GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

GEOCHEMICAL ANALYSIS REPORT
WELL NOCS 30/9-1

Authors: Malvin Bjorøy
Kjell Arne Bakken
Peter B. Hall
Rita Løberg
Lorraine Buxton
Ian L. Ferriday

Geolab Nor A/S
Hornebergveien 5
7038 Trondheim
Norway

Date : 23.06.89

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

LIST OF CONTENTS

LIST OF FIGURES

APPENDIX 1: LIST OF TABLES

SUMMARY

Well NOCS 30/9-1 is situated in the southern part of the Oseberg Field in the Norwegian sector of the North Sea.

Samples were analysed from the Cretaceous through the Jurassic.

The well is immature/moderately mature down to about 2750 m within the Etive Fm. Below it is mature. Peak oil generation zone is estimated at about 3500 m.

The petroleum potential of the Draupne and Heather Fms. is rich and the potential is for oil, but the formations are immature/moderately mature. The Drake Fm. has a good petroleum potential, probably for oil, but it has a maturity in top of the oil window and has probably not contributed much to the oil found in the well.

The Ness Fm. (and possibly the Etive Fm.) contain oil. This oil seems to have affected all samples below the Ness Fm. by staining the samples.

The Ness Fm. oil has GC-MS patterns typical for well mature Viking Graben hydrocarbons.

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

INTRODUCTION

Well NOCS 30/9-1 is situated in the southern part of the Oseberg Field in the Norwegian sector of the North Sea. The total drilled depth was 2895 m. Samples were collected between 2350 m and 2895 m from the Norwegian Petroleum Directorate in Stavanger. A total of 155 samples was collected, washed (only the cuttings samples) and described. The analysed section of the well is from 2365 m to 2895 m, with sampling interval 5 m for the cuttings samples and a more variable sampling interval for the core chip samples. A careful selection of suitable samples was made for screening analysis (i.e. TOC and Rock-Eval analysis). Eighty samples were selected for this analysis, and from the data obtained the samples were chosen for follow-up analyses. These were:

Thermal extraction - pyrolysis - gas chromatography	32 samples
Extraction, MPLC fractionation, saturated and aromatic hydrocarbon gas chromatography	10 samples
Vitrinite reflectance microscopy	13 samples
Visual kerogen analysis	12 samples
Gas chromatography - mass spectrometry	4 samples
Isotope analysis of C_{15}+ fractions	4 samples

Tables listing in detail which samples were analysed, the results and logs are given in the appendix. The following is a list of formation tops for the sampled section of the well:

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Viking Group	2420 - 2485 m
Draupne Formation	2420 - 2470 m
Heather Formation	2470 - 2485 m
Brent Group	2485 - 2783 m
Ness Formation	2485 - 2735 m
Etive Formation	2735 - 2783 m
Dunlin Group	2783 - 2895 m
Drake Formation	2783 - 2895 m, TD

LITHOLOGY AND TOTAL ORGANIC CARBON CONTENT

Figure 1 shows the variation in TOC over the analysed interval of the well plotted with a generalised lithological column.

Cretaceous (? - 2420 m)

Fourteen samples were described from this section (from 2350 m and down). Samples in the upper part of the section are dominated by white chalk and medium grey marl. The samples in the lower part are dominated by green-grey, brown-grey and grey-red claystones. One marl (from 2365 m), one claystone (from 2390 m) and one chalk (from 2400 m) were analysed for TOC content. The marl and the claystone have fair TOC contents (0.84 % and 0.50 %), while the chalk is almost barren of organic material (0.06 % TOC).

Jurassic (2420 - 2485 m)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2470 m)

Ten samples were described from this formation (from and including 2420 m, to and including 2465 m). The samples are totally dominated by a dark grey to dusky yellowish brown claystone. This claystone was analysed for TOC content in all of the ten samples. All ten samples have rich TOC contents (2.98 % to 6.94 %).

Heather Formation (2470 - 2485 m)

Four samples were described from this formation (from and including 2470 m, to and including 2485 m). The samples are totally dominated by a dark grey to dusky yellowish brown claystone. This claystone was analysed for TOC content in all of the four samples. All four samples have rich TOC contents (4.67 % to 5.81 %). The claystone seems to become siltier downwards. In addition to the four above mentioned samples, two samples (claystone from 2490 m and siltstone from 2495 m) have lithologies and analytical results which indicate that they belong to the same facies as the Heather Fm. samples. These two samples are therefore in the following chapters regarded as belonging to the Heather Fm. They both have rich TOC contents (5.23 % and 4.10 %).

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Seventy-six samples were described from this formation, including the two above mentioned samples (from and including 2490 m, to and including 2735 m). Forty-nine of these samples are cuttings samples and the other twenty-seven are core chips. The top of the formation (down to about 2520 m) consists of a dark grey to dusky yellowish brown siltstone. From 2520 m to 2555 m the samples are totally dominated by contaminants and the true in-situ lithology cannot be extracted from the cuttings samples. From 2555 m and down the formation consists of interbedded sandstones, siltstones and claystones of grey colours. These may represent coarsening/fining sequences within the same depositional environment. Around 2700 m coal stringers are present.

Thirty-eight samples were analysed for TOC content from the Ness Fm., excluding the two siltstones described as belonging to the Heather Fm. facies. Ten of the samples are siltstones, fourteen are sandstones, ten are claystones, one is a carbonate, two are coals and one is a conglomerate matrix.

The siltstones from the upper part of the formation (nine samples down to 2630 m) all have rich TOC contents (3.21 % to 6.27 %). The one siltstone from the lower parts of the formation (from 2697.02 m) has a fair TOC content (0.51 %).

The claystones have very variable TOC contents ranging from poor to rich (0.10 % to 4.56 %), but most have contents in the poor to fair range. The single carbonate sample analysed has a TOC content of 0.72 %.

The two analysed coal samples have rich TOC contents (7.92 % and 33.03 %). However, the TOC contents are much lower than would be anticipated for pure coal and therefore it seems that these samples contain a mixture of coal and clay.

The TOC content of the sandstones and the conglomerate matrix sample is highly variable, ranging from 0.23 % to 5.25 %. The variations are believed to be at least partly due to the presence of coal particles in the sandstones.

Etive Formation (2735 - 2783 m)

Twenty-five samples were described from this formation (from and including 2739.3 m, to and including 2783 m). Six of these were cuttings samples, the other nineteen were core chips. The formation consists predominantly of sandstones with thin beds of claystone and siltstone. Twelve samples were analysed for TOC content, one being claystone (from 2740 m), one of siltstone (from 2783 m) and the other ten being sandstones.

The claystone has a good TOC content (1.55 %), while the siltstone has a fair TOC content (0.96 %). The sandstones have generally low TOC contents (0.07 % to 0.38 %).

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

Twenty-five samples were described from this formation (from 2783.8 m, to 2895 m inclusive). Two of the samples are core chips, the other twenty-three are cuttings samples. The very top of the formation consists of dark grey to dusky yellowish brown claystone. Most of the formation (down to about 2850 m) consists of sandstone. From about 2850 m the dominant lithology is a brown-grey to medium grey siltstone that grades to claystone at the base of the formation.

Eleven samples from the formation were analysed. Two claystones from the upper part of the formation (from 2784.75 m and 2800 m) have good TOC contents (1.47 % and 1.06 %). The two sandstones analysed (from 2830 m and 2845 m) have TOC contents of 0.25 % and 0.94 %. The siltstones and claystones from the lower part of the formation (from 2850 m and down) have good to rich TOC contents (1.29 % to 2.62 %). The TOC content of these siltstones and claystones generally increases downwards.

ROCK-EVAL ANALYSIS

Eighty samples were analysed. The data are listed in Table 2, Appendix 1. Production index is plotted in Figure 2, Tmax in Figure 3 and Tmax versus hydrogen index in Figure 4.

Kerogen Type and Richness
(Hydrogen Index, Oxygen Index and Petroleum Potential)

Cretaceous (? - 2420 m)

Three samples were analysed, one marl (2365 m), one claystone (2390 m) and one chalk sample (from 2400 m). The petroleum potential is poor for all three samples, ranging from below detection limit to 0.6 mg HC/g rock. The hydrogen indices range from 17 to 55, while the oxigen indices range from 127 to 850. The samples appear to contain only kerogen type IV and are without any potential for hydrocarbon generation.

Jurassic (2420 - 2895 m, TD)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2479 m)

Ten samples were analysed. They all have a rich petroleum potential (20.5 to 29.5 mg HC/g rock). They have hydrogen indices ranging from 399 to 668 and oxygen indices ranging from 17 to 71. The formation contains kerogen type II and has a rich potential for generation of oil, but has not yet reached the oil window (see discussion on maturity below).

Heather Formation (2470 - 2485 m)

Six samples were analysed, including the two samples from 2490 m and 2495 m (see discussion in lithology chapter). The petroleum potential is good to rich (13.2 to 22.7 mg HC/g rock). The hydrogen indices range from 309 to 379 and the oxygen indices range from 25 to 40. The hydrogen indices are generally highest towards the top as are the petroleum potentials. The samples towards the top of the formation contain kerogen type II. This changes to kerogen type II/III towards the base of the formation. The formation has a rich potential for the generation of oil at the top grading towards a good potential for oil and gas generation towards the base. As for the Draupne Fm., the Heather Fm. does not seem to have reached the oil window (see discussion below).

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Thirty-eight samples were analysed excluding the two silt-stones described as belonging to the Heather Fm. Ten of the samples are siltstones, fourteen are sandstones, ten are claystones, one is a carbonate, two are coals and one is of a conglomerate matrix.

The siltstones at the top of the formation (down to about 2520 m) have good petroleum potentials (8.6 to 11.3 mg HC/g rock). They have hydrogen indices ranging from 172 to 277 and oxygen indices ranging from 18 to 46. These samples contain a mixture of kerogen type II/III and III. They have a good potential for generation of predominantly gas, but also some oil. One other siltstone (from 2620 m) has a rich petroleum potential (16.7 mg HC/g rock), a hydrogen index of 300 and an oxygen index of 36. This sample seems to have a rich potential for generation of oil and gas, but the volume of this latter siltstone seems to be very small.

The other siltstones and the claystones present in Ness Fm. (below 2520 m) have poor to good petroleum potentials (0.2 to 12.9 mg HC/g rock). They have hydrogen indices ranging 65 to 191 and oxygen indices ranging 6 to 680. The samples contain kerogen type III and IV. There seems to be a trend towards poorer petroleum potential and kerogen type IV downwards in the formation. The samples seem generally to have a fair potential for the generation of gas.

The two analysed coal samples have good and rich petroleum potentials (7.6 and 40.1 mg HC/g rock). They have hydrogen indices of 74 and 108 and oxygen indices of 3 and 4. They contain kerogen type III.

Some of the analysed sandstones have TOC contents high enough to give credibility to the hydrogen indices. All these sandstones have hydrogen indices suggesting that they contain kerogen type III, i.e. they have some potential for the generation of mostly gas (from coal particles ?).

Most of the Ness Fm. (below 2520 m) seems to have a fair potential for the generation of gas and possibly small amounts of heavy oil. The top of the formation seems to have a good potential for the generation of mostly gas, but also some oil.

Etive Formation (2735 - 2783 m)

Twelve samples were analysed. The single claystone sample analysed has a fair petroleum potential (5.0 mg HC/g rock), a hydrogen index of 130 and an oxygen index of 20, The sample seems to contain kerogen type III. The analysed siltstone has a poor petroleum potential (1.2 mg HC/g rock), a hydrogen index of 110 and an oxygen index of 35. It contains kerogen type III. None of the sandstones have TOC contents that make the hydrogen indices reliable.

Generally, the Etive Fm. has a negligible potential for the generation of gas.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

Eleven samples were analysed. Two of these were sandstone samples. The siltstone and claystone in the upper half of the formation (down to 2850 m) have fair petroleum potentials (2.2 and 4.1 mg HC/g rock). They have hydrogen indices of 122 and 121 and oxygen indices 27 and 26. They contain kerogen type III.

The siltstones and claystones in the lower half of the formation (below 2850 m) have fair to good petroleum potentials (2.5 to 13.9 mg HC/g rock). This potential seems to increase markedly downwards. The hydrogen indices range from 174 to 434 and oxygen indices range 15 to 38. Also the hydrogen indices seem to have a marked downward increase. This lower half of the Drake Fm. contains kerogen type II and II/III. It is in the oil window (see discussion below) and has therefore already produced some hydrocarbons. It is therefore likely that the original petroleum potential was higher.

The upper half (above 2850 m) has at present a fair potential for the generation of gas.

The lower half (below 2850 m) has at present a good potential for the generation of predominantly oil, but also some gas.

Generation and Migration
(Production Index S1/(S1+S2))

The production indices in the Cretaceous section, Draupne Fm. and Heather Fm. are all low and there is no evidence of migrated hydrocarbons. This part of the well is also immature/moderately mature and no significant generation of hydrocarbons seems to have taken place.

The upper part of the Ness Fm. (down to 2520 m) has low production indices and there are no indications of the presence of migrated hydrocarbons or of significant in-situ generation of hydrocarbons.

In the lower part of the of the Ness Fm. (below 2550 m) and down to the upper part of the Etive Fm. (about 2745 m) the productions indices can be high. The highest values occur between 2684 m and 2735 m. Migrated hydrocarbons are believed to be present in this zone between 2550 m and 2745 m and in particular in the zone between 2684 m and 2735 m. Due to the kerogen quality (see above) and the fairly low maturity in most of this section (see below), the in-situ generation of hydrocarbons is believed to be small.

Most of the Etive Fm. sandstone samples below 2745 m have low production indices. The zone is probably not barren of migrated hydrocarbons, but these are much less prominent than in the overlying zone.

The claystones and siltstones of the Drake Fm. have production indices typical of source rocks in the oil window. It is believed that these claystones and siltstones have generated hydrocarbons, as they have the apppriate maturity and kerogen type. The sandstones in the Drake Fm. contain free hydrocarbons (high production indices). These could be "migrated" locally from the Drake Fm. claystones and siltstones.

Maturity (Tmax)

Based on the Tmax values a maturity trend for the well has been proposed (see Figure 3). The well seems to be immature/moderately mature down to about 2570 m. Between 2570 m and about 2730 m the well is moderately mature, passing in to the oil window at about 2730 m.

THERMAL EXTRACTION - GAS CHROMATOGRAPHY

Thirty-two samples were analysed by thermal extraction gas chromatography. Typical thermal extract chromatograms are shown in Figures 5.

Cretaceous (? - 2420 m)

No samples were analysed.

Jurassic (2420 - 2895 m, TD)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2470 m)

Six samples were analysed. The chromatograms of these samples are similar. A typical chromatogram is shown in Figure 5a. The samples are dominated by light molecular weight hydrocarbons (few compounds heavier than nC_{15}). Naphthalenes and alkylbenzenes are quite abundant. The ratio of pristane to nC_{17} is about one, suggesting a fairly low maturity. Only a very small amount of the generating potential is believed to have been realised at present.

Heather Formation (2470 - 2485 m)

Three samples were analysed, including a sample from 2495 m. (See discussion in lithology chapter). The chromatograms of these samples (see Figure 5b for an example) are not very different to those of the Draupne Fm. samples (compare with Figure 5a). The Heather Fm. seems to produce a slightly narrower range of hydrocarbons than Draupne Fm. It seems to produce less hydrocarbons in the nC_8 to nC_{12} range than the Draupne Fm.

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Fourteen samples were analysed, excluding a sample from 2495 m. (See discussion in lithology chapter). Four of the analysed samples are siltstones, seven are sandstones, one is a carbonate, one is a coal and one is of a conglomerate matrix.

The two upper siltstone samples (from 2505 m and 2515 m) have chromatograms that resembles those of the Heather Fm., but the lower ones in particular are poorer in content. They seem to represent a gradual transition from the Heather Fm. to the Ness Fm.

All the sandstones, siltstones and the carbonate sample in the interval from 2550 m to 2675 m have similar chromatograms (see Figure 5c). These chromatograms represent migrated hydrocarbons (oil). Nearly all of the lighter hydrocarbons ($<nC_{14}$) seem to have been lost before analysis could take place. The chromatograms contain prominent, but not dominant naphthalene peaks as do those of the Draupne Fm. shales. This could bee seen as an indication that the oil is derived from a source rock similar to that produced from the Draupne Fm. The hydrocarbons seem to be fairly mature, based on the relative content of isoprenoids. They probably have a maturity close to peak oil maturity. See more detailed discussion in the extraction chapter.

The sandstones and the conglomerate matrix from the interval from 2684.66 - 2735 m also have similar chromatograms, but they are somewhat different to those of the overlying samples (compare Figures 5c and 5d). The hydrocarbons in the lower interval resemble those from the upper interval, but heavy molecular weight hydrocarbons are very prominent in the samples from the lower interval. Some process must have enriched the lower samples in these heavy molecular weight hydrocarbons. However, the hydrocarbons have the same maturity as those in the interval above and there are no positive indications that they should come from a different source.

The coal sample contains mostly light molecular weight hydrocarbons, especially aromatic compounds. These are believed to be generated in-situ. They do not seem to have affected the hydrocarbons in the surrounding sandstones to any significant degree.

Except for the siltstones at the top of the Ness Fm. there seem to be only insignificant amounts of in-situ generated hydrocarbons present. The hydrocarbons present are dominantly migrated oil, with a maturity believed to be close to peak oil (0.8 - 0.9 % Ro).

Etive Formation (2735 - 2783 m)

Two samples were analysed, one claystone and one sandstone. Both samples have chromatograms that resemble those of the upper interval of the Ness Fm. They seem to contain the same hydrocarbons as the latter and one of the same maturity. No significant amounts of in-situ generated hydrocarbons appear to be present.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

Seven samples were analysed, one sandstone, one siltstone and five claystones. The chromatograms for all these samples, sandstone, siltstone and claystones are very similar, and they are also very similar to those from the upper part of the Ness Fm., although the claystone samples seem to contain lighter hydrocarbons than the Ness Fm. samples. Compare Figure 5c and 5e. The hydrocarbons in the Drake Fm. seem to be fairly mature (close to peak oil). They seem to be more mature than can be explained from the maturity of the Drake Fm. shales as defined by vitrinite reflectance. On the basis of these observations it seems unlikely that all the hydrocarbons observed in the Drake Fm. samples are generated in-situ. It is believed that the Drake Fm. samples must be stained by oil from the Ness Fm./Etive Fm., although they most likely also contain some in-situ generated hydrocarbons.

PYROLYSIS - GAS CHROMATOGRAPHY

Thirty-two samples were analysed. Typical pyrograms can be seen in Figures 6 and a pyrolysis products triangle in Figure 7. Pyrolysis GC data are listed in Table 3, Appendix 1.

Cretaceous (? - 2420 m)

No samples were analysed.

Jurassic (2420 - 2895 m, TD)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2470 m)

Six samples were analysed. The pyrograms of these six samples are very similar (see Figure 6a). They also have very similar pyrolysis data (Table 3) and plot in the same area in the pyrolysis triangle (Figure 7). The pyrograms are dominated by alkene/alkane doublets and a raising baseline. These samples are clearly immature and contain kerogen type II, i.e. they are typical marine source rocks.

Heather Formation (2470 - 2485 m)

Three samples were analysed, including one from 2495 m (see discussion in lithology chapter). The upper sample resembles the samples from the Draupne Fm., the next is less like them (see Figure 6b) and contains kerogen type II/III rather than kerogen type II. The lower sample seems to contain kerogen type III and the prominence of n-alkanes could indicate pyrolysation of migrated hydrocarbons, i.e. that the sample does contain some migrated hydrocarbons, similar to those found in the Ness Fm.

In the pyrolysis triangle the Heather Fm. samples plot close to those from the Draupne Fm. Both plot in the "oil-prone, immature" section of the triangle.

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Fourteen samples were analysed, excluding the one from 2495 m (see discussion in lithology chapter). The siltstones and sandstones in the upper part of the formation (down to about 2700 m) have fairly similar chromatograms. The chromatograms are typically dominated by the light compounds, with alkene/alkane doublets being less prominent. Light aromatic compounds are abundant in these chromatograms. See Figure 6c for an example. These samples seem to contain kerogen type III, i.e. they are terrestrial/gas-prone. The kerogen is probably present as small inclusions of coal/claystone particles in the sandstone. The single carbonate sample analysed is virtually barren of pyrolysable material.

The coal sample (from 2700.4 m) is dominated by toluene, xylenes, naphthalenes and phenols (see Figure 6d). These are compounds typically produced during pyrolysis of immature coal. The sample is believed to be gas-prone.

The sandstones in the lower part of the formation (below about 2700 m) have pyrograms dominated by the same compounds as those in the above mentioned coal, but in addition they contain single n-alkane peaks. The n-alkanes are most likely derived from pyrolysation of the heavier compounds of the free hydrocarbons present in the samples.

The conglomerate matrix sample at the base of the formation is dominated by alkene/alkane doublets, with alkenes as the dominant. The sample is believed to contain asphaltic material as well as some kerogen type III.

The samples from the Ness Fm. are scattered in Figure 7. None of the analysed samples can be characterised as good source rocks. At best, the formation seems to have a slight potential for gas generation.

Etive Formation (2735 - 2783 m)

Two samples were analysed, one claystone and one sandstone. The claystone sample contains a mixture of light molecular weight aromatic compounds and n-alkanes. Most of the n-alkanes are believed to be derived from pyrolysation of migrated hydrocarbons. The sandstone samples contain very little pyrolysable material.

There is no indication of any in-situ potential for the generation of hydrocarbons.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

Seven samples were analysed, one sandstone, one siltstone and five claystones. The upper claystone sample (from 2800 m) is dominated by n-alkanes. These are probably derived from migrated hydrocarbons, present in the form of staining. The sandstone sample contains little pyrolysable material. What is present is fairly similar in composition to that of the claystone samples below.

The four claystone samples below 2800 m and the siltstone sample have fairly similar pyrograms (see Figure 6e). The pyrograms are dominated by alkene/alkane doublets. The samples are thought to contain mature kerogen type II/III or possibly kerogen type II.

The Drake Fm. samples plot variably in Figure 7. Those at the top of the formation plot towards the mid bottom of the figure, while those at the base of the Drake Fm. plot very close to the samples of the Draupne and Heather Fms. It seems that the base of the Drake Fm. has a similar potential for hydrocarbon generation as the Heather and Draupne Fms.

EXTRACTION DATA

Ten samples were extracted, fractionated and the hydrocarbons analysed by gas chromatography. The data are listed in Tables 4a-e, Table 5 and Table 6, all in Appendix 1. The data are plotted in Enclosure 2. The chromatograms are in Appendix 4. Typical saturated chromatograms are shown in Figure 8 and typical aromatic chromatograms in Figure 9.

Cretaceous (? - 2420 m)

No samples were analysed.

Jurassic (2420 - 2895 m, TD)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2470 m)

Two samples were analysed, these being composite samples from 2440 m and 2465 m. Both samples have rich contents of extractable organic material (4140 and 3465 ppm) and of extractable hydrocarbons (2142 and 1668 ppm). The samples have ratios of saturated to aromatic hydrocarbons and hydrocarbons to non-hydrocarbons of about 1:1. Normalised to TOC the samples have only fair contents of extractable organic material (56.79 and 59.34 mg EOM/g TOC) and good contents of extractable hydrocarbons (29.39 and 28.57 mg HC/g TOC), indicating that very little of the organic material has yet been converted to bitumen. These data are typical of immature, but potentially rich marine source rocks.

Heather Formation (2470 - 2485 m)

One sample was analysed, a composite sample from 2495 m (see discussion in lithology chapter). The data for this sample are very similar to those for the Draupne Fm. samples. The sample has rich contents of extractable organic material (2312 ppm) and of extractable hydrocarbons (1252 ppm). The sample has ratios of saturated to aromatic hydrocarbons and hydrocarbons to non-hydrocarbons of about 1:1. Normalised to TOC the sample has only poor contents of extractable organic material (43.15 mg EOM/g TOC) and good contents of extractable hydrocarbons (23.37 mg HC/g TOC), indicating that very little of the organic material has yet been converted to bitumen. These data are typical of immature, but potentially rich marine source rocks.

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Five samples were analysed, consisting of two siltstones (composites) and three sandstones (whereof two composites). All five samples have rich contents of extractable organic material (4463 to 7870 ppm) as well as of extractable hydrocarbons (2515 to 6214 ppm). Four of the samples have ratios of about 2:1 for both saturated to aromatic hydrocarbons and hydrocarbons to non-hydrocarbons. The fifth sample (from 2630 m) has ratios of 1:1. These data suggest more mature hydrocarbons than those in the Viking Gp. samples in four of the samples, i.e. they contain migrated hydrocarbons from a more mature source than the Viking Gr. in this well. One siltstone probably contains a fairly large proportion of in-situ generated hydrocarbons. Normalised to TOC it can be seen that the siltstones have much lower contents of extractable hydrocarbons than the sandstones, reflecting mainly the siltstones' higher TOC.

Etive Formation (2735 - 2783 m)

One sample was analysed. The claystone sample has rich contents of extractable hydrocarbons (6450 ppm) as well as extractable hydrocarbons (4744 ppm). The ratios are about 3:1 for saturated to aromatic hydrocarbons and hydrocarbons to non-hydrocarbons. Normalised to TOC the sample has a rich content of extractable organic material (444.85 mg EOM/g TOC) as well as extractable hydrocarbons (327.21 mg HC/g TOC). These data seem to suggest that the hydrocarbons in the Etive Fm. sample is as mature and of the same type as those in the Ness Fm. The hydrocarbons in the Etive Fm. shale are therefore not believed to be generated in-situ as the rock is too immature. The hydrocarbons present are probably due to staining by the Ness Fm. oil.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

One sample was analysed. The claystone sample has a rich content of extractable organic material (3921 ppm) as well as of extractable hydrocarbons (2470 ppm). The ratios are 2:1 for saturated to aromatic hydrocarbons and hydrocarbons to non-hydrocarbons. Normalised to TOC the sample has a good content of extractable organic material (145.25 mh EOM/g TOC) and a rich content of extractable hydrocarbons (91.50 mg HC/g TOC). These data give the impression that the maturity and the amounts of free hydrocarbons present are higher than those which would be expected of a source rock of the maturity indicated by vitrinite reflectance (see vitrinite chapter). It seems likely that the hydrocarbons present in the sample must be affected by staining with the Ness Fm. oil, although some in-situ generation is highly likely.

Saturated Hydrocarbons

Jurassic (2420 - 2485 m, TD)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2470 m)

The two analysed samples have almost identical chromatograms (see Figure 8a). The chromatograms contain abundant isoprenoids, indicating low maturity. This is also reflected in the pristane/nC_{17} ratio (> 1) which suggests low maturity. The CPI is close to 1, indicating that terrestrially derived material has not played a significant role in the organic input.

The samples contain in-situ generated hydrocarbons of low maturity. The source rock is almost purely marine.

Heather Formation (2470 - 2485 m)

One sample was analysed. The sample has a chromatogram almost identical to those of the Draupne Fm. samples, see discussion above.

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Five samples were analysed. The two siltstones analysed have almost identical chromatograms (see Figure 8b). They contain mature hydrocarbons (pristane:nC_{17} < 1). These hydrocarbons cannot be entirely generated in-situ, but must at least be migrated into the rock.

The three analysed sandstones have very similar chromatograms (see Figure 8c). These hydrocarbons appear to have a similar maturity to those in the siltstones, this being evident both from the chromatograms and from the saturated ratio tables. The hydrocarbons in the sandstones do, however, contain much heavier molecular weight hydrocarbons than the siltstones. It is unknown whether this is a physical effect of the rock type or could be due to an enrichment of the heavier compounds in this zone of the Ness Fm.

Etive Formation (2735 - 2783 m)

One sample was analysed. The chromatogram of this sample is almost identical to those of the siltstone samples from the Ness Fm. and are believed to contain the same type of migrated hydrocarbons.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

One sample was analysed. The sample has a chromatogram almost identical to those for the Ness Fm. siltstones and the Etive Fm. claystone (see Figure 8d). The hydrocarbons are fairly mature. They cannot be entirely generated in-situ, as the fingerprinting is too mature, but are probably due to staining of the cuttings with the Ness Fm. oil.

Aromatic Hydrocarbons

Jurassic (2420 - 2895 m, TD)

Viking Group (2420 - 2485 m)

Draupne Formation (2420 - 2470 m)

Two samples were analysed. The two samples have almost identical FID chromatograms (see Figure 9a) and FPD chromatograms (see Figure 9b). The MPI 1 amd MPI 2 ratios seem to be unreliable for these two samples, as it was difficult to separate the 3-MP and the 2-MP. Based on the sulphur compounds (FPD chromatograms) the hydrocarbons present seem to have a low maturity (4/1 MDBT < 1). The relatively high proportion of various naphthalenes seems to suggest the "oil-proneness" of the samples.

Heather Formation (2470 - 2485 m)

One sample was analysed. The data for this sample is almost identical to those for the Draupne Fm. samples. See discussion above.

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Five samples were analysed. Two siltstones have almost identical FID chromatograms (see Figure 9c). The samples are rich in naphthalenes and phenanthrenes, but lacking in polyaromatic compounds. Based on the MPI 1 indicates they seem to have maturities equivalent to about 0.9 % Ro, i.e. they have been generated close to peak oil maturity. They must therefore have migrated into the rock.

The FPD chromatograms are very similar for all the Ness Fm. samples (see Figure 9d). The samples have much higher 4/1 MDBT and (3+2)/1 MDBT ratios than the Draupne Fm. samples, suggesting that they are much more mature.

The three sandstone samples have FID chromatograms which give the same aromatic ratios as those of the siltstone samples, but they contain considerably more polyaromatic compounds, i.e. much more heavy molecular weight compounds (see Figure 9e). They have the same maturity (about 0.9 % Ro) as the siltstones and the hydrocarbons are believed to be basically the same. Some process must have enriched the heavy molecular weight compounds in the sandstones in this zone of the Ness Fm.

Etive Formation (2735 - 2783 m)

One sample was analysed. The FID and the FPD chromatograms and the aromatic ratios are very similar to those of the Ness Fm. siltstones. The Etive Fm. sample is believed to be stained by the Ness Fm. oil.

Dunlin Group (2783 - 2895 m)

Drake Formation (2783 - 2895 m)

One sample was analysed. Both the FID (see Figure 9f) and the FPD chromatograms, also the aromatic ratios are very similar to those of the Ness Fm. siltstones. The Drake Fm. sample is believed to be stained by the Ness Fm. oil. Although in-situ generated hydrocarbons are undoubtedly present, these are completely masked by the staining.

VITRINITE REFLECTANCE

Ten ditch cuttings samples and three core chips were analysed from the depth interval 2370 m to 2895 m in the well NOCS 30/9-1.

Data is tabulated in Table 7 and a vitrinite reflectance versus depth plot is shown in Figure 10 for this analysed section. Vitrinite reflectance histograms are located in Appendix 2.

The first three analysed shale/claystone samples (2370 m, 2425 m, 2490 m) contain only minor quantities of poor quality vitrinite. Inertinite is clearly dominant and there is a high proportion of liptinitic streaks. Organic bitumen staining is trace at 2370 m, increasing low to moderate by 2425 m and is moderate by 2490 m. The latter two samples are fairly rich in pyrite. The liptinite content at 2370 m is low when estimated in UV light. The assemblage is comprised of scattered algal and trace, light orange (SCI 5) spores, which fluoresce with a low intensity. Below (2425 m, 2490 m) liptinite is rich and is comprised of dominant algal, significant spore, minor amorphous and cuticular material. Fluorescing spores just pass into yellow orange (SCI 4) and fluoresce with a moderate intensity in these two samples.

Four kerogen concentrate samples (2510 m, 2560 m, 2620 m, 2640 m) contain equal proportions of vitrinite and inertinite with significant reworked particles and minor to significant bituminite. The vitrinite phytoclasts are coaly in parts. At 2510 m vitrinite is marginally lower reflecting and looks bitumen impregnated. In fluorescence light the first three samples are liptinitic rich, while at 2640 m liptinite is moderately rich. Algal material dominates the liptinite ni all four samples with subsidiary amounts of amorphous-L, bituminite, spore and liptodetrinite. Spores fluoresce a yellow-orange (SCI 4) with a moderate intensity to 2560 m. At 2620 m spores range yellow-orange to light orange (SCI 4-5) in colour and at 2640 m fluoresce light orange (SCI 5).

The core chip sample at 2695.02 m is comprised of a mixture of carbargillite and coaly shale lithologies. In both, inertinite is the dominant maceral with only trace, fair quality vitrinite. In fluorescence light there appears to be a sudden jump in maturity as spores fluoresce an apparent mid orange (SCI 6). Liptinite is fairly rich and dominated by spores with significant algal and minor liptodetrinite.

One core chip sample (2714.31 m) and one ditch cuttings sample (2740 m) comprises a marly claystone lithology. The phytoclast contents are low in both samples and dominated by fair quality, often stringered, coaly vitrinite; organic bitumen staining is trace to light. Partial oxidation is noted in some clasts at 2740 m. The liptinite fraction is low and comprised only of scattered spore shreds (light orange (SCI 5)) and liptodetrinite. Vitrinite fluoresces a weak, dark brown at 2714.31 m.

From the following core chip sample (2784.75 m) and to the base of the analysed section (2870 m, 2895 m), a shale/ claystone lithology has a low to moderate phytoclast content comprised, almost exclusively, of inertinite and reworked particles with minor, poor quality vitrinite (fair, but hydrogen rich, at 2895 m). Organic bitumen staining is light throughout these samles, although is moderate to strong surrounding vitrinite phytoclasts at 2895 m. Algae dominate the rich liptinitic assemblage with subsidiary spores, amorphous, spore shreds and minor bituminite and liptodetrinite. Spores fluoresce, with a low to moderate intensity, light orange to mid orange (SCI 5.5) at 2784.75 m and 2870 m and light orange (SCI 5) at 2895 m. This drop may be due to the presence of minor caved lithologies.

Vitrinite reflectance data show a distinct jump between

2560 m and 2620 m. Below this, data points follow a trend, increasing in reflectance from Ro 0.47 % (14 readings) at 2610 m, through Ro 0.56 % (16 readings) at 2740 m to Ro 0.56 % (1 reading) at the base of the analysed section (2895 m). Above this, data points follow a parallel trend which increases in maturity from Ro 0.35 % (6 readings) at 2425 m to Ro 0.41 % (26 readings) at 2560 m.

The uppermost sample at 2370 m contains only trace, poor vitrinite, which is difficult to measure. The vitrinite between 2425 m and 2560 m is a hydrogen rich variety and therefore, the reflectance would be expected to be slightly depressed in this zone. Consequently, these data are not considered representative. Spore fluorescence correlates quite well with the vitrinite reflectance data and a corresponding maturity jump is recorded in the core chip at 2695.02 m, but this may be a result of oxidation.

Taking the lower trend and using confident data points between 2640 m to 2784.75 m, the section would pass into maturity (Ro 0.55 %) by approximately 2750 m. If this trend is projected down, then peak oil window (Ro 0.70 %) would be reached at the approximated depth of 3500 m, some 600 m below the base of the analysed section.

VISUAL KEROGEN COMPOSITION

Enclosure 4 shows thermal maturity data for the well NOCS 30/9-1 plotted against lithology and depth. Figure 11 shows a triangular plot of the kerogen composition for the well, while Table 8 in Appendix 1a lists the detailed kerogen composition of the samples examined, while the SCI and spore fluorescence data are listed in Table 7 in Appendix 1.

Kerogen type is discussed according to the stratigraphic units of the well. Thermal maturity estimates based on spore colour index and spore fluorescence are presented in general terms for the well as a whole.

Twelve samples from this well were optically examined. These were from the depth interval 2420 m (Cretaceous) to 2895 m (Dunlin Gp.: Drake Fm.).

Kerogen Typing

Cretaceous (? - 2425 m)

One sample of dark grey to dusky yellow-brown shale was examined from near the base of the Cretaceous at 2420 m.

This contains abundant (?70 %) liptinite, which is particularly algal-rich,consisting mainly of good quality fluffy, green amorphinite and algal cysts. Reworked material is subordinate, while spore/pollen occurs in only trace amounts, reflecting a clearly marine environment of deposition. Vitrinite is moderately abundant (30 %) as mixed telinite, vitrodetrinite and amorphinite. Only trace inertinite is present.

This lithology has excellent potential for the generation of mainly oil.

<u>Jurassic</u> (2425 - 2895 m, TD)

Viking Group (2425 - 2585 m)

Draupne Formation (2425 - 2470 m)

One sample of dark grey to dusky yellow-brown shale similar to that from the overlying interval was examined at 2465 m.

This haa a rich kerogen composition very similar to that of the overlying sample, but is marginally richer in liptinite (80 %) at the expense of vitrinite (15 %). The assemblage also includes bituminite.

This clearly algal marine kerogen assemblage has excellent potential for the generation of oil.

Heather Formation (2470 - 2585 m)

Two samples of medium to dark grey and dark grey to dusky yellow-brown siltstone were examined from this formation at 2510 m and 2560 m respectively.

These contained abundant liptinite (35 - 40 %), which is dominated by algal/marine palynomorphs in the uppermost sample - (algae, dinoflagellates amorphous material with subordinate liptodetrinite and only trace spore/pollen). There appears to be a decrease in kerogen quality with depth, the lowest sample having a greater input of terrestrial material and lacking good quality algal amorphinite. The vitrinite content of these shales is abundant (50 - 55 %), this being mainly as telinite and vitrodetrinite. Inertinite occurs in minor to significant amounts (5 -

15 %), though in the case of the lower sample, the slightly "coaly" nature may result in the relatively high inertinite content by inclusion of thick, woody material.

