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GEOCHEMICAL EVALUATION OF STATOIL'S 30/3-3 WELL,

NORWEGIAN NORTH SEA

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GEOCHEMICAL EVALUATION OF STATOIL'S 30/3-3 WELL, NORWEGIAN NORTH SEA

SUMMARY

The Tertiary silty mudstones from 925-1350± metres are immature but potentially good source rocks for gas and minor associated condensate. Between 1350± metres and 1860± metres they are only fair source rocks and are gas prone. The rest of the Tertiary and Cretaceous section has a minimal potential for hydrocarbons.

Minor hydrocarbon generation has occurred within the shales above 2850± metres in the Jurassic but, if mature, these sediments would be rich source rocks and associated reservoirs would be very prospective. As a result of changes in organic facies they are particularly rich above 2760± metres and have a potential for light oil and gas whilst below this depth, they will yield gas and condensate.

There are shows of condensate within this Jurassic interval, with weaker shows down to approximately the top of the Brent and a diffusion halo of wet gas up to 2535± metres in the Cretaceous. At 2955-2970± metres there is a possible show of relatively paraffinic crude.

The Jurassic mudstones from 2925-2978± metres are potentially very good source rocks for gas and condensate. Within the Brent Formation the coals are potentially rich gas sources whilst the coaly shales are also rich and, although not completely mature, have a potential for gas and light oil. With the exception of the minor coals at its base, the Dunlin Formation comprises relatively uninteresting poor and fair source rocks for gas.

Oil prone source rocks are mature below 2960± metres and lie within the oil window below 3360± metres. The section is presently at approximately its maximum paleodepth of burial. A change in the maturation gradient is indicated below approximately 2900± metres.

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INTRODUCTION

This report presents a geochemical evaluation of Statoil's 30/3-3 well drilled in the Norwegian sector of the North Sea.

The study was designed to be compatible with other studies undertaken for Statoil and to investigate the hydrocarbon source potential of the section in terms of:

- source richness
- thermal maturity
- organic facies
- potential for oil, condensate and gas.

In addition, shows of migrated, out of place hydrocarbons were sought and characterised.

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

A. ANALYTICAL

A total of two hundred and nine (209) canned samples, each composited over fifteen (15) metres, were received from 280-3419(TD) metres in 30/3-3. One (1) mud sample was also included. Subsequently, four (4) core samples from the interval 2979.3-2987.6 metres and five (5) sidewall core samples from below 3000 metres were submitted. These samples were assigned the Geochem job number 786.

During the sample preparation procedures significant contamination was observed at 2220-2310 metres and 2955-3210 metres. The interval below 3077 metres was turbodrilled. Sample quality was poor at 2850-2985 metres.

Analytical guidelines were provided by Dr. H. Irwin. More analyses were run than specified and in particular, the light hydrocarbon analysis was performed upon every sample in order to generate a complete geochemical well log. No charge has been made for these extra analyses. Following the screening of every sample with the light hydrocarbon analysis and of selected samples by the organic carbon and Rockeval pyrolysis analysis, further samples were selected for the detailed analyses. A total of two hundred and ten light hydrocarbon analyses, one hundred and forty three organic carbon analyses, seventy Rockeval pyrolysis analyses, twenty four pyrolysis-GC analyses, thirty eight kerogen analyses, thirty five vitrinite reflectance determinations, eighteen C_{15+} extractions with chromatography, eighteen high resolution paraffin-naphthene analyses, and fifteen high resolution aromatic analyses were performed in this study. As instructed nine carbon isotope analyses and three mass fragmentogram analyses were run upon the sandstone core samples.

The data are presented in tables 1 through 9 and graphically in figures 1 through 10. A brief description of the analytical techniques employed in this study is included in the back of the report.

B. GENERAL INFORMATION

Ten (10) copies of this report have been forwarded to Dr. H. Irwin at Statoil in Stavanger together with the kerogen slides. In addition the analytical data have also been supplied on magnetic tape. A copy of the data has been retained by Geochem for future consultation with authorised Statoil personnel.

The remaining sample material will be returned to Statoil.

All of the results related to this study are proprietary to Statoil.

RESULTS AND INTERPRETATION

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

No well logs were available for this study but the major formation tops were supplied by Dr. H. Irwin and have been incorporated into the following discussion.

A. ZONATION

This zonation represents a synthesis of the formation tops with the light hydrocarbon (C_1-C_7) and organic carbon data. Ten (10) zones are recognised.

The Tertiary is sub-divided into Zones A^1 through A^3.

Zone A^1 280 metres to 925± metres, consists of sands with, above 720± metres, minor proportions of a basic igneous rock.

The C_1-C_4 gases generally range from (2173)2565 ppm up to 10795 ppm, although they exceed 4000 ppm only at 385-625± metres. The gases are sparser above 325± metres and below 730± metres. Above 730± metres the gases are very dry (generally less than 3% C_{2+}) but below this depth, although still dry, they are commonly 10-25% wet. The heavier C_5-C_7 hydrocarbons fail to exceed 100 ppm over some intervals but jump to (94)357-1062(2615) ppm at 370-580± metres and to (108)933-3655 ppm below 820± metres. The upper of these two intervals is also enhanced in the C_1-C_4 gases but there is no improvement in gas wetness, whilst the lower interval is characterised by wetter gases. The section between 835± metres and 910± metres is of the most interest.

Zone A^2 925± metres down to 1860± metres is dominated by silty mudstones which are light olive grey and olive grey in colour.

Within this interval the C_1-C_4 gases lie within the limits of (173)1114-10944(13113) ppm and are dry throughout, although there is a gross trend of increasing wetness with depth. Below 1000± metres their isobutane to normal butane ratios generally exceed 1.0. The C_5-C_7 fraction normally ranges from 13 ppm up to 350 ppm but is improved above 970± metres where the butane ratios are also lower.

Zone A^3 lies between 1860± metres and 2212± metres. It consists of medium grey mudstones and shales with interbeds of siltstone.

The gaseous hydrocarbons decrease from (216)1196-2622(3456) ppm above 2055± metres to 256-1155 ppm below this depth but are now commonly 8-17% wet, although there is no obvious trend against depth. However, the C_5-C_7 fraction varies more dramatically from 55 ppm to 1383 ppm, peaking at 1920-2055± metres.

Zone B 2212± metres to 2535± metres is, like Zone C, Cretaceous in age. It is composed of medium light grey shaly mudstones.

C_1-C_4 and C_5-C_7 hydrocarbon abundances are low at (92)170-556 (812) ppm and 22-85(101) ppm respectively, but the gases pass from dry (14-24% C_{2+}) above 2310± metres to marginally wet (31-47% C_{2+}) below this depth and then, below 2445± metres, to wet (52-71% C_{2+}). Isobutane to normal butane ratios are however high, although they do increase with depth.

Zone C 2535± metres to 2663± metres, comprises shaly mudstones, calcareous shales and shales.

The trend observed in Zone B continues into Zone C. Thus this interval is richer (1270-2306(3596) ppm C_1-C_4; 142-843 ppm C_5-C_7) than Zone B and is very wet, with 76-90% of the C_2-C_4 fraction. The C_5-C_7 hydrocarbons increase in abundance with depth whilst the butane ratios decrease with depth from 0.8 to 0.3.

Zone D extends from 2663± metres down to 2850± metres and corresponds to the upper part of the Jurassic. This interval is characterised by brownish black shales and silty shales. Interbeds of medium dark grey shale are also present.

The brownish black shales and silty shales above 2820± metres appear to be oil-stained and the minor silty limestone from 2790-2805± metres also exhibits a weak stain.

Zone D is rich and wet. Gas abundances lie within the limits of (8808)16696-37966 ppm, the gases are 80-94(98)% wet and their isobutane to normal butane ratios approximate 0.2. The C_5-C_7 hydrocarbons have values of 11805-19937(24761) ppm above 2760± metres but then fall to 2872-7355 ppm. Although the break is not as dramatic, the interval above 2760± metres is also richer in the C_1-C_4 fraction and is somewhat wetter.

Zone E which is also Jurassic, lies between 2850± metres and 2978± metres. The samples contain abundant lost circulation material but this interval apparently consists of olive grey mudstones (sometimes calcareous).

A slight oil stain was observed in the mudstone from 2940-2955± metres.

The C_1-C_4 gases generally lie within the limits of 1815-3037 ppm above 2925± metres and then jump to 9621-12572 ppm. They are extremely wet throughout at 85-95% C_{2+} and have low butane ratios of 0.2-0.3. C_5-C_7 abundances increase at 2910± metres from 1074-3768 ppm to 6576-8252 ppm.

Zone F 2978± metres to 3116± metres, represents the Brent Formation. The samples suggest an interval of sandstones with interbeds of coal above 2988± metres and an interval of sandstones interbedded with coaly shales (carbargillites) below 3030± metres. These two units sandwich a sequence of dolomites, mudstones and coaly shales. The latter sometimes resemble an additive but are believed to be indigenous to the section.

Zone F generally contains 11324-22300 ppm of the C_1-C_4 gaseous hydrocarbons but is significantly richer (38677-47134 ppm) at 2985-3045± metres. With the exception of the uppermost sample, gas wetnesses are much lower (50-66% C_{2+}) than in Zone E whilst butane ratios are higher at 0.3-0.4. Again with the exception of the uppermost sample, the C_5-C_7 hydrocarbons lie within the lower limits of 1017-2455 ppm.

Zone G 3116± metres to 3330± metres, represents the upper part of the Dunlin Formation and corresponds to a sequence of silty mudstones and shales interbedded with sandstones.

Geochemically, the top sample resembles Zone F but otherwise, this interval is leaner in the gases with (1849)3393-9262 ppm of marginally wet to wet (41-61(66)% C_{2+}) gas. Isobutane to normal butane ratios are low (0.2-0.3). The C_5-C_7 hydrocarbons generally lie within the limits of 2484-5864 ppm but jump to 9637-11925 ppm at 3180-3210± metres.

Zone H extends from 3330± metres to 3419± metres (TD) and also belongs to the Dunlin Formation. It consists of medium dark grey siltstones and silty shales with interbedded sandstones. Minor proportions of coal are present in the samples below 3390± metres.

Gas abundances are significantly higher than in Zone G and also jump at 3375± metres from 10397-24492 ppm at 43061-89641 ppm. This improvement is not reflected in the C_5-C_7 fraction (1683-4325 ppm) whilst the gases are now only marginally wet, with 27-51% of the C_2-C_4 hydrocarbons.

B. AMOUNT AND TYPE OF ORGANIC MATTER

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

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

The interbeds of medium greenish grey silty mudstone below 1600± metres in Zone A^2 are very lean at 0.15-0.19% organic carbon, but the olive grey silty mudstones which dominate Zone A^2 are of approximately average organic richness at (0.50)0.85-1.35% organic carbon. Wood is the major component of their organic matter which is however, better described as a mixed woody-herbaceous-algal assemblage with minor to significant proportions of amorphous material. The amorphous fraction is occasionally a major constituent but is of relatively poor quality and is not oil-prone.

Interbeds of very lean mudstone are present within Zone A^3 and even the dominant medium grey mudstones and siltstones are relatively lean at 0.26-0.52(0.95)% organic carbon. Their organic matter is generally woody and inertinitic in type but in the richest shale, it is woody with significant proportions of herbaceous, inertinitic, amorphous and algal debris. The amorphous fraction is atypical and is not oil-prone.

The Cretaceous mudstones and shales of Zones B and C contain 0.42-0.52% and 0.45-0.72% organic carbon respectively, being richest below 2595± metres in Zone C. Both zones are characterised by organic matter which is dominantly reworked woody and inertinitic in type.

In contrast, the brownish black shales which characterise the Jurassic of Zone D are organically rich with values of 4.37-7.61% organic carbon. They tend to be richest above approximately 2745± metres, although this is only a gross generalisation. However their organic matter certainly does change. Thus above 2760± metres it is dominantly amorphous with significant proportions of partially converted algal debris, although the amorphous dominance is less marked below 2720± metres where woody and inertinitic material is also significant. In fact the organic matter within the interval 2720-2760± metres is transitional towards the mixed inertinitic-amorphous-algal-herbaceous-woody assemblage below 2760± metres, which is clearly less oil-prone than the organic matter above 2720± metres. The intervals of medium dark grey shale within Zone D are much leaner at 0.49-0.62(0.92)% organic carbon.

Sample quality is poor in the Jurassic of Zone E but the calcareous mudstones at 2880-2925± metres increase with depth from 0.62% to 1.54% organic carbon and the underlying mudstones continue with this trend, increasing from 1.84% to 3.27% organic carbon. The organic matter in the calcareous mudstones is largely woody, although with significant proportions of all the other fractions, whilst the mudstones have a mixed algal-amorphous-herbaceous-woody-inertinitic assemblage which is similar in appearance to that at the base of Zone D.

The Brent Formation (Zone F) is quite variable. Thus the dolomites within the interval 2985-3060± metres are lean at 0.13-0.21% organic carbon but the coal from 2987 metres is very rich (60.3%) in organic matter which is almost entirely woody in type. The coaly shales within the interval 2985-3090± metres range from 11.2% up to 45.9% organic carbon (i.e. impure coal) but generally fail to exceed 24% and these more representative coaly shales are characterised by organic matter which is dominantly woody in type but also includes significant proportions of herbaceous and algal debris. The minor medium dark grey shales within Zone F contain 0.68-2.01% of a mixed kerogen assemblage (algal-woody-herbaceous-amorphous-inertinitic) which is very similar to those observed at the base of Zone D and in Zone E.

Most of the silty mudstones and shales of Zone G (Dunlin) contain 0.77-1.23% organic carbon but there are a few intervals (above 3135± metres, 3186 metres) with better values of 1.77-2.32% organic carbon. These variations are not convincingly reflected in the character of their organic matter as the sediments above 3150± metres have a herbaceous-woody assemblage whilst below this depth the organic matter is woody and herbaceous with minor to significant proportions of inertinite. Amorphous material is sometimes significant but this is believed to be largely contaminant.

The silts above approximately 3375± metres in Zone H contain 1.46-1.71% of organic matter which is believed to be woody, herbaceous and inertinitic in type as the abundant amorphous material is thought to be due to contamination. The underlying silty shales have lower values of 0.94-1.16% and their organic matter is dominantly woody with significant proportions of herbaceous and inertinitic debris. Finally, the minor coals below 3390± metres contain 39.1-67.6% of organic matter which is almost entirely woody in type.

The most oil-prone organic matter is that in the shales at the top of Zone D.

C. LEVEL OF THERMAL MATURATION

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

A spore colouration thermal index of 2- is achieved at a depth of 2500± metres, with indices of 2 and of 2 to 2+ being reached at 2970± metres and at 3360± metres respectively.

All organic matter with a thermal index of less than 2- is immature. At 2- the amorphous, herbaceous±algal fractions of the total organic matter become marginally mature (minor hydrocarbon generation) whilst they become mature (significant generation) at 2 and pass into the oil window of peak hydrocarbon generation at 2 to 2+. However woody material only becomes marginally mature at 2.

Thus in this well the section above 2500± metres is immature and no thermal hydrocarbon generation has occurred. Due to the character of the organic matter the remainder of the Cretaceous is effectively immature and only very limited hydrocarbon generation can be anticipated. The Jurassic of Zones D and E is however, marginally mature and off-structure (buried to below 2970± metres) will be mature. Within the Brent Formation and above 3360± metres in the Dunlin, hydrocarbon generation has generally been rather minor due to the overall nature of the organic matter although significant generation will have occurred in the herbaceous fraction which is commonly fairly abundant. Below 3360± metres significant generation has been initiated from the dominant woody organic matter whilst the significant herbaceous fraction within the silty shales lies in the oil window. Naturally, any oil-prone organic matter below 3360± metres is experiencing the optimum maturation conditions of the oil window.

Many vitrinite reflectance readings were obtained from most of the samples and, although most of these sediments contain more than one population of vitrinite, the major population apparently generally corresponds to the indigenous vitrinite. Indeed plotted against depth and allowing for the prevalent reworking in the Cretaceous (which was also observed in the kerogen preparations), the major populations give a good trend or rather two trends, as a different gradient is indicated below approximately 2900± metres. The discontinuous trend line suggests that the section is presently at approximately its paleodepth of burial. It reaches 0.45% Ro at approximately 2500± metres, 0.53% Ro at 2940± metres and 0.72% Ro at 3320± metres. As these values should correlate with spore colouration thermal indices of 2-, 2 and 2 to 2+, the correlation between the two methods is quite satisfactory.

The light hydrocarbon data and the C_{15+} paraffin-naphthene chromatograms provide qualitative support for the maturation profile derived above.

Pyrolysis Tmax determinations are influenced by organic facies but can provide an indication of maturation levels. In this well a trend is established below 2200± metres and Tmax levels of 430°C and of 440°C are achieved at depths of approximately 2400-2500± metres and 3000-3100± metres respectively.

D. SOURCE RICHNESS

A preliminary evaluation of source richness using the organic carbon data suggests that the silty mudstones of Zone A^2 have a fair to good source potential and that there are good intervals within Zones E, G and H. Zone D, together with the coals and coaly shales of Zone F (and H), is rich.

Upon Rockeval pyrolysis the dominant silty mudstones of Zone A^2 yielded 1.73-3.67(4.53) mg/g P2 (pyrolysate). They are richest towards the top of the zone and indeed, only those from above 1350± metres are assigned a good rating, with the underlying mudstones being fair. The hydrogen index indicates that organic matter quality is also better at the top of the interval and then deteriorates with depth - particularly below 1450± metres. The interbedded medium greenish grey silty mudstones are lean.

Although there is a slight improvement below 2595± metres in Zone C, Zones A^3 and C comprise poor source rocks (0.21-0.65(1.10) mg/g).

In contrast, Zone D (Jurassic) is rich. The brownish black shales yielded 23.3-36.2 mg/g P2 above 2760± metres and 14.6-18.8 mg/g below this depth. They are richest at the top of the zone above 2685± metres. Hydrogen indices also decrease at 2760± metres from 430-524(622) down to 261-371. Clearly, the interval above 2760± metres contains the best and most oil-prone organic matter. The interbedded medium dark grey shales are lean.

Zone E (Jurassic) is more varied, although the quality of its organic matter is generally comparable to that in the lower part of Zone D. The calcareous mudstones from 2895-2925± metres are potentially fair and good source rocks whilst the underlying mudstones (6.5-10.9 mg/g) have a very good source potential. The coaly shales and carbargillites of the Brent (Zone F) vary as a function of organic richness from 18.8 up to 93.2 mg/g and commonly have fair hydrogen indices. In contrast the minor medium dark grey shales are generally only fair source rocks. It is believed that the shale from 2970-2985± metres is caved from Zone E.

The silty mudstones of Zone G (Dunlin) are commonly only poor to fair source rocks, but those from 3180-3195± metres and 3285-3330± metres (4.3-4.7 mg/g) are classified as good and are also characterised by good quality organic matter. It is suspected that this apparent enhancement is due, at least in part, to contamination. Similarly in Zone H, the variation in the siltstones from 0.8 up to 6.0 mg/g is also believed to be due to contamination and, allowing for this, it is likely that these sediments are only poor or fair source rocks, although the coals at the base of this zone are rich.

Upon extraction the two silty mudstones analysed from below 1600 metres in Zone A^2 yielded 57-81 ppm C_{15+} hydrocarbons, and are clearly poor source rocks. In contrast the Jurassic shales of Zone D gave high values of 921-2975 ppm resulting in rather high hydrocarbon to organic carbon and hydrocarbon to total extract ratios. The reason for this is evident from the paraffin-naphthene chromatograms where the high background envelopes indicate the presence of non-indigenous in addition to the source indigenous hydrocarbons. However, even when allowance for this is made, it would be expected that these shales would still be very good source rocks. The calcareous mudstone from 2895-2910± metres in Zone E is probably a fair source rock but it is not possible to evaluate the mudstone from 2955-2970± metres as its apparent richness (2611 ppm) is not real but reflects the presence of contamination and possibly, also a show of crude oil (see below). Contamination is evident in Zones F through H but the shales and siltstones are probably only fair (at best) source rocks. The contamination discussed above can also be observed in the chromatograms of the aromatic hydrocarbons.

Chromatograms of the pyrolysate (P2) material define whether a source rock, when mature, will yield oil, condensate or gas. Oil-prone sediments are characterised by a well defined series of normal alkene-alkane doublets which extend out to the heavy ends and dominate the chromatogram. If these doublets are confined to the light ends then a potential for condensate is indicated whilst in gas-prone sediments the doublets are (essentially) absent and the chromatogram is dominated by the methane and aromatic compound peaks.

In this well the silty mudstones of Zone A^2 have a potential for gas with, in the richer mudstones from the top of this interval, minor associated condensate. Zones A^3 through C are gas prone. In contrast the Jurassic of Zone D, although not classically oil-prone, has a mixed potential for light oil and gas above 2760± metres whilst below this depth it will yield gas and condensate. This lower interval is deceptive as, although the peaks extend out to approximately C_{25}, it is believed that they represent contamination. A potential for gas and condensate is also assigned to the Jurassic Zone E interval. The coaly shales of the Brent (Zone F) will apparently yield gas and light oil but the silty mudstones of Zone G (Dunlin) are gas prone and those which were richer by the Rockeval technique are evidently contaminated. The silts and coals of Zone H are also gas-prone. Interestingly, the facies changes within Zone D appear to be reflected in the chromatograms of the aromatic hydrocarbons.

In summary therefore:

- dominant silty mudstones of Zone A^2 potentially good source rocks for gas with minor associated condensate above 1350± metres and fair source rocks for gas below this depth.

- Zones A^3 through C (Tertiary and Cretaceous), poor and gas prone.

- Jurassic shales of Zone D potentially rich source rocks, especially above 2760± metres (and particularly above 2685± metres). Mixed potential for light oil and gas above 2760± metres passing to gas and condensate below this depth.

- mudstones below 2925± metres in Zone E (Jurassic) potentially very good source rocks for gas and condensate. Calcareous mudstones from 2895-2925± metres fair and good source rocks.

- Brent Formation (Zone F): coals rich, probably for gas; coaly shales and carbargillites potentially rich source rocks for gas and light oil.

- Zone G (Dunlin) poor and fair for gas.

- Zone H (Dunlin): siltstones poor and fair source rocks for gas. Coals at base of interval potentially rich gas source.

E. MIGRATED HYDROCARBONS

Staining was observed in the mudstones above 2820± metres in Zone D (Jurassic), in the minor silty limestone from 2790-2805± metres and in the mudstones from 2940-2955± metres.

The C_1-C_4 data suggest the possibility of traces of fairly dry gas between 820± metres and 910± metres in Zone A^1, although the C_5-C_7 abundances are suspiciously high. This could be due either to the presence of contamination or possibility (but less likely) to residual oil. The extremely wet gases in Zone D suggest shows within this Jurassic interval with traces extending up to the top of Zone C (diffusion halo ?) and weaker shows in Zone E. It is also possible that there could be shows of wet gas within the Brent but the data are not definitive on this point.

The Rockeval Production Indices are generally low and non-indigenous hydrocarbons are suggested only in a few isolated samples (1695-1710± metres, 2580-2595± metres, 3135-3150± metres).

Samples were selected for extraction from Zones A^2 and D through H. High C_{15+} hydrocarbon yields were obtained from most of the Jurassic Zone D samples and, above 2715± metres, these hydrocarbons constitute approximately half of the total extract. However, their paraffin-naphthene chromatograms are not oil-like and any migrated C_{15+} hydrocarbons which are present could only occur as a young and relatively light product. This is also true of the sample from 2895-2910± metres in Zone E where indeed only a weak show (at best) could be present. However the sample from 2955-2970± metres is more interesting. It yielded 2611 ppm C_{15+} hydrocarbons, resulting in an anomalous hydrocarbon to organic carbon ratio and a relatively high (56.6%) proportion of hydrocarbons in the total extract. Drilling-introduced contamination is evident in the paraffin-naphthene chromatograms but the normal paraffins suggest the possibility that oil could also be present. The sandstone core samples from the Brent (Zone F) contain only 26-260 ppm C_{15+} hydrocarbons and, although the "richer" samples have good hydrocarbon to total extract ratios, their chromatograms indicate that this is due to drilling-introduced contamination. The same explanation applies to the enhanced sample from 3345-3360± metres in the Dunlin Formation.

Combining these data the following interpretation is obtained:

- Zone D (Jurassic); shows, possibly of condensate. Best shows above 2760± metres. A diffusion halo, probably of wet gas, extends up to the top of Zone C in the Cretaceous.

- Zone E (Jurassic); sample quality is poor but weaker shows (condensate ?) are suggested throughout this interval. There could be a show of a relatively paraffinic crude at 2955-2970± metres.

- Zone F (Brent); possible shows of wet gas. Only contamination was detected in the sandstone core samples and if any oil is present (but masked) it could only occur as insignificantly minor traces.

The three sandstone core samples from the Brent Formation were analysed in detail. Those from 2979 metres and 2983 metres yielded 233-260 ppm C_{15+} hydrocarbons which appear, from the paraffin-naphthene and aromatic chromatograms, to be dominantly if not entirely contaminant in origin. These two samples also have essentially identical carbon isotope compositions and phenanthrene and terpane mass fragmentograms, although there are some differences in the sterane (m/e 217) fragmentogram. In contrast the sandstone from 2987.5 metres is almost barren (26 ppm C_{15+} hydrocarbons) and its aromatic chromatogram and mass fragmentograms are quite different. The most dramatic differences are in the sterane mass fragmentogram which is not only quite unlike the others but significantly, is dominated by peaks of the 20R isomers, thus suggesting immaturity. Clearly, this is not the trace of a crude oil and must presumably, in view of its immaturity, reflect invasion by drilling mud bentonite. In conclusion therefore, the deepest core does not contain crude oil and there is nothing to suggest oil in the two shallower cores. Certainly, if oil is present, then only trace amounts could be involved.

F. CONCLUSIONS

Ten (10) zones are recognised between 280 metres and 3419 metres in 30/3-3.

The Tertiary is subdivided into Zones A^1 through A^3.

Zone A^1 (280-925± metres) is an interval of sands. It is tentatively speculated that there could be traces of fairly dry gas between 820± metres and 910± metres.

Zone A^2 (925-1860± metres) is composed of silty mudstones. The interbedded medium greenish grey variety below 1600± metres is very lean but the dominant silty mudstones throughout this zone contain (0.50)0.85-1.35% of a mixed woody-herbaceous-algal assemblage within which the woody fraction is the major constituent. These sediments are immature but the silty mudstones above 1350± metres are potentially good source rocks for gas with minor associated condensate whilst those from below this depth are only fair source rocks for gas.

In Zone A^3 (1860-2212± metres) the mudstones and siltstones generally contain only 0.26-0.52% of woody and inertinitic organic matter. They constitute poor and immature source rocks for gas, which are of no interest.

The Cretaceous is represented by Zones B (2212-2535± metres) and C (2535-2663± metres). However the differences between these two zones are minimal as, although there is an improvement below 2595± metres in Zone C, the mudstones of Zones B and C have low values of 0.42-0.52% and 0.45-0.72% organic carbon respectively and their organic matter is dominantly composed of reworked woody and inertinitic material. Zone B is immature whilst Zone C, due to the character of its organic matter, is effectively immature but even if mature, this entire interval would have only a minimal potential for gas.

Minor hydrocarbon generation would be anticipated from good quality organic matter below 2500± metres.

The post-Brent Jurassic is sub-divided into Zones D and E.

Within Zone D (2663-2850± metres) the interbeds of medium dark grey shale resemble Zone C at 0.49-0.62(0.92)% organic carbon. In contrast, the brownish black shales which characterise this interval have high values of 4.37-7.61%, tending to be richest above approximately 2745± metres. The character of their organic matter changes with depth. Thus above 2720± metres it is dominantly amorphous in type, with significant proportions of partially sapropelised algal debris. Between 2720± metres and 2760± metres the amorphous fraction is less dominant and significant proportions of woody and inertinitic material are also present. Finally, below 2760± metres, the organic matter in these shales is a mixed inertinitic-amorphous-algal-herbaceous-woody assemblage. Clearly, the environment of deposition became increasingly favourable for the formation of oil-prone source rocks towards the top of the zone and this is reflected in the source character of the sediments. Thus, whereas all of these shales are potentially rich source rocks (especially above 2760± metres and particularly above 2685± metres) their potential is for light oil and gas above 2760± metres and for gas and condensate below this depth. Minor hydrocarbon generation has already occurred on-structure and their lateral equivalents buried to below 2960± metres will be mature and starting to generate significant volumes of hydrocarbons. Within the oil window (below 3360± metres) they would generate major volumes of hydrocarbons.

Hydrocarbon generation is certainly occurring within the drainage area of the structure as Zone D contains shows which are probably of condensate. A diffusion halo of wet gas extends up into the Cretaceous up to the top of Zone C whilst there are apparently weak shows (condensate ?) down to the base of Zone E (see below) and there could be a show of a relatively paraffinic crude at 2955-2970± metres.

Sample quality is poor in Zone E (2850-2978± metres), but calcareous mudstones and mudstones are indicated at 2880-2925± metres and below 2925± metres respectively. The former contain 0.62-1.54% of a mixed organic matter assemblage within which wood is the major component whilst the mudstones have values of 1.84-3.27% organic carbon and their organic matter is algal-amorphous-herbaceous-woody-inertinitic in type. Organic carbon contents increase with depth. Minor hydrocarbon generation has occurred in this interval. The calcareous mudstones are potentially fair and good source rocks but the underlying mudstones are potentially very good source rocks for gas and condensate.

Oil-prone organic matter is mature below 2960± metres.

The Brent Formation (2978-3116± metres, Zone F) is apparently an interval of sandstones with interbedded coals and coaly shales. Dolomites are present between 2988± metres and 3030± metres but are very lean, whilst the minor medium dark grey shales vary between 0.68% and 2.01% organic carbon and contain a mixed organic matter assemblage similar to that in Zone E. The coal from 2987 metres contains 60.3% of organic matter which is almost entirely woody in type. The coaly shales from 2985-3090± metres range from 11.2% up to 45.9%

organic carbon but generally fail to exceed 24% and these more typical shales contain organic matter which is dominantly woody but which also includes significant proportions of herbaceous and algal debris. The coals represent potentially rich source rocks for gas within which only minor generation has occurred whilst the coaly shales are also potentially rich source rocks but will yield gas and light oil. Some oil generation would be anticipated from the herbaceous and algal fraction.

Indeed, there are possible shows of wet gas within the Brent Formation. Only contamination was detected in the sandstone core samples and, if any oil is present, it could only occur as insignificantly minor traces.

Zone G (3116-3330± metres, Dunlin) is a sequence of silty mudstones and shales interbedded with sandstones. The argillites generally contain 0.77-1.23% organic carbon but a few intervals (above 3135± metres, 3186 metres) are enriched at 1.77-2.32%. Their organic matter is herbaceous and woody above 3150± metres but is rather more woody below this depth. These sediments are mature, poor and fair source rocks for gas.

In Zone H (3330-3419± metres, Dunlin) the siltstones above 3375± metres contain 1.46-1.71% of mixed woody-herbaceous-inertinitic organic matter whilst the underlying silty shales are leaner at 0.94-1.16% and have organic matter which is largely woody, although the herbaceous and inertinitic fractions are both significant. They lie within the oil window but are only poor and fair source rocks for gas. The minor coals below 3390± metres have high values of 39.1-67.6% organic carbon and organic matter which is almost exclusively woody in type. Per unit of rock, the coals represent potentially rich source rocks for gas within which significant hydrocarbon generation has already been initiated.

Oil-prone source rocks are mature below 2960± metres and lie within the oil window of peak generation below 3360± metres. Sediments (including coals) in which the organic matter is dominantly woody in type are also mature (significant generation) below 3360± metres. The most oil-prone sediments in this section lie above 2760± metres in the Jurassic.

This section is presently at approximately its maximum paleodepth of burial. It is interesting to note that there is a significant change in the maturation gradient below approximately 2900± metres.

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-005	340-355m	A 90% Quartzose sand, unconsolidated, white	N9	
		B 10% Limestone, blocky, soft, minor caving, very light grey to white	N8-N9	0.08
		Minor shale, basic igneous, chert		
		Minor LCM - paint and cement		
786-010	415-430m	A 90% Quartzose sand, as 786-005A	N9	
		B 5% Limestone, as 786-005B, abundant caving	N8-N9	
		Minor basic igneous, chert, micaecous sandstone		
786-013	460-475m	A 85% Quartzose sand, as 786-005A	N9	
		B 10% Basic igneous, greenish black	5GY2/1	
		C 5% Limestone, as 786-005B, totally caved	N8-N9	
		Acid igneous, chert and micaceous sandstone		
786-018	535-550m	A 95% Quartzose sand, as 786-005A	N9	
		B 5% Basic igneous, as 786-013B	5GY2/1	
		Minor limestone and LCM - metal turnings		
786-023	610-625m	A 85% Quartzose sand, as 786-005A	N9	
		B 10% Basic igneous, as 786-013B	5GY2/1	
		C 5% Limestone, as 786-005B, dominant caving	N8-N9	
		LCM - metal turnings		
786-029	700-715m	A 90% Quartzose Sand, as 786-005A	N9	
		B 10% Basic igneous, as 786-013B	5GY2/1	
		Minor limestone and LCM - metal turnings		
786-032	745-760m	A 95% Quartzose sand, as 786-005A	N9	
		B 5% Shell fragments, molluscs, foraminifers, echinoderms & bryozoa, pinkish grey	5YR8/1	
		Minor basic igneous		
		LCM - mica		
786-039	850-865m	A 95% Quartzose sand, as 786-005A	N9	
		B 5% Shell fragment, as 786-032B	5YR8/1	
		Minor basic igneous		
		LCM - mica		
786-041	880-895m	A 95% Quartzose sand, as 786-005A	N9	
		B 5% Shell fragments, as 786-032B	5YR8/1	
		Minor basic igneous		
		LCM - mica		
		Minor siltstone		
786-044	925-940m	A 85% Silty mudstone, blocky, soft, calcareous, light olive grey	5Y6/1	0.50
		B 10% Basic igneous, as 786-013B	5GY2/1	
		C 5% Quartzose sand, as 786-005A	N9	
		Minor shell fragments		
		LCM - mica and cement		

Abbreviations = **arenaceous**, **argillaceous**, **calcareous**, **Cut**, **dolomitic**, **F**luorescence, **foraminifera**, **fossiliferous**
Lost **C**irculation **M**aterial, **moderately**, **occasionally**, **slightly**, **very**

TABLE 1
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GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-050	1020-1035m	A 98%	Silty mudstone, blocky, soft, calcareous, dominant caving, light olive grey Minor basic igneous and limestone	5Y6/1	1.18
786-056	1110-1125m	A 98%	Silty mudstone, as 786-050A, abundant caving Minor limestone and basic igneous Minor LCM - cement and mica	5Y6/1	0.92
786-060	1170-1185m	A 98%	Silty mudstone, v. soft, calc., abundant caving, light olive grey Minor limestone and basic igneous	5Y6/1	1.19
786-063	1215-1230m	A 98%	Silty mudstone, as 786-060A, dominant caving Minor limestone, mudstone and basic igneous	5Y6/1	1.17,1.18
786-069	1305-1320m	A 80%	Silty mudstone, as 786-060A, dominant	5Y6/1	0.85
		B 20%	Shaly mudstone, platy - subfissile, soft, non-calc., abundant caving, olive grey	5Y4/1	0.98
786-074	1380-1395m	A 98%	Silty mudstone, blocky - platy, v. soft, non. to sl. calc., dominant caving, medium olive grey Minor caved limestone and basic igneous	5Y5/1	0.85
786-080	1470-1485m	A 98%	Silty mudstone, blocky - platy, soft - mod. hard, non. to v. sl. calc., , abundant caving, olive grey	5Y4/1	1.08
786-083	1515-1530m	A 98%	Silty mudstone, as 786-080A, abundant caving	5Y4/1	1.17
786-090	1620-1635m	A 60%	Silty mudstone, blocky - platy, soft, non - v. sl. cacl., abundant caving, olive grey	5Y4/1	1.23,1.21
		B 40%	Silty mudstone, blocky, soft - mod. hard, non-calc., minor caving, greenish grey	5GY6/1	0.17
786-095	1695-1710m	A 65%	Silty mudstone, as 786-090B, abundant caving	5GY6/1	0.19
		B 35%	Silty mudstone, as 786-090A, abundant caving	5Y4/1	1.05
786-098	1740-1755m	A 50%	Silty mudstone, as 786-090A, abundant caving	5Y4/1	1.13
		B 50%	Silty mudstone, as 786-090B, abundant caving	5GY6/1	0.19
786-105	1845-1860m	A 60%	Silty mudstone, as 786-090A, abundant caving	5Y4/1	1.36,1.31
		B 40%	Mudstone, platy, soft, non-calc., shaly in part, sig. to abundant caving, medium dark greenish grey Minor limestone and siltstone	5GY5/1	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 SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-111	1935-1950m	A 70% Mudstone, platy, soft, non-calc., shaly in part, abundant caving, medium dark greenish grey	5GY5/1	0.26
		B 30% Mudstone, blocky, soft, non-calc., v. sl. calc., greyish red	5R4/2	0.09
		Minor other mudstone and limestone		
786-116	2010-2025m	A 70% Mudstone, as 786-111A, abundant caving	5GY5/1	0.36
		B 25% Mudstone, as 786-111B, sig. caving	5R4/2	0.10
		C 5% Siltstone, blocky, soft, non-calc., minor caving, medium grey to medium light grey	N5-N6	0.90,0.91
786-120	2055-2070m	A 60% Siltstone, as 786-116C, minor caving	N5-N6	0.32
		B 30% Shale, platy - subfissile, mod. hard, non-calc., abundant caving, medium grey	N5	0.95
		C 10% Mudstone, as 786-111A, sig. caving	5GY5/1	0.19
		Minor other mudstone		
786-126	2145-2160m	A 90% Shale, as 786-120B, sig. to abundant caving	N5	0.52
		B 10% Mudstone, as 786-111A, totally caved	5GY5/1	
		Minor siltstone		
786-130	2205-2220m	A 95% Shale, as 786-120B, sig. - abundant caving	N5	0.49
		B 5% Limestone, blocky, soft, sig. caving, very light grey	N8	
		Minor mudstone and siltstone		
786-133	2250-2265m	A 90% Shaly mudstone, blocky, mod. hard, sl. calc., abundant to dominant caving, medium light grey to medium olive grey	N6-5Y5/1	0.47,0.45
		B 10% Mudstone, as 786-111B, totally caved	N6-5Y5/1	
		Minor limestone		
786-139	2340-2355m	A 98% Shaly mudstone, as 786-133A, sig. caving	N6-5Y5/1	0.44
		Minor other mudstone and limestone		
786-143	2400-2415m	A 98% Shaly mudstone, as 786-133A, sig. caving	N6-5Y5/1	0.47
		Minor caved, other mudstone and minor limestone		
786-147	2460-2475m	A 95% Shaly mudstone, blocky - platy, soft - mod. hard, non - sl. calc., abundant caving, medium grey	N5	0.42
		B 5% Mudstone, blocky - soft, non-calc., totally caved, greyish red	10R4/2	
786-150	2505-2520m	A 98% Shaly mudstone, as 786-147A, abundant caving	N5	0.52
		Minor caved limestone and mudstone		

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-152	2535-2550m	A 98% Shaly mudstone, blocky - platy, soft - mod. hard, non - sl. calc., abundant caving, medium grey Minor caved mudstone	N5	0.45
786-153	2550-2565m	A 98% Shaly mudstone, as 786-152A, abundant caving Minor caved mudstone	N5	0.47,0.48
786-155	2580-2595m	A 98% Shaly mudstone, as 786-152A, abundant caving Minor caved mudstone and minor calcareous siltstone	N5	0.54
786-156	2595-2610m	A 85% Calcareous shale, blocky - platy, sig. caving, medium dark grey	N4	0.72
		B 10% Shaly mudstone, as 786-152A, totally caved	N5	
		C 5% Mudstone, blocky - soft, non-calc., totally caved, greyish red	10R4/2	
786-157	2610-2625m	A 98% Calcareous shale, as 786-156A, sig. caving Minor caved mudstone	N4	0.72
786-158	2625-2640m	A 98% Shale, blocky - platy, soft - mod. hard, sl. - v. calc., sig. caving, medium dark grey Minor caved mudstone	N4	0.68
786-159	2640-2655m	A 98% Shale, as 786-158A, sig. caving Minor caved mudstone	N4	0.70
786-160	2655-2670m	A 50% Shale, platy - soft, non-calc., oil stained, minor caved, brownish black	5YR2/1	6.91 [illegible]
		B 45% Shale, as 786-158A, sig. caving	N4	0.84
		C 5% Limestone, blocky, soft, white	N9	
786-161	2620-2685m	A 70% Shale, as 786-160A, oil stained, sig. caving	5YR2/1	7.57,7.65
		B 20% Shale, as 786-158A, abundant caving	N4	0.52
		C 5% Mudstone, blocky, mod. hard, sl. calc., totally caved, dark greenish grey	5GY4/1	
		D 5% Mudstone, blocky, soft - mod. hard, non-calc., totally caved, very dusky red Minor limestone	10R2/2	
786-162	2685-2700m	A 65% Shale, as 786-160A, oil stained, sig. caving	5YR2/1	5.78
		B 25% Shale, as 786-158A, abundant - dominant caving	N4	0.50
		C 5% Mudstone, as 786-161C, totally caved	5GY4/1	
		D 5% Mudstone, as 786-161D, totally caved	10R2/2	
786-163	2700-2715m	A 80% Shale, as 786-160A, oil stained, sig. - abundant caving	5YR2/1	5.64
		B 20% Shale, as 786-158A, dominant caving Minor mudstone and limestone	N4	0.50

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-164	2715-2730m	A 90% Shale, platy - soft, non-calc., oil stained, sig. caving, brownish black	5YR2/1	6.42,6.30
		B 10% Shale, blocky - platy, soft - mod. hard, sl. - v. calc., abundant caving, medium dark grey	N4	0.49
		Minor caved mudstone		
786-165	2730-2745m	A 75% Shale, as 786-164A, sig. caving	5YR2/1	5.85
		B 25% Shale, as 786-164B, abundant caving	N4	0.55
		Minor limestone		
786-166	2745-2760m	A 60% Shale, platy, soft, non - sl. calc., sig. caving, sl. oil stain, brownish black	5YR2/1	5.42
		B 40% Shale, blocky - platy, mod. hard, sig. caving, medium dark grey	N4	0.72
		Minor caved mudstone		
786-167	2760-2775m	A 65% Shale, as 786-166A, sig. caving	5YR2/1	4.91,4.93
		B 35% Shale, as 786-166B, abundant caving	N4	0.56
786-168	2775-2790m	A 70% Shale, as 786-166A, sig. caving	5YR2/1	4.37
		B 30% Shale, as 786-166B. abundant caving	N4	0.52
		Minor limestone and caved mudstone		
786-169	2790-2805m	A 55% Shale, as 786-166A, sig. caving	5YR2/1	5.06
		B 35% Shale, as 786-166B, abundant caving	N4	0.62
		C 10% Silty limestone, blocky, soft, sl. oil stain, sl. milky cut, very light grey	N8	1.39,1.39
786-170	2805-2820m	A 65% Shale, as 786-166B, abundant caving	N4	0.55
		B 35% Silty shale, blocky - platy, soft - mod. hard, sig. caving, oil stained, brownish black	5YR2/1	5.01
		Minor caved mudstone and minor limestone		
786-171	2820-2835m	A 80% Silty shale, blocky - platy, soft, sl. calc., sig. caving, brownish black	5YR2/1	5.59
		B 20% Shale, as 786-166B, sig. caving	N4	0.92
		Minor limestone		
786-172	2835-2850m	A 60% Silty shale, as 786-170B, sig. caving	5YR2/1	7.20
		B 40% Shale, as 786-166B, sig. caving	N4	0.62,0.62
		Minor limestone		
786-173	2850-2865m	A 90% LCM - cement		
		B 5% Silty shale, as 786-170B, minor caving	5YR2/1	4.09
		C 5% Shale, as 786-166B, dominantly caved	N4	
		Minor limestone		
786-174	2865-2880m	A 100% LCM - cement		
786-175	2880-2895m	A 90% LCM - cement		
		B 5% LCM - metal turnings		

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-175	2880-2895m	C 5% Calcareous shale, platy, soft, medium olive grey Minor other shale and ?basic igneous	5Y5/1	0.62
786-176	2895-2910m	A 50% LCM - cement		
		B 50% Calcareous mudstone, blocky, soft, minor caving, medium olive grey LCM - metal turnings	5Y5/1	0.96
786-177	2910-2925m	A 50% LCM - cement		
		B 50% Calcareous mudstone, as 7860176B, minor cavings LCM - metal turnings	5Y5/1	1.54
786-178	2925-2940m	A 80% LCM - cement		
		B 20% Shaly mudstone, platy - subfissile, soft, non-calc., sig. caving, medium olive grey LCM - metal turnings	5Y5/1	1.84
786-179	2940-2955m	A 85% Mudstone, blocky, soft, non - sl. calc., sig. caving, sl. oil stain, olive grey	5Y4/1	2.53,2.52
		B 15% LCM - cement LCM - metal turnings		
786-180	2955-2970m	A 50% LCM - cement		
		B 45% Mudstone, as 786-179A	5Y4/1	3.27
		C 5% LCM - metal turnings		
786-211 CORE	2979.3-.35m	A 98% Sandstone, fine grained, mod. hard - hard, laminated, light grey to very light grey	N7-N8	
786-181	2970-2985m	A 70% LCM - cement		
		B 25% Silty shale, platy - subfissile, soft - mod. hard, non calc., dominant cavings, medium dark grey	N4	2.01
		C 5% LCM - metal turnings LCM - paint		
786-212 CORE	2983.08-2983.18m	A 98% Sandstone, as 786-211A, cross laminated	N7-N8	
786-213 CORE	2986.93m	A 98% Coal, blocky, hard, lustrous, black	N1	60.30
786-214 CORE	2987.50-2987.59m	A 98% Sandstone, fine - medium grained, hard - mod. hard, micaceous, white	N9	
786-182	2985-3000m	A 50% Crystalline dolomite, blocky, soft - mod. hard, contaminated by rust, white	N9	0.21
		B 20% LCM - cement		
		C 5% Silty shale, as 786-181B	N4	1.52
		D 5% Coaly shale, blocky - platy, soft, non-calc., ?possible additive (coaly), greyish black LCM - metal turnings	N2	22.80

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GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-183	3000-3015m	A 60% Crystalline dolomite, blocky, soft - mod. hard, minor caving, contaminated by rust, white	N9	0.21,0.20
		B 35% Coaly shale, blocky - platy, soft, non-calc., ?possible additive (coaly), greyish black	N2	45.90
		C 5% LCM - metal turnings		
		Minor other shale		
786-215 SWC	3025m	A 98% Shaly mudstone, blocky, soft, non-calc., contains carbonaceous inclusions, olive grey	5Y4/1	0.68
786-184	3015-3030m	A 50% Coaly shale, as 786-183B, sig. caving	N2	33.60
		B 40% Crystalline dolomite, as 786-183A, sig. caving, contaminated by rust	N9	0.21
		C 10% Silty shale, platy - subfissile, soft - mod. hard, non calc., minor caving, medium dark grey	N4	1.62
		Minor LCM - cement and metal turnings		
786-185	3030-3045m	A 60% Quartz sand, unconsolidated, rust contaminated, white	N9	
		B 35% Coaly shale, as 786-183B, sig. to abundant caving	N2	18.70
		C 5% Crystalline dolomite, as 786-183A, minor caving, rust contaminated	N9	0.13,0.14
		LCM - metal turnings		
		Minor other shale		
786-186	3045-3060m	A 50% Quartz sand, as 786-185A	N9	
		B 25% Crystalline dolomite, as 786-183A, minor caving, rust contaminated	N9	0.21
		C 15% Silty shale, as 786-184C, abundant caving	N4	1.42
		D 10% Coaly shale, as 786-183B, abundant caving	N2	19.10
786-187	3060-3075m	A 90% Quartz sand, as 786-185A	N9	
		B 5% Shale, platy - subfissile, soft, non-calc., dominant caving, medium dark grey	N4	
		C 5% Coaly shale, as 786-183B, sig. caving	N2	14.10
		Minor LCM - metal turnings		
		Minor dolomite		
786-188	3075-3090m	A 60% Quartz sand, as 786-185A	N9	
		B 20% Shale, as 786-187B, abundant caving	N4	0.93
		C 10% Coaly shale, as 786-183B, abundant caving	N2	11.20
		D 10% Limestone, blocky, soft, white	N9	0.52
		Minor dolomite and LCM - metal turnings		
786-190	3105-3120m	A 40% Quartz sand, as 786-185A	N9	
		B 30% Shale, as 786-187B, abundant - dominant caving, dark grey	N3	0.87

Abbreviations = **a**renaceous, **arg**illaceous, **calc**areous, **Cut**, **dol**omitic, **Fluor**escence, **foram**inifera, **foss**iliferous
Lost **C**irculation **M**aterial, **mod**erately, **occ**asionally, **s**lightly, **v**ery

