PRE-CRETACEOUS HYDROCARBON POTENTIAL OF THE NORWEGIAN CENTRAL GRABEN

GEOCHEMICAL ANALYSIS
Well NOCS 2/1-3

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Date : November 1987

INTRODUCTION

This well from the Norwegian sector is situated in the north eastern part of the Central Graben. The total drilled depth was 4292 m. Samples were collected between 240 m and 4292 m from the Norwegian Petroleum Directorate in Stavanger. A total of 338 samples was collected and washed and 114 samples were described. Samples from 1040 m to 3726 m were used for maturity measurements while samples from 3726 m were also used for other geochemical analyses. From 3792 m, sample intervals of 6 m were used. A careful selection of suitable sample was made for screening analysis. Sixty-nine (69) samples were selected for this analysis and from the data obtained, samples were chosen for follow-up analyses. These were:

Thermal extraction - pyrolysis - gas chromatography	20 samples
Extraction, MPLC fractionation, saturated and aromatic hydrocarbon gas chromatography	2 samples
Vitrinite reflectance microscopy	22 samples
Visual kerogen analysis	7 samples

Tables listing in detail which samples were analysed and the results and the logs are given in the appendix. The log presented in NPD Well Summary Sheet No 12 is used in the determination of formation tops. The Ula Fm. is defined for two sandstone sequences in this log, separated by the Farsund and Haugesund Fms. In this report these are termed Ula I and Ula II.

Based on the NPD log the following formation tops are given:

Cromer Knoll Group	3534 m
Rødby Formation	3534 m
Valhall Formation	3607 m
Tyne Group	3791 m
Mandal Formation	3791 m
Vestland Group	3820 m
Ula I Formation	3820 m
Farsund Formation	3874 m
Haugesund Formation	3898 m
Ula II Formation	3966 m
Bryne Formation	3990 m
Skagerrak/Gassum Formation	4015 m
Zechstein	4219 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.

Cretaceous (3534 - 3791 m)

Cromer Knoll Group (3534 - 3791 m)

Valhall Formation (3607 - 3791 m)

The samples from the Valhall Fm. consist mainly of a green-grey, olive-grey, medium to dark grey shale and a grey-red shale, indicating that these two shales are interbedded throughout the formation. Samples of the olive-grey, medium grey to dark grey shale were analysed and these have low TOC values, approximately 0.3 %.

Jurassic (3791 - 4100 m)

Tyne Group (3791 - 3820 m)

Mandal Formation (3791 - 3820 m)

The samples from this interval consist mainly of caved material from the formation above, but small quantities of the indigenous lithology, a black to brown-black shale are also recorded. The TOC varies from 5.6 to 7.8 %, for the analysed samples, with an average of 6.9 %.

Vestland Group (3820 - 4100 m)

Ula I Formation (3820 - 3874 m)

This is a sandstone formation. Most of the samples consist of caved Cretaceous material and no analyses were undertaken.

Farsund Formation (3874 - 3898 m)

The samples from this interval are a mixture of different lithologies. The most abundant material is a light grey to dark grey shale. This has a low carbon content, similar to the Cretaceous sequence, with approximately 0.3 % organic carbon. There is a small percentage of siltstone in most of the samples, but too little to analyse.

Haugesund Formation (3898 - 3966 m)

Most of the samples show similar lithologies as found for the Farsund Fm. The lowermost sample has a far higher TOC content, 1.5 %. Some of the samples had enough siltstone to undertake TOC analysis. These show TOC values of approximately 1 %.

Ula II Formation (3966 - 3990 m)

As for the Ula I Fm., this is a sandstone formation. A few samples were analysed. These have TOC values of approximately 0.3 %.

Bryne Formation (3990 - 4015 m)

The main lithology in this formation is a medium grey to dark grey shale. Again, a very low organic carbon content is registered, approximately 0.3 %.

Skagerrak/Gassum Formation (4015 - 4219 m)

The main lithology of this interval is a medium grey to dark grey shale, silty in parts. The TOC values vary for the different samples, (range 0.3 - 0.7 %), with an average of 0.4 %. There is no systematic variation over the interval.

Zechstein (4219 - 4297 m)

The main lithology in the samples from this interval is caved material from the Skagerrak/Gassum Formation, but some anhydrite is found in most of the samples, representing the true lithology for this interval.

The lowermost four samples, from 4272 m, contain some brown-grey calcareous siltstone. This might also be caved material. It was, however, analysed and found to have TOC values between 3.0 and 3.2 % with an average of 3.1 %.

ROCK-EVAL ANALYSIS

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

Cretaceous (3534 - 3791 m)

Cromer Knoll Group (3534 -3791 m)

Valhall Formation (3607 - 3791 m)

Five olive-grey, medium grey to dark grey shale samples from this formation were analysed. Most of the samples have so little S_2 material that the peak is not recorded and the hydrogen index therefore can not be measured. Based on this, the Valhall Fm. has no source rock potential.

Jurassic (3791 - 4100 m)

Tyne Group (3791 - 3820 m)

Mandal Formation (3791 - 3820 m)

Four black to brown-black shale samples were analysed. The samples have high petroleum potentials (17.4 to 23.8), with an average of 20.6 mg HC/g rock. The hydrogen indices vary from 215 to 243 with an average of 233 mg HC/g TOC. These data, together with the relatively high maturity (Tmax 435 - 437), indicate that the samples contain kerogen type II/III, giving this interval a rich potential as a source rock for oil and gas.

Vestland Group (3820 - 4100 m)

Ula I Formation (3820 - 3874 m)

A sandstone formation. No samples from this formation were analysed.

Farsund Formation (3874 - 3898 m)

The light grey to dark grey shale from this interval varies considerably in its Rock-Eval characteristics. Two of the samples do not show any S_2 peak, one is extremely low, whilst one has a hydrogen index of 162. On the whole the analysed samples do not have any potential as a source rock for hydrocarbons. There is, however, a possibility that the analysed samples are caved material. The siltstone reported in the NPD log is hardly seen in the samples and is generally in such small quantities that analysis was impossible.

Haugesund Formation (3898 - 3966 m)

The samples from this formation are similar to those from the Farsund Fm., with the exception that the shale is medium grey to dark grey. The one light grey to medium grey siltstone, which was analysed, has a hydrogen index of 107 and a petroleum potential of 1.3. This would indicate that the siltstone contains kerogen type IV/III.

Based on these analyses, the medium grey to dark grey shale does not have any potential as a source rock for hydrocarbons, while the siltstone has a poor potential as a source rock for gas.

Ula II Formation (3966 - 3990 m)

A sandstone formation with no source rock potential.

Bryne Formation (3990 - 4015 m)

The olive-grey, medium grey to dark grey shale from this formation shows either very low hydrogen indices, or, in some cases, the value could not be calculated because the S_2 peak was not registered. The petroleum potential is also extremely low indicating that the samples contain kerogen type IV with very poor, or no, potential as a source rock for hydrocarbons.

Skagerrak/Gassum Formation (4015 - 4219 m)

The black, olive-grey, olive-black, medium grey to dark grey shale in this formation shows the same type of results as for the samples from the formations above, i.e. very low hydrogen indices (or none) together with very low petroleum potentials, indicating that the samples contain kerogen type IV with very low, or no, potential as a source rock for hydrocarbons.

Zechstein (4219 - 4297 m)

The anhydrite in this interval was not analysed. Samples from the lower 20 m of the interval contain some brown-grey siltstone, which was analysed. The siltstone has a low hydrogen index, 36 - 42, with an average of 38 mg HC/gTOC and a low petroleum potential. The data show that these samples contain kerogen type III with a poor potential as a source rock for gas.

2. Generation and Migration

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

Of all the samples analysed from this well only the samples from the Mandal Fm. show any indication of generated hydrocarbons. The Rock-Eval data suggest that these samples are generating hydrocarbons.

3. Maturity (Tmax)

Due to the extremely low S_2 values the Tmax values are uncertain for most of the analysed samples. Only the samples from the Mandal Fm. give reliable data. The values of 435 - 437 indicate that these samples have an oil window maturity.

EXTRACTION DATA

Jurassic (3791 - 4100 m)

Tyne Group (3791 - 3820 m)

Mandal Formation (3791 - 3820 m)

The only two samples from this well which were extracted are from this formation. Both samples have very high amounts of extractable organic matter (EOM), 13888 and 14751 ppm from the samples 3798 - 3884 m and 3810 - 3816 m respectively. The amounts of extractable hydrocarbons (EHC) are 2000 and 712 ppm respectively for the two samples. This is a very low percentage of extractable hydrocarbons for the sample from 3810 - 3816 m. The large percentage of non-hydrocarbons would normally indicate a low maturity. When normalized to organic carbon the samples are found to have 216 and 205 mg EOM/g TOC respectively, while they have 31 and 10 mg HC/g TOC respectively. These data clearly show that peak oil generation has not been reached.

Saturated Hydrocarbons

Mandal Formation (3791 - 3828 m)

The gas chromatograms of the saturated hydrocarbon fractions vary only slightly for the two samples. Both show a relatively smooth, front biased, unimodal n-alkane distribution, with CPI values of approximately 1.2, Figure 4. This, together with the relatively low pristane/phytane ratios and high pristane/nC_{17}, show that the samples have not reached peak oil generation.

Aromatic Hydrocarbons

Mandal Formation (3791 - 3828 m)

The gas chromatograms of the aromatic hydrocarbon fractions show similar FID traces for the two samples, with phenanthrenes and methyl phenanthrenes dominating the chromatograms. The substituted naphthalenes peaks are far smaller, probably due to a loss during the work up of the samples. There are also a number of distinct peaks in the higher molecular weight ranges. This, together with the MPI 1 and other aromatic maturity parameters, indicates that the samples have not reached peak oil generation. In the FPD traces 4 methyl dibenzothiophene dominates, with the other methyl substituted dibenzothiophenes as minor peaks.

THERMAL EXTRACTION - GAS CHROMATOGRAPHY

Twenty samples were analysed by thermal extraction gas chromatography.

Cretaceous (3534 - 3791 m)

Cromer Knoll Group (3534 - 3791 m)

Valhall Formation (3607 - 3791 m)

Only one sample, an olive-grey, medium grey to dark grey claystone from 3762 m was analysed. This shows mainly light hydrocarbons, C_1 - C_{10}, together with some alkanes in the C_{11} - C_{20} range, Figure 7a. The amount is very low and probably represents in-situ generated hydrocarbons.

Jurassic (3791 - 4100 m)

Tyne Group (3791 - 3820 m)

Mandal Formation (3791 - 3820 m)

Four black to brown-black shale samples from this interval were analysed. There are some variations in the chromatograms, but they all show a unimodal distribution with a maximum at approximately C_{21}, Figure 7b. Unless they have been dried at elevated temperatures, the loss recorded for the C_{15} - C_{20} hydrocarbons is normally not observed in source rock samples. However, such a chromatographic pattern is often observed in reservoir sequences containing residual

oil. In this well, the Mandal Fm. is a caprock and it is possible that this oil has migrated into the caprock and has been subsequently lost. This explanation is, however, speculative and it is difficult to substantiate it with other data, due to the poor quality of the samples in this well.

Vestland Group (3820 - 4100 m)

Ula I Formation (3820 - 3874 m)

No samples from this interval were analysed.

Farsund Formation (3874 - 3898 m)

Two light grey to dark grey shale samples were analysed. Both samples show minor amounts of thermal extracts, mainly light hydrocarbons, Figure 7c. These might be generated from very poor quality kerogen in the samples.

Haugesund Formation (3898 - 3966 m)

Three samples, light grey to medium grey and medium grey to dark grey shales, were analysed. All samples show only small quantities of extractable hydrocarbons, but there are distinct differences from the formation above in that hydrocarbons, in the range C_{11} - C_{21} dominate the chromatograms, Figure 7d. These could represent in-situ generated hydrocarbons, but the quantities are extremely low.

Ula II Formation (3966 - 3990 m)

No samples from this formation were analysed.

Bryne Formation (3990 - 4015 m)

One sample was analysed and found to have small amounts of light hydrocarbons, together with C_{10} to C_{17} n-alkanes (Figure 7e). This is similar to the characteristics of the sample from 3954 m in the Haugesund Fm.

Skagerrak/Gassum Formation (4015 - 4219 m)

Five shale samples from this interval were analysed. They all show similar hydrocarbon distributions to the Bryne Fm. samples, Figure 7f.

Zechstein (4219 - 4297 m)

The siltstone samples from the lower part of this sequence were analysed. They show a similar hydrocarbon distribution to samples higher up in the well, Figure 7g.

PYROLYSIS - GAS CHROMATOGRAPHY

Twenty samples were analysed by pyrolysis gas chromatography.

Cretaceous (3534 - 3791 m)

Cromer Knoll Group (3534 - 3791 m)

Valhall Formation (3607 - 3791 m)

The olive-green, medium grey to dark grey shale sample from 3762 m shows mainly aromatic material with hardly any alkane/alkene doublets, typical for kerogen type III, Figure 8a.

Jurassic (3791 - 4100 m)

Tyne Group (3791 - 3820 m)

Mandal Formation (3791 - 3820 m)

The four black to brown-black shale samples from this formation have almost identical pyrograms, with a large abundance of alkane/alkene doublets. Some aromatic compounds are detected, which would indicate some input of terrestrial material, Figure 8b. This would indicate a mixture of kerogen type II/III in this interval.

Vestland Group (3820 - 4100 m)

Ula I Formation (3820 - 3874 m)

No samples from this formation were analysed.

Farsund Formation (3874 - 3898 m)

The two light grey to dark grey shales show slightly different pyrograms. The sample from 3894 m shows a pyrogram similar to that found for the Valhall Fm., while the sample from 3888 m shows only a few aromatic peaks, typical for kerogen type IV, Figure 8c.

Haugesund Formation (3898 - 3966 m)

Three samples from this formation were analysed. The pyrogram for the sample from 3954 m is similar to the sample from 3888 m (i.e. kerogen type IV), while the samples from 3918 m and 3960 m show a series of alkane/alkene doublets which are normally found for kerogen type II, Figure 8d. These are the same samples that showed a larger proportion of hydrocarbons in the thermal extraction. The data might therefore indicate that there is some amorphous material in the samples, but only very minor quantities. These are also the samples which had the highest hydrogen indices.

Ula II Formation (3966 - 3990 m)

No samples from this formation were analysed.

Bryne Formation (3990 - 4015 m)

One sample from this interval was analysed. The pyrogram shows mainly low molecular weight compounds together with a series of alkanes, Figure 8e. Alkenes are only minor, or not present in this sample. This would indicate that the alkanes are not generated from pyrolysis, but are probably present in the original sample. The kerogen is most probably type III or type IV/III.

Skagerrak/Gassum Formation (4015 - 4219 m)

Five samples from this interval were analysed. Most of the samples show the same pattern as the sample from the Bryne Fm. while the sample from 4116 m shows only a few aromatic peaks, typical for kerogen type IV. The data would therefore indicate that the kerogen in the samples are type IV and that the hydrocarbons seen in some samples are not from pyrolysis of the kerogen, but from free hydrocarbons in the samples.

Zechstein (4219 -4297 m)

The four siltstone samples from the lower part of this interval show mainly aromatic compounds and represent probably kerogen type III/IV, Figure 8f.

VITRINITE REFLECTANCE ANALYSIS

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

Twenty-two samples were analysed, covering the interval 1040 m to 4278 m. Twelve samples were analysed from the Tertiary section of the well. The upper five samples (1040 m to 1800 m) have shale lithologies with a moderate amount of bitumen staining, a low amount of liptinitic wisps and only a trace of phytoclasts, which are mainly inertinitic. Values for this interval are, therefore, based on small numbers of individual readings but nevertheless show a smooth, very gentle increase with depth, from 0.37 % (1040 m) to 0.45 % (1800 m). In all of the samples, except the uppermost, yellow and yellow-orange spores are present, indicating a maturity equivalent to 0.3 % to 0.4 % Ro.

The two samples from 1980 m and 2190 m are much richer in organic matter than the overlying samples. Both have moderate to strong bitumen staining, high amounts of liptinitic wisps and a low amount of phytoclasts but with a reasonable proportion of vitrinite to inertinite. Reflectance values of 0.42 % and 0.50 % were obtained for the two samples respectively, from good numbers of individual readings. Spores continue to show both yellow and yellow-orange fluorescence colours.

The following two samples (2390 m and 2470 m) are again claystones but are poor in phytoclasts. No vitrinite was located in the upper sample while the lower sample gave a low value of 0.42 % from 3 readings. Yellow-orange spores were observed in both samples.

The sample from 2610 m has a mixed lithology and there is a moderate to high amount of liptinitic wisps. The phytoclast content is low and there is a good proportion of vitrinite

to inertinite. A confident reflectance value of 0.52 % was obtained from 20 readings while the yellow-orange spore fluorescence colour lags behind the reflectance a little.

The lowest two Tertiary samples are very poor in phytoclasts but contain moderate amounts of staining and liptinitic wisps. No vitrinite was located in the upper of the two samples (2730 m) whereas a rather low value of 0.45 % was obtained from 21 readings on the lower sample (2900 m). The readings for this sample have a slightly bimodal distribution which may indicate the presence of some caved material.

Five samples were analysed from the Cretaceous section of the well. Except for the lowermost sample, which is 100 % claystone, the lithologies are largely chalk and measurements are restricted to a few claystone cuttings which are probably not in-situ. Readings rise from 0.53 % at 3330 m to 0.62 % at 3630 m and spores, where present, display light orange and yellow-orange fluorescence colours. Although the values show an increase with depth, this may be purely coincidental, as only small numbers of readings were taken and the measured lithologies are likely to be caved. The lowermost Cretaceous sample (3720 m), which has a shale lithology, contains a trace of vitrinite and gave an average reflectance of 0.86 % from four readings. This value could represent reworked material but, if real, marks a strong increase in reflectance from the confident values of the Tertiary section. No spores were observed in this sample.

Three samples were analysed from the Jurassic section of the well. The uppermost (3816 m) is from the Mandal Fm. and is composed of a light shale and a dark shale. The dark shale has strong bitumen staining and a trace of vitrinite wisps, whereas the light shale has light staining and contains no vitrinite. A reflectance value of 0.58 % was obtained from five individual readings and this agrees fairly well with the observed light-orange fluorescence colour. Much low

reflecting vitrinite (Ro = 0.32 %) is present in this sample and this, along with the strong staining, leads one to suspect that the measured reflectance value is naturally depressed.

The next Jurassic sample (3930 m) is from the Haugesund Fm.. Shale and siltstone lithologies are present and bitumen staining varies between light and strong, whereas liptinitic wisps are low. Only a trace of vitrinite is present and this gives an average reflectance of 0.69 % (6 readings). Vitrinite is, however, only found in the heavily stained fraction of the sample and therefore the result is probably somewhat depressed.

The lowermost Jurassic sample is from the Gassum Fm. (4044 m). The lithology is largely claystone but some sandstone is present. The claystone is virtually barren of vitrinite and readings were restricted to a few cuttings of atypical lithology, containing excellent vitrinite. A value of 1.02 % was obtained from 20 individual readings, which have a good distribution. This high value adds to the suspicion that previous Jurassic values are depressed, as a very rapidly increasing gradient would be necessary to accommodate all values on the same curve.

One sample was analysed from the Triassic, Skagerrak Fm. (4158 m). The sample is mainly shale but also contains oxidized sandstone. In the shale, bitumen staining and liptinitic wisps are low and the phytoclast content is low and largely inertinitic. Vitrinite is restricted to a few cuttings which give an average reflectance value of 1.06 % (13 readings). This value fits in well with the previous Gassum Fm. value, if the idea of a shallower gradient is invoked (i.e. if previous Jurassic values are considered to be low).

The lowermost sample to be analysed is from the Permian Zechstein Gp. The lithology is shale and vitrinite is

restricted to a couple of cuttings with the same lithology as in the previous sample. A reflectance value of 1.02 % was obtained from six readings which show a good distribution. A higher value than this would be expected if the previous two values are correct and it therefore appears that the measurements are taken on caved material. The presence of light orange spores indicates caved material from even higher in the well.

To summarize the reflectance gradient, the upper part of the well, down to a depth of 2600 m, gives a good, gently increasing gradient, while below this depth values become scattered and the gradient is complicated. Values in the upper part of the profile are confident and often based on good numbers of individual readings, showing an increase from approximately 0.35 % at 1000 m to 0.53 % at 2600 m. Values for the Cretaceous section (3062 m to 3791 m) are very dubious due to a lack of vitrinite in the in-situ, chalky lithology. All values are likely to represent caved material. An exception is the lowermost Cretaceous sample (3720 m) which has a claystone lithology and, although poor in vitrinite, gives a high value of 0.86 % from four readings. Values in the Jurassic section of the well are scattered. The values for the Mandal and Haugesund Fms. are poor and low, whereas the Gassum Fm. value is high and based on a good number of individual readings. The Skagerrak Fm. value appears to be good but the Zechstein value probably represents caved material. The poor quality of data in the Cretaceous and Jurassic part of the well makes it difficult to define the maturity and a lot of interpretation is necessary to make sense of the data. A reasonable interpretation would give the onset of moderate maturity (0.4 % Ro) at 1450 m, maturity (~ 0.60 %) at approximately 3000 m and peak oil maturity (0.80 % to 0.90 % Ro) at approximately 3600 m to 3800 m. A maturity of just under 1.1 % is probably reached by top Permian. Alternatively, if less interpretation is placed upon the results, a lower maturity can be envisaged for the Cretaceous and Jurassic

section, with maturity being reached at approximately 3500 m to 3600 m, and a rapid increase in maturity occurring in the Gassum Fm. With this interpretation the value of 0.86 % Ro at 3720 m must be considered as representing reworked material.

VISUAL KEROGEN COMPOSITION

Seven samples from this well were examined in transmitted light. Six of these samples are shale/claystone, one is a siltstone. The samples range in depth from 3798 m to 3960 m. Four samples are from the Mandal Fm., one from the Farsund Fm. and two from the Haugesund Fm. The kerogen compositions of these samples are plotted in Figure 10.

The four samples from the Mandal Fm. are all black to brown-black claystones. The uppermost three samples have almost identical overall kerogen compositions (approximately 80 % vitrinite, 10 % liptinite and 10 % inertinite). The detailed composition, especially of the vitrinite component, varies slightly between a dominance of amorphinite V or a dominance of vitrodetrinite. The liptinite component is mainly liptodetrinite.

The one sample from the Farsund Fm. (3894 m) contains approximately 60 % vitrinite and 40 % inertinite with only a trace of detrital liptinite. The vitrinite component is vitrodetrinite whilst the inertinite is mainly inertodetrinite but also includes some semi-fusinite.

The uppermost Haugesund Fm. sample (3918 m) is a light grey to medium grey siltstone, the kerogen from which it is different to characterize with confidence, but it appears to contain approximately 50 % inertinite and 50 % vitrinite with only a trace of liptinite. The lowermost Haugesund Fm. sample is a medium grey to dark grey claystone with 50 % vitrinite (mainly vitrodetrinite but also amorphinite V), 40 % inertinite (mainly inertodetrinite but also semi-fusinite) and 10 % liptinite (liptodetrinite).

Due to the apparently very low liptinite contents (very little fluorescence and very little structured liptinite material was observed) maturity estimates from this analysis

could not generally be made. For one Mandal Fm. sample (3804 m) a tentative spore colour index of 5 - 5.5 was recorded.

In general, the Mandal Fm. samples appear to be the most promising source rocks but seem to be mainly gas prone. The remaining samples are only moderately favourable gas prone rocks.

GAS CHROMATOGRAPHY - MASS SPECTROMETRY

One sample from this well, 3804 m in the Mandal Fm., was analysed by GC - MS.

Saturated Hydrocarbons

Terpanes

The M/Z 163 fragmentogram shows only background material while the M/Z 177 fragmentogram shows only the peak of C_{29} αβ hopane. The M/Z 191 fragmentogram shows the tricyclics as minor compounds while the pentacyclic terpanes are dominant. The signal to noise ratio is rather high for this sample which might distort the pattern, there is a low relative abundance of C_{30} αβ hopane, as compared with the C_{31} - C_{35} components. The M/Z 205 fragmentogram shows only weak signals from the C_{31} 22R and S αβ hopane. The signals for the molecular ions are rather weak for this sample and interpretation based on these is therefore not undertaken.

Steranes

The M/Z 149 fragmentogram shows only one peak, with a retention time of approximately 25 minutes. The M/Z 189 fragmentogram shows the rearranged steranes, especially the C_{27} components, to be more abundant than the regular steranes. This is verified by the M/Z 259 fragmentogram, but this shows that the C_{29} is most abundant. This indicates an input of terrestrial matter in this sample. This is also seen in the M/Z 217 fragmentogram. In the M/Z 218 fragmentogram, the largest peak is one with a retention time of approximately 18 minutes. This is so dominant that it makes it difficult to evaluate the sterane pattern. The fragmento-

grams of the molecular ions verify what is discussed above, i.e. that the C_{27} rearranged steranes and the C_{29} regular steranes are the dominant peaks in the sample.

Bicyclanes

The M/Z 123, 179 and 193 fragmentograms show a series of peaks for the C_{15} and C_{16} bicyclanes, but the sample is so affected by evaporation during the work up that evaluation of these peaks are not undertaken.

Aromatic Hydrocarbons

Alkyl Benzenes

C_2-substituted benzenes show the typical pattern of doublets, together with a large single peak at approximately 42 minutes. In the M/Z 134 fragmentogram there are a large number of peaks which are difficult to interpret.

Naphthalenes

The M/Z 142 fragmentogram shows the doublet from the methyl naphthalenes, but a series of other peaks clearly shows that this sample is affected by evaporation, so comparison of the relative peak height of the two methylnaphthalenes will be incorrect. The M/Z 156 fragmentogram shows the typical pattern for the C_2 naphthalenes, while the C_3 naphthalenes are seen in the M/Z 170 fragmentogram. There is nothing of particular note in any of these patterns.

Phenanthrenes

The different phenanthrenes are seen in the M/Z 178, 192, 206 and 220 fragmentograms. The M/Z 178 fragmentogram shows the single peak for phenanthrene while the M/Z 192 shows the two doublets for methyl phenanthrenes. The 3+2 methyl phenanthrene doublet has an intensity of approximately 60 % of the intensity of the 1+9 methyl phenanthrene doublet. The C_2 phenanthrenes and C_3 phenanthrenes are seen in the M/Z 206 and 220 fragmentograms respectively. The patterns seen are normal for these compounds; there are no unusual features.

Benzothiophenes

The methyl dibenzothiophenes are recorded in the M/Z 198 fragmentogram where 4 methyl dibenzothiophene is the largest peak and 1 methyl dibenzothiophene is the smallest. This pattern is typical for well mature hydrocarbons. This is also the case for the pattern found for the C_2 dibenzothiophenes in the M/Z 212 fragmentogram.

Aromatic Steranes

In the M/Z 231 fragmentogram, the C_{20} and C_{21} triaromatic steranes dominate the pattern while the C_{26} - C_{28} components are minor. This shows a high maturity for this sample. The light components, i.e. the C_{21} and C_{22} monoaromatic steranes, are not as dominant relative to the C_{27} - C_{29} components, in the M/Z 253 fragmentogram. The two peaks are partly masked with some large unresolved envelopes, but the C_{21} component seems to have the same peak height as the largest of the peaks in the group of C_{27} - C_{29} components. These have a pattern often found for well mature Upper Jurassic samples.

CONCLUSIONS

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

1. Source Rock Potential

Cretaceous (3534 - 3791 m)

Cromer Knoll Group (3534 - 3791 m)

Valhall Formation (3607 - 3791 m)

The samples from the Valhall Formation consist mainly of a green-grey, olive-grey, medium to dark grey shale together with some grey-red interbedded shale. The analysed samples from this interval have very low TOC values. This, together with extremely low petroleum potential and hydrogen indices (where these could be measured), suggests that the kerogen is type IV. These data agree well with other data from thermal extraction/pyrolysis gas chromatography. There might be some kerogen type III/IV in some samples. Based on the available data, this interval is rated to have a very poor potential as a source rock for gas (if any hydrocarbon potential at all).

Jurassic (3791 - 4100 m)

Tyne Group (3791 - 3820 m)

Mandal Formation (3791 - 3820 m)

This interval consists of a black to brown-black shale with high TOC values, average 6.9 %. The petroleum potential is high for the analysed samples from the interval, average 20.6 mg HC/g rock. The hydrogen index is moderate (233 mg HC/g TOC), but with this interval having an oil window maturity, hydrocarbons have already been generated from the kerogen and thereby lowered the hydrogen indices. The kerogen is probably type II/III. This is confirmed by the pyrolysis - gas chromatography data which shows an abundance of alkane/alkene doublets typical for kerogen type II, but also some aromatic compounds, typical for terrestrial input, - a mixture of kerogen type II/III is therefore also suggested from these data. The samples have a large amount of EOM while the percentage of extractable hydrocarbons is low. This would normally suggest a low maturity, but since this is not the case, it would appear that the hydrocarbons have been removed from the samples while the non-hydrocarbons are left behind. The gas chromatograms of the saturated hydrocarbons show a relatively large percentage of high molecular hydrocarbons, indicating some input of terrestrial kerogen. On the whole, the gas chromatograms support the suggestion that the hydrocarbons have been generated from a mixture of kerogen type II/III. Based on the analytical data, the Mandal Fm. has a rich potential as a source rock for oil and gas.

Vestland Group (3820 - 4100 m)

Ula I Formation (3820 - 3874 m)

A sandstone formation. Due to the quality and amount of samples, none of these were analysed.

Farsund Formation (3874 - 3890 m)

The log from the NPD shows that this is a siltstone formation, but there was hardly any siltstone in the samples. The most abundant material in all of the samples was a light grey to dark grey shale, which was analysed. These samples have extremely low TOC values (0.3 %) and low petroleum potentials. In most of the analysed samples the S_2 peak can not be detected and hydrogen indices can therefore not be calculated. One sample has a hydrogen index of 162. Analysis by pyrolysis gas chromatography shows that the samples contain either kerogen type III or III/IV.

As explained above, there is some uncertainty as to the true lithology of this formation, but the analysed samples contain kerogen type IV or III/IV, with a very poor, or no, potential as a source rock for gas.

Haugesund Formation (3898 - 3966 m)

There is a similar situation for this formation as for the Farsund Formation. Most of the samples from this interval consist of a medium grey to dark grey shale with small percentages of siltstone (normally insufficient to analyse). Generally the shale has a low TOC content (0.3 %), with the exception of the lowermost sample (which has a TOC content of 1.5 %). One siltstone sample was analysed, this has a TOC content of 1.0 %. The petroleum potential is low for all the analysed samples, independent of lithology, and the low hydrogen indices show that the shale samples contain kerogen type IV or III/IV. The siltstone also contains kerogen type III/IV. The thermal extraction/pyrolysis gas chromatography analyses show that some of the samples contain free hydrocarbons. The pyrogram from these samples show alkane/alkene doublets typical for kerogen type II. This might be from asphaltenes in the samples.

Based on the limited data, the Haugesund Fm. is found to have a very poor potential as a source rock for gas.

Ula II Formation (3966 - 3990 m)

A sandstone formation with no source rock potential.

Bryne Formation (3990 - 4015 m)

The samples from this formation consist mainly of a medium grey to dark grey shale with very low TOC values, average 0.3 %. The petroleum potential is also extremely low and some of the samples do not show any S_2 peak. This indicates a kerogen type IV in this interval, which agrees with the pyrolysis gas chromatography data.

Based on these data the Bryne Fm. is found to have a very poor, or no, potential as a source rock for gas.

Skagerrak/Gassum Formation (4015 - 4219 m)

The main lithology of this interval is a medium grey to dark grey shale with low TOC values, average 0.4 % over the interval. The petroleum potential is low for the analysed samples and a number of these do not show any S_2 peak. The hydrogen indices are low where they can be measured, implying the presence of kerogen type IV. This agrees with the pyrolysis - gas chromatography data which shows only a few aromatic peaks. Based on the analytical data the Skagerrak/Gassum Fm. has a very poor, or no, potential as a source rock for gas.

Zechstein (4219 - 4297 m)

The NPD log reports that this interval is anhydrite. The anhydrite was not analysed, but the samples from the lower 25 m contained mainly a siltstone - this was analysed. The siltstone has high TOC values, average 3.1 %. The petroleum potential is, however, low and hydrogen indices of approximately 40 mg HC/g TOC indicate kerogen type IV. The pyrolysis - gas chromatography data indicate that the samples contain some poor kerogen type III/IV.

Based on these data, the siltstone from 4272 - 4297 m has a poor potential as a source rock for gas, while the anhydrite does not have any source rock potential.

2. Generation and Migration

The different analyses show only two intervals which might contain generated hydrocarbons - the Mandal Fm. and parts of the Haugesund Fm.. The Mandal Fm. has a type of kerogen and a maturity which will generate hydrocarbons. The data are, however, strange. The extraction data show that the extract mainly contains non-hydrocarbons which would indicate that the sample is either immature or that the hydrocarbons have disappeared. The maturity data shows that the interval is mature, so the second explanation is therefore more likely. This agrees with the thermal extraction - gas chromatographic data which shows hydrocarbon distributions normally found for residual oil in reservoirs which have been depleted due to gas flooding. This might be the situation here, i.e. if the Ula I Fm. contained gas, this will have leaked through the cap rock (Mandal Fm.) and removed the hydrocarbons. Presently we do not have any other explanation for the strange data.

Parts of the Haugesund Fm. show hydrocarbons generated from kerogen type II or II/III. This does not fit with the

kerogen in the analysed samples and would therefore indicate that the hydrocarbons are migrated. However, the amount in question is very small.

3. Maturity

The maturity data for this well are strange. The samples from Tertiary and Cretaceous show a normal trend - rating these as immature, increasing to mature for the lower part of the Cretaceous sequence. Rock-Eval pyrolysis data suggests that the Mandal Fm. has an oil window maturity, while the vitrinite reflectance data show a slightly lower maturity, approximately 0.6 %. This is probably low, due to staining.

The samples from the rest of the well are so poor that Rock-Eval data can not be used. Vitrinite reflectance data shows a large jump in maturity between the Haugesund Fm. and Skagerrak/Gassum Fm. (0.7 % to 1.0 %). This can be due either to a wrong measurement for the Haugesund Fm. (i.e. it should be higher) or that there has been a strong erosion. The maturity of 0.7 % at 3900 m correlates with other wells in the area and it is therefore believed that there has been an erosion.

Based on the different data, the Mandal Fm. has an early oil window maturity, while the Skagerrak/Gassum Fm. is past peak oil generation.

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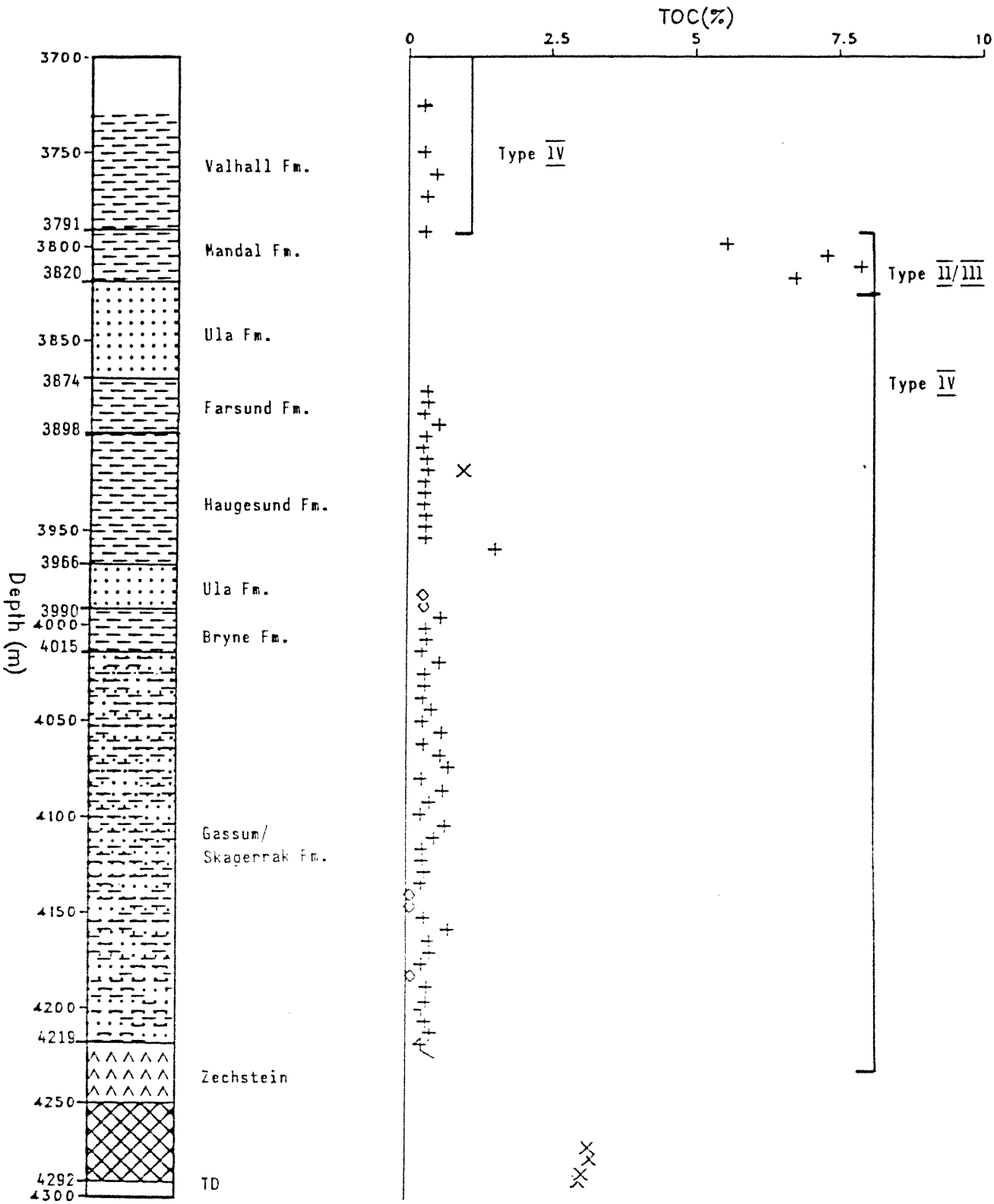
Figure: 1

Client: VARIOUS

TOC Data for Well NOCS 2/1–3



+ Shales
X Siltstones
O Coals
▷ Carbonates
◇ Sandstones
⊠ Anhydrite

Figure: 2

Client: VARIOUS

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Production Index Data for Well NOCS 2/1–3

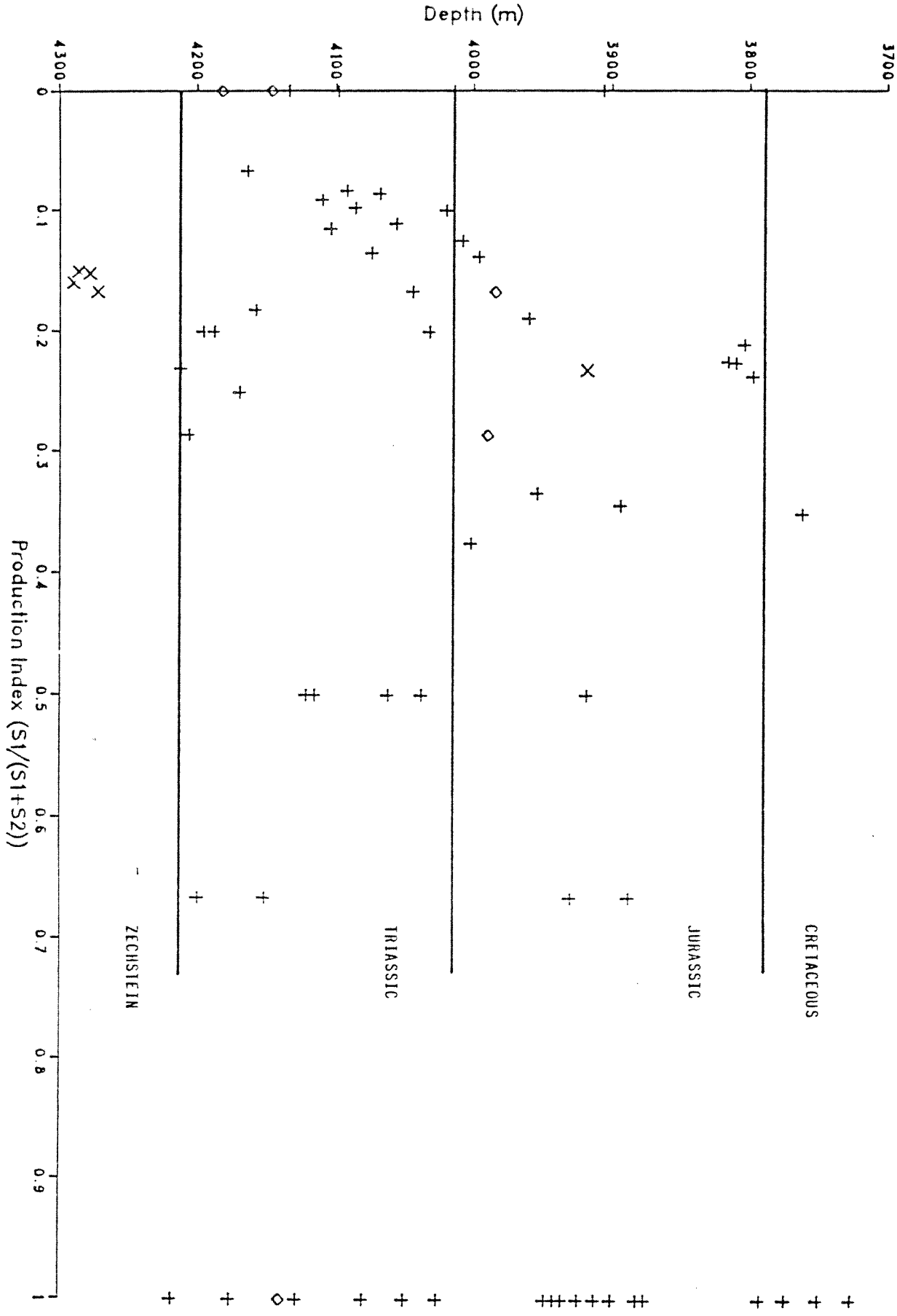
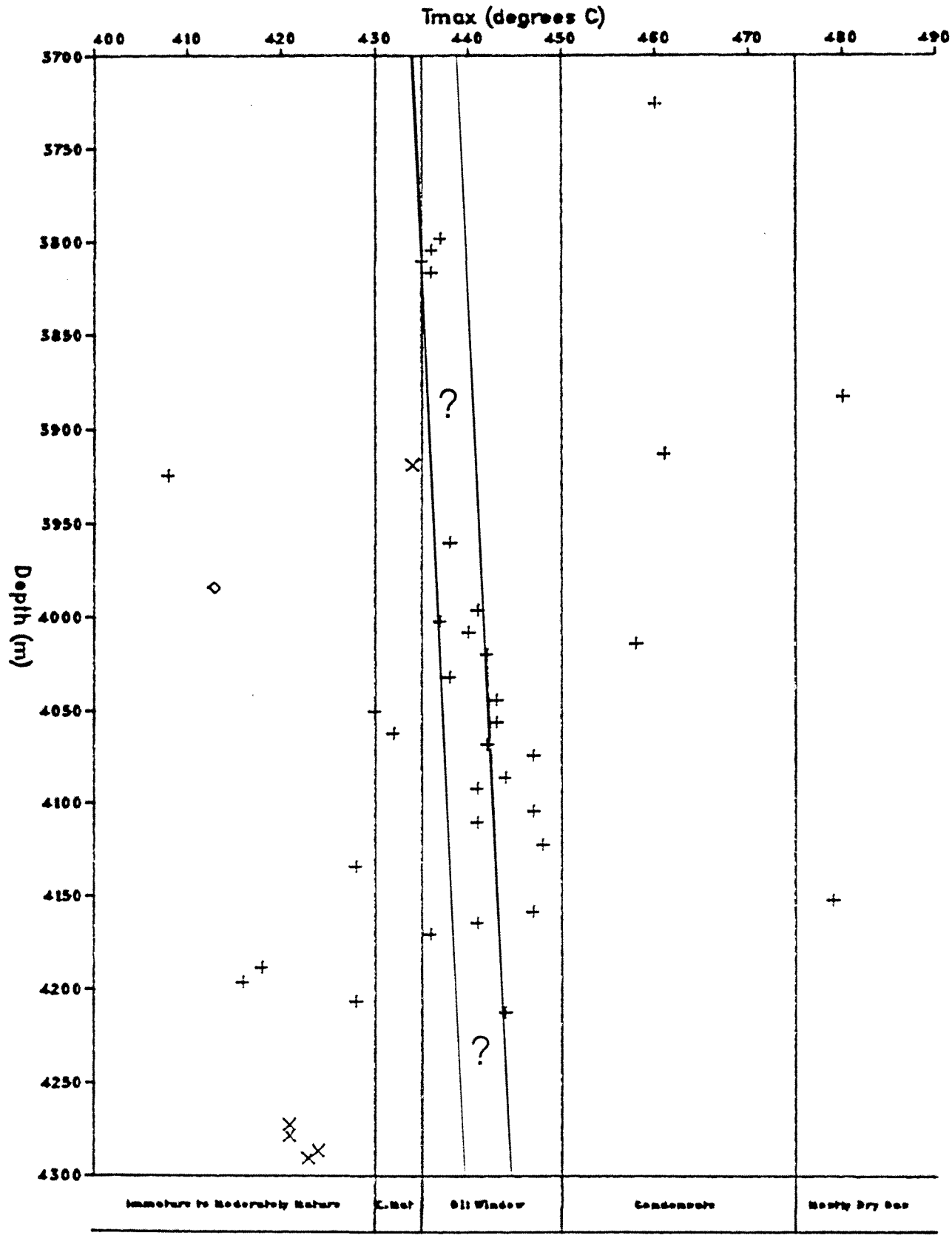
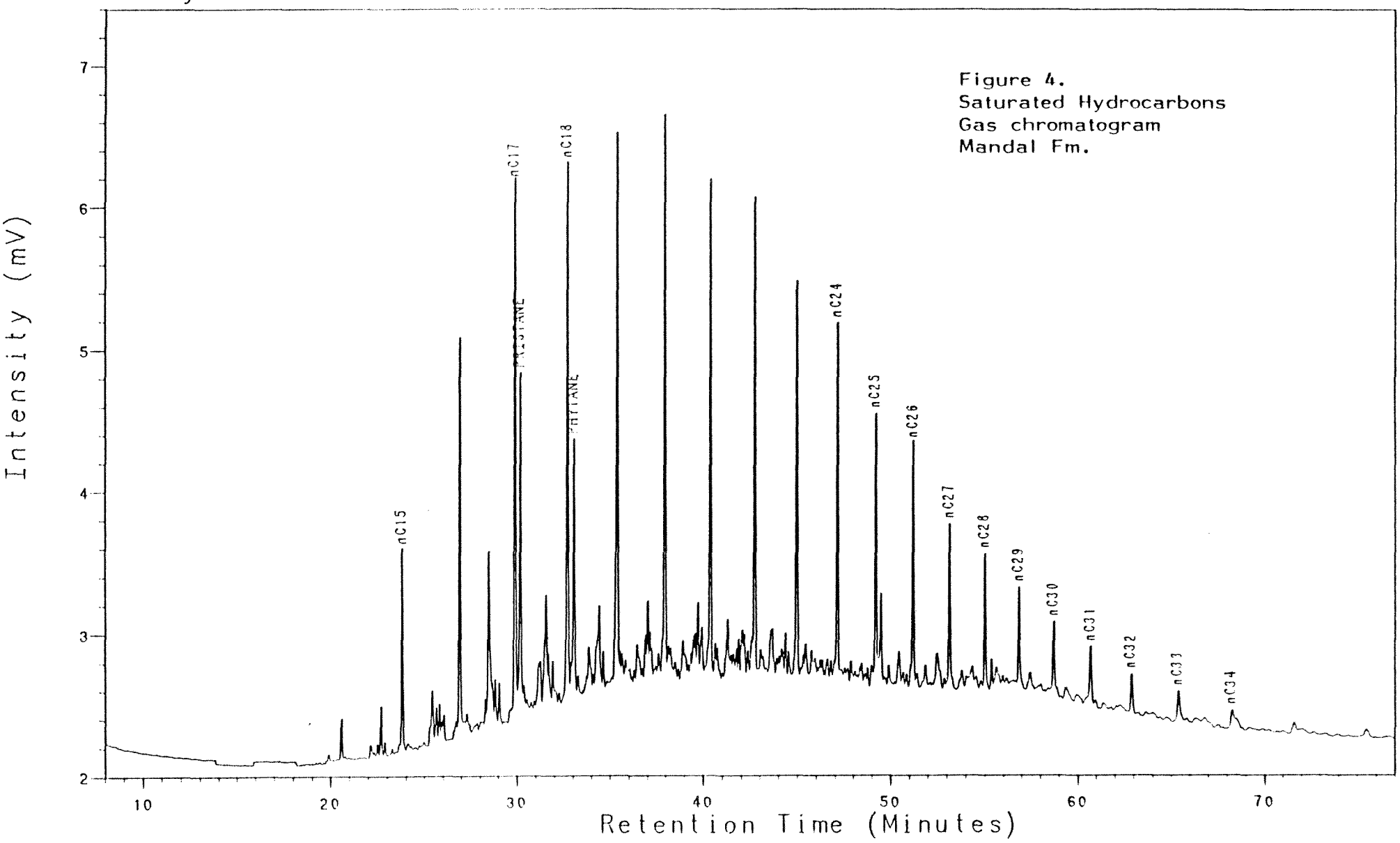


Figure: 3 Client: VARIOUS

Tmax Data for Well NOCS 2/1–3





NOCS 2/1-3 3816m
SATURATED GC
Composite sample

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Analysis AC131320B 8, 1, 1 2/1-3, 3816m, ARO

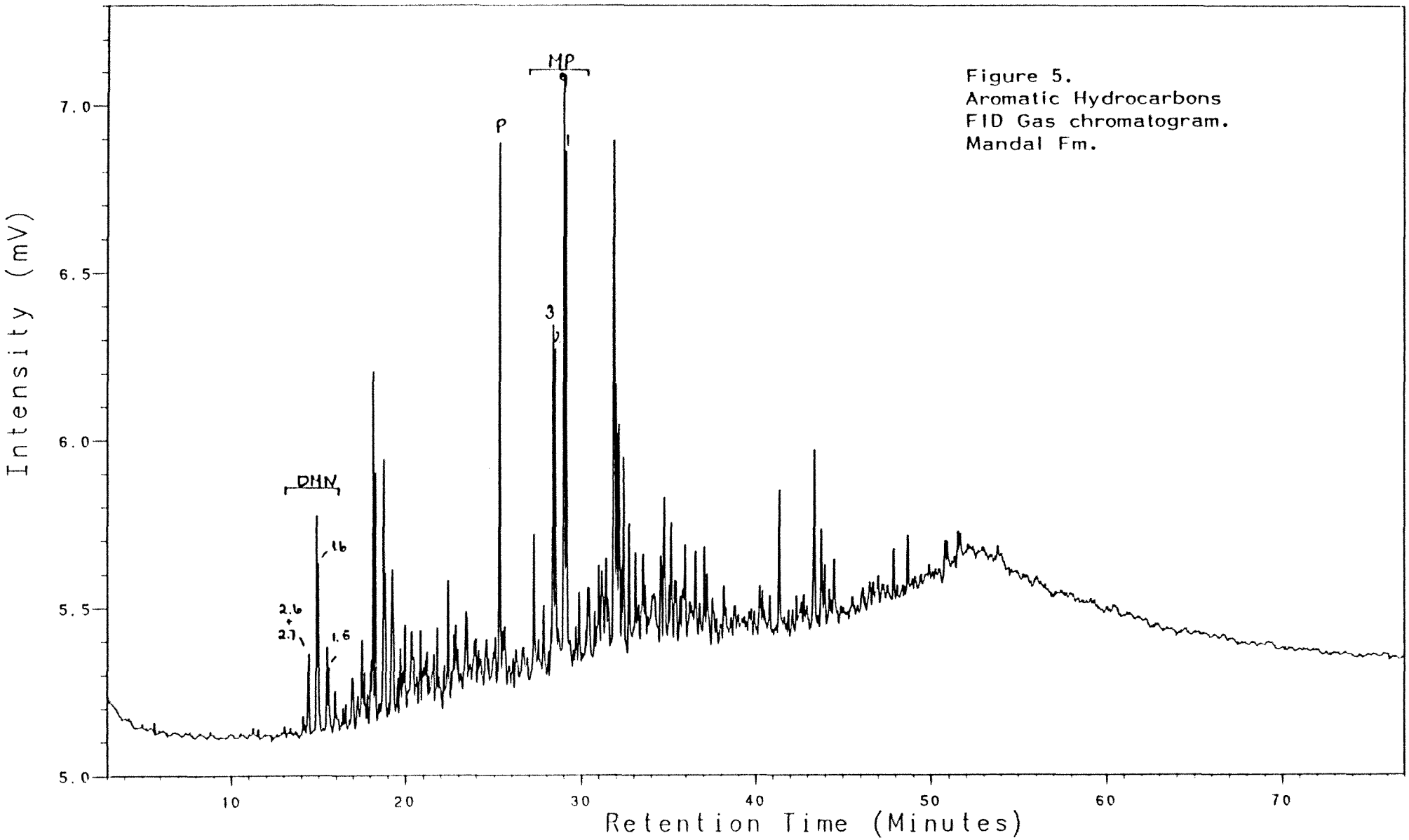

Figure 5.
Aromatic Hydrocarbons
FID Gas chromatogram.
Mandal Fm.

NOCS 2/1-3 3816m
AROMATIC GC (FID)
Composite sample

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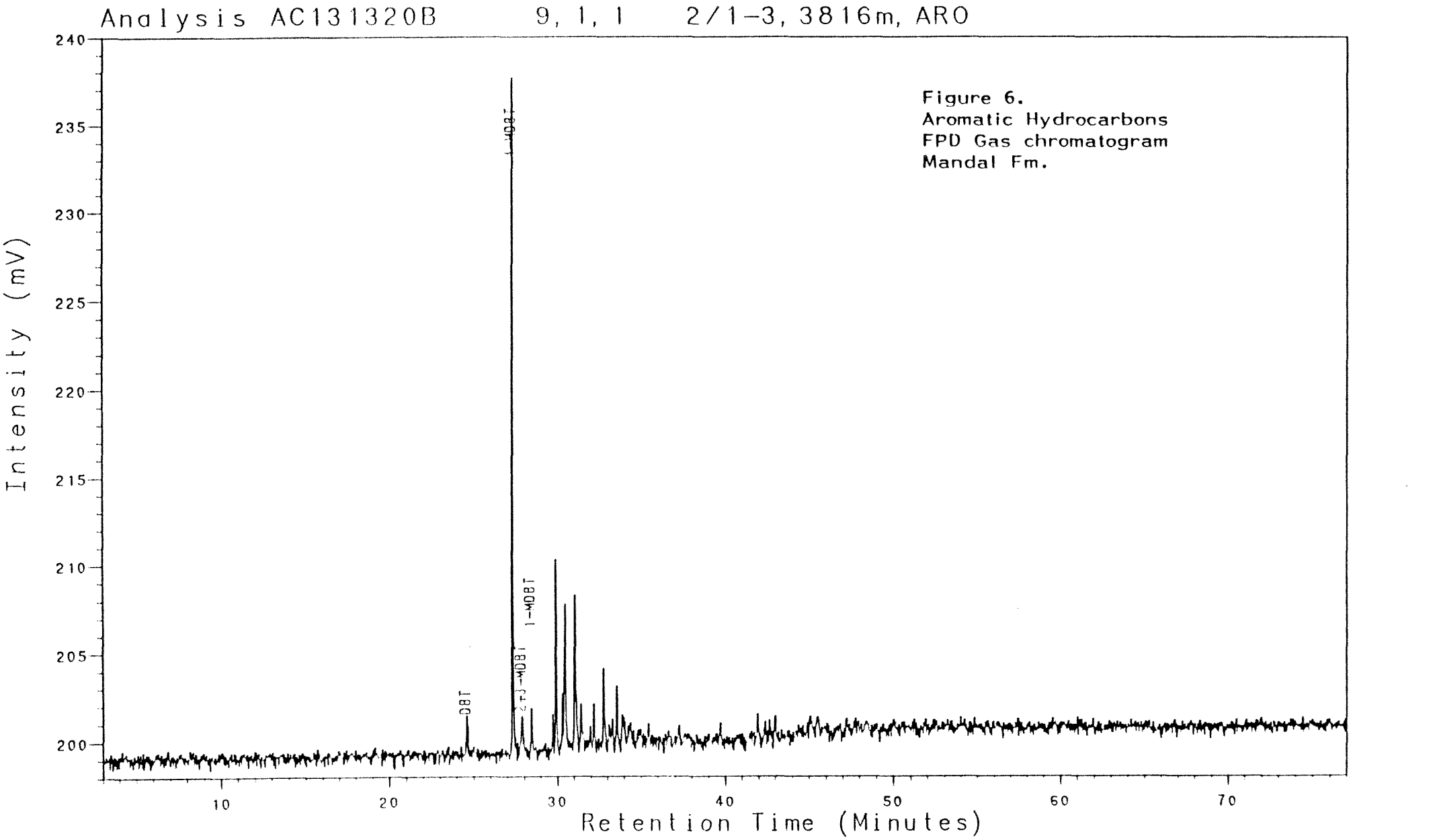

Figure 6.
Aromatic Hydrocarbons
FPD Gas chromatogram
Mandal Fm.

NOCS 2/1-3 3816m
AROMATIC GC (FPD)
Composite sample

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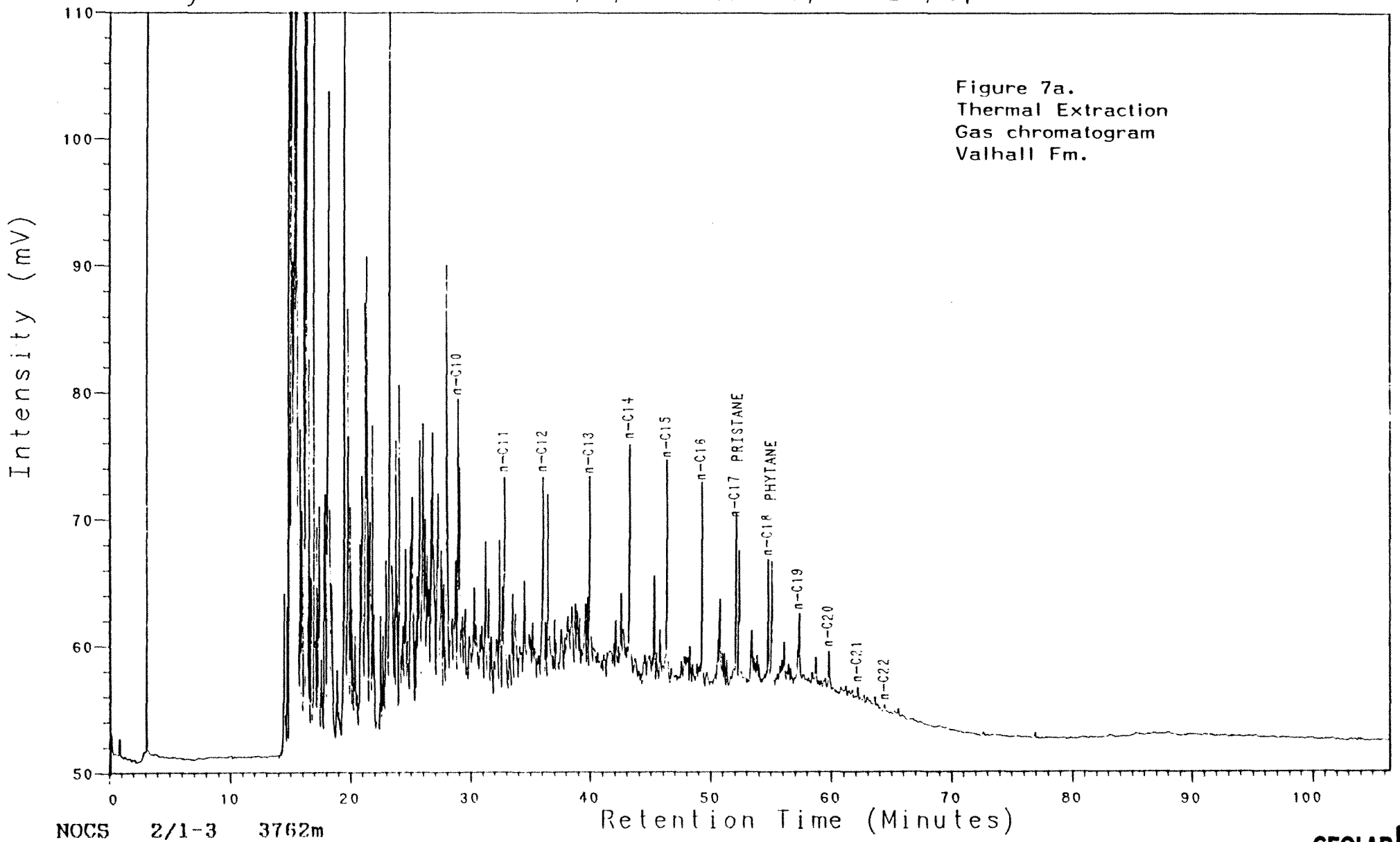

Figure 7a.
Thermal Extraction
Gas chromatogram
Valhall Fm.

NOCS 2/1-3 3762m
THERMAL EXTRACTION GC (S1)
CLST:ol gy,m gy to drk gy

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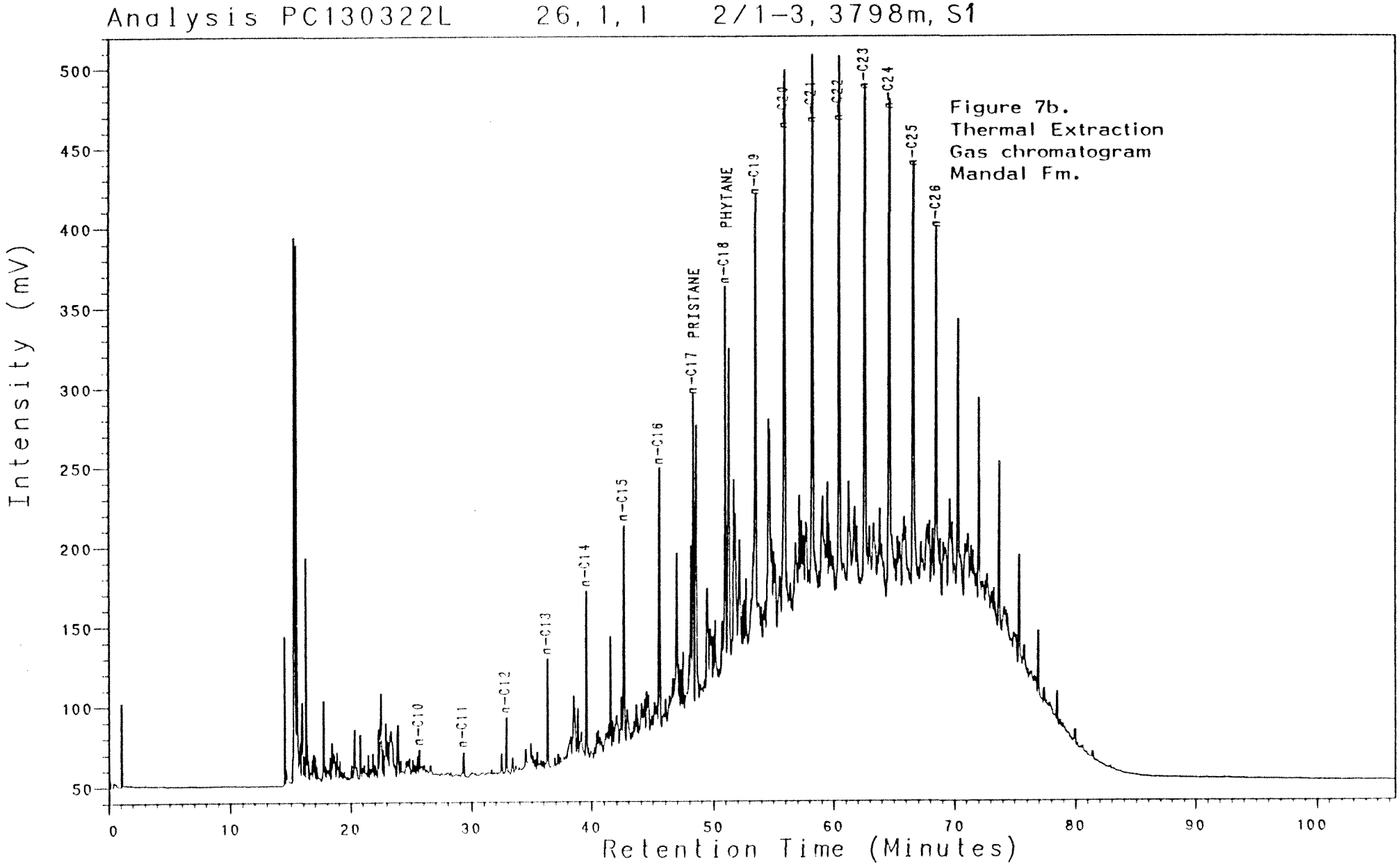

Figure 7b.
Thermal Extraction
Gas chromatogram
Mandal Fm.

NOCS 2/1-3 3798m
THERMAL EXTRACTION GC (S1)
CLST: blk to brn blk

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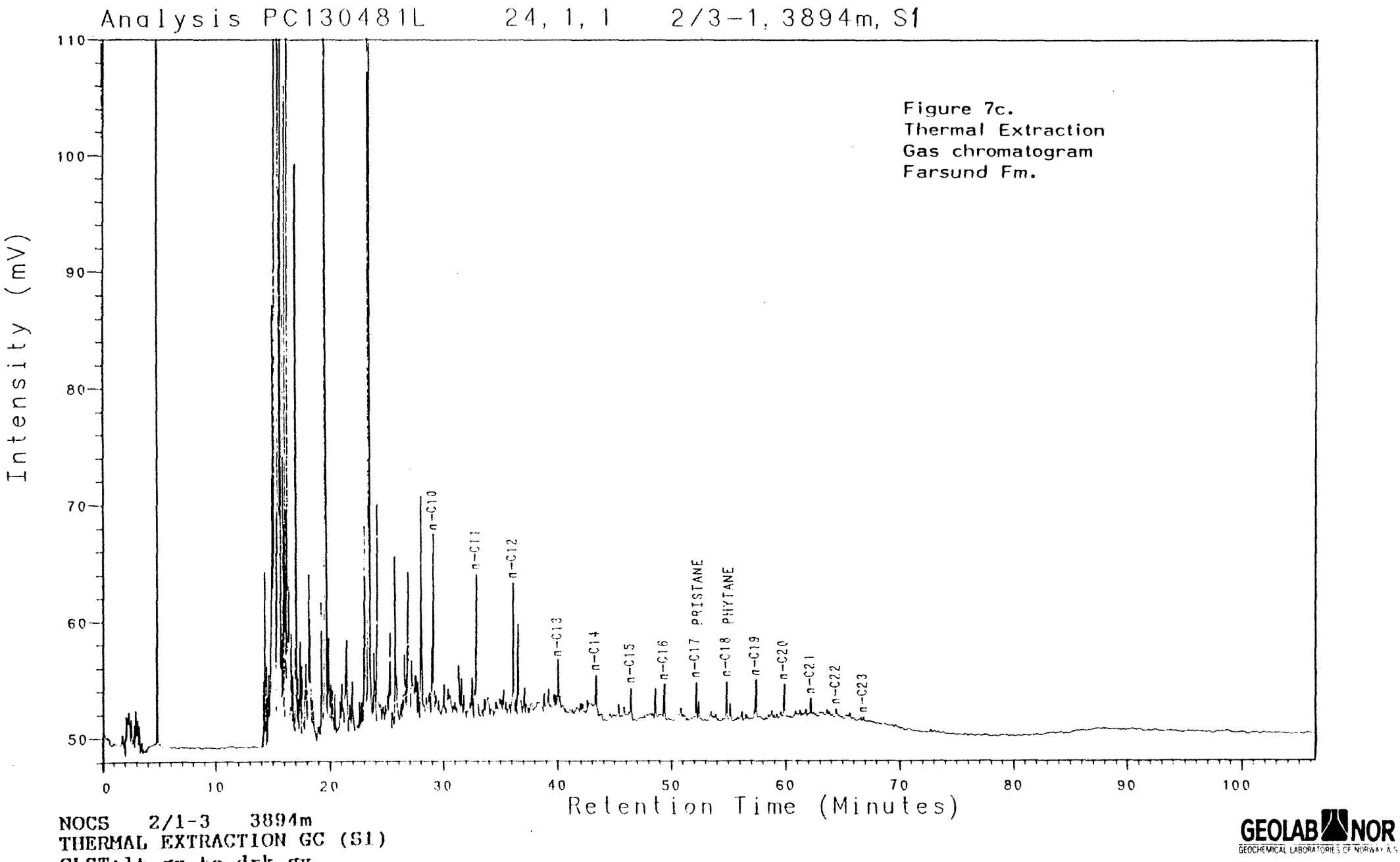

Figure 7c.
Thermal Extraction
Gas chromatogram
Farsund Fm.

NOCS 2/1-3 3894m
THERMAL EXTRACTION GC (S1)
CLST: lt gy to drk gy

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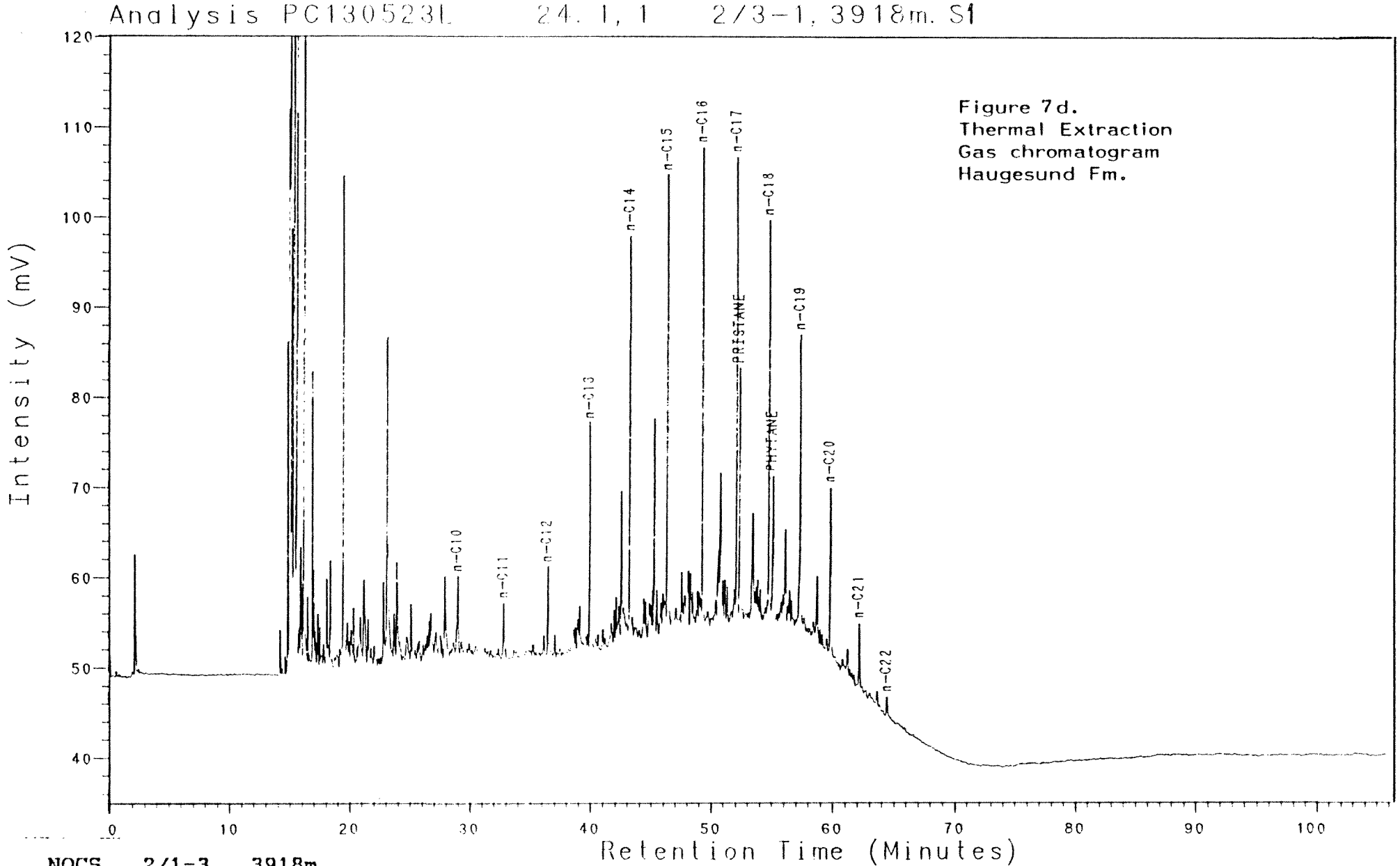

Figure 7d.
Thermal Extraction
Gas chromatogram
Haugesund Fm.

NOCS 2/1-3 3918m
THERMAL EXTRACTION GC(S1)
CLST:lt gy to m gy

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Analysis PC13065IL 24, 1, 1 2/1-3, 3996m, S1

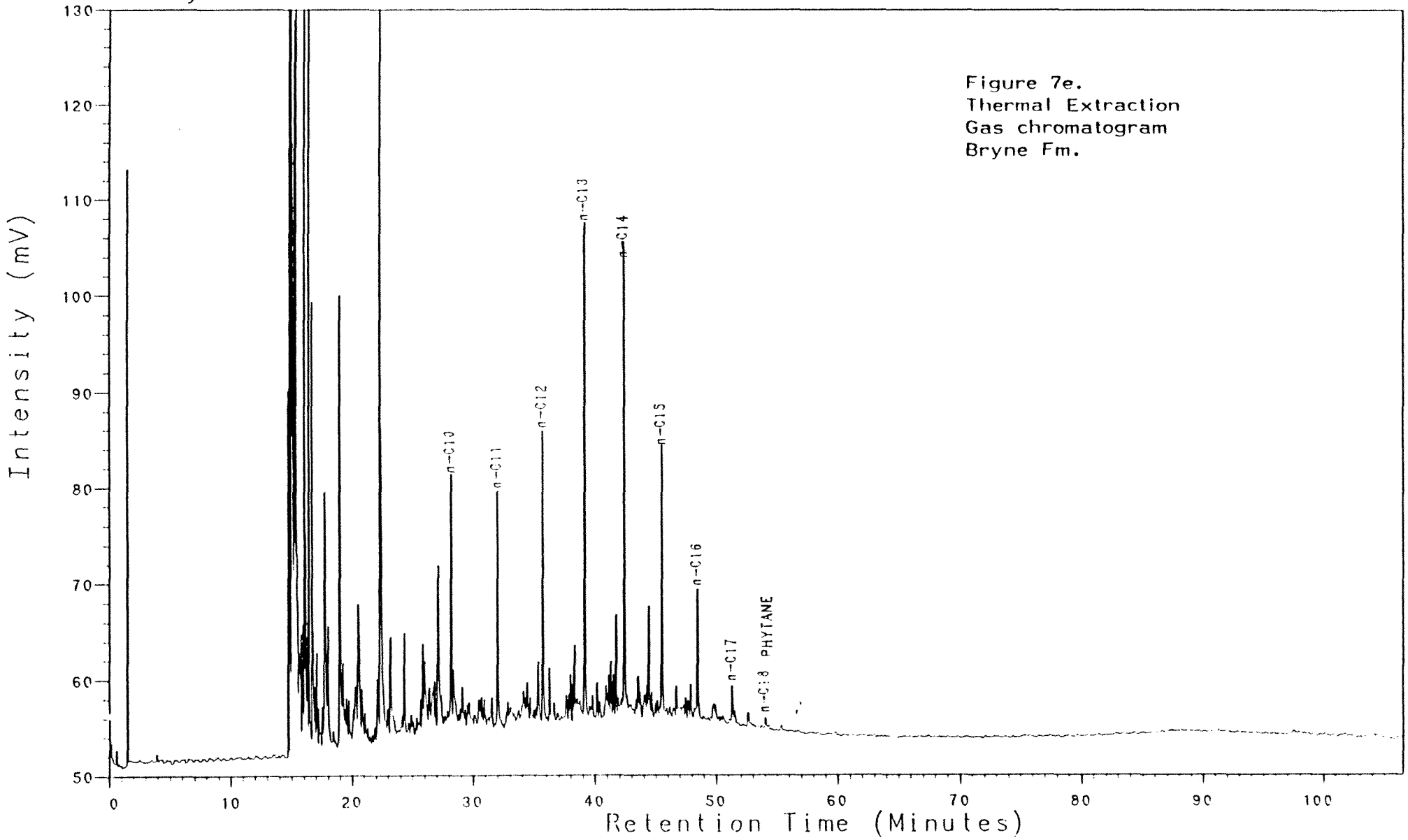

Figure 7e.
Thermal Extraction
Gas chromatogram
Bryne Fm.

NOCS 2/1-3 3996m
THERMAL EXTRACTION GC (S1)
CLST: m gy to drk gy

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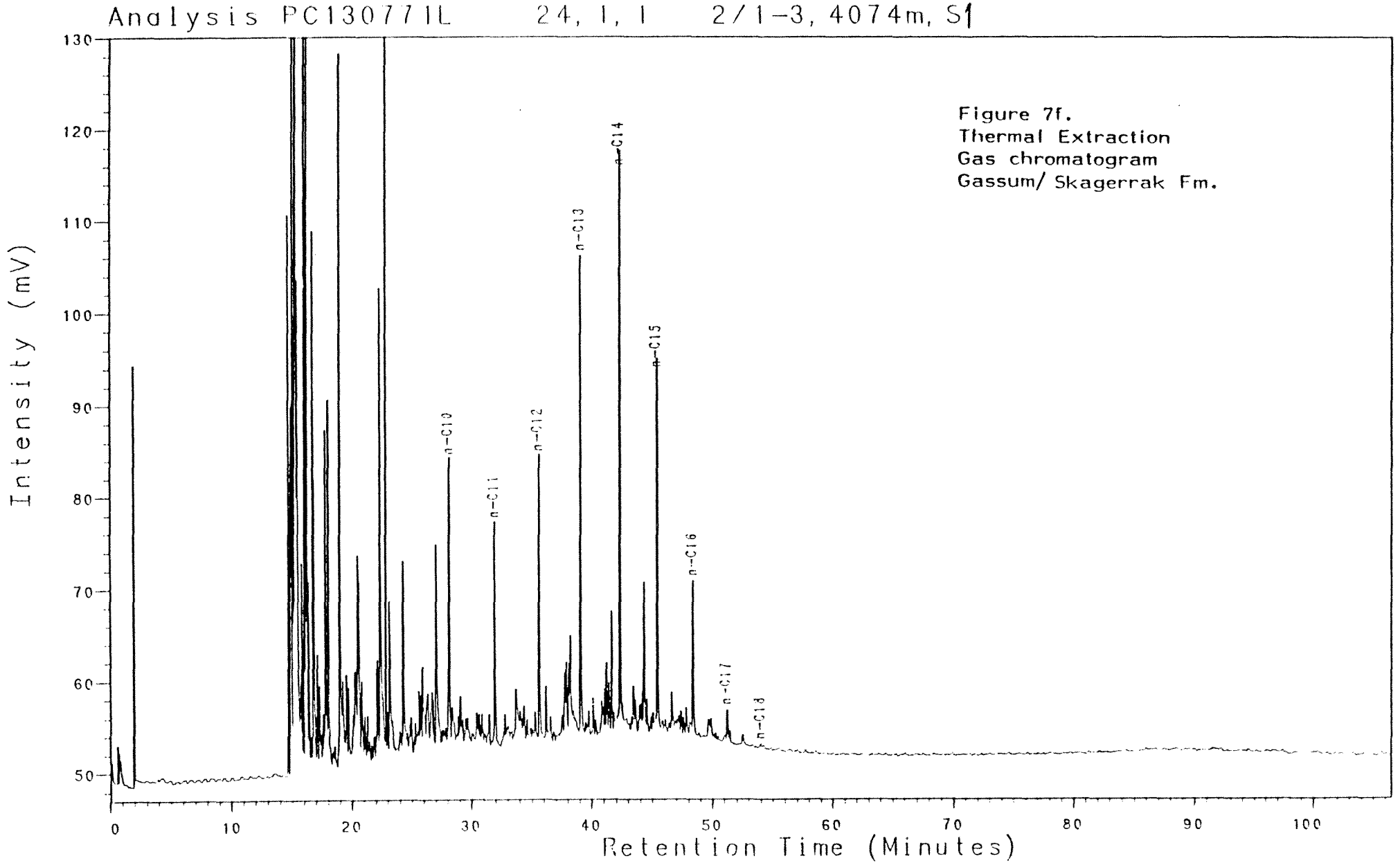

Figure 7f.
Thermal Extraction
Gas chromatogram
Gassum/ Skagerrak Fm.