The Heather Fm. siltstones appear to have good potential for the generation of mainly gaseous hydrocarbons, though at upper levels the generation of oil may approach that which could be expected from the overlying Draupne Fm.

Brent Group (2585 - 2783 m)

Ness Formation (2585 - 2735 m)

Four samples were examined from this interval, consisting of medium to dark grey siltstone and shale from 2620 m and 2640 m respectively, a coal from core chips at 2700.4 m, and a light brownish grey shale from core chips at 2714.31 m.

The grey siltstone and shale samples contain moderately abundant to abundant (20 - 50 %) liptinite. In the uppermost (siltstone) sample the liptinite is of mainly algal character, consisting mainly of poorly preserved algae and degraded algal amorphous material with traces of dinoflagellates. Spore/pollen is present in only trace amounts. In the underlying shale sample the much decreased liptinite content has a similar range and proportion of palynomorphs. In general, the kerogen assemblage of this sample has a fine-grained "coaly" appearance. Inertinite is present in accessory amounts in the siltstone, and moderately abundant amounts (25 %) in the underlying shale.

These siltstone/shale lithologies have hydrocarbon generation potentials ranging from that of mixed oil and gas in the upper levels to that of only gas in the lowest sample.

The coal sample from 2700.4 m contains only minor (5 %) liptinite, mainly as spore/pollen with trace algae, but also with traces of good quality fluffy, algal amorphous material which is somewhat unusual for a coal. Vitrinite is strongly dominant (90 %), mainly as telinite/collinite, a significant proportion of which is hydrogen-rich, having a dull brown fluorescence. Only minor inertinite is present.

The Brent Gp. coal has a rich potential for the generation of gaseous hydrocarbons.

The light brownish grey shale has only trace liptinite, this being strongly dominated by spore/pollen with subordinate/ trace algae. Vitrinite constitutes practically 100 % of the kerogen assemblage as almost exclusively telinite/collinite, giving the kerogen a decidedly coarse-grained coaly appearance. Only trace inertinite is present.

This shale has moderate potential for the generation of gaseous hydrocarbons. Traces of possible free hydroacrbons are present in this sample.

Etive Formation (2735 - 2783 m)

One sample of brownish grey shale was examined from the Etive Fm. interval at 2740 m.

This contains abundant (50 %) liptinite of terrestrial origin, dominated by spore/pollen with only trcae algae. Vitrinite is also abundant (45 % as telinite/collinite/ amorphinite, which gives the assemblage a coaly appearance. Inertinite is present in only minor amounts.

This shale probably has a moderate potential for the generation of mixed to mainly gaseous hydrocarbons.

In summary, the Brent Gp. siltstones, shales and coals, having dominantly terrestrial kerogen compositions, appear to have potential for gas generation. The upper siltstone and the lowermost (Etive Fm.) shale, however, have in addtition the potential for generation of oil,i.e. mixed hydrocarbons.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

Three samples were examined from this interval, a dark grey to dusky yellow-brown shale from core-chips at 2784.75 m, a medium grey shale from 2850 m and a brownish grey to medium grey shale from TD, 2895 m.

The dark grey to dusky yellow-brown shale from 2784.75 m has a moderate liptinite content (25 %), mainly as terrestrially sourced components (spore/pollen, cuticle, reworked material) with lesser algae and only traces of dinoflagellates. Vitrinite is dominant (60 %), mainly as telinite/ collinite which imparts a coaly appearance. Significant (15 %) inertinite is present, though this may include some thick, woody (telinite) clasts.

This shale has a kerogen assemblage capable of generating mainly gaseous hydrocarbons.

The medium grey shale from 2850 m has moderately abundant (35 %) liptinite, predominantly as reworked material of mixed provenance together with spore/pollen, algae and dinoflagellates. Vitrinite is dominant (60 %), mainly as vitrodetrinite with secondary telinite/amorphinite. A weak brown fluorescence is present. Only minor inertinite occurs in this sample.

The medium grey shale, similar to the overlying greyish to brownish shales, has potential for the generation of mainly gaseous hydrocarbons.

The lowermost shale sample contained an especially abundant liptinite content (80 %), consisting mainly of spore/pollen and good quality hydrogen-rich algal amorphous matter, with subordinate liptodetrinite, cuticle, algal and dinoflagellates. Vitrinite is subordinate (20 %), as telinite which includes abundant hydrogen-rich varieties, and as vitrodetrinite. Only trace inertinite is present.

Such a kerogen assemblage is considered to have a good potential for the generation of mainly oil.

In summary, the Drake Fm. shales, having kerogen from mixed sources, appear mainly to have potential for the generation of gas. The lowermost sample, however, also shows the presence of excellent source rocks for oil.

Thermal Maturity

According to spore colour index determinations, samples from the Viking Gp.: Draupne and Heather Fms. border on moderate maturity, based on a limited number of available spores in these samples. Below this, the well appears to be moderately mature, though bordering on the oil window in samples around 2700 m (Brent Gp.: lower Ness Fm.). According to the linear regression line for the SCI data, the top of the oil window (SCI 6.0) occurs at approximately 2875 m for type II kerogen, i.e. in the Dunlin Gp.: Drake Fm.

ISOTOPE ANALYSIS OF C15+ FRACTIONS

A total of four samples were analysed for carbon isotopes ($\delta^{13}C$) of the saturated, aromatic, NSO and asphaltene fractions. The data are listed in Table 9 and 9B and shown in Figure 12. Information from papers of Martin Schoell and Zwi Sofer are used in the interpretation.

Jurassic (2420 - 2895 m, TD)

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

Three samples were analysed, all of them being sandstone core chip samples (from 2687.62 m, 2724.35 m and 2728.70 m). The three samples have very similar isotope data and plot in the same area in Figure 12. Not surprisingly, they also plot similar to the Frigg and Oseberg Oils. It is not impossible that the source of the hydrocarbons in the Ness Fm. in this well (30/9-1) is the same as those in the Frigg (and of cource Oseberg) Oils.

Dunlin Group (2783 - 2895 m)

Drake Formation (2783 - 2895 m)

One sample was analysed, a claystone cuttings sample from 2895 m. The isotope data are similar to those of the Ness Fm. samples and it plots in the same area in Figure 12. It is, however, strongly suspected and previously discussed that this similarity is due to staining of the Drake Fm. with Ness Fm. oil and not due to any natural correlation (due to sourcing).

GAS CHROMATOGRAPHY - MASS SPECTROMETRY

A total of four samples from this well was analysed by GC-MS. These were three from the Ness Fm. and one from the Drake Fm.

Jurassic (2420 - 2485 m)

Viking Group (2420 - 2485 m)

No samples were analysed.

Brent Group (2485 - 2783 m)

Ness Foramtion (2485 - 2735 m)

The three samples analysed from this formation are sandstone core samples.

Saturated Hydrocarbons

Terpanes

The M/Z 163 fragmentograms are almost identical for the three samples, showing both steranes and triterpanes. The largest peak in all three samples is, however, 25,28,30 trisnorhopane. Of the usual triterpanes, the 17α(H) 21β(H) hopane is the largest peak, while bisnorhopane is approximately 90 % of this. The C_{29}, C_{31}, C_{32}, C_{33}, C_{34} and C_{35} triterpanes are abundant. The three samples also show almost identical fragmentograms for the three Ness Fm. samples, with 25,28,30 trisnorhopane and 17α(H) 21β(H) norhopane of similar intensity. Most of the other triterpanes are minor components with similar peak heights to the C_{27} rearranged steranes. The M/Z 191 fragmentograms are identical for the three samples, showing patterns typical for well mature hydrocarbons in the Viking Graben, with the pentacyclic terpanes as the major components. The tricyclic terpanes are only minor components for these three samples. Of the pentacyclic terpanes, 17α(H) 21β(H) hopane is the largest peak with 17α(H) 21β(H) norhopane as the second largest peak, approximately 40 % of the 17α(H) 21β(H) hopane. Bis-norhopane is quite prominent in these samples, being approximately 25 % of 17α(H) 21β(H) hopane.

The M/Z 205 fragmentograms show two sets of peaks, one consisting of the C_{30} triterpanes with 17α(H) 21β(H) hopane as the largest peak and one consisting of the C_{31} triter-panes with the 17β(H) 21α(H) homohopane as the smallest peak. A pattern like this is typical for well mature hydro-carbons where the isomerization of triterpanes has reached equilibrium.

The fragmentograms of the molecular ions verify what has been discussed above. The M/Z 370 fragmentograms clearly show the 25,28,30 trisnorhopane to be far more abundant than either 18 α(H) trisnorneohopane (T_s) or 17α(H) trisnorhopane (T_m). T_m has a peak height equal to only 20 % of the 25,28,30 trisnorhopane peak. The M/Z 384 fragmentograms show bisnorhopane as the largest peak. The second largest peak elutes earlier than bisnorhopane. This peak does not give a signal in the M/Z 191 fragmentogram, but it is found in the M/Z 177 fragmentogram and could therefore be a demethylated C_{28} triterpane.

The M/Z 398 fragmentograms give strange patterns. The largest peak is 17α(H) 21β(H) norhopane, but another which is almost as large elutes just in front of this. This peak shows only a minor signal in the M/Z 191 fragmentogram, while it is quite large in the M/Z 177. This would indicate this peak to be a demethylated C_{29} triterpane. The M/Z 412 and 426 fragmentograms show only the normal C_{30} and C_{31} triterpanes.

Steranes

The M/Z 149 fragmentograms of the three samples are almost identical and dominated by the rearranged steranes together with the triterpanes. The M/Z 189 fragmentograms of the three samples are almost identical, showing almost entirely the rearranged steranes. These are dominated by the C_{27} components. Similar conclusions can also be made for the M/Z 259 fragmentograms, though here the C_{27} components are not as dominant as in the M/Z 189 fragmentograms.

The M/Z 217 and 218 fragmentograms show similar patterns for the three samples. The rearranged steranes are the largest peaks. The C_{27} components are the largest components both for the rearranged steranes and regular steranes. The C_{21} and C_{22} components are quite abundant in these samples, clearly showing the high maturity of these hydrocarbons.

The molecular ion fragmentograms verify what has been discussed above, and that C_{30} steranes are present in all three samples.

Aromatic Hydrocarbons

Alkyl Benzenes

The M/Z 106 fragmentograms for C_2-substituted benzenes and M/Z 134 fragmentograms for C_4-substituted benzenes show some variation for the three samples. Most of this is, however, due to variation in the degree of evaporation, showing a larger loss of light weight components in the sample from

2725.35 m compared with the other two samples.

Naphthalenes

The M/Z 142, 156 and 170 fragmentograms show similar patterns for the three samples in the C_1-, C_2- and C_3-naphthalenes. The pattern seen here is typical for well mature hydrocarbons in the Viking Graben.

Phenanthrenes

The M/Z 178 fragmentograms show only the single peak for phenanthrene for all three samples. There is no sign of anthracene in any of these samples. The M/Z 192 fragmentograms show the two doublets for methylsubstituted phenanthrenes. There are only minor differences between the four samples, which show 9 methylphenanthrene as the largest peak. The M/Z 206 fragmentograms showing C_2 phenanthrenes are almost identical for the three samples. This is also found for the C_3 phenanthrenes in the M/Z 220 fragmentograms.

Dibenzothiophenes

The M/Z 198 and 212 fragmentograms showing the methyldibenzothiophenes and C_2 dibenzothiophenes respectively, show almost identical patterns for the three samples with 4 methyldibenzothiophenes being the largest peak in the M/Z 198 fragmentograms. These fragmentograms are strange, since the 1- methyldibenzothiophene is rather large compared with the 2+3-dibenzothiophene peak considering the maturity of the hydrocarbons present. There is also another peak between the 2+3-methyl and 1-methyldibenzothiophene peak. This is normally not found to be as prominent in other Viking Graben samples.

Aromatic Steranes

There is some slight variation in the M/Z 253 and 231 fragmentograms of the three samples. All three samples show the low molecular weight compounds, i.e. C_{20}, C_{21} and C_{22} compounds, which indicate the samples to have a high maturity. The main difference in the triaromatic steranes for the three samples is a decrease in the intensity of the 20R C_{27} triaromatic sterane compared to the 20S C_{28} and the 20R C_{28} triaromatic steranes. The variation found for the monoaromatic steranes is so small that this could be due to variation in injection etc.

Dunlin Group (2783 - 2895 m)

Drake Formation (2783 - 2895 m)

One sample, a shale from 2895 m in this formation, was analysed.

Saturated Hydrocarbons

Terpanes

The M/Z 149 fragmentogram shows rearranged steranes and pentacyclic terpanes. There is no evidence of 25,28,30 trisnorhopane being present in this sample. The M/Z 177 fragmentogram also shows rearranged steranes and triterpanes with $17\alpha(H)$ $21\beta(H)$ norhopane being the largest peak. The pattern seen here is distinctly different to that found in the Ness Fm. samples. The M/Z 191 fragmentogram shows mainly pentacyclic terpanes. The tricyclic terpanes have a slightly larger relative abundance compared to that seen in the Ness Fm. samples. The other main variations between the Drake Fm. shale sample and the Ness Fm. sandstone samples are a far lower abundance of bisnorhopane and a reversed T_m/T_s ratio, where this is > 1 in the Drake Fm. sample and < 1 in the Ness Fm. samples.

The M/Z 205 fragmentograms show the C_{31} components with the 17β(H) 21α(H) peak being of equal intensity to the 22S 17α(H) 21β(H) peak. The 17α(H) 21β(H) hopane is only a minor peak in this sample.

The fragmentograms of the molecular ions verify what has been discussed above. The M/Z 370 fragmentogram shows the 25,28,30 trisnorhopane as a minor component, while neither the M/Z 384 or M/Z 398 fragmentograms show any indications of demethylated components as seen for the Ness Fm. samples.

Steranes

The M/Z 149 fragmentograms show rearranged steranes and triterpanes. The relative abundance of triterpanes is far higher in this sample than that found in the Ness Fm. samples, which would indicate a higher input of terrestrial material in these samples compared to that in the kerogen generating the hydrocarbons found in the Ness Fm. The 189 and 259 fragmentograms show mainly rearranged steranes. The main difference between this sample and the Ness Fm. samples is a larger relative abundance of the C_{29} components in this sample, which would indicate a larger input of terrestrial material, in good agreement with the data from the M/Z 149 fragmentograms. The M/Z 217 and 218 fragmentograms show a far larger abundance of regular steranes relative to rearranged steranes in this sample compared to that found in the Ness Fm. samples. The C_{29} component are dominant over the C_{27} compounds, verifying the larger input of terrestrial material in this sample. The light molecular weight compounds are quite prominent. This could indicate a high maturity. This does not agree with the isomerization data, which indicate a relative low maturity for this sample.

The fragmentograms of the molecular ions verify that which has been discussed above. The M/Z 414 fragmentogram shows that the sample contains C_{30} steranes.

Aromatic Hydrocarbons

Alkyl Benzenes

The M/Z 106 fragmentogram shows the typical doublets for the C_2-substituted benzenes. The pattern is completely different to that found in the Ness Fm. samples, there being a far lower abundance of high molecular weight components in this sample. The same is also seen for the C_4-substituted benzenes in the M/Z 134 fragmentogram.

Naphthalenes

The M/Z 142, 156 and 170 fragmentograms vary all slightly from those of the Ness Fm. samples. The variations are significant enough to indicate the hydrocarbons in the Ness Fm. samples to have been generated from a different kerogen than that which is found in the Drake Fm. sample.

Phenanthrenes

The M/Z 178 fragmentogram shows only one peak for phenanthrene, similar to that found in the Ness Fm. samples. The M/Z 192, 206 and 220 fragmentograms show, however, significant variations compared to that of the Ness Fm. sample.

Some of this is due to a difference in maturity such as the decrease in the relative abundance of 9-methylphenanthrene in the Drake Fm. sample compared to the Ness Fm. samples. There are, however, also differences which are due to variations in the type of kerogen generating the hydrocarbons in the Ness Fm. and the Drake Fm. samples. This is clearly seen in the far larger abundance of (the increase of) the components with high retention time in the Drake Fm. sample for the C_3 phenanthrenes.

Dibenzothiophenes

The M/Z 198 fragmentogram of the Drake Fm. sample shows only minor variations compared with those of the Ness Fm. samples. This is similarly seen for the M/Z 212 fragmentograms for the C_2 dibenzothiophenes.

Aromatic Steranes

The M/Z 231 fragmentogram of the Drake Fm. sample shows significant variation compared with those of the Ness Fm. samples. This is mainly seen by a larger relative abundance of 20S C_{26}-, 20S C_{28}- and 20R C_{28}-triaromatic steranes compared to 20R C_{27} triaromatic sterane in the Drake Fm. sample than in the Ness Fm. samples. The M/Z 253 fragmentogram shows a pattern for the Drake Fm. sample similar to that found in the Ness Fm. samples.

CONCLUSIONS

Based on the analyses performed on samples from this well the following conclusions have been made :

Source Rock Potential

The analysed post Jurassic rocks do not have any source rock potential.

Jurassic (2420 - 2895 m, TD)

Draupne Formation (2420 - 2470 m) and
Heather Formation (2470 - 2485 m)

The Draupne Fm. and the Heather Fms. are excellent source rocks for oil in this well, but they are immature/moderately mature and are not believed to have generated any significant amounts of oil at the present maturity.

Brent Group (2485 - 2783 m)

Ness Formation (2485 - 2735 m)

The Ness Fm. has at best a poor to fair potential for the generation of gas, but the volumes that can be produced are believed to be insignificant.

Etive Formation (2735 - 2783 m)

The Etive Fm. does not seem to have any source rock potential.

Dunlin Group (2783 - 2895 m, TD)

Drake Formation (2783 - 2895 m, TD)

The Drake Fm. seems to have a good potential for the generation of oil in this well. The formation is close to the top of the oil window and has probably started to generate hydrocarbons. However, the samples from the Drake Fm. are stained with the Ness Fm. oil. This makes a quantification of the hydrocarbons produced from the Drake Fm. difficult. It does not seem that the Drake Fm. has contributed significantly to the generation of oil found in this well.

Generation and Migration

The Draupne and Heather Fms. have not yet generated significant amounts of free hydrocarbons. The Ness Fm. contains migrated hydrocarbons derived from a source with a maturity corresponding to about 0.9 % Ro. The Etive Fm. may also contain migrated hydrocarbons, but is also possibly only stained by the Ness Fm. oil. The Drake Fm. has probably generated some hydrocarbons, but staining by the Ness Fm. oil makes it impossible to evaluate this.

Maturity

Based on vitrinite reflectance the well seems to pass into maturity (0.55 % Ro) at about 2750 m. The Tmax data suggests that it enters the oil window at about 2730 m, which is in good accordance with the vitrinite data.

The well would reach peak oil window (0.7 % Ro) at about 3500 m, 600 m below TD of the well.

The migrated hydrocarbons present in the well appear to be generated at a maturity equivalent to about 0.9 % Ro. This seems to correspond to a depth of, very approximately, 4500 m.

Correlation

GC-MS data suggests that well mature Viking Graben hydrocarbons have sourced the Ness Fm. hydrocarbons. The Drake Fm. is not believed to be of any significance as source for the Ness Fm. hydrocarbons in this well, although some (mainly aromatic) hydrocarbons generated in the Drake Fm. could contribute in small amounts to the Ness Fm. hydrocarbons.

Figure: 1

Client:

TOC Data for Well NOCS 30/9–1

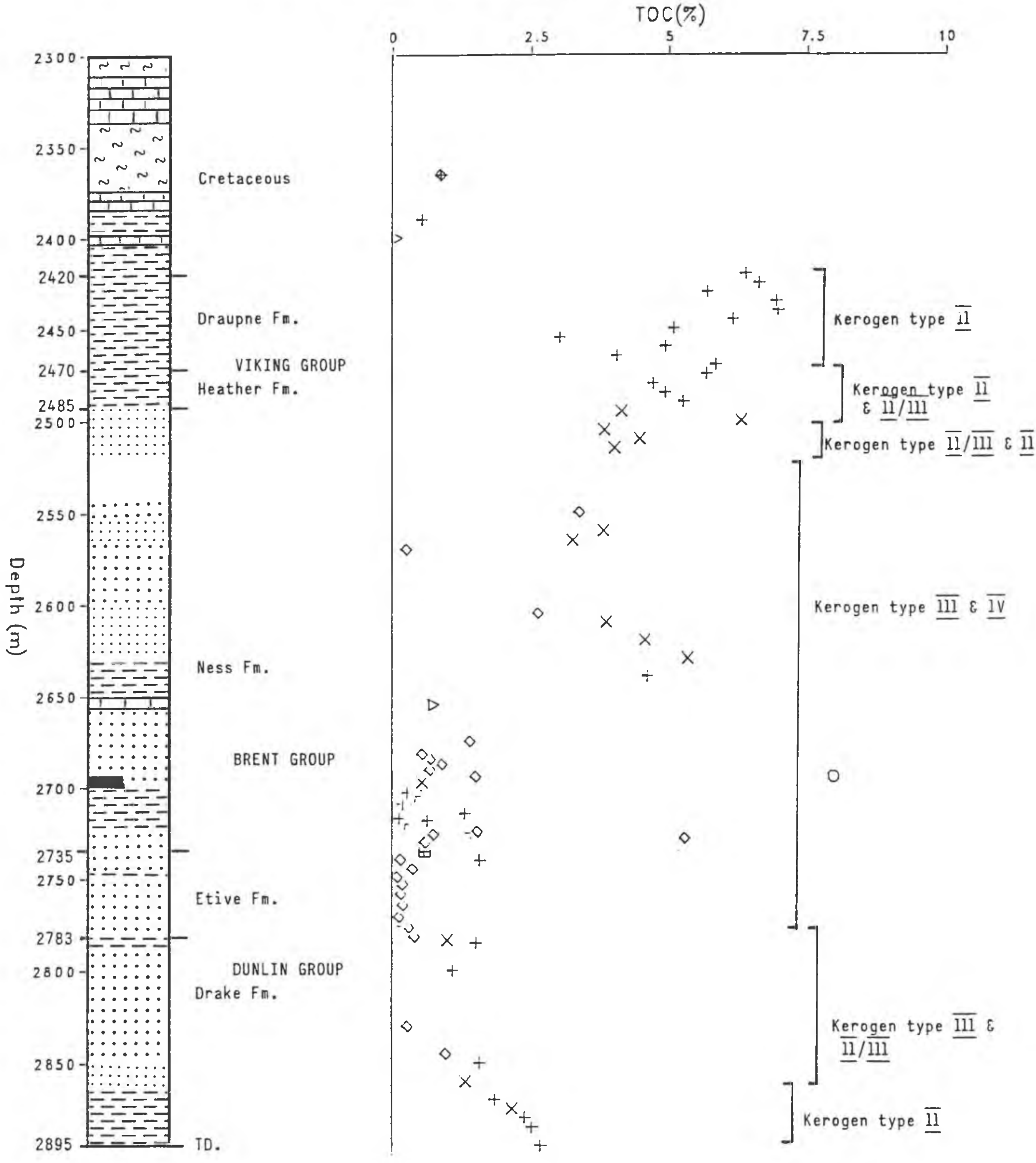
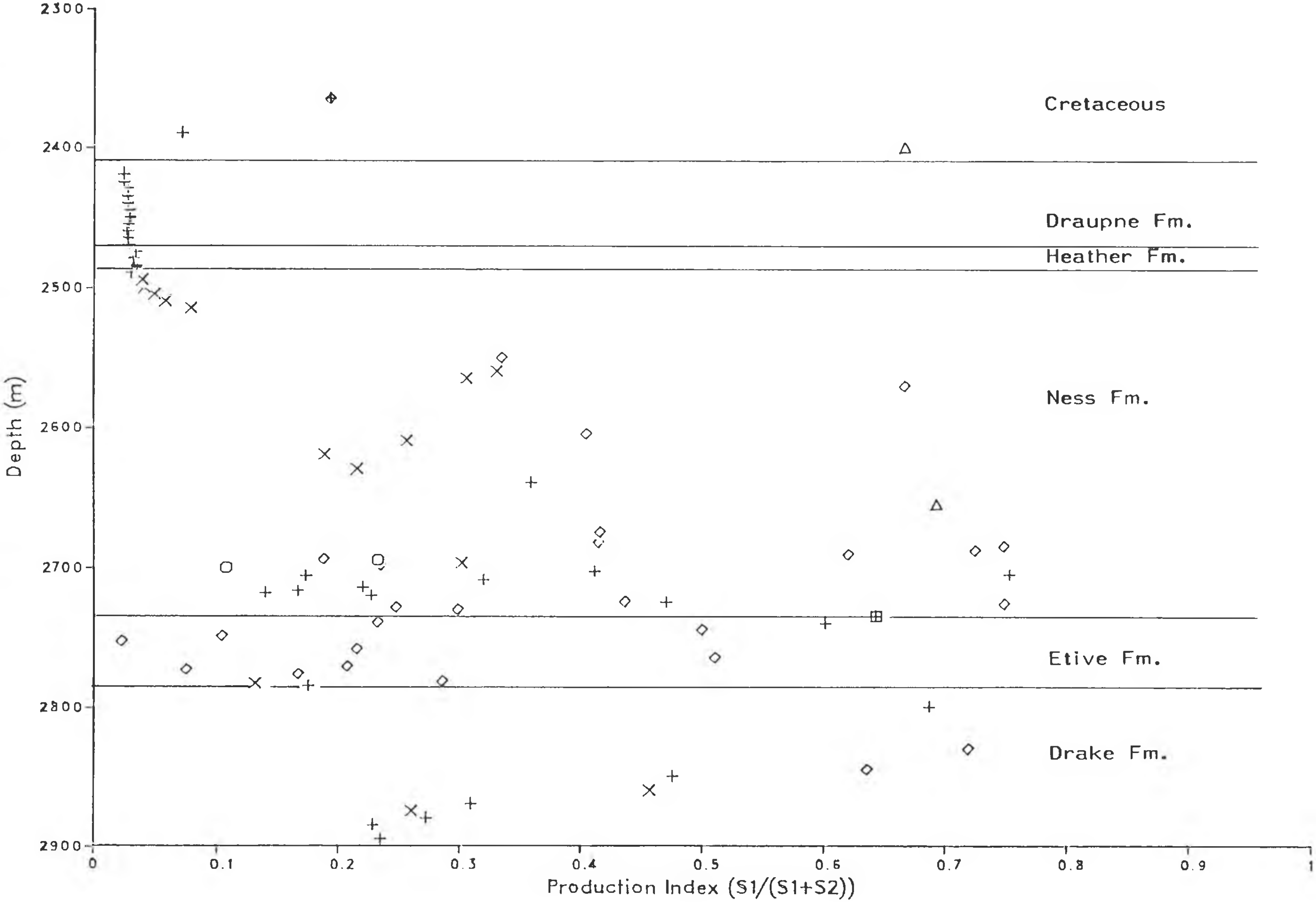


Figure: 2

Client:

Production Index Data for Well NOCS 30/9-1



GEOLAB NOR a/s - Geochemical Laboratories of Norway

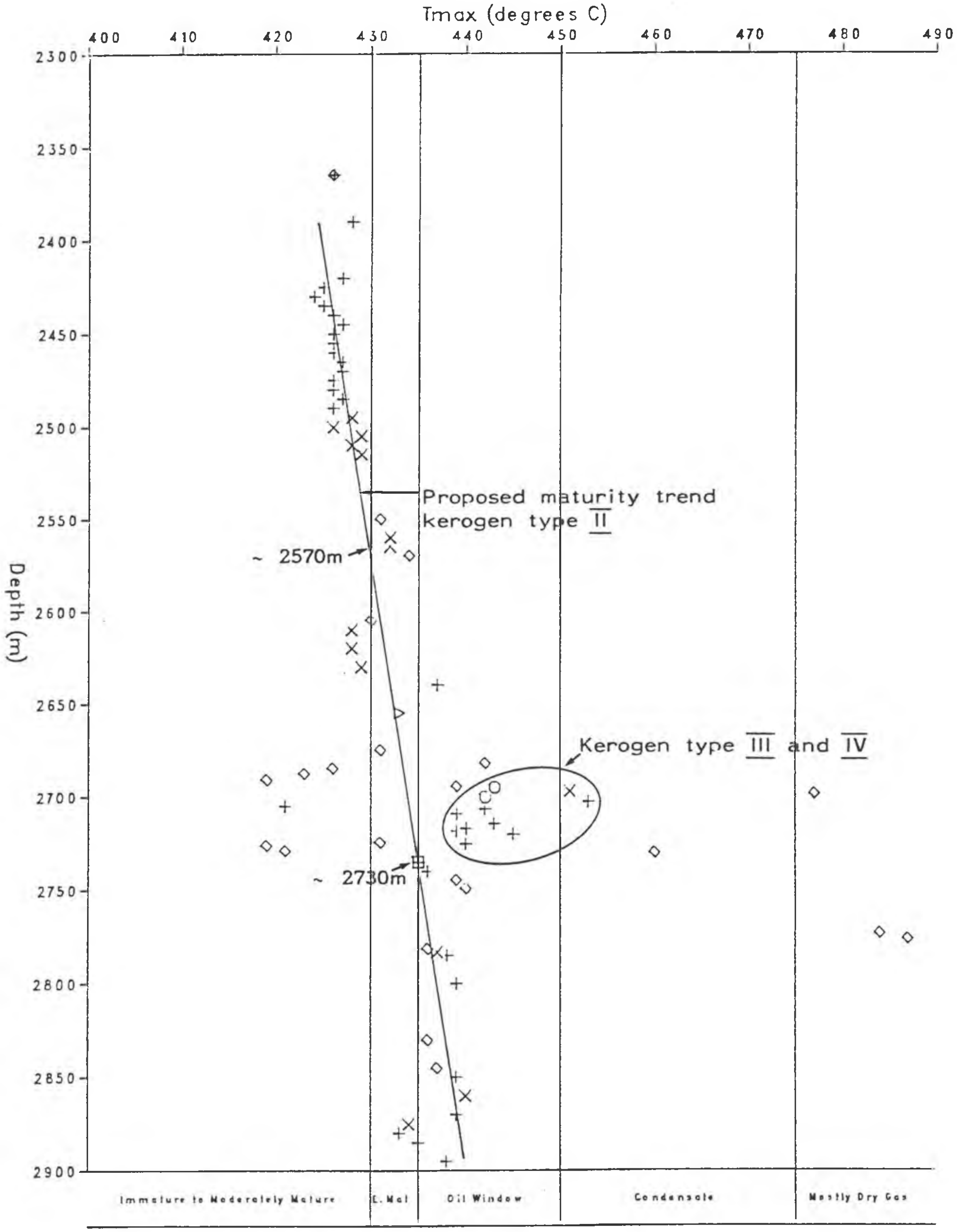
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Figure: 3

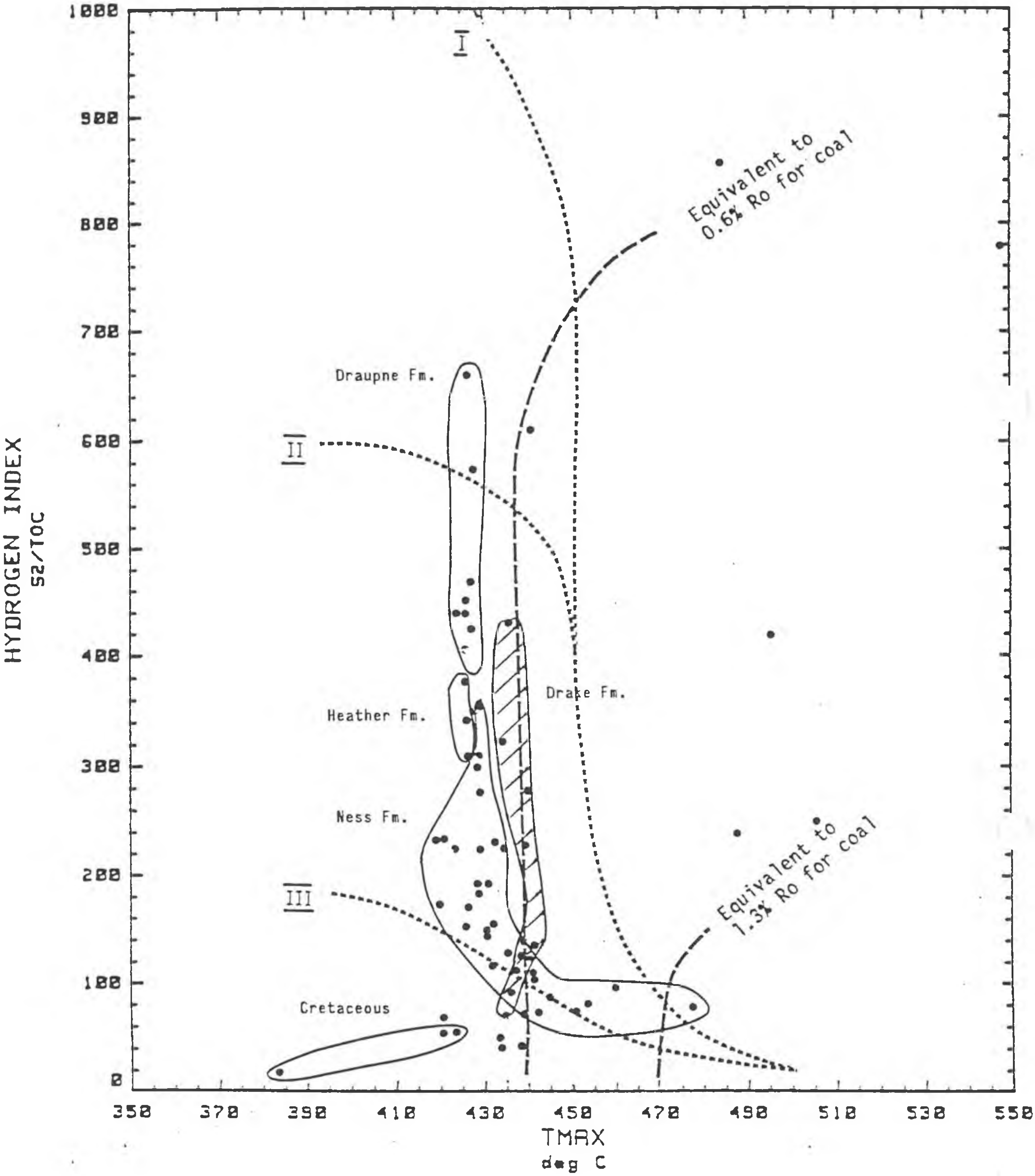
Client:

Tmax Data for Well NOCS 30/9-1



GEOLAB NOR a/s – Geochemical Laboratories of Norway

Figure 4. Hydrogen Index versus Tmax for well 30/9-1.



Analysis PV5800734 27, 1, 1 30/9-1, 2450m

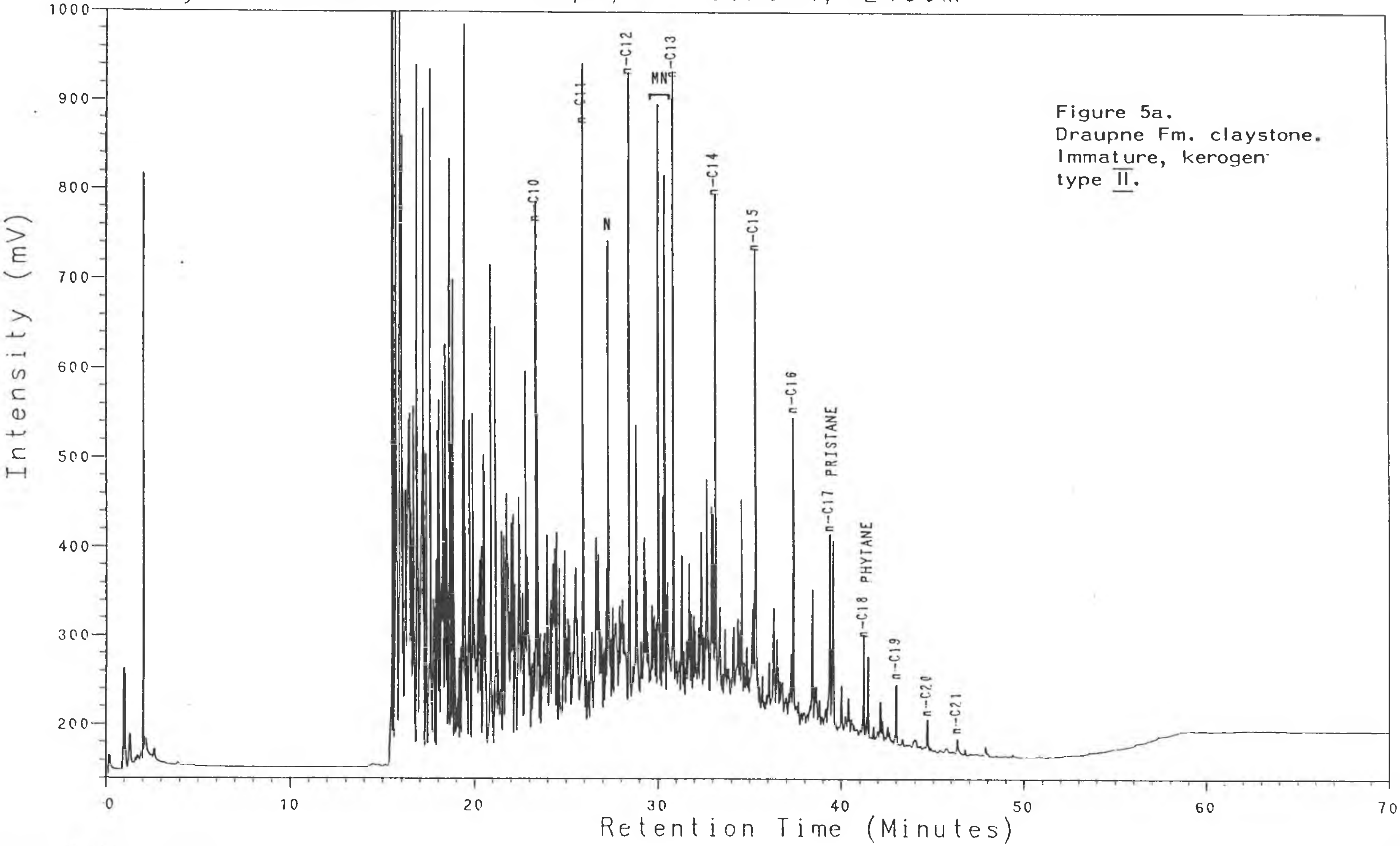


Figure 5a.
Draupne Fm. claystone.
Immature, kerogen type II.

