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PRE-CRETACEOUS HYDROCARBON POTENTIAL OF THE NORWEGIAN CENTRAL GRABEN

GEOCHEMICAL ANALYSIS
Well NOCS 2/1-2

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INTRODUCTION

This well from the Norwegian sector is situated in the north eastern part of the Central Graben. The total drilled depth was 3554 m. Samples were collected between 180 m and 3554 m from the Norwegian Petroleum Directorate in Stavanger. A total of 100 samples were collected, washed and described. The analysed section is between 3125 m and 3554 m with sample intervals of 6 metres. Samples for maturity were selected from 1080 m to 3554 m. A careful selection of suitable samples was made for screening analysis. Eighty-eight samples were selected for this analysis, and from the data obtained the samples were chosen for follow-up analysis. These were:

Thermal extraction - pyrolysis gas chromatography	34 samples.
Extraction, MPLC fractionation, saturated and aromatic hydrocarbon gas chromatography	5 samples
Vitrinite reflectance microscopy	21 samples
Visual kerogen analysis	18 samples

Tables listing in detail which samples were analysed and the results and logs are given in the appendix. The formation tops are taken from NPD Well Summary Sheet No 9. This gives the following depths:

Cromer Knoll Group	3120 m
Rødby Formation	3120 m
Valhall Formation	3170 m
Tyne Group	3295 m

Mandal Formation	3295 m
Vestland Group	3315 m
Ula Formation	3315 m
Bryne Formation	3350 m
Skagerrak Formation	3380 m
Zechstein	3520 m

LITHOLOGY AND TOTAL ORGANIC CARBON CONTENT

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

Cromer Knoll Group (3120 - 3205 m)

Rødby Formation (3120 - 3180 m)

The samples from this interval consist mainly of carbonate, caved from the chalk group, together with small amounts of a brown-grey to medium grey calcareous shale. The shale is believed to be indigenous material and was analysed. The TOC values of these samples vary from 1.1 to 1.5 % with an average of 1.3 %. One siltstone sample was also analysed. This has a TOC value of 0.4 %.

Valhall Formation (3180 - 3295 m)

The samples from this interval consist mainly of a shale with variable colour. The TOC values are mainly 0.3 - 0.4 %, with one sample at 3218 m having higher value, 0.8 %. The rest of the samples have an average TOC value of 0.3 %. A carbonate sample from 3272 m also has a high TOC value, 1.4 %.

<u>Jurassic</u> (3295 - 3380 m)

Tyne Group (3295 - 3315 m)

Mandal Formation (3295 - 3315 m)

The lithology of this interval is a brown-black shale which has high TOC values, 6.8 - 7.7 %, with an average of 7.2 %.

Vestland Group (3315 - 3380 m)

Ula Formation (3315 - 3350 m)

This is mainly a sandstone formation. Some of the samples contained different types of shale fragments. These were also analysed, mainly so that they can be used for follow-up analyses if there is not enough material in the samples from the intervals these are caved from, e.g. the Mandal Fm.

Bryne Formation (3350 - 3380 m)

The Bryne Fm. is also reported as mainly a sand/siltstone formation with interbedded shale. Some of the sandstone samples were analysed and found to have surprisingly high TOC values, 0.5 %. The olive-grey to medium dark grey shale samples have TOC values between 0.7 and 0.8 % with an average of 0.7 %.

Skagerrak Formation (3380 - 3520 m)

This formation consists of interbedded sandstone/siltstone and shale. Various lithologies were analysed. The sandstone generally has low TOC values, 0.1 - 0.2 %, while the shale has TOC values between 0.3 and 1.0 %. There is a general decrease in the TOC values with increasing depth, except for a few samples around 3520 m which have values of 0.8 - 1.0%.

Zechstein (3520 - 3554 m)

This interval consists of anhydrite with some shale stringers. The anhydrite was not analysed while the shale has values from 0.4 - 1.2 %. The medium dark grey shales between 3545 and 3554 m have the highest TOC values, 1.2 %.

ROCK-EVAL ANALYSIS

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

Cromer Knoll Group (3120 - 3295 m)

Rødby Formation (3120 - 3170 m)

The brown-grey to medium grey shale from this interval has variable petroleum potential, 0.8 - 2.3, with an average of 1.6 mg HC/g rock, whilst the hydrogen indices vary from 57 to 130, with an average of 95 mg HC/g TOC. These data suggest that the samples contain kerogen type III or III/IV with a poor potential as a source rock for gas.

The siltstone from 3164 m has a slightly higher hydrogen index and petroleum potential, 154 mg HC/g TOC and 3.7 mg HC/g rock respectively. This indicates that the siltstone contains kerogen type III with a fair potential as a source rock for gas. The siltstone contains obviously migrated hydrocarbons, this might have distorted the data somewhat if asphaltenes have been pyrolysed with the kerogen.

Valhall Formation (3170 - 3295 m)

The variable coloured shale from this formation generally has a very low petroleum potential. In most of the samples, the S_2 peak is not registered, so the hydrogen indices can not be measured, while the oxygen indices are very high. This indicates that these samples contain kerogen type IV with no potential as a source rock for hydrocarbons.

The samples from 3215 m have completely different values, the petroleum potential is 3.2 mg HC/g rock and the hydrogen indices 178 and 184 mg HC/g TOC. This indicates that these samples contain kerogen type III. However, there are indications that these samples contain free hydrocarbons and the high S_2 values could therefore be due to pyrolysed asphaltenes. The low Tmax values support this. The kerogens in these samples are therefore probably the same as for the rest of the Valhall Fm.

<u>Jurassic</u> (3295 - 3380 m)

Tyne Group (3295 - 3315 m)

Mandal Formation (3295 - 3315 m)

The brown-black shale from this interval has high hydrogen indices, 429 - 437 with an average of 432 mg HC/g TOC. The petroleum potential is also high, 32.7 to 38.0 mg HC/g rock, with an average of 35 mg HC/g rock. These data indicate that this interval contains kerogen type II with a rich potential as a source rock for oil.

Vestland Group (3315 - 3380 m)

Ula Formation (3315 - 3350 m)

Mainly a sandstone formation with no source rock potential.

Bryne Formation (3350 - 3380 m)

The olive-grey to medium dark green shale has low petroleum potentials, 0.1 - 0.7 %, with an average of 0.4 mg HC/g rock. The low hydrogen indices, 6 - 79 mg HC/g TOC and high oxygen indices, indicate that the samples contain kerogen type IV, or possibly some III/IV, with a very poor potential as a source rock for gas.

Skagerrak Formation (3380 - 3520 m)

The various coloured shale samples from this formation have low petroleum potentials, 0.1 to 1.9 mg HC/g rock. This, together with very low hydrogen indices, 0 - 93 with an average of 32 mg HC/g TOC, shows that these samples contain kerogen type IV with very low, or no, potential as a source rock for hydrocarbons.

A few samples around 3520 m have slightly higher hydrogen indices, 104 - 157, with an average of 130 mg HC/g TOC and slightly higher petroleum potential, 0.9 - 1.9, average 1.4 mg HC/g rock. This gives this thin interval a poor potential as a source rock for gas.

Zechstein (3520 - 3554 m)

Most of this formation is anhydrite with some interbedded shale. Most of the shale has similar Rock-Eval values to those found for the Skagerrak Fm., i.e. kerogen type IV with no source rock potential. A few samples towards the bottom of the well contain a medium dark grey shale with hydrogen indices between 170 and 181 mg HC/g TOC and petroleum potential of 2.3 mg HC/g rock. This, together with the lower oxygen indices, indicates that these samples contain kerogen type III with a fair potential as a source rock for gas.

2. Generation and Migration

(Production Index $S_1/(S_1+S_2)$ and S_1/TOC)

The only interval which shows any indication of generation of hydrocarbons is the Mandal Fm. The kerogen in this interval is clearly generating hydrocarbons, but the low production indices indicate that the generation is too low for migration of these hydrocarbons to have started.

It is difficult to evaluate most of the other intervals due to the very low quantities of pyrolysis products. Some of the samples clearly contain migrated hydrocarbons. Examples of this is the siltstone in the Rødby Fm. which shows by the high petroleum index (0.44), high S_1/TOC and the low Tmax that migrated hydrocarbons are present. A similar situation is seen for the shale samples between 3218 m and 3230 m in the Valhall Fm.

3. Maturity (Tmax)

The low S_2 values for most of the samples make it difficult to evaluate the maturity based on the Tmax values. Only a few samples have S_2 values large enough to make the Tmax values reliable. The Tmax value of approximately 426 - 428^oC at 3130 m is believed to be correct, increasing to approximately 430 - 433^oC at 3310 m, 435^oC at 3380 m and 437^oC at 3550 m. The reading at 3380 m might be slightly high due to the type of kerogen.

EXTRACTION DATA

Five samples from this well were analysed.

Cromer Knoll Group (3120 - 3295 m)

None of the samples from this group were analysed.

Jurassic (3295 - 3380 m)

Tyne Group (3295 - 3315 m)

Mandal Formation (3295 - 3315 m)

Three samples, all brown-black shales, were analysed from this interval. The three samples show similar extraction results, 10200 - 11000 ppm of EOM and 3150 - 3840 ppm of extractable hydrocarbons. The relatively high percentage of hydrocarbons, 30.9 - 35.0 %, shows that these samples have an oil window maturity. When the extraction data are normalized to organic carbon the three samples show an extractability of 124.1 to 132.9 mg EOM/g TOC and 38.3 to 46.4 mg HC/g TOC, showing that these samples have a rich potential as a source rock for oil.

Zechstein (3520 - 3554 m)

Two medium dark grey shales from the lower part of the Zechstein were analysed. Both samples have a low amount of extract, 680 and 1612 ppm of EOM respectively for the samples from 3548 m and 3551 m. The percentage of hydrocarbon is high (60 %) for the sample from 3548 m, while it is far lower for the sample from 3551 m (35 %), giving the two samples similar values for extractable hydrocarbons (470 and 570 ppm respectively). When normalized to organic carbon the two samples have similar values for EOM as found for the Mandal Fm. samples, 142.7 mg EOM/g TOC and 115.7 mg EOM/g TOC respectively. The amount of extractable hydrocarbons for the sample from 3551 m is similar to the values found for the Mandal Fm. while the sample from 3548 m has a far higher value, 97.0 mg HC/g TOC. The high percentage of hydrocarbons could indicate that these hydrocarbons are migrated.

Saturated Hydrocarbons

Mandal Formation (3295 - 3315 m)

The three analysed samples from this interval have similar gas chromatograms, with a front-biased, relatively smooth n-alkane distribution. The low percentages of heavy n-alkanes show that these are generated from a marine kerogen and the CPI of 1.1 and high pristane/nC_{17} ratio show that the samples have not reached peak oil generation yet, Figure 4a.

Zechstein (3520 - 3554 m)

The two analysed samples from the Zechstein show quite different chromatograms. The sample from 3548 m shows a strong front-biased, smooth n-alkane distribution with hardly any n-alkanes over C_{25}. This type of chromatogram is typical for a condensate, Figure 4b. This, together with the high percentage of hydrocarbons in the extract indicate that these are migrated hydrocarbons. The gas chromatogram of the sample from 3551 m also has a front-biased, smooth n-alkane distribution, but there is a far larger proportion of heavier n-alkanes than in the sample from 3548 m. The pristane/nC_{17} and pristane/phytane ratios are also distinctly different. This chromatogram is typical for well mature hydrocarbons and might represent in-situ generated hydrocarbons.

Aromatic Hydrocarbons

Mandal Formation (3295 - 3315 m)

The gas chromatograms of the three analysed samples from this interval are almost identical, with dimethyl naphthalenes and phenanthrene as the dominant peaks. The chromatograms are typical of moderate mature hydrocarbons generated from marine kerogen, Figure 5. The FPD chromatograms are also almost identical for the three samples with dibenzothiophene as the largest peak. 4 methyl dibenzothiophene is the second largest peak and 1 methyl dibenzothiophene is of almost the same peak height, Figure 6. This is typical for moderate mature samples of marine origin.

Zechstein (3520 - 3554 m)

The FID gas chromatograms of the two samples from the Zechstein shales are rather poor, showing only phenanthrene and methyl phenanthrenes. The lighter components might have been lost during the work up of the samples. It is therefore difficult to conclude anything from these chromatograms. Various maturity parameters do, however, suggest a low maturity in direct opposition to the saturated hydrocarbon data.

In the FPD chromatograms 4 methyl dibenzothiophene is the largest peak. The 1 methyl dibenzothiophene peak is larger than the 3+2 methyl dibenzothiophene peak in both samples. This is normally a sign of a maturity less than peak oil generation. This does not fit at all with the saturated hydrocarbon chromatogram for the sample from 3548 m. It is presently not known why this discrepancy is seen between the two analyses, but one reason might be that the amount of material is low and contamination will therefore have a very strong affect.

THERMAL EXTRACTION - GAS CHROMATOGRAPHY

Thirty-four samples were analysed by thermal extraction gas chromatography.

Cromer Knoll Group (3120 - 3295 m)

Rødby Formation (3120 - 3170 m)

Four samples, three shales and one siltstone, from this interval, were analysed. The three shale samples show only a narrow band of hydrocarbons, C_{12} - C_{17}. These hydrocarbons might be from a mud additive, Figure 7a. The siltstone shows mainly light hydrocarbons together with some C_{10} - C_{18} alkanes and a large unresolved envelope in the heavy end. The latter might represent some residual material or pipe dope.

Valhall Formation (3170 - 3295 m)

Eight samples, seven shales and one carbonate were analysed. Five of the shale samples, 3124 m, 3224 m, 3242 m, 3272 m and 3284 m show a very low abundance of light hydrocarbons and a few n-alkanes in the C_{10} - C_{15} range. These are probably from additives. The two different shale samples from 3218 m show a fair abundance of light hydrocarbons, an unresolved envelope and a few hydrocarbons in the C_{13} - C_{20} range, Figure 7b. These are also probably contaminants. The carbonate from 3272 m shows only a few hydrocarbons in the C_{10} - C_{18} range.

Jurassic (3295 - 3380 m)

Tyne Group (3295 - 3315 m)

Mandal Formation (3295 - 3315 m)

Three shale samples from this interval were analysed. They all show a good abundance of alkanes from C_{11}. The sample from 3308 m records alkanes only up to C_{27}, while the samples from 3308 m and 3314 m show n-alkanes up to nC_{28}, Figure 7c. The hydrocarbons are most probably generated in-situ and indicate that the kerogen is moderate mature/ mature.

Vestland Group (3315 - 3380 m)

Ula Formation (3315 - 3350 m)

Six samples, five shale and one sandstone, were analysed. The brown-black shale samples from 3320 m and 3332 m have a similar pattern to those seen for the Mandal Fm. samples and are most likely caved from this interval. The rest of the shale samples have a similar pattern as found for the Valhall Fm. samples and might be caved from this interval. The sandstone sample from 3350 m show only light material and a few hydrocarbons in the range C_{10} - C_{15}, which do not represent migrated hydrocarbons, Figure 7d.

Bryne Formation (3350 - 3380 m)

Three samples, two shales and one sandstone, were analysed. The sandstone sample shows the same pattern as the sandstone sample from the Ula Fm., whilst the two shale samples show some light hydrocarbons and a narrow band of alkanes, C_{10} - C_{16}, similar to the Cretaceous samples.

Skagerrak Formation (3380 - 3520 m)

Six samples, all shales of different colours, were analysed. They all show some light hydrocarbons and a narrow band of alkanes, C_{10} - C_{17}. These are probably contaminants, Figure 8e.

Zechstein (3520 - 3554 m)

Four samples from this interval were analysed. All of these samples have a similar pattern to those seen for the Cretaceous and Lower Jurassic/Triassic samples. They are all caved material.

PYROLYSIS - GAS CHROMATOGRAPHY

Thirty-four samples were analysed by pyrolysis gas chromatography.

Cromer Knoll Group (3120 - 3295 m)

Rødby Formation (3120 - 3170 m)

Four samples, three shales and one siltstone, from this interval, were analysed. All four samples show a large abundance of aromatic compounds and some alkane/alkene doublets, clearly representing kerogen type III, Figure 8a.

Valhall Formation (3170 - 3295 m)

Eight samples, seven shale and one carbonate, from this interval, were analysed. Five of the shale samples 3194 m, 3224 m, 3242 m, 3272 m and 3284 m only show a few aromatic peaks, typical for kerogen type IV, Figure 8b. The remaining two shale samples and the carbonate show a larger abundance of aromatic compounds, representing kerogen type III or III/IV.

Jurassic (3295 - 3380 m)

Tyne Group (3295 - 3315 m)

Mandal Formation (3295 - 3315 m)

Three shale samples from this interval were analysed. They all show a series of alkane/alkene doublets, together with a good abundance of aromatic compounds. A pattern like this indicates that these samples contain kerogen type II/III, Figure 8c.

Vestland Group (3315 - 3380 m)

Ula Formation (3315 - 3350 m)

Six samples, five shales and one sandstone from this interval, were analysed. The brown-black shale samples from 3320 m and 3332 m show a series of alkane/alkene doublets together with some aromatic compounds. The sample from 3320 m is similar to the samples from the Mandal Fm. and could be caved material. The sample from 3332 m shows a far lower abundance of aromatic compounds. A pattern like this could represent kerogen type II/I. It is therefore possible that this is not caved material, Figure 8d. The other three shale samples and the one sandstone sample show only a few aromatic peaks, typical for kerogen type IV. This shows that the sandstone sample does not contain migrated hydrocarbons.

Bryne Formation (3350 - 3380 m)

Three samples, two shales and one sandstone, were analysed. The sandstone sample shows only some aromatic compounds, implying that this contains kerogen type IV, while the two shale samples show a larger abundance of the aromatic compounds, together with some n-alkanes in the range C_{11} - C_{20}, indicating free hydrocarbons not transferred in the thermal extraction. The kerogens in these samples are probably kerogen type III/IV.

Skagerrak Formation (3380 - 3520 m)

Six samples, all shales, from this interval, were analysed. All show some aromatic compounds together with some n-alkanes in the C_{14} - C_{19} range. The amount of aromatic compounds increases towards the lower part of the interval, Figure 8e. The data indicate that the samples contain kerogen type IV or type III/IV towards the bottom of the interval. The n-alkanes probably represent some contaminant.

Zechstein (3520 - 3554 m)

Four samples from this interval were analysed. The three shale samples mainly show aromatic compounds, implying that they contain kerogen type III. The carbonate sample from 3548 m shows a lower abundance of aromatic compounds. This sample contains probably kerogen type IV or IV/III.

VITRINITE REFLECTANCE ANALYSIS

Reflectance data can be found in Table 6.
A depth/reflectance profile appears in Figure 9.

Twenty-one samples were analysed for vitrinite reflectance, covering the interval 1080 m to 3524 m.

The first thirteen samples are from the Tertiary section of the well. The upper five Tertiary samples (1080 to 1780 m) have shale lithologies, with generally moderate bitumen staining and a low amount of liptinitic wisps. Only a trace of phytoclasts are present but it was possible to obtain reasonable number of measurements for most of the samples. Apart from the rather high result for the sample from 1580 m, which may be due to the inclusion of reworked material into the measurements, a fairly gentle increase in reflectance is seen over this interval, with values rising from approximately 0.35 % at 1100 m to approximately 0.40 % at 1900 m. Yellow-orange spores are present in every sample. Samples between 1980 m and 2380 m again have shale lithologies but contain a generally high amount of bitumen staining and a low amount of phytoclasts with a good proportion of vitrinite. Very confident values were obtained from high numbers of individual readings for these samples and the maturity rises from approximately 0.40 % at 1900 m to approximately 0.50 % at 2400 m. Spore fluorescence colour remains yellow-orange to a depth of 2280 m, where it changes to light orange, thus agreeing well with the measured reflectance.

The following two Tertiary samples (2480 m and 2580 m) have moderate to strong bitumen staining but are poor in phytoclasts and contain very little vitrinite. A value of 0.58 % Ro (6 readings) was obtained for the upper sample and a value of 0.56 % Ro (3 readings) for the lower sample, in each case from readings with a poor distribution. Light orange spores are present in both samples suggesting a maturity equivalent to approximately 0.5 % Ro. The lowermost Tertiary sample (2680 m) has a glauconitic claystone lithology and is rich in liptinitic wisps. A low amount of phytoclasts are present but there is a high proportion of vitrinite to inertinite. The histogram for this sample shows a strongly bimodal distribution indicating the measurement of some reworked vitrinite. The lower reflecting population has a reflectance of 0.52 % (13 measurements) and represents primary vitrinite. The value is a little depressed considering the preceding gradient and this is probably due to the high amounts of liptinites present.