NOCS 2/1-3 4074m
THERMAL EXTRACTION GC (S1)
CLST: blk, ol gy, ol blk, m gy,
drk gy

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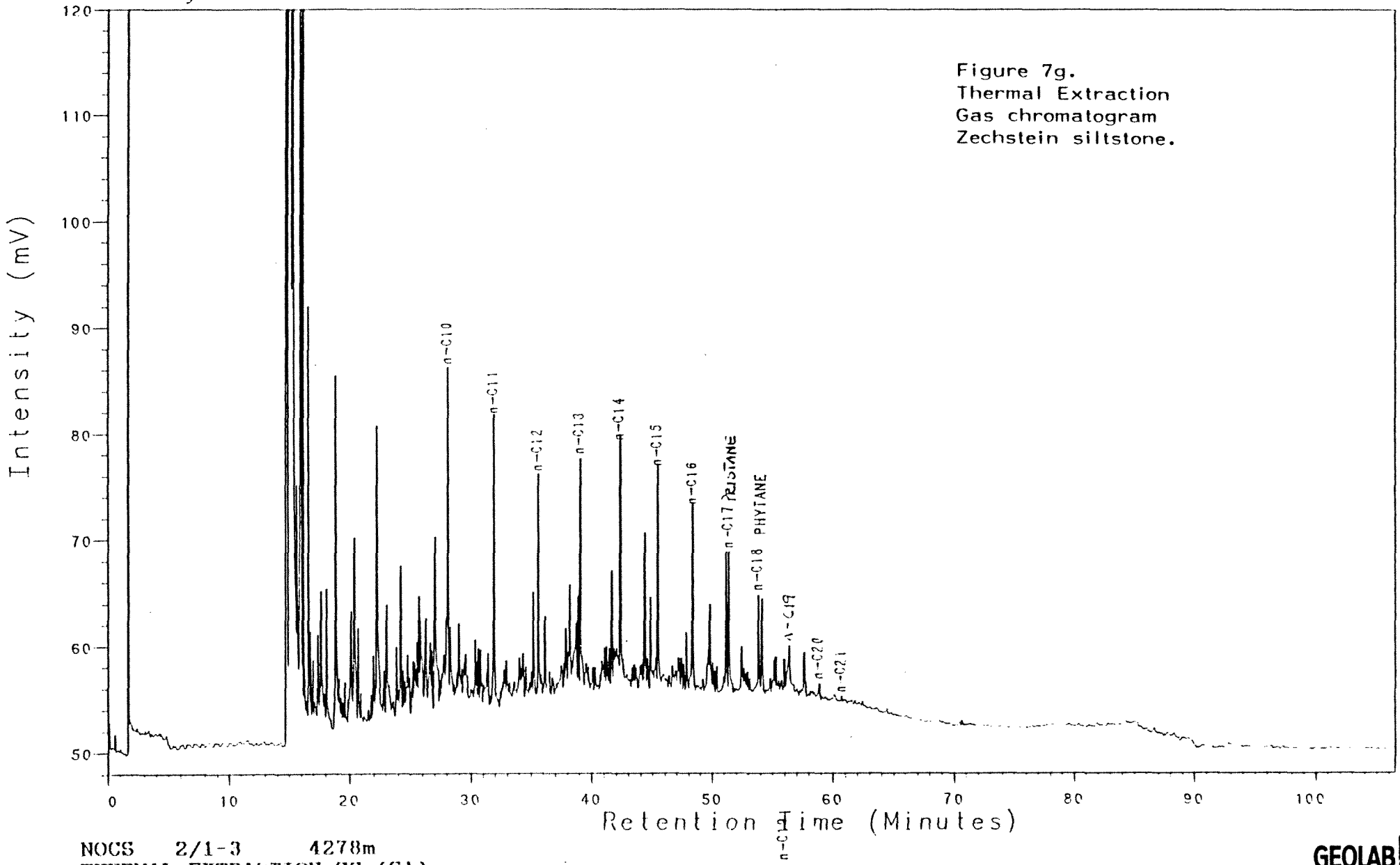

Figure 7g.
Thermal Extraction
Gas chromatogram
Zechstein siltstone.

NOCS 2/1-3 4278m
THERMAL EXTRACTION GC (S1)
SLTST: brn gy

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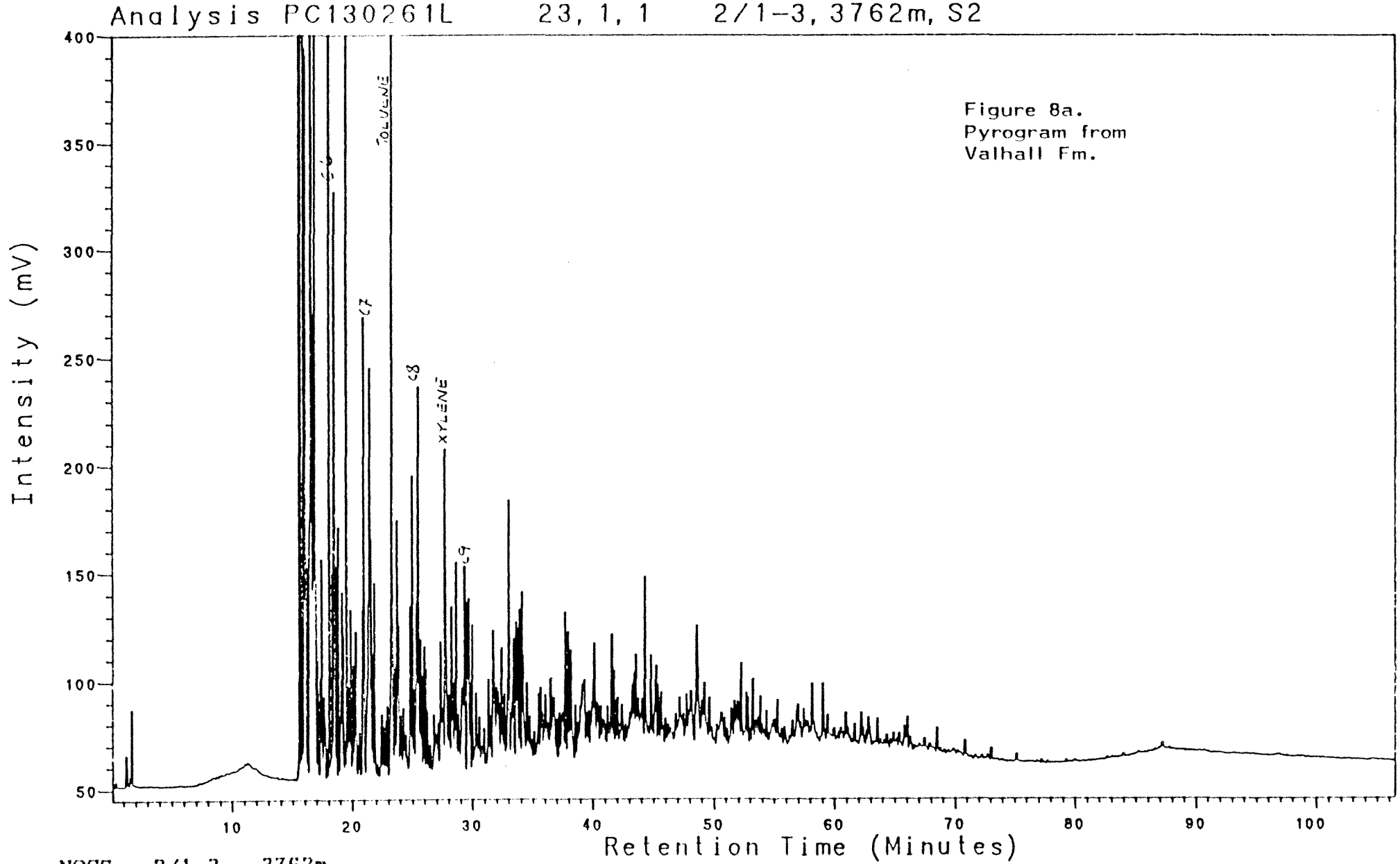

Figure 8a.
Pyrogram from
Valhall Fm.

NOCS 2/1-3 3762m
PYROLYSIS GC (S2)
CLST:ol gy,m gy to drk gy

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GEOCHEMICAL LABORATORIES OF NORWAY A.S

Analysis PC130322L 25, 1, 1 2/1-3, 3798m, S2

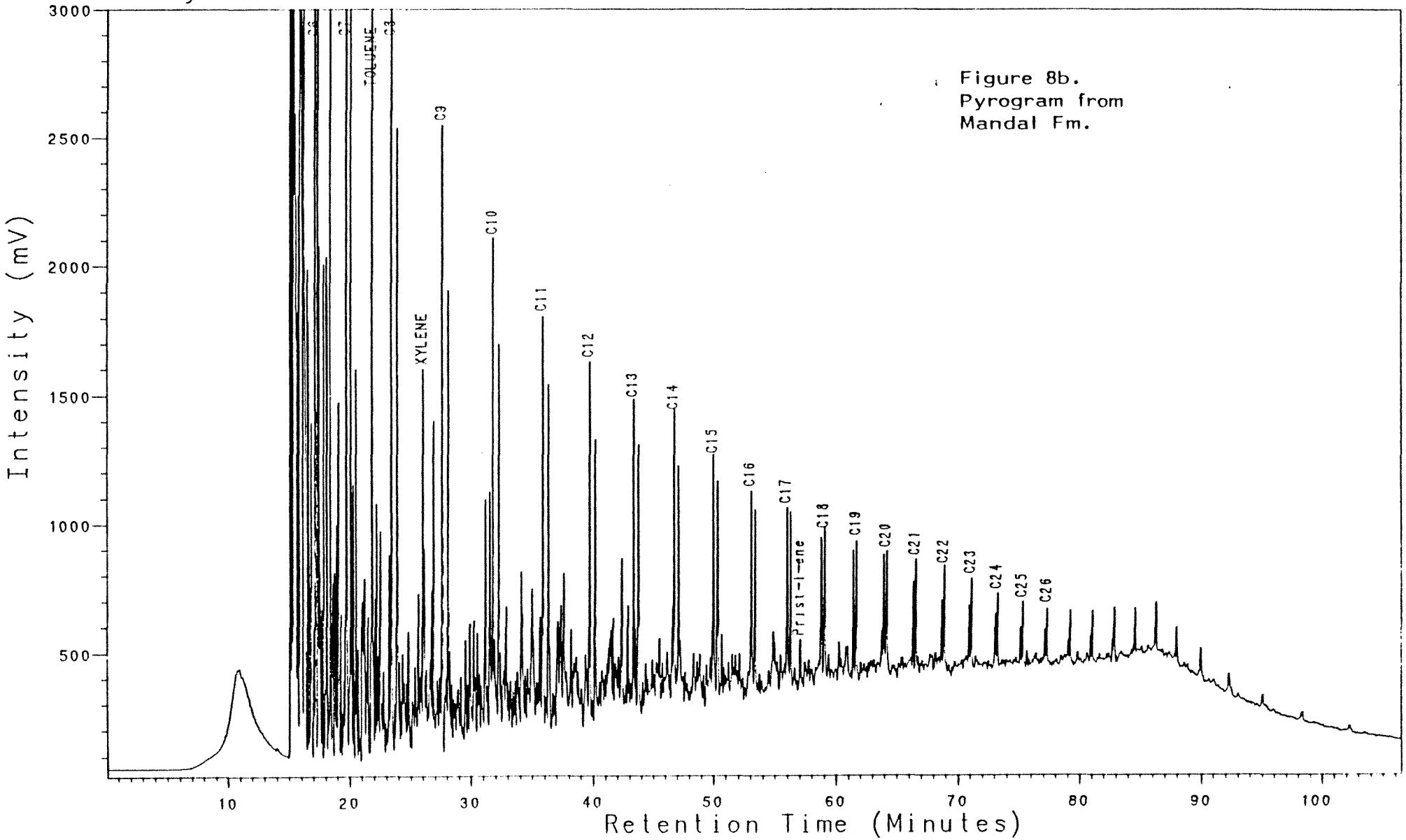

Figure 8b.
Pyrogram from
Mandal Fm.

NOCS 2/1-3 3798m
PYROLYSIS GC (S2)
CLST:blk to brn blk

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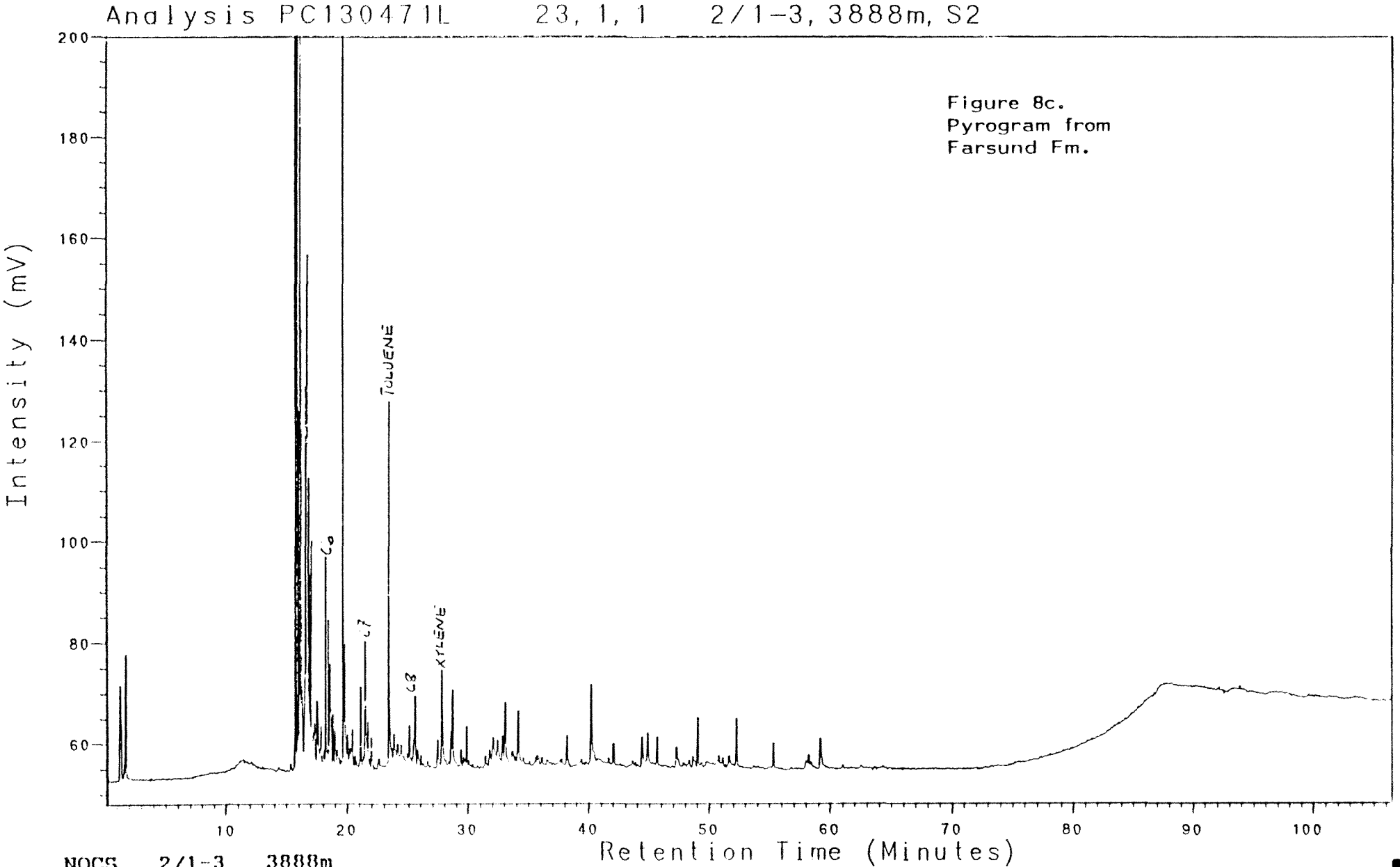

Figure 8c.
Pyrogram from
Farsund Fm.

NOCS 2/1-3 3888m
PYROLYSIS GC (S2)
CLST: lt gy to drk gy

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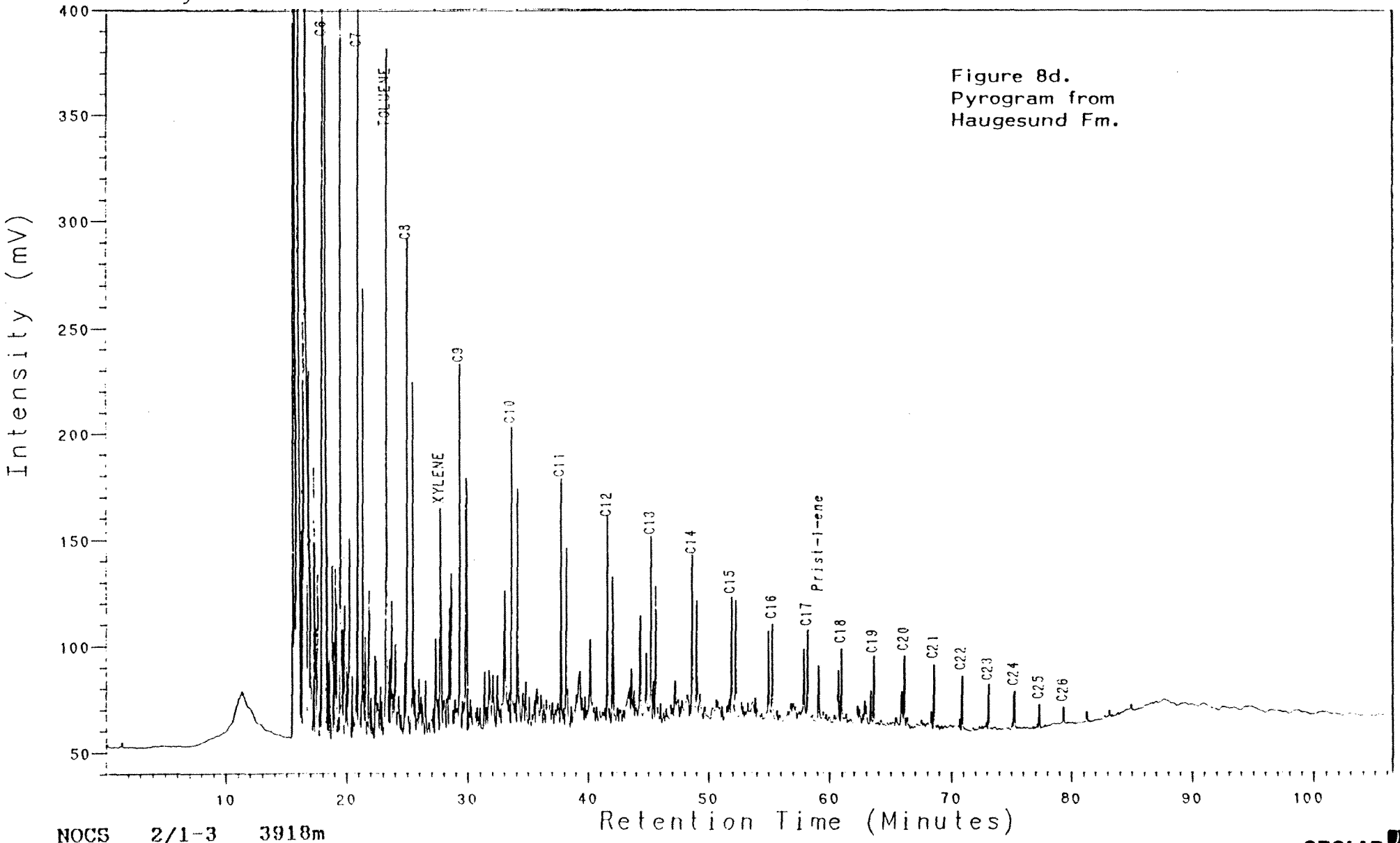

Figure 8d.
Pyrogram from
Haugesund Fm.

NOCS 2/1-3 3918m
PYROLYSIS GC (S2)
CLST:lt gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

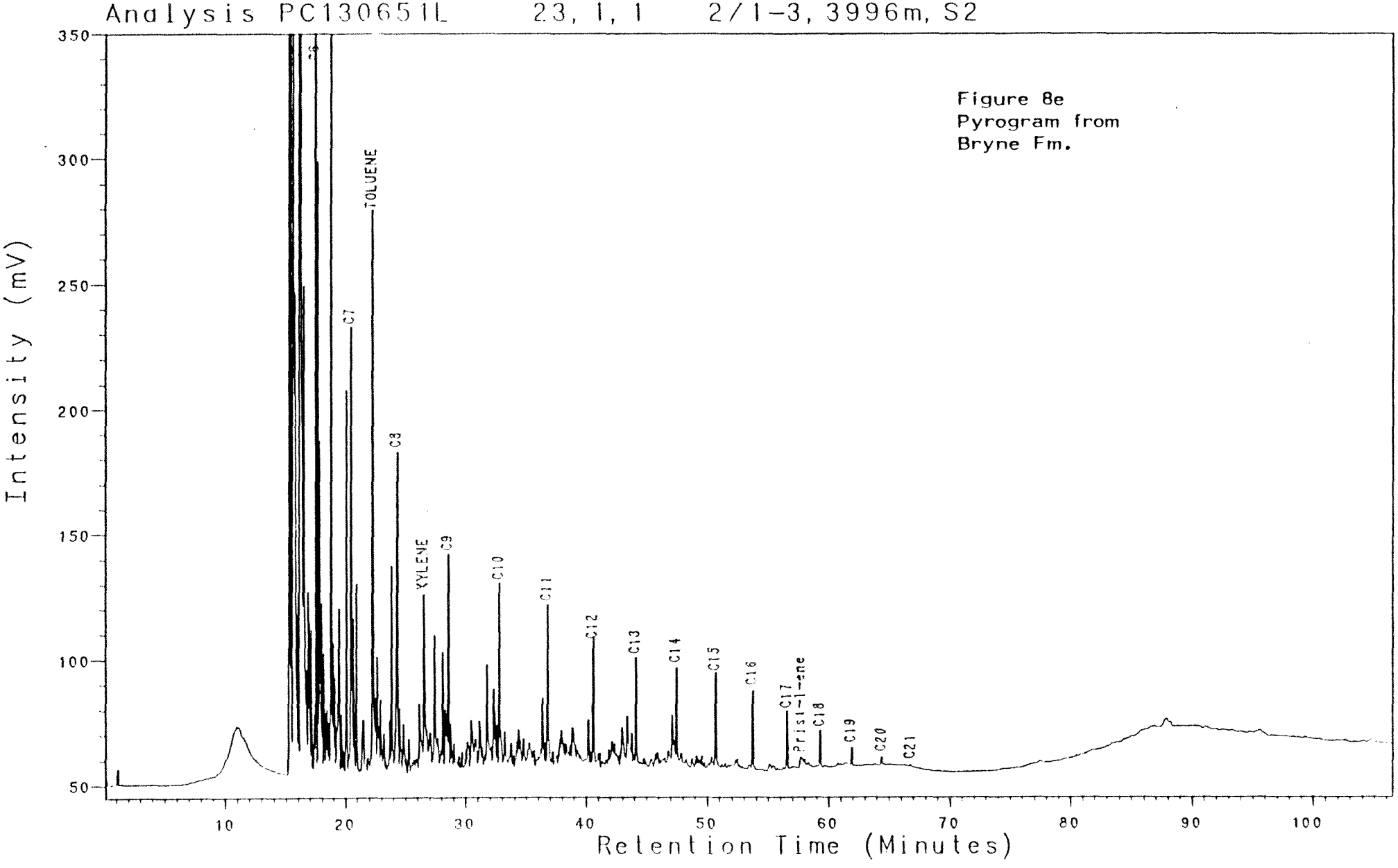

Figure 8e
Pyrogram from
Bryne Fm.

NOCS 2/1-3 3996m
PYROLYSIS GC (S2)
CLST: m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A.S

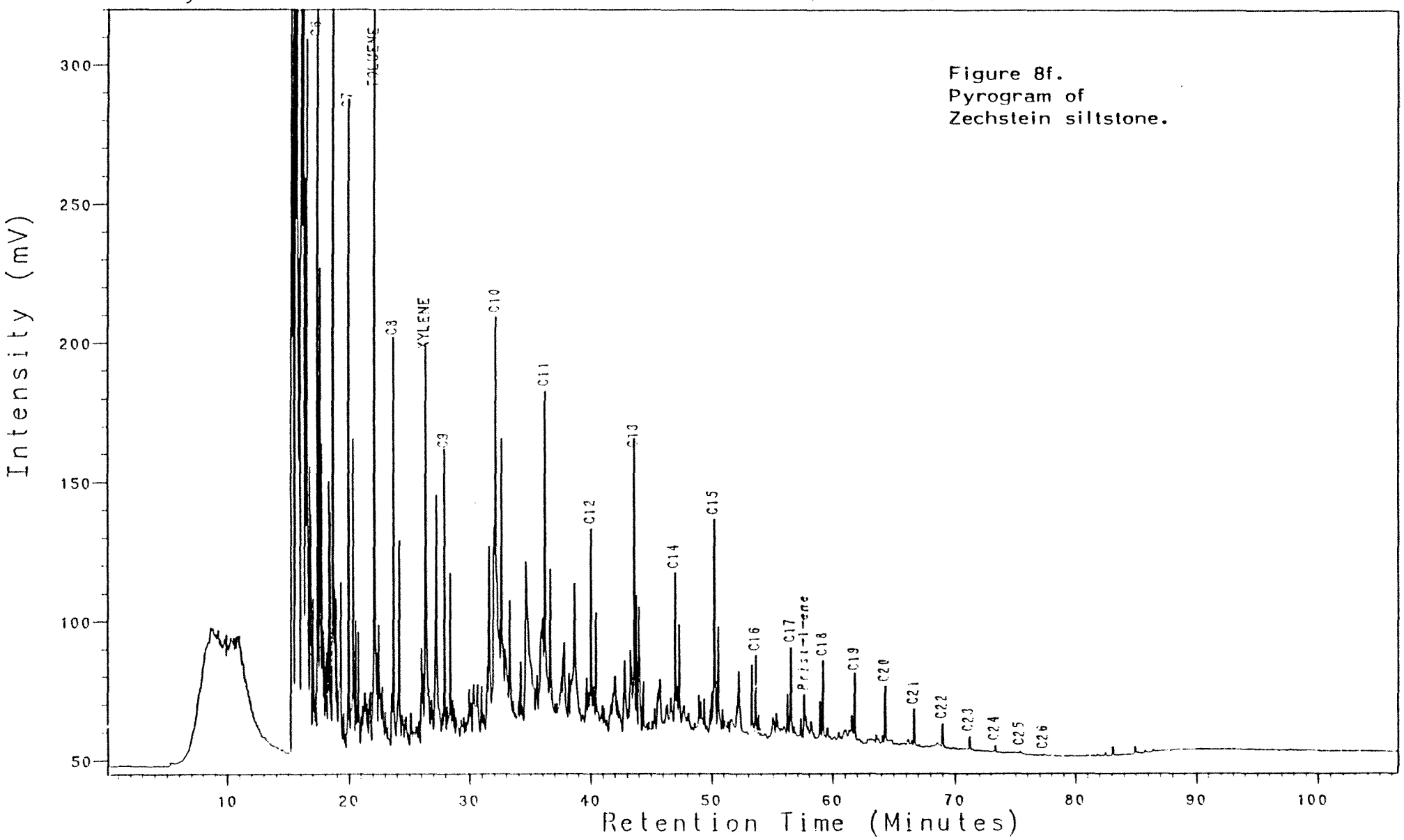

Figure 8f.
Pyrogram of
Zechstein siltstone.

NOCS 2/1-3 4272m
PYROLYSIS GC (S2)
SLTST: brn gy

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Figure 9: Vitrinite Reflectance versus Depth
Well NOCS 2/1–3

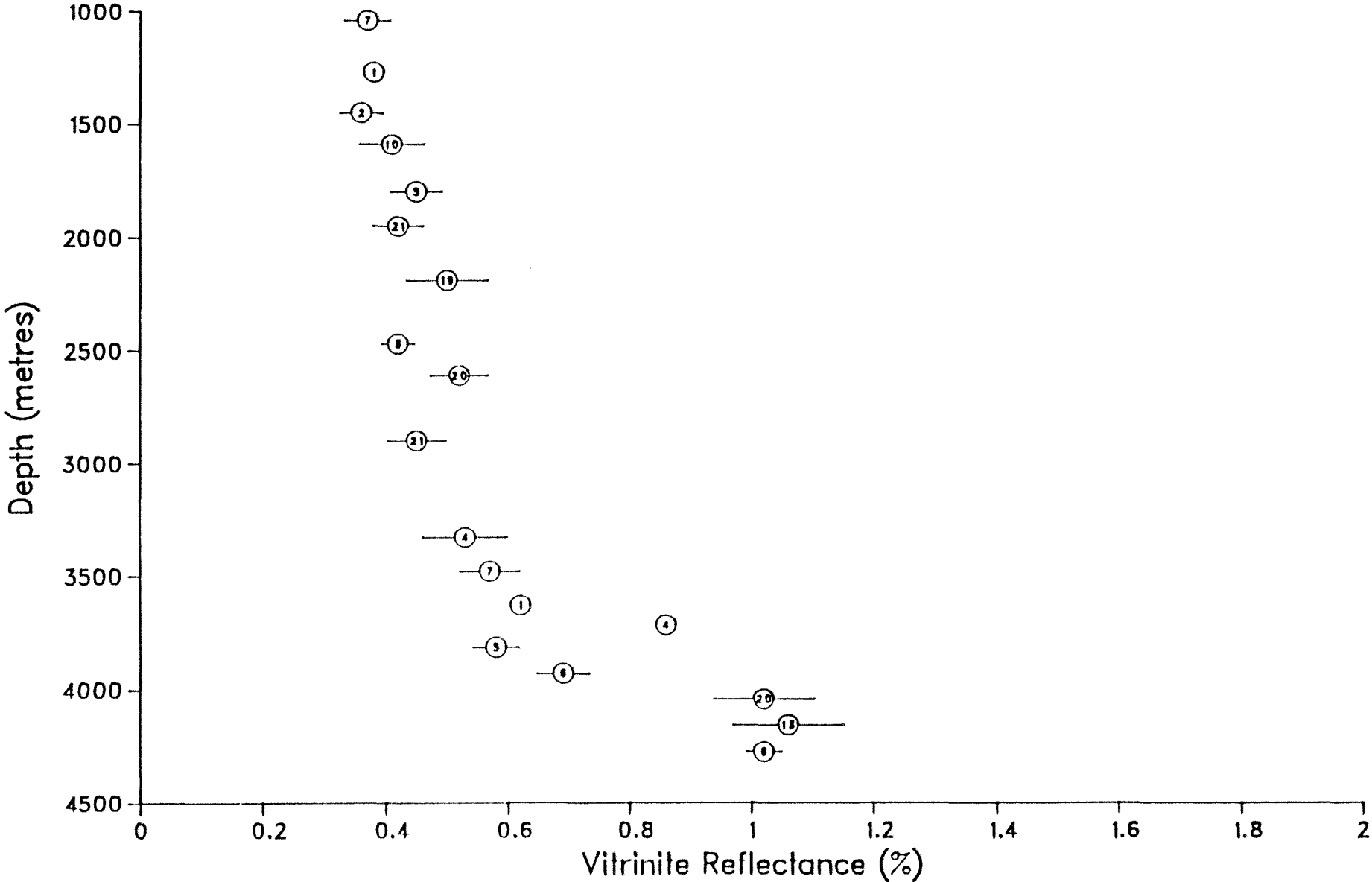

Figure 10: Kerogen Composition and Potential Hydrocarbon Products

Well NOCS 2/1-3

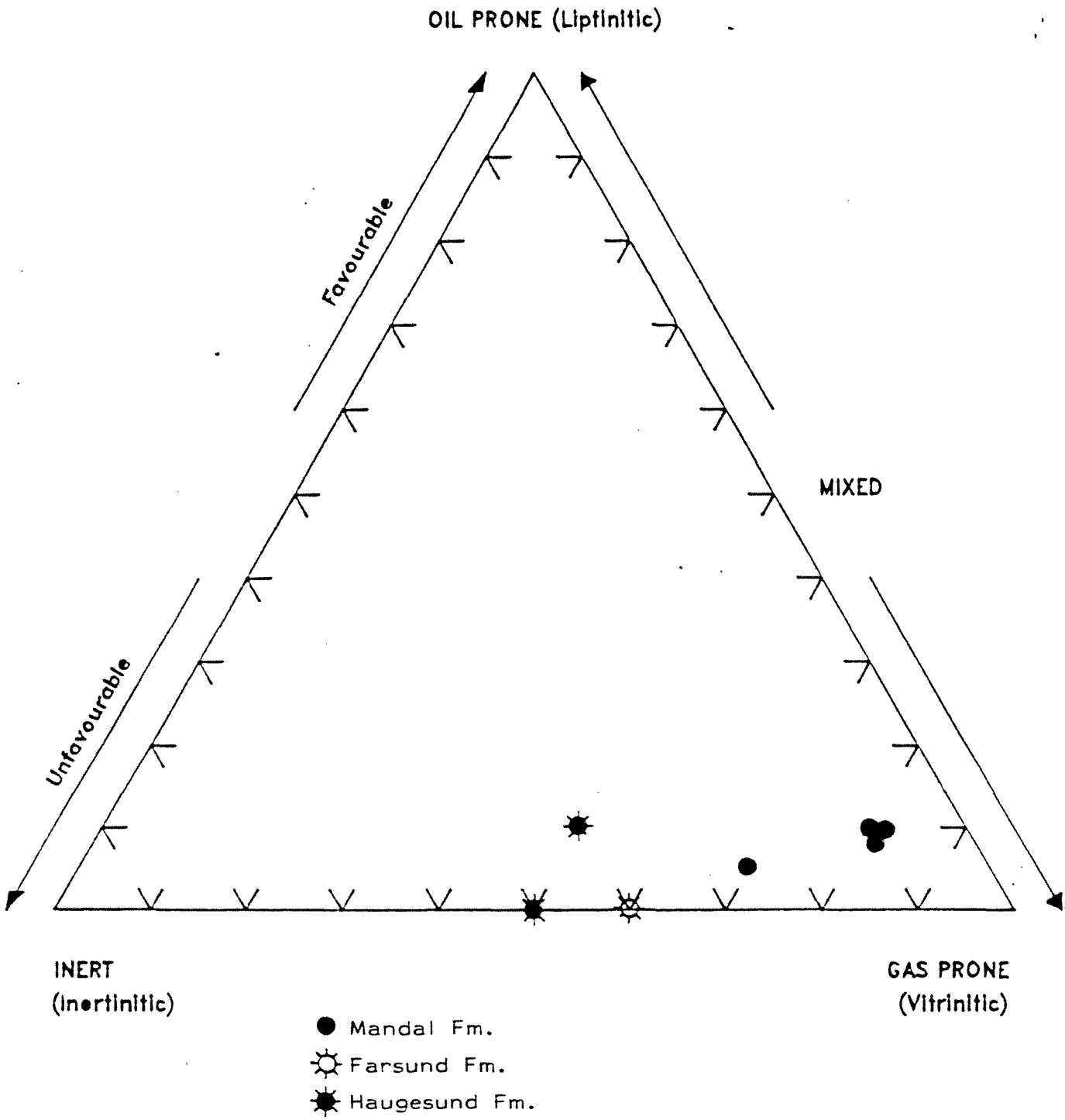

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Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	Type %	Lithology description	Trb	Sample
1040.00						
						115
			100	Sh/Clst: ol gy to m gy, calc, slt		
			tr	Cont : prp		115-1L
						115-2L
1270.00						
						116
			85	Sh/Clst: ol gy to m gy, calc, slt		
			10	Cont : cem, prp		116-1L
			5	Ca : w		116-3L
						116-2L
1450.00						
						117
			80	Sh/Clst: ol gy, calc, slt		
			20	Ca : drk y brn		117-1L
						117-2L
1590.00						
						118
			90	Sh/Clst: ol gy, calc, slt		
			10	Ca : w, drk y brn		118-1L
						118-2L
1800.00						
						119
			95	Sh/Clst: ol gy		
			5	Ca : w, pl y brn		119-1L
						119-2L
1950.00						
						120
			100	Sh/Clst: ol gy to dsk y brn		120-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2190.00						
						121
			100	Sh/Clst: ol gy to dsk y brn		
			tr	Ca : w, drk y brn		121-1L
			tr	Cont : prp		121-2L
						121-3L
2370.00						
						122
			100	Sh/Clst: ol gy to dsk y brn		
			tr	Ca : w, drk y brn		122-1L
			tr	Cont : prp		122-2L
						122-3L
2470.00						
						123
			100	Sh/Clst: ol gy to dsk y brn		
			tr	Ca : w, drk y brn		123-1L
			tr	Cont : prp		123-2L
						123-3L
2610.00						
						124
			95	Sh/Clst: ol gy		
			5	Ca : drk y brn to pl y brn		124-1L
						124-2L
2730.00						
						125
			95	Sh/Clst: gn gy to ol gy		
			5	Ca : drk y brn to pl y brn		125-1L
						125-2L
2900.00						
						126
			90	Sh/Clst: gn gy, ol gy, m gy, drk y brn, dsk y brn		126-1L
			5	Sh/Clst: gy red		
			5	S/Sst : lt gy, glauc, f, cem		126-2L
						126-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3110.00						
						127
			60	Ca : w, chk		
			40	Sh/Clst: gn gy, ol gy, m gy, drk y brn, dsk y brn		127-3L 127-1L
			tr	Sh/Clst: gy red		
						127-2L
3190.00						
						130
			70	Ca : w, chk		
			25	Sh/Clst: gn gy, ol gy, m gy, drk y brn, dsk y brn		130-3L 130-1L
			5	Sh/Clst: gy red		
						130-2L
3330.00						
						128
			90	Ca : w, chk		
			10	Sh/Clst: gn gy, ol gy, m gy, drk y brn, dsk y brn		128-3L 128-1L
			tr	Sh/Clst: gy red		
						128-2L
3480.00						
						129
			60	Ca : w, chk		
			25	Sh/Clst: gn gy, ol gy, m gy, drk y brn, dsk y brn		129-3L 129-1L
			15	Sh/Clst: gy red		
						129-2L
3606.00						
						001
	cvd		80	Ca : w to lt gy, chk		
			10	Sh/Clst: m gy to drk gy, calc		001-2L
			10	Cont : prp		001-1L 001-3L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3612.00						
						002
	cvd		80	Ca : w, gy red, red brn, lt gy, chk		002-2L
			10	Sh/Clst: m gy to drk gy, calc		002-1L
			10	Cont : prp		002-3L
3618.00						
						003
	cvd		70	Ca : w, gy red, red brn, lt gy, chk		003-2L
			20	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, calc		003-1L
			10	Cont : prp		003-3L
3624.00						
						004
	cvd		60	Ca : w, gy red, red brn, lt gy, chk		004-2L
			30	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, calc		004-1L
			10	Cont : prp		004-3L
3630.00						
						113
			50	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, dsk y brn, calc		113-1L
	cvd		20	Ca : w, red brn, lt gy, chk		113-2L
			20	Sh/Clst: gy red		113-4L
			10	Cont : prp		113-3L
3636.00						
						005
			50	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, dsk y brn, calc		005-1L
	cvd		20	Ca : w, red brn, lt gy, chk		005-2L
			20	Sh/Clst: gy red		005-4L
			10	Cont : prp		005-3L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3642.00						
						006
			50	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, dsk y brn, calc		006-1L
			30	Sh/Clst: gy red		
	cvd		10	Ca : w, red brn, lt gy, chk		006-4L
			10	Cont : prp		006-2L
						006-3L
3648.00						
						007
			50	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, dsk y brn, calc		007-1L
			30	Sh/Clst: gy red		
	cvd		10	Ca : w, red brn, lt gy, chk		007-4L
			10	Cont : prp		007-2L
						007-3L
3654.00						
						008
			70	Sh/Clst: gn gy, lt ol gy, m gy to drk gy, dsk y brn, calc		008-1L
			20	Sh/Clst: gy red		
			10	Cont : prp		008-4L
	cvd		tr	Ca : w, red brn, lt gy, chk		008-3L
						008-2L
3660.00						
						009
			70	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		009-1L
			20	Sh/Clst: gy red		
	cvd		5	Ca : w, red brn, lt gy, chk		009-4L
			5	Cont : prp		009-2L
						009-3L
3666.00						
						010
			70	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		010-1L
			20	Sh/Clst: gy red		
	cvd		5	Ca : w, red brn, lt gy, chk		010-4L
			5	Cont : prp		010-2L
						010-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3672.00						
						011
			75	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		011-1L
			20	Sh/Clst: gy red		
			5	Cont : prp		011-3L
						011-2L
3678.00						
						012
			75	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		012-1L
			20	Sh/Clst: gy red		
			5	Cont : st, Coal-ad, prp		012-3L
						012-2L
3684.00						
						013
			70	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		013-1L
			20	Sh/Clst: gy red		
			10	Cont : st, Coal-ad, prp		013-3L
						013-2L
3690.00						
						014
			75	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		014-1L
			20	Sh/Clst: gy red		
			5	Cont : st, Coal-ad, prp		014-3L
						014-2L
3696.00						
						015
			75	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		015-1L
			20	Sh/Clst: gy red		
			5	Cont : st, Coal-ad, prp		015-3L
						015-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3702.00						
						016
			75	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		016-1L
			20	Sh/Clst: gy red		
			5	Cont : st, Coal-ad, prp		016-3L
						016-2L
3708.00						
						017
			90	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		017-1L
			10	Cont : st, Coal-ad, prp		017-2L
3714.00						
						018
			90	Sh/Clst: gn gy, ol gy, ol blk, lt gn gy, m gy to drk gy		018-1L
			10	Cont : st, Coal-ad, prp		018-2L
3720.00						
						019
			95	Sh/Clst: ol gy, m gy to drk gy		019-1L
			5	Cont : prp		019-2L
3726.00						
						020
		0.27	95	Sh/Clst: ol gy, m gy to drk gy		020-1L
			5	Cont : prp		020-2L
3732.00						
						021
			95	Sh/Clst: ol gy, m gy to drk gy		021-1L
			5	Cont : st, prp		021-2L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3738.00						022
			95	Sh/Clst: ol gy, m gy to drk gy		022-1L
			5	Cont : st, prp		022-2L
3744.00						023
			95	Sh/Clst: ol gy, m gy to drk gy		023-1L
			5	Cont : st, prp		023-2L
3750.00						024
		0.28	95	Sh/Clst: ol gy, m gy to drk gy		024-1L
			5	Cont : st, prp		024-2L
3756.00						025
			95	Sh/Clst: ol gy, m gy to drk gy		025-1L
			5	Cont : st, prp		025-2L
3762.00						026
		0.49	95	Sh/Clst: ol gy, m gy to drk gy		026-1L
			5	Cont : st, prp		026-2L
3768.00						027
			100	Sh/Clst: ol gy, m gy to drk gy		027-1L
			tr	Cont : st, prp		027-2L
3774.00						028
		0.32	100	Sh/Clst: ol gy, m gy to drk gy		028-1L
			tr	Cont : st, prp		028-2L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3780.00						
						029
			100	Sh/Clst: ol gy, m gy to drk gy		
			tr	Cont : st, prp		029-1L
						029-2L
3786.00						
						030
			100	Sh/Clst: ol gy, m gy to drk gy		
			tr	Cont : st, prp		030-1L
						030-2L
3792.00						
						031
		0.29	100	Sh/Clst: ol gy, m gy to drk gy		
			tr	Cont : st, prp		031-1L
						031-2L
3798.00						
						032
	cvd		90	Sh/Clst: ol gy, m gy to drk gy		
		5.55	10	Sh/Clst: blk to brn blk		032-1L
			tr	Cont : prp		032-2L
						032-3L
3804.00						
						033
	cvd		80	Sh/Clst: ol gy, m gy to drk gy		
		7.29	20	Sh/Clst: blk to brn blk		033-1L
			tr	Cont : prp		033-2L
						033-3L
3810.00						
						034
	cvd		50	Sh/Clst: ol gy, m gy to drk gy		
		7.87	50	Sh/Clst: blk to brn blk		034-1L
			tr	Cont : prp		034-2L
						034-3L

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3816.00						035
	cvd		50	Sh/Clst: ol gy, m gy to drk gy		035-1L
		6.74	50	Sh/Clst: blk to brn blk		035-2L
			tr	Cont : prp		035-3L
3822.00						036
	cvd		90	Sh/Clst: ol gy, m gy to drk gy		036-1L
			10	Cont : st, Coal-ad, prp, dd		036-3L
	cvd		tr	Sh/Clst: blk to brn blk		036-2L
3828.00						037
	cvd		90	Sh/Clst: ol gy, m gy to drk gy		037-1L
			10	Cont : st, Coal-ad, prp, dd		037-3L
	cvd		tr	Sh/Clst: blk to brn blk		037-2L
3834.00						038
	cvd		90	Sh/Clst: ol gy, m gy to drk gy		038-1L
			10	Cont : st, Coal-ad, prp, dd		038-3L
	cvd		tr	Sh/Clst: blk to brn blk		038-2L
3840.00						039
	cvd		90	Sh/Clst: ol gy, lt gy to drk gy		039-1L
			10	Cont : st, Coal-ad, prp, dd		039-3L
	cvd		tr	Sh/Clst: blk to brn blk		039-2L
3846.00						040
	cvd		90	Sh/Clst: ol gy, lt gy to drk gy		040-1L
			10	Cont : st, Coal-ad, prp, dd		040-3L
	cvd		tr	Sh/Clst: blk to brn blk		040-2L

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3852.00						041
	cvd		90	Sh/Clst: ol gy, lt gy to drk gy		041-1L
			10	Cont : st, Coal-ad, prp, dd		041-3L
	cvd		tr	Sh/Clst: blk to brn blk		041-2L
3858.00						042
	cvd		90	Sh/Clst: ol gy, lt gy to drk gy		042-1L
			10	Cont : st, Coal-ad, prp, dd		042-3L
	cvd		tr	Sh/Clst: blk to brn blk		042-2L
3864.00						043
	cvd		90	Sh/Clst: ol gy, lt gy to drk gy		043-1L
			10	Cont : st, Coal-ad, prp, dd		043-3L
	cvd		tr	Sh/Clst: blk to brn blk		043-2L
3870.00						044
	cvd		90	Sh/Clst: ol gy, lt gy to drk gy		044-1L
			10	Cont : st, Coal-ad, prp, dd		044-3L
	cvd		tr	Sh/Clst: blk to brn blk		044-2L
3876.00						045
		0.33	80	Sh/Clst: lt gy to drk gy		045-1L
			10	Cont : Coal-ad, prp		045-3L
			5	S/Sst : lt gy, f, cem		045-4L
			5	Sltst : lt brn gy		045-5L
	cvd		tr	Sh/Clst: blk to brn blk		045-2L

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3882.00						046
		0.34	80	Sh/Clst: lt gy to drk gy		046-1L
			10	Cont : Coal-ad, prp		046-3L
			5	S/Sst : lt gy, f, cem		046-4L
			5	Sltst : lt brn gy		046-5L
	cvd		tr	Sh/Clst: blk to brn blk		046-2L
3888.00						047
		0.27	80	Sh/Clst: lt gy to drk gy		047-1L
			10	Cont : Coal-ad, prp		047-3L
			5	S/Sst : lt gy, f, cem		047-4L
			5	Sltst : lt brn gy		047-5L
	cvd		tr	Sh/Clst: blk to brn blk		047-2L
3894.00						048
		0.53	80	Sh/Clst: lt gy to drk gy		048-1L
			10	Cont : Coal-ad, prp		048-3L
			5	S/Sst : lt gy, f, cem		048-4L
			5	Sltst : lt brn gy		048-5L
	cvd		tr	Sh/Clst: blk to brn blk		048-2L
3900.00						049
		0.31	90	Sh/Clst: m gy to drk gy		049-1L
			5	Cont : st, Coal-ad, prp		049-2L
			5	Sltst : lt gy to lt brn gy		049-3L
3906.00						050
		0.25	90	Sh/Clst: m gy to drk gy		050-1L
			5	Cont : st, Coal-ad, prp		050-2L
			5	Sltst : lt gy to lt brn gy		050-3L

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3912.00						051
		0.32	90	Sh/Clst: m gy to drk gy		051-1L
			5	Cont : st, Coal-ad, prp		051-2L
			5	Sltst : lt gy to lt brn gy		051-3L
3918.00						052
		0.34	70	Sh/Clst: m gy to drk gy		052-1L
		0.96	25	Sltst : lt gy to m gy, calc, s		052-3L
			5	Cont : prp		052-2L
3924.00						053
		0.29	85	Sh/Clst: m gy to drk gy		053-1L
			15	Sltst : lt gy to m gy, calc, s		053-3L
			tr	Cont : prp		053-2L
3930.00						054
		0.29	90	Sh/Clst: m gy to drk gy		054-1L
			5	Cont : st, Coal-ad, prp		054-2L
			5	Sltst : m gy to drk gy, calc, s		054-3L
3936.00						055
		0.28	90	Sh/Clst: m gy to drk gy		055-1L
			5	Cont : st, Coal-ad, prp		055-2L
			5	Sltst : m gy to drk gy, calc, s		055-3L
3942.00						056
		0.31	90	Sh/Clst: m gy to drk gy		056-1L
			5	Cont : st, Coal-ad, prp		056-2L
			5	Sltst : m gy to drk gy, calc, s		056-3L

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3948.00						057
		0.30	85	Sh/Clst: m gy to drk gy		057-1L
			10	Sltst : m gy to drk gy, calc, s		057-3L
			5	Cont : st, Coal-ad, prp		057-2L
3954.00						058
		0.30	60	Sh/Clst: m gy to drk gy		058-1L
			30	Sltst : m gy to drk gy, calc, s		058-3L
			10	Cont : st, Coal-ad, prp		058-2L
3960.00						059
		1.52	50	Sh/Clst: m gy to drk gy		059-1L
			40	Sltst : m gy to drk gy, calc, s		059-3L
			10	Cont : st, Coal-ad, prp		059-2L
3966.00						060
	cvd		65	Sh/Clst: m gy to drk gy		060-1L
	cvd		25	Sltst : m gy to drk gy, calc, s		060-3L
			10	Cont : st, Coal-ad, prp		060-2L
3972.00						061
	cvd		70	Sh/Clst: m gy to drk gy		061-1L
	cvd		20	Sltst : m gy to drk gy, calc, s		061-3L
			10	Cont : st, Coal-ad, prp		061-2L
			tr	S/Sst : w, glauc, f, cem		061-4L
3978.00						062
	cvd		70	Sh/Clst: m gy to drk gy		062-1L
			15	Cont : Coal-ad, prp		062-2L
			15	Sh/Clst: gy red		062-5L
	cvd		tr	Sltst : m gy to drk gy, calc, s		062-3L
			tr	S/Sst : w, f, cem		062-4L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
3984.00						
						063
	cvd		55	Sh/Clst: m gy to drk gy		
		0.27	40	S/Sst : w to m gy, glauc, f, cem, l		063-1L
			5	Cont : Coal-ad, prp		063-3L
			tr	Sh/Clst: gy red		063-2L
						063-4L
3990.00						
						064
	cvd		55	Sh/Clst: m gy to drk gy		
		0.29	40	S/Sst : w to m gy, glauc, f, cem, l		064-1L
			5	Cont : Coal-ad, prp		064-3L
			tr	Sh/Clst: gy red		064-2L
						064-4L
3996.00						
						065
		0.58	50	Sh/Clst: m gy to drk gy		
	cvd		40	S/Sst : w to m gy, glauc, f, cem, l		065-1L
			10	Cont : Coal-ad, prp		065-3L
						065-2L
4002.00						
						066
		0.32	85	Sh/Clst: ol gy, m gy to drk gy		
	cvd		10	S/Sst : w to m gy, glauc, f, cem, l		066-1L
			5	Cont : prp		066-3L
						066-2L
4008.00						
						114
		0.34	65	Sh/Clst: ol gy, m gy to drk gy		
			20	Cont : Coal-ad, prp		114-1L
	cvd		10	S/Sst : w to m gy, glauc, f, cem, l		114-2L
			5	Sh/Clst: gy red		114-3L
						114-4L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4014.00						
						067
		0.26	75	Sh/Clst: ol gy, m gy to drk gy		
			15	Cont : Coal-ad		067-1L
			10	Ca : m gy		067-2L
			tr	S/Sst : w to m gy, f, cem, l		067-4L
						067-3L
4020.00						
						068
		0.57	65	Sh/Clst: m gy to drk gy		
			25	S/Sst : w to m gy, glauc, f, cem		068-1L
			5	Cont : prp		068-3L
			5	Ca : m gy		068-2L
						068-4L
4026.00						
						069
		0.31	70	Sh/Clst: m gy to drk gy		
			10	S/Sst : w to m gy, glauc, f, cem		069-1L
			10	Ca : lt gy to m gy		069-3L
			10	Sh/Clst: blk to ol blk		069-4L
			tr	Cont : st, Coal-ad, prp		069-5L
						069-2L
4032.00						
						070
		0.31	75	Sh/Clst: ol gy, m gy to drk gy		
			15	S/Sst : w to m gy, mic, cem		070-1L
			10	Ca : lt gy to m gy, drk y brn		070-3L
			tr	Cont : Coal-ad, prp		070-4L
			tr	Sh/Clst: blk to ol blk		070-2L
			tr	Sh/Clst: gy red		070-5L
						070-6L
4038.00						
						071
		0.27	80	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		
			15	S/Sst : w to m gy, mic, cem		071-1L
			5	Ca : w to m gy		071-3L
			tr	Cont : Coal-ad, prp		071-4L
						071-2L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4044.00						072
		0.43	75	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		072-1L
			20	S/Sst : w to m gy, mic, cem		072-3L
			5	Ca : w, lt gy to m gy		072-4L
			tr	Cont : Coal-ad, prp		072-2L
4050.00						073
		0.27	80	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		073-1L
			15	S/Sst : w to m gy, mic, cem		073-3L
			5	Ca : w, lt gy to m gy		073-4L
			tr	Cont : Coal-ad, prp		073-2L
4056.00						074
		0.61	75	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		074-1L
			25	S/Sst : w, brn gy, lt gy to m gy, mic, cem		074-3L
			tr	Cont : Coal-ad, prp		074-2L
			tr	Sh/Clst: gy red		074-4L
4062.00						075
		0.29	75	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		075-1L
			20	S/Sst : w, brn gy, lt gy to m gy, mic, cem		075-3L
			5	Cont : Coal-ad, prp		075-2L
			tr	Sh/Clst: gy red		075-4L
4068.00						076
		0.59	75	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		076-1L
			25	S/Sst : w, brn gy, lt gy to m gy, mic, cem		076-3L
			tr	Cont : Coal-ad, prp		076-2L
			tr	Sh/Clst: gy red		076-4L

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Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4074.00						
						077
		0.73	75	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		077-1L
			25	S/Sst : w, brn gy, lt gy to m gy, mic, cem		077-3L
			tr	Cont : Coal-ad, prp		077-2L
			tr	Sh/Clst: gy red		077-4L
4080.00						
						078
		0.26	75	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		078-1L
			25	S/Sst : w, brn gy, lt gy to m gy, mic, cem		078-3L
			tr	Cont : Coal-ad, prp		078-2L
			tr	Sh/Clst: gy red		078-4L
4086.00						
						079
		0.63	70	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		079-1L
			30	S/Sst : w, brn gy, lt gy to m gy, mic, cem		079-3L
			tr	Cont : Coal-ad, prp		079-2L
4092.00						
						080
		0.40	60	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		080-1L
			40	S/Sst : w, brn gy, lt gy to m gy, mic, cem		080-3L
			tr	Cont : Coal-ad, prp		080-2L
			tr	Sh/Clst: gy red		080-4L
4098.00						
						081
		0.24	60	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		081-1L
			40	S/Sst : w, brn gy, lt gy to m gy, mic, cem		081-3L
			tr	Cont : Coal-ad, prp		081-2L
			tr	Sh/Clst: gy red		081-4L

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GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4104.00						
						082
		0.67	60	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		082-1L
			40	S/Sst : w, brn gy, lt gy to m gy, mic, cem		082-3L
			tr	Cont : Coal-ad, prp		082-2L
			tr	Sh/Clst: gy red		082-4L
4110.00						
						083
		0.48	60	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		083-1L
			40	S/Sst : w, brn gy, lt gy to m gy, mic, cem		083-3L
			tr	Cont : st, Coal-ad, prp		083-2L
			tr	Sh/Clst: gy red		083-4L
4116.00						
						084
		0.27	60	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		084-1L
			40	S/Sst : w, gy red, lt gy to m gy, mic, cem		084-3L
			tr	Cont : st, Coal-ad, prp		084-2L
4122.00						
						085
		0.27	60	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy		085-1L
			40	S/Sst : w, gy red, lt gy to m gy, mic, cem		085-3L
			tr	Cont : st, Coal-ad, prp		085-2L
4128.00						
						086
		0.31	60	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		086-1L
			40	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		086-2L
			tr	Sh/Clst: gy red, mic		086-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4134.00						087
		0.25	50	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		087-1L
			50	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		087-2L
			tr	Sh/Clst: gy red, mic		087-3L
4140.00						088
			60	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		088-1L
		0.06	40	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		088-2L
			tr	Sh/Clst: gy red, mic		088-3L
4146.00						089
			60	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		089-1L
		0.07	40	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		089-2L
			tr	Sh/Clst: gy red, mic		089-3L
4152.00						090
		0.30	60	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		090-1L
			40	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		090-2L
			tr	Sh/Clst: gy red, mic		090-3L
4158.00						091
		0.73	80	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		091-1L
			20	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		091-2L
			tr	Sh/Clst: gy red, mic		091-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth		Type			Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4164.00						092
		0.40	70	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		092-1L
			30	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		092-2L
			tr	Sh/Clst: gy red, mic		092-3L
4170.00						093
		0.42	75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		093-1L
			25	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		093-2L
			tr	Sh/Clst: gy red, mic		093-3L
4176.00						094
		0.26	75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		094-1L
			25	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		094-2L
			tr	Sh/Clst: gy red, mic		094-3L
4182.00						095
			50	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		095-1L
		0.08	50	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		095-2L
			tr	Sh/Clst: gy red, mic		095-3L
4188.00						096
		0.36	75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		096-1L
			25	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		096-2L
			tr	Sh/Clst: gy red, mic		096-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4196.00						
						097
		0.34	75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		097-1L
			20	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		097-2L
			5	Sh/Clst: gy red, mic		097-3L
4200.00						
						098
		0.27	85	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		098-1L
			10	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		098-2L
			5	Sh/Clst: gy red, mic		098-3L
4206.00						
						099
		0.33	50	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		099-1L
			30	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		099-2L
			10	Sh/Clst: gy red, mic		099-3L
			10	Cont : Coal-ad		099-4L
4212.00						
						100
		0.42	60	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		100-1L
			30	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		100-2L
			5	Sh/Clst: gy red, mic		100-3L
			5	Cont : Coal-ad		100-4L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4218.00						
						101
		0.26	80	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		101-1L
			10	S/Sst : gy red, lt gn gy, lt gy, m gy, mic, cem		101-2L
			10	Sh/Clst: gy red, mic		101-3L
4224.00						
						102
	cvd		90	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		102-1L
	cvd		10	S/Sst : w, lt gy, m gy, mic, cem		102-2L
			tr	Cont : prp		102-3L
4230.00						
						103
	cvd		90	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		103-1L
	cvd		5	Sh/Clst: gy red		103-4L
			5	Other : w to lt gy, evap		103-5L
	cvd		tr	S/Sst : w, lt gy, m gy, mic, cem		103-2L
			tr	Cont : prp		103-3L
4236.00						
						104
	cvd		85	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		104-1L
	cvd		5	S/Sst : w, lt gy, m gy, mic, cem		104-2L
	cvd		5	Sh/Clst: gy red		104-4L
			5	Other : w to lt gy, evap		104-5L
			tr	Cont : prp		104-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4242.00						
						105
	cvd		75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		105-1L
			20	Other : w to lt gy, evap		
	cvd		5	Sh/Clst: gy red		105-5L
	cvd		tr	S/Sst : w, lt gy, m gy, mic, cem		105-4L
			tr	Cont : prp		105-2L
						105-3L
4254.00						
						106
	cvd		90	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		106-1L
	cvd		5	Sh/Clst: gy red		106-4L
			5	Other : w to lt gy, evap		106-5L
	cvd		tr	S/Sst : w, lt gy, m gy, mic, cem		106-2L
			tr	Cont : prp		106-3L
4260.00						
						107
	cvd		95	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		107-1L
	cvd		5	Sh/Clst: gy red		107-2L
			tr	Other : w to lt gy, evap		107-3L
4266.00						
						108
	cvd		90	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		108-1L
	cvd		5	Sh/Clst: gy red		108-2L
			5	Other : w to lt gy, evap		108-3L
4272.00						
						109
	cvd		75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		109-1L
		3.18	20	Sltst : brn gy, calc		109-2L
			5	Cont : Coal-ad		109-3L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 1 : Lithology description for well NOCS 2/1-3

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Lithology description	Trb	Sample
4278.00						
						110
	cvd		75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		110-1L
		3.22	20	Sltst : brn gy, calc		
			5	Cont : Coal-ad		110-2L
			tr	Sh/Clst: gy red		110-3L
			tr	Other : w to lt gy		110-4L
						110-5L
4286.00						
						111
	cvd		75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		111-1L
		3.08	20	Sltst : brn gy, calc		
			5	Cont : Coal-ad		111-2L
			tr	Sh/Clst: gy red		111-3L
			tr	Other : w to lt gy		111-4L
						111-5L
4290.00						
						112
	cvd		75	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy		112-1L
		3.03	20	Sltst : brn gy, calc		
			5	Cont : Coal-ad		112-2L
			tr	Sh/Clst: gy red		112-3L
			tr	Other : w to lt gy		112-4L
						112-5L

Table 2 : Rock-Eval table for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3726.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.01	-	0.21	-	0.27	-	78	-	1.00	460	020-1L
3750.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.02	-	0.23	-	0.28	-	82	-	1.00	298	024-1L
3762.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.34	0.63	0.19	3.32	0.49	129	39	1.0	0.35	344	026-1L
3774.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.01	-	0.21	-	0.32	-	66	-	1.00	355	028-1L
3792.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.02	-	0.15	-	0.29	-	52	-	1.00	298	031-1L
3798.00	cut	Sh/Clst: blk to brn blk	4.11	13.24	0.68	19.47	5.55	239	12	17.4	0.24	437	032-2L
3804.00	cut	Sh/Clst: blk to brn blk	4.73	17.75	0.83	21.39	7.29	243	11	22.5	0.21	436	033-2L
3810.00	cut	Sh/Clst: blk to brn blk	5.36	18.40	0.87	21.15	7.87	234	11	23.8	0.23	435	034-2L
3816.00	cut	Sh/Clst: blk to brn blk	4.20	14.50	0.89	16.29	6.74	215	13	18.7	0.22	436	035-2L
3876.00	cut	Sh/Clst: lt gy to drk gy	0.03	-	0.23	-	0.33	-	70	-	1.00	499	045-1L
3882.00	cut	Sh/Clst: lt gy to drk gy	0.02	-	0.20	-	0.34	-	59	-	1.00	480	046-1L
3888.00	cut	Sh/Clst: lt gy to drk gy	0.02	0.01	0.20	0.05	0.27	4	74	-	0.67	336	047-1L
3894.00	cut	Sh/Clst: lt gy to drk gy	0.45	0.86	0.15	5.73	0.53	162	28	1.3	0.34	348	048-1L
3900.00	cut	Sh/Clst: m gy to drk gy	0.01	-	0.16	-	0.31	-	52	-	1.00	298	049-1L
3906.00	cut	Sh/Clst: m gy to drk gy	-	-	0.14	-	0.25	-	56	-	-	261	050-1L

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Table 2 : Rock-Eval table for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3912.00	cut	Sh/Clst: m gy to drk gy	0.02	-	0.15	-	0.32	-	47	-	1.00	461	051-1L
3918.00	cut	Sh/Clst: m gy to drk gy	0.02	0.02	0.14	0.14	0.34	6	41	-	0.50	298	052-1L
3918.00	cut	Sltst : lt gy to m gy	0.31	1.03	0.28	3.68	0.96	107	29	1.3	0.23	434	052-3L
3924.00	cut	Sh/Clst: m gy to drk gy	0.01	-	0.14	-	0.29	-	48	-	1.00	408	053-1L
3930.00	cut	Sh/Clst: m gy to drk gy	0.02	0.01	0.14	0.07	0.29	3	48	-	0.67	298	054-1L
3936.00	cut	Sh/Clst: m gy to drk gy	0.01	-	0.17	-	0.28	-	61	-	1.00	261	055-1L
3942.00	cut	Sh/Clst: m gy to drk gy	0.01	-	0.16	-	0.31	-	52	-	1.00	298	056-1L
3948.00	cut	Sh/Clst: m gy to drk gy	0.01	-	0.15	-	0.30	-	50	-	1.00	262	057-1L
3954.00	cut	Sh/Clst: m gy to drk gy	0.01	0.02	0.18	0.11	0.30	7	60	-	0.33	298	058-1L
3960.00	cut	Sh/Clst: m gy to drk gy	0.50	2.15	0.29	7.41	1.52	141	19	2.7	0.19	438	059-1L
3984.00	cut	S/Sst : w to m gy	0.01	0.05	0.22	0.23	0.27	19	81	0.1	0.17	413	063-3L
3990.00	cut	S/Sst : w to m gy	0.02	0.05	0.21	0.24	0.29	17	72	0.1	0.29	359	064-3L
3996.00	cut	Sh/Clst: m gy to drk gy	0.04	0.25	0.17	1.47	0.58	43	29	0.3	0.14	441	065-1L
4002.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.03	0.05	0.18	0.28	0.32	16	56	0.1	0.38	437	066-1L
4008.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.01	0.07	0.20	0.35	0.34	21	59	0.1	0.13	440	114-1L

Table 2 : Rock-Eval table for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4014.00	cut	Sh/Clst: ol gy, m gy to drk gy	-	-	0.17	-	0.26	-	65	-	-	458	067-1L
4020.00	cut	Sh/Clst: m gy to drk gy	0.03	0.27	0.22	1.23	0.57	47	39	0.3	0.10	442	068-1L
4026.00	cut	Sh/Clst: m gy to drk gy	0.01	-	0.12	-	0.31	-	39	-	1.00	273	069-1L
4032.00	cut	Sh/Clst: ol gy, m gy to drk gy	0.01	0.04	0.17	0.24	0.31	13	55	0.1	0.20	438	070-1L
4038.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.01	0.01	0.20	0.05	0.27	4	74	-	0.50	298	071-1L
4044.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.02	0.10	0.10	1.00	0.43	23	23	0.1	0.17	443	072-1L
4050.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.01	-	0.30	-	0.27	-	111	-	1.00	430	073-1L
4056.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.03	0.24	0.12	2.00	0.61	39	20	0.3	0.11	443	074-1L
4062.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.01	0.01	0.18	0.06	0.29	3	62	-	0.50	432	075-1L
4068.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.03	0.32	0.09	3.56	0.59	54	15	0.3	0.09	442	076-1L
4074.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.05	0.32	0.17	1.88	0.73	44	23	0.4	0.14	447	077-1L
4080.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.01	-	0.17	-	0.26	-	65	-	1.00	373	078-1L

Table 2 : Rock-Eval table for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4086.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.04	0.37	0.16	2.31	0.63	59	25	0.4	0.10	444	079-1L
4092.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.01	0.11	0.11	1.00	0.40	28	28	0.1	0.08	441	080-1L
4098.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	-	-	0.16	-	0.24	-	67	-	-	298	081-1L
4104.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.03	0.23	0.07	3.29	0.67	34	10	0.3	0.12	447	082-1L
4110.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.02	0.20	0.18	1.11	0.48	42	38	0.2	0.09	441	083-1L
4116.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.02	0.02	0.16	0.13	0.27	7	59	-	0.50	327	084-1L
4122.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	0.01	0.01	0.05	0.20	0.27	4	19	-	0.50	448	085-1L
4128.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.01	-	0.12	-	0.31	-	39	-	1.00	-	086-1L
4134.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	-	-	0.20	-	0.25	-	80	-	-	428	087-1L
4140.00	cut	S/Sst : gy red, lt gn gy, lt gy, m gy	0.01	-	0.06	-	0.06	-	100	-	1.00	-	088-2L

Table 2 : Rock-Eval table for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4146.00	cut	S/Sst : gy red, lt gn gy, lt gy, m gy	-	-	0.10	-	0.07	-	143	-	-	-	089-2L
4152.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.02	0.01	0.18	0.06	0.30	3	60	-	0.67	479	090-1L
4158.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.06	0.27	0.14	1.93	0.73	37	19	0.3	0.18	447	091-1L
4164.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.01	0.14	0.05	2.80	0.40	35	13	0.2	0.07	441	092-1L
4170.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.03	0.09	0.09	1.00	0.42	21	21	0.1	0.25	436	093-1L
4176.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.01	-	0.16	-	0.26	-	62	-	1.00	296	094-1L
4182.00	cut	S/Sst : gy red, lt gn gy, lt gy, m gy	-	-	0.13	-	0.08	-	163	-	-	-	095-2L
4188.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.02	0.08	0.08	1.00	0.36	22	22	0.1	0.20	418	096-1L
4196.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.02	0.08	0.11	0.73	0.34	24	32	0.1	0.20	416	097-1L
4200.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.02	0.01	0.15	0.07	0.27	4	56	-	0.67	297	098-1L

Table 2 : Rock-Eval table for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4206.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.02	0.05	0.17	0.29	0.33	15	52	0.1	0.29	428	099-1L
4212.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.03	0.10	0.08	1.25	0.42	24	19	0.1	0.23	444	100-1L
4218.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	0.01	-	0.13	-	0.26	-	50	-	1.00	298	101-1L
4272.00	cut	Sltst : brn gy	0.23	1.15	3.91	0.29	3.18	36	123	1.4	0.17	421	109-2L
4278.00	cut	Sltst : brn gy	0.22	1.23	3.84	0.32	3.22	38	119	1.5	0.15	421	110-2L
4286.00	cut	Sltst : brn gy	0.23	1.30	4.73	0.27	3.08	42	154	1.5	0.15	424	111-2L
4290.00	cut	Sltst : brn gy	0.22	1.16	3.53	0.33	3.03	38	117	1.4	0.16	423	112-2L

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

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
3804.00	com	Composite sample - see table 3 e	2.7	37.5	4.1	1.3	3.5	28.6	5.4	32.1	6.44	131-0B
3816.00	com	Composite sample - see table 3 e	4.6	68.3	2.0	1.3	5.8	59.2	3.3	65.0	7.20	132-0B

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

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3804.00	com	Composite sample - see table 3 e	13888	1518	481	1296	10592	2000	11888	131-0B
3816.00	com	Composite sample - see table 3 e	14751	431	280	1252	12786	712	14038	132-0B

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

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3804.00	com	Composite sample - see table 3 e	215.67	23.58	7.48	20.13	164.48	31.06	184.61	131-0B
3816.00	com	Composite sample - see table 3 e	204.88	6.00	3.90	17.40	177.59	9.90	194.98	132-0B

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

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
3804.00	com	Composite sample - see table 3 e	10.93	3.47	9.33	76.27	14.40	85.60	315.38	16.82	131-0B
3816.00	com	Composite sample - see table 3 e	2.93	1.90	8.49	86.68	4.83	95.17	153.85	5.08	132-0B

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

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
3798.00	3804.00	com	131-0B	is composed of:	3798.00	cut	Sh/Clst: blk to brn blk	032-2L
					3804.00	cut	Sh/Clst: blk to brn blk	033-2L
3810.00	3816.00	com	132-0B	is composed of:	3810.00	cut	Sh/Clst: blk to brn blk	034-2L
					3816.00	cut	Sh/Clst: blk to brn blk	035-2L

Table 4 : Saturated Hydrocarbon Ratios for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	Pristane / nC17	Pristane / Phytane	Pristane + Phytane / nC17 + nC18	Phytane / nC18	CPI	Sample
3804.00	com	bulk	0.64	1.32	0.56	0.48	1.15	131-0B
3816.00	com	bulk	0.66	1.23	0.59	0.52	1.17	132-0B

Table 5 : Aromatic Hydrocarbon Ratios for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	DBT/P	4/1MDBT	(3+2)/1MDBT	Sample
3804.00	com	bulk	-	1.02	0.05	0.58	0.58	0.57	0.10	-	21.20	131-0B
3816.00	com	bulk	-	1.54	-	0.62	0.61	0.59	0.09	12.90	0.87	132-0B

Table 6 : Thermal Maturity Data for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
1040.00	cut	bulk	0.37	7	0.04	0	-	-	115-0B
1270.00	cut	bulk	0.38	1	0.00	3	-	-	116-0B
1450.00	cut	bulk	0.36	2	0.04	3+4	-	-	117-0B
1590.00	cut	bulk	0.41	10	0.05	3+4	-	-	118-0B
1800.00	cut	bulk	0.45	5	0.04	3+4	-	-	119-0B
1950.00	cut	bulk	0.42	21	0.04	3+4	-	-	120-0B
2190.00	cut	bulk	0.50	19	0.07	3+4+5	-	-	121-0B
2370.00	cut	bulk	NDP	-	-	4	-	-	122-0B
2470.00	cut	bulk	0.42	3	0.03	4	-	-	123-0B
2610.00	cut	bulk	0.52	20	0.05	4	-	-	124-0B
2730.00	cut	bulk	NDP	-	-	4+5	-	-	125-0B
2900.00	cut	bulk	0.45	21	0.05	4	-	-	126-0B
3110.00	cut	bulk	NDP	-	-	5	-	-	127-0B
3330.00	cut	bulk	0.53	4	0.07	4	-	-	128-0B

Table 6 : Thermal Maturity Data for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
3480.00	cut	bulk	0.57	7	0.05	4	-	-	129-0B
3630.00	cut	bulk	0.62	1	0.00	4	-	-	113-0B
3720.00	cut	bulk	0.86	4	0.00	0	-	-	019-0B
3798.00	cut	Sh/Clst: blk to brn blk	-	-	-	-	NDP	437	032-2L
3804.00	cut	Sh/Clst: blk to brn blk	-	-	-	-	5 - 5.5	436	033-2L
3810.00	cut	Sh/Clst: blk to brn blk	-	-	-	-	NDP	435	034-2L
3816.00	cut	bulk	0.58	5	0.04	5	-	-	035-0B
3816.00	cut	Sh/Clst: blk to brn blk	-	-	-	-	NDP	436	035-2L
3894.00	cut	Sh/Clst: lt gy to drk gy	-	-	-	-	NDP	348	048-1L
3918.00	cut	Sltst : lt gy to m gy	-	-	-	-	NDP	434	052-3L
3930.00	cut	bulk	0.69	6	0.04	0	-	-	054-0B
3960.00	cut	Sh/Clst: m gy to drk gy	-	-	-	-	NDP	438	059-1L
4044.00	cut	bulk	1.02	20	0.08	0	-	-	072-0B
4158.00	cut	bulk	1.06	13	0.09	0	-	-	091-0B

Table 6 : Thermal Maturity Data for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
4278.00	cut	bulk	1.02	6	0.03	5	-	-	110-0B

Table 7 : Visual Kerogen Composition Data for well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	LIPT %	Amor L	LipDet	Sp/Pol	Cutic l	Resin	Algae	Dinof l	Acrit	BitL	INERT %	Fusin	Semfus	IntDet	Micrin	Sclero	BitI	VITR %	Telin	Colinn	Vitdet	Amorv	BitV	Sample
3798.00	cut	Sh/Clst: blk to brn blk	10		*								10		*	*				80			**	*		032-2L
3804.00	cut	Sh/Clst: blk to brn blk	10		*	*							10		*	*				80			*	**		033-2L
3810.00	cut	Sh/Clst: blk to brn blk	10		*								10		*	*				80			**	*		034-2L
3816.00	cut	Sh/Clst: blk to brn blk	5		*								25		*	**				70			**	*		035-2L
3894.00	cut	Sh/Clst: lt gy to drk gy	TR?		?								40?		*	**				60?			*			048-1L
3918.00	cut	Sltst : lt gy to m gy	TR		*								50?		*	**				50?			*			052-3L
3960.00	cut	Sh/Clst: m gy to drk gy	10		*								40		*	**				50			**	*		059-1L

Table 8 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
3762.00	cut	Sh/Clst: ol gy, m gy to drk gy	2.32	16.17	54.15	27.36	0.63	026-1L
3798.00	cut	Sh/Clst: blk to brn blk	3.43	8.90	37.57	50.10	13.24	032-2L
3804.00	cut	Sh/Clst: blk to brn blk	6.94	14.13	36.09	42.85	17.75	033-2L
3810.00	cut	Sh/Clst: blk to brn blk	3.11	12.39	35.18	49.32	18.40	034-2L
3816.00	cut	Sh/Clst: blk to brn blk	3.59	15.07	36.06	45.28	14.50	035-2L
3888.00	cut	Sh/Clst: lt gy to drk gy	8.64	43.71	42.90	4.76	0.01	047-1L
3894.00	cut	Sh/Clst: lt gy to drk gy	2.50	22.18	59.72	15.61	0.86	048-1L
3918.00	cut	Sltst : lt gy to m gy	4.80	26.70	45.47	23.03	1.03	052-3L
3954.00	cut	Sh/Clst: m gy to drk gy	9.60	42.86	41.05	6.50	0.02	058-1L
3960.00	cut	Sh/Clst: m gy to drk gy	5.63	29.51	45.18	19.69	2.15	059-1L
3996.00	cut	Sh/Clst: m gy to drk gy	7.29	37.62	50.89	4.20	0.25	065-1L
4020.00	cut	Sh/Clst: m gy to drk gy	7.65	34.46	52.59	5.30	0.27	068-1L
4074.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	9.87	33.25	49.10	7.77	0.32	077-1L
4104.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	8.30	31.13	52.75	7.82	0.23	082-1L

