GEOLAB NOR

Geochemical Analysis Report for

NOCS 30/2-2

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Date : 10.01.92

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Summary

Cuttings and core samples from the interval 3872 - 4172 m of Upper to Lower Jurassic age were analysed from well NOCS 30/2-2. The well was classified as a gas/ condensate discovery, being located in the Huldra field.

Source Rocks

The main source rocks of this well are the Upper Jurassic Draupne Fm. shales which presently have only limited potential for gas due to their high maturity, having probably originally had oil - gas-prone kerogen type II-II/III. The Draupne Fm. of this well has a lower source quality than that which is usual for the formation elsewhere in the North Sea, being relatively enriched in terrestrial organic matter. The underlying Heather Fm. has, and probably has had, kerogen type III with potential only for gas. In the apparently mainly sandy Drake Fm. there occur shales originally containing kerogen type II-II/III which would have had good potential for oil and oil - gas.

Maturity

The well is interpreted to reach oil window maturity (0.6 % Ro) between 3500 m and 3700 m, i.e. in the Lower Cretaceous. The oil floor (1.0 % Ro) is interpreted to be reached between 4100 m and 4250 m, i.e. in the lowermost Middle Jurassic or Lower Jurassic.

Generation

The Draupne Fm. has exhausted the bulk of its potential, lying at or past peak oil generation. The Heather Fm., containing less prolific kerogen, spans the oil window for type III kerogen, the lower levels being in the condensate window. This has

generated and possibly expelled (?)heavy oil and condensate. The Drake Fm. shales have exhausted all but their gas potential, lying in the condensate window, these having generated oils similar to, but more waxy than, the Draupne Fm. oils.

Migration

Migrated oils occur in the Brent Gp., Ness Fm. sands down to ~ 3974 m where a shale horizon appears to have acted as a barrier. These oils appear to be mixtures of oils sourced in an anoxic, strongly marine, Draupne-type source rock at greater depth/maturity than that in the well (? Ro 1.0 - 1.3 %) and less mature oils sourced in a less anoxic, more terrestrially influenced source rock similar to the Drake Fm. shale.

Chapter 1

Introduction

1.1 General Comments

Well NOCS 30/2-2 is located in the Huldra field, north of the Oseberg field on the east margin of the North Viking Graben of the North Sea, having TD at 4170 m in the Lower Jurassic Drake Fm. This was drilled by Statoil in 1985.

In this report, emphasis is placed on both characterization of source rocks (the Draupne, Heather and (?)the Drake Fms.) and that of migrated hydrocarbons in the Brent Gp. The oil sample recorded from the Brent Gp., Ness Fm. (3935 - 3974 m) was not available at the time of writing of this report. The report on this sample is the subject of a separate report.

1.2 Analytical Program

A total of 209 cuttings and core-chip samples formed the basis for the analytical program.

Analysis type	No of samples	Figures	Tables
Lithology description	209	1	1
TOC - total organic carbon	40	1	1,2
Rock-Eval pyrolysis	40	2-4	2
Thermal extraction GC (GHM, S_1)	16	5a-g	
Pyrolysis GC (GHM, S_2)	16	6a-f, 7	3
Solvent Extraction	10		4a-e
MPLC separation and asphaltene precipitation	10		4a-e
Saturated hydrocarbon GC	10	8a-f	5
Aromatic hydrocarbon GC	10	9a-k	6
Vitrinite reflectance	17	10	7
Visual kerogen microscopy	11	11	7,8
Isotope composition of EOM and C_{15}+ fractions	5	12,13	9a-b
GC - MS of saturated and aromatic fractions	7	14a-p	10a-i

1.3 Stratigraphy

The following stratigraphy sub-division of the well has been used, this being based on published data from the Norwegian Petroleum Directorate:

Tertiary	Top RBK	Thickness
Nordland Group	153 m	734 m
Hordaland Group	887 m	1083 m
Rogaland Group	1970 m	252 m
Cretaceous		
Shetland Group	2222 m	1478 m
Cromer Knoll Group	3700 m	78 m
Jurassic		
Viking Group	3778 m	157 m
Draupne Formation	3778 m	26 m
Heather Formation	3804 m	131 m
Brent Group	3935 m	202 m
Ness Formation	3935 m	163 m
Etive Formation	4098 m	39 m
Dunlin Group	4137 m	33 m
Drake Formation	4137 m	33 m
TD	4170 m	

Chapter 2

Screening Analyses

2.1 Lithology, TOC and Rock-Eval

A total of 209 cuttings and core-chip samples was described, screening analyses being performed mainly on picked lithologies from the Draupne Fm. downwards to the Drake Fm. over the interval 3872 - 4172 m. In addition, a Tertiary sandstone from the Hordaland Gp. was screened for migrated hydrocarbons. TOC, production index and Tmax are plotted against depth in Figures 1-3, while TOC is also included with the lithological descriptions, Table 1. Figure 4 shows a Tmax - hydrogen index crossplot.

2.1.1 Source Rock Potential

The Draupne Fm. consists of dark grey to brownish black shales, having rich TOC contents (~ 4.1 - 4.8 %) and good petroleum potentials of ~ 6 - 9 mg HC/g rock. Their present potential is undoubtedly lower than their original potential due to their advanced maturity according to Tmax, these shales presently containing kerogen equivalent to type IV/III according to their hydrogen indices (77 - 107 mg HC/g TOC). The Draupne Fm. shales therefore have only remaining potential for gas generation in this well.

The Heather Fm. appears to be of similar shales, the data indicating these to be also geochemically similar in the upper levels, though caving of Draupne material may have an affect here. Below the 3854 m sample the TOC contents drop, though still remaining good to rich (~ 1.4 - 2.6 %). At these levels the petroleum potentials recorded are fair (~ 3 - 5 mg HC/g rock), while the hydrogen indices are in fact slightly higher than in the Draupne Fm., ranging 70 - 126 mg HC/g TOC, still indicating however present equivalent kerogen of type III/IV. The Heather Fm. therefore has a remaining potential only for gas. It could be speculated that the slightly higher hydrogen indices for the Heather Fm. below 3854 m, which is rather unusual, may be due to the presence of traces of pyrolysable contaminants. The lithological descriptions show abundant contamination to occur in the cuttings at 3754 m and below, albeit mainly drillmud and paint/rust/plastics. However, the core-chip sample (3908.1 m) has the highest hydrogen index of all. The reason for the higher hydrogen indices for the Heather Fm. could also be explained by the occurrence of original type III kerogen in the Heather Fm. which has not yet reached appreciable maturity, the original (type II-II/III?) kerogen of the Draupne Fm. having been thermally degraded and to have generated the bulk of its potential hydrocarbons.

The Brent Gp., Ness and Etive Fms. are mainly sandy and silty units and are considered to have little or no source potential. Seams of coal and partly carbonaceous shale do occur within the Ness Fm., these having very variable TOC contents (~ 0.3 - 5.3 %) and hydrogen indices suggesting kerogen type III. Petroleum potentials are poor/fair (apart from in the coals), being less than ~ 2 mg HC/g rock.

The Dunlin Gp., Drake Fm. also appears from cuttings to be a mainly sandy unit. It is not known to what degree this reflects caving from the Brent Gp., although at least below 4157 m the Drake Fm. cuttings sands appear different to those of the Brent Gp., being kaolinitic. Medium to dark grey waxy shales occur in moderate to abundant amounts, the single sample analysed having a fair TOC content (~ 1.7 %), a fair petroleum potential (3.4 mg HC/g rock) and, similar to the Brent Gp. shales, kerogen type III, though their original potential may have been higher. It can be concluded therefore that the Brent and Dunlin Gps. penetrated in this well have potential only for small amounts of gas at present.

2.1.2 Maturity

The Tmax data for this well must be treated with caution due to the advanced maturity of the analysed section, the uncertainties regarding the original kerogen types in the various formations, and the possibility of staining by asphaltenes which will lower the Tmax values. If one assumes the Draupne and Heather formations to have originally contained kerogen types II-II/III and III respectively (i.e. assuming the elevated hydrogen indices of the Heather Fm. to be at least in part due to staining), the top of the oil window for type II-II/III kerogen (435°C) would occur at approximately 3690 m according to the trend shown in Figure 3 and the oil-floor at approximately 3920 m. Such a narrow oil window could imply a high heat-flow/steep geothermal gradient in the locality of this well, however see vitrinite reflectance and visual kerogen chapters.

2.1.3 Generation

The Draupne Fm. shales have production indices in the range 0.41 - 0.46, indicating these to lie well within the oil window (near peak oil generation) in agreement with the Tmax data. The Heather Fm. shales have production indices ranging 0.34 - 0.54, suggesting these to lie lower in the oil window for type II kerogen. If the Heather Fm. originally contained type III kerogen, then this unit spans the oil window for type III kerogen, the lower levels being close to the base of the oil window or within the upper part of the condensate window. The low production indices in the lower part of the Heather Fm. may indicate that these levels have both generated and expelled the bulk of their liquid (? heavy oil) hydrocarbons. If so, the the higher hydrogen indices of these levels noted earlier may in fact be due rather to retention of, or staining by, asphaltenes. The Drake Fm. shale analysed has a production index of ~ 0.4 which is fairly high considering the maturity (probably well within the condensate window, indicating that the kerogen in the Drake Fm. shales has not yet expelled large amounts of hydrocarbons.

2.1.4 Migrated Hydrocarbons

No migrated hydrocarbons have been detected in the Tertiary sands of this well, while the sands near the base of the Heather Fm. contain only small amounts of possibly mainly locally migrated hydrocarbons.

The Brent Gp., Ness Fm. is the prime reservoir unit of this well, containing abundant migrated hydrocarbons in sandstones and siltstones down to 3974 m (~ 0.5 - 1.3 mg HC/g rock). This is underlain by a shale seam which may have acted as a barrier since the sandstones and siltstones below this contain mainly only traces of free hydrocarbons (the exception being the sand at 4076 m, 0.5 mg HC/g rock). The Etive Fm. similarly appears practically barren of migrated hydrocarbons, the maximum amount recorded (0.11 mg HC/g rock) occurring in the basal conglomerate.

The Drake Fm. sands are barren of migrated hydrocarbons, having less than 0.05 mg HC/g rock, i.e. near detection limit.

Chapter 3

Detailed Geochemical Analyses

3.1 GHM - Thermal Extraction

Fifteen samples were analysed, these covering the interval 3782 - 4169 m of Upper - Lower Jurassic age. Exemplary thermal extract chromatograms are shown in Figures 5a-g.

The two Draupne Fm. shales have practically identical chromatograms, showing a population of n-alkanes ranging nC_{10} - $nC_{23/24}$, centered around nC_{14-15} with a moderate content of aromatics. These are interpreted to be the remains of in-situ generated hydrocarbons (the lighter components having been lost) of light oil range, as the pristane/nC_{17} and phytane/nC_{18} ratios suggest well-mature oils, appropriate to the maturity of the host shales from Tmax (Figure 5a). The pristane/phytane ratios of ~ 2.0 suggest moderately anoxic source rock deposition.

The five Heather Fm. samples comprise four shales and one sandstone. The two uppermost shale samples (3842, 3890 m) have chromatograms broadly similar to those of the Draupne Fm. samples. The two lowermost samples (core-chips 3908.1m, 3912.5 m) have different chromatograms, where the relative content of aromatics is distinctly lower and where the isoprenoid/n-alkane ratios are also clearly lower.
The lower samples also have a slightly lighter composition, with n-alkanes centered around nC_{12-14} (Figure 5b). The pristane/phytane ratios are in addition higher at ~ 4.0, suggesting a comparatively aerobic source rock. The free hydrocarbons recorded in all four samples are interpreted to be in-situ generated, the lighter components having been lost. However, since to two upper samples are of cuttings, it is possible that these rather represent caved Draupne Fm. material, while the two

lower core samples are the true representatives of the Heather Fm., having greater maturity and a less anoxic aspect. Some of the differences however may well be due to differences in the nature of the samples, i.e. the core samples could be expected to be less depleted in n-alkanes relative to aromatics/isoprenoids and would retain more of the lighter components.

The Heather Fm. sandstone (cuttings 3909.0 m) shows a distinct population of migrated hydrocarbons ranging nC_{12} - nC_{34} with a skewed distribution, centered around nC_{24-26} on a slight unresolved hump (Figure 5c). The isoprenoid/n-alkane ratios here are almost certainly spurious due to preferential depletion of n-alkanes and even the pristane/phytane ratio may be low due to greater removal of pristane. The oil here has a very low aromatics content. This was probably generated in a Draupne-type source rock similar to that originally present in this well (see pyrolysis GC results).

Regarding the Brent Gp., Ness Fm., four sandstones, one siltstone, one shale and one coal were analysed, all from core-chips. Of the sandstones, all these except for the 3954.0 m sample have similar chromatograms, showing abundant migrated hydrocarbons having a range of n-alkanes nC_{13} - nC_{30-34} on low unresolved envelopes (Figure 5d). These hydrocarbons have isoprenoid/n-alkane and pristane/phytane ratios similar to those of the Draupne Fm. samples and it is concluded that these were sourced in a unit similar to the Draupne Fm. of this well and at a similar maturity, i.e. that the oils are not distally migrated. These have a lighter average composition than the Heather Fm. sand hydrocarbons, being centered more in the nC_{15} - nC_{22} range. This may well however be due to the latter sample being of cuttings rather than core, such that there has been abundant loss of the lighter components. In addition, the Heather Fm. sand appears from the lithological descriptions to be less well cemented, facilitating hydrocarbon loss both in-situ and during drilling. The 3954.0 m Ness sandstone sample has a lighter, shorter range of n-alkanes, nC_{10} - nC_{24}, centered around nC_{14-15}, similar to the free hydrocarbons recorded in the Draupne Fm. shales. These have more the appearance of locally migrated hydrocarbons where the lighter components have been depleted, the chromatogram being similar to that of the Ness Fm. shale hydrocarbons (see below), though having a greater range, implying mixing with true migrated oil. According to the Rock-Eval this sample has a high TOC, reflecting a relatively high clay content.

The Ness Fm. shale and siltstone have similar chromatograms showing light aromatics with a population of n-alkanes centered around nC_{13-14} (Figure 5e). These are interpreted to be in-situ generated hydrocarbons where the lighter n-alkanes have been depleted similar to those which probably dominate in the above mentioned sandstone. The Ness Fm. coal contains gaseous, aromatic-rich hydrocarbons and n-alkanes extending to nC_{26} in its thermal extract chromatogram, where the n-alkanes up to nC_{14} have been depleted (Figure 5f). These are fairly typical for in-situ generated hydrocarbons in coals.

In general the potential source rock horizons (coal, shales, siltstones) of the Ness Fm. have free hydrocarbons representing in-situ generation, the aromatics contents and (where reliable) isoprenoid/n-alkane, pristane/phytane ratios of these being compatible with the host lithologies both with regard to maturity and organic matter type (strongly terrestrially influenced, relatively aerobic.

One conglomeratic sandstone was analysed from the Brent Gp., Etive Fm. The thermal extract shows only small amounts of the remains of a suite of hydrocarbons, where the isoprenoid/n-alkane ratios suggest strong depletion of all the n-alkanes. Due to this it is not possible to assess the original nature of the free hydrocarbons with much confidence. The pristane/phytane ratio is ~ 2.0, similar to that of the hydrocarbons generated from the Draupne Fm., but it is possible that this is higher if pristane has also been removed, i.e. making more aerobic source rock units such as those in the Brent Gp. equally good candidates.

The Drake Fm. shale analysed has a chromatogram showing a narrow range of n-alkanes centered around nC_{13-15} (Figure 5g). These are somewhat similar to the hydrocarbons of the Draupne Fm., though having slightly greater pristane/phytane ratio and a lesser range of n-alkanes. The isoprenoid/n-alkane ratios are considered low due to selective loss of n-alkanes. This suite probably representing the remains of in-situ generated hydrocarbons from the apparently prolific kerogen present in the Drake Fm. shale horizons.

3.2 GHM - Pyrolysis Gas Chromatography

The same fifteen samples thermally extracted were pyrolysed. Pyrolysis - GC data is shown in Table 3 and plotted in a pyrolysis products triangle, Figure 7. Exemplary pyrograms are shown in Figures 6a-f.

The two Draupne Fm. shales have very similar pyrograms showing a good alkene - alkane homology and a flat baseline with relatively few aromatics, typical of mature/well-mature type II/II-III kerogen (Figure 6a). These shales have probably had very good potential for mixed oil and gas, but presently probably lie close to peak oil maturity, much of their potential having been realized.

The Heather Fm. shales have similar pyrograms to each other, generally showing increased amounts of aromatics and often poorer alkene - alkane homologies compared with the Draupne Fm. samples (Figure 6b). These shales presently appear to have the equivalent of type III - II/III kerogen with a remaining potential mainly only for gas, though the original potential may have been greater.

The Heather Fm. sandstone has a pyrogram showing abundant alkenes in relation to alkanes out to C_{18} which is typical for the pyrolysates of asphaltenes from residual oils (Figure 6c).

The shales and siltstone from the Brent Gp., Ness Fm. have pyrograms showing pyrolysates with poor homologies and relatively high proportions of aromatics/ isoprenoids indicative of present equivalent kerogen of type IV/III (Figure 6d). These have therefore potential only for minor gas at present. Considering the high maturity at these levels, these may have had slightly better potential previously (? kerogen type III), but the low TOC contents according to Rock-Eval still relegate these horizons to being poor source rocks. The Ness Fm. coal has a broadly similar pyrogram, though showing greater amounts of gaseous and aromatic/isoprenoid pyrolysate components.

It can be concluded that the Ness Fm. has not had significant potential other than that for minor gas from shale/coal seams.

The Ness Fm. sandstones analysed have pyrograms showing either variable amounts of asphaltene pyrolysis products from residual oil (e.g. 3939.05 m, Figure 6c), or the pyrolysates of poor quality kerogen occurring within the more clayey facies, similar to the Ness. Fm. shales.

The Etive Fm. conglomerate analysed is virtually completely barren of pyrolysable organic matter.

The Drake Fm. shale has a pyrogram not dissimilar to those of the Draupne Fm. shales, though showing greater maturity and lesser amounts of aromatics (Figure 6f). At present this has realized the bulk of its potential, now having potential for mainly gas. Originally however this lithology may have had a very good oil/gas potential, possibly representing a lagoonal deposition site with type II kerogen. However, the evidently restricted amounts of these shales in the Drake Fm. of this well, together with their lowish TOC contents, severely limit the amounts which could have been generated.

3.3 Solvent Extraction and Chromatography

Ten samples from NOCS 30/2-2 were analysed. Data from extraction/separation and saturated and aromatic GC are shown in Tables 4-6 respectively. Exemplary saturated and aromatic chromatograms are shown in Figures 8a-f and 9a-k respectively.

3.3.1 Extraction

The two Draupne Fm. shales analysed have rich contents of both extractable organic matter (EOM) and hydrocarbons (EHC), 3750 - 6802 ppm and 2500 - 4011 ppm respectively. When normalized against TOC the EOM becomes fair - good (~ 75 - 134 mg EOM/g TOC), while EHC remains rich (~ 50 - 79 mg EHC/g TOC). The hydrocarbons have constitute ~ 59 - 67 % of EOM and have moderately high saturated:aromatic ratios (~ 1.8 - 2.0). This data is compatible with in-situ generated hydrocarbons from the mature host shales.

The two Heather Fm. shale samples have similar extraction data, i.e. rich EOM and EHC (~ 3900 - 5400 ppm and ~ 3100 ppm respectively). Similar to the Draupne Fm., these are also good and rich respectively when normalized against TOC (~ 109 - 135 mg EOM/g TOC and 63 - 106 mg EHC/g TOC). Hydrocarbons constitute ~ 58 - 79 % of EOM and have moderate to high saturated:aromatic ratios, ~ 2.2 - 3.9. Again the data supports the hydrocarbons being well-mature, in-situ generated.

Four sandstones and one coal from the Brent Gp., Ness Fm. were analysed. The coal (4049 m) has (very) rich EOM and EHC data (~ 41600 ppm and 4650 ppm respectively). When normalized against TOC however these become only fair and poor (~ 73 mg EOM/g TOC and 8 mg EHC/g TOC). Hydrocarbons constitute only ~ 11 % of EOM and have a low saturated:aromatic ratio of ~ 0.6, the bulk of EOM being as asphaltenes (~ 87 %). The data for the Ness Fm. coal therefore shows these to contain abundant retained asphaltenes from in-situ generated hydrocarbons. The Ness Fm. sandstones have fair to good EOM (612 - 1741 ppm) and good to rich EHC (306 - 1200 ppm). When normalized against TOC these become good - rich (~ 121 - 471 mg EOM/g TOC) and rich (~ 83 - 301 mg EHC/g TOC). Hydrocarbons here make up ~ 50 - 72 % of EOM and have moderate to high saturated:aromatic ratios, ~ 1.1 - 4.8, broadly increasing with depth. The Brent sands data is consistent with abundant migrated, well-mature hydrocarbons.

The single Drake Fm. shale has data not unlike that of the Draupne and Heather Fms., with rich EOM and EHC data (3233 ppm and 2335 ppm respectively) which are good and rich when normalized against TOC (~ 128 mg EOM/g TOC and 93 mg EHC/g TOC). Hydrocarbons constitute ~ 72 % of EOM and have a moderately high saturated:aromatic ratio of ~ 2.3, consistent with mature in-situ generated hydrocarbons.

3.3.2 Saturated Hydrocarbon Chromatography

The Draupne Fm. shales have saturated hydrocarbon chromatograms showing a full range of n-alkanes nC_{12} - nC_{37}+ with low pristane/nC_{17} and phytane/nC_{18} ratios of ~ 0.5 and a somewhat concave profile, consistent with mature/well-mature hydrocarbons. The pristane/phytane ratio is compatible with in-situ generated hydrocarbons, indicating an anoxic environment typical of the host formation (Figure 8a).

The Heather Fm. shales have broadly similar chromatograms to the above, though showing a slight enhancement of n-alkanes in the nC_{24} - nC_{30} range, possibly reflecting greater input of higher plant matter in this formation (Figure 8b). Again these support in-situ generated hydrocarbons.

The Ness Fm. coal shows n-alkanes nC_{11} - nC_{32} with low isoprenoid/n-alkane ratios, increased aromatics and evident biomarkers, and an increased pristane/phytane ratio compared with the Draupne and Heather Fms.' samples. These are compatible with in-situ generated hydrocarbons (Figure 8c).

The Ness Fm. sandstones have somewhat variable chromatograms, though mainly in the proportion of heavier n-alkanes present (~ nC_{22} - nC_{35}), the isoprenoid/n-alkanes and pristane/phytane ratios being similar. The data supports the presence of migrated hydrocarbons from the coal seams which are responsible for the above variations. The pristane/phytane ratio appears to increase with depth (~ 1.8 to 2.0), perhaps reflecting generally greater contribution from the coals towards the lower levels (Figures 8d,e). Otherwise the isoprenoid/n-alkane ratios are more similar to those of the Heather or Drake Fm. shales than to those of the Draupne Fm., though this could equally result from mixing of Draupne generation products with coal generation products.

The Drake Fm. shale has a chromatogram which is most similar to those of the Heather Fm. shales, both in profile and isoprenoid ratios (Figure 8f). These show similar in-situ generation products.

3.3.4 Aromatic Hydrocarbon Chromatography

The Draupne Fm. shales have similar FID chromatograms showing roughly equal amounts of methylated naphthalenes and phenanthrene/methyl phenanthrenes together with prominent ?trimethyl naphthalenes. (Figure 9a). All the aromatic ratios show the hydrocarbons to be mature/well-mature, ~ 0.7 - 0.8 % Ro, compatible with the maturity of the Draupne shales themselves. The FPD chromatograms are also similar, with very strongly dominant 4-MDBT and hardly detectable 2+3- or 1-MDBT, suggesting a maturity close to (or ?past) peak oil generation (Figure 9h).

The Heather Fm. shales have FID chromatograms showing greater relative amounts of methylated naphthalenes compared with the Draupne Fm., and particularly increased amounts of 2- and 1-methyl naphthalene, suggesting the presence of condensate/oil (Figure 9b). Again the aromatic ratio data shows very well-mature oils, well past peak oil generation and probably in the condensate window. The FPD chromatograms are similar to those of the Draupne Fm. and confirm the above conclusions.

The Ness Fm. coal shows a continuation of the trend shown by the Draupne and Heather Fms.' shales, having dominant 2- and 1-methyl naphthalene together with lesser methylated naphthalenes and subordinate phenanthrene/methyl phenanthrenes (Figure 9c). The biphenyl content is also noticeably higher and this, together with all the calculated aromatic ratios, confirms in-situ generated hydrocarbons at condensate level maturity. The FPD trace shows much increased dibenzothiophene together with a generally increased total level of sulphur compounds. These, and the 4/1 MDBT ratio support the above conclusions (Figure 9i).

The Ness Fm. sandstones have quite variable FID chromatograms. The uppermost sample (3939.05 m) shows mainly an unresolved envelope with dominant phenanthrene/methyl phenanthrenes and only minor (di)methyl naphthalenes (Figure 9d). Beneath this, at 3954.0 m and 3974.0 m, the unresolved envelope is much less evident and the methylated naphthalenes (including 2- and 1-methyl naphthalenes) are either dominant (upper sample) or subordinate to phenanthrene/methyl phenanthrenes (lower sample (Figure 9e). The lowermost sample at 4076.0 m is most similar to the uppermost sample at 3439.05 m, but is even more dominated by an unresolved hump and a series of compounds eluting after the methyl phenanthrenes (Figure 9f). These differences are, at least in part, probably due to varying porosity of the sandstones and work-up effects. The calculated aromatic ratios are all almost without exception considerably higher than those of either the Draupne/Heather Fms. or the Drake Fm., showing very well-mature hydrocarbons, the ratios being closer to those of the Ness Fm. coals. It is possible that the aromatic fractions of the oils in this section are strongly influenced by aromatics from the latter. The FPD traces of the Ness Fm. sandstone oils show relatively small amounts of sulphur compounds compared with the coals and either the upper or lower Jurassic shales, which may be expected from well-mature, distally migrated oils. There is some variation, mainly in the amounts present. The uppermost and lowermost samples (those having the prominent unresolved humps on FID) have little or no sulphur aromatics, while the two middle samples have small amounts where the 4/1 MDBT ratio indicates very highly mature oils (Figure 9j). The same group of late-eluting compounds detected in the Brent coals is also observed in these two samples, again inferring contribution from local sources.

The Drake Fm. FID trace (Figure 9g) is compositionally rather similar to those of the Draupne Fm., though the MPI index clearly shows a much higher maturity. The FPD trace (Figure 9k) indicates well-mature hydrocarbons and has compositional features in common with both the Upper Jurassic units.

3.4 Vitrinite Reflectance

A total of 13 picked rock samples was examined for thermal maturity using vitrinite reflectance. The samples from the depth interval 1080 - 4169 m covered the stratigraphic range of Hordaland Gp. (Tertiary) down to Drake Fm. (Lower Jurassic). The thermal maturity data is presented in Table 7, while the plot of vitrinite reflectance versus depth is shown in Figure 10.

3.4.1 Description of samples

The two Hordaland Gp. samples contain only low/trace phytoclast contents with trace to ~ 80 % vitrinite. Spores occur in trace to moderate amounts, as do dinoflagellates. Bitumen staining is light/moderate, with a moderate content of bitumen wisps. Both are rich in foram debris.

The two Rogaland Gp. samples similarly contain only trace/very low phytoclast contents with only traces of vitrinite clasts. Spore are also in traces. Bitumen staining is only light/very light, with a very low - moderate content of wisps.

Six Shetland Gp. samples were examined, these having phytoclast contents ranging from virtually barren to moderate, consisting of practically 100 % inertinite. These have mainly low spore contents, with yellow-orange fluorescence. The lowermost sample (3560 m) contains specks of green fluorescent free hydrocarbons. Bitumen staining is generally light to very light throughout, with a low/trace content of bitumen wisps.

The two Draupne Fm. shales examined have low - moderate phytoclast contents, containing trace to 70 % vitrinite. Staining is moderate to strong in these samples, the lowermost of which (3794 m) contains traces of light orange fluorescent specks of free hydrocarbons.

The Drake Fm. shale consist mainly of inertinite clasts. Bitumen staining is very variable within the sample, light to strong, with a low content of bitumen wisps.

3.4.2 Maturity

Based on the vitrinite reflectance results obtained and other microscopic observations made during the sample examination, a thermal maturity trend is proposed for the well as shown in Figure 10. Accordingly, the well is estimated to be immature until about 3250 m (Ro less than 0.5 %). The top of the oil window (Ro 0.6 %) is located at approximately 3500 m. The base of the oil window (Ro 1.0 %) by extrapolation is tentatively placed at ~ 4250 m.

3.5 Visual Kerogen Microscopy

Eleven samples were optically examined from NOCS 30/2-2, covering the depth range 2000 - 4169 m. Detailed kerogen compositions are shown in Table 8, while the gross compositions are plotted in a triangular diagram, Figure 11. Maturity data (Spore Colour Index) is included in Table 7.

3.5.1 Kerogen Typing

The Rogaland Gp. sample yielded insufficient organic matter for reliable kerogen typing, but appears to contain mainly terrigenous kerogen, the liptinitic component being dominated by oxidized spore/pollen with subordinate liptodetrinite, algae, dinoflagellates and amorphous matter (probably degraded woody material).

The three Cretaceous samples examined contain accessory to abundant liptinite (10 - 70 %), though this is mainly of "dead" reworked and oxidized material. The samples indicate mainly terrigenous input with relatively abundant vitrinite.

The Draupne Fm. sample is, in stark contrast to the above, strongly dominated by amorphous liptinite, with subordinate fine algal shreds/cysts. The content of woody clasts (20 % combined semi-fusinitic inertinite and vitrinite) is however somewhat high for the Draupne Fm. and it may be speculated that the Draupne Fm. in this well is of relatively poorer quality than that usually met with. The amorphous component may contain significant degraded woody (vitro-humic) material rather than marine "sapropelic" matter, lowering its oil-generative potential. The Draupne Fm. is still however considered to have good potential for oil and gas generation, though the oil may well be heavier than that normally generated from this unit. Due to the maturity of the Draupne shales, a significant proportion of their generative capacity has probably been realized.

The relatively poor quality of the Viking Gp. in this well is supported by the two Heather Fm. samples examined. The uppermost sample in particular has a decidedly "coaly" texture, containing 65 % combined inertinite and vitrinite (part-butiminous) and only ~ 35 % liptinite consisting mainly of terrestrially derived clasts (spores, cuticle). The lowermost sample has increased liptinite (50 %), though again mainly as spores and amorphous material evidently composed of degraded spores, with only trace algae. The Heather Fm. is therefore interpreted to have (and to have had) potential only for moderate amounts of gas and lesser heavy oil in this well, i.e. kerogen type III.