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-190	3105-3120m	C 30% Coaly shale, blocky - platy, soft, non-calc., ?possible additive (coaly), totally caved, greyish black Minor dolomite and LCM - metal turnings Minor bitumen	N2	
786-191	3120-3135m	A 90% Shale, platy - subfissile, soft, non-calc., sig. caving, medium dark grey	N3	2.05
		B 10% Coaly shale, as 786-190C, sig. caving Minor dolomite, bitumen and LCM - metal turnings	N2	23.90
786-216 SWC	3125m	A 98% Silty shale, fissile - subfissile, mod. hard, non-calc., micaeous, dark grey	N3	1.77
786-192	3135-3150m	A 80% Silty mudstone, blocky, mod. hard, non-calc., minor cavings, turbo-drilled, dark brownish grey	5YR3/1	0.80
		B 15% Sandstone, blocky, unconsolidated in part, fine grained, subangular, non-calc. matrix, clear, white	N9	
		C <5% Shale, platy to subfissile, mod. hard, non-calc., sl. carbonaceous, dominant? cavings, dark grey to dark grey to dark olive grey	N3-5Y3/1	
786-194	3165-3180m	A 40% Silty mudstone, as 786-192A, minor cavings, turbodrilled	5YR3/1	0.77
		B 35% Sandstone, as 786-192B	N9	
		C 20% Silty mudstone, blocky, soft to mod. hard, non-calc., abundant? cavings, medium grey to medium brownish grey	N5-5YR5/1	1.19
		D <5% Shale, as 786-192C, dominant? cavings	N3-5Y3/1	
786-195	3180-3195m	A 65% Silty mudstone, blocky, mod. hard, non-calc., minor cavings, turbo-drilled, medium dark grey to brownish grey	N4-5YR4/1	0.88
		B 35% Sandstone, mostly unconsolidated, medium grained, subangular, fairly well sorted, clear, white Minor caved siltstone and carbonaceous shale	N9	
786-217 SWC	3186m	A 98% Silty shale, as 786-216A	N3	2.32
786-196	3195-3210m	A 70% Silty mudstone, as 786-195A, minor cavings	N4-5YR4/1	0.77
		B 20% Mudstone, blocky, soft, non-calc., sl. silty, minor to sig.? cavings, medium brownish grey	5YR5/1	0.87,0.89
		C 10% Sandstone, as 786-195B Minor caved 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 SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-198	3225-3240m	A 65% Sandstone, blocky, medium to fine grained, mostly unconsolidated, sub-angular, poorly sorted, clear, white	N9	
		B 20% Silty mudstone, blocky, mod. hard, non-calc., turbodrilled, sig.? cavings, medium dark grey to brownish grey	N4-5YR4/1	0.78
		C 10% Mudstone, blocky, soft to mod. hard, non-calc., sl. silty, sig. to abundant? cavings, medium brownish grey	5YR5/1	1.16
		D <5% Silty shale, platy, non-calc., dominant cavings, dark grey	N3	
		Minor caved shales		
786-200	3255-3270m	A 70% Sandstone, as 786-198A	N9	
		B 20% Silty mudstone, as 786-198B, sig. cavings	N4-5YR4/1	0.86
		C 10% Mudstone, as 786-198C, minor cavings	5YR5/1	1.17
		Minor coal and shale - caved?		
786-202	3285-3300m	A 40% Sandstone, blocky fine grained, sub-angular, white	N9	
		B 40% Silty mudstone, blocky, mod. hard, non-calc., turbodrilled, sig.? cavings, dark grey to dark brownish grey	N3-5YR3/1	0.91
		C 15% Siltstone, blocky, soft to mod. hard, non-calc., sl. micaceous, medium brownish grey	5YR5/1	1.37
		D 5% Shale, platy, mod. hard, non-calc., caved, dark grey to medium dark grey	N3-4	
		Minor coal and other shale - caved		
786-218 SWC	3297m	A 98% Silty shale, fissile - subfissile, mod. hard, non-calc., micaeous, dark grey	N3	0.95
786-204	3315-3330m	A 30% Sandstone, as 786-202A	N9	
		B 30% Silty mudstone, as 786-202B, sig. cavings	N3-5YR3/1	1.23
		C 25% Mudstone, blocky, soft, non-calc., minor cavings, medium dark grey to brownish grey	N4-5YR4/1	1.02,1.07
		D 10% Shale, platy, caved, dark grey	N3	
		E <5% Siltstone, as 786-202C, sig. cavings	5YR5/1	
		Minor coal		
786-205	3330-3345m	A 60% Siltstone, platy to blocky, soft to mod. hard, sl. micaceous, non-calc., minor to sig. cavings, medium grey to medium brownish grey	N5-5YR5/1	1.60
		B 30% Silty mudstone, as 786-202B, sig. cavings	N3-5YR3/1	0.96
		C 10% Sandstone, as 786-202A	N9	
		Minor shale and coal - caved		

Abbreviations = **are**naceous, **arg**illaceous, **calc**areous, **Cut**, **dol**omitic, **Fluor**escence, **foram**inifera, **foss**iliferous
Lost **C**irculation **M**aterial, **mod**erately, **occ**asionally, **sl**ightly, **v**ery

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
786-206	3345-3360m	A 98% Siltstone, blocky, mod. hard, non-calc., minor cavings, turbodrilled, medium dark grey to brownish grey Minor caved shale, coal and sand	N4-5YR4/1	1.71
786-208	3375-3390m	A 60% Sand, unconsolidated, medium to fine grained, subrounded to subangular, fairly well sorted, clear, white	N9	
		B 40% Siltstone, blocky, mod. hard, non-calc., turbodrilled, minor cavings, medium dark grey to brownish grey Minor caved shale and coal?	N4-5YR4/1	1.46,1.46
786-219 SWC	3376m	A 98% Silty shale, fissile, soft, non-calc., micaceous, medium dark grey to medium grey	N4-N5	1.15,1.17
786-209	3390-3405m	A 70% Sand, as 786-208A	N9	
		B 20% Coal, blocky, glassy, brittle, sig. cavings, greyish black	N2	67.60
		C 10% Silty shale, blocky, mod. hard, non-calc., turbodrilled, sig. cavings, medium dark grey to brownish grey Minor caved shale	N4-5YR4/1	0.94
786-210	3405-3420m	A 70% Sand, as 786-208A	N9	
		B 20% Silty shale, as 786-209C, sig. cavings	N4-5YR4/1	1.10
		C 10% Coal, as 786-209B, sig. cavings Minor caved shale	N2	39.10

Abbreviations = **aren**aceous, **arg**illaceous, **calc**areous, **C**ut, **dol**omitic, **Fl**uorescence, **foram**inifera, **foss**iliferous **L**ost **C**irculation **M**aterial, **mod**erately, **occ**asionally, **sl**ightly, **v**ery

TABLE 2A

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-001	280-295	791	5	2	0	2	799	9	1.1	31	0.04
786-002	295-310	560	5	1	0	1	566	6	1.1	22	0.07
786-003	310-325	1511	6	1	0	0	1518	8	0.5	9	0.07
786-004	325-340	1987	7	1	0	1	1996	9	0.5	7	0.09
786-005	340-355	3193	9	3	0	2	3207	13	0.4	13	0.10
786-006	355-370	1932	9	3	1	1	1945	14	0.7	0	1.45
786-007	370-385	2213	42	32	0	3	2290	77	3.3	501	0.07
786-008	385-400	6403	53	20	1	3	6480	77	1.2	408	0.33
786-009	400-415	6312	64	22	2	2	6402	90	1.4	625	1.07
786-010	415-430	10144	159	83	10	0	10395	251	2.4	2460	*.**
786-011	430-445	7196	53	18	1	0	7269	72	1.0	425	*.**
786-012	445-460	7242	54	26	4	0	7325	84	1.1	526	*.**
786-013	460-475	5428	53	15	2	0	5499	70	1.3	511	*.**
786-014	475-490	5933	56	26	2	1	6018	85	1.4	481	1.81
786-015	490-505 15	5439	42	14	2	1	5498	60	1.1	331	1.83
786-016	505-520	8508	23	3	1	1	8536	28	0.3	60	2.43
786-017	520-535	10319	95	46	35	15	10511	192	1.8	644	2.41
786-018	535-550	9064	110	57	10	11	9253	189	2.0	953	0.92
786-019	550-565	9996	77	23	1	2	10100	103	1.0	507	0.71
786-020	565-580	5484	50	10	2	2	5549	65	1.2	212	0.94
786-021	580-595	5825	17	3	1	1	5847	22	0.4	8	0.38
786-022	595-610	3472	12	4	1	1	3491	18	0.5	3	1.78
786-023	610-625	3749	13	3	2	2	3769	20	0.5	32	1.02
786-024	625-640	2388	11	2	1	0	2402	14	0.6	14	1.63
786-025	640-655	2550	8	3	0	1	2563	12	0.5	12	0.04
786-026	655-670	2198	9	1	1	0	2209	11	0.5	14	1.59
786-027	670-685	2812	12	3	1	1	2830	18	0.6	25	1.10
786-028	685-700	2343	8	2	0	0	2353	10	0.4	2	2.61
786-029	700-715	2638	11	4	1	2	2656	19	0.7	26	0.61
786-030	715-730 30	1884	7	1	0	0	1893	9	0.5	1	1.06

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-031	730-745 31	41	2	1	0	1	45	4	8.6	3	0.48
786-032	745-760	719	5	1	0	1	727	7	1.0	13	0.09
786-033	760-775	202	27	4	0	2	236	34	14.3	8	0.06
786-034	775-790	451	16	2	0	1	471	20	4.2	3	0.30
786-035	790-805	692	9	1	0	1	704	12	1.7	1	0.11
786-036	805-820	687	14	1	0	1	704	17	2.4	2	0.15
786-037	820-835	484	41	30	0	5	561	77	13.7	7	0.08
786-038	835-850	878	101	106	25	26	1135	258	22.7	16	0.98
786-039	850-865	3639	418	101	1	11	4172	532	12.8	2102	0.13
786-040	865-880	1395	126	93	1	6	1622	227	14.0	2311	0.18
786-041	880-895	731	124	116	1	6	978	247	25.3	3502	0.11
786-042	895-910	1001	73	97	0	1	1172	171	14.6	1974	0.00
786-043	910-925	1625	36	29	0	3	1693	68	4.0	740	0.13
786-044	925-940	2840	53	48	3	3	2946	107	3.6	1042	0.92
786-045	940-955 45	2631	48	44	8	14	2745	114	4.1	445	0.60
786-046	955-970	3503	36	37	8	8	3592	89	2.5	291	1.03
786-047	970-995	1378	26	15	3	2	1424	46	3.2	6	1.55
786-048	995-1010	326	3	2	1	0	331	6	1.7	1	2.63
786-049	1010-1025	358	2	1	0	0	361	3	0.9	1	2.51
786-050	1020-1035 50/1	1821	24	19	5	2	1872	52	2.8	5	2.46
786-051	1035-1050	969	20	15	4	2	1011	42	4.1	4	2.56
786-052	1050-1065	313	3	2	1	0	319	7	2.0	1	2.42
786-053	1065-1080	546	5	4	1	0	557	11	1.9	2	2.39
786-054	1080-1095	994	27	20	5	2	1049	55	5.2	5	2.36
786-055	1095-1110	1660	21	14	3	1	1699	39	2.3	4	2.22
786-056	1110-1125 57/8	8943	87	58	11	6	9106	163	1.8	14	1.75
786-057	1125-1140	6382	44	33	8	7	6474	93	1.4	28	1.06
786-058	1140-1155	9297	97	45	9	7	9455	158	1.7	23	1.30
786-059	1155-1170	4130	35	24	5	3	4198	68	1.6	18	1.73
786-060	1170-1185 62/3	12736	71	39	9	6	12861	125	1.0	14	1.59

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-061	1185-1200 64	6903	100	39	8	4	7053	150	2.1	19	2.14
786-062	1200-1215	8040	136	52	9	5	8242	202	2.5	25	1.63
786-063	1215-1230 66/7	7664	63	27	1	6	7761	97	1.2	44	0.17
786-064	1230-1245	6522	52	26	5	4	6608	86	1.3	35	1.44
786-065	1245-1260	6579	59	28	8	5	6680	100	1.5	50	1.55
786-066	1260-1275	6542	53	29	7	4	6635	93	1.4	41	1.69
786-067	1275-1290	491	6	4	2	1	504	13	2.5	14	1.42
786-068	1290-1305	1287	58	24	5	2	1376	89	6.5	10	1.87
786-069	1305-1320 73/4	1120	32	13	3	2	1171	51	4.3	9	1.34
786-070	1320-1335	1394	55	22	5	2	1477	84	5.7	7	1.87
786-071	1335-1350	1569	43	19	4	2	1639	69	4.2	9	1.92
786-072	1350-1365	843	27	9	2	1	883	40	4.5	4	1.97
786-073	1365-1380	2019	65	26	7	4	2121	102	4.8	16	1.89
786-074	1380-1395 79/80	4021	137	61	20	10	4250	228	5.4	50	1.87
786-075	1395-1410	1385	73	24	8	4	1493	108	7.3	16	1.98
786-076	1410-1425 82	1379	75	28	13	6	1501	122	8.1	23	2.05
786-077	1425-1440	1912	144	45	17	9	2127	215	10.1	35	1.88
786-078	1440-1455	1360	98	33	13	7	1510	150	10.0	26	2.02
786-079	1455-1470	1939	101	35	15	8	2098	159	7.6	23	1.88
786-080	1470-1485 86/7	8619	229	99	46	31	9024	405	4.5	145	1.49
786-081	1485-1500	8933	168	70	28	19	9218	285	3.1	126	1.51
786-082	1500-1515	2064	90	84	44	26	2309	245	10.6	122	1.74
786-083	1515-1530 89/90	6885	139	84	35	21	7164	279	3.9	80	1.69
786-084	1530-1545	1095	83	35	14	6	1233	138	11.2	13	2.18
786-085	1545-1560	12	0	0	0	0	12	1	4.7	3	6.23
786-086	1560-1575	887	56	28	11	5	987	101	10.2	13	2.04
786-087	1575-1590	135	3	2	1	0	142	7	4.6	1	2.31
786-088	1590-1605	327	8	4	2	1	341	15	4.3	2	2.41
786-089	1605-1620	271	3	2	1	0	276	6	2.0	0	2.33
786-090	1620-1635 97/8	3886	72	46	19	12	4036	150	3.7	50	1.54

TABLE 2A

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-091	1635-1650 99	1321	45	26	8	4	1405	84	6.0	9	1.90
786-092	1650-1665	2735	113	67	24	12	2951	216	7.3	13	1.94
786-093	1665-1680	1393	38	17	6	3	1456	63	4.3	10	2.06
786-094	1680-1695	2096	131	51	16	8	2302	206	8.9	18	2.05
786-095	1695-1710 103/4	3331	51	33	13	7	3435	104	3.0	16	1.82
786-096	1710-1725	5450	82	53	22	12	5618	168	3.0	43	1.77
786-097	1725-1740	2380	37	30	15	10	2472	92	3.7	29	1.53
786-098	1740-1755 107/8	7387	147	88	35	20	7677	289	3.8	32	1.76
786-099	1755-1770	2836	55	41	18	11	2960	124	4.2	38	1.69
786-100	1770-1785	1526	37	26	12	6	1607	81	5.0	16	2.02
786-101	1785-1800	449	13	9	4	2	477	28	5.9	4	2.12
786-102	1800-1815	943	21	15	8	4	990	48	4.8	10	2.06
786-103	1815-1830	302	5	3	1	1	312	10	3.1	2	2.36
786-104	1830-1845	91	2	1	1	0	95	4	4.5	1	2.52
786-105	1845-1860 115/6	27	1	0	0	0	29	1	4.4	1	2.17
786-106	1860-1875	800	28	21	10	5	864	64	7.4	10	2.09
786-107	1875-1890	1097	21	20	12	8	1158	62	5.3	65	1.48
786-108	1890-1905	27	0	0	0	0	28	1	3.2	8	1.05
786-109	1905-1920	1247	31	37	24	16	1354	107	7.9	58	1.47
786-110	1920-1935	1481	47	67	44	39	1678	196	11.7	377	1.11
786-111	1935-1950 122/3	2809	65	94	70	60	3098	290	9.4	442	1.16
786-112	1950-1965	1895	43	50	38	29	2056	160	7.8	348	1.33
786-115	1995-2010	1172	34	46	28	34	1314	142	10.8	239	0.82
786-113	1965-1980	1270	23	26	16	15	1351	81	6.0	193	1.03
786-114	1980-1995	1620	44	74	55	63	1856	236	12.7	35	0.87
786-116	2010-2025 128/9	1748	49	59	32	45	1933	185	9.6	408	0.71
786-117	2025-2040	1344	31	37	20	27	1460	116	7.9	240	0.74
786-118	2040-2055	987	20	24	15	23	1070	82	7.7	272	0.66
786-119	2050	871	9	5	1	2	890	18	2.1	56	0.59
786-120	2055-2070 133/4	451	14	15	6	10	496	45	9.0	78	0.59

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-121	2070-2085 135	664	15	9	4	6	698	33	4.8	57	0.63
786-122	2085-2100	824	21	21	9	11	885	61	6.9	50	0.77
786-123	2100-2115	516	12	12	6	6	553	37	6.8	21	0.98
786-124	2115-2130	701	17	15	7	6	746	45	6.1	16	1.09
786-125	2130-2145	223	7	7	3	3	244	21	8.5	11	1.27
786-126	2145-2160 140/1	943	33	33	20	17	1048	104	10.0	61	1.18
786-127	2160-2175	546	22	26	15	10	619	73	11.8	37	1.47
786-128	2175-2190	776	31	30	15	10	862	86	10.0	6	1.46
786-129	2190-2205	228	6	5	3	2	245	17	6.9	11	1.39
786-130	2205-2220 145/6	130	4	3	1	1	139	9	6.7	9	1.64
786-131	2220-2235	276	11	12	7	4	310	34	11.0	8	1.68
786-132	2235-2250	155	8	11	7	3	184	29	15.5	7	2.19
786-133	2250-2265	209	10	11	6	3	239	29	12.2	10	1.98
786-134	2265-2280	316	15	17	9	4	361	45	12.4	9	2.42
786-135	2280-2295	63	4	6	4	2	78	16	20.0	5	2.23
786-136	2295-2310	115	7	9	4	1	137	21	15.6	3	3.36
786-137	2310-2325	2	0	0	0	0	3	1	44.9	0	0.55
786-138	2325-2340	27	2	4	2	1	36	9	25.9	5	3.19
786-139	2340-2355 156/7	114	11	26	14	5	170	56	32.9	14	2.83
786-140	2355-2370	64	5	12	7	2	90	26	29.2	8	2.91
786-141	2370-2385	92	8	17	8	3	127	35	27.4	5	2.74
786-142	2385-2400	56	4	9	4	1	74	19	25.0	2	2.90
786-143	2400-2415 161/2	178	17	35	14	4	249	71	28.6	5	3.22
786-144	2415-2430	20	2	3	1	0	26	6	23.3	1	2.41
786-145	2430-2445	69	5	9	4	2	88	20	22.2	2	1.99
786-146	2445-2460	58	8	16	6	2	89	31	35.3	1	2.98
786-147	2460-2475 166/7	83	16	58	22	12	191	108	56.6	8	1.87
786-148	2475-2490	110	17	62	23	15	227	117	51.5	8	1.50
786-149	2490-2505	123	19	67	26	16	252	128	51.0	8	1.61
786-150	2505-2520 170/1	143	30	115	40	29	356	213	60.0	15	1.41

TABLE 2A

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-151	2520-2535 172	164	41	187	72	59	524	360	68.6	49	1.22
786-152	2535-2550 173/74	168	100	454	127	139	988	820	83.0	97	0.92
786-153	2550-2565 175/6	288	191	650	153	188	1470	1182	80.4	124	0.81
786-154	2565-2580	277	112	428	93	108	1019	742	72.8	45	0.86
786-155	2580-2595 178/9	752	320	1226	268	345	2912	2160	74.2	162	0.78
786-156	2595-2610 180/1	274	126	545	109	171	1225	951	77.6	50	0.64
786-157	2610-2625 182/3	250	134	777	163	297	1622	1371	84.6	158	0.55
786-158	2625-2640 184/5	226	113	872	190	504	1903	1678	88.1	454	0.38
786-159	2640-2655	131	62	621	155	461	1430	1298	90.8	485	0.34
786-160	2655-2670 187/8	2683	2235	8427	1315	5032	19693	17010	86.4	5622	0.26
786-161	2670-2685 189/90	1986	1292	2112	825	2337	8552	6566	76.8	2804	0.35
786-162	2685-2700 191/2	2329	1698	2707	1178	3278	11189	8860	79.2	4686	0.36
786-163	2700-2715	2392	1762	2540	1152	3027	10874	8482	78.0	4034	0.38
786-164	2715-2730	1589	1150	1660	794	2086	7279	5690	78.2	3071	0.38
786-165	2730-2745	3691	2741	4600	2279	6524	19836	16144	81.4	7658	0.35
786-166	2745-2760	1835	1707	10018	1377	6988	21925	20090	91.6	9885	0.20
786-167	2760-2775	14	13	79	11	62	180	166	92.2	179	0.18
786-168	2775-2790	1929	1028	2318	469	1867	7611	5682	74.6	1586	0.25
786-169	2790-2805	1811	1316	1990	328	1231	6677	4865	72.9	1226	0.27
786-170	2805-2820	2653	1661	2256	420	1437	8427	5774	68.5	756	0.29
786-171	2820-2835	3590	2106	3170	510	1722	11099	7508	67.7	639	0.30
786-172	2835-2850 212/13	5695	4656	12943	1300	4409	29003	23308	80.4	3649	0.29
786-173	2850-2865	62	56	192	20	74	404	343	84.7	82	0.27
786-174	2865-2880	38	12	88	25	124	288	250	86.7	601	0.20
786-175	2880-2895	309	153	853	268	884	2467	2158	87.5	1921	0.30
786-176	2895-2910	6	4	30	9	34	83	78	93.3	116	0.25
786-177	2910-2925	4	4	37	13	55	112	108	96.3	140	0.24
786-178	2925-2940	480	459	2733	727	2584	6983	6503	93.1	3770	0.28
786-179	2940-2955	1219	893	3531	710	2359	8712	7493	86.0	3238	0.30
786-180	2955-2970 225/6	745	687	3964	1135	3412	9945	9199	92.5	4097	0.33

TABLE 2A

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-181	2970-2985 229/230	1897	1368	3831	746	2137	9979	8082	81.0	2841	0.35
786-182	2985-3000 233	11690	5735	4715	405	861	23407	11716	50.1	566	0.47
786-183	3000-3015	11153	5601	4692	533	941	22920	11767	51.3	426	0.57
786-184	3015-3030	4145	2033	1760	412	641	8992	4847	53.9	237	0.64
786-185	3030-3045	3252	1754	1581	277	509	7372	4120	55.9	225	0.54
786-186	3045-3060	2208	1192	1083	173	336	4992	2784	55.8	187	0.51
786-187	3060-3075	4708	2358	2065	196	466	9792	5084	51.9	450	0.42
786-188	3075-3090	9442	4533	3241	322	723	18260	8819	48.3	591	0.45
786-189	3090-3105	3463	1775	2103	223	448	8011	4548	56.8	299	0.50
786-190	3105-3120	4163	2049	1721	243	532	8709	4546	52.2	600	0.46
786-191	3120-3135	2569	1560	1367	97	230	5823	3254	55.9	177	0.42
786-192	3135-3150	1844	903	690	114	310	3861	2017	52.2	660	0.37
786-193	3150-3165	1911	917	754	106	295	3984	2073	52.0	616	0.36
786-194	3165-3180	825	272	359	72	215	1743	918	52.6	564	0.33
786-195	3180-3195	406	139	184	45	155	929	524	56.3	2257	0.29
786-196	3195-3210	1210	476	852	191	759	3489	2279	65.3	4365	0.25
786-197	3210-3225 263	1288	457	638	114	446	2943	1655	56.2	1697	0.26
786-198	3225-3240	1917	685	748	105	419	3874	1957	50.5	1177	0.25
786-199	3240-3255	3920	964	912	120	451	6367	2448	38.4	1298	0.27
786-200	3255-3270	1751	736	491	61	201	3240	1489	46.0	257	0.31
786-201	3270-3285	1281	549	397	60	184	2471	1190	48.1	366	0.33
786-202	3285-3300	1533	544	421	68	201	2766	1234	44.6	502	0.34
786-203	3300-3315	2616	552	577	92	291	4128	1513	36.6	153	0.32
786-204	3315-3330	3721	901	1031	159	587	6399	2679	41.9	3280	0.27
786-205	3330-3345	5452	1090	851	104	315	7811	2359	30.2	1296	0.33
786-206	3345-3360	6589	1665	1274	144	472	10144	3555	35.0	1235	0.31
786-207	3360-3375	1166	573	478	53	160	2430	1264	52.0	695	0.33
786-208	3375-3390	16568	7917	3063	231	557	28336	11768	41.5	1009	0.41
786-209	3390-3405	27061	12562	7477	551	1211	48863	21802	44.6	1483	0.46
786-210	3405-3420 286/7	12987	6186	4112	351	707	24343	11356	46.7	894	0.50

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-001	280-295	117	26	30	4	8	185	68	37.0	61	0.53
786-002	295-310	43	11	12	2	4	71	28	39.4	56	0.62
786-003	310-325	100	15	14	2	4	135	36	26.3	40	0.51
786-004	325-340	658	47	34	4	13	756	97	12.9	27	0.27
786-005	340-355	634	32	21	3	9	699	65	9.3	27	0.40
786-006	355-370	910	34	20	0	11	976	66	6.8	68	0.02
786-007	370-385	245	28	18	0	10	302	57	18.8	179	0.03
786-008	385-400	276	22	13	0	8	319	43	13.4	156	0.03
786-009	400-415	282	26	19	1	20	348	65	18.8	124	0.05
786-010	415-430	226	18	12	0	7	264	38	14.4	155	0.03
786-011	430-445	550	43	26	0	14	633	83	13.1	196	0.01
786-012	445-460	206	18	11	0	8	243	37	15.3	107	0.01
786-013	460-475	253	22	13	0	10	298	45	15.1	134	0.01
786-014	475-490	202	17	12	0	16	248	46	18.5	148	0.02
786-015	490-505	159	12	8	0	4	184	25	13.4	111	0.04
786-016	505-520	156	6	6	1	4	173	17	9.8	34	0.13
786-017	520-535	228	27	13	1	15	284	56	19.7	143	0.07
786-018	535-550	218	33	26	1	18	296	78	26.4	109	0.06
786-019	550-565	382	19	10	1	12	424	43	10.1	151	0.08
786-020	565-580	307	29	13	0	7	355	48	13.5	145	0.02
786-021	580-595	313	20	13	0	6	353	40	11.2	50	0.06
786-022	595-610	341	20	11	0	5	376	36	9.5	49	0.09
786-023	610-625	759	15	8	0	6	788	29	3.7	55	0.08
786-024	625-640	565	16	8	1	4	593	28	4.8	50	0.15
786-025	640-655	620	17	9	0	5	651	31	4.8	39	0.07
786-026	655-670	315	23	12	0	6	356	42	11.7	42	0.04
786-027	670-685	251	19	13	1	6	290	39	13.4	61	0.11
786-028	685-700	243	15	7	0	4	269	26	9.8	55	0.10
786-029	700-715	247	13	6	0	4	271	24	8.8	27	0.08
786-030	715-730	248	17	10	0	4	280	31	11.2	19	0.05

TABLE 2B

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-031	730-745	159	15	7	0	7	188	29	15.6	27	0.05
786-032	745-760	170	19	11	0	6	206	36	17.4	16	0.04
786-033	760-775	128	15	7	0	4	154	26	17.0	14	0.04
786-034	775-790	204	28	15	1	10	257	53	20.6	5	0.06
786-035	790-805	215	25	14	0	9	263	48	18.2	43	0.06
786-036	805-820	101	13	6	0	4	124	23	18.6	2	0.07
786-037	820-835	148	25	13	1	11	198	50	25.1	135	0.05
786-038	835-850	193	22	12	1	9	236	43	18.3	93	0.09
786-039	850-865	231	38	22	1	11	302	71	23.6	130	0.10
786-040	865-880	272	31	17	0	9	330	58	17.6	144	0.05
786-041	880-895	146	22	11	0	7	186	41	21.8	163	0.04
786-042	895-910	93	13	14	0	4	124	31	24.7	75	0.09
786-043	910-925	153	24	15	0	13	205	52	25.3	193	0.03
786-044	925-940	124	21	14	0	11	171	47	27.5	164	0.04
786-045	940-955	176	19	15	1	9	220	44	19.9	80	0.05
786-046	955-970	127	20	13	0	10	170	43	25.2	93	0.03
786-047	970-995	2101	26	16	3	5	2153	51	2.4	7	0.60
786-048	995-1010	1877	26	17	5	5	1930	52	2.7	32	0.96
786-049	1010-1025	2118	28	21	6	6	2178	60	2.8	40	0.93
786-050	1020-1035	2153	28	29	11	8	2229	76	3.4	48	1.39
786-051	1035-1050	1056	21	16	4	4	1102	46	4.2	30	1.04
786-052	1050-1065	1632	30	28	8	5	1703	71	4.2	32	1.49
786-053	1065-1080	4139	35	25	7	5	4211	72	1.7	13	1.54
786-054	1080-1095	1625	21	21	7	6	1679	55	3.2	33	1.12
786-055	1095-1110	1811	24	19	6	5	1865	54	2.9	38	1.26
786-056	1110-1125	445	12	12	5	3	477	32	6.7	33	1.35
786-057	1125-1140	757	20	14	3	5	799	42	5.3	40	0.72
786-058	1140-1155	1436	22	20	6	5	1489	53	3.6	49	1.16
786-059	1155-1170	876	20	20	6	5	927	52	5.6	47	1.15
786-060	1170-1185	225	11	9	4	4	252	27	10.7	25	1.02

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-061	1185-1200	2311	30	25	1	7	2374	63	2.7	30	0.16
786-062	1200-1215	2560	33	28	7	5	2633	73	2.8	35	1.43
786-063	1215-1230	1524	29	25	6	7	1591	67	4.2	62	0.84
786-064	1230-1245	550	20	21	7	8	607	57	9.3	31	0.80
786-065	1245-1260	658	18	11	3	5	695	37	5.3	161	0.62
786-066	1260-1275	1039	24	27	9	8	1106	67	6.1	82	1.06
786-067	1275-1290	111	2	2	2	1	117	6	5.3	67	1.49
786-068	1290-1305	3917	51	36	10	8	4023	106	2.6	94	1.24
786-069	1305-1320	6024	68	37	9	9	6147	123	2.0	72	1.00
786-070	1320-1335	2683	50	36	9	9	2787	103	3.7	89	1.03
786-071	1335-1350	3549	50	39	12	15	3665	117	3.2	175	0.79
786-072	1350-1365	3634	43	23	5	6	3710	77	2.1	84	0.71
786-073	1365-1380	2306	35	27	11	10	2388	82	3.4	107	1.07
786-074	1380-1395	584	20	18	7	8	637	53	8.4	183	0.83
786-075	1395-1410	2200	59	44	20	17	2338	139	5.9	137	1.20
786-076	1410-1425	1640	51	40	29	27	1787	146	8.2	194	1.07
786-077	1425-1440	3559	88	45	25	20	3737	178	4.8	189	1.23
786-078	1440-1455	1553	51	38	20	17	1678	126	7.5	55	1.18
786-079	1455-1470	2603	107	80	43	34	2866	264	9.2	154	1.28
786-080	1470-1485	196	20	20	18	21	275	79	28.6	182	0.86
786-081	1485-1500	201	21	38	31	25	315	115	36.4	204	1.23
786-082	1500-1515	130	23	37	29	28	246	117	47.4	228	1.03
786-083	1515-1530	2647	88	67	33	30	2865	218	7.6	174	1.10
786-084	1530-1545	1012	57	54	31	25	1179	167	14.2	189	1.25
786-085	1545-1560	139	5	8	5	4	161	22	13.8	13	1.19
786-086	1560-1575	2382	78	65	29	23	2578	195	7.6	94	1.25
786-087	1575-1590	1189	49	53	29	24	1344	155	11.5	70	1.25
786-088	1590-1605	1023	37	29	14	12	1116	93	8.3	47	1.13
786-089	1605-1620	1101	34	28	13	12	1188	87	7.3	54	1.15
786-090	1620-1635	147	14	18	15	13	207	60	29.2	116	1.14

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-091	1635-1650	583	33	32	14	13	676	93	13.7	89	1.10
786-092	1650-1665	245	15	17	10	10	297	52	17.5	80	0.98
786-093	1665-1680	6363	77	39	13	9	6501	138	2.1	55	1.49
786-094	1680-1695	4009	87	61	25	24	4206	196	4.7	140	1.05
786-095	1695-1710	493	25	25	12	12	567	73	12.9	21	1.06
786-096	1710-1725	82	10	7	3	4	106	24	22.4	47	0.77
786-097	1725-1740	1366	31	27	11	9	1446	80	5.5	47	1.21
786-098	1740-1755	1170	35	37	16	14	1272	103	8.1	26	1.19
786-099	1755-1770	1121	31	46	27	22	1248	127	10.2	120	1.22
786-100	1770-1785	641	22	22	12	10	706	66	9.3	11	1.14
786-101	1785-1800	211	6	5	3	2	227	16	7.1	57	1.26
786-102	1800-1815	540	19	21	14	11	605	65	10.7	83	1.25
786-103	1815-1830	409	18	22	11	8	468	59	12.5	94	1.27
786-104	1830-1845	190	11	17	10	8	236	46	19.4	78	1.25
786-105	1845-1860	949	38	49	28	22	1085	137	12.6	126	1.31
786-106	1860-1875	254	19	28	17	14	332	77	23.3	77	1.24
786-107	1875-1890	309	24	35	35	38	440	131	29.8	200	0.91
786-108	1890-1905	143	9	15	12	9	188	45	24.1	87	1.34
786-109	1905-1920	138	22	29	28	25	242	103	42.8	142	1.10
786-110	1920-1935	49	10	14	11	15	99	50	50.3	264	0.74
786-111	1935-1950	276	16	24	18	24	357	81	22.8	456	0.75
786-112	1950-1965	376	30	61	43	57	567	191	33.7	548	0.76
786-115	1995-2010	335	26	40	30	44	475	139	29.4	490	0.69
786-113	1965-1980	595	54	88	70	86	893	298	33.4	1190	0.82
786-114	1980-1995	162	16	21	20	30	249	88	35.1	655	0.67
786-116	2010-2025	284	21	52	32	60	448	164	36.6	685	0.53
786-117	2025-2040	381	28	46	29	58	542	161	29.8	840	0.51
786-118	2040-2055	234	16	27	15	34	326	92	28.1	909	0.44
786-119	2050	175	9	6	0	5	196	21	10.7	276	0.04
786-120	2055-2070	133	12	15	8	19	188	55	29.3	456	0.43

TABLE 2B

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-121	2070-2085	149	9	6	2	4	170	21	12.4	143	0.55
786-122	2085-2100	64	5	5	0	4	78	14	18.2	94	0.08
786-123	2100-2115	44	3	2	1	4	54	10	18.5	75	0.22
786-124	2115-2130	285	14	20	12	25	357	71	20.0	96	0.46
786-125	2130-2145	232	14	17	12	11	287	55	19.1	82	1.06
786-126	2145-2160	80	5	8	6	7	107	27	24.9	69	0.88
786-127	2160-2175	11	2	1	1	1	17	6	32.7	29	0.80
786-128	2175-2190	24	2	5	5	6	42	18	42.9	49	0.92
786-129	2190-2205	81	5	5	2	3	97	16	16.2	45	0.83
786-130	2205-2220	92	9	8	5	3	117	25	21.5	47	1.47
786-131	2220-2235	96	15	13	6	9	139	43	30.9	68	0.63
786-132	2235-2250	25	4	3	4	0	38	12	32.3	35	*.**
786-133	2250-2265	209	15	18	10	7	259	50	19.4	75	1.35
786-134	2265-2280	34	3	4	2	2	44	10	23.5	42	1.35
786-135	2280-2295	94	11	11	7	5	128	35	27.0	28	1.44
786-136	2295-2310	51	5	8	3	2	70	19	27.1	22	1.39
786-137	2310-2325	62	10	13	3	1	90	27	30.4	32	2.74
786-138	2325-2340	84	18	41	19	13	175	91	51.8	56	1.54
786-139	2340-2355	93	21	35	21	15	184	92	49.8	67	1.44
786-140	2355-2370	40	8	16	9	7	80	40	50.1	62	1.37
786-141	2370-2385	72	13	33	15	10	143	71	49.4	45	1.44
786-142	2385-2400	51	11	22	8	6	97	46	47.7	42	1.47
786-143	2400-2415	167	28	65	22	16	299	132	44.0	49	1.44
786-144	2415-2430	216	36	85	30	19	386	170	44.0	21	1.55
786-145	2430-2445	63	9	18	7	5	103	39	38.2	48	1.53
786-146	2445-2460	61	16	49	18	14	158	97	61.2	42	1.32
786-147	2460-2475	81	20	91	39	29	259	179	68.9	71	1.37
786-148	2475-2490	65	18	57	18	19	177	112	63.0	46	0.93
786-149	2490-2505	84	21	74	25	25	230	145	63.2	32	1.00
786-150	2505-2520	59	17	74	24	27	200	141	70.6	20	0.90

TABLE 2B

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-151	2520-2535	71	21	111	35	50	288	217	75.3	52	0.70
786-152	2535-2550	74	18	97	34	58	282	208	73.8	73	0.59
786-153	2550-2565	71	23	224	83	173	575	504	87.6	124	0.48
786-154	2565-2580	153	73	351	78	147	802	648	80.9	96	0.53
786-155	2580-2595	90	50	290	65	190	684	595	86.9	130	0.34
786-156	2595-2610	107	61	408	90	263	929	822	88.5	203	0.34
786-157	2610-2625	65	39	274	61	245	685	620	90.5	233	0.25
786-158	2625-2640	47	15	107	32	148	349	302	86.6	264	0.22
786-159	2640-2655	41	15	69	25	137	286	245	85.7	359	0.18
786-160	2655-2670	596	428	2584	574	2755	6936	6340	91.4	6183	0.21
786-161	2670-2685	488	629	4967	1160	6048	13293	12805	96.3	11896	0.19
786-162	2685-2700	992	890	4788	969	5757	13396	12404	92.6	12708	0.17
786-163	2700-2715	812	1179	5386	2952	9405	19735	18922	95.9	15903	0.31
786-164	2715-2730	654	993	6890	1802	9687	20027	19372	96.7	16314	0.19
786-165	2730-2745	221	428	4302	1163	7449	13563	13341	98.4	17103	0.16
786-166	2745-2760	110	165	2066	764	5080	8185	8075	98.7	7172	0.15
786-167	2760-2775	145	292	3228	693	4270	8628	8483	98.3	7176	0.16
786-168	2775-2790	591	602	3543	573	3776	9084	8494	93.5	5094	0.15
786-169	2790-2805	613	1123	5387	602	3605	11331	10717	94.6	3413	0.17
786-170	2805-2820	994	1196	5658	637	3639	12125	11131	91.8	2916	0.18
786-171	2820-2835	472	695	4338	519	2988	9012	8539	94.8	2232	0.17
786-172	2835-2850	196	558	4719	570	2921	8963	8768	97.8	1969	0.20
786-173	2850-2865	68	58	689	112	797	1723	1655	96.1	1239	0.14
786-174	2865-2880	32	13	53	13	65	176	144	82.0	473	0.20
786-175	2880-2895	82	31	126	48	282	570	489	85.6	1847	0.17
786-176	2895-2910	115	47	441	191	939	1732	1617	93.4	3079	0.20
786-177	2910-2925	145	160	496	302	1715	2818	2673	94.9	6436	0.18
786-178	2925-2940	172	70	581	284	1532	2638	2467	93.5	4303	0.19
786-179	2940-2955	297	145	1069	391	1957	3859	3562	92.3	5015	0.20
786-180	2955-2970	113	83	462	181	1047	1885	1772	94.0	3437	0.17

TABLE 2B

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-181	2970-2985	217	76	342	120	588	1345	1127	83.8	2288	0.20
786-182	2985-3000	9731	6012	5784	558	1641	23727	13996	59.0	1075	0.34
786-183	3000-3015	8845	5898	5541	427	1463	22174	13329	60.1	806	0.29
786-184	3015-3030	13788	9013	9010	1592	3828	37230	23442	63.0	1434	0.42
786-185	3030-3045	10710	7869	8317	1105	3305	31306	20596	65.8	1562	0.33
786-186	3045-3060	2353	1974	2573	285	1046	8231	5878	71.4	850	0.27
786-187	3060-3075	594	507	1509	185	797	3592	2998	83.5	760	0.23
786-188	3075-3090	833	836	1462	198	711	4040	3207	79.4	990	0.28
786-189	3090-3105	1943	863	1053	134	528	4522	2579	57.0	718	0.25
786-190	3105-3120	4372	1462	1561	208	776	8378	4007	47.8	1855	0.27
786-191	3120-3135	8399	3367	2709	325	1081	15881	7483	47.1	1341	0.30
786-192	3135-3150	2354	514	379	66	321	3634	1280	35.2	2258	0.20
786-193	3150-3165	1861	434	541	99	427	3362	1501	44.6	2276	0.23
786-194	3165-3180	680	179	323	74	393	1650	970	58.8	3047	0.19
786-195	3180-3195	417	119	84	43	256	919	502	54.6	9668	0.17
786-196	3195-3210	332	102	184	73	380	1070	738	69.0	5273	0.19
786-197	3210-3225	340	112	235	82	407	1176	836	71.1	4167	0.20
786-198	3225-3240	437	183	348	70	461	1500	1062	70.8	3417	0.15
786-199	3240-3255	1014	402	547	107	680	2750	1736	63.1	4370	0.16
786-200	3255-3270	3747	959	718	87	511	6022	2275	37.8	2330	0.17
786-201	3270-3285	1306	632	652	91	550	3231	1925	59.6	2953	0.16
786-202	3285-3300	1965	445	499	88	374	3370	1406	41.7	1982	0.23
786-203	3300-3315	530	185	241	47	238	1240	710	57.3	2883	0.20
786-204	3315-3330	693	253	284	53	258	1542	849	55.0	2369	0.21
786-205	3330-3345	644	550	793	112	488	2586	1942	75.1	3029	0.23
786-206	3345-3360	11214	1456	851	152	676	14348	3134	21.8	448	0.22
786-207	3360-3375	11886	2338	1475	139	619	16458	4572	27.8	1629	0.22
786-208	3375-3390	10978	2154	1120	92	381	14725	3747	25.4	1016	0.24
786-209	3390-3405	16810	11041	9652	790	2484	40778	23967	58.8	1440	0.32
786-210	3405-3420	11830	3998	2740	247	820	19635	7805	39.7	1135	0.30

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-001	280-295	907	31	31	4	10	985	77	7.8	92	0.43
786-002	295-310	603	15	12	2	4	637	34	5.4	78	0.54
786-003	310-325	1610	21	15	2	5	1653	43	2.6	49	0.47
786-004	325-340	2645	54	35	4	14	2752	107	3.9	34	0.26
786-005	340-355	3827	41	24	4	10	3906	79	2.0	39	0.36
786-006	355-370	2841	44	23	1	12	2921	80	2.7	68	0.09
786-007	370-385	2459	70	49	1	13	2592	133	5.1	680	0.04
786-008	385-400	6679	75	33	1	11	6799	120	1.8	564	0.12
786-009	400-415	6594	91	41	3	21	6750	156	2.3	750	0.14
786-010	415-430	10370	177	95	10	8	10659	290	2.7	2615	1.25
786-011	430-445	7747	96	44	1	14	7902	155	2.0	622	0.09
786-012	445-460	7447	72	37	4	8	7568	121	1.6	633	0.51
786-013	460-475	5681	76	27	2	10	5797	115	2.0	644	0.25
786-014	475-490	6135	73	38	3	17	6266	131	2.1	629	0.15
786-015	490-505	5598	55	22	2	5	5682	84	1.5	442	0.47
786-016	505-520	8663	29	10	2	5	8708	45	0.5	94	0.41
786-017	520-535	10547	122	60	36	30	10795	248	2.3	787	1.23
786-018	535-550	9281	144	83	11	29	9548	267	2.8	1062	0.40
786-019	550-565	10378	96	33	2	14	10524	146	1.4	658	0.17
786-020	565-580	5791	79	23	2	9	5904	113	1.9	357	0.26
786-021	580-595	6138	38	16	1	7	6200	62	1.0	58	0.12
786-022	595-610	3813	32	14	2	6	3867	54	1.4	52	0.32
786-023	610-625	4508	28	11	2	8	4557	49	1.1	88	0.27
786-024	625-640	2952	27	10	1	4	2995	43	1.4	64	0.30
786-025	640-655	3170	25	11	0	6	3214	44	1.4	51	0.06
786-026	655-670	2512	32	13	1	7	2565	53	2.1	56	0.12
786-027	670-685	3063	32	16	2	7	3120	56	1.8	86	0.24
786-028	685-700	2585	23	9	1	4	2622	36	1.4	57	0.21
786-029	700-715	2884	25	10	2	6	2927	43	1.5	53	0.27
786-030	715-730	2133	24	11	1	5	2173	40	1.8	19	0.11

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-031	730-745	200	16	8	1	8	233	33	14.3	30	0.08
786-032	745-760	889	24	12	0	7	932	43	4.6	29	0.04
786-033	760-775	330	43	11	0	6	390	60	15.4	22	0.05
786-034	775-790	656	44	17	1	11	728	73	10.0	8	0.08
786-035	790-805	907	34	15	1	10	966	60	6.2	44	0.06
786-036	805-820	787	27	8	0	5	827	40	4.9	4	0.09
786-037	820-835	632	66	44	1	16	759	127	16.7	142	0.06
786-038	835-850	1071	123	118	26	34	1372	301	21.9	108	0.75
786-039	850-865	3870	456	123	2	22	4473	603	13.5	2232	0.12
786-040	865-880	1668	157	111	2	16	1952	285	14.6	2455	0.10
786-041	880-895	877	146	127	1	13	1164	288	24.7	3665	0.07
786-042	895-910	1094	86	111	0	5	1296	202	15.6	2049	0.06
786-043	910-925	1778	60	44	1	16	1898	120	6.3	933	0.05
786-044	925-940	2964	74	62	3	14	3118	154	4.9	1206	0.24
786-045	940-955	2808	67	58	9	23	2965	157	5.3	525	0.38
786-046	955-970	3631	56	49	8	18	3762	131	3.5	384	0.45
786-047	970-995	3480	52	32	6	7	3577	97	2.7	13	0.83
786-048	995-1010	2203	29	19	6	5	2261	58	2.6	33	1.04
786-049	1010-1025	2475	30	22	6	6	2539	64	2.5	41	0.97
786-050	1020-1035	3974	53	48	17	10	4101	128	3.1	53	1.62
786-051	1035-1050	2025	42	31	9	6	2113	88	4.2	34	1.47
786-052	1050-1065	1944	33	30	9	6	2022	78	3.8	32	1.54
786-053	1065-1080	4685	40	29	8	5	4768	83	1.7	15	1.61
786-054	1080-1095	2619	48	41	12	8	2728	109	4.0	38	1.45
786-055	1095-1110	3472	45	33	9	6	3564	92	2.6	41	1.48
786-056	1110-1125	9388	100	70	16	10	9583	195	2.0	47	1.61
786-057	1125-1140	7139	64	47	11	12	7274	135	1.8	69	0.93
786-058	1140-1155	10733	119	65	15	12	10944	211	1.9	72	1.24
786-059	1155-1170	5006	55	44	12	9	5125	119	2.3	65	1.36
786-060	1170-1185	12962	82	48	13	9	13113	152	1.2	39	1.36

TABLE 2 C

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-061	1185-1200	9214	130	64	9	10	9427	214	2.3	49	0.83
786-062	1200-1215	10600	169	80	16	11	10876	275	2.5	60	1.53
786-063	1215-1230	9188	92	51	7	13	9352	164	1.7	105	0.53
786-064	1230-1245	7072	73	47	12	12	7215	143	2.0	66	0.98
786-065	1245-1260	7238	78	39	11	10	7375	137	1.9	212	1.10
786-066	1260-1275	7581	77	55	16	12	7741	160	2.1	123	1.28
786-067	1275-1290	602	8	5	3	2	621	19	3.0	80	1.45
786-068	1290-1305	5204	109	60	15	11	5399	195	3.6	104	1.38
786-069	1305-1320	7144	100	50	12	11	7317	174	2.4	81	1.06
786-070	1320-1335	4077	104	58	14	11	4264	187	4.4	95	1.22
786-071	1335-1350	5118	93	59	17	18	5304	186	3.5	185	0.94
786-072	1350-1365	4476	70	32	7	8	4593	117	2.5	88	0.91
786-073	1365-1380	4325	100	53	18	14	4509	184	4.1	123	1.29
786-074	1380-1395	4605	157	79	27	19	4887	282	5.8	232	1.40
786-075	1395-1410	3584	131	68	28	21	3831	247	6.5	153	1.35
786-076	1410-1425	3019	126	67	42	33	3288	269	8.2	217	1.25
786-077	1425-1440	5471	232	91	42	29	5864	393	6.7	224	1.44
786-078	1440-1455	2912	148	71	33	24	3189	276	8.7	80	1.42
786-079	1455-1470	4542	208	115	58	41	4964	422	8.5	177	1.39
786-080	1470-1485	8815	250	118	64	52	9299	484	5.2	327	1.24
786-081	1485-1500	9134	189	107	59	44	9533	399	4.2	330	1.35
786-082	1500-1515	2194	114	121	73	54	2555	362	14.2	350	1.37
786-083	1515-1530	9532	227	150	69	51	10029	497	5.0	254	1.34
786-084	1530-1545	2107	140	89	45	31	2412	305	12.6	203	1.44
786-085	1545-1560	150	6	8	5	4	173	23	13.2	16	1.22
786-086	1560-1575	3269	134	93	40	29	3565	296	8.3	108	1.40
786-087	1575-1590	1324	52	55	30	24	1486	161	10.9	71	1.26
786-088	1590-1605	1349	45	34	16	13	1457	108	7.4	48	1.21
786-089	1605-1620	1372	37	30	14	12	1465	93	6.3	55	1.18
786-090	1620-1635	4033	86	64	34	26	4243	210	5.0	167	1.33

