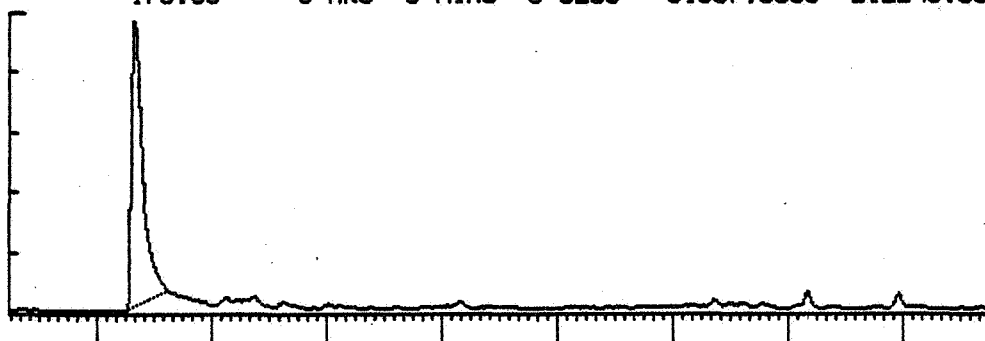
3670-3680m

# FIGURE 9e AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

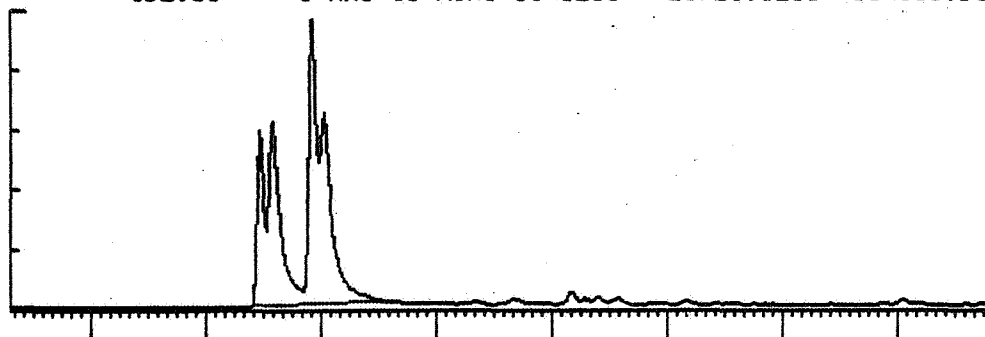
SIR REPORT. FILE - 951241 .SD RUN - 1

UNCALIBRATED.  
MASS

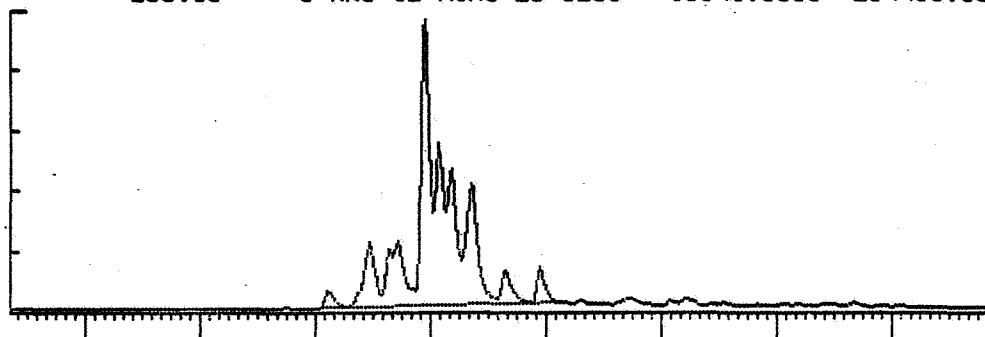
| MASS   | RETENTION TIME      | HEIGHT     | AREA        | CONC. (H) | CONC. (A) |
|--------|---------------------|------------|-------------|-----------|-----------|
| 178.00 | 0 HRS 8 MINS 8 SECS | 31307.5000 | 212248.8000 | 0.0000    | 0.0000    |



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 192.00 | 0 HRS 10 MINS 31 SECS | 23721.8200 | 384608.9000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 206.00 | 0 HRS 12 MINS 25 SECS | 15341.0500 | 284450.8000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