The three Brent Gp., Ness Fm. lithologies examined comprise one coal and two shales. The coal sample consists practically only of fine-grained, brittle-textured amorphous vitrinite clasts which have little or no bitumen staining. Only traces of recognisable liptinite are present. The Ness Fm. shale samples have very similar textures and broadly similar compositions, though the uppermost (3979 m) contains a greater liptinite content (15 %) than the lower shale sample (4095 m). Both have distinctly "coaly" textures, being dominated by semi-fusinitic/woody clasts 85 - 100 % combined vitrinite and inertinite. The Ness Fm. shales/coals are therefore interpreted to have potential only for moderate amounts of gas in this well, i.e. kerogen type III.

The Drake Fm. shale (4169 m) contains a much increased liptinite content compared with the above (60 %), being more similar to that of the Draupne Fm. However, the assemblage appears more terrestrially influenced, being dominantly of well preserved spores and subordinate cuticle. Semi-fusinitic inertinite is abundant (30 %), while there occurs only accessory woody vitrinite. This assemblage suggests the Drake Fm. to have had good potential for mixed oil and gas, the former being probably more waxy than that from the Draupne Fm.

3.5.2 Maturity

According to the SCI data for individual samples, the top of the oil window (SCI 6.0

fortype II kerogen) occurs between 3338 m and 3794 m. The linear regression line for all SCI data cannot be used since advanced maturity in the lower parts of the analysed section means that linearity does not apply. It is concluded that the top of the oil window occurs in the region of the 3500 m, i.e. in lower levels of the Shetland Gp. The base of the oil window is tentatively placed by extrapolation at approximately 4100 m.

3.6 Isotope Analysis of C_{15}+ Fractions

Five samples, a shale from the Draupne Fm., two sandstones and a coal from the Ness Fm. and a shale sample from the Drake Fm. were analysed. Saturate - aromatic isotopic ratios for the five samples are shown in Figure 12 and the Galimov plots are shown in Figure 13. Isotope data is presented in Tables 9a,b.

The hydrocarbons from the two shale samples, interpreted to be in-situ generated, plot in the marine field of Figure 12, with a clear isotopic difference for both the saturated and aromatic hydrocarbons, where the Drake Fm. hydrocarbons are isotopically heavier than those in the Draupne Fm. This is probably the result of both higher input of terrestrial organic matter and a greater maturity for the Drake Fm. shales. The Ness Fm. coal plots midway between these.

The migrated hydrocarbons in the Ness Fm. sandstones plot quite apart from the hydrocarbons in the source rock lithologies, though having similar saturated hydrocarbon values, these have heavier aromatic hydrocarbon values than the Draupne Fm. hydrocarbons. They are more similar to the Drake Fm. in this report, but their saturated hydrocarbons are isotopically heavier than those in the Drake Fm. All conidered, the isotope data for the migrated oils has characteristics similar to both the Drake and Draupne formations.

3.7 Gas Chromatography - Mass Spectrometry

Seven samples were analysed, these being two shales from the Draupne Fm., three sandstones and one coal from the Ness Fm. and one shale from the Drake Fm. GC - MS data is presented in Tables 10a-i, while exemplary fragmentograms are shown in Figures 14a-p.

3.7.1 Potential Source Rocks

Saturated Hydrocarbons

The four source rock samples, i.e. the three shales and one coal sample show wide variations in the terpane and sterane distributions which can be related to differences in input, depositional environment and maturity. The M/Z 163 fragmentograms give an indication of the relative amounts of steranes to triterpanes. The shale samples from the Draupne Fm. have high contents of steranes relative to hopanes (Figure 14a), with ratios of the dominant sterane (P_{27} diasterane peak A) to dominant hopane $C_{30}\alpha\beta$ peak E) of 3.0. The shale sample from the Drake Fm. has a lower ratio, approximately 1.0 (Figure 14b). In contrast the coal sample, which has small amounts of C_{29} diasteranes and only traces of C_{27} diasteranes, has a ratio of less than 0.2. The abundant steranes in the Draupne shales are typical of marine source rocks, while the pattern seen for the Drake Fm. sample shows either a less anoxic environment and/or higher land-plant input during deposition of the Drake Fm. shale than of the Draupne Fm. shale. A higher maturity of the Drake Fm. shale will also have affected the results slightly.

The terpane distribution of the four potential source rock samples seen in the M/Z 191 fragmentograms show distinct differences in distributions related to input and maturity.

The Draupne Fm. and Drake Fm. samples are dominated by the C_{27} - C_{30} and C_{29} - C_{30} $\alpha\beta$ hopanes, but with a significant abundance of the C_{20} - C_{25} tricyclic terpanes.

The C_{31} - C_{35} hopanes are of rather low abundance for all of these three samples (Figure 14c,d). The main difference between the three samples is the relative abundance of the unknown C_{30} triterpane peak X which has a larger relative abundance in the Draupne Fm. samples than in the Drake Fm. sample. Another difference is a lower relative abundance of 18α(H) trisnorneohopane (peak A) in the Drake Fm. sample compared with the Draupne Fm. samples. The pattern seen here with a relative large abundance of tricyclic terpanes, a large abundance of the 18α(H) trisnorneophane, a large abundance of the C_{30} hopane peak X and the C_{30} $\alpha\beta$ hopane (peak E) is typical for late mature source rocks in which most of the $\alpha\beta$ hopanes have been thermally degraded and/or expelled.

The pattern seen for the coal sample is completely different. This sample is dominated by peak X to such a degree that it is difficult to identify the remaining peaks (Figure 14e) and further interpretation is therefore not possible.

The hopane maturity parameter % C_{32} $\alpha\beta$ 22S (peaks J_1/J_1+J_2x100) has reached maximum values of approximately 60 % in the Draupne Fm., suggesting that maturity is roughly at the top of the oil window at 3800 m (i.e. 0.5 - 0.6 % Ro equivalent). Ratios of C_{29} - C_{30} $\beta\alpha/\alpha\beta$ hopanes (peaks D+F/C+E) are approximately 0.1, while the 17α(H) 22,29,30 trisnorhopane/18α(H) 22,29,30 trisnorhopane (T_m/T_s ratio of Seifert and Moldowan 1978, peaks B/A) of the Draupne Fm. are fairly low, 0.2, both indicating that these samples have reached the main phase of oil generation. The T_m/T_s ratio is slightly higher for the Drake Fm. sample, which is due to a change in the organic input for this sample compared to the Draupne Fm. samples, to a greater input of terrestrial plant material. The other maturity parameters for the Drake Fm. shale show this sample to be in the main phase of the oil generation.

The sterane distribution of the four source rock samples is best seen from the M/Z 217 fragmentograms. In the three shale samples from the Draupne and Drake Fms. the diasteranes are the major component, suggesting that they are all mature samples (Figure 14f,g). The coal sample has a completely different distribution showing almost entirely regular steranes (Figure 14h). This is due to a completely different organic input in this sample compared with the shale samples. There is only a minor difference in the sterane distribution of the Draupne Fm. shale samples compared with the Drake Fm. samples. This is mainly in the abundance of C_{29} components and regular steranes in the Drake Fm. compared with the Draupne Fm., indicating a larger abundance of terrestrial plant material in the Drake Fm. than that recorded for the Draupne Fm. samples. This is recorded in the M/Z 217 fragmentograms and in the M/Z 259 fragmentograms (Figure 14i, j). The coal sample is completely dominated by the C_{29} regular steranes, clearly showing the terrestrial input. Sterane maturity parameters such as % C_{29} $\alpha\alpha\alpha$ 20S (peaks q/q+tx100) are slightly lower for the land-plant rich material than for the marine shales of the Draupne Fm. and Drake Fm. This is generally the case and is related to heating rates, low heating rates being coupled to similar sterane isomerisation ratios in coals compared to marine shales and high heating rates giving lower sterane ratios in coals than in marine shales. Values of this parameter are close to maximum for both the Draupne and Drake Fms. (~ 50 % S). This indicate that the analysed sequence is within the main oil window interval.

Aromatic Hydrocarbons

The main difference in the four source rock samples considered here is between the marine Draupne Fm. shales, the slightly land-plant richer Drake Fm. shale and the Ness Fm. coal. The main differences are the more complex narrower range and lighter C_2- and C_4-alkyl benzenes (M/Z 106, 134) for the coal sample than for the marine shales. Distribution is also affected by maturity, most notably for the aromatic steranes. The typical distribution of triaromatic steranes (M/Z 231 fragmentograms) seen in marine anoxic siliciclastic deposits is not found for any of the analysed samples due to the high maturity. This is also recorded for the monoaromatic steranes.

3.7.2. Migrated Hydrocarbons

Three sandstone samples from the Ness Fm., which are stained with migrated hydrocarbons, were analysed.

Saturated Hydrocarbons

The M/Z 163 fragmentograms for the three samples vary significantly. The sample from 3939.05 m shows a large abundance of triterpanes with $C_{30}\alpha\beta$ hopane as the largest peak (Figure 14k), indicating the hydrocarbons in this sample to be generated from a terrestrial source, while the two samples from 3954 m and 4076 m show almost entirely diasteranes, indicating a marine source (Figure 14l). The M/Z 191 fragmentograms are also significantly different for the three samples. The sample from 3939.05 m shows almost entirely the pentacyclic triterpanes with the C_{30} $\alpha\beta$ hopane as the largest peak (Figure 14m), while the two other samples have the tricyclic terpanes as the most abundant component (Figure 14n). This is partly due to different maturities, but mainly due to a significant variation in the organic material in the source rock generating these hydrocarbons. Similar variations are recorded for the other terpane fragmentograms such as M/Z 177 for demethylated terpanes and M/Z 205 for methylated terpanes.

The sterane distribution also shows a strong variation for the three sandstone samples. This is recorded for all the different sterane fragmentograms and will be discussed below for the M/Z 217 fragmentograms. The sample from 3939.05 m shows mainly regular steranes with the C_{29} components as the dominant (Figure 14o), while the other samples show a normal pattern for hydrocarbons generated from a marine source rock (Figure 14p) with mainly diasteranes. This clearly shows, as for the terpane distributions, the greater land-plant input in the source rock generating the hydrocarbons in the sample from 3939.05 m.

Aromatic Hydrocarbons

The distinct differences found between the sample from 3939.05 m and the samples from 3954 m and 4076 m for the terpane and sterane distributions are not recorded for the various aromatic fragmentograms. Only minor variations are found for these samples, which all indicate a marine source rock generating the hydrocarbons in the sandstone samples.

3.7.3 GC - MS Summary

The Draupne Fm. shale is the most oil-prone shale occurring in this well, having a biomarker composition typical of a mature marine anoxic deposit. The Drake Fm. shale has a slightly higher land-plant input than that of the Draupne Fm. shale and was probably deposited in a less anoxic marine environment. There are apparently only minor maturity differences between the two formations. The coal sample from the Ness Fm. has distributions of both steranes and terpanes which are typical for land-plant dominated samples.

The migrated hydrocarbons in the Ness Fm. vary significantly both for the sterane and terpane distributions, where the sample from 3939.05 m shows a distribution indicating the hydrocarbons being generated from organic matter relatively enriched in land-plant material, while the two other samples show distributions typical of hydrocarbons generated from a more marine-dominated source rock.

Chapter 4

Conclusions

4.1 Source Rock Potential

The Draupne Fm. consists of dark grey to brownish black shales having rich organic contents of ~ 4 -5 % TOC with good petroleum potentials of ~ 6 - 9 mg HC/g rock. Due to advanced maturity, these presently contain only the equivalent of type III/IV kerogen, having presumably exhausted the bulk of their potential (? originally type II-II/III kerogen). These therefore have present potential only for limited amounts of gas. From kerogen microscopy observations the original potential of the Draupne Fm. of this well was however almost certainly lower than that normally encountered with in the North Sea, having a notable input of terrestrial (woody) organic matter, though remaining dominantly anoxic and marine.

The Heather Fm. consists of similar shales having lower organic matter contents of ~ 1 - 3 % TOC and fair petroleum potentials of ~ 3 - 5 mg HC/g rock. These similarly contain at present the equivalent of kerogen type III/IV, with only limited potential for gas. Kerogen studies suggest the original organic matter to have been mainly gas-prone, type III.

The Ness and Etive formations of the Brent Gp. are sand units having no major potential, this being restricted to that of intercalated coals/carbargillites within the Ness Fm., which are interpreted to be mainly gas-prone.

The Drake Fm. is again mainly a sand unit according to cuttings and core samples, the sands being kaolinitic below about 4157 m. Moderate to abundant amounts of medium to dark grey shales are however present in moderate to abundant amounts. These have fair TOC contents of ~ 2 % with a fair petroleum potential of between 3 and 4 mg HC/g rock. The kerogen of these shales is presently equivalent to type III, i.e. with potential only for gas. However, pyrolysis and kerogen microscopy suggest the original organic matter to have had greater potential, possibly good for oil and mixed oil and gas (? including kerogen type II), the oil probably being more waxy than that generated from the Draupne Fm.

4.2 Maturity

The top of the oil window for type II kerogen, according to the various methods, is as follows: Spore Colour Index 3500 m, Vitrinite Reflectance ~ 3500 m, Tmax ~ 3690 m. The estimate is therefore within the depth range 3500 - 3700 m, i.e. in the Lower Cretaceous. Estimates for the base of the oil window also vary; Spore Colour Index: ~ 4100 m, Vitrinite Reflectance: ~ 4250 m and Tmax: ~ 3920 m. Of these, the estimates from spore colour and vitrinite reflectance are given greater credence, i.e. with an oil-floor in the region 4100 - 4250 m.

4.3 Generation

The Draupne Fm. shales lie well within the oil window, approaching the stage of peak oil generation (? 0.7 - 0.8 % Ro). The oils generated here will be somewhat heavier than those from more typical Draupne/Kimmeridge Clay Fm. elsewhere in the North Sea due to a greater input of terrestrial organic matter. The Heather Fm., containing a less prolific, mainly gas-prone kerogen, is also within the oil window (for type III kerogen), the lower levels probably being in the condensate window, having generated (and possibly expelled) significant amounts of relatively heavy oil/condensate. The shales within the Drake Fm. sands lie at least at the base of the oil window, probably having condensate maturity (? 1.0 % Ro). These have generated, but apparently not expelled to the same degree as the Heather Fm., amounts of oils similar to those from the Draupne Fm., but with increased wax content due to a higher input of higher plant material.

4.4 Migration

The Ness Fm. sandstones and siltstones contain moderate/abundant (~0.5-1.3 mg/g) well mature (? Ro 1.0 - 1.3 %) hydrocarbons down to ~ 3974 m which are apparently co-sourced. Below this, a shale horizon may have acted as a tight zone. In the upper levels (down to ~ 3940 m) the oils are slightly less mature and have a relatively terrestrial signature, the oils throughout however having a dominant marine provenance. Below this, the oils have a clearly marine signature, but are locally influenced by aromatic-rich hydrocarbons generated in the Ness Fm. coals. The most likely sources are those of the Draupne Fm. (relatively marine) and the Drake Fm. (relatively greater influence from higher land-plant material). The Ness Fm. reservoir section may therefore contain a greater contribution from locally migrated Drake Fm.-type hydrocarbons in the upper levels and relatively "unadulterated" Draupne-type oils which are more distally migrated in the lower levels.

The underlying Etive and Drake formations' sands are practically barren of migrated hydrocarbons.

LEGEND TO FIGURES 1, 2 AND 3

- + Shales
- X Siltstones
- O Coals
- ▷ Carbonates
- ◇ Sandstones
- □ Bulk

Figure: 1

Client: VARIOUS GEOLAB NOR

TOC Data for Well NOCS 30/2-2

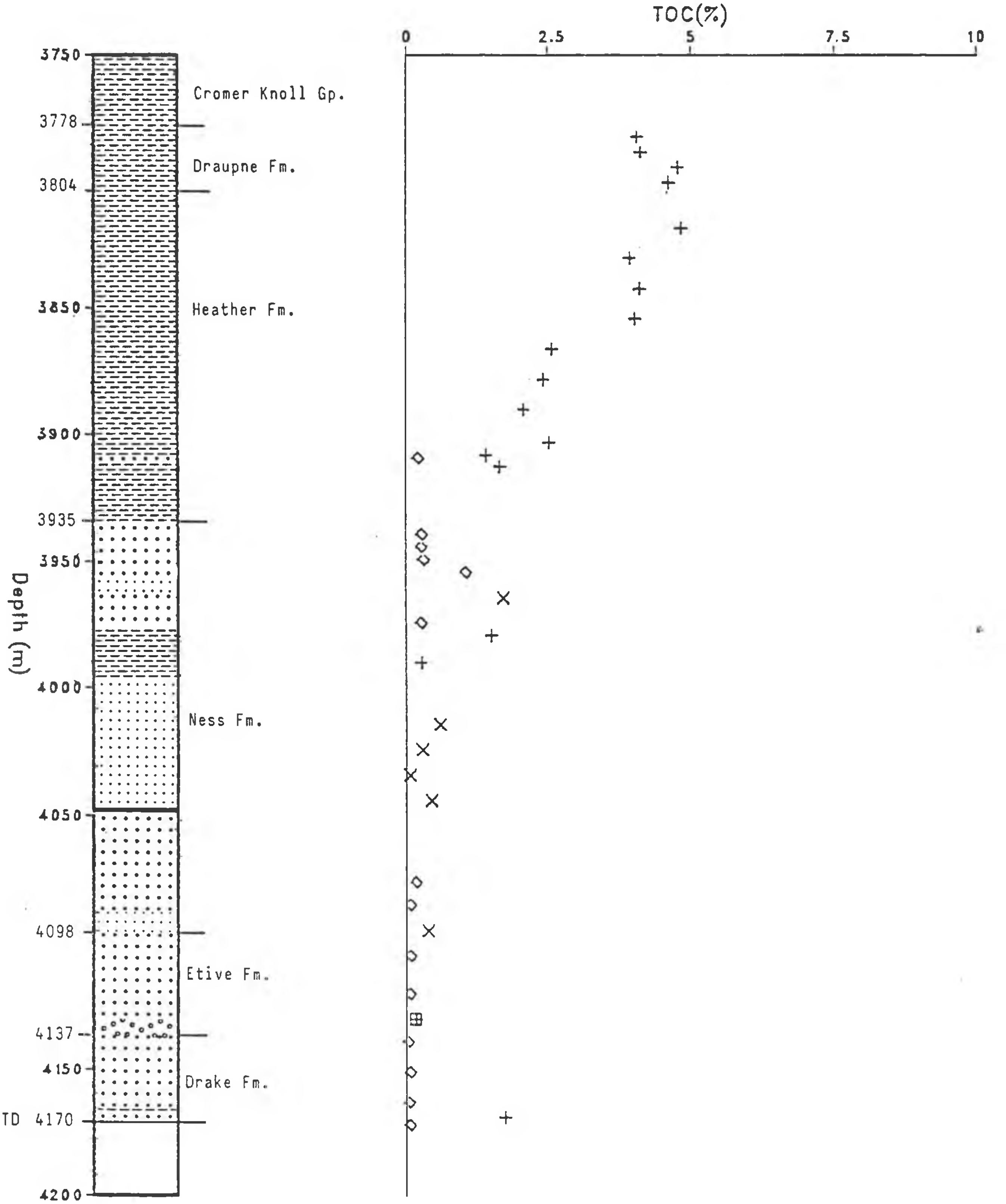
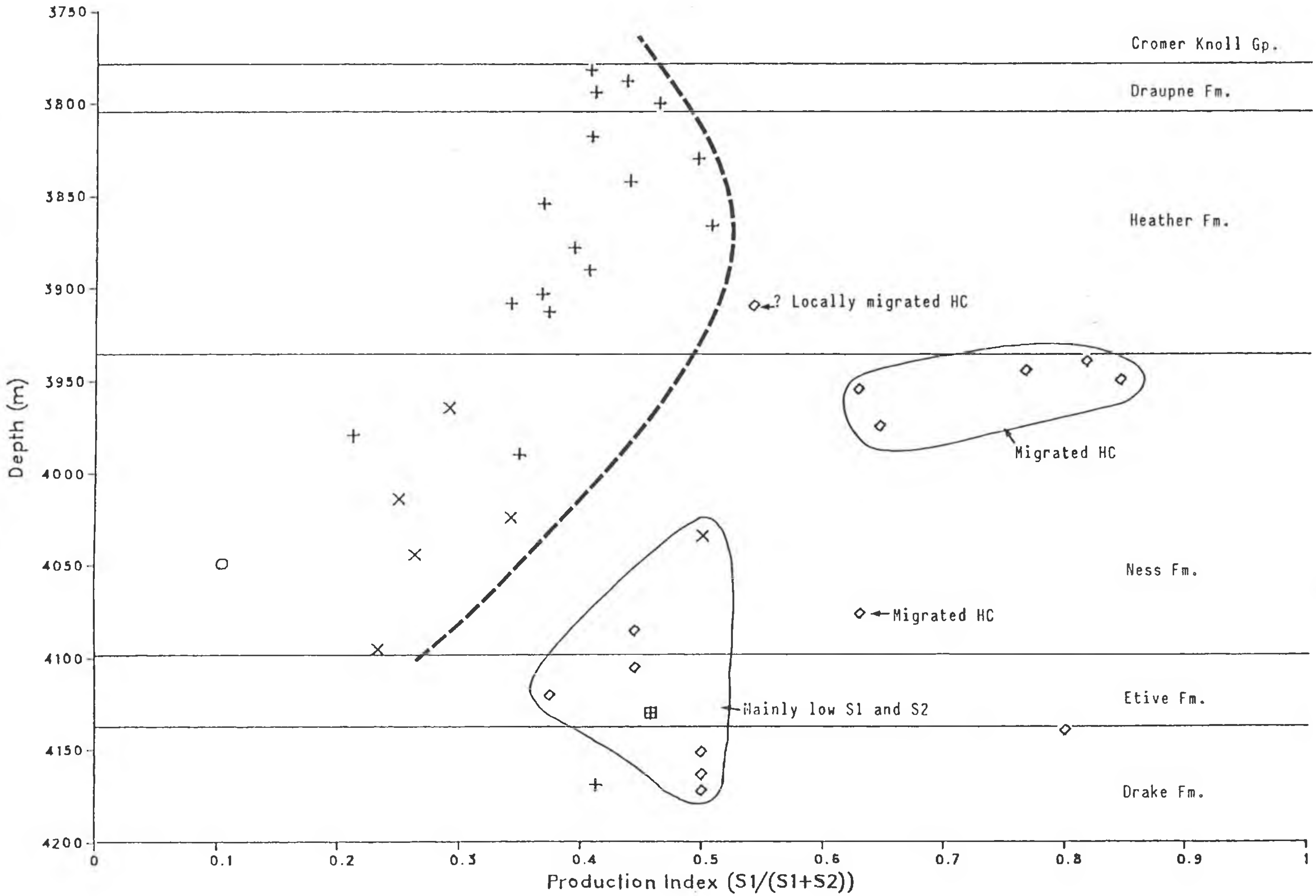


Figure: 2

Production Index Data for Well NOCS 30/2-2

Client: VARIOUS



GEOLAB NOR

GEOLAB NOR

Figure: 3

Client: VARIOUS

Tmax Data for Well NOCS 30/2-2

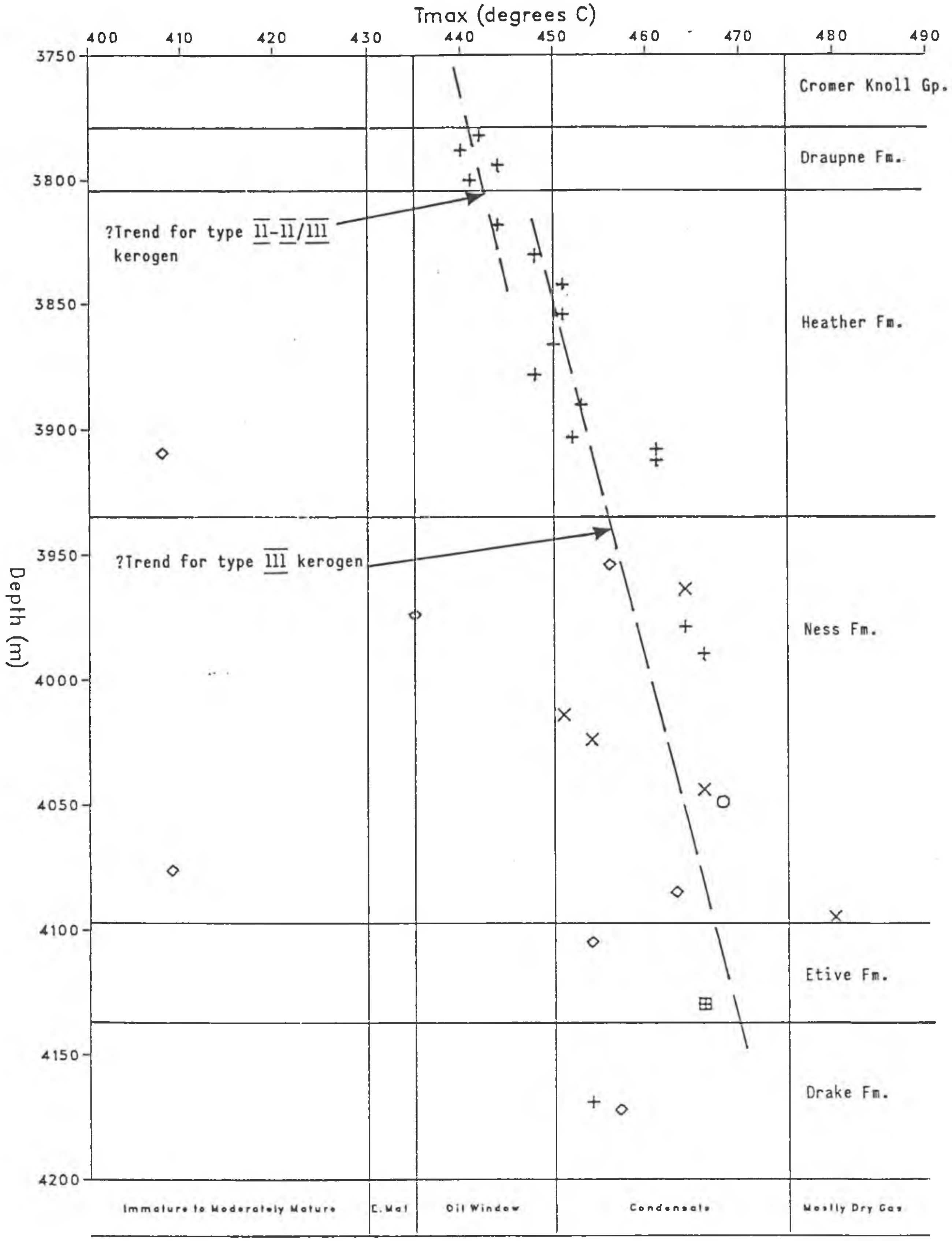
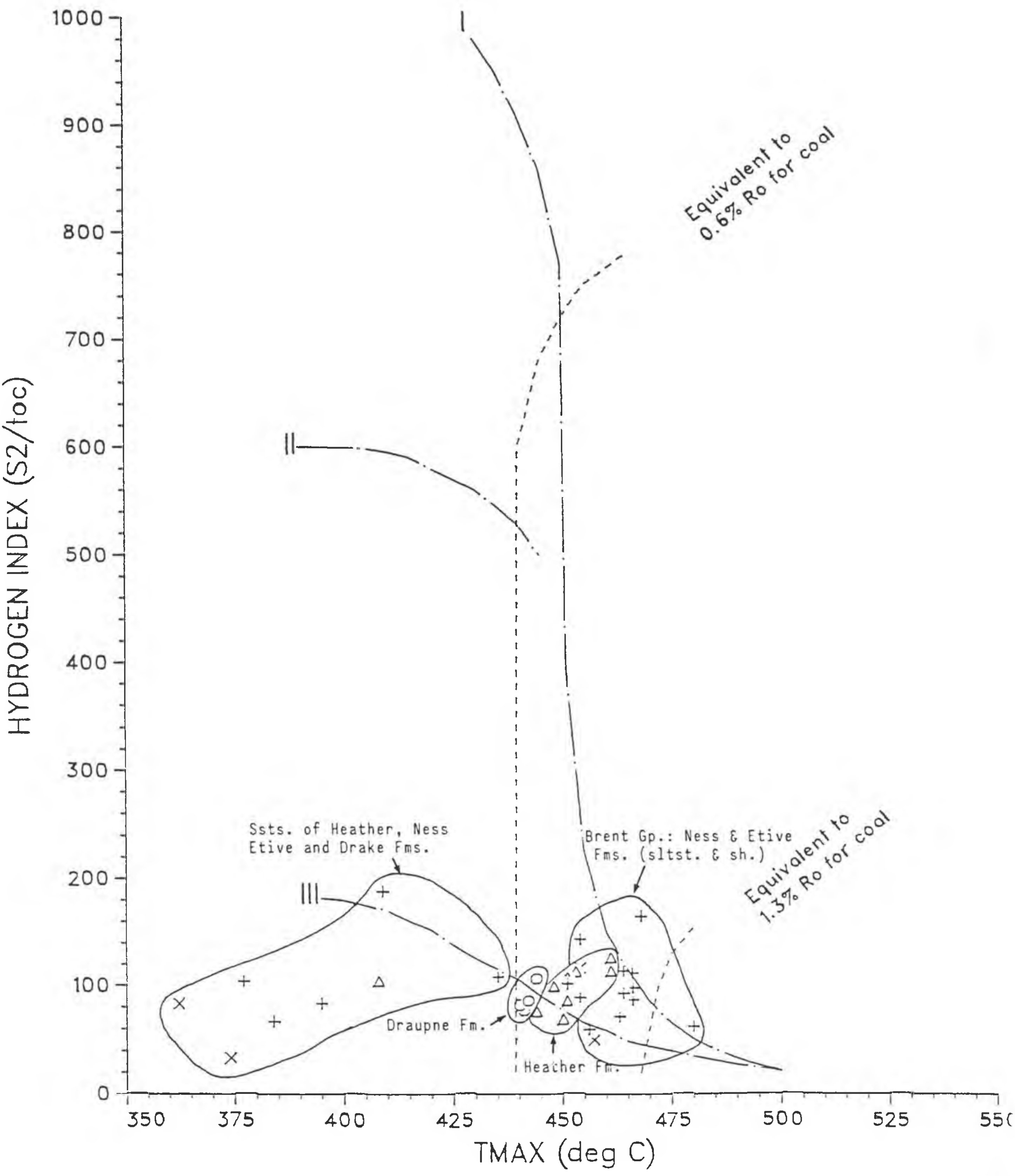