TABLE 2 C

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-091	1635-1650	1904	79	59	22	17	2081	177	8.5	98	1.30
786-092	1650-1665	2979	128	84	34	23	3248	268	8.3	92	1.51
786-093	1665-1680	7756	115	55	19	12	7958	201	2.5	66	1.63
786-094	1680-1695	6105	218	112	40	31	6507	402	6.2	159	1.29
786-095	1695-1710	3824	76	58	25	19	4002	177	4.4	37	1.35
786-096	1710-1725	5532	91	60	25	16	5724	192	3.4	90	1.53
786-097	1725-1740	3746	69	58	26	19	3917	172	4.4	76	1.37
786-098	1740-1755	8557	182	125	51	34	8949	392	4.4	57	1.53
786-099	1755-1770	3956	87	87	45	33	4208	252	6.0	157	1.38
786-100	1770-1785	2167	58	48	24	16	2313	146	6.3	27	1.46
786-101	1785-1800	660	19	14	7	4	704	44	6.3	61	1.63
786-102	1800-1815	1483	40	36	21	15	1595	112	7.1	93	1.45
786-103	1815-1830	711	23	25	12	9	780	68	8.8	96	1.33
786-104	1830-1845	281	13	18	11	8	331	50	15.1	78	1.30
786-105	1845-1860	976	38	49	29	22	1114	138	12.4	127	1.31
786-106	1860-1875	1054	47	48	27	19	1196	141	11.8	86	1.46
786-107	1875-1890	1405	45	55	47	47	1598	193	12,1	265	1.01
786-108	1890-1905	170	9	15	12	9	216	46	21.3	95	1.33
786-109	1905-1920	1385	53	66	51	41	1596	211	13.2	201	1.25
786-110	1920-1935	1531	57	80	55	55	1777	246	13.9	641	1.01
786-111	1935-1950	3084	81	118	88	84	3456	371	10.7	899	1.05
786-112	1950-1965	2271	73	112	81	86	2622	351	13.4	896	0.95
786-115	1995-2010	1507	60	87	58	77	1789	281	15.7	729	0.75
786-113	1965-1980	1865	77	115	86	101	2245	379	16.9	1383	0.85
786-114	1980-1995	1781	61	95	75	93	2105	324	15.4	690	0.81
786-116	2010-2025	2032	70	111	63	105	2380	348	14.6	1093	0.60
786-117	2025-2040	1725	59	84	49	85	2003	277	13.8	1080	0.58
786-118	2040-2055	1222	36	51	30	57	1396	174	12.5	1181	0.53
786-119	2050	1046	18	12	2	8	1086	39	3.6	332	0.20
786-120	2055-2070	584	27	30	14	29	684	100	14.6	534	0.48

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-121	2070-2085	814	24	15	6	10	868	55	6.3	200	0.60
786-122	2085-2100	888	26	25	9	15	963	75	7.8	144	0.59
786-123	2100-2115	560	15	14	7	11	607	47	7.8	96	0.68
786-124	2115-2130	986	31	35	19	32	1103	117	10.6	112	0.59
786-125	2130-2145	455	21	25	15	14	530	75	14.2	93	1.10
786-126	2145-2160	1024	39	42	26	24	1155	131	11.4	131	1.09
786-127	2160-2175	557	24	27	16	11	636	78	12.3	66	1.40
786-128	2175-2190	800	33	35	20	16	904	104	11.5	55	1.26
786-129	2190-2205	310	11	10	6	5	342	33	9.5	56	1.07
786-130	2205-2220	221	13	11	7	4	256	35	13.5	56	1.51
786-131	2220-2235	372	26	25	13	14	450	77	17.2	76	0.97
786-132	2235-2250	181	13	14	11	3	221	41	18.4	42	3.19
786-133	2250-2265	419	25	29	16	10	498	79	15.9	85	1.53
786-134	2265-2280	350	18	20	12	5	405	55	13.6	51	2.11
786-135	2280-2295	156	15	17	11	7	206	50	24.4	33	1.65
786-136	2295-2310	166	13	17	7	4	207	40	19.5	25	2.06
786-137	2310-2325	64	10	14	3	1	92	29	30.9	32	2.28
786-138	2325-2340	111	20	45	22	13	211	100	47.4	61	1.63
786-139	2340-2355	207	32	61	35	20	355	148	41.7	82	1.78
786-140	2355-2370	104	14	28	16	9	170	67	39.1	70	1.76
786-141	2370-2385	164	21	49	22	13	270	105	39.1	49	1.72
786-142	2385-2400	107	15	31	12	7	172	65	37.8	44	1.75
786-143	2400-2415	346	46	101	37	20	548	203	37.0	54	1.83
786-144	2415-2430	237	37	87	31	20	413	176	42.7	22	1.57
786-145	2430-2445	132	14	27	11	7	191	59	30.8	50	1.66
786-146	2445-2460	119	24	65	24	16	247	128	51.9	44	1.52
786-147	2460-2475	163	36	148	62	41	450	286	63.7	79	1.52
786-148	2475-2490	175	35	119	41	34	404	229	56.6	54	1.18
786-149	2490-2505	208	40	141	51	41	481	273	56.8	40	1.24
786-150	2505-2520	201	47	189	64	55	556	355	63.8	35	1.16

TABLE 2 C

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786-151	2520-2535	236	62	299	107	109	812	577	71.0	101	0.98
786-152	2535-2550	242	118	552	161	197	1270	1028	80.9	170	0.82
786-153	2550-2565	359	214	874	236	362	2045	1685	82.4	248	0.65
786-154	2565-2580	430	185	779	171	255	1820	1390	76.4	142	0.67
786-155	2580-2595	841	370	1516	333	535	3596	2754	76.6	292	0.62
786-156	2595-2610	381	187	953	199	434	2153	1773	82.3	253	0.46
786-157	2610-2625	315	173	1052	224	543	2306	1991	86.3	391	0.41
786-158	2625-2640	273	128	979	222	651	2253	1980	87.9	718	0.34
786-159	2640-2655	172	76	690	180	597	1715	1543	90.0	843	0.30
786-160	2655-2670	3279	2663	11010	1889	7787	26629	23350	87.7	11805	0.24
786-161	2670-2685	2473	1921	7079	1986	8385	21844	19371	88.7	14700	0.24
786-162	2685-2700	3321	2588	7495	2146	9036	24586	21264	86.5	17393	0.24
786-163	2700-2715	3204	2941	7927	4104	12432	30608	27404	89.5	19937	0.33
786-164	2715-2730	2243	2143	8551	2596	11773	27305	25063	91.8	19385	0.22
786-165	2730-2745	3913	3169	8902	3441	13973	33398	29486	88.3	24761	0.25
786-166	2745-2760	1945	1872	12084	2141	12068	30110	28165	93.5	17057	0.18
786-167	2760-2775	159	305	3307	704	4332	8808	8649	98.2	7355	0.16
786-168	2775-2790	2520	1630	5861	1042	5643	16696	14176	84.9	6680	0.18
786-169	2790-2805	2425	2439	7377	930	4836	18007	15583	86.5	4639	0.19
786-170	2805-2820	3647	2857	7915	1058	5076	20552	16905	82.3	3672	0.21
786-171	2820-2835	4062	2801	7508	1029	4710	20110	16048	79.8	2872	0.22
786-172	2835-2850	5891	5214	17661	1871	7330	37966	32076	84.5	5618	0.26
786-173	2850-2865	130	114	881	132	871	2128	1998	93.9	1321	0.15
786-174	2865-2880	70	25	142	38	189	464	394	84.9	1074	0.20
786-175	2880-2895	391	184	979	317	1166	3037	2646	87.1	3768	0.27
786-176	2895-2910	120	51	471	200	974	1815	1695	93.4	3195	0.21
786-177	2910-2925	149	164	533	315	1769	2930	2781	94.9	6576	0.18
786-178	2925-2940	652	529	3314	1011	4116	9621	8969	93.2	8073	0.25
786-179	2940-2955	1517	1038	4600	1101	4316	12572	11055	87.9	8252	0.26
786-180	2955-2970	859	771	4426	1316	4459	11830	10972	92.7	7534	0.30

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

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
786–181	2970–2985	2115	1444	4173	867	2725	11324	9209	81.3	5129	0.32
786–182	2985–3000	21421	11748	10500	963	2502	47134	25712	54.6	1641	0.38
786–183	3000–3015	19998	11499	10233	960	2404	45094	25096	55.7	1232	0.40
786–184	3015–3030	17933	11046	10770	2004	4469	46223	28289	61.2	1671	0.45
786–185	3030–3045	13961	9623	9898	1382	3814	38677	24716	63.9	1788	0.36
786–186	3045–3060	4561	3167	3656	458	1382	13223	8662	65.5	1037	0.33
786–187	3060–3075	5302	2865	3574	380	1263	13384	8082	60.4	1210	0.30
786–188	3075–3090	10275	5369	4703	520	1434	22300	12026	53.9	1582	0.36
786–189	3090–3105	5406	2639	3156	357	976	12533	7127	56.9	1017	0.37
786–190	3105–3120	8535	3511	3282	452	1308	17087	8552	50.1	2455	0.35
786–191	3120–3135	10968	4927	4077	422	1311	21704	10737	49.5	1518	0.32
786–192	3135–3150	4198	1417	1070	180	631	7496	3297	44.0	2919	0.29
786–193	3150–3165	3772	1351	1295	205	722	7345	3574	48.7	2892	0.28
786–194	3165–3180	1506	451	682	146	608	3393	1887	55.6	3611	0.24
786–195	3180–3195	823	258	268	89	411	1849	1026	55.5	11925	0.22
786–196	3195–3210	1542	578	1036	264	1139	4559	3017	66.2	9637	0.23
786–197	3210–3225	1628	569	872	196	854	4119	2491	60.5	5864	0.23
786–198	3225–3240	2355	868	1096	175	880	5374	3019	56.2	4593	0.20
786–199	3240–3255	4934	1366	1459	228	1131	9118	4184	45.9	5669	0.20
786–200	3255–3270	5498	1696	1209	148	712	9262	3765	40.6	2587	0.21
786–201	3270–3285	2587	1182	1049	150	734	5701	3114	54.6	3318	0.20
786–202	3285–3300	3497	989	920	155	575	6137	2639	43.0	2484	0.27
786–203	3300–3315	3146	737	818	139	529	5368	2223	41.4	3036	0.26
786–204	3315–3330	4414	1154	1315	213	845	7941	3527	44.4	5649	0.25
786–205	3330–3345	6097	1639	1644	215	802	10397	4301	41.4	4325	0.27
786–206	3345–3360	17803	3121	2125	296	1147	24492	6689	27.3	1683	0.26
786–207	3360–3375	13052	2911	1953	192	779	18888	5835	30.9	2324	0.25
786–208	3375–3390	27546	10072	4183	323	938	43061	15515	36.0	2025	0.34
786–209	3390–3405	43871	23603	17129	1342	3695	89641	45769	51.1	2923	0.36
786–210	3405–3420	24817	10184	6852	598	1527	43978	19161	43.6	2028	0.39

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION INDEX
		TYPES 40%; 10–40%; 10%	REMARKS	REWORKED (%)	PARTICLE SIZE	PRESERV-ATION	
786-050A	1020-1035m	Am**;-;W-Al-I-H	**not typically oil prone	5	F-C	F	1+ to 2-(?)
786-063A	1215-1230m	W;H-Al;Am-I		10	M-C	G	1+
786-069B	1305-1320m	W;H-Al-Am**;I	**as 050A	10	F-C	G	1+
786-080A	1470-1485m	-;W-Al-H-Am;I		10	M	G	1+ to 2-
786-090A	1620-1635m	-;W-H-Al-Am;I		10	F-M	G	1+ to 2-
786-098A	1740-1755m	-;W-Al-H-Am;I		10	F-M	G	1+ to 2-
786-105A	1845-1860m	-;Am**-W-Al-H;I	H at 2- through 2. Fungal spores **as 050A	10	F-M	F-G	1+ to 2-
786-111A	1935-1950m	-;W-Am**-H-Al-I;-	H at 2- through 2 **not typically oil prone, frequently unrecognisable and disseminated	15	F-M	F	1+ to 2-
786-120B	2055-2070m	W;H-I-Am**-Al;-	**as 111A H dominantly 2- to 2 and 2	30	F-M/C	F-G	1+ to 2-
786-126A	2145-2160m	I-W;-;Am**-H-Al	**unrecognisable, disseminated H frequently reworked	85	F-M	F	1+ to 2-(?)
786-130A	2205-2220m	W-I;-;H-Am-Al		80	M	F	1+ to 2-
786-133A	2250-2265m	W-I;-;H-Al-Am	extensive reworking	90	M	G	1+ to 2-(?)
786-143A	2400-2415m	W-I;-;H-Al	H very variable at 1+ to 2- through 2 to 2+ disseminated Am-like contaminant	90	M	F-G	1+ to 2-(?)
786-152A	2535-2550m	W-I;-;H-Al	contaminant as in 143A	90	M	F-G	2-
786-156A	2595-2610m	W-I;-;H-Al	contaminant as in 143A	85	M	F-G	2-

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

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

TABLE 3
KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION INDEX
		TYPES 40%; 10–40%; 10%	REMARKS	REWORKED (%)	PARTICLE SIZE	PRESERV-ATION	
786-160A	2655-2670m	Am**;Al*;I-W-H	**includes incompletely developed material *includes Al passing to Am H at 2- to 2	10	F-VC	G	2-
786-163A	2700-2715m	Am**;Al*;I-W-H	** * as 160A	10	F-VC	G	2- to 2
786-165A	2730-2745m	Am**;W-Al*-I;H	frequent fine pyrite ** * as 160A	35	F-M	F	2- to 2(?)
786-168A	2775-2790m	-;I-Am**-Al**-H**-W;-	significant H at 2- to 2 **includes material passing to Am	45	F-M/C	G	2- to 2
786-171A	2820-2835m	-;Al**-W-H**-Am**-I;-	**as 168A	35	M-C	G	2- to 2
786-176B	2895-2910m	W;H-I-Al-Am;-		40	M-C	F	2- to 2
786-180B	2955-2970m	-;Al**-Am**-H**-W-I;-	**as 168A	25	M-C	G	2- to 2
786-181B	2970-2985m	-;Al-W-H-Am-I;-	close to 2	30	M	G	2- to 2/2
786-213A	2986.93m CORE	W;-;I-H		10	M-C	G	2(?)
786-185B	3030-3045m	W;H**-Am**-I;Al	**includes material passing to Am	10	F-VC	G	2
786-188C	3075-3090m	W;Am-H;I-Al		10	F-C	G	2
786-216A	3125m CORE	H-W;-;Am-I-Al		5	F-C	G	2
786-192A	3135-3150m	H-W;-;I-Am-Al	disseminated Am-like contaminant	10	F-C	G	2
786-194A	3165-3180m	W-H;I;Am-Al	disseminated Am-like contaminant H at 2 to 2+	30	F-C	G	2
786-217A	3186m SWC	-;W-H-Am**-I;Al	**not prime quality, may include contamination	10	F-M/C	G	2
786-196A	3195-3210m	W-H;I;Am-Al	abundant disseminated Am-like contaminant. H at 2 to 2+	20	F-M/C	G	2

Algal, **Am**orphous, **H**erbaceous, **I**nertinite, **R**esin, **W**ood

postscript = **c**oarse, **cu**ticle, **cy**sts, **d**egraded, **f**ine, **o**ther,. **s**tructured, **sp**ore-pollen, **t**hick-walled, **u**nstructured

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION INDEX
		TYPES 40%; 10–40%; 10%	REMARKS	REWORKED (%)	PARTICLE SIZE	PRESERV-ATION	
786-200B	3255-3270m	-;W-H-Am**-I;Al	**grainy, poor quality, frequently resembles contaminant	10	F-M/C	F	2
786-202B	3285-3300m	Am**;W-H-I;Al	**as 200B	15	F-VC	F-G	2
786-218A	3297m SWC	W;H-I;Am-Al	material at 2 to 2+	20	M-C	G	2
786-206A	3345-3360m	Am**;W-H-I;Al	**as 200B. Close to 2 to 2+	20	F-C	G	2
786-219A	3376m SWC	W;H-I;Am-Al		20	M-C	G	2 to 2+
786-209B	3390-3405m	W;-;Am-H-I		-	F-VC	G	2 to 2+

Algal, **Am**orphous, **H**erbaceous, **I**nertinite, **R**esin, **W**ood

postscript = **c**oarse, **c**uticle, **c**ysts, **d**egraded, **f**ine, **o**ther,. **s**tructured, **s**pore-pollen, **t**hick-walled, **u**nstructured

TABLE 4
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)				REMARKS
			1	2	3	4	
786-050A	1020-1035m	KC	0.29(4)	0.43(17)	0.59(4)	0.76(2)	
786-063A	1215-1230m	KC	0.28(52)	0.45(6)	-	-	
786-069B	1305-1320m	KC	0.24(12)	0.40(6)	-	-	
786-080A	1470-1485m	KC	0.31(43)	-	-	-	
786-090A	1620-1635m	KC	0.33(51)	-	-	-	
786-098A	1740-1755m	KC	0.35(51)	0.47(5)	-	-	
786-105A	1845-1860m	KC	0.35(65)	0.53(2)	-	-	
786-111A	1935-1950m	WR	NO DETERMINATION POSSIBLE				
786-120B	2055-2070m	KC	0.39(20)	0.51(2)	0.84(20)	1.12(11)	
786-126A	2145-2160m	WR	0.50(2)	0.63(2)	1.20(6)	1.36(6)	
786-130A	2205-2220m	WR	0.58(2)	0.76(1)	1.20(11)	-	
786-133A	2250-2265m	WR	0.75(4)	1.25(11)	-	-	
786-143A	2400-2415m	WR	0.86(1)	1.07(4)	1.29(9)	-	
786-147A	2460-2475m	WR	1.18(8)	-	-	-	
786-152A	2535-2550m	KC	0.47(5) 1.41(3)	0.67(3)	0.91(3)	1.15(22)	
786-156A	2595-2610m	WR	0.57(1)	0.73(1)	1.26(6)	-	
786-160A	2655-2670m	KC	0.31(16) 1.14(1)	0.49(10) 1.39(2)	0.67(2)	0.93(7)	
786-163A	2700-2715m	KC	0.38(10)	0.77(7)	1.25(2)	-	
786-165A	2730-2745m	KC	0.48(42)	0.69(19)	-	-	
786-168A	2775-2790m	KC	0.34(13) 1.13(10)	0.48(8)	0.57(1)	0.83(7)	
786-171A	2820-2835m	KC	0.48(20) 1.21(1)	0.73(1)	0.81(1)	1.02(17)	
786-176B	2895-2910m	WR	0.38(5)	0.53(20)	0.81(1)	-	
786-180B	2955-2970m	KC	0.36(2)	0.45(4)	0.75(3)	1.07(8)	
786-181B	2970-2985m	KC	0.36(3)	0.58(5)	0.84(6)	1.20(9)	
786-213A	2986.93m CORE	KC	0.68(60)	-	-	-	
786-185B	3030-3045m	KC	0.46(1)	*0.69(71)	-	-	
786-188C	3075-3090m	KC	0.72(40)*	-	-	-	
786-190B	3105-3120m	KC	0.65(68)*	-	-	-	
786-216A	3125m SWC	KC	0.68(27)*	0.96(1)	-	-	
786-192A	3135-3150m	KC	0.60(30)	*0.75(7)	-	-	
786-217A	3186m SWC	KC	0.41(3)	*0.61(5)	0.86(4)	-	
786-196A	3195-3210m	WR	0.49(1)	*0.66(22)	1.11(1)	-	
786-218A	3297m SWC	KC	0.44(4)	*0.71(26)	-	-	
786-206A	3345-3360m	KC	*0.77(41)	1.09(1)	-	-	

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

TABLE 4

VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)				REMARKS
			1	2	3	4	
786-219A	3376m SWC	KC	0.48(3)	0.76(19) ✓	0.92(1)	-	
786-209B	3390-3405m	KC	0.76(26) ✓	0.88(24)	-	-	

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

TABLE 5

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HYDROGEN INDEX	PRODUCTION INDEX	TMAX (°C)
786-050A	1020-1035	0.07	3.22	1.76	272.88	0.02	425
786-056A	1110-1125	0.07	2.91	1.27	316.30	0.02	429
786-060A	1170-1185	0.09	4.53	1.78	380.67	0.02	428
786-063A	1215-1230	0.07	3.18	1.24	269.49	0.02	432
786-069B	1305-1320	0.07	3.67	0.65	374.49	0.02	453
786-074A	1380-1395	0.09	2.48	1.48	291.76	0.04	434
786-080A	1470-1485	0.08	2.64	1.04	244.44	0.03	437
786-083A	1515-1530	0.08	2.64	0.76	225.64	0.03	430
786-090A	1620-1635	0.09	2.31	1.02	189.34	0.04	430
786-095A	1695-1710	0.05	0.18	1.24	94.74	0.22	424
786-098A	1740-1755	0.06	1.73	0.74	153.10	0.03	433
786-105A	1845-1860	0.06	2.25	0.79	169.17	0.03	443
786-111A	1935-1950	0.05	0.26	0.51	100.00	0.16	436
786-116A	2010-2025	0.05	0.40	0.55	111.11	0.11	435
786-120B	2055-2070	0.08	1.10	0.51	115.79	0.07	437
786-126A	2145-2160	0.05	0.37	0.61	71.15	0.12	430
786-130A	2205-2220	0.05	0.29	0.46	59.18	0.15	430
786-133A	2250-2265	0.04	0.23	0.52	50.00	0.15	428
786-139A	2340-2355	0.05	0.30	0.28	68.18	0.14	428
786-143A	2400-2415	0.04	0.29	0.35	61.70	0.12	429
786-147A	2460-2475	0.03	0.21	0.19	50.00	0.13	429
786-150A	2505-2520	0.03	0.27	0.28	51.92	0.10	431
786-152A	2535-2550	0.03	0.26	0.23	57.78	0.10	434
786-153A	2550-2565	0.03	0.27	0.25	56.25	0.10	431
786-155A	2580-2595	0.20	0.35	0.35	64.81	0.36	434
786-156A	2595-2610	0.05	0.62	0.26	86.11	0.07	441
786-157A	2610-2625	0.06	0.65	0.25	90.28	0.08	441
786-158A	2625-2640	0.05	0.50	0.28	73.53	0.09	439
786-160A	2655-2670	1.33	36.23	0.28	524.31	0.04	436
786-161A	2670-2685	2.67	34.78	0.18	457.63	0.07	435
786-162A	2685-2700 Dwayne	1.58	28.64	0.20	495.50	0.05	435
786-163A	2700-2715	1.51	28.16	0.21	499.29	0.05	436
786-164A	2715-2730	2.27	27.12	0.25	622.02	0.08	435
786-165A	2730-2745	2.07	26.07	0.27	445.64	0.07	434
786-166A	2745-2760	1.39	23.31	0.30	430.07	0.06	436
786-167A	2760-2775	0.99	16.89	0.38	343.29	0.06	438
786-168A	2775-2790	0.91	14.56	0.34	333.18	0.06	438
786-169A	2790-2805	1.10	18.79	0.31	371.34	0.06	439
786-170B	2805-2820	1.11	14.79	0.23	295.21	0.07	441
786-171A	2820-2835	1.27	15.15	0.27	271.02	0.08	440
786-171B	2821-2835	0.08	0.52	0.25	56.52	0.13	439
786-172A	2835-2850 Heather	1.35	18.81	0.32	261.25	0.07	438
786-176B	2895-2910	0.26	2.55	0.31	265.62	0.09	437
786-177B	2910-2925	0.33	4.44	0.37	288.31	0.07	438
786-178B	2925-2940	0.56	8.71	0.45	473.37	0.06	437
786-179A	2940-2955	0.38	6.50	0.25	256.92	0.06	439
786-180B	2955-2970	0.71	10.94	0.31	334.56	0.06	438
786-181B	2970-2985	0.23	5.31	0.25	264.18	0.04	442
786-183B	3000-3015	5.40	82.15	0.78	178.98	0.06	445

Brent

TABLE 5

ROCKEVAL PYROLYSIS DATA

	GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HYDROGEN INDEX	PRODUCTION INDEX	TMAX (°C)
	786-184A	3015-3030	6.93	93.19	0.76	277.35	0.07	444
	786-185B	3030-3045	2.76	52.43	0.34	280.37	0.05	442
	786-186C	3045-3060	0.23	2.35	0.22	165.49	0.09	443
	786-187C	3060-3075	0.60	18.79	0.13	133.26	0.03	440
	786-188C	3075-3090	1.31	36.42	0.37	313.97	0.03	440
	786-190B	3105-3120	0.23	4.02	0.18	462.07	0.05	443
	786-191B	3120-3135	3.02	62.59	0.43	261.88	0.05	441
	786-192A	3135-3150	0.17	0.29	0.08	36.25	0.37	441
	786-194A	3165-3180	0.25	1.65	0.09	214.29	0.13	439
Drake	786-194C	3166-3180	0.17	1.82	0.15	152.94	0.09	441
	786-195A	3180-3195	0.35	4.29	0.06	487.50	0.08	438
	786-196A	3195-3210	0.31	2.03	0.25	263.64	0.13	442
	786-198C	3225-3240	0.27	0.98	0.29	84.48	0.22	445
Cook	786-200B	3255-3270	0.30	2.26	0.29	262.79	0.12	444
	786-202B	3285-3300	0.26	4.35	0.19	478.02	0.06	444
	786-204B	3315-3330	0.28	4.68	0.21	380.49	0.06	446
Am/Burt	786-205A	3330-3345	0.18	2.11	0.18	131.87	0.08	446
	786-206A	3345-3360	0.84	5.03	0.16	294.15	0.14	441
	786-208B	3375-3390	0.18	0.75	0.23	51.37	0.19	446
	786-209B	3390-3405	5.31	105.01	1.26	155.34	0.05	450
	786-210B	3405-3420	0.43	5.99	0.28	544.55	0.07	446

TABLE 6a

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

GEOCHEM SAMPLE NUMBER	DEPTH	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS			
			Paraffin - Naphthenes	Aromatics	TOTAL	Preciptd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	Sulphur
								NSO	
786-090A 98	1620-1635	455	41	39	81	238	86	42	8
786-098A 108	1740-1755	278	20	37	57	149	51	18	2
786-160 187	2655-2670 D	1927	375	546	921	538	382	78	8
786-163A 194	2700-2715 D	5417	1117	1612	2729	1304	975	393	16
786-165A 198	2730-2745 D	7739	1193	1782	2975	3437	882	151	294
786-168 203	2775-2790 D	4595	475	885	1359	2434	576	206	19
786-171A 210	2820-2835 D	3936	442	1268	1710	1489	608	129	0
786-176 217	2895-2910 H!	928	145	231	376	384	117	40	11
786-180 225	2955-2970 H!	4609	1200	1411	2611	1456	447	74	20
786-211 SS 227	2979.3-.35	407	180	53	233	102	37	10	24
786-212 SS 228	2983.08-18	471	218	42	260	101	26	5	79
786-214 SS 232	2987.50-.59	140	12	14	26	69	19	9	16
786-185 238	3030-3045	1125	108	251	359	652	85	19	10
786-190B 248	3105-3120	1287	182	327	509	585	140	45	9
786-196A 262	3195-3210	1386	178	268	446	746	178	16	0
786-202 271	3285-3300	808	150	190	339	262	102	32	72
786-206 278	3345-3360	2995	542	978	1520	1004	394	42	34
786-209 284	3390-3405	1997	179	594	773	1019	148	31	27

TABLE 6b

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

GEOCHEM SAMPLE NUMBER	DEPTH	HYDROCARBONS		NON HYDROCARBONS			
		Paraffin – Naphthenes	Aromatics	Preciptd. Asphaltenes	Eluted NSO's	Non eluted NSO's	Sulphur
786-090A	1620-1635	9.09	8.64	52.27	18.86	9.32	1.82
786-098A	1740-1755	7.35	13.24	53.78	18.49	6.30	0.84
786-160	2655-2670	19.46	28.33	27.93	19.82	4.05	0.41
786-163A	2700-2715	20.62	29.76	24.07	18.00	7.25	0.29
786-165A	2730-2745	15.42	23.02	44.41	11.40	1.95	3.80
786-168	2775-2790	10.33	19.25	52.98	12.54	4.49	0.41
786-171A	2820-2835	11.24	32.22	37.83	15.45	3.27	0.00
786-176	2895-2910	15.63	24.93	41.35	12.56	4.35	1.19
786-180	2955-2970	26.04	30.61	31.60	9.71	1.61	0.44
786-211	2979.3-.35	44.12	13.04	25.15	9.20	2.56	5.94
786-212	2983.08-18	46.31	8.83	21.50	5.50	1.14	16.72
786-214	2987.50-.59	8.68	9.97	49.52	13.83	6.75	11.25
786-185	3030-3045	9.59	22.28	57.94	7.55	1.71	0.93
786-190B	3105-3120	14.15	25.41	45.43	10.88	3.46	0.67
786-196A	3195-3210	12.87	19.30	53.80	12.87	1.17	0.00
786-202	3285-3300	18.52	23.49	32.46	12.64	4.00	8.89
786-206	3345-3360	18.10	32.67	33.53	13.17	1.40	1.13
786-209	3390-3405	8.96	29.75	51.03	7.39	1.54	1.33

TABLE 7

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

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC CARBON (wt. %)	HYDROCARBONS / TOTAL EXTRACT	HYDROCARBONS / ORG. CARBON	TOTAL EXTRACT / ORG. CARBON	P-NAPHTHENES / AROMATICS
786-090A	1620-1635	0.92	17.73	0.88	4.95	1.05
786-098A	1740-1755	0.73	20.59	0.78	3.80	0.56
786-160	2655-2670	1.92	47.80	4.80	10.04	0.69
786-163A	2700-2715	3.70	50.38	7.38	14.64	0.69
786-165A	2730-2745	3.95	38.44	7.53	19.59	0.67
786-168	2775-2790	2.94	29.58	4.62	15.63	0.54
786-171A	2820-2835	3.58	43.46	4.78	10.99	0.35
786-176	2895-2910	0.60	40.55	6.27	15.47	0.63
786-180	2955-2970	1.94	56.64	13.46	23.76	0.85
786-211	2979.3-.35	0.14	57.16	16.61	29.07	3.38
786-212	2983.08-18	0.10	55.14	25.97	47.09	5.25
786-214	2987.50-.59	0.06	18.65	4.36	23.39	0.87
786-185	3030-3045	1.81	31.87	1.98	6.22	0.43
786-190B	3105-3120	1.25	39.56	4.07	10.30	0.56
786-196A	3195-3210	1.04	32.16	4.29	13.33	0.67
786-202	3285-3300	1.08	42.01	3.14	7.48	0.79
786-206	3345-3360	1.25	50.77	12.16	23.96	0.55
786-209	3390-3405	2.34	38.71	3.30	8.54	0.30

TABLE 8

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

GEOCHEM SAMPLE NUMBER	-090A	-098A	-160	-163A	-165A	-168
DEPTH	1620-1635m	1740-1755m	2655-2670m	2700-2715m	2730-2745m	2775-2790m
SAMPLE TYPE						
nC_{15}	8.55	11.01	11.46	11.85	10.02	11.41
nC_{16}	14.77	15.75	11.46	9.76	10.27	10.49
nC_{17}	15.93	14.04	11.36	12.32	11.26	9.85
nC_{18}	11.66	12.33	8.06	8.06	9.03	7.94
nC_{19}	7.38	8.35	7.09	7.58	8.91	8.12
nC_{20}	6.09	7.59	7.28	7.87	7.80	7.30
nC_{21}	7.64	6.64	5.92	6.82	8.04	6.30
nC_{22}	5.70	6.83	6.12	6.07	6.93	6.57
nC_{23}	9.84	8.16	7.38	5.97	8.17	6.66
nC_{24}	4.15	3.98	5.92	6.07	5.94	5.84
nC_{25}	3.89	2.47	3.69	5.12	5.07	5.29
nC_{26}	1.55	0.95	4.85	4.74	3.84	4.65
nC_{27}	1.04	0.57	3.69	3.22	1.73	4.29
nC_{28}	0.78	0.38	2.23	1.61	1.24	2.55
nC_{29}	0.39	0.19	1.75	1.33	0.62	1.64
nC_{30}	0.26	0.19	0.68	0.66	0.25	0.46
nC_{31}	0.13	0.19	0.39	0.38	0.25	0.18
nC_{32}	0.13	0.19	0.29	0.19	0.25	0.18
nC_{33}	0.13	0.19	0.19	0.19	0.12	0.09
nC_{34}	0.00	0.00	0.10	0.09	0.12	0.09
nC_{35}	0.00	0.00	0.10	0.09	0.12	0.09
PARAFFIN	24.99	21.18	32.23	33.14	33.51	37.29
ISOPRENOID	5.44	6.51	6.54	6.66	7.67	6.67
NAPHTHENE	69.57	72.31	61.23	60.19	58.81	56.04
CPI INDEX A	1.56	1.20	0.97	1.00	1.11	1.04
CPI INDEX B	1.40	1.31	0.94	1.08	1.03	1.15
PRISTANE/PHYTANE	2.57	3.91	1.58	1.41	2.19	2.06
PRISTANE/nC_{17}	0.98	1.74	1.09	0.95	1.40	1.22

TABLE 8

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

GEOCHEM SAMPLE NUMBER	-171A	-176	-180	-211	-212	-214
DEPTH	2820-2835m	2895-2910m	2955-2970m	2979.3-2979.35m	2983.08-2983.18m	2987.50-2987.59m
SAMPLE TYPE				CORE	CORE	CORE
nC_{15}	10.87	7.09	10.11	4.62	10.98	2.08
nC_{16}	9.91	9.64	10.35	8.32	9.80	6.52
nC_{17}	9.53	12.67	9.79	10.17	7.45	10.05
nC_{18}	7.82	9.55	8.29	10.57	6.67	12.05
nC_{19}	7.63	8.03	7.58	9.78	8.24	10.60
nC_{20}	7.15	7.56	7.03	11.49	9.41	10.24
nC_{21}	6.01	8.51	6.64	8.19	11.37	9.33
nC_{22}	6.10	6.24	5.37	7.13	7.06	9.33
nC_{23}	6.77	7.56	5.13	7.00	4.71	8.06
nC_{24}	6.48	5.48	4.50	7.00	4.31	6.70
nC_{25}	6.39	4.16	4.58	5.55	3.53	5.53
nC_{26}	5.15	3.97	3.95	3.83	3.92	3.62
nC_{27}	4.19	3.88	3.55	1.85	3.53	2.54
nC_{28}	2.86	2.55	3.63	1.59	2.75	1.18
nC_{29}	1.14	1.23	3.16	1.06	1.96	0.82
nC_{30}	0.76	0.57	2.45	0.79	1.57	0.54
nC_{31}	0.48	0.47	1.90	0.40	0.78	0.27
nC_{32}	0.38	0.28	1.03	0.26	0.78	0.18
nC_{33}	0.19	0.28	0.63	0.13	0.39	0.18
nC_{34}	0.10	0.19	0.24	0.13	0.39	0.09
nC_{35}	0.10	0.09	0.08	0.13	0.39	0.09
PARAFFIN	38.47	36.80	36.58	13.05	5.12	31.27
ISOPRENOID	6.75	4.59	3.47	1.41	0.52	3.68
NAPHTHENE	54.79	58.61	59.95	85.54	94.36	65.05
CPI INDEX A	1.04	1.18	1.05	0.96	1.11	1.04
CPI INDEX B	1.07	1.05	1.05	1.02	0.93	1.21
PRISTANE/PHYTANE	2.61	2.47	2.16	1.41	1.89	1.89
PRISTANE/nC_{17}	1.33	0.70	0.66	0.62	0.89	0.77

TABLE 8

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

GEOCHEM SAMPLE NUMBER	-185	-190B	-196A	-202	-206	-209
DEPTH	3030-3045m	3105-3120m	3195-3210m	3285-3300m	3345-3360m	3390-3405m
SAMPLE TYPE						
nC_{15}	7.45	10.34	9.79	7.56	8.68	9.78
nC_{16}	7.88	12.23	11.56	8.85	7.97	8.24
nC_{17}	8.60	9.80	15.68	8.98	7.84	8.63
nC_{18}	8.45	7.73	10.26	8.71	7.46	8.09
nC_{19}	7.02	7.37	8.61	8.17	7.01	7.55
nC_{20}	6.95	6.65	8.61	7.90	6.43	7.16
nC_{21}	7.88	6.56	7.19	7.02	5.40	6.47
nC_{22}	6.23	6.03	6.72	6.62	5.46	6.86
nC_{23}	6.88	6.83	6.60	7.29	5.40	6.24
nC_{24}	6.16	5.58	6.72	5.00	5.66	5.86
nC_{25}	6.95	6.38	4.48	6.14	5.33	6.55
nC_{26}	4.73	5.04	1.53	4.52	4.76	5.01
nC_{27}	5.80	4.59	0.59	4.39	4.69	4.85
nC_{28}	3.80	2.25	0.35	2.90	3.92	3.00
nC_{29}	3.08	1.35	0.35	2.50	3.66	2.77
nC_{30}	1.29	0.45	0.24	1.28	3.21	1.23
nC_{31}	0.50	0.27	0.24	0.95	2.83	0.62
nC_{32}	0.14	0.18	0.12	0.41	1.93	0.39
nC_{33}	0.07	0.18	0.12	0.41	1.61	0.31
nC_{34}	0.07	0.09	0.12	0.27	0.51	0.23
nC_{35}	0.07	0.09	0.12	0.14	0.26	0.15
PARAFFIN	51.14	48.50	40.04	48.65	30.85	48.25
ISOPRENOID	6.41	5.84	4.86	3.06	2.38	6.25
NAPHTHENE	42.45	45.66	55.10	48.29	66.77	45.50
CPI INDEX A	1.23	1.17	1.02	1.17	0.99	1.07
CPI INDEX B	1.33	1.27	1.58	1.28	1.07	1.26
PRISTANE/PHYTANE	3.38	4.15	2.32	2.58	2.43	3.80
PRISTANE/nC_{17}	1.13	0.99	0.54	0.50	0.70	1.19

TABLE 9

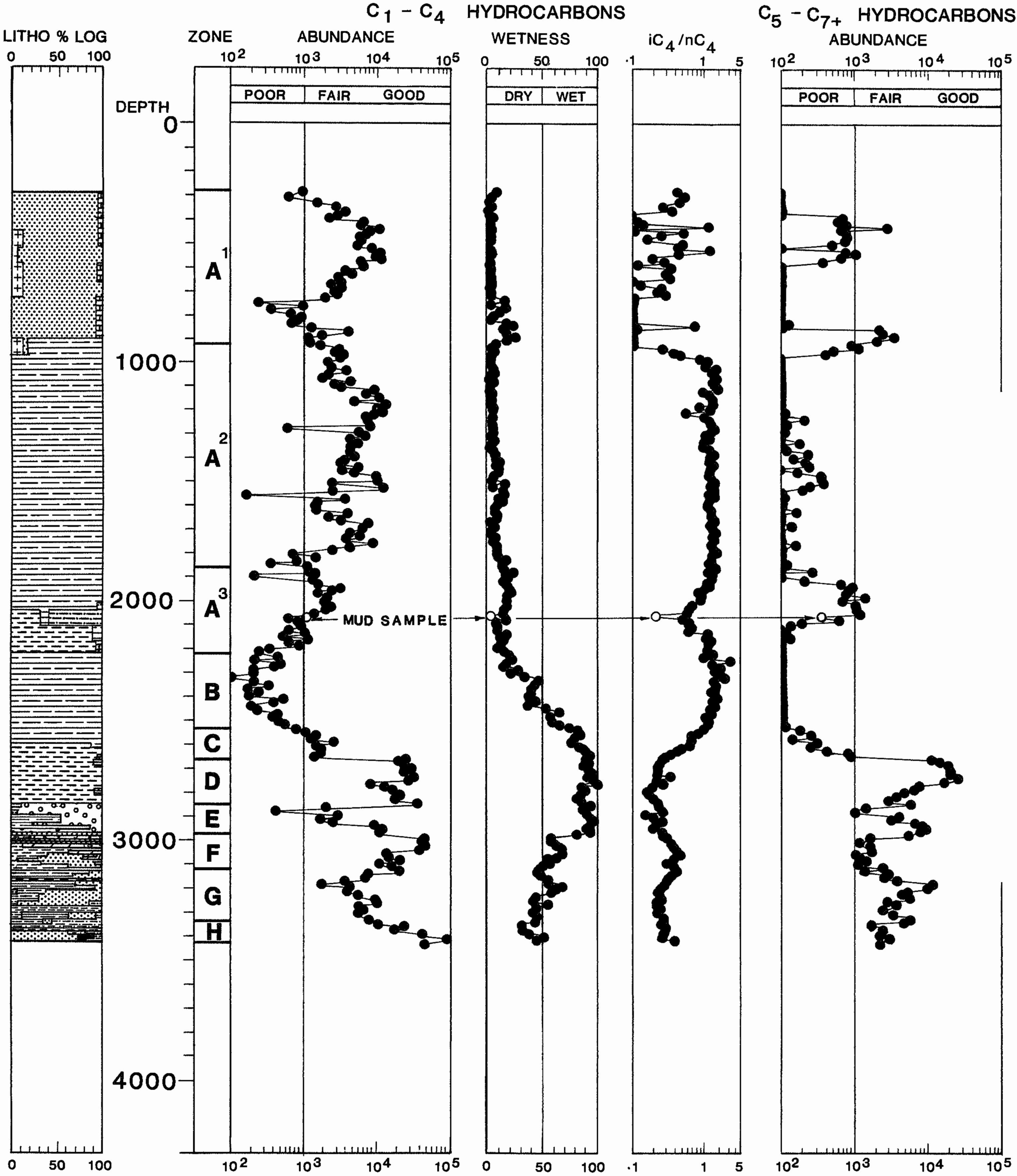
CARBON ISOTOPE RESULTS (^{o}/oo, PDB)

GEOCHEM SAMPLE NUMBER	DEPTH	PARAFFIN-NAPHTHENE	AROMATICS	ASPHALTENES
786-211 CORE	2979.3-.35m	-28.67	-27.89	-26.77
786-212 CORE	2938.08-.18m	-28.67	-27.74	-27.43
786-214 CORE	2987.50-.59m	-28.56	-27.63	-27.42

FIGURE 1

C_1-C_7 HYDROCARBONS

WELL 30/3-3



LIMESTONE

DOLOMITE

SHALE

MUDSTONE/ CLAYSTONE

COAL

SILTSTONE

SANDSTONE

EVAPORITE

IGNEOUS

L.C.M.