0 HRS 9 MINS 21 SECS

0 HRS 17 MINS 32 SECS

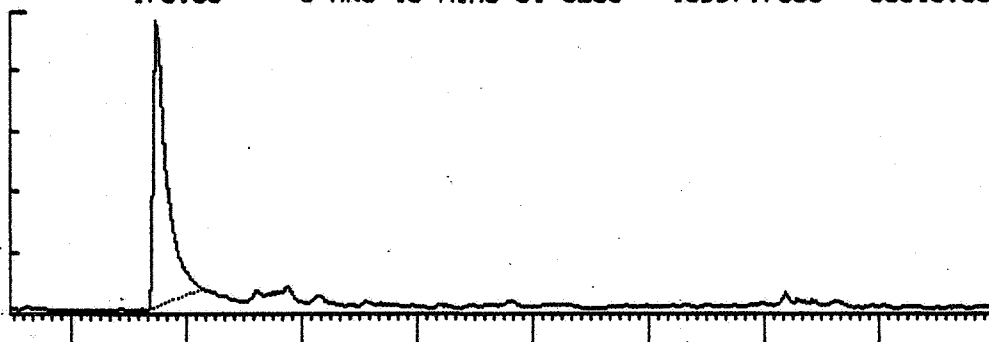
3930-3940m

# FIGURE 9f AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

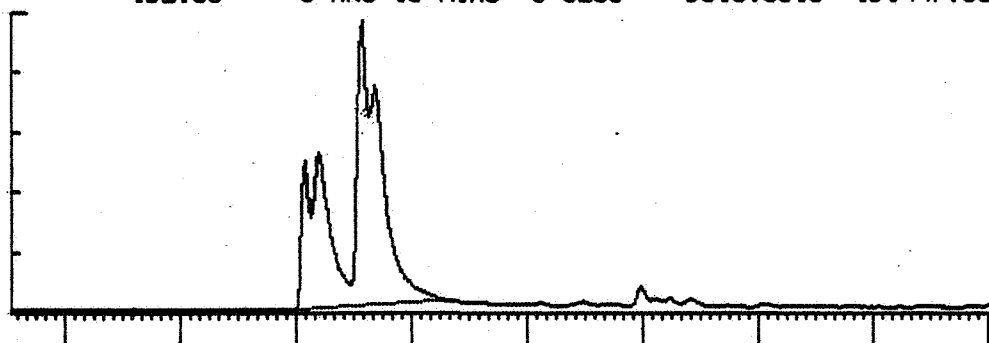
SIR REPORT. FILE - 951262 .SD RUN - 1

UNCALIBRATED.  
MASS

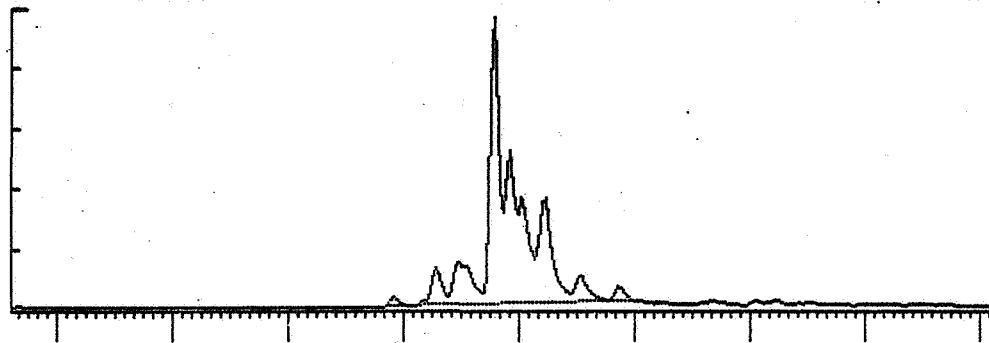
| MASS   | RETENTION TIME        | HEIGHT     | AREA       | CONC. (H) | CONC. (A) |
|--------|-----------------------|------------|------------|-----------|-----------|
| 178.00 | 0 HRS 10 MINS 31 SECS | 10997.7600 | 85518.5500 | 0.0000    | 0.0000    |



|        |                      |           |             |        |        |
|--------|----------------------|-----------|-------------|--------|--------|
| 192.00 | 0 HRS 13 MINS 6 SECS | 9015.3310 | 191447.8000 | 0.0000 | 0.0000 |
|--------|----------------------|-----------|-------------|--------|--------|



|        |                      |           |             |        |        |
|--------|----------------------|-----------|-------------|--------|--------|
| 206.00 | 0 HRS 15 MINS 9 SECS | 8620.1160 | 145018.2000 | 0.0000 | 0.0000 |
|--------|----------------------|-----------|-------------|--------|--------|



0 HRS 11 MINS 36 SECS

0 HRS 19 MINS 47 SECS

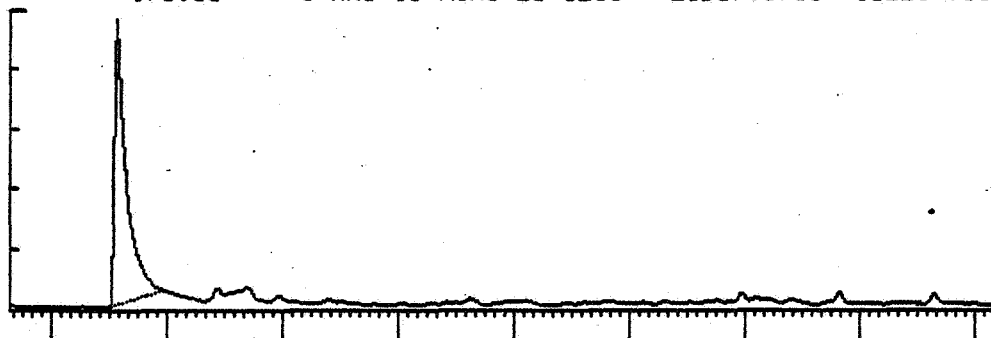
4130-4140m

# FIGURE 9g AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

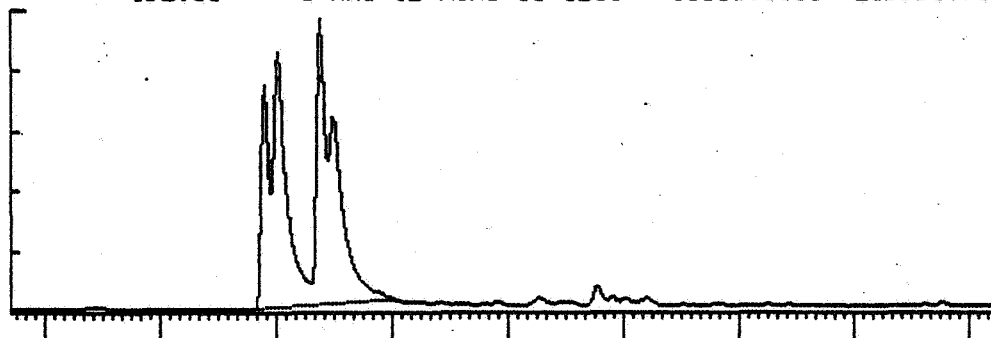
SIR REPORT. FILE - 951296 .SD RUN - 1

UNCALIBRATED.