Figure 4 : Hydrogen Index v.s. Tmax values
Well NOCS 30/2-2



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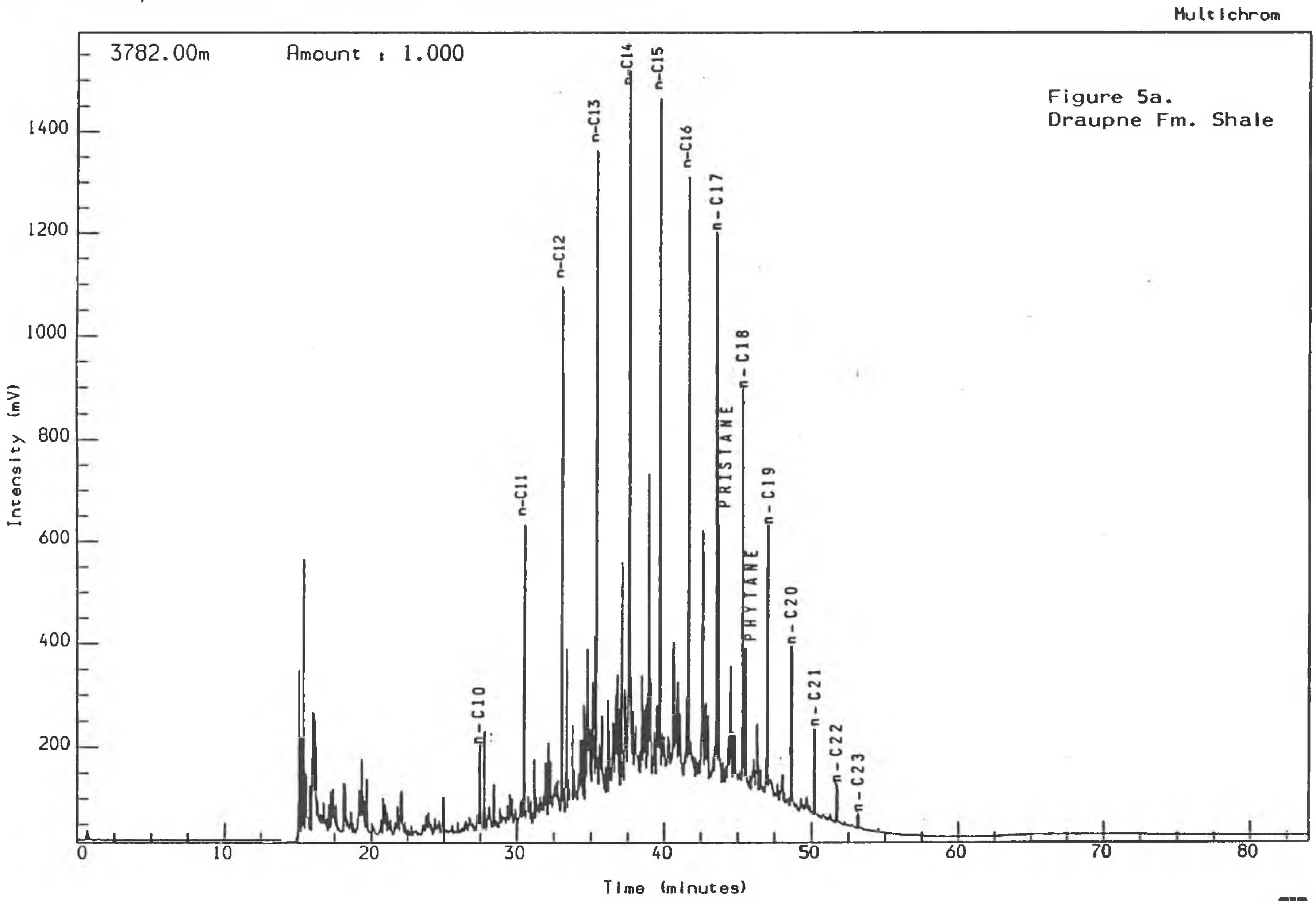

WELL NOCS 30/2-2 3782.00m cut Reported on 16-APR-1991 at 13:34

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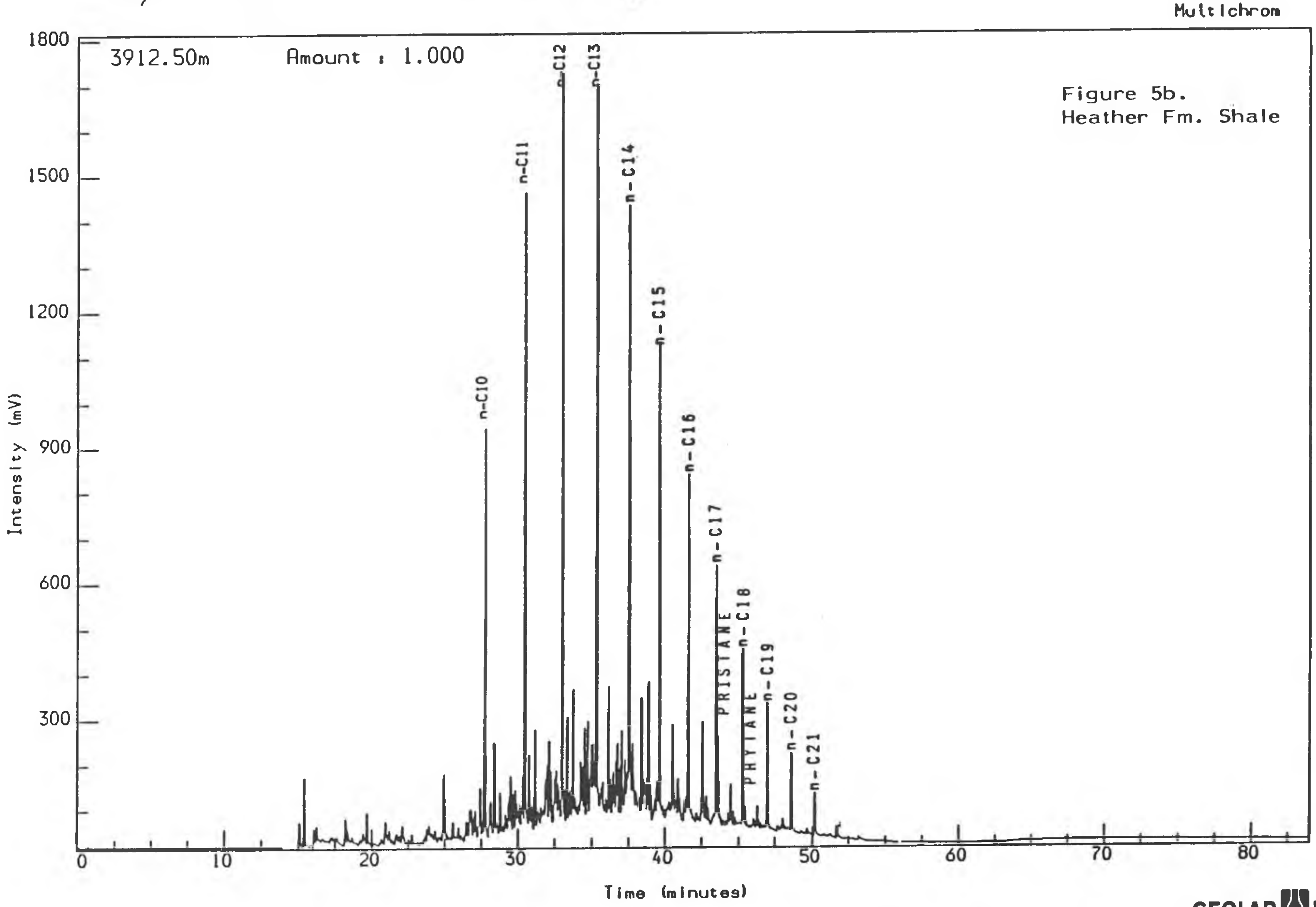
Sh/Clst: drk gy to brn blk

GEOLAB NOR

Analysis Name : [522006] 26 PF09A,6,1.



GEOLAB NOR

WELL NOCS 30/2-2 3912.50m ccp

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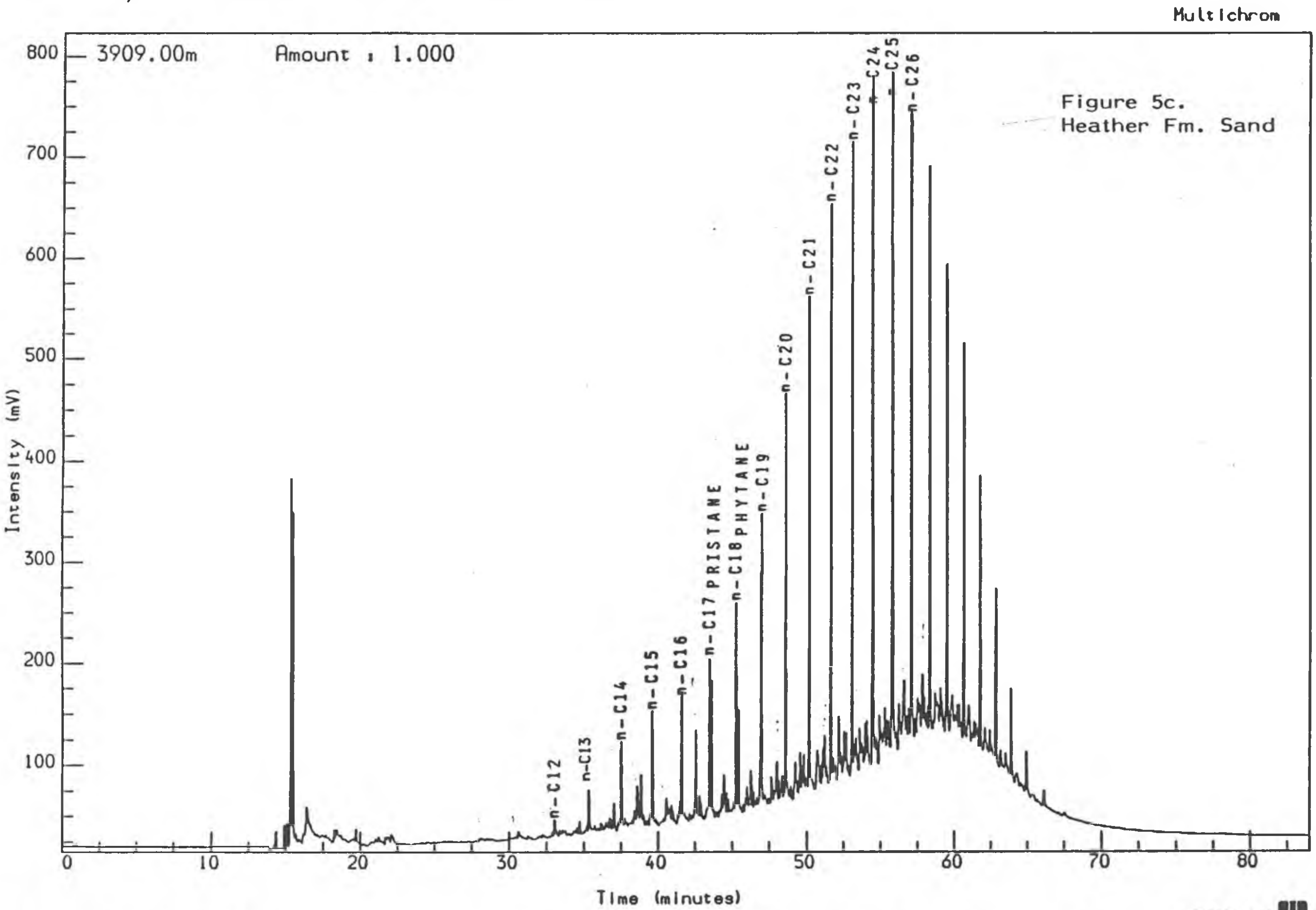
Reported on 16-APR-1991 at 13:40

Analysis Name : [522006] 26 PF09A,5,1.



GEOLAB NOR

WELL NOCS 30/2-2 3909.00m cut Reported on 16-APR-1991 at 13:40
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S/Sst: lt gy to lt brn gy

Analysis Name : [522006] 26 PF0900031,1,1.

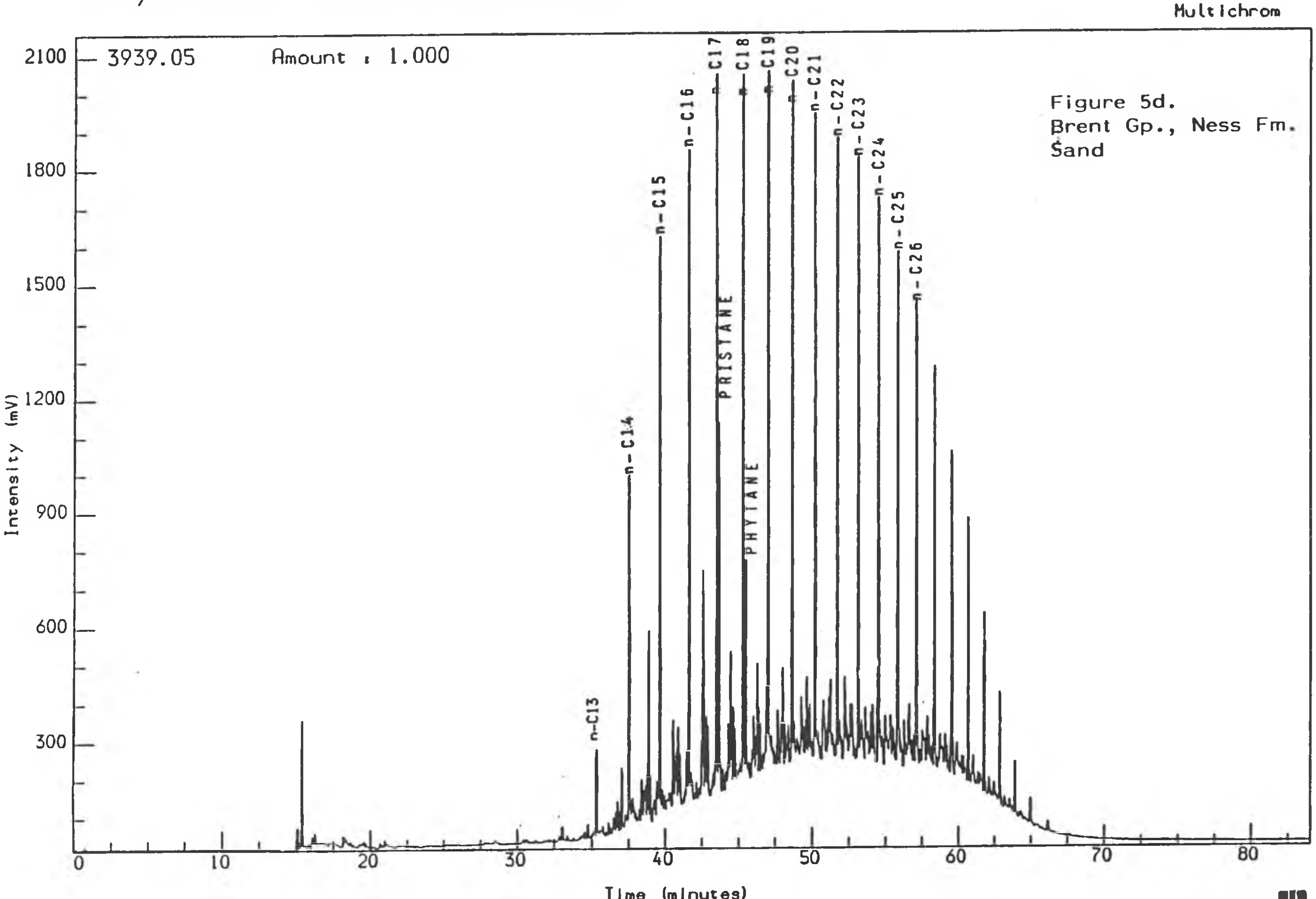


Figure 5d.
Brent Gp., Ness Fm.
Sand

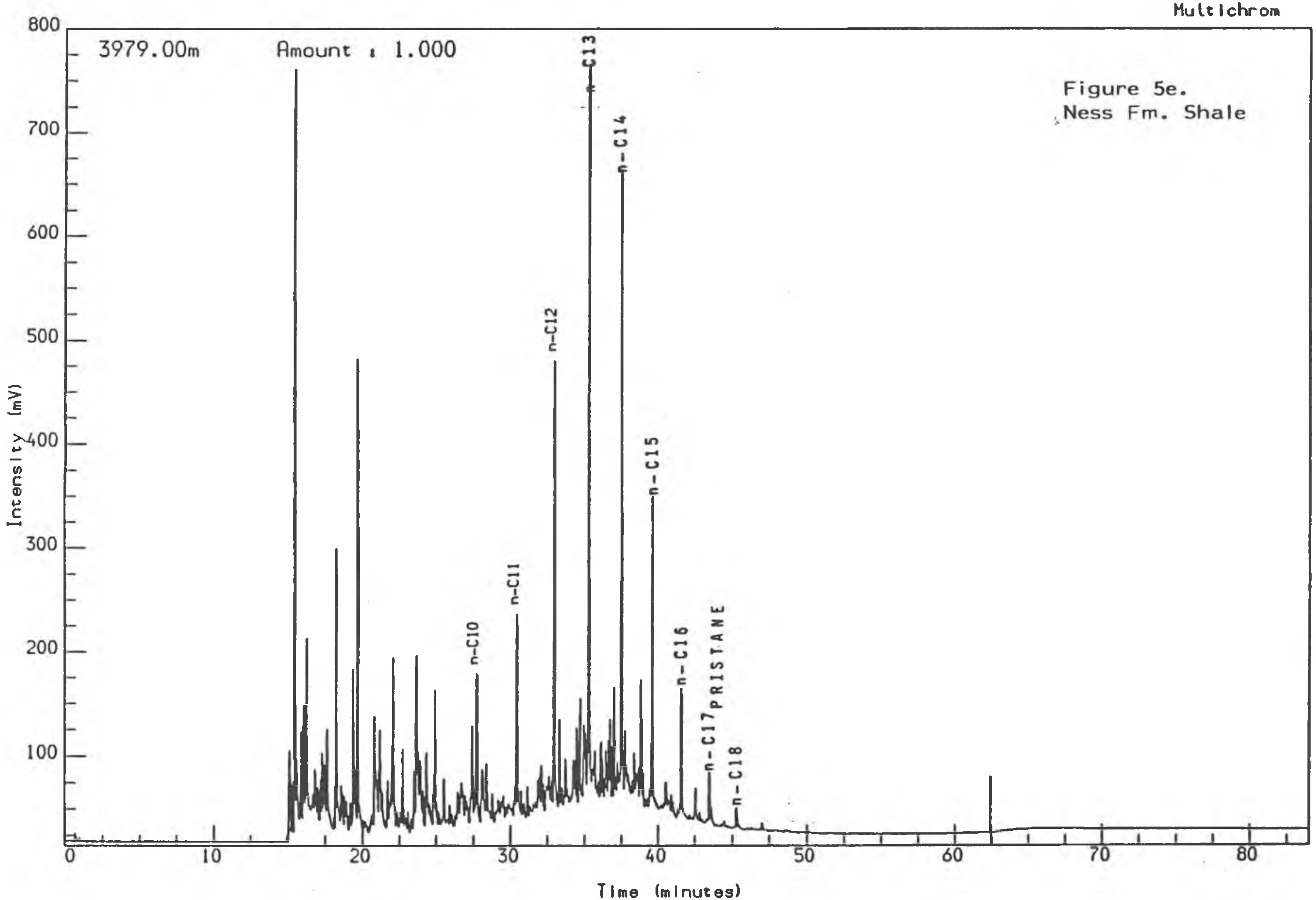
GEOLAB NOR

WELL NOCS 30/2-2 3939.05m ccp
Reported on 16-APR-1991 at 13:41

THERMAL EXTRACTION GC (S1)

S/Sst: lt gy to lt brn ... lt brn gy

Analysis Name : [522006] 26 PF09B,1,1.



WELL NOCS 30/2-2 3979.00m ccp Reported on 16-APR-1991 at 13:44

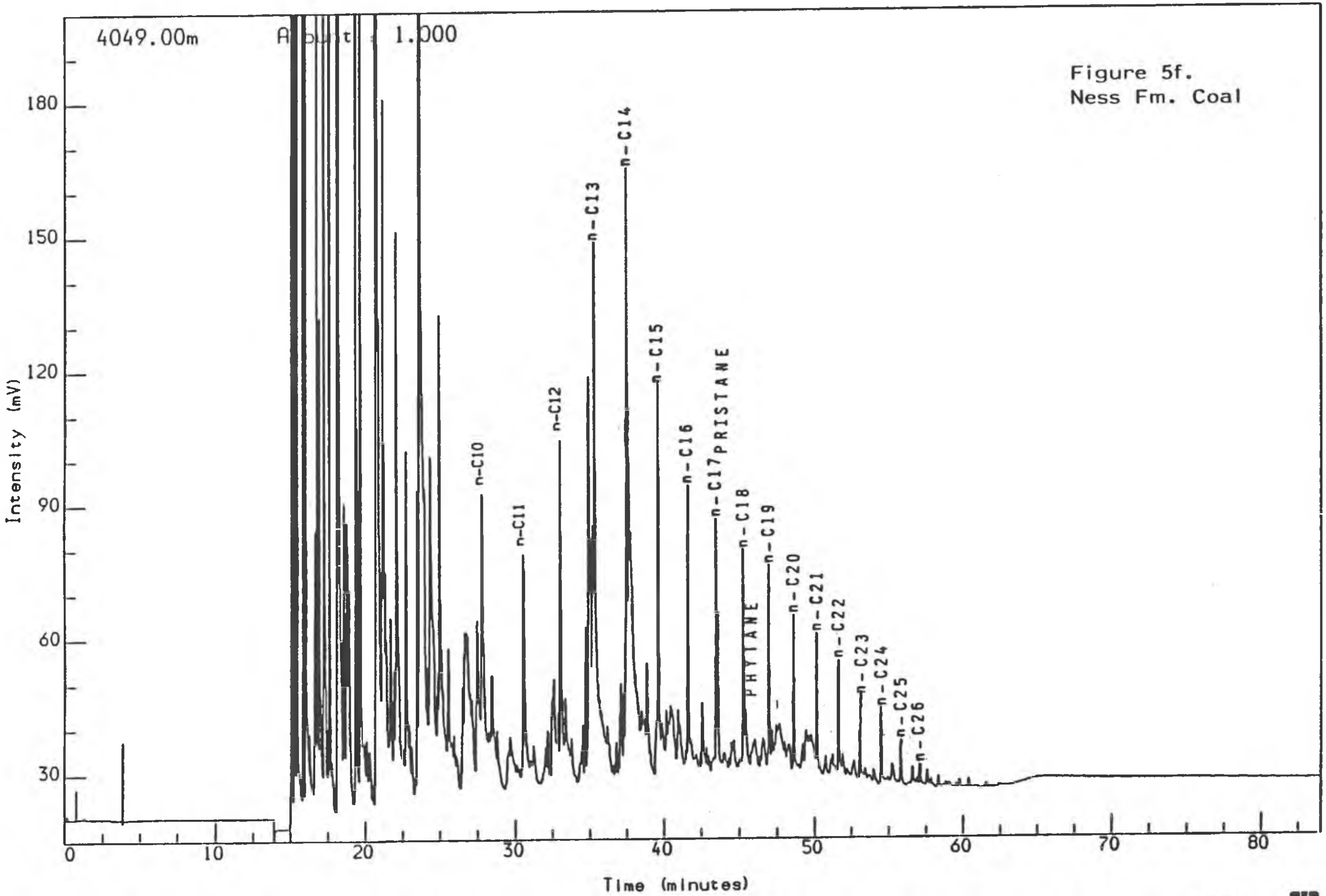
THERMAL EXTRACTION GC (S1)

Sh/Clst: dsk brn to brn gy

GEOLAB NOR

Analysis Name : [522006] 26 PF09B,3,1.

Multichrom



WELL NOCS 30/2-2 4049.00m ccp

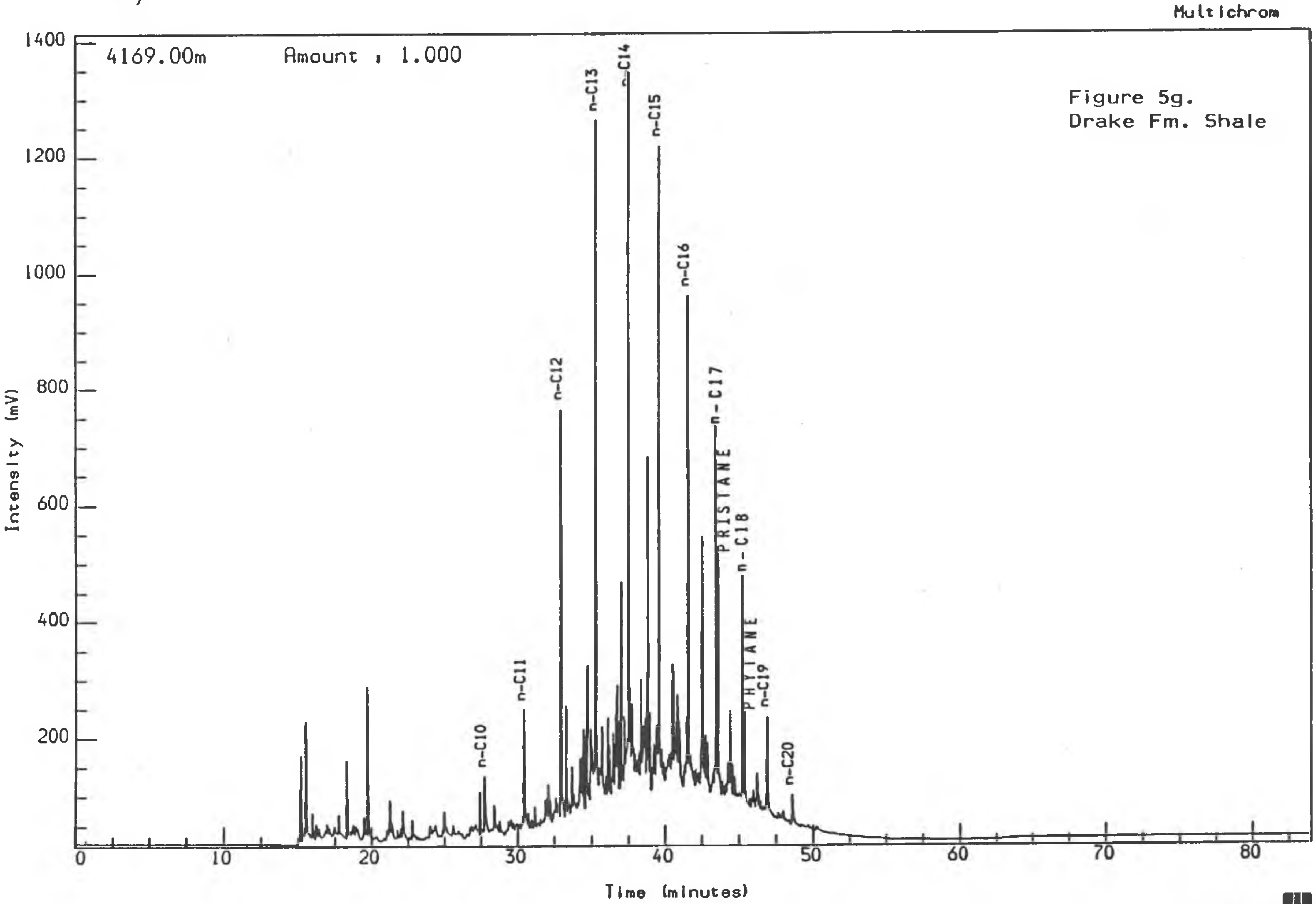
THERMAL EXTRACTION GC (F1)

Coal: blk

Reported on 16-APR-1991 at 13:46

GEOLAB NOR

Analysis Name : [522006] 26 PF0902092,1,1.



WELL NOCS 30/2-2 4169.00m cut

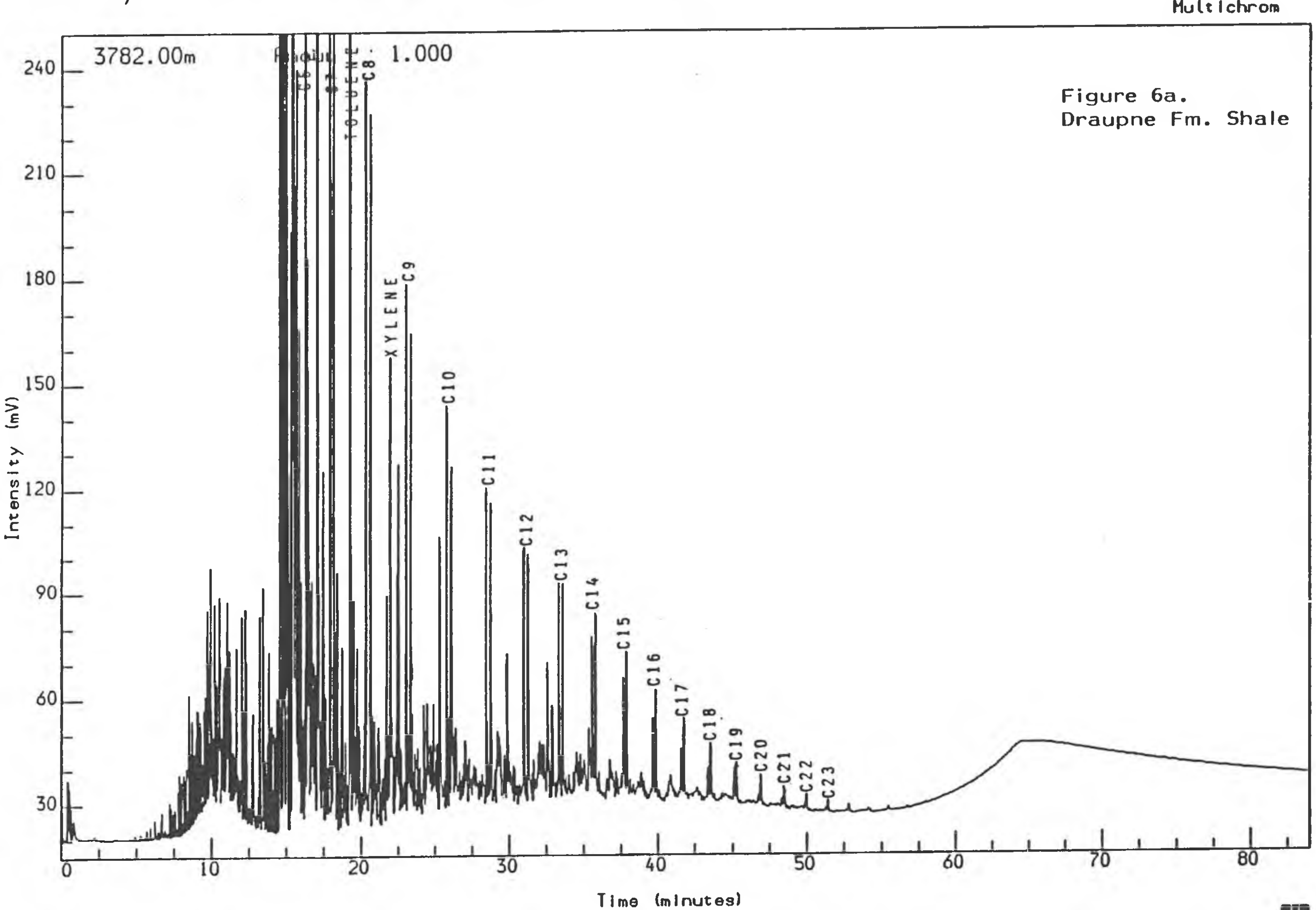
THERMAL EXTRACTION GC (S1)

Sh/Clst: m gy to drk gy

Reported on 17-APR-1991 at 14:59

GEOLAB NOR

Analysis Name : [522006] 25 PF0901771,1,1.