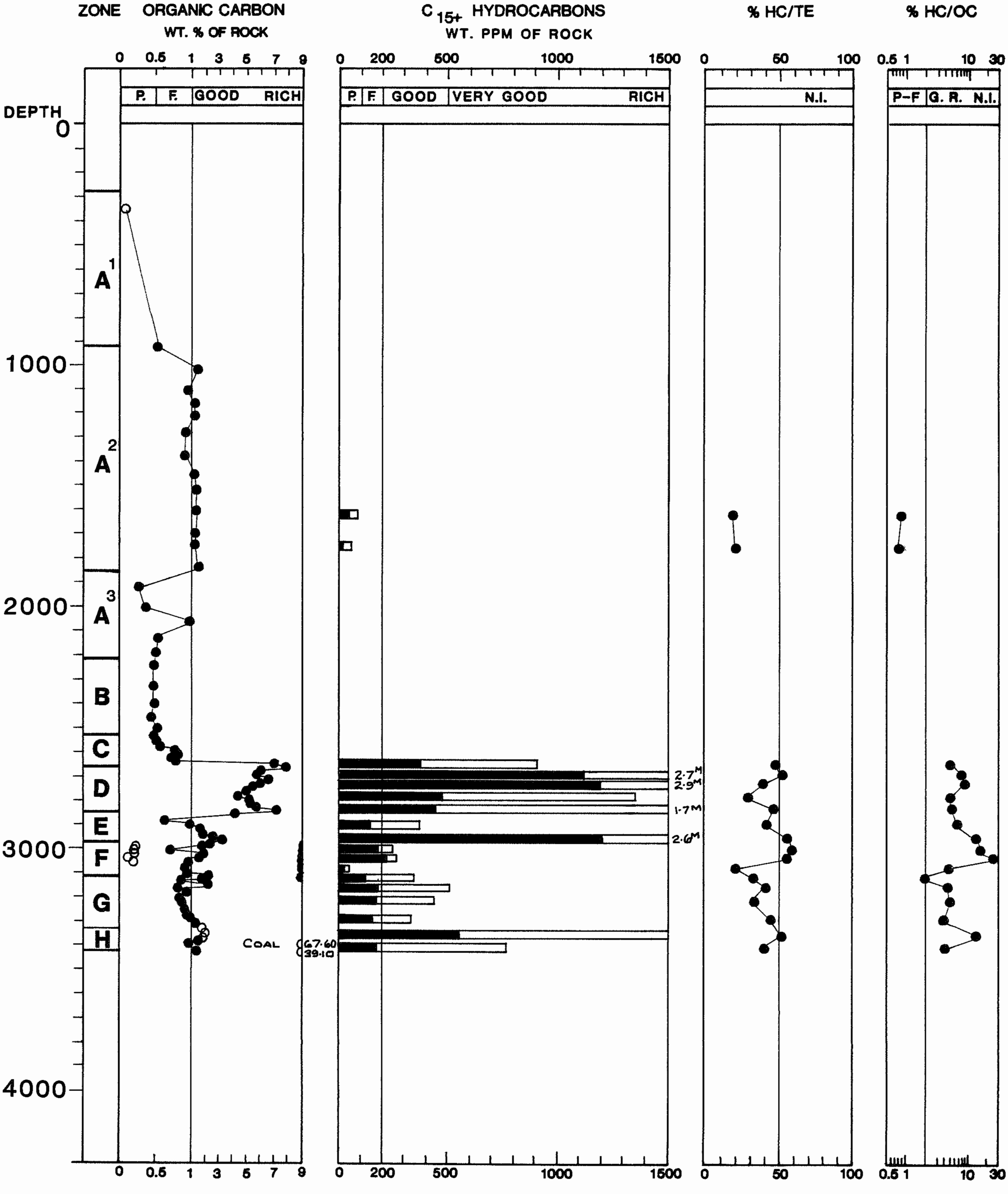
iC_4 - ISOBUTANE

nC_4 - NORMAL BUTANE

ABUNDANCE - VOLUME PPM OF ROCK

WETNESS - % C_2-C_4 IN C_1-C_4

FIGURE 2 **RICHNESS** WELL 30/3-3



● SHALE

O OTHER LITHOLOGIES

P - N - PARAFFIN - NAPHTHENES

AROM - AROMATICS

HC - C_{15+} HYDROCARBONS

OC - ORGANIC CARBON

TE - TOTAL C_{15+} EXTRACT

P - POOR

F - FAIR

G - GOOD

R - RICH

N.I. - NON-INDIGENOUS HYDROCARBONS

FIGURE 3 **ROCKEVAL DATA** WELL 30/3-3

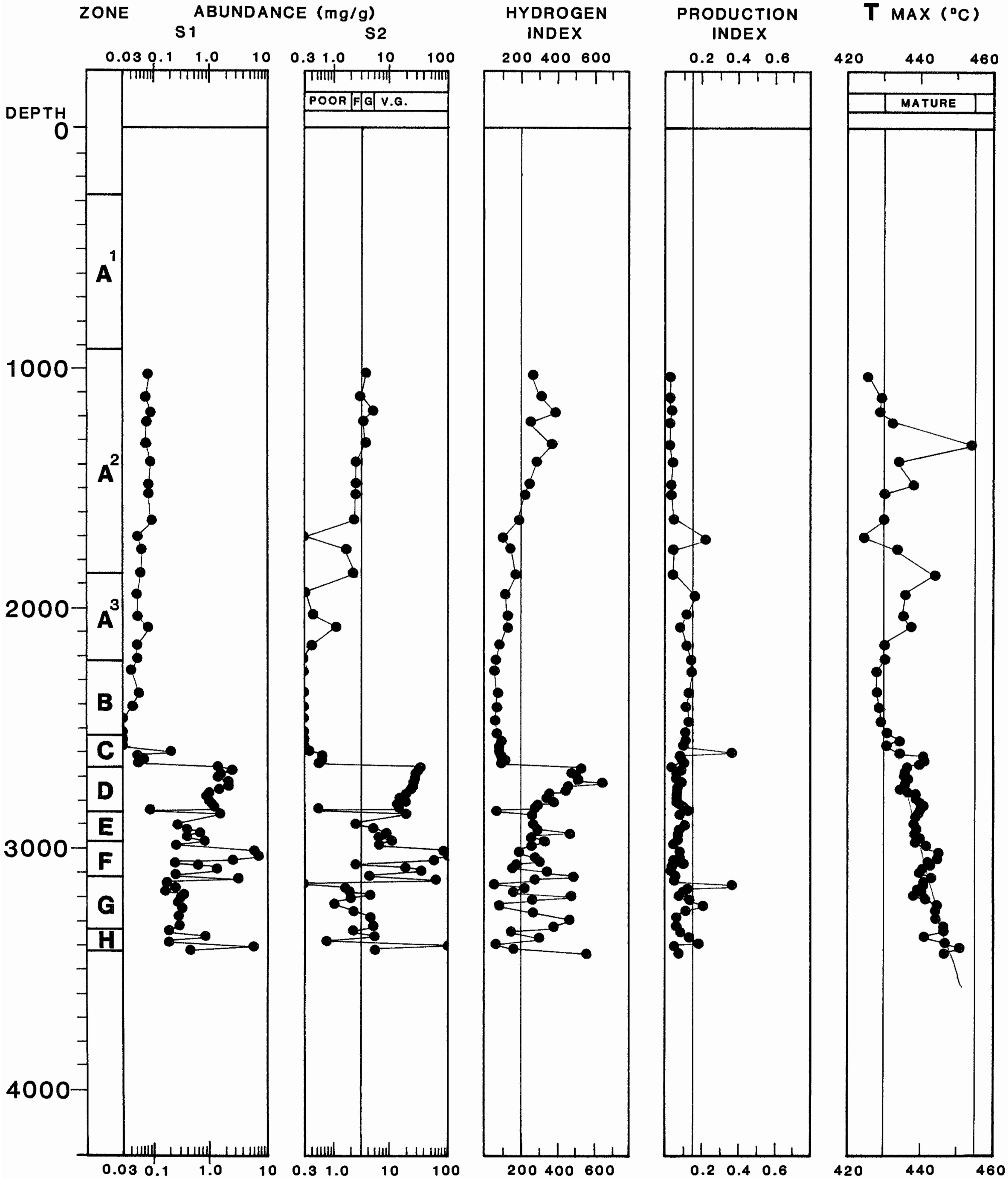


FIGURE 4a **PYROLYSIS GC** WELL 30/3-3

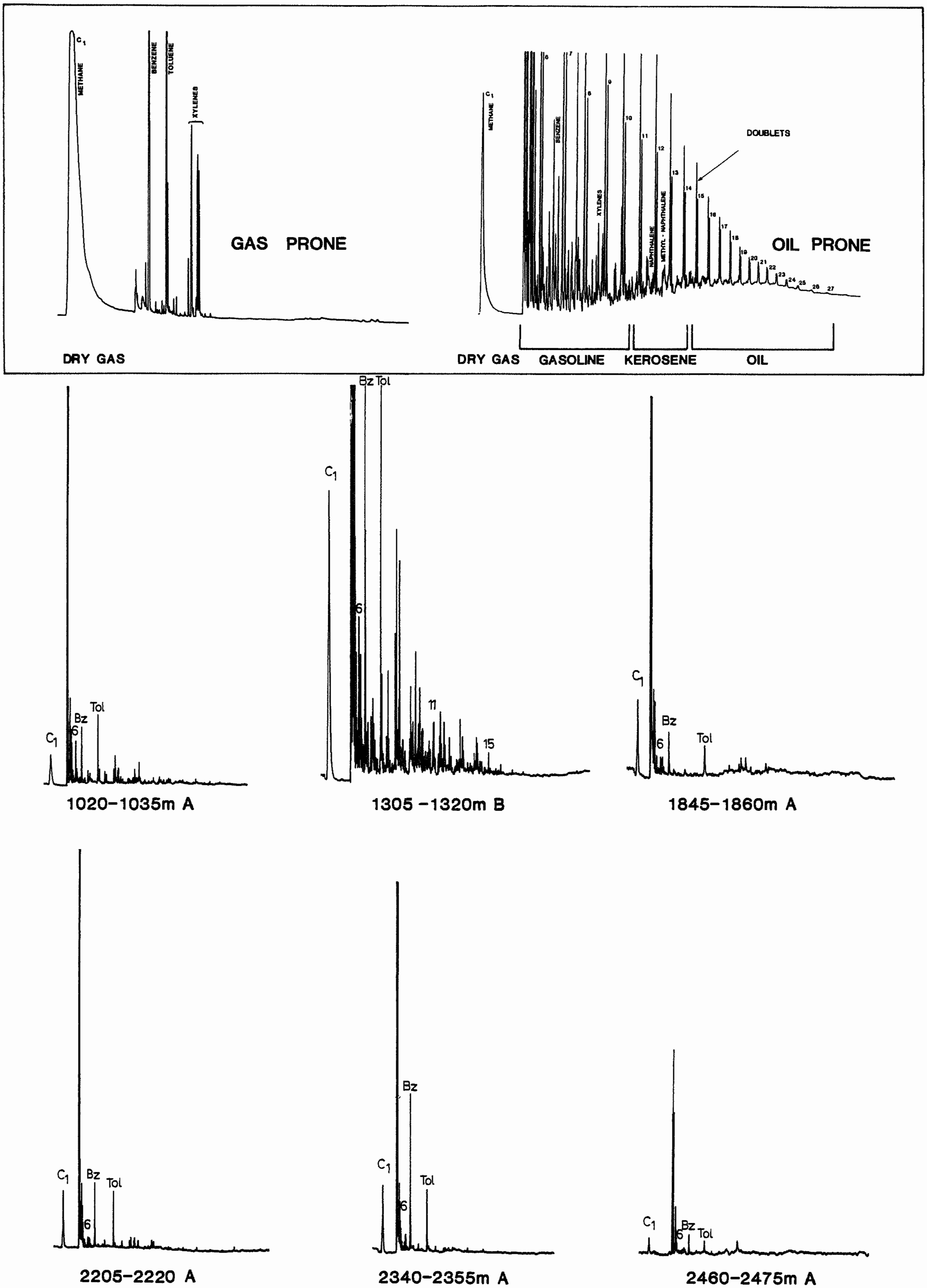


FIGURE 4b **PYROLYSIS GC** WELL 30/3-3

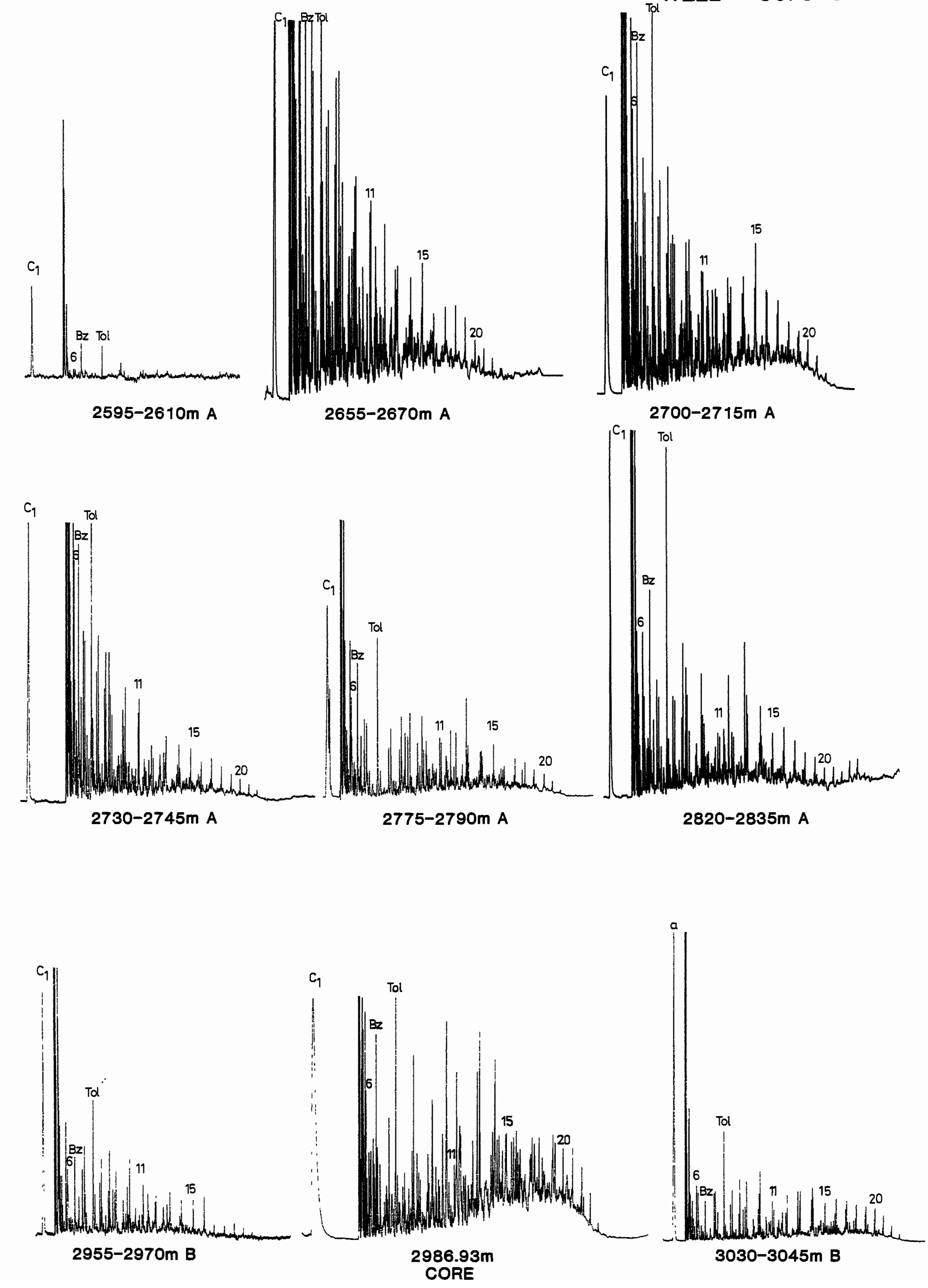


FIGURE 4c PYROLYSIS GC WELL 30/3-3

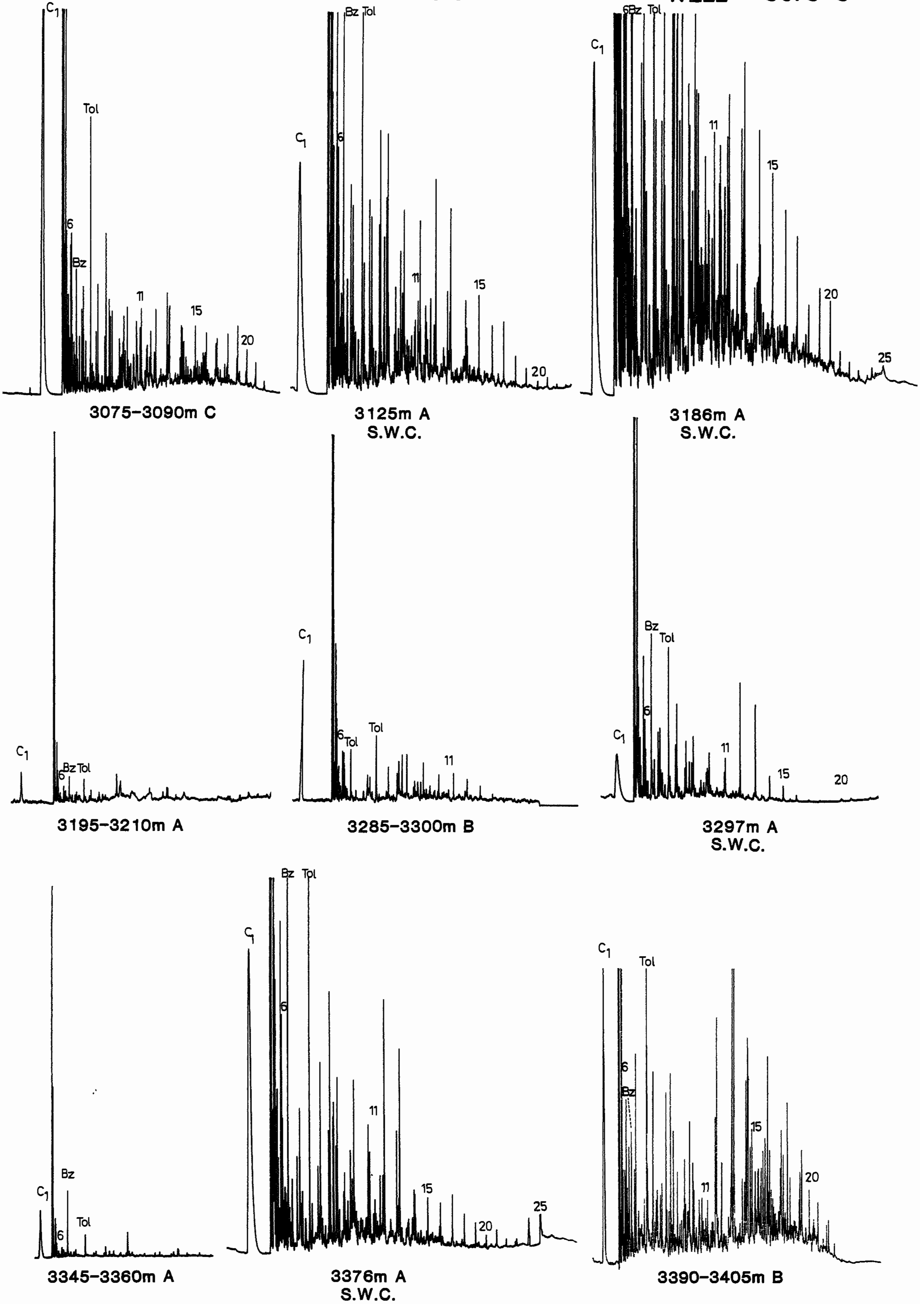
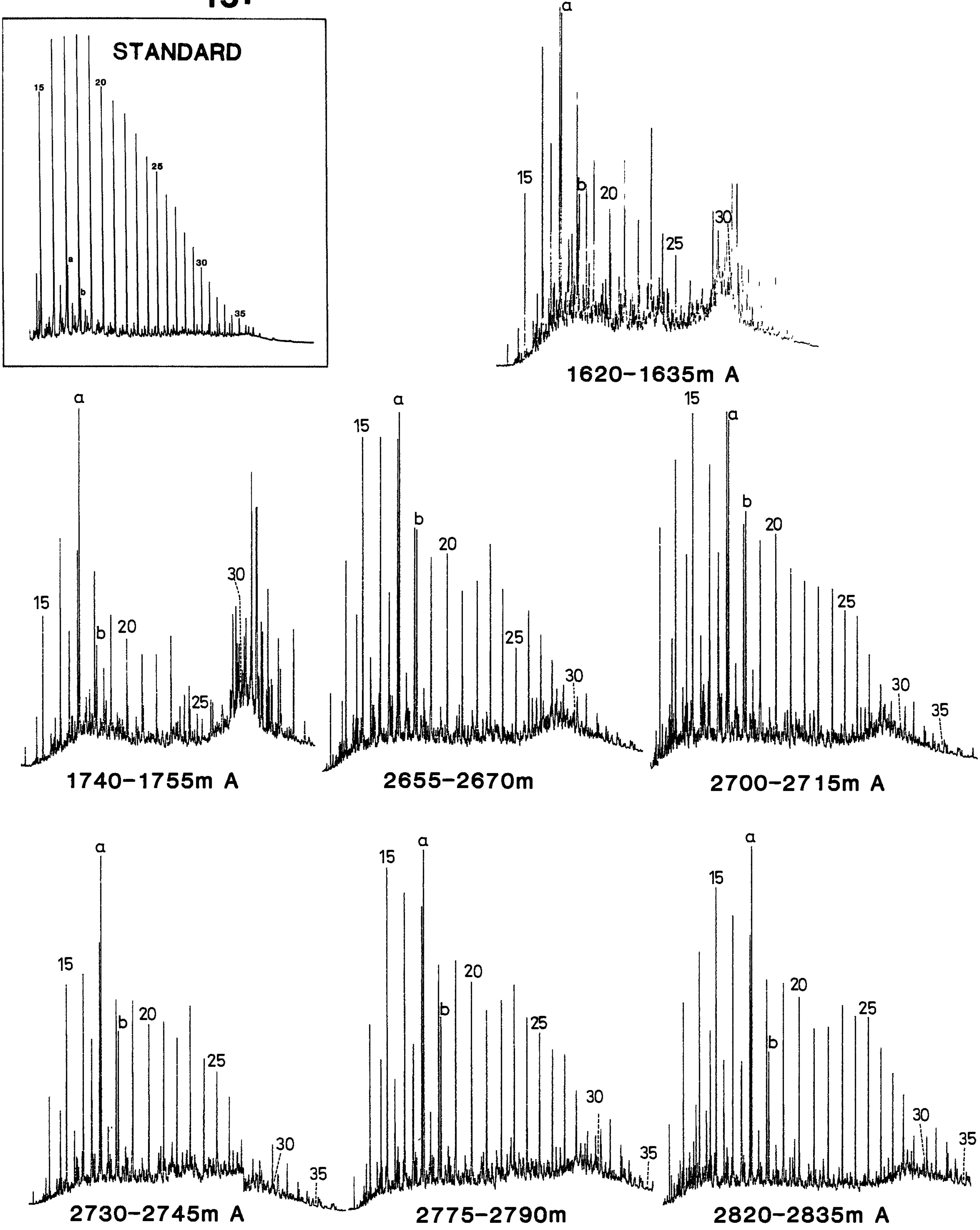


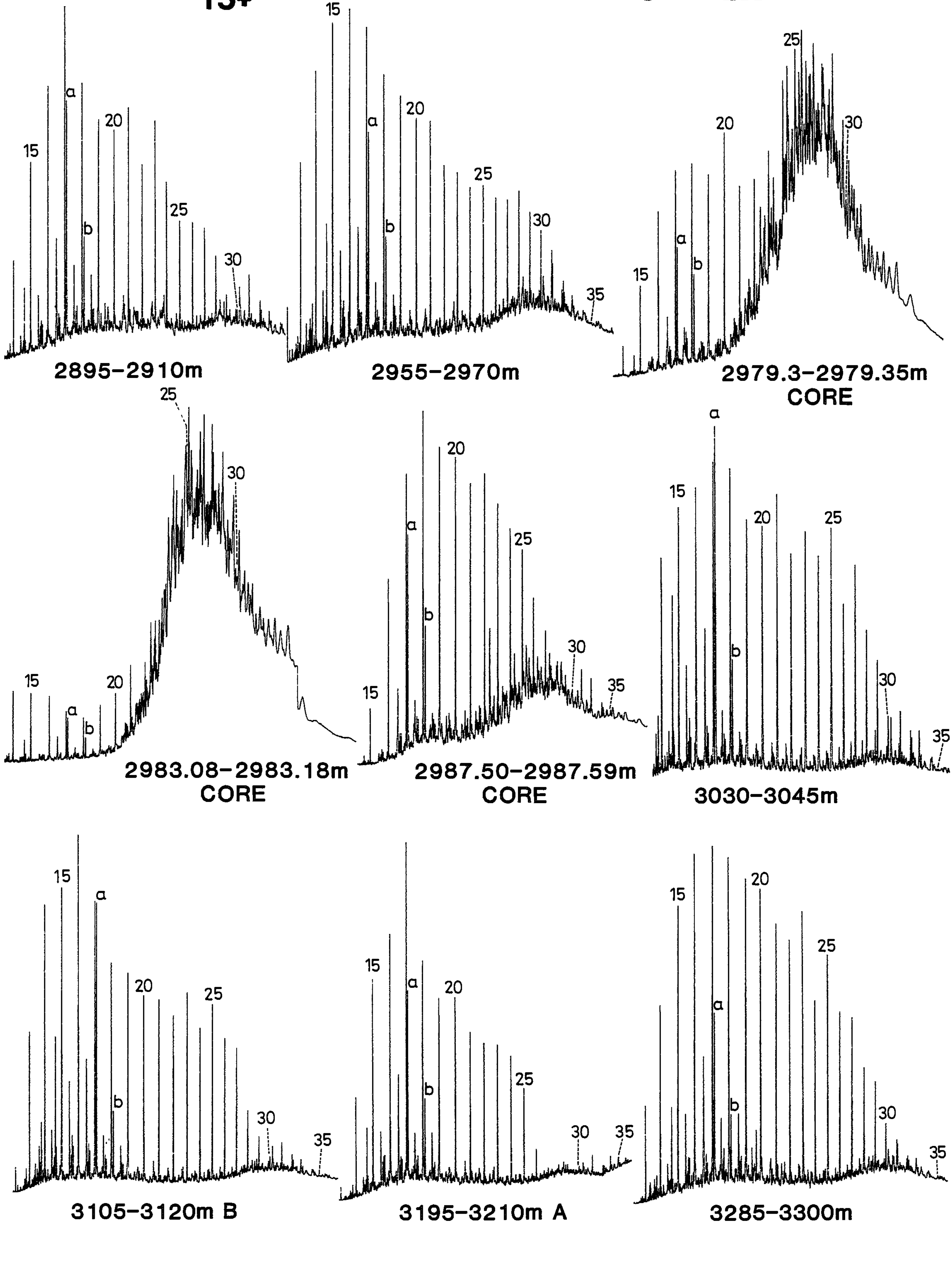
FIGURE 5a C_{15+} PARAFFIN-NAPHTHENES WELL 30/3-3



a - PRISTANE
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC_{20})

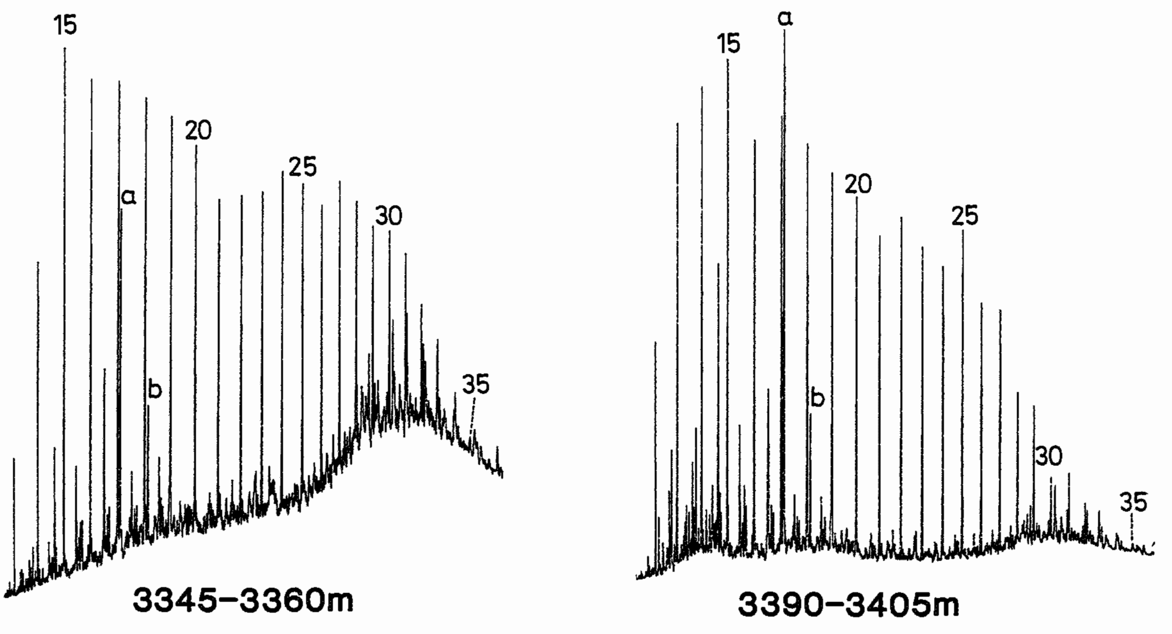
FIGURE 5b C_{15+} PARAFFIN - NAPHTHENES WELL 30/3-3



a - PRISTANE
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC_{20})

FIGURE 5c C_{15+} PARAFFIN - NAPHTHENES WELL 30/3-3



a - PRISTANE
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC_{20})

FIGURE 6a **AROMATIC CHROMATOGRAMS** WELL 30/3-32

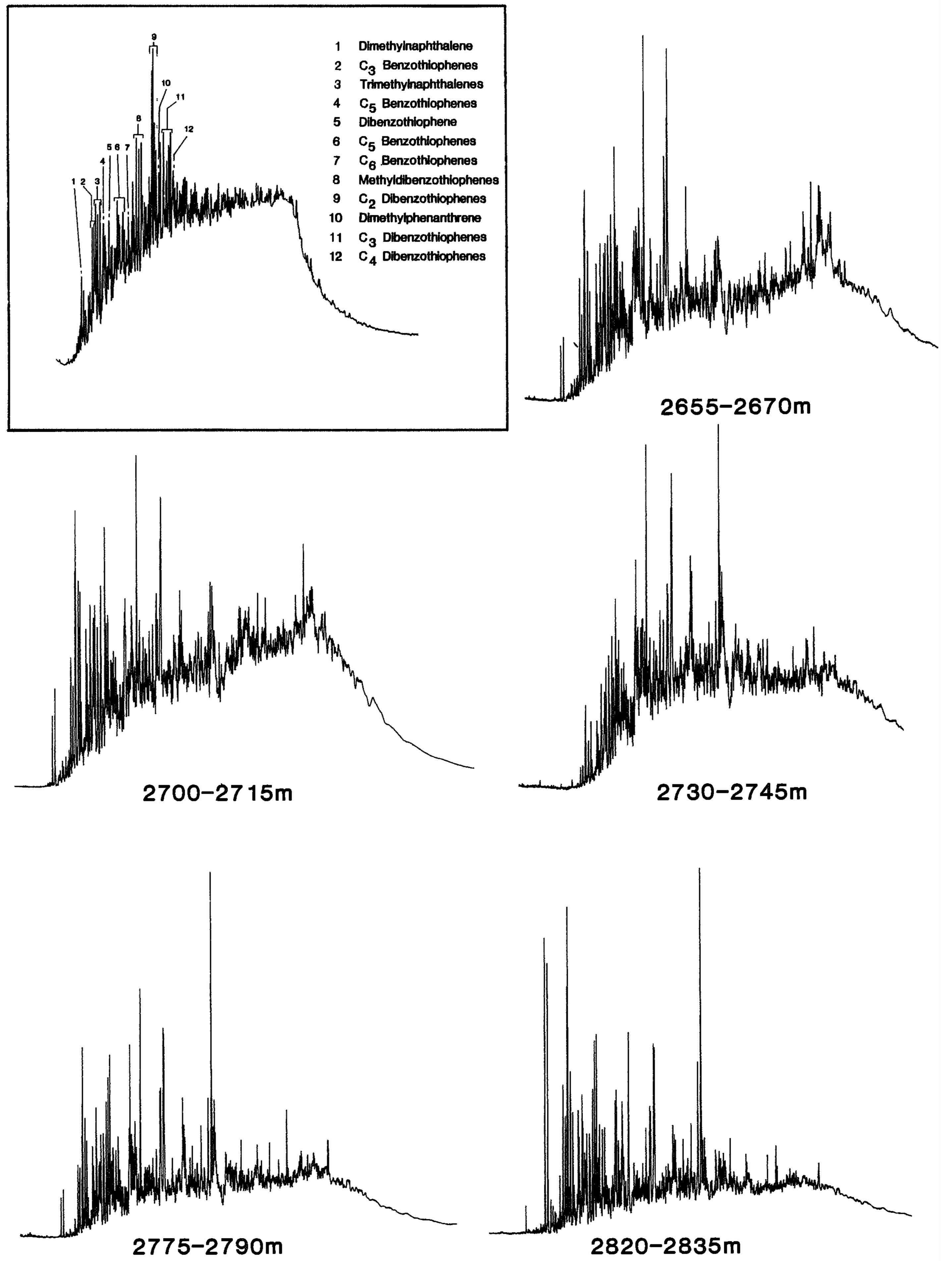


FIGURE 6b **AROMATIC CHROMATOGRAMS** WELL 30/3-3

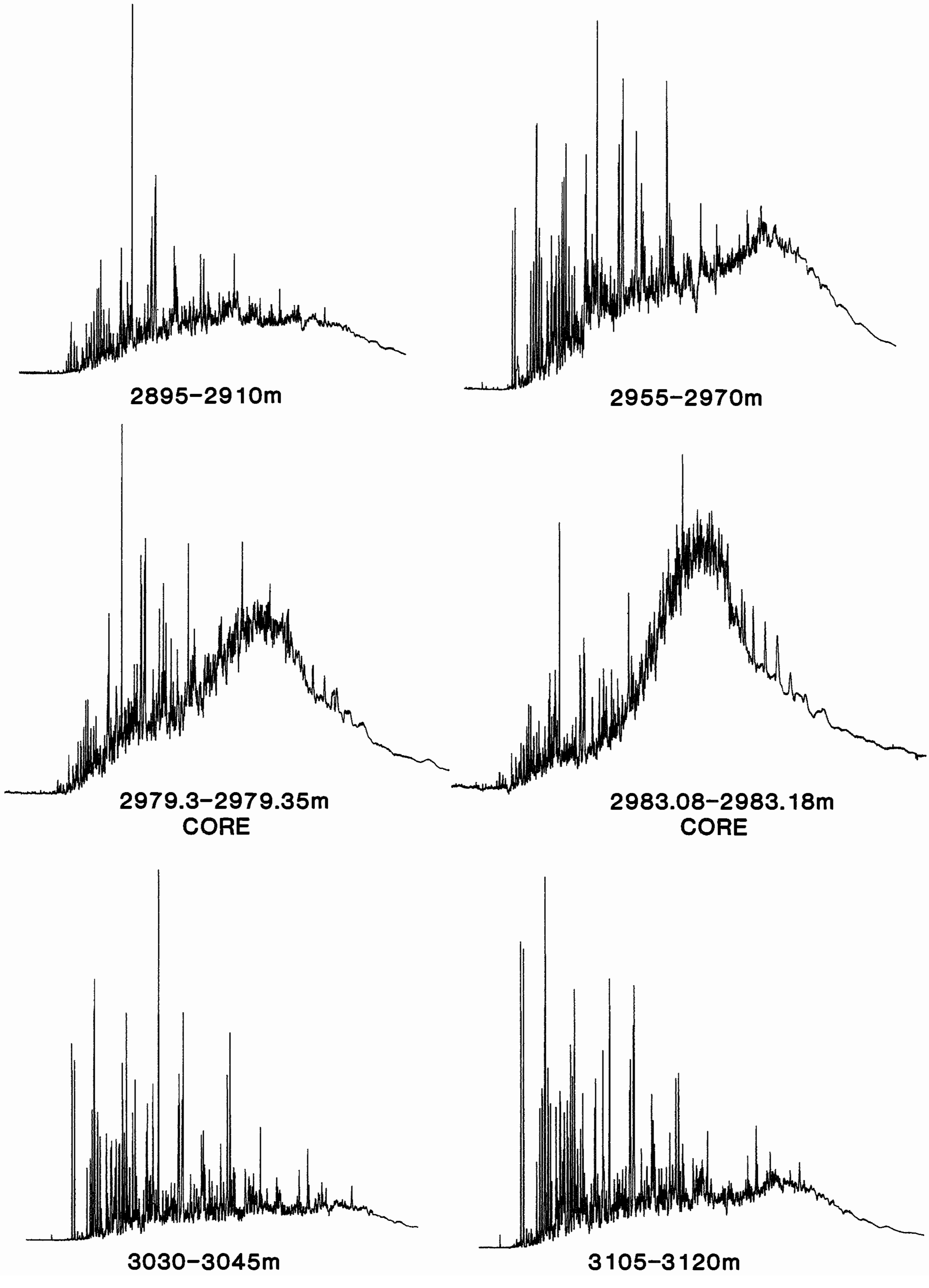
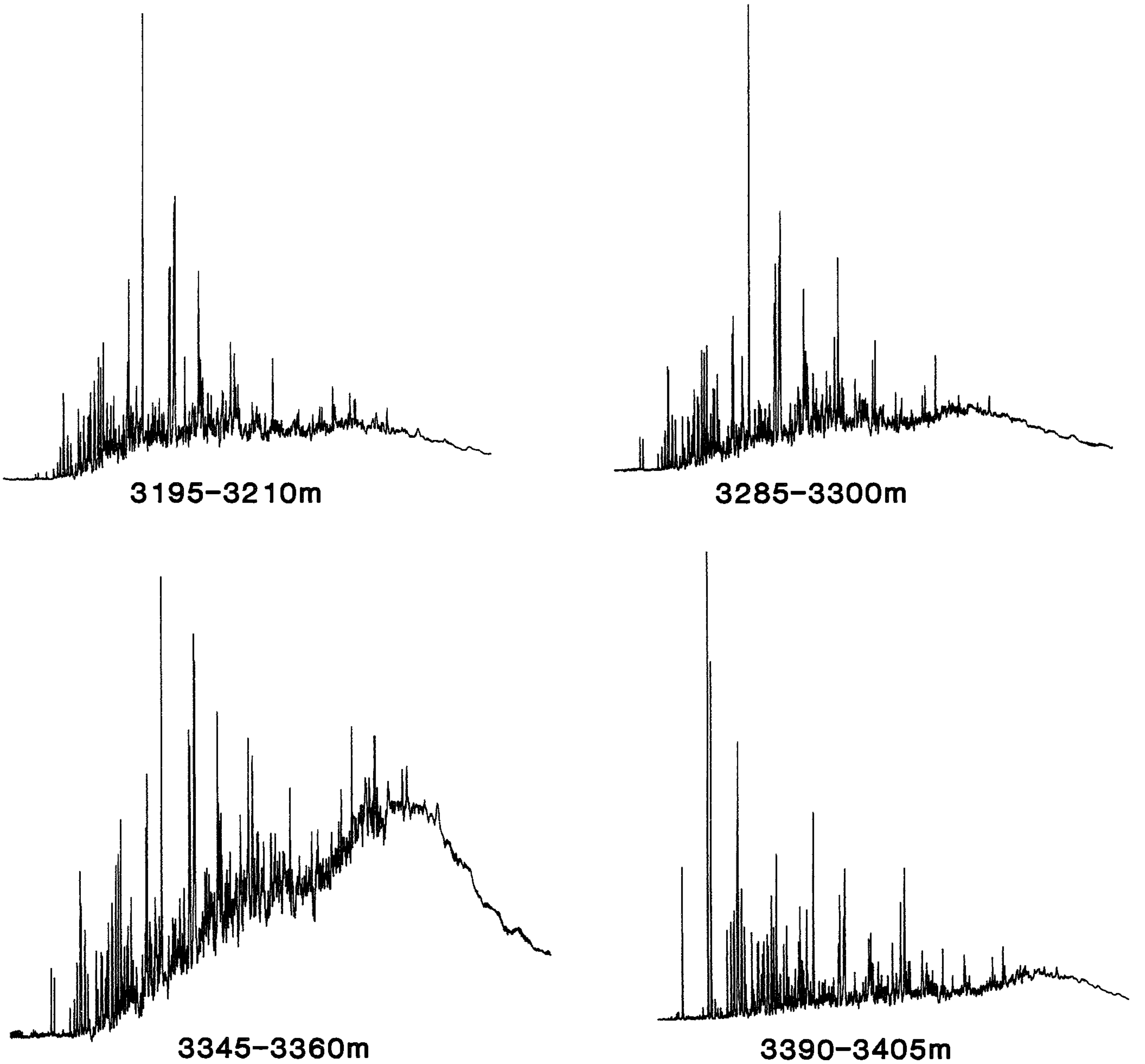
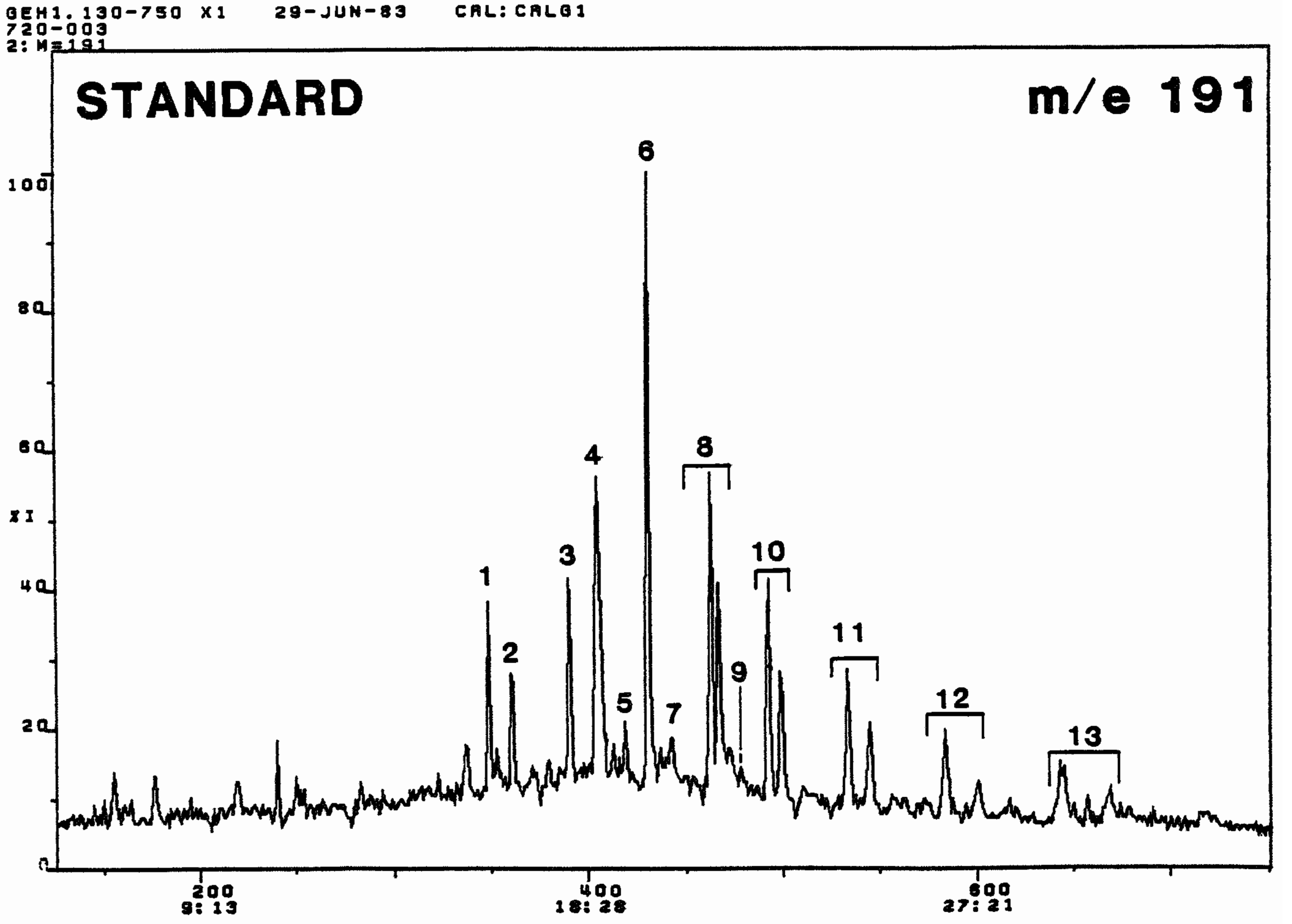


FIGURE 6c **AROMATIC CHROMATOGRAMS** WELL 30/3-3



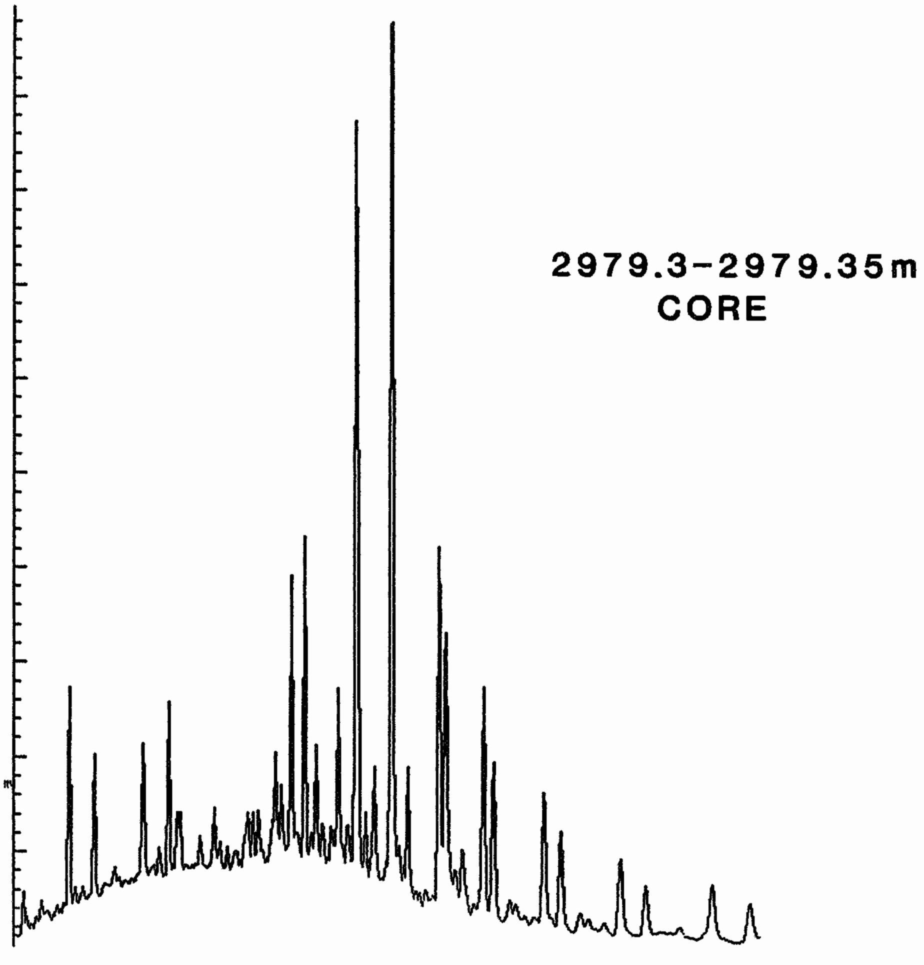


LIST OF IDENTIFIED TRITERPANES

1		17αH TRISNORHOPANE (C_{27})
2		17αH TRISNORHOPANE (C_{27})
3		BISNORHOPANE (C_{28})
4		17αH NORHOPANE (C_{29})
5		NORMORETANE (C_{29})
6		17αH HOPANE (C_{30})
7		17αH MORETANE (C_{30})
8	(22S) (22R)	17αH HOMOHOPANES (C_{31})
9		GAMMACERANE
10	(22S) (22R)	BISHOMOHOPANE (C_{32})
11	(22S) (22R)	TRISHOMOHOPANES (C_{33})
12	(22S) (22R)	TETRAHOPANES (C_{34})
13	(22S) (22R)	HOPANES (C_{35})

FIGURE 7a MASSFRAGMENTOGRAMS WELL 30/3-3

TRITERPANES m/e 191



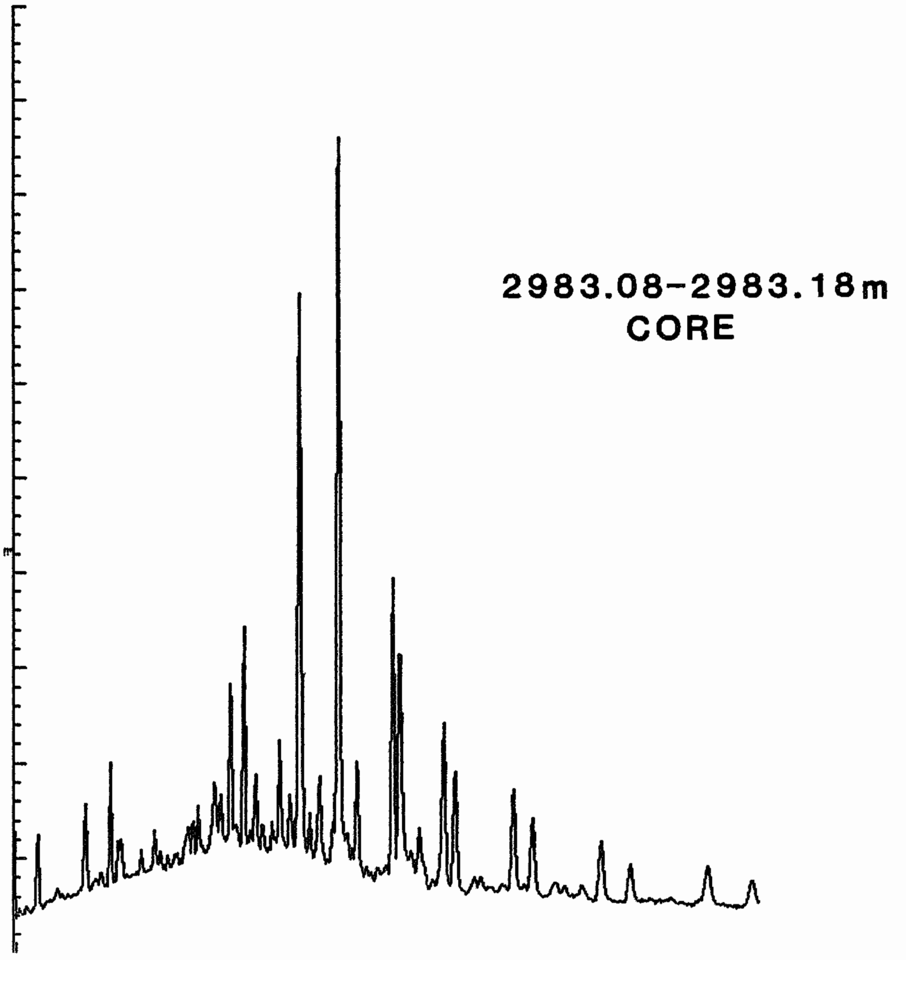
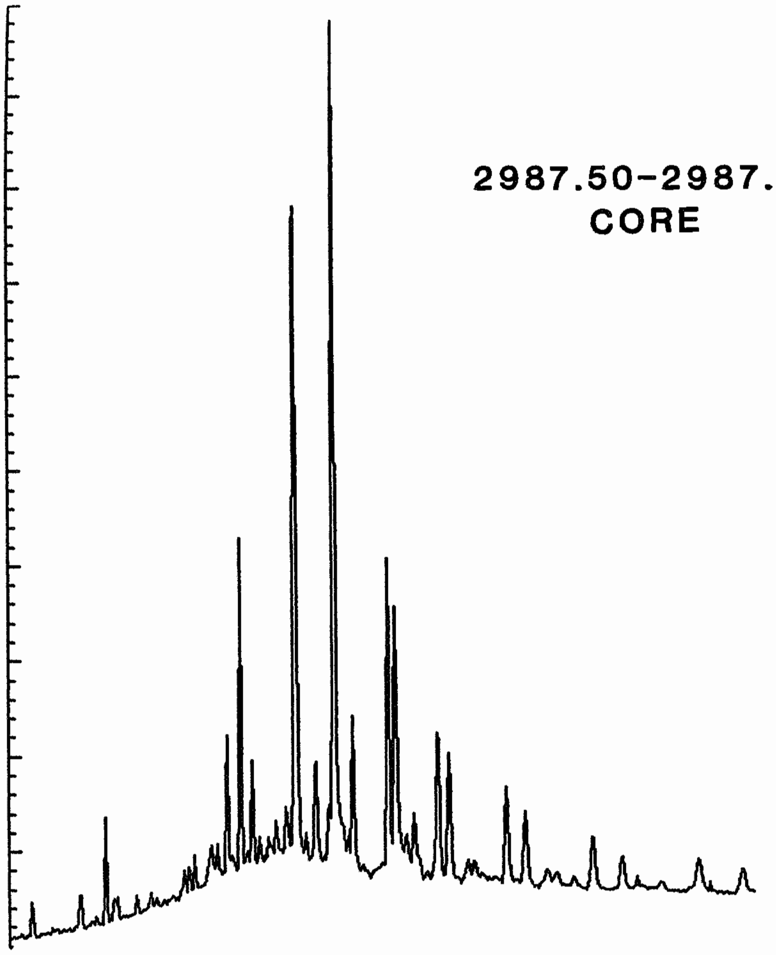
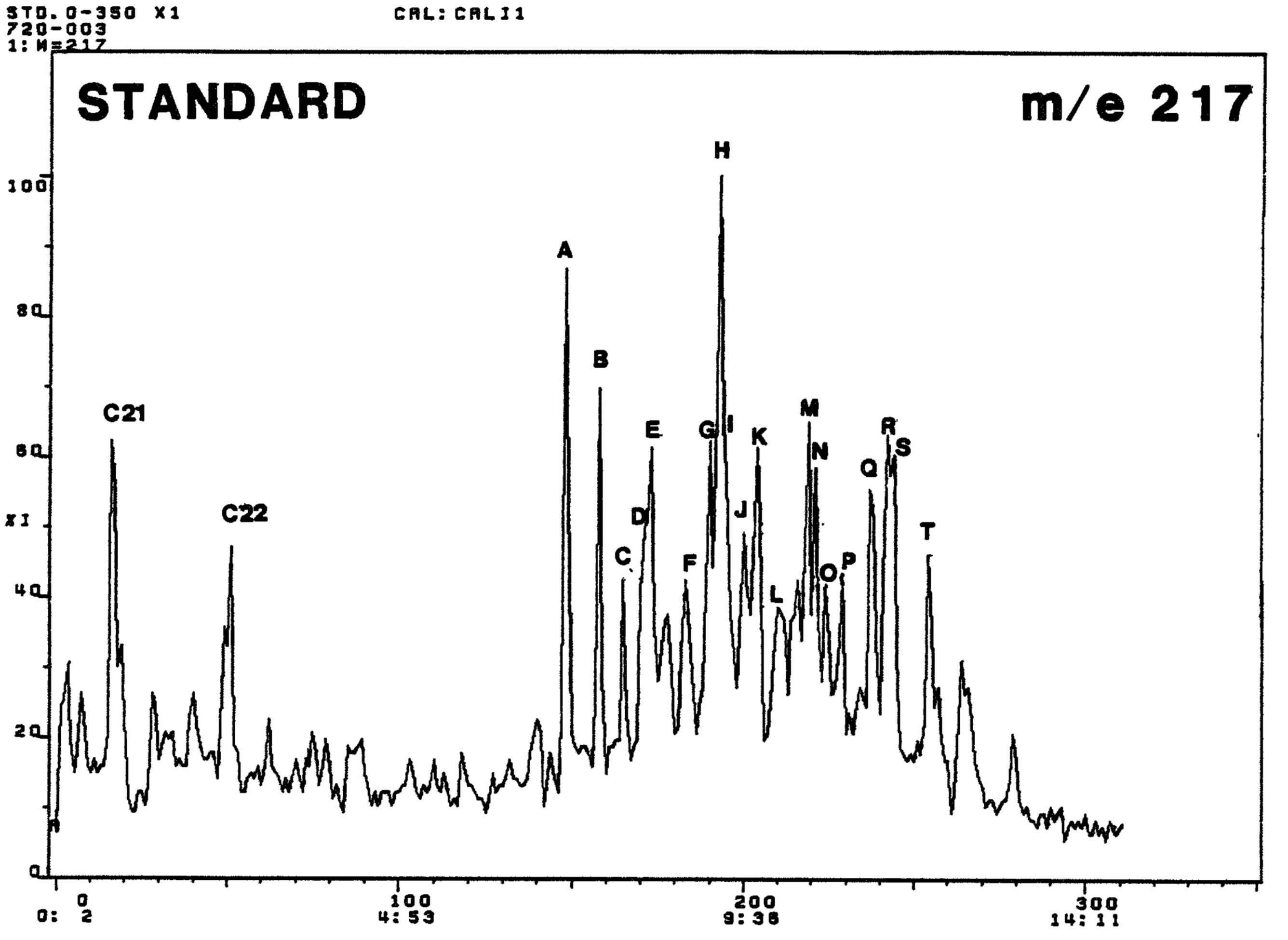