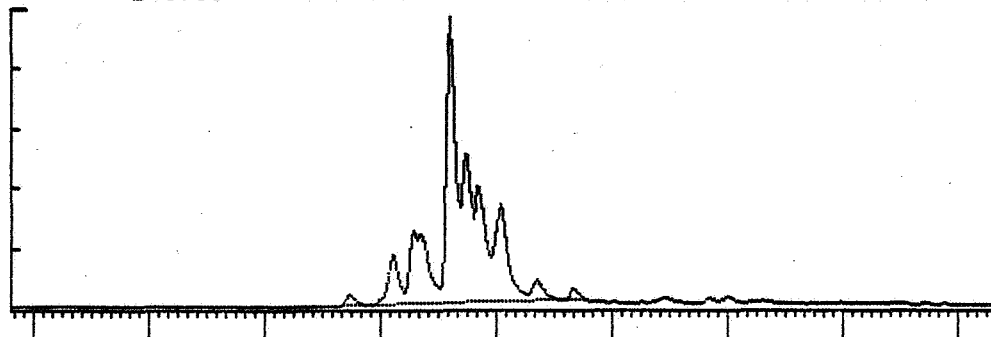
| MASS   | RETENTION TIME        | HEIGHT     | AREA        | CONC. (H) | CONC. (A) |
|--------|-----------------------|------------|-------------|-----------|-----------|
| 178.00 | 0 HRS 10 MINS 26 SECS | 21957.5700 | 152264.5000 | 0.0000    | 0.0000    |



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 192.00 | 0 HRS 12 MINS 58 SECS | 13688.6500 | 289995.7000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 206.00 | 0 HRS 14 MINS 60 SECS | 13422.7300 | 237138.7000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



0 HRS 11 MINS 47 SECS

0 HRS 19 MINS 59 SECS

4473.2m

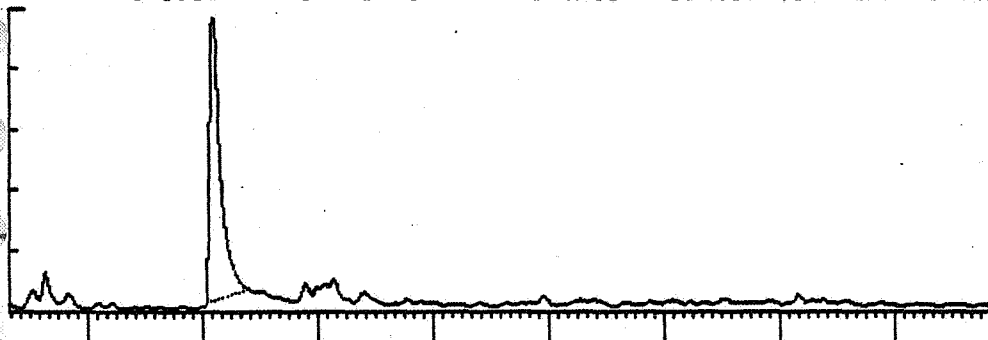
S.W.C.

# FIGURE 9h AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

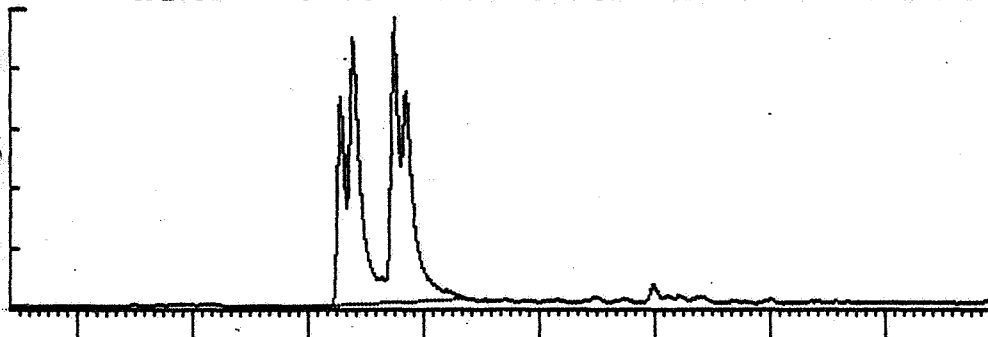
SIR REPORT. FILE - 951302 .SD RUN - 1

UNCALIBRATED.  
MASS

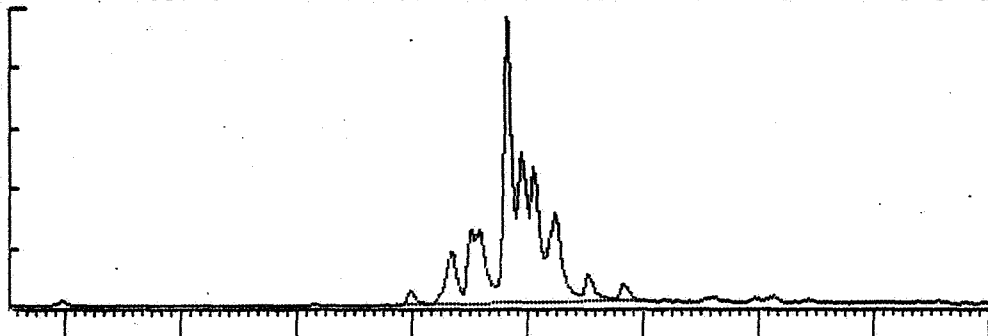
| RETENTION TIME | HEIGHT                | AREA       | CONC. (H)   | CONC. (A) |        |
|----------------|-----------------------|------------|-------------|-----------|--------|
| 178.00         | 0 HRS 11 MINS 51 SECS | 30658.4500 | 199979.5000 | 0.0000    | 0.0000 |



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 192.00 | 0 HRS 14 MINS 16 SECS | 22471.8400 | 426133.0000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 206.00 | 0 HRS 16 MINS 10 SECS | 20145.8200 | 350915.7000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