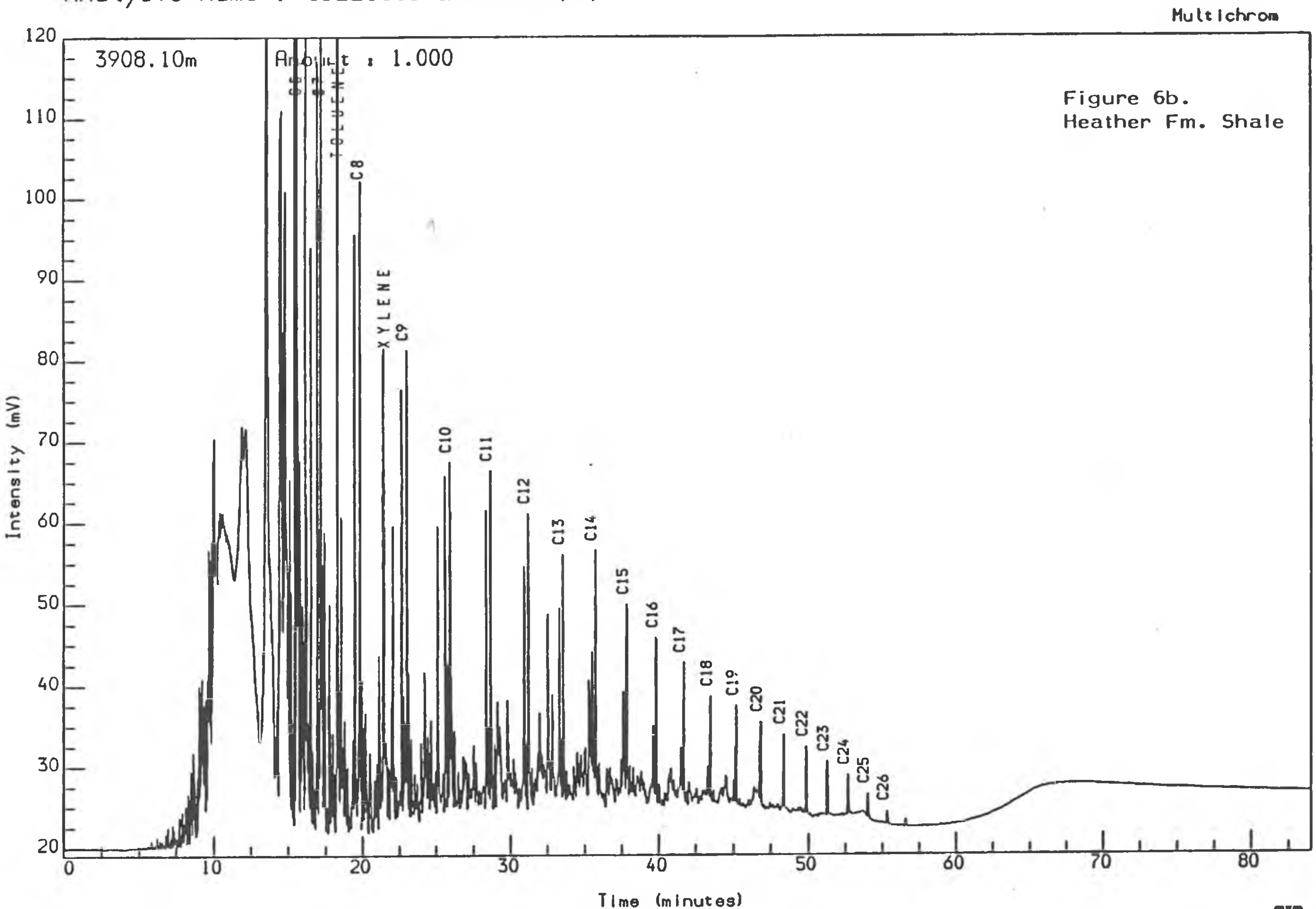
WELL NOCS 30/2-2 3782.00m cut Reported on 16-APR-1991 at 12:23

GEOLAB NOR

PYROLYSIS GC (S2)

Sh/Clst: drk gy to brn blk

Analysis Name : [522006] 25 PF09A.4.1.



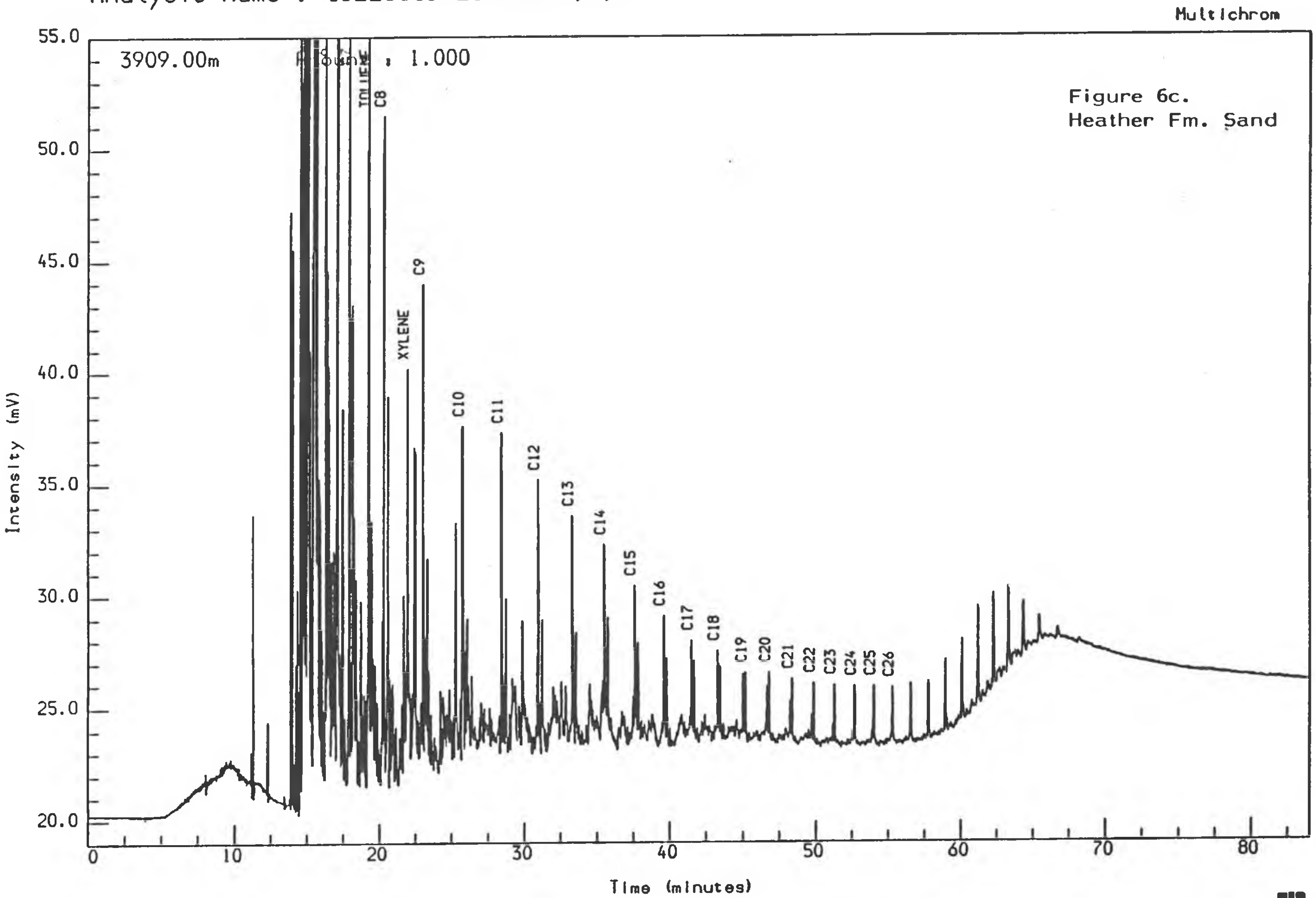
GEOLAB NOR

WELL NOCS 30/2-2 3908.10m ccp Reported on 19-APR-1991 at 08:35

PYROLYSIS GC (S2)

Sh/Clst: drk gy to brn blk

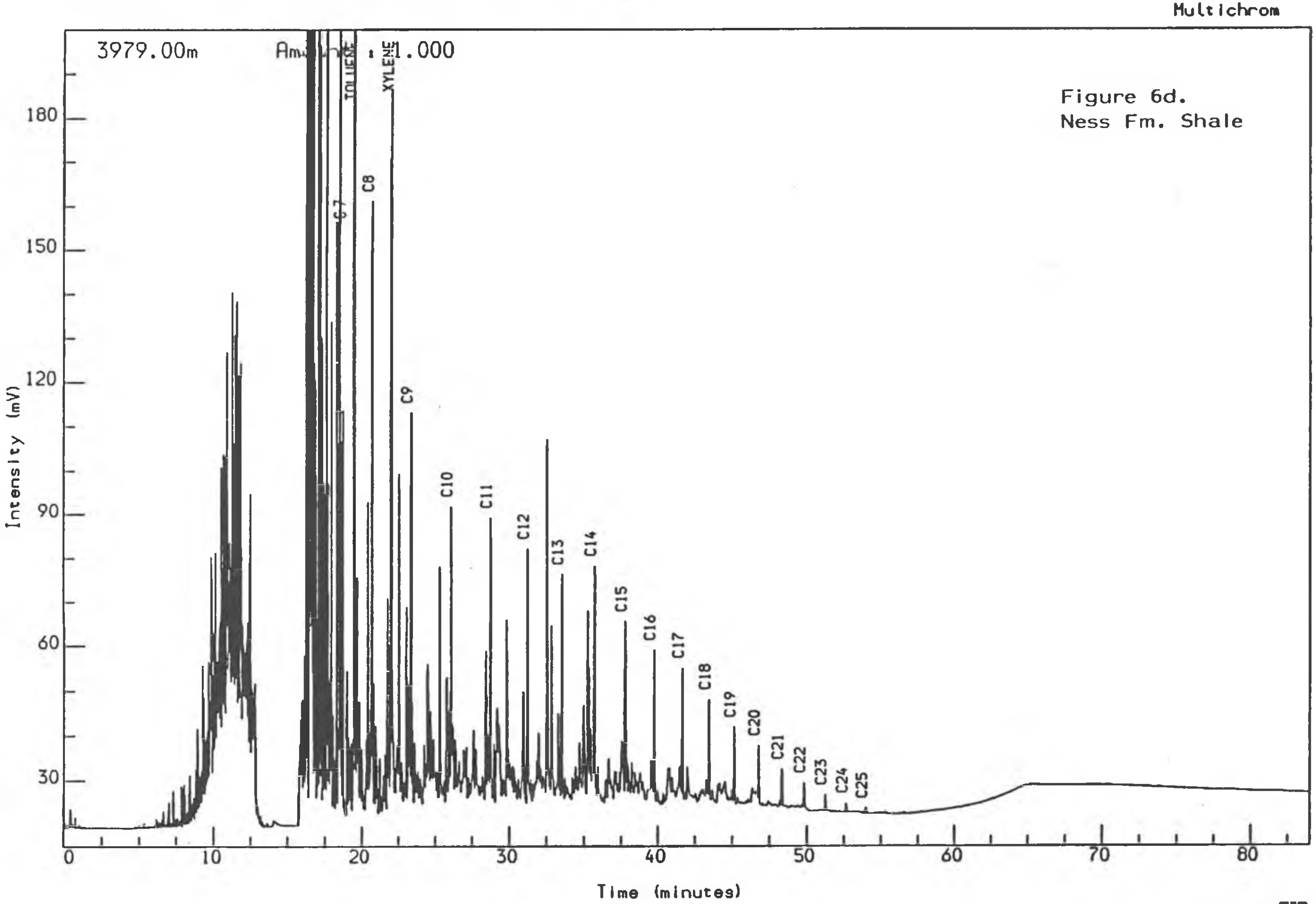
Analysis Name : [522006] 25 PF09A,5,1.



GEOLAB NOR

WELL NOCS 30/2-2 3909.00m cut Reported on 19-APR-1991 at 10:30
PYROLYSIS GC (S2)
S/Sst: lt gy to lt brn gy

Analysis Name : [522006] 25 PF09B,1,1.



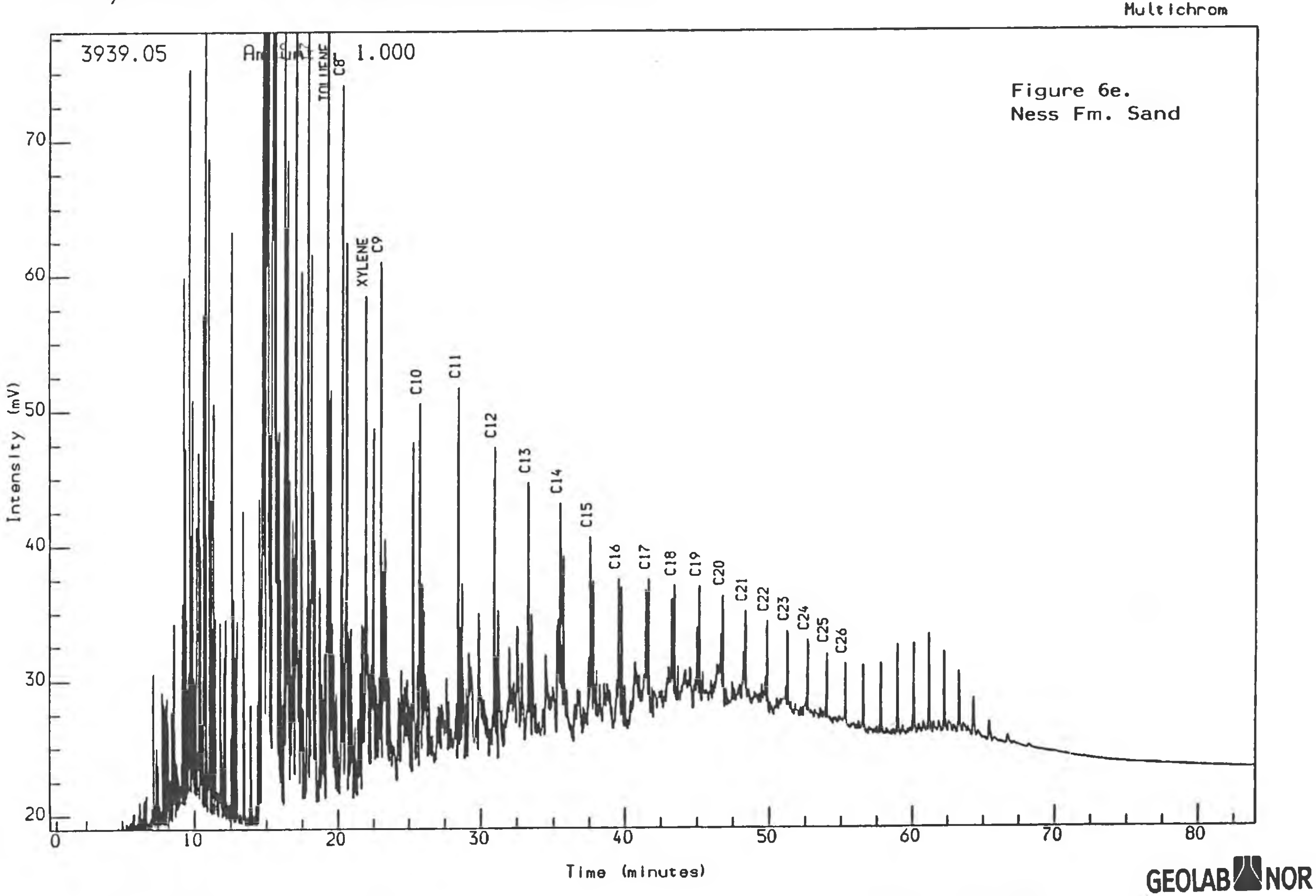
GEOLAB NOR

WELL NOCS 30/2-2 3979.00m ccp Reported on 19-APR-1991 at 08:49

PYROLYSIS GC (S2)

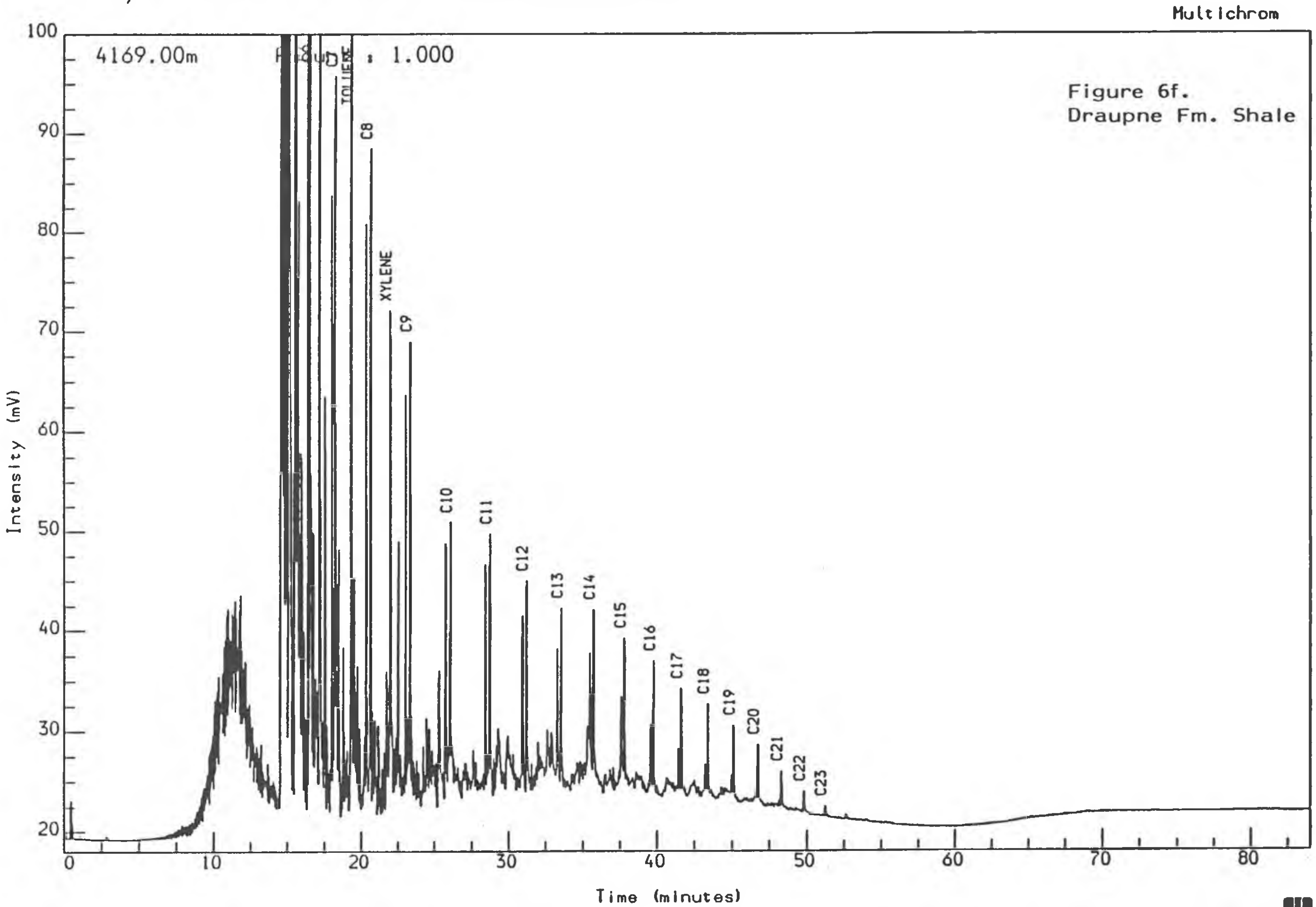
Sh/Clst: dsk brn to brn gy

Analysis Name : [522006] 25 PF0900031.1.1.



WELL NOCS 30/2-2 3939.05m ccp Reported on 19-APR-1991 at 10:28
PYROLYSIS GC (S2)
S/Sst: lt gy to lt brn to lt brn gy

Analysis Name : [522006] 25 PF0902092,1,1.

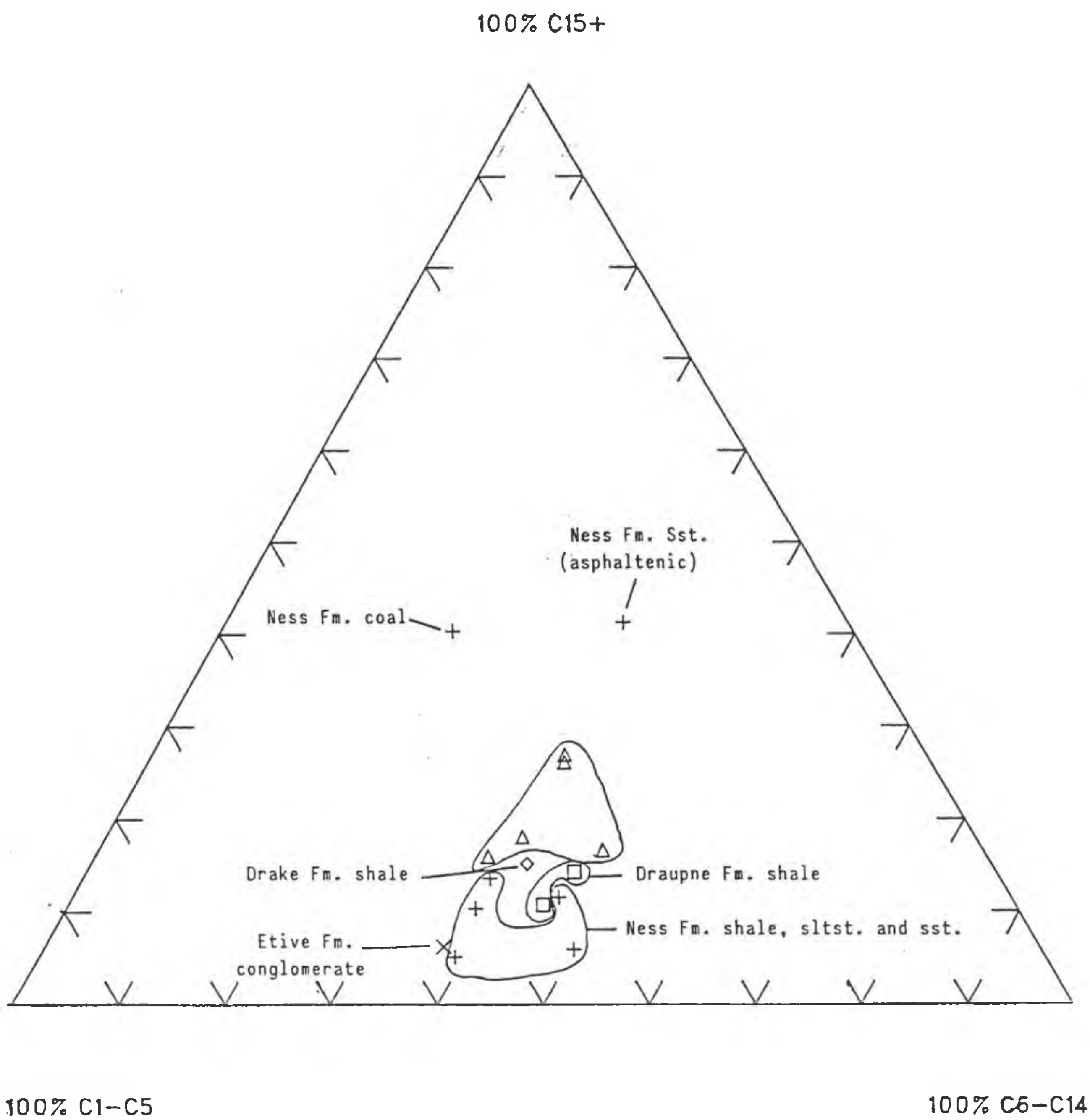


GEOLAB NOR

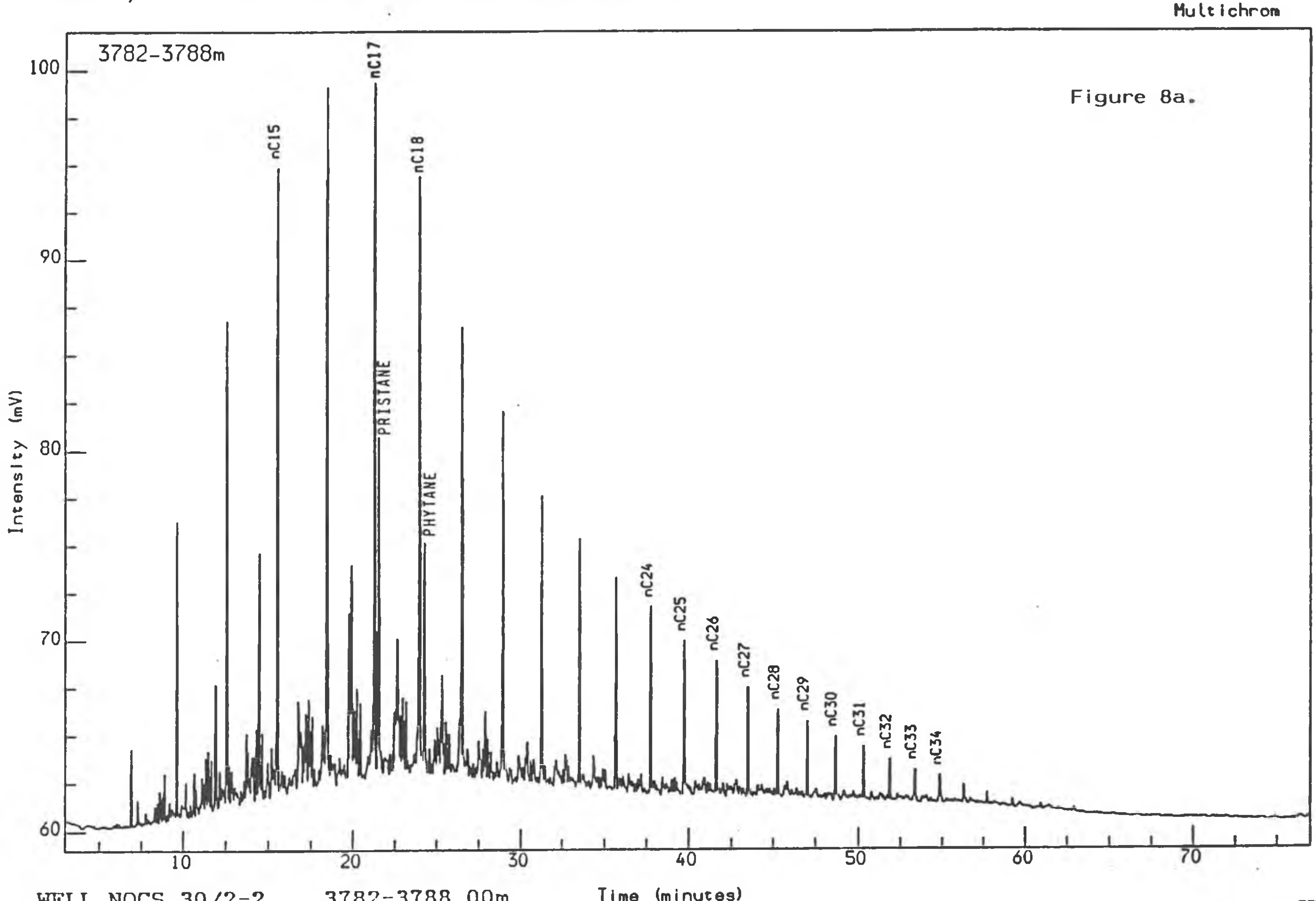
WELL NOCS 30/2-2 4169.00m cut Reported on 19-APR-1991 at 08:56
PYROLYSIS GC (S2)
Sh/Clst: m gy to drk gy

Figure 7 : Pyrolysis GC Composition

Well NOCS 30/2-2



Analysis Name : [522006] 11 SF0902100B.1.1.