Table 8 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 2/1-3

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
4116.00	cut	Sh/Clst: blk, ol gy, ol blk, m gy, drk gy	11.57	38.97	43.78	5.69	0.02	084-1L
4158.00	cut	Sh/Clst: gy blk, gn gy, ol gy, m gy, drk gy	11.07	33.08	46.24	9.61	0.27	091-1L
4272.00	cut	Sltst : brn gy	12.25	25.71	48.67	13.38	1.15	109-2L
4278.00	cut	Sltst : brn gy	11.09	22.98	48.49	17.44	1.23	110-2L
4286.00	cut	Sltst : brn gy	11.68	24.33	48.86	15.14	1.30	111-2L
4290.00	cut	Sltst : brn gy	12.35	22.83	51.28	13.54	1.16	112-2L

Table 9: Variation in Triterpane Distribution for Well NOCS 2/1-3

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
3804.00	Sh/Clst	0.95	0.49	0.18	0.52	0.34	0.18	0.07	0.13	0.06	0.21	0.89	0.34	0.12	60.00	131-0

Table 10: Variation in Sterane Distribution for Well NOCS 2/1-3

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Sample
3804.00	Sh/Clst	0.84	51.52	71.79	1.25	0.71	0.47	0.37	131-0

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

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Table 11: Aromatisation of Steranes for Well NOCS 2/1-3

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Sample
3804.00	Sh/Clst	0.29	0.89	131-0

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

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Table 12: Variation in Triaromatic Sterane Distribution for Well NOCS 2/1-3

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
3804.00	Sh/Clst	0.87	0.85	0.72	0.69	0.82	131-0

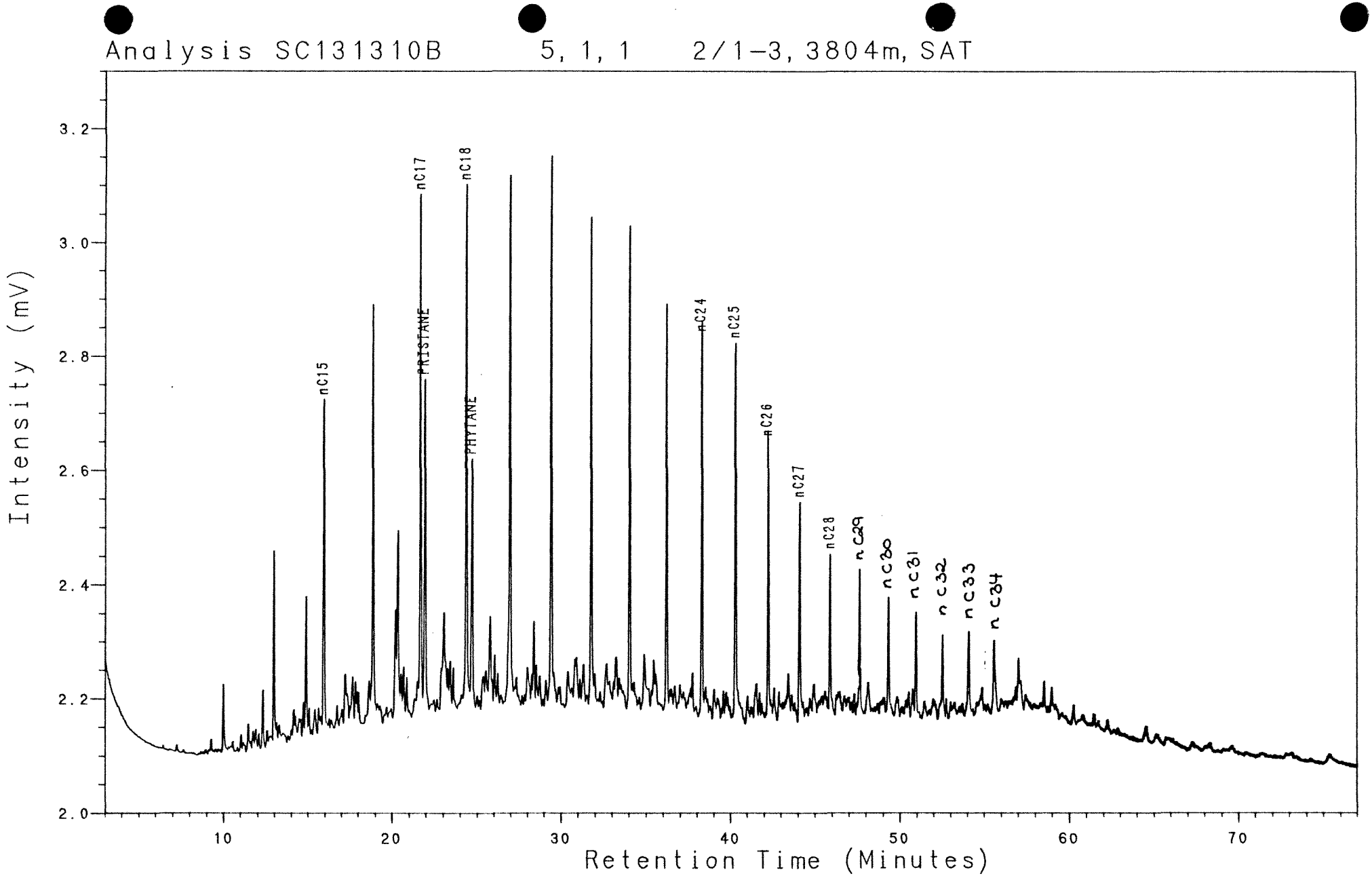
Ratio1: a1 / a1 + g1
Ratio2: b1 / b1 + g1
Ratio3: a1 + b1 / a1 + b1 + c1 + d1 + e1 + f1 + g1
Ratio4: a1 / a1 + e1 + f1 + g1
Ratio5: a1 / a1 + d1

Table 13: Variation in Monoaromatic Sterane Distribution for Well NOCS 2/1-3

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Sample
3804.00	Sh/Clst	0.63	0.43	0.47	0.35	131-0

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



NOCS 2/1-3 3804m
SATURATED GC
Composite sample

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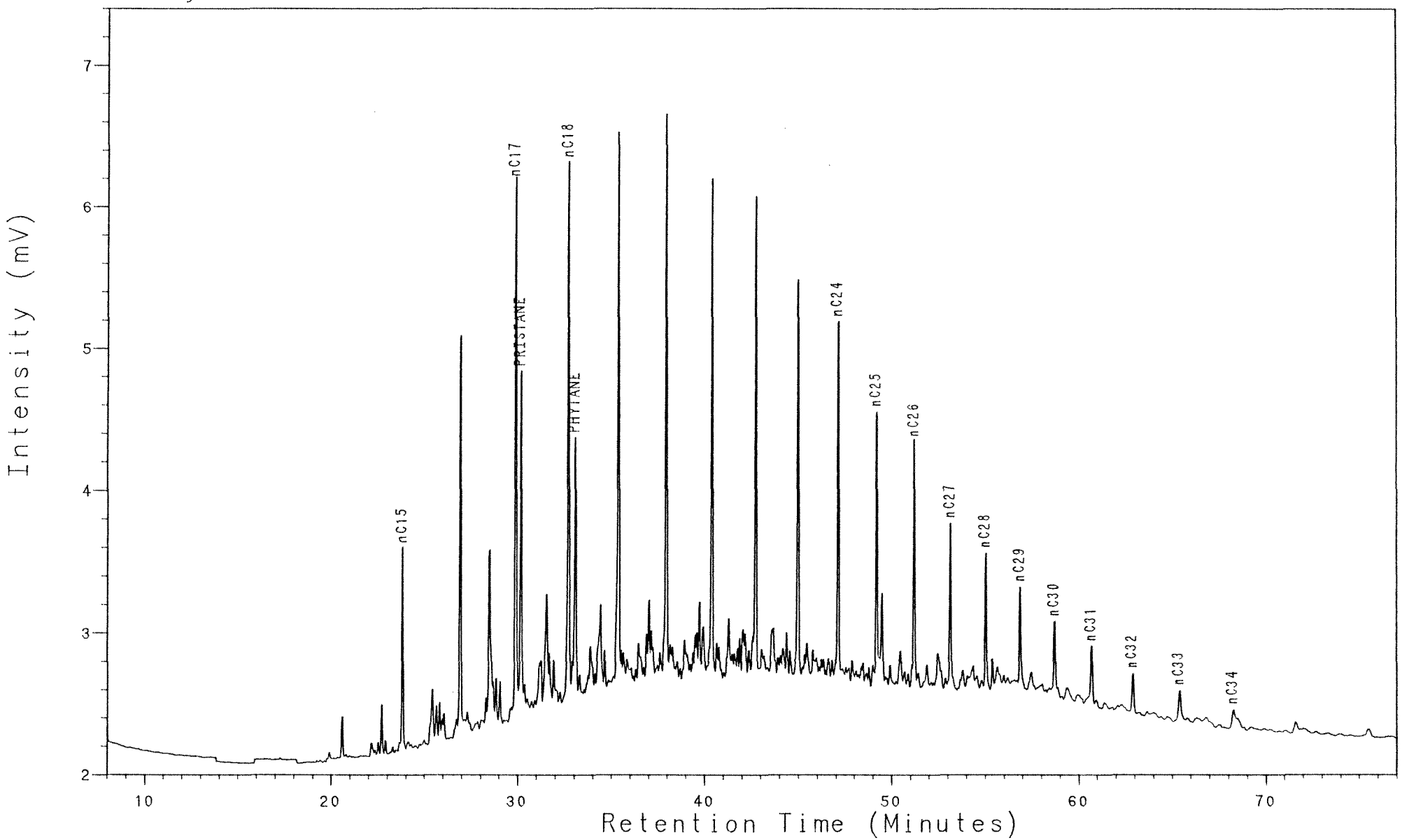
Analysis SC131320B 5, 1, 1 2/1-3, 3816m, SAT



NOCS 2/1-3 3816m
SATURATED GC
Composite sample

GEOLAB NOR
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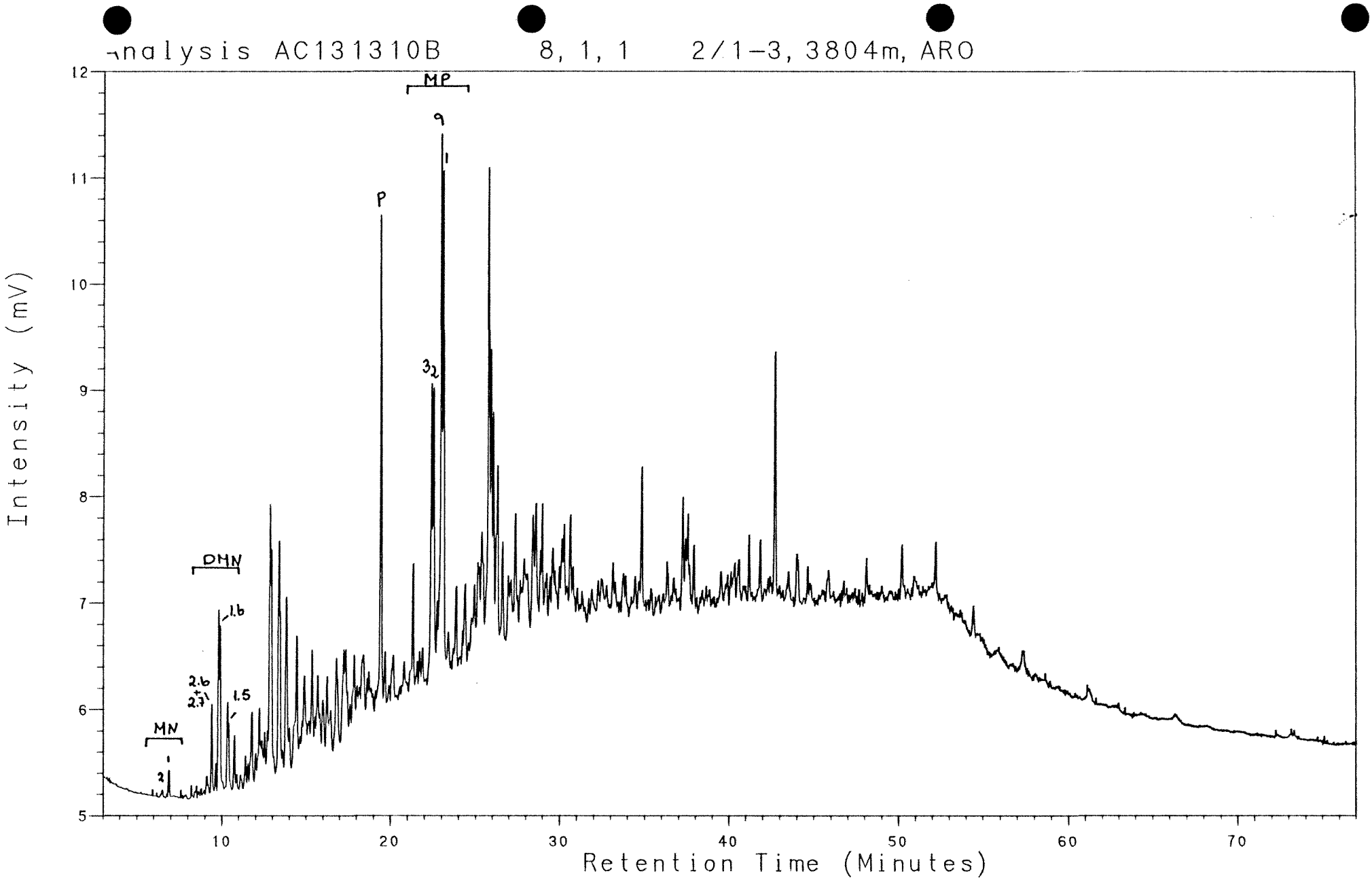

NOCS 2/1-3 3804m
AROMATIC GC (FID)
Composite sample

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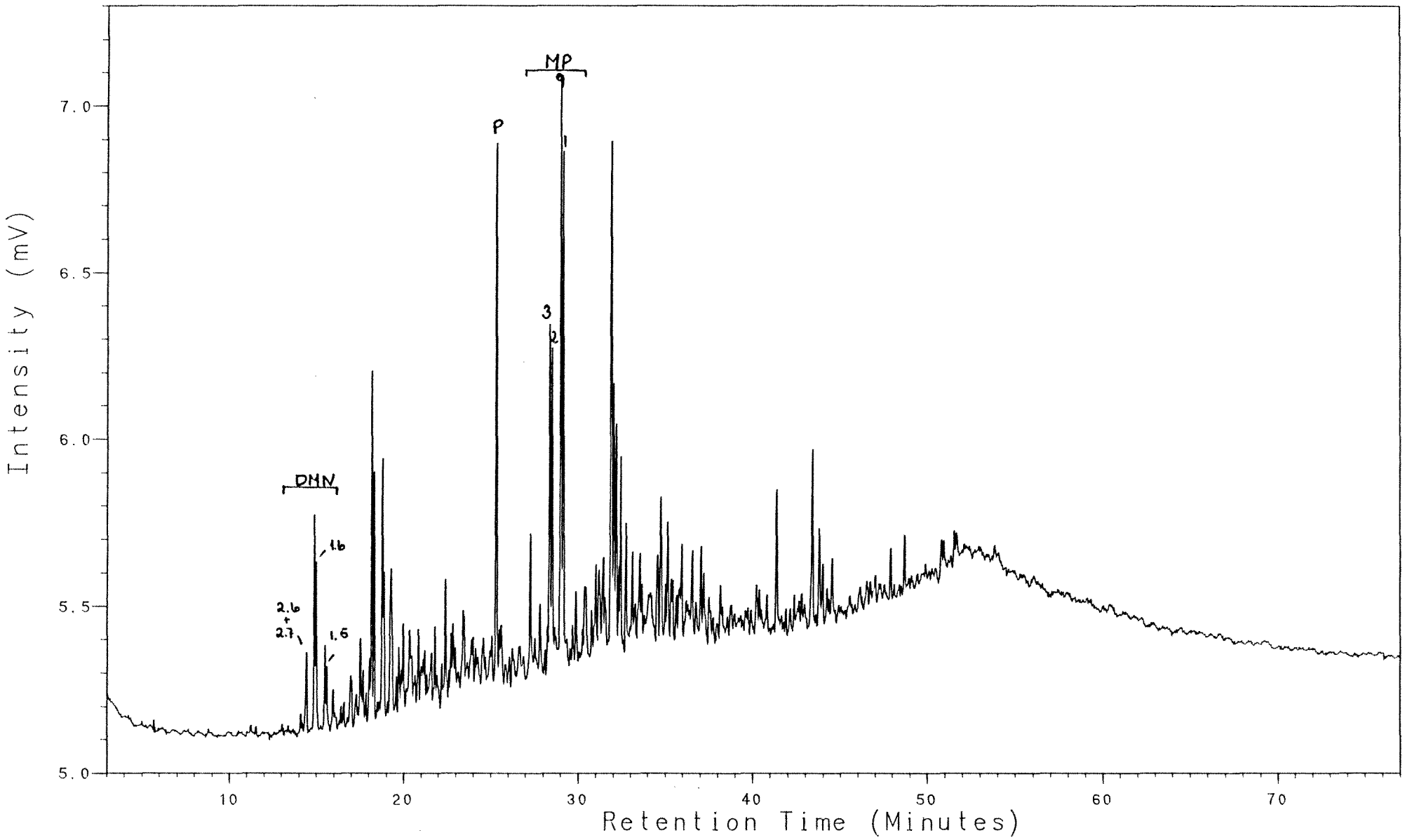
Analysis AC131320B 8, 1, 1 2/1-3, 3816m, ARO



NOCS 2/1-3 3816m
AROMATIC GC (FID)
Composite sample

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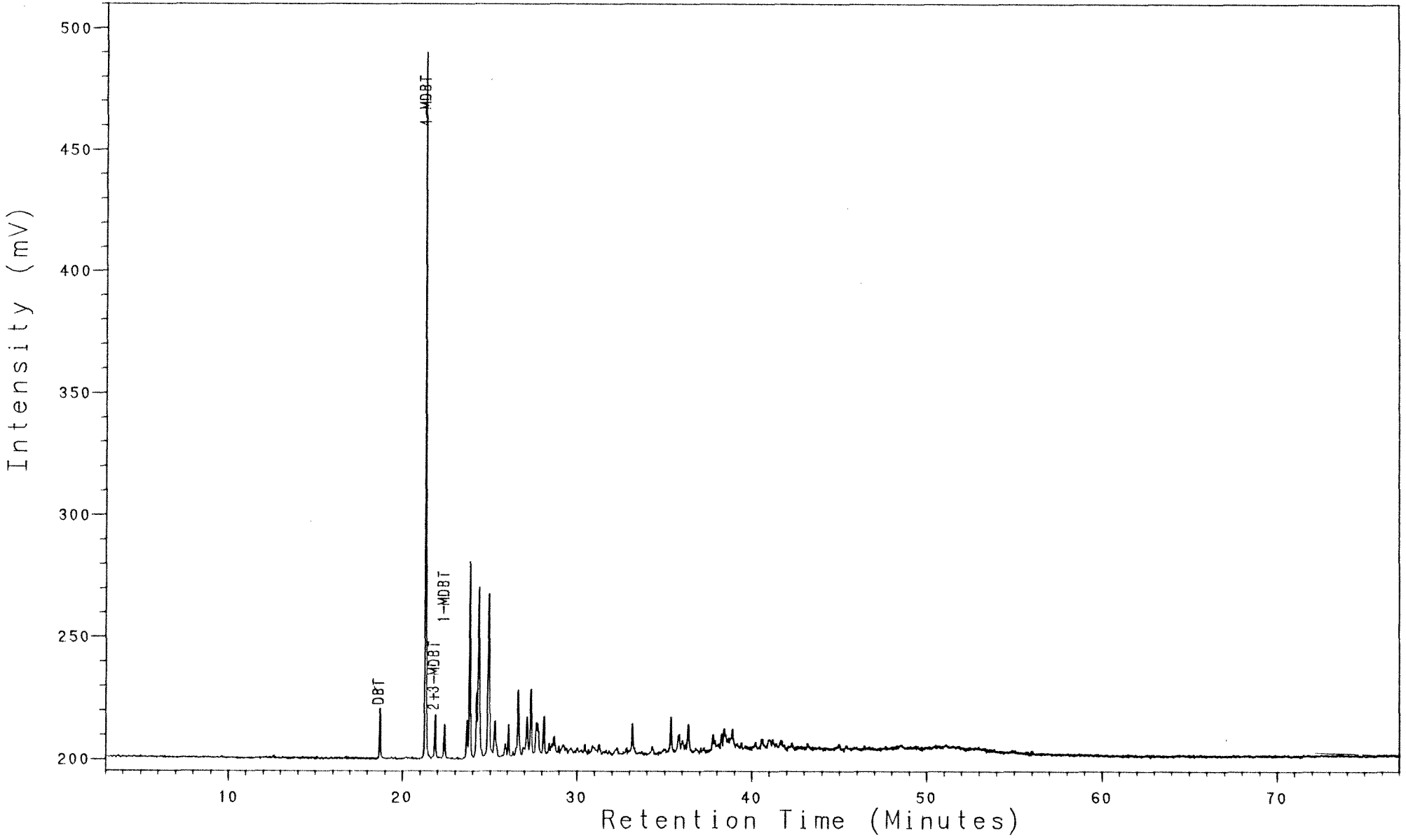
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis AC131310B 9, 1, 1 2/1-3, 3804m, ARO



NOCS 2/1-3 3804m
AROMATIC GC (FPD)
Composite sample

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

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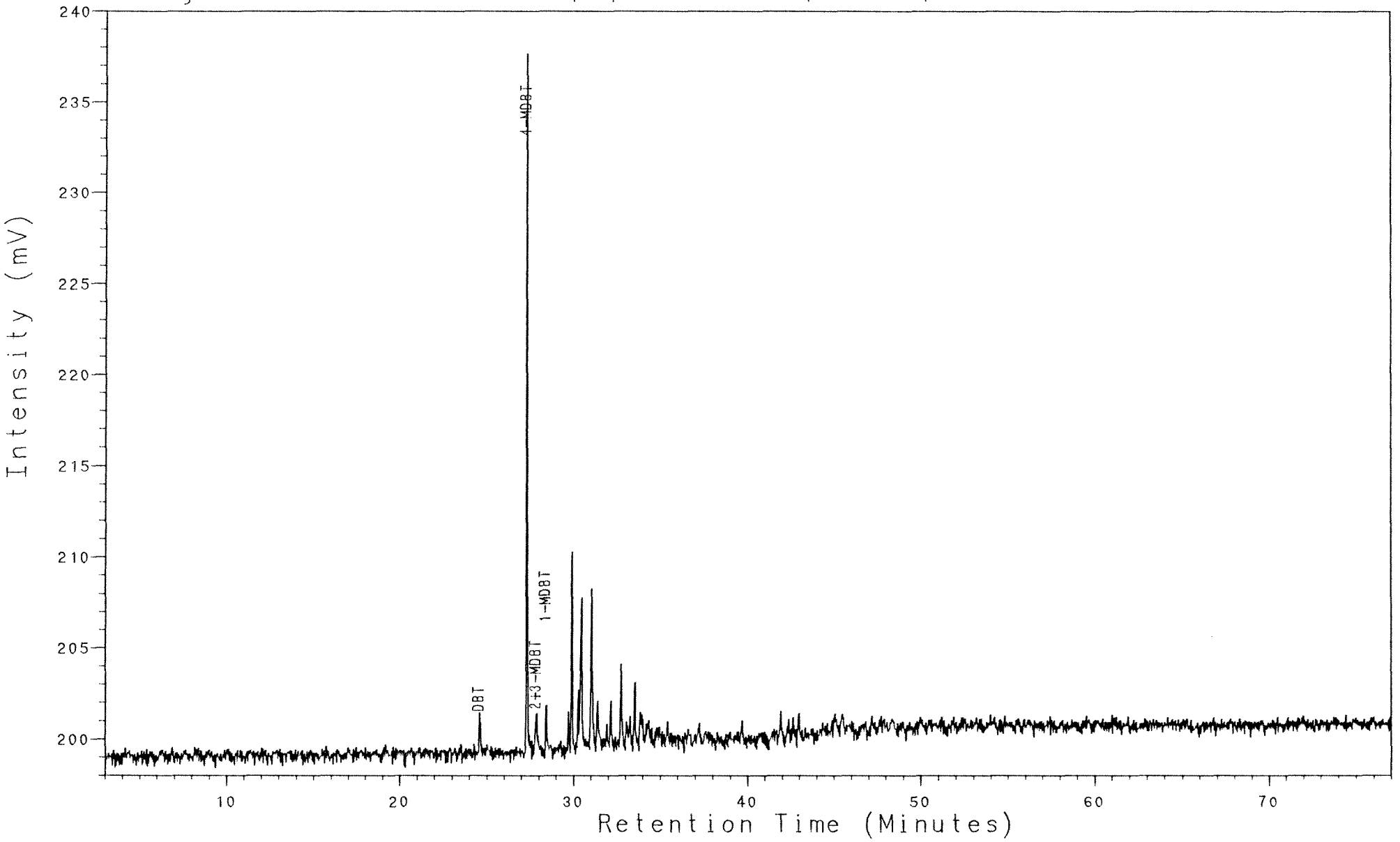

NOCS 2/1-3 3816m
AROMATIC GC (FPD)
Composite sample

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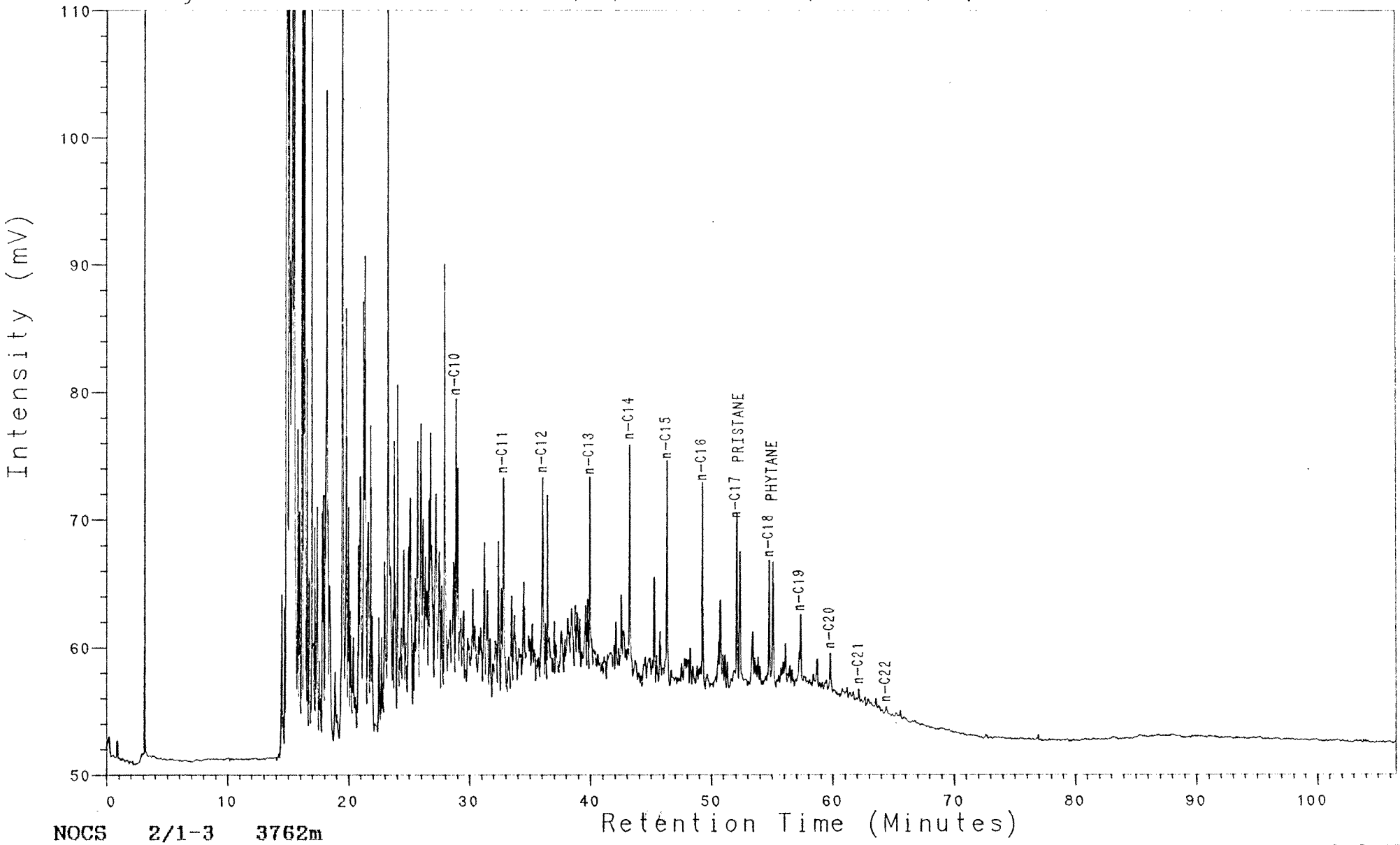
Analysis PC130261L 24, 1, 1 2/1-3, 3762m, S1



NOCS 2/1-3 3762m
THERMAL EXTRACTION GC (S1)
CLST:ol gy,m gy to drk gy

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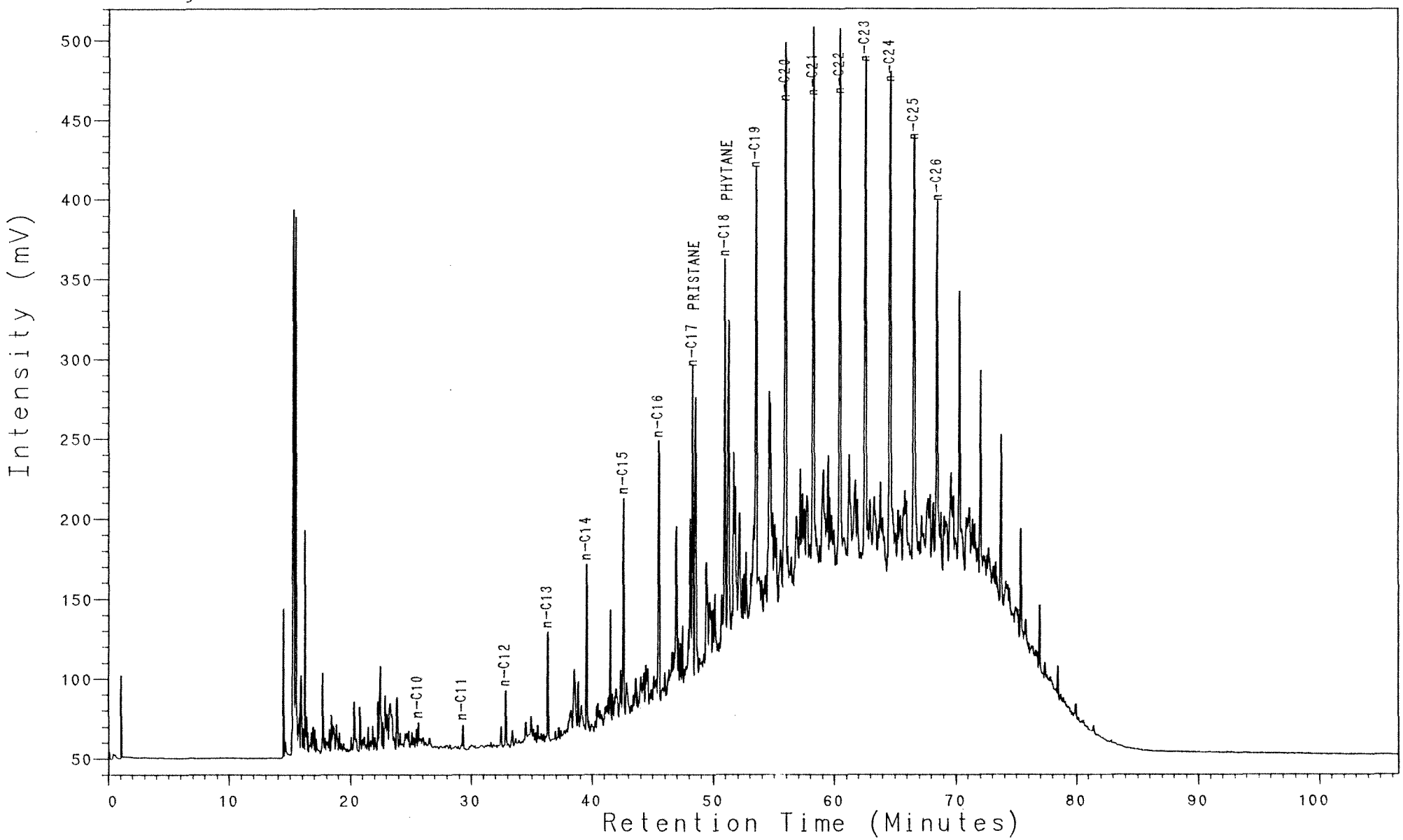
GEOCHEMICAL LABORATORIES OF NORWAY A/S

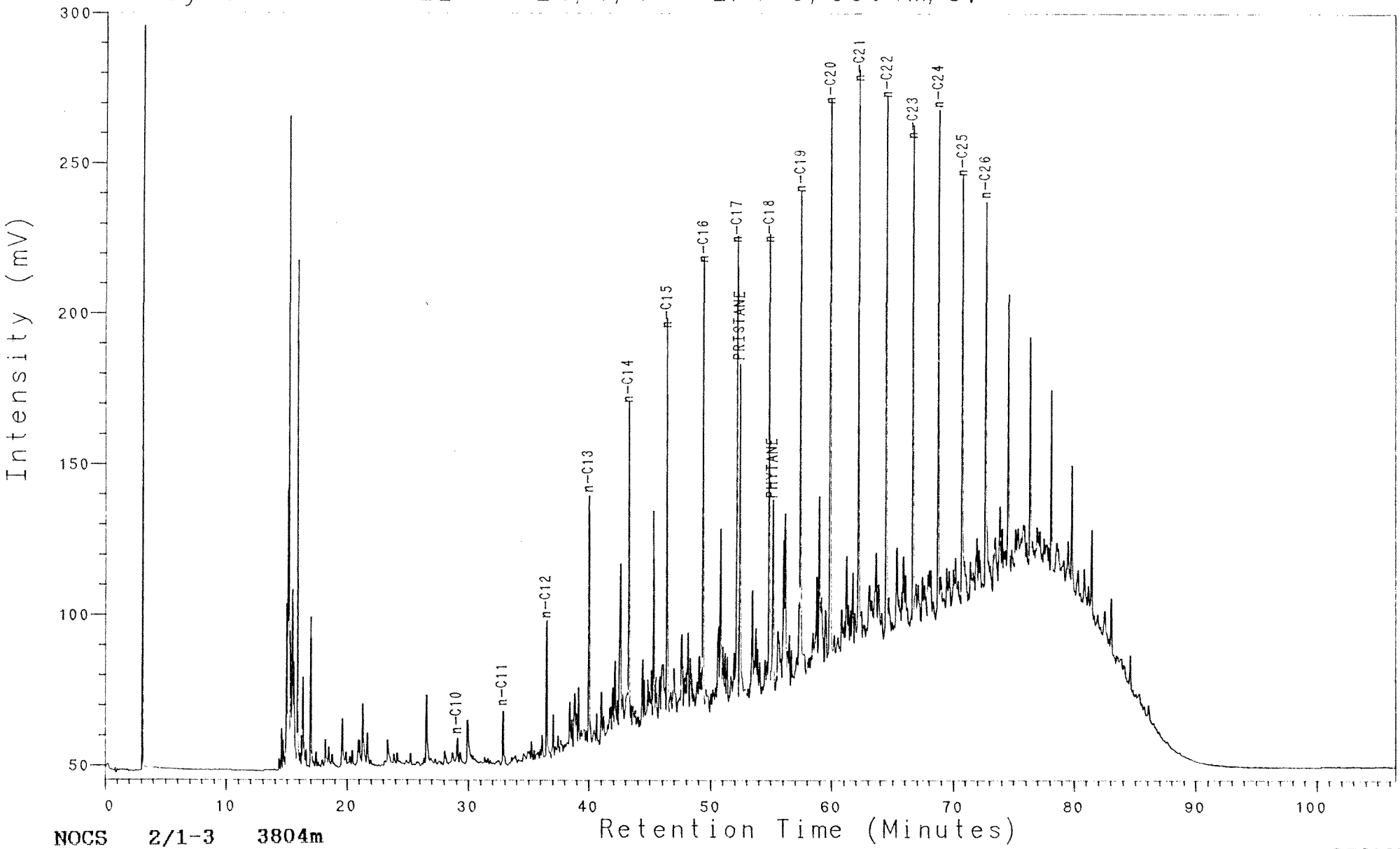
Analysis PC130322L 26, 1, 1 2/1-3, 3798m, S1



NOCS 2/1-3 3798m
THERMAL EXTRACTION GC (S1)
CLST:blk to brn blk

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130332L 24, 1, 1 2/1-3, 3804m, S1



NOCS 2/1-3 3804m
THERMAL EXTRACTION GC (S1)
CLST:blk to brn blk

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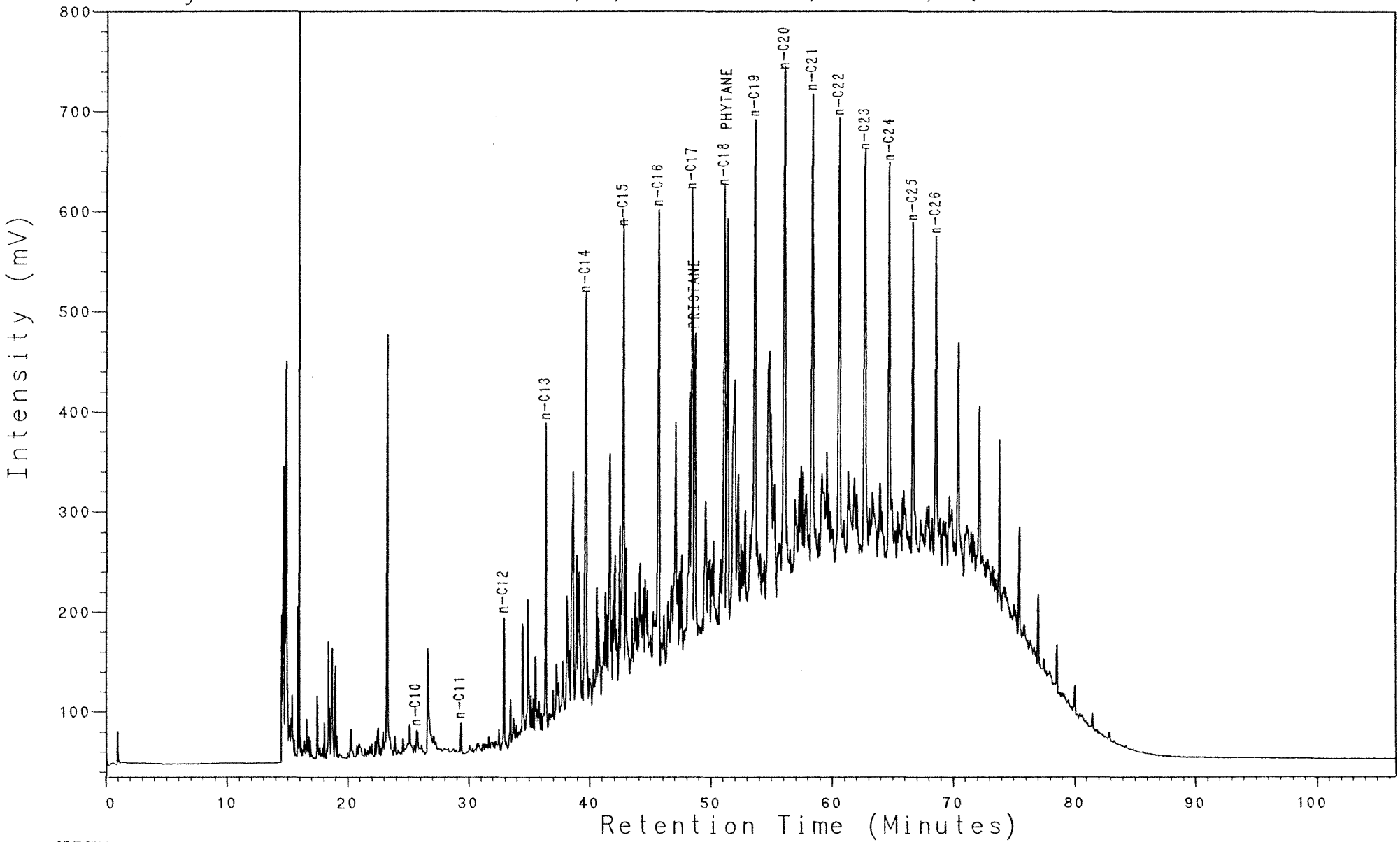
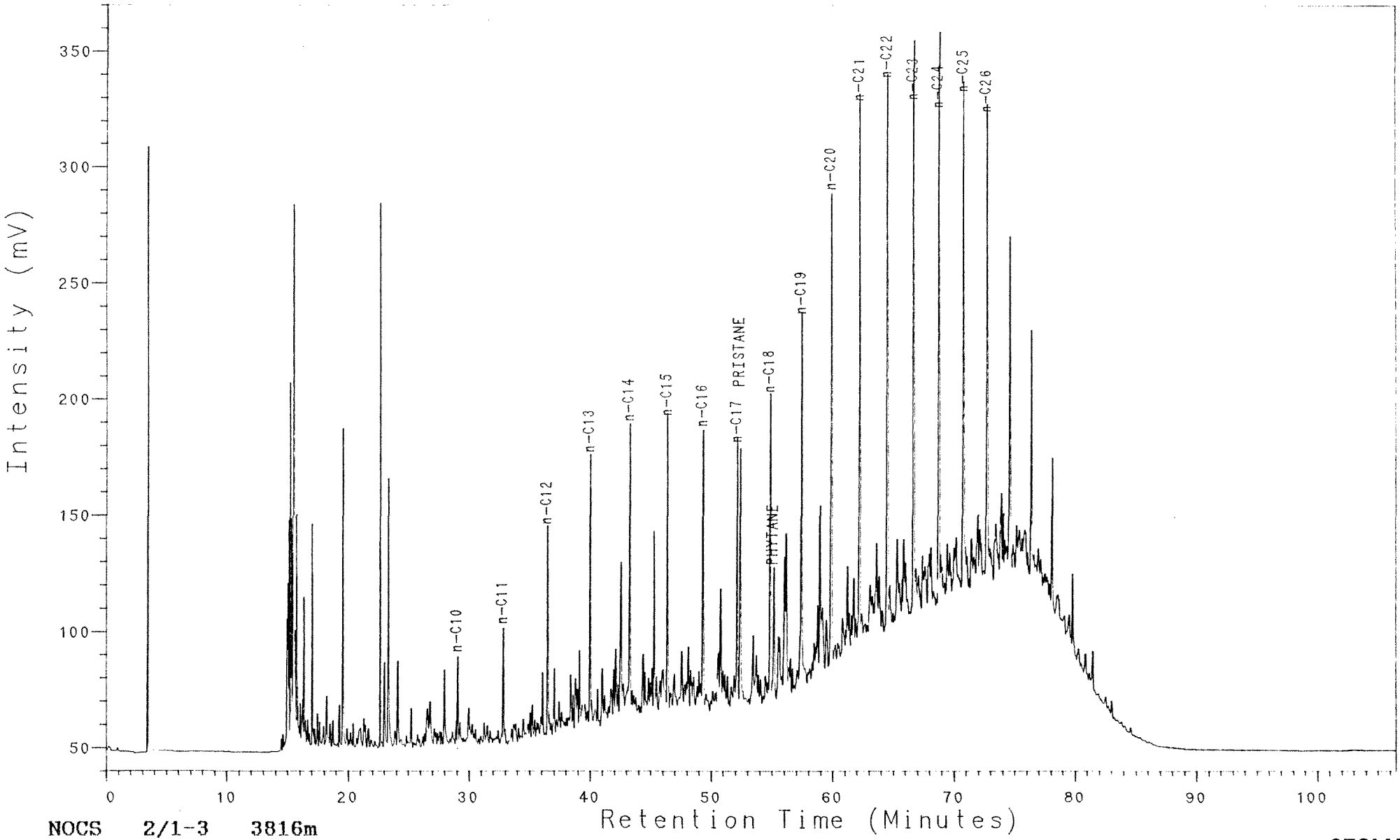


NOCS 2/1-3 3810m
THERMAL EXTRACTION GC (S1)
CLST:blk to brn blk

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130352L 24, 1, 1 2/1-3, 3816m, S1



NOCS 2/1-3 3816m
THERMAL EXTRACTION GC (S1)
CLST:blk to brn blk

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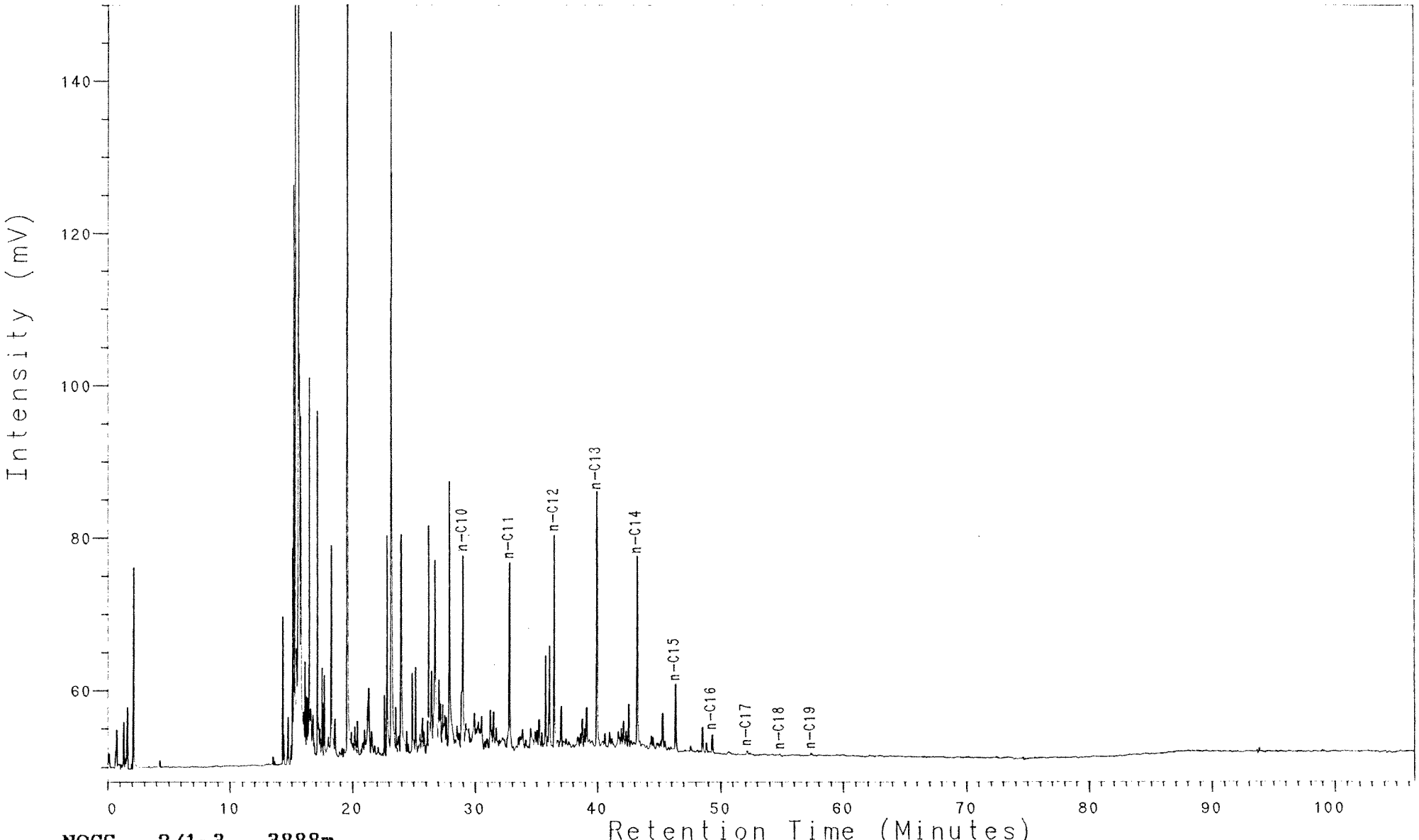
GEOCHEMICAL LABORATORIES OF NORWAY A/S

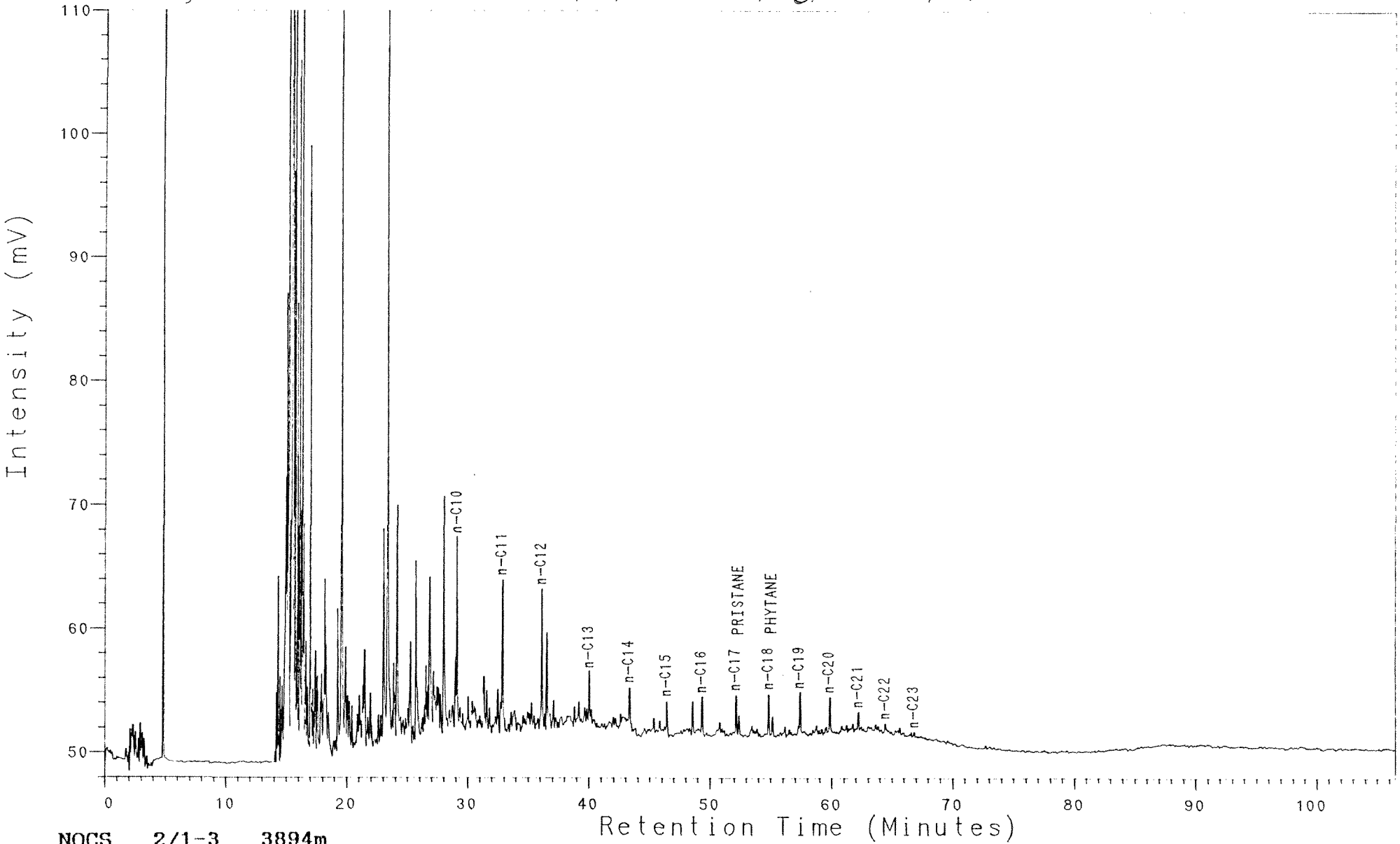
Analysis PC130471L 24, 1, 1 2/1-3, 3888m, S1



NOCS 2/1-3 3888m
THERMAL EXTRACTION GC (S1)
CLST: lt gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

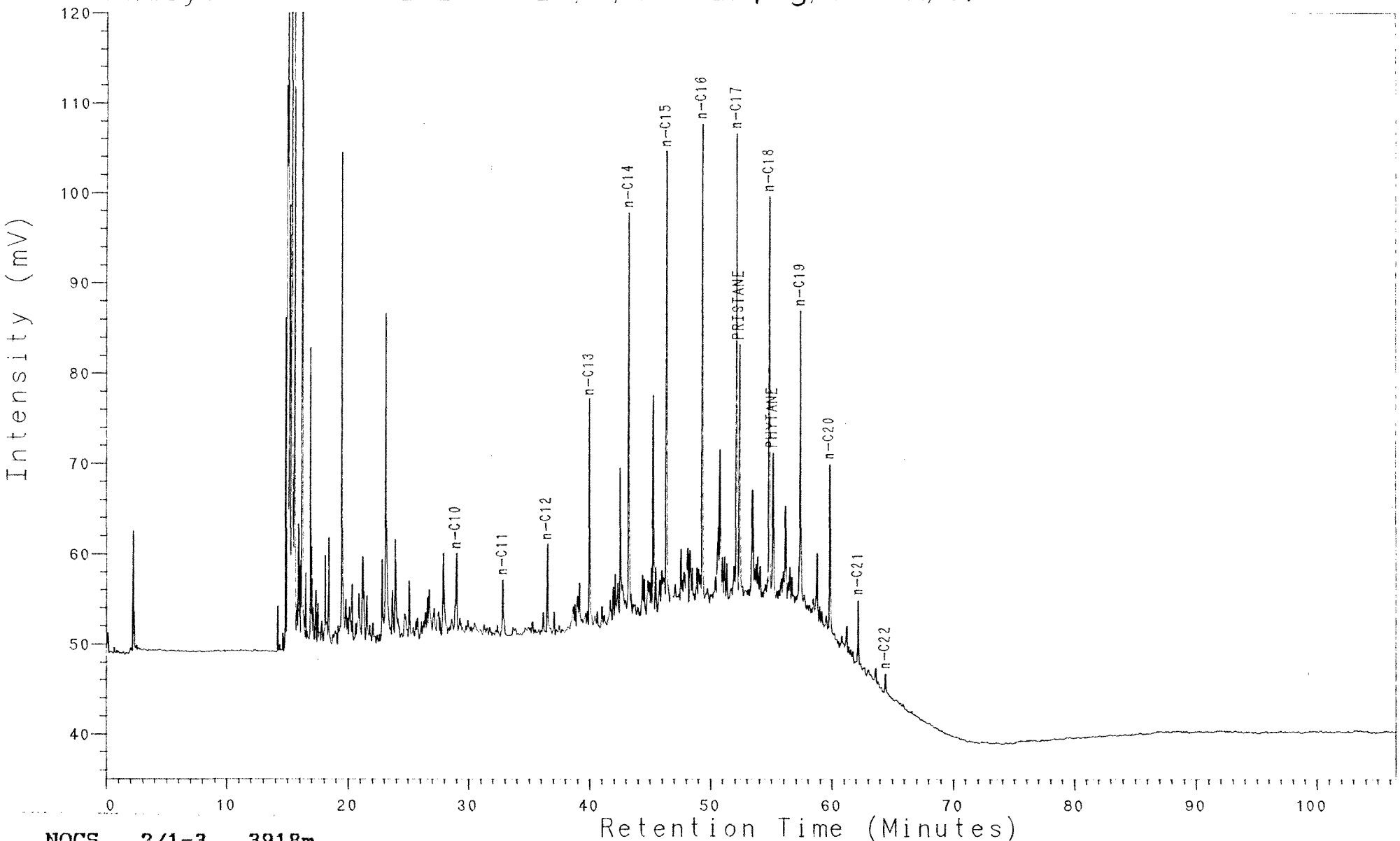
Analysis PC130481L 24, 1, 1 2/1-3, 3894m, S1



NOCS 2/1-3 3894m
THERMAL EXTRACTION GC (S1)
CLST:lt gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

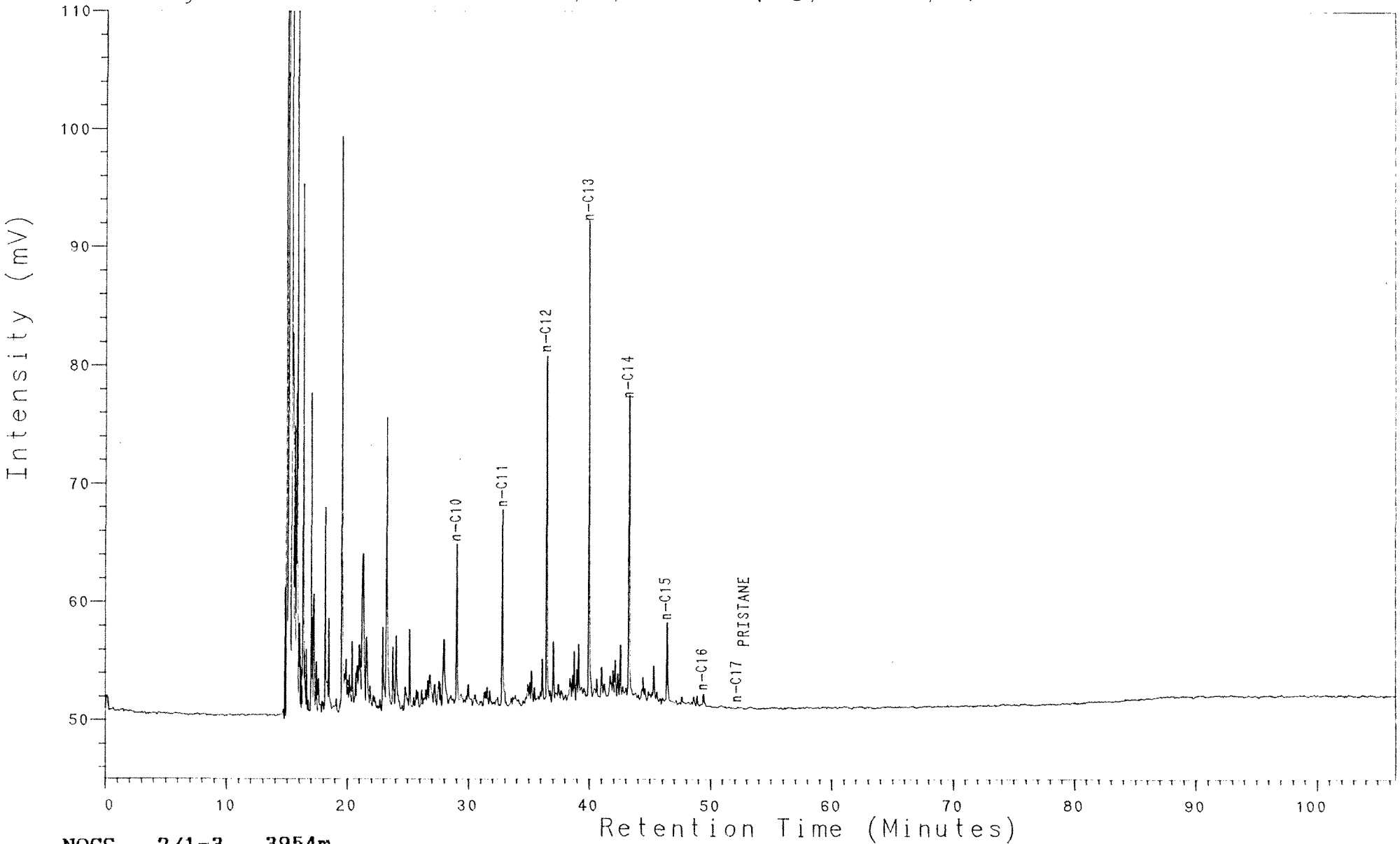
Analysis PC130523L 24, 1, 1 2/1-3, 3918m, S1



NOCS 2/1-3 3918m
PYROLYSIS GC (S2)
CLST:lt gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

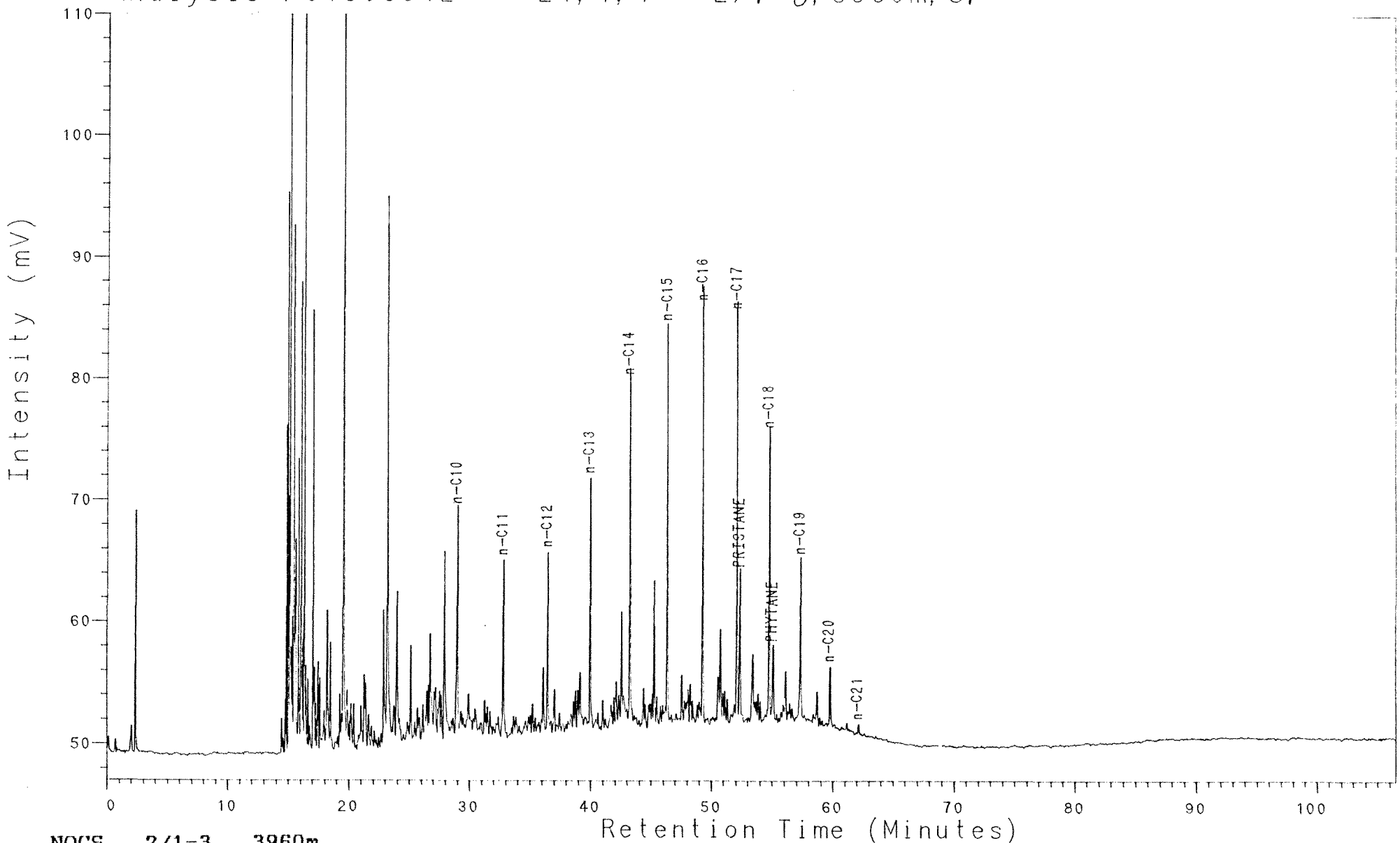
Analysis PC130581L 24, 1, 1 2/1-3, 3954m, S1



NOCS 2/1-3 3954m
THERMAL EXTRACTION GC (S1)
CLST:m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

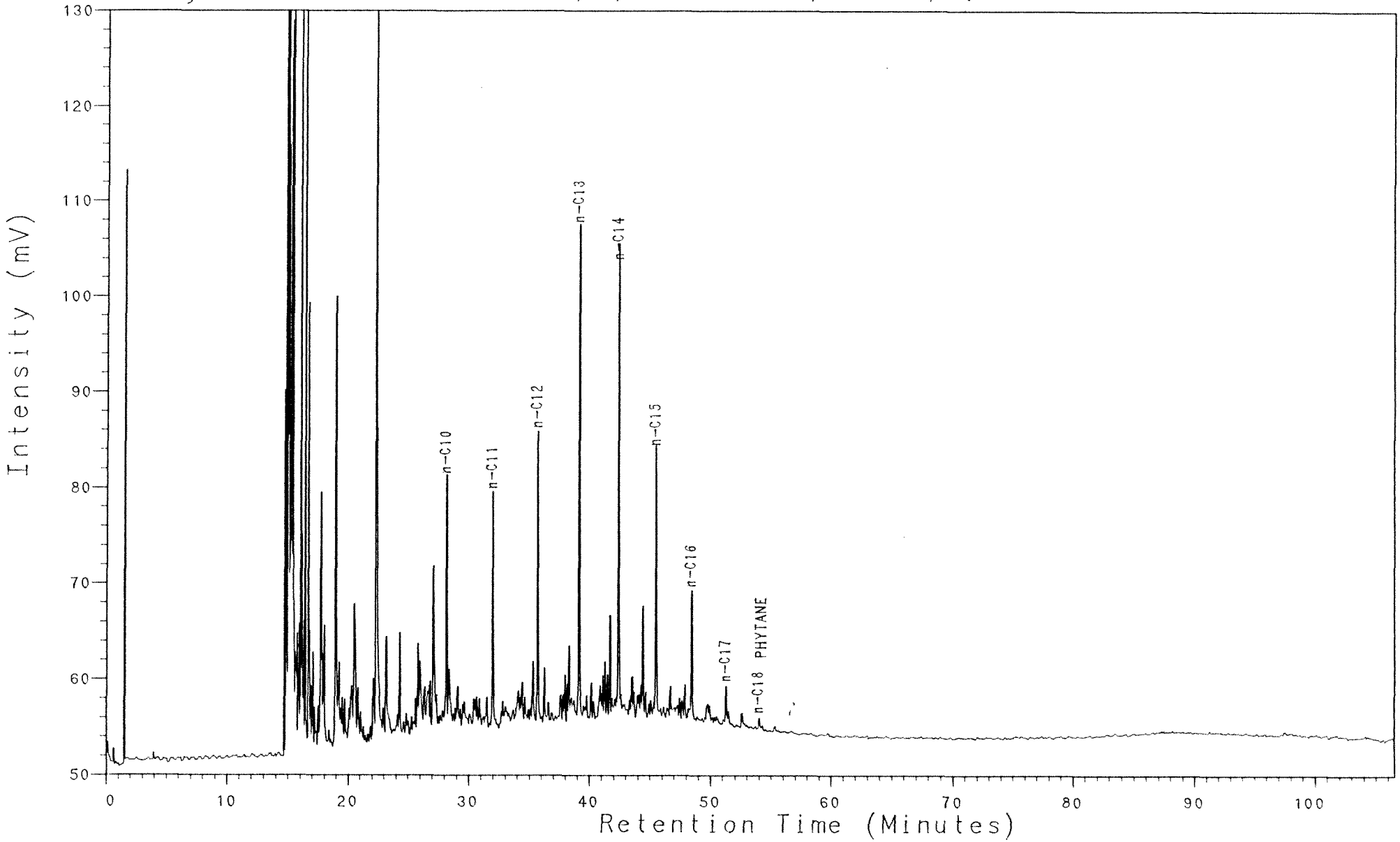
Analysis PC130591L 24, 1, 1 2/1-3, 3960m, S1



NOCS 2/1-3 3960m
THERMAL EXTRACTION GC (S1)
CLST:m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

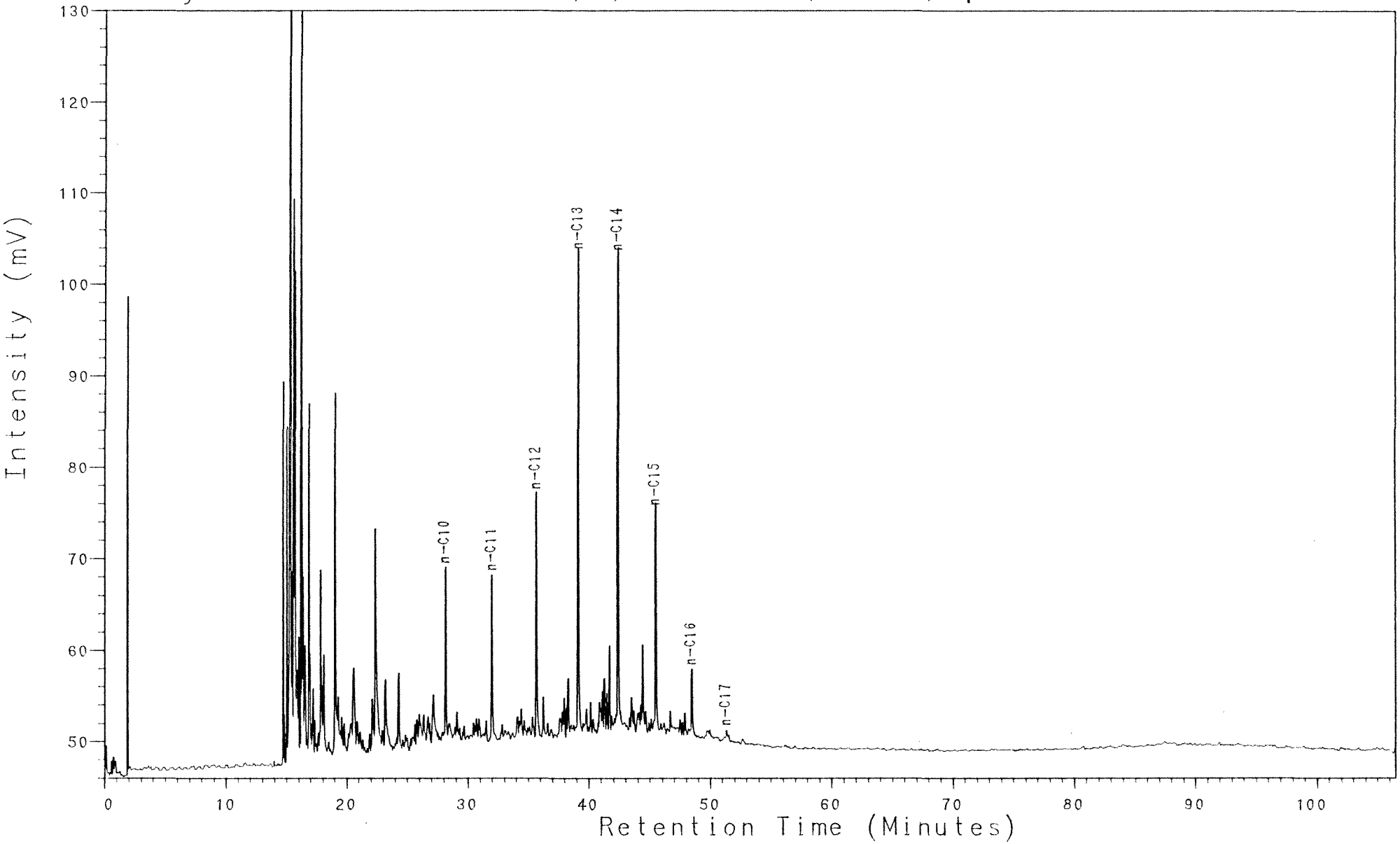
Analysis PC130651L 24, 1, 1 2/1-3, 3996m, S1



NOCS 2/1-3 3996m
THERMAL EXTRACTION GC (S1)
CLST: m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

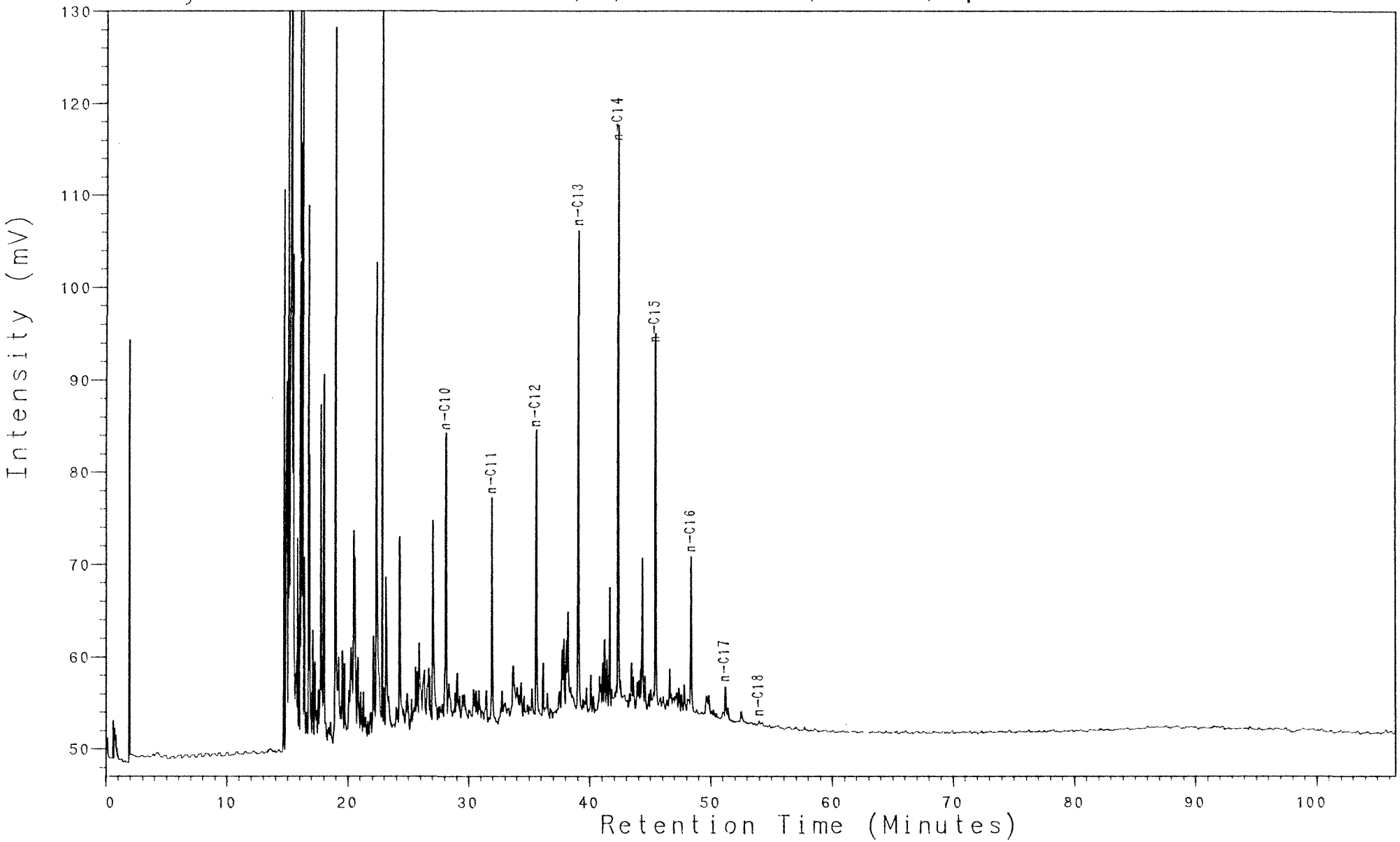
Analysis PC130681L 24, 1, 1 2/1-3, 4020m, S1



NOCS 2/1-3 4020m
THERMAL EXTRACTION GC (S1)
CLST: m gy to drk gy

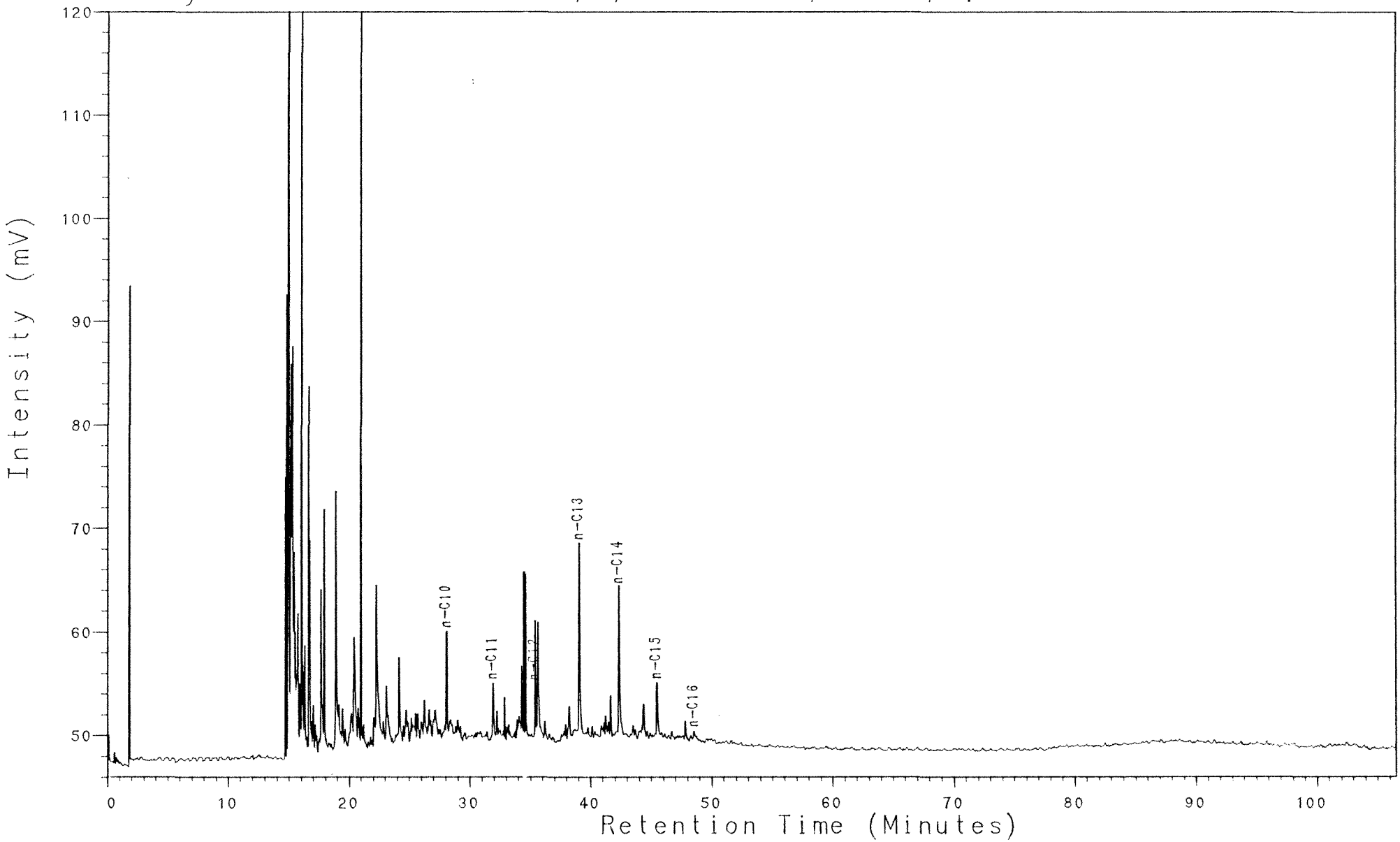
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130771L 24, 1, 1 2/1-3, 4074m, S1