Four samples were analysed from the Cretaceous section of the well. The upper two samples (2880 m and 3080 m) both have chalk lithologies with a trace of shale which is possibly caved. No vitrinite occurs in the chalk, however, so measurements were restricted to the shale. A value of 0.59 % was obtained from 7 readings with a good distribution, from the upper sample and a value of 0.65 % obtained from 4 readings on the lower sample. Although the origin of the shale is dubious, these values agree very well with the reflectance gradient above and below suggesting that the vitrinite measured is, in fact, in-situ. The following Cretaceous sample (3200 m) contains a mixture of shale lithologies and is partly oxidized. Only three vitrinites were located. Two have high reflectances giving an average value of 0.75 % Ro while the other is obviously caved, having a reflectance of 0.51 %. The high value probably represents in-situ phytoclasts but is higher than expected at this depth and may have been elevated by the oxidized state of the sample. Light orange to moderate orange spores are present in this sample suggesting a maturity in the area of 0.5 % to 0.6 % Ro. The lowermost Cretaceous sample (3278 m) has a shale lithology with light staining and a low amount of liptinitic wisps. Only a trace of phytoclasts are present and there is very little vitrinite. A reflectance value of 0.68 % was obtained from

6 measurements.

Two samples were analysed from the Jurassic section of the well. The upper sample (3340 m) is from the Ula Fm. and contains shale and calcareous shale. Bitumen staining is light and liptinitic wisps are present in low amounts. There is a low amount of phytoclasts, of which only a minor proportion are vitrinites. A reflectance value of 0.60 % was obtained from 10 readings and agrees well with the observed moderate orange spore fluorescence colour.

The value is, however, rather low considering values above and below and may include some low-reflecting vitrinite as seen at this stratigraphic level in many other wells in the area. The second Jurassic sample (3374 m) has a mixed shale and sandstone lithology. Staining and liptinitic wisps are low in the shale and the phytoclast content is also low. Only five vitrinites were located, giving an average reflectance of 0.78 % from a good distribution of values. No spores were observed in the sample.

One sample (3452 m) was analysed from the Triassic section of the well. The sample has a shale lithology and is organic lean. A reflectance value of 0.76 % was obtained from 3 readings which have a poor distribution, however, this value confirms the level of reflectance of the previous sample which is only 70 m above. Yellow-orange spores are present in this sample indicating the presence of caved material.

The lowermost sample analysed (3524 m) is Permian. This shale lithology is low in organic matter and contains only a trace of vitrinite. A reflectance value of 0.57 % was obtained from 3 readings with a poor distribution. This low value and the presence of yellow-orange and light orange spores indicates caving.

To summarize, reflectance values for the Tertiary section of the well are generally very good and indicate a clear gradient rising from 0.35 % at 1000 m to just under 0.55 % at 2600 m. Cretaceous values are based on low numbers of individual readings taken on non-representative lithologies but rise steadily with depth, describing a gradient which increases from 0.55 % at approximately 2650 m to a little over 0.70 % at approximately 3300 m. This is not including the value at 3200 m (0.75 %), which was obtained from only two measurements on a semi-oxidized lithology. The two Jurassic values show poor agreement and this is possibly due to low-reflecting vitrinite in the Ula Fm. sample. The Bryne Fm. sample, although poor in vitrinite, appears to give a more realistic result for this depth. The same is true of the Triassic sample, while the Permian value appears to represent caved material. The reflectance data for the lower part of the well does, therefore, require a certain degree of interpretation, but appears to indicate a rise in reflectance from just over 0.7 % at 3300 m, to approximately 0.8 % at 3500 m.

With such a reflectance profile moderate maturity will be reached by about 1900 m and maturity will be reached at about 2900 m. At TD (3554 m) the maturity should be just over 0.8 %.

VISUAL KEROGEN COMPOSITION

Eighteen samples from this well were examined in transmitted light. The samples range from 3125 m (Rødby Fm.) to 3551 m (Zechstein). Apart from one siltstone at the base of the Rødby Fm. all of the samples are shale/claystone, various coloured in the Cretaceous, mainly brown-black in the Jurassic and medium dark grey in the Zechstein. The data are plotted in Figure 10.

Four samples from the Rødby Fm. were analysed. These samples are all dominated by vitrinite (70 or 75% in the claystones, 50 % in the siltstone). The vitrinite is dominantly vitrodetrinite throughout but also includes amorphous material. In the siltstone inertinite is secondary in abundance (40 %) and includes inertodetrinite, semi-fusinite and fusinite, whilst the liptinite content is only 10 % but includes liptodetrinite, spore/pollen material and dinoflagellates. In the claystone samples liptinite is secondary (15 or 20 %, both detrital and spore/pollen material) whilst the inertinite is 10 % throughout. The siltstone has an "oily" smear and has "oil" drops which suggests the presence of a contaminant. The maturity of this sequence is difficult to assess due to a mixture of material. A spore colour index of 4 is considered most acceptable and this suggests a moderate mature section.

Two samples from the Valhall Fm. were examined. These are from the same depth (3218 m) but appeared to be slightly different claystones. The kerogen compositions are virtually identical. Both samples are dominated by vitrinite (70 %) with secondary inertinite (20 %) and minor liptinite (10 %). Both samples appear to be affected by the same contamination as the siltstone from the Rødby Fm.

Three samples from the Mandal Fm. were examined. There is a drastic improvement in the kerogen quality in these samples.

They are all very liptinite rich and fluoresce strongly. The approximate composition for all of the samples is 70 % liptinite, 30 % vitrinite and a trace of inertinite. The liptinite content is very diverse and includes amorphous, detrital and spore/pollen material but also significant algal material. A spore colour index of 5 is estimated for this sequence (implying moderate maturity).

Four samples from the Ula Fm. were examined. These lithologies are similar to the Mandal Fm. lithologies and the samples are considers to be caved. Although dominated by liptinites, samples in this section do not appear to be as rich as those from the Mandal Fm. It is probable that some dilution has occurred.

Two samples from the Skagerrak Fm. were examined. These were both from the same depth (3518 m) but were slightly different claystones. Both samples are dominated by vitrinite (60 and 70 %) and in the light olive-grey claystones inertinite comprises 30 % and liptinite 10 %, whilst in the medium dark grey claystone there is approximately 15 % of each.

Three samples from the Zechstein were analysed. These were all medium dark grey claystones and all are dominated by vitrinite (60 - 70 %) which is both detrital and amorphous. The inertinite content is 15 or 20 % and includes both inertodetrinite and semi-fusinite. The liptinite content is 15 or 25 % and includes liptodetrinite and spore/pollen material throughout with some amorphous and some algal material observed. The liptinite material is concentrated in aggregates - this may signify that some material is caved.

GAS CHROMATOGRAPHY - MASS SPECTROMETRY

Three samples from this well were analysed by GC - MS. These were one from the Mandal Fm. and two from Zechstein.

Saturated Hydrocarbons

Terpanes

The three samples show distinct differences in the M/Z 163 fragmentograms. The Mandal Fm. sample from 3388 m shows a number of peaks in the sterane range, together with the αβ C_{29} hopane and C_{18} trisnorhopane. The sample from 3540 m shows no steranes, only C_{27} rearranged steranes, while the 17 α trisnorhopane, 18 α trisnorneohopane, αβ C_{29} hopane and αβ C_{30} hopane are abundant. The sample from 3551 m shows also the C_{27} rearranged steranes together with a minor abundance of the other rearranged steranes and some triterpanes. Of these, the αβ hopane is particularly abundant. The M/Z 177 fragmentograms also show strong differences for the three samples. The sample from 3308 m in the Mandal Fm. shows a number of minor peaks in the steranes range together with a good abundance of the αβ C_{29} hopane and a smaller amount of the βα C_{29} moretane. The sample from 3548 m shows five peaks. The two C_{29} compounds, αβ C_{29} hopane and βα C_{29} moretane are the major peaks, with the two C_{27} hopanes and αβ C_{30} hopane as minor peaks. The sample from 3551 m shows the rearranged steranes together with the two C_{29} terpanes and αβ C_{30} hopane. The M/Z 191 fragmentograms also show large differences between the three samples. In the sample from 3308 m the pentacyclic terpanes are the major components as compared with the tricyclic terpanes. Of these, the C_{23} compound is the most abundant.

The pentacyclic terpanes show a strange pattern. αβ C_{29}

hopane and αβ C_{30} hopane have approximately the same abundance as the most abundant peaks. The C_{31} to C_{35}, 22 R and S αβ hopanes are abundant, and the C_{34} 22S αβ hopane is more abundant than the C_{34} 22R αβ hopane while the others, i.e. the C_{31}, C_{32}, C_{33} and C_{35} αβ hopanes show the normal pattern, with the 22R isomer larger than the 22S isomers. Bisnorhopane is also quite abundant in this sample.

The tricyclic components have a larger relative abundance in the sample from 3540 m than in the sample from 3308 m. The pentacyclic triterpanes show that the C_{29} and C_{30} αβ hopanes are the most abundant peaks with the 17 αβ trisnorhopane showing a slightly lower abundance. In this sample the moretanes, C_{29}, C_{30} and C_{31} are very abundant compared to what is normally found in North Sea samples. The C_{31} - C_{35} isomers show a far lower relative abundance than what was found for the Mandal Fm. samples.

The sample from 3551 m is different again. The tricyclic components are minor as compared to αβ C_{30} hopane which is by far the most abundant compound. C_{29} αβ hopane has only 30 % of the peak height of the αβ C_{30} hopane. This is only slightly higher than the αβ trisnorhopane and the C_{31} αβ hopanes. In this sample the C_{35} 22S αβ hopane is larger than the 22R isomer.

The M/Z 205 fragmentograms also show some differences between the three samples. The main difference is in the relative abundance of the C_{31} βα moretane, as compared with the C_{31} αβ hopane. In the sample from 3308 m the 22R hopane and the moretane are of approximately the same peak height, while in the two other samples the moretane is far more abundant than the hopane components.

The fragmentograms of the molecular ions verify what has been discussed above, i.e. the three samples are very different, clearly showing that the hydrocarbons have been generated from different types of kerogen.

Steranes

The M/Z 149 fragmentograms are different for the three samples. The sample from 3308 m shows the rearranged steranes and regular steranes in approximately equal abundance, while the sample from 3540 m shows only one peak, with retention time approximately 25 minutes. This peak is also the largest peak in the sample from 3551 m but here the rearranged steranes and regular steranes can be distinguished. Similar variations are seen for the three samples in the M/Z 189 fragmentograms. The C_{27} rearranged steranes are the most abundant in all three samples, but this is particularly noticeable for the samples from 3548 m and 3551 m. These two samples are fairly similar. A similar pattern is also seen for the M/Z 259 fragmentograms. The C_{27} rearranged steranes are very abundant in the sample from 3548 m. The other steranes are slightly more abundant for the sample from 3551 m while the sample from 3308 m shows a "normal" sterane pattern.

The M/Z 217 fragmentograms also show large differences between the three samples. The sample from 3308 m shows approximately equal abundance of rearranged steranes and regular steranes, with the C_{27} components as the most abundant. The other two samples show the C_{27} rearranged steranes as the most abundant components. The rest of the rearranged steranes and regular steranes are only minor components in both samples from 3548 m and 3551 m.

The M/Z 218 fragmentograms also show a large variation between the three samples. All of the three samples have a peak with retention time at approximately 18 minutes as the major peak. This is especially the situation for the sample from 3548 m where the rearranged and regular steranes can hardly be recognized. The other two samples show that the $\beta\beta$ regular steranes are more abundant than the $\beta\beta$ rearranged steranes.

The molecular ion fragmentograms confirm that the rearranged steranes are dominant and that there is a strong variation between the three samples.

Aromatic Hydrocarbons

Alkyl Benzenes

C_2-substituted benzenes in the M/Z 106 fragmentograms and C_4-substituted benzenes in the M/Z 134 fragmentograms, show differences between the three samples. This difference is both in the relative abundance of the lighter molecular weight compounds, but also in the relative abundance in the peaks in the doublets, which is reversed in the sample from 3308 m for the C_2-substituted benzenes. The sample from 3551 m shows intermediate values. It is also noted that the samples from 3308 m and a large peak with a retention time of approximately 42 minutes. The C_4-substituted benzenes show that the samples from 3548 m and 3551 m have similar patterns, i.e. the typical series of seven peaks, while in the sample from 3308 m these peaks almost disappear in the background.

Naphthalenes

The M/Z 142, 156 and 170 fragmentograms show that the samples from 3548 m and 3551 m have been evaporated so hard that most of the naphthalenes are lost. The sample from 3308 m shows the normal pattern for the C_1, C_2 and C_3 naphthalenes.

Phenanthrenes

The M/Z 178, 192, 206 and 220 fragmentograms for phenanthrene, methyl phenanthrenes, C_2 phenanthrenes and C_3 phenanthrenes show only small differences for the three samples. The M/Z 178 fragmentograms show only the single peak for phenanthrene in all the three samples while the M/Z 192 fragmentograms show the 1+9 methyl phenanthrene doublet to be slightly more abundant than the 3+2 methyl phenanthrene doublet. This is more pronounced in the sample from 3308 m than in the other two samples. The M/Z 206 fragmentograms show only minor differences for the three samples, while the M/Z 220 fragmentograms show differences, especially in the relative height of the peak with a retention time of 35.4 minutes. This is the largest in the sample from 3308 m, has equal abundance with the other major peak in the sample from 3551 m and is far smaller in the sample from 3548 m.

Dibenzothiophenes

The M/Z 198 and 212 fragmentograms also show differences between the three samples. The sample from 3308 m shows that the 4 methyl dibenzothiophene is most abundant, with 1 methyl dibenzothiophene only slightly smaller in the M/Z 192 fragmentogram, typical for immature samples, whilst in the sample from 3548 m the 1 methyl dibenzothiophene is the smallest peak, typical for well mature samples. The sample from 3551 m shows a pattern in between these two. This picture, i.e. the 3308 m and 3548 m as showing most variation and 3551 m intermediate, is also seen for the M/Z 212 fragmentograms for the C_2 dibenzothiophenes.

Aromatic Steranes

In the M/Z 231 fragmentogram for the triaromatic steranes, the main difference between the samples is in the relative abundance of the C_{20} and C_{21} components compared to the C_{27} - C_{28} components. These lower molecular weight components are most abundant in the sample from 3548 m and least abundant in the sample from 3308 m. The relative abundance of each of the C_{27} - C_{28} components is very similar for the three samples. The variation seen for the triaromatic compounds is most likely due to maturity variation, with the sample from 3308 m the least mature and the sample from 3548 m the most mature.

The M/Z 253 fragmentograms for the monoaromatic steranes show a larger degree of differences. Here the samples from 3551 m and 3308 m are fairly similar, while the sample from 3548 shows a completely different picture both in the relative abundance of the C_{27} - C_{29} components and also in that the largest component in this sample is hardly detected in the other samples.

The GC - MS data both for the aromatic and saturated hydrocarbon fractions show that the three samples are different. Some of the differences are due to maturity, but most is due to variation in the organic matter generating the hydrocarbons.

CONCLUSIONS

Based on the various analyses undertaken on samples from this well the following conclusions were made.

1. Source Rock Potential

Cromer Knoll Group (3120 - 3295 m)

Rødby Formation (3120 - 3170 m)

The brown-grey to medium grey calcareous shale from this interval has an average TOC value of 1.3 %, while one siltstone sample has a TOC value of 0.4 %.. The shale has low petroleum potentials, average 1.6 mg HC/g rock, which together with low hydrogen indices (average 95 mg HC/g TOC), shows that this interval consists mainly of kerogen type III or III/IV with a poor potential as a source rock for gas.

Valhall Formation (3170 - 3295 m)

The variable coloured shale from this interval has low TOC values-approximately 0.3 %. The samples have very low hydrogen indices and petroleum potentials indicating that this interval contains kerogen type IV with no potential as a source rock for hydrocarbons.

Tyne Group (3295 - 3315 m)

Mandal Formation (3295 - 3315 m)

This interval consists of a brown-black shale with high TOC values (average 7.2 %), and a very high petroleum potential, (average 35.0 mg HC/g rock). The high hydrogen indices found for these samples (average 432 mg HC/g TOC), indicate that these contain kerogen type II with a rich source rock potential. This agrees with other data. The extraction data show that the samples have a high extractability with a relatively large percentage of hydrocarbons, indicating that the source rock is generating hydrocarbons with a oil window maturity. The various data show that this interval has a rich potential as a source rock for oil and gas.

Vestland Group (3315 - 3380 m)

Ula Formation (3315 - 3350 m)

This is mainly a sandstone interval, with no source rock potential.

Bryne Formation (3350 - 3380 m)

This is also mainly a sandstone interval with some interbedded siltstone and some olive-grey to medium dark grey shale. The shale samples have an average TOC value of 0.7 % with a low petroleum potential, average 0.4 mg HC/g rock. The low hydrogen indices show that the samples contain either kerogen type IV or III/IV, with a very low potential as a source rock for gas.

Skagerrak Formation (3380 - 3520 m)

This interval consists of interbedded sandstone/siltstone/ shale. The shale has variable TOC values, 0.3 - 1.0 %, with a general increase with increasing depth. Rock-Eval data show that the shale samples have low petroleum potential, average 0.3 mg HC/g rock, while the low hydrogen indices indicate that the samples contain kerogen type IV, giving this interval, with exception of a thin interval around 3520 m, no potential as a source rock for hydrocarbons. The thin interval around 3520 m has slightly higher values, giving this a poor potential as a source rock for gas.

Zechstein (3520 - 3554 m)

Mainly an anhydrite interval with a few shale stringers. The shale has TOC values between 0.4 and 1.2 %. The samples between 3545 m and 3554 m have the highest TOC values, average 1.2 %. These samples have a petroleum potential of 2.3 mg HC/g rock and an average hydrogen index of 175 mg HC/g TOC. These data indicate that the samples contain kerogen type III. This is verified by the pyrolysis gas chromatography data. Extraction data show a high percentage of hydrocarbons in the samples which have gas chromatograms indicating a condensate type pattern. This does not fit very well with the low maturity of the samples and might therefore be an additive or migrated hydrocarbons. The available data indicate that these samples have a poor potential as a source rock for gas.

2. Generation and Migration

The only interval which has data which clearly shows that hydrocarbons have been generated is the Mandal Fm., but the generation is too low at the present maturity for hydrocarbons to migrate out of the source rock. Various data from the Cretaceous samples show that these contain diesel. This makes it difficult to evaluate the analytical data.

3. Maturity

Tmax values of 426 - 428°C for the samples from the Mandal Fm. show that this well is moderate mature at this depth, (approximately 3130 m), increasing to peak oil generation at approximately 3550 m. The vitrinite reflectance data indicate a slightly higher maturity, approximately 0.6 % at 3000 m increasing to 0.8 % at 3500 m. Taking into account also the extraction data, the well is found to be mature from approximately 3000 m, having an oil window maturity from approximately 3200 m.