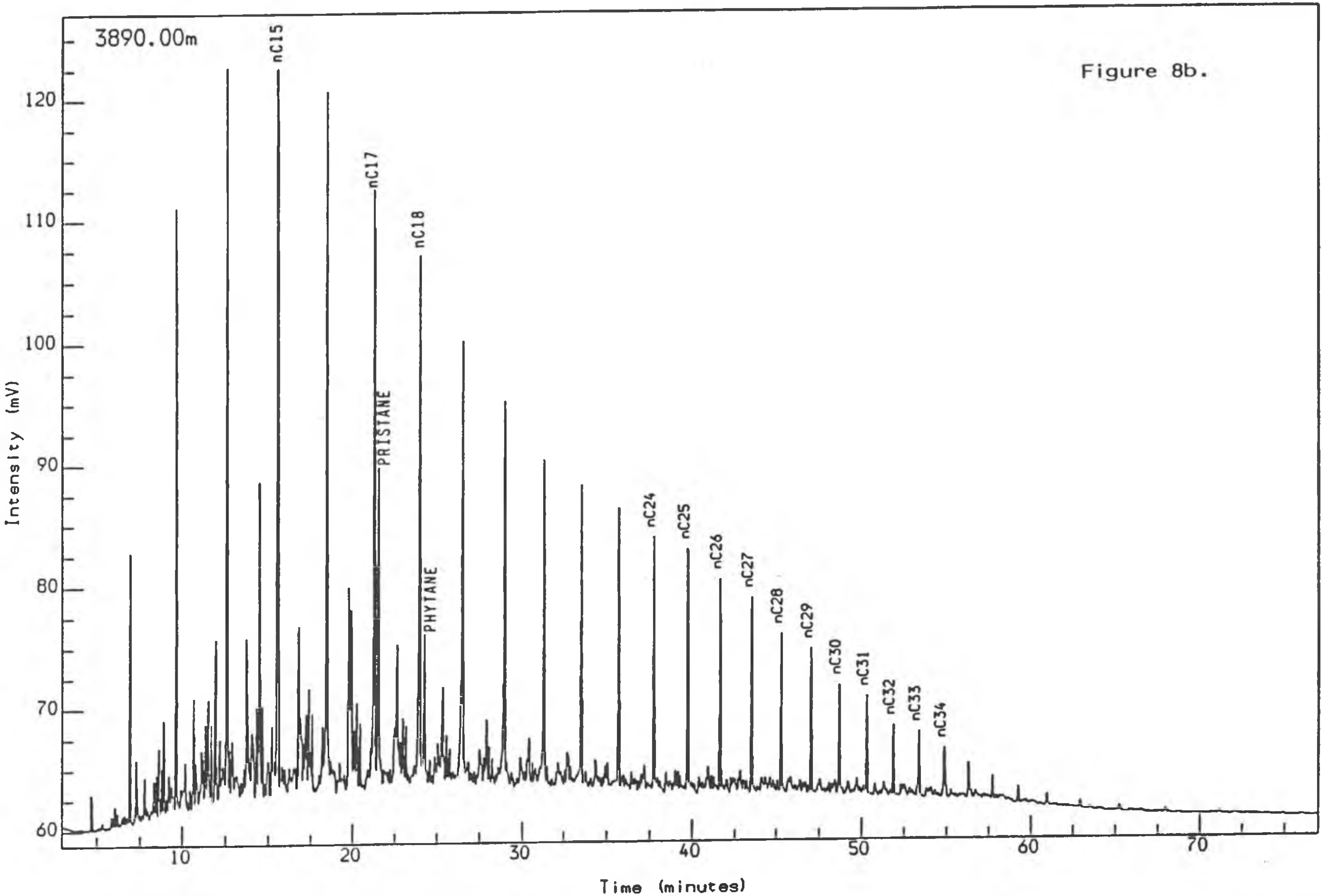
WELL NOCS 30/2-2 3782-3788.00m
SATURATED GC
Sh/Clst:drk gy to brn blk

Reported on 8-MAY-1991 at 13:30

GEOLAB NOR

Analysis Name : [522006] 11 SF0901951L.1.1.

Multichrom

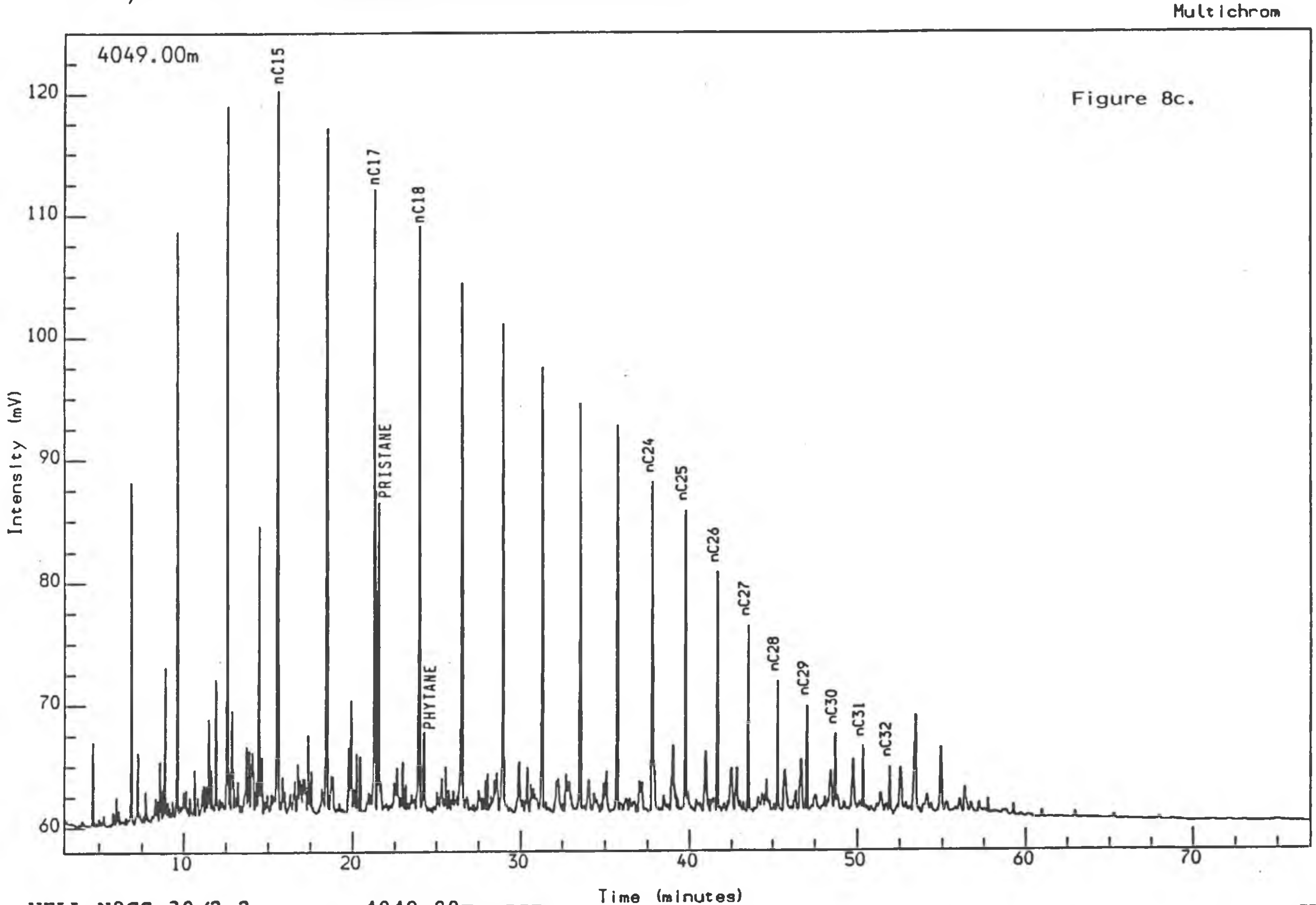


WELL NOCS 30/2-2 3890.00m cut
SATURATED GC
Sh/Clst: drk gy to brn blk

Reported on 3-MAY-1991 at 08:30

GEOLAB NOR

Analysis Name : [522006] 11 SF0900221L,1,1.

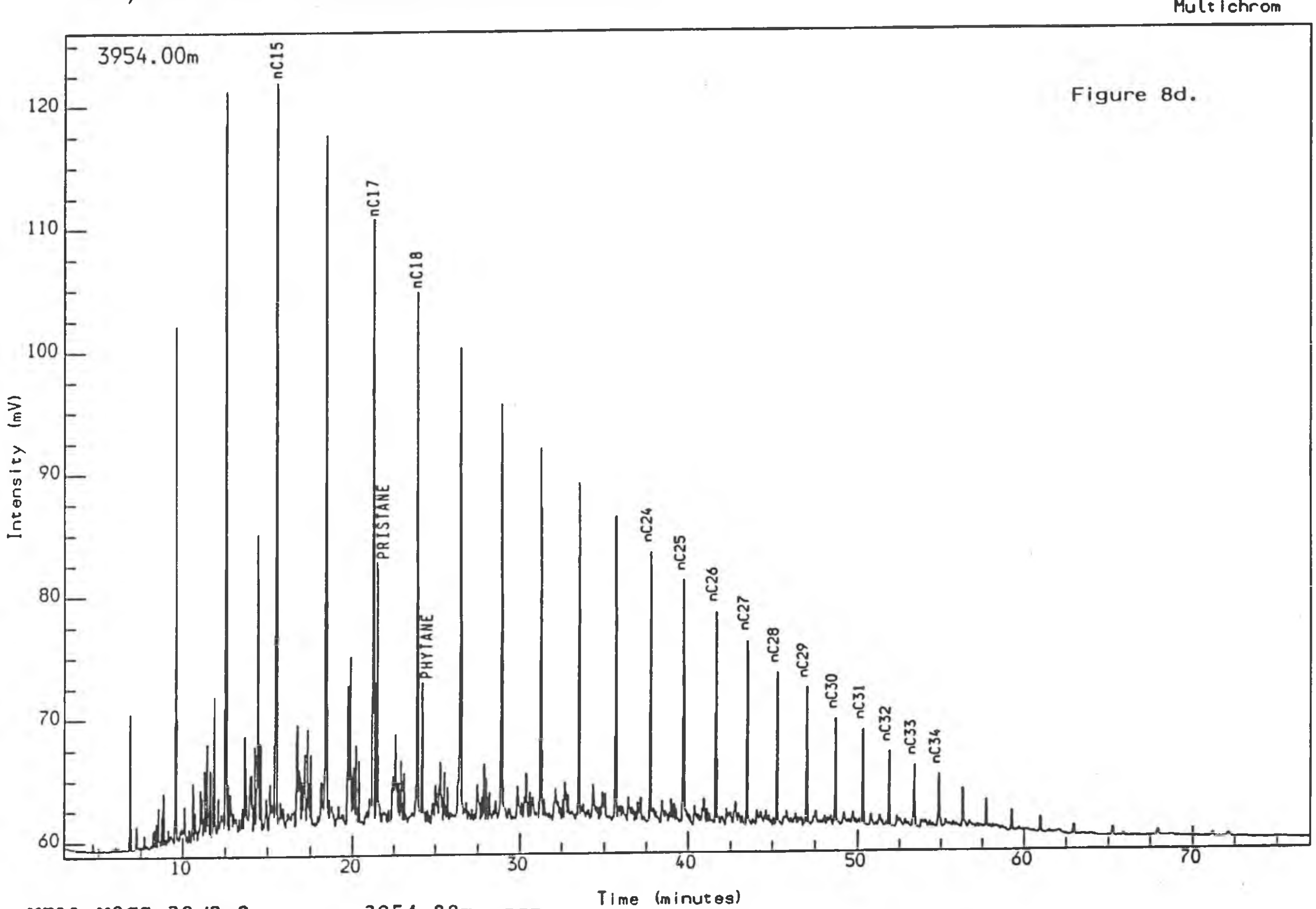


WELL NOCS 30/2-2 4049.00m ccp
SATURATED GC
Coal: blk

Reported on 8-MAY-1991 at 16:12

GEOLAB NOR

Analysis Name : [522006] 11 SF0900061L.1.1.

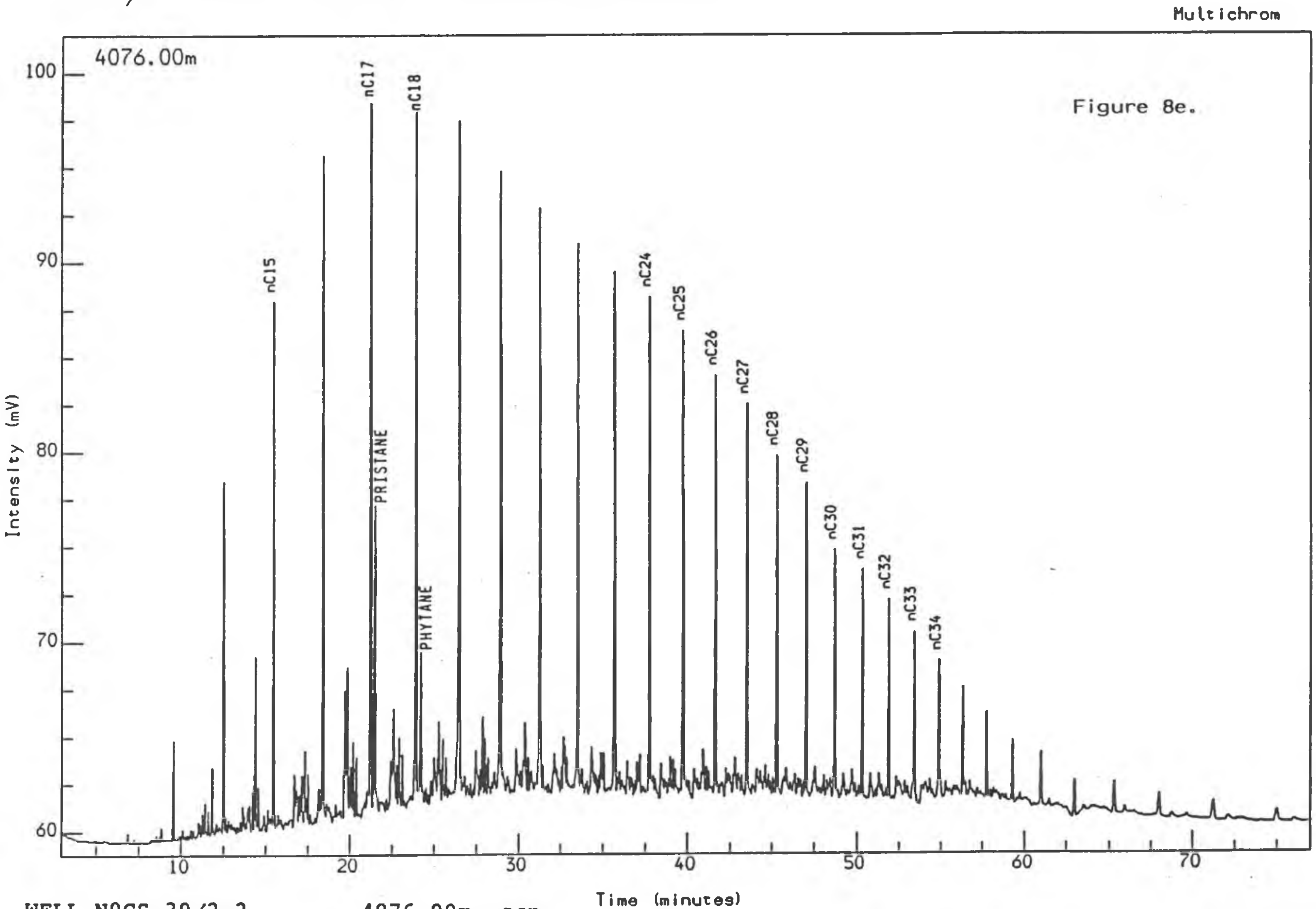


WELL NOCS 30/2-2 3954.00m ccp
SATURATED GC
S/Sst: lt gy to m gy to brn gy

Reported on 3-MAY-1991 at 09:53

GEOLAB NOR

Analysis Name : [522006] 11 SF0900241L.1.1.

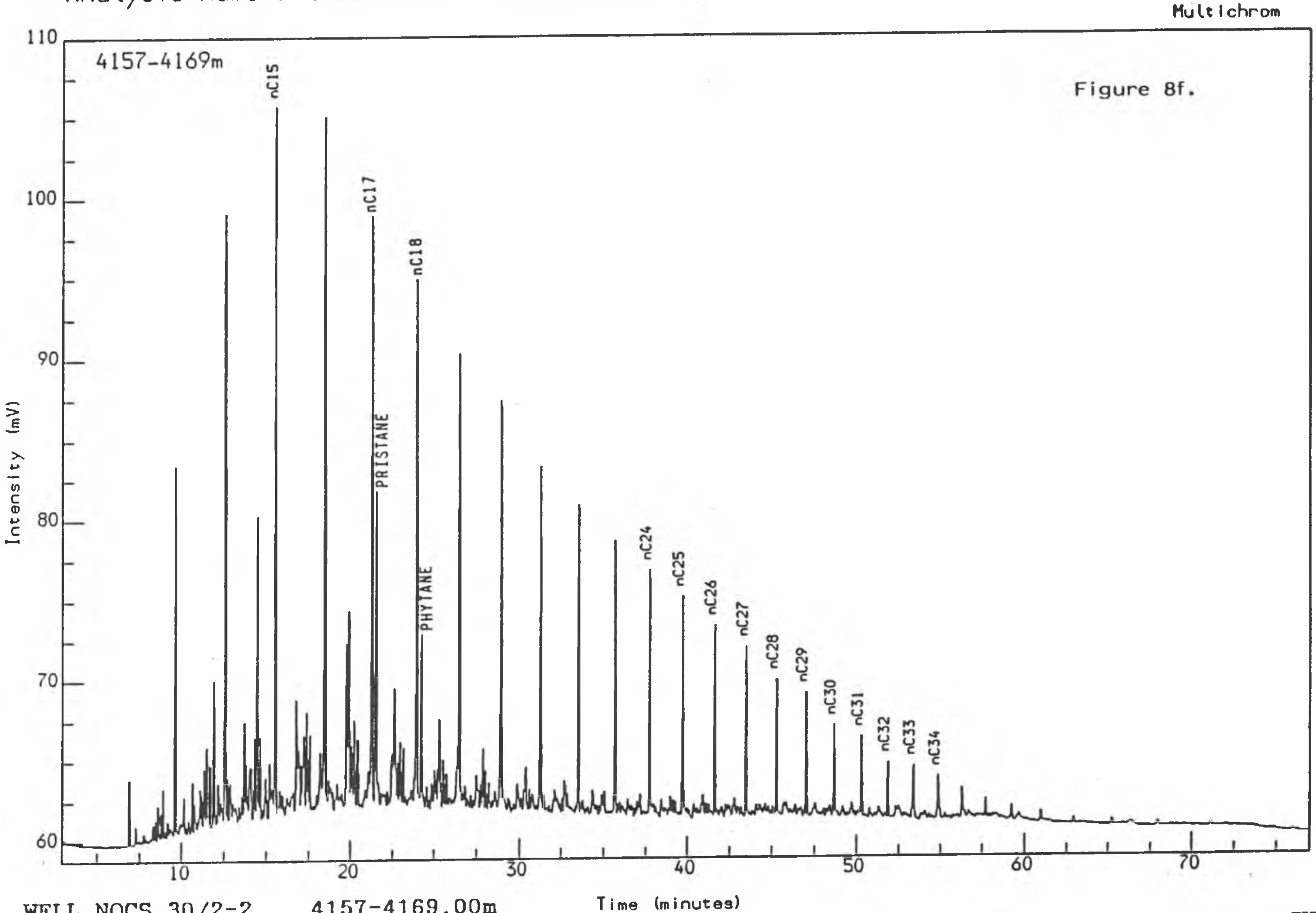


WELL NOCS 30/2-2 4076.00m ccp
SATURATED GC
S/Sst: lt gy to gy brn

Reported on 3-MAY-1991 at 12:59

GEOLAB NOR

Analysis Name : [522006] 11 SF0902150B.1.1.

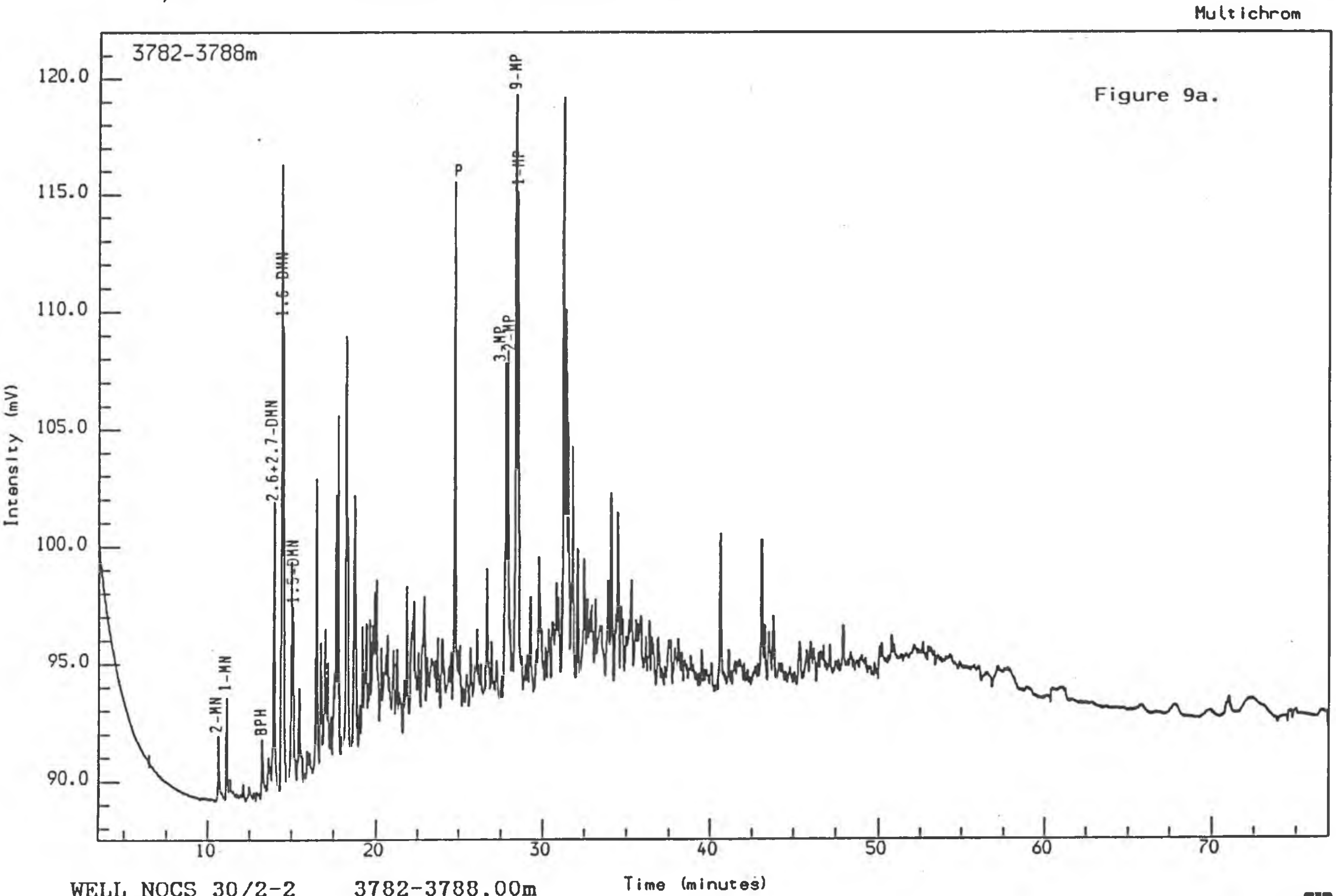


WELL NOCS 30/2-2 4157-4169.00m
SATURATED GC
Sh/Clst:m gy to drk gy

Reported on 3-MAY-1991 at 14:22

GEOLAB NOR

Analysis Name : [522006] 9 AF0902100B,1,1.

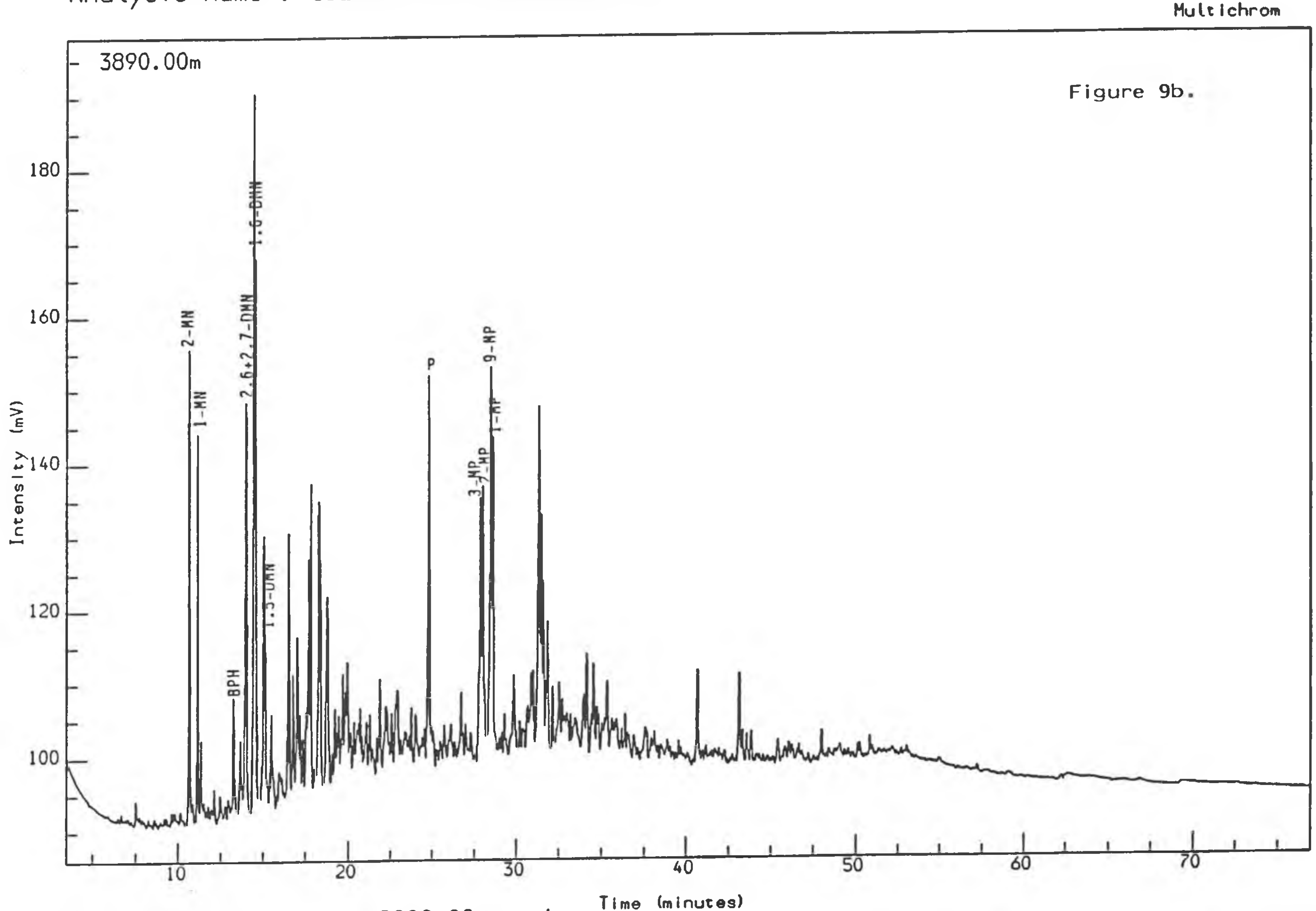


WELL NOCS 30/2-2 3782-3788.00m
AROMATIC GC (FID)
Sh/Clst:drk gy to brn blk

Reported on 8-MAY-1991 at 16:05

GEOLAB NOR

Analysis Name : [522006] 9 AF0901951L,1,1.



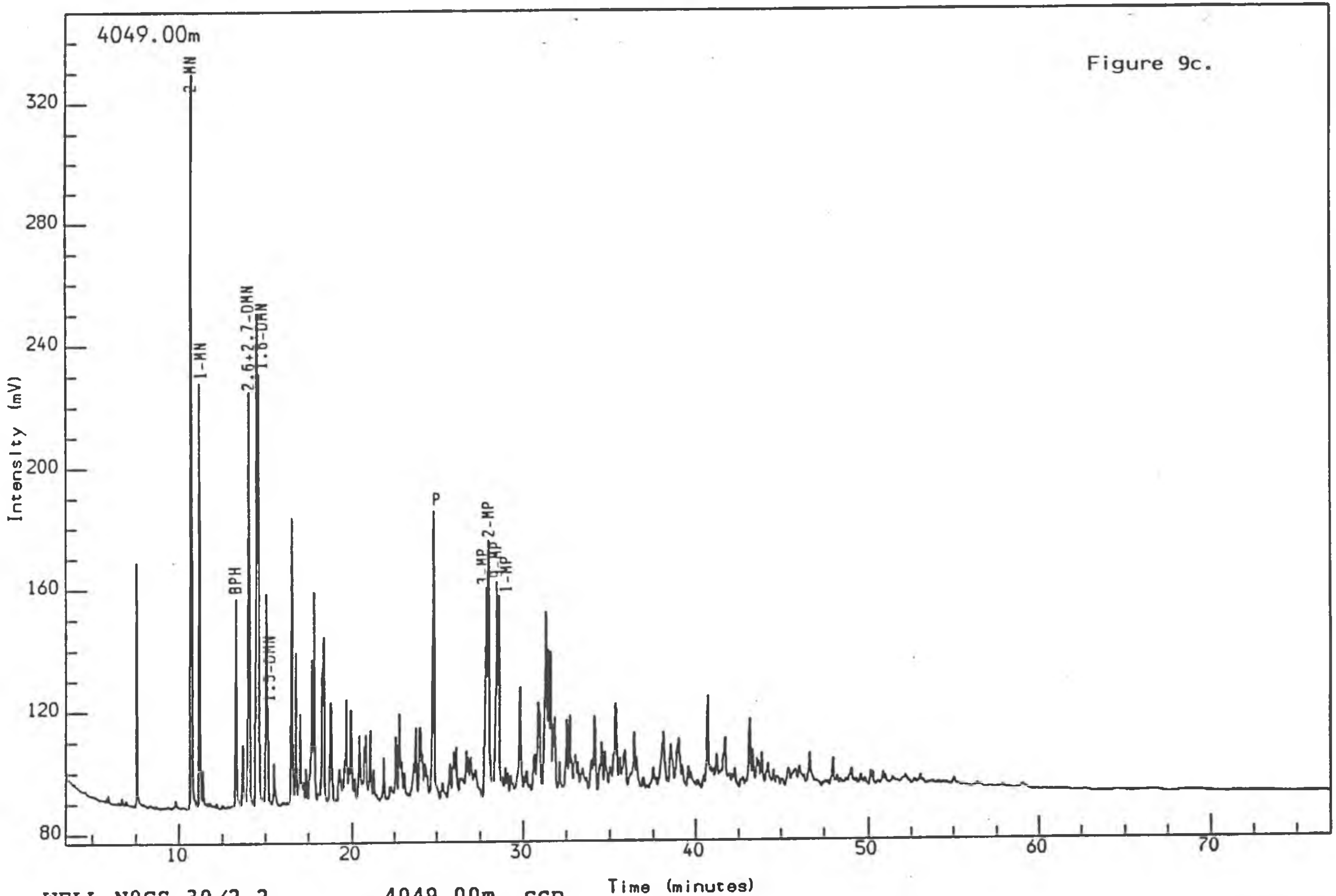
WELL NOCS 30/2-2 3890.00m cut
AROMATIC GC (FID)
Sh/Clst: drk gy to brn blk

Reported on 3-MAY-1991 at 09:02

GEOLAB NOR

Analysis Name : [522006] 9 AF0900221L.1.1.