NOCS 30/9-1 2450m
THERMAL EXTRACTION (S1)
Sh/Clst: drk gy to dsk y brn

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PV5800804 27, 1, 1 30/9-1, 2485m

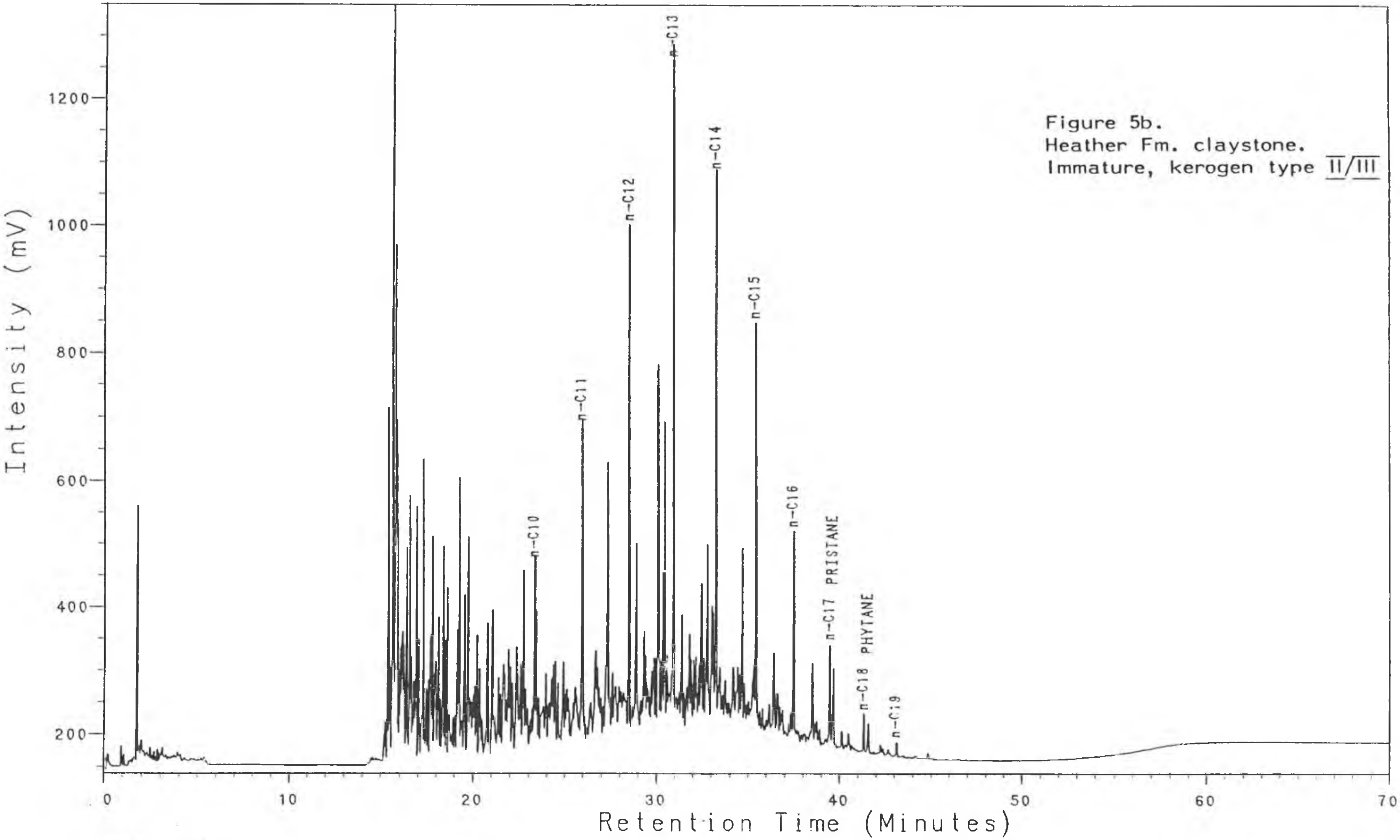


Figure 5b.
Heather Fm. claystone.
Immature, kerogen type II/III

NOCS 30/9-1 2465m
THERM EXTRACTION (S1)
Sh/Cl... drk gy to dsk y brn

GEOLAB NOR

Analysis PV5800935 27, 1, 1 30/9-1, 2550m

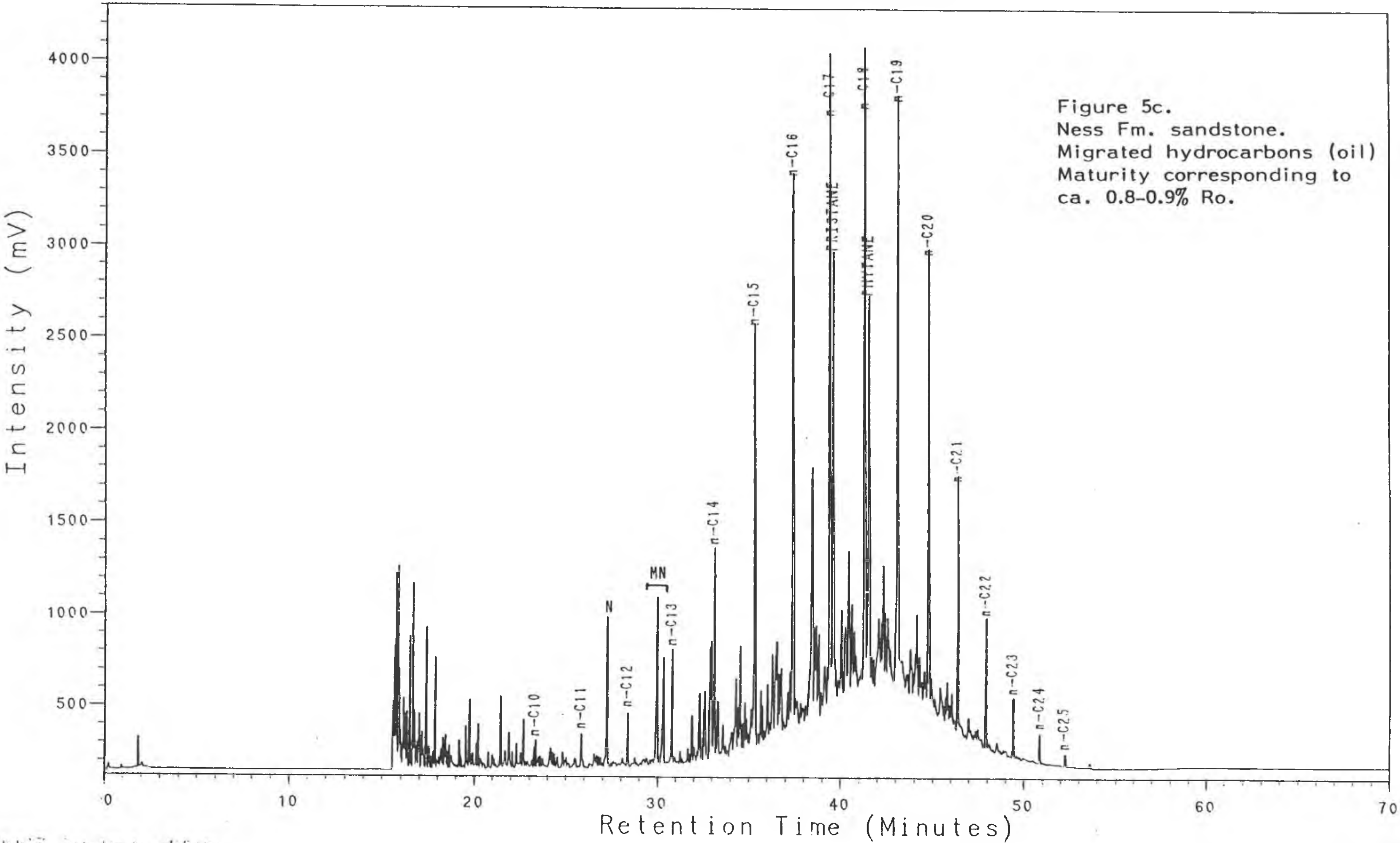


Figure 5c.
Ness Fm. sandstone.
Migrated hydrocarbons (oil)
Maturity corresponding to
ca. 0.8-0.9% Ro.

NOCS 30/9-1 2550m
THERMAL EXTRACTION (S1)
S/Sst: m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PV5800081 27, 1, 1 30/9-1, 2687,62m

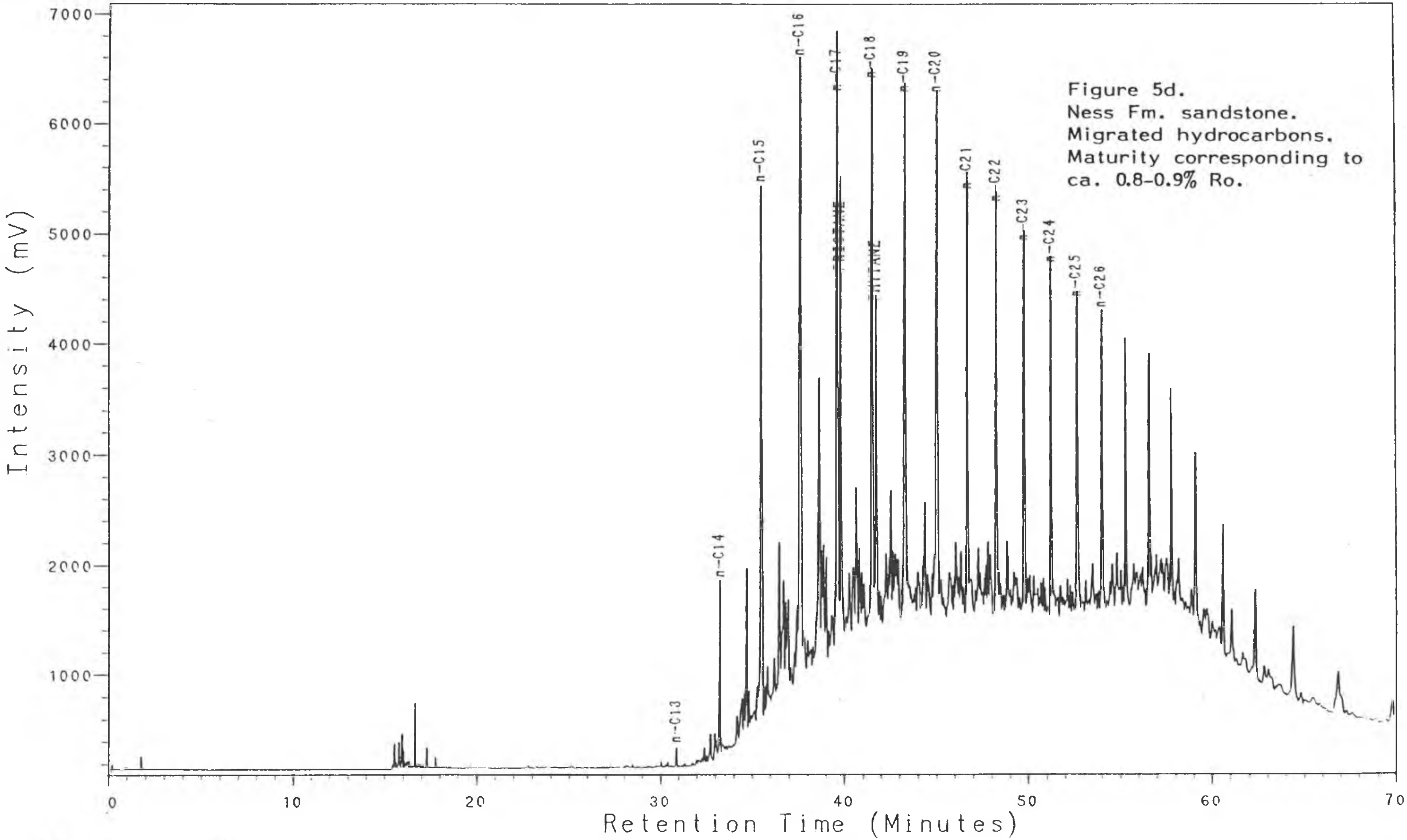


Figure 5d.
Ness Fm. sandstone.
Migrated hydrocarbons.
Maturity corresponding to
ca. 0.8-0.9% Ro.

NOCS 30/9-1 2687.62m ccp
THERMAL EXTRACTION (S1)

Analysis PV5801543 27, 1, 1 30/9-1, 2870m

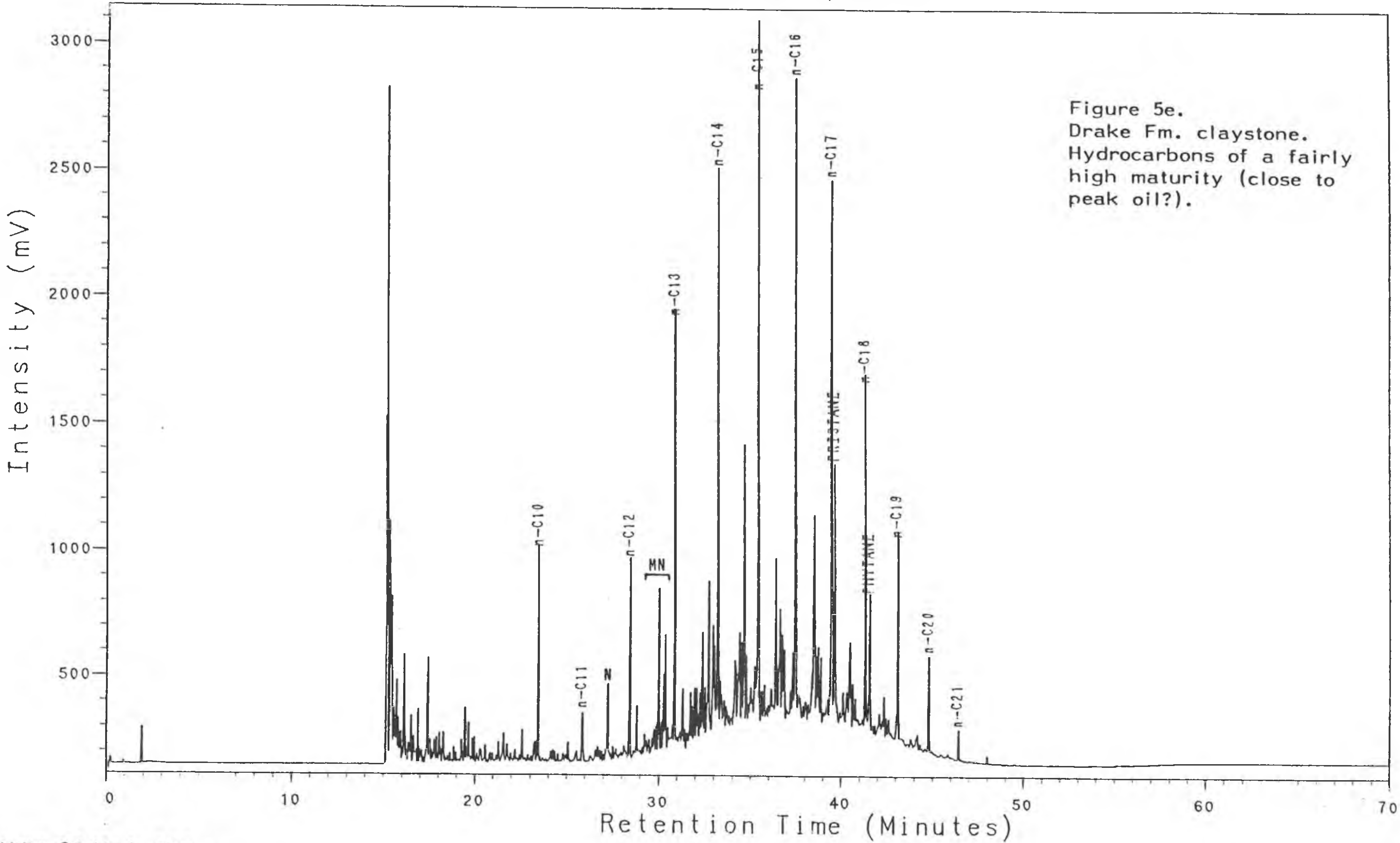


Figure 5e.
Drake Fm. claystone.
Hydrocarbons of a fairly high maturity (close to peak oil?).

30/9-1 287 m
THERMAL EXTRACTION (S1)
Sh/Clst:brn gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

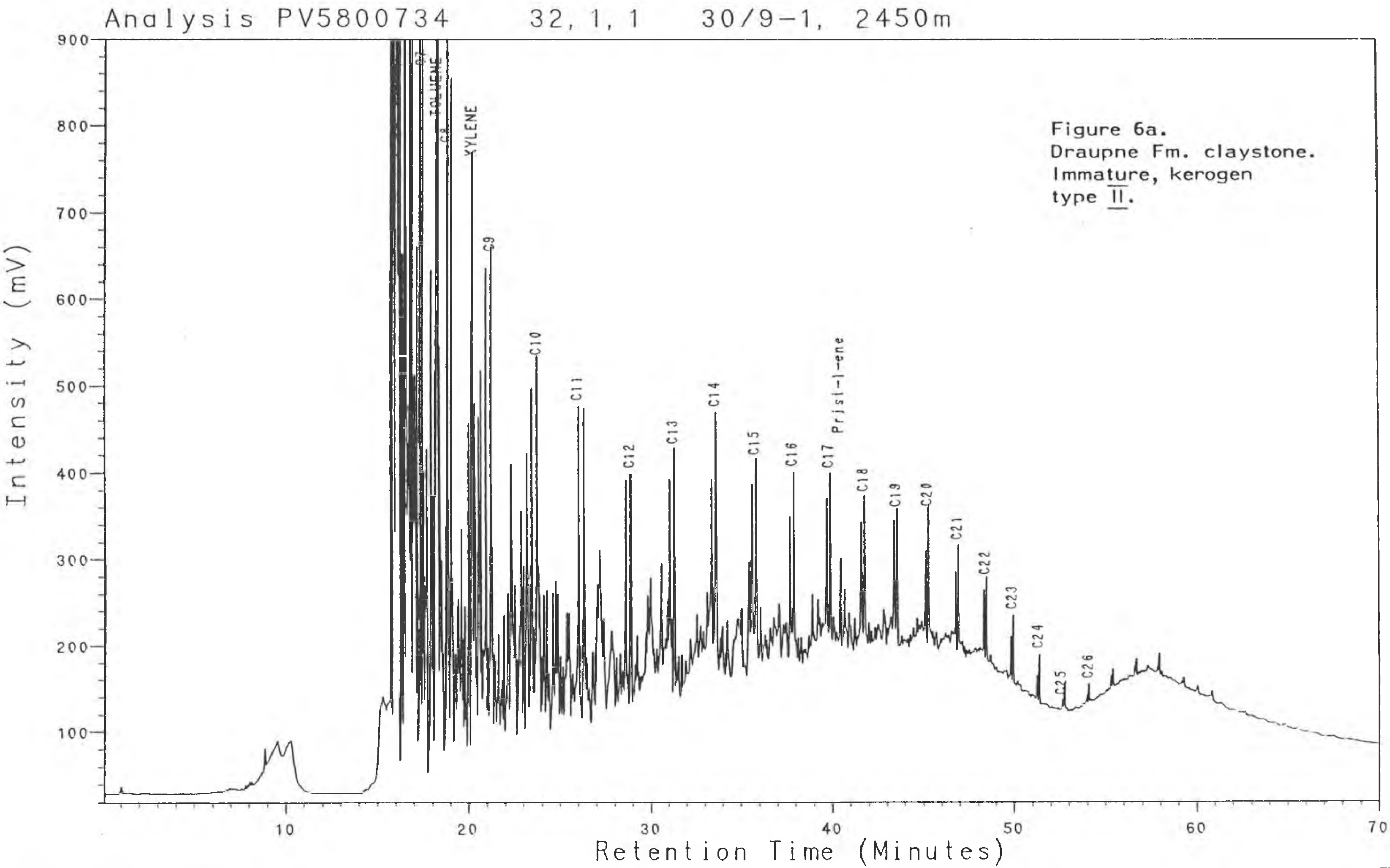
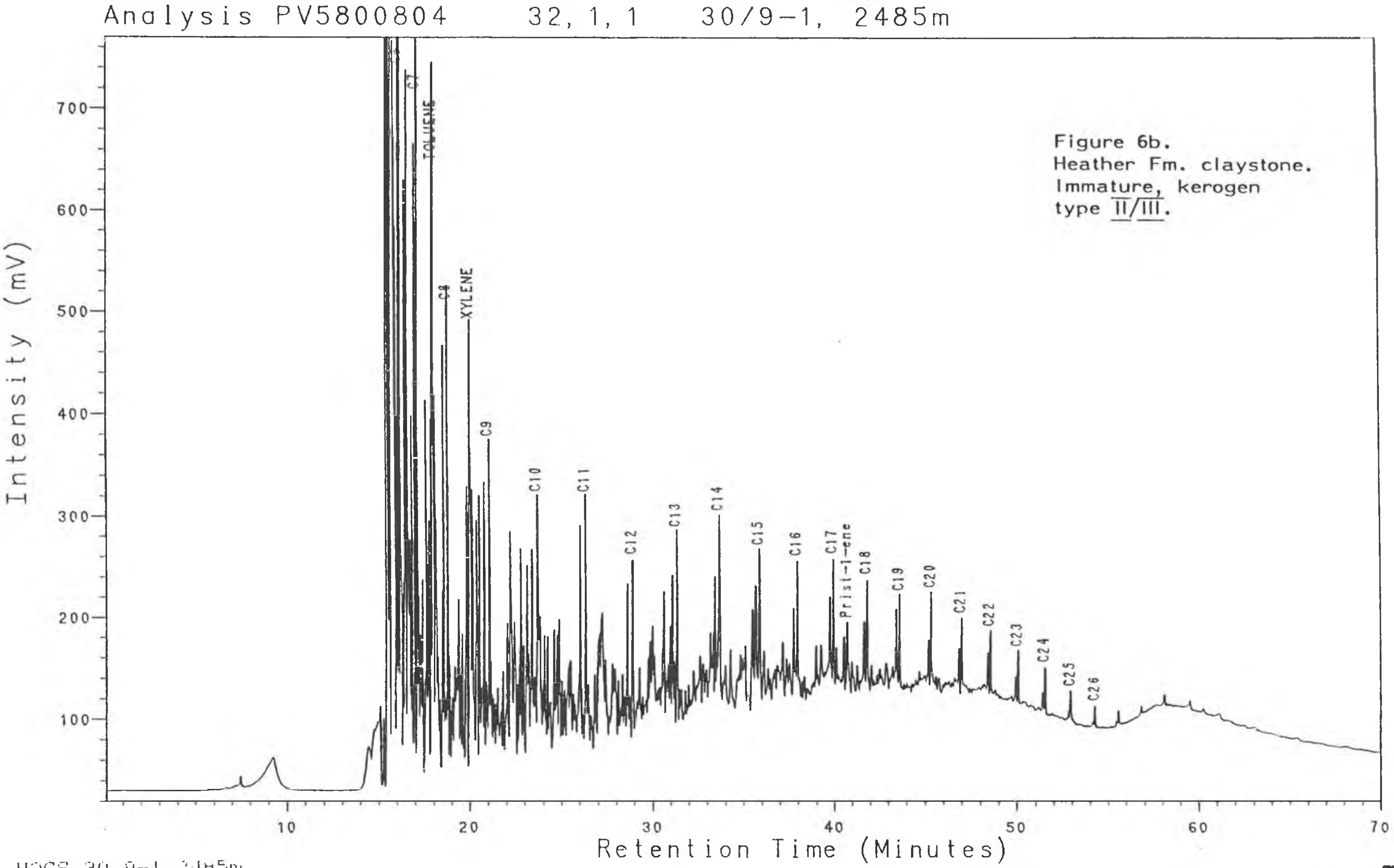


Figure 6a.
Draupne Fm. claystone.
Immature, kerogen type II.

NOCS 30/9-1 2450m
PYROLYSIS GC (S2)
Sh/C...: drk gy to dsk y brn



NOCS 30/9-1 2485m
PYROLYSIS GC (S2)
Sh/Clst: drk gy to dsk y brn

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

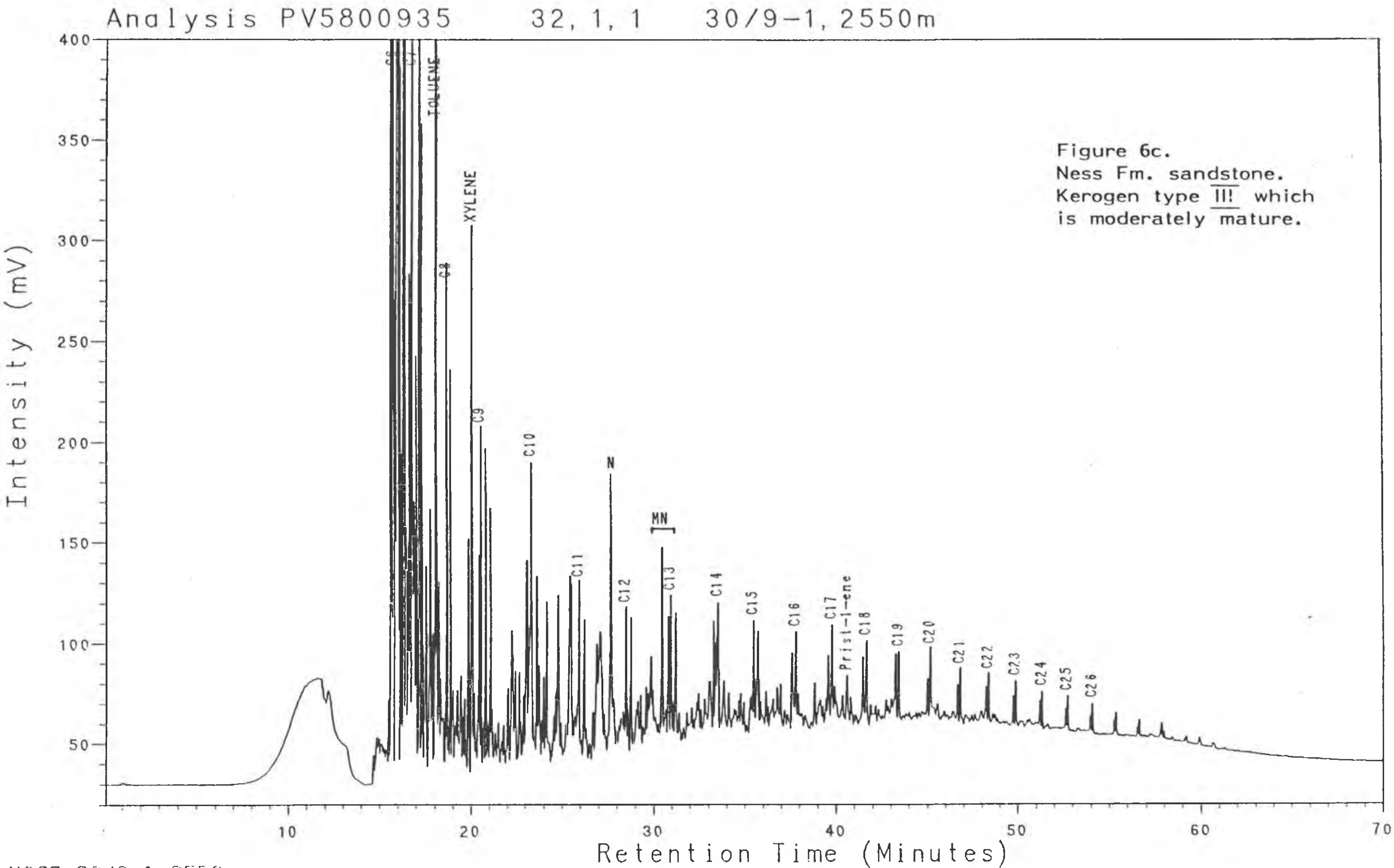


Figure 6c.
Ness Fm. sandstone.
Kerogen type III which
is moderately mature.

NOCS 30/9-1 2550m
PYROLY S GC (S2)
S/Sst: gy

GEOL NOR
GEOCHEMICA TORIES OF NORWAY A/S

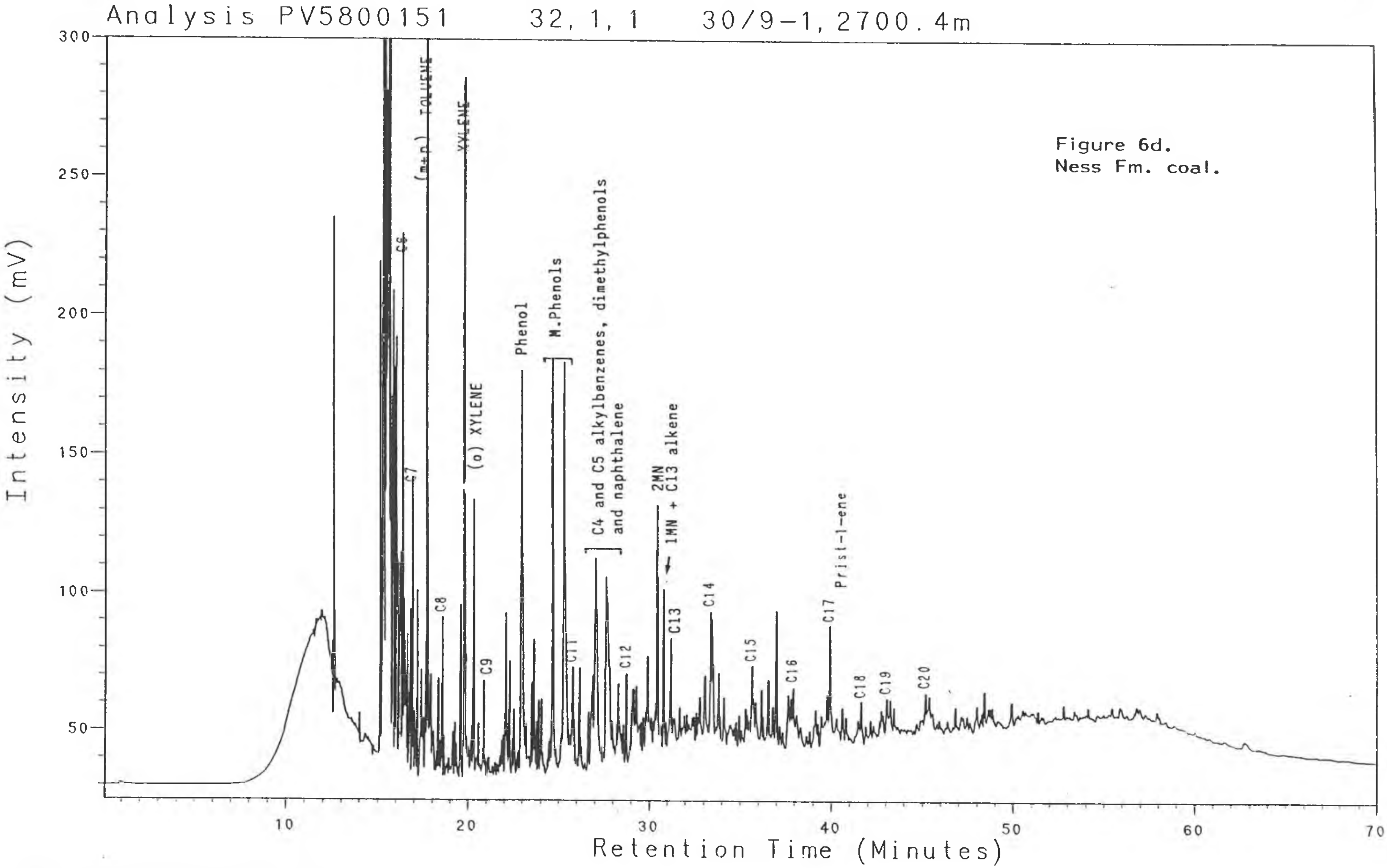
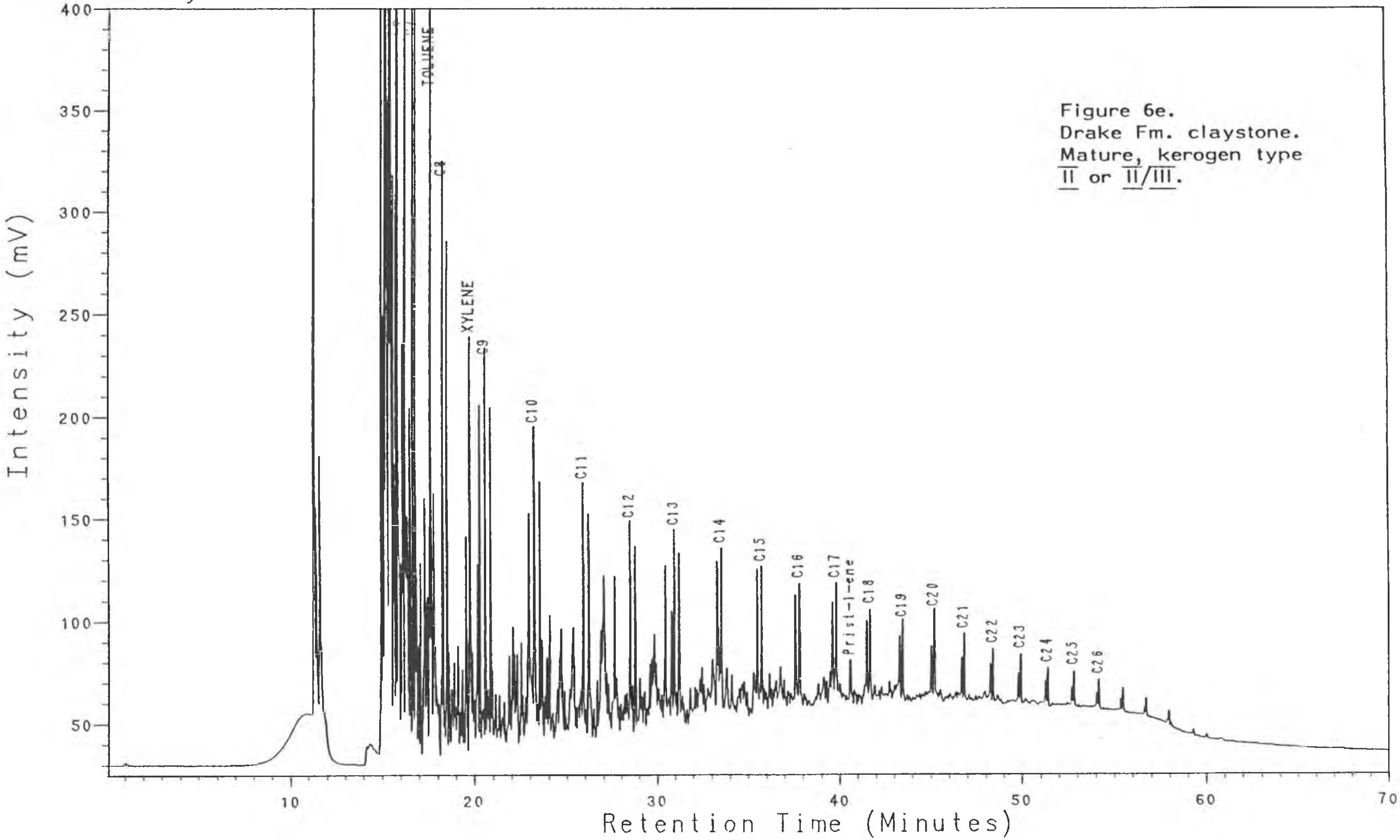


Figure 6d.
Ness Fm. coal.