FIGURE 7b MASSFRAGMENTOGRAMS WELL 30/3-3

TRITERPANES m/e 191





LIST OF IDENTIFIED STERANES

A C_{27} DIACHOLESTANE (20S)

B C_{27} DIACHOLESTANE (20R)

C C_{27} DIACHOLESTANE (20S)

D C_{27} DIACHOLESTANE (20R)

E C_{28} METHYL DIACHOLESTANE (20S)

F C_{28} METHYL DIACHOLESTANE (20R)

G C_{28} METHYL DIACHOLESTANE (20S)

H C_{29} ETHYL DIACHOLESTANE (20S)

I C_{27} CHOLESTANE (20S) & C_{28} METHYL DIACHOLESTANE (20R)

J C_{27} CHOLESTANE (20R)

K C_{29} ETHYL DIACHOLESTANE (20R)

L C_{29} ETHYL DIACHOLESTANE (20S)

M C_{28} METHYL CHOLESTANE (20S)

N C_{29} ETHYL DIACHOLESTANE (20R)

O C_{28} METHYL CHOLESTANE (20S)

P C_{28} METHYL CHOLESTANE (20R)

Q C_{29} ETHYL CHOLESTANE (20S) [$\alpha\alpha$]

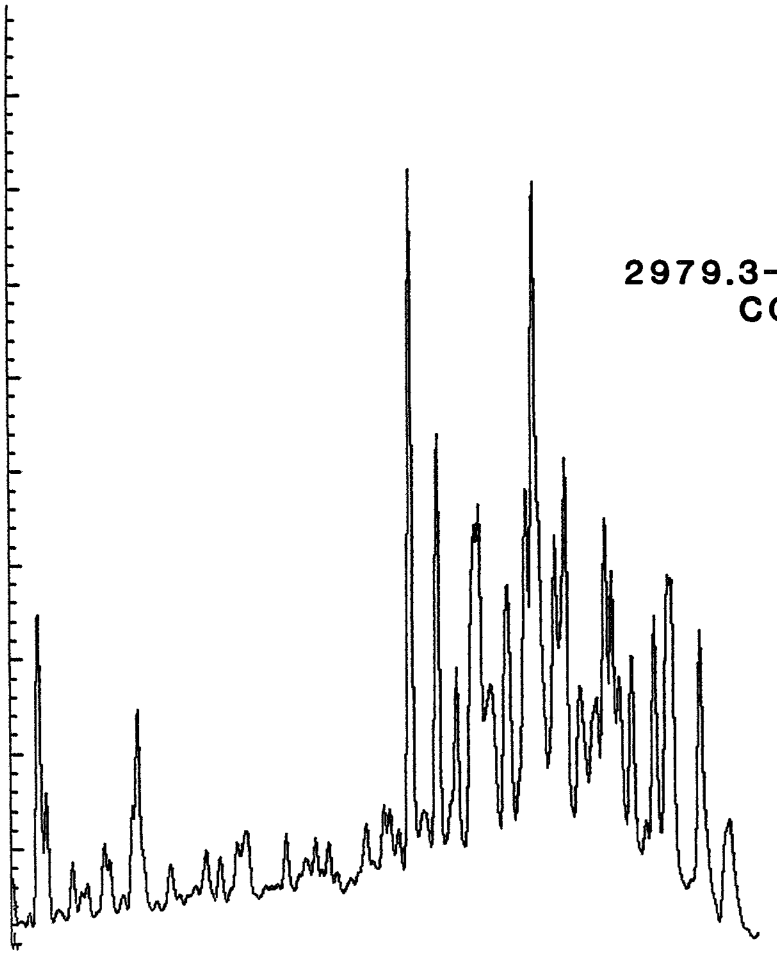
R C_{29} ETHYL CHOLESTANE (20R) [$\beta\beta$]

S C_{29} ETHYL CHOLESTANE (20S) [$\beta\beta$]

T C_{29} ETHYL CHOLESTANE (20R) [$\alpha\alpha$]

FIGURE 7C MASSFRAGMENTOGRAMS WELL 30/3-3

STERANES m/e 217



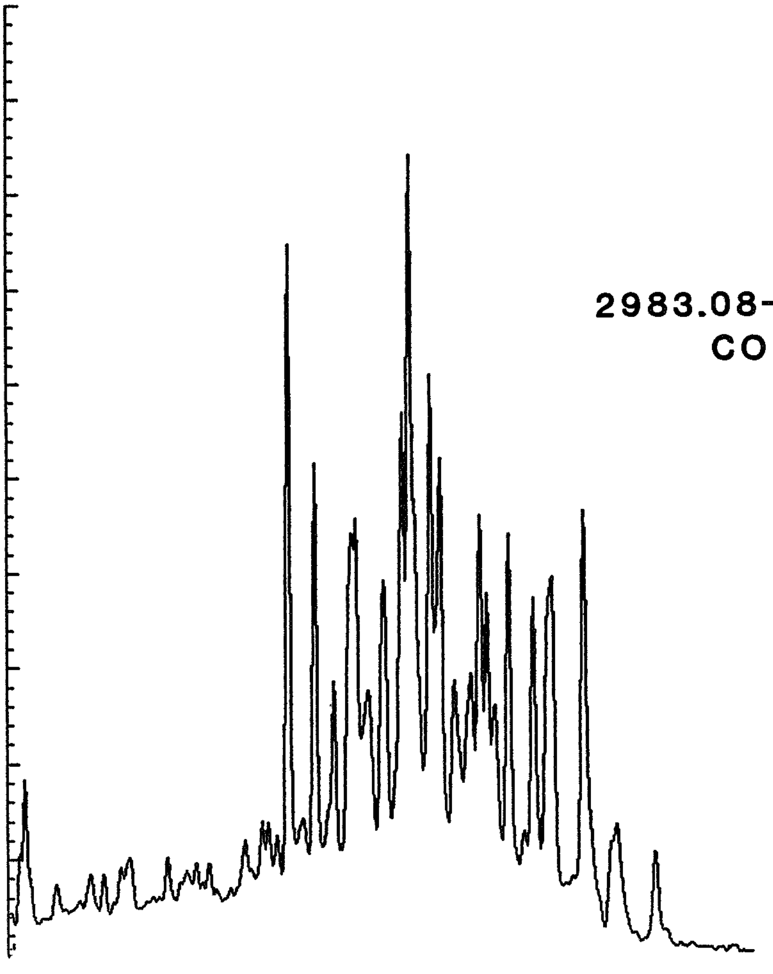


FIGURE 7d MASSFRAGMENTOGRAMS WELL 30/3-3

STERANES m/e 217

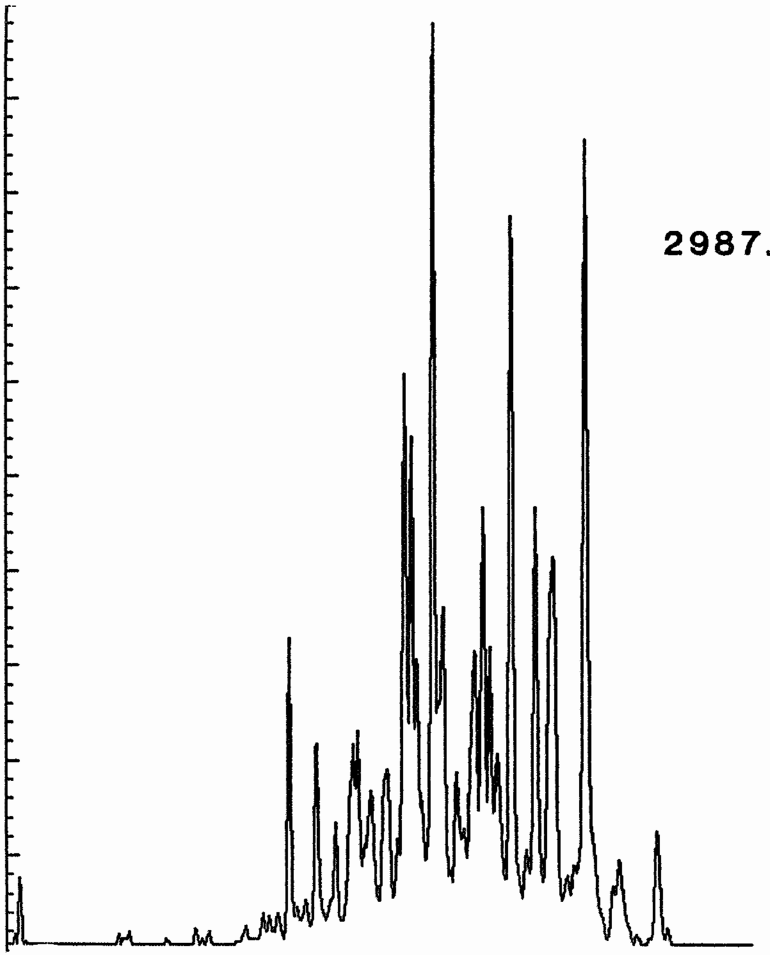


FIGURE 7e MASSFRAGMENTOGRAMS WELL 30/3-3

STERANES m/e 259

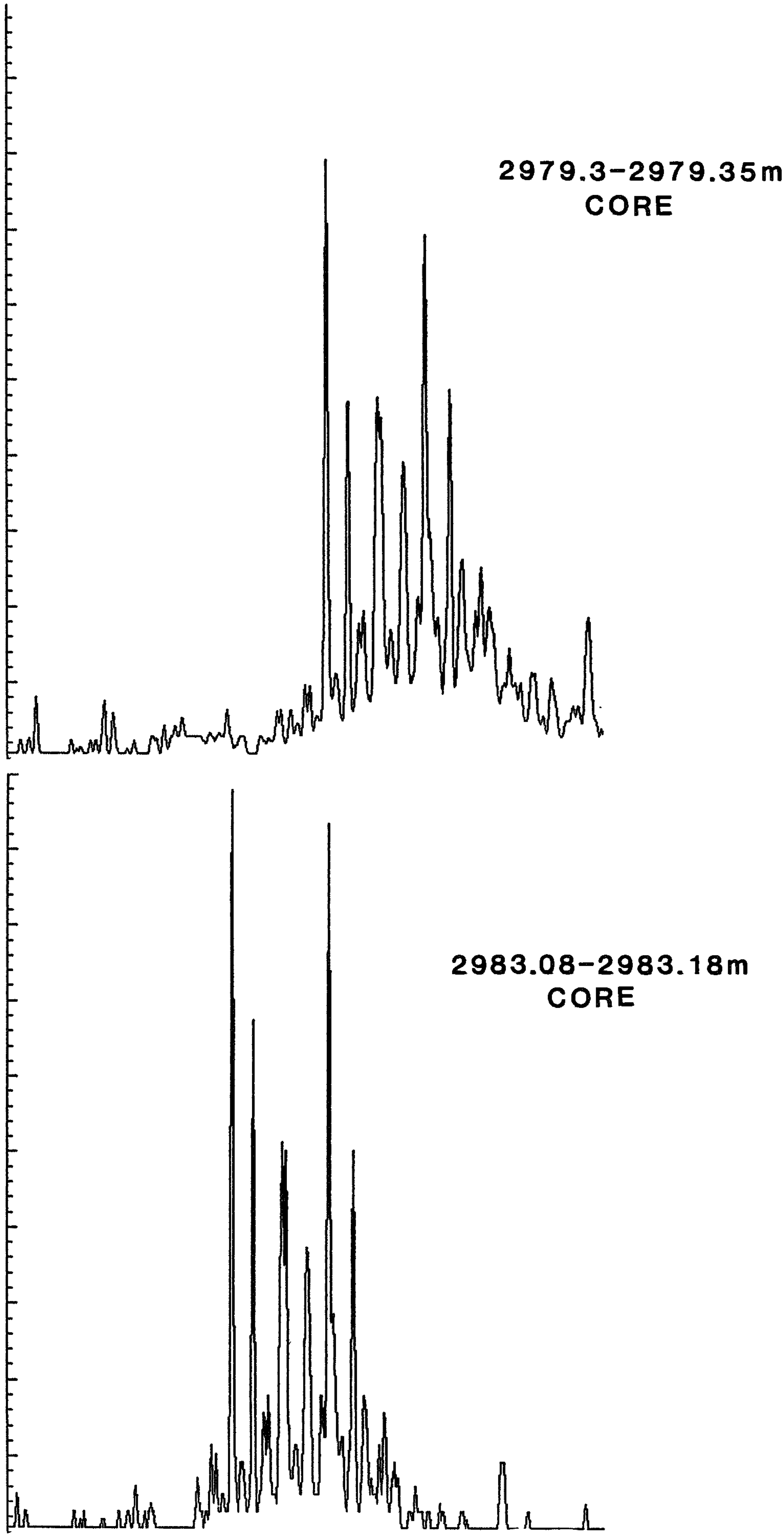


FIGURE 7f **MASSFRAGMENTOGRAMS** WELL 30/3-3

PHENANTHRENES

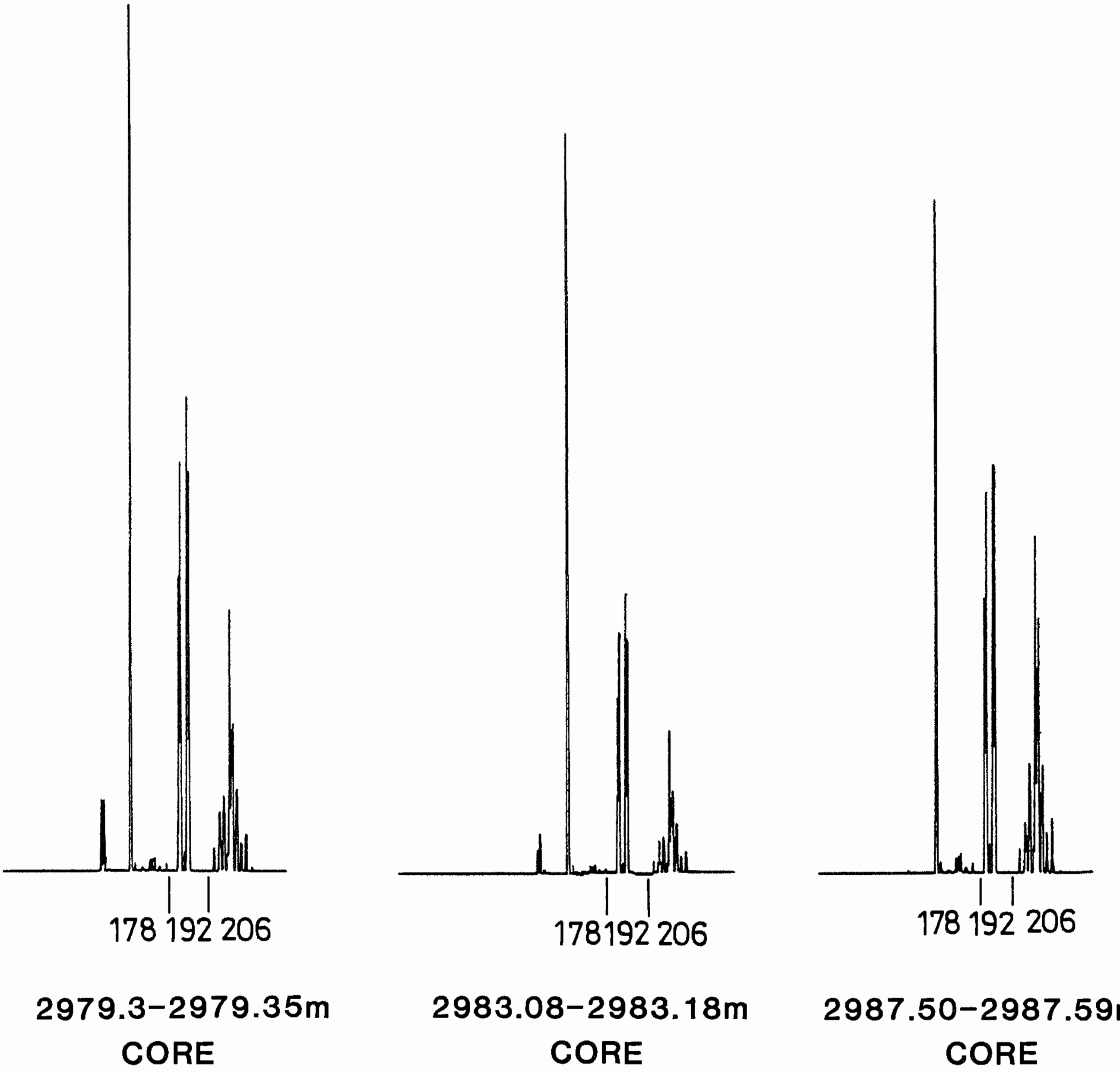
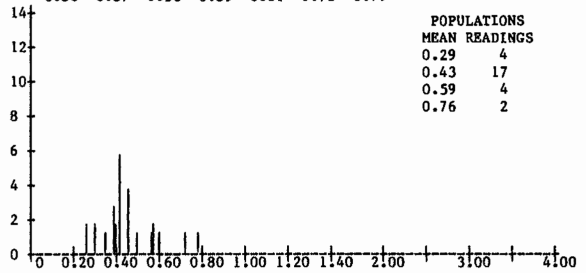


FIGURE 8a VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-050A DEPTH 1020 VITRINITE REFLECTANCE VALUES

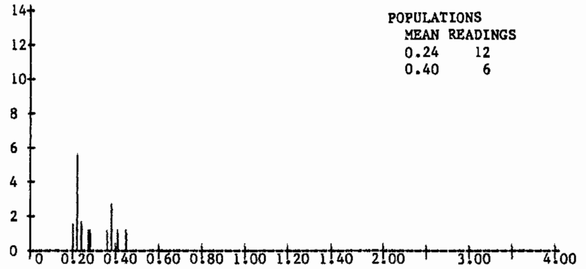
0.26	0.26	0.30	0.31	0.35	0.39	0.39	0.39	0.40	0.40
0.42	0.42	0.42	0.42	0.43	0.43	0.46	0.46	0.47	0.47
0.50	0.57	0.58	0.59	0.61	0.73	0.79			



REMARKS VERY DOMINANTLY AMORPHOUS MATERIAL SMALL VITRINITE PARTICLES OF VERY VARIABLE REFLECTANCE.

SAMPLE 786-069B DEPTH 1305 VITRINITE REFLECTANCE VALUES

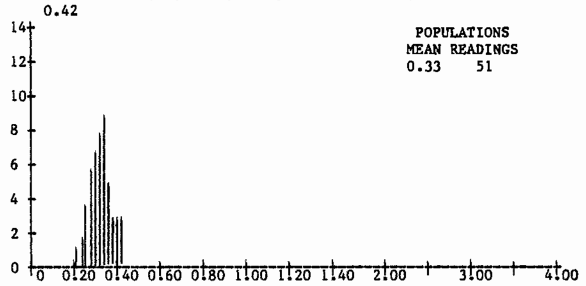
0.20	0.21	0.22	0.22	0.22	0.22	0.23	0.23	0.24	0.24
0.27	0.28	0.36	0.38	0.38	0.38	0.41	0.45		



REMARKS LARGELY UNRECOGNISABLE POOR SAMPLE.

SAMPLE 786-090A DEPTH 1620 VITRINITE REFLECTANCE VALUES

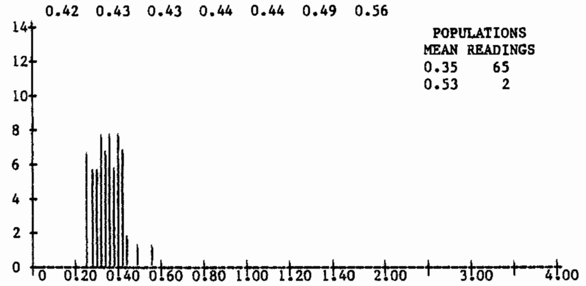
0.21	0.24	0.24	0.25	0.27	0.27	0.27	0.28	0.28	0.28
0.29	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.31
0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.34	0.34
0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.36	0.37	0.37
0.37	0.37	0.38	0.38	0.39	0.40	0.40	0.41	0.42	0.42
0.42									



REMARKS DIFFERENTIATION FREQUENTLY DIFFICULT - MEASURED VITRINITE INCLUDES MATERIAL OF VERY LOW REFLECTANCE

SAMPLE 786-105A DEPTH 1845 VITRINITE REFLECTANCE VALUES

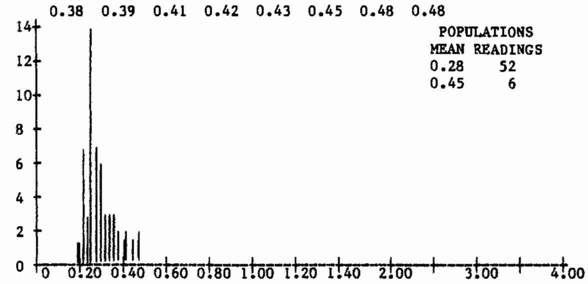
0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28
0.28	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.32
0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.34	0.34	0.35
0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.37
0.37	0.37	0.38	0.38	0.38	0.38	0.38	0.39	0.40	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.42	0.42	0.42	0.42
0.42	0.43	0.43	0.44	0.44	0.49	0.56			



REMARKS DOMINANTLY AMORPHOUS/ALGAL SIGNIFICANT VITRINITE MINOR INERTINITE

SAMPLE 786-063A DEPTH 1215 VITRINITE REFLECTANCE VALUES

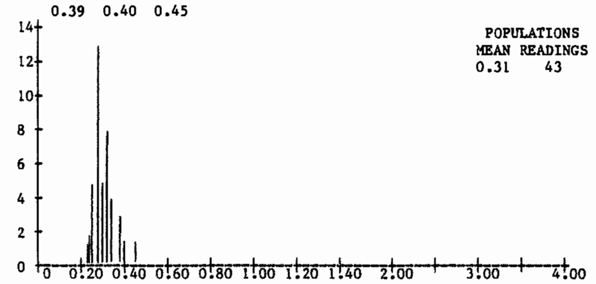
0.19	0.20	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.24
0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.28	0.28
0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.31
0.31	0.32	0.33	0.33	0.34	0.34	0.35	0.36	0.36	0.36
0.38	0.39	0.41	0.42	0.43	0.45	0.48	0.48		



REMARKS IDENTIFICATION DIFFICULT FREQUENTLY UNRECOGNISABLE

SAMPLE 786-080A DEPTH 1470 VITRINITE REFLECTANCE VALUES

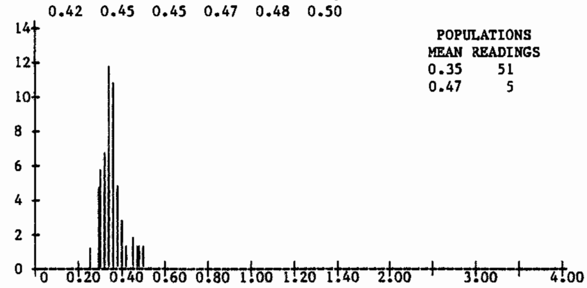
0.23	0.24	0.24	0.25	0.26	0.27	0.27	0.27	0.28	0.28
0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29
0.29	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.33
0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.35	0.38	0.38
0.39	0.40	0.45							



REMARKS MIXED ASSEMBLAGE FREQUENT VITRINITE MINOR INERTINITE.

SAMPLE 786-098A DEPTH 1755 VITRINITE REFLECTANCE VALUES

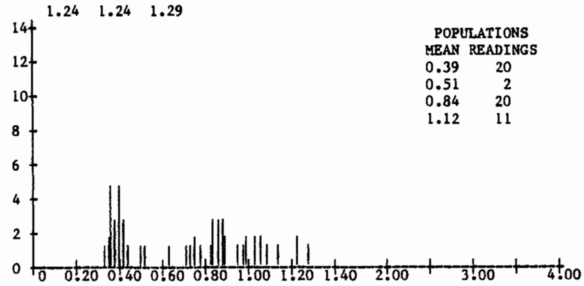
0.25	0.29	0.29	0.29	0.29	0.29	0.30	0.31	0.31	0.31
0.31	0.31	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.34
0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35
0.35	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37
0.37	0.37	0.38	0.38	0.38	0.39	0.39	0.40	0.41	0.41
0.42	0.45	0.45	0.47	0.48	0.50				



REMARKS MIXED ASSEMBLAGE FREQUENT VITRINITE - SOME VARIATION IN R_o APPARENT MINOR INERTINITE.

SAMPLE 786-120B DEPTH 2055 VITRINITE REFLECTANCE VALUES

0.33	0.35	0.35	0.36	0.37	0.37	0.37	0.37	0.38	0.38
0.39	0.40	0.40	0.40	0.41	0.41	0.42	0.43	0.43	0.44
0.50	0.52	0.63	0.71	0.73	0.75	0.76	0.78	0.83	0.84
0.85	0.85	0.87	0.87	0.87	0.89	0.89	0.89	0.90	0.91
0.96	0.99	1.00	1.01	1.04	1.05	1.07	1.07	1.10	1.15
1.24	1.24	1.29							



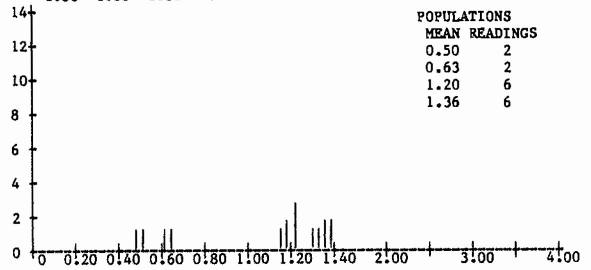
REMARKS FREQUENT REWORKING

FIGURE 8b VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-126A DEPTH 2145 VITRINITE REFLECTANCE VALUES

0.48 0.51 0.61 0.64 1.15 1.18 1.19 1.22 1.22 1.22
1.30 1.33 1.36 1.36 1.39 1.39

POPULATIONS MEAN	READINGS
0.50	2
0.63	2
1.20	6
1.36	6

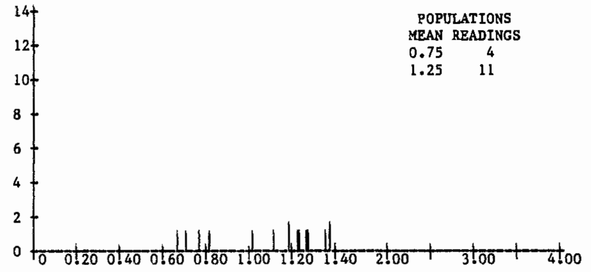


REMARKS SMALL SCATTERED PARTICLES OF REWORKED VITRINITE AND INERTINITE (PLUS BITUMEN STAINING). LITTLE INDIGENOUS VITRINITE SEEN. POOR SAMPLE

SAMPLE 786-133A DEPTH 2250 VITRINITE REFLECTANCE VALUES

0.67 0.71 0.77 0.82 1.02 1.12 1.19 1.19 1.23 1.24
1.27 1.28 1.36 1.38 1.39

POPULATIONS MEAN	READINGS
0.75	4
1.25	11

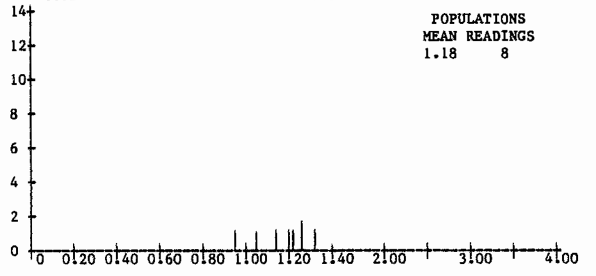


REMARKS SMALL SCATTERED POOR QUALITY PARTICLES OF INERTINITE AND REWORKED VITRINITE. FREQUENTLY UNSUITABLE FOR REFLECTANCE DETERMINATION. POOR SAMPLE.

SAMPLE 786-147A DEPTH 2460 VITRINITE REFLECTANCE VALUES

0.95 1.05 1.14 1.20 1.22 1.26 1.27 1.32

POPULATIONS MEAN	READINGS
1.18	8

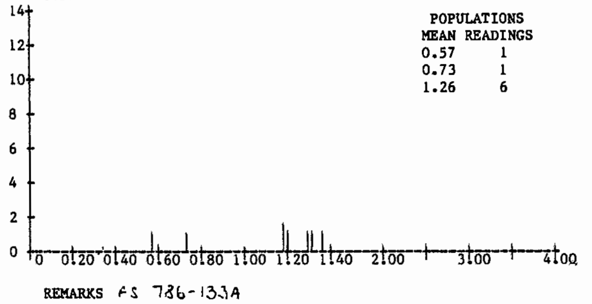


REMARKS AS 786-133A

SAMPLE 786-156A DEPTH 2595 VITRINITE REFLECTANCE VALUES

0.57 0.73 1.18 1.18 1.20 1.29 1.31 1.36

POPULATIONS MEAN	READINGS
0.57	1
0.73	1
1.26	6

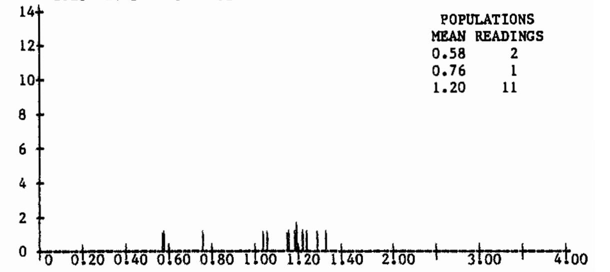


REMARKS AS 786-133A

SAMPLE 786-130A DEPTH 2205 VITRINITE REFLECTANCE VALUES

0.57 0.58 0.76 1.04 1.06 1.15 1.16 1.19 1.20 1.21
1.23 1.25 1.30 1.34

POPULATIONS MEAN	READINGS
0.58	2
0.76	1
1.20	11

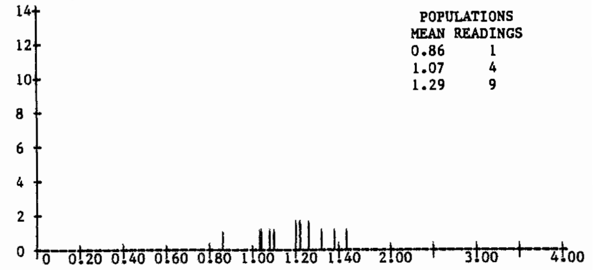


REMARKS AS 786-133A

SAMPLE 786-143A DEPTH 2400 VITRINITE REFLECTANCE VALUES

0.86 1.03 1.04 1.08 1.10 1.20 1.21 1.22 1.23 1.26
1.27 1.32 1.38 1.49

POPULATIONS MEAN	READINGS
0.86	1
1.07	4
1.29	9

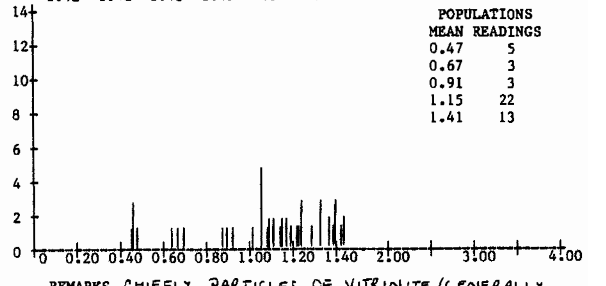


REMARKS AS 786-133A

SAMPLE 786-152A DEPTH 2535 VITRINITE REFLECTANCE VALUES

0.45 0.46 0.46 0.47 0.48 0.64 0.67 0.70 0.88 0.90
0.93 1.02 1.06 1.07 1.07 1.07 1.07 1.09 1.10 1.10
1.12 1.13 1.15 1.16 1.16 1.18 1.18 1.20 1.23 1.24
1.25 1.27 1.27 1.30 1.34 1.35 1.35 1.38 1.39 1.40
1.42 1.42 1.43 1.49 1.52 1.53

POPULATIONS MEAN	READINGS
0.47	5
0.67	3
0.91	3
1.15	22
1.41	13

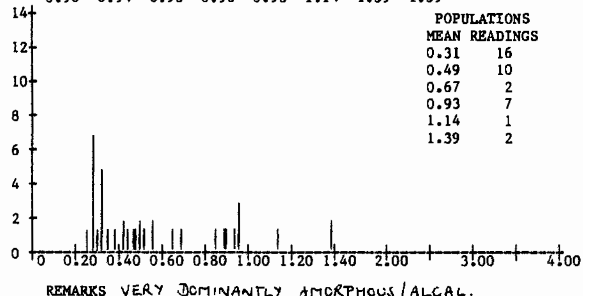


REMARKS CHIEFLY PARTICLES OF VITRINITE (GENERALLY REWORKED) PLUS INERTINITE POOR SAMPLE

SAMPLE 786-160A DEPTH 2655 VITRINITE REFLECTANCE VALUES

0.25 0.28 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.32
0.32 0.32 0.33 0.33 0.35 0.38 0.42 0.43 0.44 0.47
0.48 0.50 0.51 0.52 0.56 0.57 0.65 0.69 0.85 0.89
0.90 0.94 0.96 0.96 0.96 1.14 1.39 1.39

POPULATIONS MEAN	READINGS
0.31	16
0.49	10
0.67	2
0.93	7
1.14	1
1.39	2

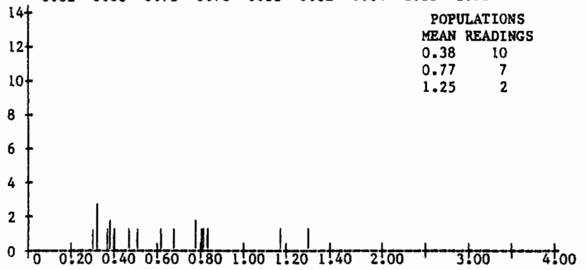


REMARKS VERY DOMINANTLY AMORPHOUS/ALGAL. MINOR INERTINITE AND VITRINITE AS SMALL, UNRELIABLE PARTICLES, LARGELY REWORKED POOR SAMPLE

FIGURE 8c # VITRINITE REFLECTANCE **WELL 30/3-3**

SAMPLE 786-163A DEPTH 2700 VITRINITE REFLECTANCE VALUES

0.30 0.32 0.33 0.33 0.37 0.38 0.39 0.40 0.47 0.51
0.62 0.68 0.78 0.78 0.81 0.82 0.84 1.18 1.31

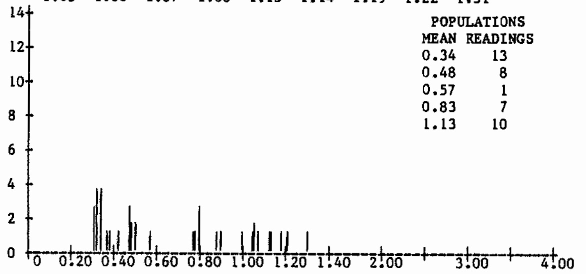


POPULATIONS MEAN	READINGS
0.38	10
0.77	7
1.25	2

REMARKS VERY DOMINANTLY AMORPHOUS/ALGAL. MINOR INERTINITE HANDFUL OF TINY, UNRELIABLE VITRINITE PARTICLES OF VARIABLE REFLECTANCE. POOR SAMPLE

SAMPLE 786-168A DEPTH 2775 VITRINITE REFLECTANCE VALUES

0.31 0.31 0.31 0.32 0.32 0.33 0.33 0.34 0.35 0.35
0.35 0.37 0.38 0.42 0.47 0.47 0.47 0.48 0.48 0.50
0.50 0.57 0.77 0.78 0.80 0.81 0.81 0.88 0.90 1.00
1.05 1.06 1.07 1.08 1.13 1.14 1.19 1.22 1.31

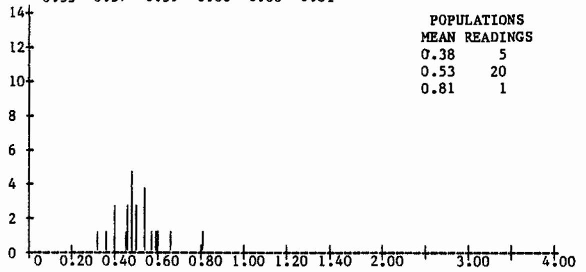


POPULATIONS MEAN	READINGS
0.34	13
0.48	8
0.57	1
0.83	7
1.13	10

REMARKS MIXED ASSEMBLAGE. VITRINITE AS SMALL PARTICLES BOTH REWORKED AND OF ANOMALOUSLY LOW R_o - POSSIBLY CAVED AND/OR ADDITIVE.

SAMPLE 786-176B DEPTH 2895 VITRINITE REFLECTANCE VALUES

0.32 0.36 0.40 0.41 0.41 0.45 0.46 0.47 0.47 0.48
0.48 0.49 0.49 0.49 0.50 0.51 0.51 0.54 0.55 0.55
0.55 0.57 0.59 0.60 0.66 0.81

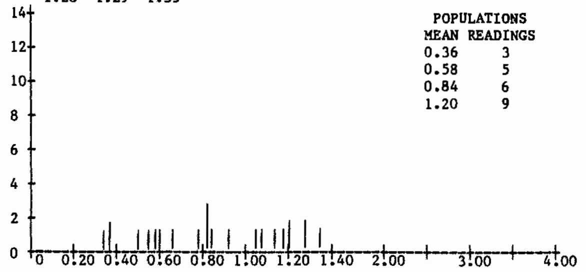


POPULATIONS MEAN	READINGS
0.38	5
0.53	20
0.81	1

REMARKS SMALL SCATTERED VITRINITE PARTICLES - SOME VARIATION IN REFLECTANCE APPARENT

SAMPLE 786-181B DEPTH 2970 VITRINITE REFLECTANCE VALUES

0.34 0.37 0.37 0.50 0.55 0.58 0.60 0.66 0.78 0.82
0.83 0.83 0.84 0.92 1.05 1.08 1.14 1.18 1.21 1.21
1.28 1.29 1.35

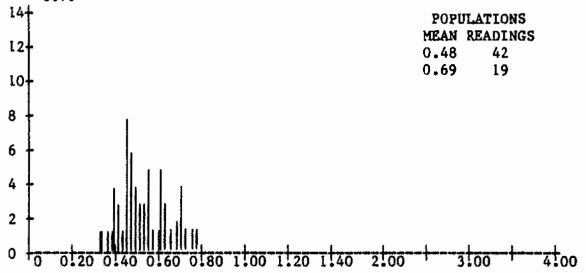


POPULATIONS MEAN	READINGS
0.36	3
0.58	5
0.84	6
1.20	9

REMARKS MIXED ASSEMBLAGE. SIGNIFICANT VITRINITE AND INERTINITE SIGNIFICANT VARIATION IN REFLECTANCE APPARENT - WIDESPREAD REWORKING

SAMPLE 786-165A DEPTH 2730 VITRINITE REFLECTANCE VALUES

0.33 0.34 0.37 0.39 0.40 0.41 0.41 0.41 0.42 0.43
0.43 0.44 0.46 0.46 0.46 0.46 0.46 0.47 0.47 0.47
0.48 0.48 0.48 0.48 0.49 0.49 0.50 0.50 0.51 0.51
0.52 0.53 0.53 0.54 0.54 0.54 0.56 0.57 0.57 0.57
0.57 0.58 0.61 0.62 0.63 0.63 0.63 0.63 0.64 0.64
0.65 0.67 0.70 0.70 0.72 0.73 0.73 0.73 0.74 0.77
0.79

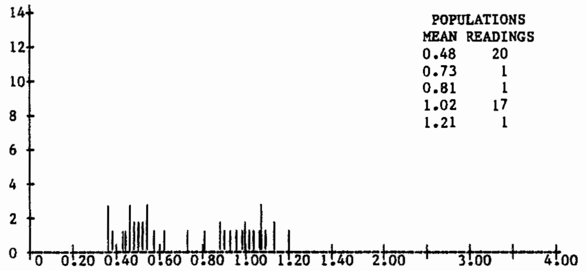


POPULATIONS MEAN	READINGS
0.48	42
0.69	19

REMARKS DOMINANTLY ALGAL/AMORPHOUS SIGNIFICANT INERTINITE AND VITRINITE - LATTER AS GENERALLY POOR PARTICLES OF VARIABLE REFLECTANCE.

SAMPLE 786-171A DEPTH 2820 VITRINITE REFLECTANCE VALUES

0.36 0.36 0.37 0.38 0.43 0.44 0.46 0.46 0.47 0.48
0.48 0.50 0.50 0.52 0.53 0.54 0.55 0.55 0.57 0.62
0.73 0.81 0.88 0.89 0.90 0.93 0.96 0.99 1.00 1.01
1.02 1.04 1.07 1.08 1.08 1.09 1.10 1.14 1.14 1.21

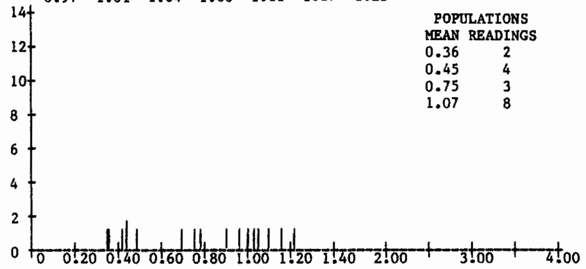


POPULATIONS MEAN	READINGS
0.48	20
0.73	1
0.81	1
1.02	17
1.21	1

REMARKS MIXED VITRINITE OF VERY VARIABLE REFLECTANCE, FREQUENTLY REWORKED. SUGGESTIONS OF CAVING/ADDITIVE.

SAMPLE 786-180B DEPTH 2955 VITRINITE REFLECTANCE VALUES

0.35 0.36 0.42 0.44 0.45 0.49 0.70 0.76 0.79 0.91
0.97 1.01 1.04 1.06 1.11 1.17 1.23

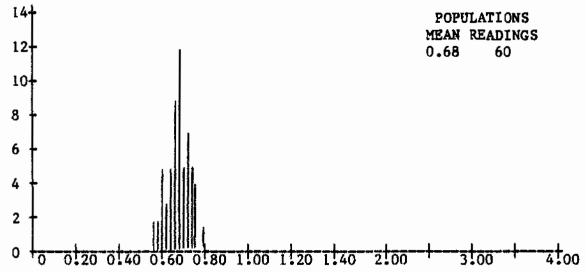


POPULATIONS MEAN	READINGS
0.36	2
0.45	4
0.75	3
1.07	8

REMARKS MIXED ASSEMBLAGE SIGNIFICANT VITRINITE AND INERTINITE WIDESPREAD REWORKING.

SAMPLE 786-213A DEPTH 2986.93 VITRINITE REFLECTANCE VALUES

0.56 0.57 0.58 0.59 0.60 0.60 0.60 0.61 0.61 0.62
0.63 0.63 0.64 0.65 0.65 0.65 0.65 0.66 0.66 0.66
0.66 0.66 0.66 0.67 0.67 0.67 0.68 0.68 0.68 0.68
0.68 0.69 0.69 0.69 0.69 0.69 0.69 0.69 0.70 0.70
0.71 0.71 0.71 0.72 0.72 0.73 0.73 0.73 0.73 0.73
0.74 0.74 0.74 0.74 0.74 0.75 0.75 0.75 0.76 0.79



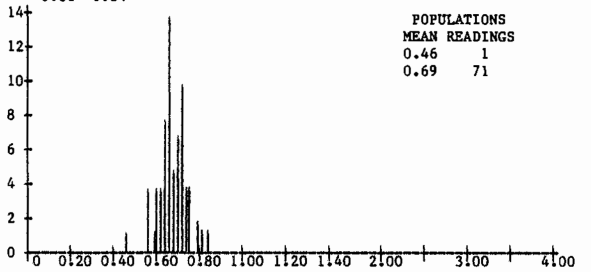
POPULATIONS MEAN	READINGS
0.68	60

REMARKS AS 786-209B

FIGURE 8d VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-185B DEPTH 3030 VITRINITE REFLECTANCE VALUES

0.46 0.56 0.56 0.57 0.57 0.59 0.60 0.60 0.61 0.61
0.62 0.62 0.63 0.63 0.64 0.64 0.64 0.65 0.65 0.65
0.65 0.65 0.66 0.66 0.66 0.66 0.66 0.66 0.66 0.66
0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.68 0.68
0.69 0.69 0.69 0.70 0.70 0.70 0.70 0.71 0.71 0.71
0.72 0.72 0.72 0.72 0.72 0.72 0.73 0.73 0.73 0.73
0.74 0.74 0.74 0.74 0.75 0.75 0.76 0.76 0.79 0.79
0.81 0.84

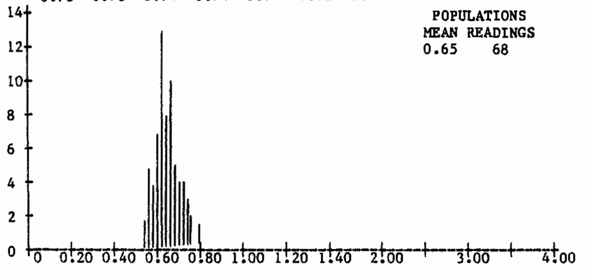


POPULATIONS	
MEAN	READINGS
0.46	1
0.69	71

REMARKS CHIEFLY VITRINITE PARTICLES OF VARIABLE SIZE, LARGER PARTICLES FREQUENTLY OF COALY APPEARANCE.