NOCS 2/1-3 4074m
THERMAL EXTRACTION GC (S1)
CLST: blk, ol gy, ol blk, m gy,
drk gy

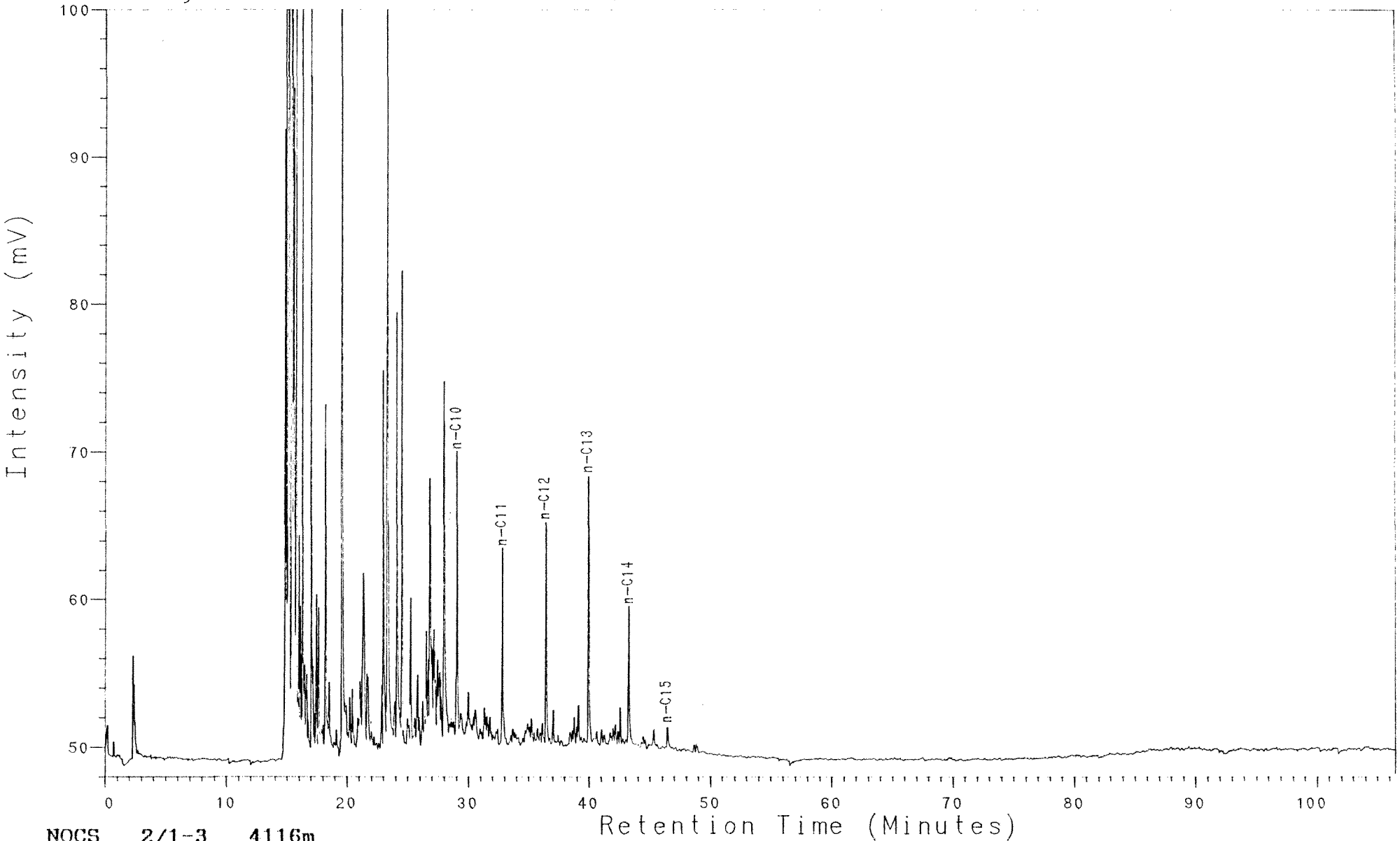
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4104m
THERMAL EXTRACTION GC (S1)
CLST: blk, ol gy, ol blk, m gy,
drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

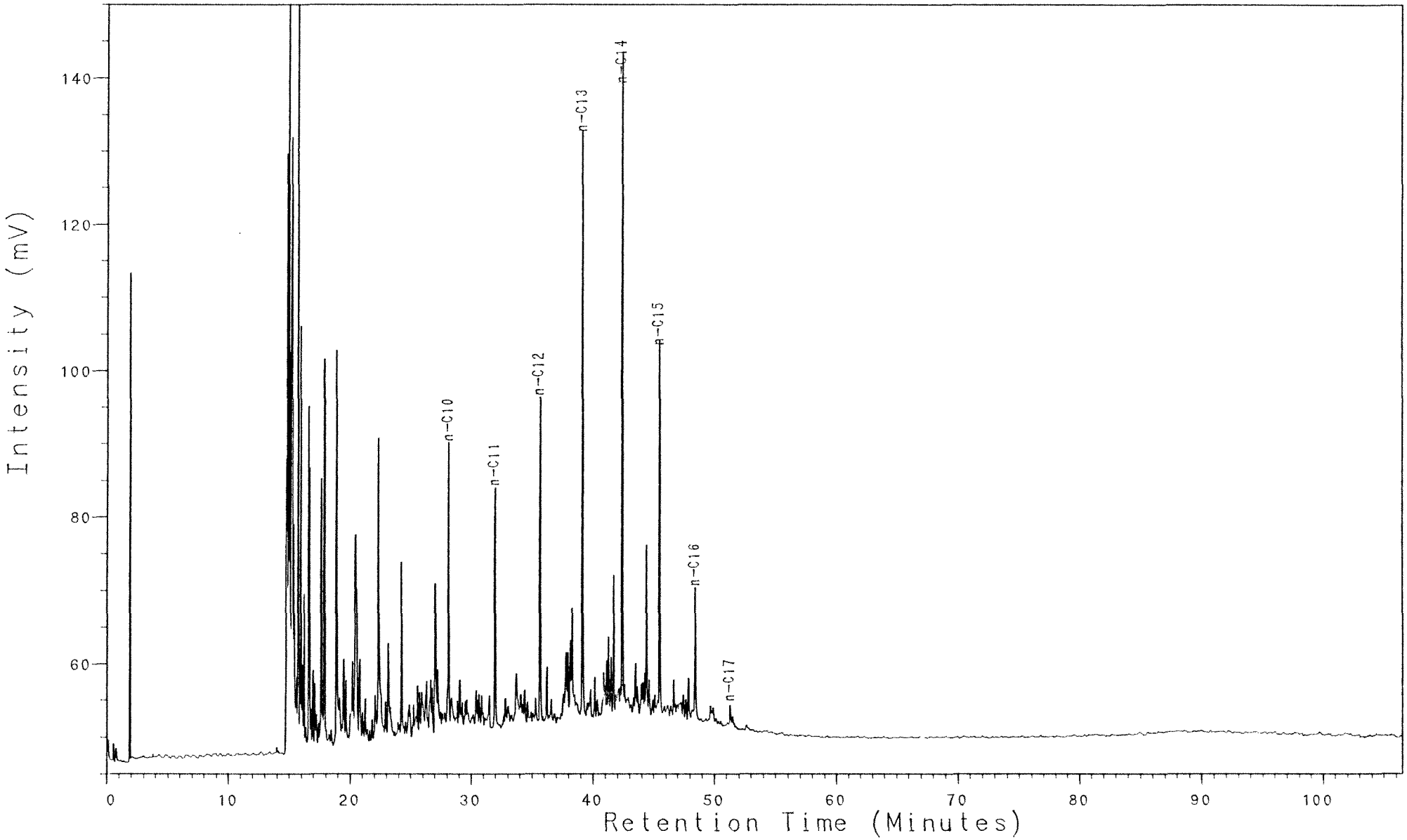
Analysis PC130841L 24, 1, 1 2/3-1, 4116m, S1



NOCS 2/1-3 4116m
THERMAL EXTRACTION GC (S1)
CLST:blk,ol gy,ol blk,m gy,
drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

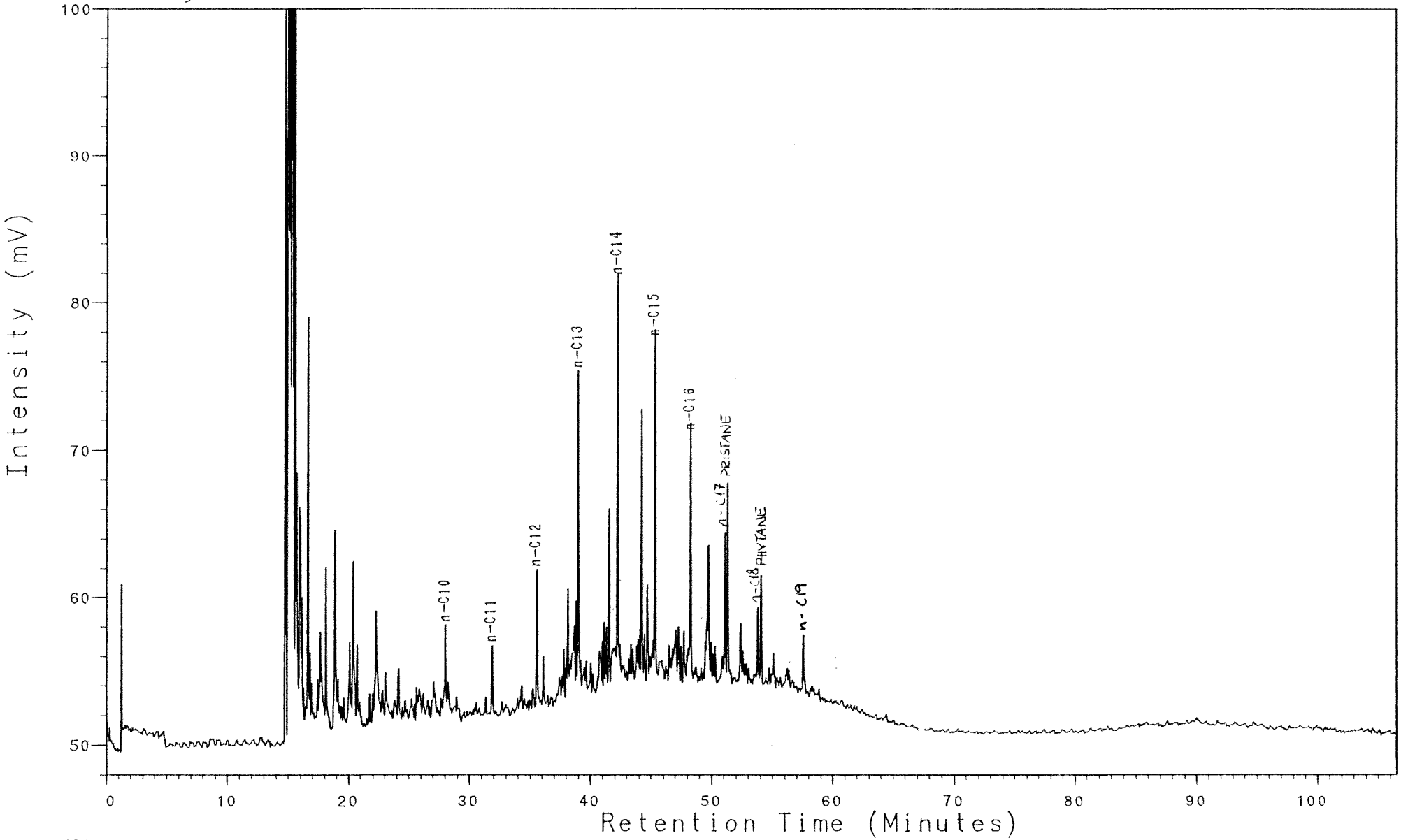
Analysis PC130911L 24, 1, 1 2/1-3, 4158m, S1



NOCS 2/1-3 4158m
THERMAL EXTRACTION GC (S1)
CLST: gy blk, gn gy, ol gy, m gy, drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

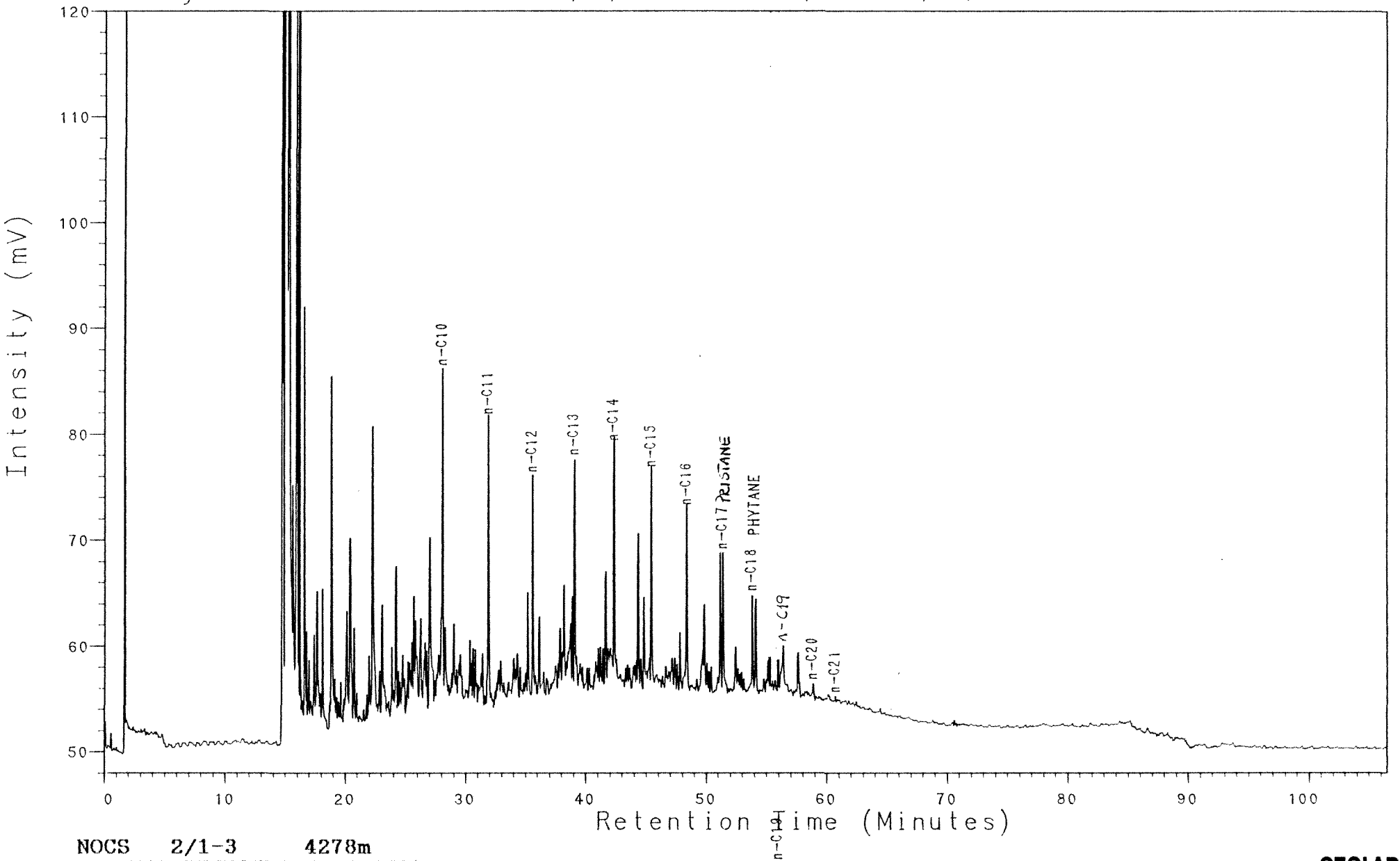
Analysis PC131092L 24, 1, 1 2/1-3, 4272m, S1



NOCS 2/1-3 4272m
THERMAL EXTRACTION GC (S1)
SLTST: brn gy

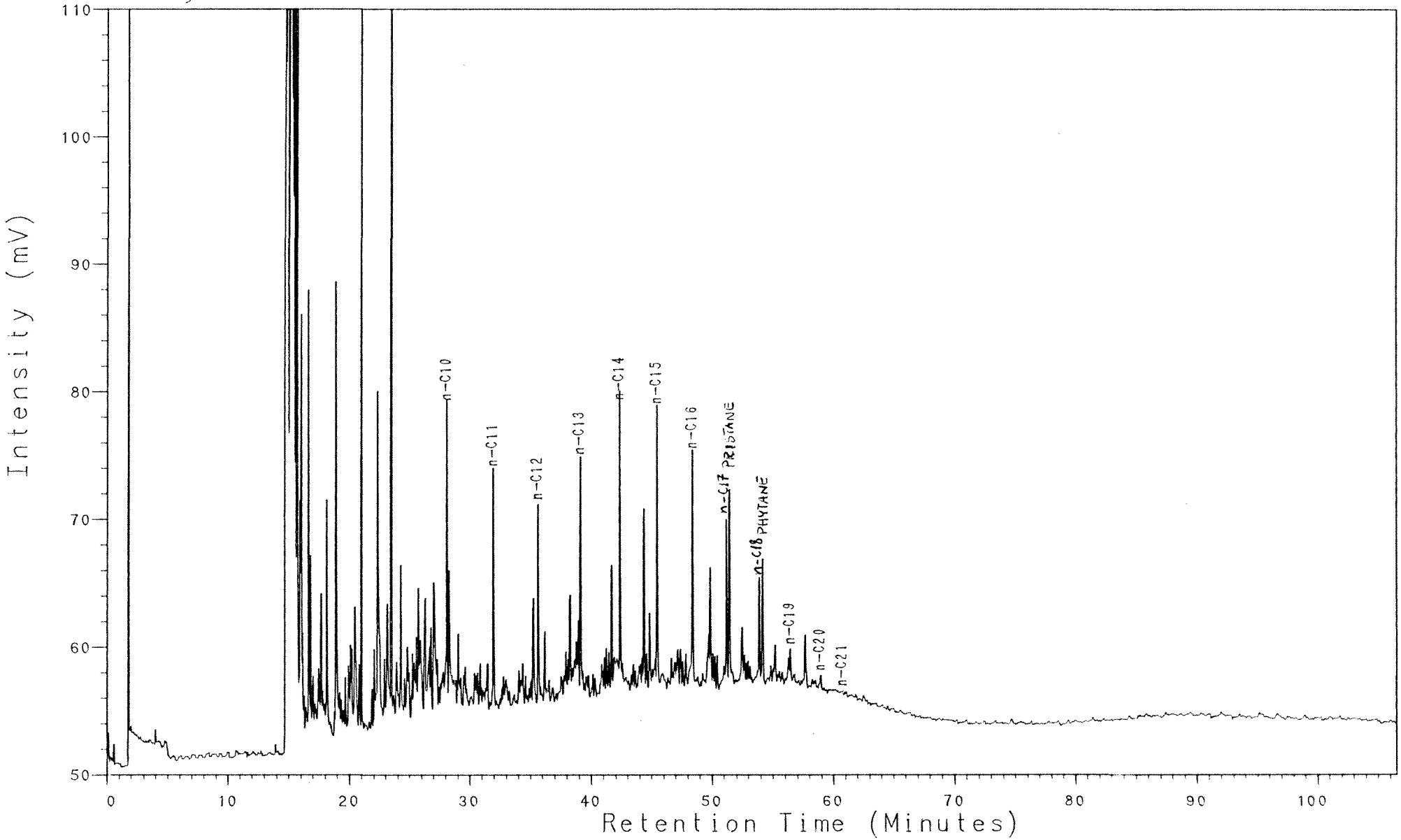
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC131102L 24, 1, 1 2/1-3, 4278m, S1



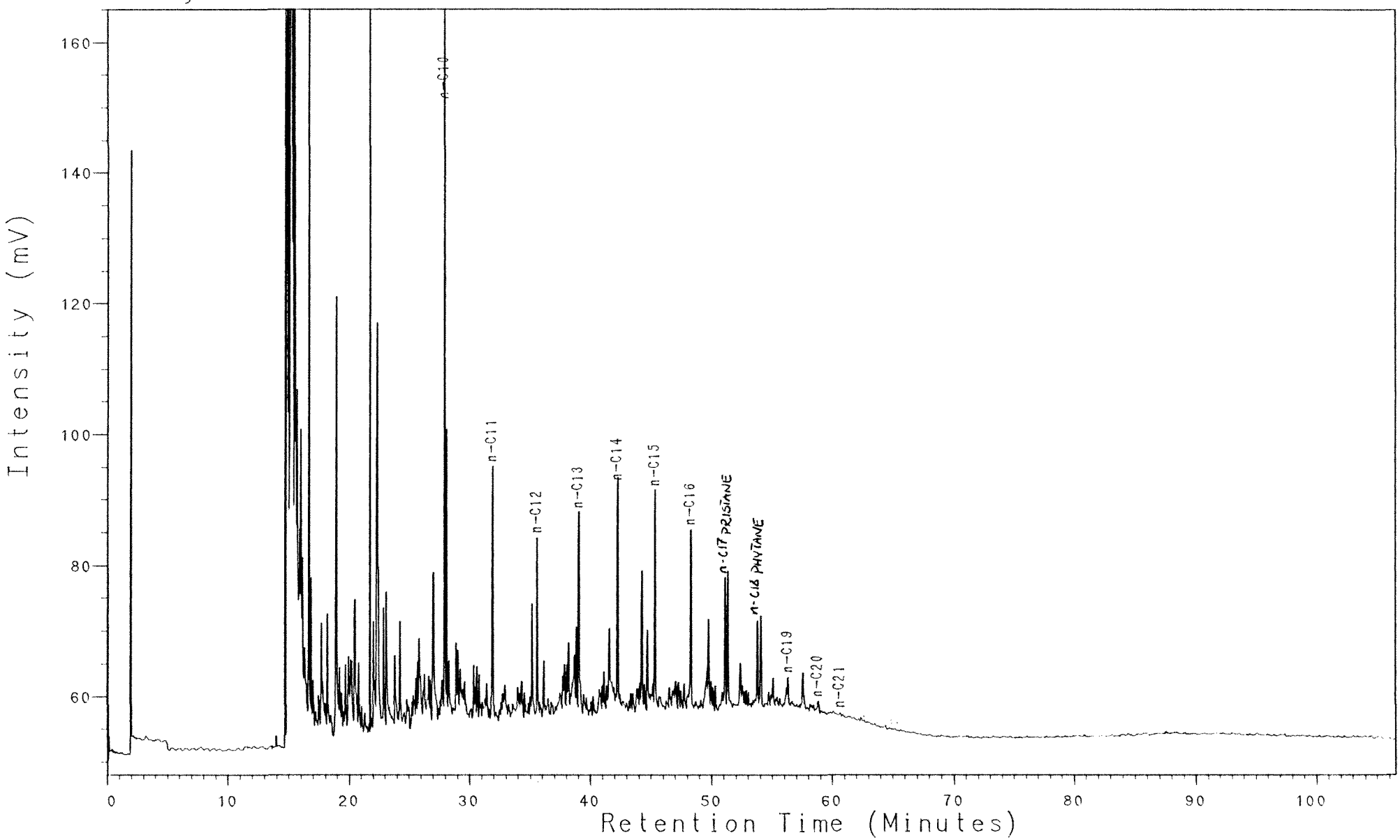
NOCS 2/1-3 4278m
THERMAL EXTRACTION GC (S1)
SLTST: brn gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4286m
THERMAL EXTRACTION GC (S1)
SLTST: brn gy

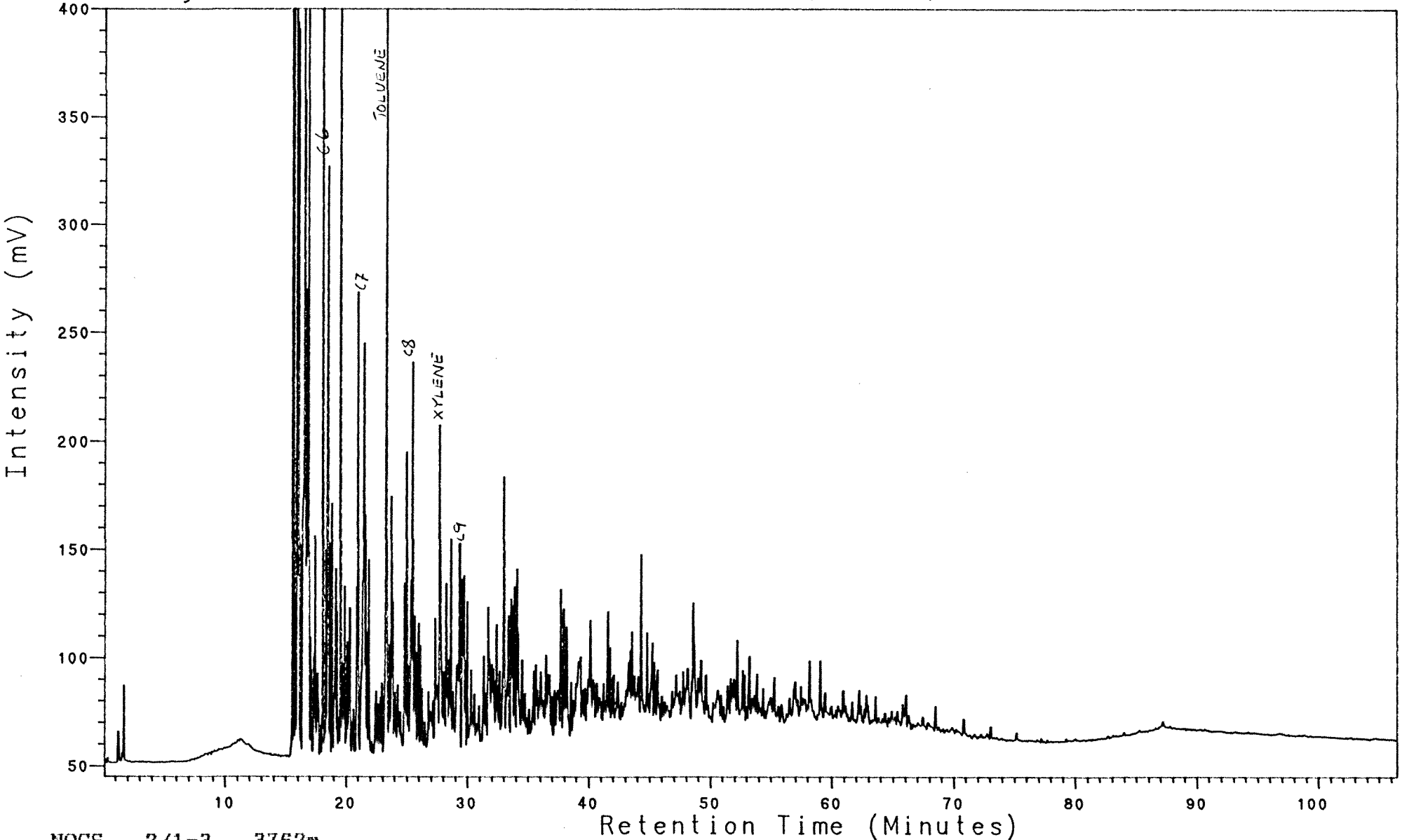
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4290m
THERMAL EXTRACTION GC (S1)
SLTST: brn gy

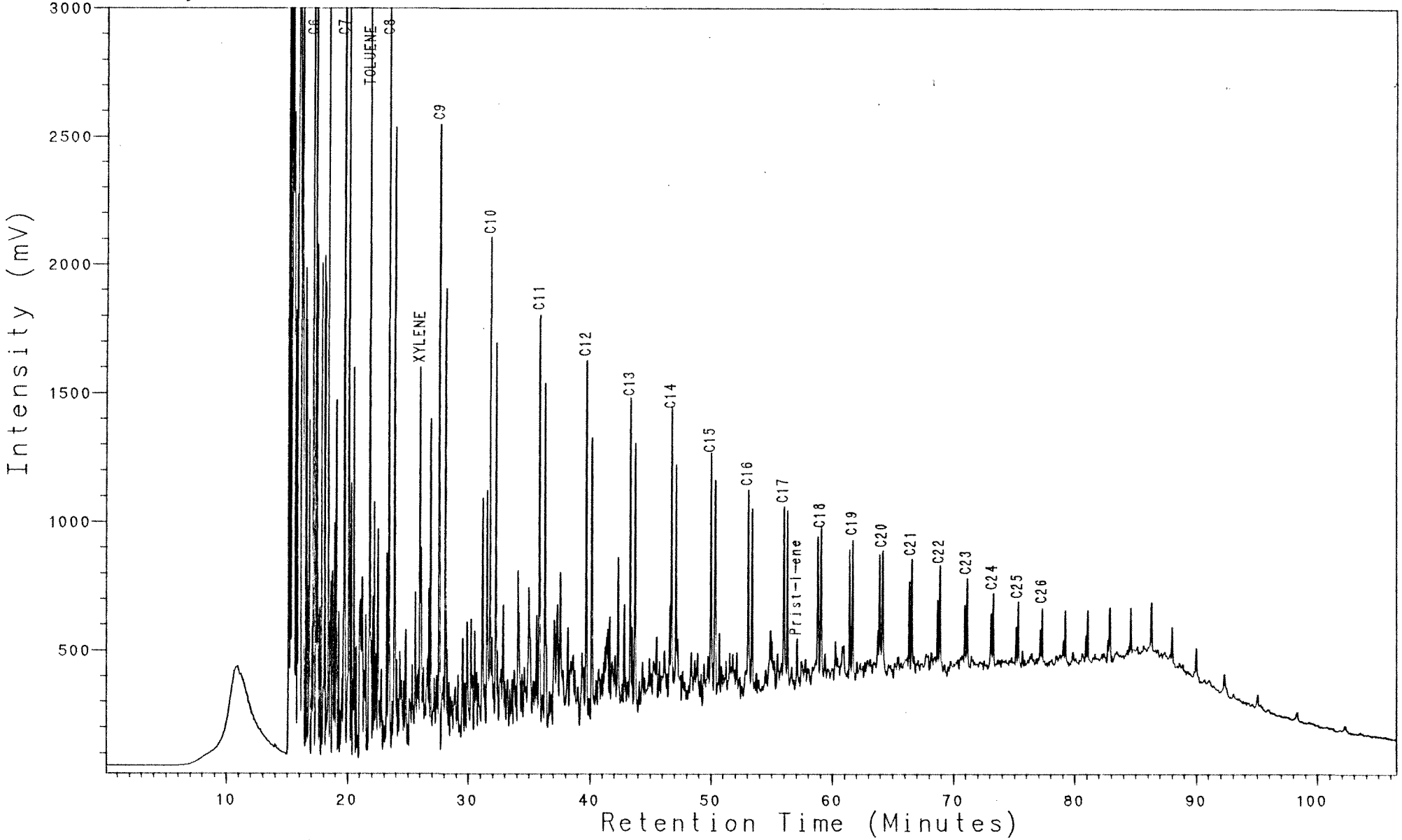
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130261L 23, 1, 1 2/1-3, 3762m, S2



NOCS 2/1-3 3762m
PYROLYSIS GC (S2)
CLST:ol gy,m gy to drk gy

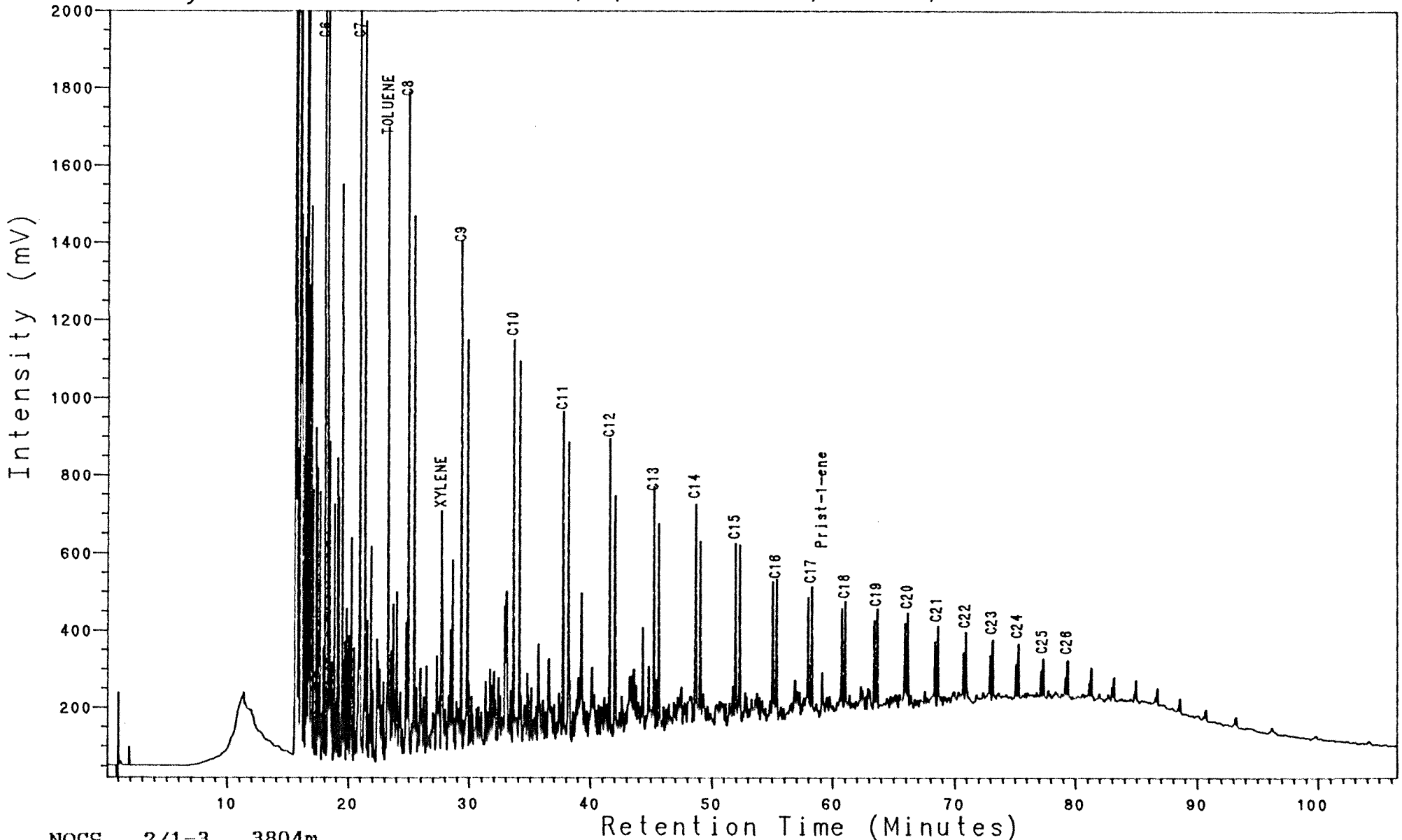
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 3798m
PYROLYSIS GC (S2)
CLST:blk to brn blk

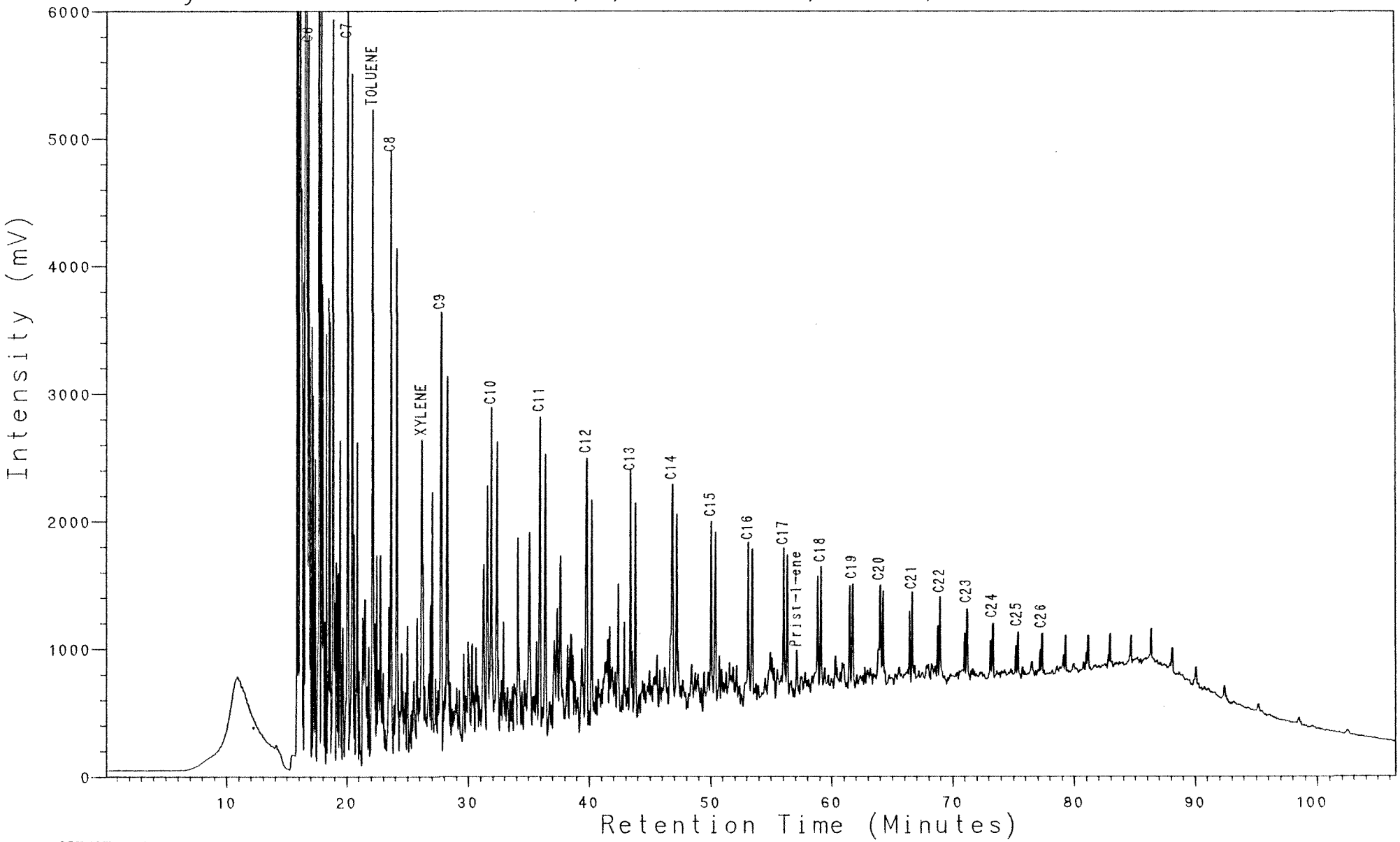
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130332L 23, 1, 1 2/1-3, 3804m, S2



NOCS 2/1-3 3804m
PYROLYSIS GC (S2)
CLST:blk to brn blk

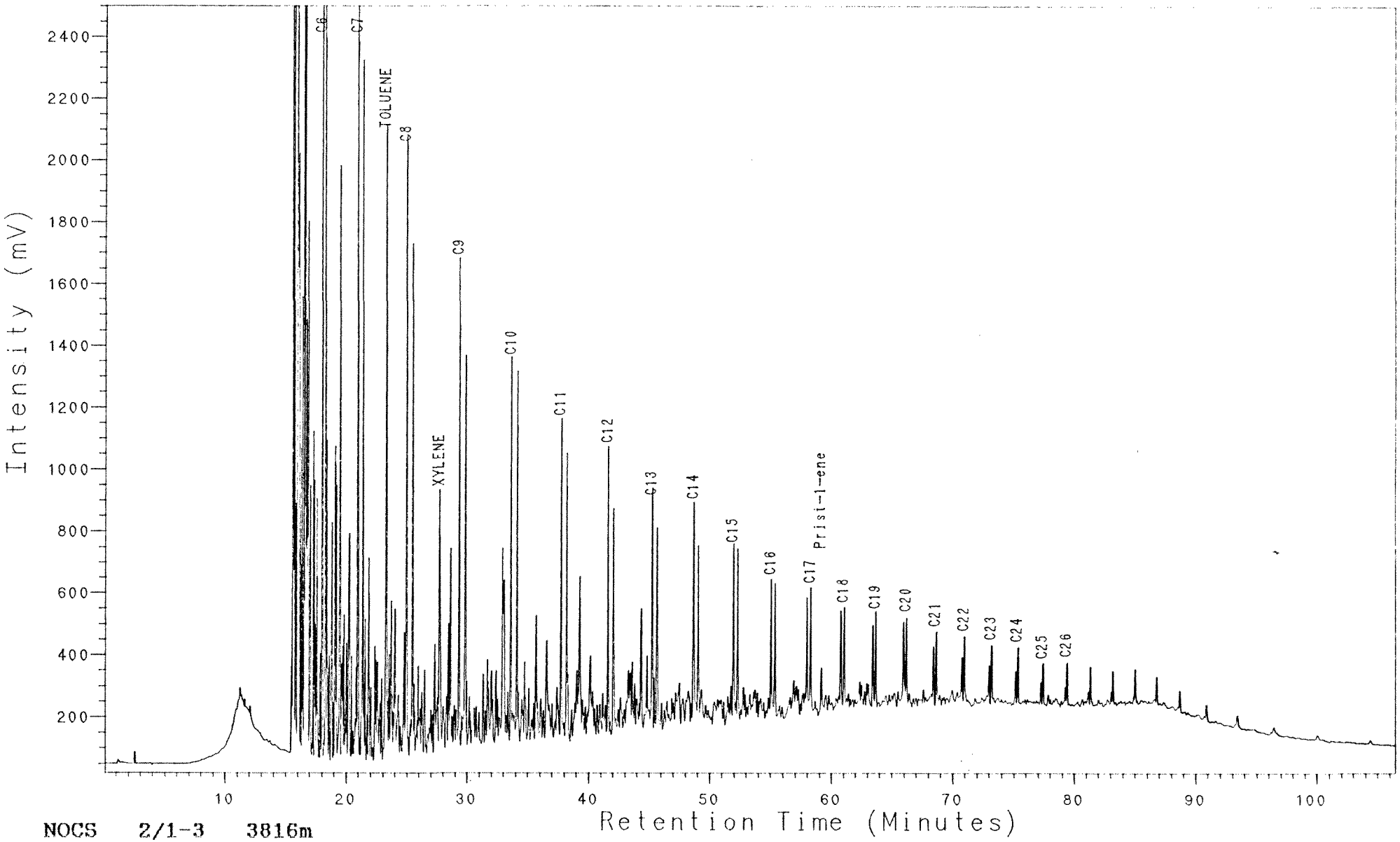
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 3810m
PYROLYSIS GC (S2)
CLST:blk to brn blk

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

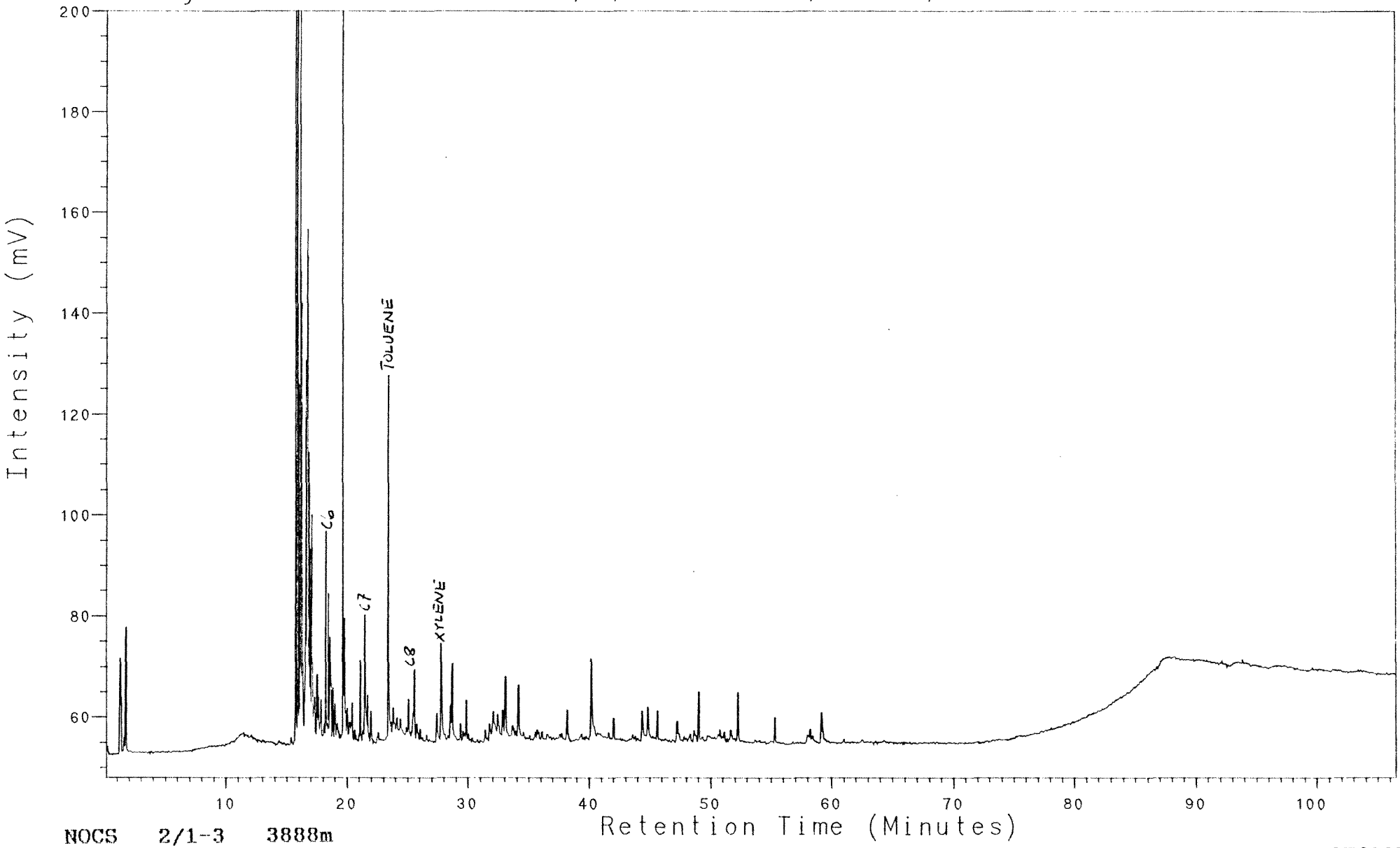
Analysis PC130352L 23, 1, 1 2/1-3, 3816m, S2



NOCS 2/1-3 3816m
PYROLYSIS GC (S2)
CLST:blk to brn blk

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

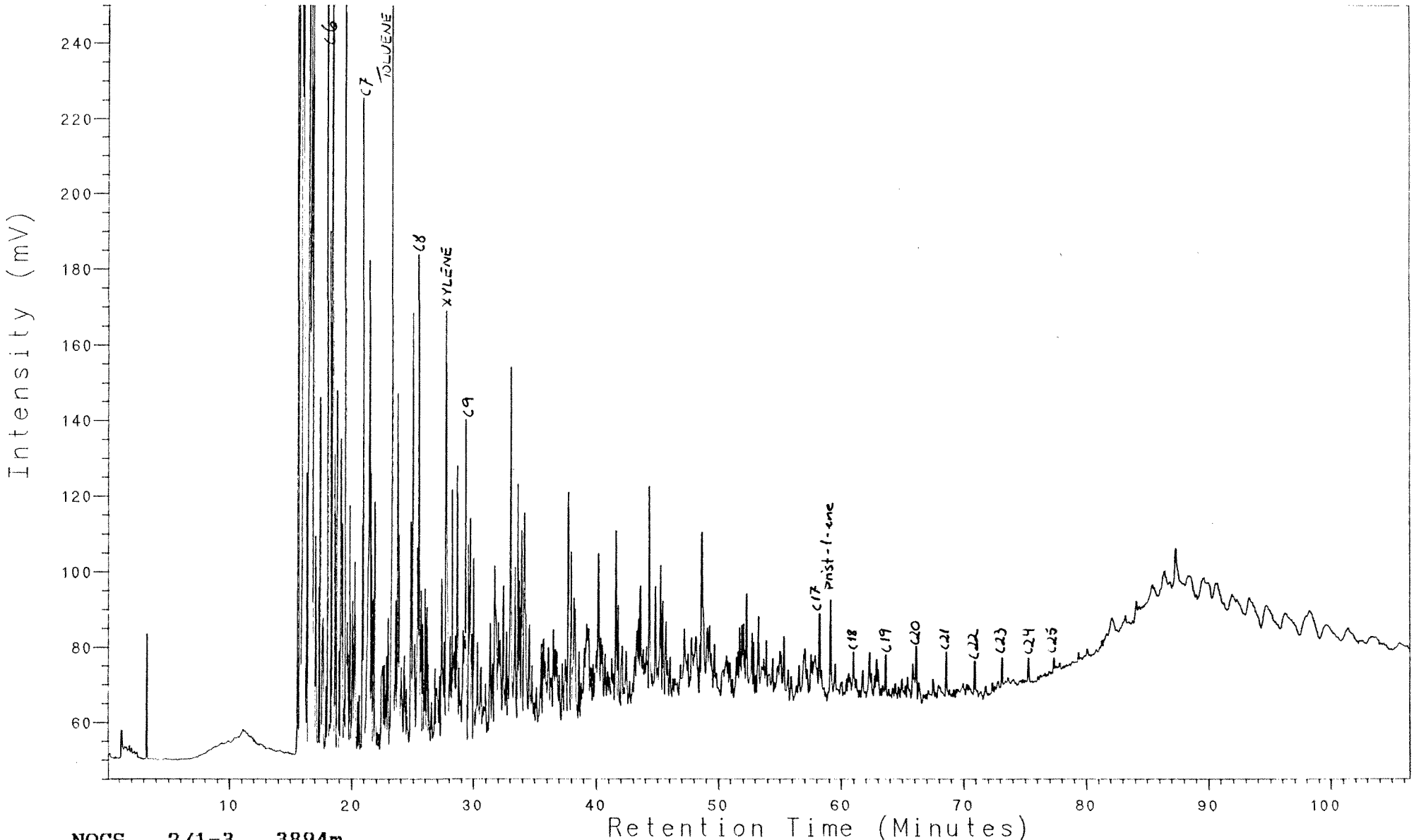
Analysis PC130471L 23, 1, 1 2/1-3, 3888m, S2



NOCS 2/1-3 3888m
PYROLYSIS GC (S2)
CLST: lt gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

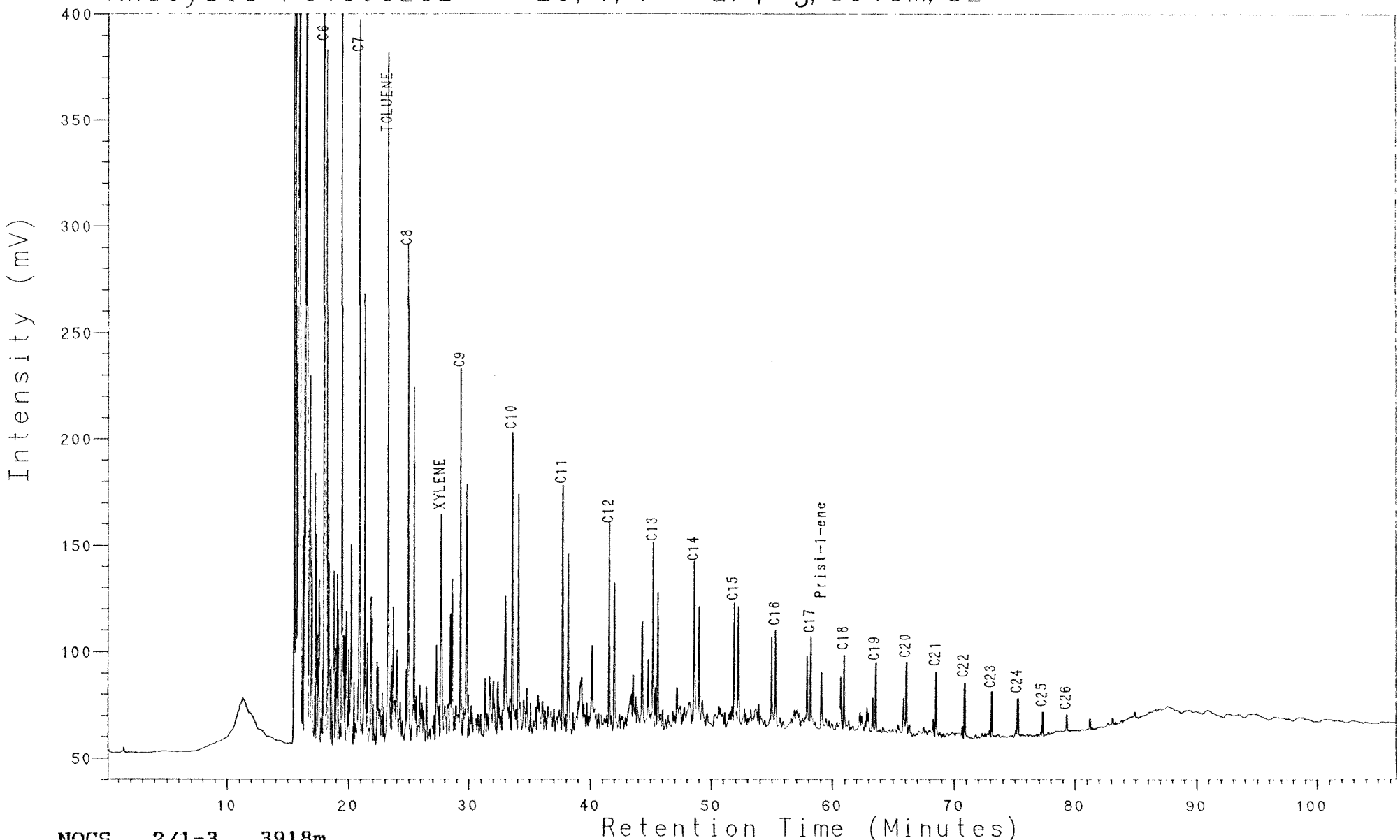
Analysis PC130481L 23, 1, 1 2/1-3, 3894m, S2



NOCS 2/1-3 3894m
PYROLYSIS GC (S2)
CLST: lt gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

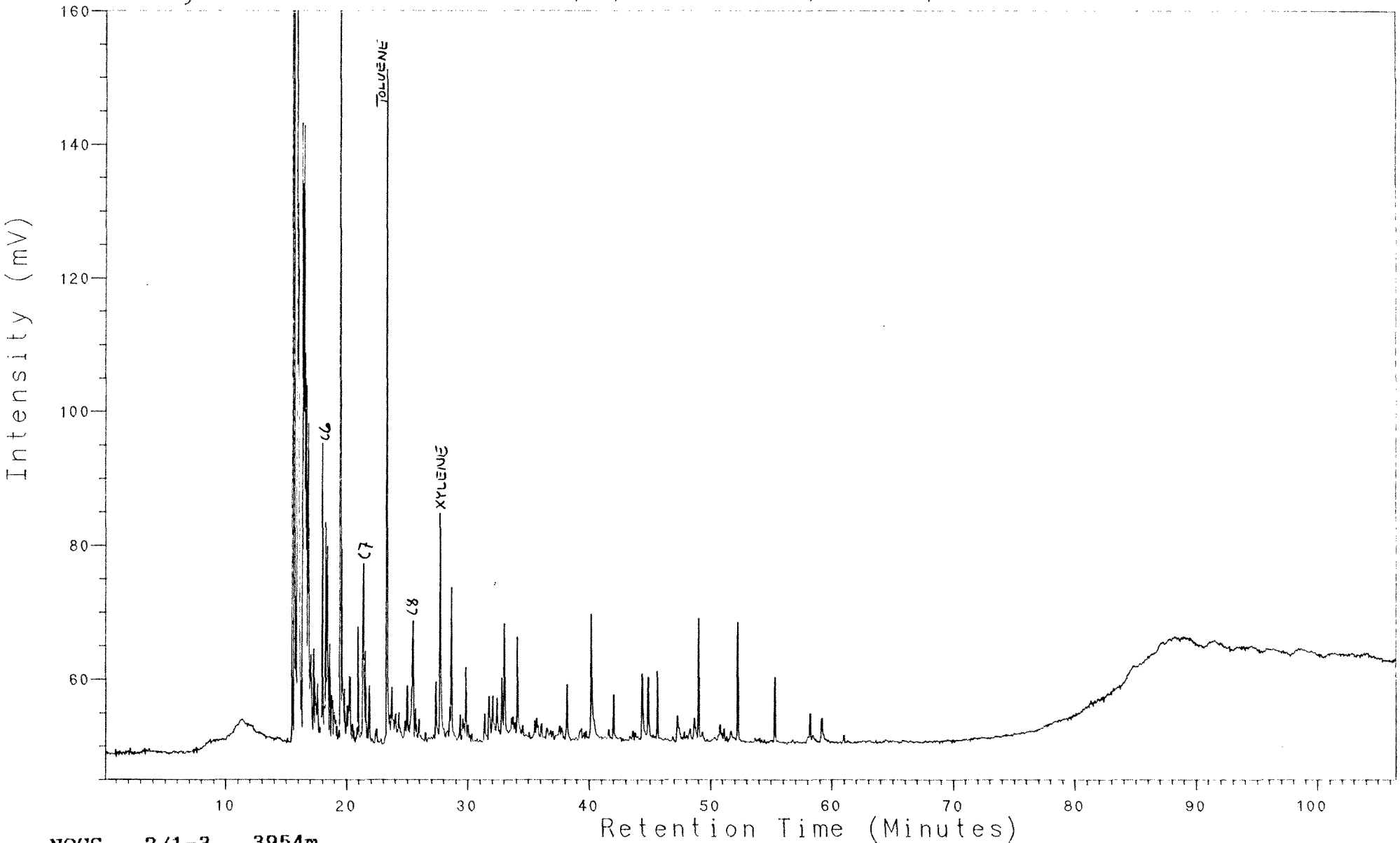
Analysis PC130523L 23, 1, 1 2/1-3, 3918m, S2



NOCS 2/1-3 3918m
PYROLYSIS GC (S2)
CLST: lt gy to m gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

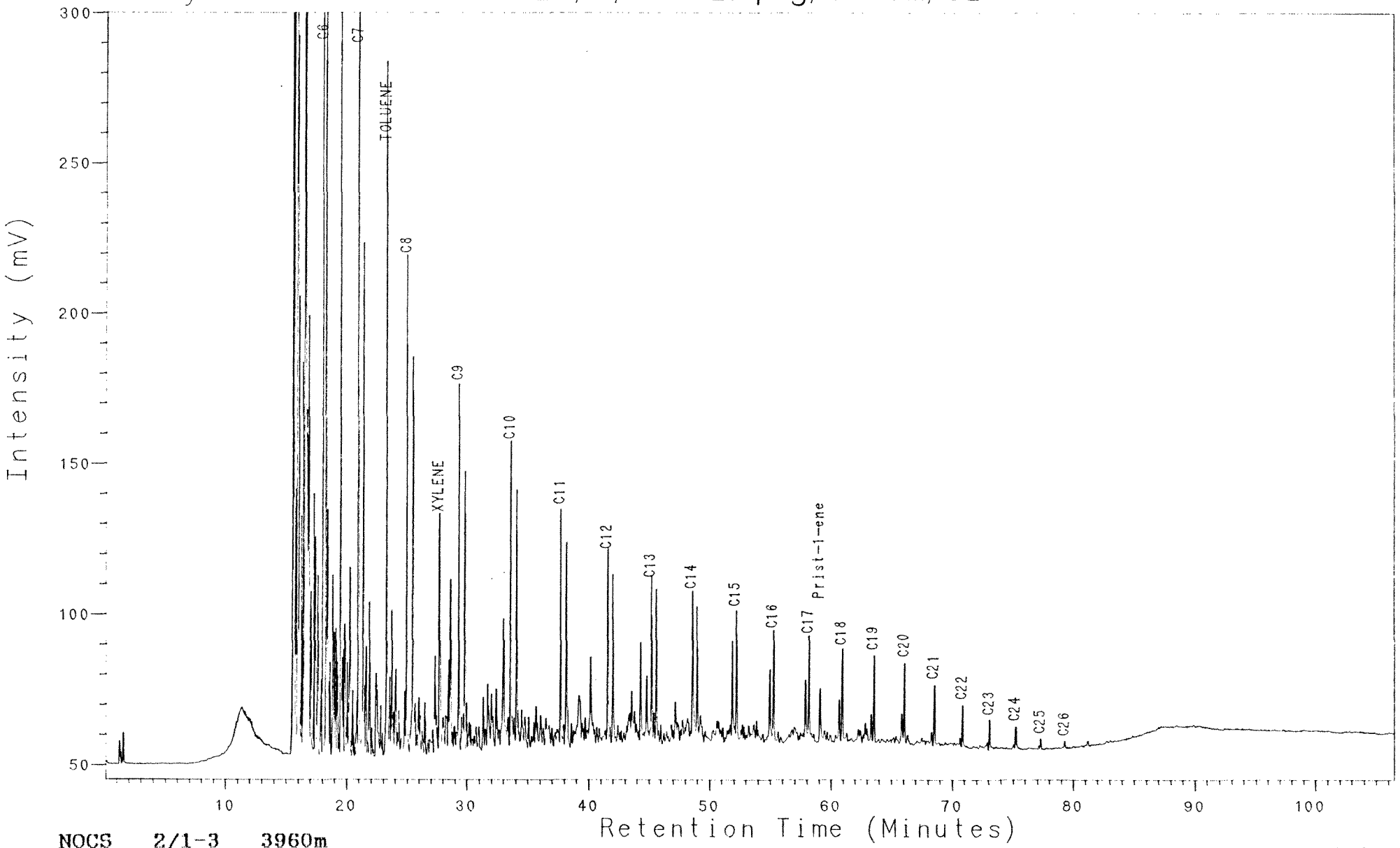
Analysis PC130581L 23, 1, 1 2/1-3, 3954m, S2



NOCS 2/1-3 3954m
PYROLYSIS GC (S2)
CLST:m gy to drk gy

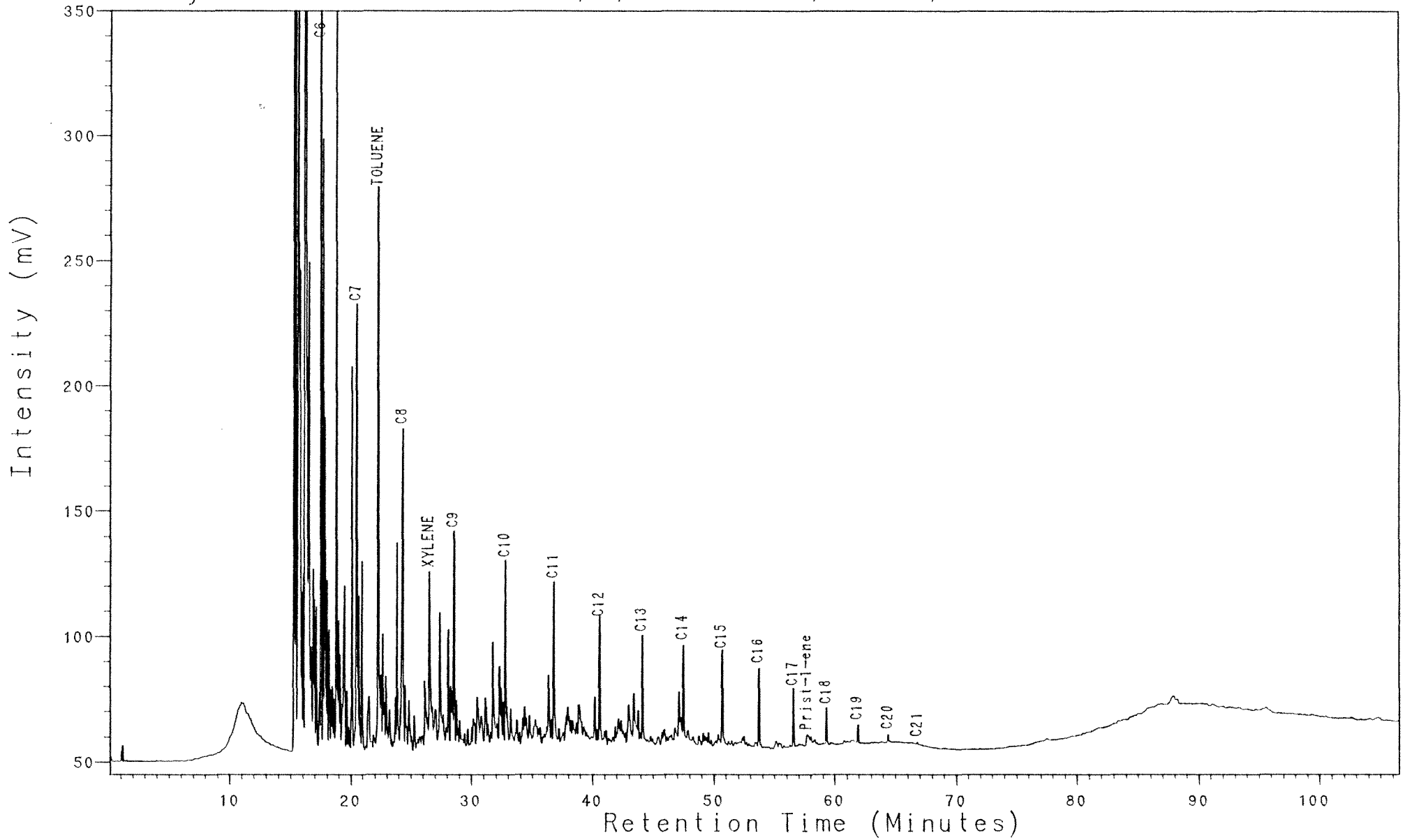
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130591L 23, 1, 1 2/1-3, 3960m, S2



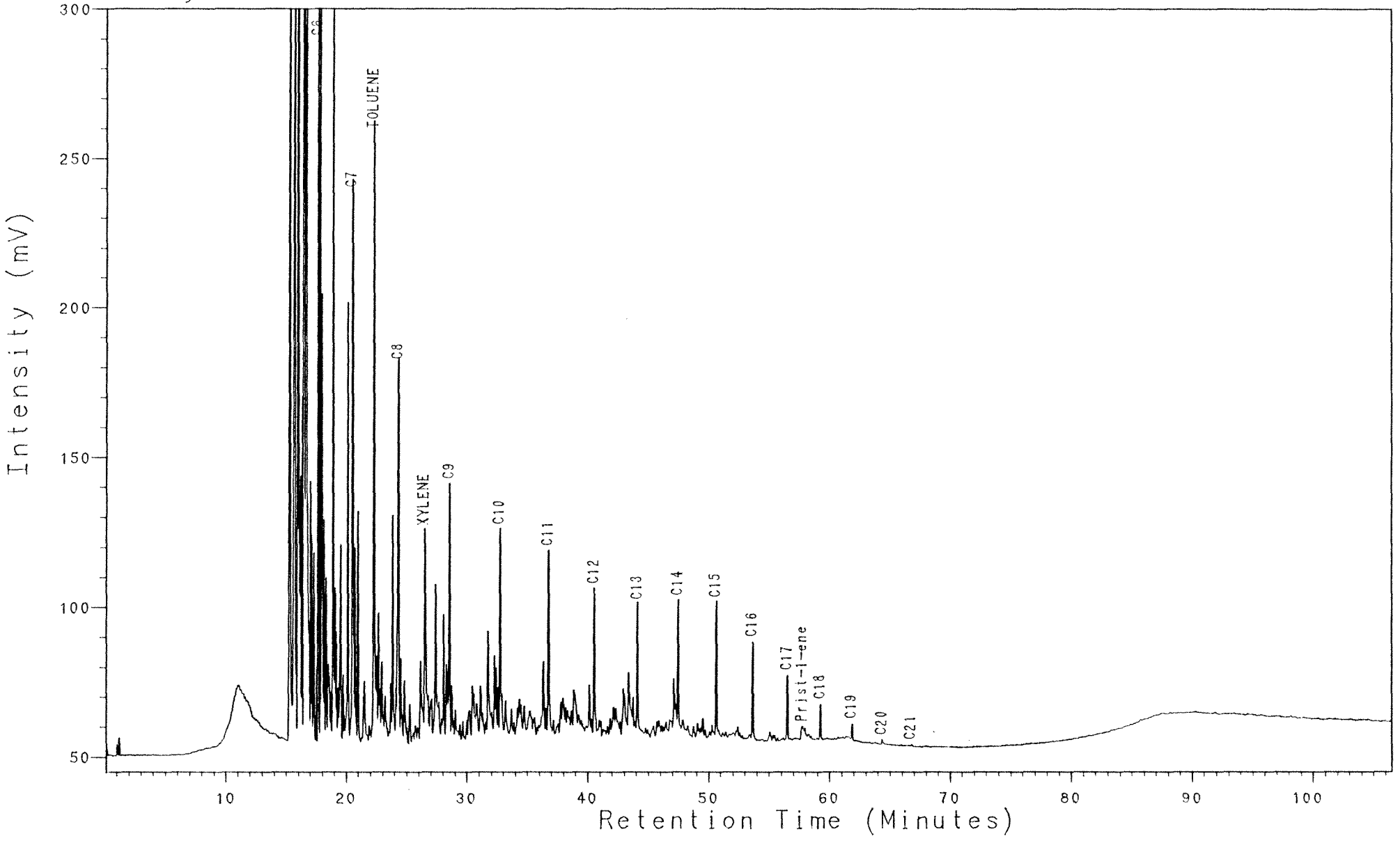
NOCS 2/1-3 3960m
PYROLYSIS GC (S2)
CLST:m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



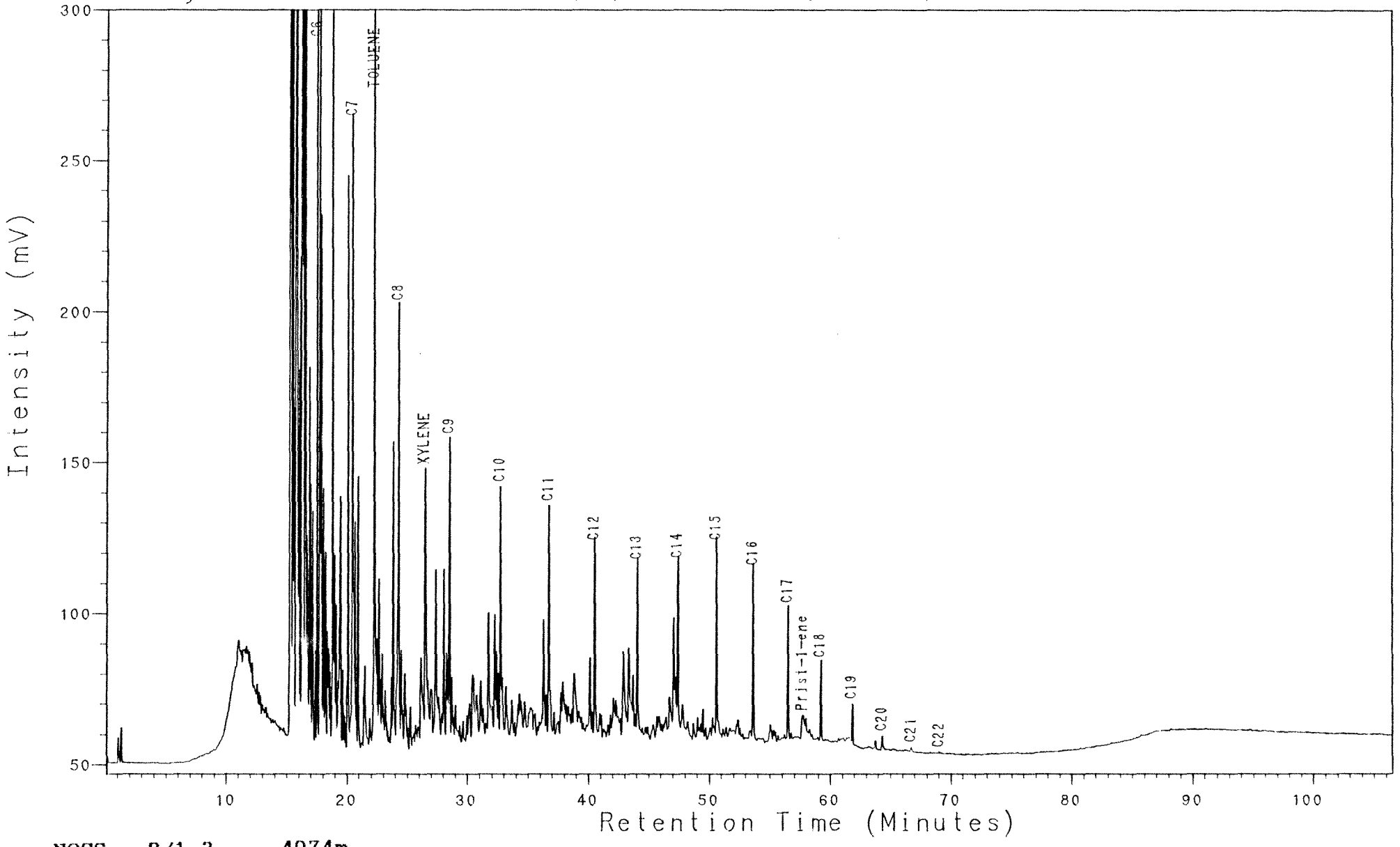
NOCS 2/1-3 3996m
PYROLYSIS GC (S2)
CLST: m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



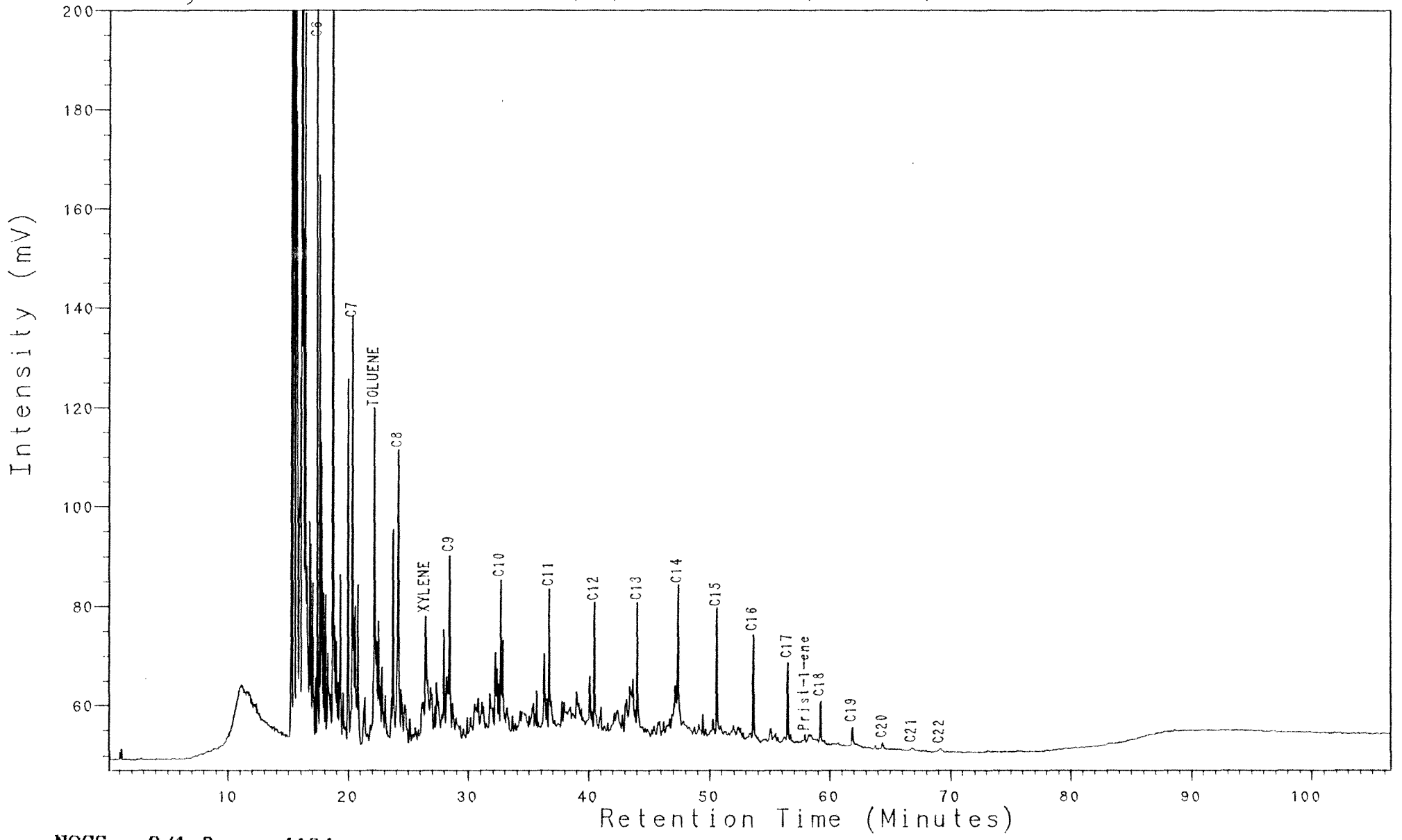
NOCS 2/1-3 4020m
PYROLYSIS GC (S2)
CLST: m gy to drk gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4074m
PYROLYSIS GC (S2)
CLST: blk, ol gy, ol blk, m gy, drk gy