NOCS 30/9-1 2700.40m ccp
PYROLYSIS GC (S2)
Coal: blk

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PV5801543 32, 1, 1 30/9-1, 2870m

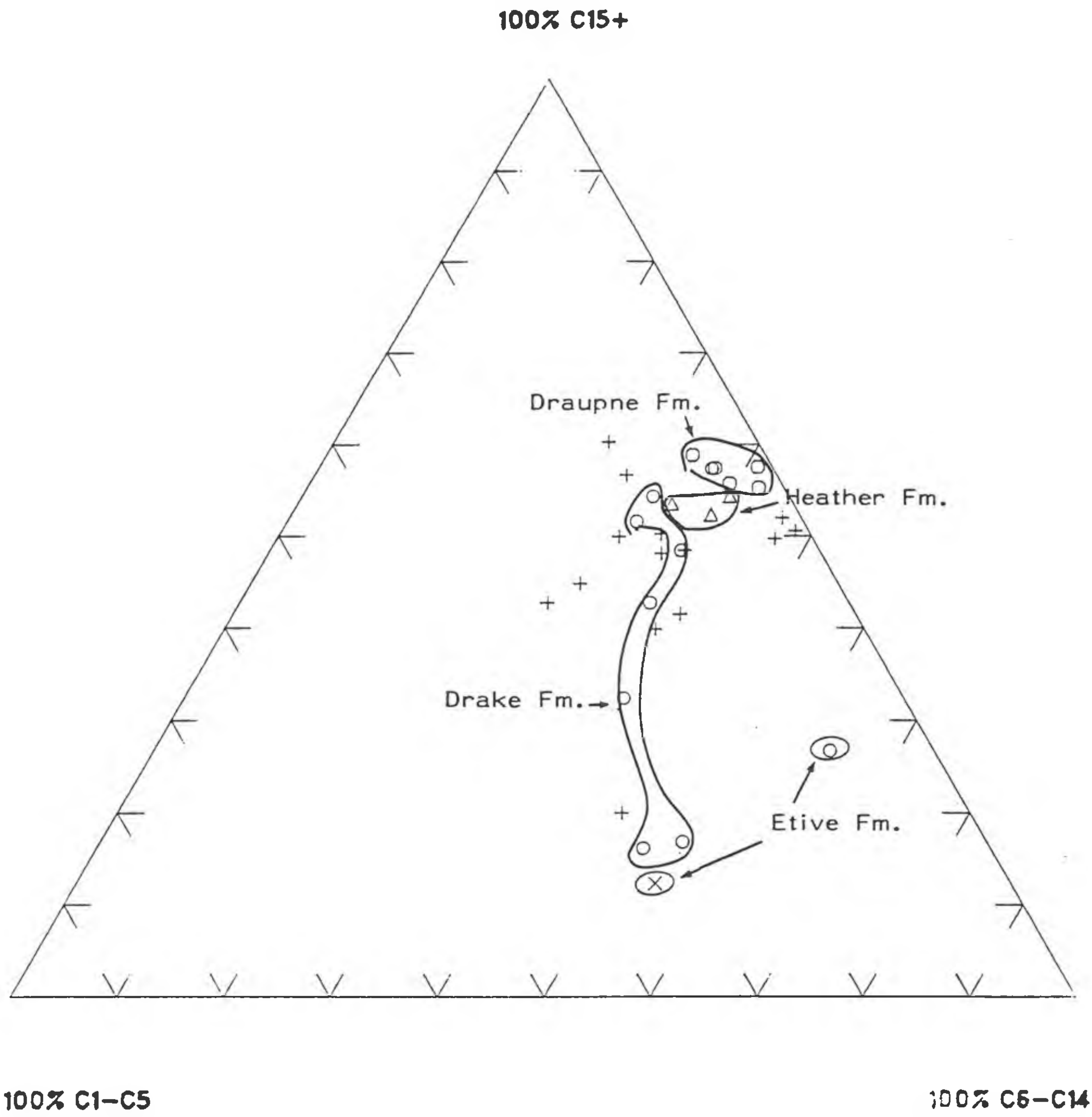


NOCS 30/9-1 2870m
PYROLYSIS GC (S2)
Sh/Clst: brn gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Figure 7 : Pyrolysis GC Composition

Well NOCS 30/9-1



Startdepth: 2420.00 Enddepth: 2470.00
Startdepth: 2470.00 Enddepth: 2500.00
Startdepth: 2500.00 Enddepth: 2737.00
Startdepth: 2737.00 Enddepth: 2783.00
Startdepth: 2783.00 Enddepth: 2800.00

Analysis SC9242440 5, 1, 1 30/9-1, 2420-40m

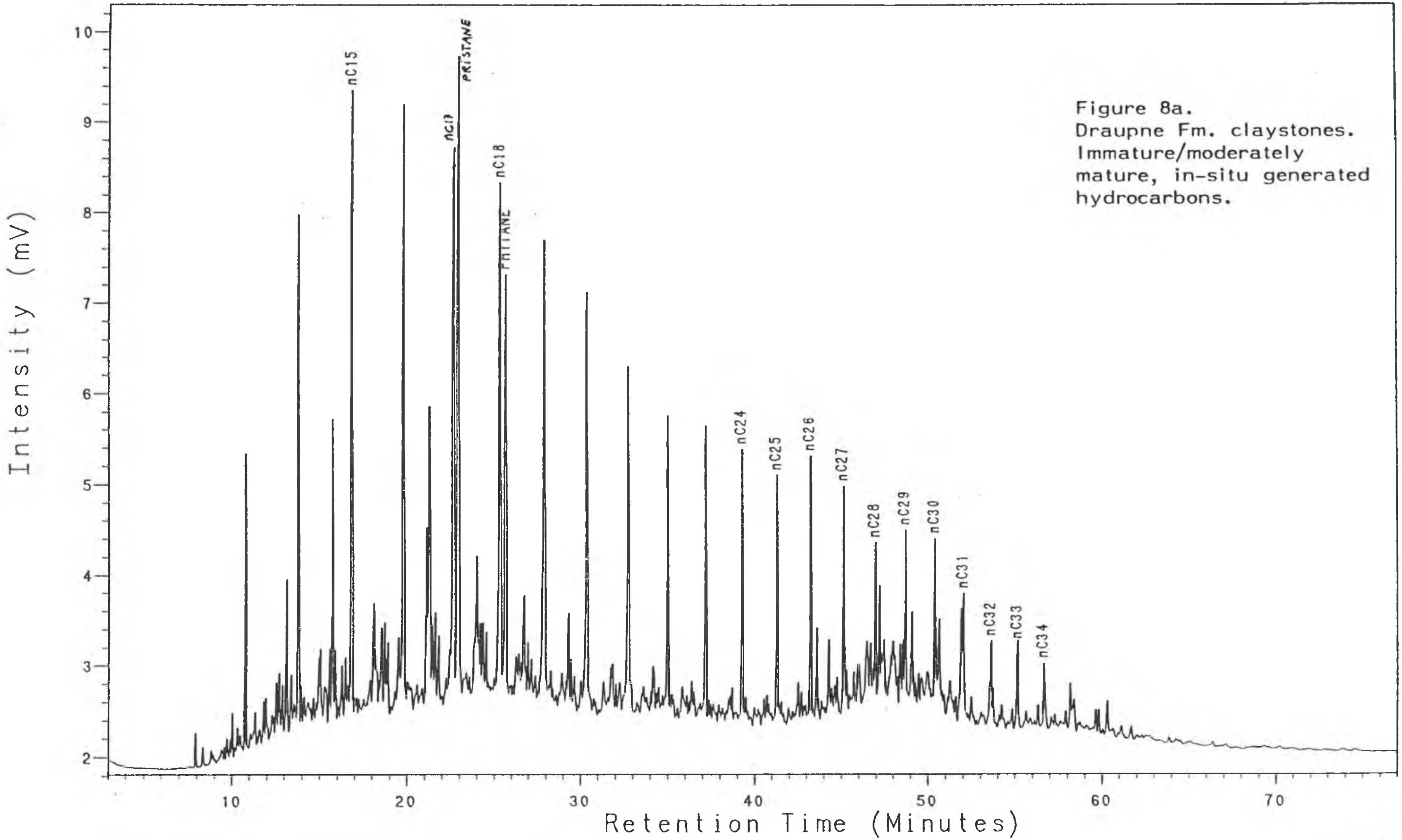


Figure 8a.
Draupne Fm. claystones.
Immature/moderately
mature, in-situ generated
hydrocarbons.

NOCS 30/9-1 2420-2440m
TURATED GC
LST:drk gy to dsk y brn

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis SC9242565 5, 1, 1 30/9-1 2560-2565m

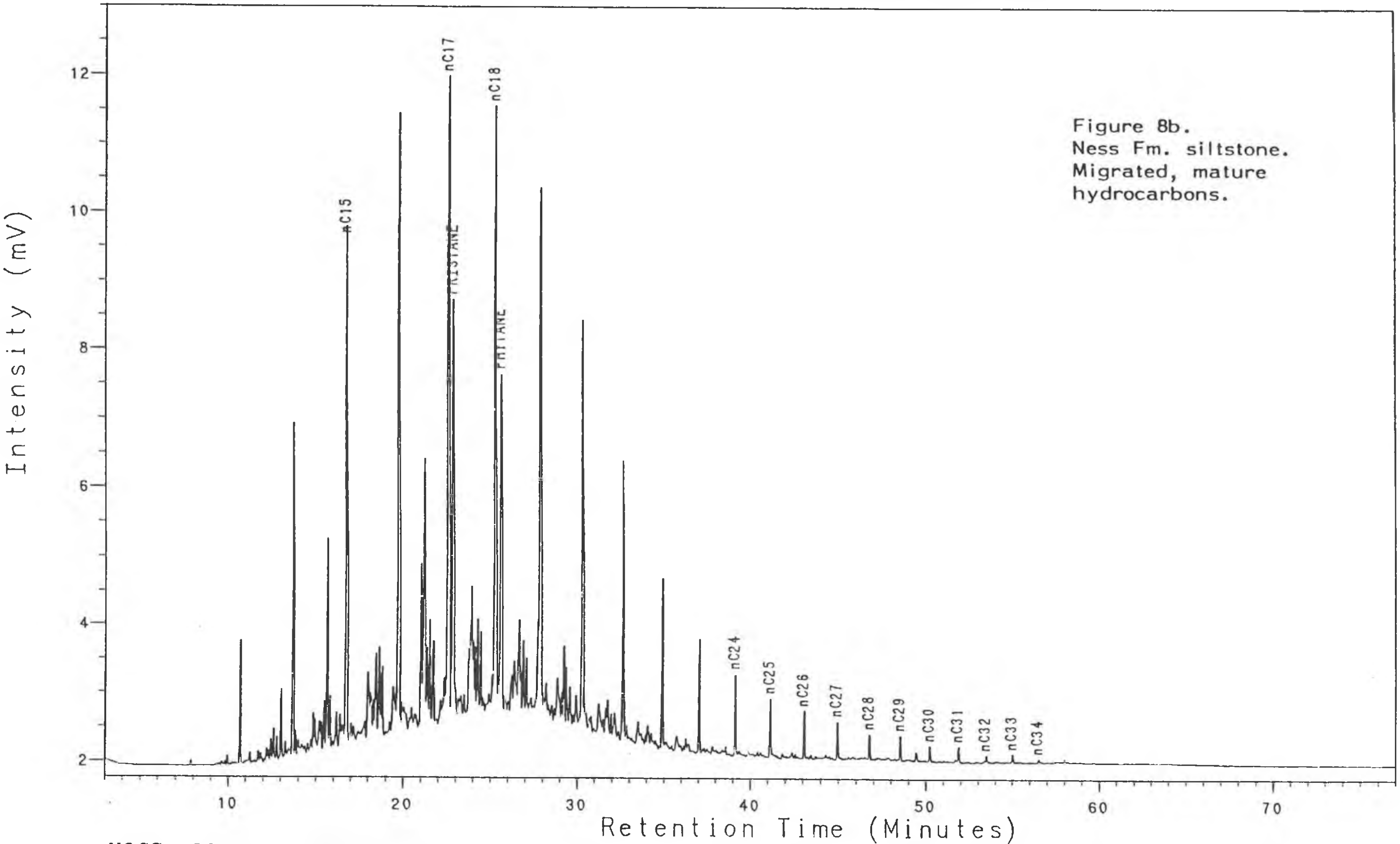


Figure 8b.
Ness Fm. siltstone.
Migrated, mature
hydrocarbons.

NOCS 30/9-1 2560-2565m
SATURATED GC
SLTST:m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis SC9242724 5, 1, 1 30/9-1, 2724.35m

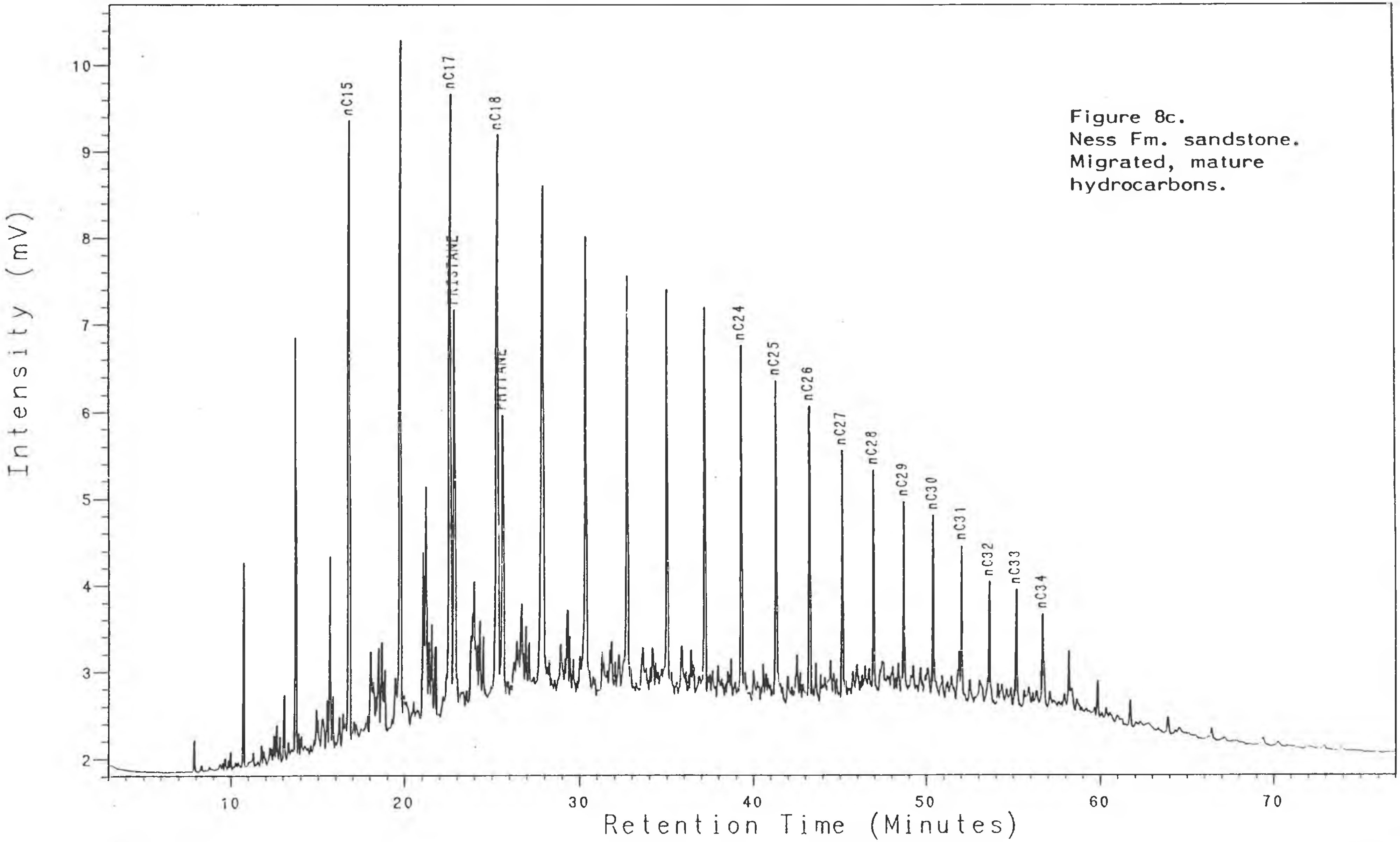
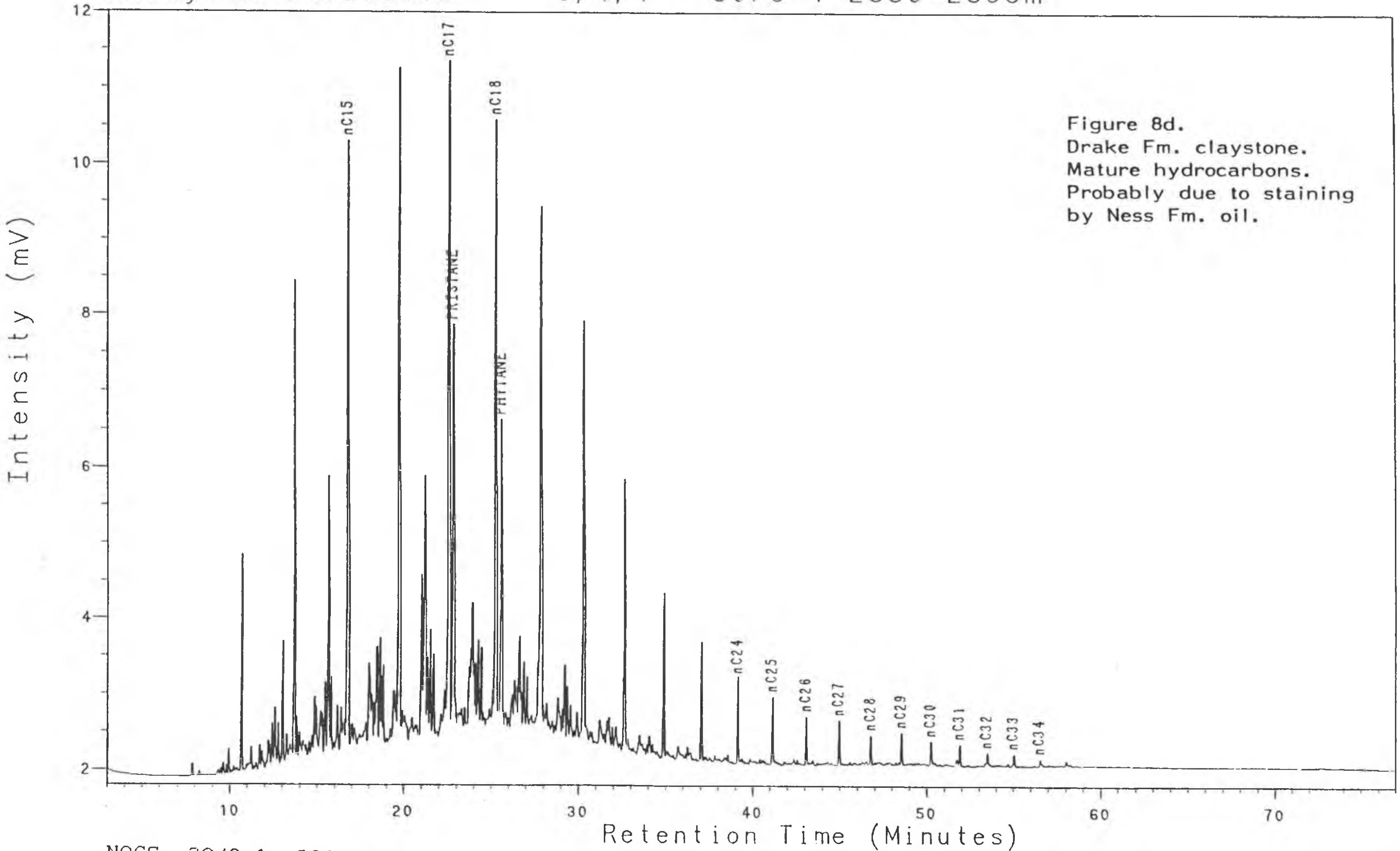


Figure 8c.
Ness Fm. sandstone.
Migrated, mature
hydrocarbons.

NOCS 30/9-1 2724.35m
TURATED GC
ST:pl y brn to or gy

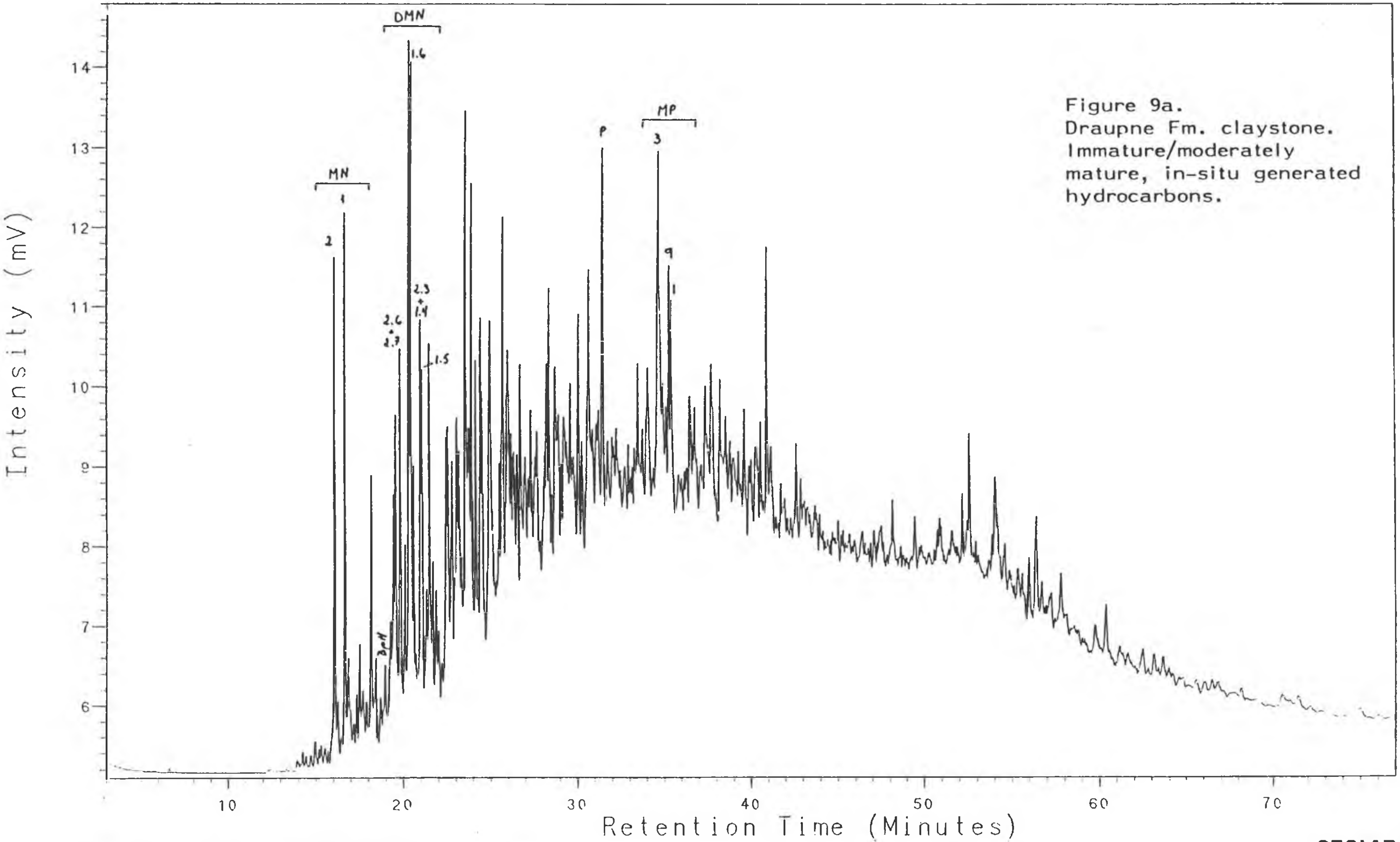
Analysis SC9242895 5, 1, 1 30/9-1 2880-2895m



NOCS 30/9-1 2880-2895m
SATURATED GC
CLST:brn gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

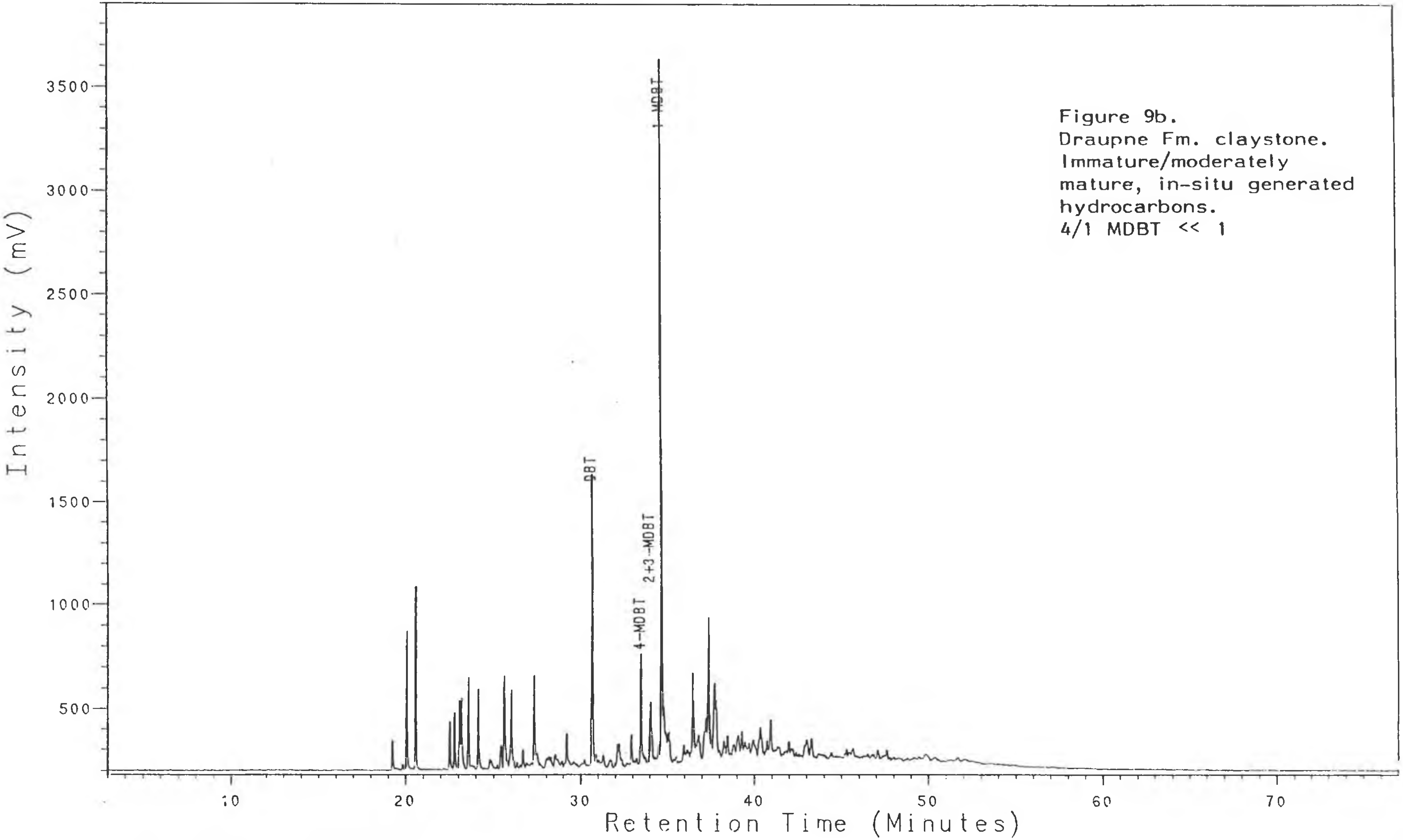
Analysis AR9242440 8, 1, 1 30/9-1, 2420-40m



NOCS 30/9-1 2420-2440m
ROMATIC GC (FID)
CLST:drk gy to dsk y brn

GEOLAB NOR
GEOCHEMIC... ATORIES OF NORWAY A/S

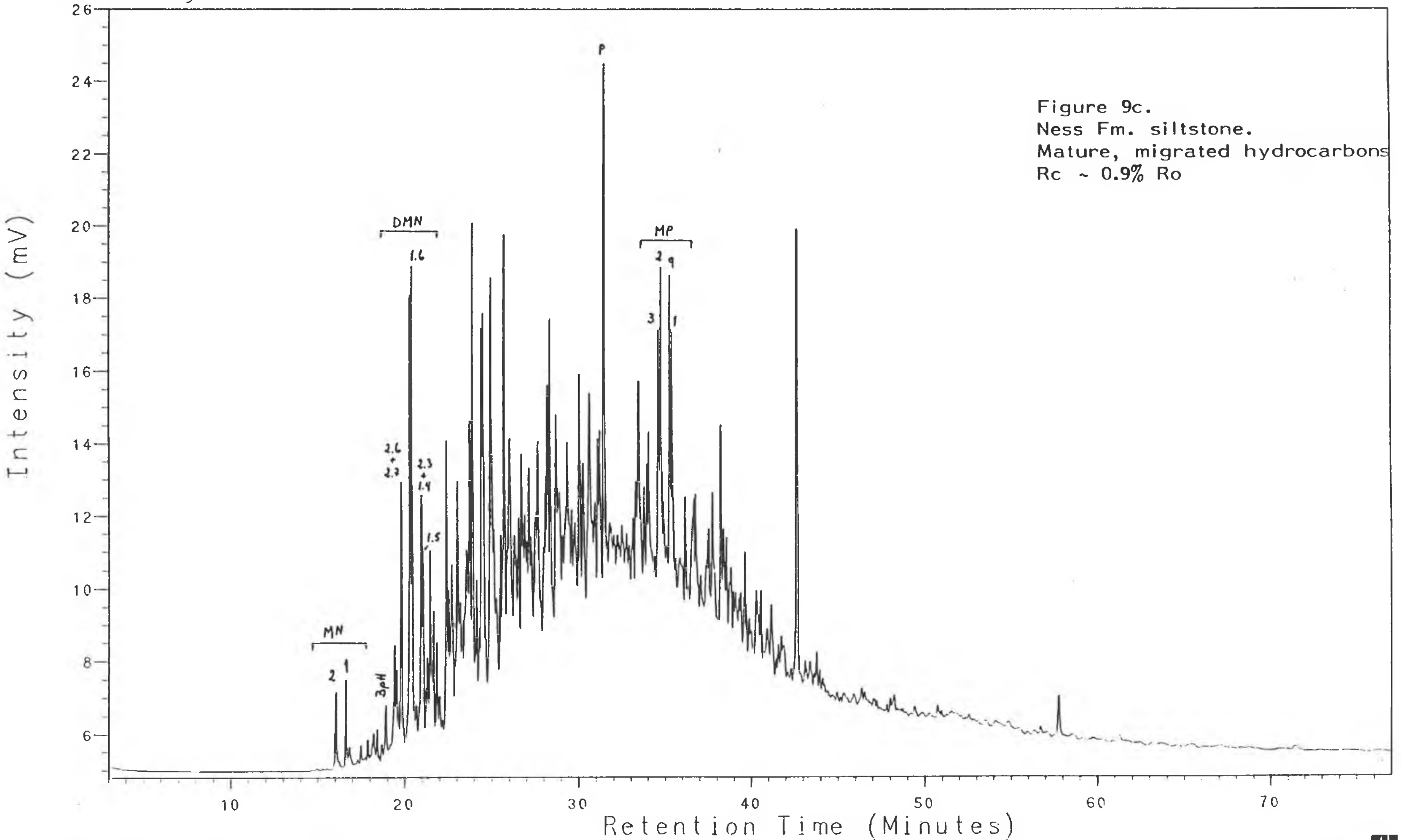
Analysis AR9242440 7, 1, 1 30/9-1, 2420-40m



NOCS 30/9-1 2420-2440m
AROMATIC GC (FPD)
CLST:drk gy to dsk y brn

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis AR9242565 8, 1, 1 30/9-1, 2560-65m



NOCS 30/9-1 2560-2565m
AROMATIC GC (FID)
SLTST:m gy to drk gy

Analysis AR9242565 7, 1, 1 30/9-1, 2560-65m

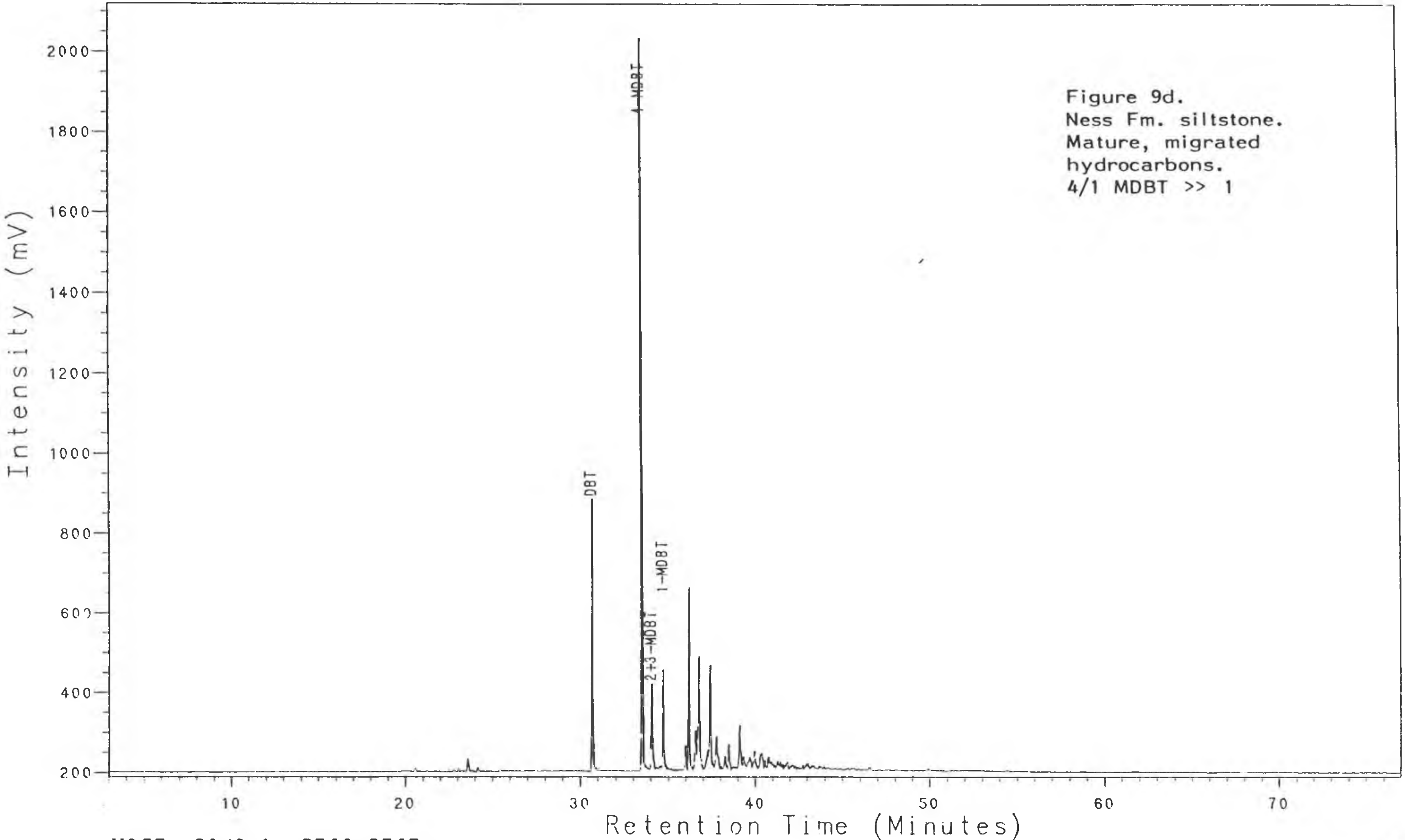
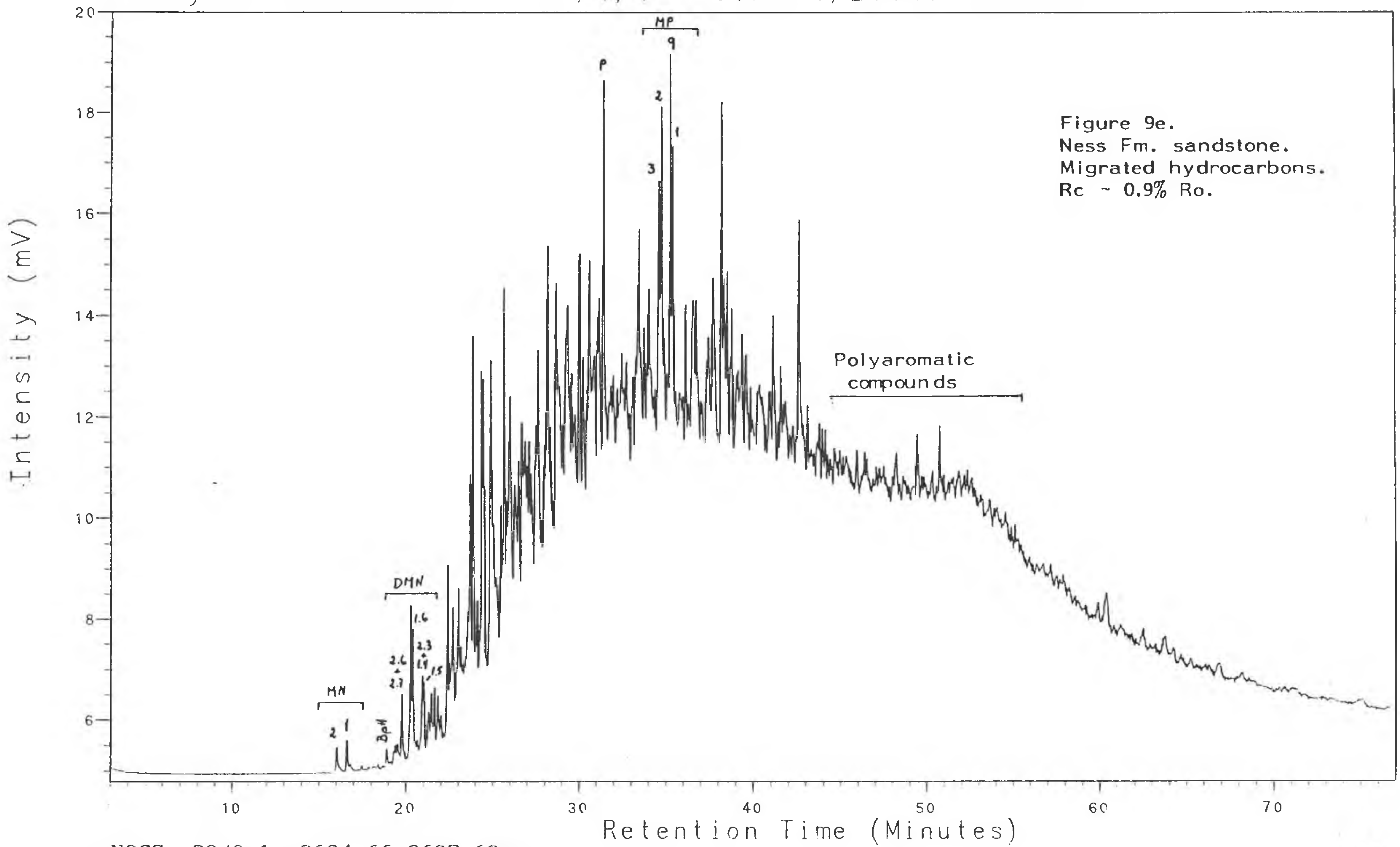