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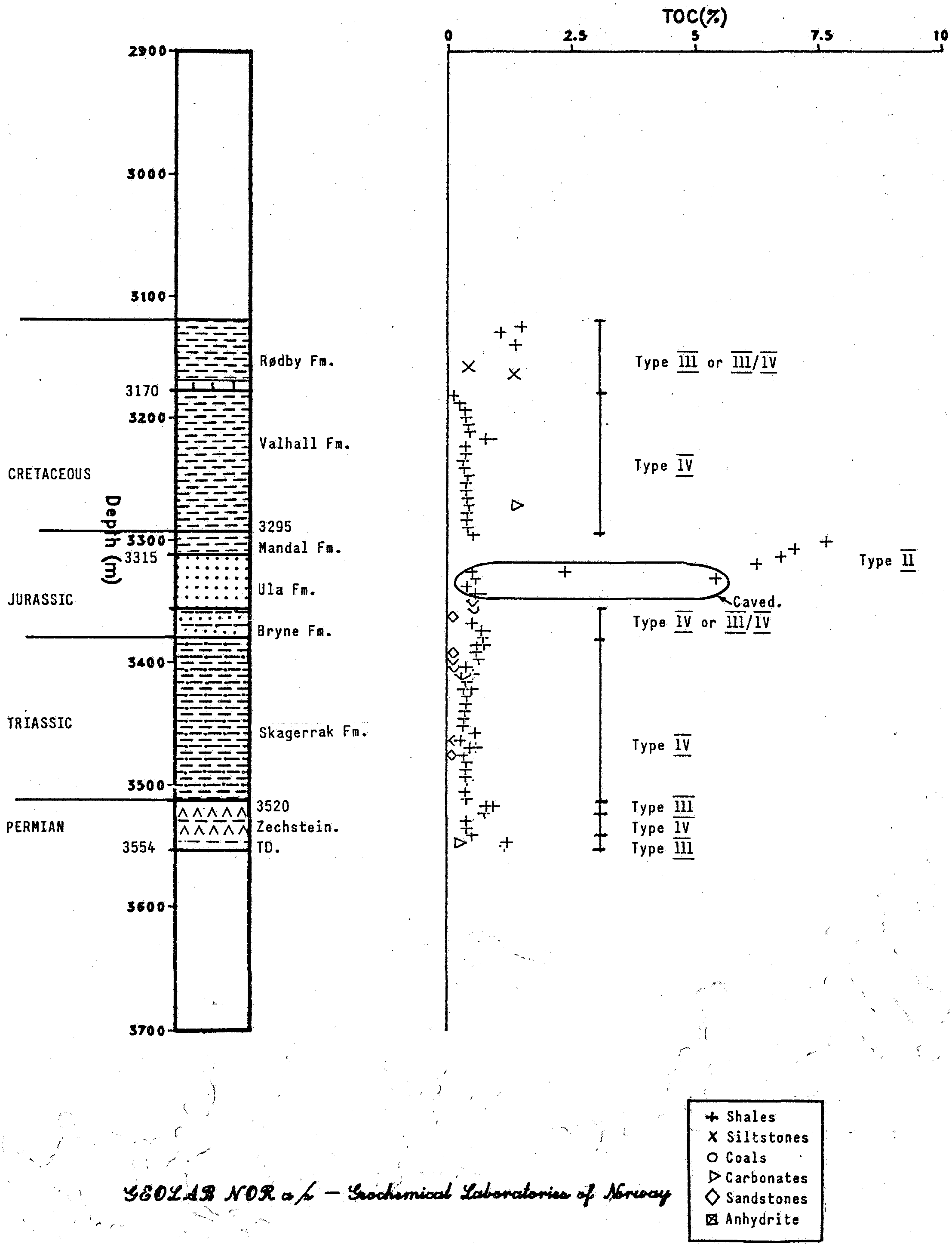
Figure: 1

Client: VARIOUS

TOC Data for Well NOCS 2/1-2



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Client: VARIOUS

Figure: 2

Production Index Data for Well NOCS 2/1-2

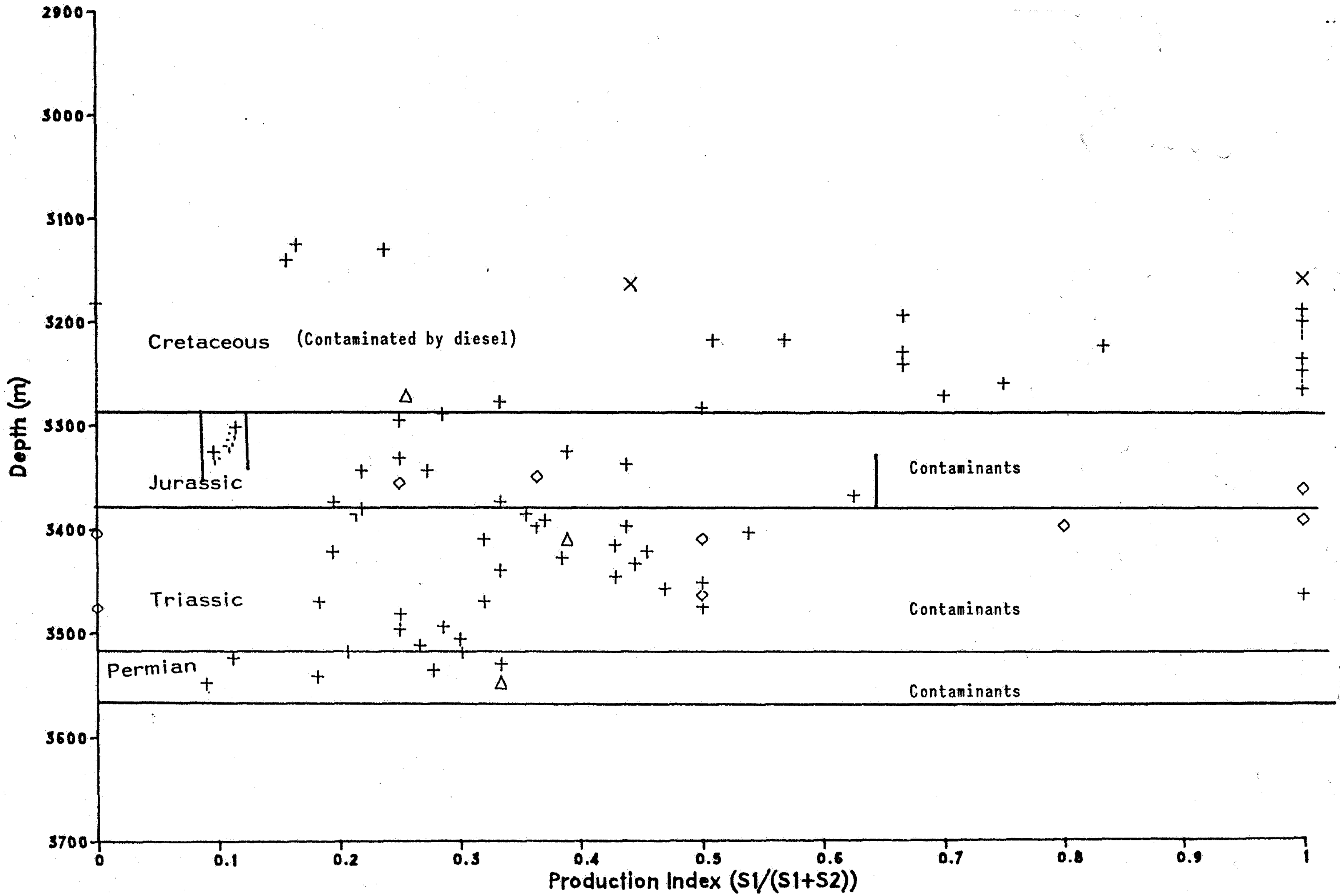

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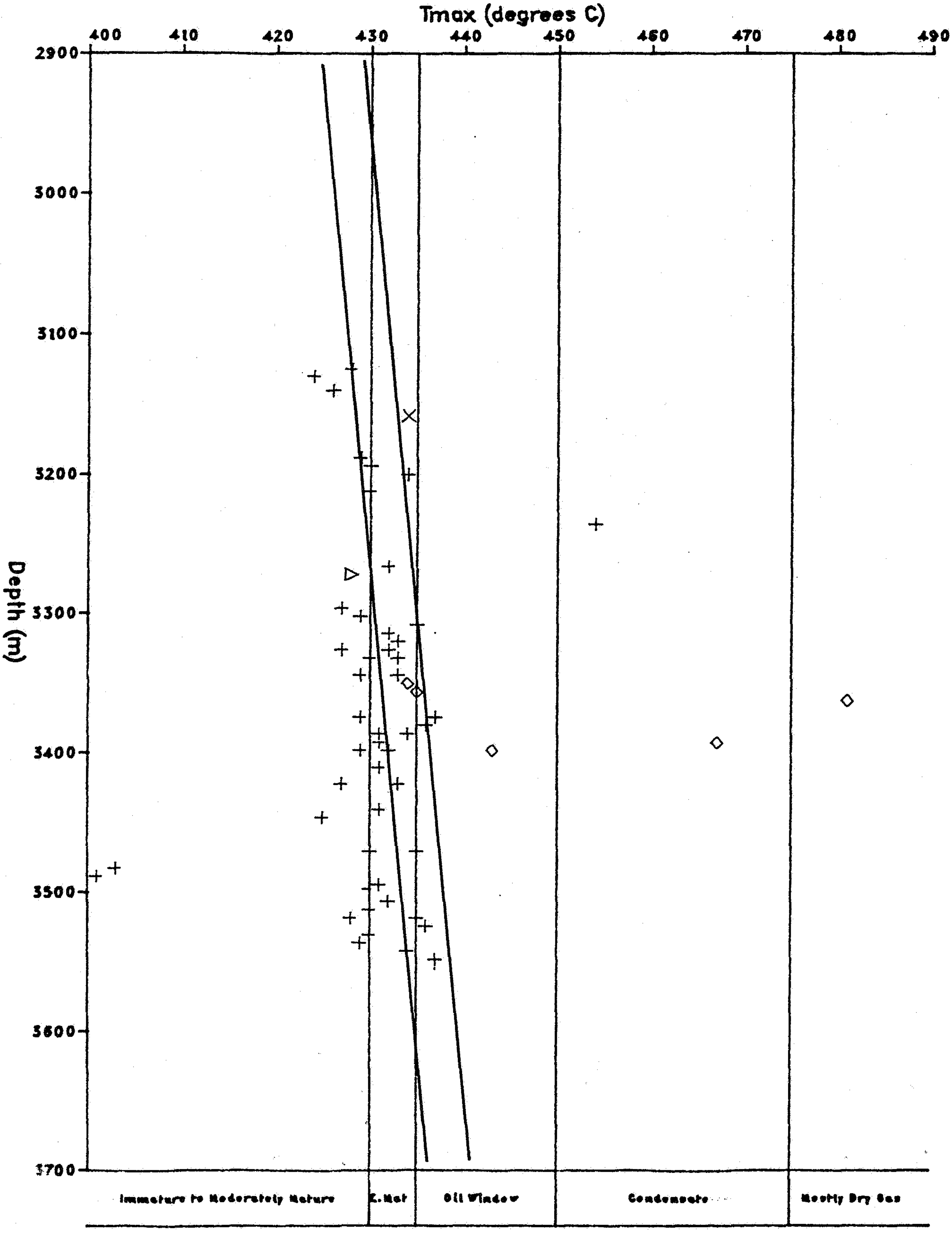
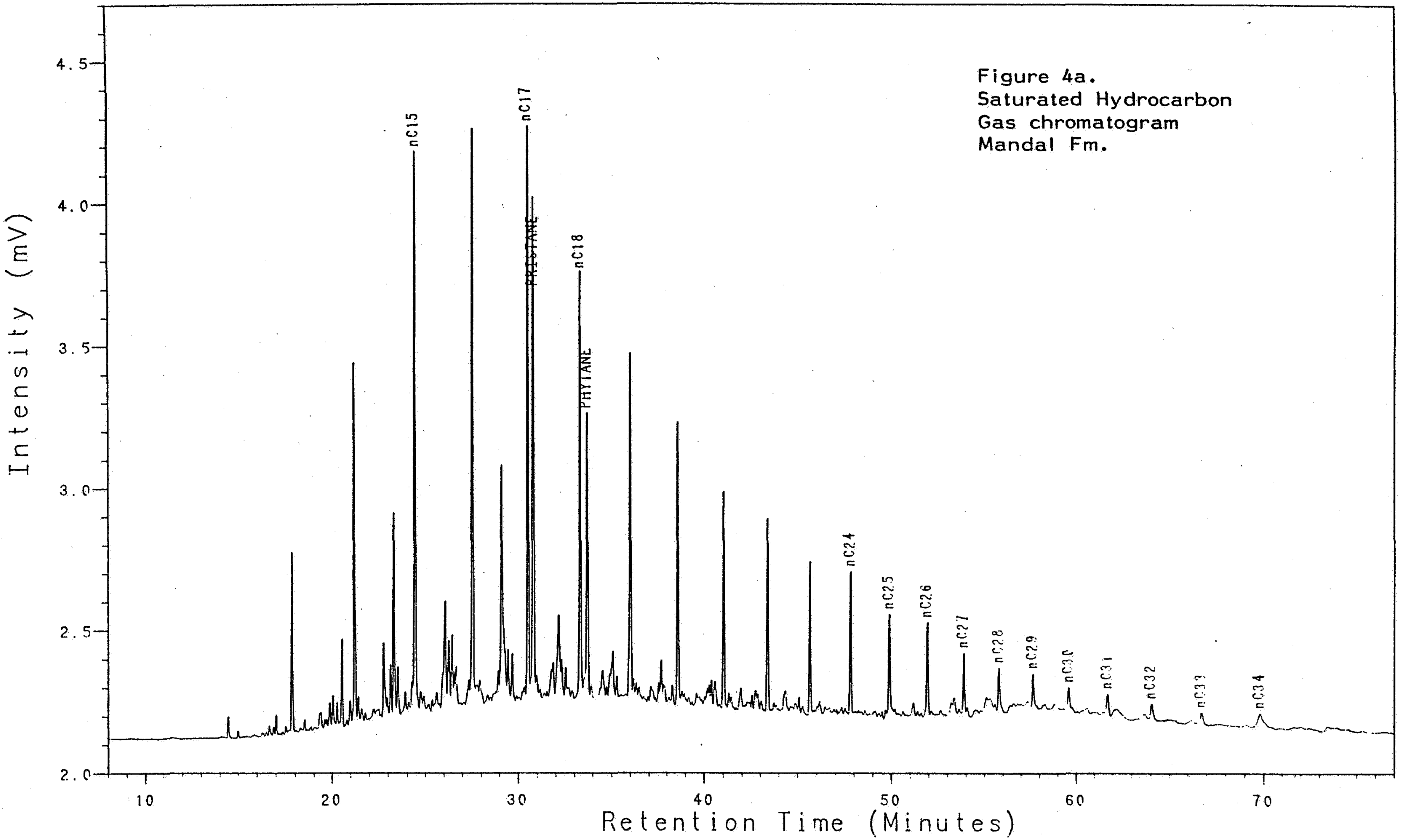
Figure: 3 Client: VARIOUS

Tmax Data for Well NOCS 2/1-2



Analysis SC140672L 5, 1, 1 2/1-2, 3308m, SAT



NOCS 2/1-2 3308m
SATURATED GC
CLST:brn blk

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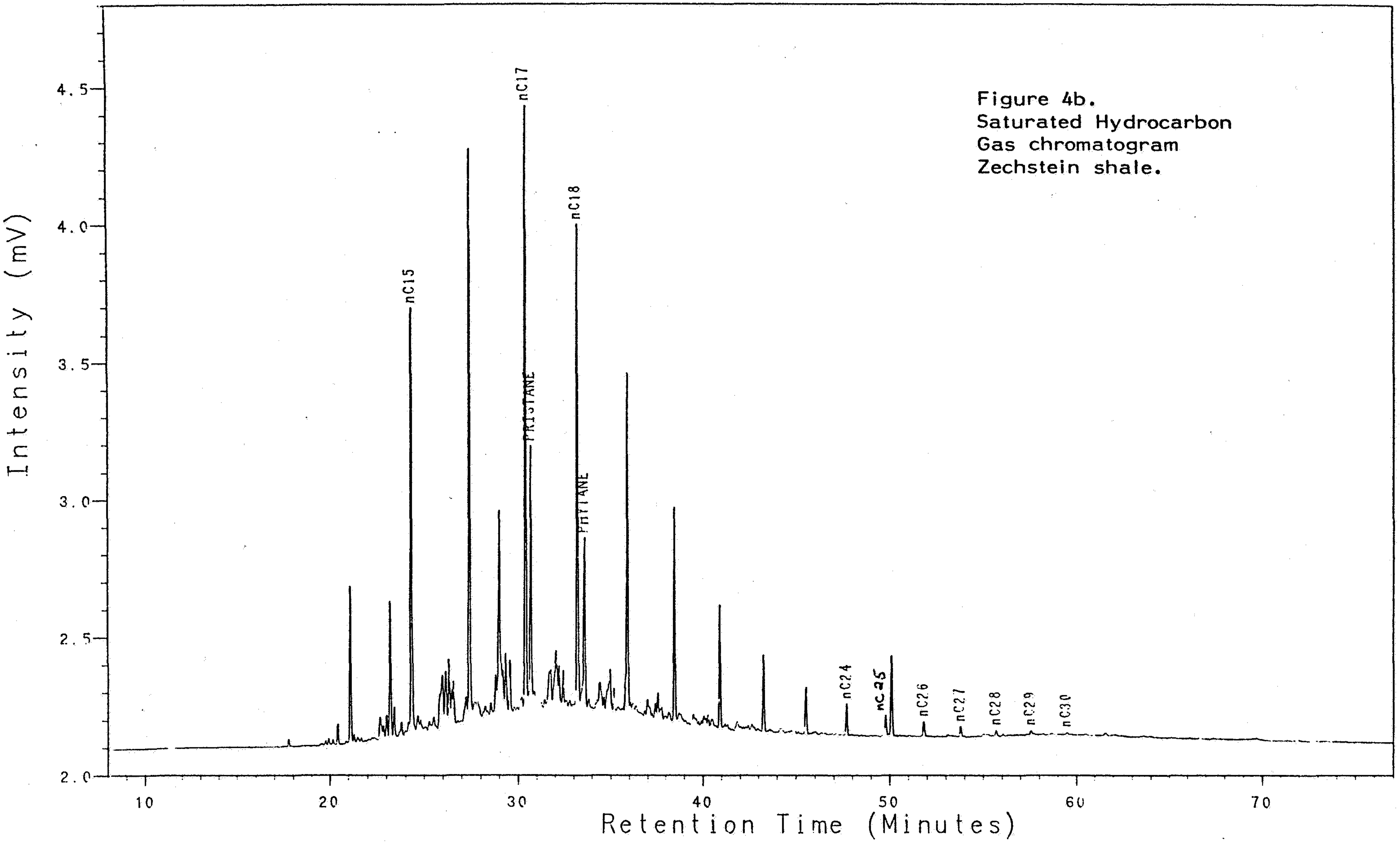
Analysis SC141073L 5, 1, 1 2/1-2, 3548m, SAT



NOCS 2/1-2 3548m
SATURATED GC
CLST:m drk gy

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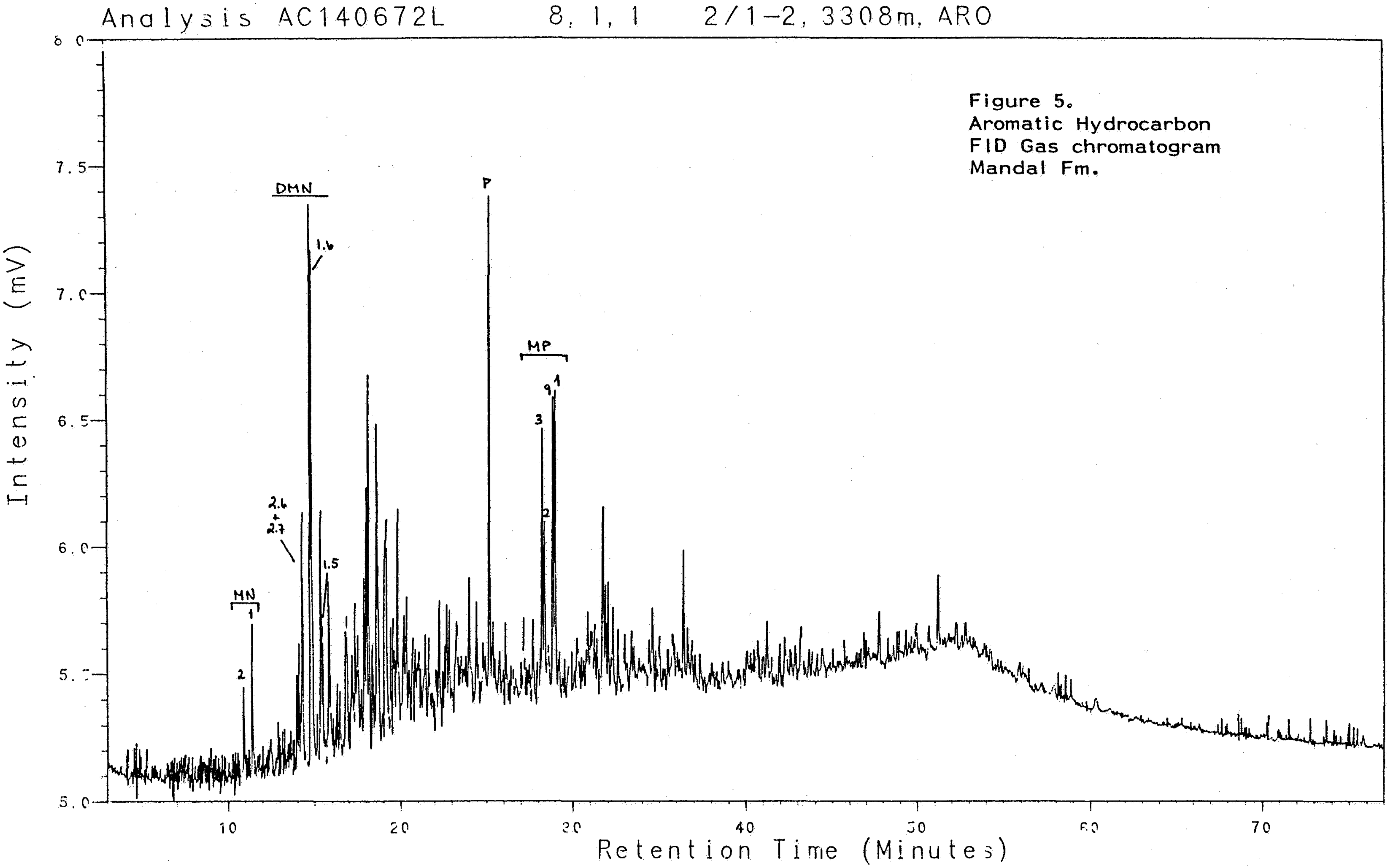

NOCS 2/1-2 3308m
AROMATIC GC (FID)
CLST:brn blk

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Analysis AC140672L 9, 1, 1 2/1-2, 3308m. ARO

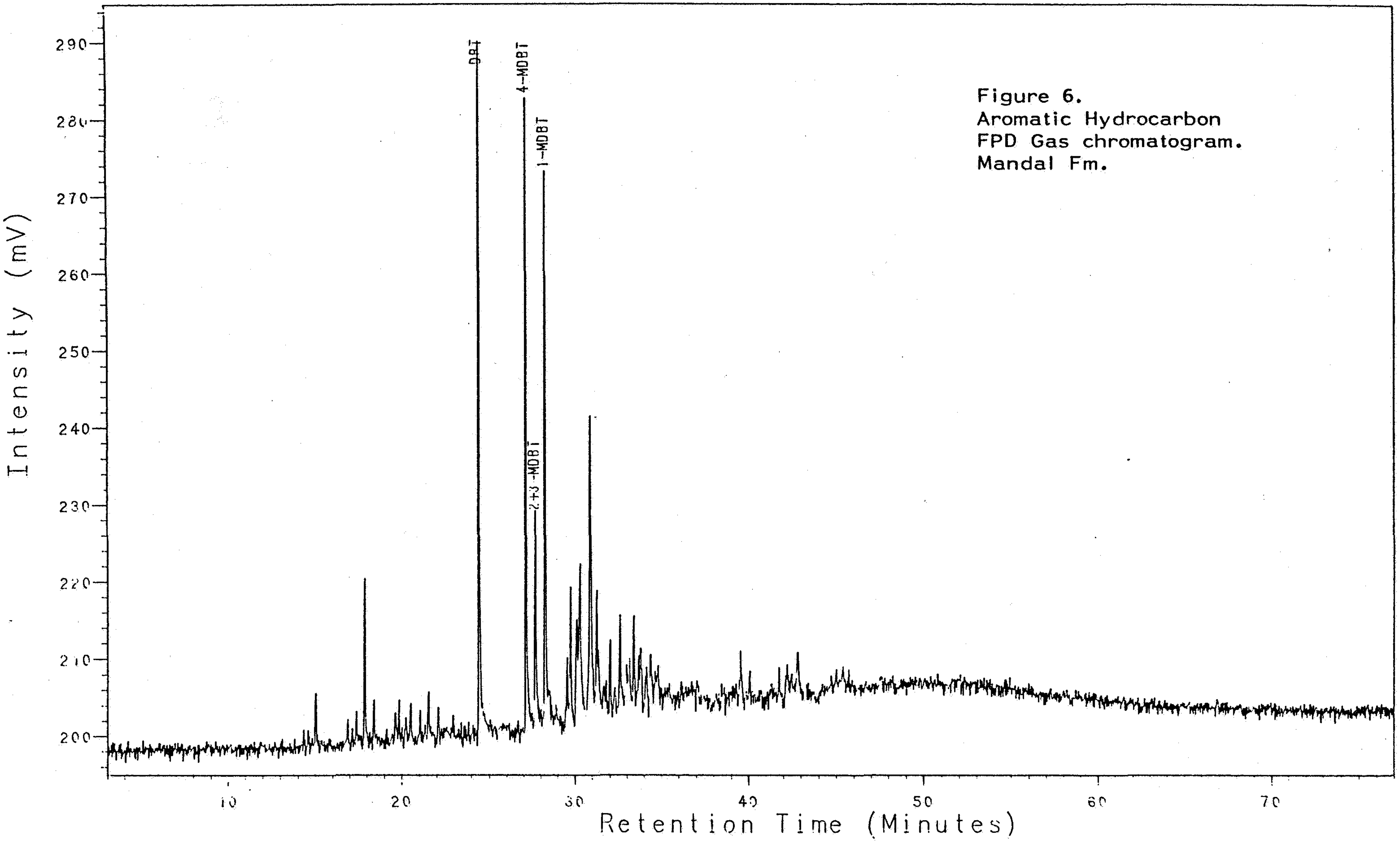

Figure 6.
Aromatic Hydrocarbon
FPD Gas chromatogram.
Mandal Fm.