Multichrom



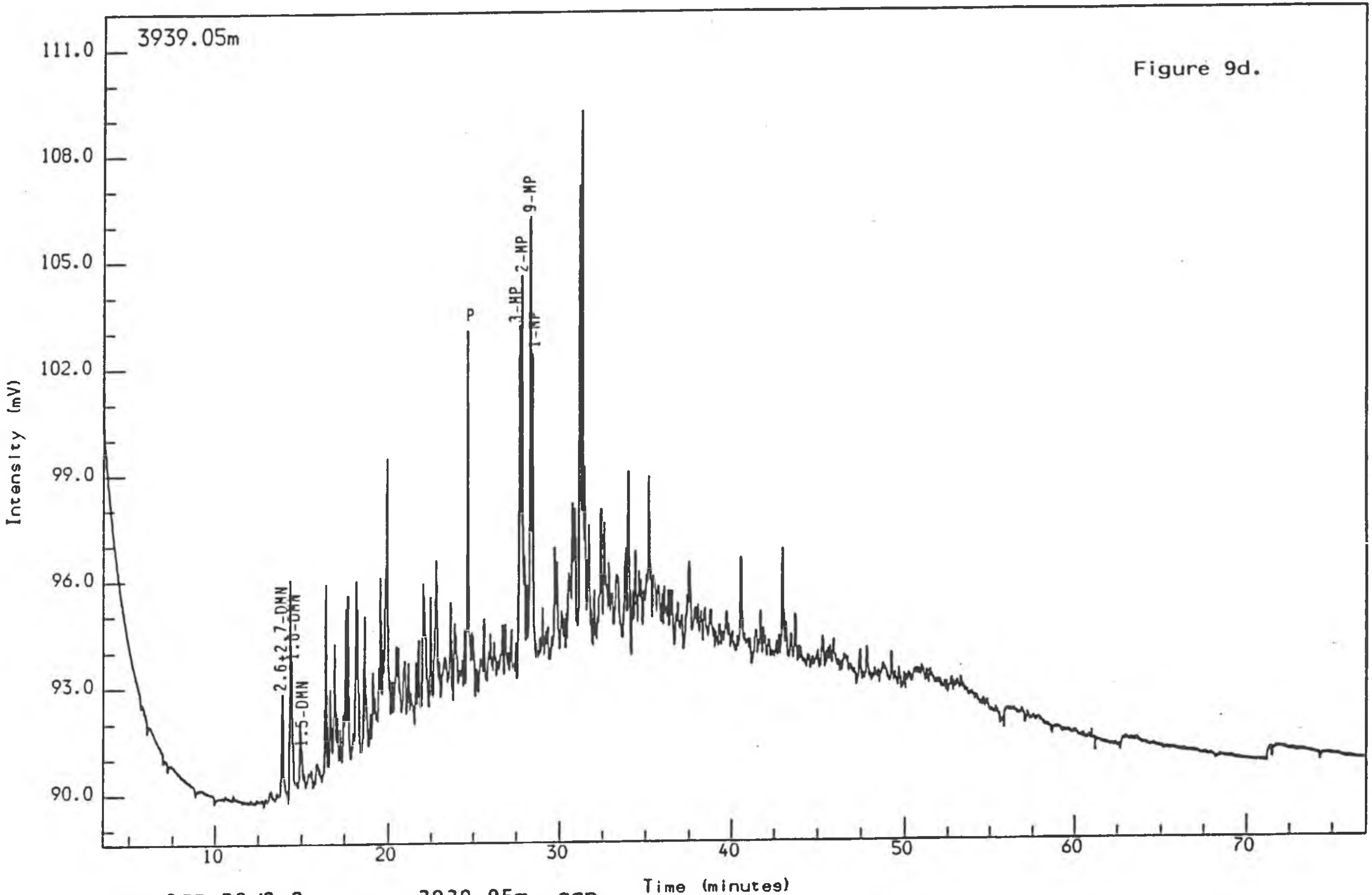
WELL NOCS 30/2-2 4049.00m ccp
AROMATIC GC (FID)
Coal: blk

Reported on 8-MAY-1991 at 14:34

GEOLAB NOR

Analysis Name : [522006] 9 AF0900031LB.1.1.

Multichrom

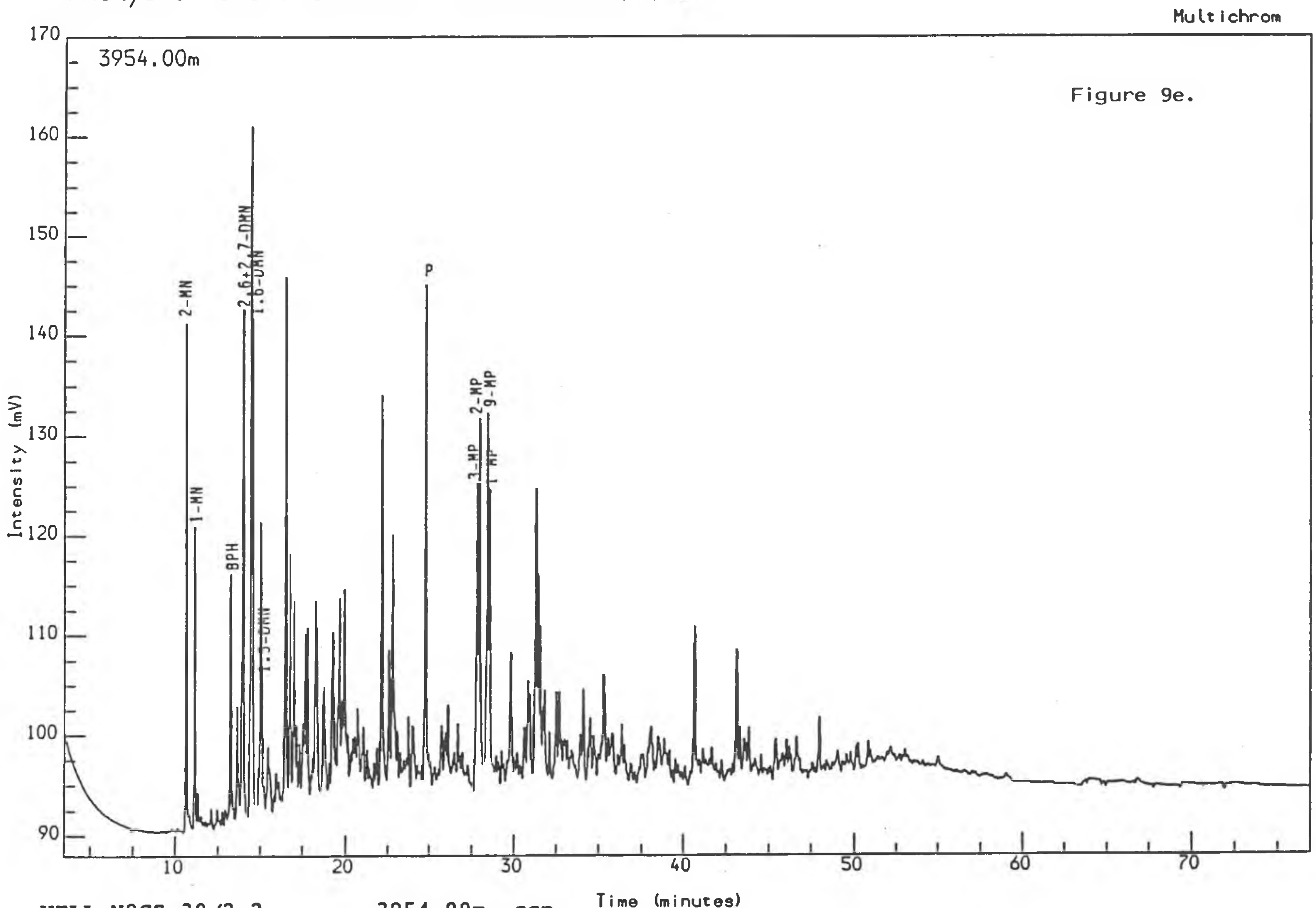


WELL NOCS 30/2-2 3939.05m ccp
AROMATIC GC (FID)
S/Sst: lt gy to lt brn to lt brn gy

Reported on 24-MAY-1991 at 15:53

GEOLAB NOR

Analysis Name : [522006] 9 AF0900061L,1,1.

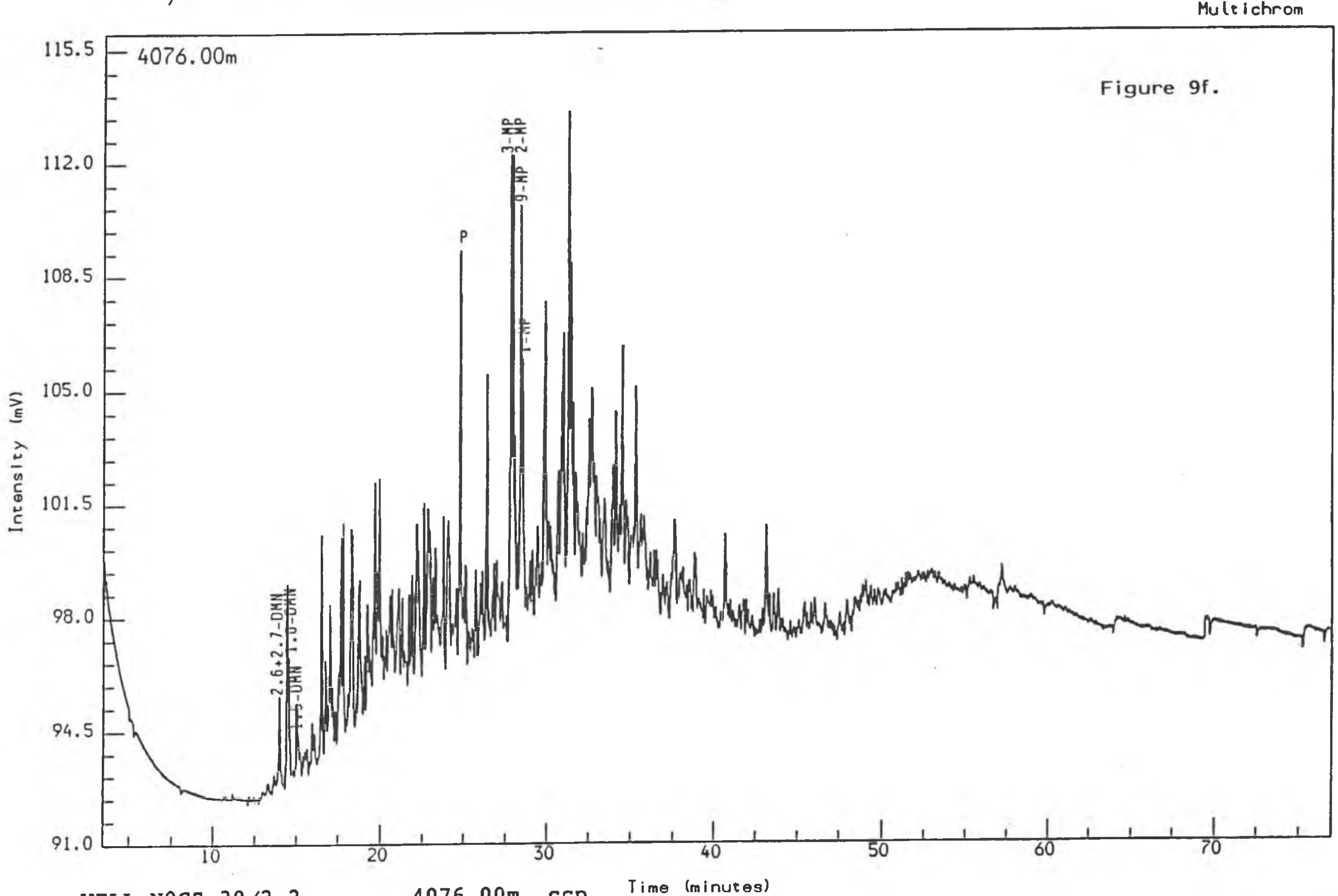


WELL NOCS 30/2-2 3954.00m ccp
AROMATIC GC (FID)
S/Sst: lt gy to m gy to brn gy

Reported on 3-MAY-1991 at 11:23

GEOLAB NOR

Analysis Name : [522006] 9 AF0900241L,1,1.

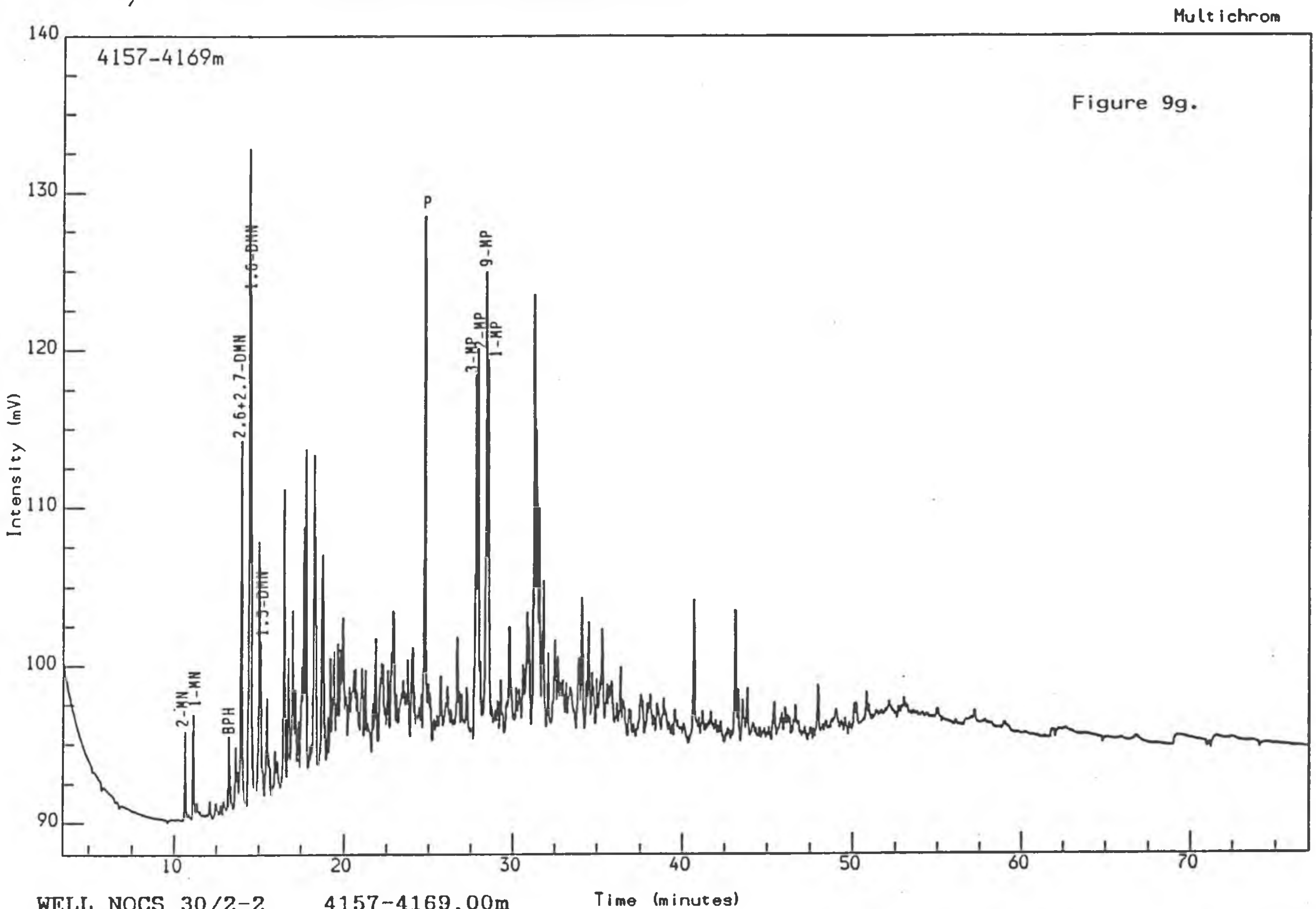


WELL NOCS 30/2-2 4076.00m ccp
AROMATIC GC (FID)
S/Sst: lt gy to gy brn

Reported on 3-MAY-1991 at 14:24

GEOLAB NOR

Analysis Name : [522006] 9 AF0902150B,1,1.

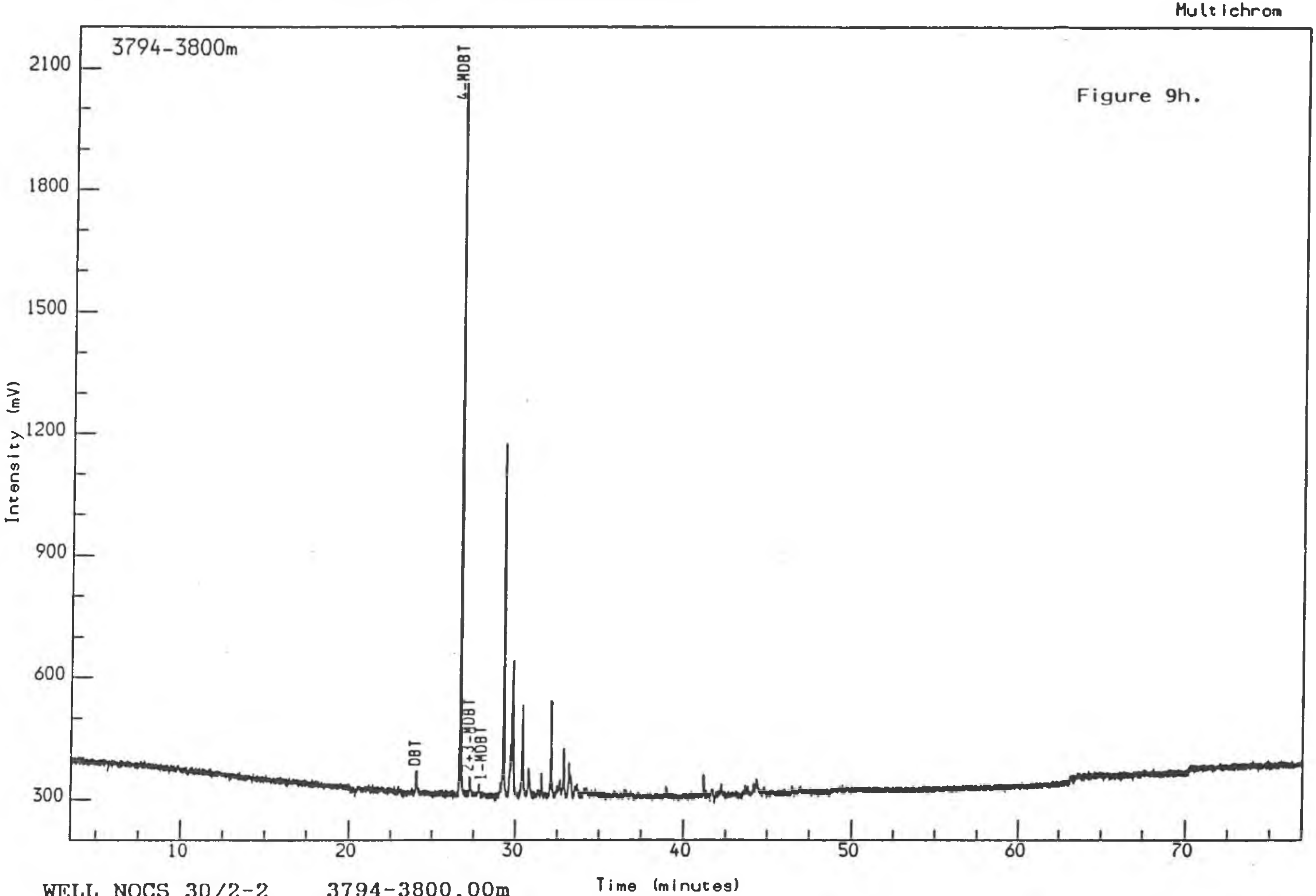


WELL NOCS 30/2-2 4157-4169.00m
AROMATIC GC (FID)
Sh/Clst:m gy to drk gy

Reported on 3-MAY-1991 at 15:50

GEOLAB NOR

Analysis Name : [522006] 10 AF0902140B,1,1.

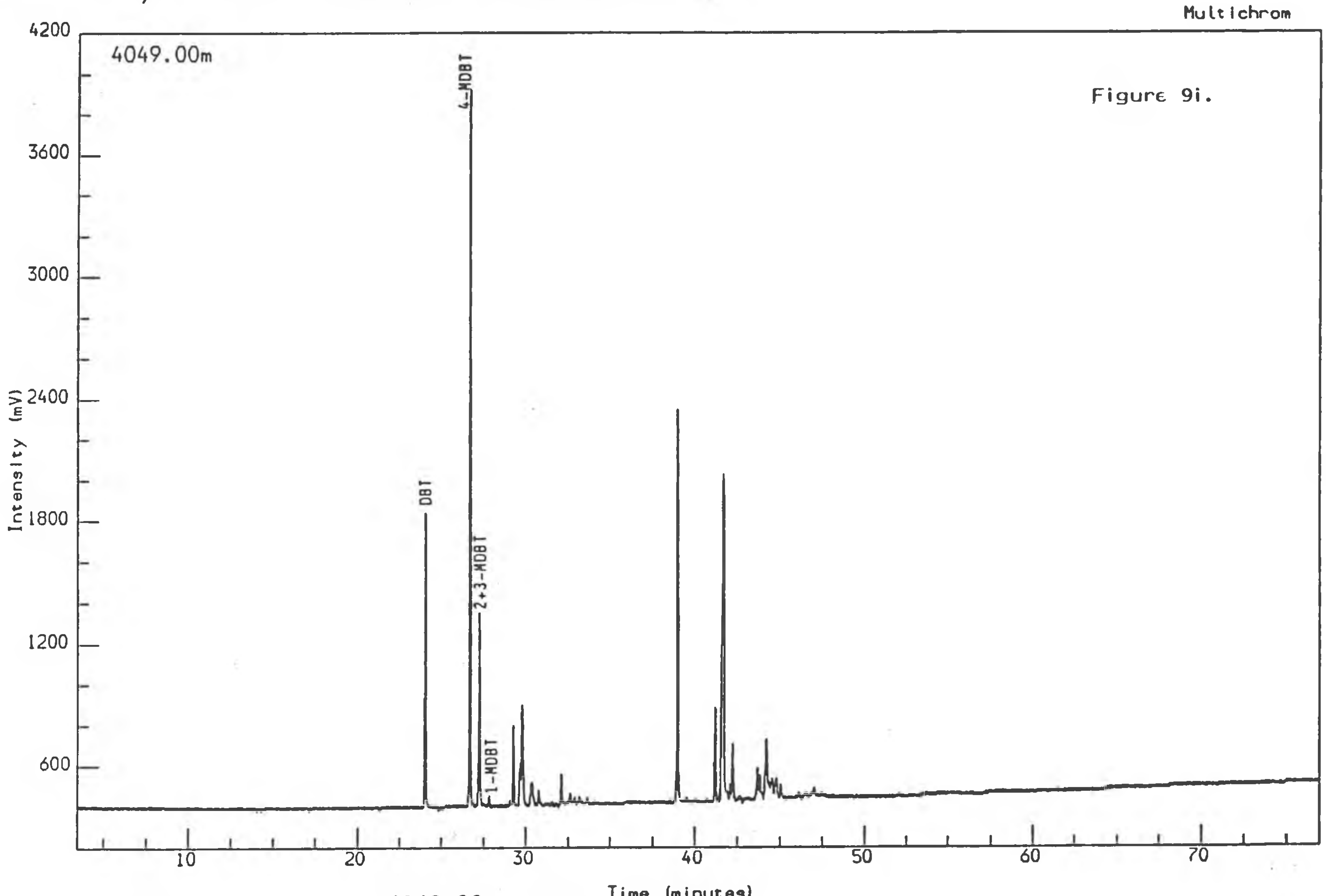


WELL NOCS 30/2-2 3794-3800.00m
AROMATIC GC (FPD)
Sh/Clst:drk gy to brn blk

Reported on 3-MAY-1991 at 08:15

GEOLAB NOR

Analysis Name : [522006] 10 AF0900221L,1,1.



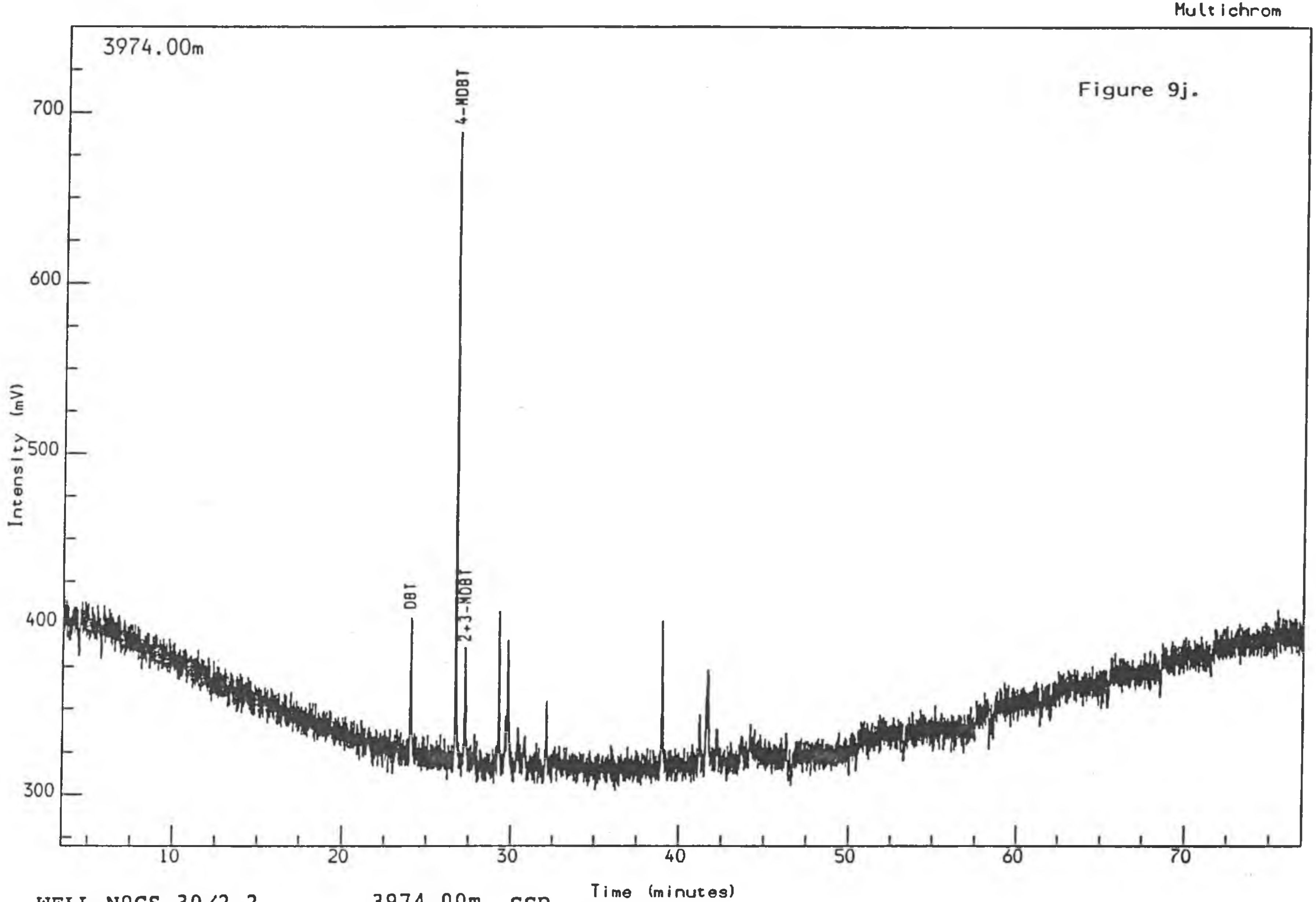
WELL NOCS 30/2-2
AROMATIC GC (FPD)
Coal: blk

4049.00m ccp

Reported on 8-MAY-1991 at 13:35

GEOLAB NOR

Analysis Name : [522006] 10 AF0900101L,1,1.

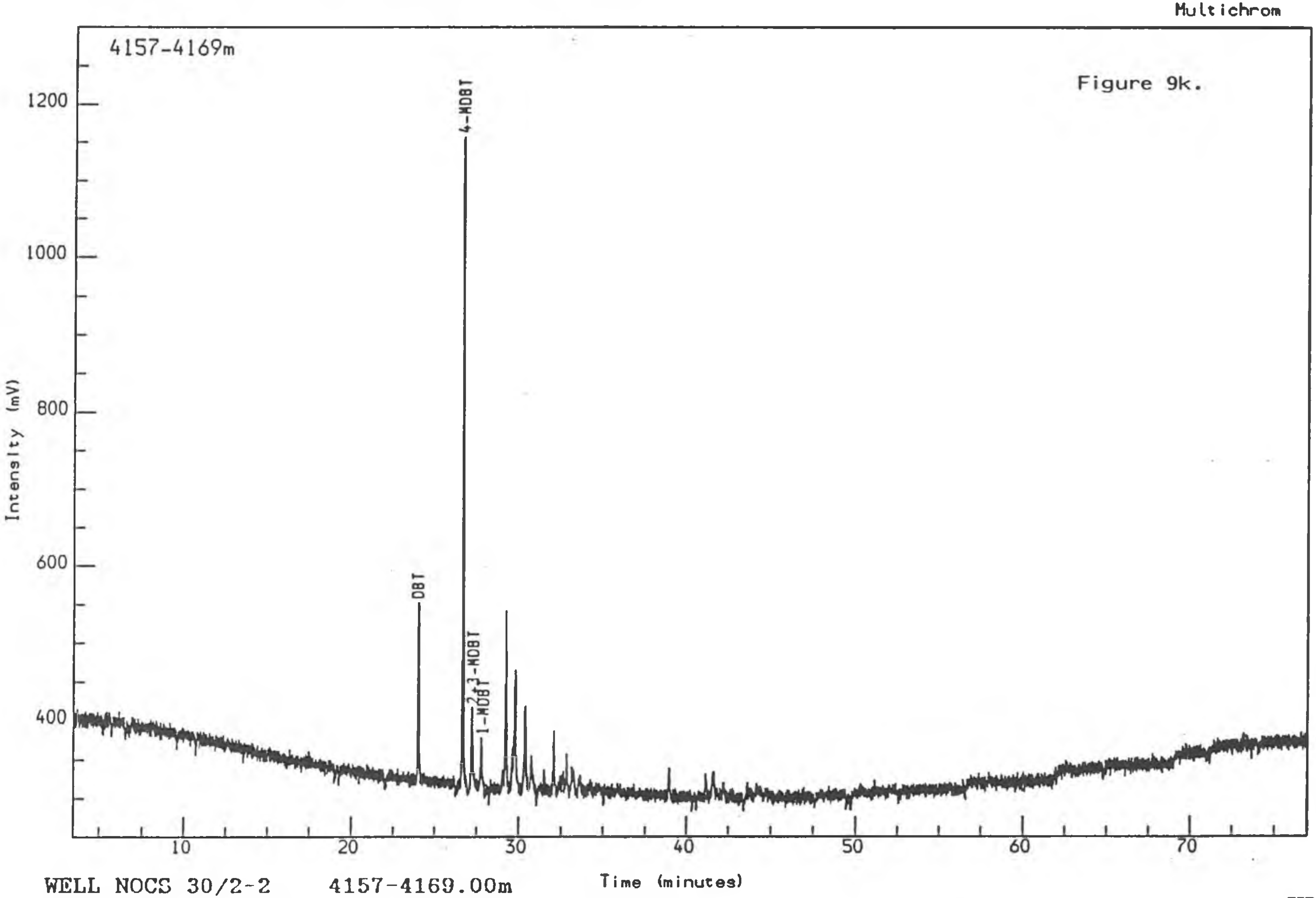


WELL NOCS 30/2-2 3974.00m ccp
AROMATIC GC (FPD)
S/Sst: lt gy to lt brn to pl brn

Reported on 3-MAY-1991 at 13:00

GEOLAB NOR

Analysis Name : [522006] 10 AF0902150B.1.1.