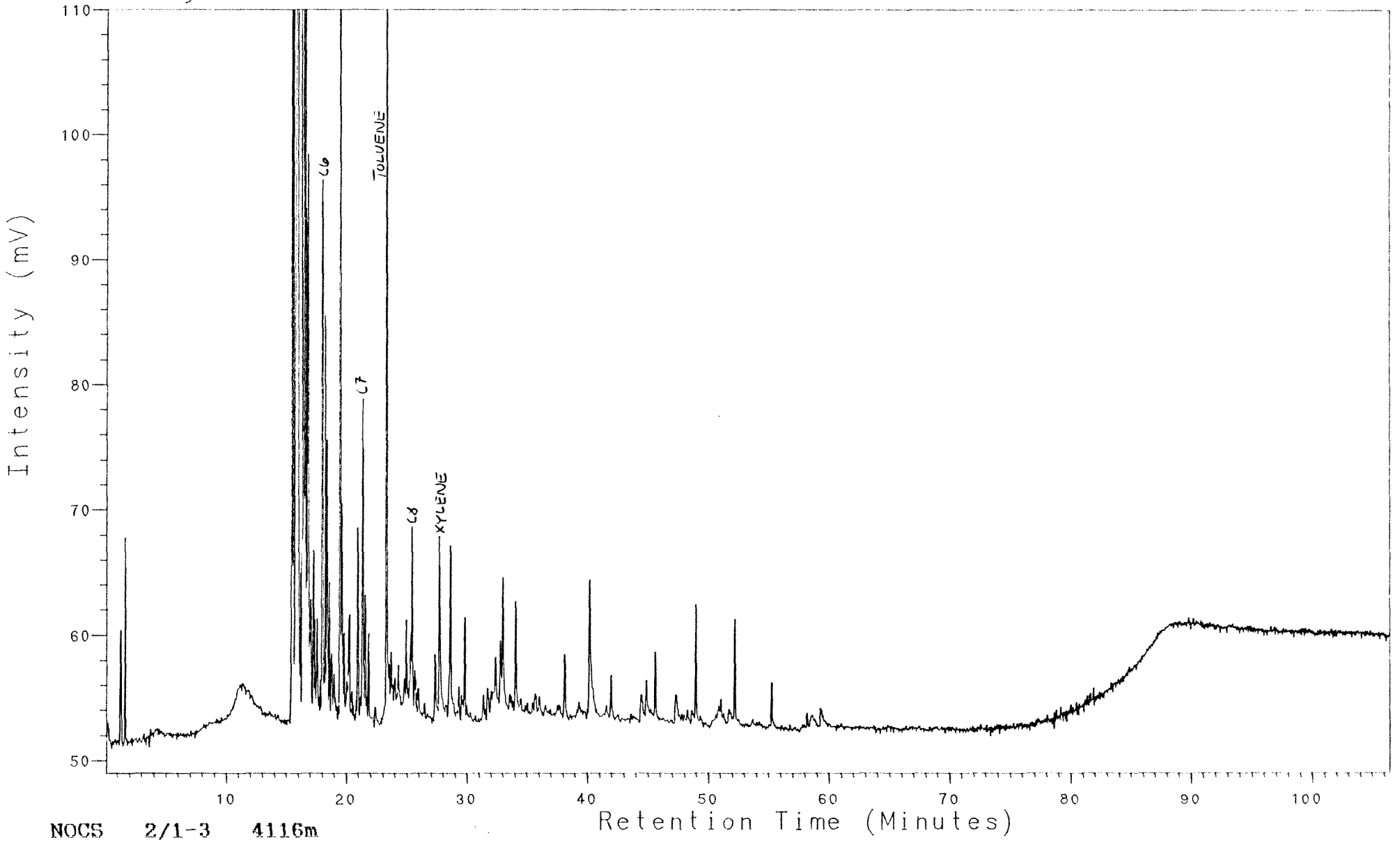
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4104m
PYROLYSIS GC (S2)
CLST: blk, ol gy, ol blk, m gy, drk gy

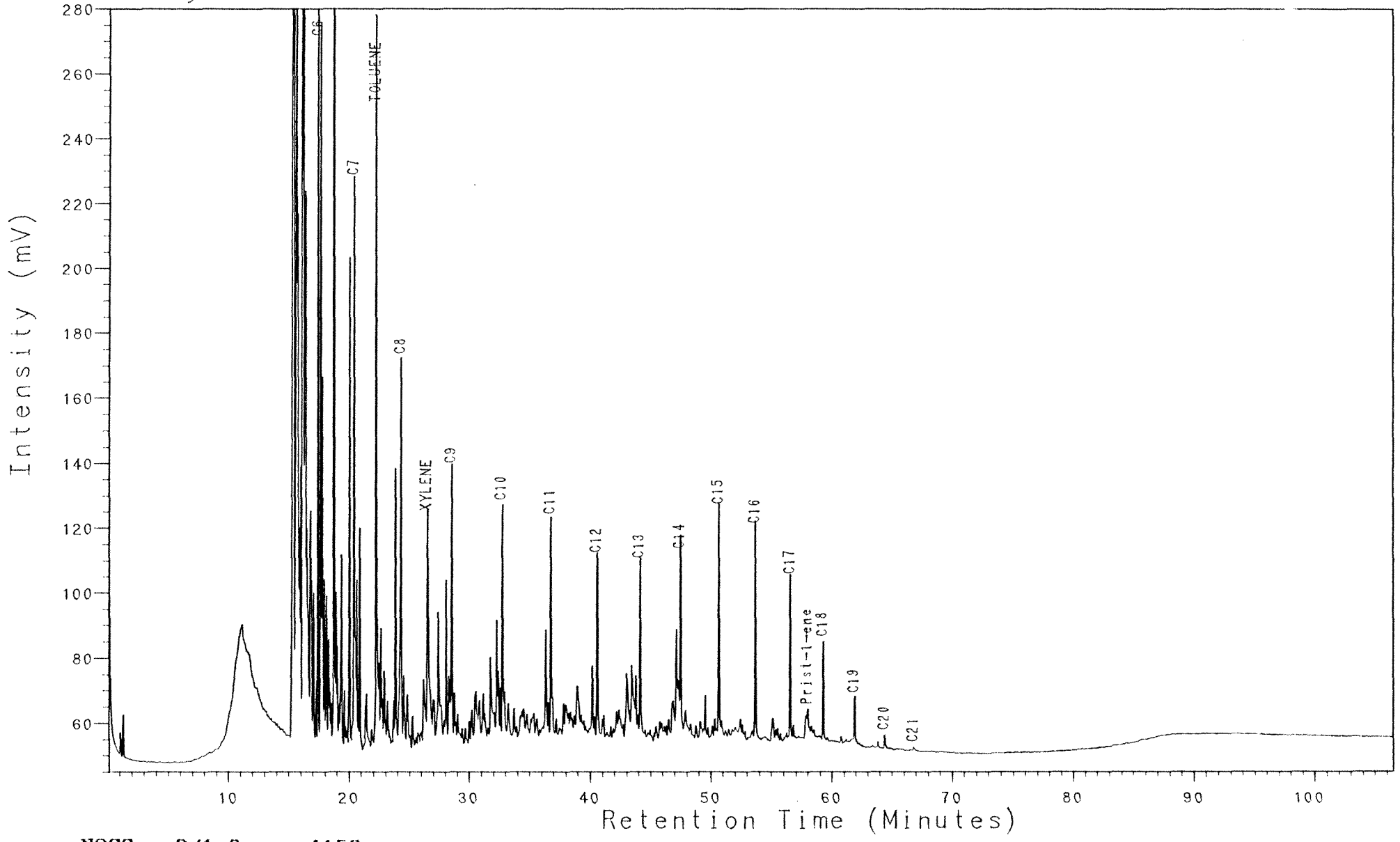
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC130841L 23, 1, 1 2/3-1, 4116m, S2



NOCS 2/1-3 4116m
PYROLYSIS GC (S2)
CLST:blk,ol gy,ol blk,m gy,
drk gy

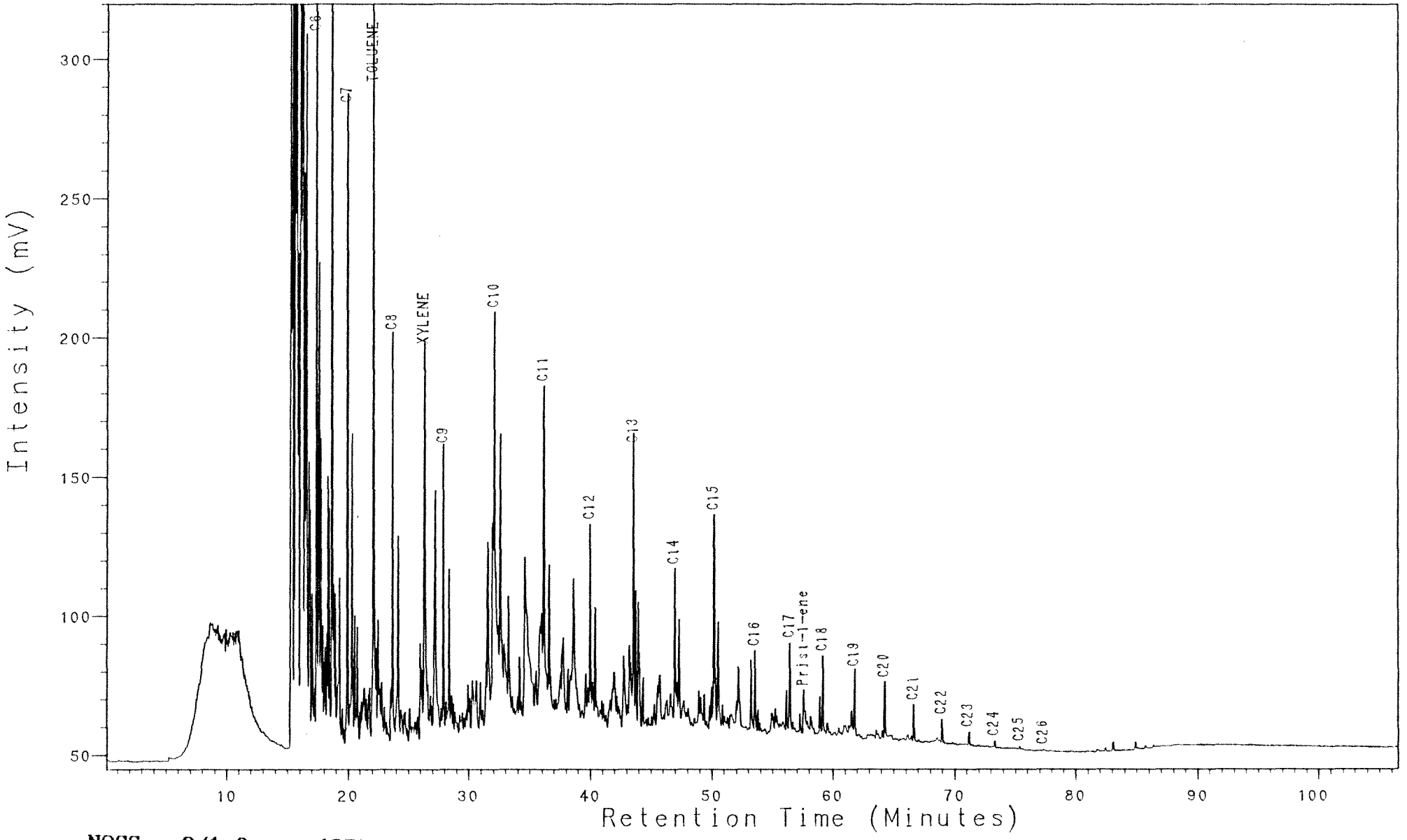
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4158m
PYROLYSIS GC (S2)
CLST: gy blk, gn gy, ol gy, m gy, drk gy

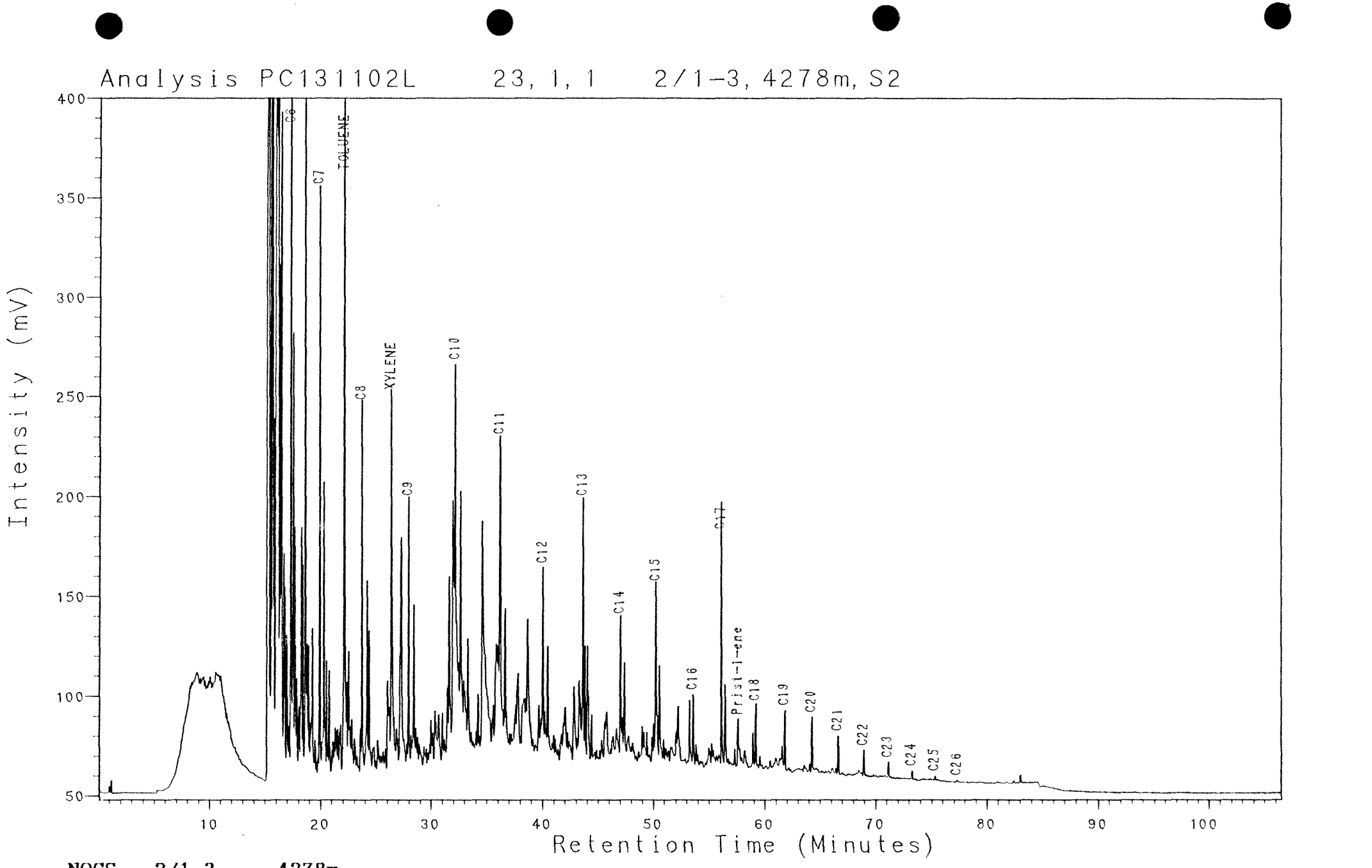
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Analysis PC131092L 23, 1, 1 2/1-3, 4272m, S2



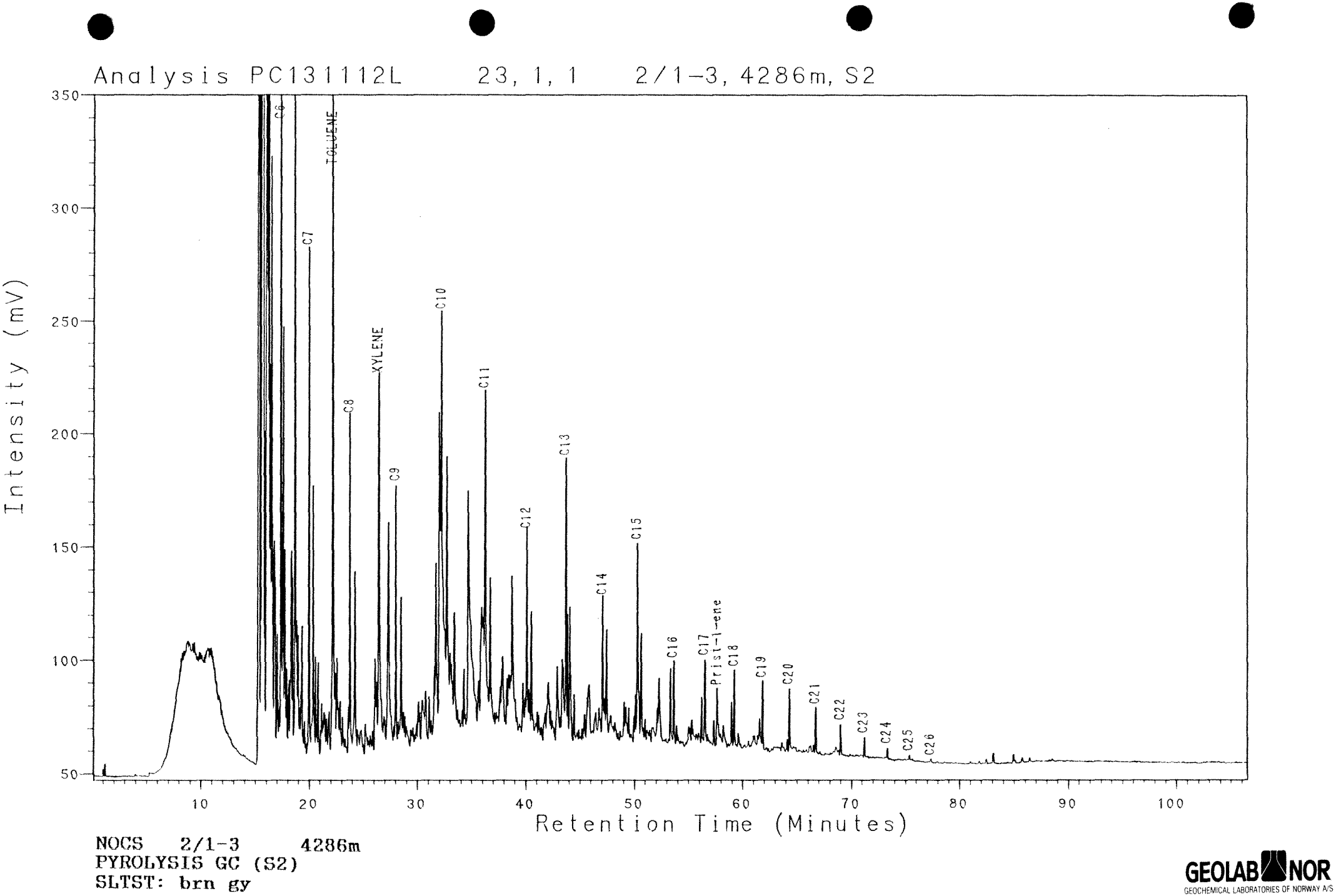
NOCS 2/1-3 4272m
PYROLYSIS GC (S2)
SLTST: brn gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



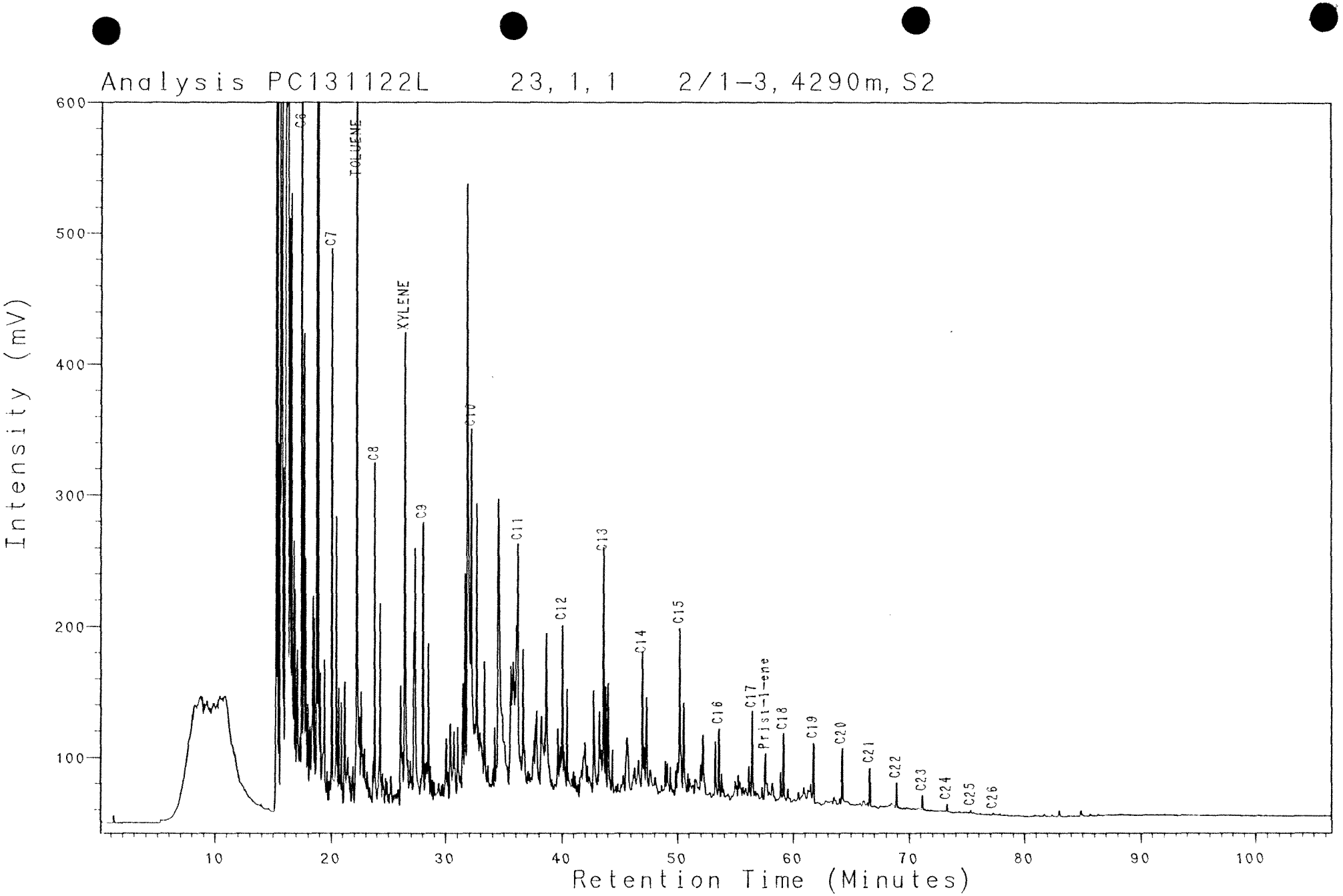
NOCS 2/1-3 4278m
PYROLYSIS GC (S2)
SLTST: brn gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



NOCS 2/1-3 4286m
PYROLYSIS GC (S2)
SLTST: brn gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S



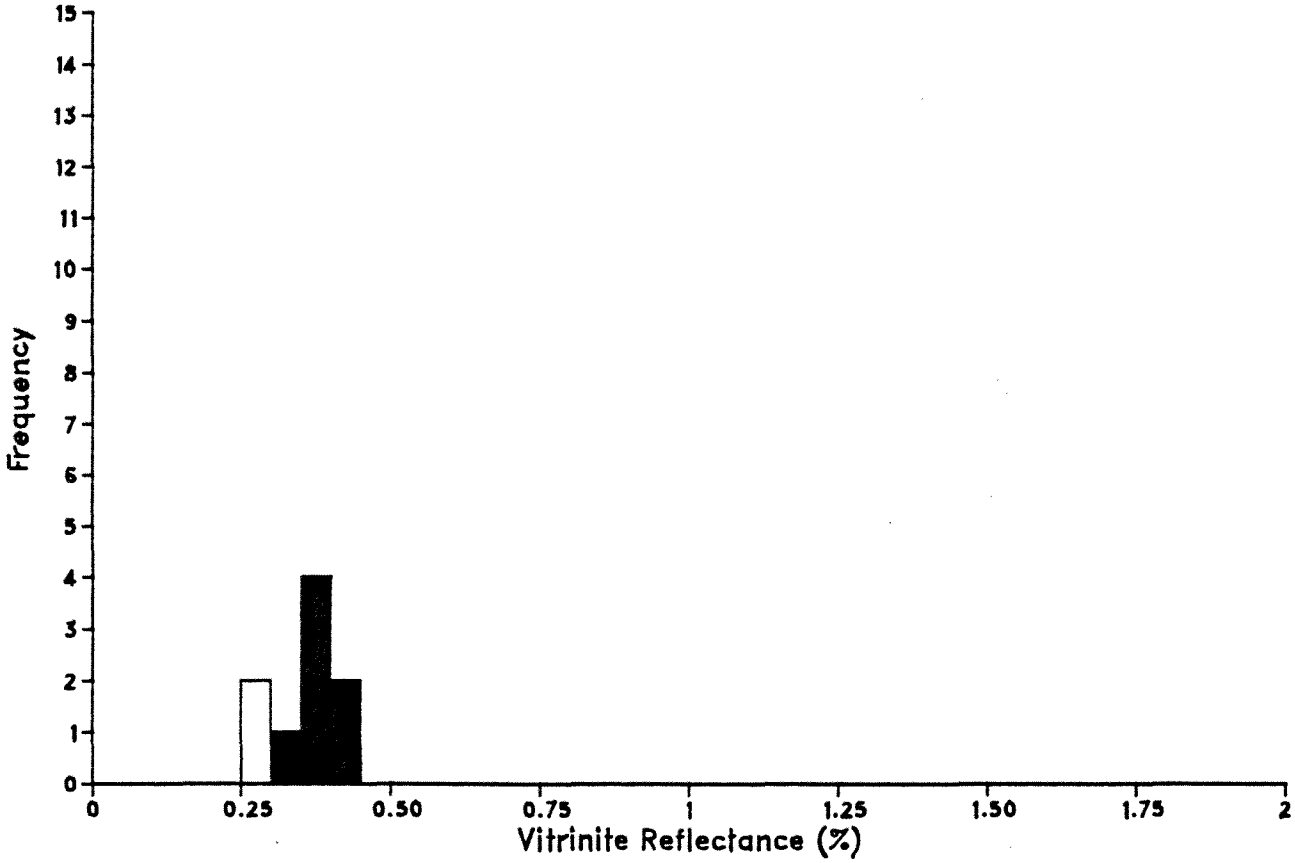
NOCS 2/1-3 4290m
PYROLYSIS GC (S2)
SLTST: brn gy

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 1040.00(m)
Sample: 115- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.300 to 0.450):	0.37	0.04	7
Population Two (from 0.250 to 0.299):	0.28	0.00	2

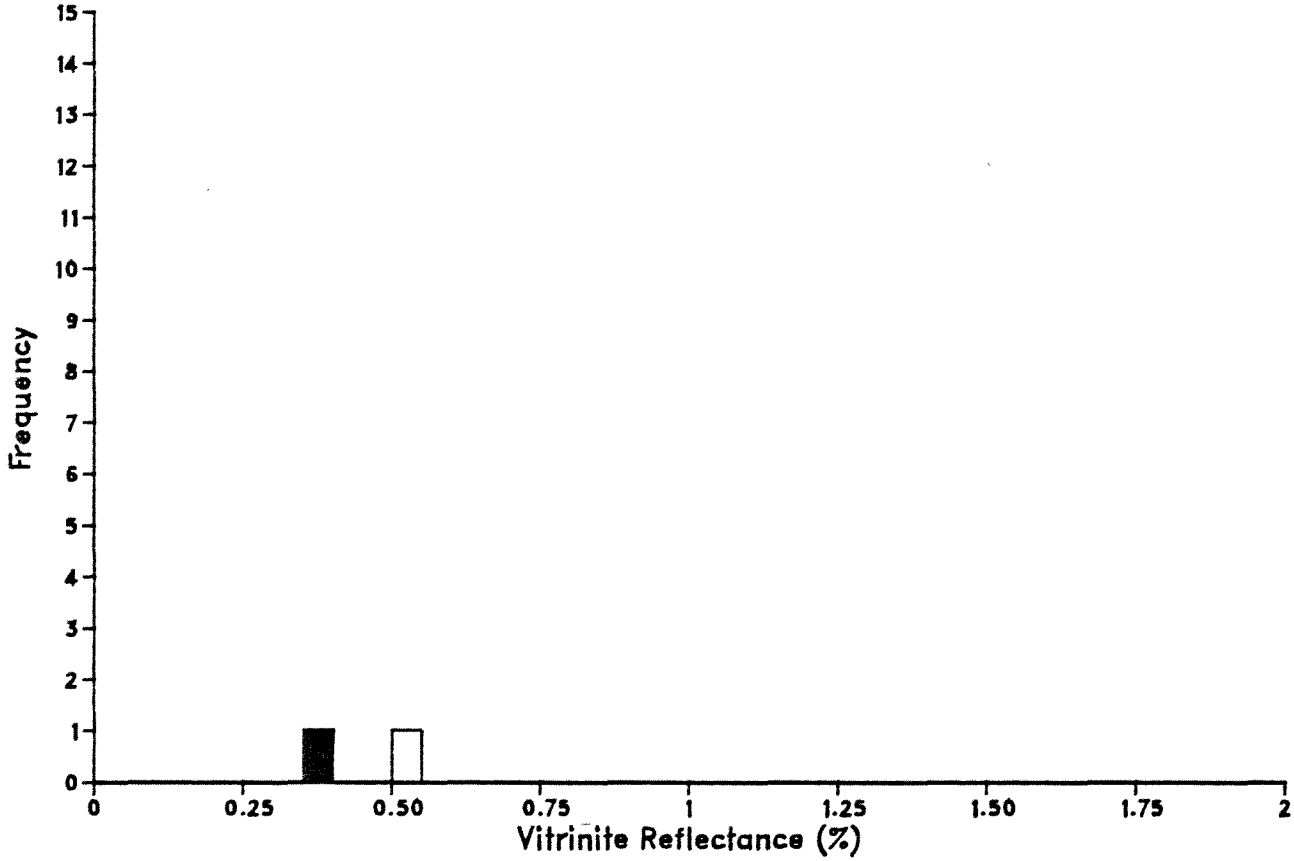
Readings:

0.280 0.280 0.300 0.350 0.380 0.390 0.390 0.400 0.410

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 1270.00(m)
Sample: 116- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.400):	0.38	0.00	1
Population Two (from 0.500 to 0.550):	0.51	0.00	1

Readings:

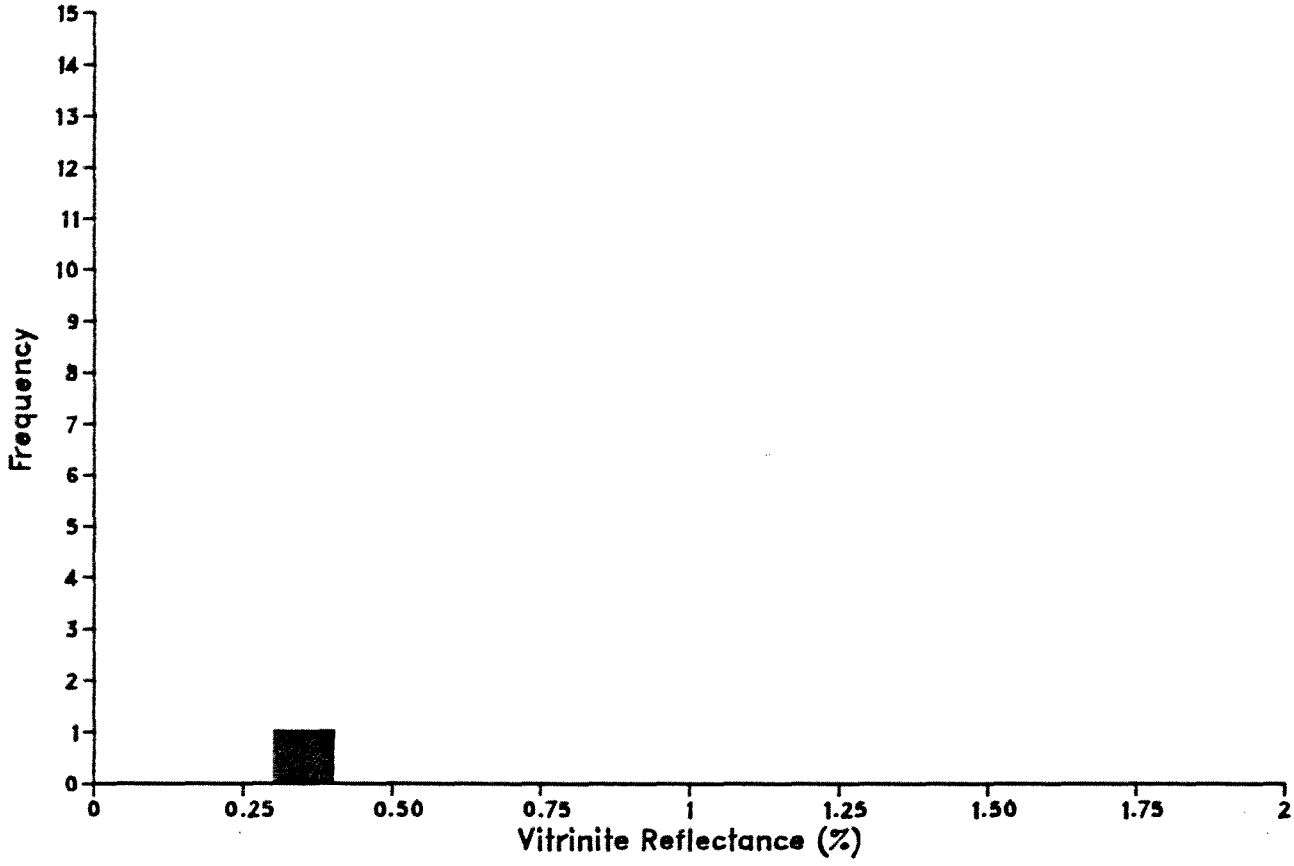
0.380 0.510

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 1450.00(m)
Sample: 117- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.300 to 0.400):	0.36	0.04	2

Readings:

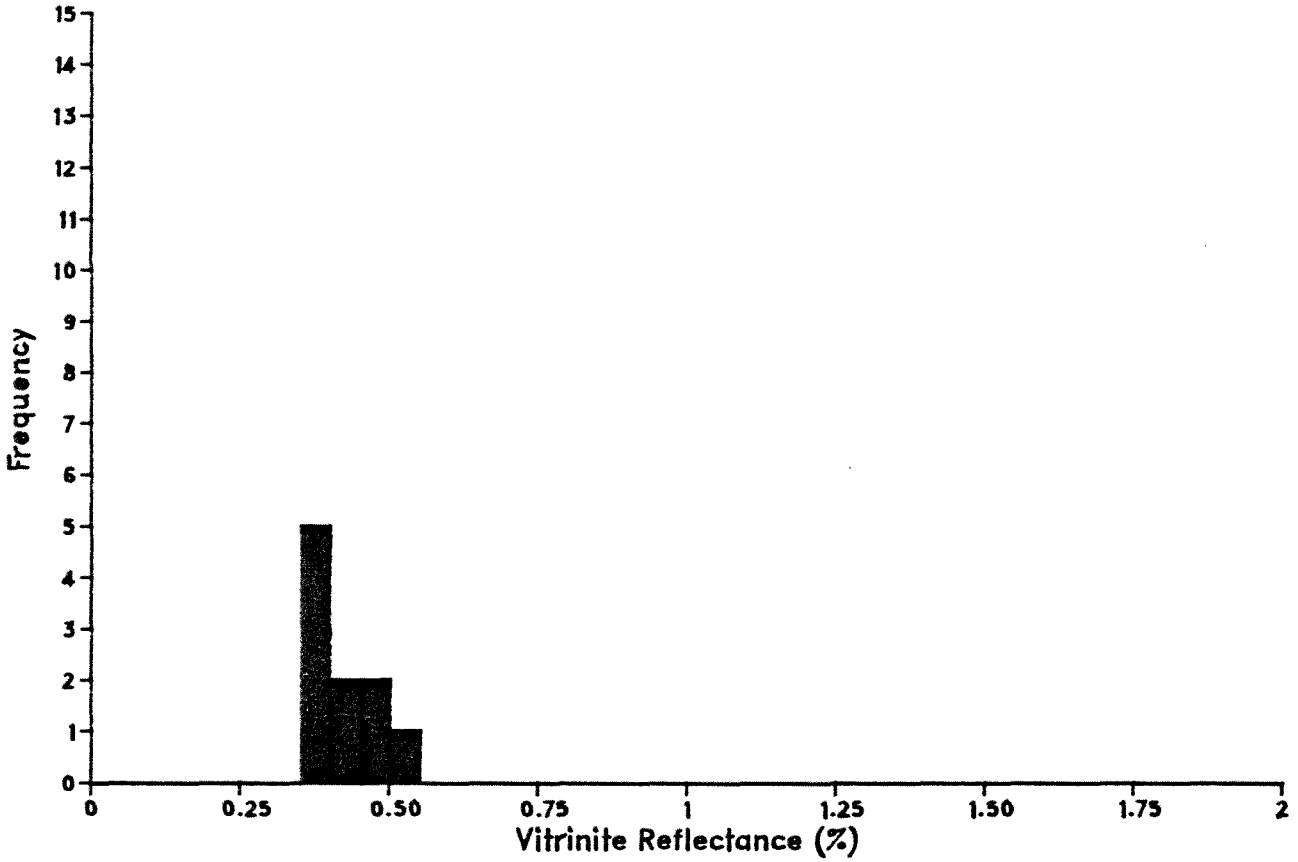
0.330 0.380

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 1590.00(m)
Sample: 118- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.550):	0.41	0.05	10

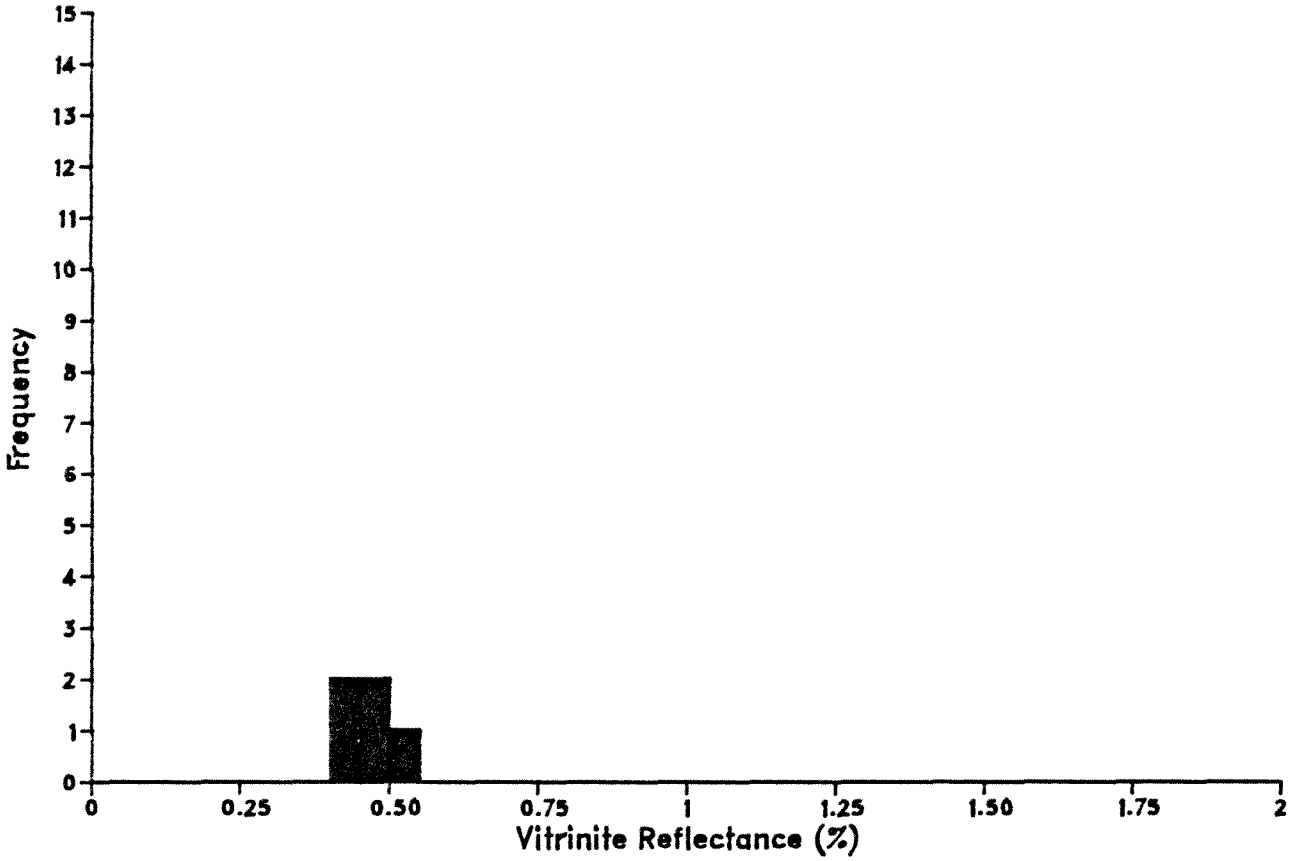
Readings:

0.360	0.370	0.370	0.370	0.390	0.410	0.430	0.450	0.450	0.530

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 1800.00(m)
Sample: 119- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.550):	0.45	0.04	5

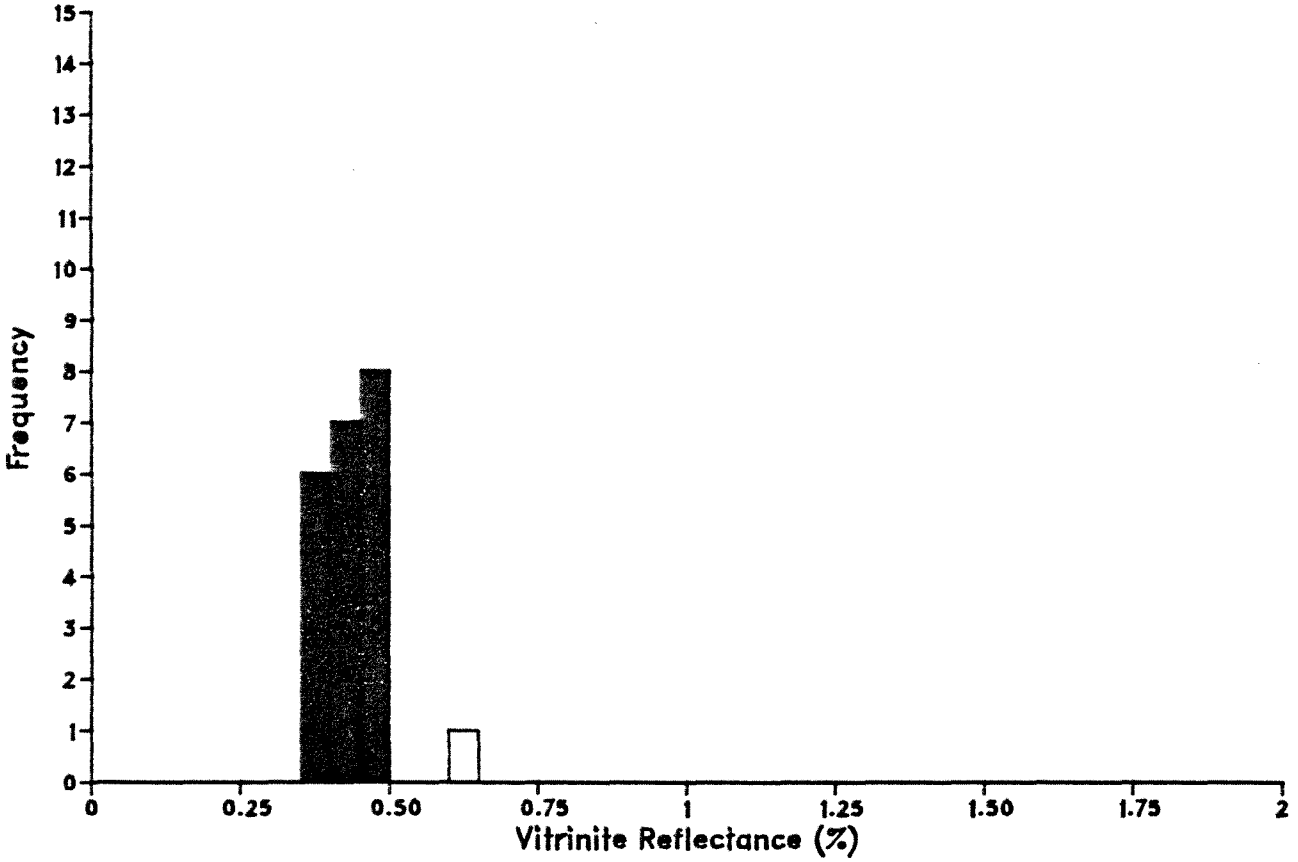
Readings:

0.400 0.410 0.470 0.470 0.500

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 1950.00(m)
Sample: 120- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.550):	0.42	0.04	21
Population Two (from 0.600 to 0.650):	0.60	0.00	1

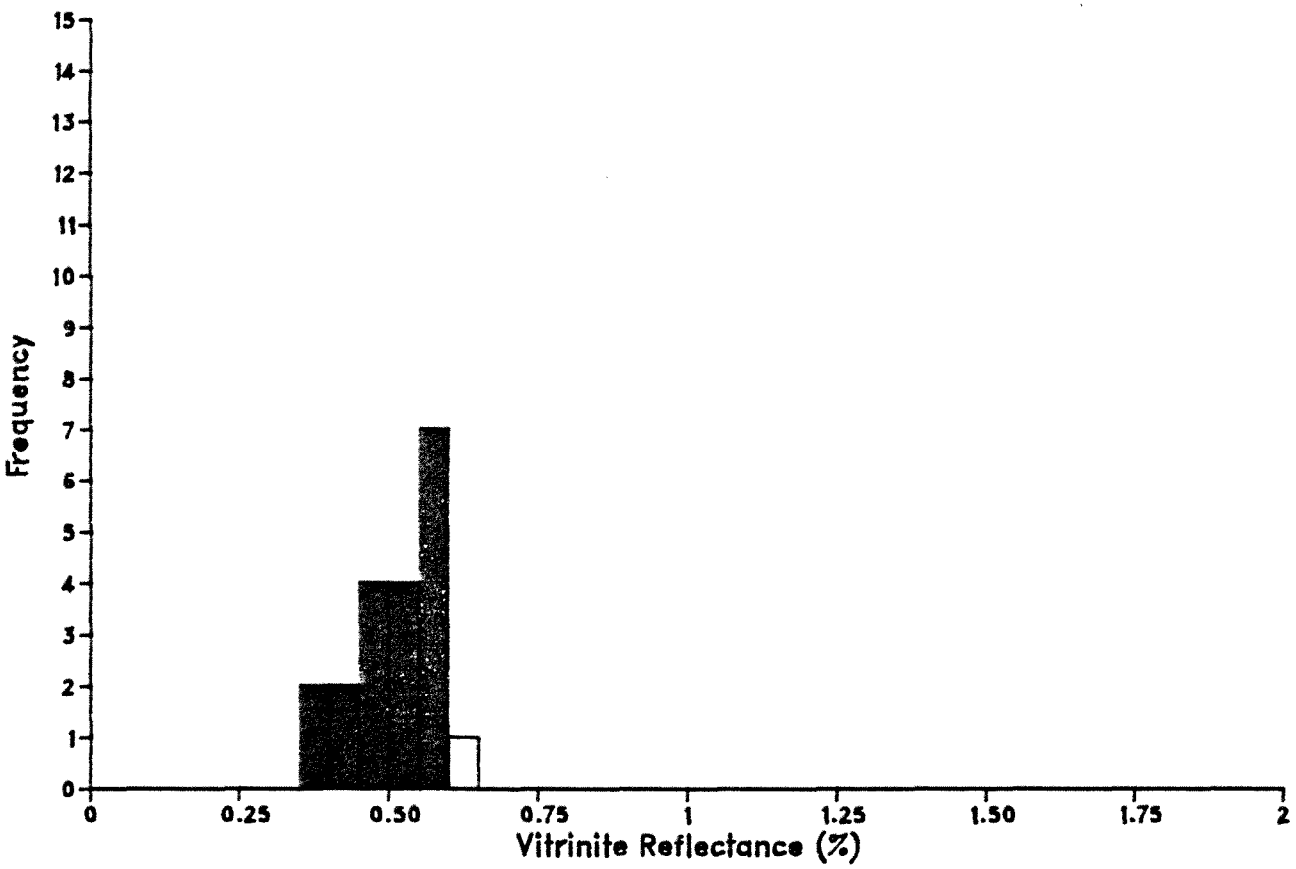
Readings:

0.350	0.360	0.360	0.360	0.390	0.390	0.400	0.400	0.400	0.400
0.440	0.440	0.440	0.450	0.450	0.460	0.460	0.460	0.470	0.470
0.470	0.552	0.600							

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 2190.00(m)
Sample: 121- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.600):	0.50	0.07	19
Population Two (from 0.650 to 0.700):	0.65	0.00	1

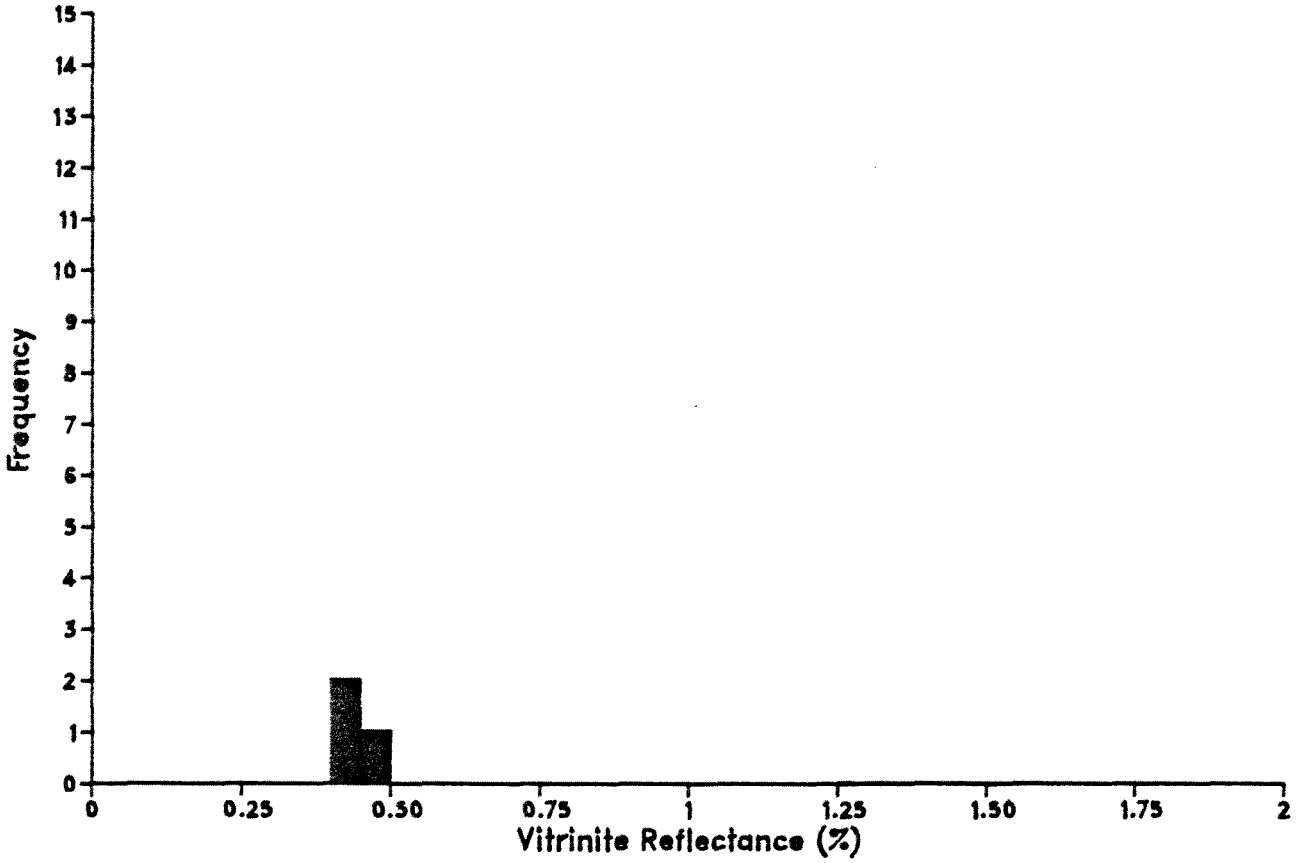
Readings:

0.360	0.370	0.400	0.410	0.460	0.480	0.480	0.490	0.500	0.510
0.520	0.540	0.550	0.550	0.550	0.560	0.560	0.560	0.560	0.650

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 2470.00(m)
Sample: 123- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.500):	0.42	0.03	3

Readings:

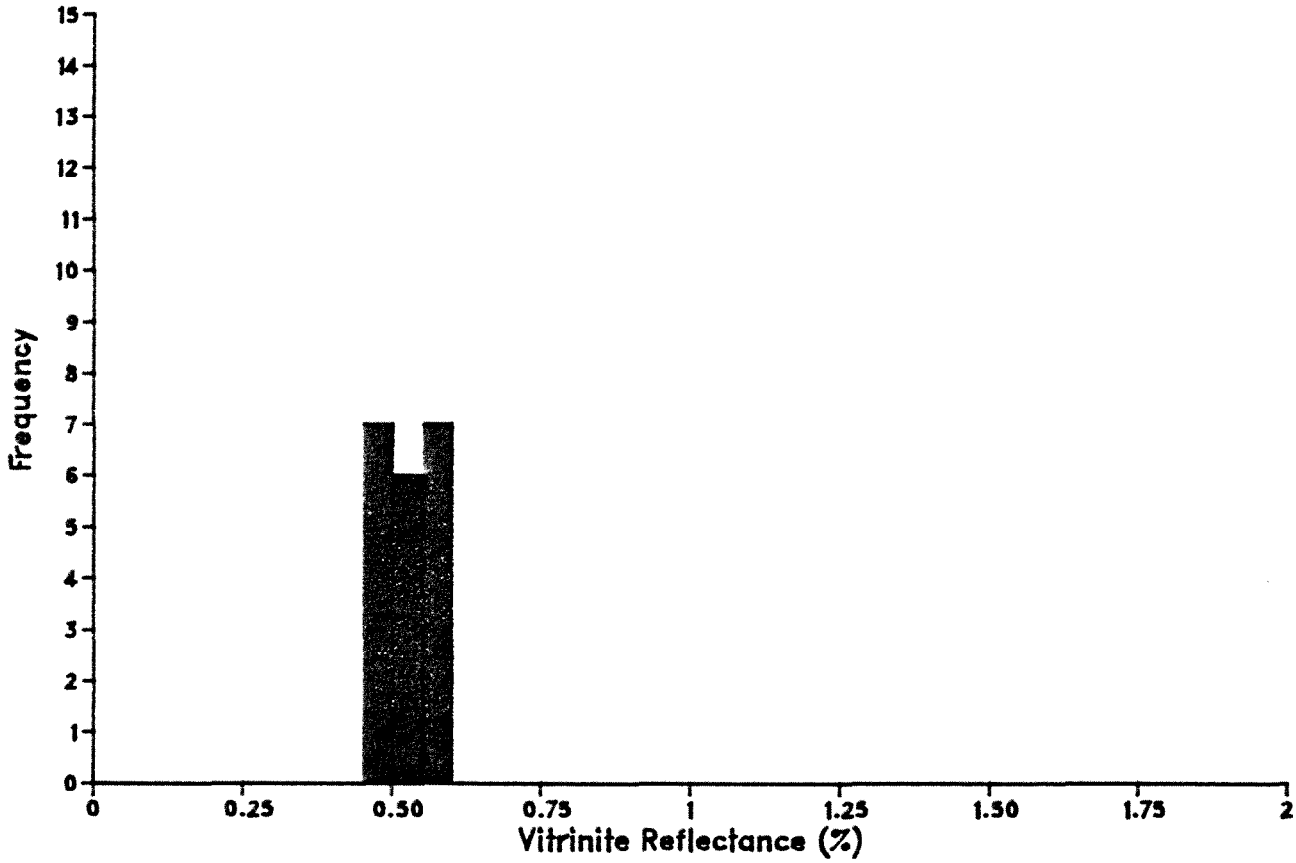
0.400 0.410 0.450

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 2610.00(m)
Sample: 124- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.600):	0.52	0.05	20

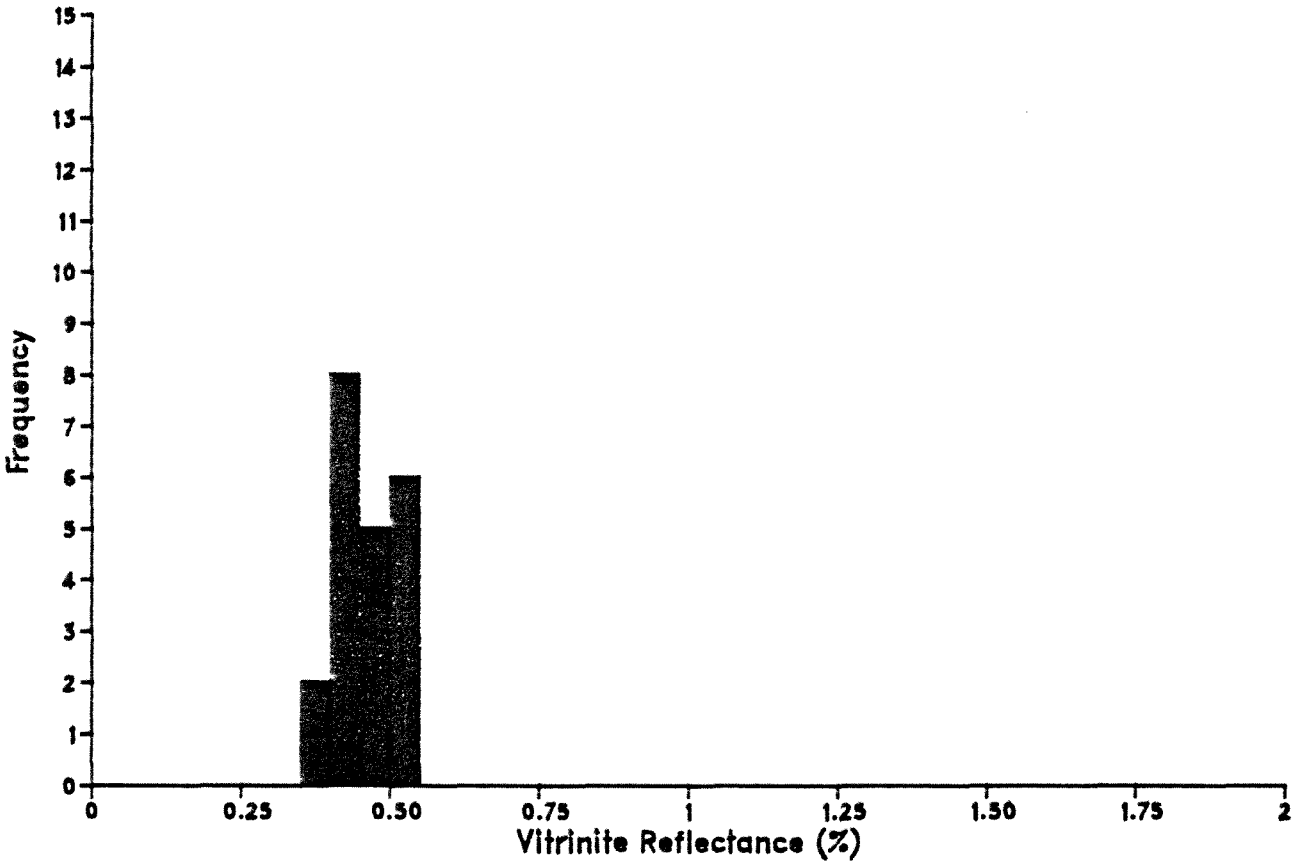
Readings:

0.450	0.450	0.460	0.460	0.470	0.470	0.480	0.510	0.510	0.520
0.530	0.540	0.540	0.550	0.550	0.550	0.570	0.580	0.590	0.590

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 2900.00(m)
Sample: 126- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.550):	0.45	0.05	21

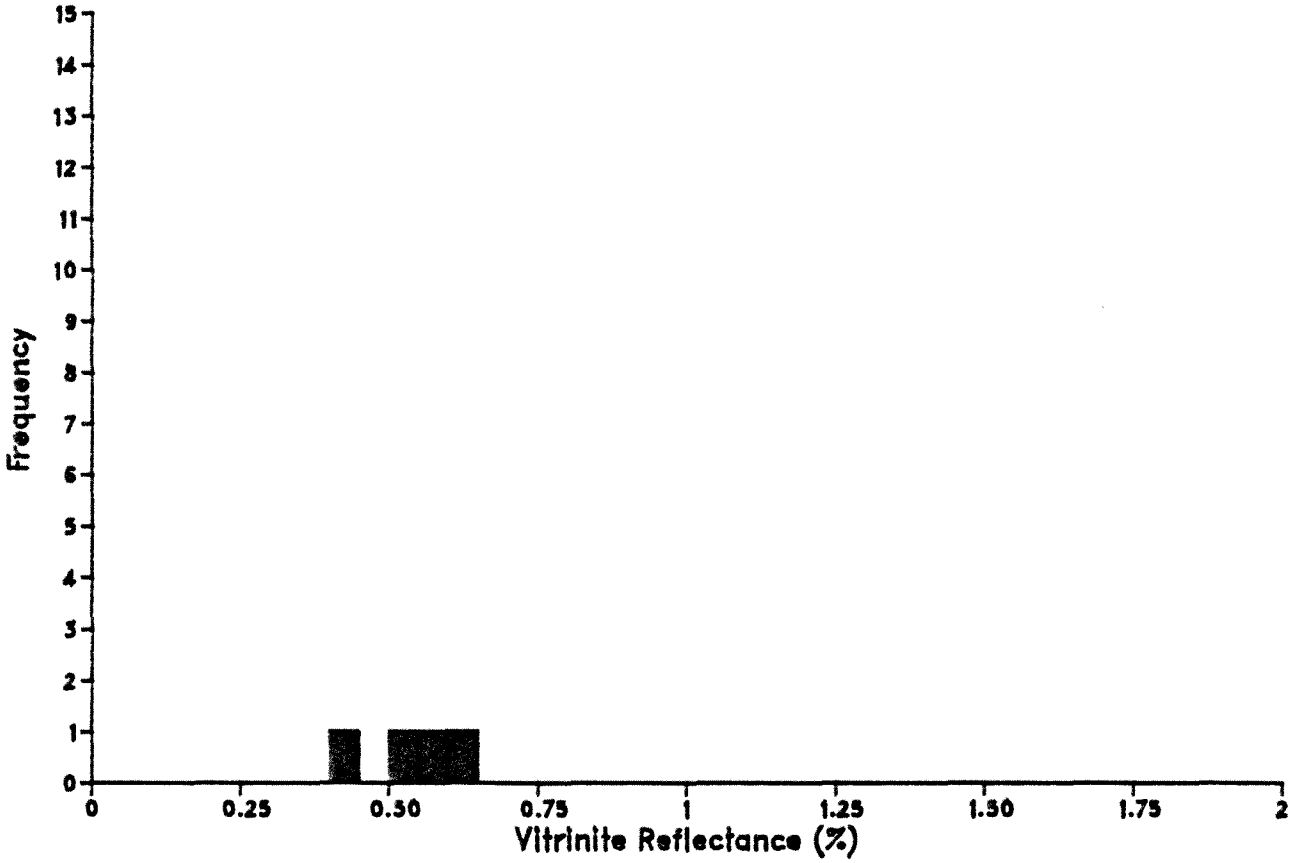
Readings:

0.350	0.370	0.400	0.420	0.430	0.430	0.430	0.430	0.440	0.440
0.450	0.450	0.460	0.460	0.480	0.500	0.500	0.500	0.520	0.520
0.540									

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 3330.00(m)
Sample: 128- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.650):	0.54	0.07	4

Readings:

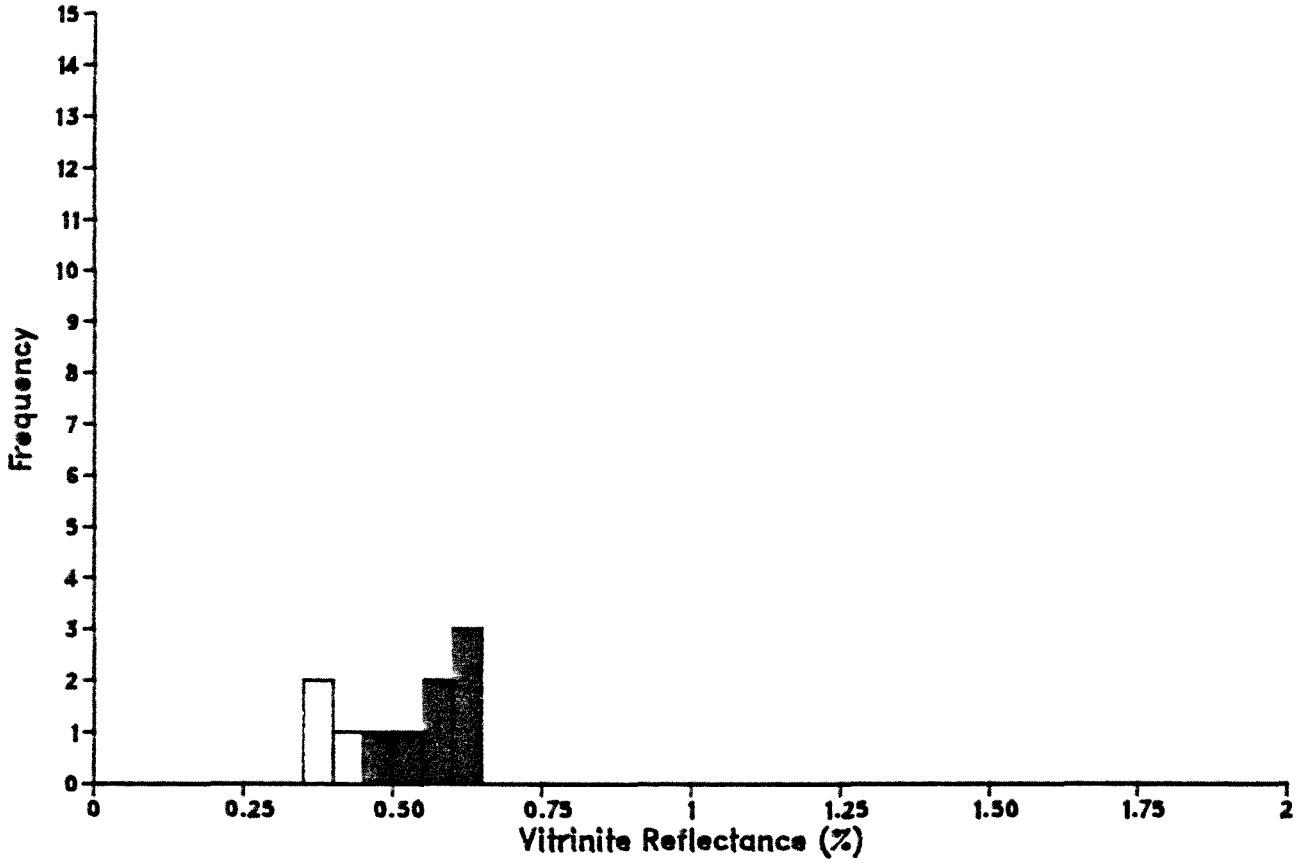
0.440 0.530 0.570 0.600

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 3480.00(m)
Sample: 129- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.650):	0.57	0.05	7
Population Two (from 0.350 to 0.450):	0.39	0.02	3

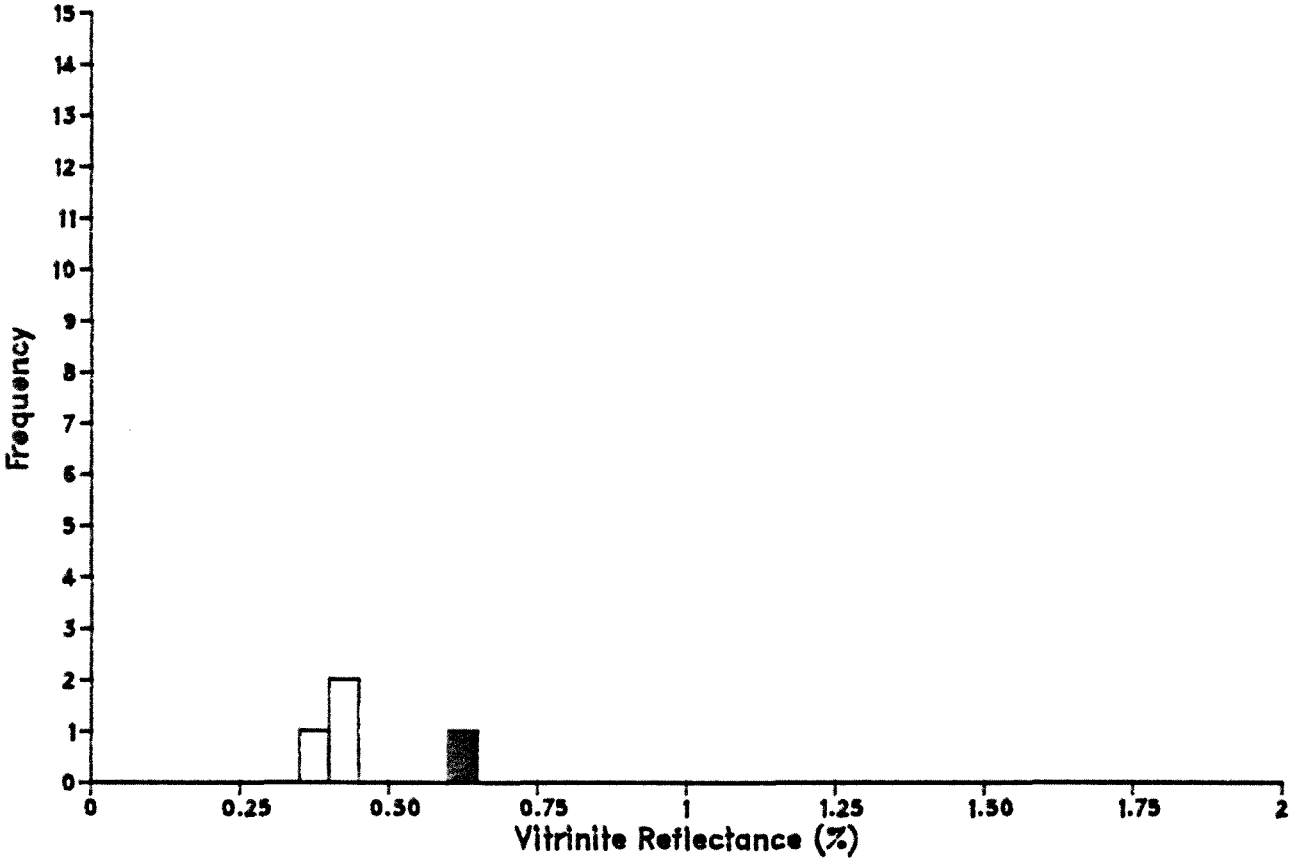
Readings:

0.370 0.380 0.410 0.490 0.520 0.570 0.570 0.600 0.620 0.620

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 3630.00(m)
Sample: 113- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.600 to 0.650):	0.62	0.00	1
Population Two (from 0.350 to 0.450):	0.41	0.03	3

Readings:

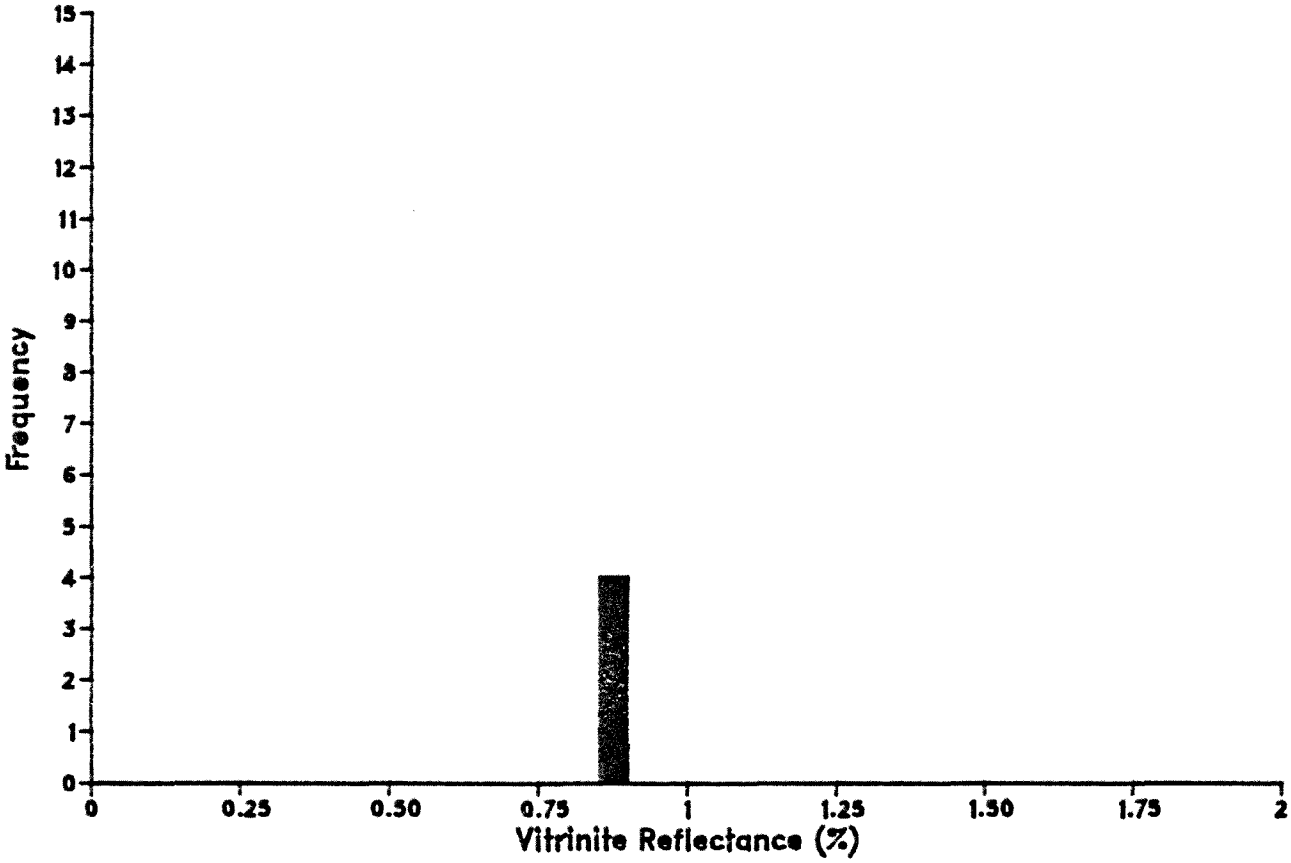
0.370 0.430 0.430 0.620

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 3720.00(m)
Sample: 19- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.900):	0.86	0.00	4

Readings:

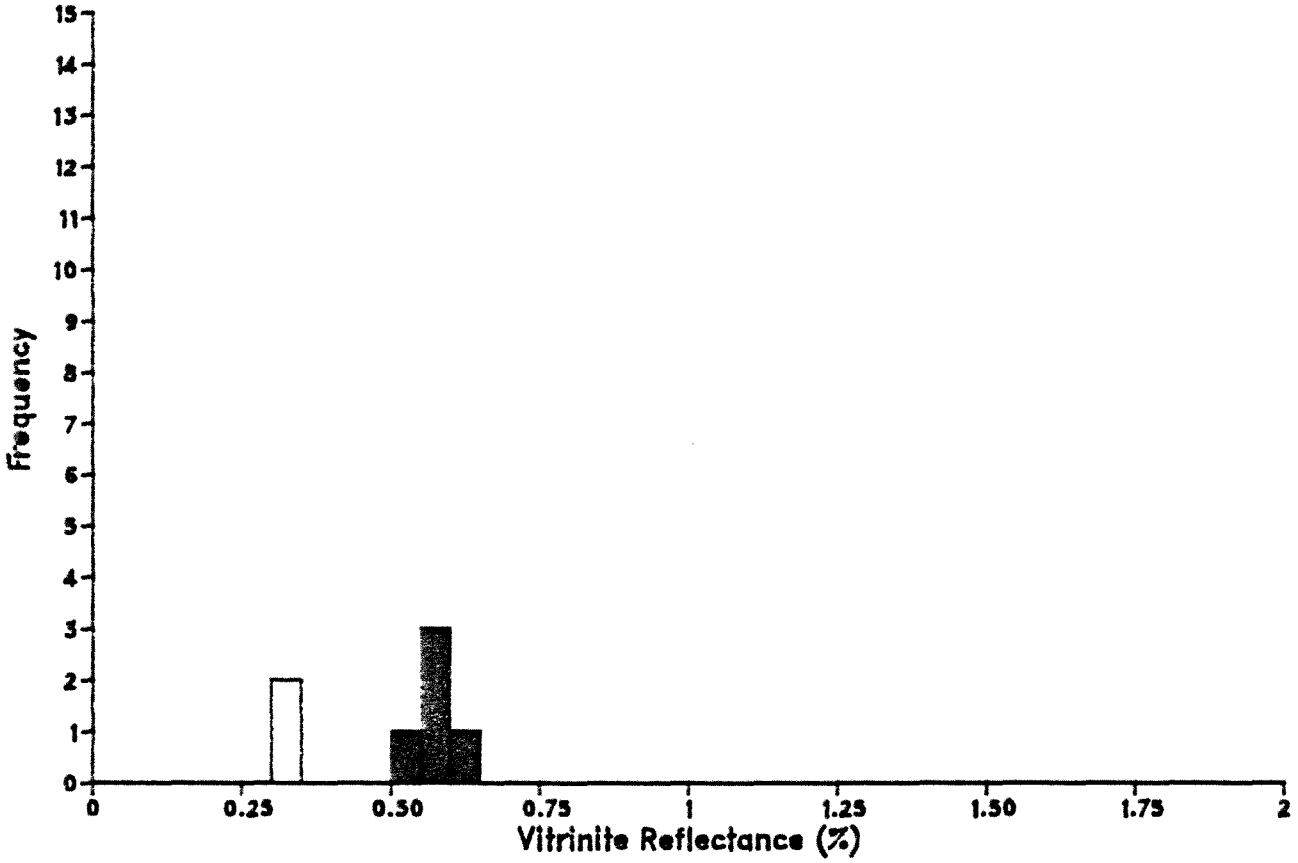
0.860 0.860 0.860 0.870

GEOLAB NOR a/s – Geochemical Laboratories of Norway

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 3816.00(m)
Sample: 35- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.500 to 0.650):	0.58	0.04	5
Population Two (from 0.300 to 0.350):	0.32	0.00	2