NOCS 2/1-2 3308m
AROMATIC GC (FPD)
CLST:brn blk

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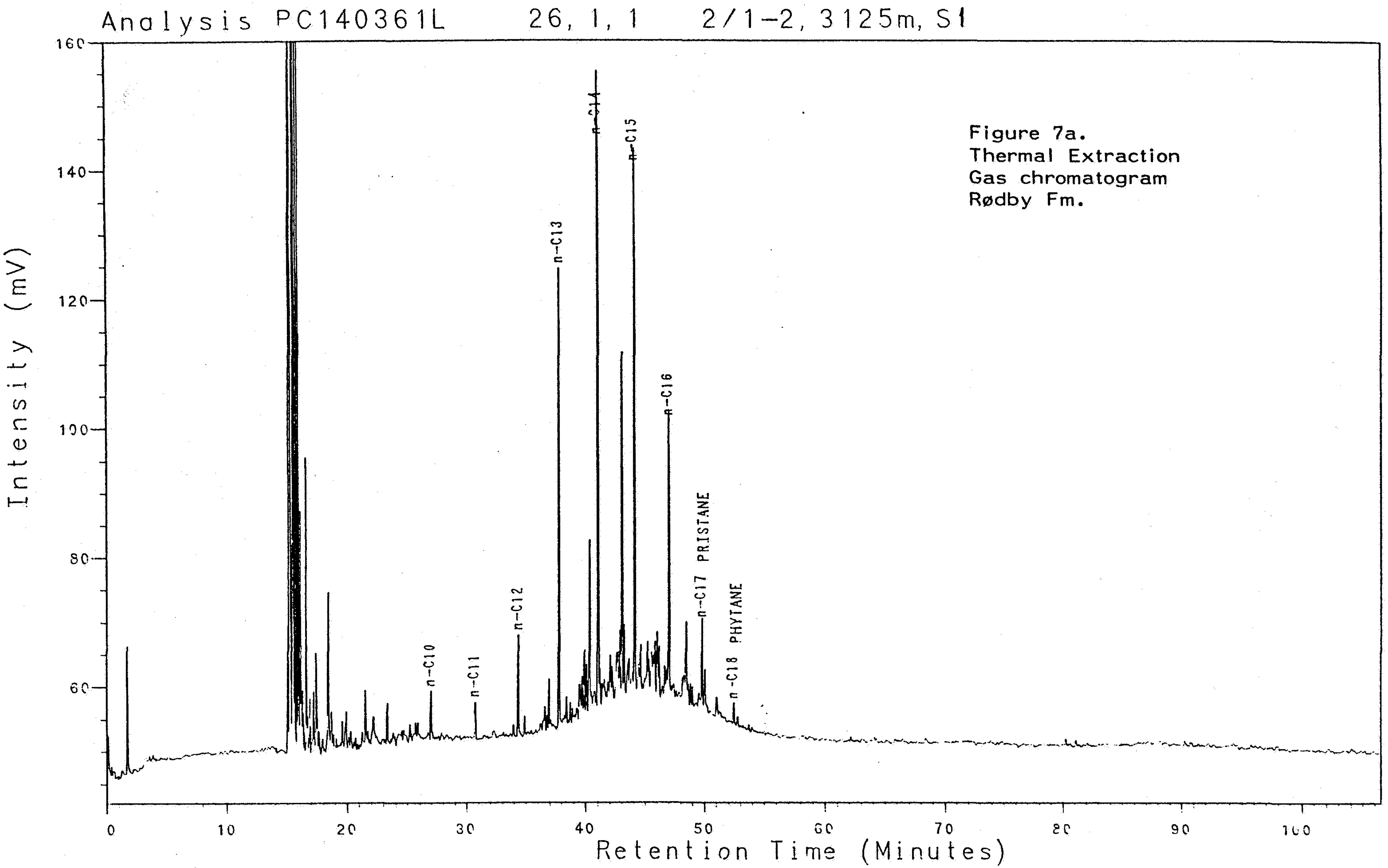

NOCS 2/1-2 3125m
THERMAL EXTRACTION GC (S1)
CLST: brn gy to m gy to ol gy

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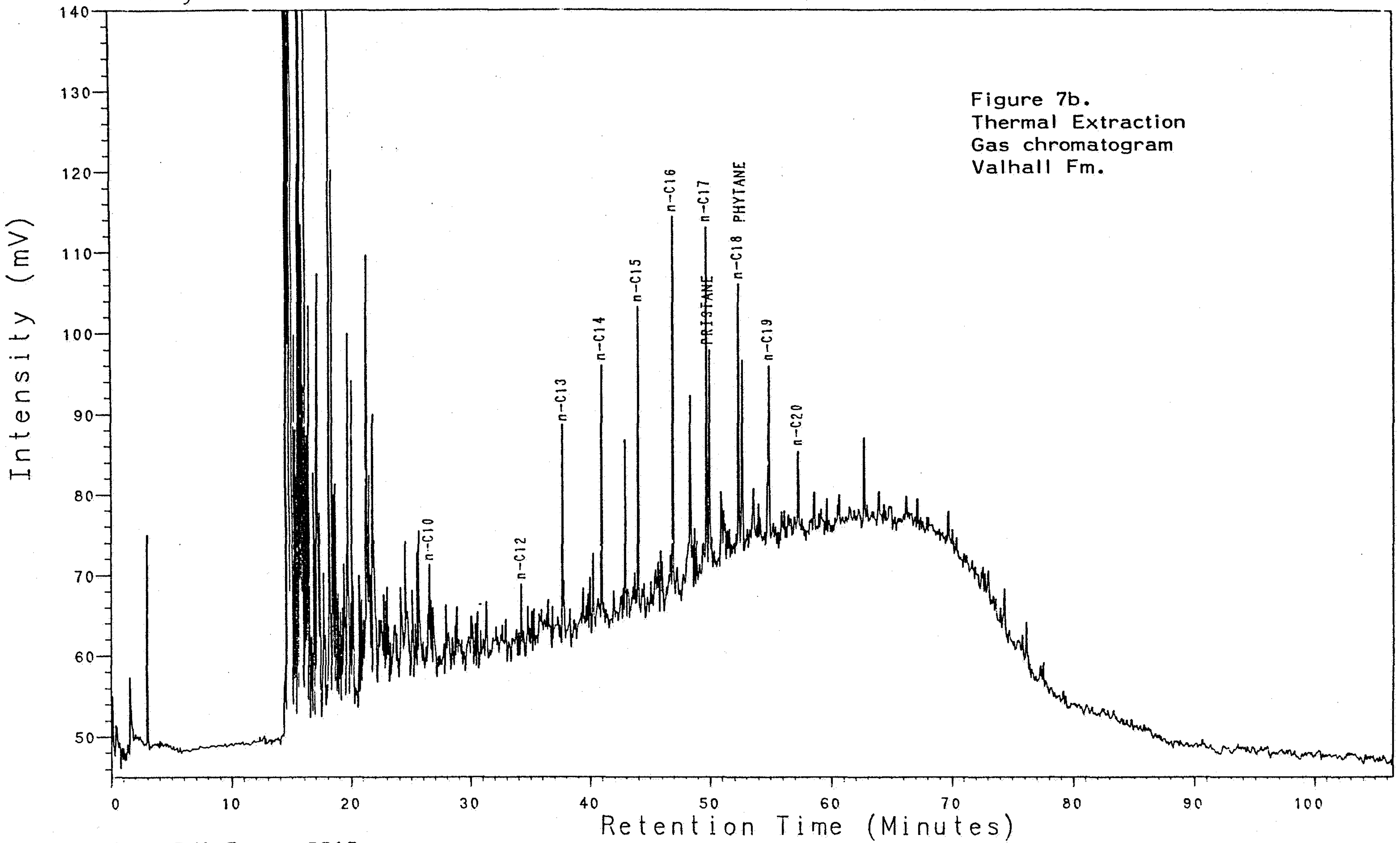
Analysis PC140522L 26, 1, 1 2/1-2, 3218m, S1



NOCS 2/1-2 3218m
THERMAL EXTRACTION GC (S1)
CLST: v col

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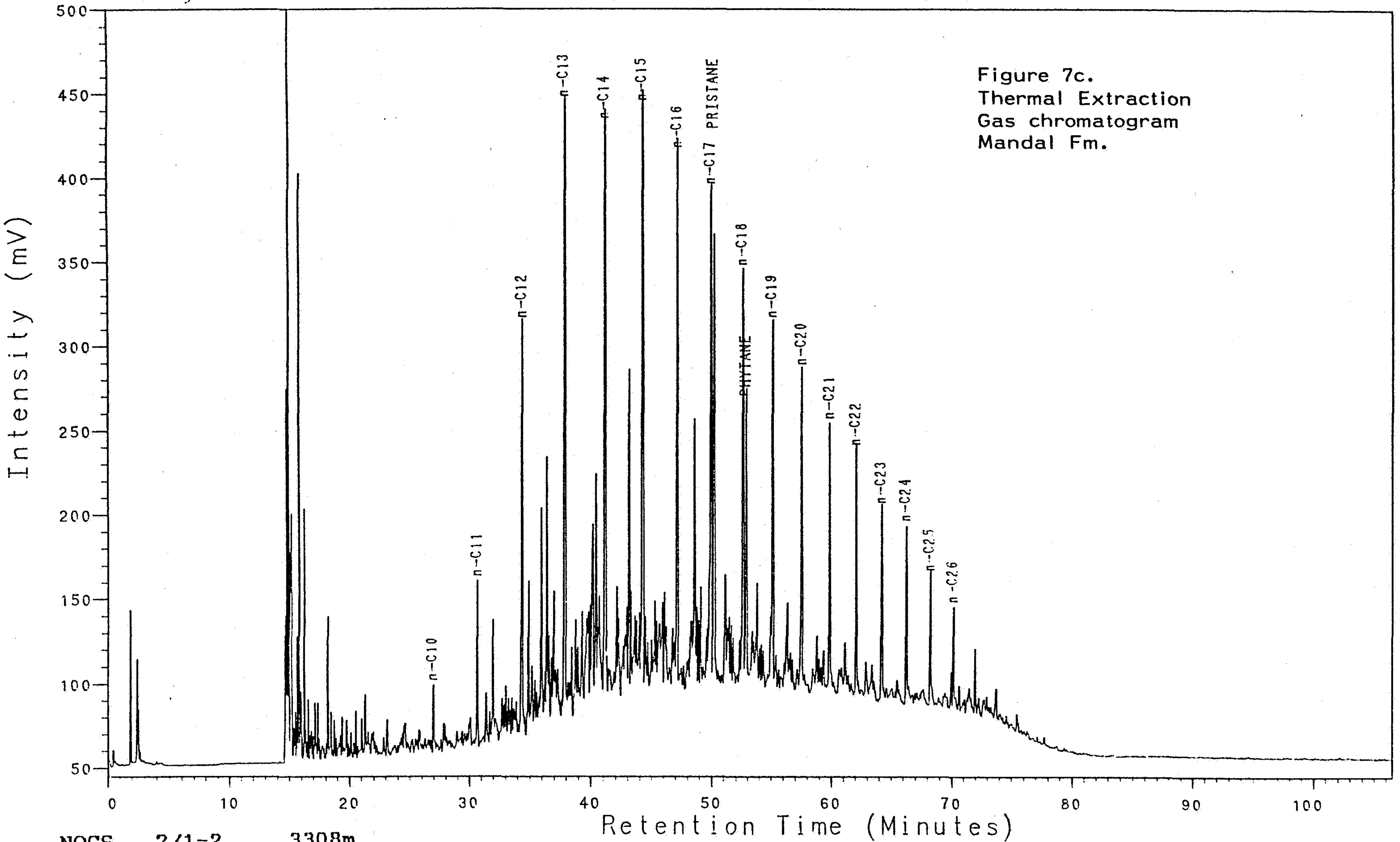
Analysis PC140672L 26, 1, I 2/1-2, 3308m, S1



NOCS 2/1-2 3308m
THERMAL EXTRACTION GC (S1)
CLST: brn blk

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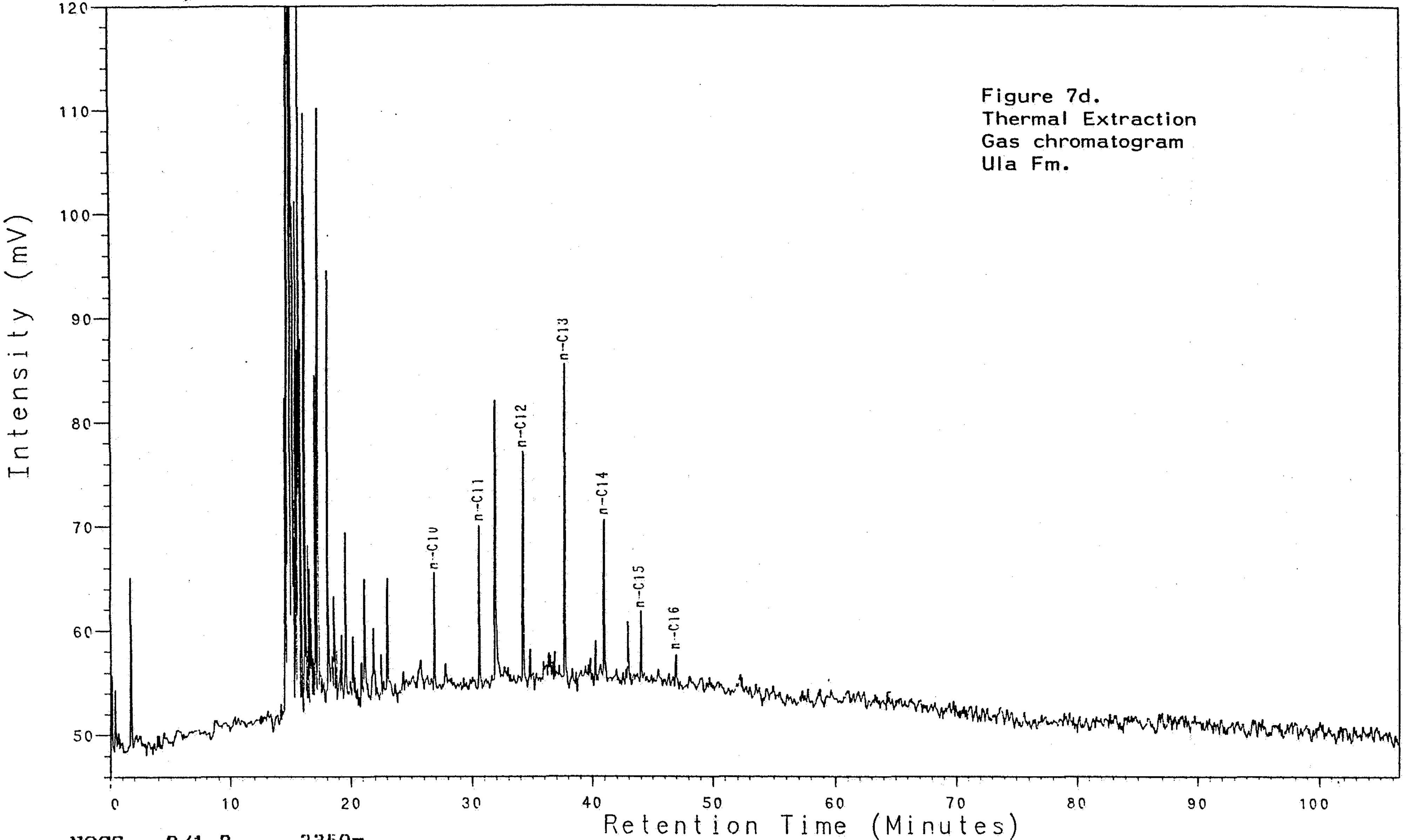
Analysis PC140741L 26, 1, 1 2/1-2, 3350m, S1



NOCS 2/1-2 3350m
THERMAL EXTRACTION GC (S1)
SST: lt gy to drk gy

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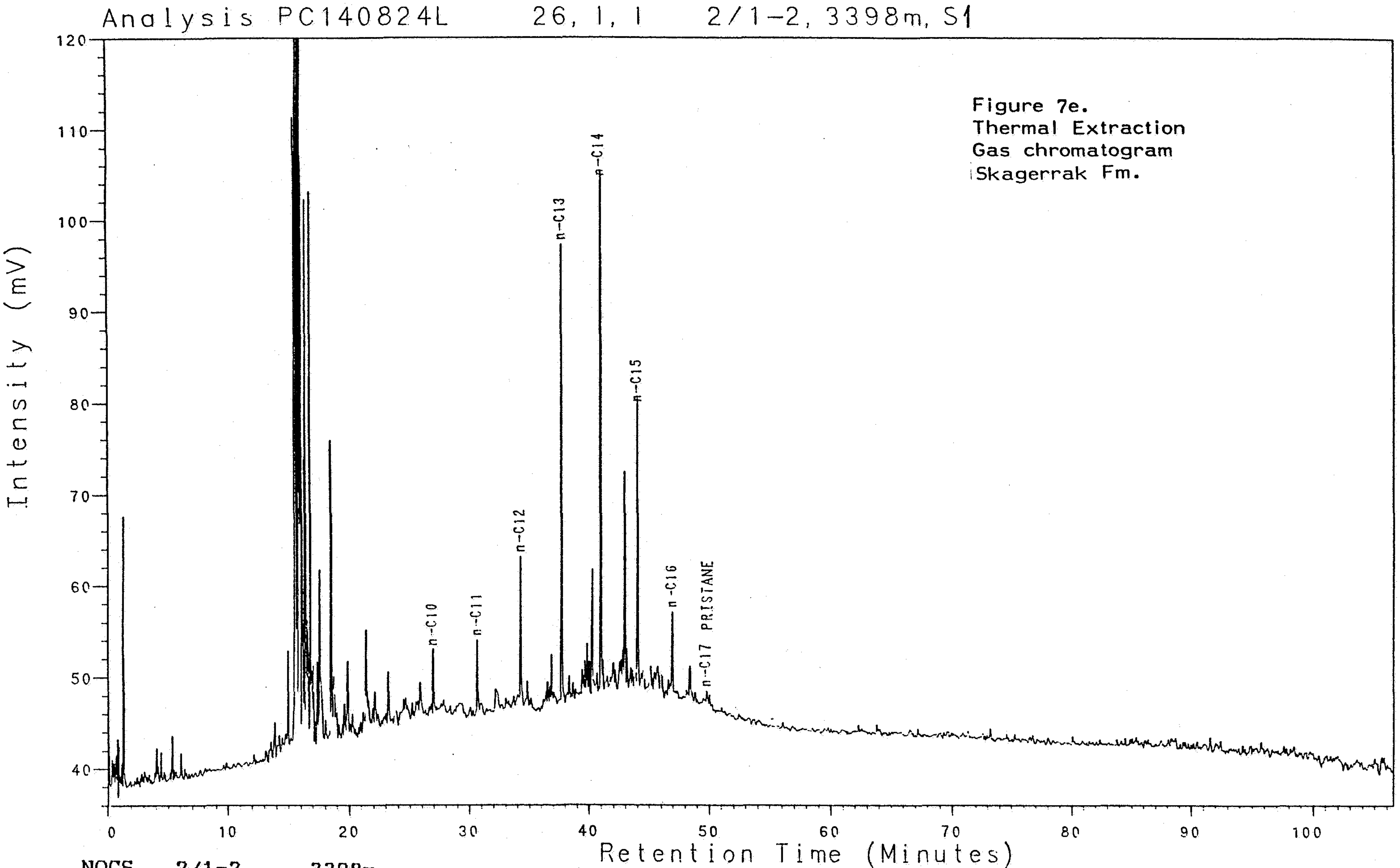