Figure 9d.
Ness Fm. siltstone.
Mature, migrated
hydrocarbons.
4/1 MDBT >> 1

NOCS 30/9-1 2560-2565m
AROMATIC GC (FPD)
SLTST:m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

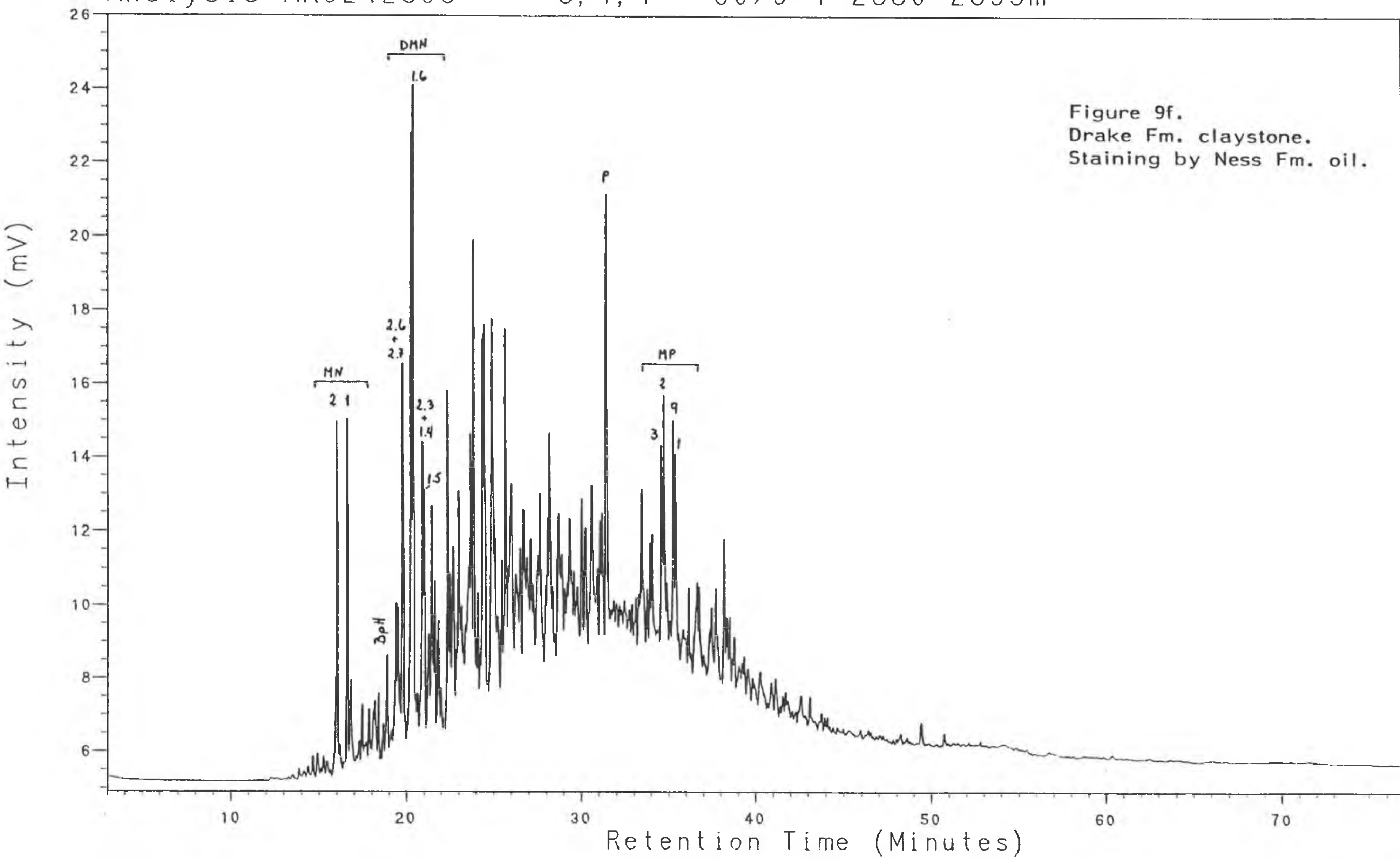
Analysis AR9242687 8, 1, 1 30/9-1, 2684.7-87.6m



NOCS 30/9-1 2684,66-2687,62m
'ROMATIC GC (FID)
JST:gy brn to dsk brn

GEOLAB NOR

Analysis AR9242895 8, 1, 1 30/9-1 2880-2895m



NOCS 30/9-1 2880-2895m
AROMATIC GC (FID)
CLST: brn gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Figure 10: Vitrinite Reflectance versus Depth
Well NOCS 30/9-1

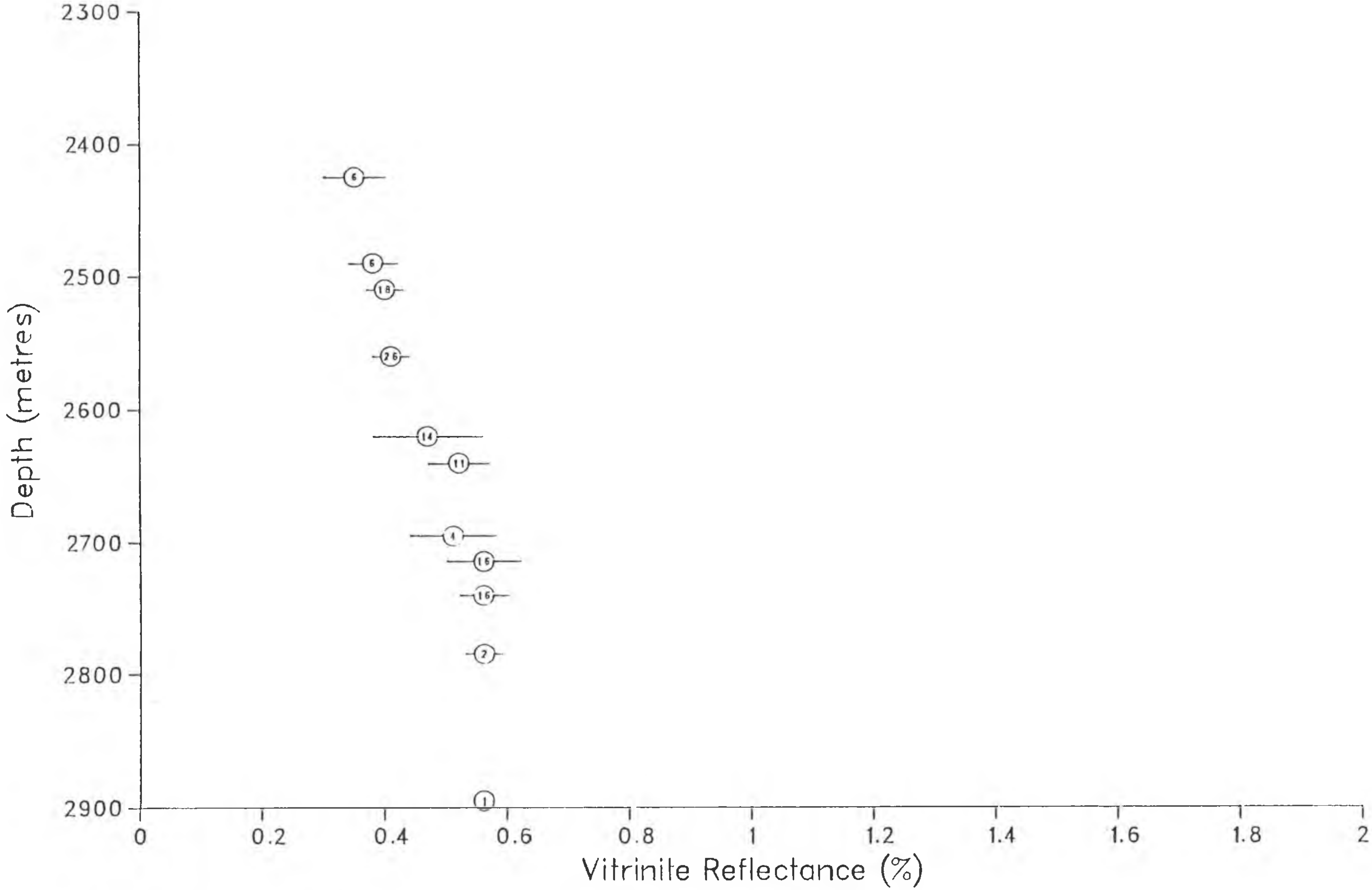


Figure 11: Kerogen Composition and Potential Hydrocarbon Products

Well NOCS 30/9-1

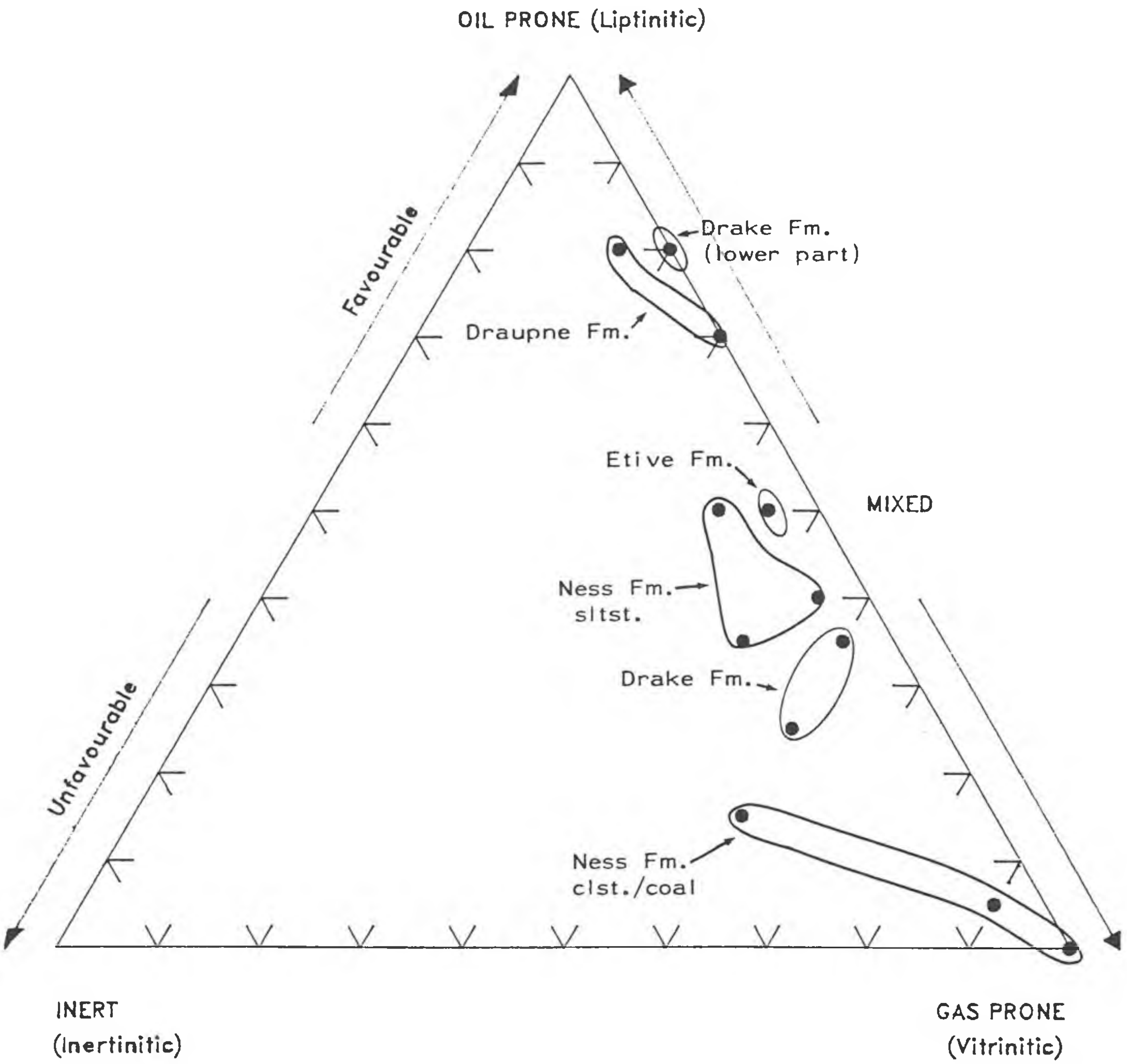
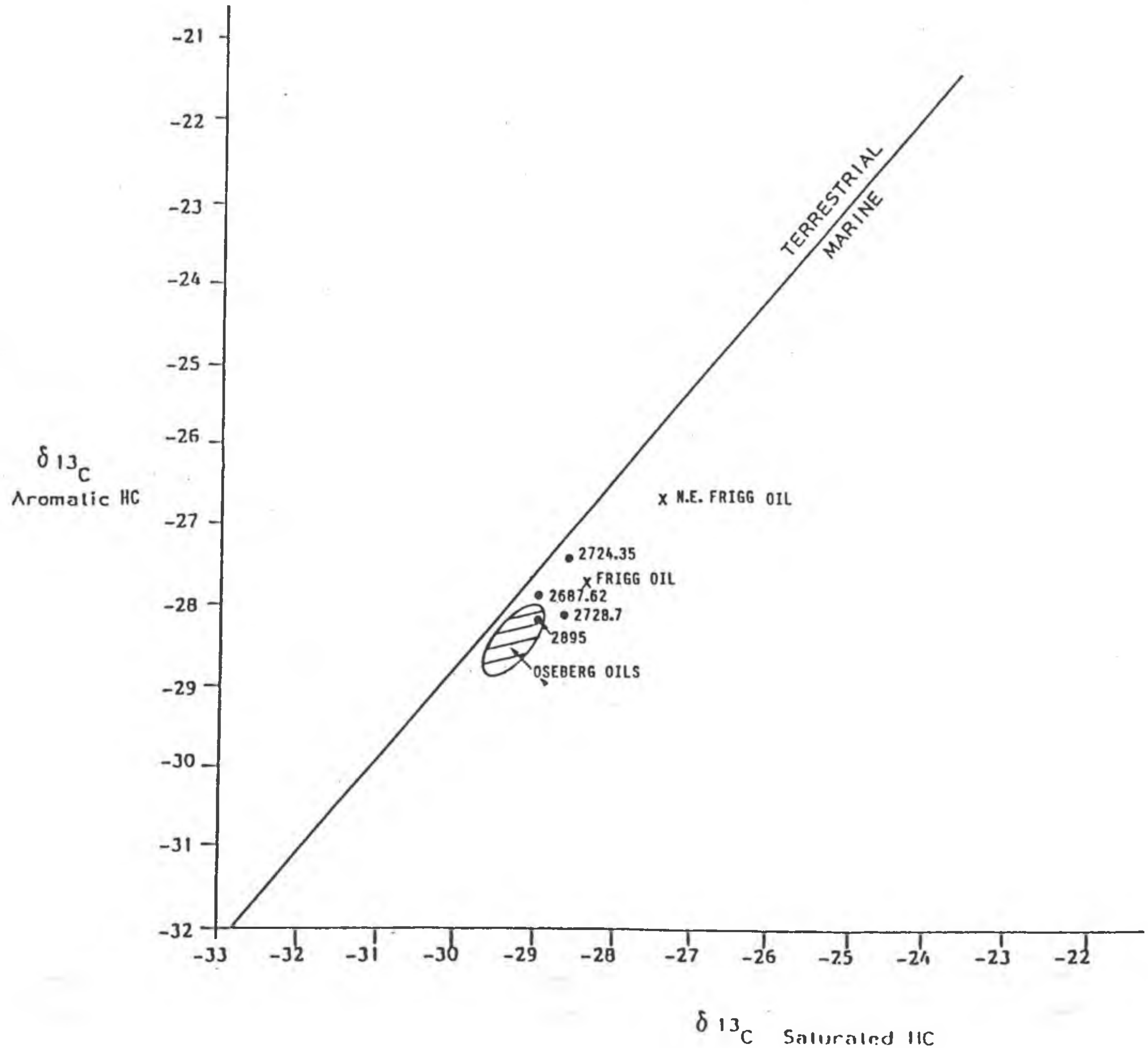


Figure 12. Plot of $\delta^{13}C$ in saturated fraction versus aromatic fraction for Well NOCS 30/9-1.



Appendix 1

Tables

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Frm / Age / Lithology description	Trb	Sample
2350.00				Cretaceous		0054
			50	Ca : w, chk		0054-1L
			50	Marl : m gy		0054-2L
			tr	Sh/Clst: gy red		0054-3L
			tr	Cont : prp		0054-4L
2355.00				Cretaceous		0055
			60	Ca : w, chk		0055-1L
			30	Sh/Clst: gn gy, gy red		0055-4L
			10	Marl : m gy		0055-2L
			tr	Cont : prp		0055-3L
			tr	Other : pyr		0055-5L
2360.00				Cretaceous		0056
			60	Sh/Clst: gn gy, gy red to brn gy		0056-4L
			25	Marl : m gy		0056-2L
			15	Ca : w, chk		0056-1L
			tr	Cont : prp		0056-3L
			tr	Other : pyr		0056-5L
2365.00				Cretaceous		0057
		0.84	75	Marl : m gy		0057-2L
			20	Sh/Clst: gn gy, gy red to brn gy		0057-4L
			5	Ca : w, chk		0057-1L
			tr	Cont : prp		0057-3L
			tr	Other : pyr		0057-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Frm / Age — Lithology description	Trb	Sample
2370.00				Cretaceous		0058
			70	Marl : m gy		0058-2L
			15	Cont : dd		0058-3L
			10	Sh/Clst: gn gy, gy red to brn gy		0058-4L
			5	Ca : w, chk		0058-1L
			tr	Other : pyr		0058-5L
2375.00				Cretaceous		0059
			45	Ca : w, chk		0059-1L
			25	Marl : m gy		0059-
			25	Sh/Clst: gn gy, gy red to brn gy		0059-4L
			5	Cont : prp		0059-3L
			tr	Other : pyr		0059-5L
2380.00				Cretaceous		0060
			50	Ca : w, chk		0060-1L
			40	Sh/Clst: gn gy, gy red to brn gy, mic		0060-4L
			10	Marl : m gy		0060-2L
			tr	Cont : prp		0060-3L
2385.00				Cretaceous		0160
			70	Sh/Clst: gn gy, gy red to brn gy		0160-4L
			15	Ca : w, chk		0160-1L
			15	Sh/Clst: m gy, calc		0160-2L
			tr	Cont : prp		0160-3L
2390.00				Cretaceous		0061
		0.50	70	Sh/Clst: gn gy, gy red to brn gy, mic		0061-4L
			20	Ca : w, chk		0061-1L
			10	Marl : m gy		0061-2L
			tr	Cont : fib		0061-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Frm / Age / Lithology description	Trb	Sample
2395.00				Cretaceous		0062
			45	Sh/Clst: gn gy, gy red to brn gy, mic		0062-4L
			35	Ca : w, chk		0062-1L
			20	Marl : m gy		0062-2L
			tr	Cont : fib		0062-3L
2400.00				Cretaceous		0063
		0.06	40	Ca : w, chk		0063-1L
			35	Marl : m gy		0063-2L
			25	Sh/Clst: gn gy, brn gy to gy red		0063-3L
			tr	Other : pyr		0063-4L
2405.00				Cretaceous		0064
			60	Sh/Clst: gn gy, brn gy to gy red		0064-3L
			25	Ca : w, chk		0064-1L
			15	Marl : m gy		0064-2L
			tr	Other : pyr		0064-4L
			tr	Ca : lt brn		0064-5L
2410.00				Cretaceous		0065
			40	Marl : m gy		0065-2L
			40	Sh/Clst: gn gy, brn gy to gy red		0065-3L
			20	Ca : w, chk		0065-1L
			tr	Other : pyr		0065-4L
			tr	Ca : lt brn		0065-5L
2415.00				Cretaceous		0066
			70	Sh/Clst: gn gy, brn gy to gy red		0066-3L
			15	Ca : w, chk		0066-1L
			15	Sh/Clst: m gy, calc		0066-2L
			tr	Other : pyr		0066-4L
			tr	Ca : lt brn		0066-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Frm / Age — Lithology description	Trb	Sample
2420.00				Cretaceous		0067
		6.35	95	Sh/Clst: drk gy to dsk y brn		0067-5L
			5	Sh/Clst: gn gy, brn gy to gy red		0067-3L
			tr	Ca : w, chk		0067-1L
			tr	Sh/Clst: m gy, calc		0067-2L
			tr	Other : pyr		0067-4L
2425.00				Viki Drau Upper Jurassic		0068
		6.59	100	Sh/Clst: drk gy to dsk y brn		0068-5L
			tr	Ca : w, chk		0068
			tr	Sh/Clst: m gy, calc		0068-2L
			tr	Sh/Clst: gn gy, brn gy to gy red		0068-3L
			tr	Other : pyr		0068-4L
2430.00				Viki Drau Upper Jurassic		0069
		5.66	100	Sh/Clst: drk gy to dsk y brn		0069-5L
			tr	Ca : w, chk		0069-1L
			tr	Sh/Clst: m gy, calc		0069-2L
			tr	Sh/Clst: gn gy, brn gy to gy red		0069-3L
			tr	Other : pyr		0069-4L
2435.00				Viki Drau Upper Jurassic		0070
		6.90	100	Sh/Clst: drk gy to dsk y brn		0070-4L
			tr	Ca : w, chk		0070-1L
			tr	Sh/Clst: gn gy, brn gy to gy red		0070-2L
			tr	Other : pyr		0070
2440.00				Viki Drau Upper Jurassic		0071
		6.94	100	Sh/Clst: drk gy to dsk y brn		0071-4L
			tr	Ca : w, chk		0071-1L
			tr	Sh/Clst: gn gy, brn gy to gy red		0071-2L
			tr	Other : pyr		0071-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2445.00				Viki	Drau	Upper Jurassic		0072
		6.12	100	Sh/Clst: drk gy to dsk y brn				0072-4L
			tr	Ca : w, chk				0072-1L
			tr	Sh/Clst: gn gy, brn gy to gy red				0072-2L
			tr	Other : pyr				0072-3L
2450.00				Viki	Drau	Upper Jurassic		0073
		5.05	100	Sh/Clst: drk gy to dsk y brn				0073-4L
			tr	Ca : w, chk				0073-1L
			tr	Sh/Clst: gn gy, brn gy to gy red				0073-2L
			tr	Other : pyr				0073-3L
2455.00				Viki	Drau	Upper Jurassic		0074
		2.98	100	Sh/Clst: drk gy to dsk y brn				0074-4L
			tr	Ca : w, chk				0074-1L
			tr	Sh/Clst: gn gy, brn gy to gy red				0074-2L
			tr	Other : pyr				0074-3L
2460.00				Viki	Drau	Upper Jurassic		0075
		4.90	100	Sh/Clst: drk gy to dsk y brn				0075-4L
			tr	Ca : w, chk				0075-1L
			tr	Sh/Clst: gn gy, brn gy to gy red				0075-2L
			tr	Other : pyr				0075-3L
2465.00				Viki	Drau	Upper Jurassic		0076
		4.01	100	Sh/Clst: drk gy to dsk y brn				0076-4L
			tr	Ca : w, chk				0076-1L
			tr	Sh/Clst: gn gy, brn gy to gy red				0076-2L
			tr	Other : pyr				0076-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth	Type		Grp Frm Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description		
2470.00			Viki Drau Upper Jurassic		0077
	5.81	100	Sh/Clst: drk gy to dsk y brn		0077-4L
		tr	Ca : w, chk		0077-1L
		tr	Sh/Clst: gn gy, brn gy to gy red		0077-2L
		tr	Other : pyr		0077-3L
2475.00			Viki Heat Upper Jurassic		0078
	5.64	100	Sh/Clst: drk gy to dsk y brn		0078-4L
		tr	Ca : w, chk		0078-1L
		tr	Sh/Clst: gn gy, brn gy to gy red		0078[illegible]
		tr	Other : pyr		0078-3L
2480.00			Viki Heat Upper Jurassic		0079
	4.67	95	Sh/Clst: drk gy to dsk y brn, slt		0079-4L
		5	Cont : dd		0079-5L
		tr	Ca : w, chk		0079-1L
		tr	Sh/Clst: gn gy, brn gy to gy red		0079-2L
		tr	Other : pyr		0079-3L
2485.00			Viki Heat Upper Jurassic		0080
	4.89	100	Sh/Clst: drk gy to dsk y brn, slt, mic		0080-4L
		tr	Ca : w, chk		0080-1L
		tr	Sh/Clst: gn gy, brn gy to gy red		0080-2L
		tr	Other : pyr		0080-3L
		tr	Cont : dd		0080-5L
2490.00			Viki Heat Upper Jurassic		0081
	5.23	90	Sh/Clst: drk gy to dsk y brn, slt, mic		0081-4L
		5	Sh/Clst: gn gy, brn gy to gy red		0081-2L
		5	Cont : dd		0081-5L
		tr	Ca : w, chk		0081-1L
		tr	Other : pyr		0081-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2495.00				Viki Heat Upper Jurassic		0082
		4.10	95	Sltst : drk gy to dsk y brn, cly, mic		0082-4L
			5	Sh/Clst: gn gy, brn gy to gy red		0082-2L
			tr	Ca : w, chk		0082-1L
			tr	Other : pyr		0082-3L
			tr	Cont : dd		0082-5L
2500.00				Viki Heat Upper Jurassic		0083
		6.27	90	Sltst : drk gy to dsk y brn, cly, mic		0083-4L
			10	Sh/Clst: gn gy, brn gy to gy red		0083-2L
			tr	Ca : w, chk		0083-1L
			tr	Other : pyr		0083-3L
			tr	Cont : dd		0083-5L
2505.00				Viki Heat Upper Jurassic		0084
		3.79	90	Sltst : drk gy to dsk y brn, cly, mic		0084-4L
			10	Sh/Clst: gn gy, brn gy to gy red		0084-2L
			tr	Ca : w, chk		0084-1L
			tr	Other : pyr		0084-3L
			tr	Cont : dd		0084-5L
2510.00				Viki Heat Upper Jurassic		0085
		4.43	85	Sltst : drk gy to dsk y brn, cly, mic		0085-4L
			15	Sh/Clst: gn gy, brn gy to gy red		0085-2L
			tr	Ca : w, chk		0085-1L
			tr	Other : pyr		0085-3L
			tr	Cont : dd		0085-5L
2515.00				Viki Heat Upper Jurassic		0086
		3.97	90	Sltst : drk gy to dsk y brn, cly, mic		0086-4L
			10	Sh/Clst: gn gy, brn gy to gy red		0086-2L
			tr	Ca : w, chk		0086-1L
			tr	Other : pyr		0086-3L
			tr	Cont : dd		0086-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth	Type		Grp Frm Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description		
2520.00			Viki Heat Upper Jurassic		0087
		75	Cont : cem		0087-5L
		15	Sh/Clst: gn gy, brn gy to gy red		0087-2L
		10	Sltst : drk gy to dsk y brn, cly, mic		0087-4L
		tr	Ca : w, chk		0087-1L
		tr	Other : pyr		0087-3L
2525.00			Viki Heat Upper Jurassic		0088
		85	Cont : cem		0088-5L
		10	Sh/Clst: gn gy, brn gy to gy red		0088-
		5	Sltst : drk gy to dsk y brn, cly, mic		0088-4L
		tr	Ca : w, chk		0088-1L
		tr	Other : pyr		0088-3L
2530.00			Viki Heat Upper Jurassic		0089
		95	Cont : cem, dd		0089-5L
		5	Sh/Clst: gn gy, brn gy to gy red		0089-2L
		tr	Ca : w, chk		0089-1L
		tr	Other : pyr		0089-3L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0089-4L
		tr	S/Sst : w to lt gy, cem, kln		0089-6L
2535.00			Viki Heat Upper Jurassic		0090
		100	Cont : cem, prp, dd		0090-5L
		tr	Ca : w, chk		0090-1L
		tr	Sh/Clst: gn gy, brn gy to gy red		0090-
		tr	Other : pyr		0090-3L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0090-4L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2540.00				Viki Heat Upper Jurassic		0091
			90	Cont : cem, prp, dd		0091-4L
			10	Sh/Clst: gn gy, brn gy to gy red		0091-1L
			tr	Other : pyr		0091-2L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0091-3L
2545.00				Viki Heat Upper Jurassic		0092
			50	Cont : cem, prp, dd		0092-4L
			50	S/Sst : m gy, slt, mic, cem, l		0092-5L
			tr	Sh/Clst: gn gy, brn gy to gy red		0092-1L
			tr	Other : pyr		0092-2L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0092-3L
2550.00				Viki Heat Upper Jurassic		0093
		3.34	70	S/Sst : m gy, slt, mic, cem, l		0093-5L
			30	Cont : dd, fib		0093-4L
			tr	Sh/Clst: gn gy, brn gy to gy red		0093-1L
			tr	Other : pyr		0093-2L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0093-3L
2555.00				Viki Heat Upper Jurassic		0094
			80	Cont : dd, fib		0094-3L
			20	S/Sst : m gy, slt, mic, cem, l		0094-4L
			tr	Sh/Clst: gn gy, brn gy to gy red		0094-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0094-2L
			tr	Coal : blk		0094-5L
2560.00				Viki Heat Upper Jurassic		0095
		3.77	85	Sltst : m gy to drk gy, s, mic		0095-4L
			15	Cont : dd, fib		0095-3L
			tr	Sh/Clst: gn gy, brn gy to gy red		0095-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0095-2L
			tr	Coal : blk		0095-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2565.00				Viki Heat Upper Jurassic		0096
		3.21	60	Sltst : m gy to drk gy, s, mic		0096-4L
			40	Cont : dd		0096-3L
			tr	Sh/Clst: gn gy, brn gy to gy red		0096-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0096-2L
			tr	Coal : blk		0096-5L
2570.00				Viki Heat Upper Jurassic		0097
			75	Cont : dd		0097-3L
		0.23	25	S/Sst : m gy to drk gy, slt, mic, cem, l		0097-
			tr	Sh/Clst: gn gy, brn gy to gy red		0097-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0097-2L
			tr	Coal : blk		0097-5L
2575.00				Viki Heat Upper Jurassic		0098
			85	S/Sst : m gy to drk gy, mic, l		0098-4L
			15	Cont : dd		0098-3L
			tr	Sh/Clst: gn gy, brn gy to gy red		0098-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0098-2L
2580.00				Viki Heat Upper Jurassic		0099
			90	Cont : dd		0099-3L
			10	S/Sst : m gy to drk gy, mic, l		0099-4L
			tr	Sh/Clst: gn gy, brn gy to gy red		0099-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0099-2L
2585.00				Viki Heat Upper Jurassic		0100
			85	Cont : dd		0100-3L
			15	S/Sst : w to m gy to drk gy, mic, l		0100-4L
			tr	Sh/Clst: gn gy, brn gy to gy red		0100-1L
			tr	Sltst : drk gy to dsk y brn, cly, mic		0100-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth (Int Cvd)	Type (TOC%)	%	Grp Frm Age / Lithology description	Trb	Sample
2590.00			Brnt Ness Middle Jurassic		0101
		90	Cont : dd		0101-3L
		10	S/Sst : w to m gy to drk gy, mic, l		0101-4L
		tr	Sh/Clst: gn gy, brn gy to gy red		0101-1L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0101-2L
2595.00			Brnt Ness Middle Jurassic		0102
		80	Cont : dd		0102-3L
		20	S/Sst : w to m gy to drk gy, mic, cem, l		0102-4L
		tr	Sh/Clst: gn gy, brn gy to gy red		0102-1L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0102-2L
2600.00			Brnt Ness Middle Jurassic		0103
		90	Cont : dd		0103-3L
		10	S/Sst : w to m gy to drk gy, mic, cem, l		0103-4L
		tr	Sh/Clst: gn gy, brn gy to gy red		0103-1L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0103-2L
2605.00			Brnt Ness Middle Jurassic		0104
	2.59	65	S/Sst : w to m gy to drk gy, mic, cem, l		0104-4L
		35	Cont : prp, dd		0104-3L
		tr	Sh/Clst: gn gy, brn gy to gy red		0104-1L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0104-2L
2610.00			Brnt Ness Middle Jurassic		0105
	3.82	60	Sltst : m gy to drk gy, s, mic		0105-4L
		40	Cont : prp, dd		0105-3L
		tr	Sh/Clst: gn gy, brn gy to gy red		0105-1L
		tr	Sltst : drk gy to dsk y brn, cly, mic		0105-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2615.00			Brnt Ness Middle Jurassic		0106
		100	Sltst : m gy to drk gy, s, mic		0106-3L
		tr	Sh/Clst: gn gy, brn gy to gy red		0106-1L
		tr	Cont : prp, dd		0106-2L
		tr	S/Sst : w		0106-4L
2620.00			Brnt Ness Middle Jurassic		0107
	4.52	80	Sltst : m gy to drk gy, carb, s, mic		0107-3L
		20	Cont : dd		0107-2L
		tr	Sh/Clst: gn gy, brn gy to gy red		0107-
		tr	S/Sst : w		0107-4L
2625.00			Brnt Ness Middle Jurassic		0108
		85	Sltst : m gy to drk gy, mic		0108-3L
		15	Cont : dd		0108-2L
		tr	Sh/Clst: gn gy, brn gy to gy red		0108-1L
		tr	S/Sst : w		0108-4L
2630.00			Brnt Ness Middle Jurassic		0109
	5.30	90	Sltst : m gy to drk gy, mic		0109-3L
		10	Cont : dd		0109-2L
		tr	Sh/Clst: gn gy, brn gy to gy red		0109-1L
		tr	S/Sst : w		0109-4L
		tr	Ca : lt brn, dol		0109-5L
2635.00			Brnt Ness Middle Jurassic		0110
		60	Sh/Clst: m gy to drk gy, slt, mic		0110-2L
		40	Cont : dd		0110-1L
		tr	S/Sst : w		0110-3L
		tr	Ca : lt brn, dol		0110-4L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2640.00				Brnt Ness Middle Jurassic		0111
		4.56	90	Sh/Clst: m gy to drk gy, slt, mic		0111-2L
			10	Ca : lt brn, brn gy, dol		0111-4L
			tr	Cont : dd		0111-1L
			tr	S/Sst : w		0111-3L
2645.00				Brnt Ness Middle Jurassic		0112
			80	Sh/Clst: m gy to drk gy, slt, mic		0112-2L
			15	Ca : lt brn, brn gy		0112-4L
			5	Cont : dd		0112-1L
			tr	S/Sst : w		0112-3L
2650.00				Brnt Ness Middle Jurassic		0113
			45	Cont : dd		0113-1L
			45	Sh/Clst: m gy to drk gy, slt, mic		0113-2L
			10	Ca : lt brn, brn gy		0113-4L
			tr	S/Sst : w		0113-3L
2655.00				Brnt Ness Middle Jurassic		0114
			75	Cont : dd		0114-1L
		0.72	20	Ca : lt brn, brn gy		0114-4L
			5	Sh/Clst: m gy to drk gy, slt, mic		0114-2L
			tr	S/Sst : w		0114-3L
2660.00				Brnt Ness Middle Jurassic		0115
			75	Cont : dd		0115-1L
			20	Ca : lt brn, brn gy		0115-4L
			5	Sh/Clst: m gy to drk gy, slt, mic		0115-2L
			tr	S/Sst : w		0115-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth (Int Cvd)	Type / TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2665.00			Brnt Ness Middle Jurassic		0116
		85	Cont : dd		0116-1L
		10	Ca : lt brn, brn gy		0116-4L
		5	Sh/Clst: m gy to drk gy, slt, mic		0116-2L
		tr	S/Sst : w		0116-3L
2670.00			Brnt Ness Middle Jurassic		0117
		70	Cont : dd		0117-1L
		25	S/Sst : w to brn gy, slt, mic, l		0117-3L
		5	Ca : lt brn, brn gy		0117-
		tr	Sh/Clst: m gy to drk gy, slt, mic		0117-2L
		tr	Coal : blk		0117-5L
2675.00			Brnt Ness Middle Jurassic		0118
	1.37	85	S/Sst : w to brn gy, slt, mic, l		0118-3L
		10	Cont : dd		0118-1L
		5	Ca : lt brn, brn gy		0118-4L
		tr	Sltst : m gy to drk gy, mic		0118-2L
		tr	Coal : blk		0118-5L
2680.00			Brnt Ness Middle Jurassic		0119
		75	S/Sst : w to brn gy, slt, mic, l		0119-3L
		15	Cont : dd		0119-1L
		5	Sltst : m gy to drk gy, mic		0119-2L
		5	Ca : lt brn, brn gy		0119-4L
		tr	Coal : blk		0119-
2682.02	ccp		Brnt Ness Middle Jurassic		0006
	0.52	100	S/Sst : m gy, calc, cem		0006-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2684.66	ccp			Brnt	Ness	Middle Jurassic		0007
		0.66	100	S/Sst		: gy brn to dsk brn, cem		0007-1L
2685.00				Brnt	Ness	Middle Jurassic		0120
			60	Cont		: prp, dd		0120-1L
			40	S/Sst		: w to brn gy, l		0120-3L
			tr	Sltst		: m gy to drk gy, mic		0120-2L
			tr	Ca		: lt brn, brn gy		0120-4L
			tr	Coal		: blk		0120-5L
2687.62	ccp			Brnt	Ness	Middle Jurassic		0008
		0.87	100	S/Sst		: gy brn to dsk brn, cem		0008-1L
2690.00				Brnt	Ness	Middle Jurassic		0121
			65	Cont		: prp, dd		0121-1L
			35	S/Sst		: w to brn gy, l		0121-3L
			tr	Sltst		: m gy to drk gy, mic		0121-2L
			tr	Ca		: lt brn, brn gy		0121-4L
			tr	Coal		: blk		0121-5L
2690.74	ccp			Brnt	Ness	Middle Jurassic		0009
		0.66	100	S/Sst		: lt or to pl y brn, cem		0009-1L
2692.70	ccp			Brnt	Ness	Middle Jurassic		0010
			100	S/Sst		: lt or to pl y brn, cem, lam		0010-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type / TOC%	%	Grp / Lithology	Frm	Age / description	Trb	Sample
2694.35		ccp		Brnt	Ness	Middle Jurassic		0011
		1.47	100	S/Sst		: lt gy to m gy, f, cem, lam		0011-1L
2695.00				Brnt	Ness	Middle Jurassic		0122
			70	Cont		: prp, dd		0122-1L
			15	S/Sst		: w to brn gy, l		0122-3L
			10	Coal		: blk		0122-5L
			5	Sltst		: m gy to drk gy, mic		0122-2L
			tr	Ca		: lt brn, brn gy		0122-4L
2695.02		ccp		Brnt	Ness	Middle Jurassic		0012
		7.92	100	Coal		: blk		0012-1L
2697.02		ccp		Brnt	Ness	Middle Jurassic		0013
		0.51	100	Sltst		: lt gy to m gy, s		0013-1L
2698.70		ccp		Brnt	Ness	Middle Jurassic		0014
		0.50	100	S/Sst		: lt gy to m gy, slt, cem		0014-1L
2700.00				Brnt	Ness	Middle Jurassic		0123
			65	Cont		: prp, dd		0123-1[illegible]
			35	S/Sst		: w to brn gy, l		0123-[illegible]
			tr	Sltst		: m gy to drk gy, mic		0123-2L
			tr	Ca		: lt brn, brn gy		0123-4L
			tr	Coal		: blk		0123-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2700.40	ccp		Brnt Ness Middle Jurassic		0015
	33.03	100	Coal : blk		0015-1L
2702.95	ccp		Brnt Ness Middle Jurassic		0016
	0.25	100	Sh/Clst: lt brn gy to lt gy		0016-1L
2704.90	ccp		Brnt Ness Middle Jurassic		0017
	0.37	100	Sh/Clst: brn gy to lt brn gy, slt		0017-1L
2705.00			Brnt Ness Middle Jurassic		0124
		65	S/Sst : w to brn gy, l		0124-3L
		20	Coal : blk, cly		0124-5L
		10	Cont : prp, dd		0124-1L
		5	Sh/Clst: brn gy, wx		0124-6L
		tr	Sltst : m gy to drk gy, mic		0124-2L
		tr	Ca : lt brn, brn gy		0124-4L
2706.31	ccp		Brnt Ness Middle Jurassic		0018
	0.31	100	Sh/Clst: brn gy to lt brn gy, wx		0018-1L
2709.06	ccp		Brnt Ness Middle Jurassic		0019
	0.16	100	Sh/Clst: brn gy to lt brn gy, slt, mic		0019-1L
2710.00			Brnt Ness Middle Jurassic		0125
		80	Cont : prp, dd		0125-1L
		10	Coal : blk, cly		0125-5L
		5	S/Sst : w to brn gy, l		0125-3L
		5	Sh/Clst: brn gy, wx		0125-6L
		tr	Sltst : m gy to drk gy, mic		0125-2L
		tr	Ca : lt brn, brn gy		0125-4L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2711.29	ccp			Brnt Ness Middle Jurassic		0020
			100	Sh/Clst: brn gy to lt brn gy, slt, mic		0020-1L
2714.31	ccp			Brnt Ness Middle Jurassic		0021
		1.28	100	Sh/Clst: lt brn gy		0021-1L
			tr	Other : carb		0021-2L
2715.00				Brnt Ness Middle Jurassic		0126
			40	Sh/Clst: brn gy, wx		0126-5L
			35	Cont : prp, dd		0126-1L
			15	S/Sst : w to brn gy, l		0126-2L
			10	Coal : blk, cly		0126-4L
			tr	Ca : lt brn, brn gy		0126-3L
			tr	Other : pyr		0126-6L
2716.83	ccp			Brnt Ness Middle Jurassic		0022
		0.10	100	Sh/Clst: lt brn gy, s		0022-1L
2718.13	ccp			Brnt Ness Middle Jurassic		0023
		0.61	100	Sh/Clst: brn gy to lt brn gy, slt, mic		0023-1L
2720.00	ccp			Brnt Ness Middle Jurassic		0024
		0.19	100	Sh/Clst: brn gy to lt brn gy, slt, mic		0024-1L
2720.00				Brnt Ness Middle Jurassic		0127
			90	Sh/Clst: brn gy to dsk y brn, wx		0127-4L
			5	Cont : prp, dd		0127-1L
			5	Coal : blk, cly		0127-3L
			tr	S/Sst : w to brn gy, l		0127-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth (Int Cvd)	Type / TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2722.05	ccp		Brnt Ness Middle Jurassic		0025
		100	S/Sst : w to lt gy, cem, lam		0025-1L
2724.35	ccp		Brnt Ness Middle Jurassic		0026
	1.50	100	S/Sst : pl y brn to or gy, cem		0026-1L
		tr	Other : carb		0026-2L
2725.00			Brnt Ness Middle Jurassic		0128
	1.38	90	Sh/Clst: brn gy to dsk y brn, wx		0128-4L
		5	Cont : prp, dd		0128-1L
		5	Coal : blk, cly		0128-3L
		tr	S/Sst : w to brn gy, l		0128-2L
2725.84	ccp		Brnt Ness Middle Jurassic		0027
	0.72	100	S/Sst : drk y brn, cem		0027-1L
2727.72	ccp		Brnt Ness Middle Jurassic		0028
		100	S/Sst : drk y brn, cem		0028-1L
2728.70	ccp		Brnt Ness Middle Jurassic		0029
	5.25	100	S/Sst : drk y brn, cem		0029-1L
		tr	Other : carb		0029-2L
2730.00			Brnt Ness Middle Jurassic		0129
		90	Sh/Clst: brn gy to dsk y brn, wx		0129-4L
		5	Cont : prp, dd		0129-1L
		5	Coal : blk, cly		0129-3L
		tr	S/Sst : w to brn gy, l		0129-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth (Int Cvd)	Type / TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2730.08	ccp		Brnt Ness Middle Jurassic		0030
	0.57	100	S/Sst : w to lt gy, cem		0030-1L
2732.70	ccp		Brnt Ness Middle Jurassic		0031
		100	S/Sst : w to lt gy to pl y brn, mic, cem		0031-1L
2735.00	ccp		Brnt Ness Middle Jurassic		0032
	0.55	100	Congl : pl y brn to dsk y brn, st, cem		0032·
2735.00			Brnt Ness Middle Jurassic		0130
		80	Sh/Clst: brn gy, wx		0130-4L
		20	Cont : prp, dd		0130-1L
		tr	S/Sst : w to brn gy, l		0130-2L
		tr	Coal : blk, cly		0130-3L
2737.74	ccp		Brnt Etiv Middle Jurassic		0033
		100	S/Sst : pl y brn to drk gy, crs, cem		0033-1L
		tr	Other : carb		0033-2L
2739.30	ccp		Brnt Etiv Middle Jurassic		0034
	0.13	100	S/Sst : lt or to lt gy, cem, lam		0034-1L
2740.00			Brnt Etiv Middle Jurassic		0131
	1.55	100	Sh/Clst: brn gy, wx		0131-4L
		tr	Cont : prp, dd		0131-1L
		tr	S/Sst : w to brn gy, l		0131-2L
		tr	Coal : blk, cly		0131-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type	TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2741.70		ccp			Brnt	Etiv	Middle Jurassic		0035
				100	S/Sst		: pl y brn to drk gy, crs, cem		0035-1L
				tr	Other		: carb		0035-2L
2742.00					Brnt	Etiv	Middle Jurassic		0132
				60	S/Sst		: w to lt gy, l		0132-2L
				30	Sh/Clst		: brn gy to dsk y brn, wx		0132-4L
				10	Cont		: prp, dd		0132-1L
				tr	Coal		: blk, cly		0132-3L
2744.47		ccp			Brnt	Etiv	Middle Jurassic		0036
			0.35	100	S/Sst		: pl y brn to drk gy, crs, cem		0036-1L
				tr	Other		: carb		0036-2L
2746.05		ccp			Brnt	Etiv	Middle Jurassic		0037
				100	S/Sst		: pl y brn to lt brn gy, cngl, cem		0037-1L
2748.80		ccp			Brnt	Etiv	Middle Jurassic		0038
			0.07	100	S/Sst		: pl y brn to lt brn gy, pyr, cngl, cem		0038-1L
2750.00					Brnt	Etiv	Middle Jurassic		0133
				100	S/Sst		: w, l		0133-2L
				tr	Cont		: prp, dd		0133-1L
				tr	Coal		: blk, cly		0133-3L
				tr	Sh/Clst		: brn gy to dsk y brn, wx		0133-4L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Cvd	Type	TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2750.80		ccp			Brnt	Etiv	Middle Jurassic		0039
				100	S/Sst : w to lt gy, crs, cem				0039-1L
2752.83		ccp			Brnt	Etiv	Middle Jurassic		0040
			0.15	100	S/Sst : w to lt gy, crs, cem				0040-1L
2755.35		ccp			Brnt	Etiv	Middle Jurassic		0041
				100	S/Sst : w to lt gy, crs, cem				0041-
2758.25		ccp			Brnt	Etiv	Middle Jurassic		0042
			0.13	100	S/Sst : w to lt gy, crs, cem				0042-1L
2760.00					Brnt	Etiv	Middle Jurassic		0134
				100	S/Sst : w, l				0134-2L
				tr	Cont : prp, dd				0134-1L
				tr	Coal : blk, cly				0134-3L
				tr	Sh/Clst: brn gy to dsk y brn, wx				0134-4L
2761.10		ccp			Brnt	Etiv	Middle Jurassic		0043
				100	S/Sst : w to lt gy, mic, crs, cem				0043-1L
2764.30		ccp			Brnt	Etiv	Middle Jurassic		0044
			0.17	100	S/Sst : m gy to pl y brn, mic, crs, cem				0044-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type	TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2765.00					Brnt	Etiv	Middle Jurassic		0135
				60	Sh/Clst:		brn gy, wx		0135-4L
				35	S/Sst		: w, l		0135-2L
				5	Coal		: blk, cly		0135-3L
				tr	Cont		: prp, dd		0135-1L
2767.00		ccp			Brnt	Etiv	Middle Jurassic		0045
				100	S/Sst		: w to lt gy, mic, crs, cem		0045-1L
2770.66		ccp			Brnt	Etiv	Middle Jurassic		0046
			0.10	100	S/Sst		: lt gy to drk gy, mic, crs, cem		0046-1L
2773.00		ccp			Brnt	Etiv	Middle Jurassic		0047
			0.10	100	S/Sst		: lt gy to m gy to drk y brn, mic, crs, cem		0047-1L
2775.00					Brnt	Etiv	Middle Jurassic		0136
				100	S/Sst		: w, l		0136-2L
				tr	Cont		: prp, dd		0136-1L
				tr	Coal		: blk, cly		0136-3L
				tr	Sh/Clst:		brn gy, wx		0136-4L
2776.04		ccp			Brnt	Etiv	Middle Jurassic		0048
			0.27	100	S/Sst		: w to lt gy, crs, cem		0048-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth (Int)	Depth (Cvd)	Type / TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2779.35		ccp		Brnt	Etiv	Middle Jurassic		0049
			100	S/Sst : m gy, pyr, cem				0049-1L
2781.34		ccp		Brnt	Etiv	Middle Jurassic		0050
		0.38	100	S/Sst : lt gy to or gy, calc, cem				0050-1L
2783.00		ccp		Brnt	Etiv	Middle Jurassic		0051
		0.96	100	Sltst : brn gy to dsk y brn, cly, mic				0051-
2783.80		ccp		Dunl	Drak	Middle Jurassic		0053
			100	Sh/Clst: drk gy to dsk y brn, slt, mic				0053-1L
2784.75		ccp		Dunl	Drak	Middle Jurassic		0052
		1.47	100	Sh/Clst: drk gy to dsk y brn, slt, mic				0052-1L
2785.00				Dunl	Drak	Middle Jurassic		0137
			80	S/Sst : w to lt gy, l				0137-2L
			15	Cont : prp, dd, tar-ad				0137-1L
			5	Sh/Clst: brn gy, wx				0137-4L
			tr	Coal : blk, cly				0137-3L
2790.00				Dunl	Drak	Middle Jurassic		0138
			55	Cont : prp, dd				0138-1L
			30	S/Sst : w to lt gy, l				0138-2L
			15	Sh/Clst: brn gy, wx				0138-4L
			tr	Coal : blk, cly				0138-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2795.00				Dunl	Drak	Middle Jurassic		0139
			50	S/Sst		: w to lt gy, l		0139-2L
			40	Cont		: prp, dd		0139-1L
			10	Sh/Clst		: brn gy, wx		0139-4L
			tr	Coal		: blk, cly		0139-3L
2800.00				Dunl	Drak	Middle Jurassic		0140
			65	S/Sst		: w to lt gy, l		0140-2L
		1.06	20	Sh/Clst		: brn gy, wx		0140-4L
			15	Cont		: prp, dd		0140-1L
			tr	Coal		: blk, cly		0140-3L
2805.00				Dunl	Drak	Middle Jurassic		0141
			75	S/Sst		: w to lt gy, l		0141-2L
			15	Cont		: prp, dd		0141-1L
			10	Sh/Clst		: brn gy, wx		0141-4L
			tr	Coal		: blk, cly		0141-3L
2810.00				Dunl	Drak	Middle Jurassic		0142
			75	S/Sst		: w to lt gy, l		0142-2L
			15	Sh/Clst		: brn gy, wx		0142-4L
			10	Cont		: prp, dd		0142-1L
			tr	Coal		: blk, cly		0142-3L
			tr	Other		: pyr		0142-5L
2815.00				Dunl	Drak	Middle Jurassic		0143
			75	S/Sst		: w to lt gy, l		0143-2L
			20	Cont		: prp, dd		0143-1L
			5	Sh/Clst		: brn gy, wx		0143-4L
			tr	Coal		: blk, cly		0143-3L
			tr	Ca		: lt brn		0143-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2820.00			Dunl Drak Middle Jurassic		0144
		70	S/Sst : w to lt gy, l		0144-2L
		20	Cont : prp, dd		0144-1L
		5	Sh/Clst: brn gy, wx		0144-4L
		5	Sltst : drk gy, mic		0144-6L
		tr	Coal : blk, cly		0144-3L
		tr	Ca : lt brn		0144-5L
2825.00			Dunl Drak Middle Jurassic		0145
		60	S/Sst : w to lt gy, l		0145-
		30	Cont : dd		0145-1L
		5	Sh/Clst: brn gy, wx		0145-4L
		5	Sltst : drk gy, mic		0145-6L
		tr	Coal : blk, cly		0145-3L
		tr	Ca : lt brn		0145-5L
2830.00			Dunl Drak Middle Jurassic		0146
	0.25	75	S/Sst : w to lt gy, calc, crs, l		0146-2L
		10	Cont : dd		0146-1L
		10	Sltst : drk gy, mic		0146-6L
		5	Sh/Clst: brn gy, wx		0146-4L
		tr	Coal : blk, cly		0146-3L
		tr	Ca : lt brn		0146-5L
2835.00			Dunl Drak Middle Jurassic		0147
		75	S/Sst : w to lt gy, calc, crs, l		0147-
		15	Cont : dd		0147-1L
		5	Sh/Clst: brn gy, wx		0147-4L
		5	Sltst : drk gy, mic		0147-6L
		tr	Coal : blk, cly		0147-3L
		tr	Ca : lt brn		0147-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2840.00				Dunl	Drak	Middle Jurassic		0148
			80	S/Sst		: w to lt gy, calc, glauc, crs, l		0148-2L
			15	Cont		: dd		0148-1L
			5	Sltst		: drk gy, mic		0148-6L
			tr	Coal		: blk, cly		0148-3L
			tr	Sh/Clst		: brn gy, wx		0148-4L
			tr	Ca		: lt brn		0148-5L
			tr	Other		: pyr		0148-7L
2845.00				Dunl	Drak	Middle Jurassic		0149
		0.94	100	S/Sst		: w to lt gy, calc, glauc, crs, cem, l		0149-2L
			tr	Cont		: dd		0149-1L
			tr	Coal		: blk, cly		0149-3L
			tr	Sh/Clst		: brn gy, wx		0149-4L
			tr	Ca		: lt brn		0149-5L
			tr	Sltst		: drk gy, mic		0149-6L
			tr	Other		: pyr		0149-7L
2850.00				Dunl	Drak	Middle Jurassic		0150
			75	Cont		: dd		0150-1L
		1.54	25	Sh/Clst		: m gy, slt, mic		0150-4L
			tr	S/Sst		: w to lt gy, calc, glauc, crs, cem, l		0150-2L
			tr	Sh/Clst		: brn gy, wx		0150-3L
			tr	Other		: pyr		0150-5L
2855.00				Dunl	Drak	Middle Jurassic		0151
			80	Cont		: dd		0151-1L
			10	S/Sst		: w to lt gy, calc, glauc, crs, cem, l		0151-2L
			10	Sltst		: m gy to brn gy, mic		0151-4L
			tr	Sh/Clst		: brn gy, wx		0151-3L
			tr	Other		: pyr		0151-5L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp / Frm / Age — Lithology description	Trb	Sample
2860.00				Dunl Drak Middle Jurassic		0152
		1.29	85	Sltst : brn gy to m gy, s, mic		0152-4L
			10	Cont : dd		0152-1L
			5	S/Sst : w to lt gy, calc, glauc, crs, cem, l		0152-2L
			tr	Sh/Clst: brn gy, wx		0152-3L
			tr	Other : pyr		0152-5L
2865.00				Dunl Drak Middle Jurassic		0153
			70	Sltst : brn gy to m gy, s, mic		0153-
			20	Cont : dd		0153-1L
			10	S/Sst : w to lt gy, calc, glauc, crs, cem, l		0153-2L
			tr	Other : pyr		0153-4L
2870.00				Dunl Drak Middle Jurassic		0154
		1.80	75	Sh/Clst: brn gy to m gy, slt, mic		0154-3L
			25	Cont : dd		0154-1L
			tr	S/Sst : w to lt gy, l		0154-2L
			tr	Other : pyr		0154-4L
2875.00				Dunl Drak Middle Jurassic		0155
		2.11	90	Sltst : brn gy to m gy, cly, mic		0155-3L
			10	Cont : dd		0155-1L
			tr	S/Sst : w to lt gy, l		0155-2L
			tr	Other : pyr		0155-
2880.00				Dunl Drak Middle Jurassic		0156
		2.34	80	Sh/Clst: brn gy to m gy, slt, mic		0156-3L
			20	Cont : dd		0156-1L
			tr	S/Sst : w to lt gy, l		0156-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 30/9-1