WELL NOCS 30/2-2 4157-4169.00m
AROMATIC GC (FPD)
Sh/Clst:m gy to drk gy

Reported on 3-MAY-1991 at 15:48

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Figure 10: Vitrinite Reflectance versus Depth
Well NOCS 30/2–2

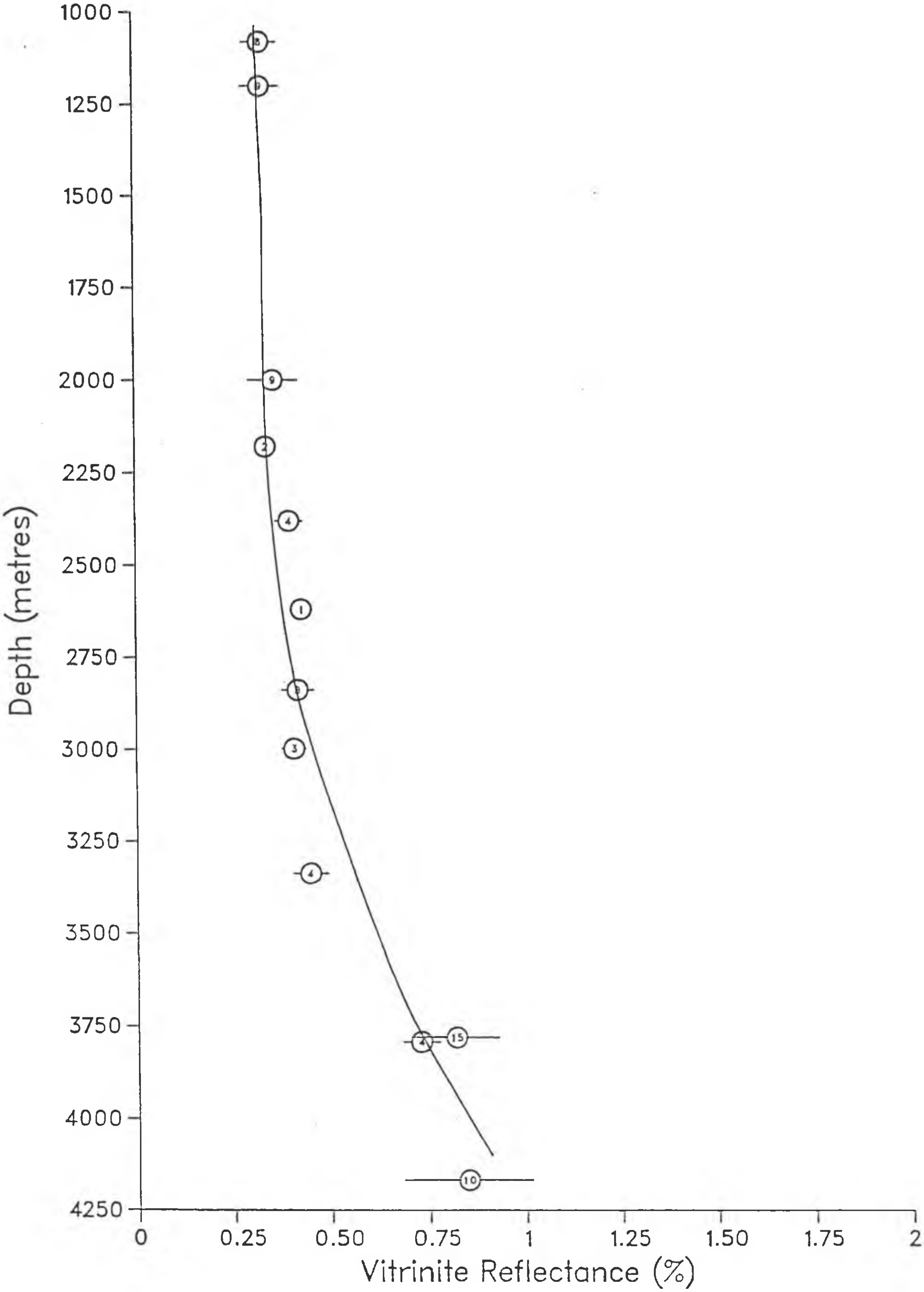

Figure 11: Kerogen Composition and Potential Hydrocarbon Products

Well NOCS 30/2-2

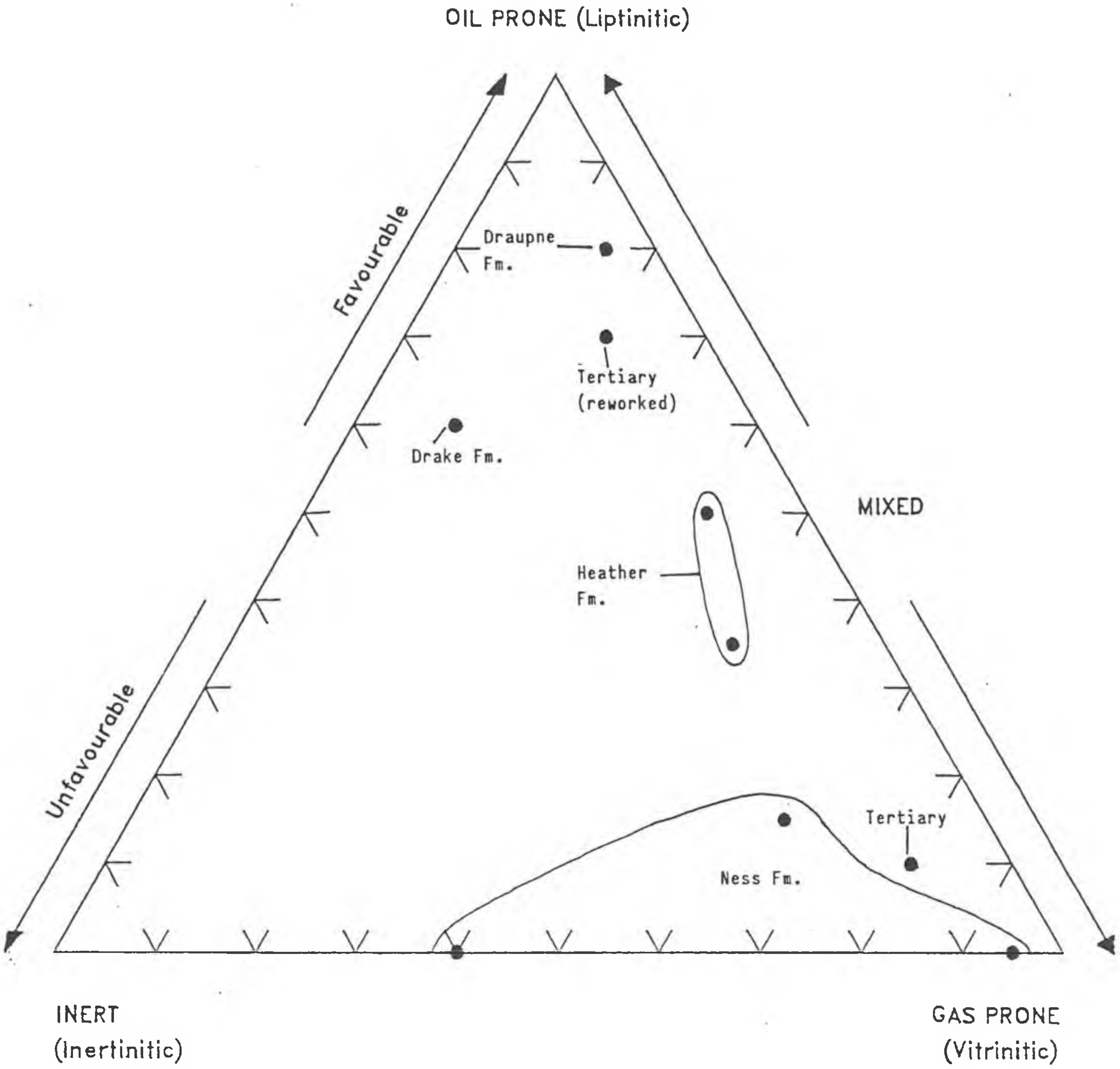

Figure 12: Aromatic v.s. saturate isotope values

Well NOCS 30/2-2

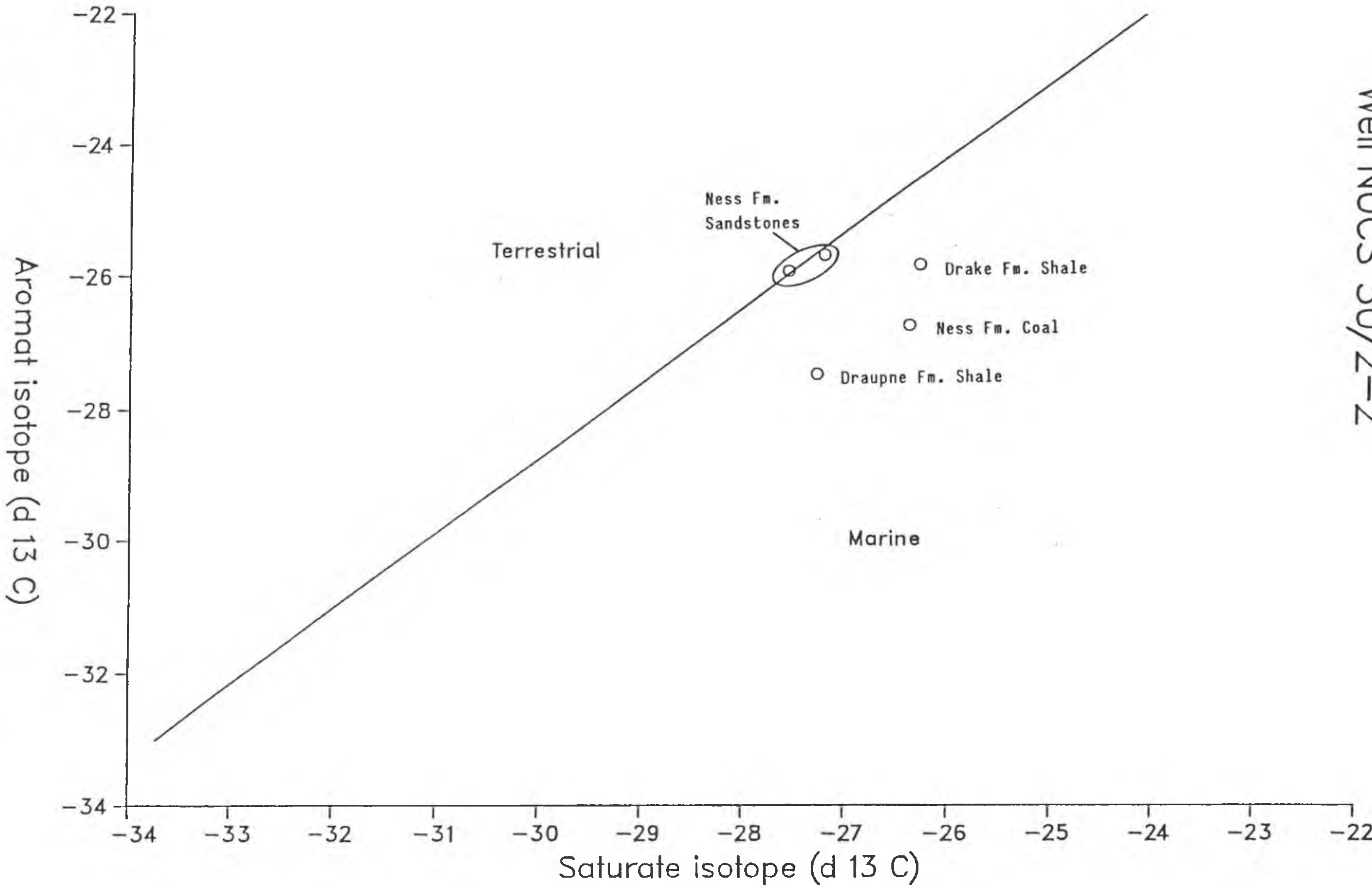

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Figure 13: 13C/12C isotope ratios. Galimov plot. Well NOCS 30/2-2

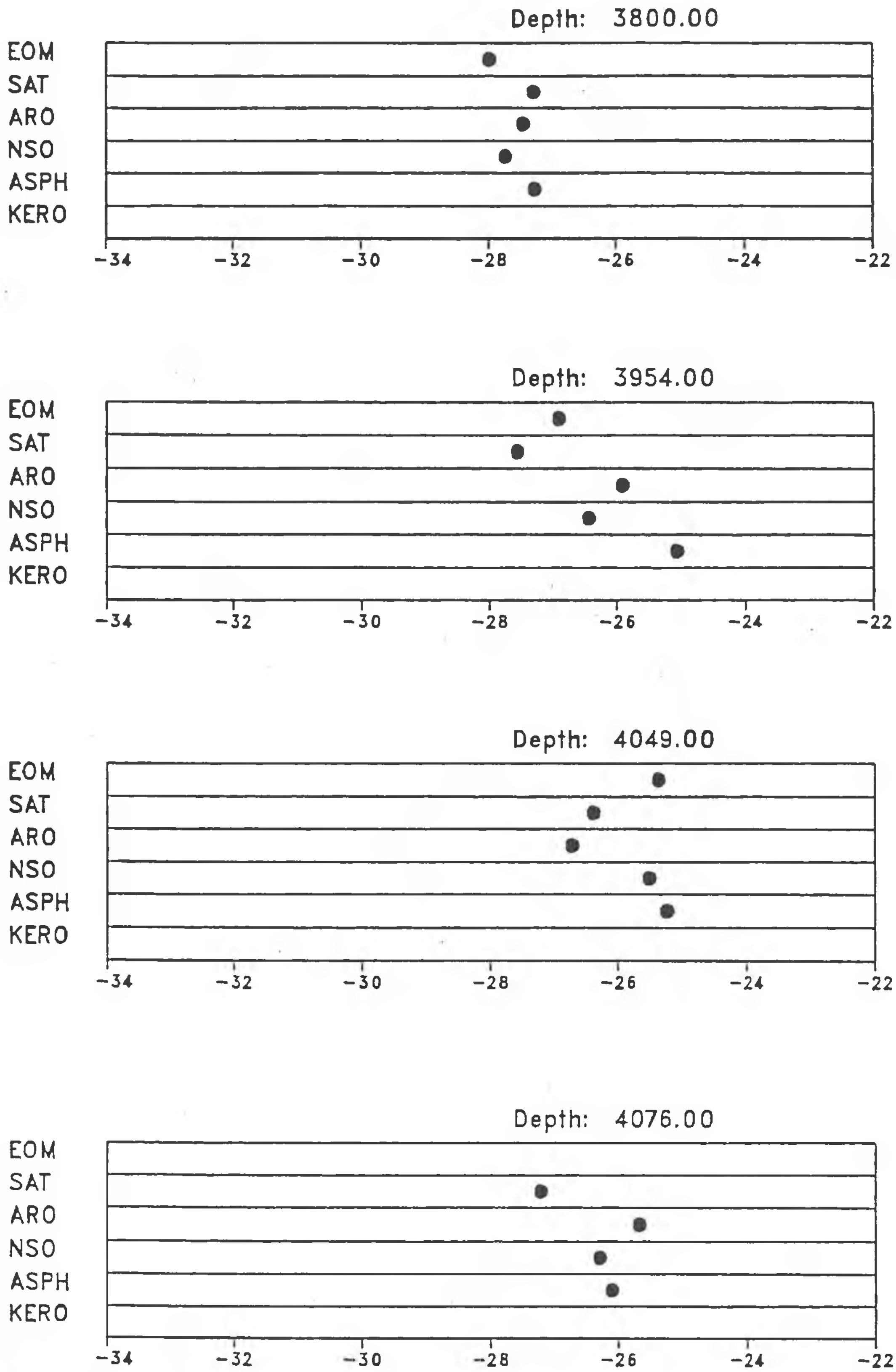
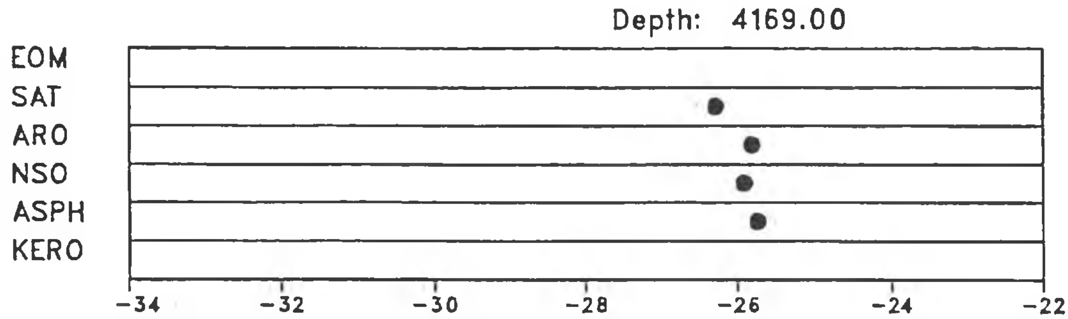
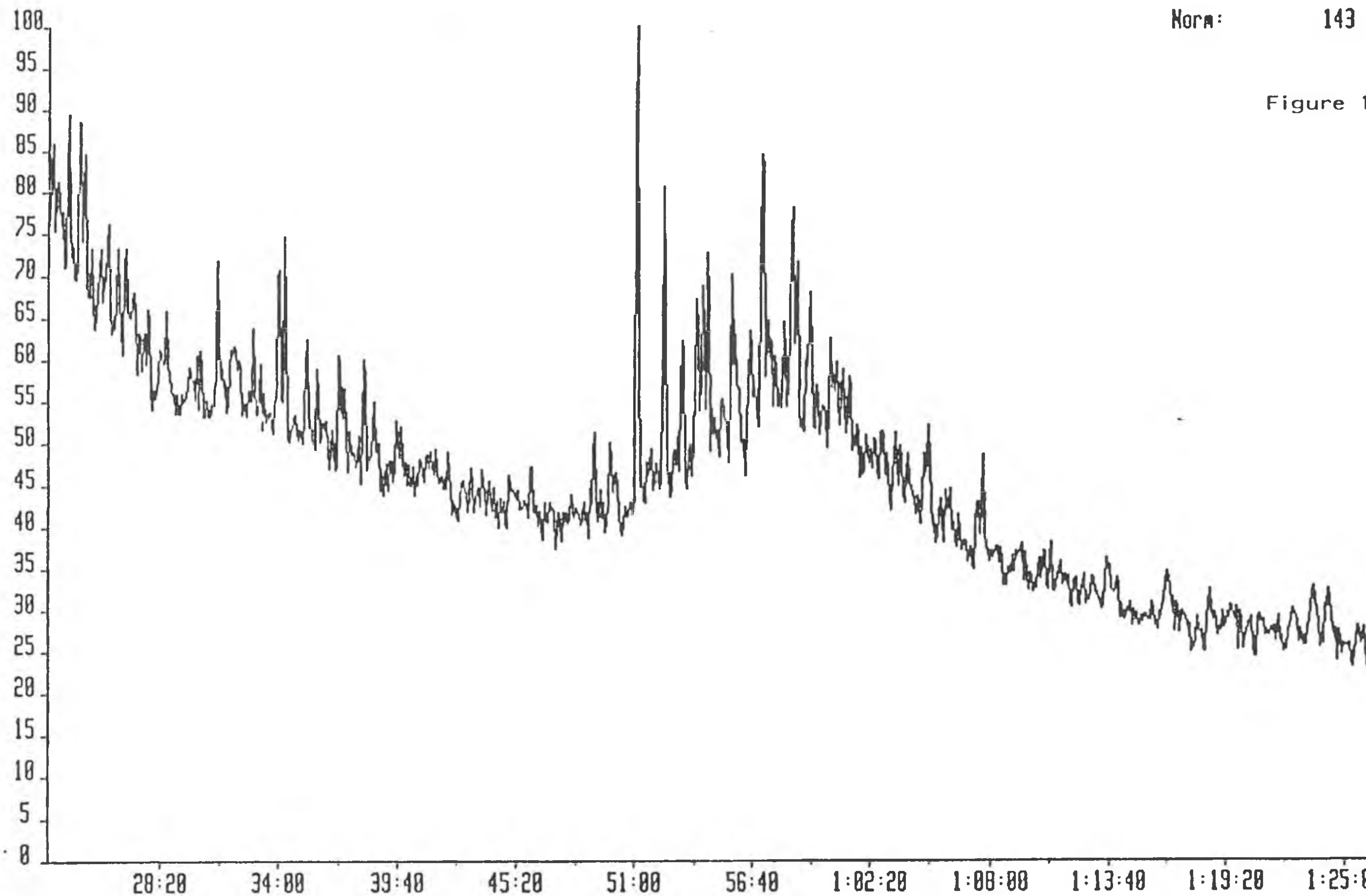


Figure 13: 13C/12C isotope ratios. Galimov plot. Well NOCS 30/2-2



KEYSAT2   24-JUL-91   Sir:Magnetic TS250   Acnt:GEOLAB   System:SAT1
Sample 3   Injection 1   Group 1   Mass 163.1485
Text:WELL 30/2-2, 3000M, SATURATED FRACTION

Figure 14a.



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KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 7 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/2-2, 4169M, SATURATED FRACTION

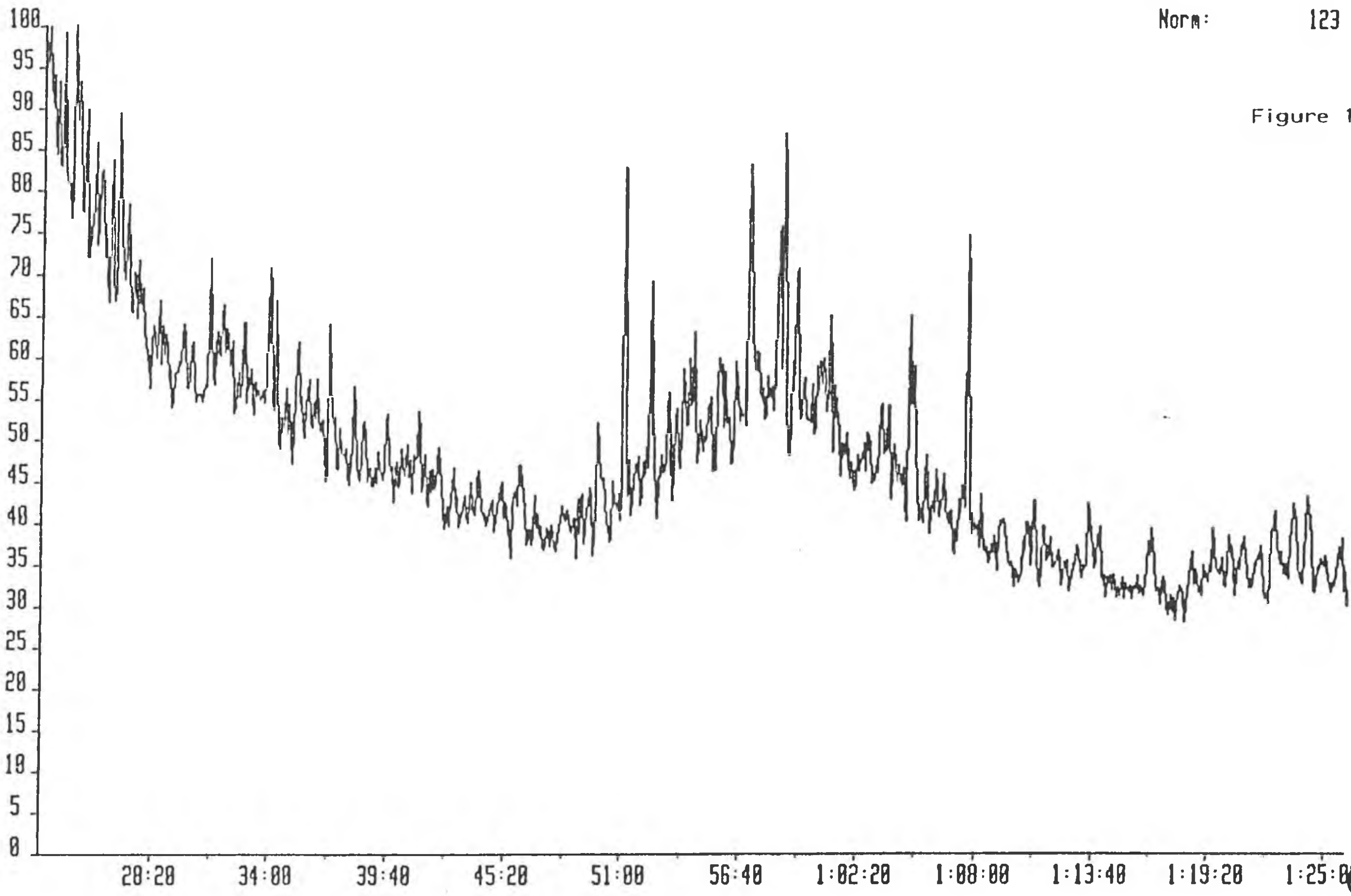


Figure 14b.

GEOLAB NOR

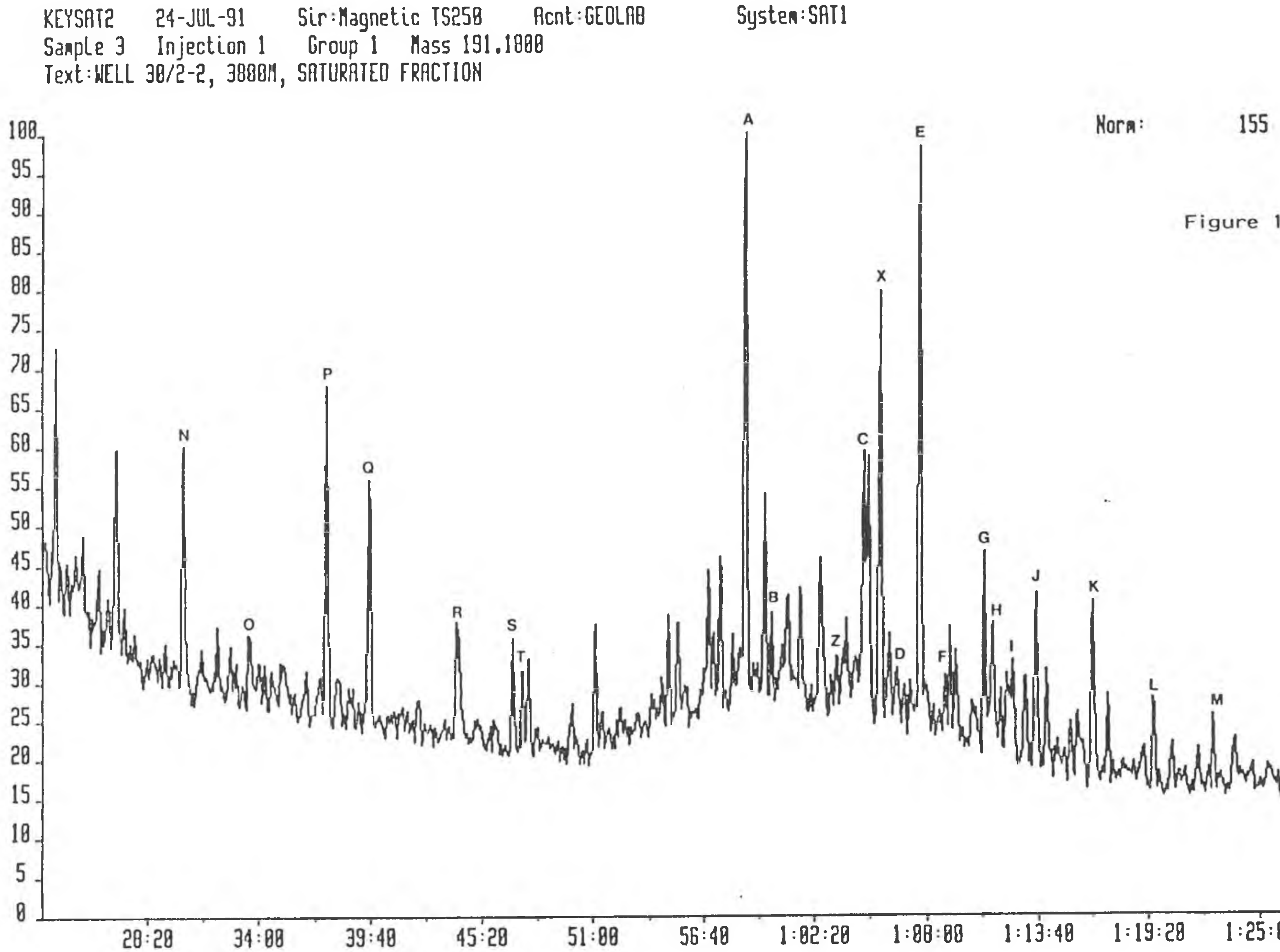
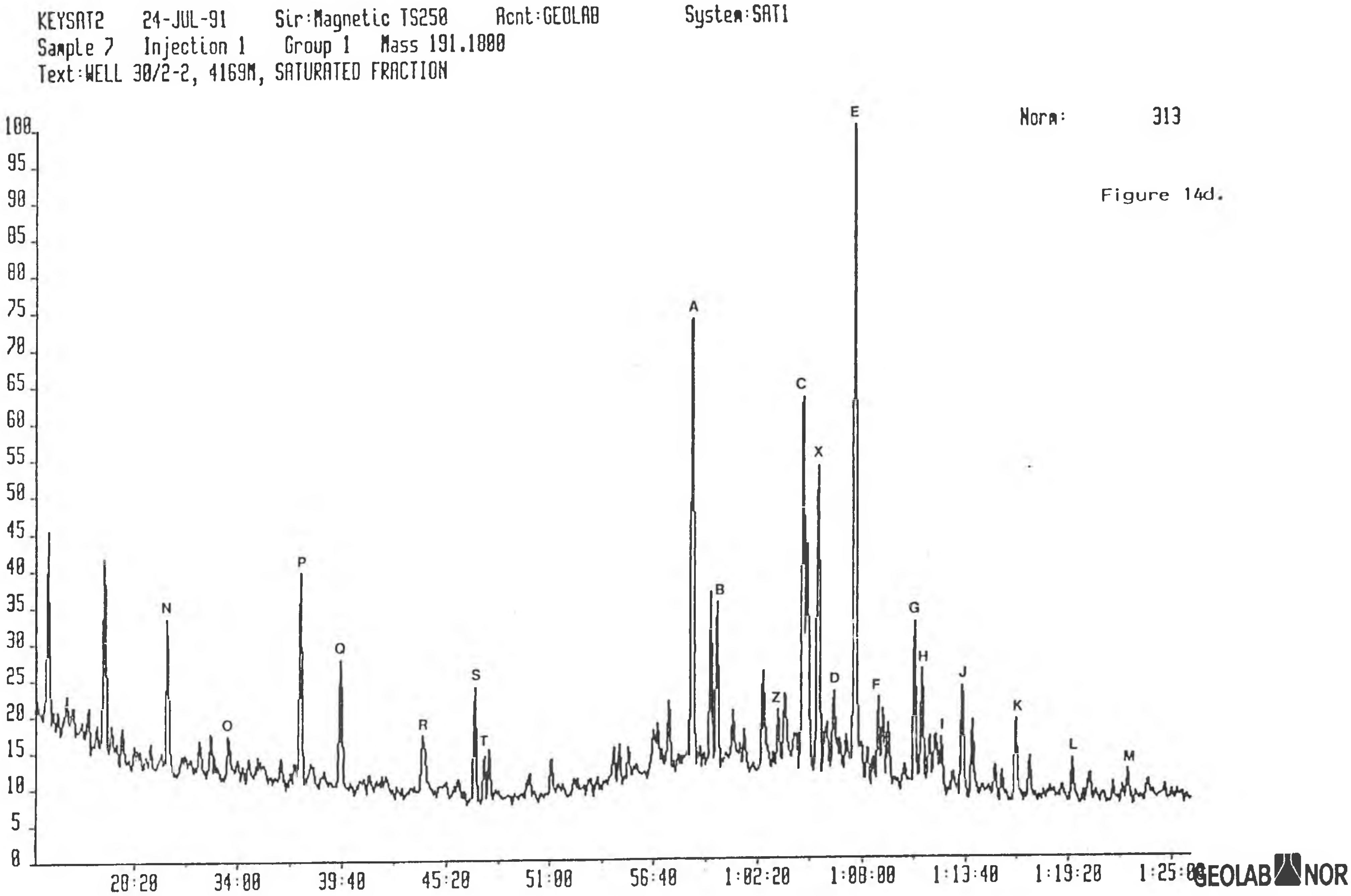


Figure 14c.