NOCS 2/1-2 3398m
THERMAL EXTRACTION GC (S1)
CLST: ol gy to m drk gy

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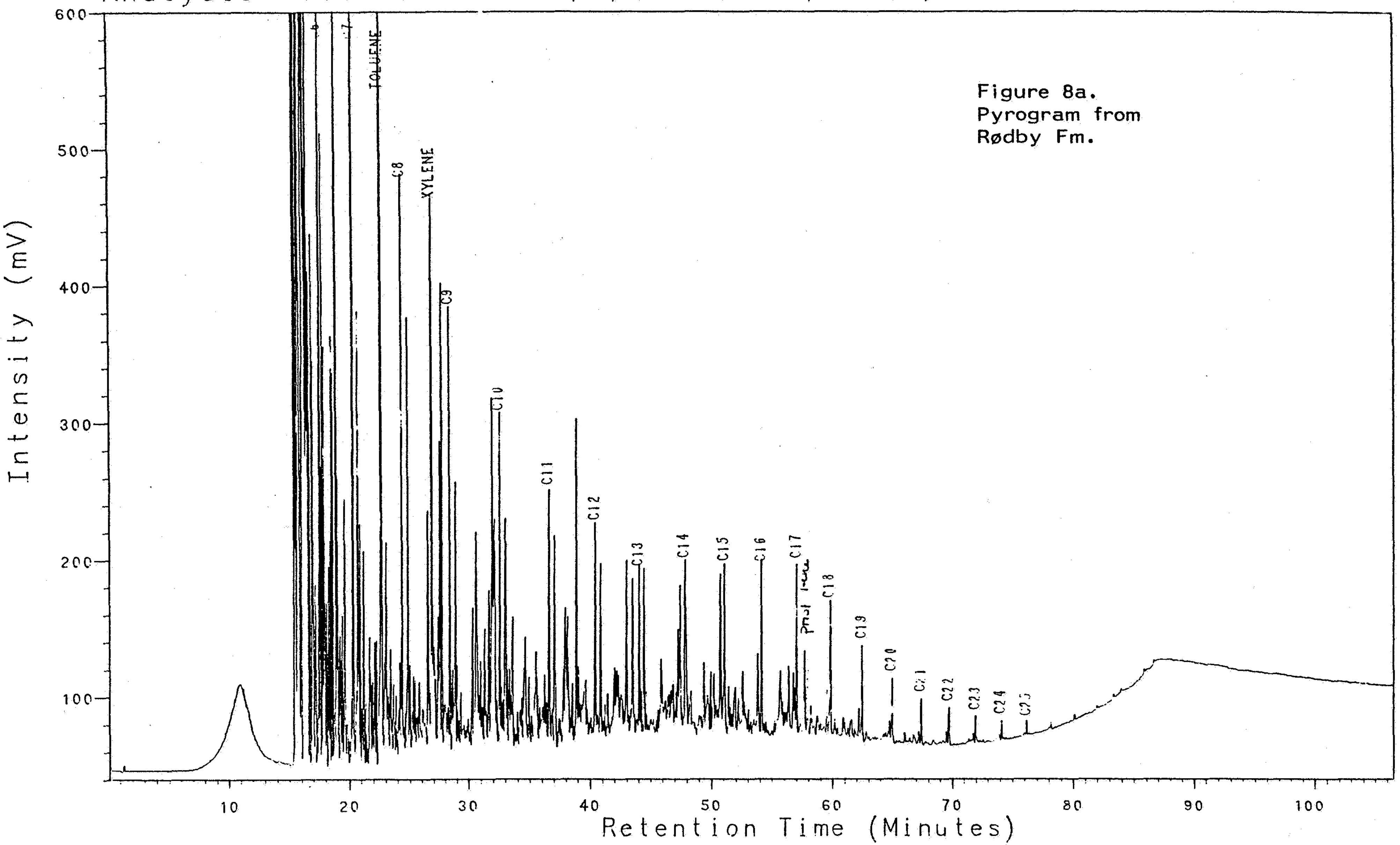
Analysis PC140361L 25, 1, 1 2/1-2, 3125m, S2



NOCS 2/1-2 3125m
PYROLYSIS GC (S2)
CLST: brn gy to m gy to ol gy

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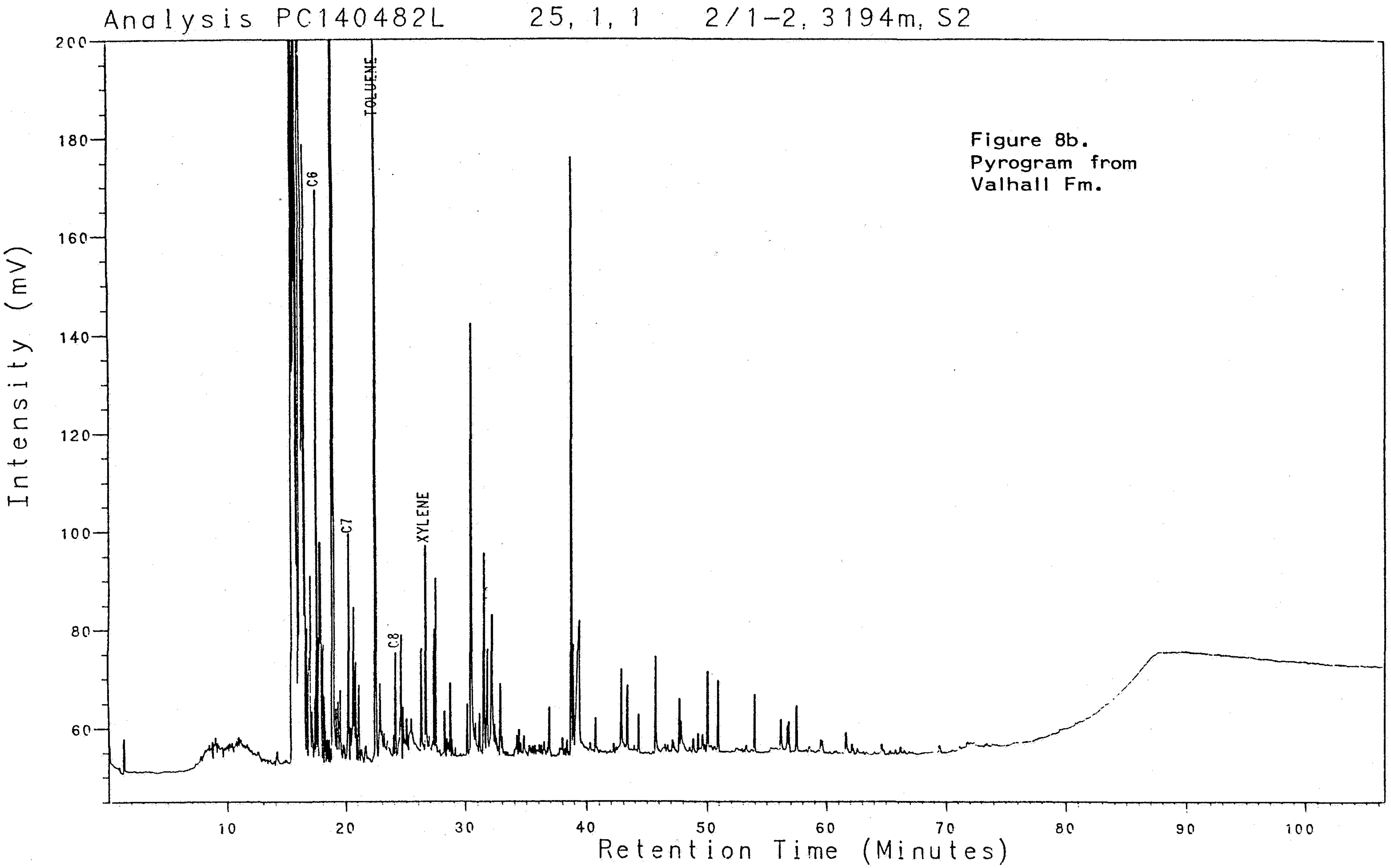

Figure 8b.
Pyrogram from
Valhall Fm.

NOCS 2/1-2 3194m
PYROLYSIS GC (S2)
CLST: v col

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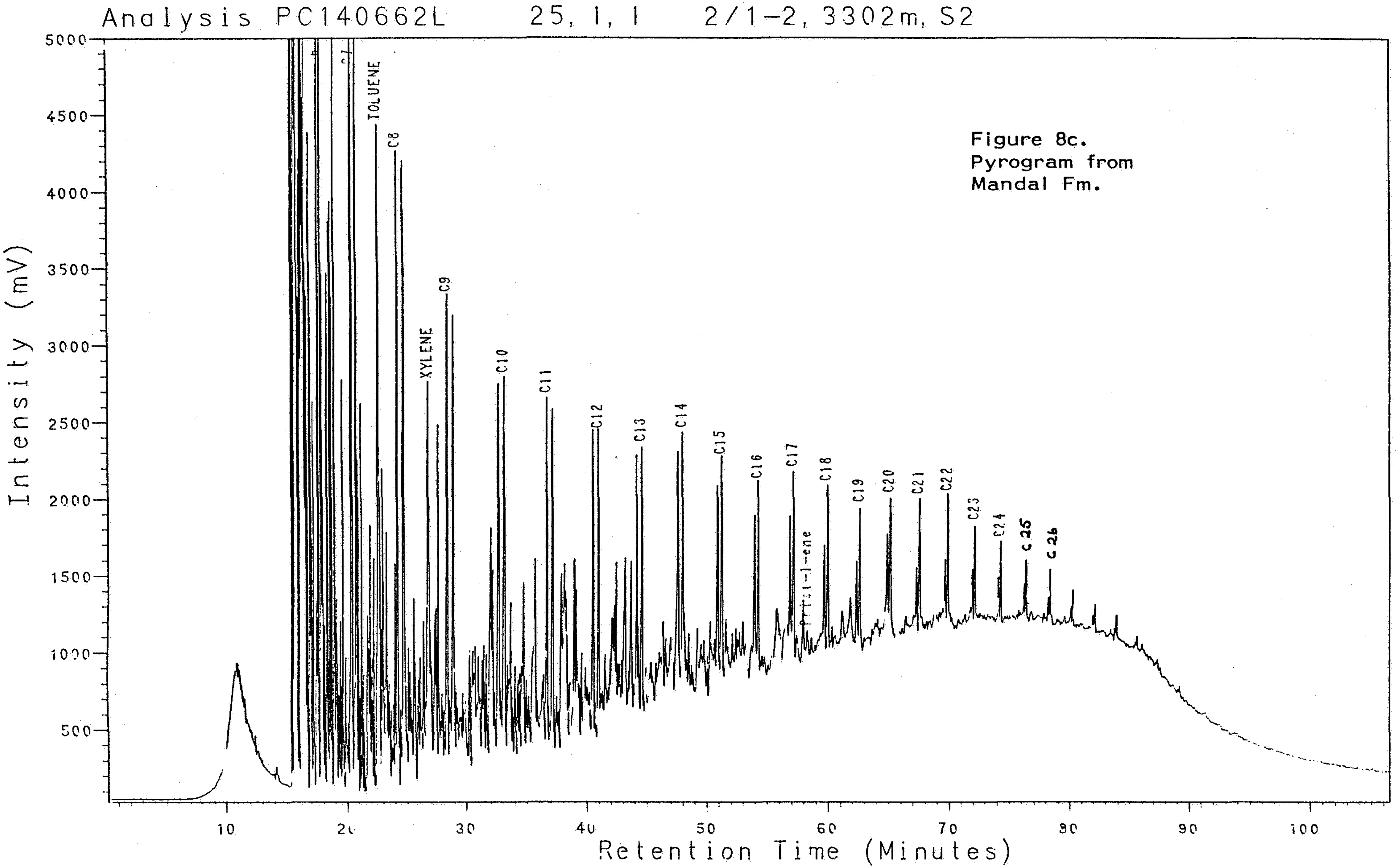

Figure 8c.
Pyrogram from
Mandal Fm.

NOCS 2/1-2 3302m
PYROLYSIS GC (S2)
CLST: brn blk

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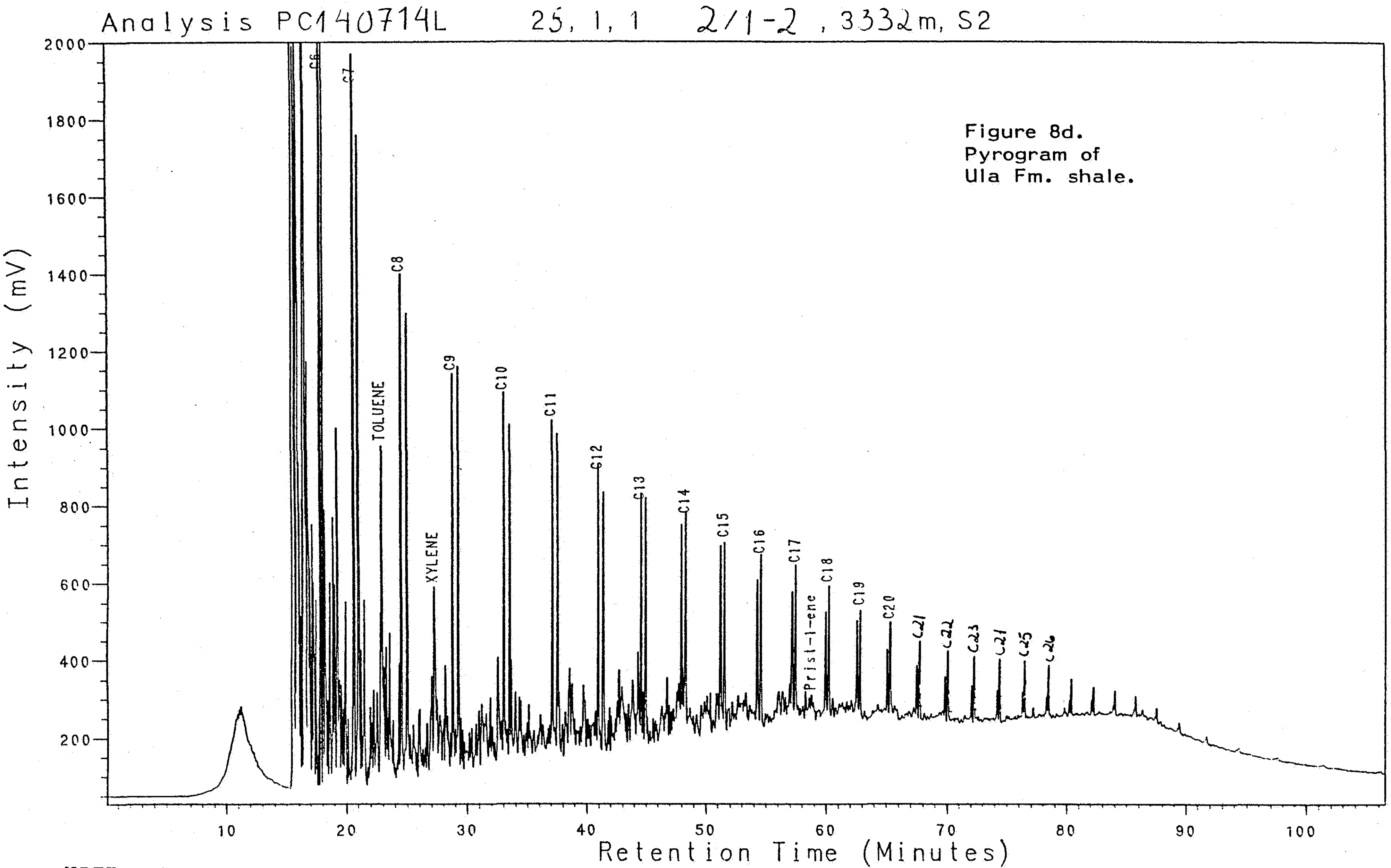

NOCS 2/1-2 3332m
PYROLYSIS GC (S2)
CLST: brn blk

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Analysis PC141021L 25, 1, 1 2/1-2, 3518m, S2

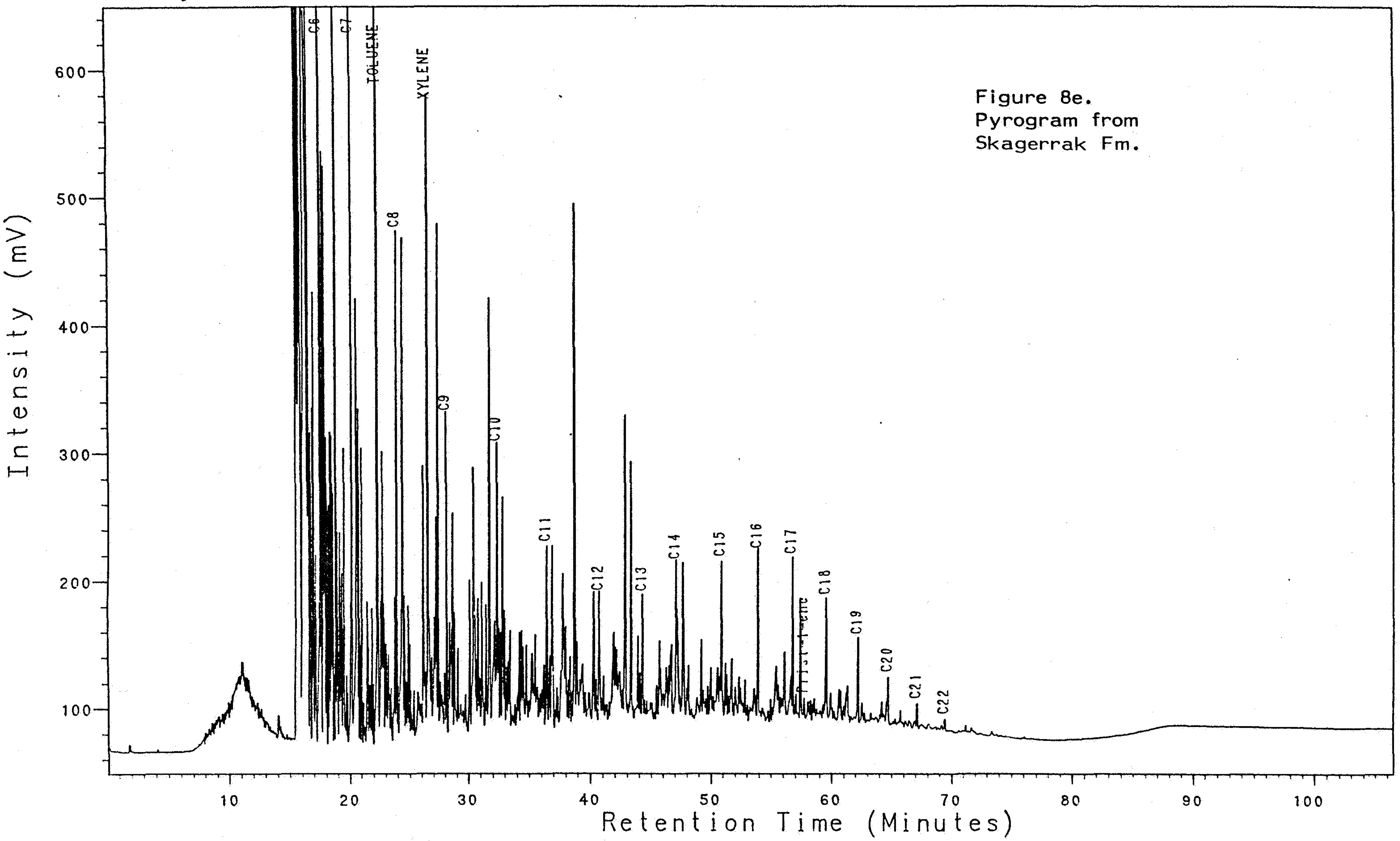

Figure 8e.
Pyrogram from
Skagerrak Fm.