0 HRS 12 MINS 30 SECS

0 HRS 20 MINS 42 SECS

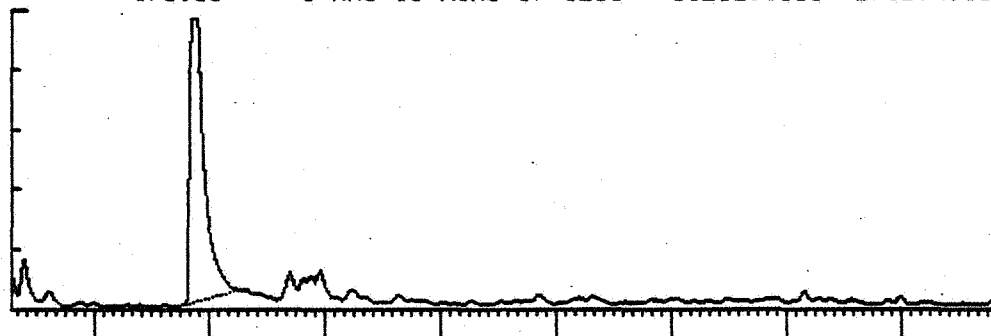
4510-4520m

# FIGURE 9i AROMATIC MASS FRAGMENTOGRAMS WELL 6406/3-1 PHENANTHRENE SERIES

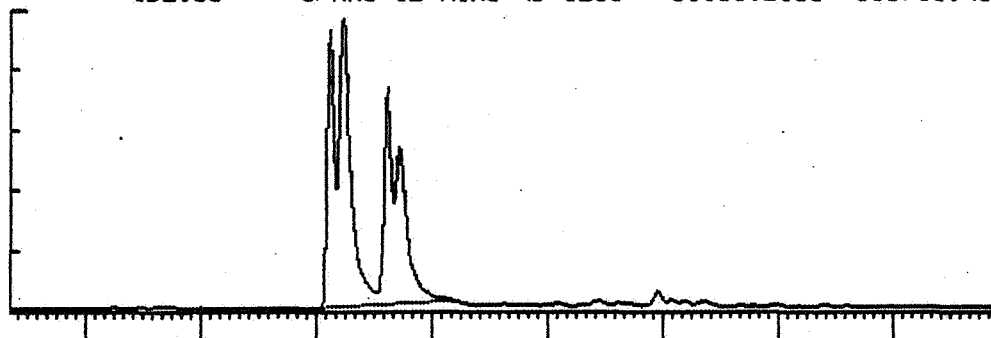
SIR REPORT. FILE - 951327 .SD RUN - 1

UNCALIBRATED.

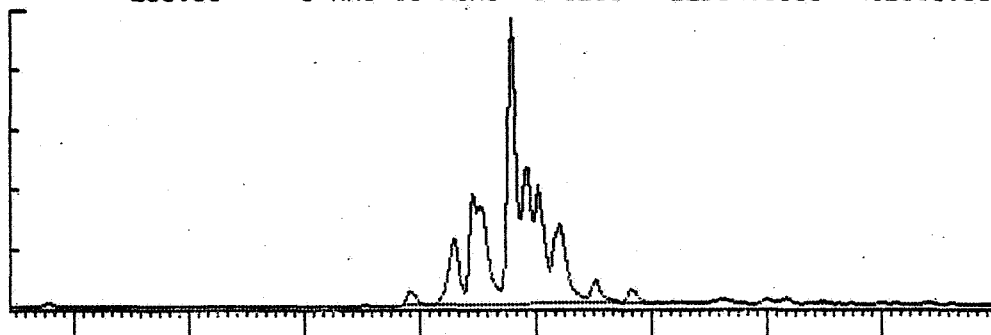
| MASS   | RETENTION TIME        | HEIGHT     | AREA        | CONC. (H) | CONC. (A) |
|--------|-----------------------|------------|-------------|-----------|-----------|
| 178.00 | 0 HRS 10 MINS 37 SECS | 31282.1000 | 271214.1000 | 0.0000    | 0.0000    |



|        |                       |            |             |        |        |
|--------|-----------------------|------------|-------------|--------|--------|
| 192.00 | 0 HRS 12 MINS 49 SECS | 31135.2100 | 563715.4000 | 0.0000 | 0.0000 |
|--------|-----------------------|------------|-------------|--------|--------|



|        |                      |            |             |        |        |
|--------|----------------------|------------|-------------|--------|--------|
| 206.00 | 0 HRS 15 MINS 8 SECS | 22904.5000 | 412863.8000 | 0.0000 | 0.0000 |
|--------|----------------------|------------|-------------|--------|--------|