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2885.00				Dunl	Drak	Middle Jurassic		0157
		2.47	85	Sh/Clst: brn gy to m gy, slt, mic				0157-3L
			15	Cont : dd				0157-1L
			tr	S/Sst : w to lt gy, l				0157-2L
2890.00				Dunl	Drak	Middle Jurassic		0158
			95	Sh/Clst: brn gy to m gy, slt, mic				0158-3L
			5	Cont : dd				0158-1L
			tr	S/Sst : w to lt gy, l				0158-2L
2895.00				Dunl	Drak	Middle Jurassic		0159
		2.62	75	Sh/Clst: brn gy to m gy, slt, mic				0159-3L
			25	Cont : dd				0159-1L
			tr	S/Sst : w to lt gy, l				0159-2L

Table 2 : Rock-Eval table for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2365.00	cut	Marl : m gy	0.11	0.46	1.07	0.43	0.84	55	127	0.6	0.19	426	0057-2L
2390.00	cut	Sh/Clst: gn gy, gy red to brn gy	0.02	0.26	0.84	0.31	0.50	52	168	0.3	0.07	428	0061-4L
2400.00	cut	Ca : w	0.02	0.01	0.51	0.02	0.06	17	850	-	0.67	384	0063-1L
2420.00	cut	Sh/Clst: drk gy to dsk y brn	0.68	27.41	1.10	24.92	6.35	432	17	28.1	0.02	427	0067-5L
2425.00	cut	Sh/Clst: drk gy to dsk y brn	0.66	26.30	1.45	18.14	6.59	399	22	27.0	0.02	425	0068-5L
2430.00	cut	Sh/Clst: drk gy to dsk y brn	0.71	25.24	1.63	15.48	5.66	446	29	25.9	0.03	424	0069-5L
2435.00	cut	Sh/Clst: drk gy to dsk y brn	0.80	28.11	1.37	20.52	6.90	407	20	28.9	0.03	425	0070-4L
2440.00	cut	Sh/Clst: drk gy to dsk y brn	0.80	28.00	1.40	20.00	6.94	403	20	28.8	0.03	426	0071-4L
2445.00	cut	Sh/Clst: drk gy to dsk y brn	0.87	28.58	1.41	20.27	6.12	467	23	29.5	0.03	427	0072-4L
2450.00	cut	Sh/Clst: drk gy to dsk y brn	0.71	22.98	1.91	12.03	5.05	455	38	23.7	0.03	426	0073-4L
2455.00	cut	Sh/Clst: drk gy to dsk y brn	0.58	19.90	2.13	9.34	2.98	668	71	20.5	0.03	426	0074-4L
2460.00	cut	Sh/Clst: drk gy to dsk y brn	0.63	21.61	1.50	14.41	4.90	441	31	22.2	0.03	426	0075-4L
2465.00	cut	Sh/Clst: drk gy to dsk y brn	0.65	23.05	1.46	15.79	4.01	575	36	23.7	0.03	427	0076-4L
2470.00	cut	Sh/Clst: drk gy to dsk y brn	0.65	22.01	1.55	14.20	5.81	379	27	22.7	0.03	427	0077-4L
2475.00	cut	Sh/Clst: drk gy to dsk y brn	0.75	21.10	1.39	15.18	5.64	374	25	21.9	0.03	426	0078-4L

Table 2 : Rock-Eval table for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2480.00	cut	Sh/Clst: drk gy to dsk y brn	0.48	14.43	1.43	10.09	4.67	309	31	14.9	0.03	426	0079-4L
2485.00	cut	Sh/Clst: drk gy to dsk y brn	0.62	17.12	1.27	13.48	4.89	350	26	17.7	0.03	427	0080-4L
2490.00	cut	Sh/Clst: drk gy to dsk y brn	0.56	17.99	1.52	11.84	5.23	344	29	18.5	0.03	426	0081-4L
2495.00	cut	Sltst : drk gy to dsk y brn	0.52	12.72	1.62	7.85	4.10	310	40	13.2	0.04	428	0082-4L
2500.00	cut	Sltst : drk gy to dsk y brn	0.46	10.81	1.12	9.65	6.27	172	18	11.3	0.04	426	0083-4L
2505.00	cut	Sltst : drk gy to dsk y brn	0.54	10.50	1.76	5.97	3.79	277	46	11.0	0.05	429	0084-4L
2510.00	cut	Sltst : drk gy to dsk y brn	0.50	8.11	1.77	4.58	4.43	183	40	8.6	0.06	428	0085-4L
2515.00	cut	Sltst : drk gy to dsk y brn	0.76	8.88	1.51	5.88	3.97	224	38	9.6	0.08	429	0086-4L
2550.00	cut	S/Sst : m gy	1.98	3.93	1.53	2.57	3.34	118	46	5.9	0.34	431	0093-5L
2560.00	cut	Sltst : m gy to drk gy	2.91	5.89	1.55	3.80	3.77	156	41	8.8	0.33	432	0095-4L
2565.00	cut	Sltst : m gy to drk gy	1.75	3.97	1.41	2.82	3.21	124	44	5.7	0.31	432	0096-4L
2570.00	cut	S/Sst : m gy to drk gy	0.20	0.10	0.55	0.18	0.23	43	239	0.3	0.67	434	0097-4L
2605.00	cut	S/Sst : w to m gy to drk gy	2.51	3.69	1.67	2.21	2.59	142	64	6.2	0.40	430	0104-4L
2610.00	cut	Sltst : m gy to drk gy	2.48	7.19	1.32	5.45	3.82	188	35	9.7	0.26	428	0105-4L
2620.00	cut	Sltst : m gy to drk gy	3.15	13.55	1.63	8.31	4.52	300	36	16.7	0.19	428	0107-3L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2630.00	cut	Sltst : m gy to drk gy	2.78	10.12	1.21	8.36	5.30	191	23	12.9	0.22	429	0109-3L
2640.00	cut	Sh/Clst: m gy to drk gy	2.22	3.96	1.13	3.50	4.56	87	25	6.2	0.36	437	0111-2L
2655.00	cut	Ca : lt brn, brn gy	0.79	0.35	1.78	0.20	0.72	49	247	1.1	0.69	433	0114-4L
2675.00	cut	S/Sst : w to brn gy	1.42	1.99	0.92	2.16	1.37	145	67	3.4	0.42	431	0118-3L
2682.02	ccp	S/Sst : m gy	0.27	0.38	0.27	1.41	0.52	73	52	0.7	0.42	442	0006-1L
2684.66	ccp	S/Sst : gy brn to dsk brn	2.91	0.98	0.65	1.51	0.66	148	98	3.9	0.75	426	0007-1L
2687.62	ccp	S/Sst : gy brn to dsk brn	5.15	1.96	0.27	7.26	0.87	225	31	7.1	0.72	423	0008-1L
2690.74	ccp	S/Sst : lt or to pl y brn	1.81	1.11	0.27	4.11	0.66	168	41	2.9	0.62	419	0009-1L
2694.35	ccp	S/Sst : lt gy to m gy	0.22	0.95	0.68	1.40	1.47	65	46	1.2	0.19	439	0011-1L
2695.02	ccp	Coal : blk	1.77	5.83	0.25	23.32	7.92	74	3	7.6	0.23	443	0012-1L
2697.02	ccp	Sltst : lt gy to m gy	0.16	0.37	0.03	12.33	0.51	73	6	0.5	0.30	451	0013-1L
2698.70	ccp	S/Sst : lt gy to m gy	0.12	0.39	0.23	1.70	0.50	78	46	0.5	0.24	477	0014-1L
2700.40	ccp	Coal : blk	4.32	35.81	1.21	29.60	33.03	108	4	40.1	0.11	442	0015-1L
2702.95	ccp	Sh/Clst: lt brn gy to lt gy	0.14	0.20	0.24	0.83	0.25	80	96	0.3	0.41	453	0016-1L
2704.90	ccp	Sh/Clst: brn gy to lt brn gy	0.73	0.24	0.67	0.36	0.37	65	181	1.0	0.75	421	0017-1L

Table 2 : Rock-Eval table for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2706.31	ccp	Sh/Clst: brn gy to lt brn gy	0.09	0.43	0.14	3.07	0.31	139	45	0.5	0.17	442	0018-1L
2709.06	ccp	Sh/Clst: brn gy to lt brn gy	0.08	0.17	0.04	4.25	0.16	106	25	0.3	0.32	439	0019-1L
2714.31	ccp	Sh/Clst: lt brn gy	0.26	0.92	0.08	11.50	1.28	72	6	1.2	0.22	443	0021-1L
2716.83	ccp	Sh/Clst: lt brn gy	0.02	0.10	0.68	0.15	0.10	100	680	0.1	0.17	440	0022-1L
2718.13	ccp	Sh/Clst: brn gy to lt brn gy	0.14	0.86	0.19	4.53	0.61	141	31	1.0	0.14	439	0023-1L
2720.00	ccp	Sh/Clst: brn gy to lt brn gy	0.05	0.17	1.03	0.17	0.19	89	542	0.2	0.23	445	0024-1L
2724.35	ccp	S/Sst : pl y brn to or gy	2.21	2.85	0.24	11.88	1.50	190	16	5.1	0.44	431	0026-1L
2725.00	cut	Sh/Clst: brn gy to dsk y brn	1.51	1.70	0.61	2.79	1.38	123	44	3.2	0.47	440	0128-4L
2725.84	ccp	S/Sst : drk y brn	4.94	1.66	0.40	4.15	0.72	231	56	6.6	0.75	419	0027-1L
2728.70	ccp	S/Sst : drk y brn	4.06	12.31	0.69	17.84	5.25	234	13	16.4	0.25	421	0029-1L
2730.08	ccp	S/Sst : w to lt gy	0.23	0.54	0.43	1.26	0.57	95	75	0.8	0.30	460	0030-1L
2735.00	ccp	Congl : pl y brn to dsk y brn	2.25	1.25	0.39	3.21	0.55	227	71	3.5	0.64	435	0032-1L
2739.30	ccp	S/Sst : lt or to lt gy	0.10	0.33	0.10	3.30	0.13	254	77	0.4	0.23	505	0034-1L
2740.00	cut	Sh/Clst: brn gy	3.03	2.01	0.31	6.48	1.55	130	20	5.0	0.60	436	0131-4L
2744.47	ccp	S/Sst : pl y brn to drk gy	0.98	0.98	0.09	10.89	0.35	280	26	2.0	0.50	439	0036-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2748.80	ccp	S/Sst : pl y brn to lt brn gy	0.05	0.43	0.07	6.14	0.07	614	100	0.5	0.10	440	0038-1L
2752.83	ccp	S/Sst : w to lt gy	0.04	1.72	0.05	34.40	0.15	1147	33	1.8	0.02	530	0040-1L
2758.25	ccp	S/Sst : w to lt gy	0.28	1.02	0.29	3.52	0.13	785	223	1.3	0.22	549	0042-1L
2764.30	ccp	S/Sst : m gy to pl y brn	0.50	0.48	0.67	0.72	0.17	282	394	1.0	0.51	585	0044-1L
2770.66	ccp	S/Sst : lt gy to drk gy	0.11	0.42	0.02	21.00	0.10	420	20	0.5	0.21	495	0046-1L
2773.00	ccp	S/Sst : lt gy to m gy to drk y brn	0.07	0.86	0.05	17.20	0.10	860	50	0.9	0.08	484	0047-1L
2776.04	ccp	S/Sst : w to lt gy	0.13	0.65	0.06	10.83	0.27	241	22	0.8	0.17	487	0048-1L
2781.34	ccp	S/Sst : lt gy to or gy	0.06	0.15	0.14	1.07	0.38	39	37	0.2	0.29	436	0050-1L
2783.00	ccp	Sltst : brn gy to dsk y brn	0.16	1.06	0.34	3.12	0.96	110	35	1.2	0.13	437	0051-1L
2784.75	ccp	Sh/Clst: drk gy to dsk y brn	0.38	1.79	0.39	4.59	1.47	122	27	2.2	0.18	438	0052-1L
2800.00	cut	Sh/Clst: brn gy	2.81	1.28	0.28	4.57	1.06	121	26	4.1	0.69	439	0140-4L
2830.00	cut	S/Sst : w to lt gy	0.46	0.18	0.11	1.64	0.25	72	44	0.6	0.72	436	0146-2L
2845.00	cut	S/Sst : w to lt gy	1.62	0.93	0.69	1.35	0.94	99	73	2.5	0.64	437	0149-2L
2850.00	cut	Sh/Clst: m gy	2.43	2.68	0.58	4.62	1.54	174	38	5.1	0.48	439	0150-4L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2860.00	cut	Sltst : brn gy to m gy	1.94	2.31	0.47	4.91	1.29	179	36	4.3	0.46	440	0152-4L
2870.00	cut	Sh/Clst: brn gy to m gy	1.88	4.19	0.42	9.98	1.80	233	23	6.1	0.31	439	0154-3L
2875.00	cut	Sltst : brn gy to m gy	2.37	6.73	0.54	12.46	2.11	319	26	9.1	0.26	434	0155-3L
2880.00	cut	Sh/Clst: brn gy to m gy	2.90	7.73	0.77	10.04	2.34	330	33	10.6	0.27	433	0156-3L
2885.00	cut	Sh/Clst: brn gy to m gy	3.18	10.73	0.36	29.81	2.47	434	15	13.9	0.23	435	0157-3L
2895.00	cut	Sh/Clst: brn gy to m gy	2.95	9.59	0.73	13.14	2.62	366	28	12.5	0.24	438	0159-3L

Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
2420.00	cut	Sh/Clst: drk gy to dsk y brn	2.05	3.71	36.91	57.33	27.41	0067-5L
2430.00	cut	Sh/Clst: drk gy to dsk y brn	0.23	5.19	37.20	57.37	25.24	0069-5L
2440.00	cut	Sh/Clst: drk gy to dsk y brn	0.41	0.51	41.14	57.52	28.00	0071-4L
2450.00	cut	Sh/Clst: drk gy to dsk y brn	1.56	0.81	42.36	55.27	22.98	0073-4L
2455.00	cut	Sh/Clst: drk gy to dsk y brn	2.03	2.61	39.36	55.71	19.90	0074-4L
2465.00	cut	Sh/Clst: drk gy to dsk y brn	0.39	6.42	34.34	58.86	23.05	0076-4L
2475.00	cut	Sh/Clst: drk gy to dsk y brn	1.02	4.52	40.16	54.31	21.10	0078-4L
2485.00	cut	Sh/Clst: drk gy to dsk y brn	1.03	6.85	39.38	52.31	17.12	0080-4L
2495.00	cut	Sltst : drk gy to dsk y brn	1.22	10.11	35.13	53.53	12.72	0082-4L
2505.00	cut	Sltst : drk gy to dsk y brn	1.13	0.11	48.21	50.55	10.50	0084-4L
2515.00	cut	Sltst : drk gy to dsk y brn	2.30	10.35	38.91	48.44	8.88	0086-4L
2550.00	cut	S/Sst : m gy	7.94	8.58	41.99	41.49	3.93	0093-5L
2560.00	cut	Sltst : m gy to drk gy	5.18	9.84	36.87	48.11	5.89	0095-4L
2605.00	cut	S/Sst : w to m gy to drk gy	1.78	-	46.28	51.94	3.69	0104-4L

Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
2620.00	cut	Sltst : m gy to drk gy	1.19	12.81	35.76	50.24	13.55	0107-3L
2655.00	cut	Ca : lt brn, brn gy	6.42	26.30	47.30	19.97	0.35	0114-4L
2675.00	cut	S/Sst : w to brn gy	2.43	17.26	40.42	39.90	1.99	0118-3L
2684.66	ccp	S/Sst : gy brn to dsk brn	4.93	19.37	30.85	44.85	0.98	0007-1L
2687.62	ccp	S/Sst : gy brn to dsk brn	3.75	14.38	31.92	49.95	1.96	0008-1L
2700.40	ccp	Coal : blk	15.14	12.35	28.82	42.76	35.81	0015-1L
2724.35	ccp	S/Sst : pl y brn to or gy	6.21	7.91	29.20	56.68	2.85	0026-1L
2728.70	ccp	S/Sst : drk y brn	8.02	5.97	25.69	60.31	12.31	0029-1L
2735.00	ccp	Congl : pl y brn to dsk y brn	2.49	1.09	46.71	49.71	1.25	0032-1L
2740.00	cut	Sh/Clst: brn gy	9.03	0.78	63.48	26.71	2.01	0131-4L
2764.30	ccp	S/Sst : m gy to pl y brn	3.20	30.28	54.29	12.23	0.48	0044-1L
2800.00	cut	Sh/Clst: brn gy	6.83	21.77	54.62	16.77	1.28	0140-4L
2845.00	cut	S/Sst : w to lt gy	3.93	28.77	51.21	16.09	0.93	0149-2L
2850.00	cut	Sh/Clst: m gy	4.63	21.74	41.17	32.47	2.68	0150-4L

Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
2870.00	cut	Sh/Clst: brn gy to m gy	5.69	13.02	38.47	42.73	4.19	0154-3L
2875.00	cut	Sltst : brn gy to m gy	3.21	9.82	38.56	48.41	6.73	0155-3L
2885.00	cut	Sh/Clst: brn gy to m gy	5.78	9.91	32.73	51.59	10.73	0157-3L
2895.00	cut	Sh/Clst: brn gy to m gy	0.98	11.82	32.88	54.32	9.59	0159-3L