NOCS 2/1-2 3518m
PYROLYSIS GC (S2)
CLST: lt ol gy to red gy to
m gy

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Figure 9: Vitrinite Reflectance versus Depth
Well NOCS 2/1-2

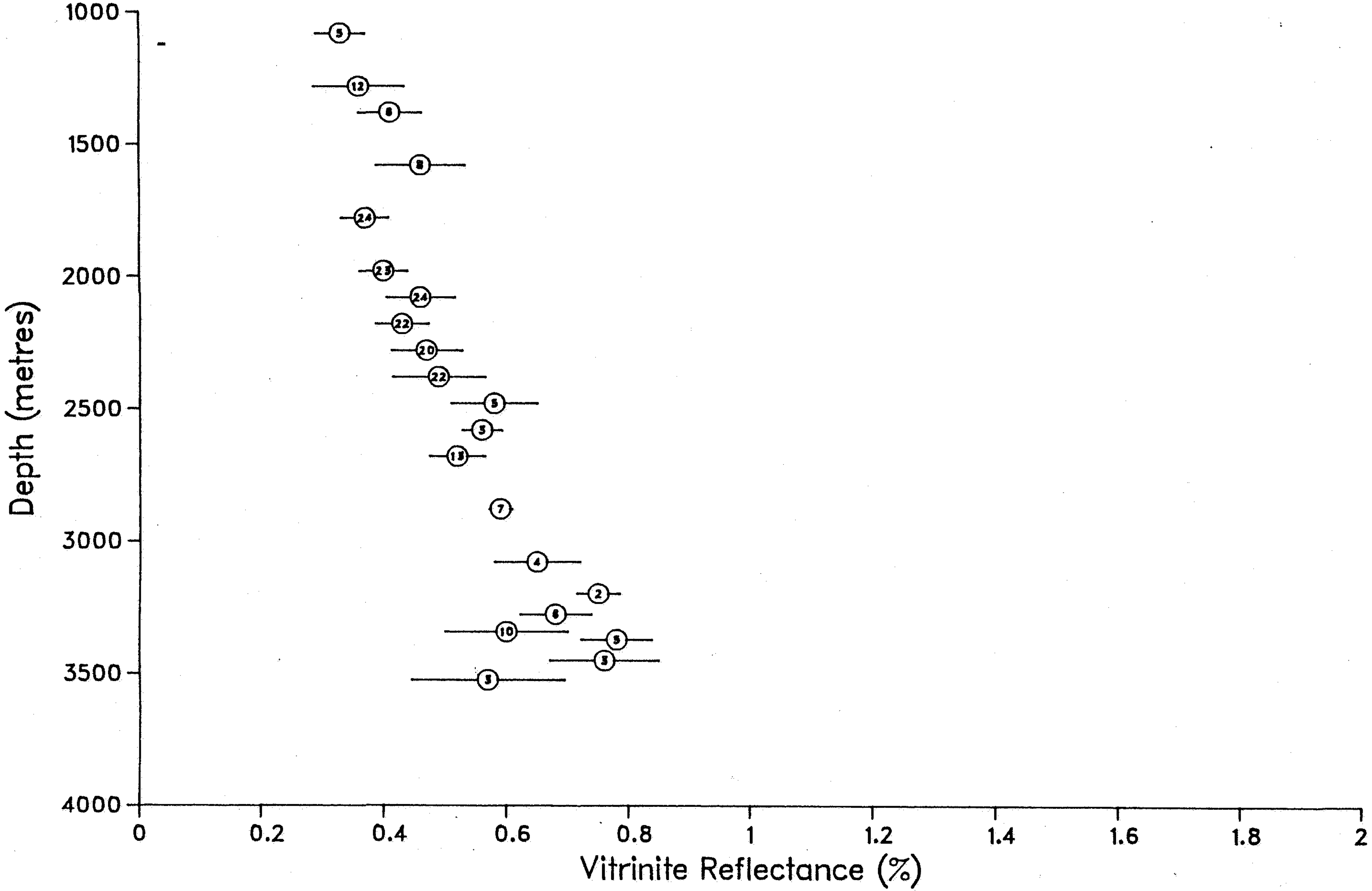

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Figure 10: Kerogen Composition and Potential Hydrocarbon Products

Well NOCS 2/1-2

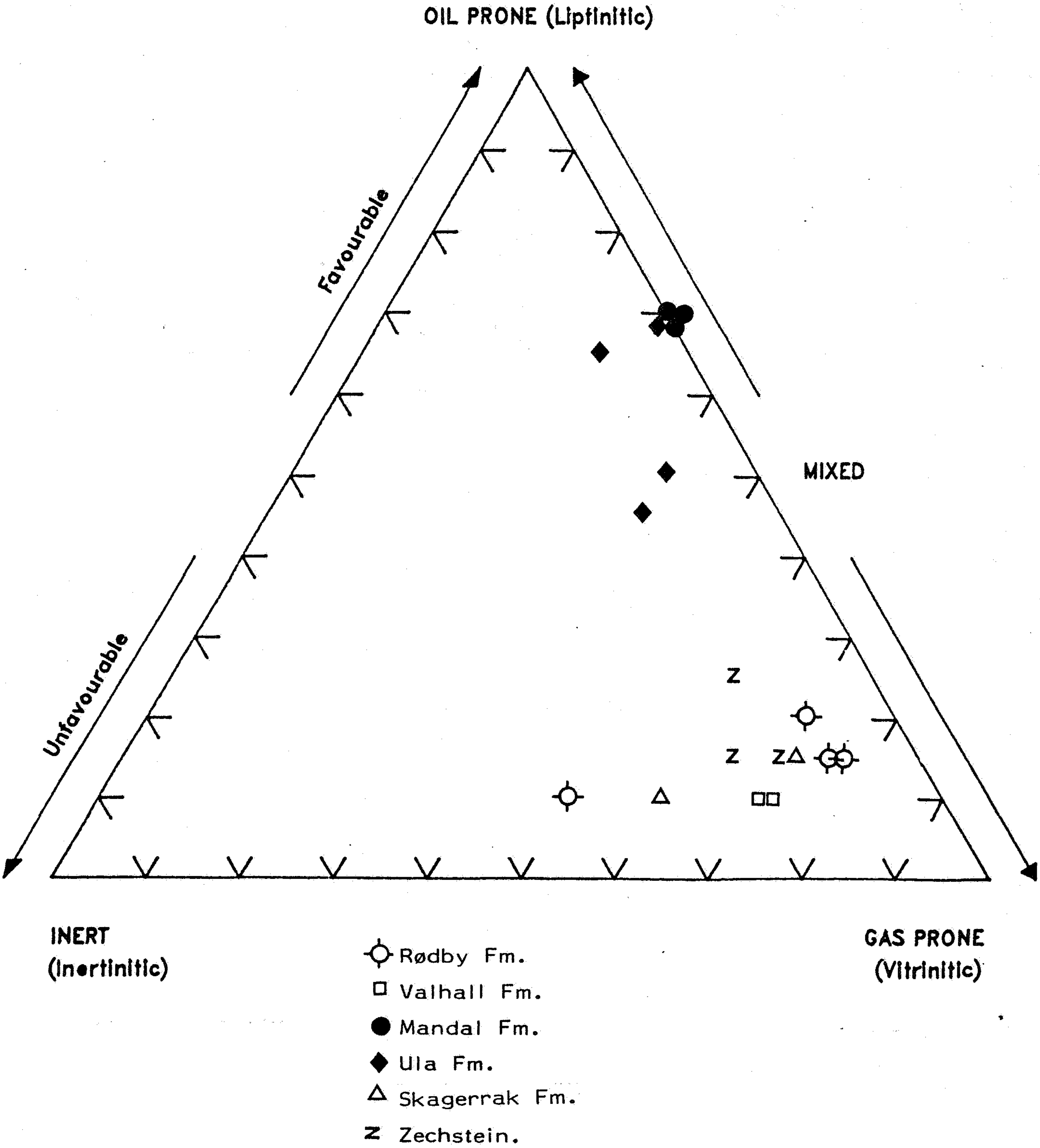

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Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
180.00						001
			90	S/Sst : v col, crs, l		001-2L
			10	Ca : w, slt		001-1L
280.00						002
			90	S/Sst : w, carb, mic, l		002-2L
			10	Sh/Clst: dsk y brn, carb		002-1L
380.00						003
			85	S/Sst : v col, crs, l		003-3L
			10	Ca : w to y gy		003-2L
			5	Coal : blk		003-1L
480.00						004
			85	S/Sst : v col, crs, l		004-3L
			10	Ca : w to y gy		004-2L
			5	Coal : blk		004-1L
580.00						005
			80	Sltst : lt ol gy, calc		005-3L
			10	Cont : cem		005-1L
			10	S/Sst : v col, crs, l		005-2L
680.00						006
			70	Sltst : lt ol gy, calc		006-2L
			30	S/Sst : w to m gy, crs, l		006-1L
			tr	Ca : y gy		006-3L
			tr	Coal : blk		006-4L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
780.00						007
			80	Sltst : lt ol gy, calc		007-2L
			20	Cont : cem, dd		007-1L
			tr	Ca : y gy		007-3L
880.00						008
			80	Sltst : lt ol gy to ol gy, calc		008-3L
			10	Cont : cem, prp, dd		008-1L
			10	Ca : y gy		008-2L
980.00						009
			50	Sltst : lt ol gy, calc		009-4L
			30	Ca : y gy, slt		009-3L
			10	Sh/Clst: brn blk, carb		009-1L
			10	Cont : cem, prp, dd		009-2L
1080.00						010
			80	Sltst : drk y brn to dsk y brn, mic		010-2L
			20	Cont : dd, fib		010-1L
1180.00						011
			60	Sltst : ol gy, calc, mic		011-3L
			30	S/Sst : w, l		011-1L
			10	Coal : blk		011-2L
			tr	Other : pyr		011-4L
1280.00						012
			90	Sltst : ol gy, calc, mic		012-3L
			10	Ca : w to y gy		012-2L
			tr	Sh/Clst: brn blk, carb		012-1L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
1380.00						013
			85	Sltst : ol gy, calc, mic		013-3L
			10	Ca : w to or gy to pl y brn, dol		013-2L
			5	S/Sst : w, l		013-1L
1480.00						014
			100	Sh/Clst: drk y brn, slt		014-1L
			tr	Cont : dd		014-2L
1580.00						015
			100	Sh/Clst: drk y brn, slt		015-1L
			tr	Cont : dd		015-2L
1680.00						016
			50	Sh/Clst: pl y brn to dsk y brn		016-1L
			50	Cont : dd		016-2L
1780.00						017
			50	Sh/Clst: pl y brn to dsk y brn		017-1L
			50	Cont : dd		017-2L
1880.00						018
			80	Sh/Clst: pl y brn to dsk y brn, mic		018-2L
			20	Cont : dd		018-1L
			tr	Sh/Clst: m gy		018-3L
			tr	Other : pyr		018-4L

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Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
1980.00						019
			100	Sh/Clst: drk y brn to dsk y brn, slt, mic		019-1L
			tr	Ca : w		019-2L
			tr	Cont : prp		019-3L
2080.00						020
			90	Sh/Clst: drk y brn to dsk y brn, slt, mic		020-1L
			10	Ca : w to drk y brn, dol		020-2L
			tr	Cont : prp, dd		020-3L
2180.00						021
			80	Sh/Clst: ol gy to pl y brn to dsk y brn, calc, slt, mic		021-2L
			20	Ca : w to or gy to drk y brn, dol		021-1L
2280.00						022
			90	Sh/Clst: ol gy, calc, mic		022-2L
			10	Cont : cem, prp, dd		022-1L
2380.00						023
			80	Sh/Clst: ol gy to dsk y brn, calc, mic		023-2L
			20	Cont : dd		023-1L
2480.00						024
			80	Sh/Clst: gn gy to ol gy to drk gn gy		024-3L
			10	Cont : prp, dd		024-1L
			10	Sh/Clst: dsk y brn, calc, slt, mic		024-2L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
2580.00						025
			60	Ca : drk y brn		025-1L
			30	Sh/Clst: m gy		025-4L
			5	Ca : m gy to drk y brn, dol		025-2L
			5	Sh/Clst: drk y brn to dsk y brn, slt, mic		025-3L
2680.00						026
			40	Sh/Clst: m gy to m drk gy, calc, slt, mic		026-3L
			30	S/Sst : ol gy, calc, carb, mic, glauc		026-1L
			30	Sh/Clst: brn gy, calc, mic		026-2L
2780.00						027
			95	Ca : w to or gy, evap		027-3L
			5	Sh/Clst: m gy, calc, mic		027-1L
			tr	S/Sst : ol gy, calc, carb, mic, glauc		027-2L
2880.00						028
			90	Ca : w to gn gy to or gy, evap		028-3L
			5	S/Sst : ol gy, calc, carb, mic, glauc		028-1L
			5	Sh/Clst: m gy to dsk y brn, calc, mic		028-2L
2980.00						029
			90	Ca : w to gn gy to or gy, evap		029-3L
			5	S/Sst : ol gy, calc, carb, mic, glauc		029-1L
			5	Sh/Clst: m gy to dsk y brn, calc, mic		029-2L
3080.00						030
			90	Ca : w to gn gy to or gy, evap		030-3L
			5	S/Sst : ol gy, calc, carb, mic, glauc		030-1L
			5	Sh/Clst: m gy to dsk y brn, calc, mic		030-2L

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Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3100.00						031
			85	Ca : w to gy pi, evap		031-3L
			10	Sh/Clst: gn gy to m gy to brn gy, calc, slt, mic		031-2L
			5	Cont : Coal-ad		031-1L
3105.00						032
			50	Ca : w to gy pi, evap		032-1L
			50	Sh/Clst: ol gy, calc, mic		032-2L
			tr	Sh/Clst: dsk y brn, slt, mic		032-3L
			tr	S/Sst : ol gy, calc, carb, mic, glauc		032-4L
3110.00						033
			90	Ca : w to gy pi, st, evap		033-1L
			10	Sh/Clst: gn gy to brn gy to ol gy, calc, mic		033-2L
			tr	S/Sst : ol gy, calc, carb, mic, glauc		033-3L
			tr	Other : pyr		033-4L
3115.00						034
			100	Ca : w to gy pi, st, evap		034-1L
			tr	Sh/Clst: ol gy, calc, mic		034-2L
3120.00						035
			100	Ca : w to gy pi, st, evap		035-1L
			tr	Sh/Clst: ol gy, calc, mic		035-2L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3125.00						036
			90	Ca : w to gy pi to m gy, s, st, evap		036-2L
	cvd	1.49	10	Sh/Clst: brn gy to m gy to ol gy, calc		036-1L
3130.00						037
			90	Ca : w to gy pi to m gy, s, st, evap		037-2L
	cvd	1.07	10	Sh/Clst: brn gy to m gy to ol gy, calc		037-1L
3135.00						038
			90	Ca : w to gy pi, st, evap		038-2L
	cvd		10	Sh/Clst: gn gy to red gy to brn gy, calc, slt, mic		038-1L
3140.00						039
			50	S/Sst : ol gy to m gy, calc, carb, mic, st		039-3L
		1.37	40	Sh/Clst: m gy, calc, slt, mic		039-2L
	cvd		10	Ca : w to gy pi, evap		039-1L
			tr	Cont : dd		039-4L
3146.00						040
			100	Cont : prp, dd		040-1L
3152.00						041
			100	Cont : Coal-ad, prp, dd		041-1L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3158.00						042
		0.41	50	Sltst : v col, carb, s, mic		042-2L
			30	Sh/Clst: gy pu to dsk y brn, slt, mic		042-1L
			20	Cont : cem, prp, dd		042-3L
3164.00						043
			80	Cont : prp, dd		043-2L
		1.34	20	Sltst : brn gy to m gy to dsk y brn, s, mic		043-1L
3170.00						044
			50	Ca : y gy to pl red		044-1L
			30	Sltst : v col, s, mic		044-3L
			20	Sh/Clst: dsk y brn		044-2L
			tr	Cont : Coal-ad, prp		044-4L
3176.00						045
			50	Ca : y gy to pl red		045-1L
			30	Sltst : v col, s, mic		045-3L
			20	Sh/Clst: dsk y brn		045-2L
			tr	Cont : Coal-ad, prp		045-4L
3182.00						046
		0.12	80	Sh/Clst: v col, calc		046-2L
			20	Ca : w to pl red		046-1L
			tr	Cont : cem, fib		046-3L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3188.00						047
			50	Cont : dd, fib		047-1L
		0.23	50	Sh/Clst: v col, calc		047-2L
			tr	Sltst : m gy, carb, s, mic		047-3L
3194.00						048
		0.35	80	Sh/Clst: v col, calc		048-2L
			20	Sh/Clst: ol gy, calc		048-1L
			tr	Sltst : m gy, carb, s, mic		048-3L
3200.00						049
		0.36	70	Sh/Clst: ol gy, calc		049-1L
			30	Sh/Clst: v col, calc		049-2L
3206.00						050
		0.41	70	Sh/Clst: ol gy, calc		050-1L
			30	Sh/Clst: v col, calc		050-2L
3212.00						051
		0.44	70	Sh/Clst: ol gy, calc		051-1L
			30	Sh/Clst: v col, calc		051-2L
3218.00						052
		0.86	70	Sh/Clst: ol gy, calc		052-1L
		0.76	30	Sh/Clst: v col, calc		052-2L
			tr	Ca : dsk y brn		052-3L
			tr	Cont : prp, dd		052-4L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3224.00						053
		0.36	95	Sh/Clst: ol gy to drk gy, mic, st		053-2L
			5	Sh/Clst: v col, calc		053-1L
			tr	Cont : dd, fib		053-3L
3230.00						054
		0.36	95	Sh/Clst: ol gy to drk gy, mic, st		054-2L
			5	Sh/Clst: v col, calc		054-1L
			tr	Cont : dd, fib		054-3L
3236.00						055
		0.31	95	Sh/Clst: ol gy to drk gy, mic, st		055-2L
			5	Sh/Clst: v col, calc		055-1L
			tr	Cont : dd, fib		055-3L
3242.00						056
		0.33	90	Sh/Clst: ol gy to drk gy		056-3L
			5	Ca : lt brn gy, slt		056-1L
			5	Sh/Clst: v col, calc		056-2L
			tr	S/Sst : m gy, mic		056-4L
3248.00						057
		0.41	85	Sh/Clst: ol gy to drk gy		057-2L
			15	Ca : lt y gy, slt		057-1L
			tr	Cont : prp		057-3L
3254.00						058
		0.37	90	Sh/Clst: ol gy to gn gy		058-2L
			10	Sh/Clst: lt ol gy to red gy, calc		058-1L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3260.00						059
		0.37	95	Sh/Clst: ol gy to drk gy		059-2L
			5	Ca : w to y gy to lt brn gy to brn gy		059-1L
3266.00						060
		0.39	90	Sh/Clst: ol gy to drk gy		060-3L
			5	Ca : y gy to lt brn gy		060-1L
			5	Sh/Clst: lt ol gy to red gy, calc		060-2L
3272.00						061
		0.43	90	Sh/Clst: ol gy to drk gy		061-2L
		1.42	10	Ca : lt y gy, slt		061-1L
			tr	Sh/Clst: red gy, calc		061-3L
3278.00						062
		0.39	100	Sh/Clst: drk gy		062-1L
			tr	Sh/Clst: red gy, calc		062-2L
			tr	Ca : lt y gy, slt		062-3L
3284.00						063
		0.38	95	Sh/Clst: drk gy		063-3L
			5	Ca : lt ol gy to lt y gy, slt		063-1L
			tr	Sh/Clst: red gy, calc		063-2L
3290.00						064
		0.40	95	Sh/Clst: drk gy		064-3L
			5	Ca : lt ol gy to lt y gy, slt		064-1L
			tr	Sh/Clst: red gy, calc		064-2L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3296.00						065
		0.51	100	Sh/Clst: drk gy to brn blk, mic		065-1L
			tr	Sh/Clst: lt ol gy to red gy, calc		065-2L
3302.00						066
		7.68	50	Sh/Clst: brn blk, carb, fis		066-2L
	cvd		40	Sh/Clst: drk gy, mic		066-3L
	cvd		10	Sh/Clst: lt ol gy, calc		066-1L
			tr	Sh/Clst: red gy, calc		066-4L
3308.00						067
		7.04	50	Sh/Clst: brn blk, carb, fis		067-2L
	cvd		40	Sh/Clst: drk gy, mic		067-3L
	cvd		10	Sh/Clst: lt ol gy, calc		067-1L
			tr	Sh/Clst: red gy, calc		067-4L
3314.00						068
		6.77	50	Sh/Clst: brn blk, carb, fis		068-2L
	cvd		40	Sh/Clst: drk gy, mic		068-3L
	cvd		10	Sh/Clst: lt ol gy, calc		068-1L
			tr	Sh/Clst: red gy, calc		068-4L
			tr	Ca : w		068-5L
3320.00						069
	cvd	6.28	50	Sh/Clst: brn blk, carb, mic, st		069-2L
	cvd		40	Sh/Clst: drk gy		069-3L
	cvd		10	Sh/Clst: lt ol gy to red gy, calc, slt		069-1L
			tr	S/Sst : lt ol gy, mic		069-4L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Lithology description	Trb	Sample
3326.00						070
	cvd	0.50	50	Sh/Clst: drk gy		070-3L
	cvd	2.38	30	Sh/Clst: brn blk, carb, fis		070-4L
	cvd		10	Ca : lt y gy, slt		070-1L
	cvd		10	Sh/Clst: red gy to lt ol gy, calc		070-2L
3332.00						071
	cvd	0.57	50	Sh/Clst: drk gy		071-3L
	cvd	5.44	30	Sh/Clst: brn blk, carb, fis		071-4L
	cvd		10	Ca : lt y gy, slt		071-1L
	cvd		10	Sh/Clst: red gy to lt ol gy, calc		071-2L
3338.00						072
	cvd	0.40	65	Sh/Clst: drk gy, mic		072-5L
	cvd		20	Sh/Clst: brn blk, carb, fis		072-2L
	cvd		5	Sh/Clst: blk, carb		072-1L
	cvd		5	Ca : y gy to lt ol gy, slt		072-3L
	cvd		5	Sh/Clst: lt ol gy to red gy, calc		072-4L
3344.00						073
	cvd	0.66	45	Sh/Clst: ol gy to drk gy		073-4L
	cvd	0.56	30	Sh/Clst: y gy to lt ol gy to red gy, calc, st		073-2L
	cvd		20	Sh/Clst: brn blk, carb, st, fis		073-3L
			5	S/Sst : m gy, carb, mic, glauc, st		073-1L
3350.00						074
	cvd		60	Sh/Clst: red gy to lt ol gy to m gy, slt		074-3L
		0.51	20	S/Sst : lt gy to drk gy, carb, mic, glauc, st		074-1L
			20	Sh/Clst: ol gy to drk gy, slt, st		074-2L
			tr	Coal : blk		074-4L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3356.00						075
		0.55	40	S/Sst : lt gy to lt ol gy, calc, carb, mic, st		075-1L
			30	Sh/Clst: ol gy to drk gy		075-2L
			30	Sh/Clst: red gy to lt ol gy to m gy, slt		075-3L
			tr	Ca : w to y gy		075-4L
			tr	Cont : dd		075-5L
			tr	Coal : blk		075-6L
3362.00						076
		0.12	40	S/Sst : lt gy to lt ol gy, calc, carb, mic, st		076-1L
			30	Sh/Clst: ol gy to drk gy		076-2L
			30	Sh/Clst: red gy to lt ol gy to m gy, slt		076-3L
			tr	Ca : w to y gy		076-4L
			tr	Cont : dd		076-5L
			tr	Coal : blk		076-6L
3368.00						077
		0.50	60	Sh/Clst: ol gy to m drk gy		077-1L
			20	Sh/Clst: gn gy to lt ol gy to m gy, calc		077-2L
			20	S/Sst : lt gy to lt ol gy, calc, carb, mic, st		077-3L
			tr	Ca : w, carb		077-4L
3374.00						078
		0.75	60	Sh/Clst: ol gy to m drk gy		078-1L
		0.69	20	Sh/Clst: gn gy to lt ol gy to m gy, calc		078-2L
			20	S/Sst : lt gy to lt ol gy, calc, carb, mic, st		078-3L
			tr	Ca : w, carb		078-4L