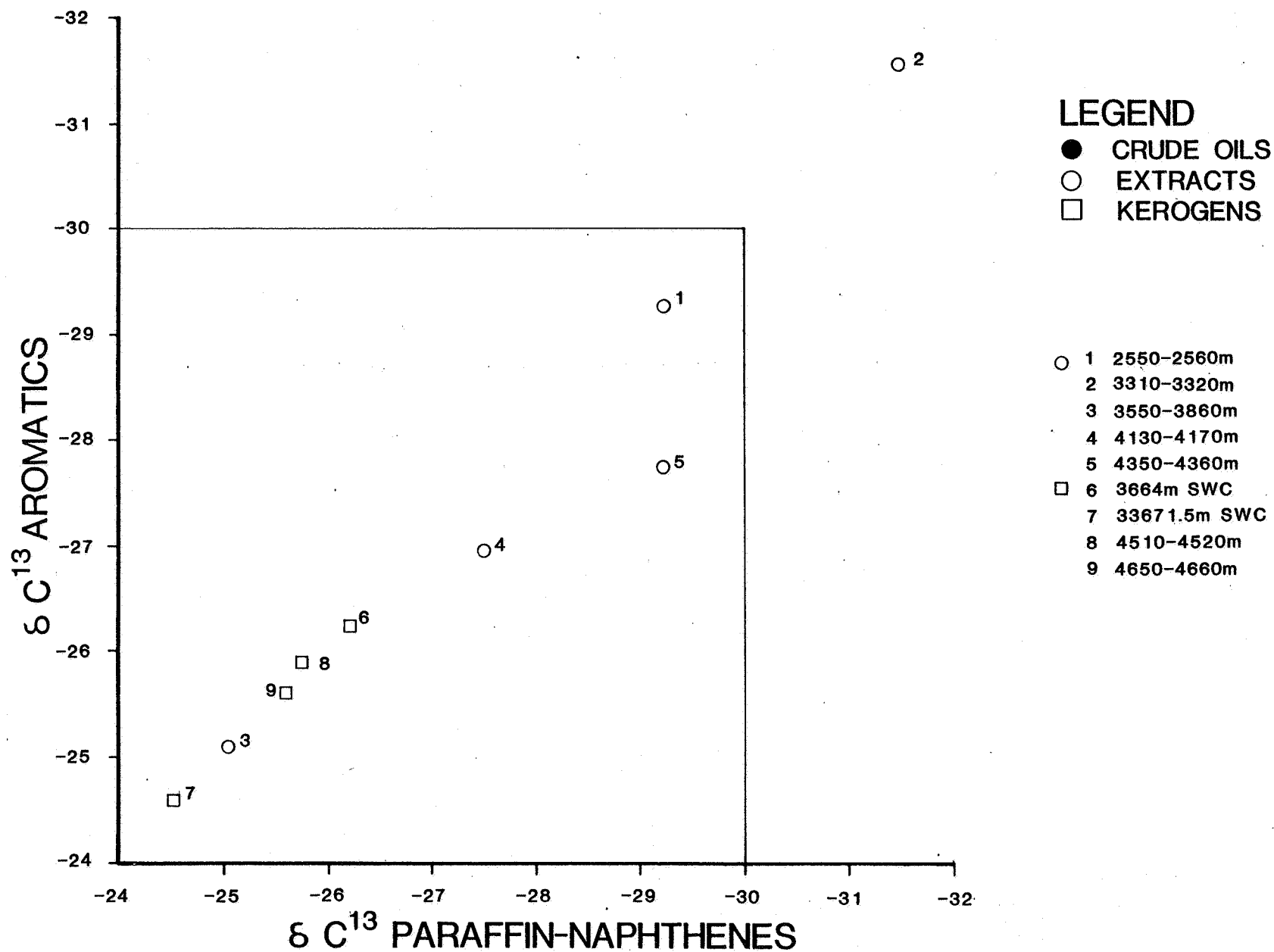


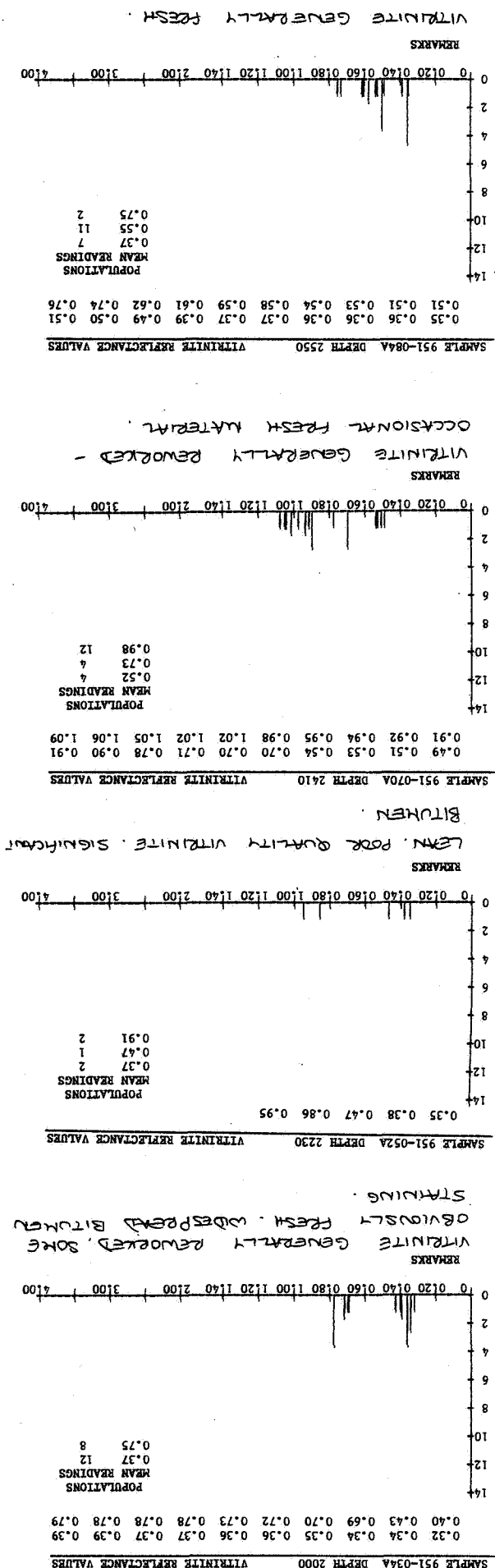
0 HRS 11 MINS 26 SECS

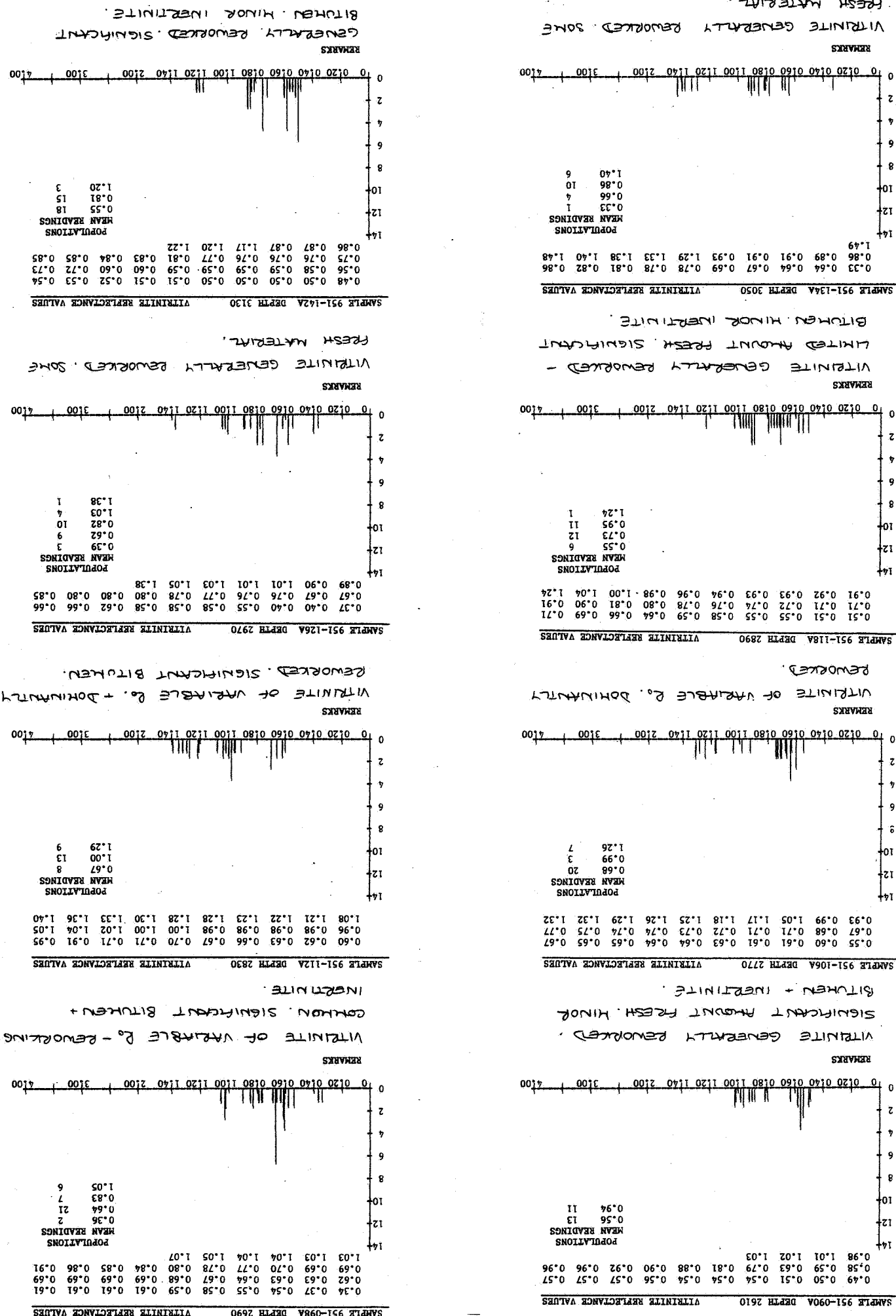