SAMPLE 786-190A DEPTH 3105 VITRINITE REFLECTANCE VALUES

0.54 0.54 0.56 0.56 0.57 0.57 0.57 0.58 0.58 0.59
0.59 0.60 0.60 0.61 0.61 0.61 0.61 0.61 0.62 0.62
0.62 0.62 0.62 0.62 0.63 0.63 0.63 0.63 0.63 0.63
0.63 0.64 0.64 0.64 0.64 0.65 0.65 0.65 0.65 0.66
0.66 0.66 0.66 0.66 0.66 0.66 0.67 0.67 0.67 0.68
0.68 0.68 0.69 0.69 0.70 0.70 0.70 0.71 0.72 0.72
0.73 0.73 0.74 0.74 0.74 0.75 0.75 0.79

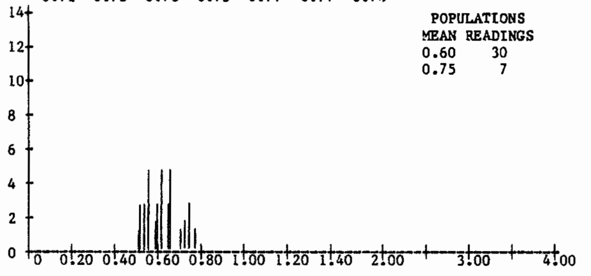


POPULATIONS	
MEAN	READINGS
0.65	68

REMARKS FREQUENT GOOD SIZED VITRINITE PARTICLES

SAMPLE 786-192A DEPTH 3135 VITRINITE REFLECTANCE VALUES

0.51 0.52 0.52 0.53 0.54 0.55 0.55 0.56 0.56 0.56
0.56 0.57 0.59 0.59 0.60 0.60 0.61 0.62 0.62 0.63
0.63 0.63 0.65 0.65 0.65 0.66 0.66 0.66 0.67 0.67
0.71 0.73 0.73 0.75 0.77 0.77 0.78

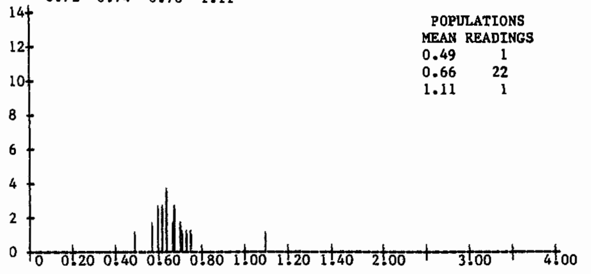


POPULATIONS	
MEAN	READINGS
0.60	30
0.75	7

REMARKS FREQUENT VITRINITE SOME VARIATION IN REFLECTANCE APPARENT

SAMPLE 786-196A DEPTH 3195 VITRINITE REFLECTANCE VALUES

0.49 0.57 0.57 0.60 0.61 0.61 0.62 0.63 0.63 0.64
0.64 0.65 0.65 0.67 0.67 0.68 0.69 0.69 0.71 0.71
0.72 0.74 0.76 1.11

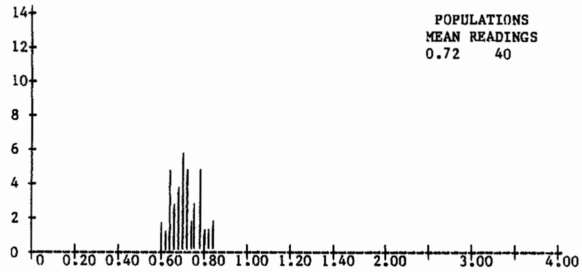


POPULATIONS	
MEAN	READINGS
0.49	1
0.66	22
1.11	1

REMARKS FREQUENT SIGNS OF TURBODRILLING, MIXTURE OF VITRINITE AND BITUMEN STAINING SIGNIFICANT INERTINITE.

SAMPLE 786-188C DEPTH 3057 VITRINITE REFLECTANCE VALUES

0.60 0.61 0.62 0.64 0.64 0.65 0.65 0.65 0.66 0.67
0.67 0.68 0.69 0.69 0.69 0.70 0.70 0.71 0.71 0.71
0.71 0.72 0.72 0.72 0.73 0.73 0.74 0.74 0.75 0.76
0.77 0.78 0.78 0.78 0.79 0.79 0.80 0.82 0.84 0.84

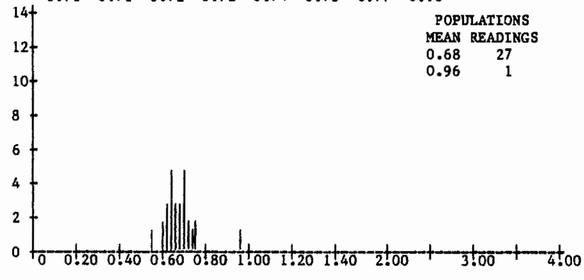


POPULATIONS	
MEAN	READINGS
0.72	40

REMARKS FREQUENT GOOD VITRINITE PARTICLES

SAMPLE 786-216A DEPTH 3125 VITRINITE REFLECTANCE VALUES

0.55 0.60 0.61 0.62 0.62 0.63 0.64 0.64 0.64 0.65
0.65 0.66 0.66 0.66 0.68 0.68 0.69 0.70 0.70 0.70
0.71 0.71 0.72 0.72 0.74 0.75 0.77 0.96

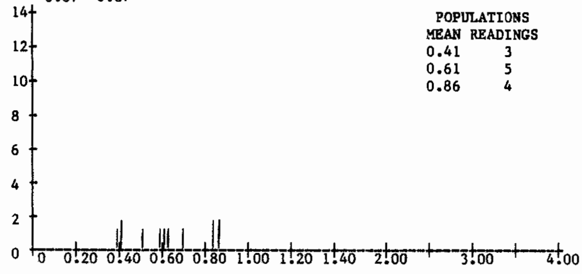


POPULATIONS	
MEAN	READINGS
0.68	27
0.96	1

REMARKS ALMOST EXCLUSIVELY VITRINITE

SAMPLE 786-217A DEPTH 3186 VITRINITE REFLECTANCE VALUES

0.39 0.41 0.41 0.51 0.59 0.61 0.63 0.70 0.84 0.85
0.87 0.87

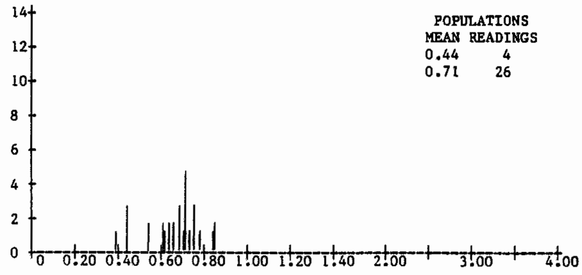


POPULATIONS	
MEAN	READINGS
0.41	3
0.61	5
0.86	4

REMARKS MIXED ASSEMBLAGE SOME VARIATION IN REFLECTANCE APPARENT

SAMPLE 786-218A DEPTH 3297 VITRINITE REFLECTANCE VALUES

0.39 0.44 0.45 0.45 0.54 0.55 0.61 0.61 0.62 0.64
0.65 0.66 0.67 0.69 0.69 0.69 0.71 0.72 0.72 0.73
0.73 0.73 0.74 0.76 0.77 0.77 0.79 0.85 0.86 0.87



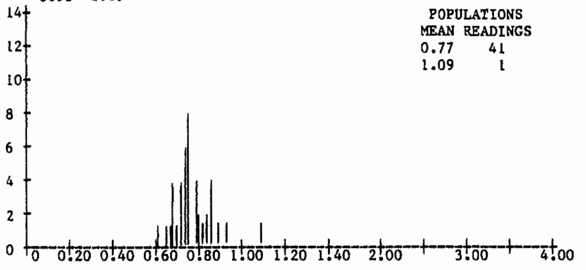
POPULATIONS	
MEAN	READINGS
0.44	4
0.71	26

REMARKS PARTICLES OF VITRINITE AND INERTINITE SOME VARIATION IN REFLECTANCE APPARENT

FIGURE 8e VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-206A DEPTH 3345 VITRINITE REFLECTANCE VALUES

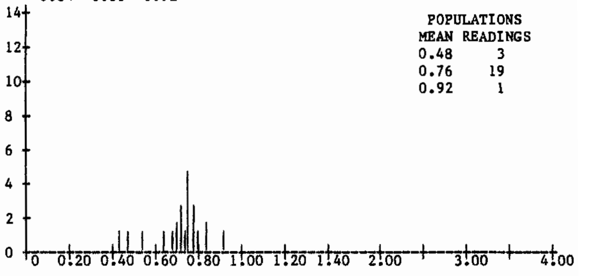
0.61 0.65 0.67 0.68 0.68 0.69 0.69 0.70 0.72 0.73
0.73 0.73 0.74 0.74 0.74 0.74 0.74 0.74 0.75 0.75
0.75 0.76 0.76 0.76 0.77 0.77 0.79 0.79 0.79 0.79
0.80 0.80 0.82 0.84 0.84 0.86 0.86 0.86 0.87 0.89
0.93 1.09



REMARKS FAIRLY MIXED ASSEMBLAGE VITRINITE DOMINANT - FREQUENTLY OF COALY APPEARANCE.

SAMPLE 786-219A DEPTH 3376 VITRINITE REFLECTANCE VALUES

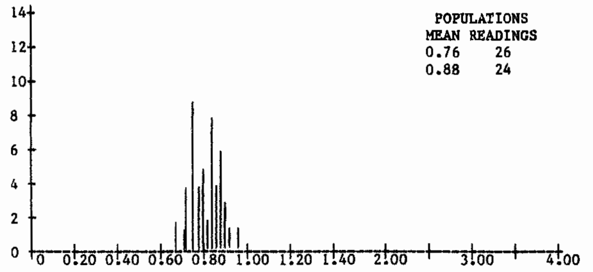
0.43 0.47 0.54 0.64 0.68 0.70 0.70 0.72 0.73 0.73
0.74 0.75 0.76 0.77 0.77 0.77 0.78 0.78 0.78 0.80
0.84 0.85 0.92



REMARKS AS 786-218A

SAMPLE 786-209B DEPTH 3390 VITRINITE REFLECTANCE VALUES

0.67 0.67 0.71 0.72 0.72 0.73 0.73 0.75 0.75 0.75
0.75 0.76 0.76 0.77 0.77 0.77 0.78 0.78 0.78 0.79
0.80 0.80 0.81 0.81 0.81 0.82 0.83 0.84 0.84 0.84
0.84 0.84 0.84 0.85 0.85 0.86 0.86 0.87 0.87 0.88
0.88 0.88 0.89 0.89 0.89 0.90 0.91 0.91 0.92 0.96



REMARKS ALMOST EXCLUSIVELY VITRINITE AS LARGE PARTICLES/CUTTINGS

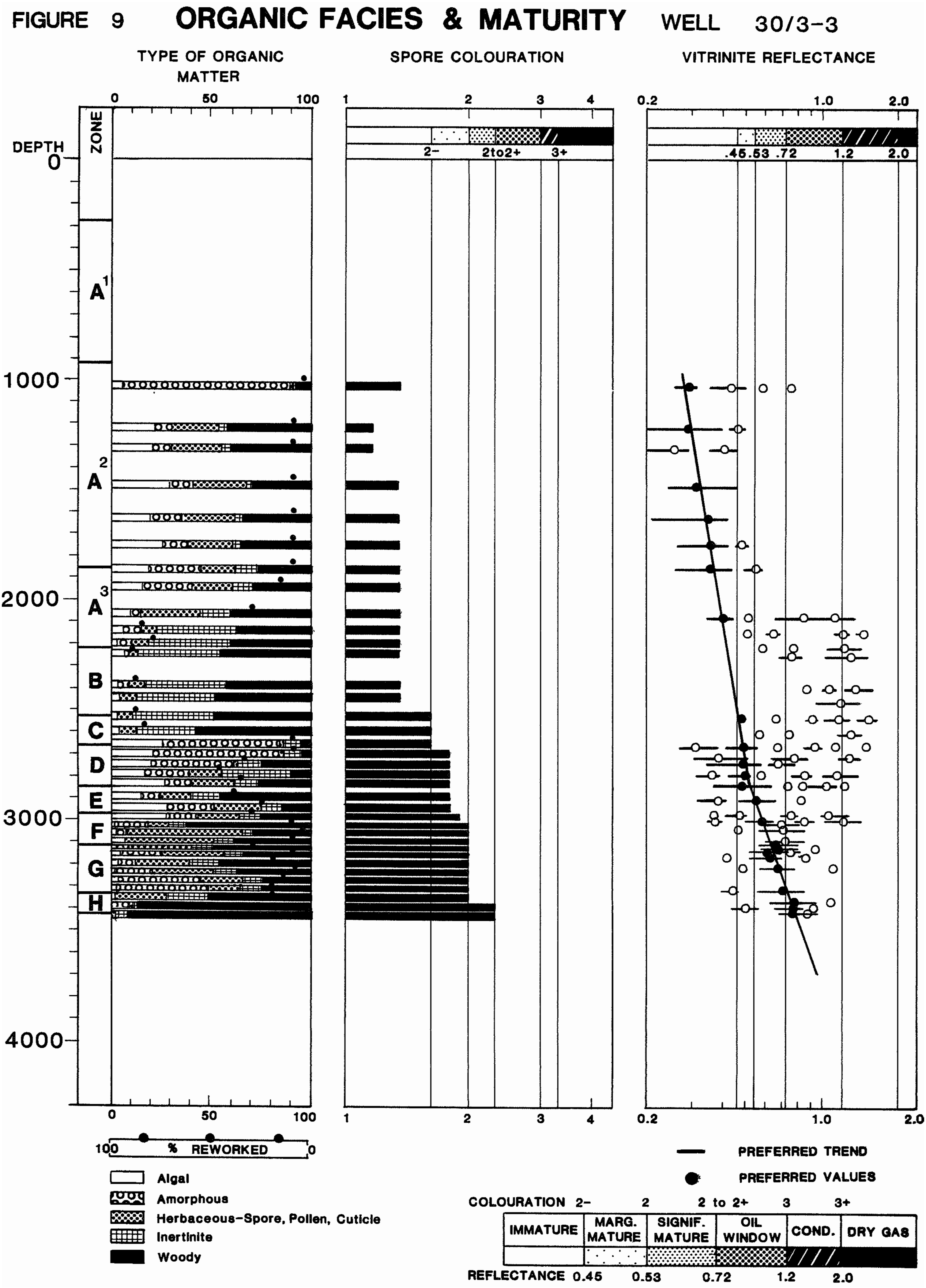
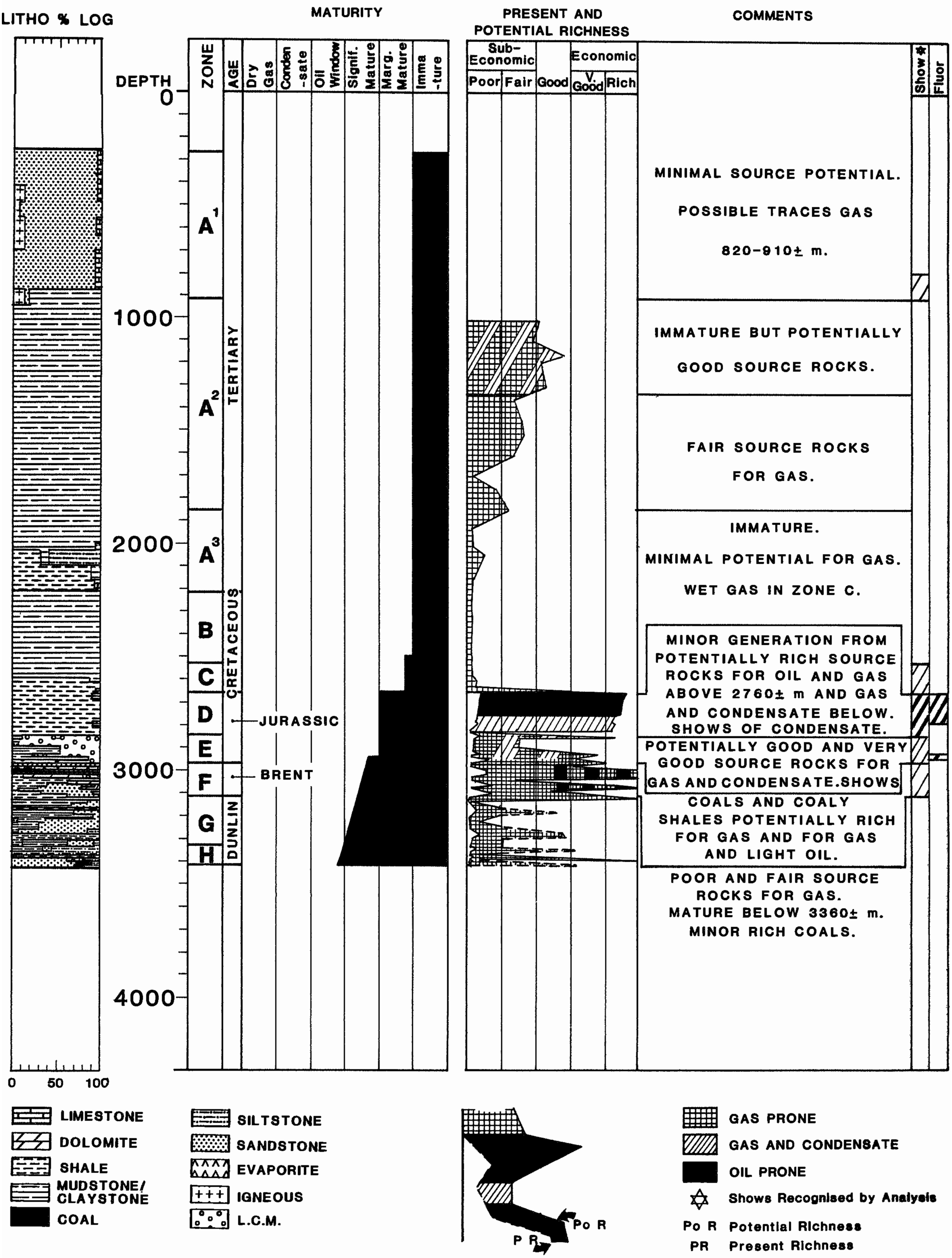


FIGURE 9 ORGANIC FACIES & MATURITY WELL 30/3-3
TYPE OF ORGANIC MATTER
SPORE COLOURATION
VITRINITE REFLECTANCE
DEPTH
ZONE
A1
A2
A3
B
C
D
E
F
G
H
0
1000
2000
3000
4000
0 50 100
1 2 3 4
0.2 1.0 2.0
2- 2to2+ 3+
.45 .53 .72 1.2 2.0
100 % REWORKED 0
Algal
Amorphous
Herbaceous-Spore, Pollen, Cuticle
Inertinite
Woody
PREFERRED TREND
PREFERRED VALUES
COLOURATION 2- 2 2 to 2+ 3 3+
IMMATURE
MARG. MATURE
SIGNIF. MATURE
OIL WINDOW
COND.
DRY GAS
REFLECTANCE 0.45 0.53 0.72 1.2 2.0

FIGURE 10 **RATING** WELL 30/3-3



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 betwwen 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 (<u>not</u> 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 <u>all</u> 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) <u>ORGANIC CARBON ANALYSIS</u>

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

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

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

D) <u>MINI-PYROLYSIS</u>

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) <u>DETAILED C_4-C_7 HYDROCARBON ANALYSIS</u>

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) <u>KEROGEN TYPE AND MATURATION</u>

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 <u>directly</u> 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 organic matter present and their relative abundances, an estimate of the proportion of reworked material, preservation state, the thermal maturity of the non-reworked organic matter using the spore colouration technique.

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

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

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

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

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

G) VITRINITE REFLECTANCE

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

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

If possible, forty to fifty measurements are taken per sample - unless the sediments are organically lean, vitrinite is sparse or only a single uniform population is present. The data are plotted in a histogram which distinguishes the indigenous vitrinite from possible reworked or caved material. Averages are calculated for each population. Comments upon exinite fluorescence and upon the character of the phytoclasts are noted on the histograms. The reports contain the tabulated data, histograms and the reflectivities plotted against depth.

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

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

Sections "A" and "E" dealt with analyses covering the light end of the hydrocarbon spectrum. This section is concerned with the solvent extractable 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, high mass spectroscopy) including correlation studies.

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

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

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

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

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

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

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

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

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

K) PYROLYSIS

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

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

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

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

The data are tabulated and presented graphically. MINI-PYROLYSIS includes ppm thermal bitumen and ppm pyrolsate. 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$\pm$normal paraffin distributions are used to "fingerprint" the samples.
- capillary chromatograms of whole oils and of the C_{8+} 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 determing the reservoir history of a crude and of evaluating whether adjacent traps will or will not be prospective for oil. In carbonate sections, where organic matter is sometimes sparse, this technique is also used to evaluate thermal maturation levels.

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

N) CRUDE OIL ANALYSIS

N-1) API GRAVITY

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

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

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

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

N-5) FRACTIONAL DISTILLATION

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

FIGURE 9 ORGANIC FACIES & MATURITY WELL 30/3-3

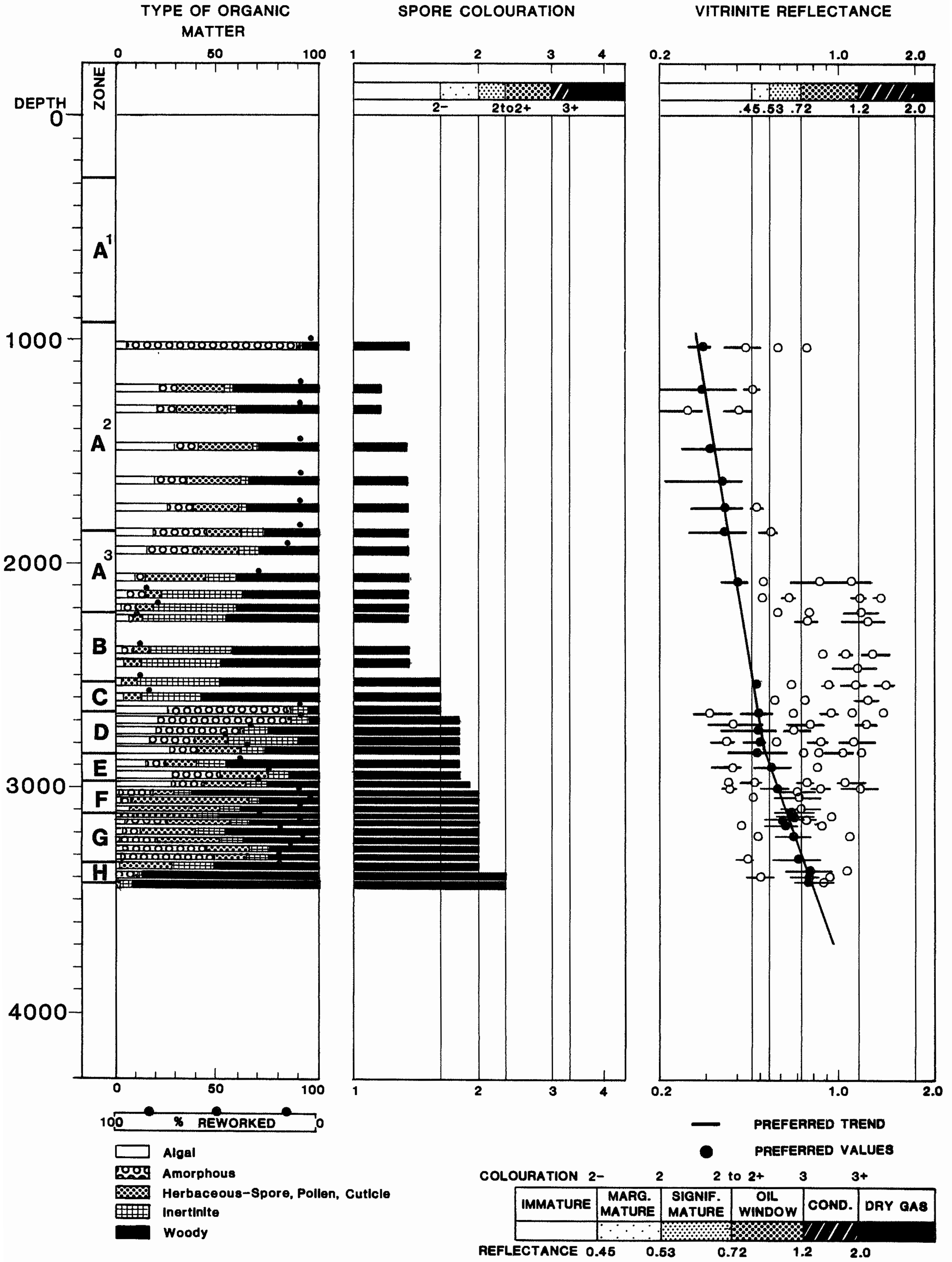


FIGURE 10 **RATING** WELL 30/3-3

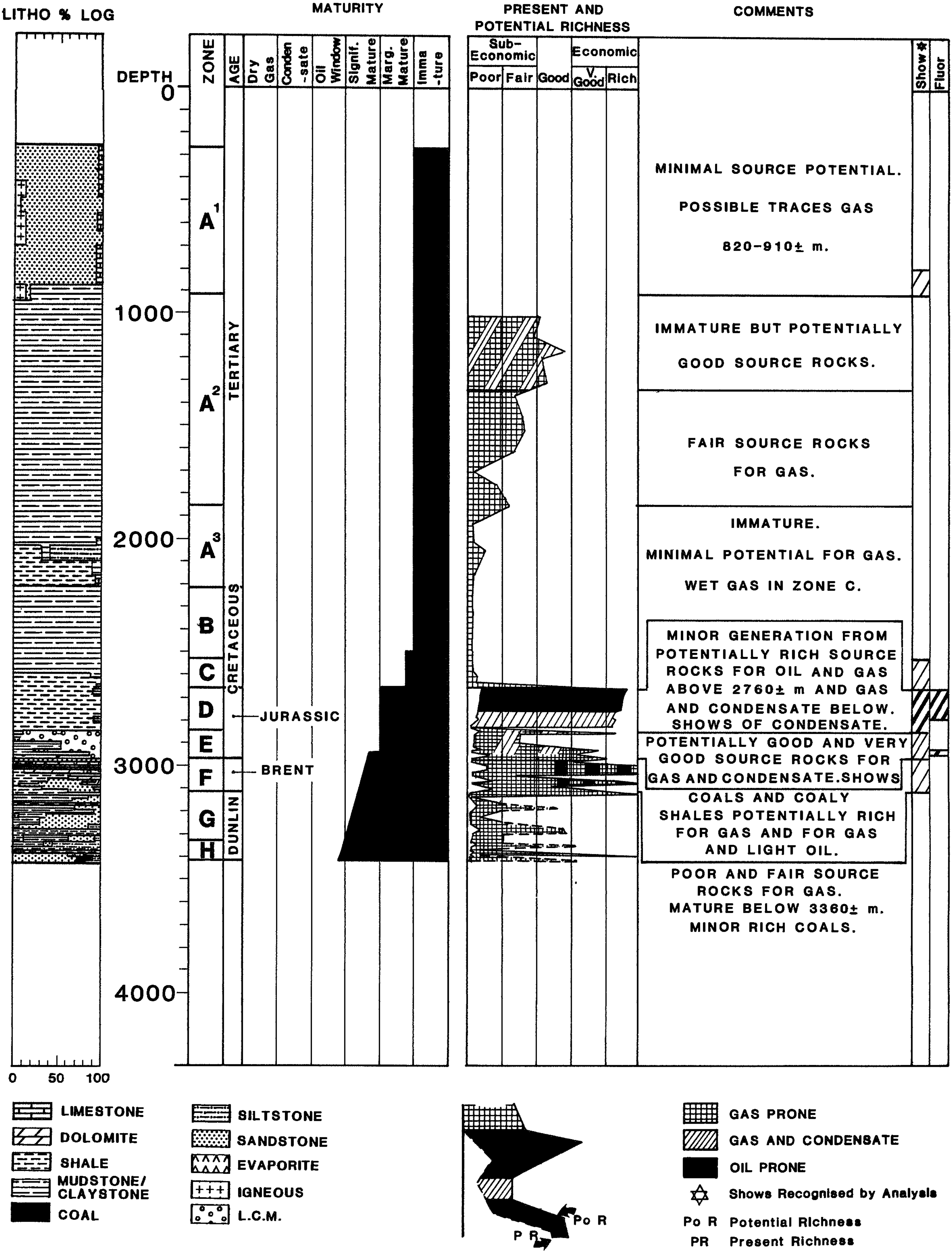


FIGURE 4c **PYROLYSIS GC** **WELL 30/3-3**

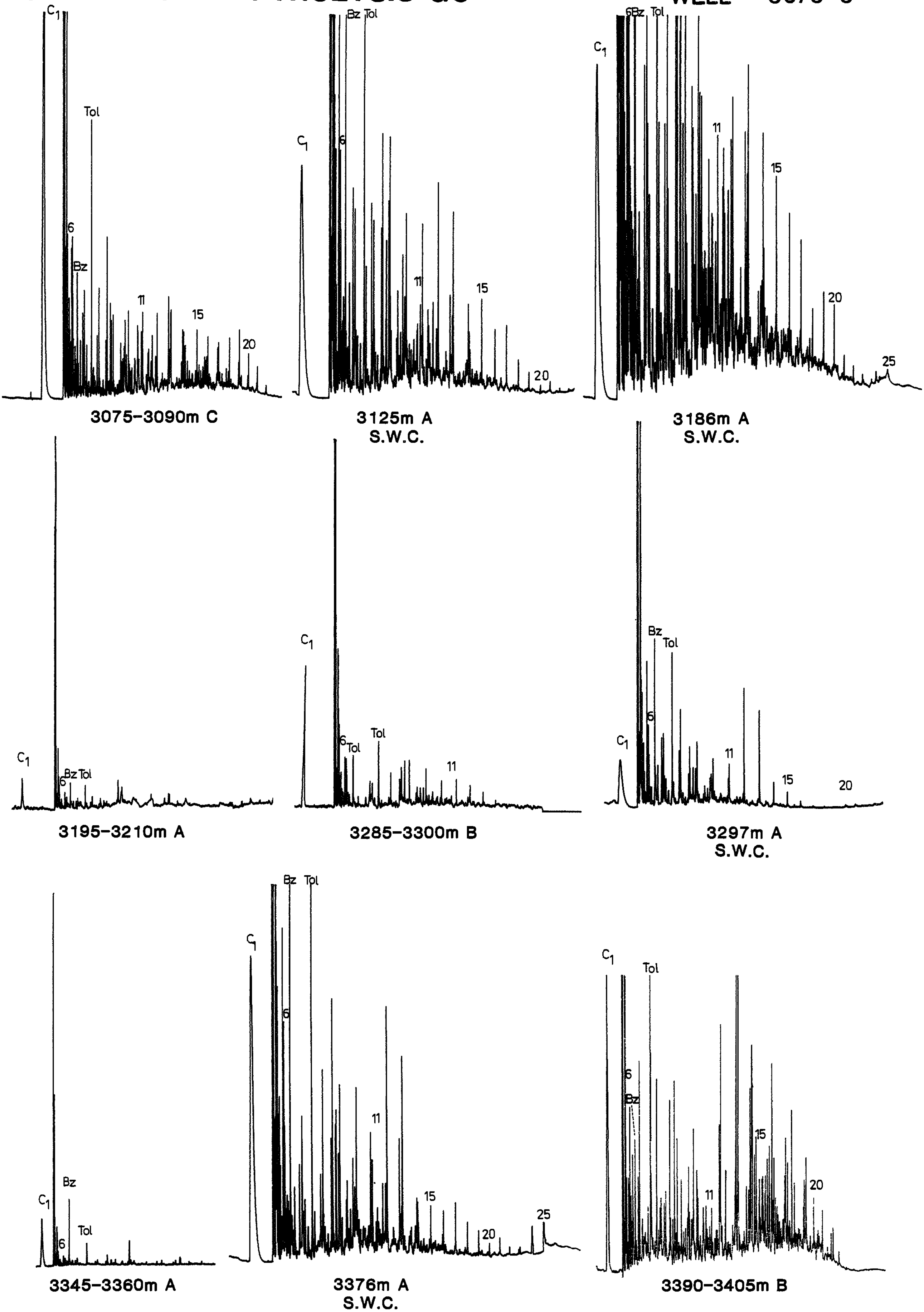
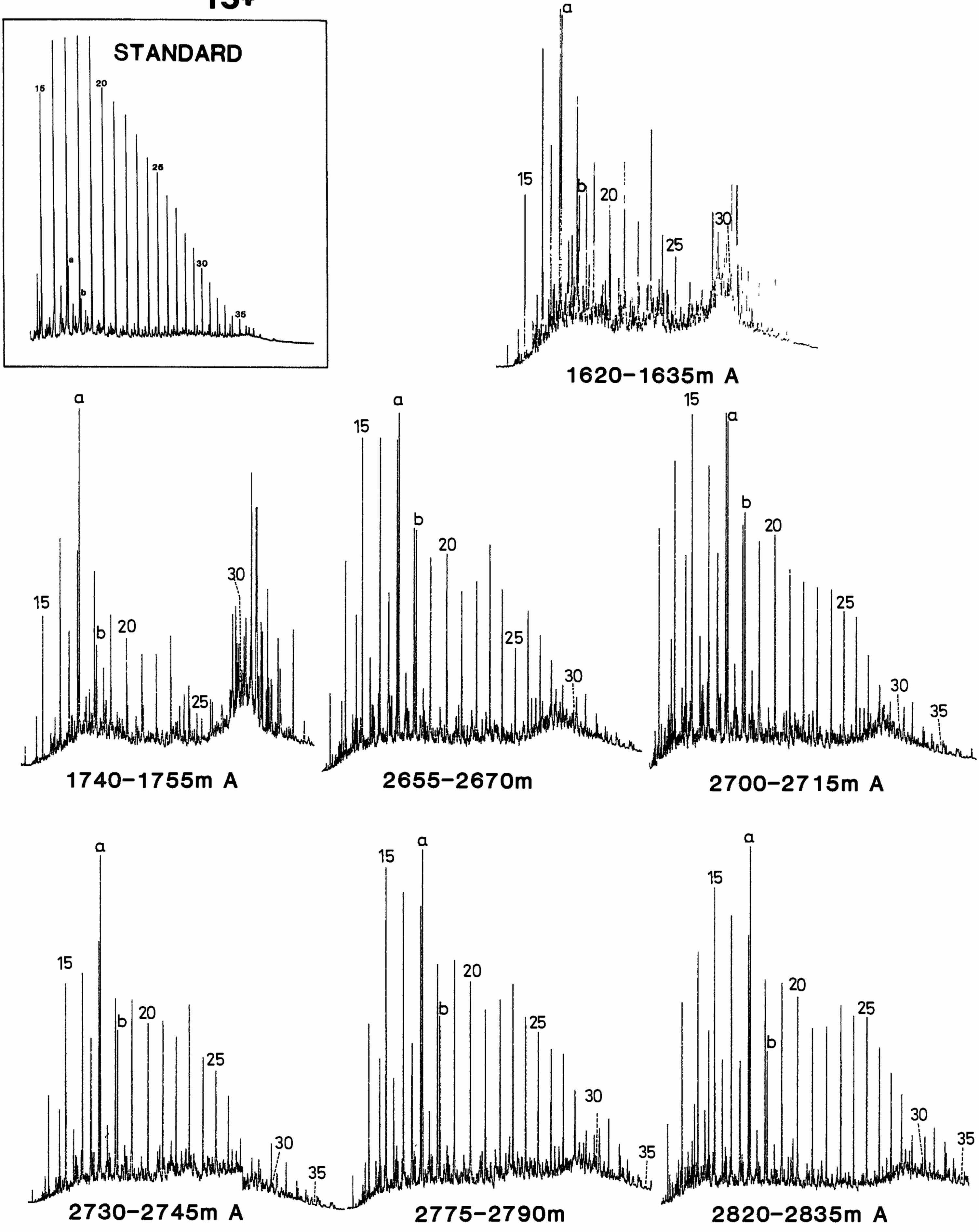


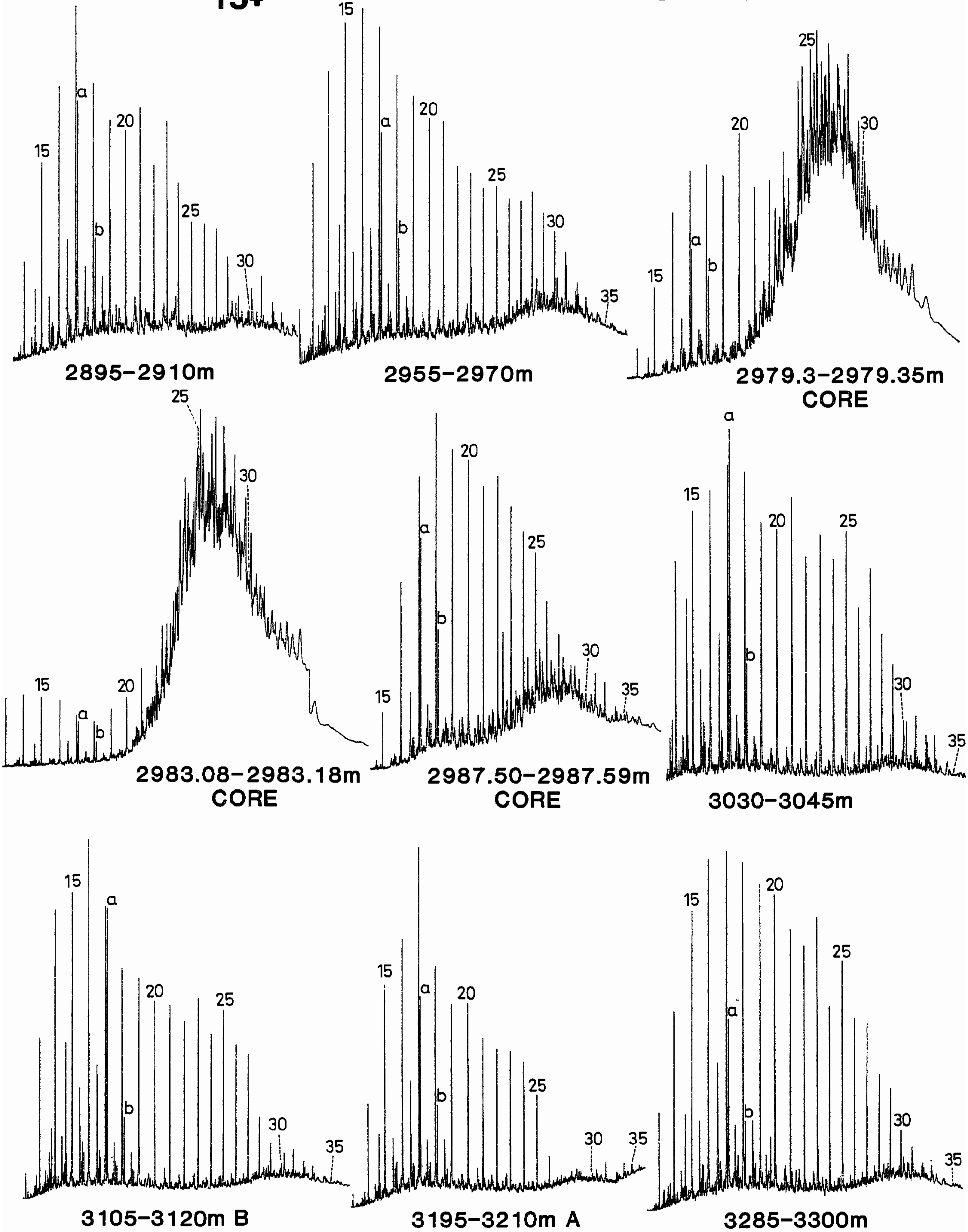
FIGURE 5a C_{15+} PARAFFIN - NAPHTHENES WELL 30/3-3



a - PRISTANE
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC_{20})

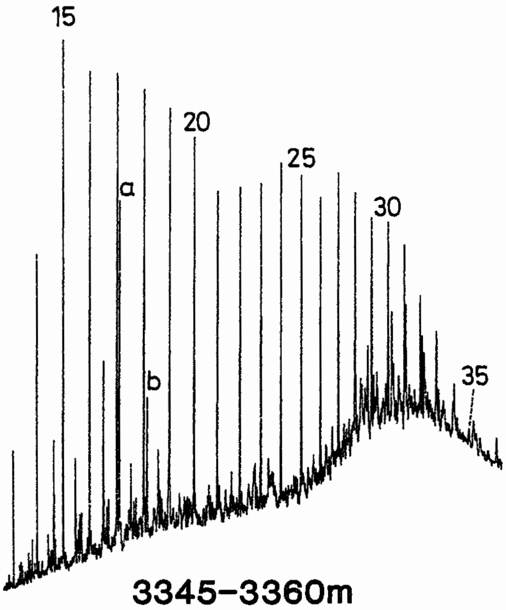
FIGURE 5b C_{15+} PARAFFIN - NAPHTHENES WELL 30/3-3



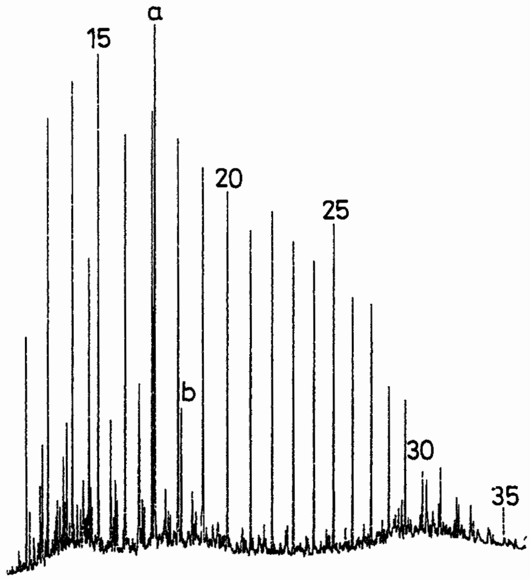
a - PRISTANE
b - PHYTANE

CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC_{20})

FIGURE 5c C_{15+} PARAFFIN - NAPHTHENES WELL 30/3-3



3345-3360m

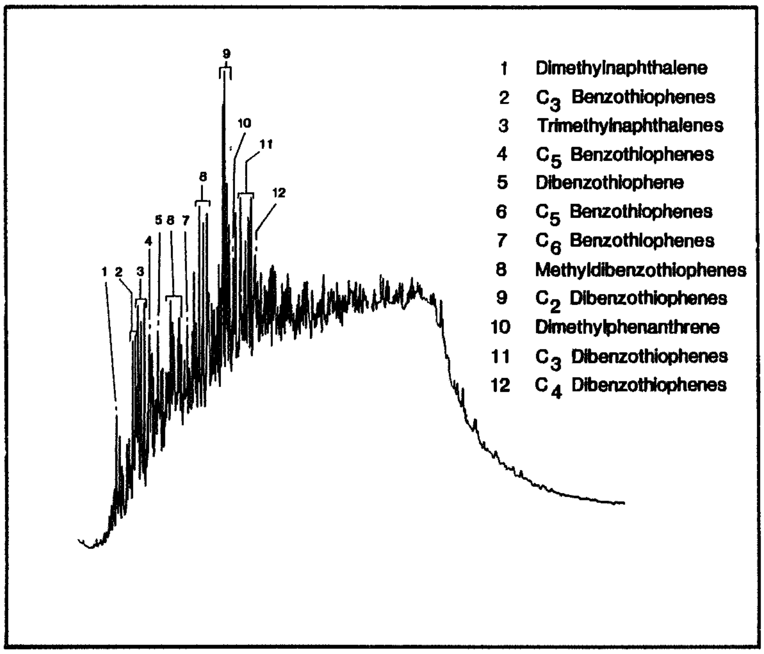


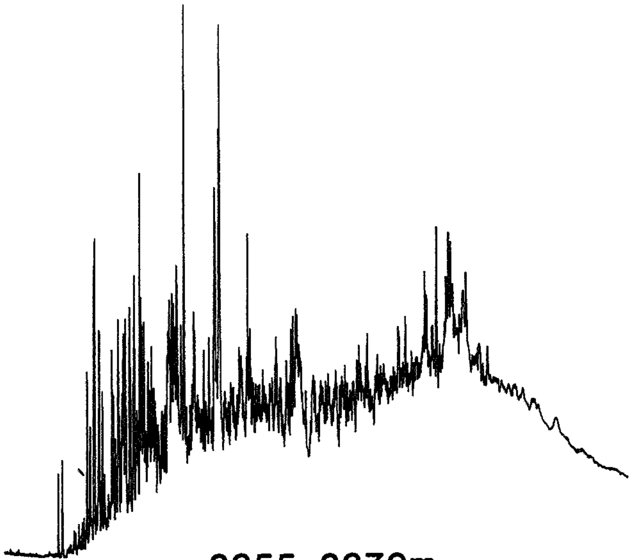
3390-3405m

a - PRISTANE
b - PHYTANE

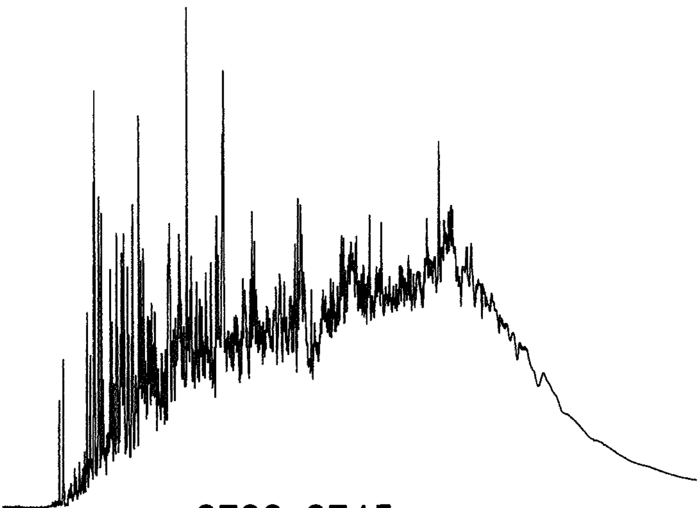
CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC_{20})