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Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3380.00						079
		0.72	80	Sh/Clst: ol gy to m drk gy, st		079-2L
			20	Sh/Clst: red gy to lt ol gy to m gy, calc, slt, st		079-1L
			tr	S/Sst : lt gy to lt ol gy, calc, carb, mic, st		079-3L
3386.00						080
		0.76	50	Sh/Clst: ol gy to m drk gy		080-2L
		0.60	40	Sh/Clst: red gy to lt ol gy to brn gy, calc, slt		080-3L
			10	S/Sst : lt gy to lt ol gy, calc, carb, mic, st, l		080-1L
			tr	Ca : w		080-4L
3392.00						081
		0.59	40	Sh/Clst: ol gy to m drk gy		081-3L
		0.13	30	S/Sst : lt gy to lt ol gy, calc, carb, mic, st, l		081-1L
			25	Sh/Clst: lt ol gy to m gy, calc, slt, st		081-4L
			5	Sh/Clst: gn gy, calc, slt, mic		081-2L
3398.00						082
		0.12	40	S/Sst : lt gy to lt ol gy, calc, carb, mic, st, l		082-1L
		0.63	30	Sh/Clst: ol gy to m drk gy		082-4L
		0.67	25	Sh/Clst: red gy to lt ol gy to m gy, calc, slt		082-3L
			5	Sltst : m gy, carb, mic		082-2L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3404.00						083
		0.14	40	S/Sst : lt gy to lt ol gy, calc, carb, mic, st, l		083-1L
		0.38	30	Sh/Clst: ol gy to m drk gy		083-4L
			25	Sh/Clst: red gy to lt ol gy to m gy, calc, slt		083-3L
			5	Sltst : m gy, carb, mic		083-2L
3410.00						084
		0.52	40	Sh/Clst: ol gy to m drk gy		084-4L
		0.27	30	S/Sst : w to red gy to gn gy, calc, carb, mic, l		084-1L
		0.39	20	Ca : w to red gy to y gy to brn gy		084-2L
			10	Sh/Clst: lt ol gy to m gy, calc, slt		084-3L
			tr	Sltst : red gy to m gy, mic		084-5L
3416.00						085
		0.38	50	Sh/Clst: ol gy to m drk gy		085-2L
			40	Sh/Clst: brn gy to lt ol gy to red gy, calc		085-3L
			10	S/Sst : w to red gy to gn gy, calc, carb, mic, glauc, l		085-1L
			tr	Sltst : gn gy, calc		085-4L
3422.00						086
		0.50	50	Sh/Clst: ol gy to dsk y brn		086-2L
		0.33	45	Sh/Clst: brn gy to red gy to lt ol gy, calc		086-3L
			5	S/Sst : w to red gy to gn gy, calc, carb, mic, glauc, l		086-1L

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Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth (Int Cvd)	Type (TOC%)	%	Lithology description	Trb	Sample
3428.00					087
	0.39	80	Sh/Clst: ol gy to dsk y brn, st		087-3L
		10	Sh/Clst: red gy, calc, carb, mic, l		087-1L
		10	Sh/Clst: brn gy to red gy to lt ol gy, calc		087-2L
3434.00					088
	0.38	90	Sh/Clst: ol gy to dsk y brn		088-3L
		5	S/Sst : red gy, calc, carb, mic, l		088-1L
		5	Sh/Clst: red gy to lt ol gy, calc		088-2L
		tr	Cont : dd		088-4L
3440.00					089
	0.36	90	Sh/Clst: ol gy to dsk y brn		089-3L
		5	S/Sst : red gy, calc, carb, mic, l		089-1L
		5	Sh/Clst: red gy to lt ol gy, calc		089-2L
		tr	Cont : dd		089-4L
3446.00					090
	0.34	90	Sh/Clst: ol gy to dsk y brn		090-3L
		5	S/Sst : red gy, calc, carb, mic, l		090-1L
		5	Sh/Clst: red gy to lt ol gy, calc		090-2L
		tr	Cont : dd		090-4L
3452.00					091
	0.32	90	Sh/Clst: ol gy to dsk y brn		091-3L
		5	S/Sst : red gy, calc, carb, mic, l		091-1L
		5	Sh/Clst: red gy to lt ol gy, calc		091-2L
		tr	Cont : dd		091-4L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3458.00						092
		0.56	90	Sh/Clst: ol gy to dsk y brn		092-3L
			5	S/Sst : red gy, calc, carb, mic, l		092-1L
			5	Sh/Clst: red gy to lt ol gy, calc		092-2L
			tr	Cont : dd		092-4L
3464.00						093
		0.28	75	Sh/Clst: ol gy to dsk y brn		093-3L
		0.15	15	S/Sst : red gy to gn gy, calc, carb, mic, l		093-1L
			10	Sh/Clst: lt ol gy to m gy, calc		093-2L
3470.00						094
		0.59	75	Sh/Clst: ol gy to dsk y brn		094-3L
			15	S/Sst : red gy to gn gy, calc, carb, mic, l		094-1L
		0.46	10	Sh/Clst: lt ol gy to m gy, calc		094-2L
			tr	Ca : w		094-4L
3476.00						095
		0.34	75	Sh/Clst: ol gy to dsk y brn		095-3L
		0.10	15	S/Sst : red gy to gn gy, calc, carb, mic, l		095-1L
			10	Sh/Clst: lt ol gy to m gy, calc		095-2L
3482.00						096
		0.39	75	Sh/Clst: ol gy to dsk y brn		096-3L
			15	S/Sst : red gy to gn gy, calc, carb, mic, l		096-1L
			10	Sh/Clst: lt ol gy to m gy, calc		096-2L
			tr	Cont : dd		096-4L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3488.00						097
		0.38	80	Sh/Clst: m drk gy		097-3L
			10	S/Sst : w to red gy, calc, carb, mic, 1		097-1L
			10	Sh/Clst: lt ol gy to brn gy, calc		097-2L
3494.00						098
		0.38	80	Sh/Clst: m drk gy		098-3L
			10	S/Sst : w to red gy, calc, carb, mic, 1		098-1L
			10	Sh/Clst: lt ol gy to brn gy, calc		098-2L
3497.00						099
		0.42	80	Sh/Clst: m drk gy		099-3L
			10	S/Sst : w to red gy, calc, carb, mic, 1		099-1L
			10	Sh/Clst: lt ol gy to brn gy, calc		099-2L
3506.00						100
		0.37	80	Sh/Clst: m drk gy		100-3L
			10	S/Sst : w to red gy, calc, carb, mic, 1		100-1L
			10	Sh/Clst: lt ol gy to brn gy, calc		100-2L
3512.00						101
		0.40	80	Sh/Clst: m drk gy		101-3L
			10	S/Sst : w to red gy, calc, carb, mic, 1		101-1L
			10	Sh/Clst: lt ol gy to brn gy, calc		101-2L
3518.00						102
		0.95	80	Sh/Clst: m drk gy, st		102-2L
		0.80	20	Sh/Clst: lt ol gy to red gy to m gy, calc		102-1L
			tr	S/Sst : red gy, calc, carb, mic, 1		102-3L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3524.00						103
		0.76	75	Sh/Clst: m drk gy		103-3L
			20	Sh/Clst: red gy to lt ol gy to m gy, calc		103-2L
			5	S/Sst : red gy, calc, carb, mic, l		103-1L
3530.00						104
		0.39	75	Sh/Clst: m drk gy		104-3L
			20	Sh/Clst: red gy to lt ol gy to m gy, calc		104-2L
			5	S/Sst : red gy, calc, carb, mic, l		104-1L
3536.00						105
		0.39	50	Sh/Clst: red gy to ol gy to m drk gy		105-2L
			30	Sh/Clst: brn blk, carb		105-3L
			20	Ca : w		105-1L
3542.00						106
		0.50	70	Sh/Clst: m drk gy		106-3L
			20	Ca : w		106-1L
			10	Sh/Clst: red gy to lt ol gy, calc		106-2L
			tr	Sh/Clst: brn blk, carb, fis		106-4L
3548.00						107
		1.22	70	Sh/Clst: m drk gy		107-3L
		0.28	20	Ca : w		107-1L
			10	Sh/Clst: red gy to lt ol gy, calc		107-2L
			tr	Sh/Clst: brn blk, carb, fis		107-4L

Table 1 : Lithology description for well NOCS 2/1-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3551.00						108
		1.16	70	Sh/Clst: m drk gy		108-3L
			20	Ca : w		108-1L
			10	Sh/Clst: red gy to lt ol gy, calc		108-2L
			tr	Sh/Clst: brn blk, carb, fis		108-4L
			tr	Coal : blk		108-5L

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

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3125.00	cut	Sh/Clst: brn gy to m gy to ol gy	0.38	1.93	0.51	3.78	1.49	130	34	2.3	0.16	428	036-1L
3130.00	cut	Sh/Clst: brn gy to m gy to ol gy	0.19	0.61	0.56	1.09	1.07	57	52	0.8	0.24	424	037-1L
3140.00	cut	Sh/Clst: m gy	0.25	1.34	0.81	1.65	1.37	98	59	1.6	0.16	426	039-2L
3158.00	cut	Sltst : v col	0.05	-	0.26	-	0.41	-	63	0.1	1.00	434	042-2L
3164.00	cut	Sltst : brn gy to m gy to dsk y brn	1.64	2.07	0.43	4.81	1.34	154	32	3.7	0.44	349	043-1L
3182.00	cut	Sh/Clst: v col	-	-	0.35	-	0.12	-	292	-	-	221	046-2L
3188.00	cut	Sh/Clst: v col	0.02	-	0.49	-	0.23	-	213	-	1.00	429	047-2L
3194.00	cut	Sh/Clst: v col	0.04	0.02	0.43	0.05	0.35	6	123	0.1	0.67	430	048-2L
3200.00	cut	Sh/Clst: ol gy	0.02	-	0.33	-	0.36	-	92	-	1.00	434	049-1L
3206.00	cut	Sh/Clst: ol gy	0.06	-	0.22	-	0.41	-	54	0.1	1.00	385	050-1L
3212.00	cut	Sh/Clst: ol gy	0.04	-	0.22	-	0.44	-	50	-	1.00	430	051-1L
3218.00	cut	Sh/Clst: ol gy	1.64	1.58	0.30	5.27	0.86	184	35	3.2	0.51	342	052-1L
3218.00	cut	Sh/Clst: v col	1.78	1.35	0.45	3.00	0.76	178	59	3.1	0.57	337	052-2L
3224.00	cut	Sh/Clst: ol gy to drk gy	0.05	0.01	0.18	0.06	0.36	3	50	0.1	0.83	350	053-2L
3230.00	cut	Sh/Clst: ol gy to drk gy	0.04	0.02	0.28	0.07	0.36	6	78	0.1	0.67	254	054-2L

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

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3236.00	cut	Sh/Clst: ol gy to drk gy	0.01	-	0.22	-	0.31	-	71	-	1.00	454	055-2L
3242.00	cut	Sh/Clst: ol gy to drk gy	0.04	0.02	0.26	0.08	0.33	6	79	0.1	0.67	299	056-3L
3248.00	cut	Sh/Clst: ol gy to drk gy	0.04	-	0.27	-	0.41	-	66	-	1.00	299	057-2L
3254.00	cut	Sh/Clst: ol gy to gn gy	0.02	-	0.23	-	0.37	-	62	-	1.00	299	058-2L
3260.00	cut	Sh/Clst: ol gy to drk gy	0.03	0.01	0.30	0.03	0.37	3	81	-	0.75	299	059-2L
3266.00	cut	Sh/Clst: ol gy to drk gy	0.04	-	0.22	-	0.39	-	56	-	1.00	432	060-3L
3272.00	cut	Ca : lt y gy	0.31	0.90	2.22	0.41	1.42	63	156	1.2	0.26	428	061-1L
3272.00	cut	Sh/Clst: ol gy to drk gy	0.07	0.03	0.13	0.23	0.43	7	30	0.1	0.70	385	061-2L
3278.00	cut	Sh/Clst: drk gy	0.02	0.04	0.18	0.22	0.39	10	46	0.1	0.33	316	062-1L
3284.00	cut	Sh/Clst: drk gy	0.04	0.04	0.04	1.00	0.38	11	11	0.1	0.50	297	063-3L
3290.00	cut	Sh/Clst: drk gy	0.02	0.05	0.33	0.15	0.40	13	83	0.1	0.29	377	064-3L
3296.00	cut	Sh/Clst: drk gy to brn blk	0.06	0.18	0.25	0.72	0.51	35	49	0.2	0.25	427	065-1L
3302.00	cut	Sh/Clst: brn blk	4.37	33.59	0.61	55.07	7.68	437	8	38.0	0.12	429	066-2L
3308.00	cut	Sh/Clst: brn blk	3.91	30.31	0.44	68.89	7.04	431	6	34.2	0.11	435	067-2L
3314.00	cut	Sh/Clst: brn blk	3.69	29.02	0.50	58.04	6.77	429	7	32.7	0.11	432	068-2L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3320.00	cut	Sh/Clst: brn blk	3.13	25.29	0.56	45.16	6.28	403	9	28.4	0.11	433	069-2L
3326.00	cut	Sh/Clst: drk gy	0.07	0.11	0.28	0.39	0.50	22	56	0.2	0.39	427	070-3L
3326.00	cut	Sh/Clst: brn blk	0.66	6.14	0.40	15.35	2.38	258	17	6.8	0.10	432	070-4L
3332.00	cut	Sh/Clst: drk gy	0.05	0.15	0.23	0.65	0.57	26	40	0.2	0.25	430	071-3L
3332.00	cut	Sh/Clst: brn blk	2.33	21.46	0.60	35.77	5.44	394	11	23.8	0.10	433	071-4L
3338.00	cut	Sh/Clst: drk gy	0.07	0.09	0.26	0.35	0.40	23	65	0.2	0.44	368	072-5L
3344.00	cut	Sh/Clst: y gy to lt ol gy to red gy	0.09	0.24	0.45	0.53	0.56	43	80	0.3	0.27	429	073-2L
3344.00	cut	Sh/Clst: ol gy to drk gy	0.07	0.25	0.31	0.81	0.66	38	47	0.3	0.22	433	073-4L
3350.00	cut	S/Sst : lt gy to drk gy	0.08	0.14	0.28	0.50	0.51	27	55	0.2	0.36	434	074-1L
3356.00	cut	S/Sst : lt gy to lt ol gy	0.06	0.18	0.19	0.95	0.55	33	35	0.2	0.25	435	075-1L
3362.00	cut	S/Sst : lt gy to lt ol gy	0.01	-	0.16	-	0.12	-	133	-	1.00	481	076-1L
3368.00	cut	Sh/Clst: ol gy to m drk gy	0.05	0.03	0.25	0.12	0.50	6	50	0.1	0.63	300	077-1L
3374.00	cut	Sh/Clst: ol gy to m drk gy	0.10	0.41	0.26	1.58	0.75	55	35	0.5	0.20	437	078-1L
3374.00	cut	Sh/Clst: gn gy to lt ol gy to m gy	0.14	0.28	0.46	0.61	0.69	41	67	0.4	0.33	429	078-2L
3380.00	cut	Sh/Clst: ol gy to m drk gy	0.16	0.57	0.30	1.90	0.72	79	42	0.7	0.22	436	079-2L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3386.00	cut	Sh/Clst: ol gy to m drk gy	0.12	0.44	0.25	1.76	0.76	58	33	0.6	0.21	434	080-2L
3386.00	cut	Sh/Clst: red gy to lt ol gy to brn gy	0.11	0.20	0.46	0.43	0.60	33	77	0.3	0.35	431	080-3L
3392.00	cut	S/Sst : lt gy to lt ol gy	0.01	-	0.18	-	0.13	-	138	-	1.00	467	081-1L
3392.00	cut	Sh/Clst: ol gy to m drk gy	0.10	0.17	0.31	0.55	0.59	29	53	0.3	0.37	431	081-3L
3398.00	cut	S/Sst : lt gy to lt ol gy	0.04	0.01	0.17	0.06	0.12	8	142	0.1	0.80	443	082-1L
3398.00	cut	Sh/Clst: red gy to lt ol gy to m gy	0.20	0.35	0.43	0.81	0.67	52	64	0.6	0.36	429	082-3L
3398.00	cut	Sh/Clst: ol gy to m drk gy	0.14	0.18	0.25	0.72	0.63	29	40	0.3	0.44	432	082-4L
3404.00	cut	S/Sst : lt gy to lt ol gy	-	-	0.10	-	0.14	-	71	-	-	-	083-1L
3404.00	cut	Sh/Clst: ol gy to m drk gy	0.07	0.06	0.17	0.35	0.38	16	45	0.1	0.54	331	083-4L
3410.00	cut	S/Sst : w to red gy to gn gy	0.02	0.02	0.15	0.13	0.27	7	56	-	0.50	-	084-1L
3410.00	cut	Ca : w to red gy to y gy to brn gy	0.07	0.11	0.61	0.18	0.39	28	156	0.2	0.39	339	084-2L
3410.00	cut	Sh/Clst: ol gy to m drk gy	0.08	0.17	0.20	0.85	0.52	33	38	0.3	0.32	431	084-4L
3416.00	cut	Sh/Clst: ol gy to m drk gy	0.06	0.08	0.21	0.38	0.38	21	55	0.1	0.43	390	085-2L
3422.00	cut	Sh/Clst: ol gy to dsk y brn	0.08	0.33	0.18	1.83	0.50	66	36	0.4	0.20	433	086-2L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3422.00	cut	Sh/Clst: brn gy to red gy to lt ol gy	0.05	0.06	0.39	0.15	0.33	18	118	0.1	0.45	427	086-3L
3428.00	cut	Sh/Clst: ol gy to dsk y brn	0.05	0.08	0.20	0.40	0.39	21	51	0.1	0.38	352	087-3L
3434.00	cut	Sh/Clst: ol gy to dsk y brn	0.04	0.05	0.16	0.31	0.38	13	42	0.1	0.44	356	088-3L
3440.00	cut	Sh/Clst: ol gy to dsk y brn	0.02	0.04	0.17	0.24	0.36	11	47	0.1	0.33	431	089-3L
3446.00	cut	Sh/Clst: ol gy to dsk y brn	0.03	0.04	0.14	0.29	0.34	12	41	0.1	0.43	425	090-3L
3452.00	cut	Sh/Clst: ol gy to dsk y brn	0.03	0.03	0.15	0.20	0.32	9	47	0.1	0.50	357	091-3L
3458.00	cut	Sh/Clst: ol gy to dsk y brn	0.46	0.52	0.15	3.47	0.56	93	27	1.0	0.47	336	092-3L
3464.00	cut	S/Sst : red gy to gn gy	0.01	0.01	0.10	0.10	0.15	7	67	-	0.50	346	093-1L
3464.00	cut	Sh/Clst: ol gy to dsk y brn	0.01	-	0.26	-	0.28	-	93	-	1.00	-	093-3L
3470.00	cut	Sh/Clst: lt ol gy to m gy	0.08	0.17	0.24	0.71	0.46	37	52	0.3	0.32	430	094-2L
3470.00	cut	Sh/Clst: ol gy to dsk y brn	0.09	0.40	0.12	3.33	0.59	68	20	0.5	0.18	435	094-3L
3476.00	cut	S/Sst : red gy to gn gy	-	-	0.08	-	0.10	-	80	-	-	-	095-1L
3476.00	cut	Sh/Clst: ol gy to dsk y brn	0.02	0.02	0.16	0.13	0.34	6	47	-	0.50	372	095-3L
3482.00	cut	Sh/Clst: ol gy to dsk y brn	0.02	0.06	0.16	0.38	0.39	15	41	0.1	0.25	403	096-3L
3488.00	cut	Sh/Clst: m drk gy	0.02	0.06	0.13	0.46	0.38	16	34	0.1	0.25	401	097-3L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3494.00	cut	Sh/Clst: m drk gy	0.02	0.05	0.14	0.36	0.38	13	37	0.1	0.29	431	098-3L
3497.00	cut	Sh/Clst: m drk gy	0.02	0.06	0.16	0.38	0.42	14	38	0.1	0.25	430	099-3L
3506.00	cut	Sh/Clst: m drk gy	0.03	0.07	0.20	0.35	0.37	19	54	0.1	0.30	432	100-3L
3512.00	cut	Sh/Clst: m drk gy	0.04	0.11	0.15	0.73	0.40	28	38	0.2	0.27	430	101-3L
3518.00	cut	Sh/Clst: lt ol gy to red gy to m gy	0.44	1.02	0.30	3.40	0.80	128	38	1.5	0.30	428	102-1L
3518.00	cut	Sh/Clst: m drk gy	0.39	1.49	0.15	9.93	0.95	157	16	1.9	0.21	435	102-2L
3524.00	cut	Sh/Clst: m drk gy	0.10	0.79	0.15	5.27	0.76	104	20	0.9	0.11	436	103-3L
3530.00	cut	Sh/Clst: m drk gy	0.03	0.06	0.20	0.30	0.39	15	51	0.1	0.33	430	104-3L
3536.00	cut	Sh/Clst: red gy to ol gy to m drk gy	0.05	0.13	0.23	0.57	0.39	33	59	0.2	0.28	429	105-2L
3542.00	cut	Sh/Clst: m drk gy	0.06	0.27	0.15	1.80	0.50	54	30	0.3	0.18	434	106-3L
3548.00	cut	Ca : w	0.10	0.20	0.66	0.30	0.28	71	236	0.3	0.33	387	107-1L
3548.00	cut	Sh/Clst: m drk gy	0.22	2.21	0.15	14.73	1.22	181	12	2.4	0.09	437	107-3L
3551.00	cut	Sh/Clst: m drk gy	0.20	1.97	0.21	9.38	1.16	170	18	2.2	0.09	437	108-3L