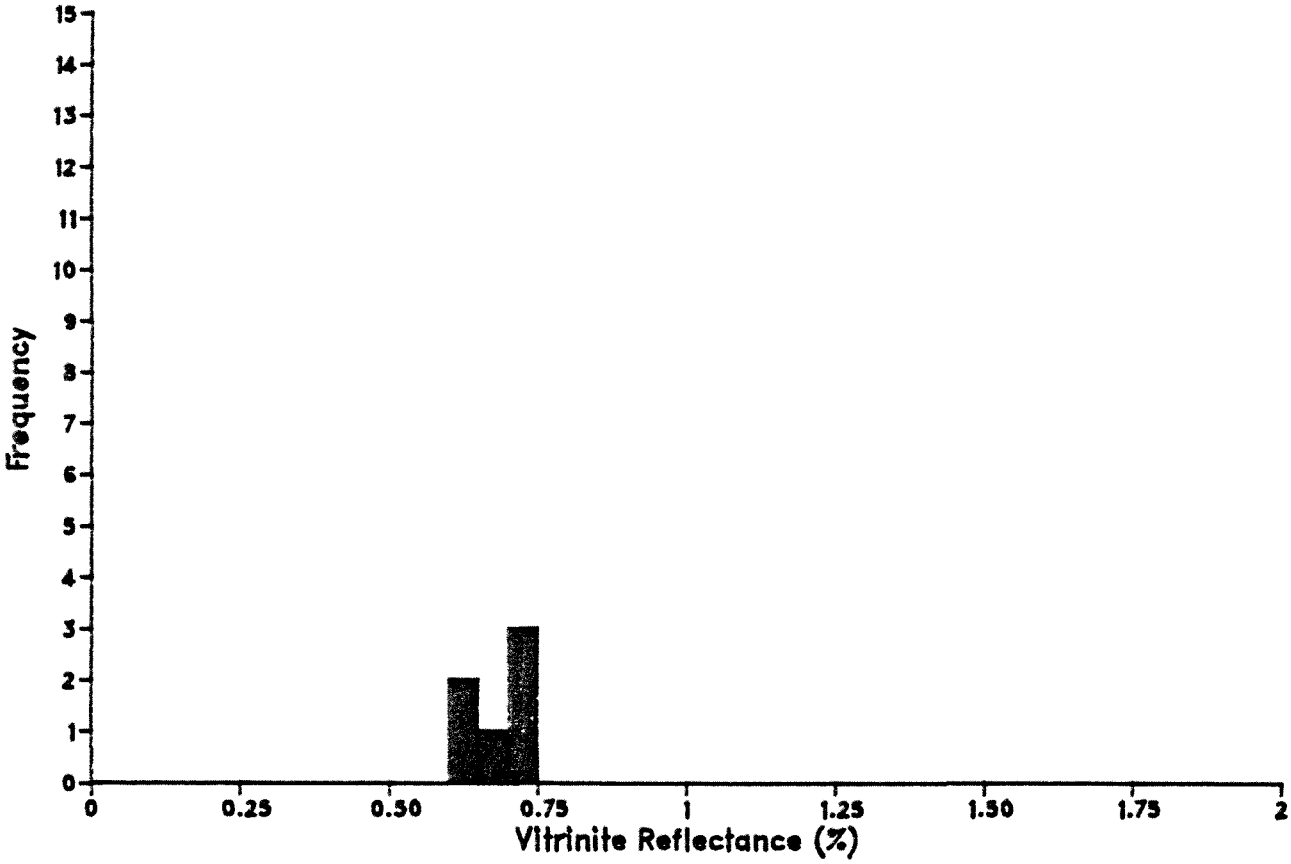
Readings:

0.310 0.320 0.530 0.550 0.580 0.590 0.630

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 3930.00(m)
Sample: 54– 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.600 to 0.750):	0.69	0.04	6

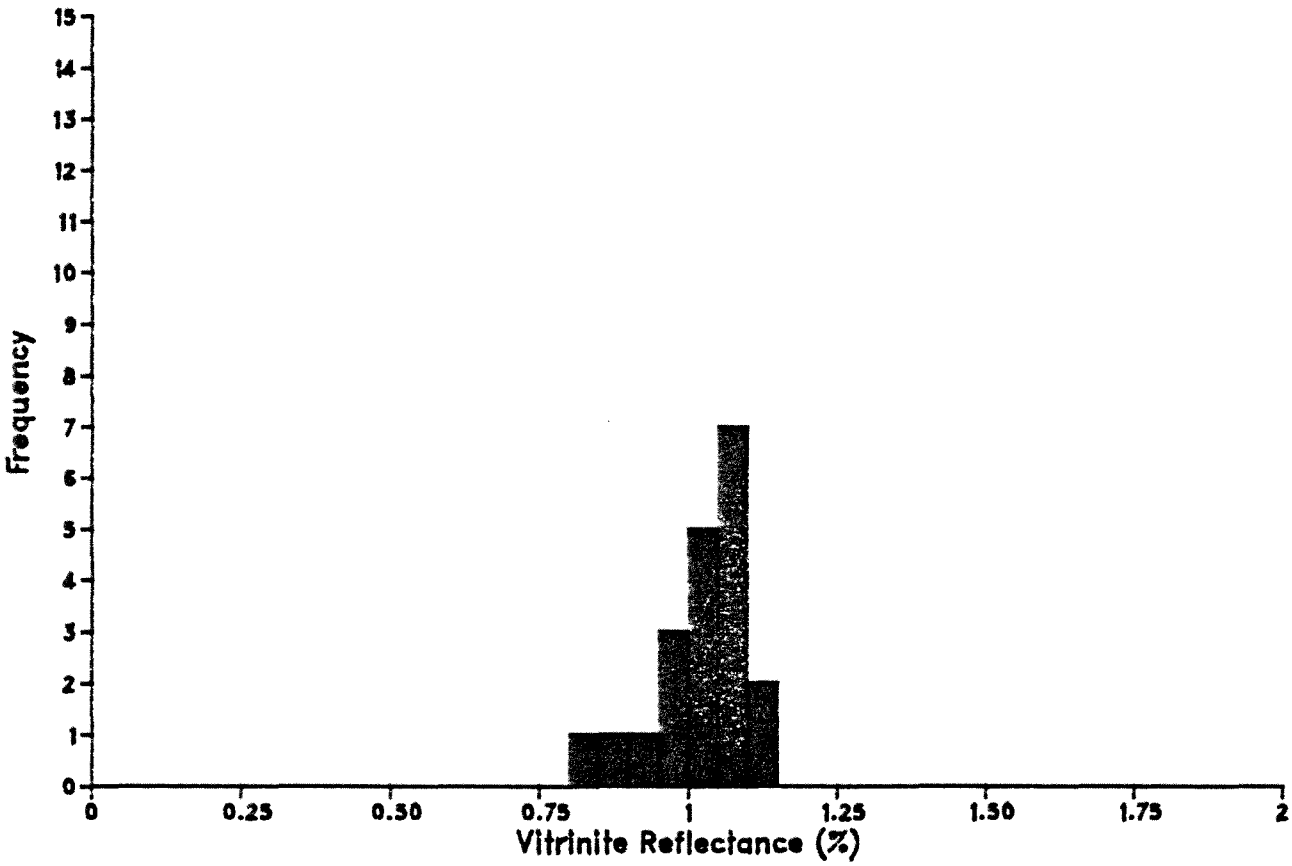
Readings:

0.640 0.640 0.670 0.700 0.730 0.740

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 4044.00(m)
Sample: 72- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.800 to 1.200):	1.02	0.08	20

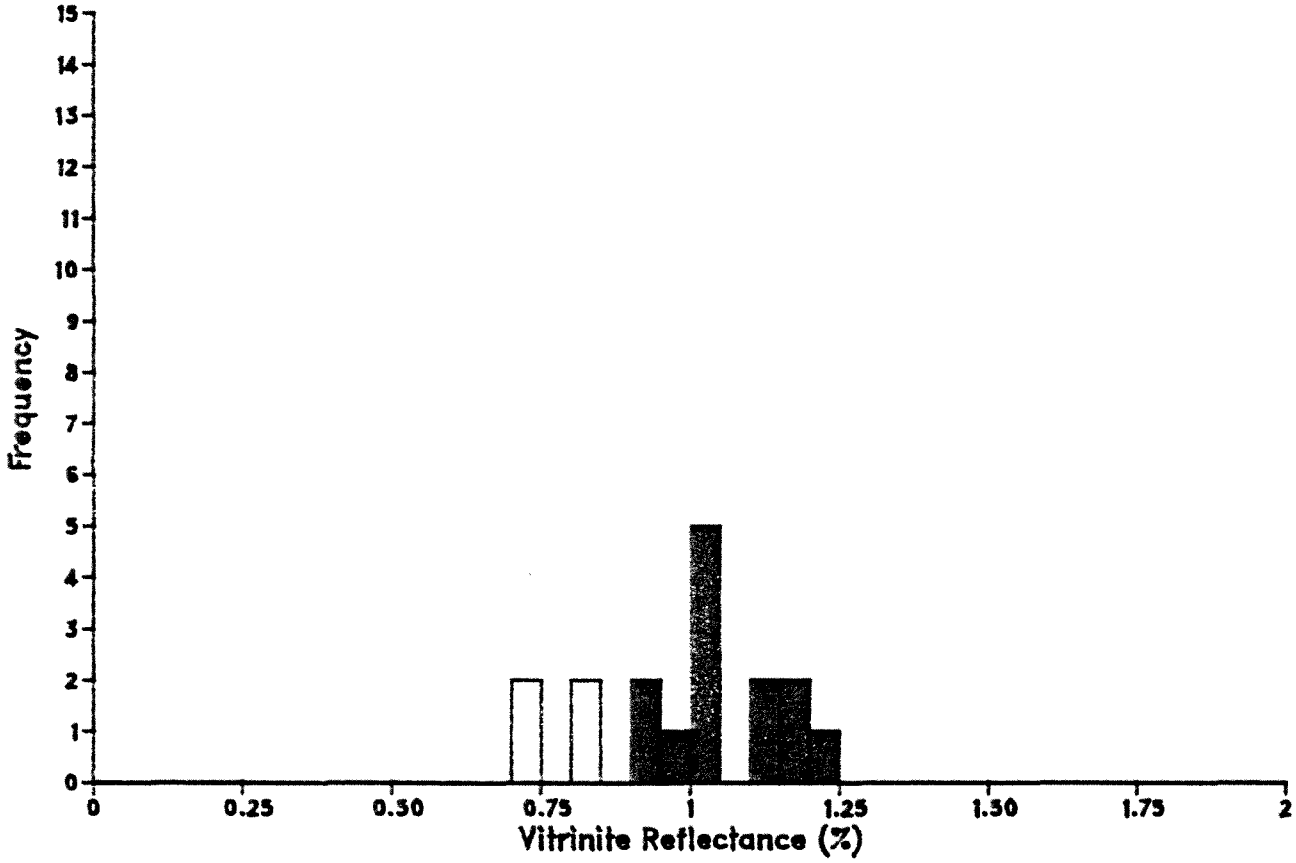
Readings:

0.810	0.870	0.920	0.950	0.950	0.990	1.000	1.020	1.030	1.030
1.040	1.070	1.070	1.070	1.080	1.080	1.090	1.090	1.100	1.120

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 4158.00(m)
Sample: 91- 0b



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.900 to 1.300):	1.06	0.09	13
Population Two (from 0.700 to 0.850):	0.77	0.06	4

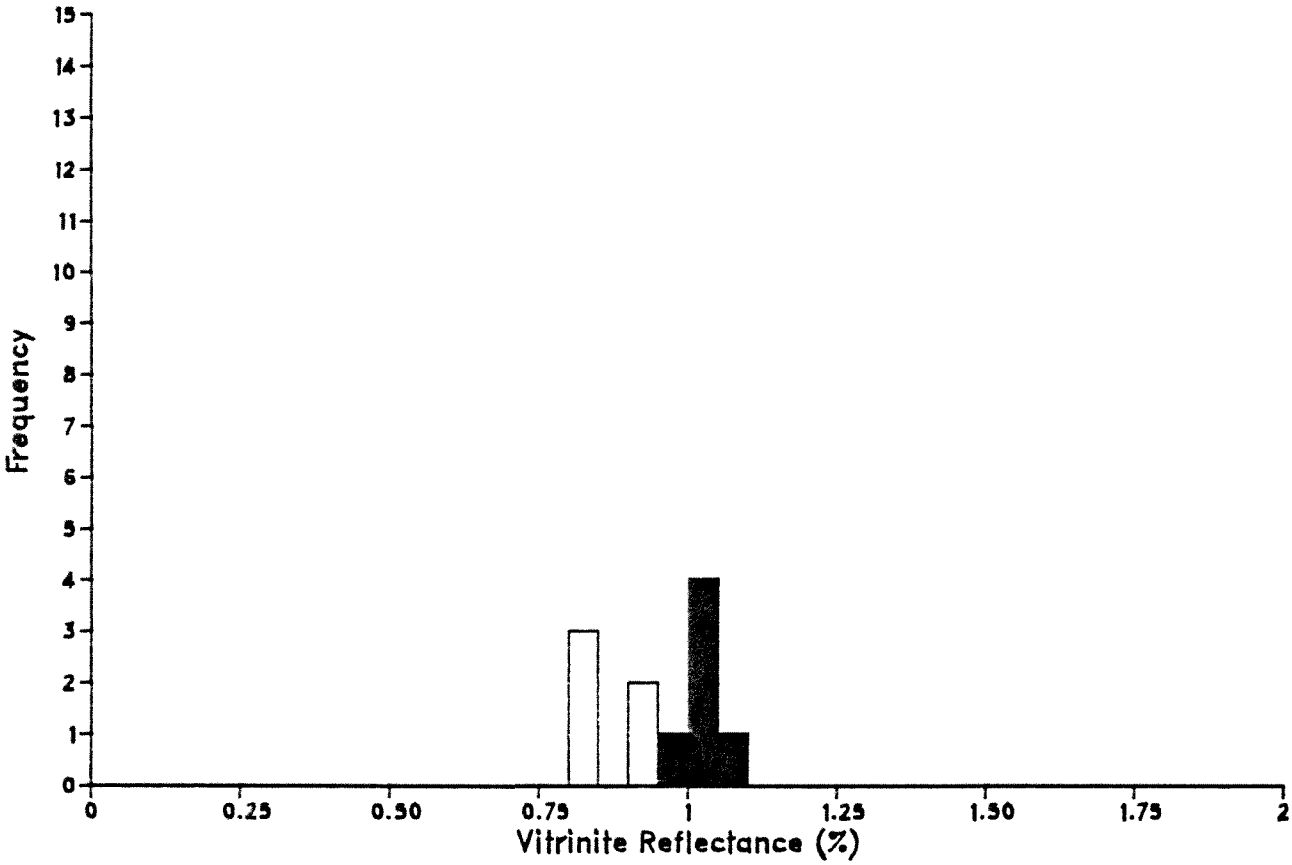
Readings:

0.710	0.720	0.820	0.820	0.930	0.940	0.960	1.010	1.020	1.020
1.030	1.040	1.110	1.130	1.160	1.170	1.210			

Vitrinite Reflectance Histogram

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

Well: NOCS 2/1-3
Depth: 4278.00(m)
Sample: 110- 0b



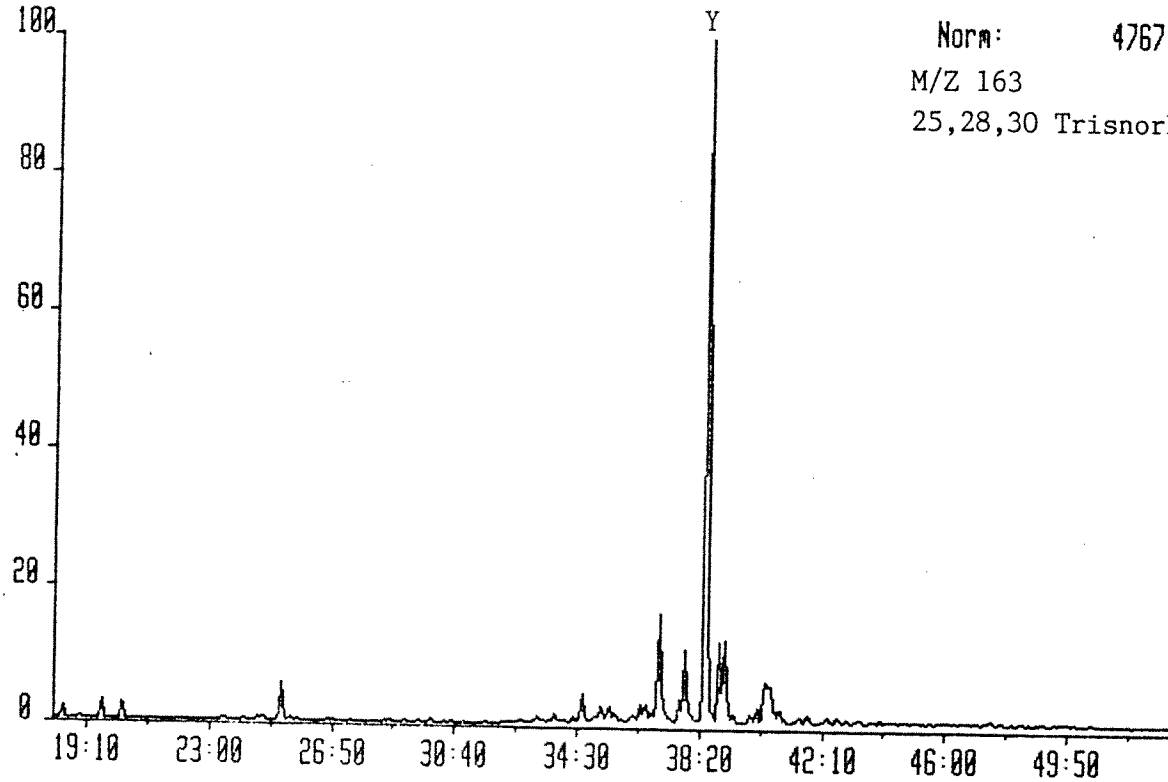
Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.950 to 1.100):	1.02	0.03	6
Population Two (from 0.800 to 0.949):	0.86	0.05	5

Readings:

0.830 0.830 0.830 0.910 0.920 0.980 1.000 1.020 1.030 1.040
1.060

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

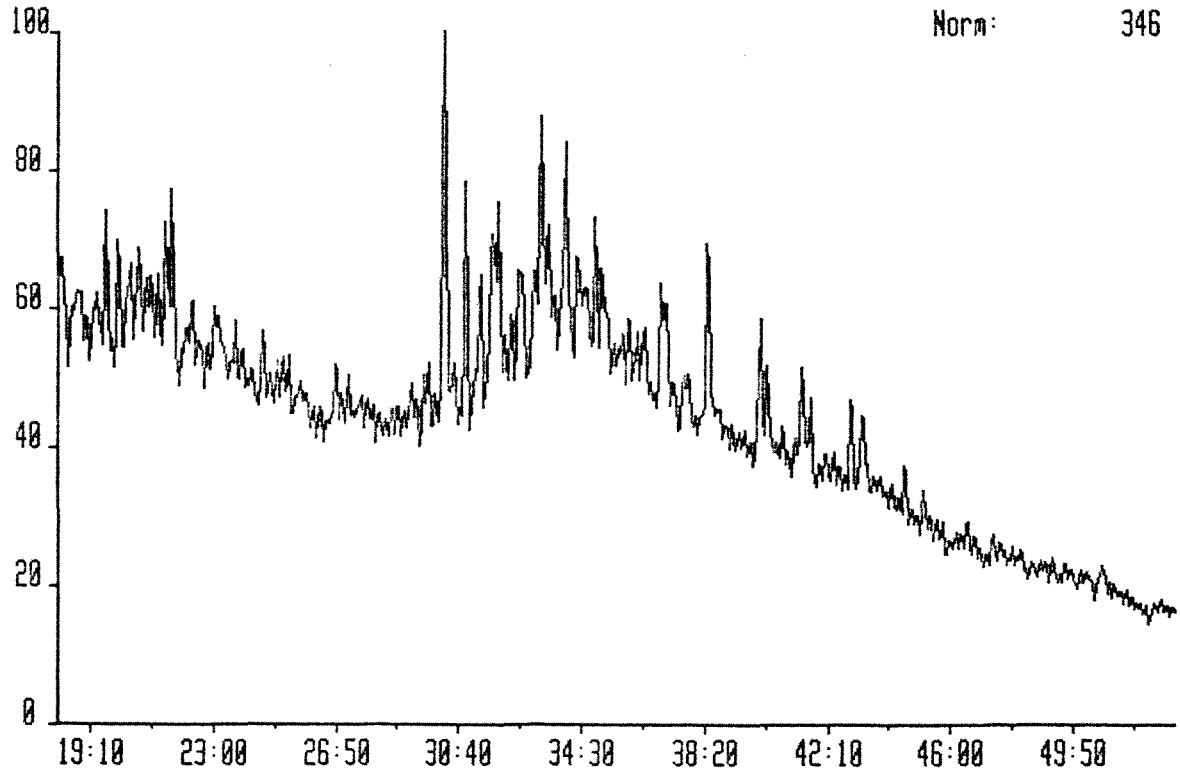
EXAMPLE OF PEAK IDENTIFICATION FOR 25, 28, 30 TRISNORHOPANE/MORETANE



Norm: 4767
M/Z 163
25,28,30 Trisnorhopane/Moretane

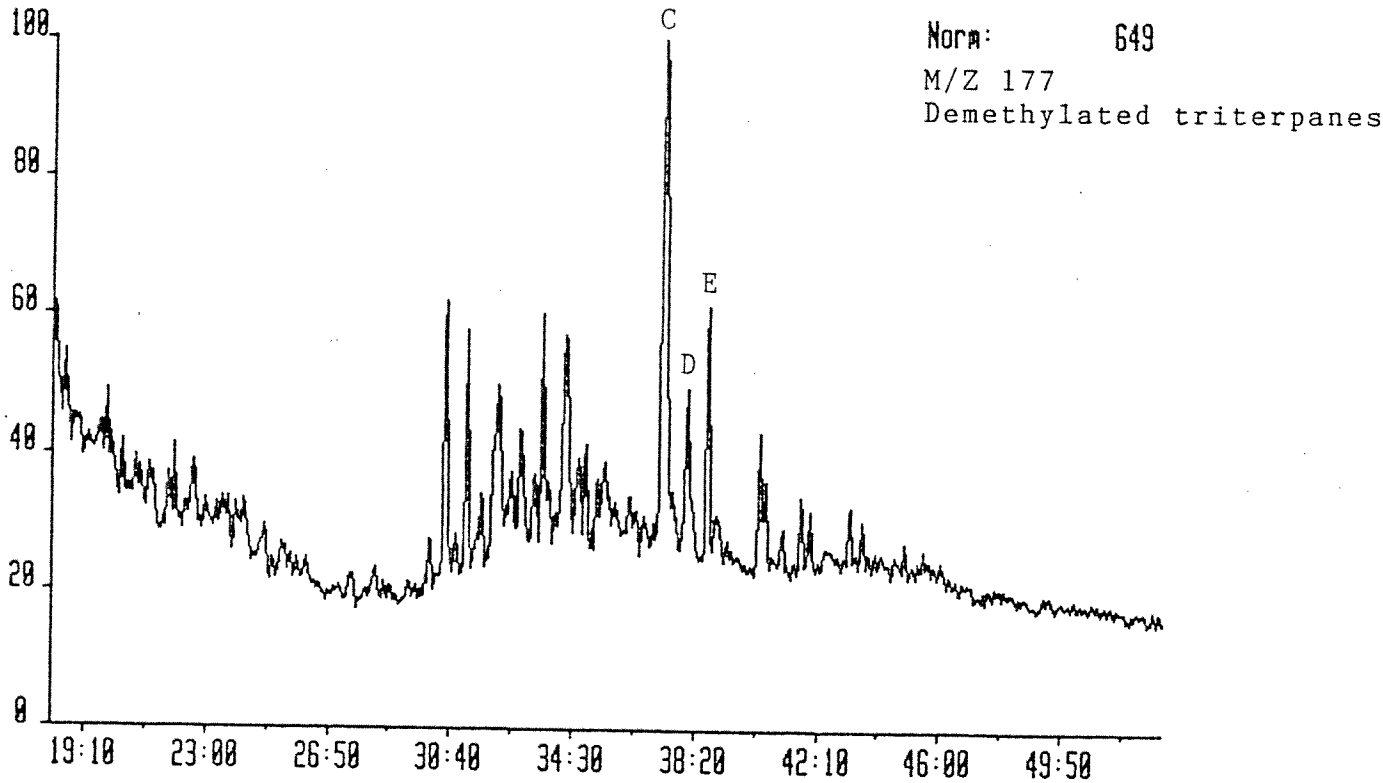
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 163.1485
Text:WELL 2/1-3, 3804M, SATURATED FRACTION

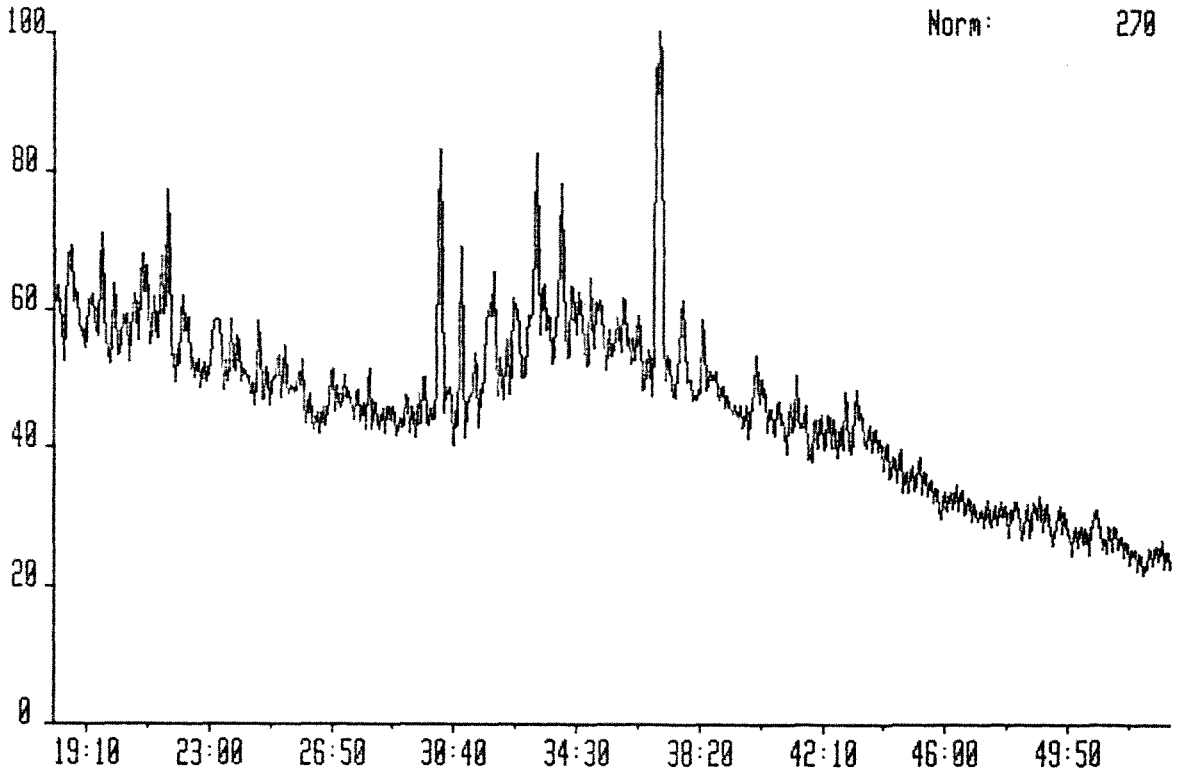


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR DEMETHYLATED TRITERPANES

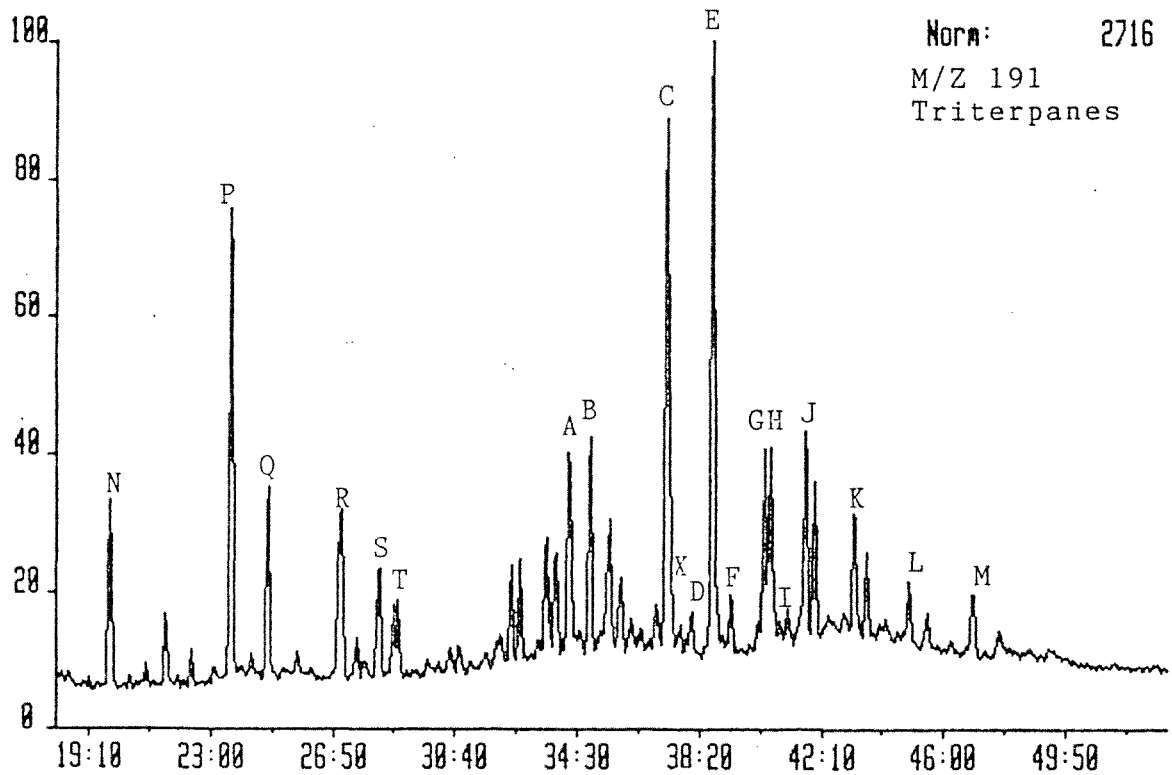


CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 177.1642
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



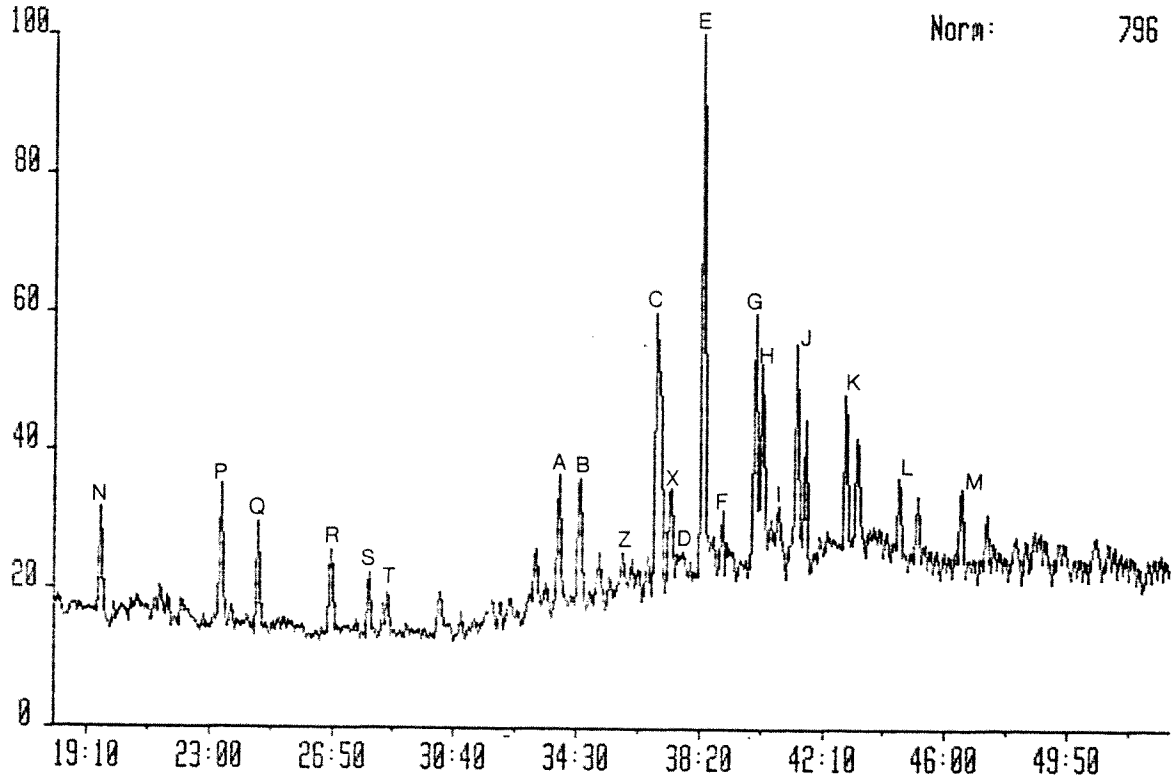
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR TRITERPANES



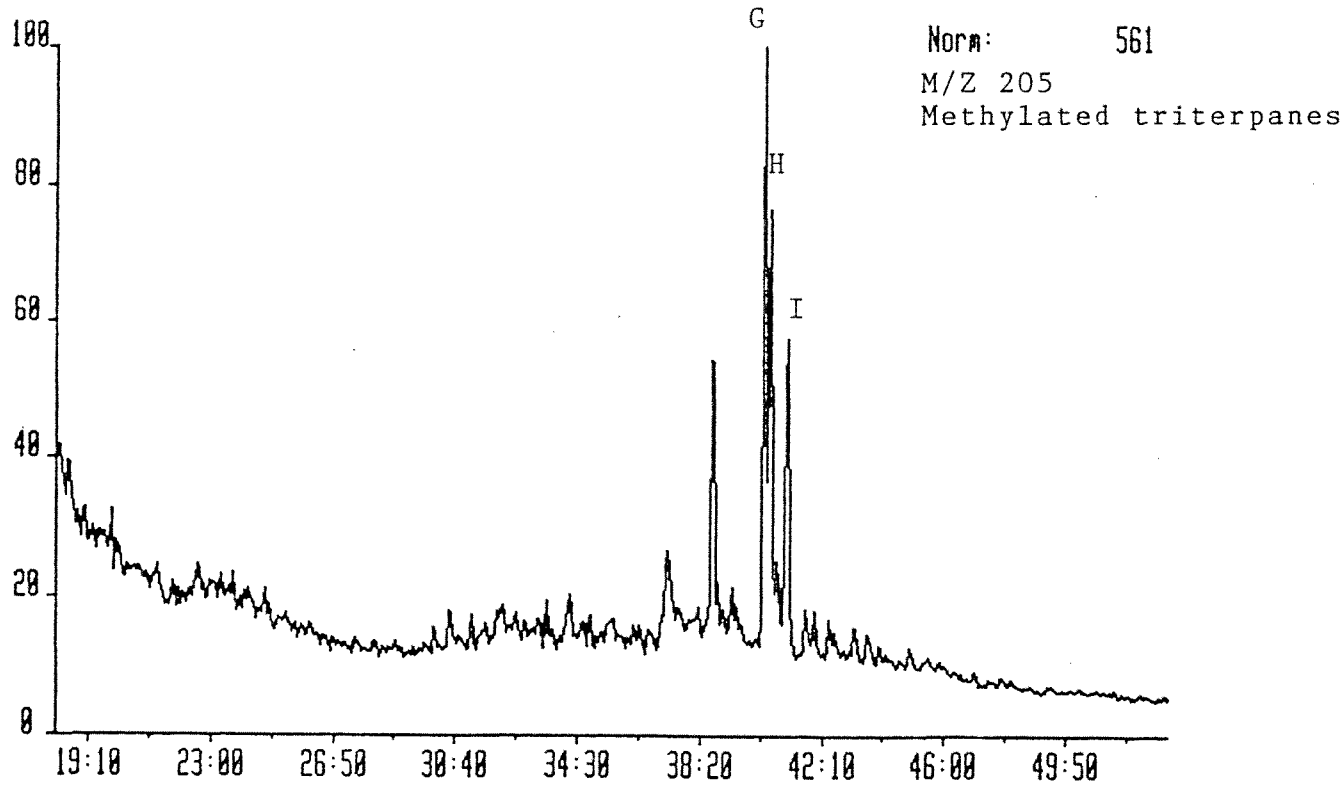
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 191.1800
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



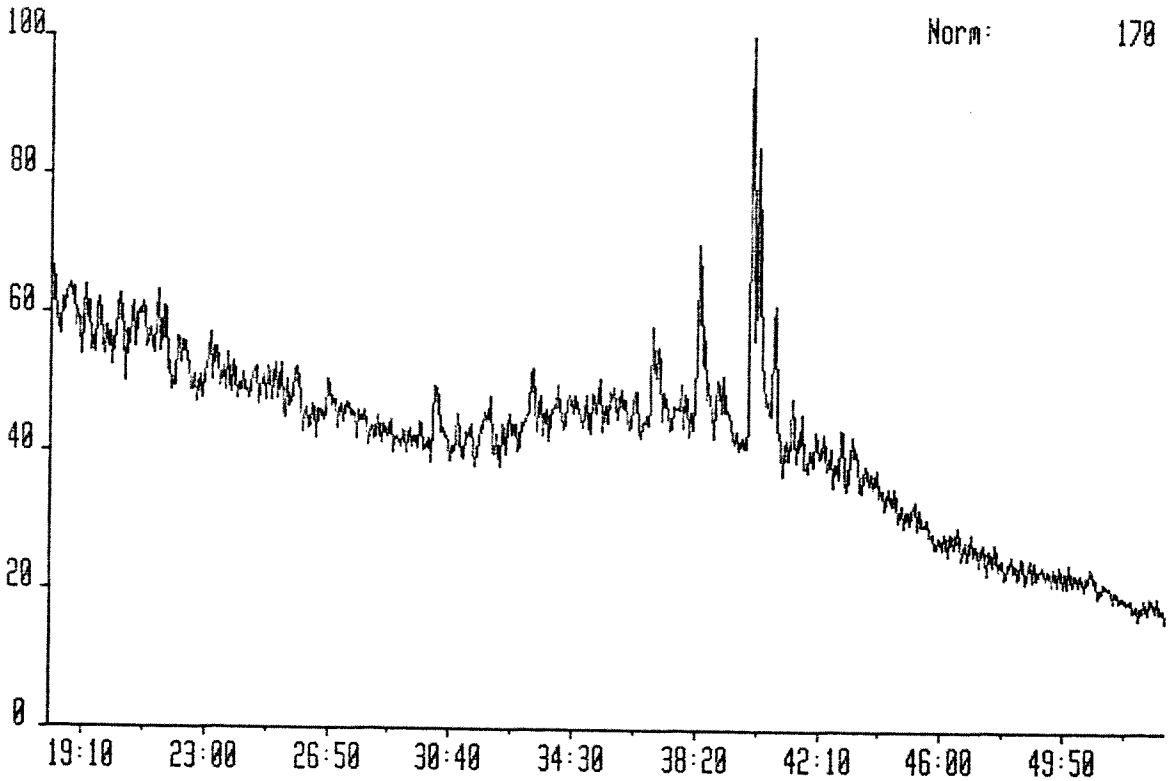
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF IDENTIFICATION FOR METHYLATED TRITERPANES

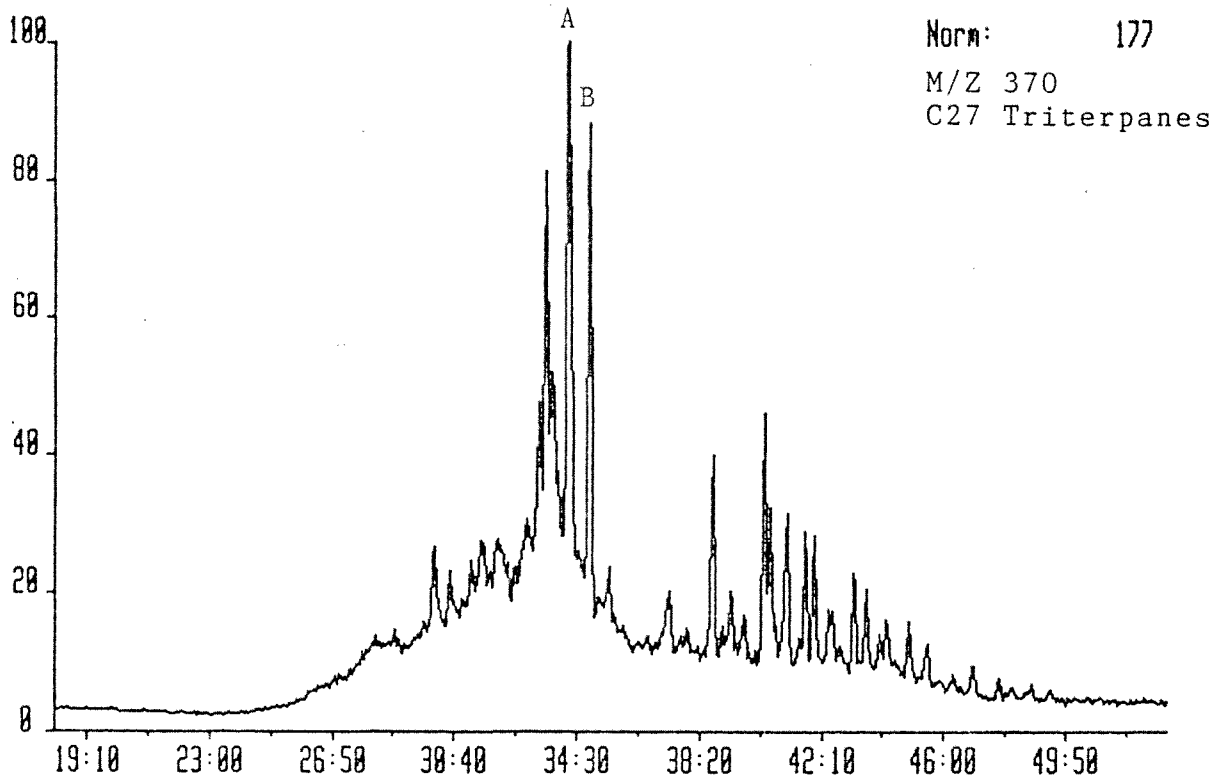


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 205.1956
Text:WELL 2/1-3, 3804M, SATURATED FRACTION

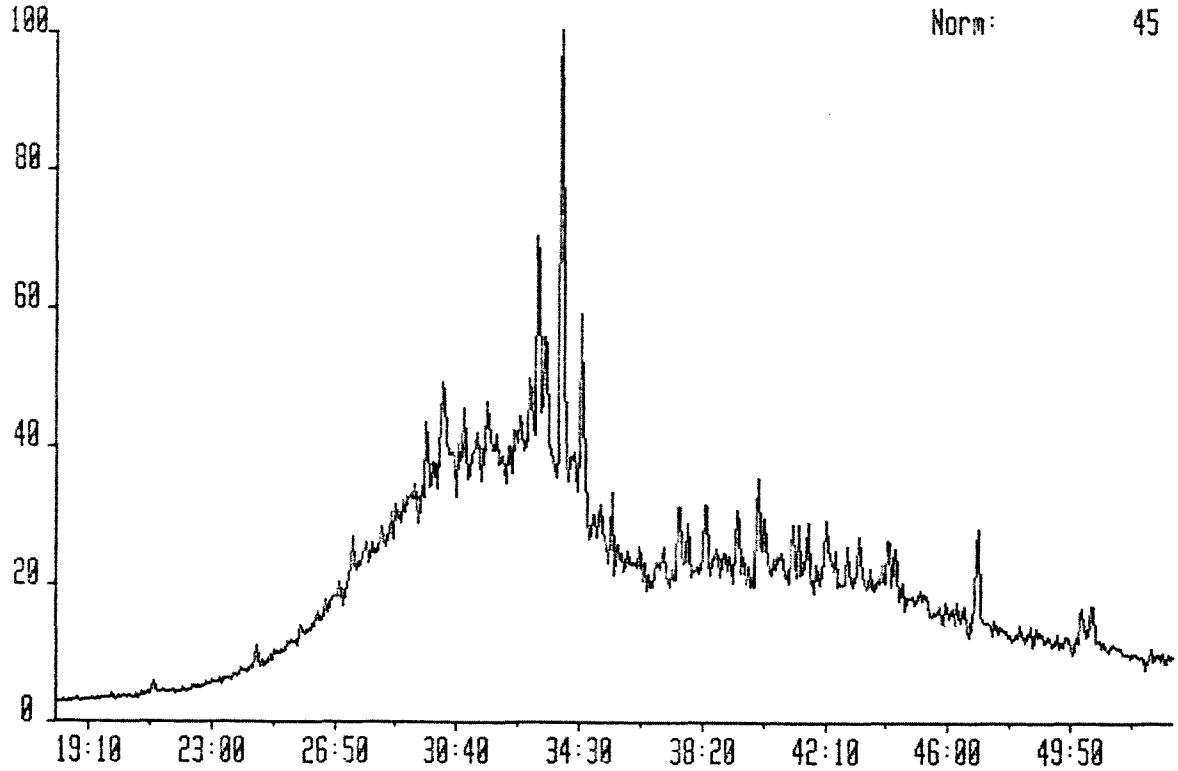


EXAMPLE OF PEAK IDENTIFICATION FOR C27 TRITERPANES



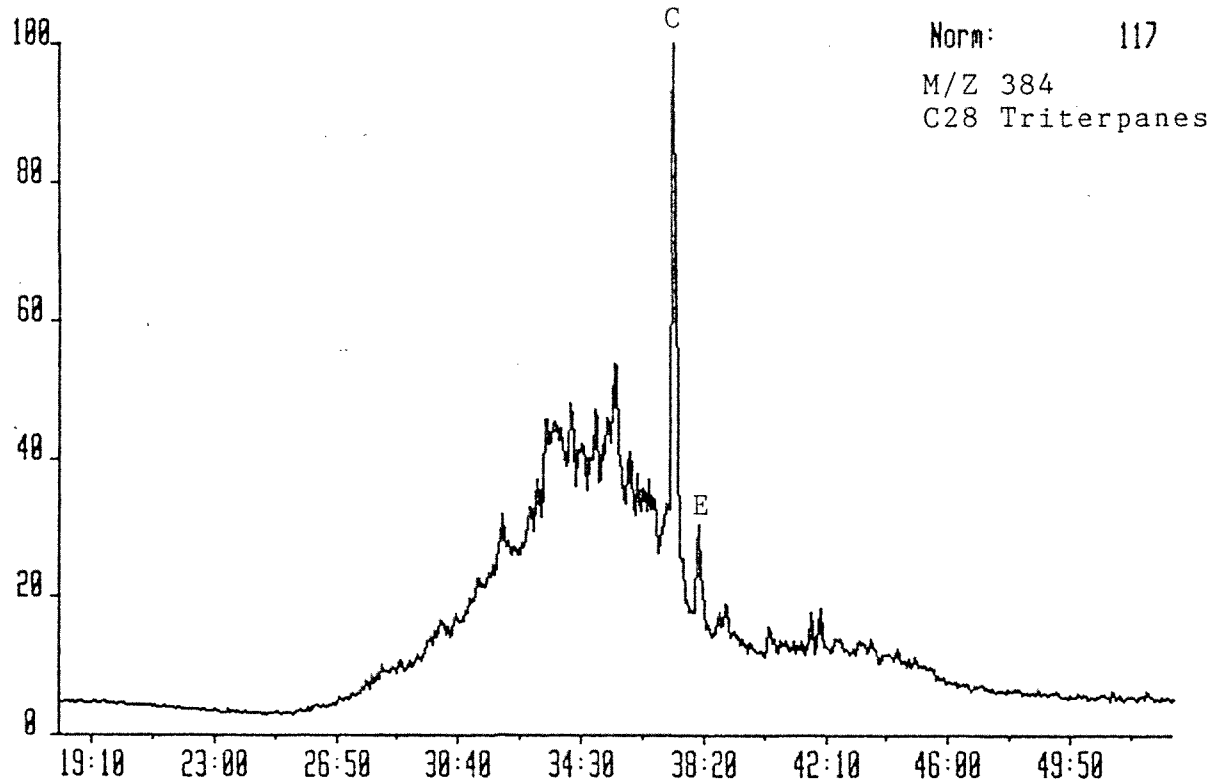
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 370.3608
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



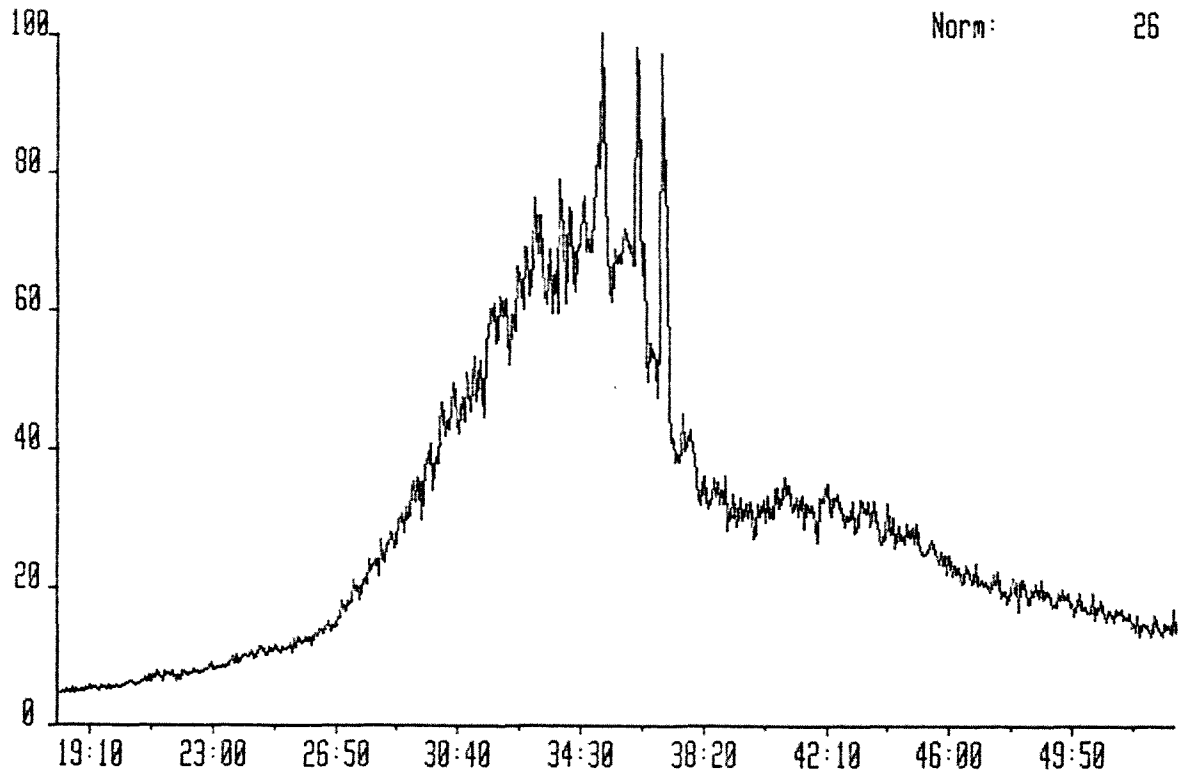
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C28 TRITERPANES



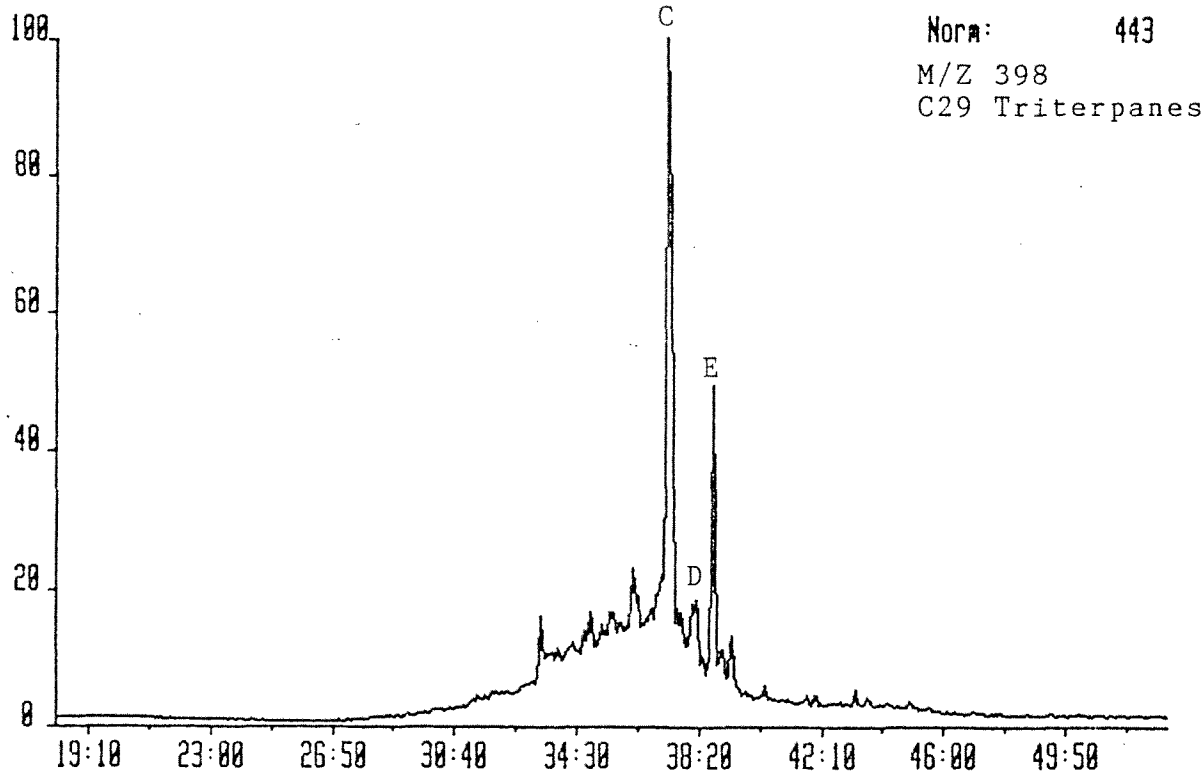
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 384.3757
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



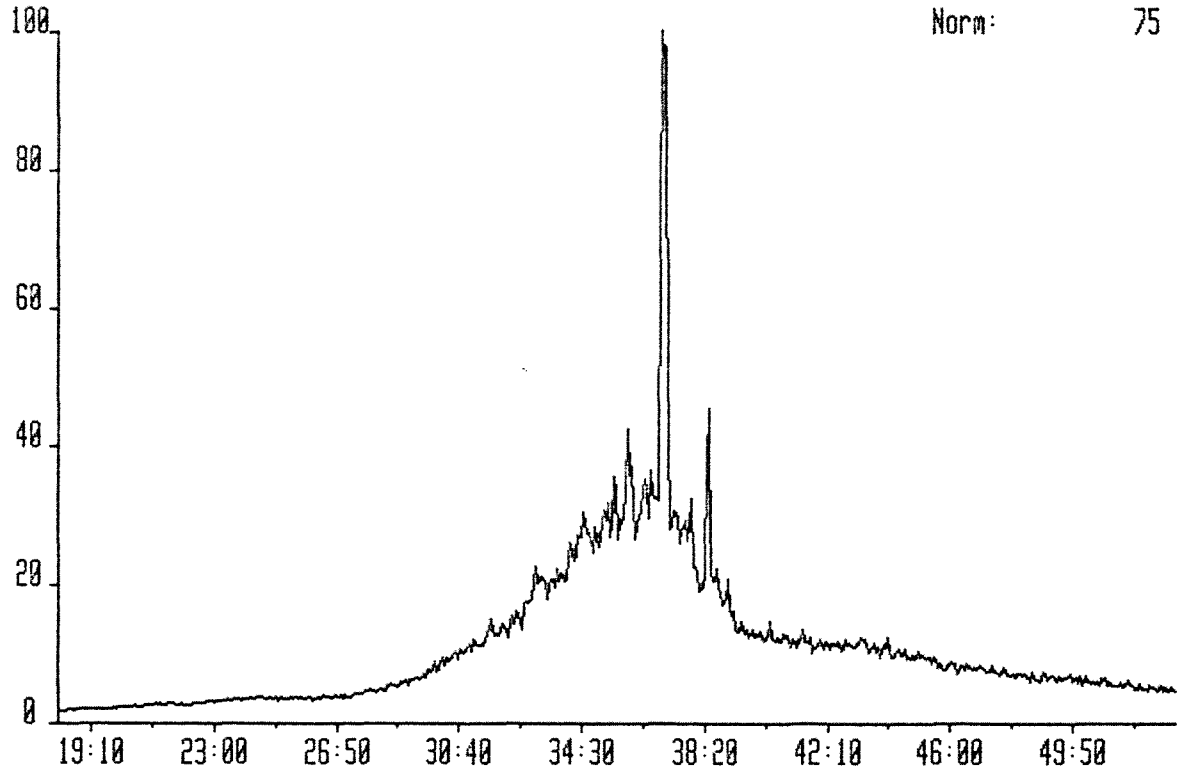
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C29 TRITERPANES



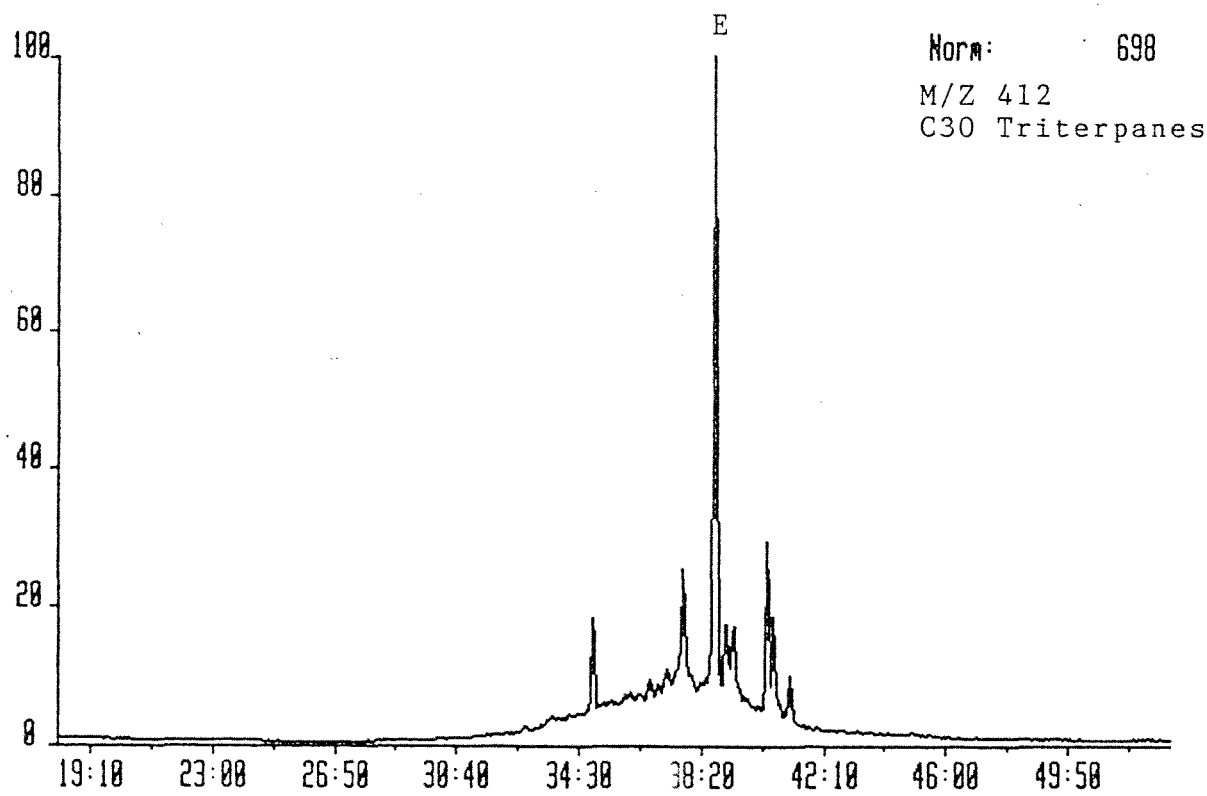
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 398.3914
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



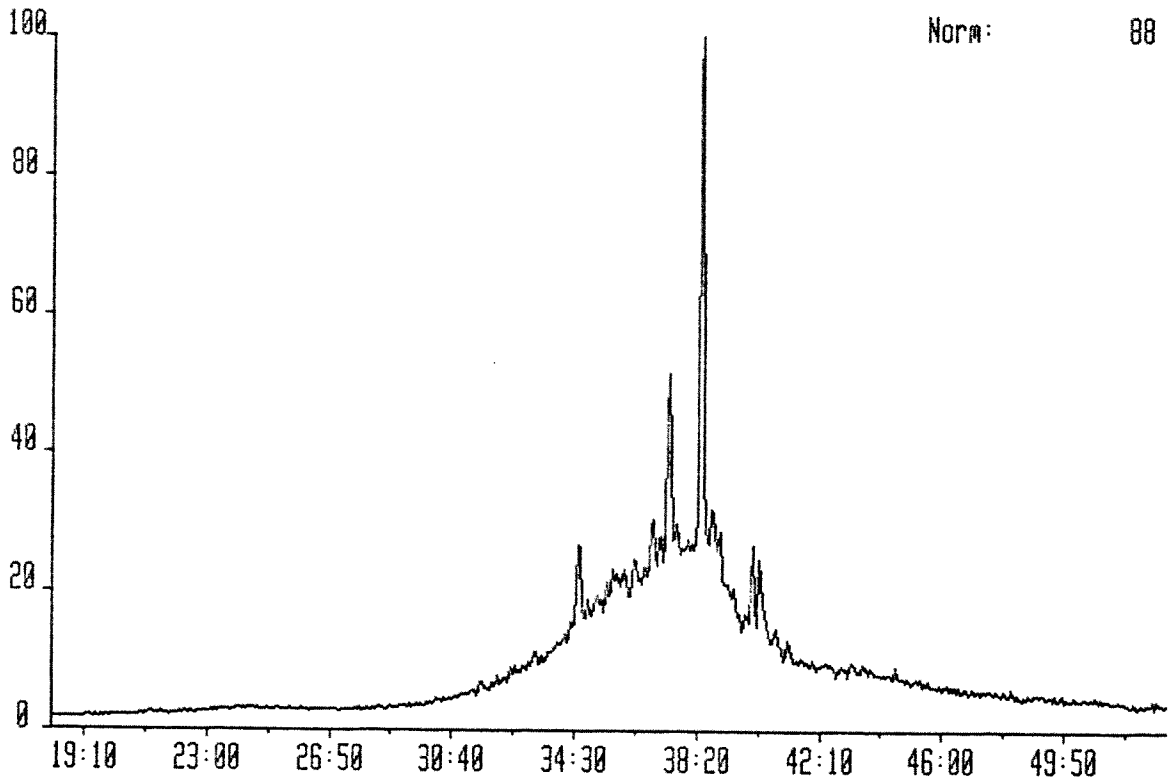
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C30 TRITERPANES



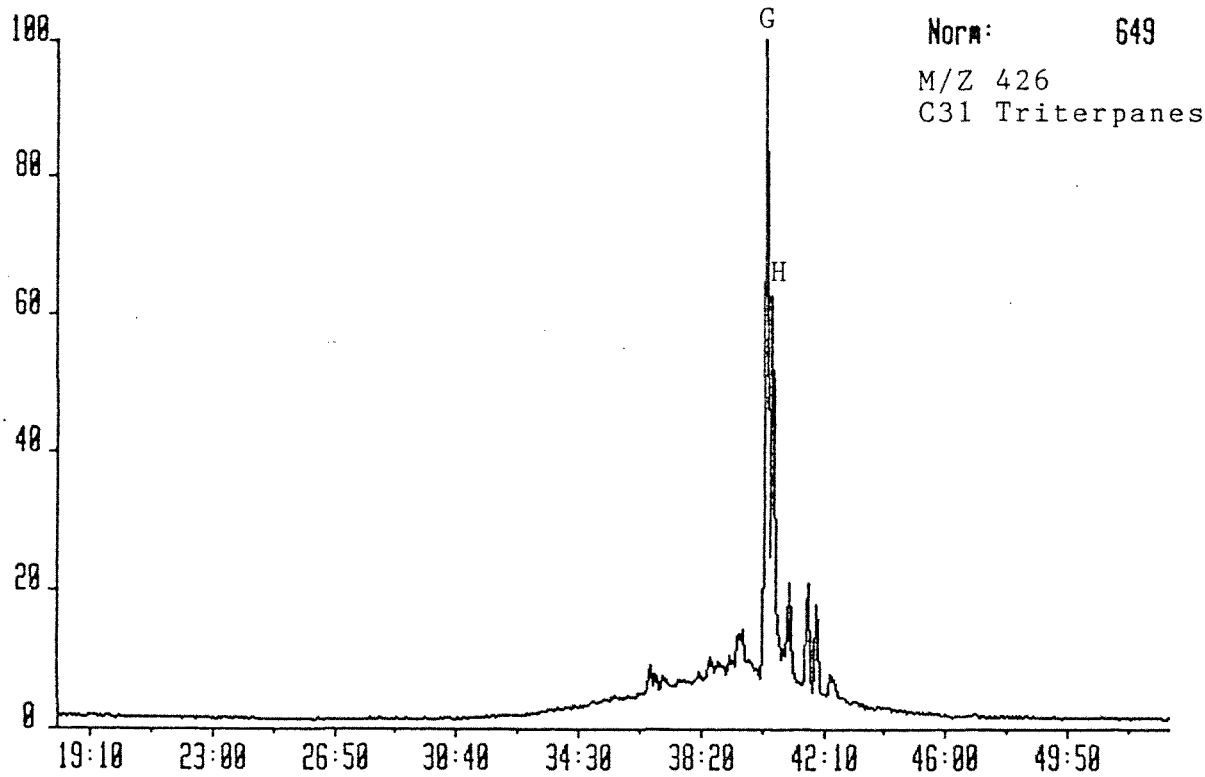
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 412.4069
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



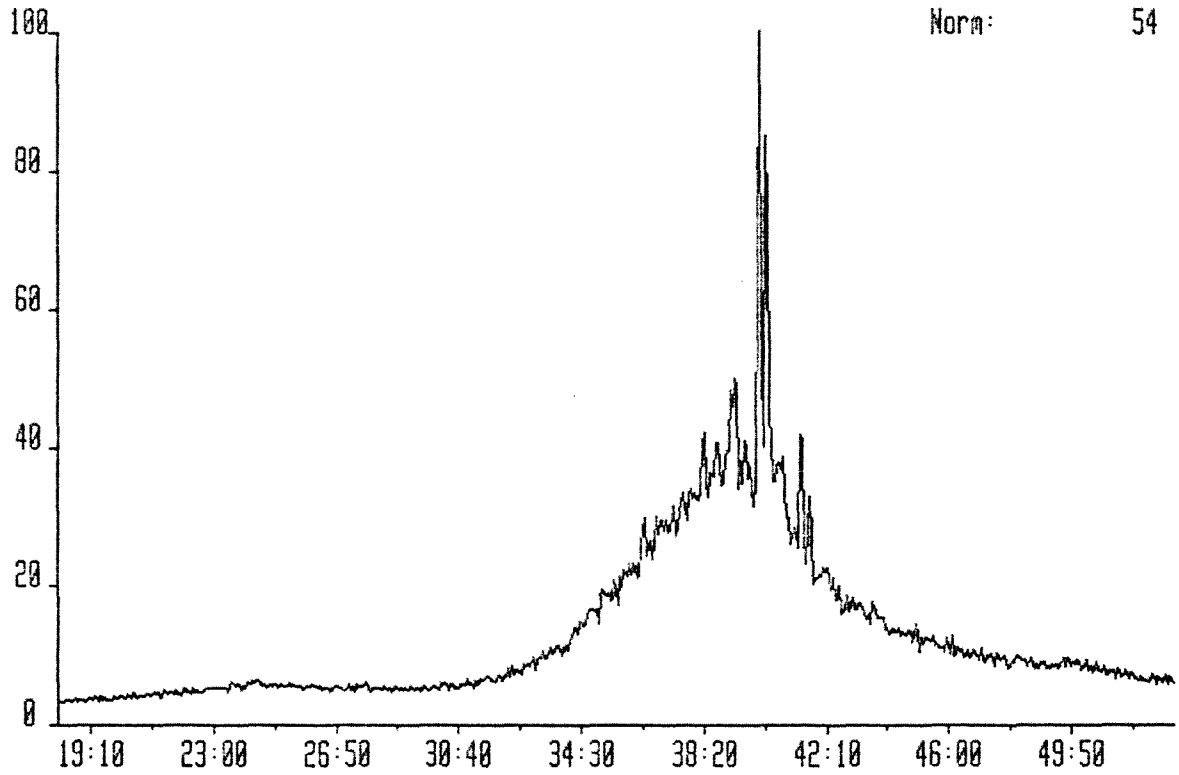
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C31 TRITERPANES



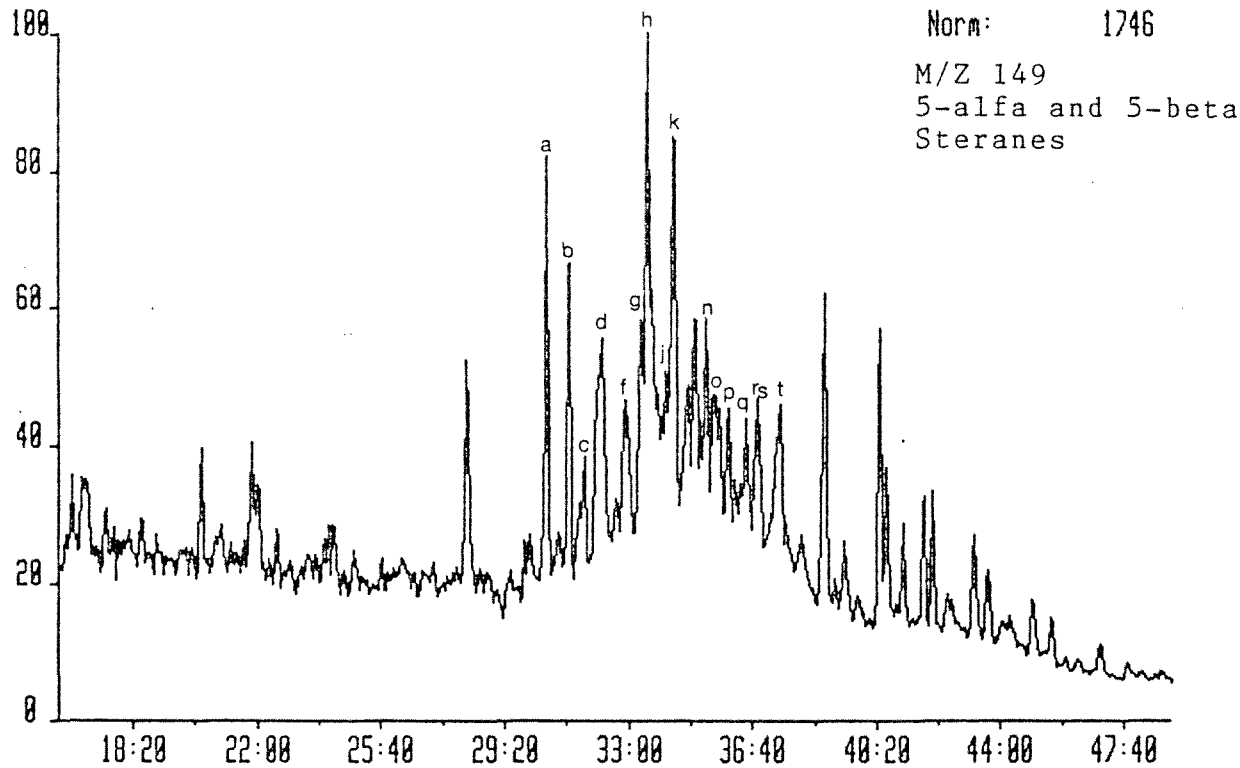
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 426.4226
Text:WELL 2/1-3, 3804M, SATURATED FRACTION

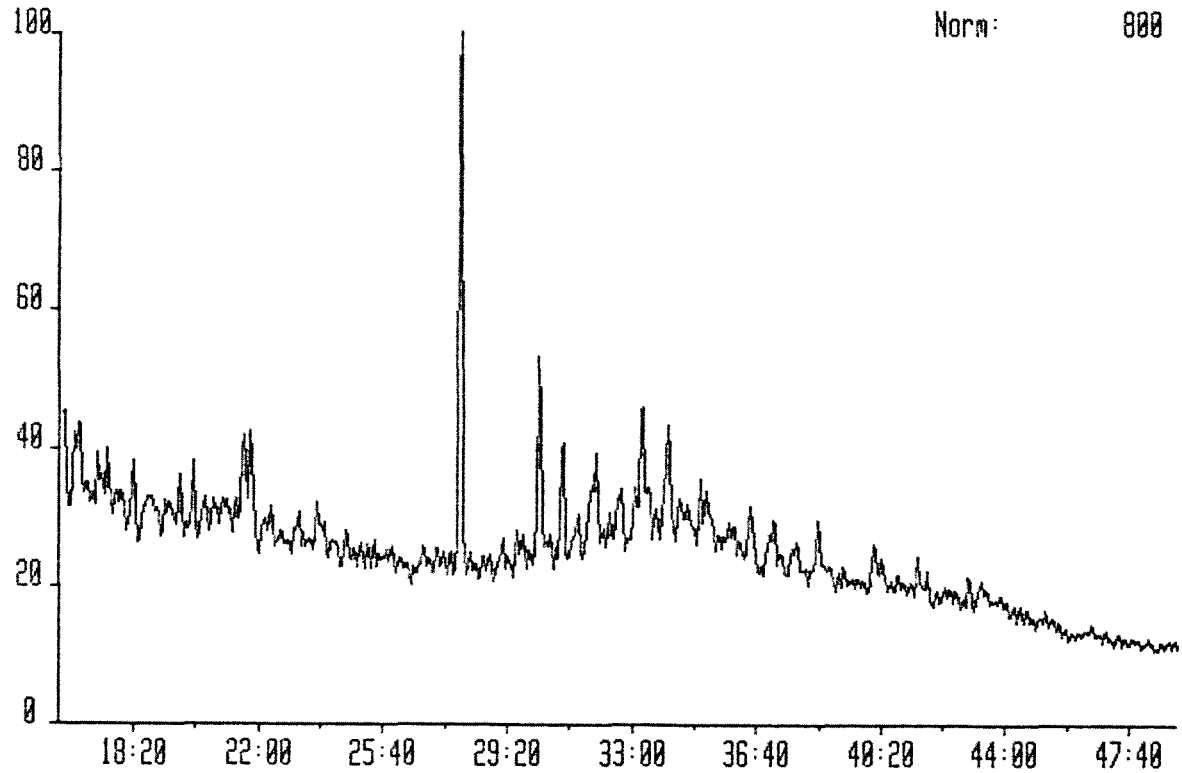


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR 5-ALFA AND 5-BETA STERANES

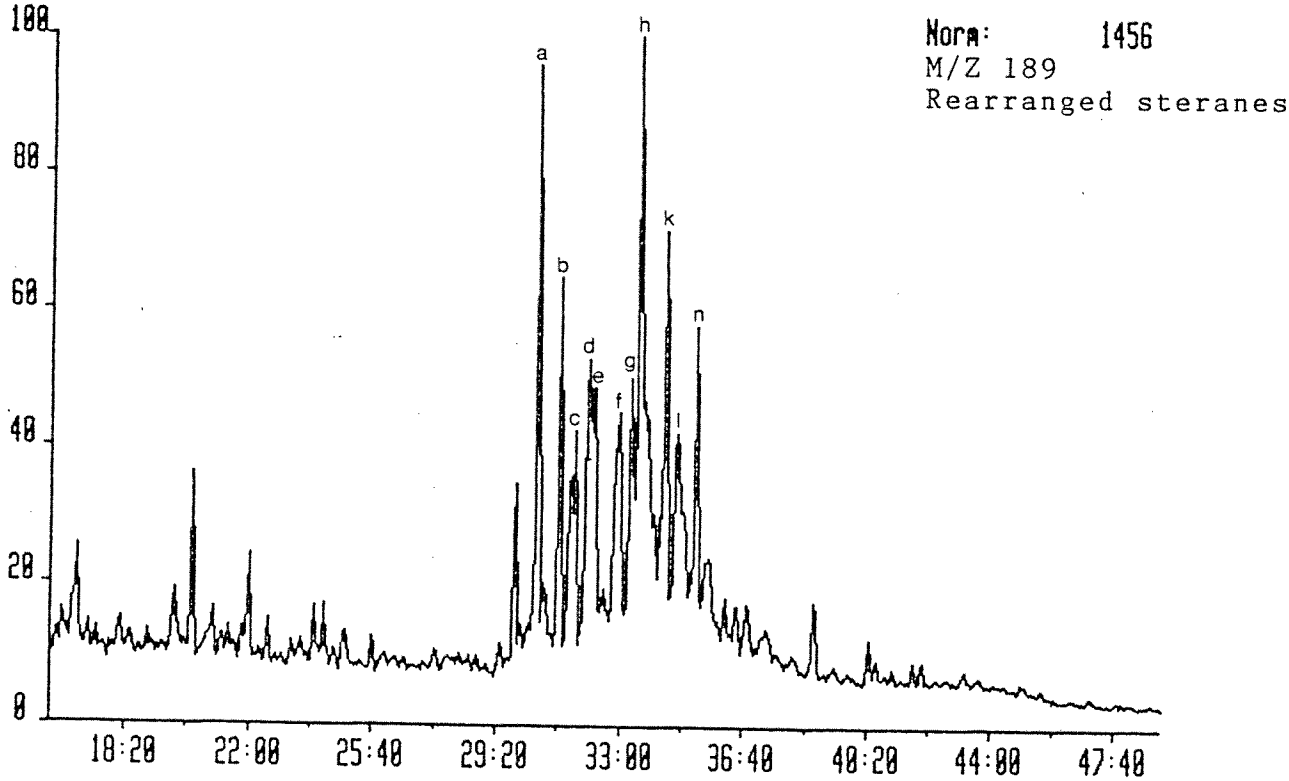


CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 149.1328
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



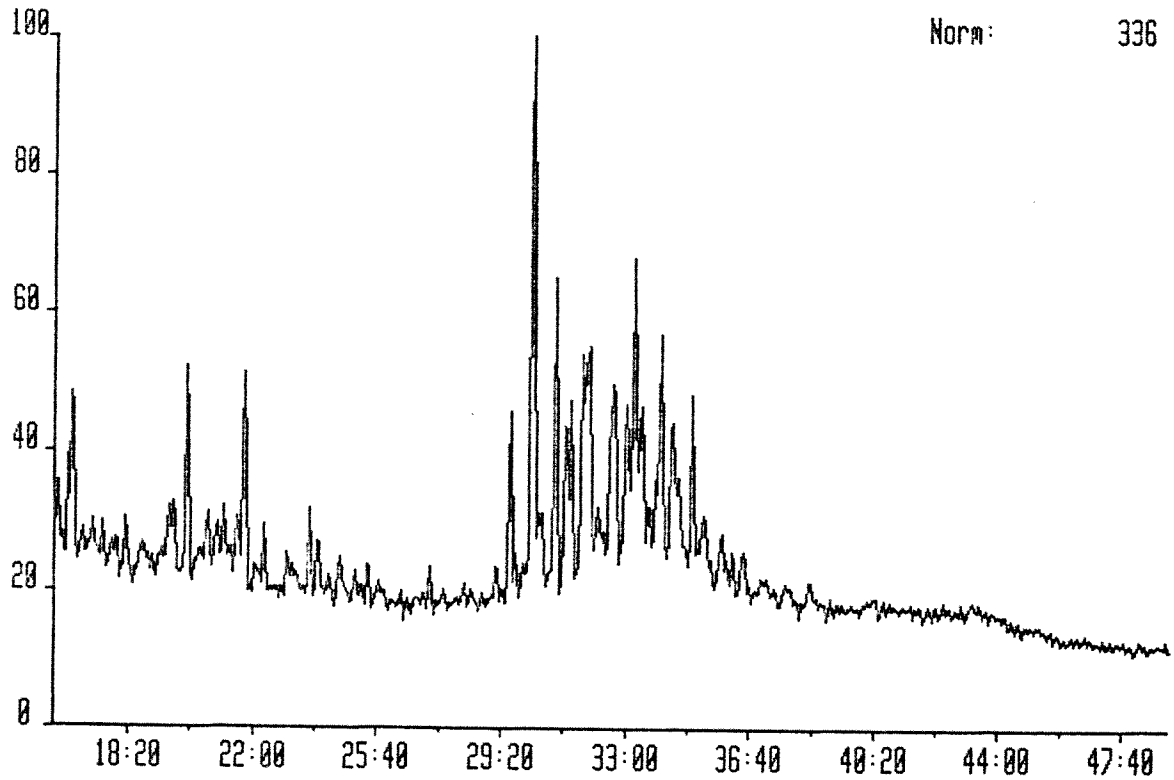
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR REARRANGED STERANES