FIGURE 6a **AROMATIC CHROMATOGRAMS** WELL 30/3-32

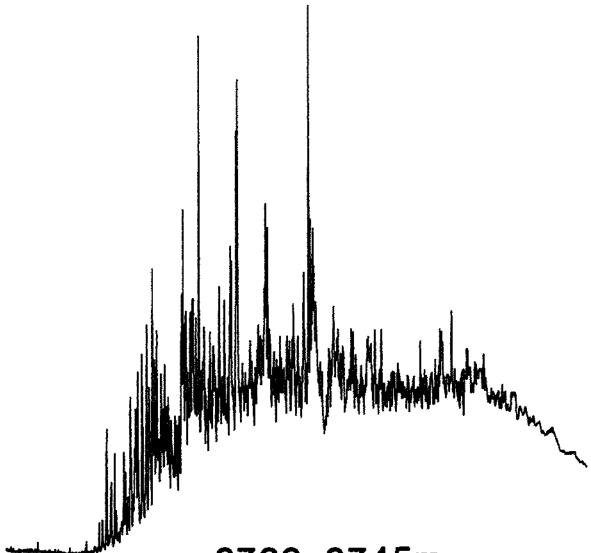




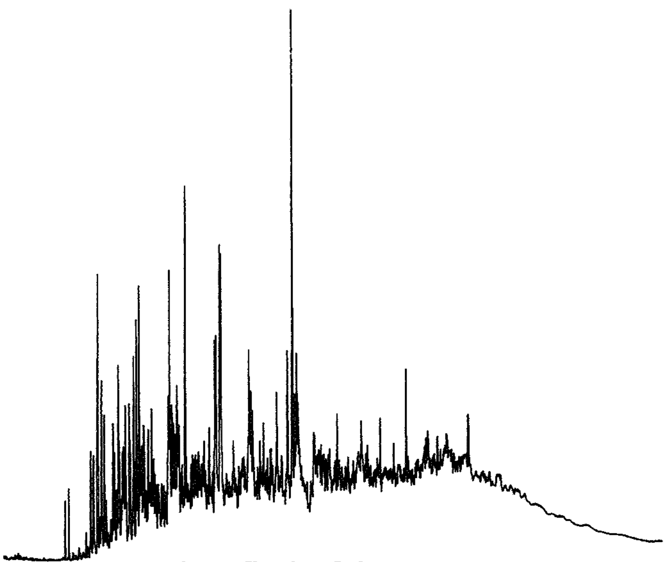
2655-2670m



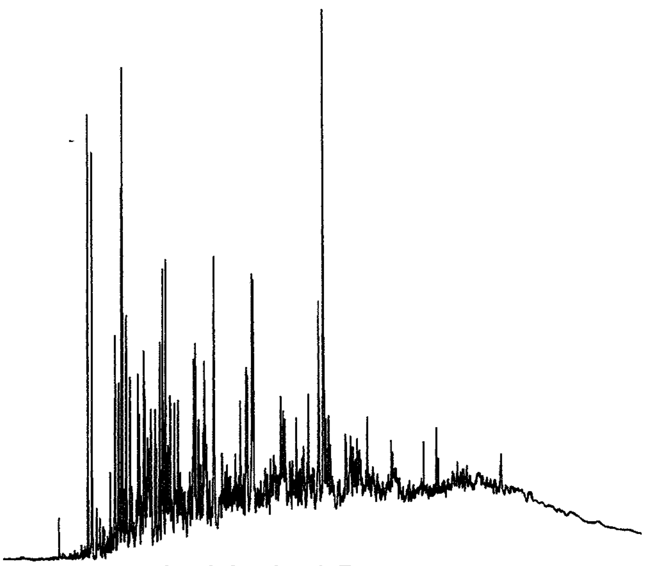
2700-2715m



2730-2745m



2775-2790m



2820-2835m

FIGURE 6b **AROMATIC CHROMATOGRAMS** WELL 30/3-3

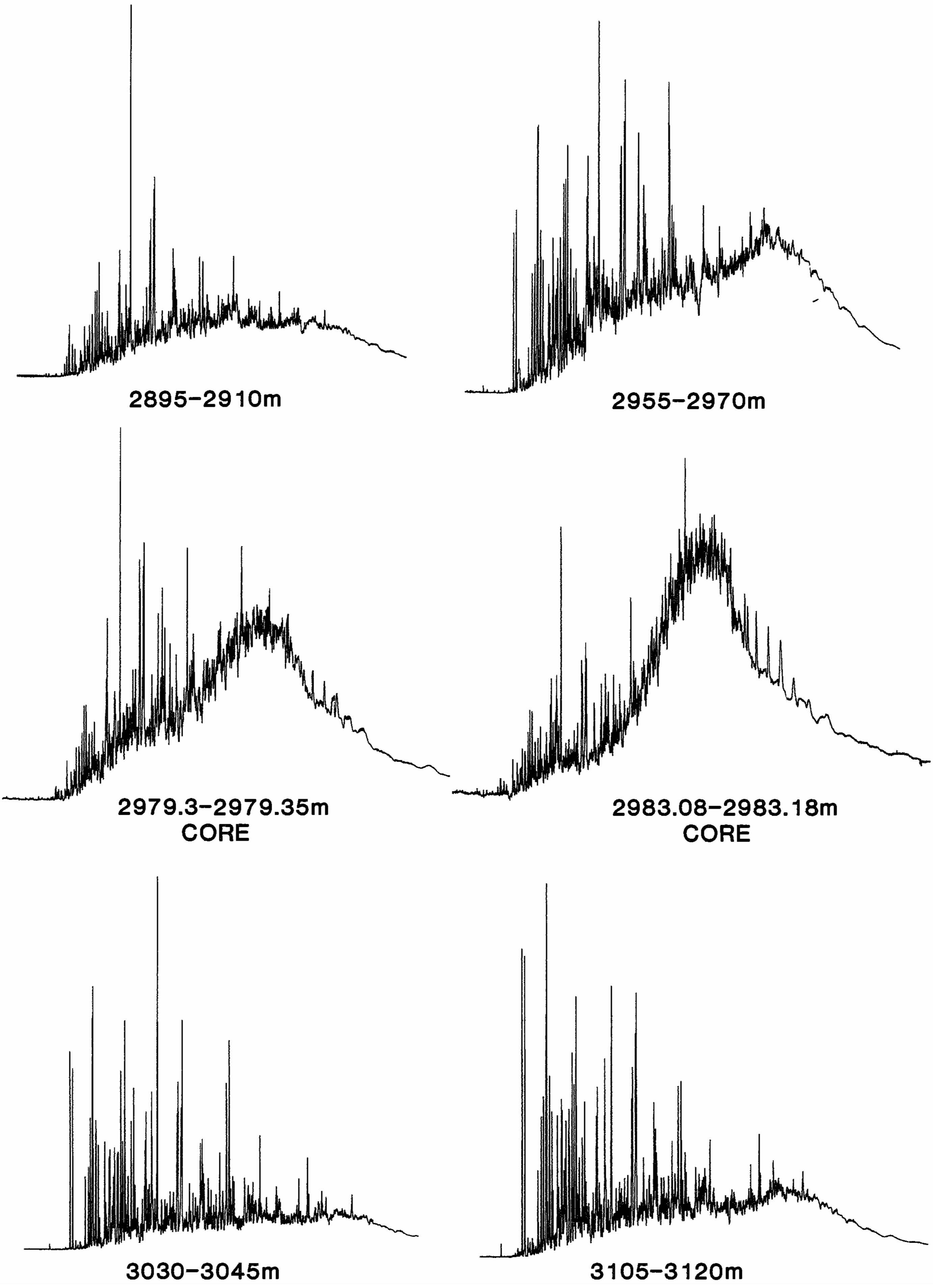
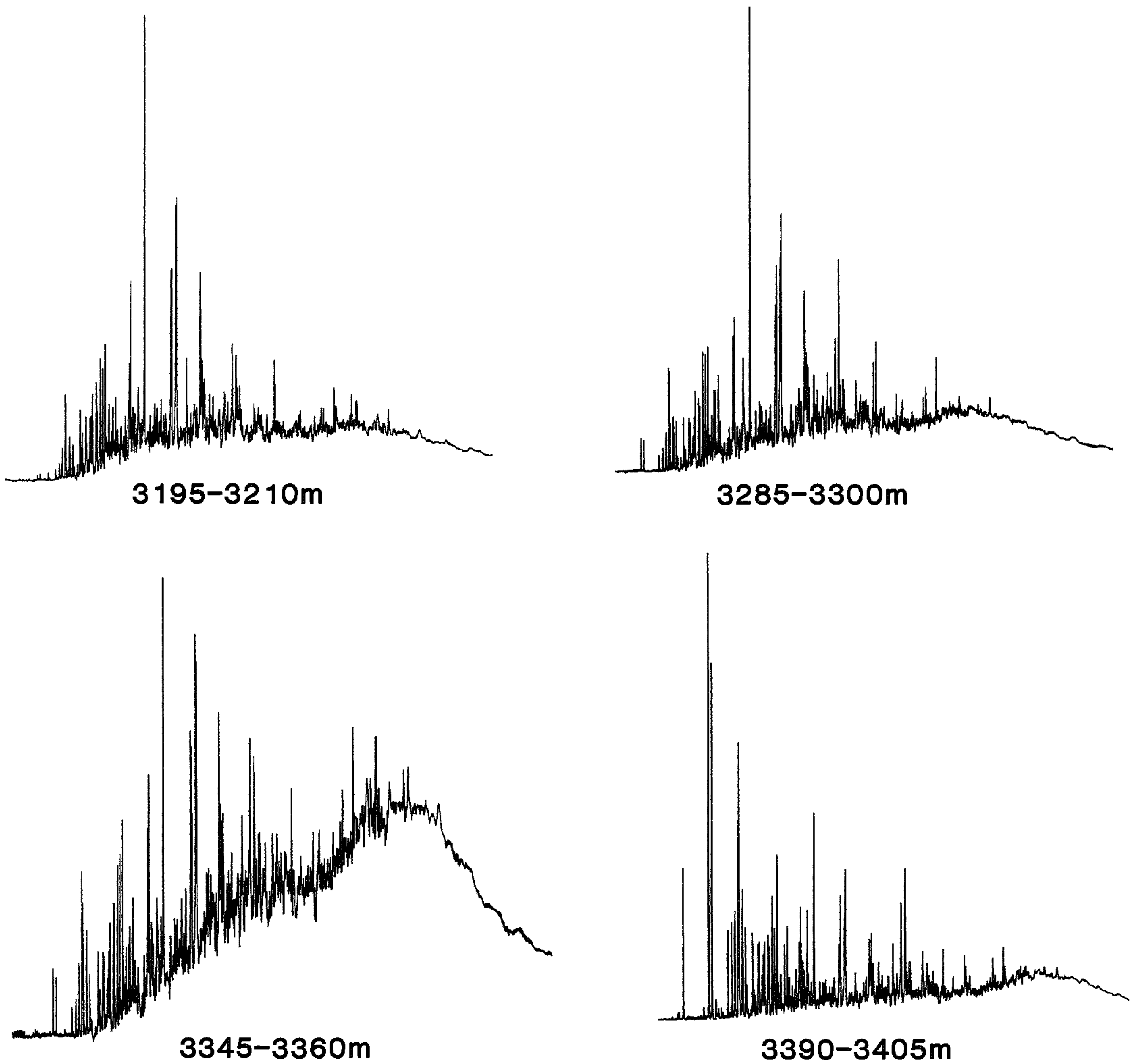
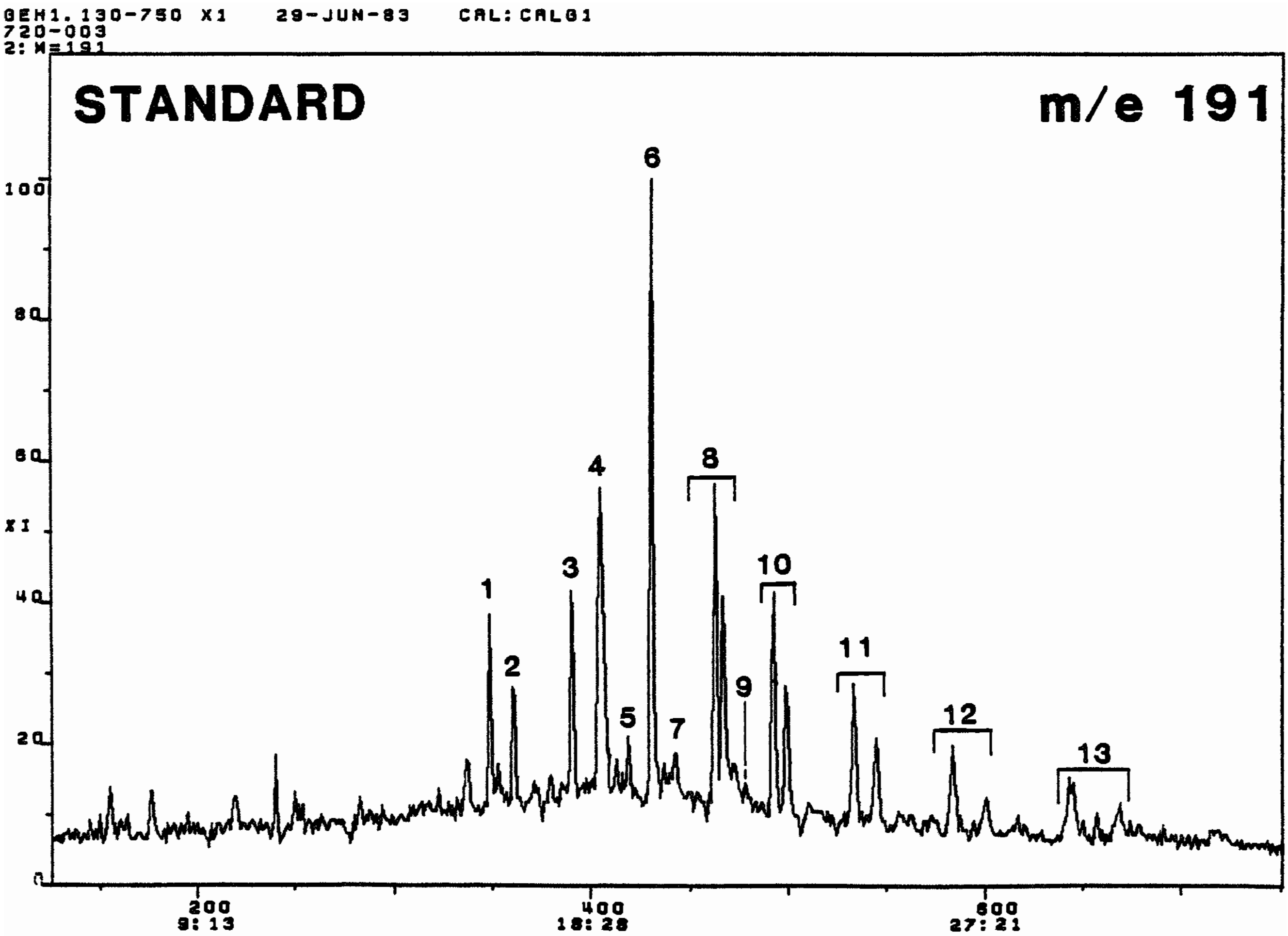


FIGURE 6c **AROMATIC CHROMATOGRAMS** WELL 30/3-3



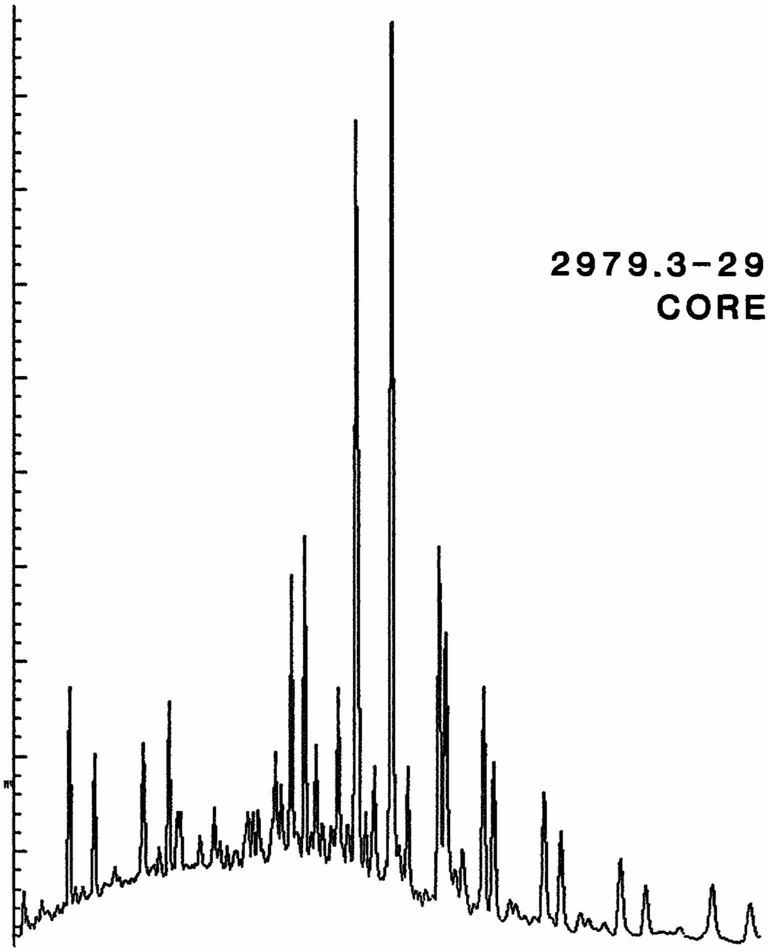


LIST OF IDENTIFIED TRITERPANES

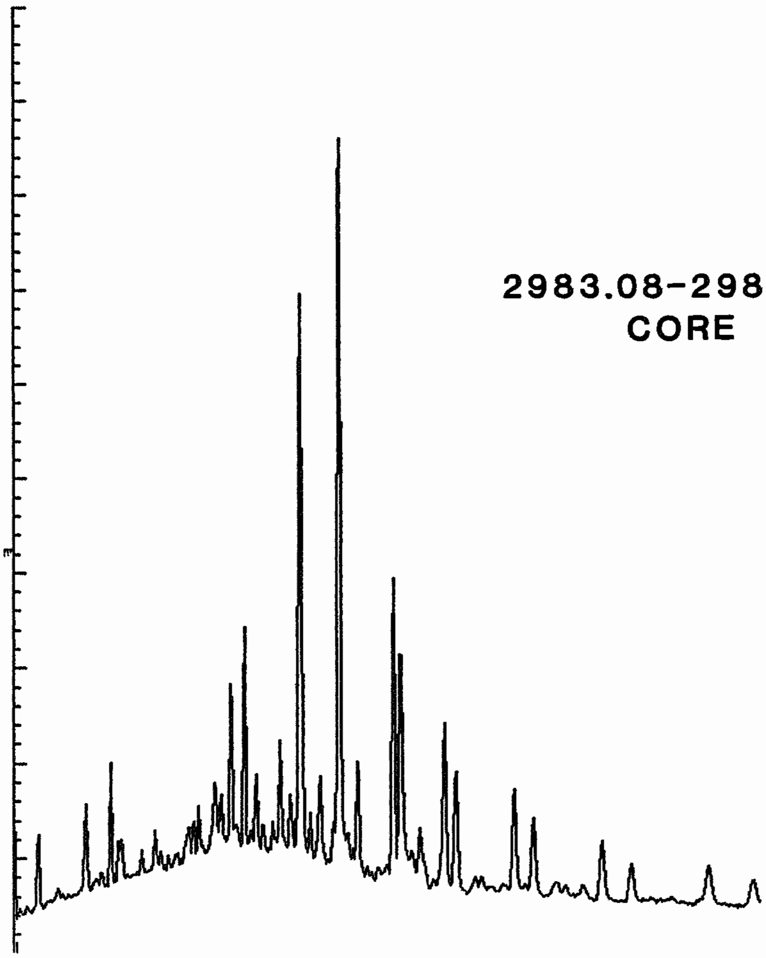
1		17αH TRISNORHOPANE (C_{27})
2		17αH TRISNORHOPANE (C_{27})
3		BISNORHOPANE (C_{28})
4		17αH NORHOPANE (C_{29})
5		NORMORETANE (C_{29})
6		17αH HOPANE (C_{30})
7		17αH MORETANE (C_{30})
8	(22S) (22R)	17αH HOMOHOPANES (C_{31})
9		GAMMACERANE
10	(22S) (22R)	BISHOMOHOPANE (C_{32})
11	(22S) (22R)	TRISHOMOHOPANES (C_{33})
12	(22S) (22R)	TETRAHOPANES (C_{34})
13	(22S) (22R)	HOPANES (C_{35})

FIGURE 7a MASSFRAGMENTOGRAMS WELL 30/3-3

TRITERPANES m/e 191



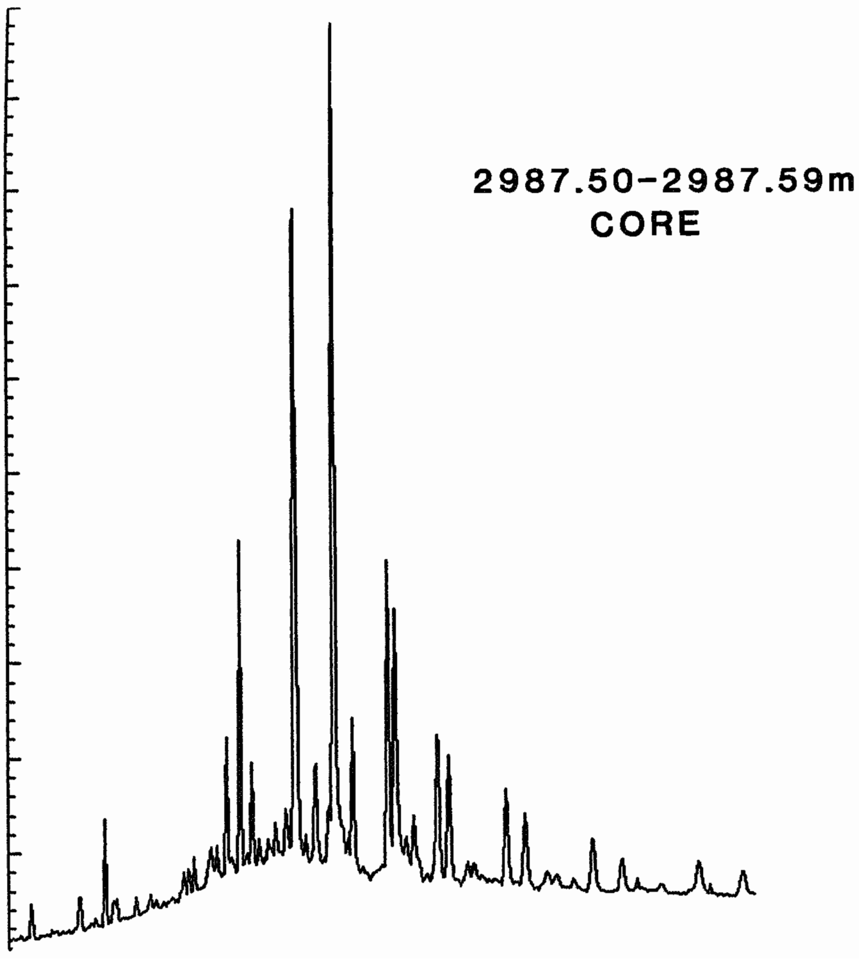
2979.3-2979.35m
CORE

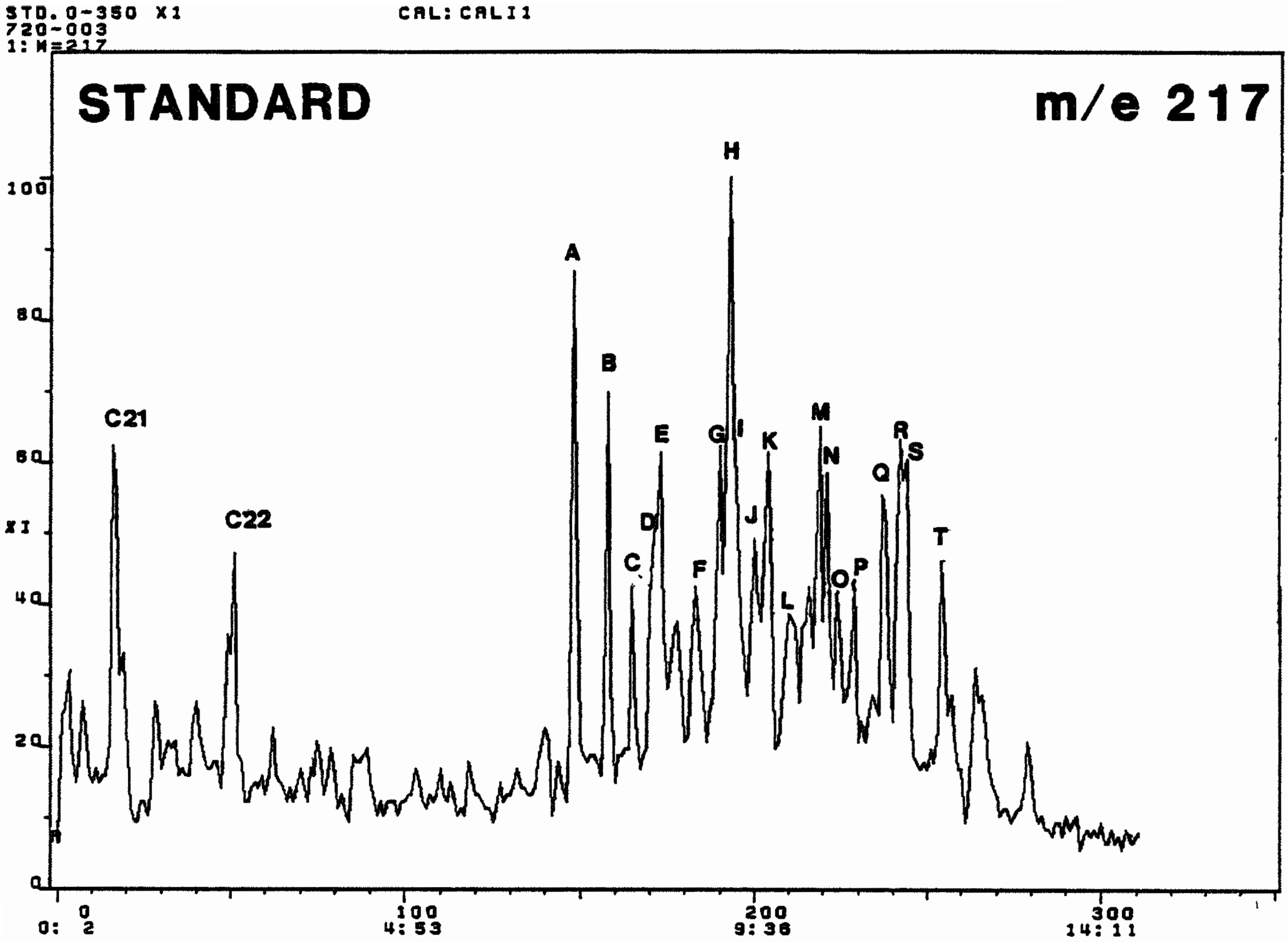


2983.08-2983.18m
CORE

FIGURE 7b MASSFRAGMENTOGRAMS WELL 30/3-3

TRITERPANES m/e 191





LIST OF IDENTIFIED STERANES

A C_{27} DIACHOLESTANE (20S)

B C_{27} DIACHOLESTANE (20R)

C C_{27} DIACHOLESTANE (20S)

D C_{27} DIACHOLESTANE (20R)

E C_{28} METHYL DIACHOLESTANE (20S)

F C_{28} METHYL DIACHOLESTANE (20R)

G C_{28} METHYL DIACHOLESTANE (20S)

H C_{29} ETHYL DIACHOLESTANE (20S)

I C_{27} CHOLESTANE (20S) & C_{28} METHYL DIACHOLESTANE (20R)

J C_{27} CHOLESTANE (20R)

K C_{29} ETHYL DIACHOLESTANE (20R)

L C_{29} ETHYL DIACHOLESTANE (20S)

M C_{28} METHYL CHOLESTANE (20S)

N C_{29} ETHYL DIACHOLESTANE (20R)

O C_{28} METHYL CHOLESTANE (20S)

P C_{28} METHYL CHOLESTANE (20R)

Q C_{29} ETHYL CHOLESTANE (20S) $[\alpha\alpha]$

R C_{29} ETHYL CHOLESTANE (20R) $[\beta\beta]$

S C_{29} ETHYL CHOLESTANE (20S) $[\beta\beta]$

T C_{29} ETHYL CHOLESTANE (20R) $[\alpha\alpha]$

FIGURE 7C MASSFRAGMENTOGRAMS WELL 30/3-3

STERANES m/e 217

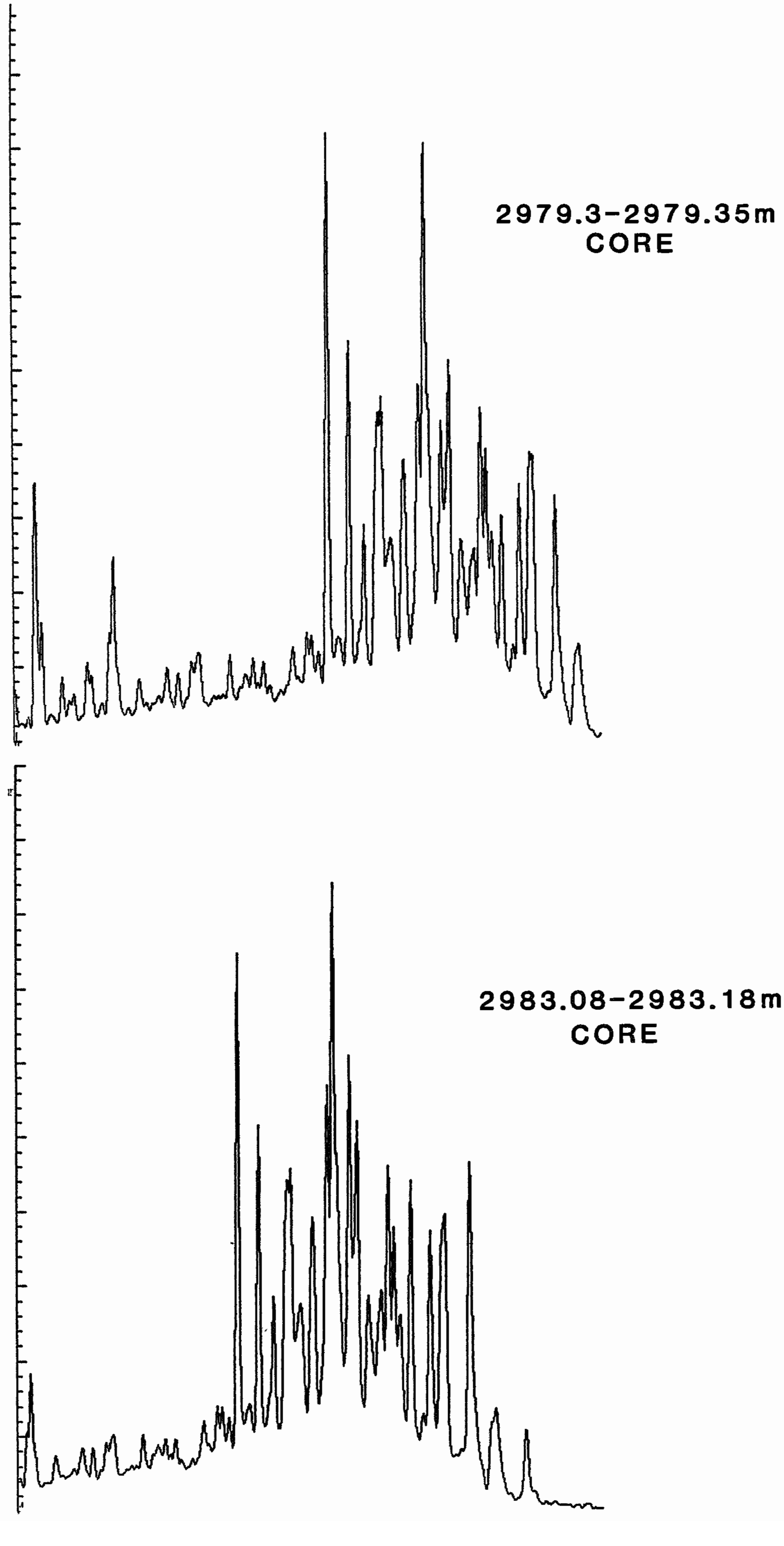


FIGURE 7d MASSFRAGMENTOGRAMS WELL 30/3-3

STERANES m/e 217

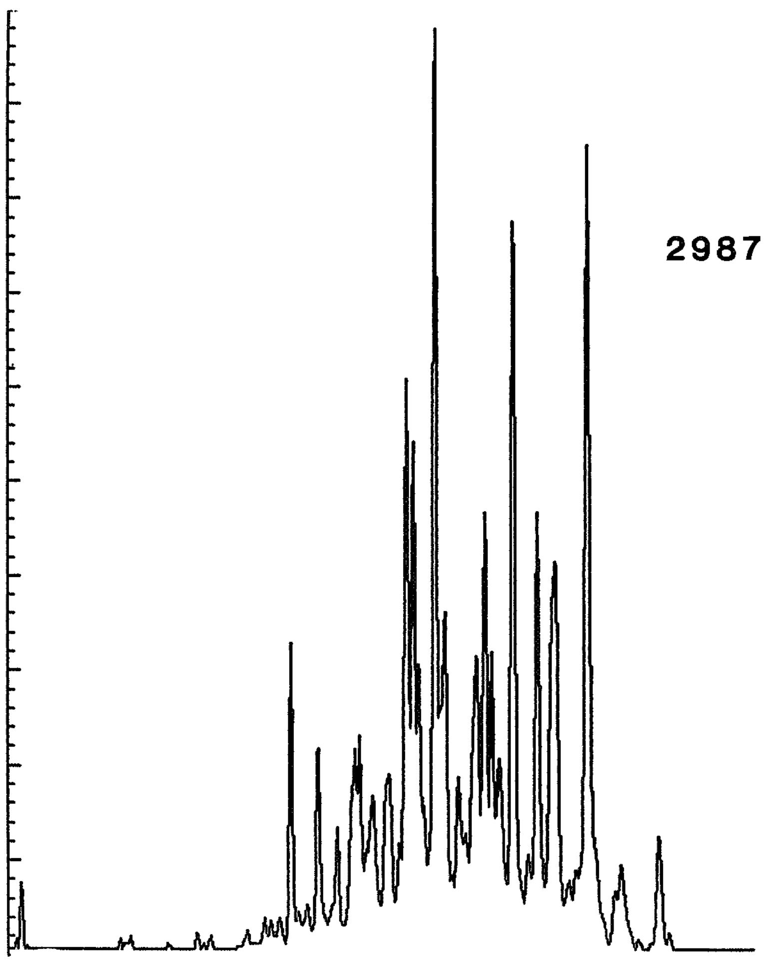
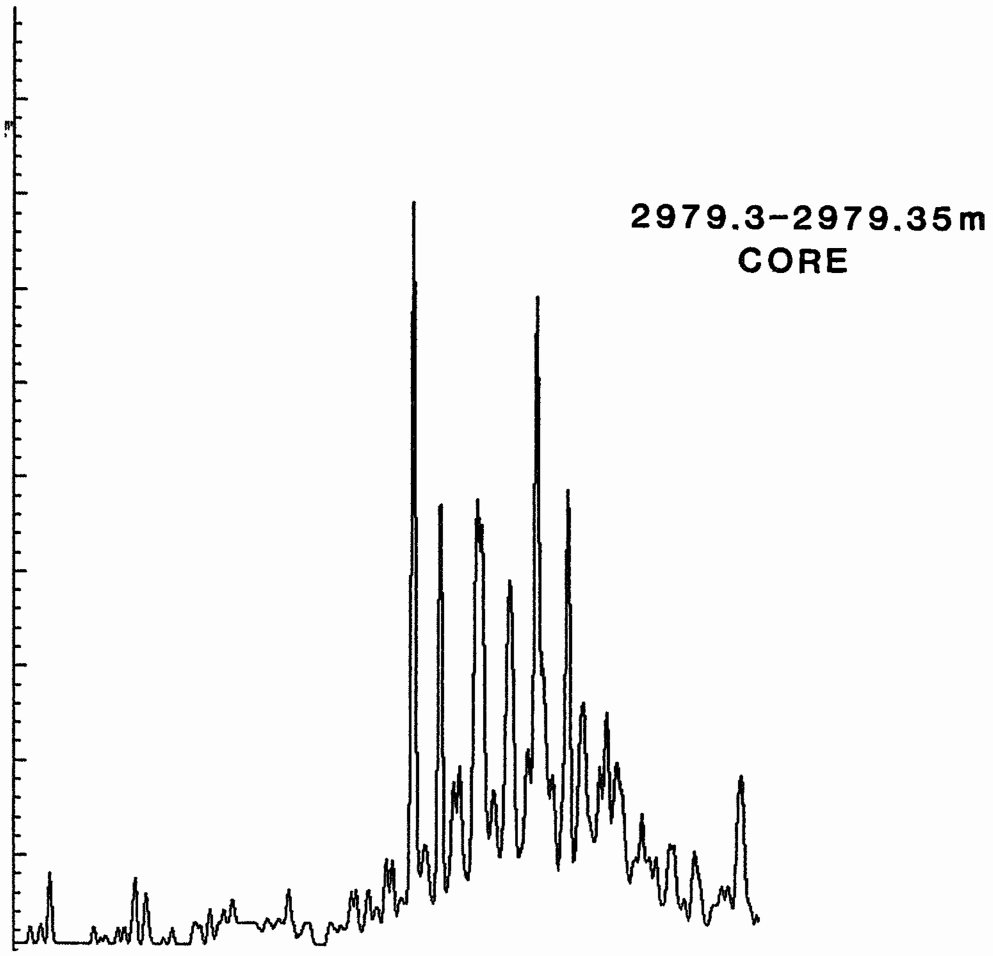


FIGURE 7e MASSFRAGMENTOGRAMS WELL 30/3-3

STERANES m/e 259



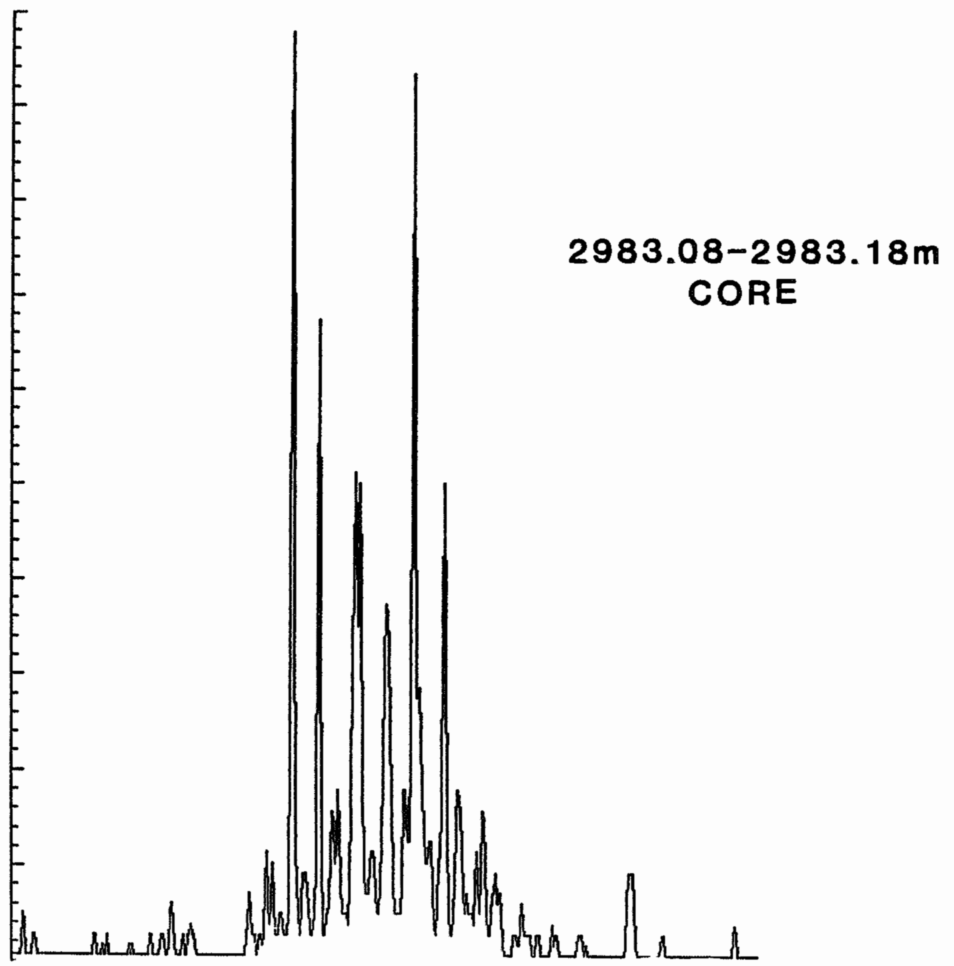
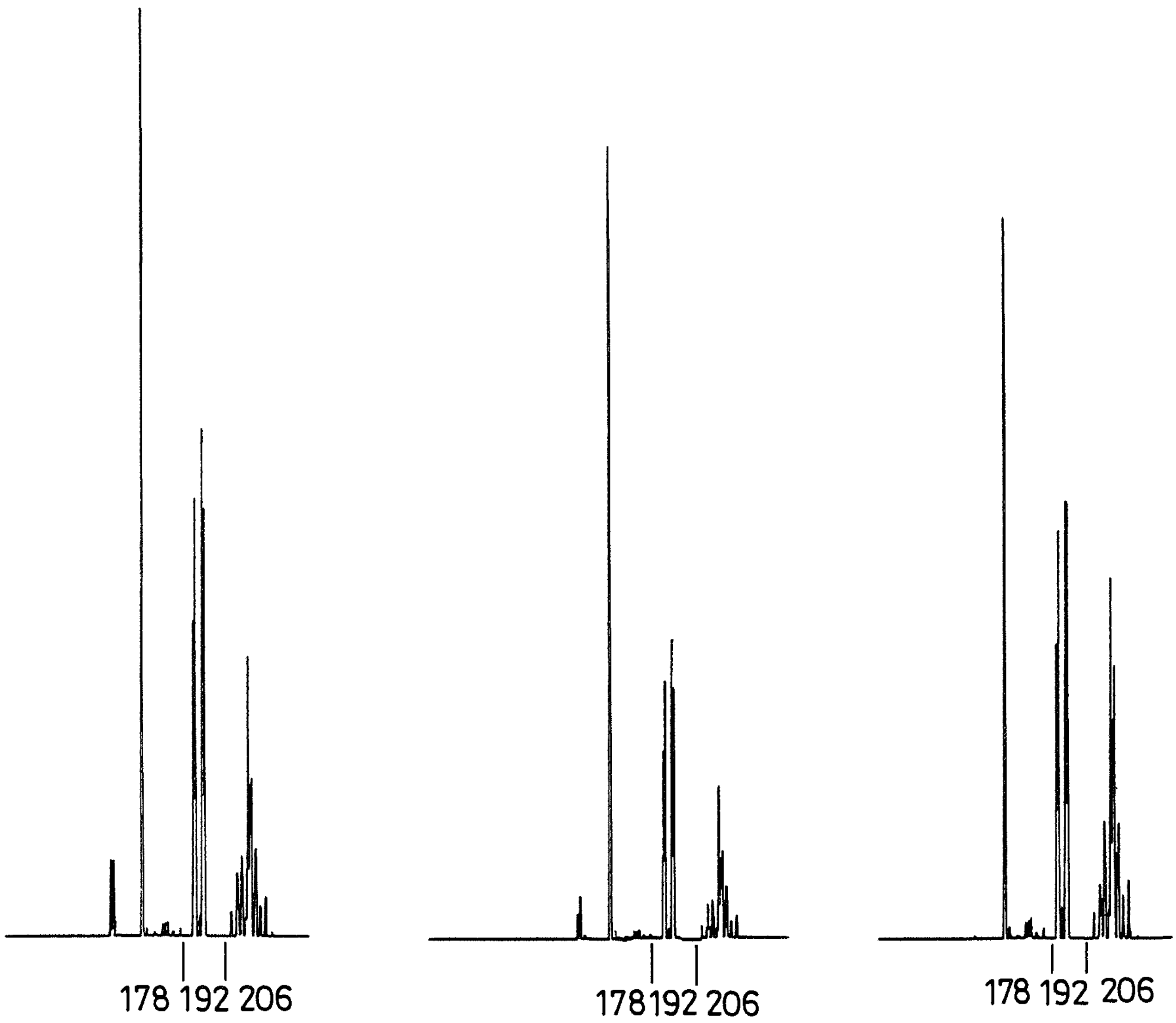


FIGURE 7f **MASSFRAGMENTOGRAMS** WELL 30/3-3

PHENANTHRENES



2979.3-2979.35m
CORE

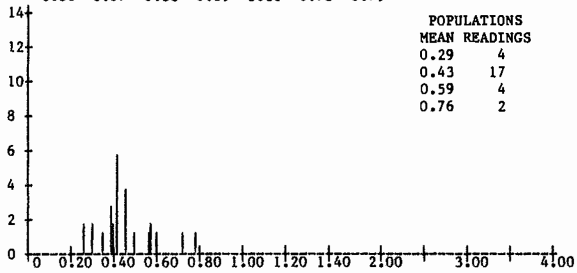
2983.08-2983.18m
CORE

2987.50-2987.59m
CORE

FIGURE 8a VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-050A DEPTH 1020 VITRINITE REFLECTANCE VALUES

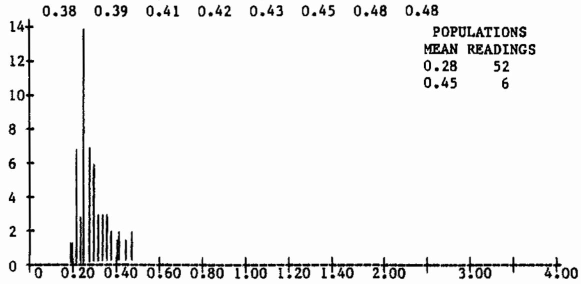
0.26	0.26	0.30	0.31	0.35	0.39	0.39	0.39	0.40	0.40
0.42	0.42	0.42	0.42	0.43	0.43	0.46	0.46	0.47	0.47
0.50	0.57	0.58	0.59	0.61	0.73	0.79			



REMARKS VERY DOMINANTLY AMORPHOUS MATERIAL SMALL VITRINITE PARTICLES OF VERY VARIABLE REFLECTANCE

SAMPLE 786-063A DEPTH 1215 VITRINITE REFLECTANCE VALUES

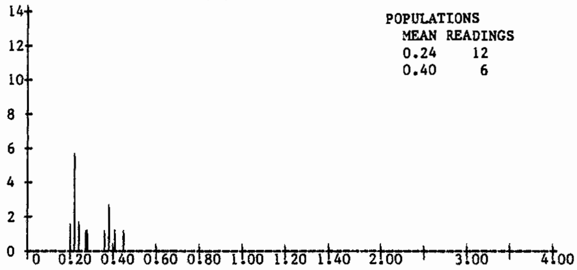
0.19	0.20	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.24
0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.28	0.28
0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.31
0.31	0.32	0.33	0.33	0.34	0.34	0.35	0.36	0.36	0.36
0.38	0.39	0.41	0.42	0.43	0.45	0.48	0.48		



REMARKS IDENTIFICATION DIFFICULT FREQUENTLY UNRECOGNISABLE

SAMPLE 786-069B DEPTH 1305 VITRINITE REFLECTANCE VALUES

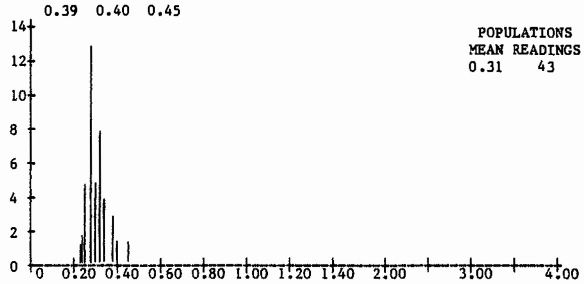
0.20	0.21	0.22	0.22	0.22	0.22	0.23	0.23	0.24	0.24
0.27	0.28	0.36	0.38	0.38	0.38	0.41	0.45		



REMARKS LARGELY UNRECOGNISABLE POOR SAMPLE

SAMPLE 786-080A DEPTH 1470 VITRINITE REFLECTANCE VALUES

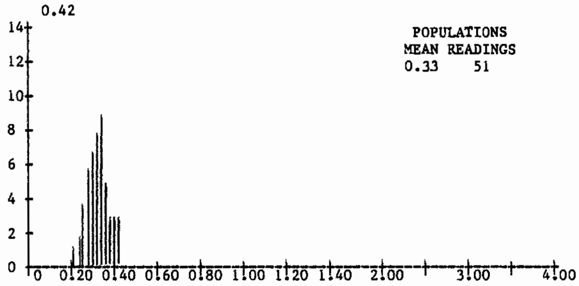
0.23	0.24	0.24	0.25	0.26	0.27	0.27	0.27	0.28	0.28
0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29
0.29	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.33
0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.35	0.38	0.38
0.39	0.40	0.45							



REMARKS MIXED ASSEMBLAGE FREQUENT VITRINITE MINOR INERTINITE.

SAMPLE 786-090A DEPTH 1620 VITRINITE REFLECTANCE VALUES

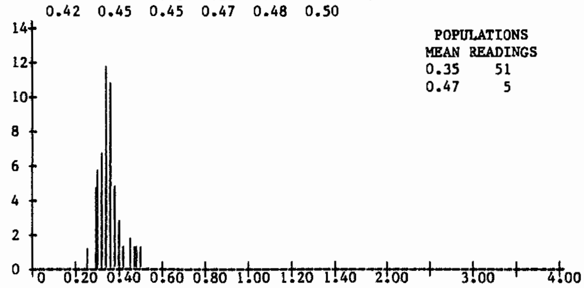
0.21	0.24	0.24	0.25	0.27	0.27	0.27	0.28	0.28	0.28
0.29	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.31
0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.34	0.34
0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.36	0.37	0.37
0.37	0.37	0.38	0.38	0.39	0.40	0.40	0.41	0.42	0.42
0.42									



REMARKS DIFFERENTIATION FREQUENTLY DIFFICULT - MEASURED 'VITRINITE INCLUDES MATERIAL OF VERY LOW REFLECTANCE

SAMPLE 786-098A DEPTH 1755 VITRINITE REFLECTANCE VALUES

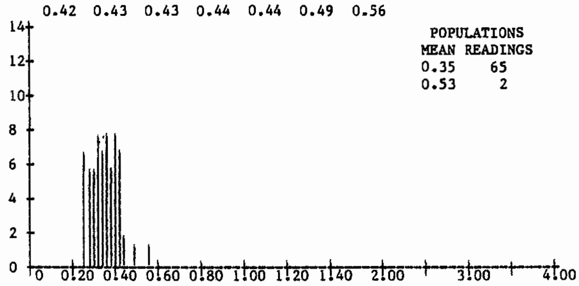
0.25	0.29	0.29	0.29	0.29	0.29	0.30	0.31	0.31	0.31
0.31	0.31	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.34
0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35
0.35	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37
0.37	0.37	0.38	0.38	0.38	0.39	0.39	0.40	0.41	0.41
0.42	0.45	0.45	0.47	0.48	0.50				



REMARKS MIXED ASSEMBLAGE. FREQUENT VITRINITE - SOME VARIATION IN R_o APPARENT MINOR INERTINITE.

SAMPLE 786-105A DEPTH 1845 VITRINITE REFLECTANCE VALUES

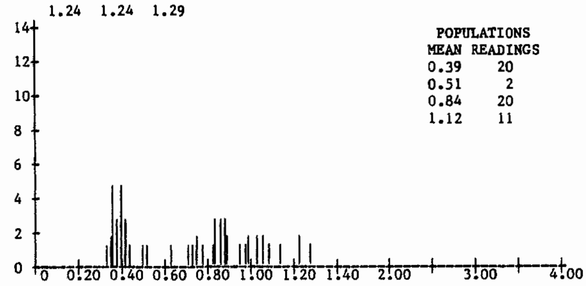
0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28
0.28	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.32
0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.34	0.34	0.35
0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.37
0.37	0.37	0.38	0.38	0.38	0.38	0.38	0.39	0.40	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.42	0.42	0.42	0.42
0.42	0.43	0.43	0.44	0.44	0.49	0.56			



REMARKS DOMINANTLY AMORPHOUS/ALGAL SIGNIFICANT VITRINITE MINOR INERTINITE.