0 HRS 19 MINS 38 SECS

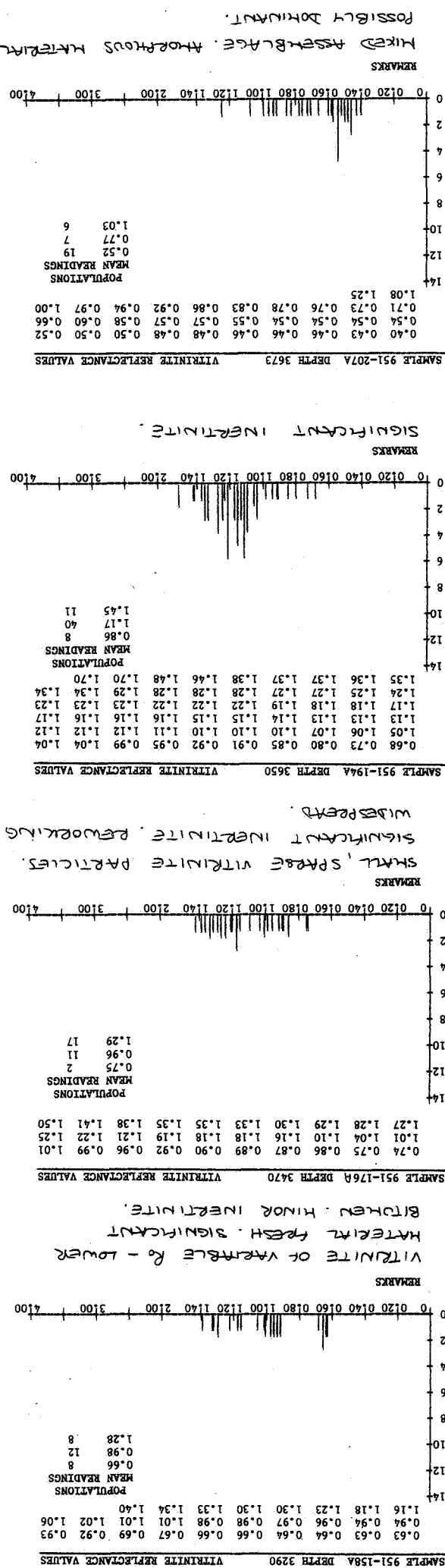
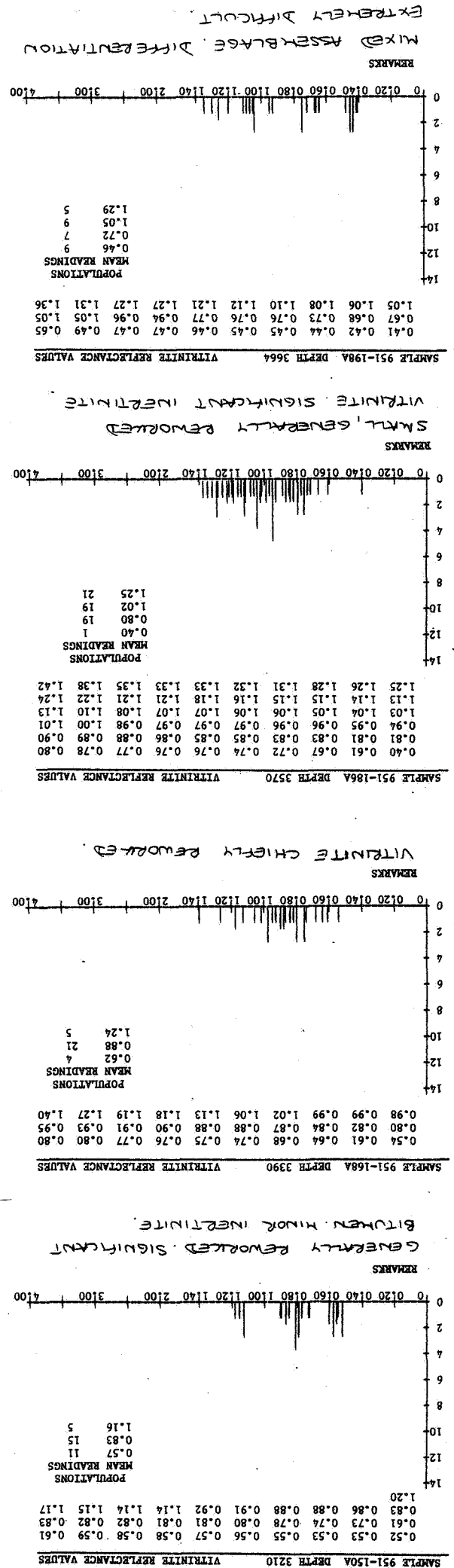
4753m  
S.W.C.