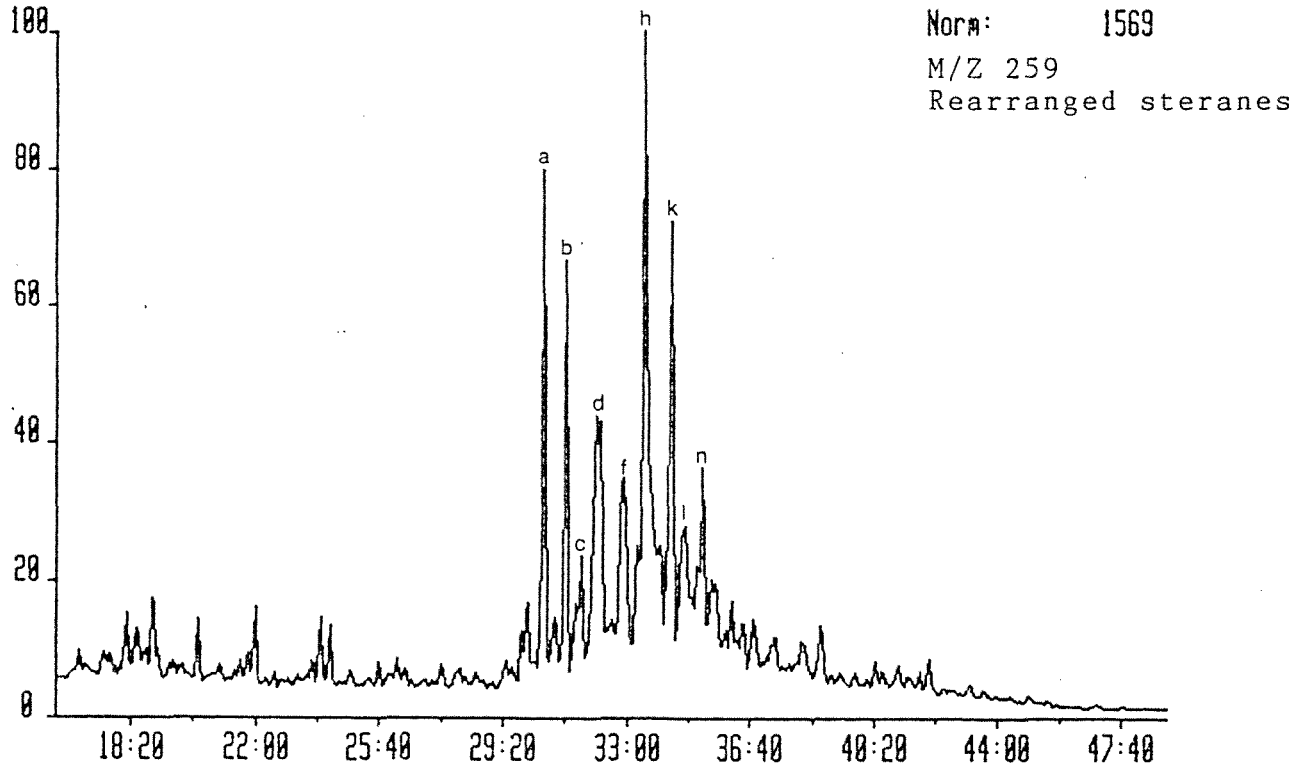
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 189.1643
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



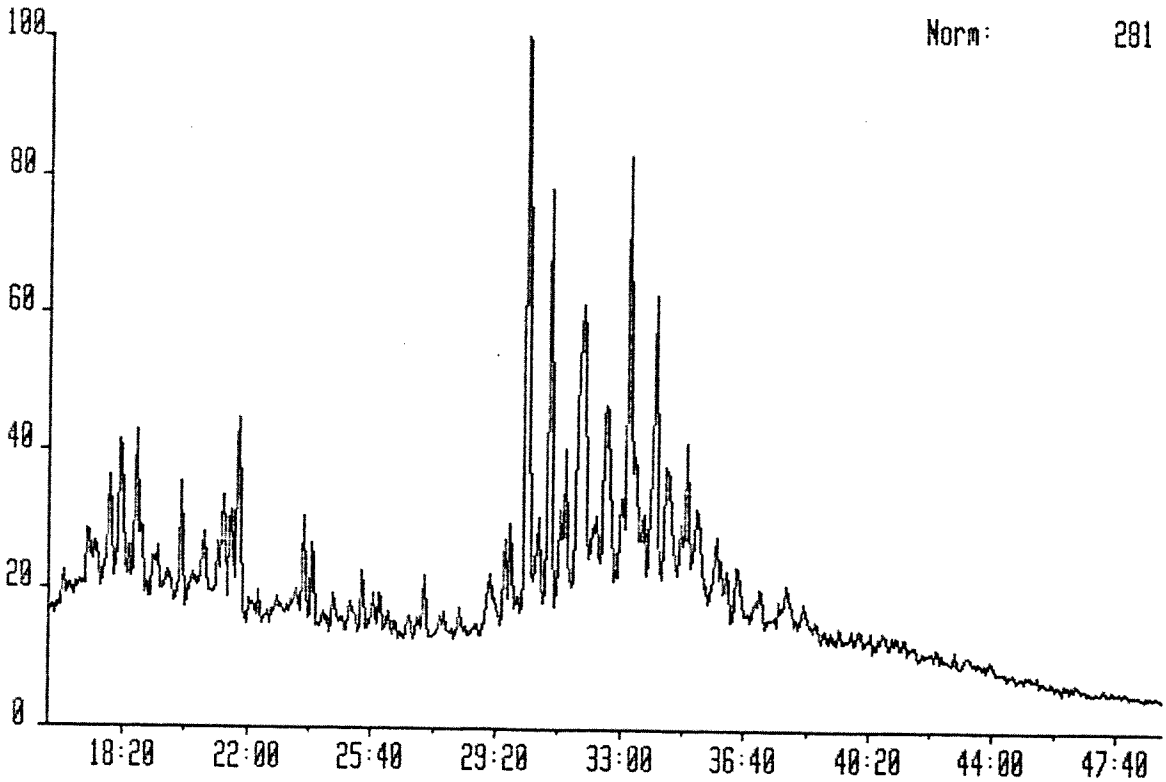
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR REARRANGED STERANES



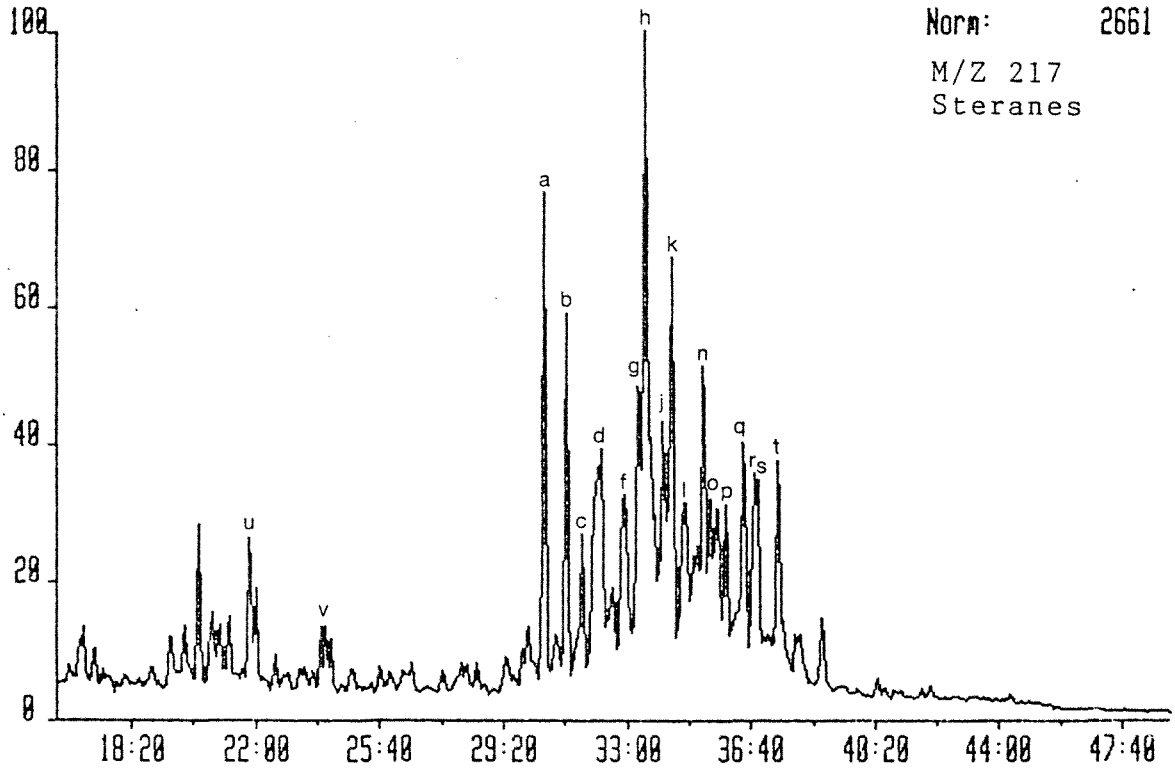
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 259.2427
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



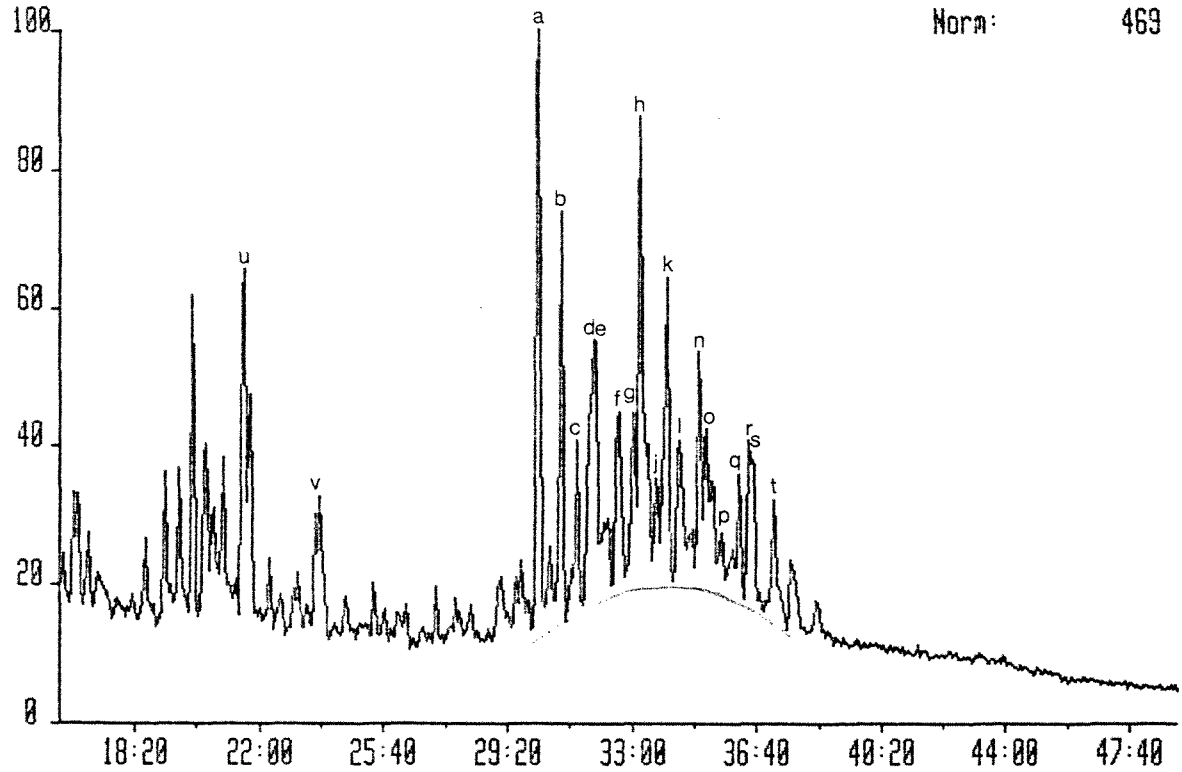
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR STERANES



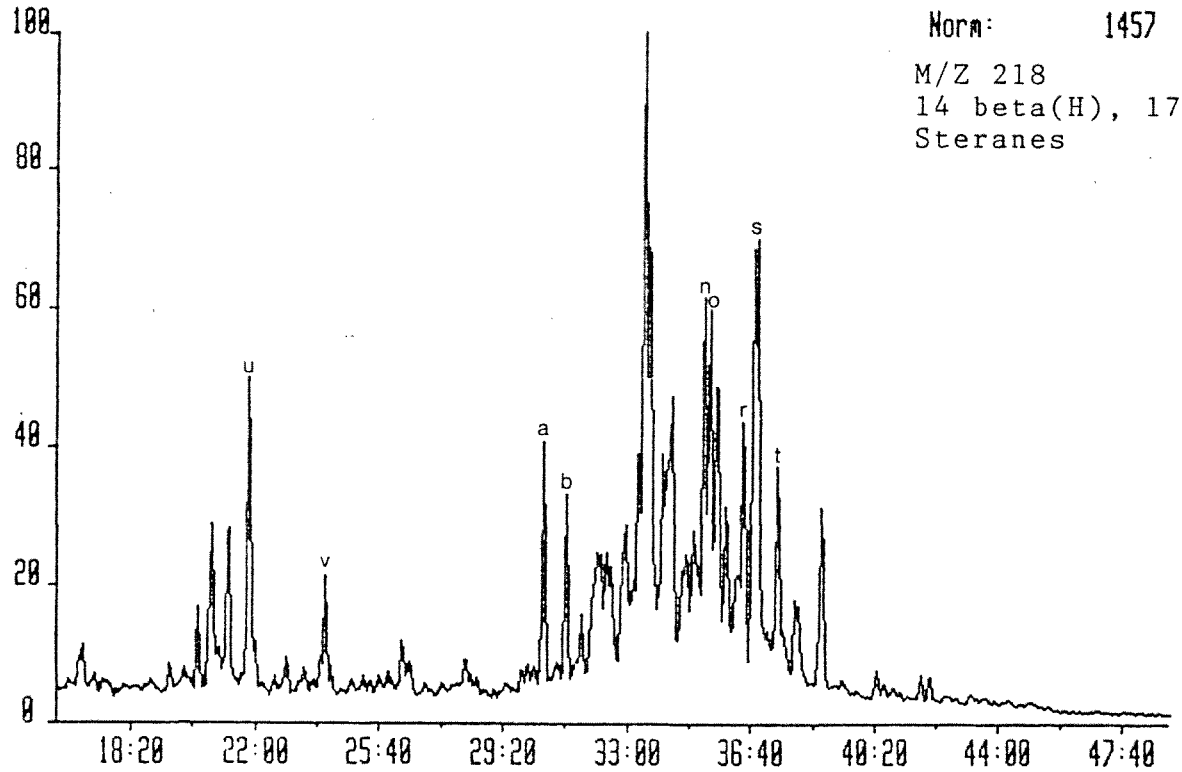
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 217.1956
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



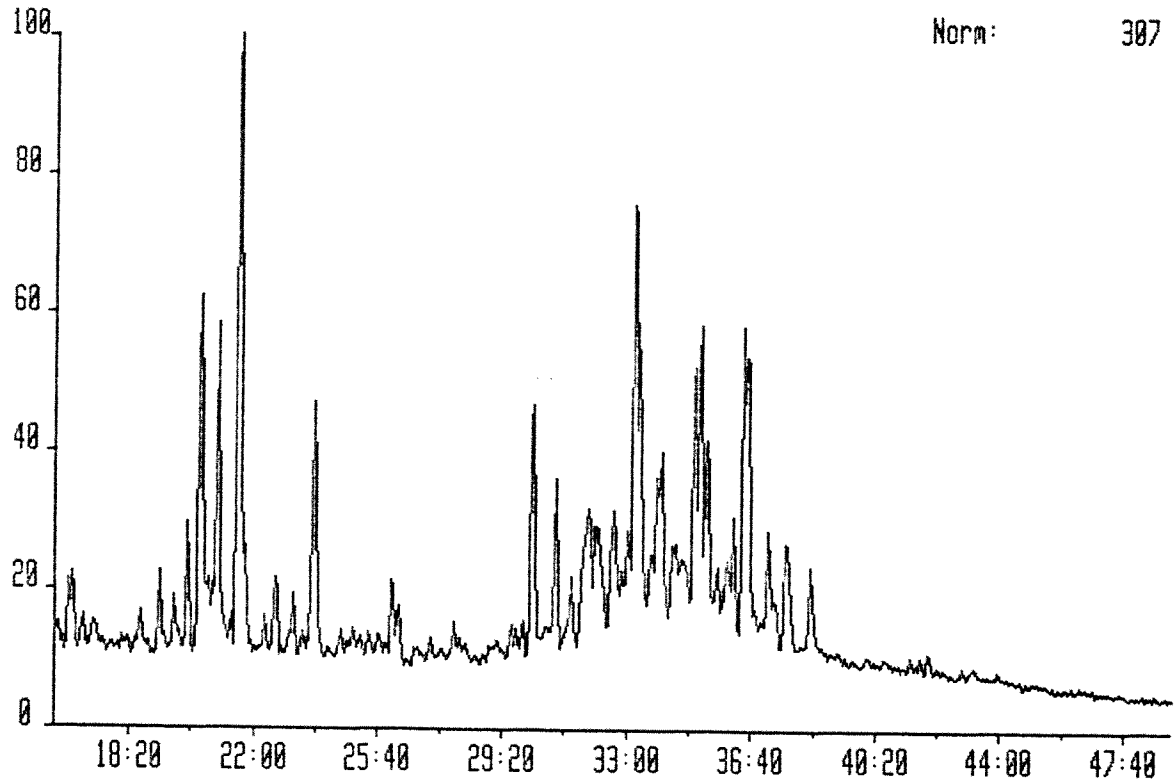
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR 14 BETA(H), 17 BETA(H) STERANES



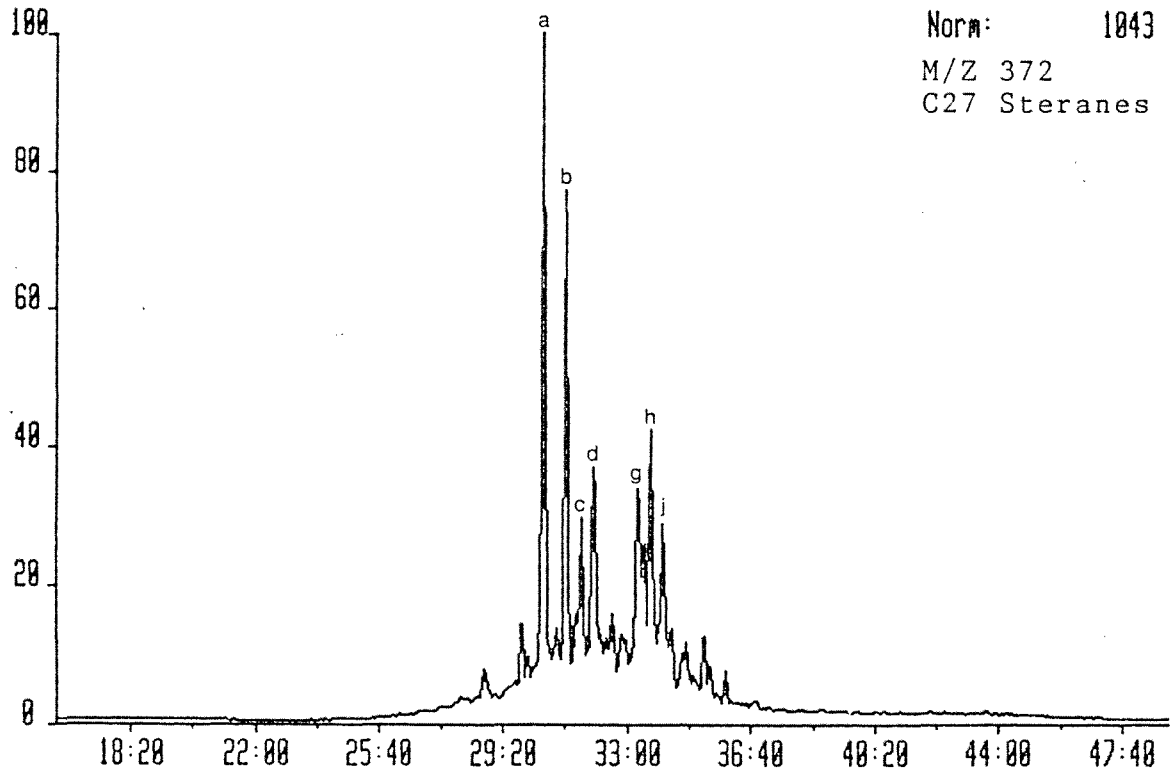
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 218.2034
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



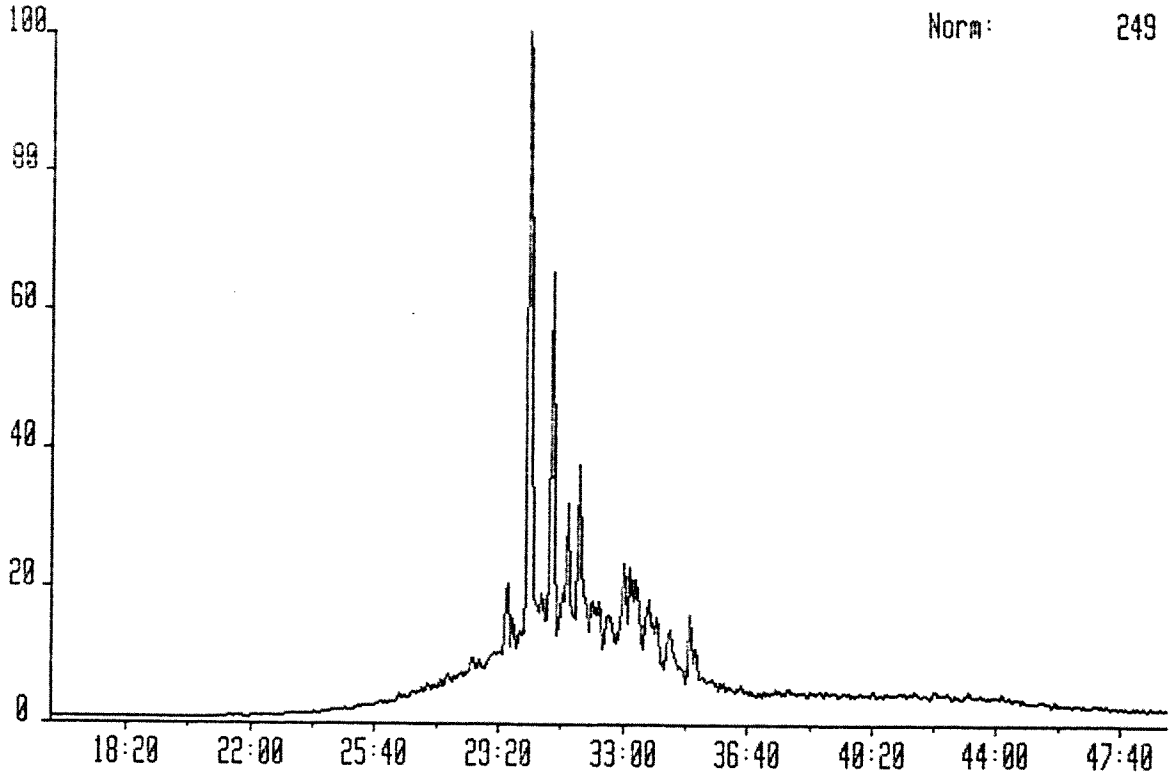
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C27 STERANES

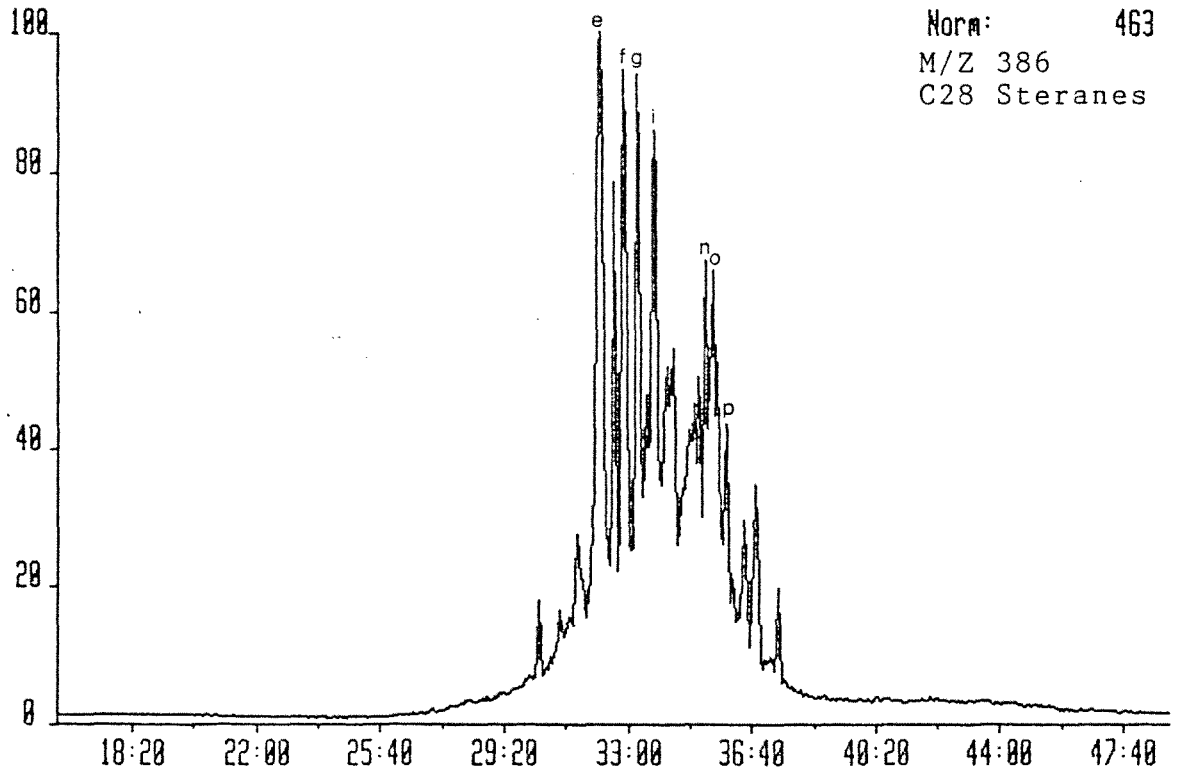


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 372.3756
Text:WELL 2/1-3, 3804M, SATURATED FRACTION

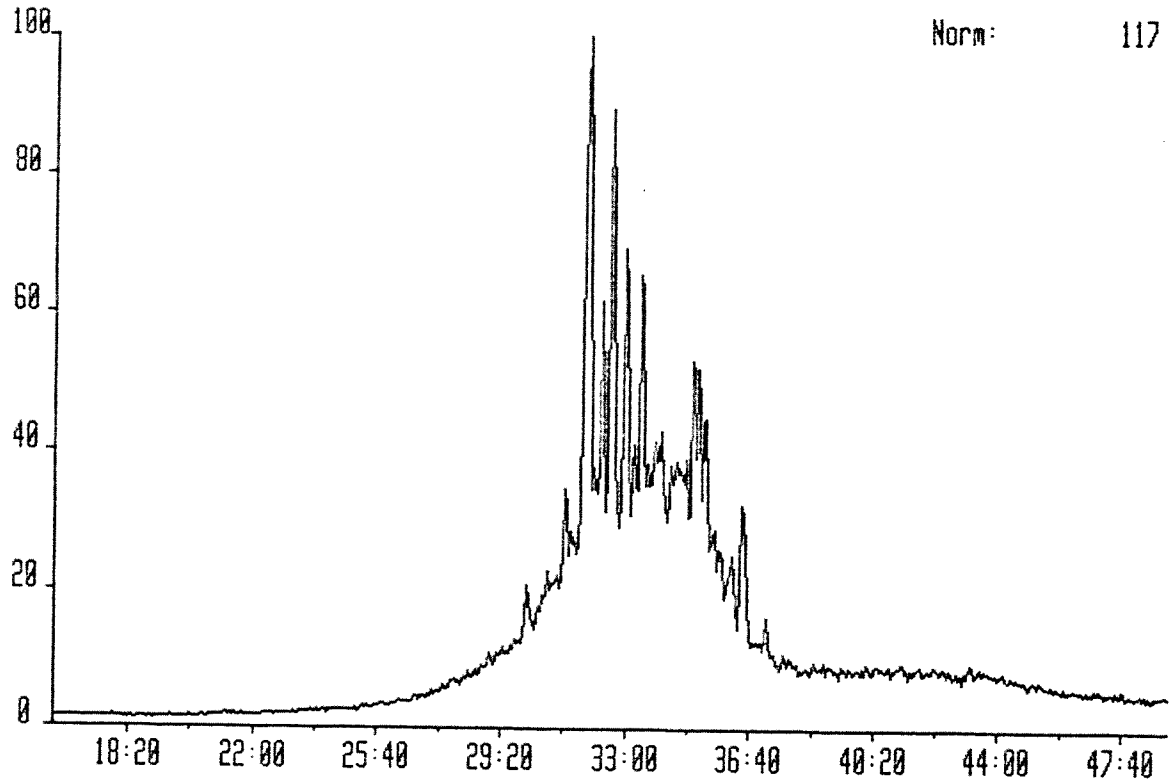


EXAMPLE OF PEAK IDENTIFICATION FOR C28 STERANES



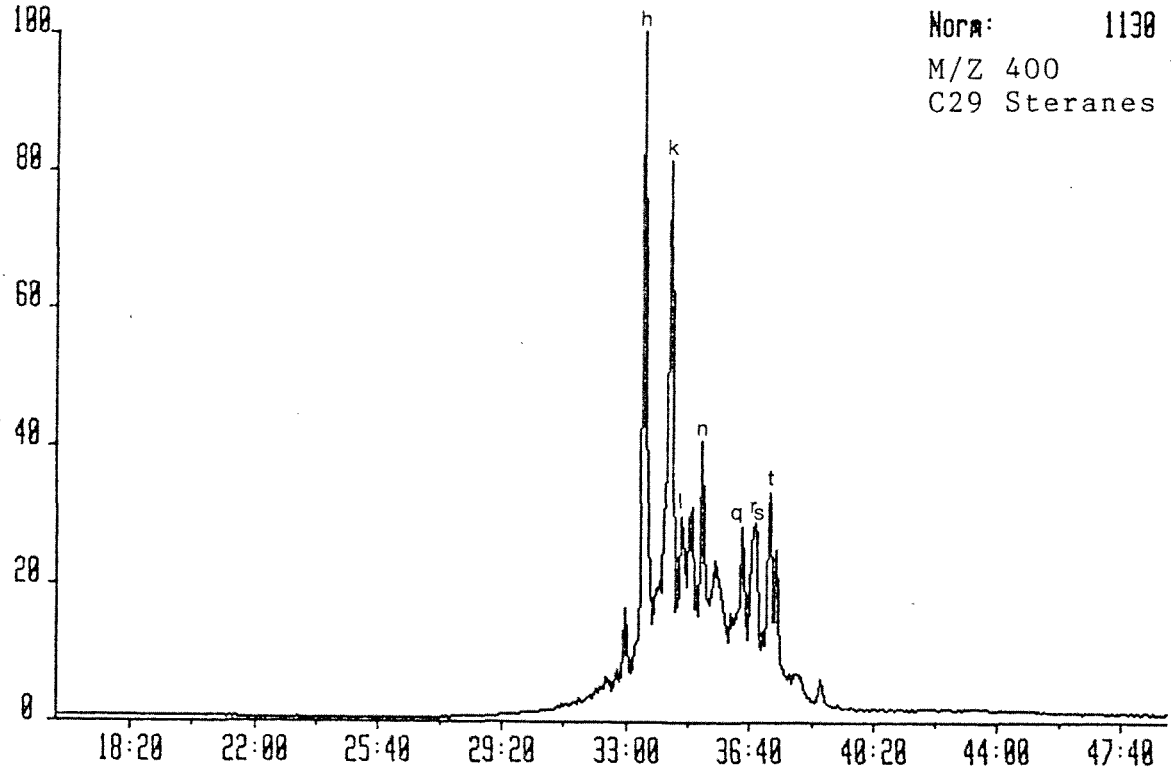
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 386.3913
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



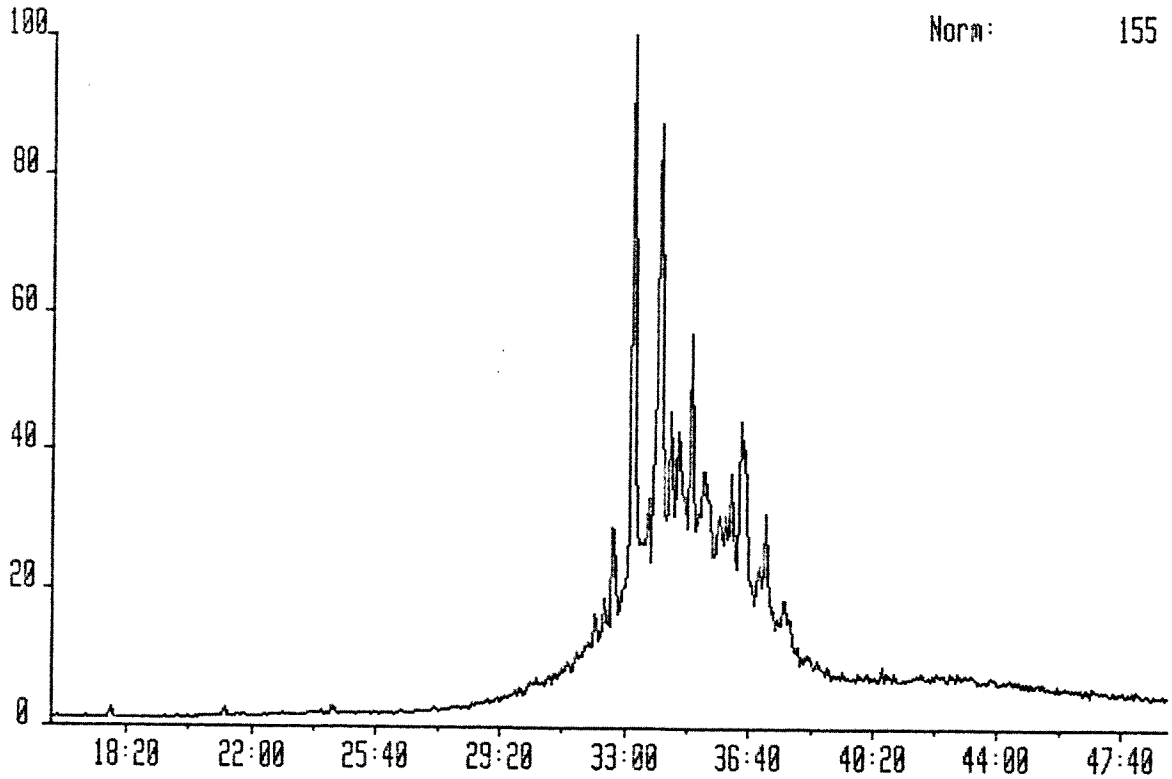
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C29 STERANES



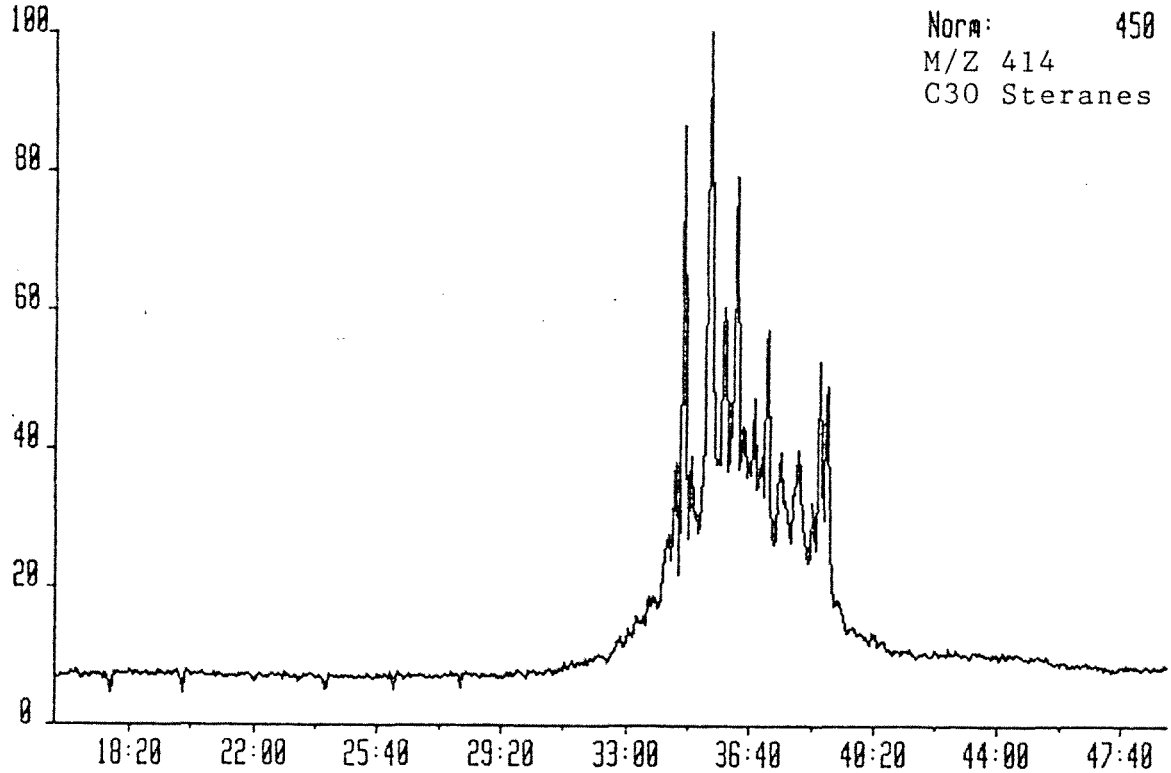
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 400.4069
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



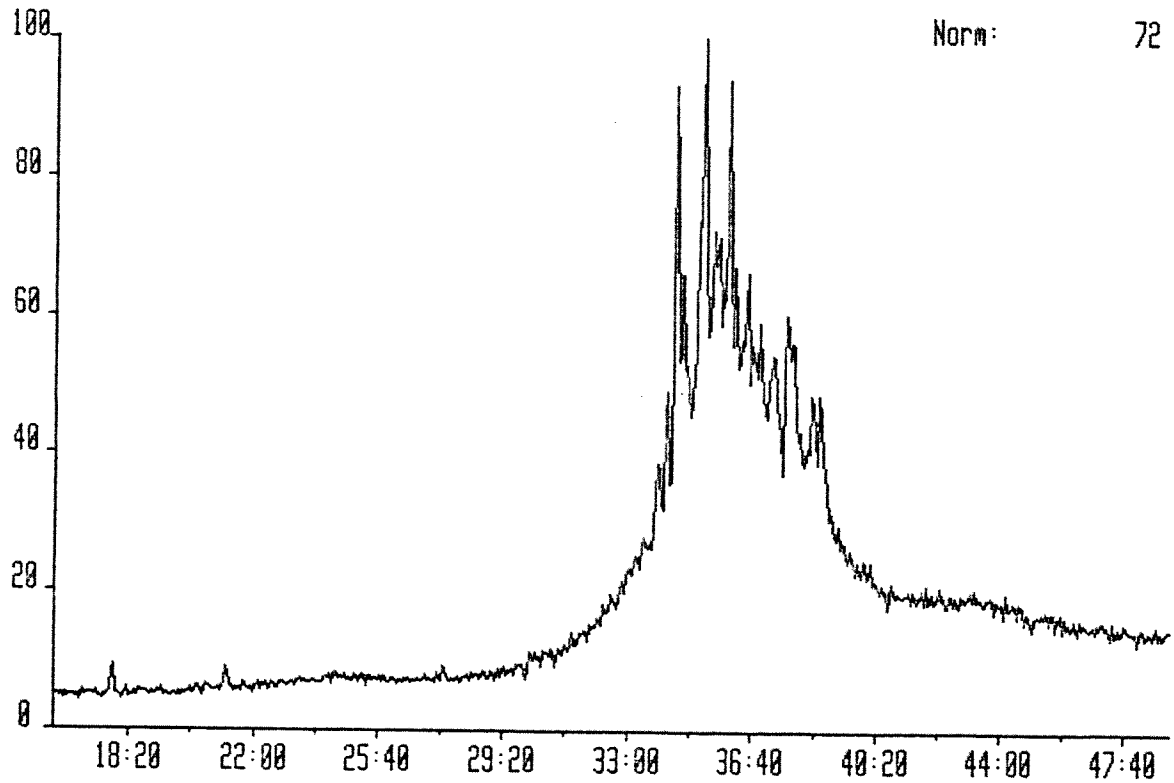
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C30 STERANES



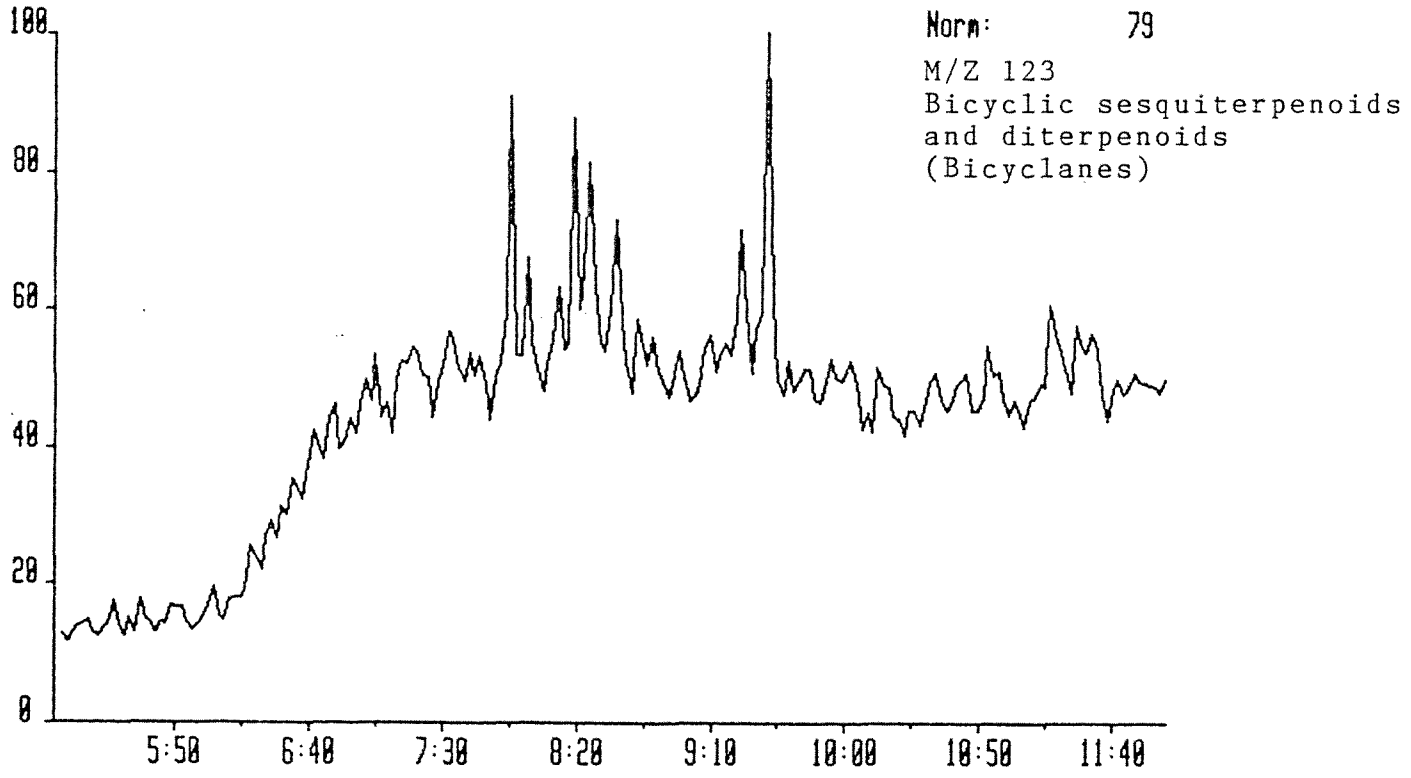
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 414.4226
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



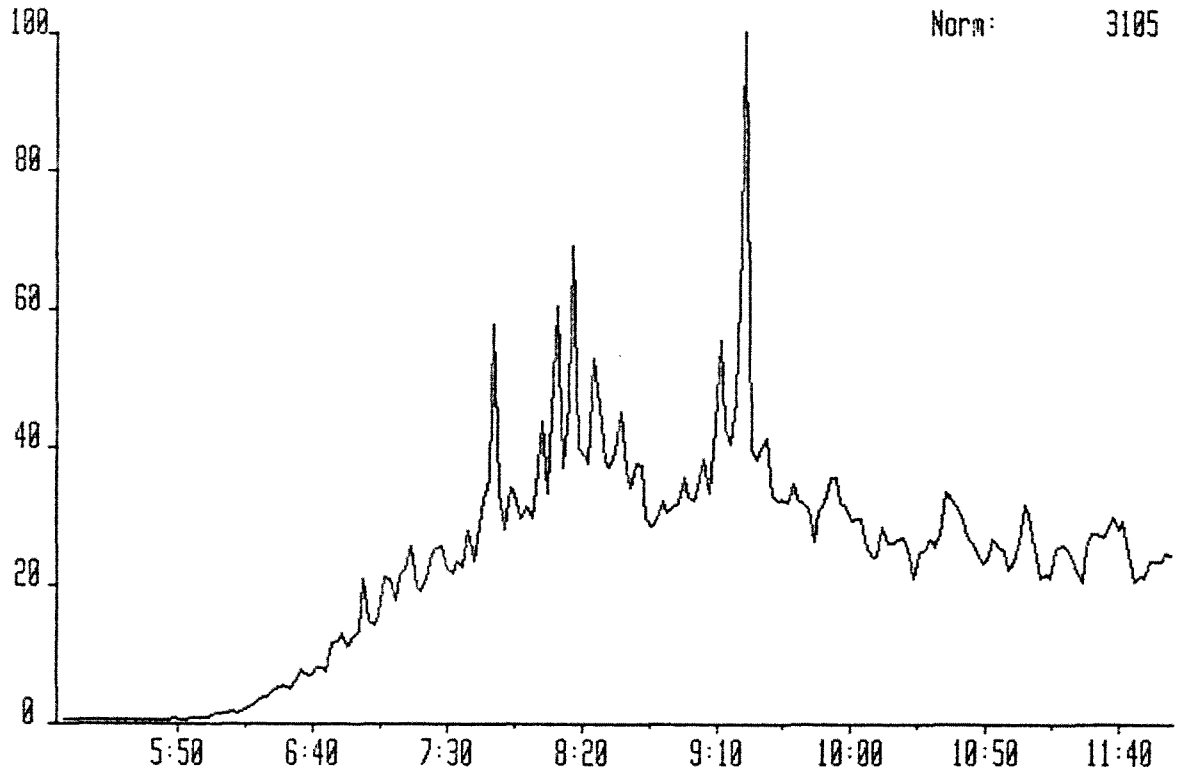
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR BICYCLIC SESQUITERPENOIDS AND DITERPENOIDS (BICYCLANES)



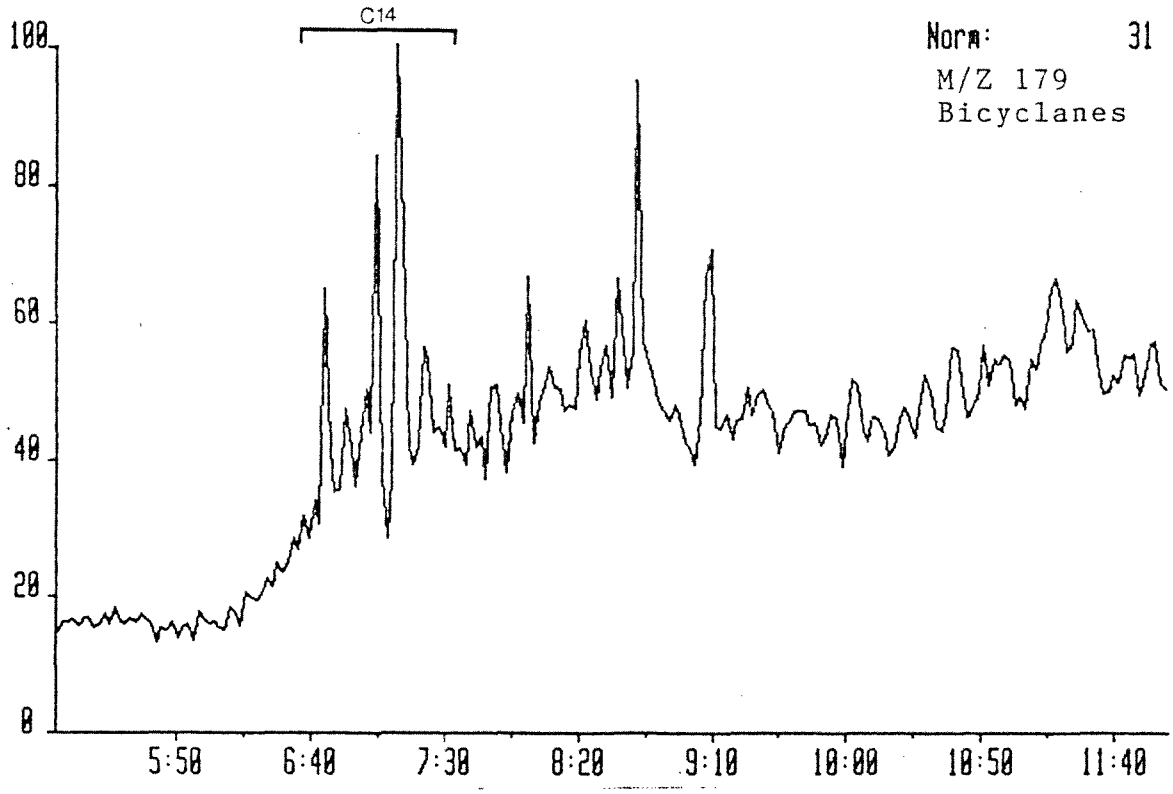
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 123.1174
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



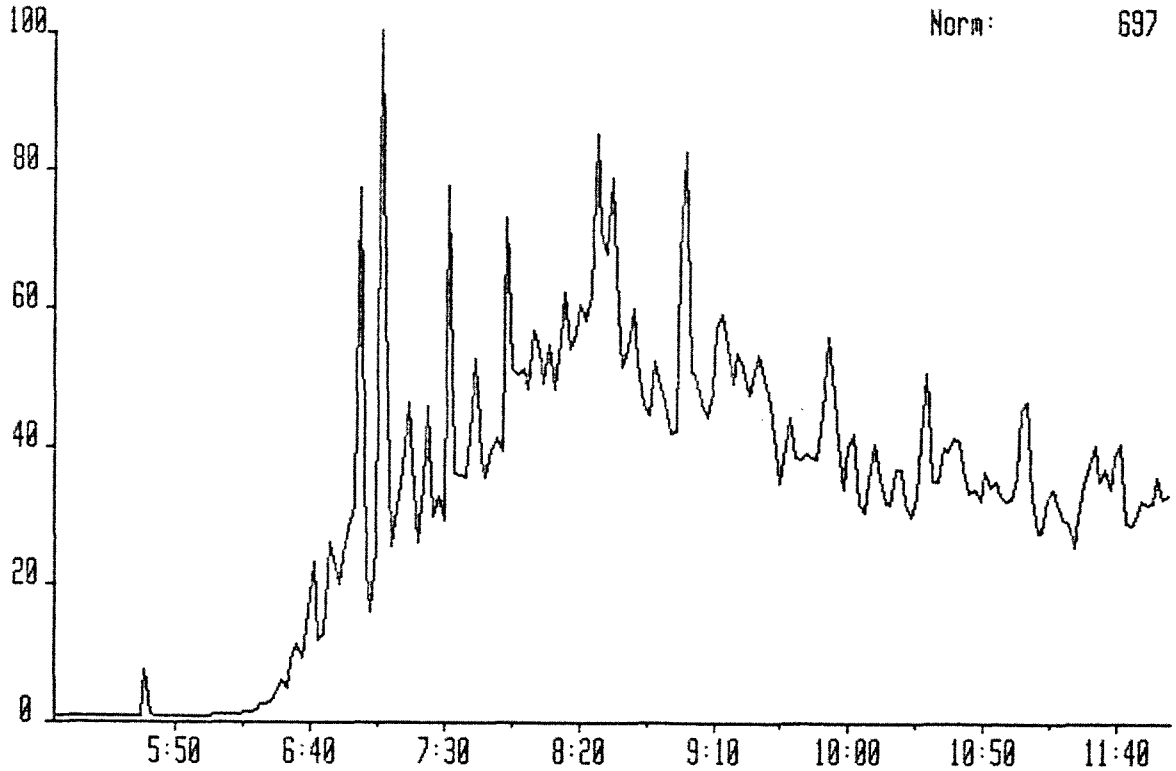
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR BICYCLANES



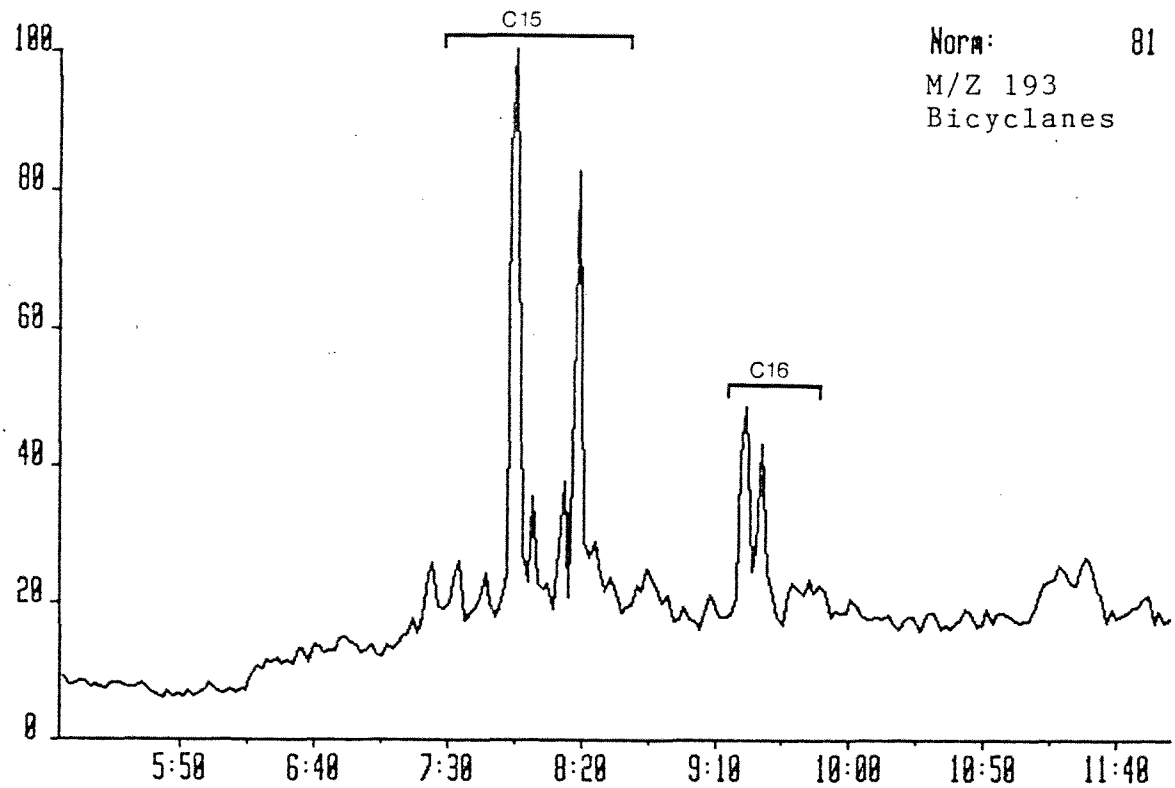
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 179.1800
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



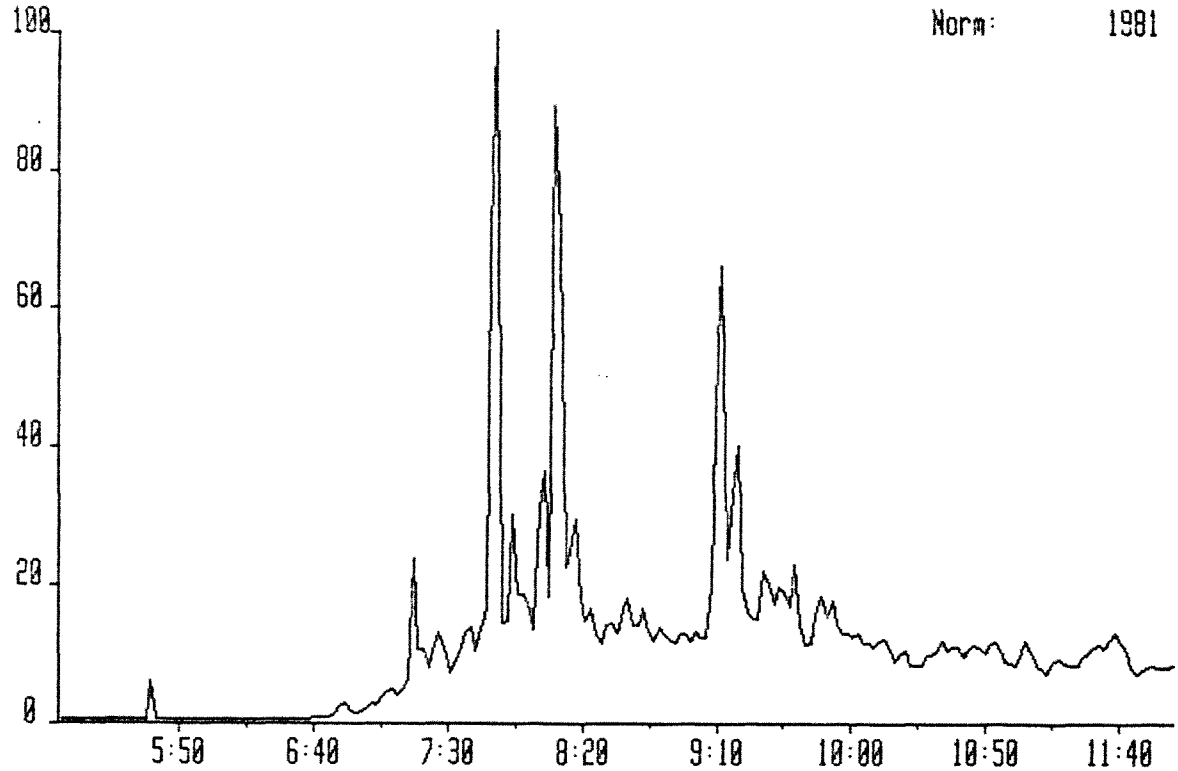
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR BICYCLANES



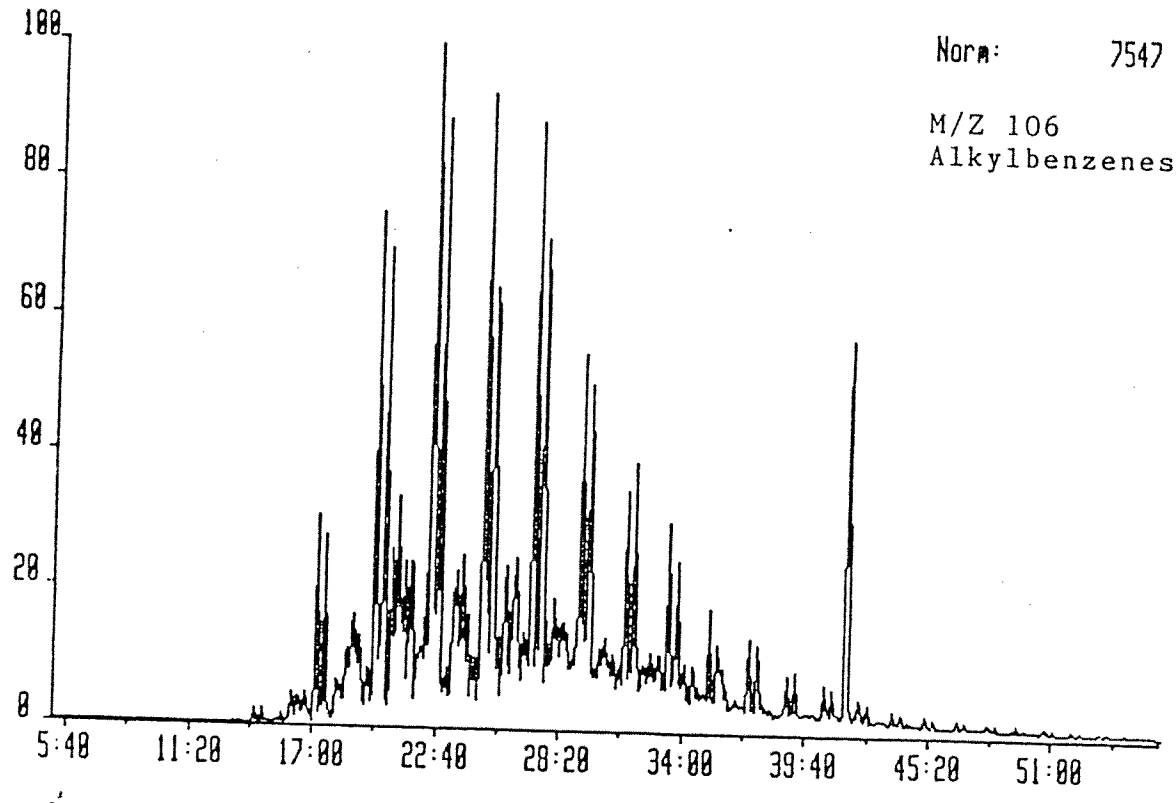
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGSAT5 23-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 12 Injection 1 Group 1 Mass 193.1956
Text:WELL 2/1-3, 3804M, SATURATED FRACTION



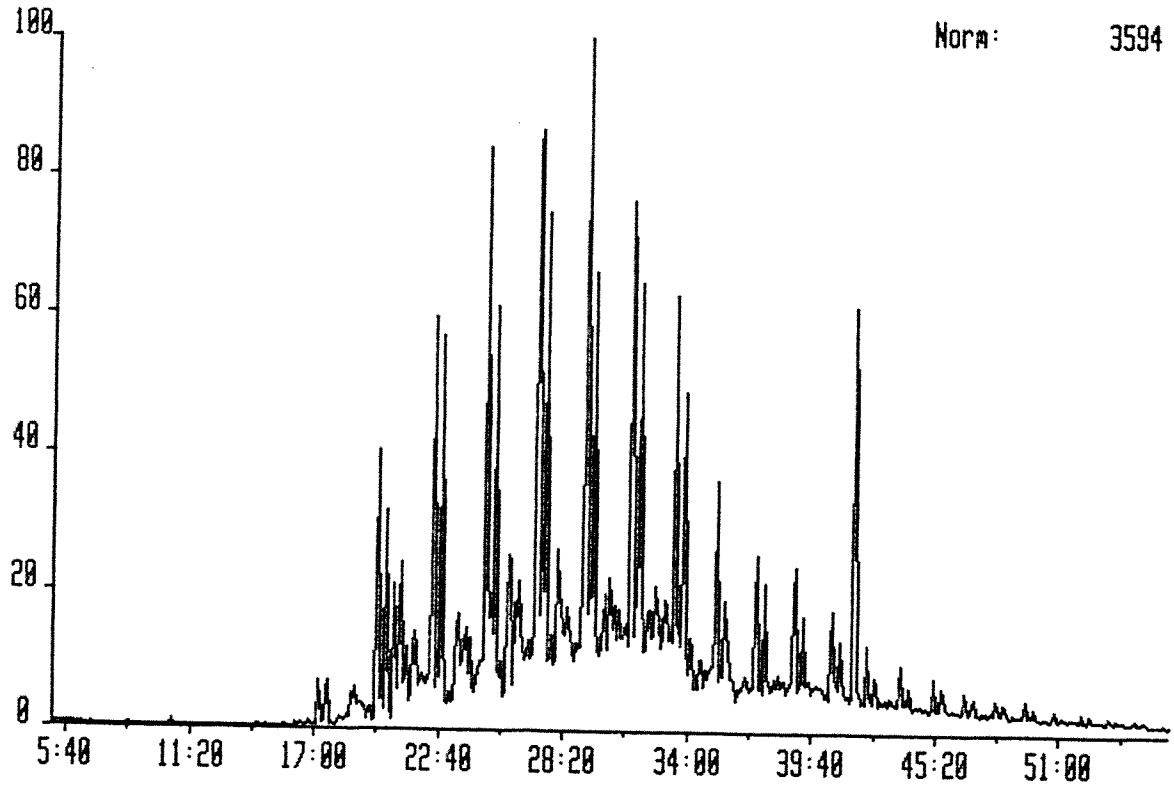
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR ALKYLBENZENES.

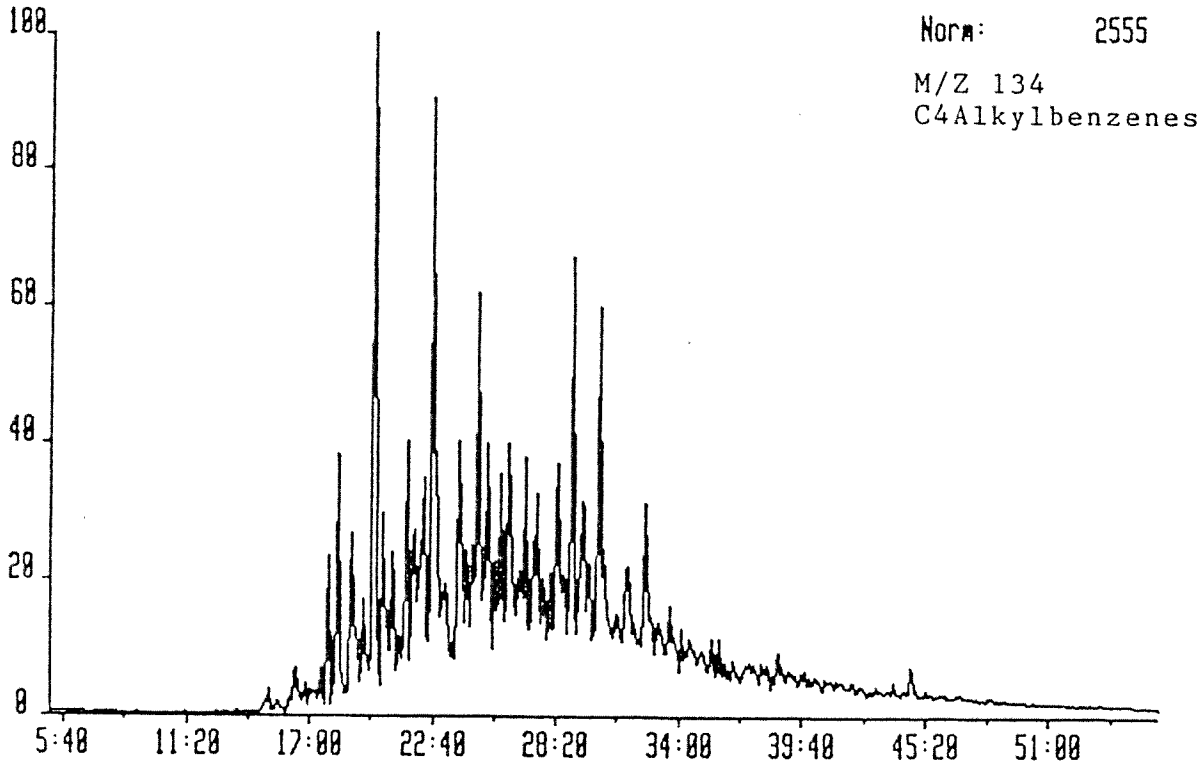


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGAR03 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:AR01
Sample 4 Injection 1 Group 1 Mass 106.0783
Text:WELL 2/1-3, 3884M, AROMATIC FRACTION

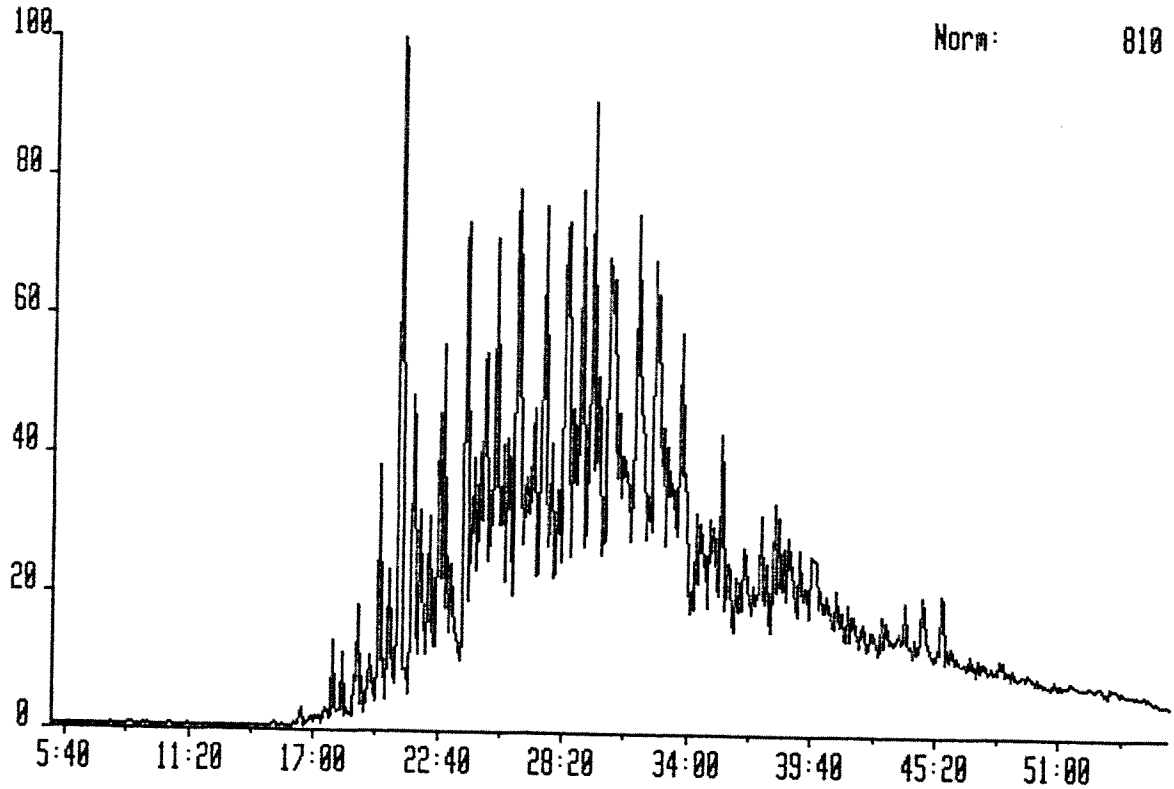


EXAMPL OF PEAK IDENTIFICATION FOR ALKYLBENZENES.



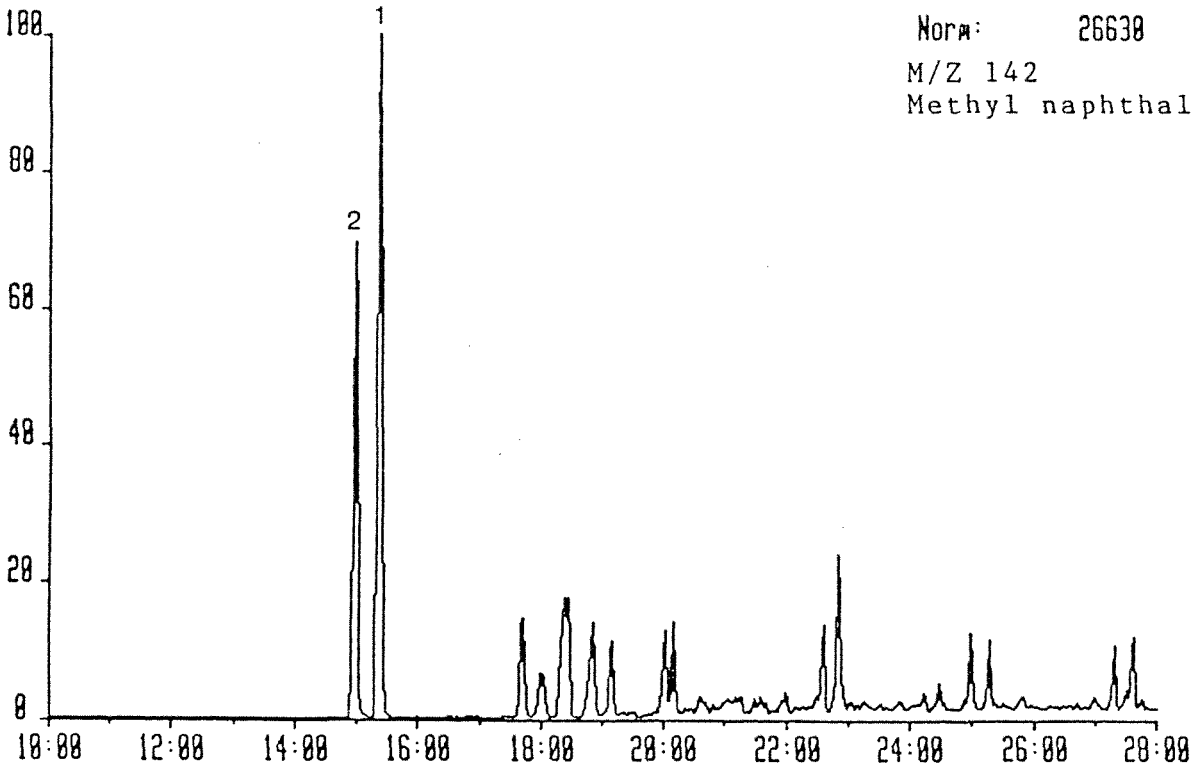
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 134.1096
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



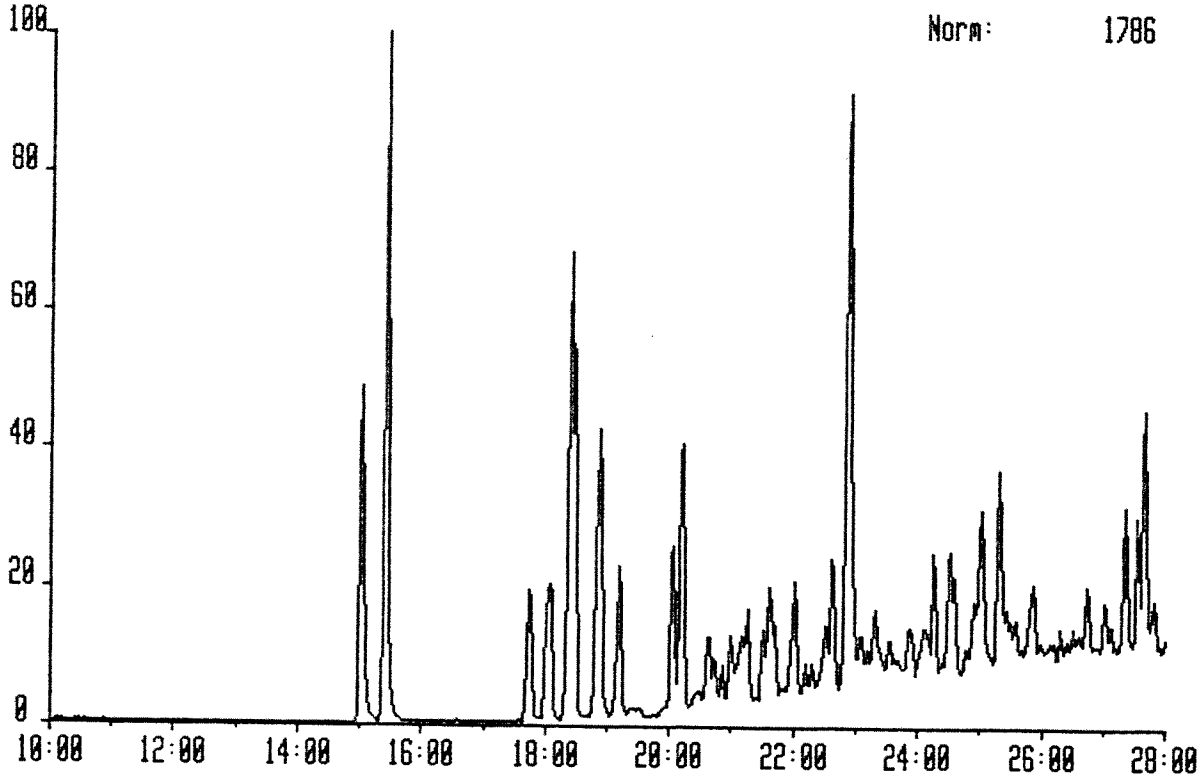
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAPLE OF PEAK IDENTIFICATION FOR METHYL NAPHTHALENES.