Table 3 a: Weight of EOM and Chromatographic Fraction for well NOCS 2/1-2

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
3302.00	cut	Sh/Clst: brn blk	3.5	36.9	7.0	5.4	2.4	22.1	12.4	24.5	8.42	066-2L
3308.00	cut	Sh/Clst: brn blk	2.6	28.9	6.0	4.1	2.0	16.8	10.1	18.8	8.27	067-2L
3320.00	com	Composite sample - see table 3 e	5.9	60.3	10.6	8.0	3.3	38.4	18.6	41.7	8.22	109-0B
3548.00	cut	Sh/Clst: m drk gy	3.7	2.5	1.0	0.7	0.4	0.4	1.7	0.8	0.48	107-3L
3551.00	cut	Sh/Clst: m drk gy	2.5	4.0	0.8	0.6	0.4	2.2	1.4	2.6	1.40	108-3L

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Table 3 b: Concentration of EOM and Chromatographic Fraction (wt ppm rock) for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3302.00	cut	Sh/Clst: brn blk	10512	1994	1538	683	6296	3532	6980	066-2L
3308.00	cut	Sh/Clst: brn blk	10988	2281	1558	760	6387	3840	7148	067-2L
3320.00	com	Composite sample - see table 3 e	10203	1793	1353	558	6497	3147	7055	109-0B
3548.00	cut	Sh/Clst: m drk gy	684	273	191	109	109	465	219	107-3L
3551.00	cut	Sh/Clst: m drk gy	1619	323	242	161	890	566	1052	108-3L

Table 3 c: Concentration of EOM and Chromatographic Fraction (mg/g TOC(e)) for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3302.00	cut	Sh/Clst: brn blk	124.86	23.69	18.27	8.12	74.78	41.96	82.90	066-2L
3308.00	cut	Sh/Clst: brn blk	132.87	27.59	18.85	9.20	77.24	46.44	86.44	067-2L
3320.00	com	Composite sample - see table 3 e	124.12	21.82	16.47	6.79	79.04	38.29	85.84	109-0B
3548.00	cut	Sh/Clst: m drk gy	142.69	57.08	39.95	22.83	22.83	97.03	45.66	107-3L
3551.00	cut	Sh/Clst: m drk gy	115.67	23.13	17.35	11.57	63.62	40.49	75.19	108-3L

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Table 3 d: Composition of material extracted from the rock (%) for well NOCS 2/1-2

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
3302.00	cut	Sh/Clst: brn blk	18.97	14.63	6.50	59.89	33.60	66.40	129.63	50.61	066-2L
3308.00	cut	Sh/Clst: brn blk	20.76	14.19	6.92	58.13	34.95	65.05	146.34	53.72	067-2L
3320.00	com	Composite sample - see table 3 e	17.58	13.27	5.47	63.68	30.85	69.15	132.50	44.60	109-0B
3548.00	cut	Sh/Clst: m drk gy	40.00	28.00	16.00	16.00	68.00	32.00	142.86	212.50	107-3L
3551.00	cut	Sh/Clst: m drk gy	20.00	15.00	10.00	55.00	35.00	65.00	133.33	53.85	108-3L

Table 3 e: List of composite samples appearing in the extraction tables for well NOCS 2/1-2

Depth unit of measure: m

NOTE: Depths shown in tables 3 a to d correspond to the composite samples' lower depth.

Upper depth	Lower depth	Typ	Sample		Depth	Typ	Lithology	Sample
3314.00	3320.00	com	109-0B	is composed of:	3314.00	cut	Sh/Clst: brn blk, carb, fis	068-2L
					3320.00	cut	Sh/Clst: brn blk, carb, mic, st	069-2L

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Table 4 : Saturated Hydrocarbon Ratios for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	Pristane / nC17	Pristane / Phytane	Pristane + Phytane / nC17 + nC18	Phytane / nC18	CPI	Sample
3302.00	cut	Sh/Clst: brn blk	0.80	1.58	0.74	0.66	1.07	066-2L
3308.00	cut	Sh/Clst: brn blk	0.88	1.70	0.80	0.68	1.15	067-2L
3320.00	com	bulk	0.86	1.61	0.78	0.68	1.09	109-0B
3548.00	cut	Sh/Clst: m drk gy	0.44	1.58	0.40	0.35	4.09	107-3L
3551.00	cut	Sh/Clst: m drk gy	0.66	1.40	0.60	0.54	1.09	108-3L

Table 5 : Aromatic Hydrocarbon Ratios for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	DBT/P	4/1MDBT	(3+2)/1MDBT	Sample
3302.00	cut	Sh/Clst: brn blk	0.81	2.01	0.06	0.60	0.61	0.50	0.19	1.14	0.35	066-2L
3308.00	cut	Sh/Clst: brn blk	0.57	1.91	-	0.58	0.60	0.47	0.23	1.13	0.41	067-2L
3320.00	com	bulk	0.74	1.93	-	0.58	0.63	0.49	0.22	1.13	0.28	109-0B
3548.00	cut	Sh/Clst: m drk gy	-	-	-	0.98	0.81	0.83	0.21	6.66	1.02	107-3L
3551.00	cut	Sh/Clst: m drk gy	-	-	-	0.69	0.66	0.58	0.21	2.05	0.64	108-3L

Table 6 : Thermal Maturity Data for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
1080.00	cut	bulk	0.33	5	0.04	4	–	–	010-0B
1280.00	cut	bulk	0.36	12	0.07	4	–	–	012-0B
1380.00	cut	bulk	0.41	6	0.05	4	–	–	013-0B
1580.00	cut	bulk	0.46	8	0.07	4	–	–	015-0B
1780.00	cut	bulk	0.37	24	0.04	4	–	–	017-0B
1980.00	cut	bulk	0.40	23	0.04	4	–	–	019-0B
2080.00	cut	bulk	0.46	24	0.06	0	–	–	020-0B
2180.00	cut	bulk	0.43	22	0.04	4	–	–	021-0B
2280.00	cut	bulk	0.47	20	0.06	5	–	–	022-0B
2380.00	cut	bulk	0.49	22	0.08	5	–	–	023-0B
2480.00	cut	bulk	0.58	5	0.07	5	–	–	024-0B
2580.00	cut	bulk	0.56	3	0.03	4+5	–	–	025-0B
2680.00	cut	bulk	0.52	13	0.05	4+5	–	–	026-0B
2880.00	cut	bulk	0.59	7	0.02	0	–	–	028-0B

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Table 6 : Thermal Maturity Data for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
3080.00	cut	bulk	0.65	4	0.07	0	-	-	030-0B
3125.00	cut	Sh/Clst: brn gy to m gy to ol gy	-	-	-	-	4	428	036-1L
3130.00	cut	Sh/Clst: brn gy to m gy to ol gy	-	-	-	-	4 6 - 7	424	037-1L
3140.00	cut	Sh/Clst: m gy	-	-	-	-	4 6 - 7	426	039-2L
3164.00	cut	Sltst : brn gy to m gy to dsk y brn	-	-	-	-	6?	349	043-1L
3200.00	cut	bulk	0.75	2	0.04	5+6	-	-	049-0B
3218.00	cut	Sh/Clst: ol gy	-	-	-	-	NDP	342	052-1L
3218.00	cut	Sh/Clst: v col	-	-	-	-	NDP	337	052-2L
3278.00	cut	bulk	0.68	6	0.06	0	-	-	062-0B
3302.00	cut	Sh/Clst: brn blk	-	-	-	-	4 - 5?	429	066-2L
3308.00	cut	Sh/Clst: brn blk	-	-	-	-	4 - 5?	435	067-2L
3314.00	cut	Sh/Clst: brn blk	-	-	-	-	5?	432	068-2L
3320.00	cut	Sh/Clst: brn blk	-	-	-	-	5?	433	069-2L
3326.00	cut	Sh/Clst: brn blk	-	-	-	-	5 - 5.5?	432	070-4L

Table 6 : Thermal Maturity Data for well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
3332.00	cut	Sh/Clst: brn blk	-	-	-	-	5?	433	071-4L
3338.00	cut	Sh/Clst: drk gy	-	-	-	-	NDP	368	072-5L
3344.00	cut	bulk	0.60	10	0.10	6	-	-	073-0B
3374.00	cut	bulk	0.78	5	0.06	0	-	-	078-0B
3452.00	cut	bulk	0.76	3	0.09	4	-	-	091-0B
3518.00	cut	Sh/Clst: lt ol gy to red gy to m gy	-	-	-	-	NDP	428	102-1L
3518.00	cut	Sh/Clst: m drk gy	-	-	-	-	6?	435	102-2L
3524.00	cut	bulk	0.57	3	0.13	4+5	-	-	103-0B
3524.00	cut	Sh/Clst: m drk gy	-	-	-	-	6?	436	103-3L
3548.00	cut	Sh/Clst: m drk gy	-	-	-	-	NDP	437	107-3L
3551.00	cut	Sh/Clst: m drk gy	-	-	-	-	6?	437	108-3L

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Table 7.: Visual Kerogen Composition Data for well NOCS 2/1-2

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	Micrino	Sclero	Bit I	VITR %	Telin	Collin	VitDet	Amor V	Bit V	Sample
3125.00	cut	Sh/Clst: brn gy to m gy to ol gy	15		**	*							10		**	*				75			**	*		036-1L
3130.00	cut	Sh/Clst: brn gy to m gy to ol gy	15		**	*							10		**	*				75			**	*		037-1L
3140.00	cut	Sh/Clst: m gy	20		*	**				*			10			*				70			**	*		039-2L
3164.00	cut	Sltst : brn gy to m gy to dsk y brn	10		*	*				*			40	*	**	*				50			**	*		043-1L
3218.00	cut	Sh/Clst: ol gy	10		*								20		*	*				70	*		**	*		052-1L
3218.00	cut	Sh/Clst: v col	10		*								20		*	*				70	*		**	*		052-2L
3302.00	cut	Sh/Clst: brn blk	70	*	*	**	*		**				TR							30			**	*		066-2L
3308.00	cut	Sh/Clst: brn blk	70	*	**	*			*	?			TR							30			*	*		067-2L
3314.00	cut	Sh/Clst: brn blk	70		**	*	?		*				TR							30			**	*		068-2L
3320.00	cut	Sh/Clst: brn blk	70		**	*	?		*				TR							30			**	*		069-2L
3326.00	cut	Sh/Clst: brn blk	50	*	*	*			*				10		*	*				40			**	*		070-4L
3332.00	cut	Sh/Clst: brn blk	65	**	*	*			*				10		*	*				25		*	**	**		071-4L
3338.00	cut	Sh/Clst: drk gy	45	*	**	*			*				15		*	*				40			**	*		072-5L

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Table 7.: Visual Kerogen Composition Data for well NOCS 2/1-2

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
3518.00	cut	Sh/Clst: lt ol gy to red gy to m gy	10		*								30			*				60			*			102-1L
3518.00	cut	Sh/Clst: m drk gy	15		*	*			*				15		*	*				70			*	*		102-2L
3524.00	cut	Sh/Clst: m drk gy	15		*	*			*				15		*	*				70			*	*		103-3L
3548.00	cut	Sh/Clst: m drk gy	15	*	**	*							20		*	**				65			**	*		107-3L
3551.00	cut	Sh/Clst: m drk gy	25		*	*			*				15		*	**				60			**	*		108-3L

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Table 8 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
3125.00	cut	Sh/Clst: brn gy to m gy to ol gy	5.46	29.94	55.65	8.95	1.93	036-1L
3130.00	cut	Sh/Clst: brn gy to m gy to ol gy	7.17	36.73	52.31	3.79	0.61	037-1L
3140.00	cut	Sh/Clst: m gy	4.87	30.37	54.81	9.95	1.34	039-2L
3164.00	cut	Sltst : brn gy to m gy to dsk y brn	1.64	14.27	43.11	40.98	2.07	043-1L
3194.00	cut	Sh/Clst: v col	6.54	42.08	46.02	5.36	0.02	048-2L
3218.00	cut	Sh/Clst: ol gy	3.72	13.75	45.45	37.08	1.58	052-1L
3218.00	cut	Sh/Clst: v col	2.45	12.77	42.22	42.57	1.35	052-2L
3224.00	cut	Sh/Clst: ol gy to drk gy	12.21	31.85	51.85	4.09	0.01	053-2L
3242.00	cut	Sh/Clst: ol gy to drk gy	11.72	40.58	43.63	4.07	0.02	056-3L
3272.00	cut	Ca : lt y gy	10.91	30.19	47.62	11.28	0.90	061-1L
3272.00	cut	Sh/Clst: ol gy to drk gy	7.28	40.81	47.32	4.60	0.03	061-2L
3284.00	cut	Sh/Clst: drk gy	12.19	41.56	44.56	1.69	0.04	063-3L
3302.00	cut	Sh/Clst: brn blk	2.64	6.91	34.20	56.25	33.59	066-2L
3308.00	cut	Sh/Clst: brn blk	2.68	7.21	33.56	56.55	30.31	067-2L

Table 8 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
3314.00	cut	Sh/Clst: brn blk	2.65	7.12	34.61	55.63	29.02	068-2L
3320.00	cut	Sh/Clst: brn blk	2.57	6.47	32.79	58.16	25.29	069-2L
3326.00	cut	Sh/Clst: brn blk	3.85	38.55	47.40	10.21	6.14	070-4L
3332.00	cut	Sh/Clst: brn blk	1.67	13.92	33.77	50.65	21.46	071-4L
3338.00	cut	Sh/Clst: drk gy	5.32	42.77	47.10	4.82	0.09	072-5L
3344.00	cut	Sh/Clst: y gy to lt ol gy to red gy	3.46	39.80	50.98	5.76	0.24	073-2L
3350.00	cut	S/Sst : lt gy to drk gy	17.55	46.09	32.43	3.94	0.14	074-1L
3356.00	cut	S/Sst : lt gy to lt ol gy	15.21	41.63	39.21	3.96	0.18	075-1L
3374.00	cut	Sh/Clst: gn gy to lt ol gy to m gy	9.28	36.89	49.76	4.07	0.28	078-2L
3380.00	cut	Sh/Clst: ol gy to m drk gy	5.25	32.64	54.27	7.84	0.57	079-2L
3398.00	cut	Sh/Clst: red gy to lt ol gy to m gy	6.81	35.06	51.57	6.56	0.35	082-3L
3398.00	cut	Sh/Clst: ol gy to m drk gy	7.58	37.16	49.52	5.74	0.18	082-4L
3458.00	cut	Sh/Clst: ol gy to dsk y brn	6.62	16.36	52.44	24.58	0.52	092-3L
3470.00	cut	Sh/Clst: ol gy to dsk y brn	7.00	34.71	50.26	8.03	0.40	094-3L

Table 8 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
3518.00	cut	Sh/Clst: lt ol gy to red gy to m gy	5.26	25.41	53.64	15.69	1.02	102-1L
3518.00	cut	Sh/Clst: m drk gy	4.49	19.01	52.69	23.81	1.49	102-2L
3524.00	cut	Sh/Clst: m drk gy	6.73	33.00	54.72	5.55	0.79	103-3L
3548.00	cut	Ca : w	14.11	40.56	41.57	3.76	0.20	107-1L
3548.00	cut	Sh/Clst: m drk gy	5.27	21.59	55.95	17.20	2.21	107-3L
3551.00	cut	Sh/Clst: m drk gy	4.72	22.33	57.45	15.50	1.97	108-3L

Table 9: Variation in Triterpane Distribution for Well NOCS 2/1-2

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
3308.00	Sh/Clst	2.33	0.70	0.17	0.45	0.31	0.12	0.41	0.92	0.29	0.11	0.83	0.30	0.19	57.58	067-2
3548.00	Sh/Clst	7.50	0.88	0.38	0.94	0.49	0.06	0.13	0.14	0.11	0.23	0.71	0.46	0.35	52.00	107-3
3551.00	Sh/Clst	3.00	0.75	0.28	0.69	0.41	0.14	0.15	0.22	0.13	0.14	0.76	0.39	0.27	57.76	108-3

Table 10: Variation in Sterane Distribution for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Sample
3308.00	Sh/Clst	0.76	53.19	62.40	1.56	0.61	0.33	0.24	067-2
3548.00	Sh/Clst	0.62	45.71	60.67	1.22	0.63	0.62	0.53	107-3
3551.00	Sh/Clst	0.73	50.00	59.06	1.42	0.59	0.34	0.25	108-3

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

Table 11: Aromatisation of Steranes for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Sample
3308.00	Sh/Clst	0.60	0.73	067-2
3548.00	Sh/Clst	0.48	0.74	107-3
3551.00	Sh/Clst	0.58	0.75	108-3

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

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Table 12: Variation in Triaromatic Sterane Distribution for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
3308.00	Sh/Clst	0.58	0.48	0.25	0.31	0.32	067-2
3548.00	Sh/Clst	0.69	0.59	0.37	0.42	0.51	107-3
3551.00	Sh/Clst	0.62	0.52	0.29	0.34	0.38	108-3

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 13: Variation in Monoaromatic Sterane Distribution for Well NOCS 2/1-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Sample
3308.00	Sh/Clst	0.44	0.27	0.30	0.23	067-2
3548.00	Sh/Clst	0.62	0.50	0.44	0.31	107-3
3551.00	Sh/Clst	0.41	0.31	0.28	0.23	108-3

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