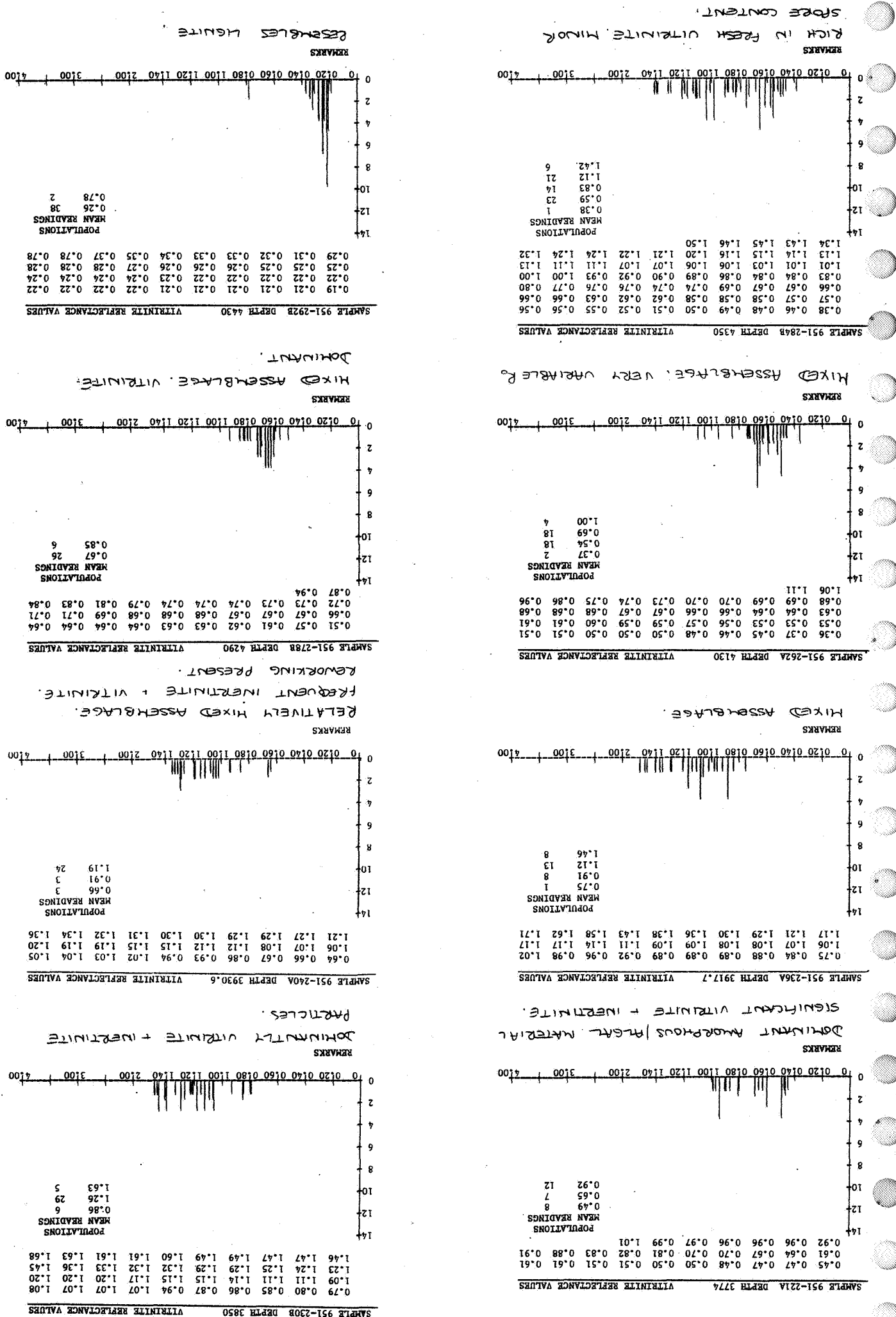
(‰, PDB)













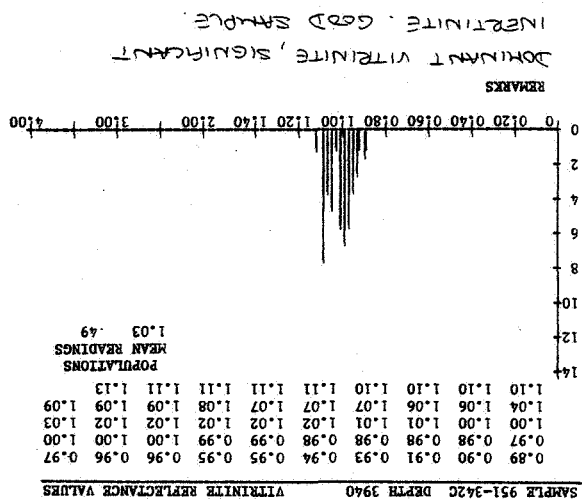
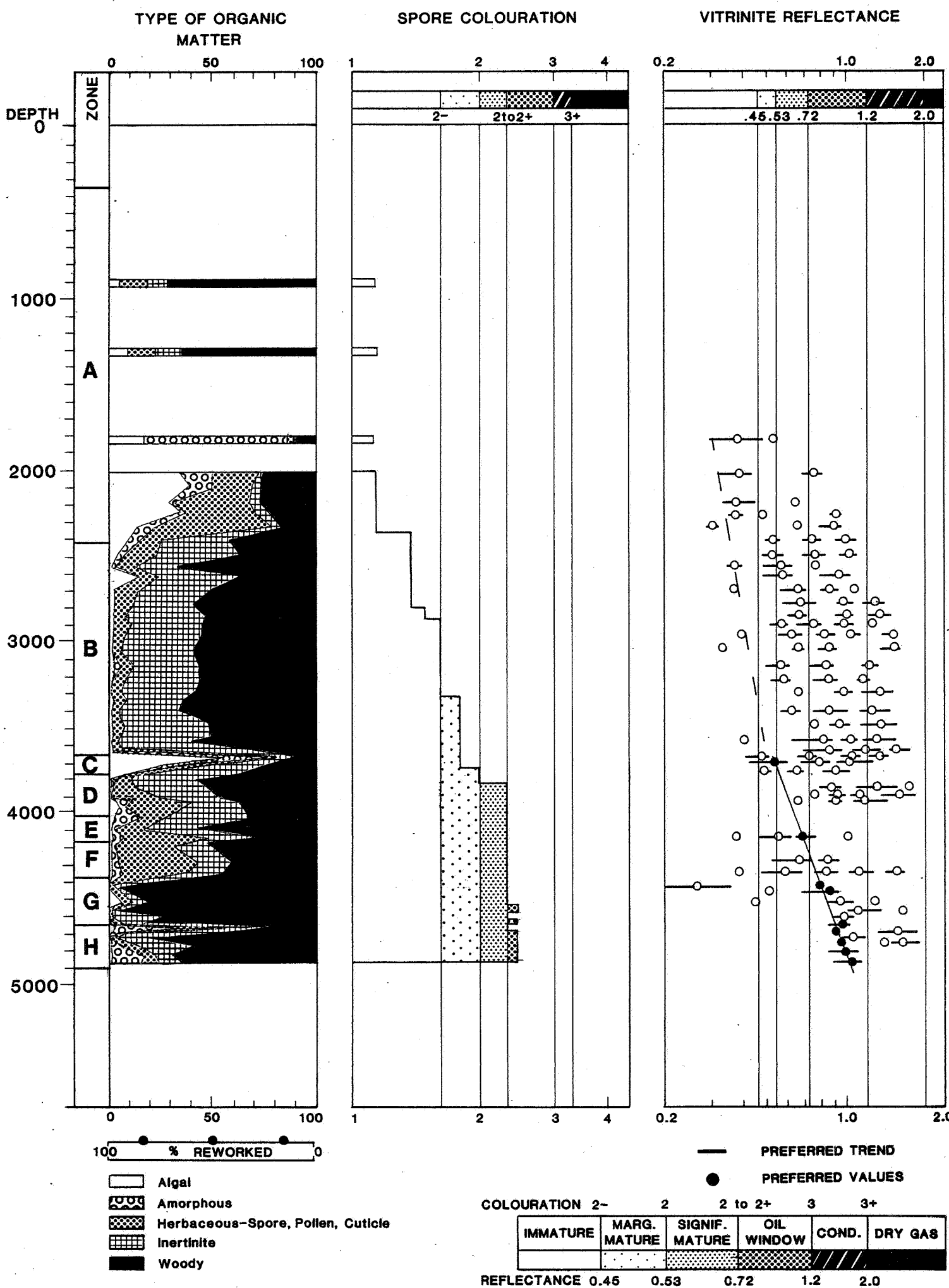