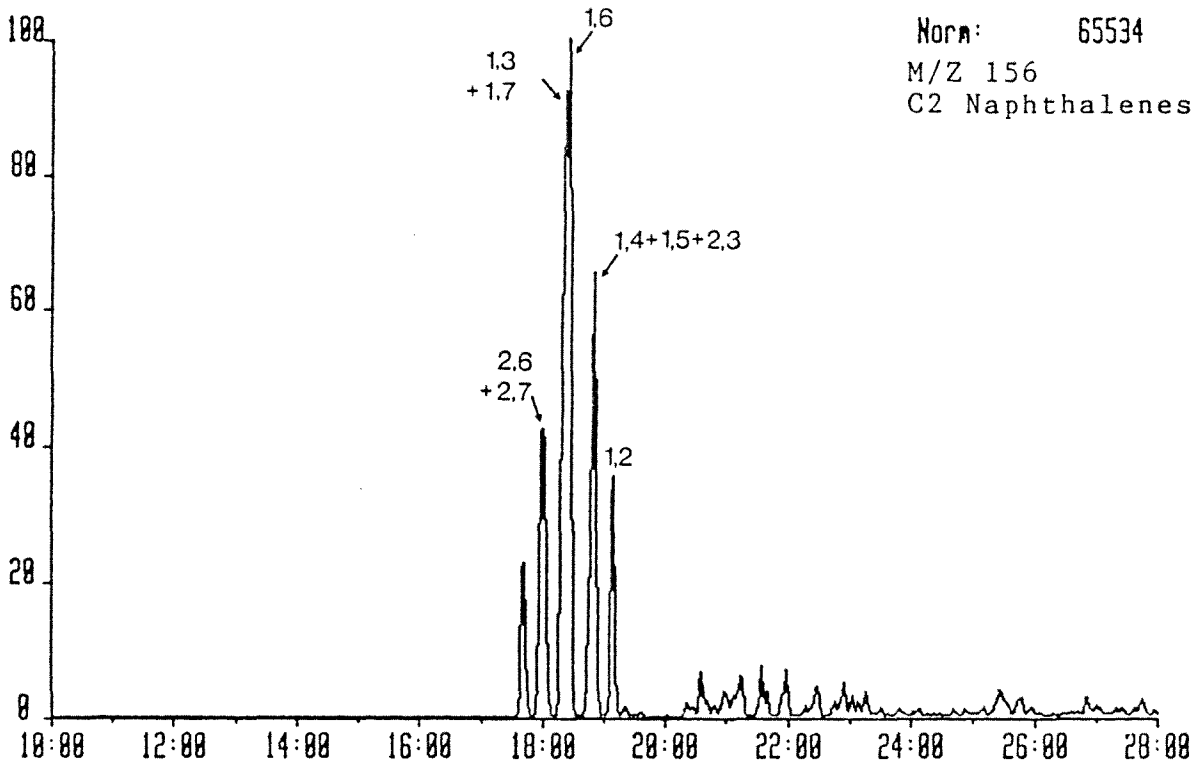


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 142.0783
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION

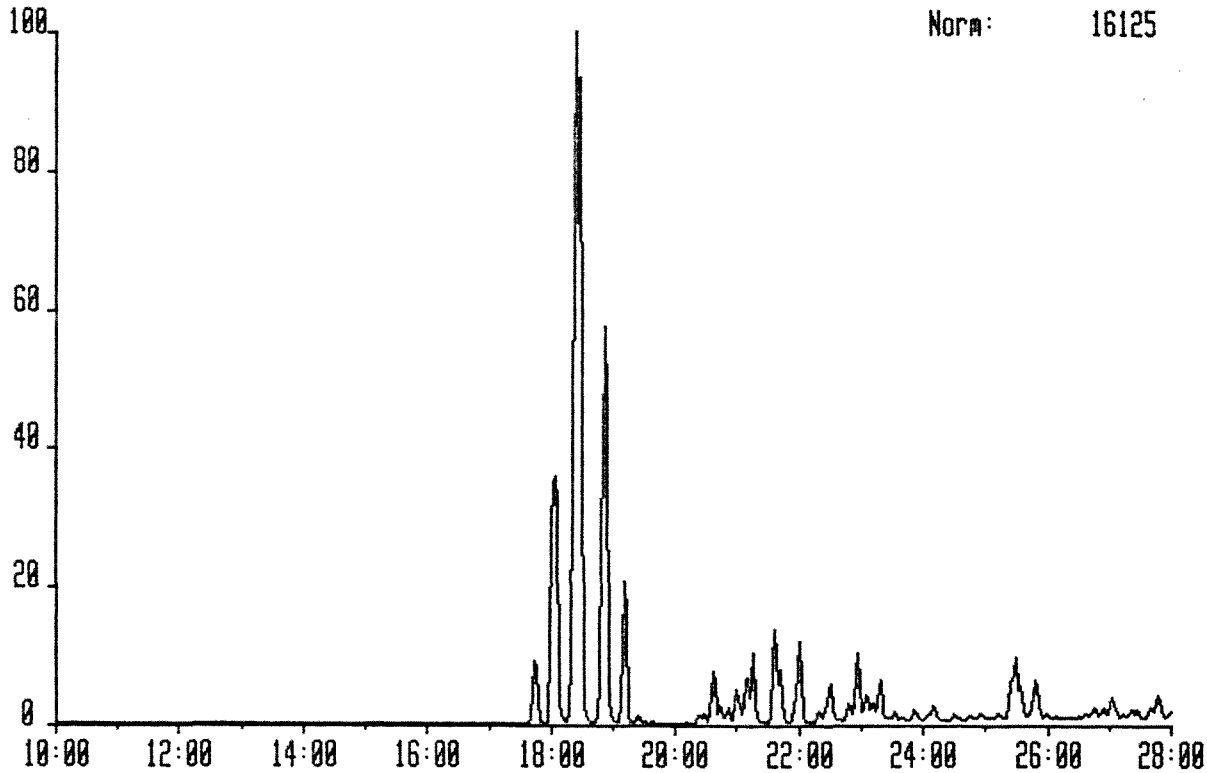


EXAMPLE OF PEAK IDENTIFICATION FOR C2 NAPHTHALENES.

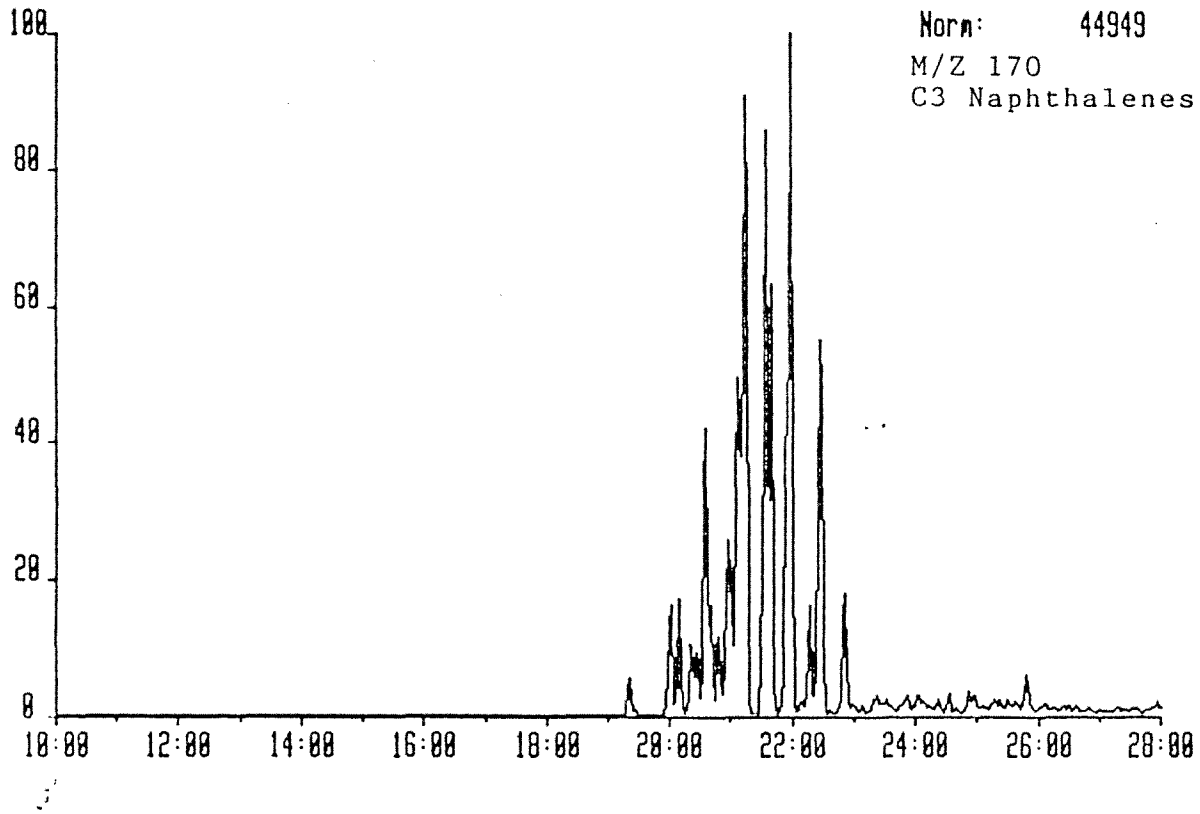


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGAR03 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:AR01
Sample 4 Injection 1 Group 1 Mass 156.0939
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION

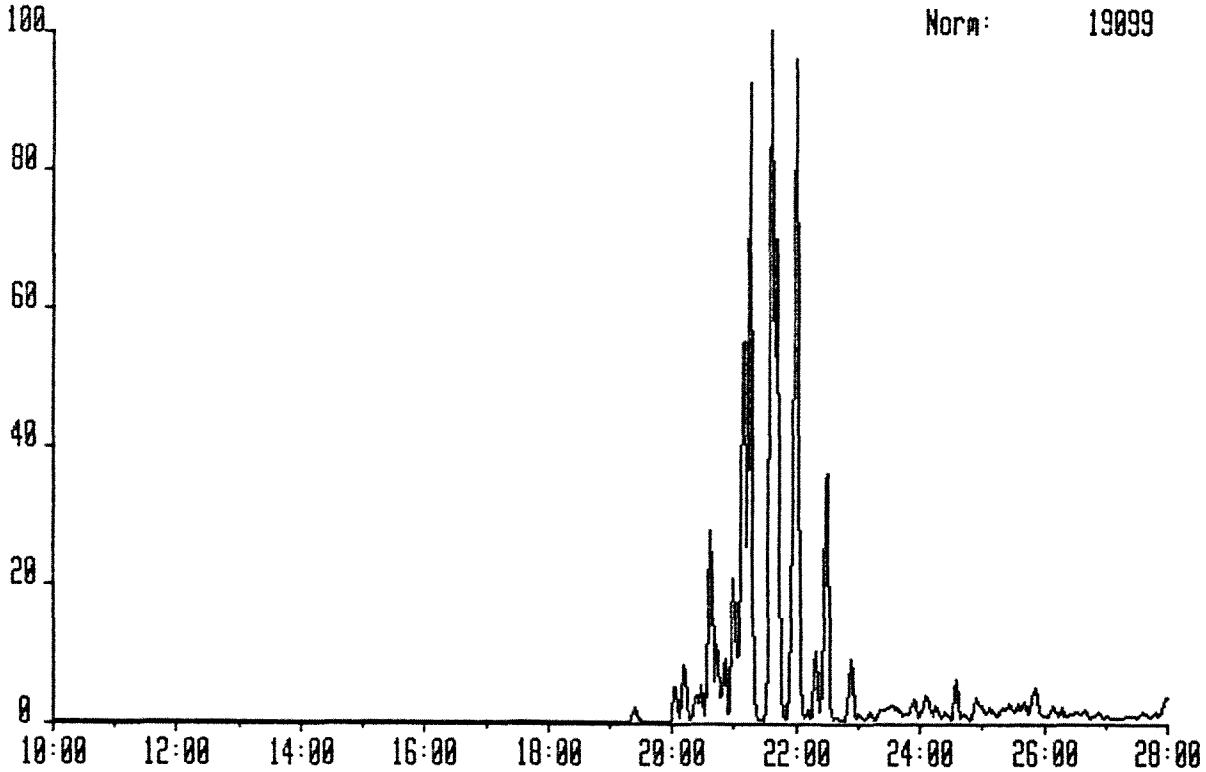


EXAMPLE OF PEAK IDENTIFICATION FOR C3 NAPHTHALENES.



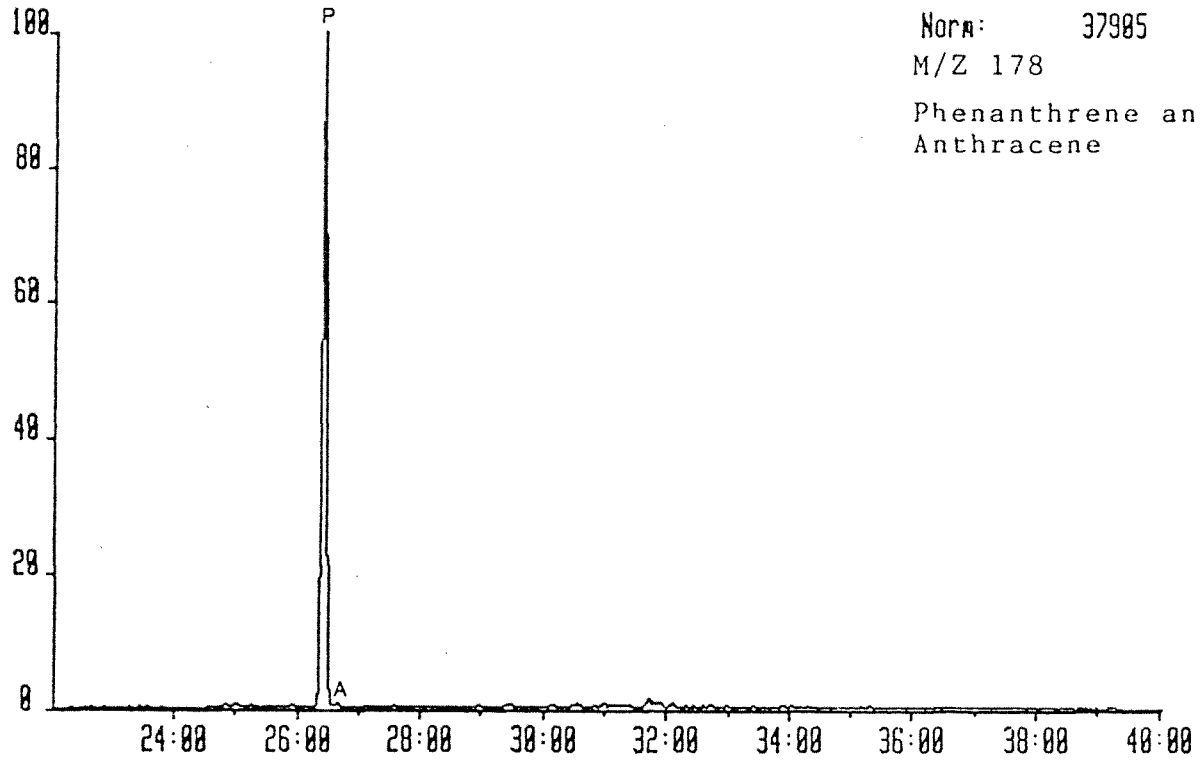
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 170.1096
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



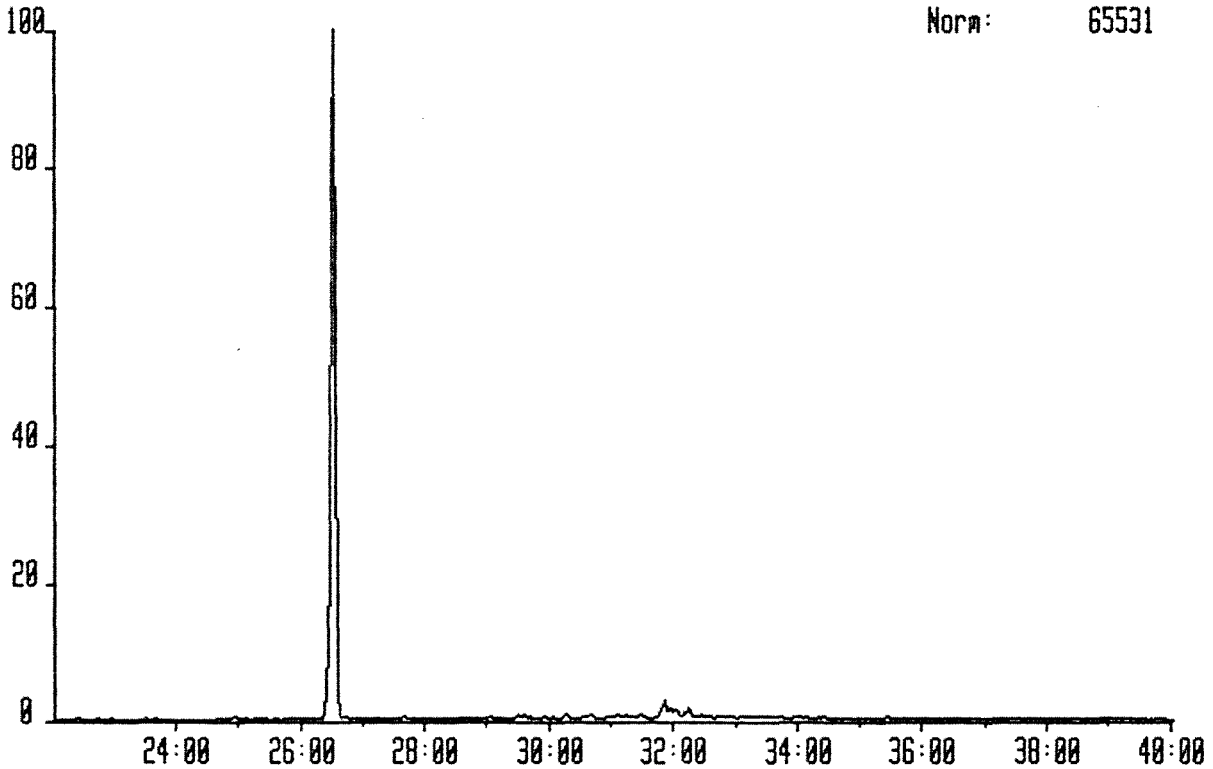
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR PHENANTHRENE AND ANTHRACENE.



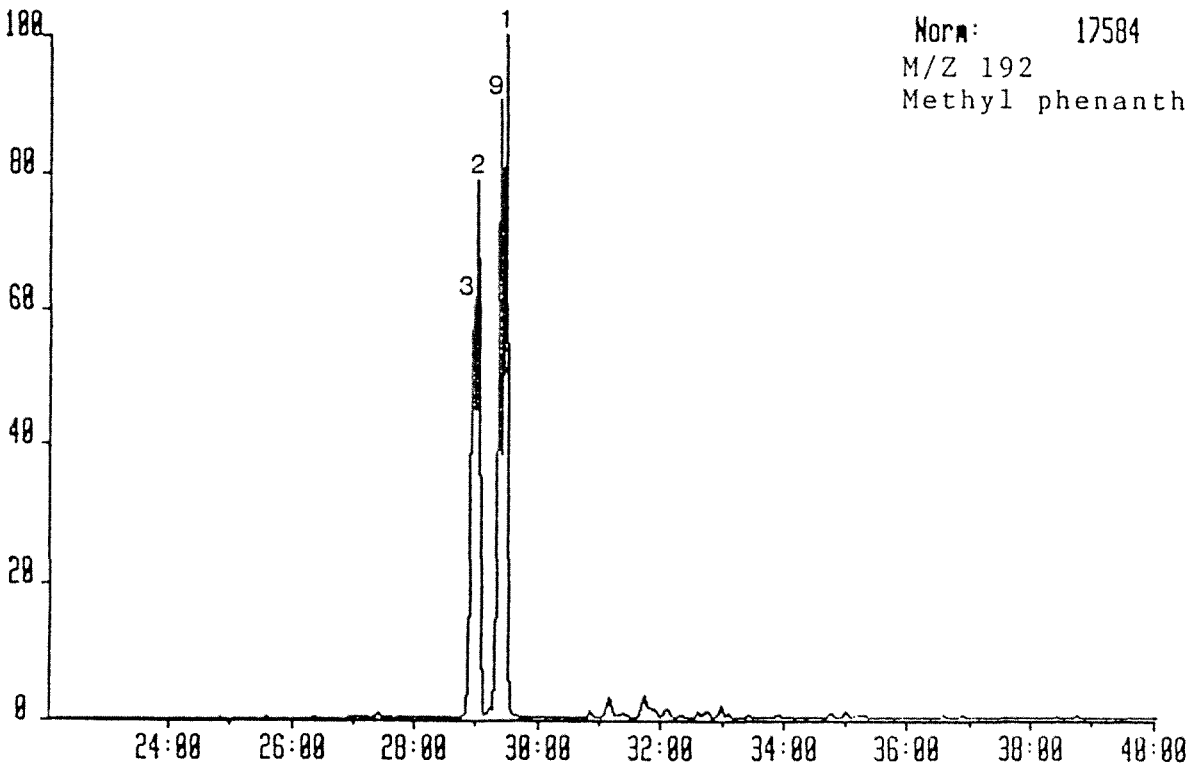
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGAR03 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:AR01
Sample 4 Injection 1 Group 1 Mass 178.0783
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

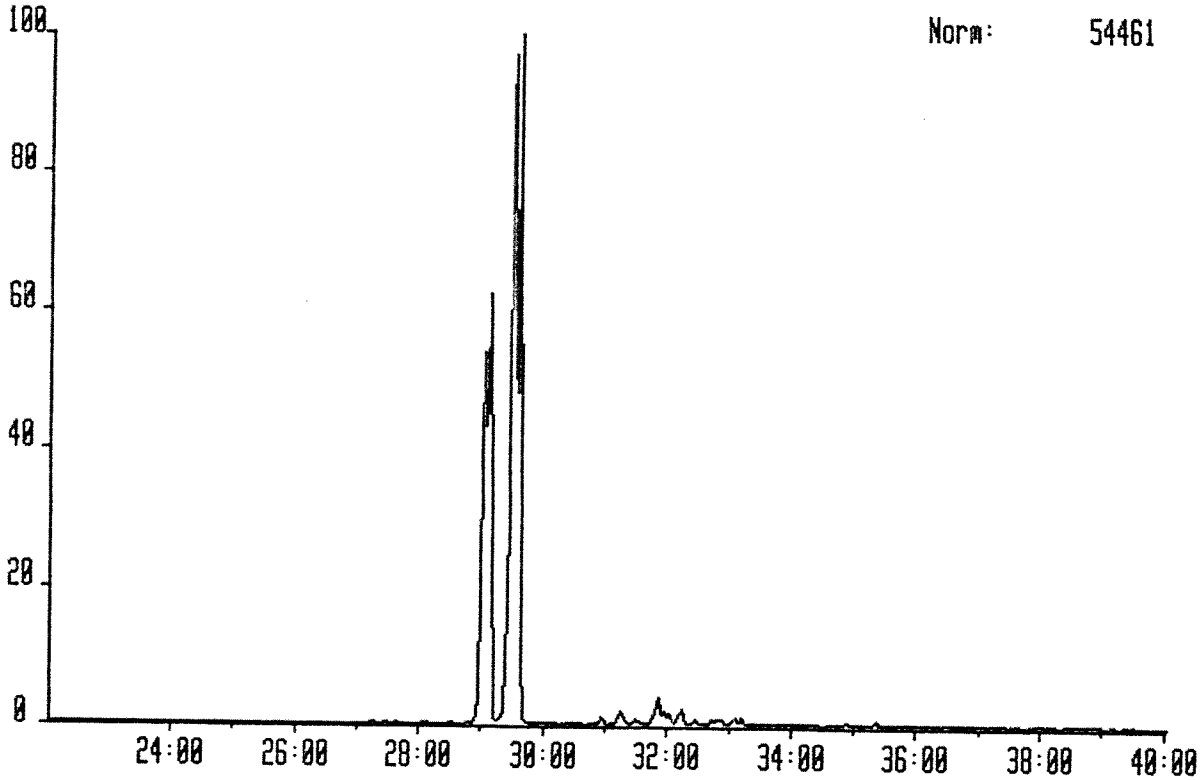
EXAMPLE OF PEAK IDENTIFICATION FOR METHYL PHENANTHRENES.



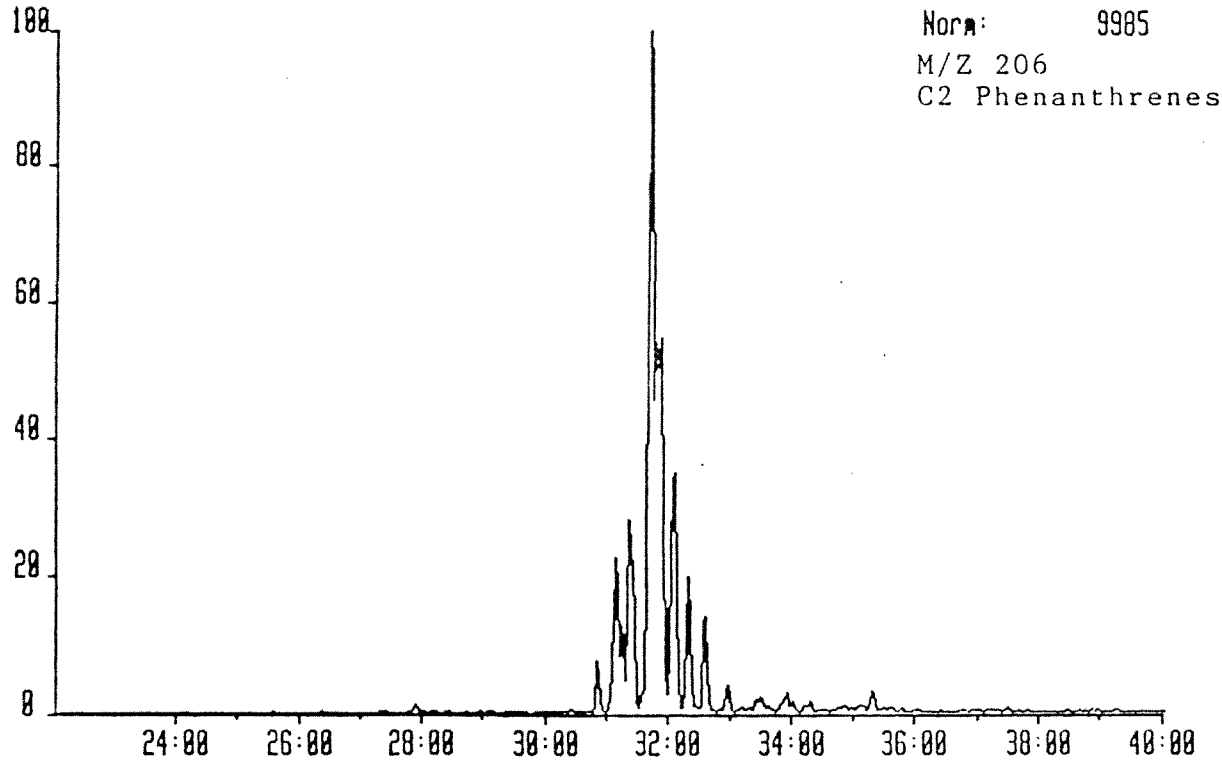
Norm: 17584
M/Z 192
Methyl phenanthrenes

GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 192.0939
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION

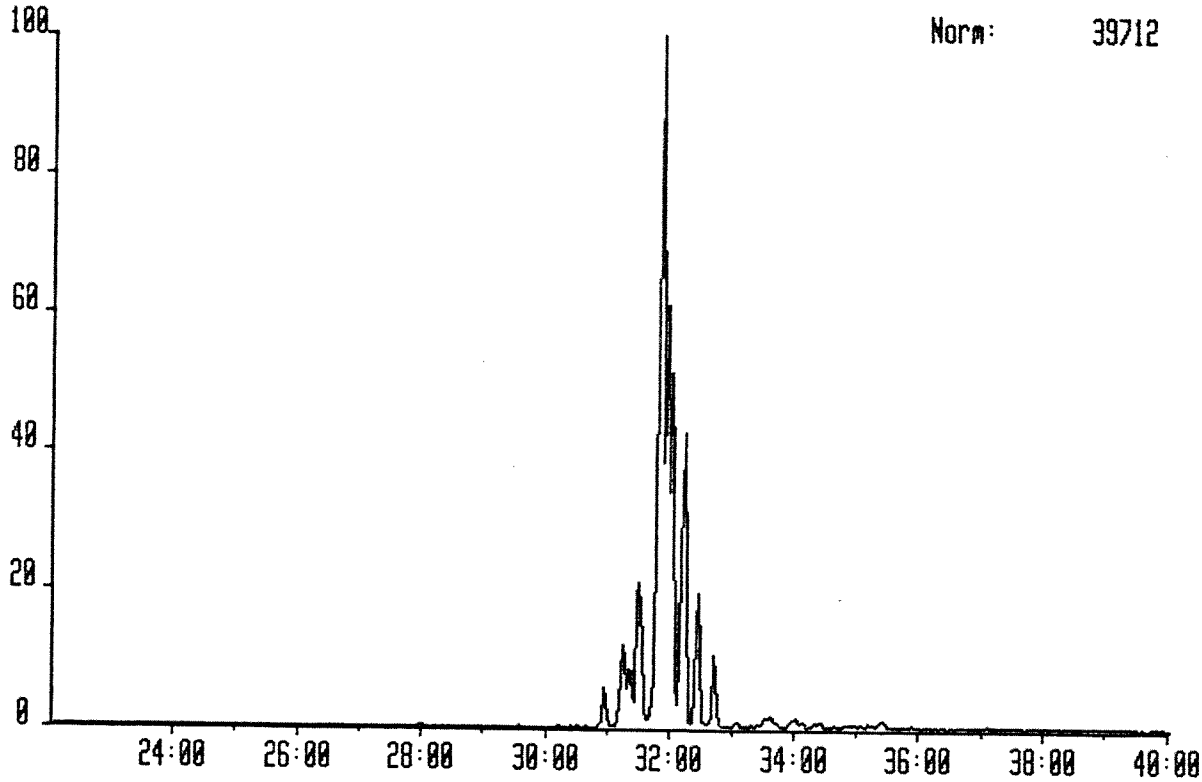


EXAMPLE OF PEAK IDENTIFICATION FOR C2 PHENANTHRENES.

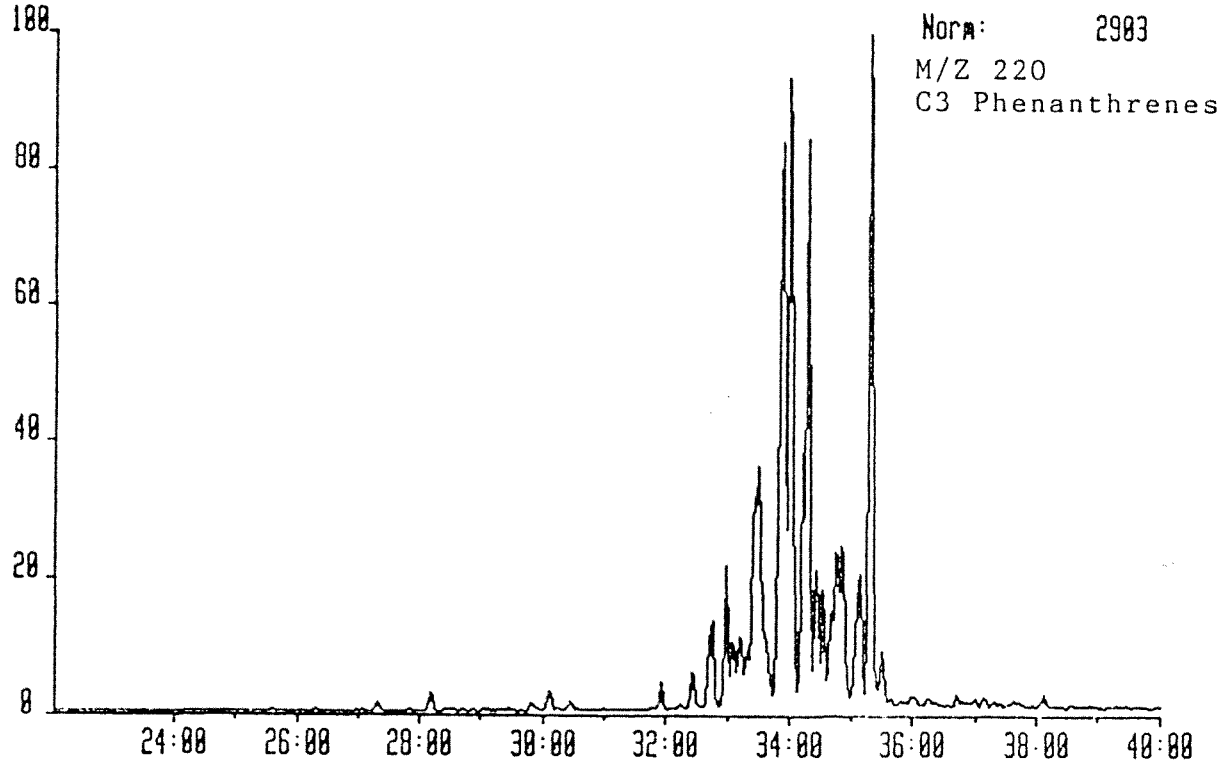


GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 206.1896
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION

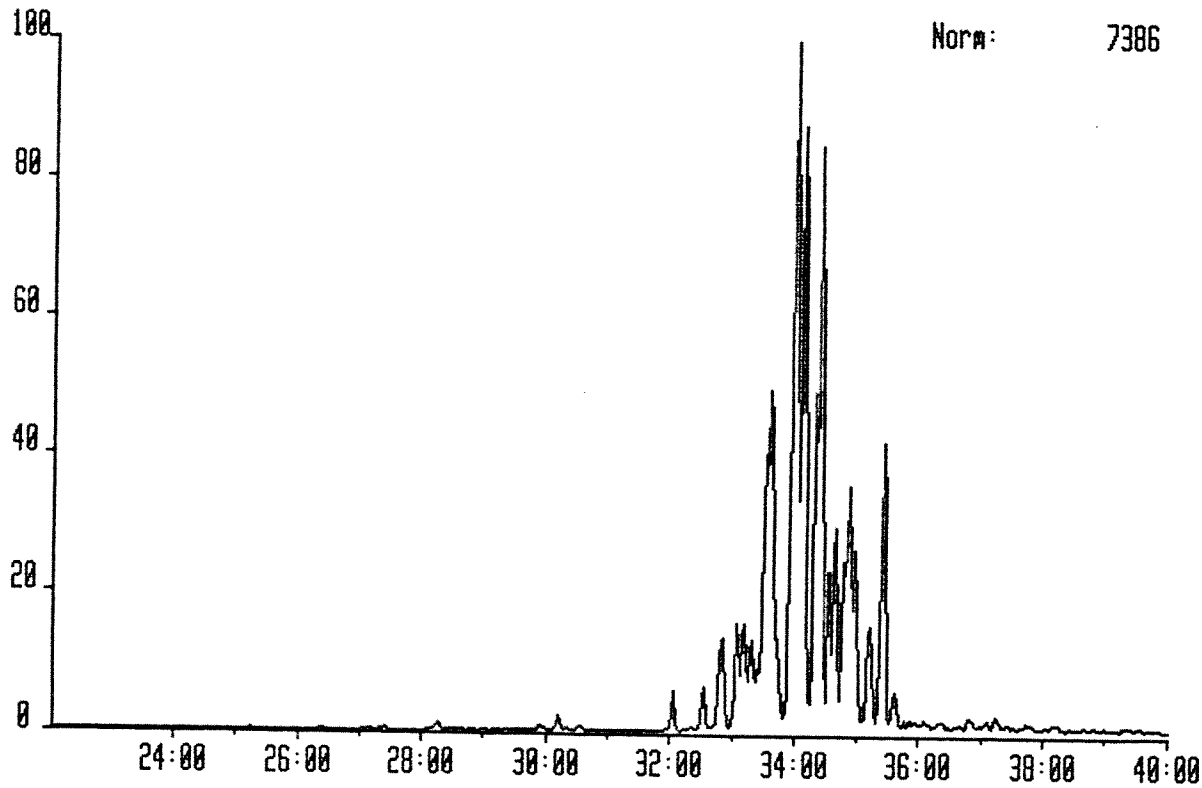


EXAMPLE OF PEAK IDENTIFICATION FOR C3 PHENANTHRENES.



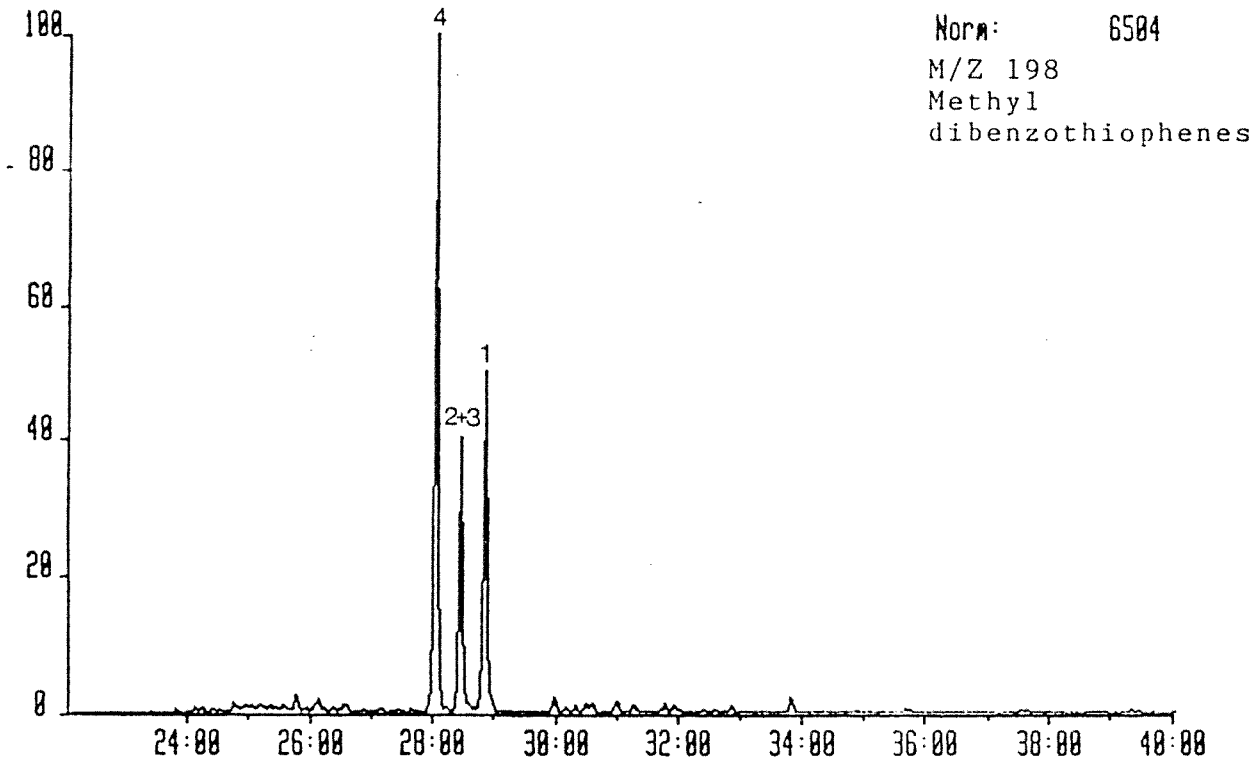
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGAR03 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:AR01
Sample 4 Injection 1 Group 1 Mass 220.1253
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



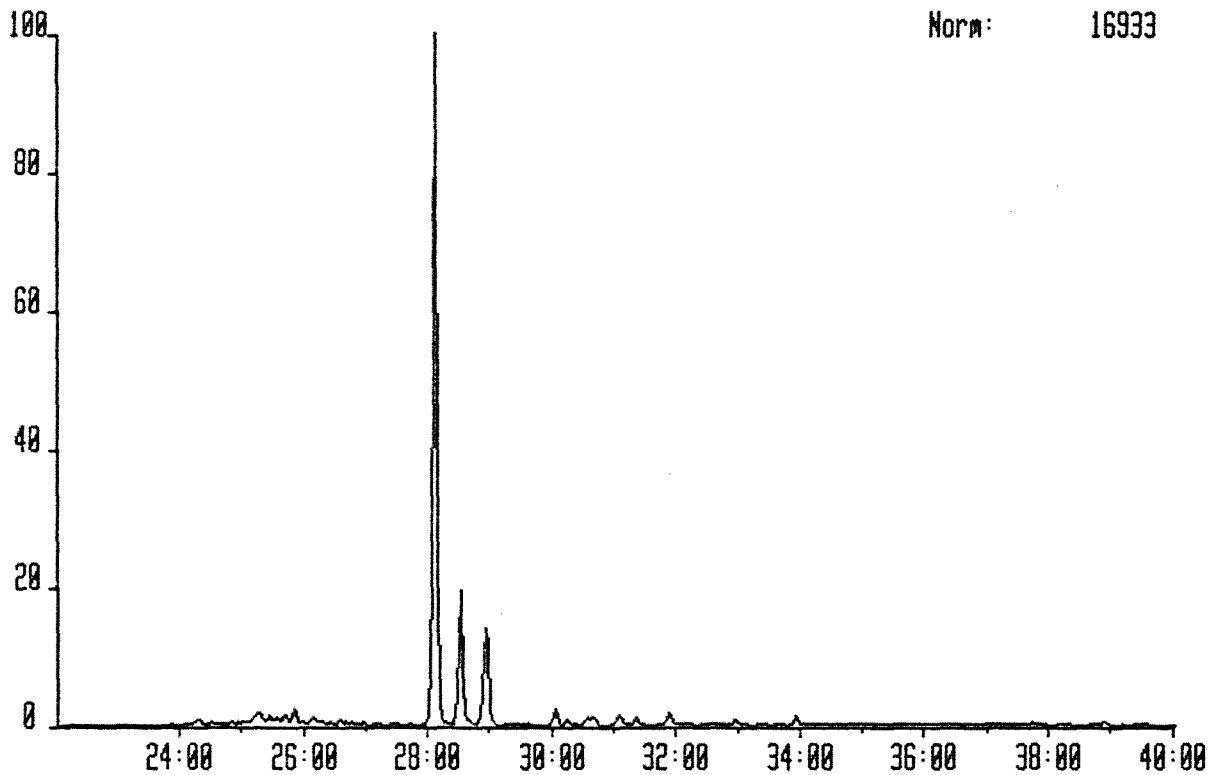
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR METHYL DIBENZOTHIOPHENES.



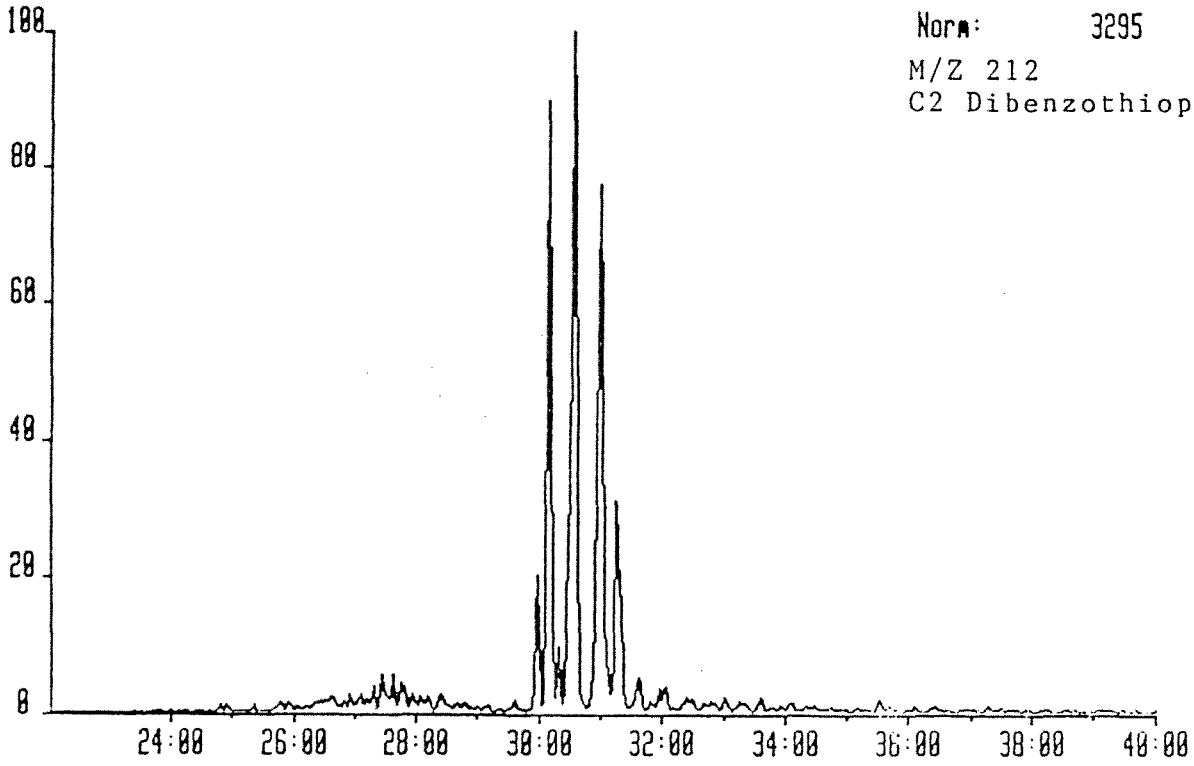
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 198.0503
Text:WELL 2/1-3, 3884M, AROMATIC FRACTION



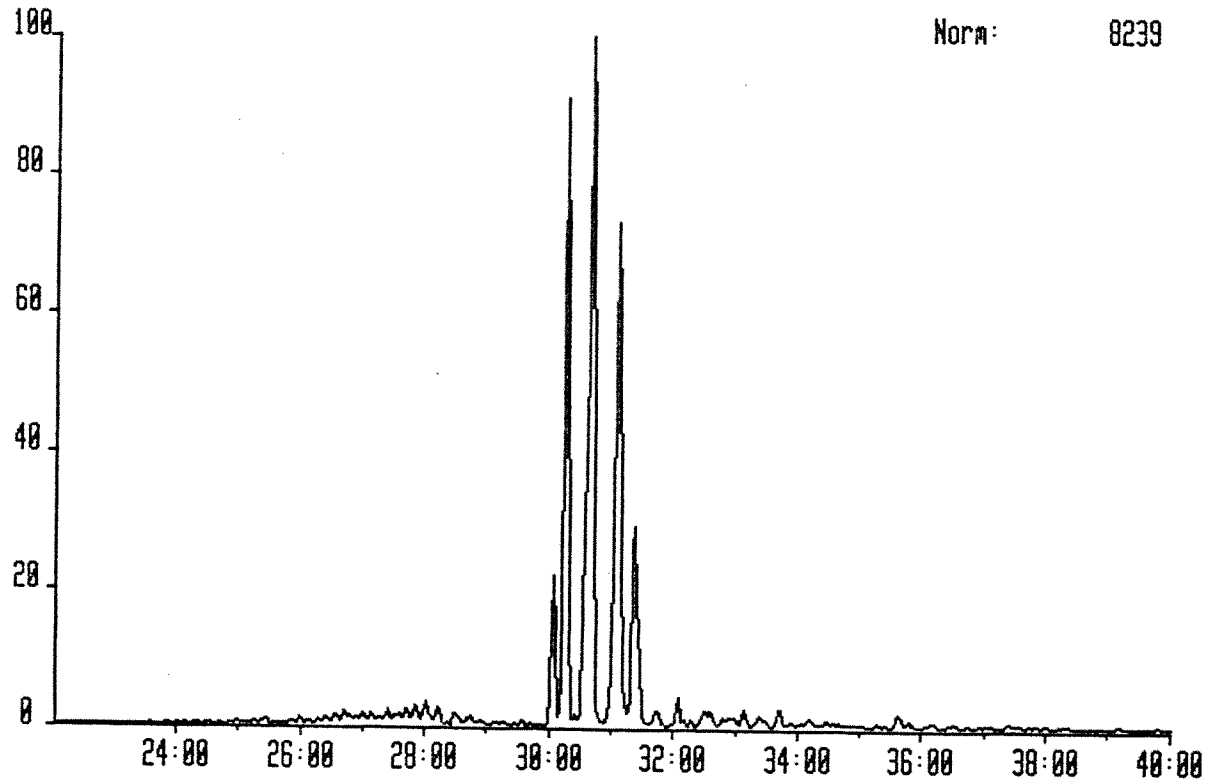
GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

EXAMPLE OF PEAK IDENTIFICATION FOR C2 DIBENZOTHIOPHENES.



GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGAR03 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:AR01
Sample 4 Injection 1 Group 1 Mass 212.0660
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



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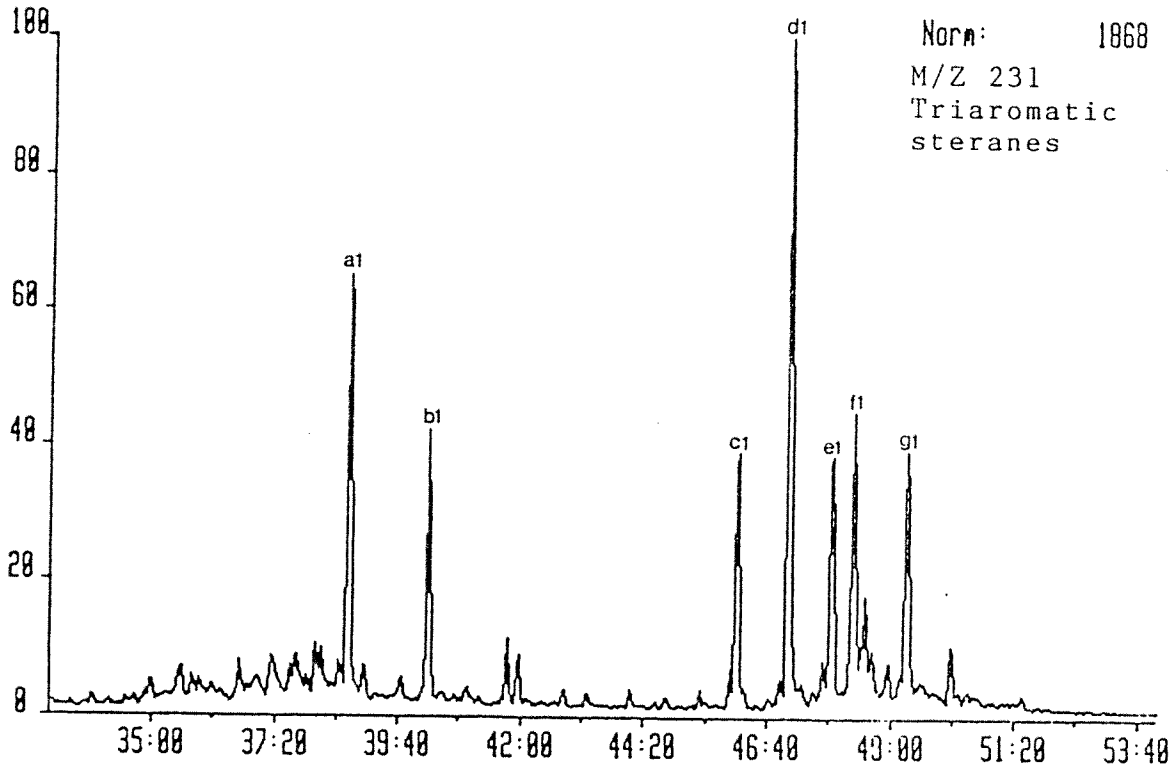
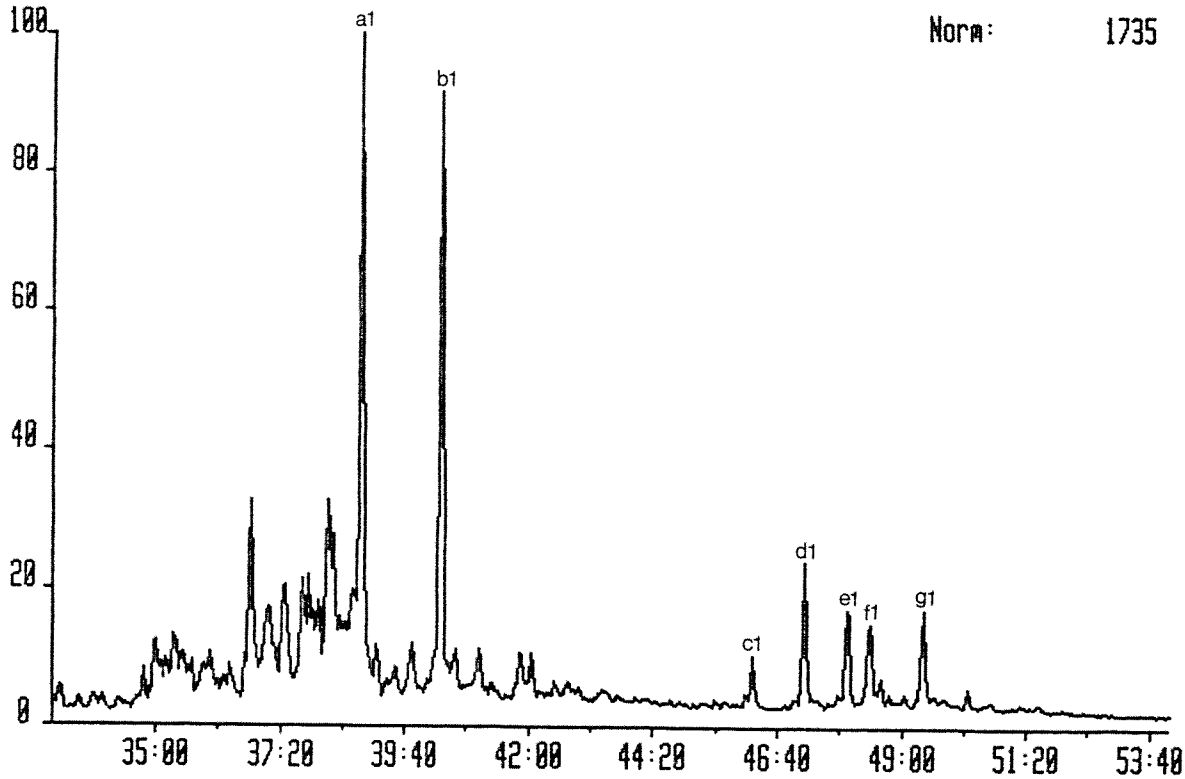
EXAMPLE OF PEAK IDENTIFICATION FOR TRIAROMATIC STERANES.



GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 231.1174
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



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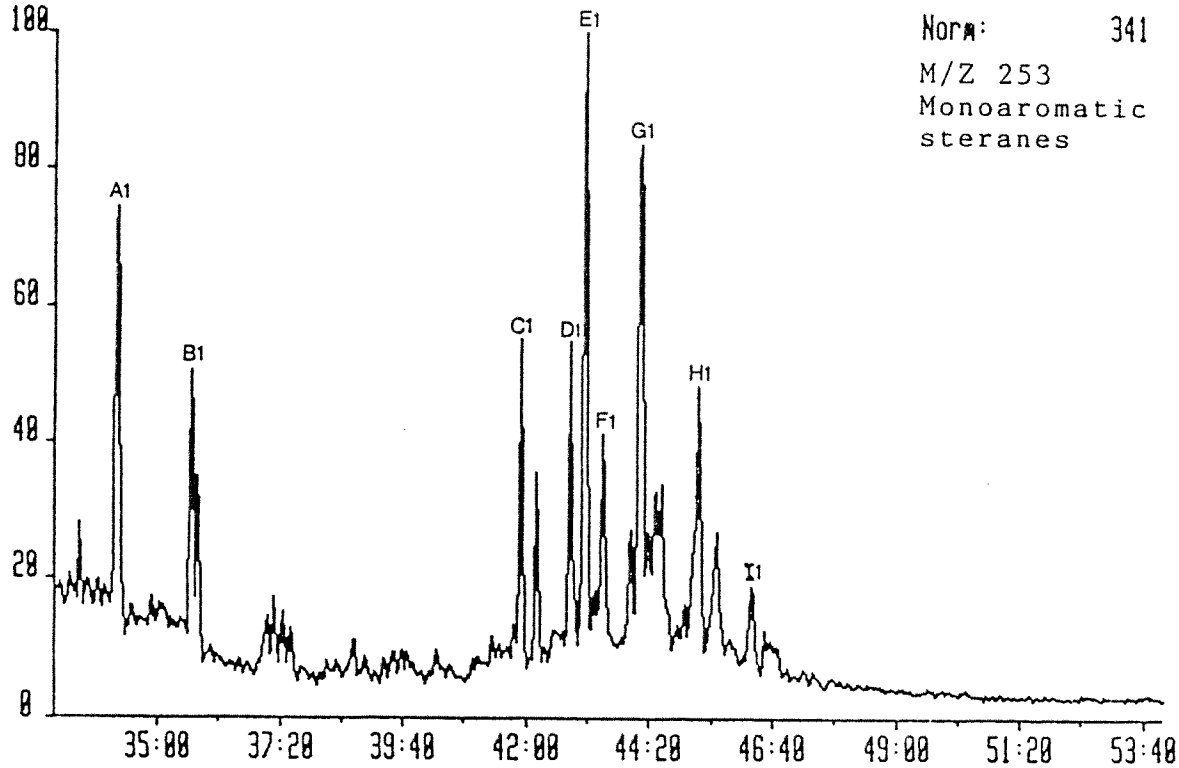
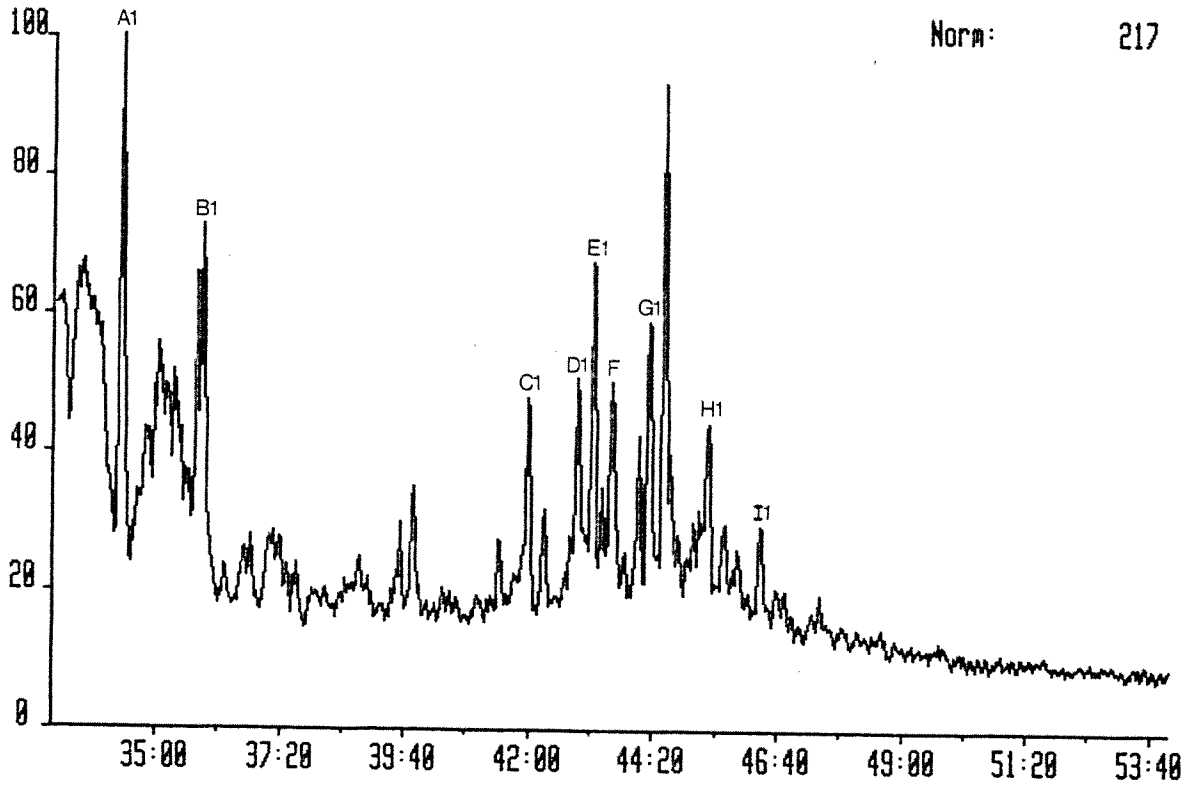
EXAMPLE OF PEAK IDENTIFICATION FOR MONOAROMATIC STERANES.



GEOLAB NOR
GEOCHEMICAL LABORATORIES OF NORWAY A/S

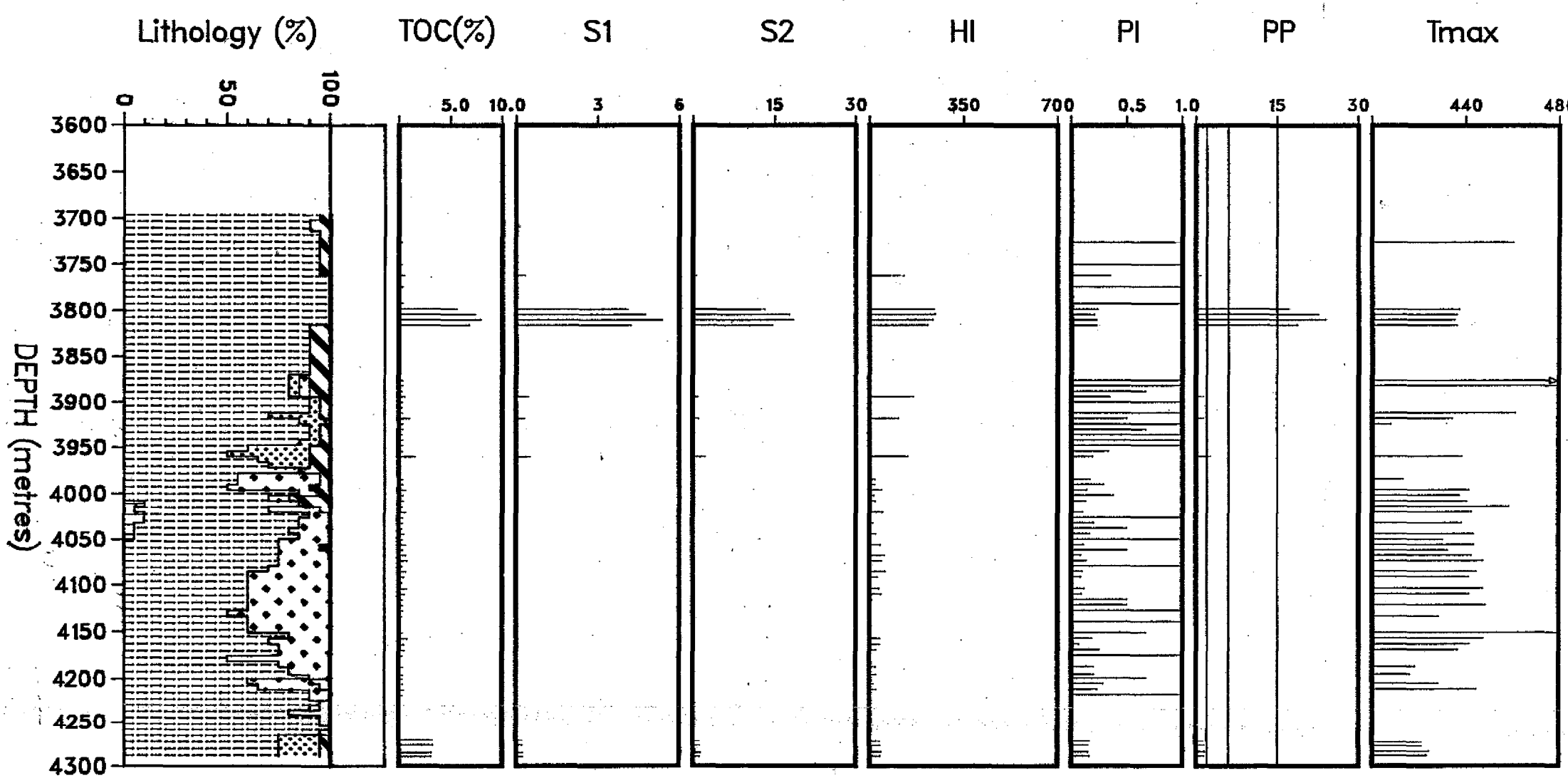
CGARO3 11-NOV-87 Sir:Magnetic TS250 Acnt:GEOLAB System:ARO1
Sample 4 Injection 1 Group 1 Mass 253.1956
Text:WELL 2/1-3, 3804M, AROMATIC FRACTION



Enclosure: 1

Client: VARIOUS

Rock–Eval Pyrolysis Data for Well NOCS 2/1–3



Coal
Carbonate
Shale/Claystone
Siltstone
Sand/Sandstone
Contamination
Volcanics
Tuff
Marl
Kaolin
Chert
Conglomerate

◀ SWC
◁ Core Chip or Core Plug

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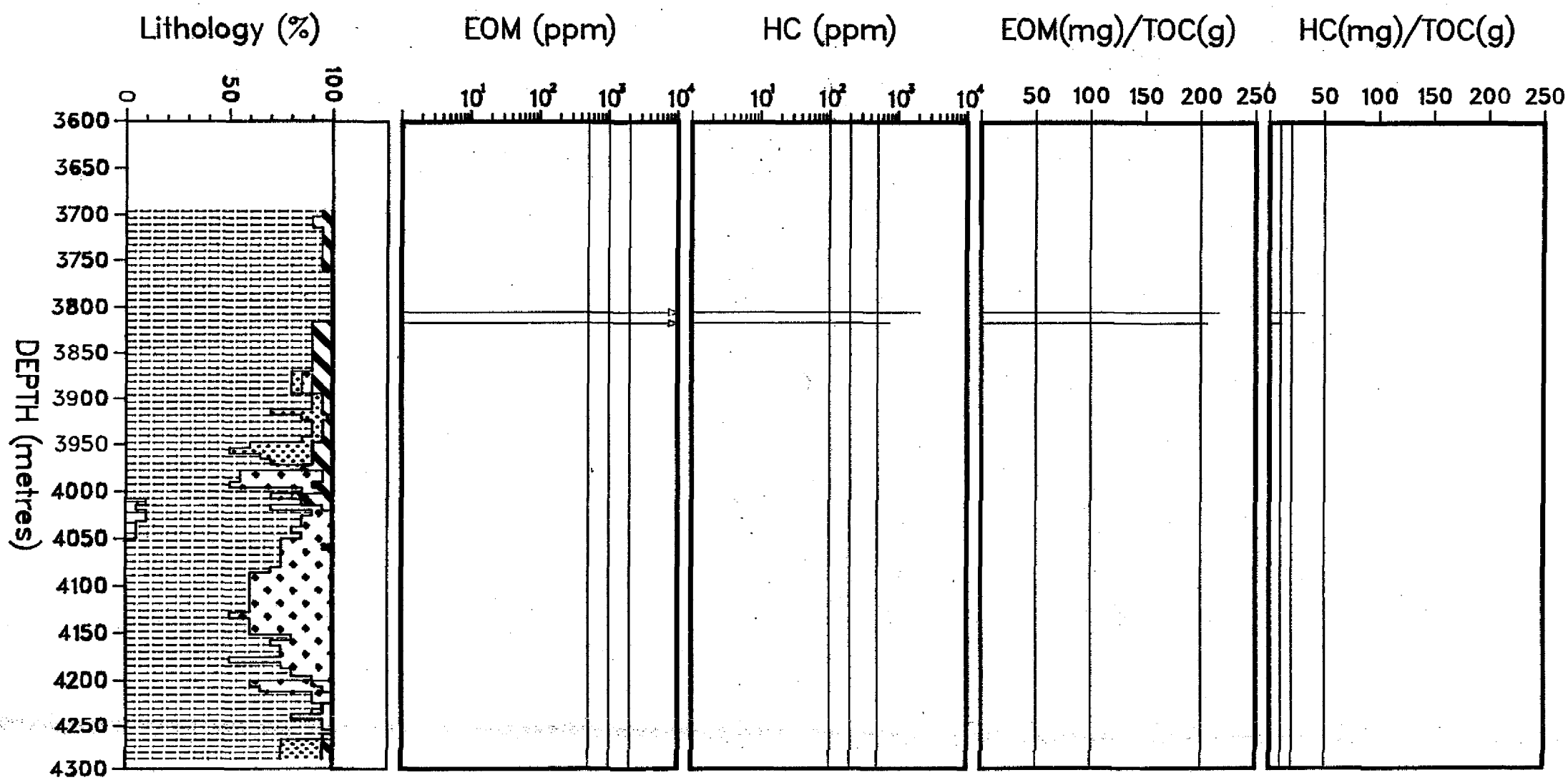
Enclosure: 2

Client: VARIOUS

Extraction Data for Well NOCS 2/1–3



Coal
Carbonate
Shale/Claystone
Siltstone
Sand/Sandstone
Contamination
Volcanics
Tuff
Marl
Kaolin
Chert
Conglomerate

◀ SWC
◁ Core Chip or Core Plug

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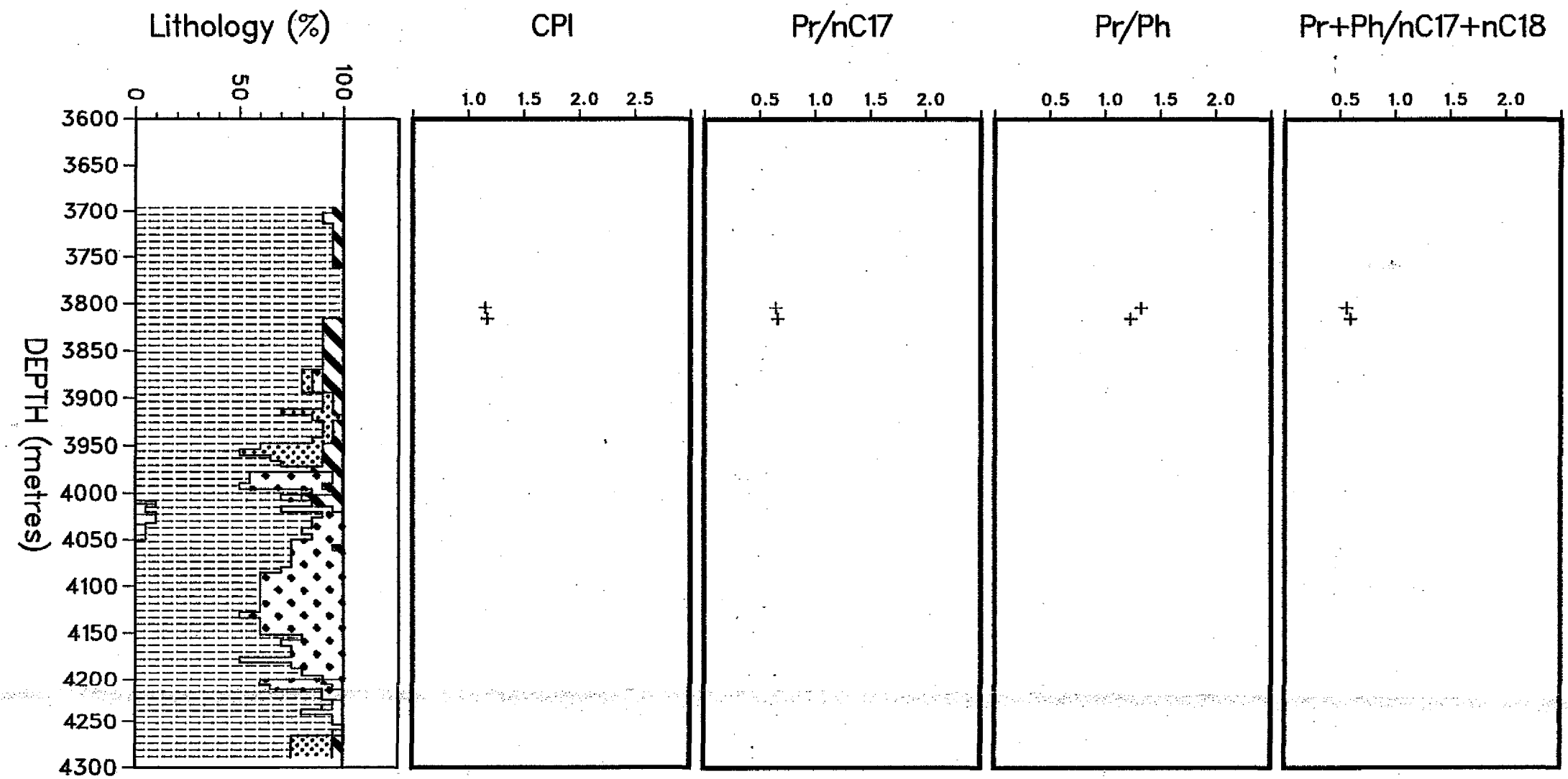
Enclosure: 3

Client: VARIOUS

Saturated Hydrocarbon Ratios for Well NOCS 2/1–3



Coal
Carbonate
Shale/Claystone
Siltstone
Sand/Sandstone
Contamination
Volcanics
Tuff
Marl
Kaolin
Chert
Conglomerate

◀ SWC
◁ Core Chip or Core Plug

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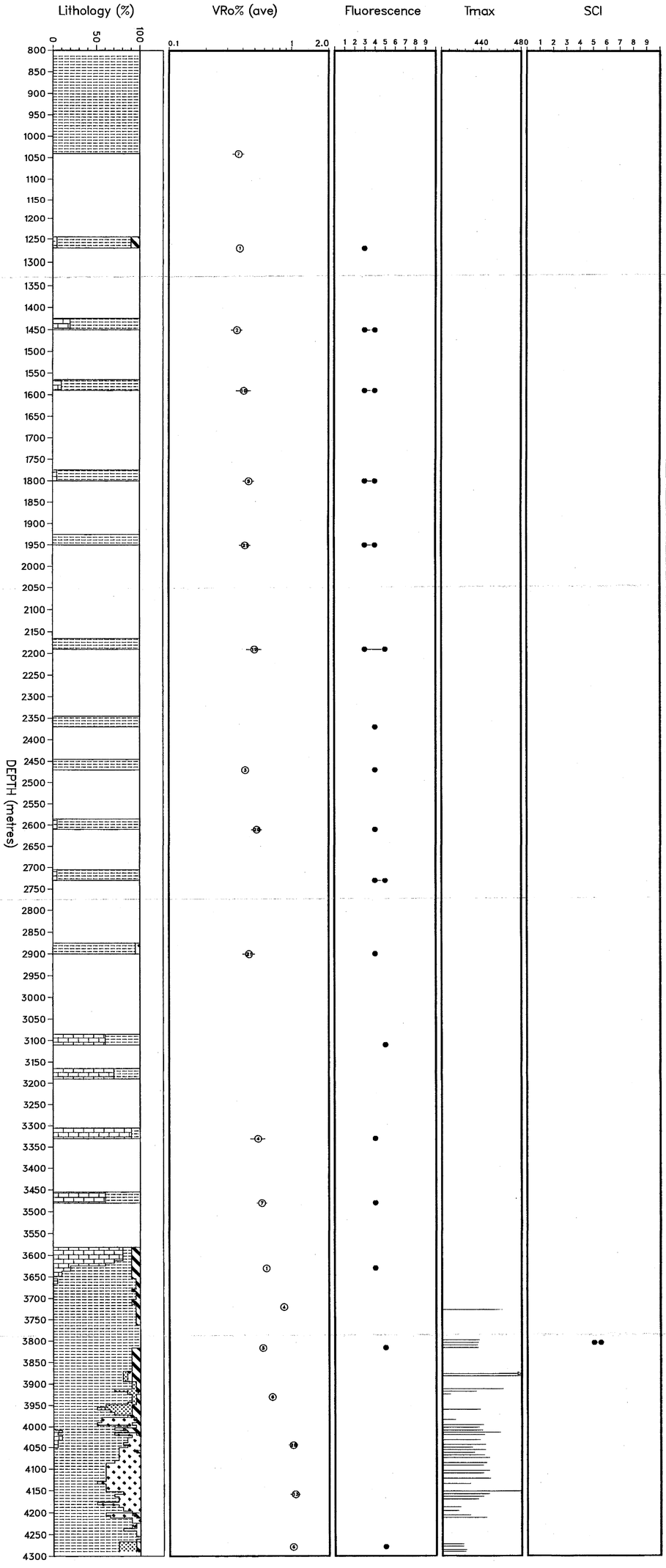
Enclosure: 4

Client: VARIOUS

Thermal Maturity Data for Well NOCS 2/1–3



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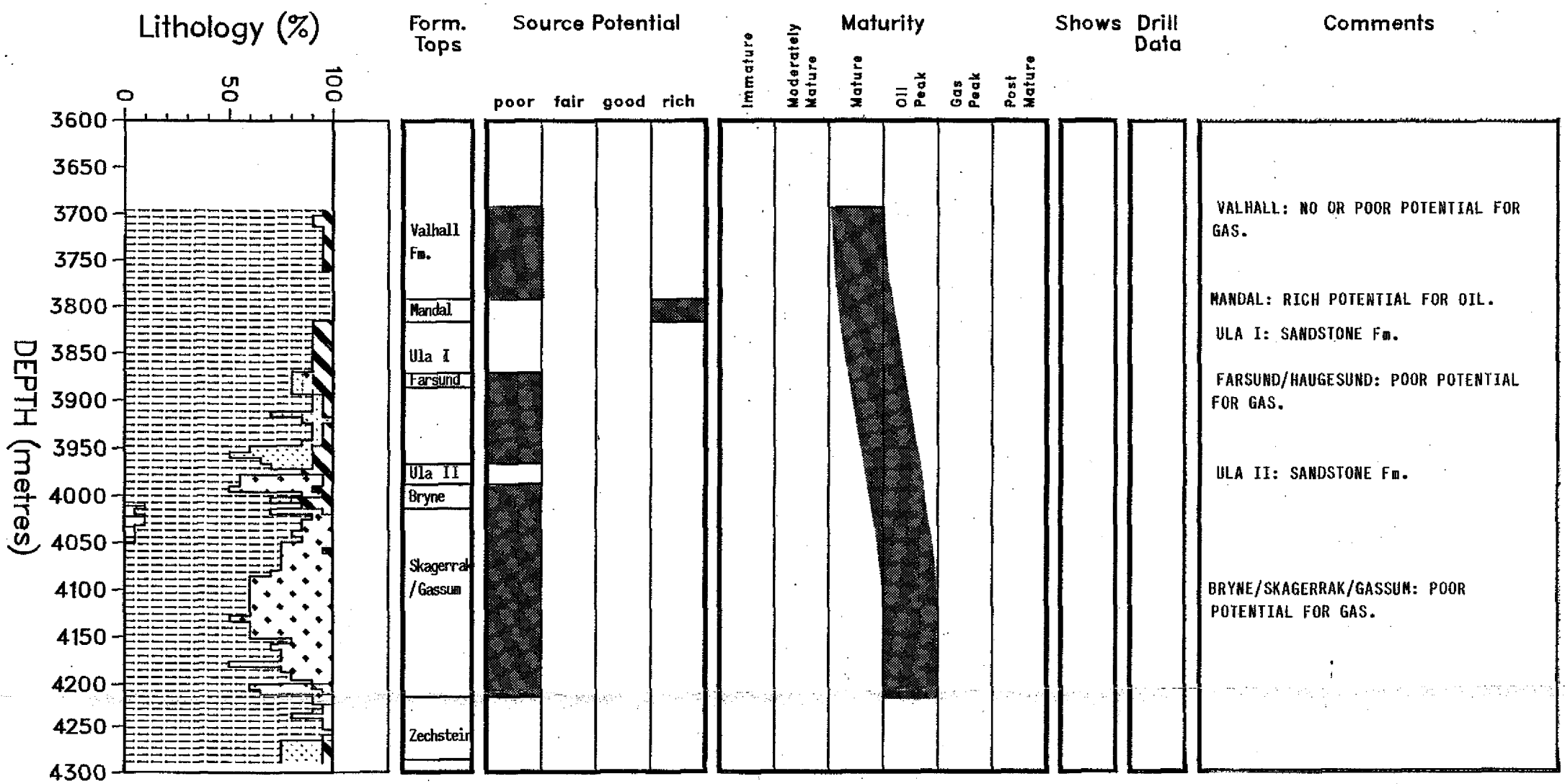
Enclosure: 5

Client: VARIOUS

Summary Log for Well NOCS 2/1–3



Coal
Carbonate
Shale/Claystone
Siltstone
Sand/Sandstone
Contamination
Volcanics
Tuff
Marl
Kaolin
Chert
Conglomerate

◄ SWC
◁ Core Chip or Core Plug

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