Table 4 a: Weight of EOM and Chromatographic Fraction for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	Rock Extracted (g)	EOM (mg)	Sat (mg)	Aro (mg)	Asph (mg)	NSO (mg)	HC (mg)	Non-HC (mg)	TOC(e) (%)	Sample
2440.00	com	Composite sample - see table 4 e	7.6	31.3	8.1	8.1	2.1	13.0	16.2	15.1	7.29	0161-0B
2465.00	com	Composite sample - see table 4 e	10.1	34.9	8.3	8.6	2.0	16.1	16.8	18.1	5.84	0162-0B
2495.00	com	Composite sample - see table 4 e	4.7	10.8	2.7	3.2	1.2	3.8	5.9	4.9	5.36	0163-0B
2565.00	com	Composite sample - see table 4 e	3.5	15.4	6.9	2.4	0.8	5.3	9.3	6.1	3.58	0165-0B
2630.00	com	Composite sample - see table 4 e	6.6	38.0	9.0	7.7	1.6	19.8	16.6	21.4	5.87	0166-0B
2687.62	com	Composite sample - see table 4 e	9.4	73.9	39.9	18.5	3.4	12.2	58.4	15.5	0.90	0167-0B
2724.35	ccp	S/Sst : pl y brn to or gy	7.7	31.7	13.1	8.1	1.9	8.7	21.2	10.5	1.87	0026-1L
2728.70	com	Composite sample - see table 4 e	10.1	77.4	33.8	19.5	6.8	17.4	53.3	24.1	1.89	0168-0B
2740.00	cut	Sh/Clst: brn gy	7.2	46.7	26.4	7.9	0.6	11.8	34.3	12.4	1.45	0131-4L
2895.00	com	Composite sample - see table 4 e	8.4	33.1	14.9	6.0	0.5	11.7	20.9	12.3	2.70	0169-0B

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 4 b: Concentration of EOM and Chromatographic Fraction (wt ppm rock) for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
2440.00	com	Composite sample - see table 4 e	4140	1071	1071	277	1719	2142	1997	0161-0B
2465.00	com	Composite sample - see table 4 e	3465	819	849	198	1598	1668	1797	0162-0B
2495.00	com	Composite sample - see table 4 e	2312	578	674	256	802	1252	1059	0163-0B
2565.00	com	Composite sample - see table 4 e	4463	2000	695	231	1536	2695	1768	0165-0B
2630.00	com	Composite sample - see table 4 e	5740	1359	1155	241	2983	2515	3225	0166-0B
2687.62	com	Composite sample - see table 4 e	7870	4249	1964	362	1293	6214	1656	0167-0B
2724.35	ccp	S/Sst : pl y brn to or gy	4143	1705	1058	248	1130	2764	1379	0026-1L
2728.70	com	Composite sample - see table 4 e	7663	3341	1930	673	1717	5272	2391	0168-0B
2740.00	cut	Sh/Clst: brn gy	6450	3646	1098	82	1622	4744	1705	0131-4L
2895.00	com	Composite sample - see table 4 e	3921	1759	710	59	1392	2470	1451	0169-0B

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 4 c: Concentration of EOM and Chromatographic Fraction (mg/g TOC(e)) for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
2440.00	com	Composite sample - see table 4 e	56.79	14.70	14.70	3.81	23.59	29.39	27.40	0161-0B
2465.00	com	Composite sample - see table 4 e	59.34	14.03	14.54	3.40	27.38	28.57	30.78	0162-0B
2495.00	com	Composite sample - see table 4 e	43.15	10.79	12.58	4.79	14.98	23.37	19.78	0163-0B
2565.00	com	Composite sample - see table 4 e	124.69	55.87	19.43	6.48	42.91	75.30	49.39	0165-0B
2630.00	com	Composite sample - see table 4 e	97.79	23.16	19.69	4.12	50.82	42.85	54.94	0166-0B
2687.62	com	Composite sample - see table 4 e	874.45	472.13	218.32	40.23	143.77	690.45	184.00	0167-0B
2724.35	ccp	S/Sst : pl y brn to or gy	221.59	91.22	56.62	13.28	60.47	147.85	73.75	0026-1L
2728.70	com	Composite sample - see table 4 e	405.47	176.80	102.15	35.62	90.89	278.96	126.51	0168-0B
2740.00	cut	Sh/Clst: brn gy	444.85	251.48	75.73	5.72	111.93	327.21	117.64	0131-4L
2895.00	com	Composite sample - see table 4 e	145.25	65.17	26.33	2.19	51.56	91.50	53.76	0169-0B

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 4 d: Composition of material extracted from the rock (%) for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	Sat / EOM	Aro / EOM	Asph / EOM	NSO / EOM	HC / EOM	Non-HC / EOM	Sat / Aro	HC / Non-HC	Sample
2440.00	com	Composite sample - see table 4 e	25.88	25.88	6.71	41.53	51.76	48.24	100.00	107.28	0161-0B
2465.00	com	Composite sample - see table 4 e	23.64	24.50	5.73	46.13	48.14	51.86	96.49	92.82	0162-0B
2495.00	com	Composite sample - see table 4 e	25.00	29.17	11.11	34.72	54.17	45.83	85.71	118.18	0163-0B
2565.00	com	Composite sample - see table 4 e	44.81	15.58	5.19	34.42	60.39	39.61	287.50	152.46	0165-0B
2630.00	com	Composite sample - see table 4 e	23.68	20.13	4.21	51.97	43.82	56.18	117.65	77.99	0166-0B
2687.62	com	Composite sample - see table 4 e	53.99	24.97	4.60	16.44	78.96	21.04	216.26	375.24	0167-0B
2724.35	ccp	S/Sst : pl y brn to or gy	41.17	25.55	5.99	27.29	66.72	33.28	161.11	200.47	0026-1L
2728.70	com	Composite sample - see table 4 e	43.60	25.19	8.79	22.42	68.80	31.20	173.08	220.50	0168-0B
2740.00	cut	Sh/Clst: brn gy	56.53	17.02	1.28	25.16	73.55	26.45	332.08	278.14	0131-4L
2895.00	com	Composite sample - see table 4 e	44.86	18.13	1.51	35.50	62.99	37.01	247.50	170.20	0169-0B

Table 4 e: List of composite samples appearing in the extraction tables for well NOCS 30/9-1

Depth unit of measure: m

NOTE: Depths shown in tables 4 a to d correspond to the composite samples' lower depth.

Upper depth	Lower depth	Typ	Sample	Depth	Typ	Lithology	Sample
2420.00	2440.00	com	0161-0B is composed of:	2420.00	cut	Sh/Clst: drk gy to dsk y brn	0067-5L
				2425.00	cut	Sh/Clst: drk gy to dsk y brn	0068-5L
				2430.00	cut	Sh/Clst: drk gy to dsk y brn	0069-5L
				2435.00	cut	Sh/Clst: drk gy to dsk y brn	0070-4L
				2440.00	cut	Sh/Clst: drk gy to dsk y brn	0071-4L
2445.00	2465.00	com	0162-0B is composed of:	2445.00	cut	Sh/Clst: drk gy to dsk y brn	0072-4L
				2450.00	cut	Sh/Clst: drk gy to dsk y brn	0073-4L
				2455.00	cut	Sh/Clst: drk gy to dsk y brn	0074-4L
				2460.00	cut	Sh/Clst: drk gy to dsk y brn	0075-4L
				2465.00	cut	Sh/Clst: drk gy to dsk y brn	0076-4L
2480.00	2495.00	com	0163-0B is composed of:	2480.00	cut	Sh/Clst: drk gy to dsk y brn, slt	0079-4L
				2485.00	cut	Sh/Clst: drk gy to dsk y brn, slt, mic	0080-4L
				2490.00	cut	Sh/Clst: drk gy to dsk y brn, slt, mic	0081-4L
				2495.00	cut	Sltst : drk gy to dsk y brn, cly, mic	0082-4L
2560.00	2565.00	com	0165-0B is composed of:	2560.00	cut	Sltst : m gy to drk gy, s, mic	0095-4L
				2565.00	cut	Sltst : m gy to drk gy, s, mic	0096-4L
2610.00	2630.00	com	0166-0B is composed of:	2610.00	cut	Sltst : m gy to drk gy, s, mic	0105-4L
				2620.00	cut	Sltst : m gy to drk gy, carb, s, mic	0107-3L
				2630.00	cut	Sltst : m gy to drk gy, mic	0109-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 4 e: List of composite samples appearing in the extraction tables for well NOCS 30/9-1

Depth unit of measure: m

NOTE: Depths shown in tables 4 a to d correspond to the composite samples' lower depth.

Upper depth	Lower depth	Typ	Sample	Depth	Typ	Lithology	Sample
2684.66	2687.62	com	0167-0B is composed of:	2684.66	ccp	S/Sst : gy brn to dsk brn, cem	0007-1L
				2687.62	ccp	S/Sst : gy brn to dsk brn, cem	0008-1L
2725.84	2728.70	com	0168-0B is composed of:	2725.84	ccp	S/Sst : drk y brn, cem	0027-1L
				2728.70	ccp	S/Sst : drk y brn, cem	0029-1L
2880.00	2895.00	com	0169-0B is composed of:	2880.00	cut	Sh/Clst: brn gy to m gy, slt, mic	0156-3L
				2885.00	cut	Sh/Clst: brn gy to m gy, slt, mic	0157-3L
				2895.00	cut	Sh/Clst: brn gy to m gy, slt, mic	0159-3L

Table 5 : Saturated Hydrocarbon Ratios for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	Pristane / nC17	Pristane / Phytane	Pristane + Phytane / nC17 + nC18	Phytane / nC18	CPI	Sample
2440.00	com	bulk	1.16	1.51	1.00	0.82	1.02	0161-0B
2465.00	com	bulk	1.06	1.46	1.01	0.94	1.01	0162-0B
2495.00	com	bulk	1.16	1.57	1.08	0.97	0.94	0163-0B
2565.00	com	bulk	0.65	1.26	0.61	0.56	1.11	0165-0B
2630.00	com	bulk	0.56	1.35	0.50	0.45	1.26	0166-0B
2687.62	com	bulk	0.88	1.18	0.81	0.73	0.93	0167-0B
2724.35	ccp	S/Sst : pl y brn to or gy	0.65	1.44	0.58	0.50	1.05	0026-1L
2728.70	com	bulk	0.74	1.19	0.68	0.61	0.92	0168-0B
2740.00	cut	Sh/Clst: brn gy	0.66	1.45	0.60	0.54	1.20	0131-4L
2895.00	com	bulk	0.61	1.33	0.56	0.51	1.17	0169-0B

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 6 : Aromatic Hydrocarbon Ratios for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	Rc	DBT/P	4/1MDBT	(3+2) /1MDBT	Sample
2440.00	com	bulk	0.92	1.06	0.14	1.00	1.02	0.88	1.01	0.80	0.16	0.10	0161-0B
2465.00	com	bulk	0.96	1.11	0.16	-	0.55	-	0.73	0.78	0.18	0.10	0162-0B
2495.00	com	bulk	0.60	0.85	0.10	-	0.52	-	0.71	0.67	0.17	0.09	0163-0B
2565.00	com	bulk	0.88	1.38	0.11	1.20	0.83	0.90	0.90	0.48	7.08	0.87	0165-0B
2630.00	com	bulk	1.06	1.47	0.20	1.15	0.84	0.90	0.90	0.52	5.84	0.74	0166-0B
2687.62	com	bulk	0.71	0.88	0.15	1.07	0.92	0.98	0.95	0.73	5.84	0.85	0167-0B
2724.35	ccp	S/Sst : pl y brn to or gy	1.13	2.00	0.38	1.02	0.78	0.87	0.87	0.44	8.25	1.11	0026-1L
2728.70	com	bulk	1.25	2.20	0.42	1.03	0.84	0.94	0.90	0.51	7.19	0.98	0168-0B
2740.00	cut	Sh/Clst: brn gy	0.96	1.22	0.18	1.25	0.93	1.00	0.96	0.69	9.75	0.92	0131-4L
2895.00	com	bulk	0.99	1.44	0.18	1.19	0.84	0.90	0.90	0.49	7.39	0.76	0169-0B

Table 7 : Thermal Maturity Data for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
2370.00	cut	bulk	NDP	-	-	5 (?)	-	-	0058-0B
2420.00	cut	Sh/Clst: drk gy to dsk y brn	-	-	-	-	4.5 ?	427	0067-5L
2425.00	cut	bulk	0.35	6	0.05	4	-	-	0068-0B
2465.00	cut	Sh/Clst: drk gy to dsk y brn	-	-	-	-	4.5-5.0 ?	427	0076-4L
2490.00	cut	bulk	0.38	6	0.04	4	-	-	0081-0B
2510.00	cut	bulk	0.40	18	0.03	4	-	-	0085-0B
2510.00	cut	Sltst : drk gy to dsk y brn	-	-	-	-	5.0	428	0085-4L
2560.00	cut	bulk	0.41	26	0.03	4	-	-	0095-0B
2560.00	cut	Sltst : m gy to drk gy	-	-	-	-	5.0	432	0095-4L
2620.00	cut	bulk	0.47	14	0.09	4.5	-	-	0107-0B
2620.00	cut	Sltst : m gy to drk gy	-	-	-	-	5.0-5.5 ?	428	0107-3L
2640.00	cut	bulk	0.52	11	0.05	5	-	-	0111-0B
2640.00	cut	Sh/Clst: m gy to drk gy	-	-	-	-	5.5 ?	437	0111-2L
2695.02	ccp	bulk	0.51	4	0.07	6 (?)	-	-	0012-0B

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 7 : Thermal Maturity Data for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
2700.40	ccp	Coal : blk	-	-	-	-	6.0	442	0015-1L
2714.31	ccp	bulk	0.56	16	0.06	5 (?)	-	-	0021-0B
2714.31	ccp	Sh/Clst: lt brn gy	-	-	-	-	5.5-6.0	443	0021-1L
2740.00	cut	bulk	0.56	16	0.04	5.5	-	-	0131-0B
2740.00	cut	Sh/Clst: brn gy	-	-	-	-	5.0-5.5	436	0131-4L
2784.75	ccp	bulk	0.56	2	0.03	5.5	-	-	0052-0B
2784.75	ccp	Sh/Clst: drk gy to dsk y brn	-	-	-	-	5.5	438	0052-1L
2850.00	cut	Sh/Clst: m gy	-	-	-	-	5.5-6.0	439	0150-4L
2870.00	cut	bulk	NDP	-	-	5.5	-	-	0154-0B
2895.00	cut	bulk	0.56	1	0.00	5.5	-	-	0159-0B
2895.00	cut	Sh/Clst: brn gy to m gy	-	-	-	-	5.5	438	0159-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 8 : Visual Kerogen Composition Data for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	LIPT %	Amor L	LipDet	Sp/Pol	Cuticl	Resin	Algae	Dinofl	Acrit	Bit L	INERT %	Fusin	SemFus	IntDet	Micrin	Sclero	Bit I	VITR %	Telin	Collin	VitDet	Amor V	Bit V	Sample
2420.00	cut	Sh/Clst: drk gy to dsk y brn	70	**	*	*			**	*			TR			*				30	*		*	*		0067-5L
2465.00	cut	Sh/Clst: drk gy to dsk y brn	80	**		*	*		**	*		*	5			*				15	*			*		0076-4L
2510.00	cut	Sltst : drk gy to dsk y brn	40	**	*	*			**	*		?	5		*	*				55	*		*			0085-4L
2560.00	cut	Sltst : m gy to drk gy	35	*	*	**			**				15	*	*					50	*		**			0095-4L
2620.00	cut	Sltst : m gy to drk gy	50	**		*			**	*			10	*	*	*				40	*		*			0107-3L
2640.00	cut	Sh/Clst: m gy to drk gy	15			*	?		**	*			25	*	*	*				60	*	*	**	*		0111-2L
2700.40	ccp	Coal : blk	5	*		**			*				5	*	*					90	**	*	*	*		0015-1L
2714.31	ccp	Sh/Clst: lt brn gy	TR	*		**			*				TR		*					100	**	*				0021-1L
2740.00	cut	Sh/Clst: brn gy	50			**			*				5		*					45	**	*		*		0131-4L
2784.75	ccp	Sh/Clst: drk gy to dsk y brn	25		*	**	*		*	*			15	*	**					60	**	*		*		0052-1L
2850.00	cut	Sh/Clst: m gy	35		**	*			*	*			5			*				60	*		**	*		0150-4L
2895.00	cut	Sh/Clst: brn gy to m gy	80	**	*	**	*		*	*			TR		*	*				20	*		*			0159-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 9A: Tabulation of carbon isotope data for EOM/EOM - fractions or Oils for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology	EOM/Oil	Saturated	Aromatic	NSO	Asphaltenes	Kerogen	Sample
2687.62	com	Composite sample	-	-29.01	-27.90	-27.62	-26.47	-	0167-0B
2724.35	ccp		-	-28.64	-27.34	-26.37	-25.84	-	0026-1L
2728.70	com	Composite sample	-	-28.71	-28.11	-26.95	-25.54	-	0168-0B
2895.00	com	Composite sample	-	-29.15	-28.15	-26.65	-25.89	-	0169-0B

Table 9B : Tabulation of cv values from carbon isotope data for well NOCS 30/9-1

Depth unit of measure: m

Depth	Typ	Lithology		Saturated	Aromatic	cv value	Interpretation	Sample
2687.62	com	Composite sample		-29.01	-27.90	-0.19	Marine	0167-0B
2724.35	ccp			-28.64	-27.34	0.11	Marine	0026-1L
2728.70	com	Composite sample		-28.71	-28.11	-1.42	Marine	0168-0B
2895.00	com	Composite sample		-29.15	-28.15	-0.39	Marine	0169-0B

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A.S

Table 10A: Variation in Triterpane Distribution for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	B/A	B/B+A	B / B+E+F	C/E	C/C+E	X/E	Z/E	Z/C	Z/Z+E	Q/E	E/E+F	C+D / C+D+E+F	D+F/C+E	J1 / J1+J2%	Sample
2687.62	S/Sst	0.81	0.45	0.12	0.43	0.30	0.09	0.24	0.57	0.20	0.08	0.91	0.32	0.14	59.81	0167-0
2724.35	S/Sst	0.80	0.45	0.12	0.47	0.32	0.09	0.27	0.56	0.21	0.09	0.91	0.35	0.15	57.02	0026-1
2728.70	S/Sst	0.80	0.44	0.13	0.45	0.31	0.09	0.27	0.60	0.21	0.09	0.91	0.33	0.14	60.00	0168-0
2895.00	Sh/Clst	1.96	0.66	0.14	0.50	0.33	0.08	0.09	0.18	0.08	0.10	0.85	0.33	0.18	56.45	0169-0

Table 10B: Variation in Sterane Distribution (peak height) for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Ratio10	Sample
2687.62	S/Sst	0.80	48.78	72.48	1.19	0.73	0.43	0.32	0.57	0.95	2.57	0167-0
2724.35	S/Sst	0.80	49.02	72.33	1.14	0.73	0.46	0.35	0.57	0.96	2.56	0026-1
2728.70	S/Sst	0.78	47.31	72.93	1.11	0.74	0.43	0.32	0.57	0.90	2.56	0168-0
2895.00	Sh/Clst	0.51	34.91	48.66	0.86	0.58	0.26	0.21	0.32	0.54	0.73	0169-0

Ratio1: a / a + j
Ratio2: q / q + t * 100%
Ratio3: 2(r + s)/(q + t + 2(r + s)) * 100%
Ratio4: a + b + c + d / h + k + l + n
Ratio5: r + s / r + s + q

Ratio6: u + v / u + v + q + r + s + t
Ratio7: u + v / u + v + i + m + n + q + r + s + t
Ratio8: r + s / q + r + s + t
Ratio9: q / t
Ratio10: r + s / t

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 10C: Aromatisation of Steranes for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Sample
2687.62	S/Sst	0.31	0.93	0167-0
2724.35	S/Sst	0.28	0.93	0026-1
2728.70	S/Sst	0.30	0.92	0168-0
2895.00	Sh/Clst	0.80	0.63	0169-0

Ratio1: $\frac{C1+D1+E1+F1+G1+H1+I1}{C1+D1+E1+F1+G1+H1+I1 + c1+d1+e1+f1+g1}$

Ratio2: g1 / g1 + I1

Table 10b: Variation in Monoaromatic Sterane Distribution for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Sample
2687.62	S/Sst	0.33	0.21	0.15	0.13	0167-0
2724.35	S/Sst	0.30	0.22	0.12	0.11	0026-1
2728.70	S/Sst	0.25	0.11	0.12	0.09	0168-0
2895.00	Sh/Clst	0.30	0.19	0.13	0.11	0169-0

Ratio1: A1 / A1 + E1
Ratio2: B1 / B1 + E1
Ratio3: A1 / A1 + E1 + G1
Ratio4: A1+B1 / A1+B1+C1+D1+E1+F1+G1+H1+I1

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 10E: Variation in Triaromatic Sterane Distribution for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
2687.62	S/Sst	0.28	0.27	0.14	0.13	0.21	0167-0
2724.35	S/Sst	0.32	0.36	0.18	0.15	0.24	0026-1
2728.70	S/Sst	0.27	0.32	0.14	0.12	0.18	0168-0
2895.00	Sh/Clst	0.21	0.23	0.12	0.10	0.16	0169-0

Ratio1: a1 / a1 + g1
Ratio2: b1 / b1 + g1
Ratio3: a1 + b1 / a1 + b1 + c1 + d1 + e1 + f1 + g1
Ratio4: a1 / a1 + e1 + f1 + g1
Ratio5: a1 / a1 + d1

Table 10F: Raw GCMS triterpane data (peak height) for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	p	q	r	s	t	a	b	z	c	x	d	e	f	g	h	i	j1	j2	k1	k2	l1	l2	m1	m2	Sample
2687.62	S/Sst	14.00	11.00	7.00	10.50	4.50	24.00	19.50	32.50	57.00	12.50	13.50	134.00	12.50	45.00	31.50	6.00	32.00	21.50	27.50	17.00	15.50	9.50	12.50	8.00	0167-0
2724.35	S/Sst	17.50	12.50	7.50	10.50	4.50	25.50	20.50	35.50	63.00	12.00	15.00	133.50	14.00	48.00	32.00	7.50	32.50	24.50	29.50	19.00	15.00	10.00	12.50	8.00	0026-1
2728.70	S/Sst	17.50	11.50	7.00	11.50	4.00	27.50	22.00	36.00	60.00	12.00	14.00	134.00	14.00	45.50	33.00	7.00	33.00	22.00	27.00	18.00	15.50	9.50	12.50	8.00	0168-0
2895.00	Sh/Clst	31.50	13.50	9.00	9.50	4.00	13.50	26.50	12.00	67.50	10.50	12.00	135.50	24.00	60.50	41.00	18.00	35.00	27.00	28.50	20.00	20.00	14.00	10.50	8.50	0169-0

Table 10G: Raw GCMS sterane data (peak height) for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	u	v	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	Sample
2687.62	S/Sst	96.50	44.00	129.00	77.00	33.00	57.50	69.00	41.00	39.00	112.50	54.00	33.00	75.50	23.50	20.50	38.50	51.50	17.50	40.00	65.00	43.00	42.00	0167-0
2724.35	S/Sst	102.00	48.00	128.00	76.00	33.00	50.00	62.00	39.50	38.50	119.00	50.00	32.50	74.00	23.00	18.50	36.00	46.50	15.50	37.50	60.00	40.00	39.00	0026-1
2728.70	S/Sst	95.50	51.50	122.50	81.00	33.00	58.00	65.00	40.00	39.00	118.50	52.00	34.00	81.00	25.00	22.00	40.00	53.00	20.50	39.50	68.50	44.00	44.00	0168-0
2895.00	Sh/Clst	76.00	29.00	97.00	59.50	23.50	32.50	37.00	26.50	61.00	116.00	41.00	93.00	68.00	25.50	26.00	37.00	26.00	41.50	70.00	61.00	34.00	130.50	0169-0

Table 10H: Raw GCMS monoaromatic sterane data (peak height) for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	h1	i1	Sample
2687.62	S/Sst	124.66	69.42	161.45	168.13	257.68	42.52	445.73	216.53	49.80	0167-0
2724.35	S/Sst	105.92	70.23	146.35	137.82	249.86	47.78	523.94	244.63	53.03	0026-1
2728.70	S/Sst	108.81	38.67	148.32	166.70	321.00	41.91	465.21	270.78	57.80	0168-0
2895.00	Sh/Clst	131.39	72.17	161.52	193.23	310.89	55.48	583.76	358.18	56.08	0169-0

Table 10I: Raw GCMS trioaromatic sterane data (peak height) for Well NOCS 30/9-1

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	Sample
2687.62	S/Sst	245.49	233.19	291.15	939.46	603.82	462.12	630.15	0167-0
2724.35	S/Sst	357.72	418.23	369.89	1137.66	733.48	616.73	756.67	0026-1
2728.70	S/Sst	257.47	330.31	366.09	1170.12	628.22	591.34	711.39	0168-0
2895.00	Sh/Clst	26.00	29.00	59.00	136.00	82.00	51.00	95.00	0169-0

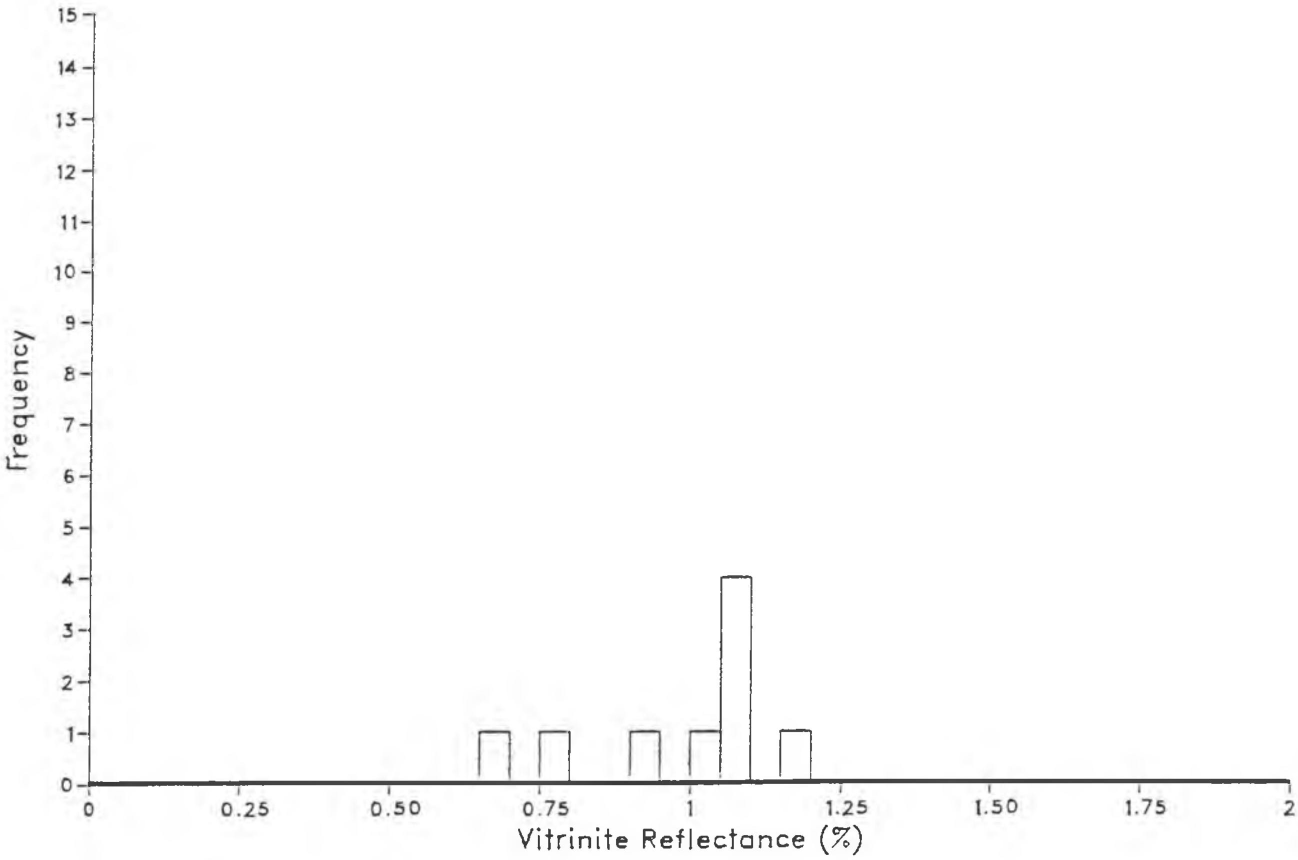
APPENDIX 2

Histograms

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2370.00(m)
Sample: 58- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.000 to 0.000):	0.00	0.00	0
Population Two (from 0.650 to 0.800):	0.74	0.07	2
Population Three (from 0.900 to 1.100):	1.04	0.05	6
Population Four (from 1.150 to 1.200):	1.16	0.00	1

Readings:

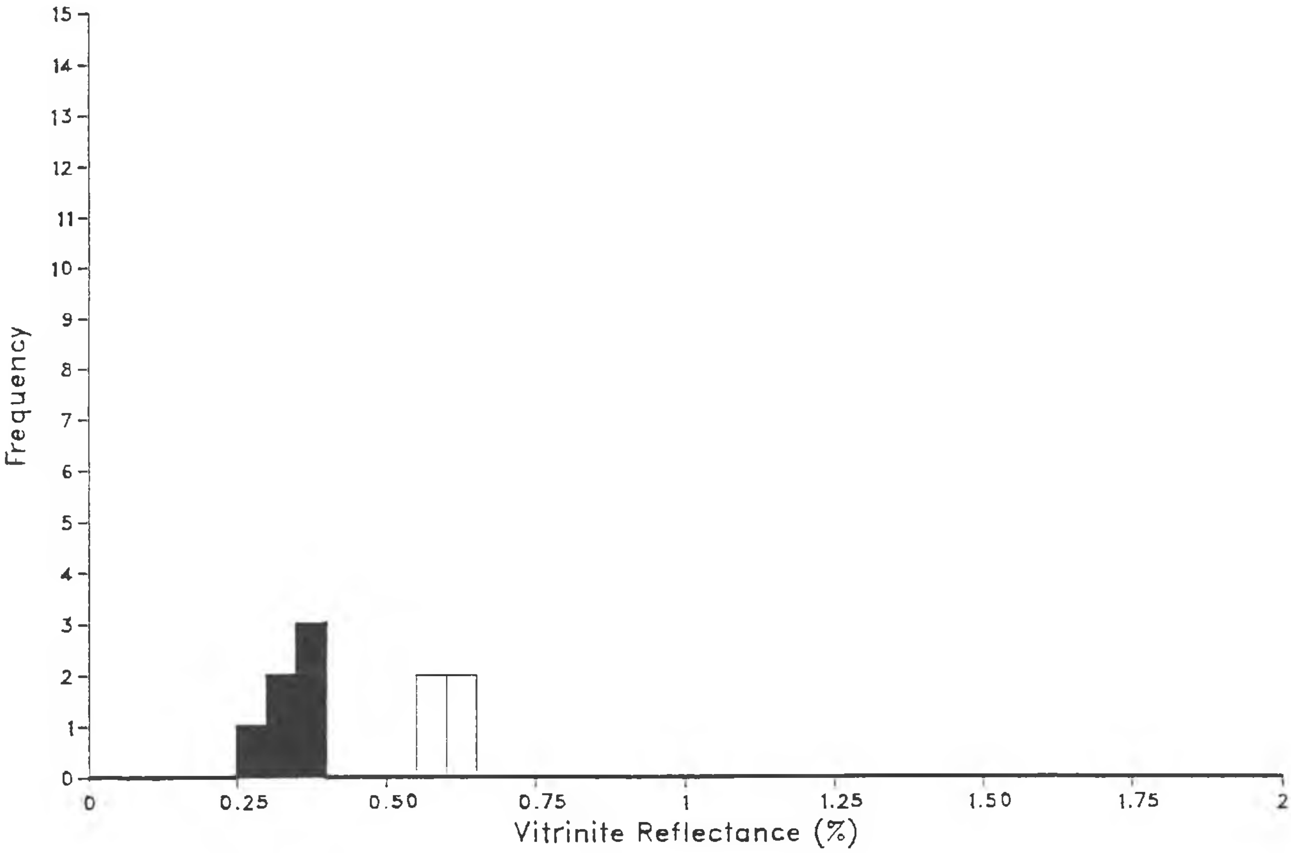
0.689 0.787 0.940 1.013 1.061 1.064 1.073 1.079 1.163

GEOLAB NOR a/s — Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2425.00(m)
Sample: 68- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.250 to 0.400):	0.35	0.05	6
Population Two (from 0.550 to 0.650):	0.60	0.03	4

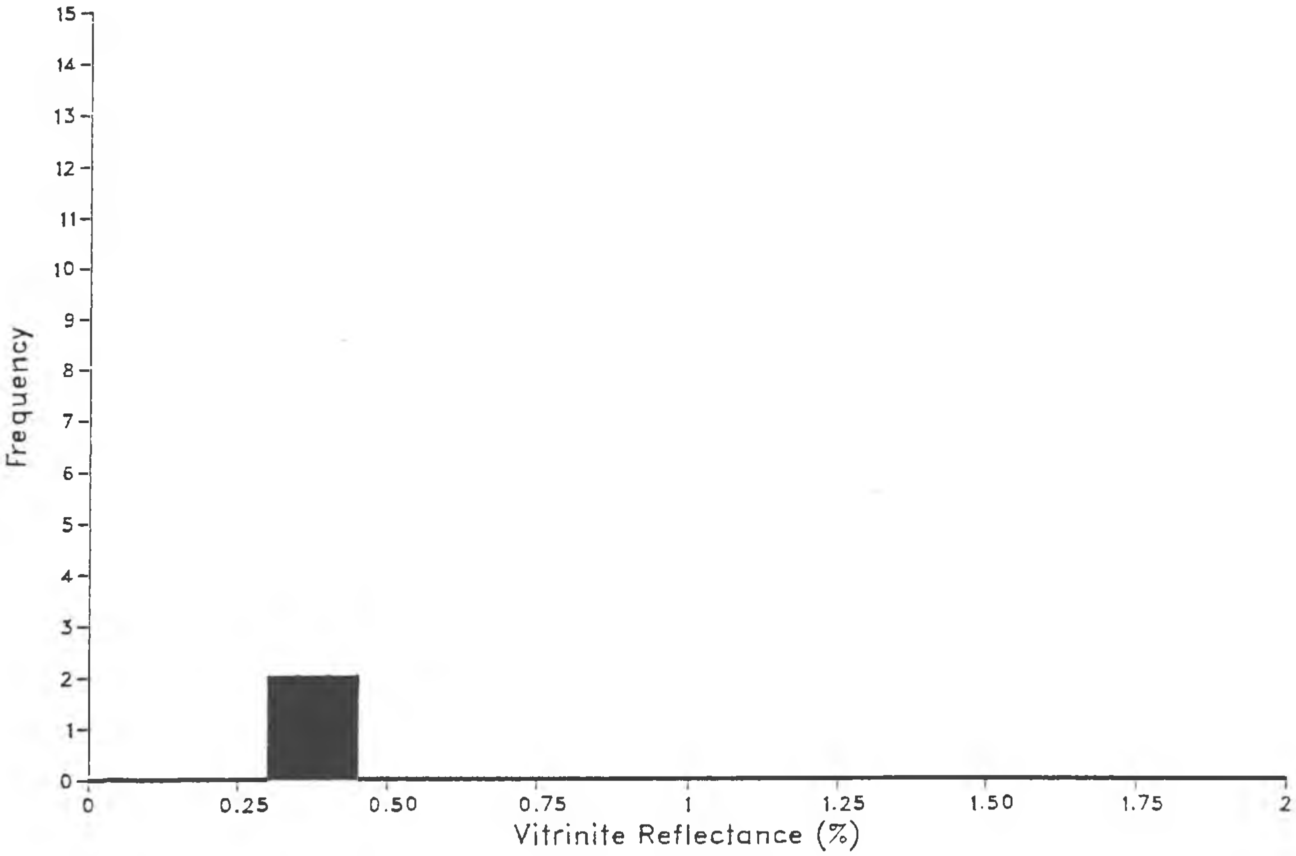
Readings:

0.291	0.307	0.311	0.387	0.389	0.399	0.567	0.591	0.601	0.644

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2490.00(m)
Sample: 81- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.300 to 0.450):	0.38	0.04	6