FIGURE 12      **ORGANIC FACIES & MATURITY**      WELL    6406/3-1



## BRIEF DESCRIPTION OF THE ANALYSES PERFORMED BY GEOCHEM

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

### A) $C_1-C_7$ LIGHT HYDROCARBON ANALYSIS

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

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

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

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

### B) SAMPLE WASHING AND HAND PICKING

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

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

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

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

### C) ORGANIC CARBON ANALYSIS

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

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

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

### D) MINI-PYROLYSIS

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

### E) DETAILED $C_4-C_7$ HYDROCARBON ANALYSIS

The abundance and composition of the  $C_4-C_7$  gasoline-range hydrocarbons in sediments reflects their source quality, level of thermal maturation and organic facies. In addition, the data also reveal the 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  $C_{15+}$  analyses.

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

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

### F) KEROGEN TYPE AND MATURATION

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

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

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

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

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

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

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

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

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

#### G) VITRINITE REFLECTANCE

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

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

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

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

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

#### H) C<sub>15+</sub> EXTRACTION, DEASPHALTENING AND CHROMATOGRAPHIC SEPARATION

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

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

#### J) GC ANALYSIS OF C<sub>15+</sub> PARAFFIN-NAPHTHENE HYDROCARBONS

The gas chromatographic configurations of the heavy C<sub>15+</sub> paraffin-naphthene hydrocarbons reflect source type, the degree of thermal maturation and the presence and character of migrated hydrocarbons or contamination.

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

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

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

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

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

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.<sub>A</sub> and C.P.I.<sub>B</sub>; pristane to phytane ratio; pristane to nC<sub>17</sub> ratio.

#### K) PYROLYSIS

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

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

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

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

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

#### L) CORRELATION STUDY ANALYSES

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

- detailed  $C_4$ - $C_7$  hydrocarbon (gasoline range) analysis. See Section E. Although these hydrocarbons can be affected by migrational/alteration processes, they commonly provide a very useful correlation parameter.
- capillary gas chromatography of the  $C_{15+}$  paraffin-naphthenes. See section J. The branched+normal paraffin distributions are used to "fingerprint" the samples.
- capillary chromatograms of whole oils and of the  $C_{4+}$  fraction of source rocks.
- capillary gas chromatography of  $C_{15+}$  aromatic hydrocarbons. Separate chromatograms of the hydrocarbons and of the sulphur-bearing species are reproduced.
- high pressure liquid chromatograms.
- mass spectrometric carbon isotope analyses of crude oil and rock extract fractions and of kerogen separations. A powerful tool for comparing hydrocarbons and correlating hydrocarbons to organic matter. With this technique the problem of source rock contamination can be avoided. The data are recorded on x-y or Galimov plots.
- mass fragmentograms (mass chromatograms) of fragment ions characteristic of selected hydrocarbon groups such as the steranes and terpanes. The fragmentograms provide a convenient and simple means of presenting detailed mass spectrometric data and are used as a sophisticated fingerprinting technique. This provides the ultimate resolution for correlating hydrocarbons and facilitates the examination of hydrocarbon classes.
- vanadium and nickel contents.

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

M) ANALYSES FOR SPECIAL CASES

M-1) ELEMENTAL KEROGEN ANALYSIS

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

M-2) SULPHUR ANALYSIS

The abundance of sulphur in source rocks and crude oils.

M-3) CARBONATE CONTENT

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

M-4) NORMAL PARAFFIN ANALYSIS

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

M-5 SOLID BITUMEN EVALUATION

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

The analysis involves the determination of the solubility (in CS<sub>2</sub>) of the solid bitumen and of the atomic hydrogen to carbon ratio of the insoluble fraction.

N) CRUDE OIL ANALYSIS

N-1) API GRAVITY

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

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

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

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

N-5) FRACTIONAL DISTILLATION

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