SAMPLE 786-120B DEPTH 2055 VITRINITE REFLECTANCE VALUES

0.33	0.35	0.35	0.36	0.37	0.37	0.37	0.37	0.38	0.38
0.39	0.40	0.40	0.40	0.41	0.41	0.42	0.43	0.43	0.44
0.50	0.52	0.63	0.71	0.73	0.75	0.76	0.78	0.83	0.84
0.85	0.85	0.87	0.87	0.87	0.89	0.89	0.89	0.90	0.91
0.96	0.99	1.00	1.01	1.04	1.05	1.07	1.07	1.10	1.15
1.24	1.24	1.29							

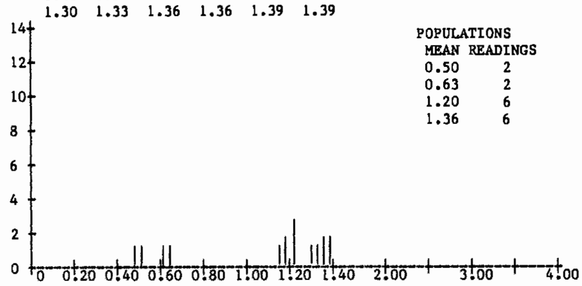


REMARKS FREQUENT REWORKING

FIGURE 8b VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-126A DEPTH 2145 VITRINITE REFLECTANCE VALUES

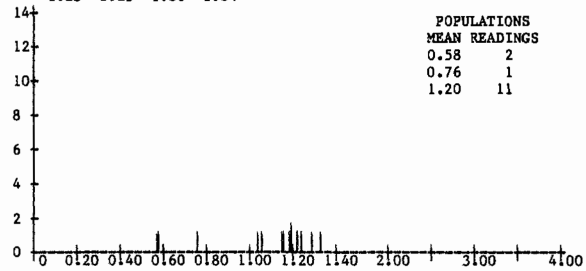
0.48 0.51 0.61 0.64 1.15 1.18 1.19 1.22 1.22 1.22
1.30 1.33 1.36 1.36 1.39 1.39



REMARKS SMALL SCATTERED PARTICLES OF REWORKED VITRINITE AND INERTINITE (PLUS BITUMEN STAINING) LITTLE INDIGENOUS VITRINITE SEEN. POOR SAMPLE

SAMPLE 786-130A DEPTH 2205 VITRINITE REFLECTANCE VALUES

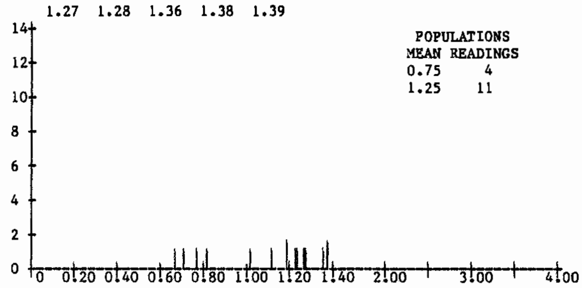
0.57 0.58 0.76 1.04 1.06 1.15 1.16 1.19 1.20 1.21
1.23 1.25 1.30 1.34



REMARKS AS 786-133A

SAMPLE 786-133A DEPTH 2250 VITRINITE REFLECTANCE VALUES

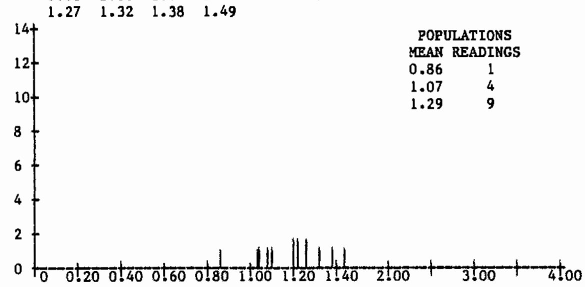
0.67 0.71 0.77 0.82 1.02 1.12 1.19 1.19 1.23 1.24
1.27 1.28 1.36 1.38 1.39



REMARKS SMALL SCATTERED POOR QUALITY PARTICLES OF INERTINITE AND REWORKED VITRINITE. FREQUENTLY UNSUITABLE FOR REFLECTANCE DETERMINATION. POOR SAMPLE.

SAMPLE 786-143A DEPTH 2400 VITRINITE REFLECTANCE VALUES

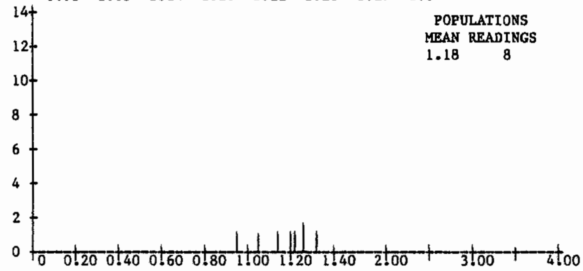
0.86 1.03 1.04 1.08 1.10 1.20 1.21 1.22 1.23 1.26
1.27 1.32 1.38 1.49



REMARKS AS 786-133A

SAMPLE 786-147A DEPTH 2460 VITRINITE REFLECTANCE VALUES

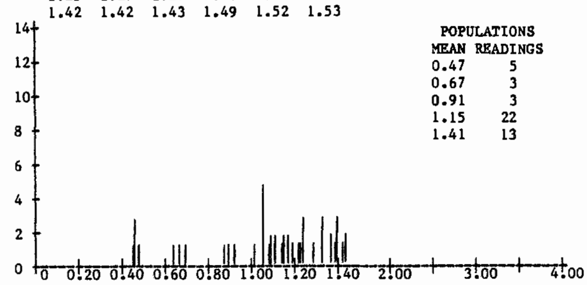
0.95 1.05 1.14 1.20 1.22 1.26 1.27 1.32



REMARKS AS 786-133A

SAMPLE 786-152A DEPTH 2535 VITRINITE REFLECTANCE VALUES

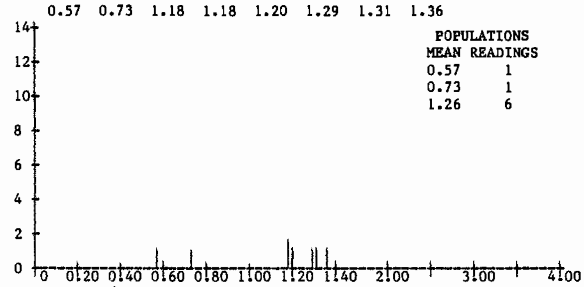
0.45 0.46 0.46 0.47 0.48 0.64 0.67 0.70 0.88 0.90
0.93 1.02 1.06 1.07 1.07 1.07 1.07 1.09 1.10 1.10
1.12 1.13 1.15 1.16 1.16 1.18 1.18 1.20 1.23 1.24
1.25 1.27 1.27 1.30 1.34 1.35 1.35 1.38 1.39 1.40
1.42 1.42 1.43 1.49 1.52 1.53



REMARKS CHIEFLY PARTICLES OF VITRINITE (GENERALLY REWORKED) PLUS INERTINITE. POOR SAMPLE.

SAMPLE 786-156A DEPTH 2595 VITRINITE REFLECTANCE VALUES

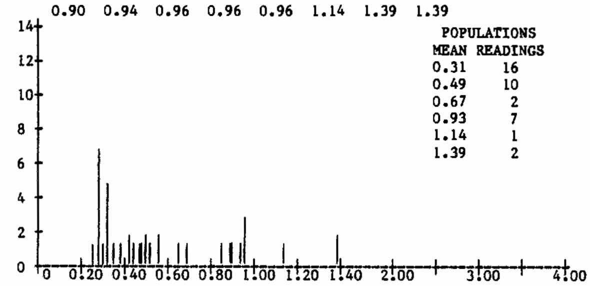
0.57 0.73 1.18 1.18 1.20 1.29 1.31 1.36



REMARKS AS 786-133A

SAMPLE 786-160A DEPTH 2655 VITRINITE REFLECTANCE VALUES

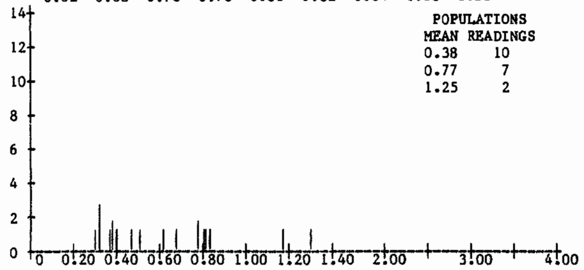
0.25 0.28 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.32
0.32 0.32 0.33 0.33 0.35 0.38 0.42 0.43 0.44 0.47
0.48 0.50 0.51 0.52 0.56 0.57 0.65 0.69 0.85 0.89
0.90 0.94 0.96 0.96 0.96 1.14 1.39 1.39



REMARKS VERY DOMINANTLY AMORPHOUS/ALGAL MINOR INERTINITE AND VITRINITE AS SMALL, UNRELIABLE PARTICLES, LARGELY REWORKED POOR SAMPLE

SAMPLE 786-163A DEPTH 2700 VITRINITE REFLECTANCE VALUES

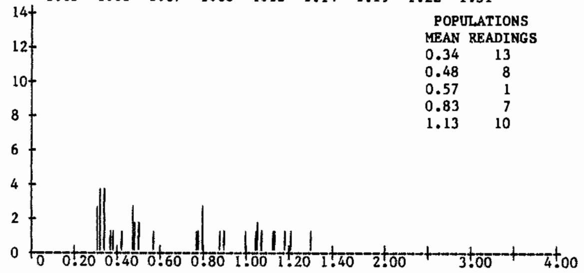
0.30	0.32	0.33	0.33	0.37	0.38	0.39	0.40	0.47	0.51
0.62	0.68	0.78	0.78	0.81	0.82	0.84	1.18	1.31	



REMARKS VERY DOMINANTLY AMORPHOUS/ALGAL. MINOR INERTINITE HANDFUL OF TINY, UNRELIABLE VITRINITE PARTICLES OF VARIABLE REFLECTANCE. POOR SAMPLE

SAMPLE 786-168A DEPTH 2775 VITRINITE REFLECTANCE VALUES

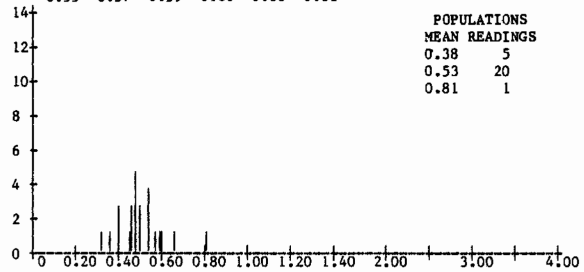
0.31	0.31	0.31.	0.32	0.32	0.33	0.33	0.34	0.35	0.35
0.35	0.37	0.38	0.42	0.47	0.47	0.47	0.48	0.48	0.50
0.50	0.57	0.77	0.78	0.80	0.81	0.81	0.88	0.90	1.00
1.05	1.06	1.07	1.08	1.13	1.14	1.19	1.22	1.31	



REMARKS MIXED ASSEMBLAGE VITRINITE AS SMALL PARTICLES BOTH REWORKED AND OF ANOMALOUSLY LOW R_o - POSSIBLY CAVED AND/OR ADDITIVE.

SAMPLE 786-176B DEPTH 2895 VITRINITE REFLECTANCE VALUES

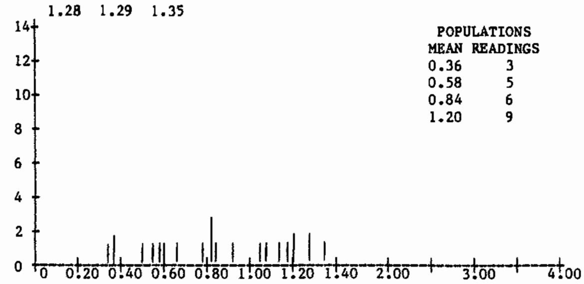
0.32	0.36	0.40	0.41	0.41	0.45	0.46	0.47	0.47	0.48
0.48	0.49	0.49	0.49	0.50	0.51	0.51	0.54	0.55	0.55
0.55	0.57	0.59	0.60	0.66	0.81				



REMARKS SMALL SCATTERED VITRINITE PARTICLES - SOME VARIATION IN REFLECTANCE APPARENT

SAMPLE 786-181B DEPTH 2970 VITRINITE REFLECTANCE VALUES

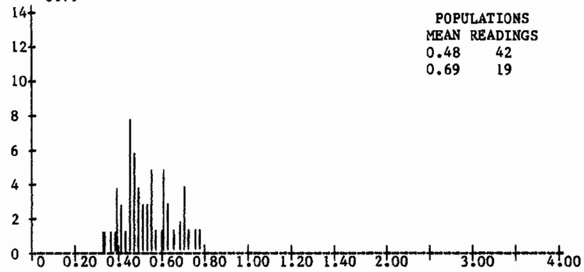
0.34	0.37	0.37	0.50	0.55	0.58	0.60	0.66	0.78	0.82
0.83	0.83	0.84	0.92	1.05	1.08	1.14	1.18	1.21	1.21
1.28	1.29	1.35							



REMARKS MIXED ASSEMBLAGE. SIGNIFICANT VITRINITE AND INERTINITE SIGNIFICANT VARIATION IN REFLECTANCE APPARENT - WIDESPREAD REWORKING

SAMPLE 786-165A DEPTH 2730 VITRINITE REFLECTANCE VALUES

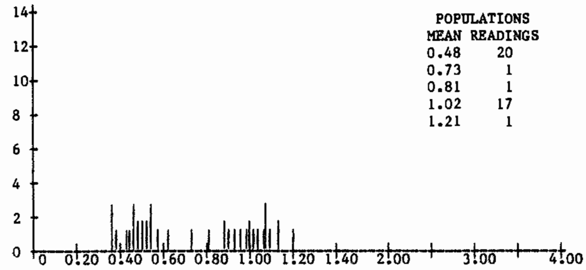
0.33	0.34	0.37	0.39	0.40	0.41	0.41	0.41	0.42	0.43
0.43	0.44	0.46	0.46	0.46	0.46	0.46	0.47	0.47	0.47
0.48	0.48	0.48	0.48	0.49	0.49	0.50	0.50	0.51	0.51
0.52	0.53	0.53	0.54	0.54	0.54	0.56	0.57	0.57	0.57
0.57	0.58	0.61	0.62	0.63	0.63	0.63	0.63	0.64	0.64
0.65	0.67	0.70	0.70	0.72	0.73	0.73	0.73	0.74	0.77
0.79									



REMARKS DOMINANTLY ALGAL/AMORPHOUS SIGNIFICANT INERTINITE AND VITRINITE - LATTER AS GENERALLY POOR PARTICLES OF VARIABLE REFLECTANCE

SAMPLE 786-171A DEPTH 2820 VITRINITE REFLECTANCE VALUES

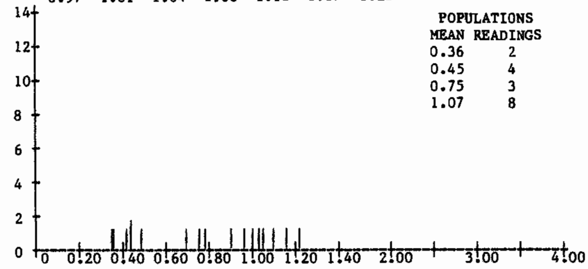
0.36	0.36	0.37	0.38	0.43	0.44	0.46	0.46	0.47	0.48
0.48	0.50	0.50	0.52	0.53	0.54	0.55	0.55	0.57	0.62
0.73	0.81	0.88	0.89	0.90	0.93	0.96	0.99	1.00	1.01
1.02	1.04	1.07	1.08	1.08	1.09	1.10	1.14	1.14	1.21



REMARKS MIXED VITRINITE OF VERY VARIABLE REFLECTANCE, FREQUENTLY REWORKED. SUGGESTIONS OF CAVING/ ADDITIVE

SAMPLE 786-180B DEPTH 2955 VITRINITE REFLECTANCE VALUES

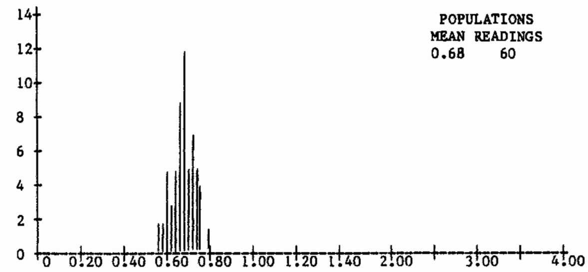
0.35	0.36	0.42	0.44	0.45	0.49	0.70	0.76	0.79	0.91
0.97	1.01	1.04	1.06	1.11	1.17	1.23			



REMARKS MIXED ASSEMBLAGE SIGNIFICANT VITRINITE AND INERTINITE WIDESPREAD REWORKING.

SAMPLE 786-213A DEPTH 2986.93 VITRINITE REFLECTANCE VALUES

0.56	0.57	0.58	0.59	0.60	0.60	0.60	0.61	0.61	0.62
0.63	0.63	0.64	0.65	0.65	0.65	0.65	0.66	0.66	0.66
0.66	0.66	0.66	0.67	0.67	0.67	0.68	0.68	0.68	0.68
0.68	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.70
0.71	0.71	0.71	0.72	0.72	0.73	0.73	0.73	0.73	0.73
0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.76	0.79

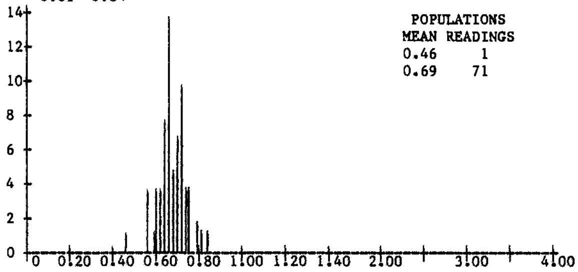


REMARKS AS 786-209B

FIGURE 8d VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-185B DEPTH 3030 VITRINITE REFLECTANCE VALUES

0.46	0.56	0.56	0.57	0.57	0.59	0.60	0.60	0.61	0.61
0.62	0.62	0.63	0.63	0.64	0.64	0.64	0.65	0.65	0.65
0.65	0.65	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.68	0.68
0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.71	0.71	0.71
0.72	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73
0.74	0.74	0.74	0.74	0.75	0.75	0.76	0.76	0.79	0.79
0.81	0.84								



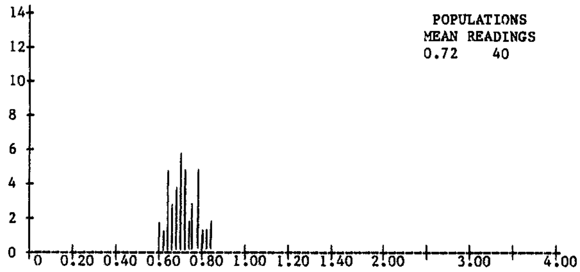
POPULATIONS

MEAN	READINGS
0.46	1
0.69	71

REMARKS CHIEFLY VITRINITE PARTICLES OF VARIABLE SIZE, LARGER PARTICLES FREQUENTLY OF COALY APPEARANCE.

SAMPLE 786-188C DEPTH 3057 VITRINITE REFLECTANCE VALUES

0.60	0.61	0.62	0.64	0.64	0.65	0.65	0.65	0.66	0.67
0.67	0.68	0.69	0.69	0.69	0.70	0.70	0.71	0.71	0.71
0.71	0.72	0.72	0.72	0.73	0.73	0.74	0.74	0.75	0.76
0.77	0.78	0.78	0.78	0.79	0.79	0.80	0.82	0.84	0.84



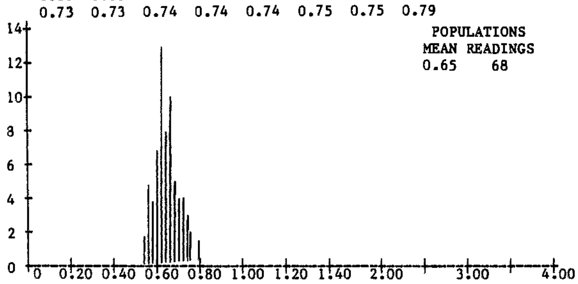
POPULATIONS

MEAN	READINGS
0.72	40

REMARKS FREQUENT GOOD VITRINITE PARTICLES

SAMPLE 786-190A DEPTH 3105 VITRINITE REFLECTANCE VALUES

0.54	0.54	0.56	0.56	0.57	0.57	0.57	0.58	0.58	0.59
0.59	0.60	0.60	0.61	0.61	0.61	0.61	0.61	0.62	0.62
0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63
0.63	0.64	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.66
0.66	0.66	0.66	0.66	0.66	0.66	0.67	0.67	0.67	0.68
0.68	0.68	0.69	0.69	0.70	0.70	0.70	0.71	0.72	0.72
0.73	0.73	0.74	0.74	0.74	0.75	0.75	0.79		



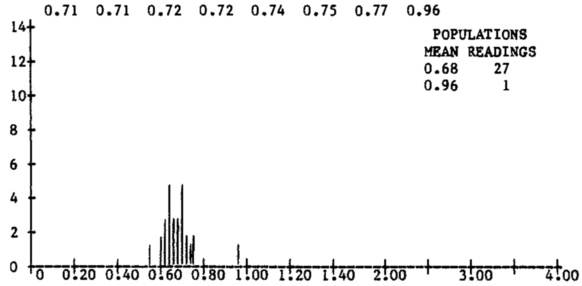
POPULATIONS

MEAN	READINGS
0.65	68

REMARKS FREQUENT GOOD-SIZED VITRINITE PARTICLES

SAMPLE 786-216A DEPTH 3125 VITRINITE REFLECTANCE VALUES

0.55	0.60	0.61	0.62	0.62	0.63	0.64	0.64	0.64	0.65
0.65	0.66	0.66	0.66	0.68	0.68	0.69	0.70	0.70	0.70
0.71	0.71	0.72	0.72	0.74	0.75	0.77	0.96		



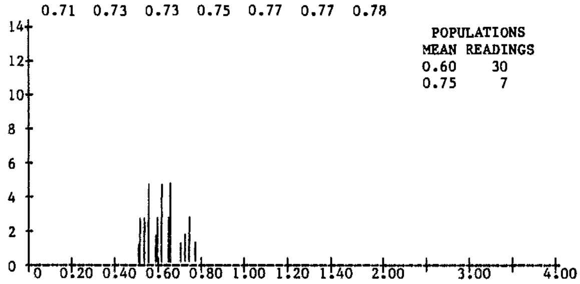
POPULATIONS

MEAN	READINGS
0.68	27
0.96	1

REMARKS ALMOST EXCLUSIVELY VITRINITE

SAMPLE 786-192A DEPTH 3135 VITRINITE REFLECTANCE VALUES

0.51	0.52	0.52	0.53	0.54	0.55	0.55	0.56	0.56	0.56
0.56	0.57	0.59	0.59	0.60	0.60	0.61	0.62	0.62	0.63
0.63	0.63	0.65	0.65	0.65	0.66	0.66	0.66	0.67	0.67
0.71	0.73	0.73	0.75	0.77	0.77	0.78			



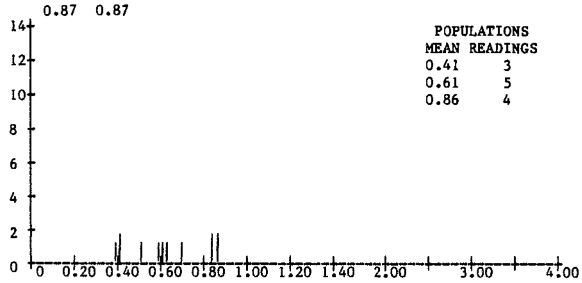
POPULATIONS

MEAN	READINGS
0.60	30
0.75	7

REMARKS FREQUENT VITRINITE. SOME VARIATION IN REFLECTANCE APPARENT

SAMPLE 786-217A DEPTH 3186 VITRINITE REFLECTANCE VALUES

0.39	0.41	0.41	0.51	0.59	0.61	0.63	0.70	0.84	0.85
0.87	0.87								



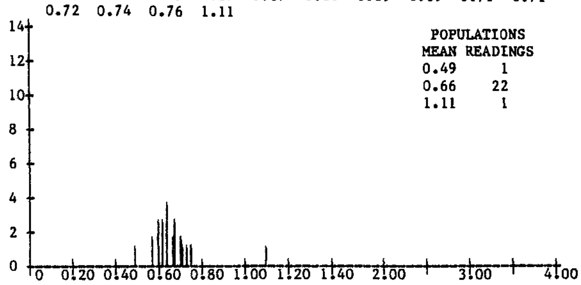
POPULATIONS

MEAN	READINGS
0.41	3
0.61	5
0.86	4

REMARKS MIXED ASSEMBLAGE SOME VARIATION IN REFLECTANCE APPARENT

SAMPLE 786-196A DEPTH 3195 VITRINITE REFLECTANCE VALUES

0.49	0.57	0.57	0.60	0.61	0.61	0.62	0.63	0.63	0.64
0.64	0.65	0.65	0.67	0.67	0.68	0.69	0.69	0.71	0.71
0.72	0.74	0.76	1.11						



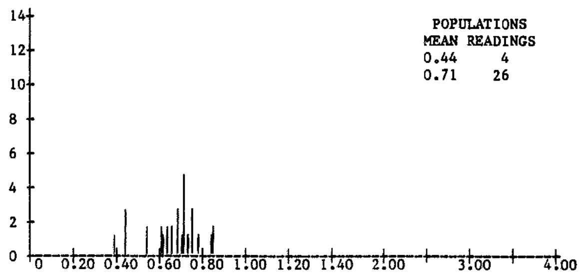
POPULATIONS

MEAN	READINGS
0.49	1
0.66	22
1.11	1

REMARKS FREQUENT SIGNS OF TURBODRILLING MIXTURE OF VITRINITE AND BITUMEN STAINING SIGNIFICANT INERTINITE.

SAMPLE 786-218A DEPTH 3297 VITRINITE REFLECTANCE VALUES

0.39	0.44	0.45	0.45	0.54	0.55	0.61	0.61	0.62	0.64
0.65	0.66	0.67	0.69	0.69	0.69	0.71	0.72	0.72	0.73
0.73	0.73	0.74	0.76	0.77	0.77	0.79	0.85	0.86	0.87

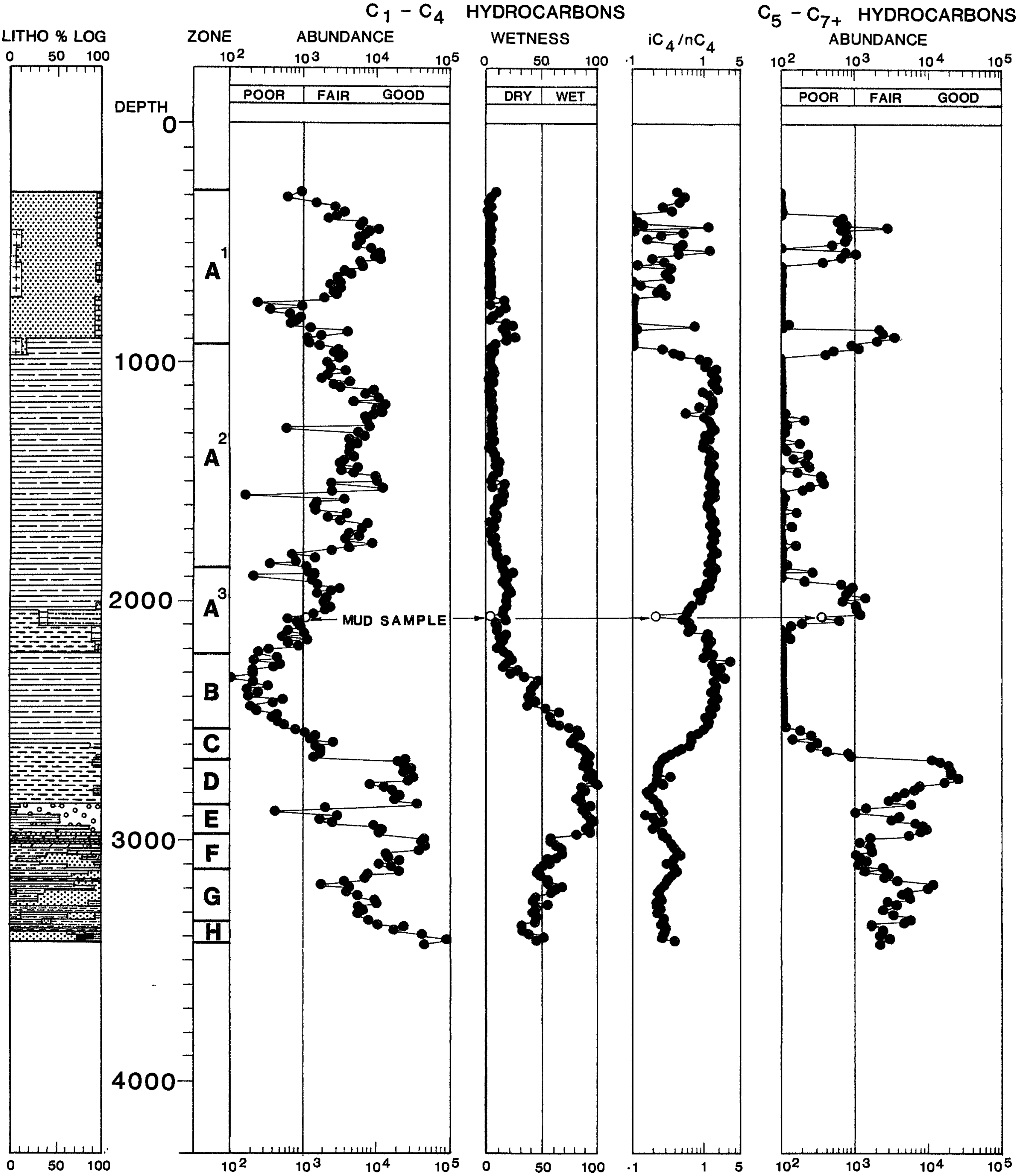


POPULATIONS

MEAN	READINGS
0.44	4
0.71	26

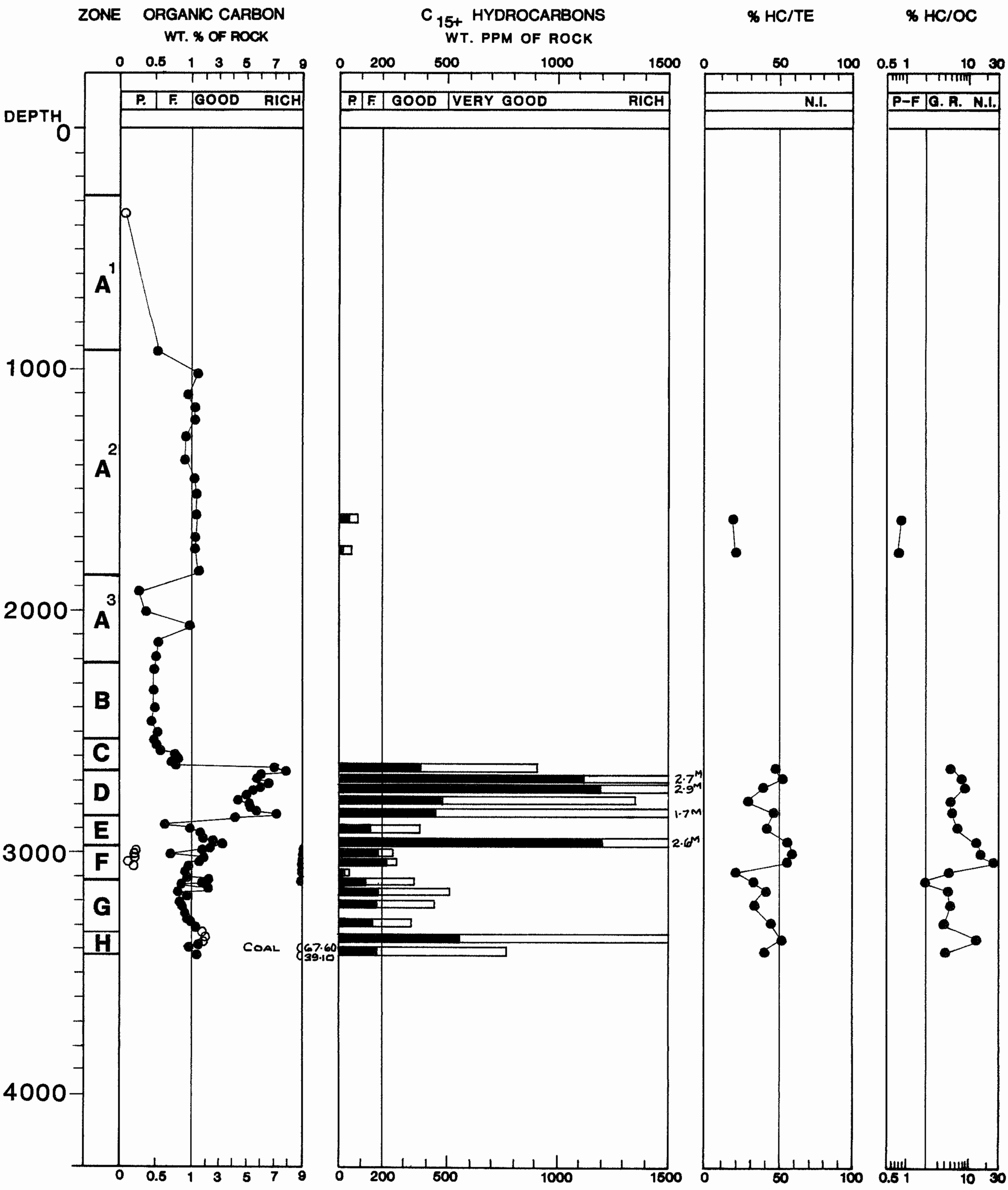
REMARKS PARTICLES OF VITRINITE AND INERTINITE SOME VARIATION IN REFLECTANCE APPARENT

FIGURE 1 C_1-C_7 HYDROCARBONS WELL 30/3-3



LIMESTONE	SILTSTONE	iC_4	- ISOBUTANE
DOLOMITE	SANDSTONE	nC_4	- NORMAL BUTANE
SHALE	EVAPORITE	ABUNDANCE	- VOLUME PPM OF ROCK
MUDSTONE/ CLAYSTONE	IGNEOUS	WETNESS	- % C_2-C_4 IN C_1-C_4
COAL	L.C.M.		

FIGURE 2 **RICHNESS** WELL 30/3-3



● SHALE
○ OTHER LITHOLOGIES

P-N - PARAFFIN - NAPHTHENES
AROM - AROMATICS
HC - C_{15+} HYDROCARBONS
OC - ORGANIC CARBON
TE - TOTAL C_{15+} EXTRACT

P - POOR
F - FAIR
G - GOOD
R - RICH
N.I. - NON-INDIGENOUS HYDROCARBONS

FIGURE 3 **ROCKEVAL DATA** WELL 30/3-3

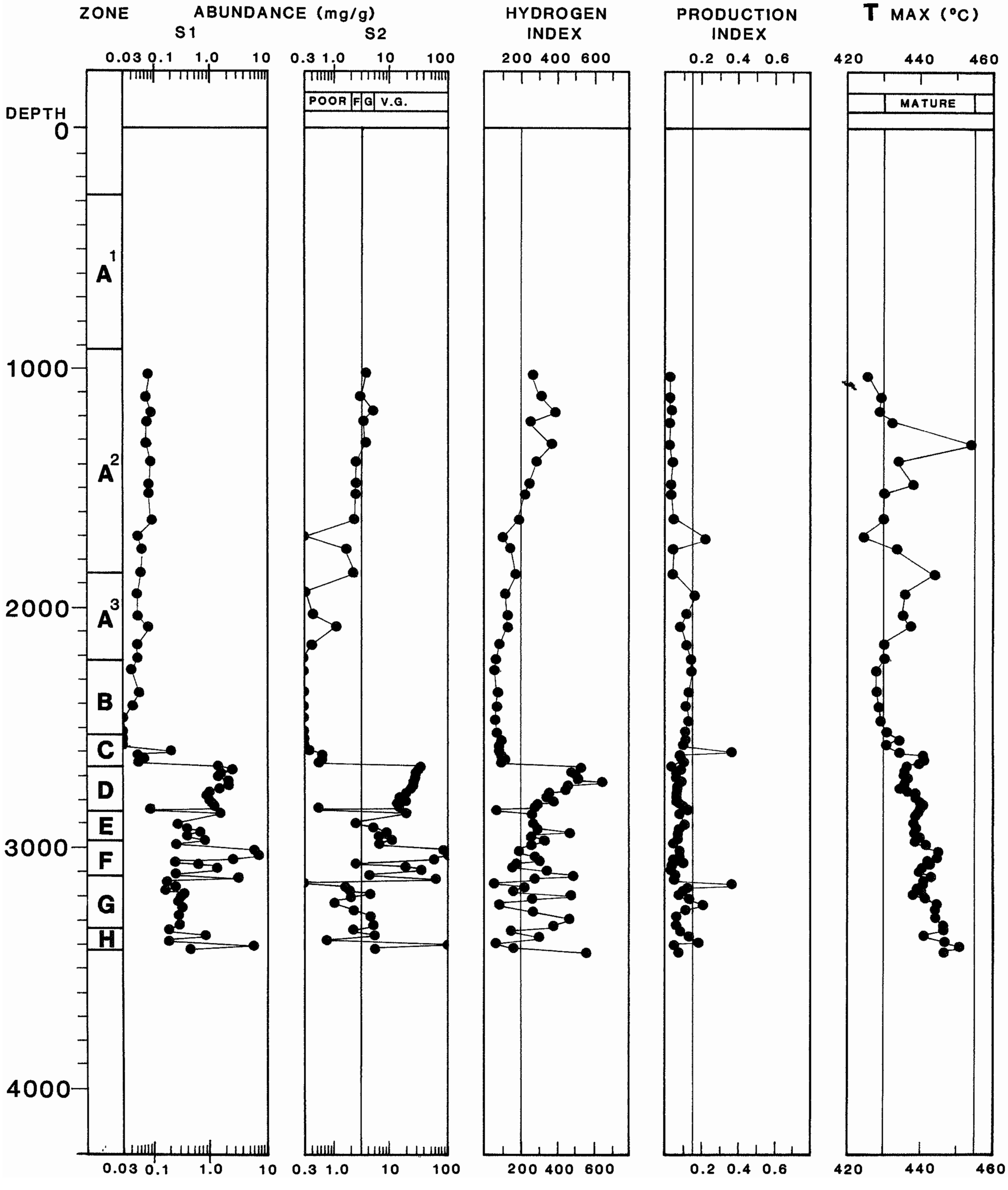


FIGURE 4b **PYROLYSIS GC** WELL 30/3-3

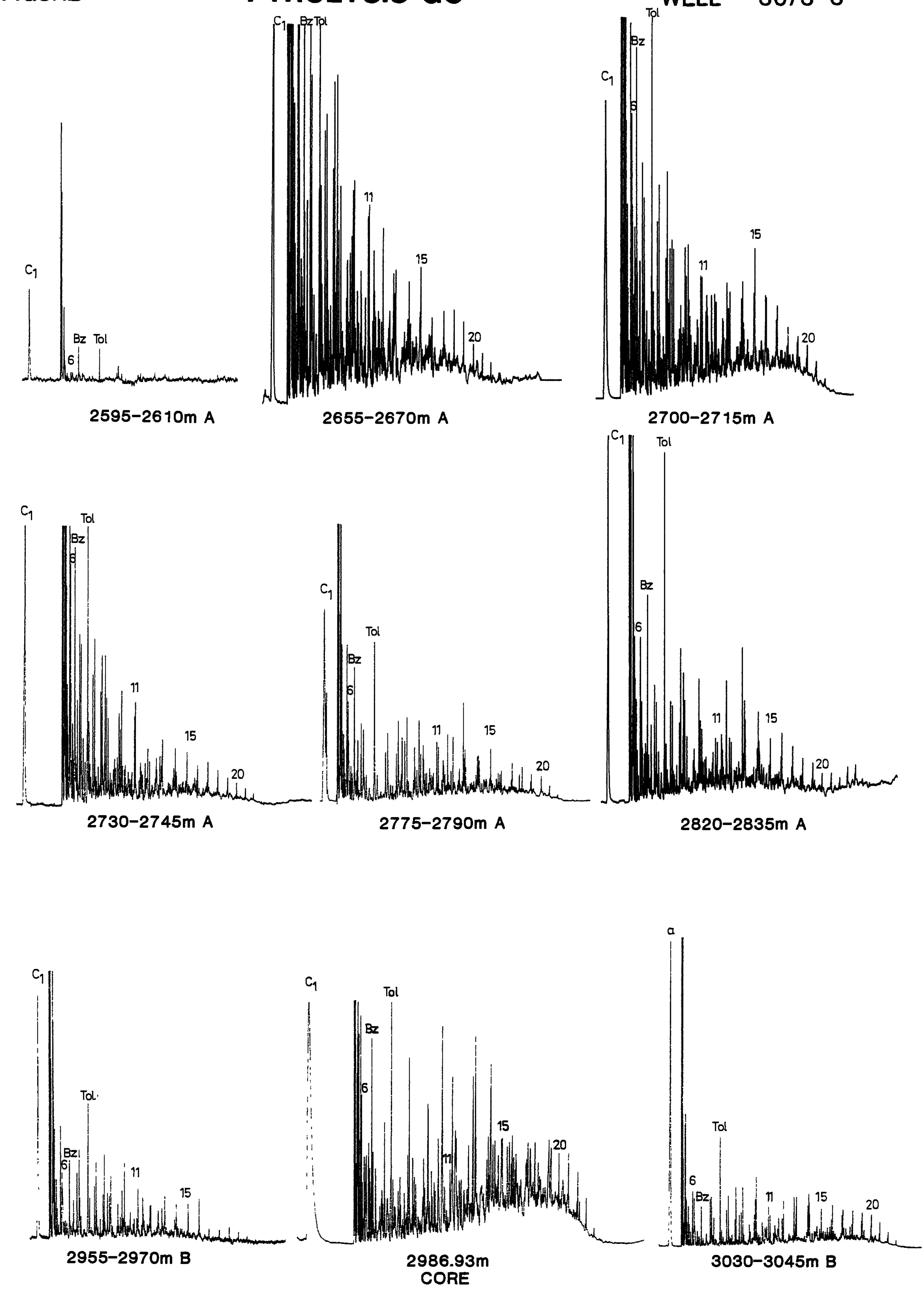


FIGURE 4a **PYROLYSIS GC** WELL 30/3-3

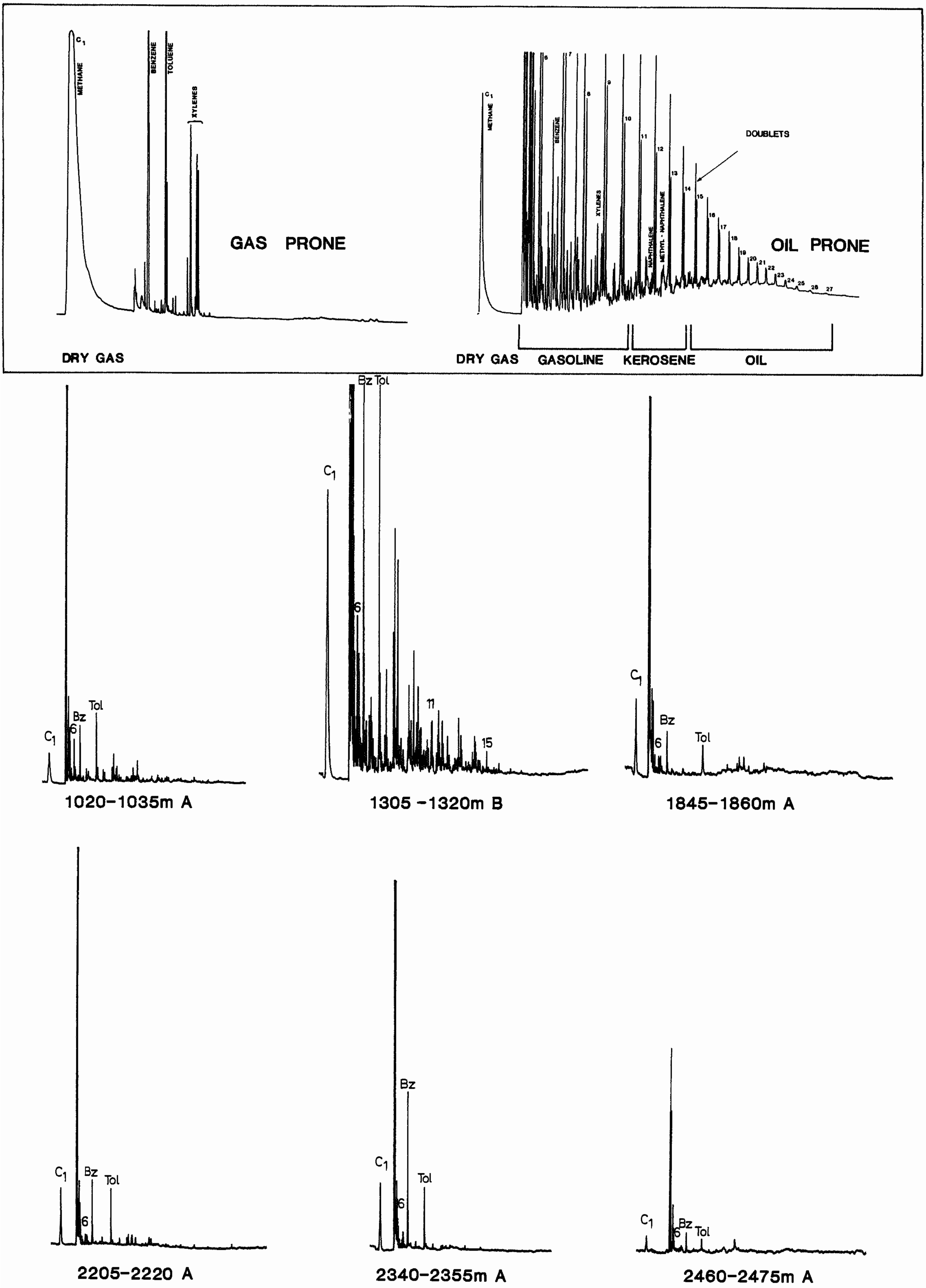
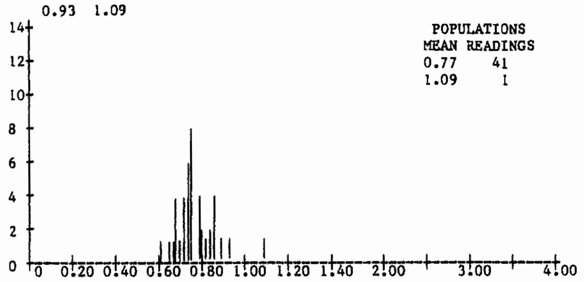


FIGURE 8e VITRINITE REFLECTANCE WELL 30/3-3

SAMPLE 786-206A DEPTH 3345 VITRINITE REFLECTANCE VALUES

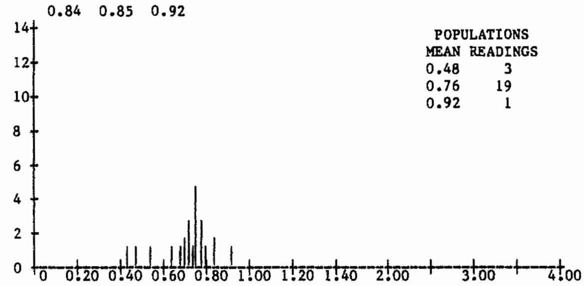
0.61	0.65	0.67	0.68	0.68	0.69	0.69	0.70	0.72	0.73
0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75
0.75	0.76	0.76	0.76	0.77	0.77	0.79	0.79	0.79	0.79
0.80	0.80	0.82	0.84	0.84	0.86	0.86	0.86	0.87	0.89
0.93	1.09								



REMARKS FAIRLY MIXED ASSEMBLAGE. VITRINITE DOMINANT - FREQUENTLY OF COALY APPEARANCE.

SAMPLE 786-219A DEPTH 3376 VITRINITE REFLECTANCE VALUES

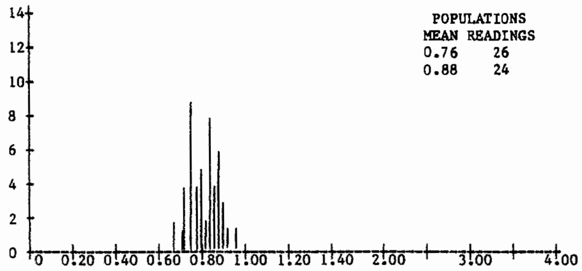
0.43	0.47	0.54	0.64	0.68	0.70	0.70	0.72	0.73	0.73
0.74	0.75	0.76	0.77	0.77	0.77	0.78	0.78	0.78	0.80
0.84	0.85	0.92							



REMARKS AS 786-218A

SAMPLE 786-209B DEPTH 3390 VITRINITE REFLECTANCE VALUES

0.67	0.67	0.71	0.72	0.72	0.73	0.73	0.75	0.75	0.75
0.75	0.76	0.76	0.77	0.77	0.77	0.78	0.78	0.78	0.79
0.80	0.80	0.81	0.81	0.81	0.82	0.83	0.84	0.84	0.84
0.84	0.84	0.84	0.85	0.85	0.86	0.86	0.87	0.87	0.88
0.88	0.88	0.89	0.89	0.89	0.90	0.91	0.91	0.92	0.96



REMARKS ALMOST EXCLUSIVELY VITRINITE AS LARGE PARTICLES/CUTTINGS