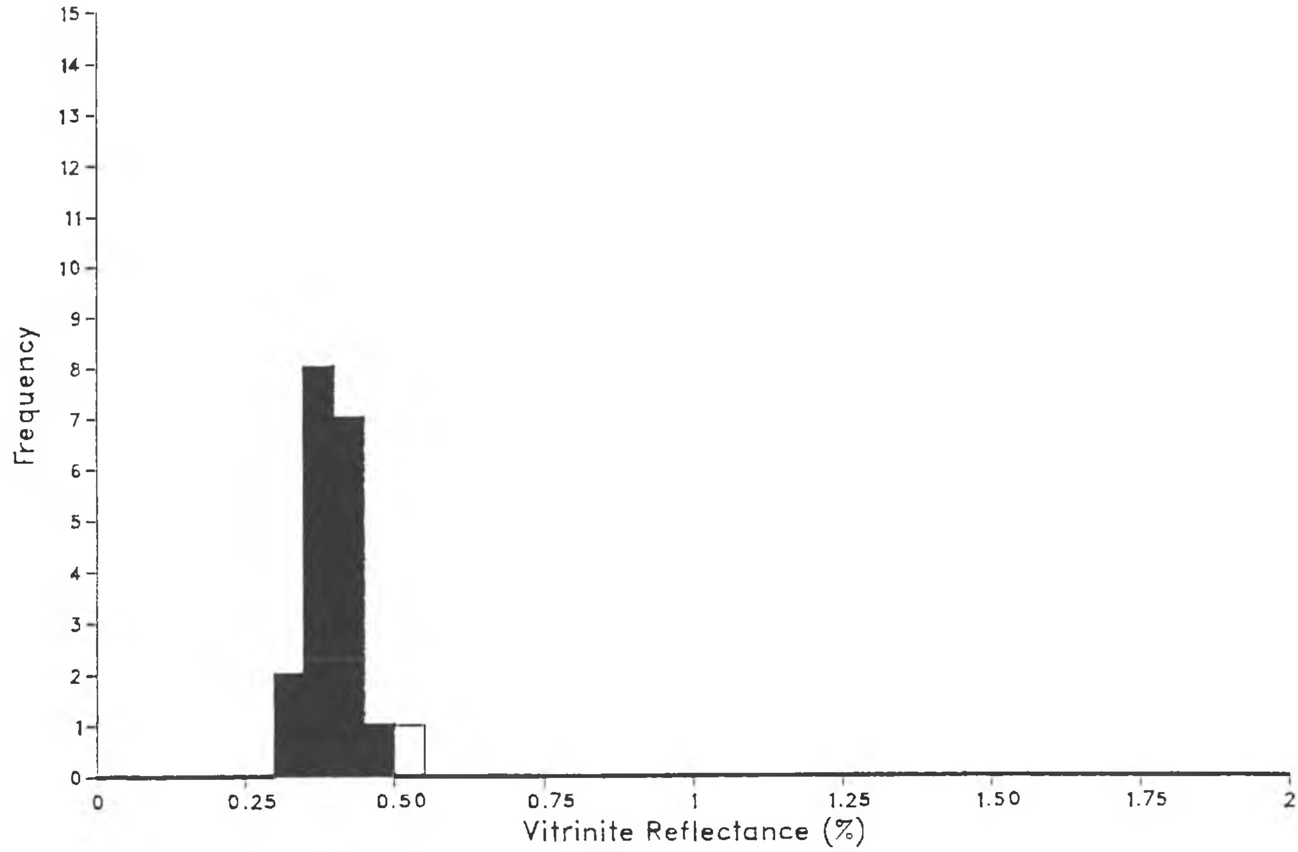
Readings:

0.303 0.346 0.388 0.396 0.402 0.425

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2510.00(m)
Sample: 85- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.300 to 0.500):	0.40	0.03	18
Population Two (from 0.500 to 0.550):	0.54	0.00	1

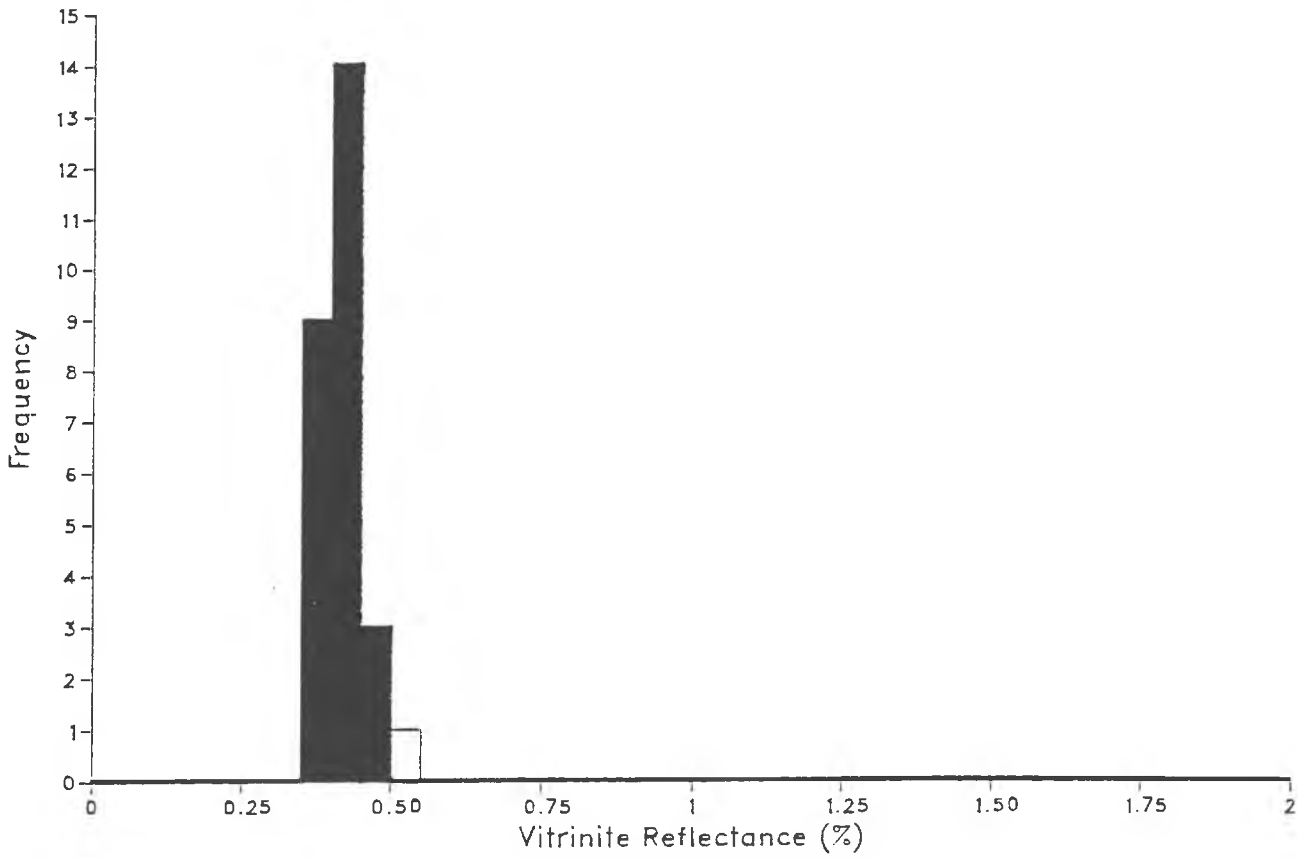
Readings:

0.324	0.348	0.369	0.376	0.379	0.389	0.396	0.397	0.398	0.399
0.400	0.402	0.406	0.411	0.428	0.431	0.432	0.465	0.540	

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2560.00(m)
Sample: 95- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.500):	0.41	0.03	26
Population Two (from 0.500 to 0.550):	0.53	0.00	1

Readings:

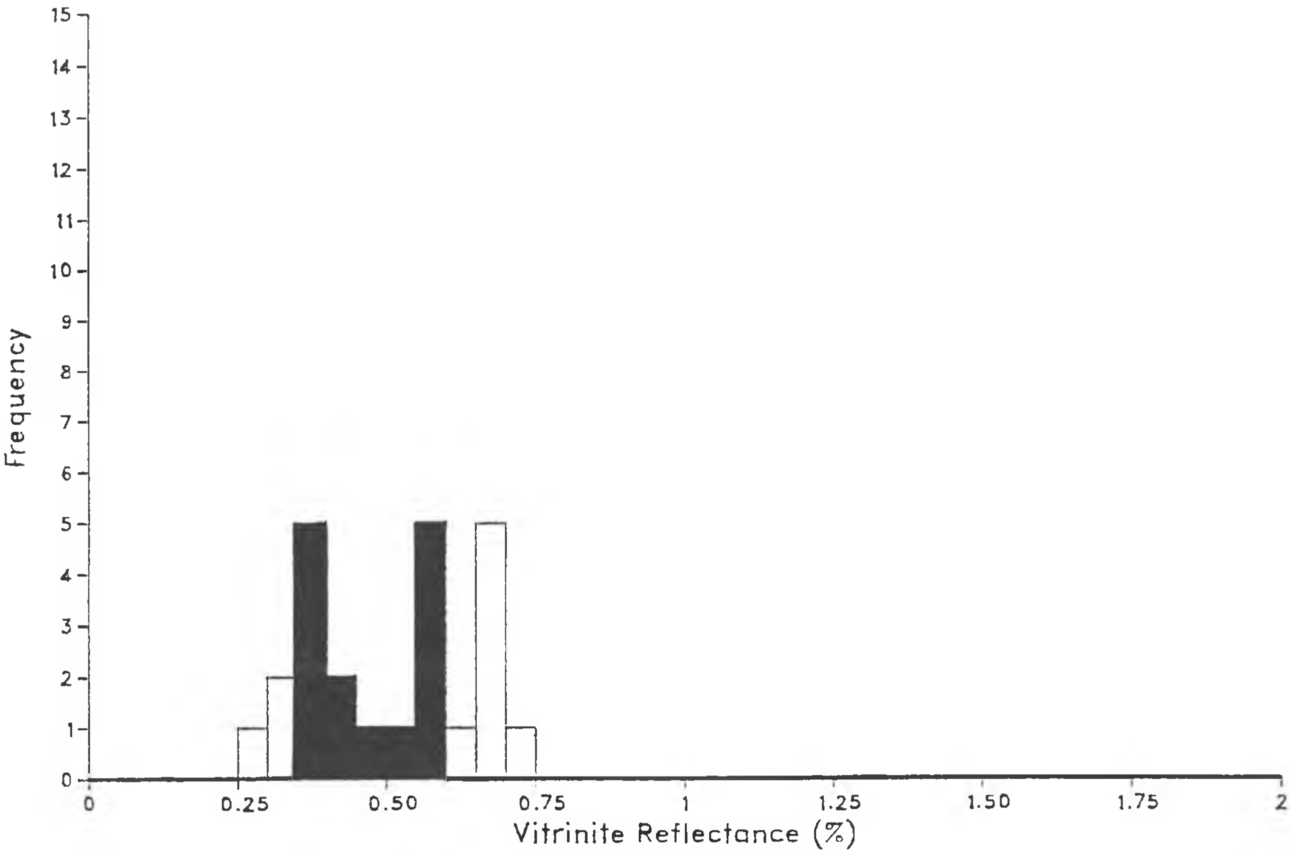
0.350	0.353	0.363	0.372	0.380	0.384	0.388	0.394	0.399	0.401
0.402	0.404	0.405	0.409	0.413	0.416	0.420	0.433	0.434	0.435
0.437	0.439	0.443	0.463	0.472	0.478	0.532			

GEOLAB NOR a/s — Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2620.00(m)
Sample: 107- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.600):	0.47	0.09	14
Population Two (from 0.250 to 0.350):	0.30	0.00	3
Population Three (from 0.600 to 0.750):	0.68	0.03	7

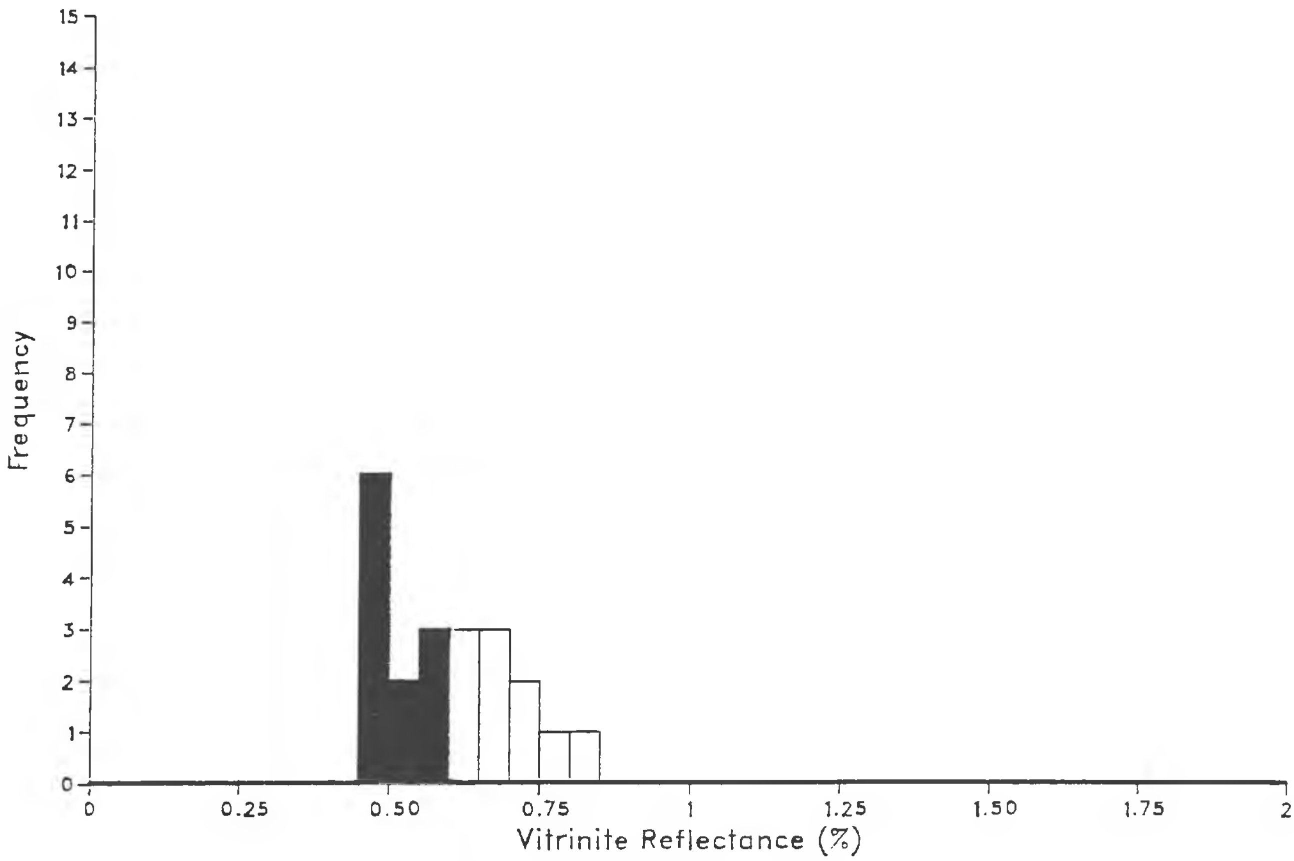
Readings:

0.292	0.305	0.307	0.365	0.374	0.381	0.391	0.397	0.421	0.439
0.486	0.522	0.550	0.569	0.572	0.573	0.583	0.631	0.657	0.664
0.675	0.698	0.699	0.711						

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2640.00(m)
Sample: 111- 0b



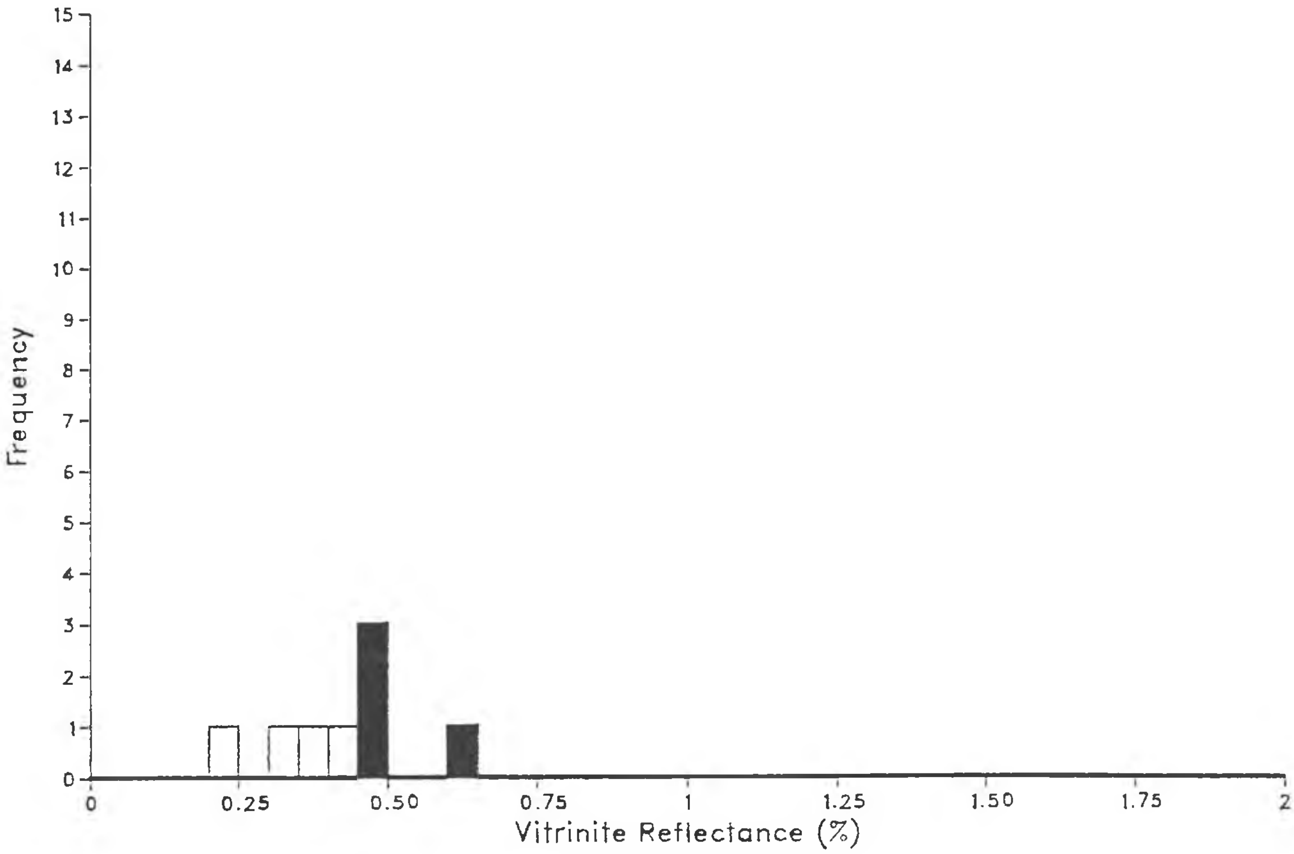
Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.600):	0.52	0.05	11
Population Two (from 0.600 to 0.850):	0.69	0.07	10

Readings:

0.462	0.472	0.476	0.496	0.497	0.498	0.515	0.536	0.553	0.598
0.598	0.611	0.619	0.634	0.662	0.665	0.690	0.706	0.708	0.794
0.827									

Vitrinite Reflectance Histogram

Well: NOCS 30/9-1
Depth: 2695.02(m)
Sample: 12- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.650):	0.51	0.07	4
Population Two (from 0.200 to 0.450):	0.33	0.08	4

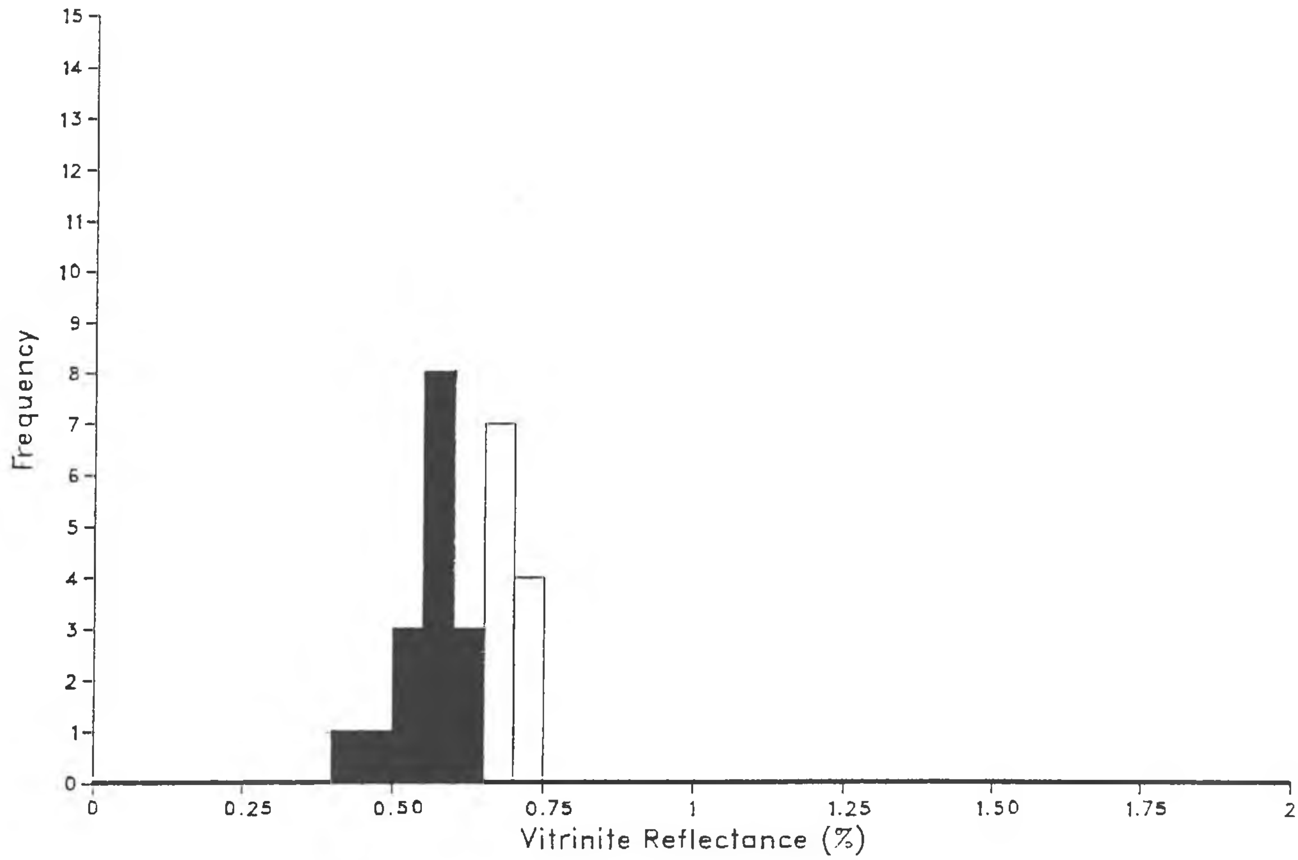
Readings:

0.228 0.316 0.375 0.403 0.476 0.477 0.481 0.616

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2714.31(m)
Sample: 21- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.650):	0.56	0.06	16
Population Two (from 0.650 to 0.750):	0.69	0.03	11

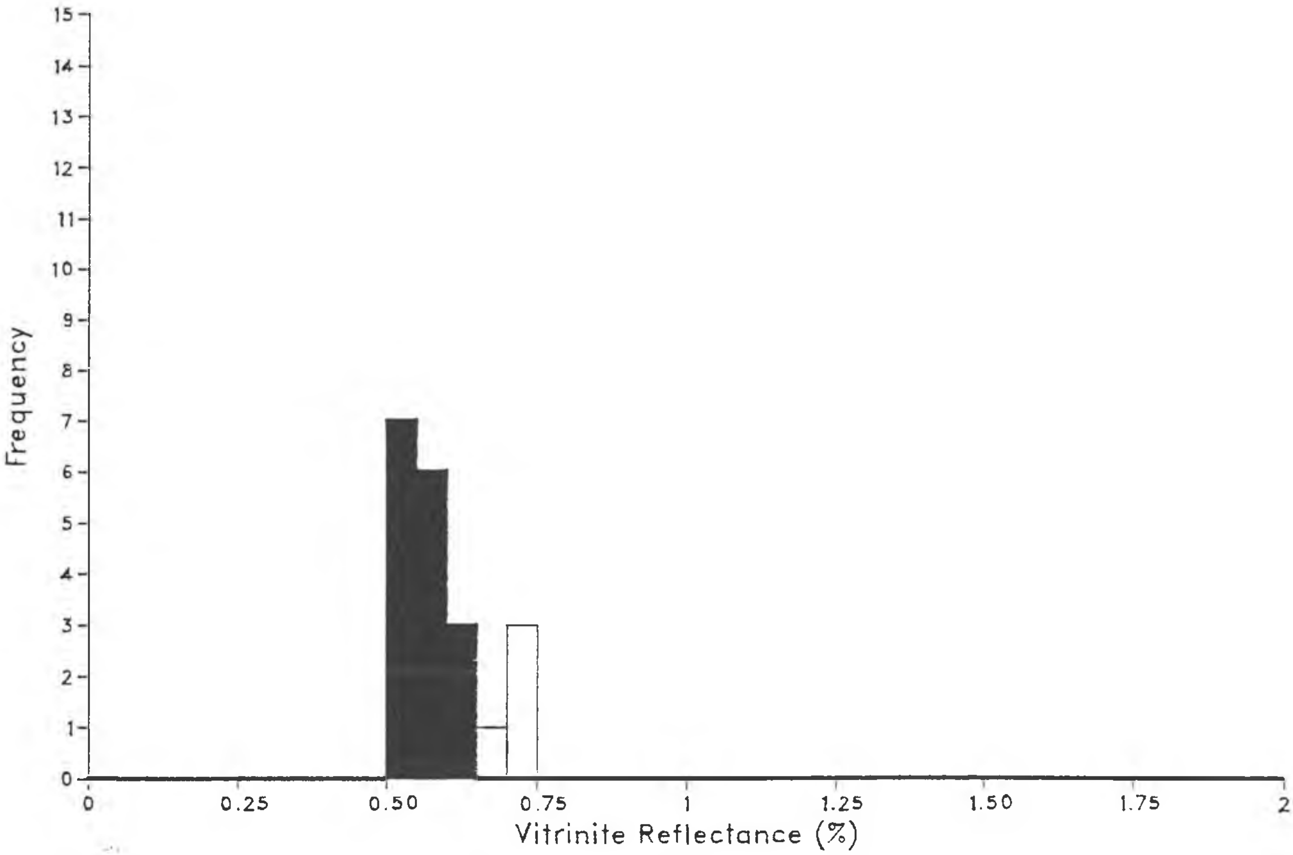
Readings:

0.417	0.495	0.513	0.525	0.536	0.565	0.575	0.583	0.586	0.588
0.590	0.593	0.594	0.606	0.619	0.648	0.651	0.652	0.656	0.669
0.677	0.684	0.695	0.702	0.713	0.714	0.739			

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2740.00(m)
Sample: 131- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.500 to 0.650):	0.56	0.04	16
Population Two (from 0.650 to 0.750):	0.70	0.03	4

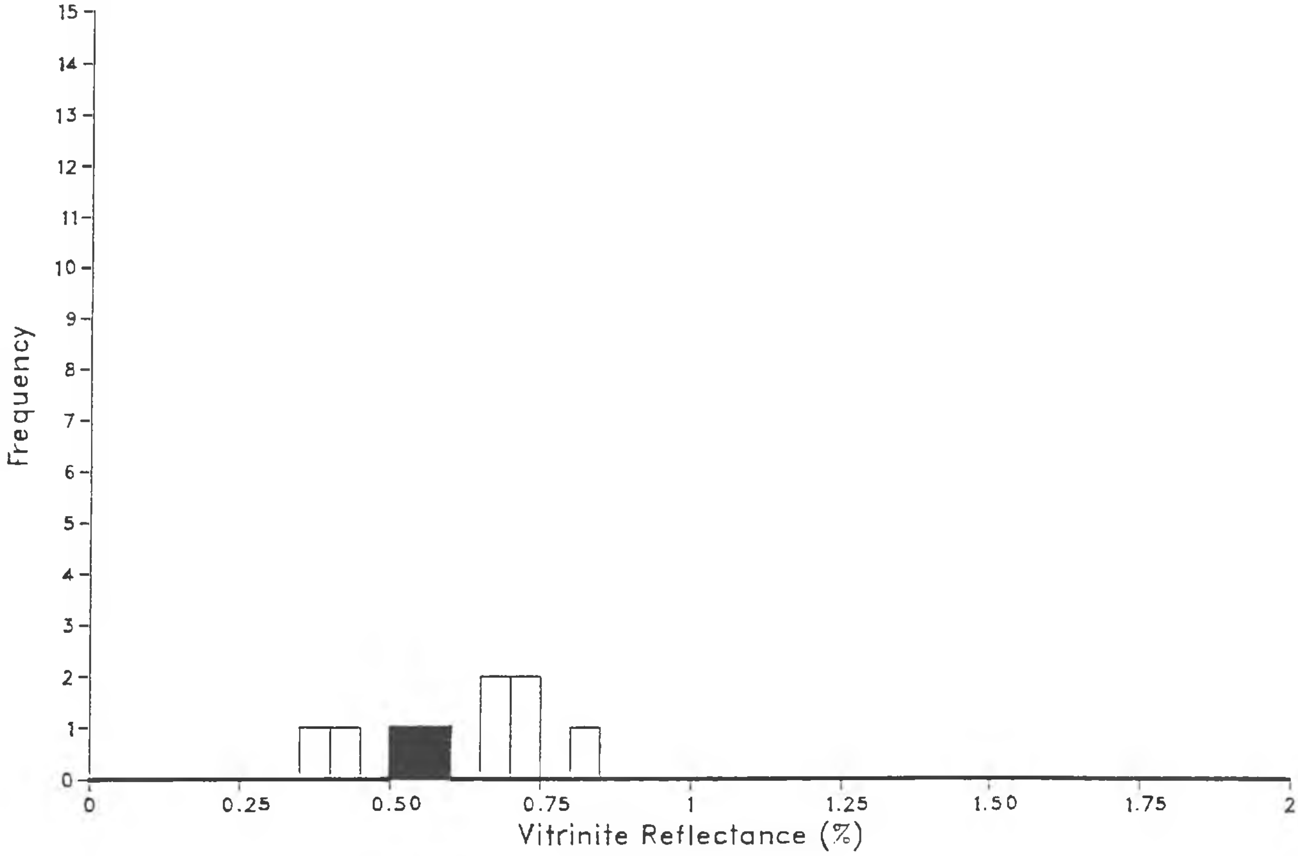
Readings:

0.500	0.503	0.529	0.538	0.541	0.545	0.547	0.554	0.567	0.569
0.572	0.574	0.598	0.602	0.631	0.646	0.668	0.704	0.711	0.728

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2784.75(m)
Sample: 52- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.500 to 0.600):	0.56	0.03	2
Population Two (from 0.350 to 0.450):	0.40	0.03	2
Population Three (from 0.650 to 0.850):	0.72	0.07	5

Readings:

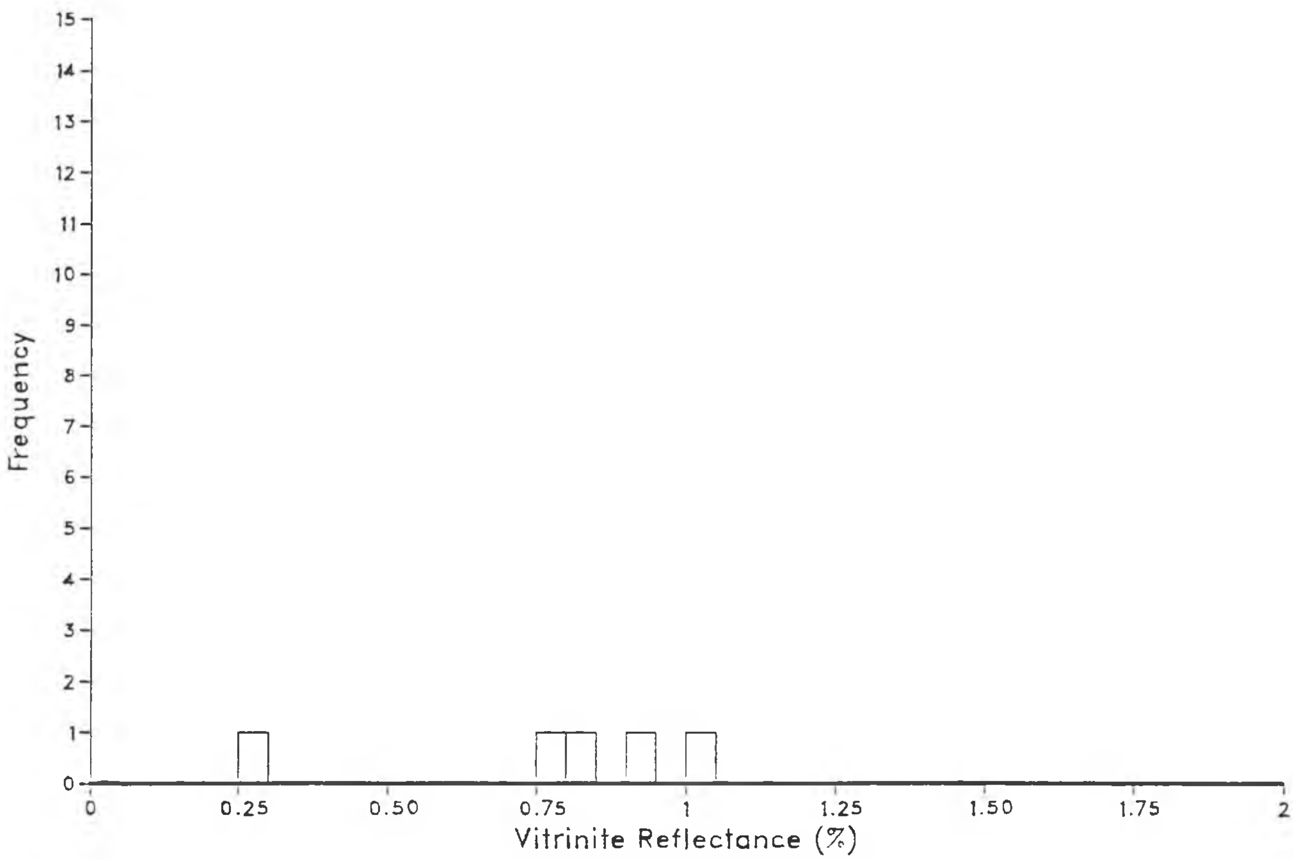
0.375 0.415 0.542 0.581 0.662 0.663 0.708 0.738 0.832

GEOLAB NOR a/s — Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2870.00(m)
Sample: 154- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.000 to 0.000):	0.00	0.00	0
Population Two (from 0.250 to 0.300):	0.26	0.00	1
Population Three (from 0.750 to 0.850):	0.79	0.05	2
Population Four (from 0.900 to 1.050):	0.97	0.07	2

Readings:

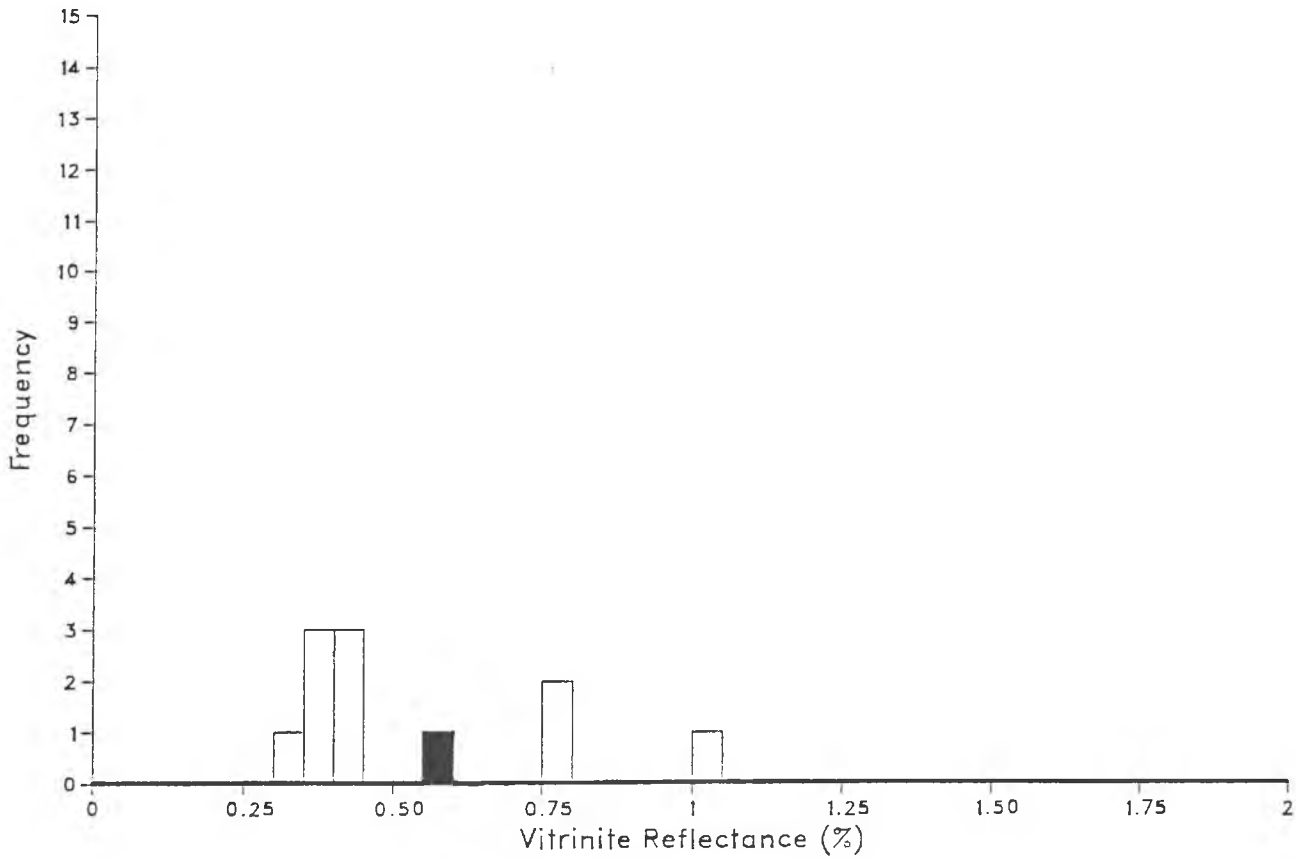
0.264 0.752 0.821 0.923 1.021

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 30/9-1
Depth: 2895.00(m)
Sample: 159- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.550 to 0.600):	0.56	0.00	1
Population Two (from 0.300 to 0.450):	0.39	0.03	7
Population Three (from 0.750 to 0.800):	0.78	0.00	2
Population Four (from 1.000 to 1.050):	1.05	0.00	1

Readings:

0.346 0.369 0.373 0.399 0.405 0.415 0.423 0.564 0.772 0.782
1.047

GEOLAB NOR a/s - Geochemical Laboratories of Norway