GEOLAB NOR

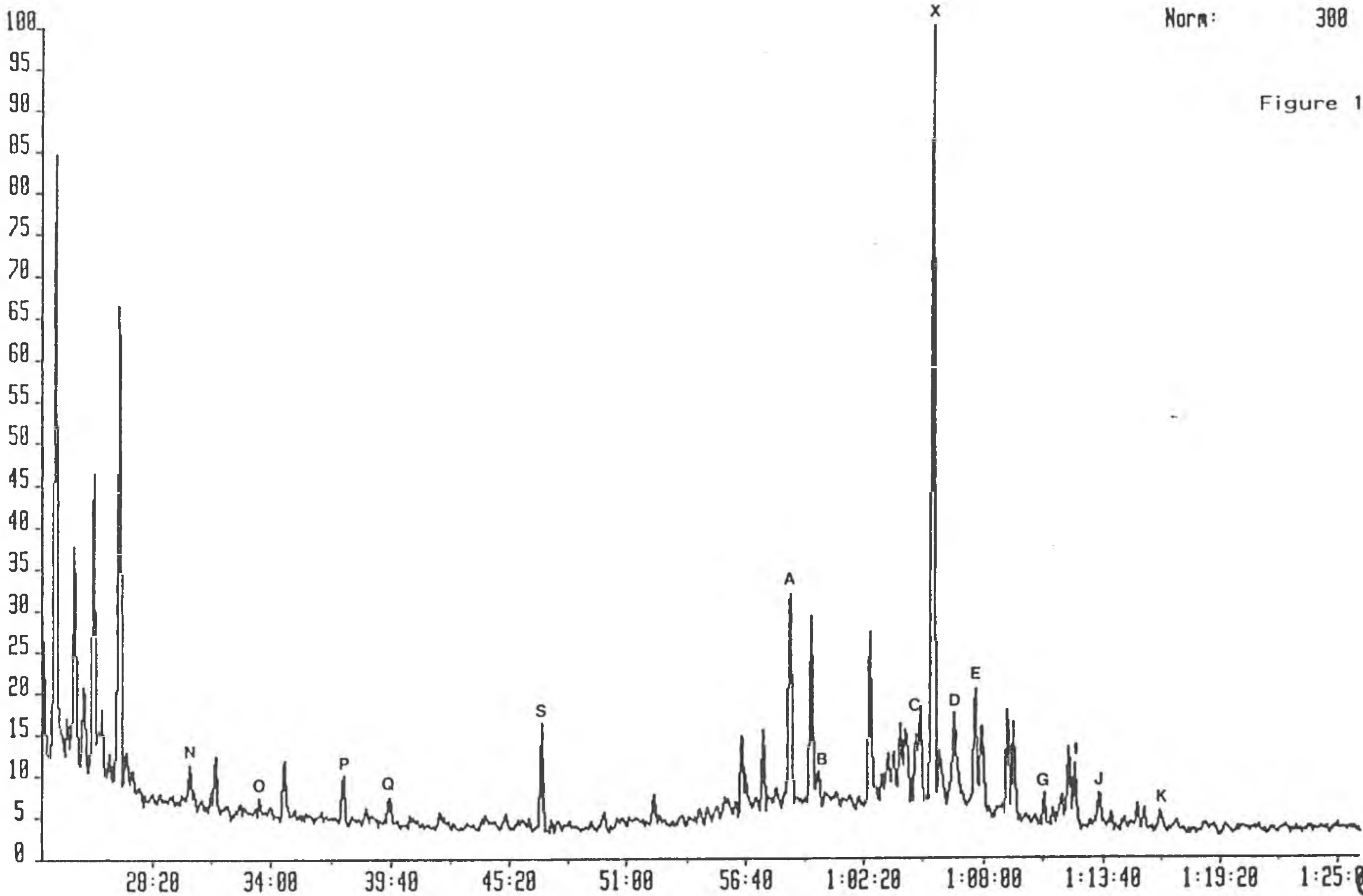


KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 7 Injection 1 Group 1 Mass 191.1800
Text:WELL 30/2-2, 4169M, SATURATED FRACTION
Norm: 313
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
A
B
C
X
E
Z
D
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
20:20
34:00
39:40
45:20
51:00
56:40
1:02:20
1:08:00
1:13:40
1:19:20
1:25:00
GEOLAB NOR

Figure 14d.

KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 5 Injection 1 Group 1 Mass 191.1000
Text:WELL 30/2-2, 4049M, SATURATED FRACTION

Figure 14e.



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KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 3 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/2-2, 3800M, SATURATED FRACTION

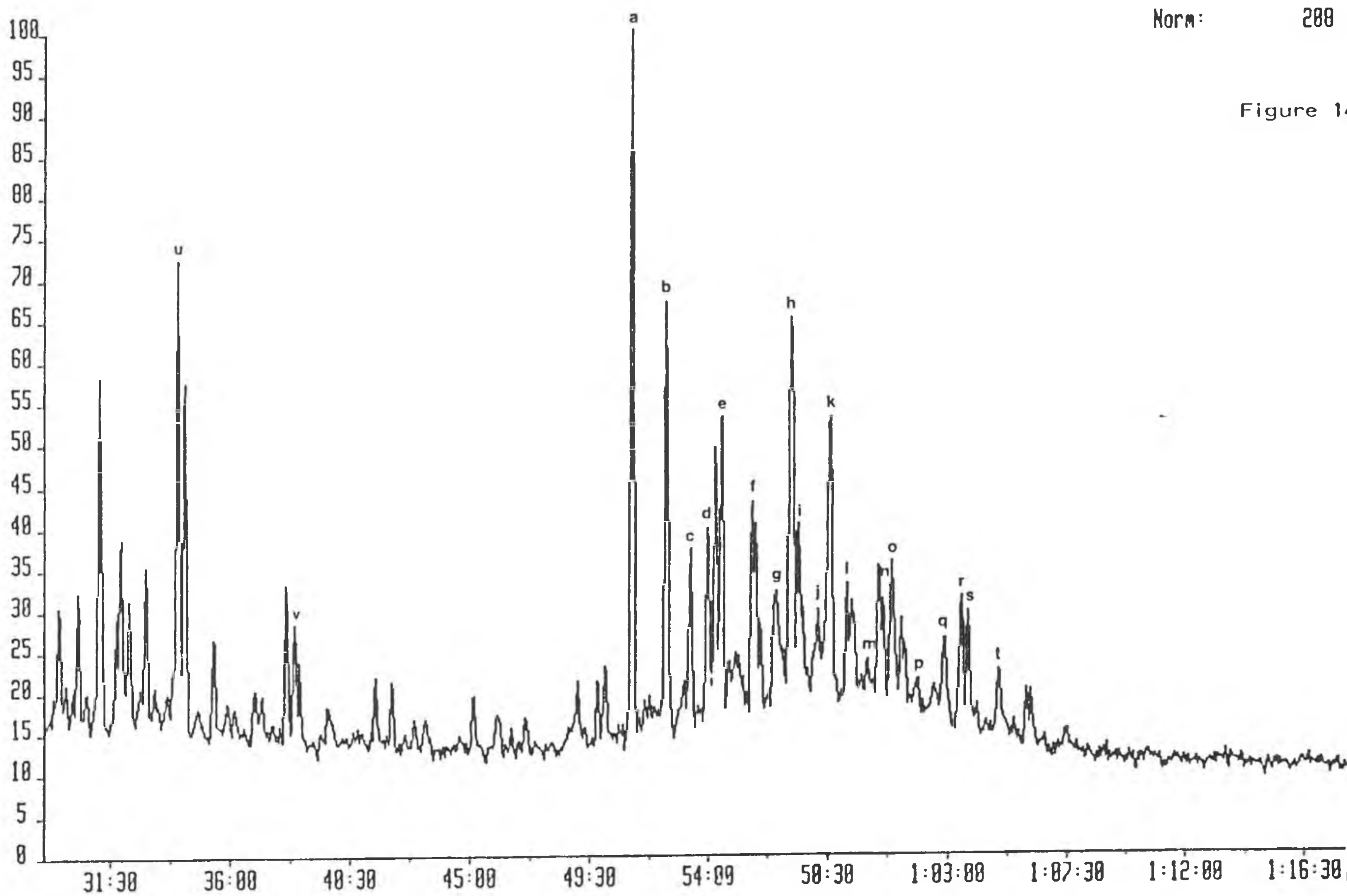
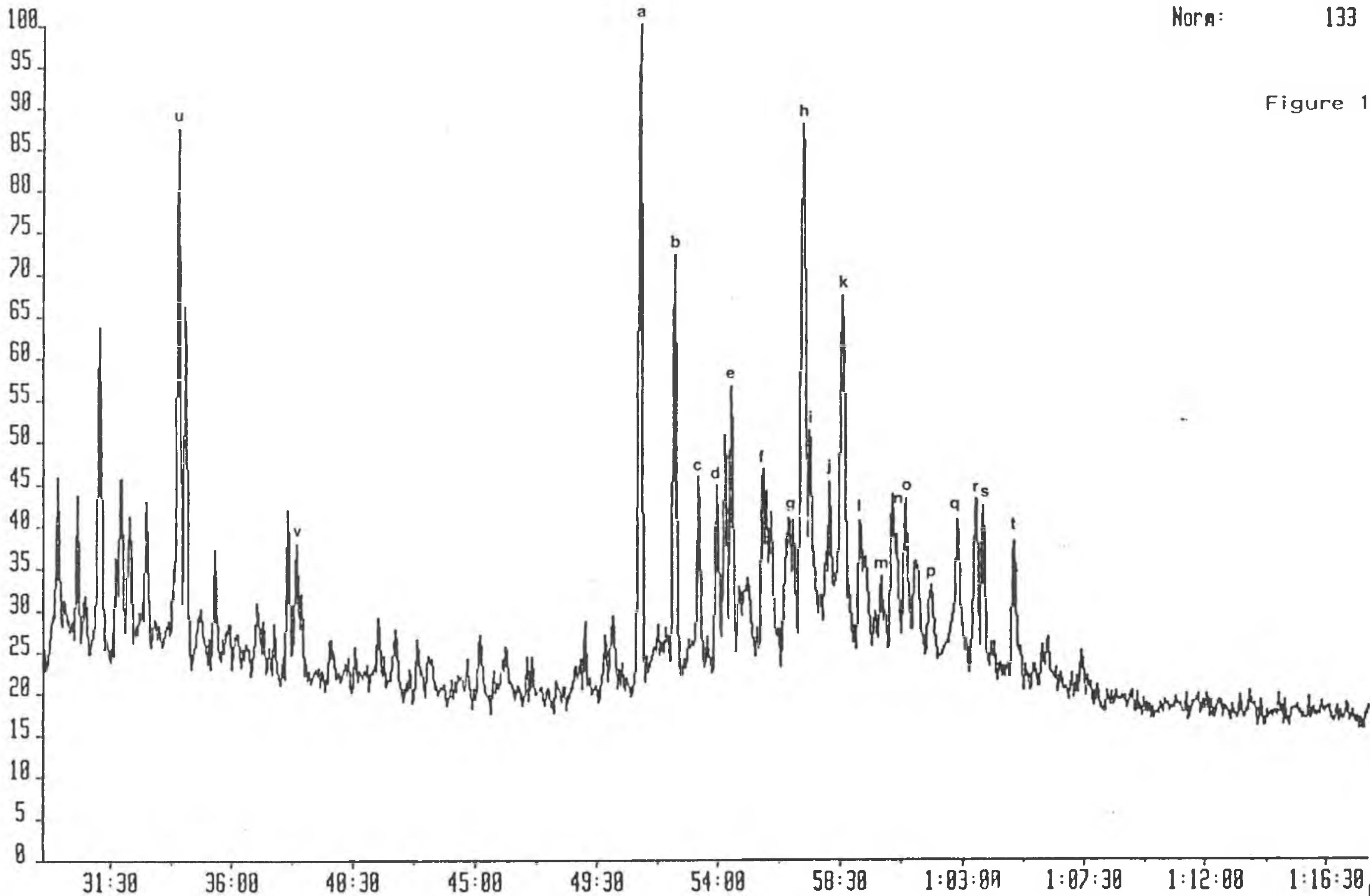


Figure 14f.

GEOLAB NOR

KEYSAT2   24-JUL-91   Sir:Magnetic TS250   Acnt:GEOLAB   System:SAT1
Sample 7   Injection 1   Group 1   Mass 217.1956
Text:WELL 30/2-2, 4169M, SATURATED FRACTION

Figure 14g.



GEOLAB NOR

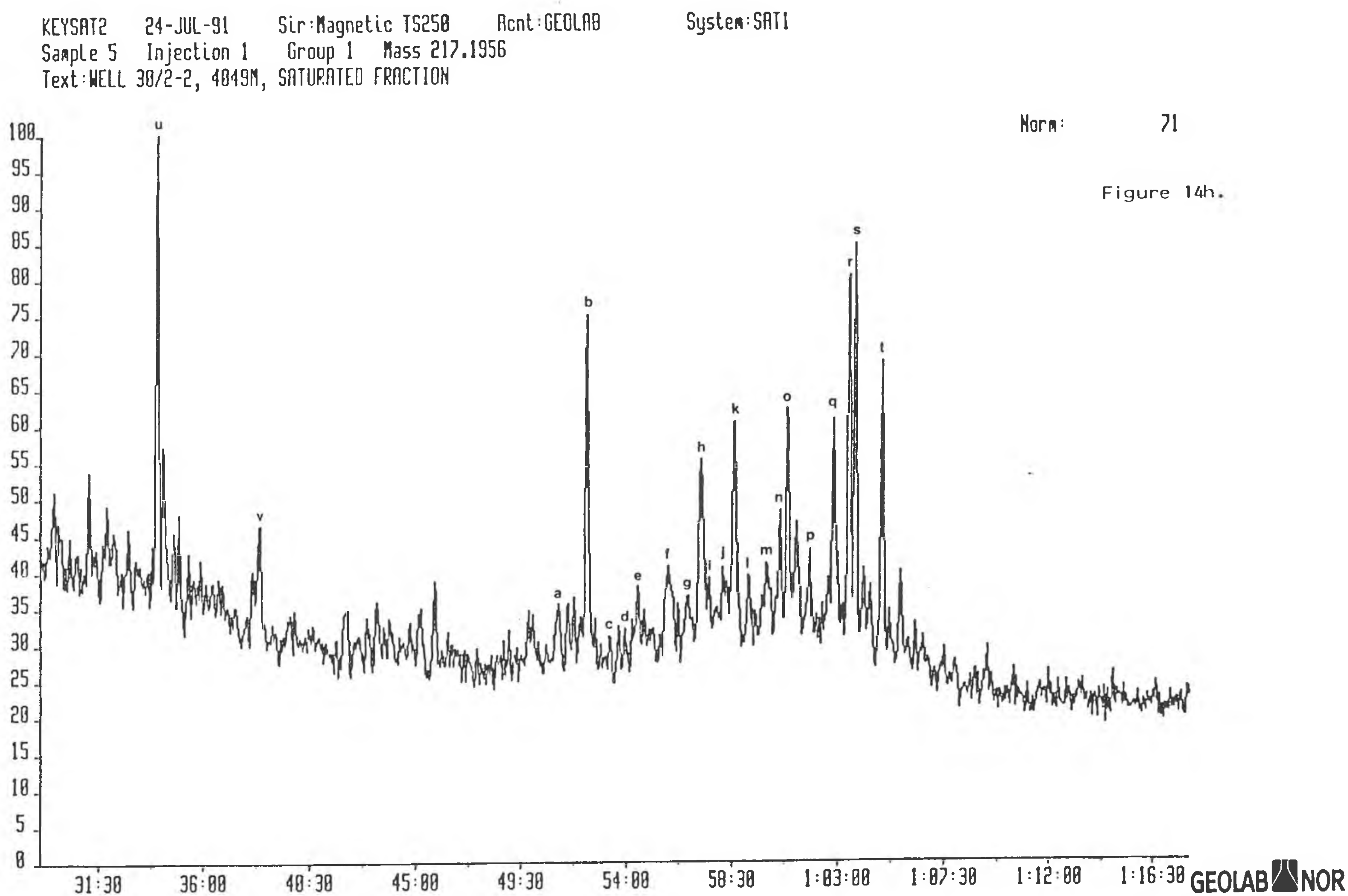

KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 5 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/2-2, 4049M, SATURATED FRACTION
Norm: 71
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
u
v
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
31:30
36:00
40:30
45:00
49:30
54:00
58:30
1:03:00
1:07:30
1:12:00
1:16:30
GEOLAB NOR

Figure 14h.

KEYSAT4 29-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 2 Injection 1 Group 1 Mass 259.2427
Text:WELL 30/2-2, 3788M, SATURATED FRACTION

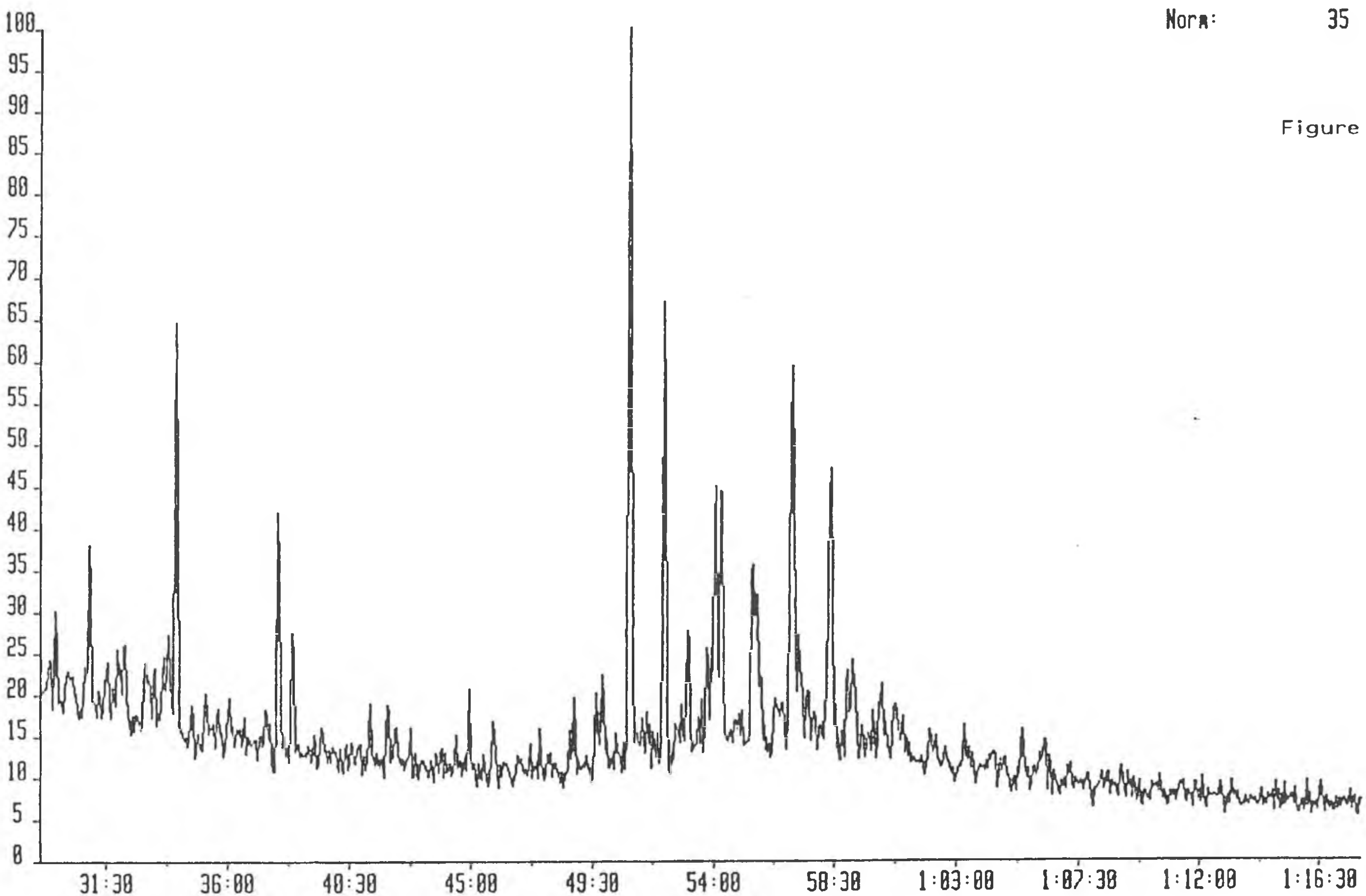


Figure 14i.

GEOLAB NOR

KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 7 Injection 1 Group 1 Mass 259.2427
Text:WELL 30/2-2, 4169M, SATURATED FRACTION

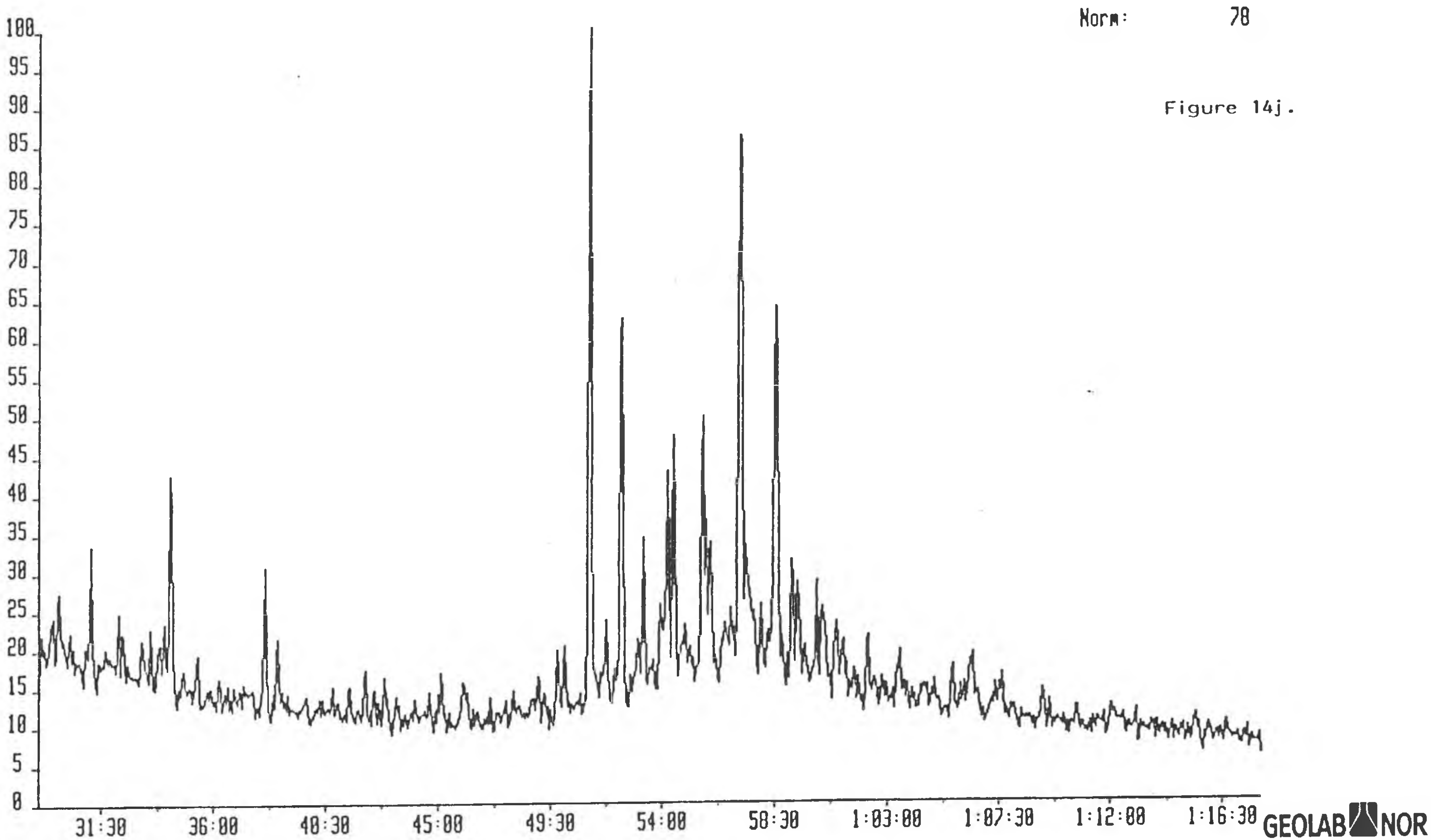
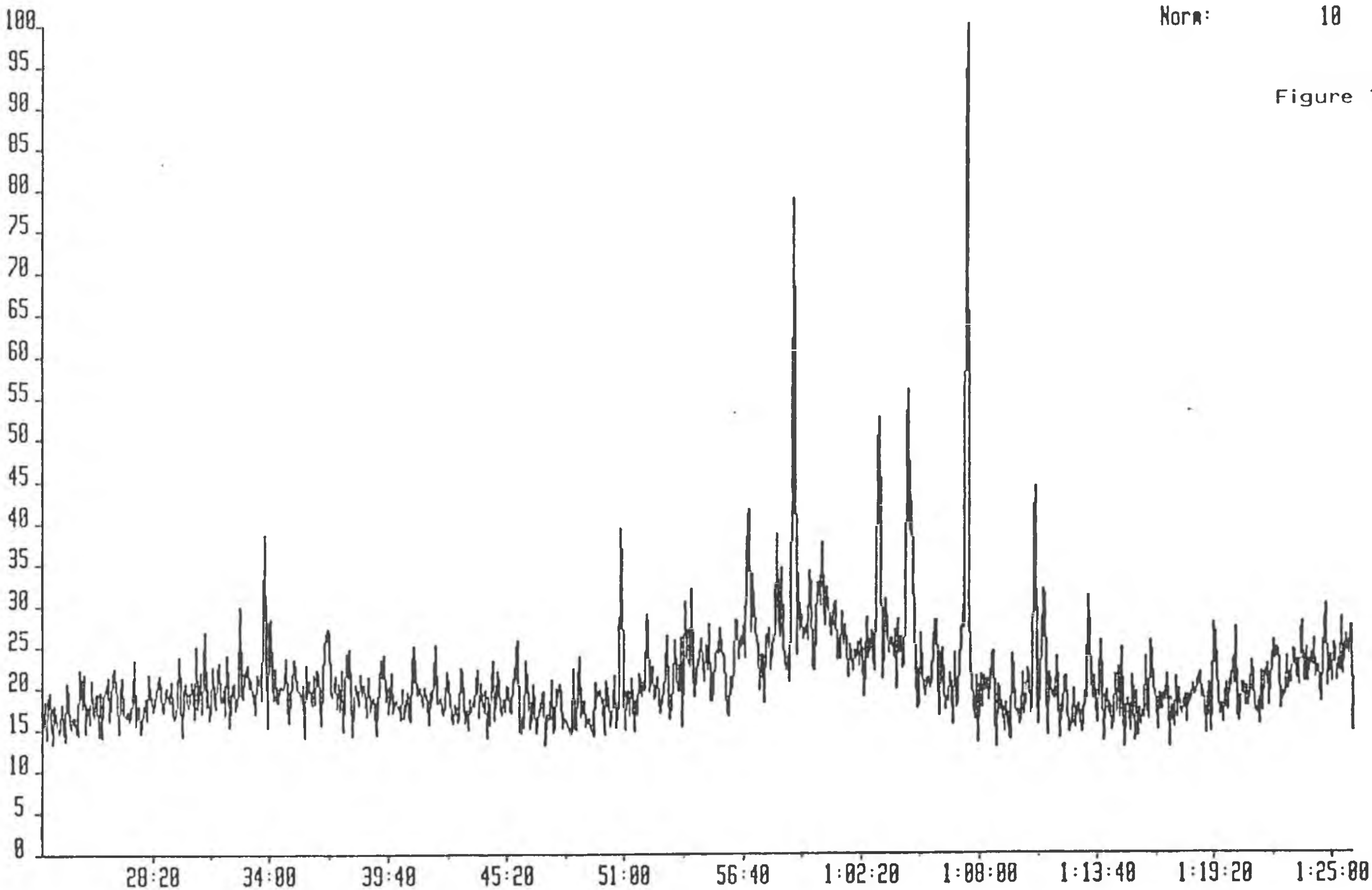


Figure 14j.

KEYSAT4 29-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 3 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/2-2, 3939.05M, SATURATED FRACTION

Figure 14k.



GEOLAB NOR

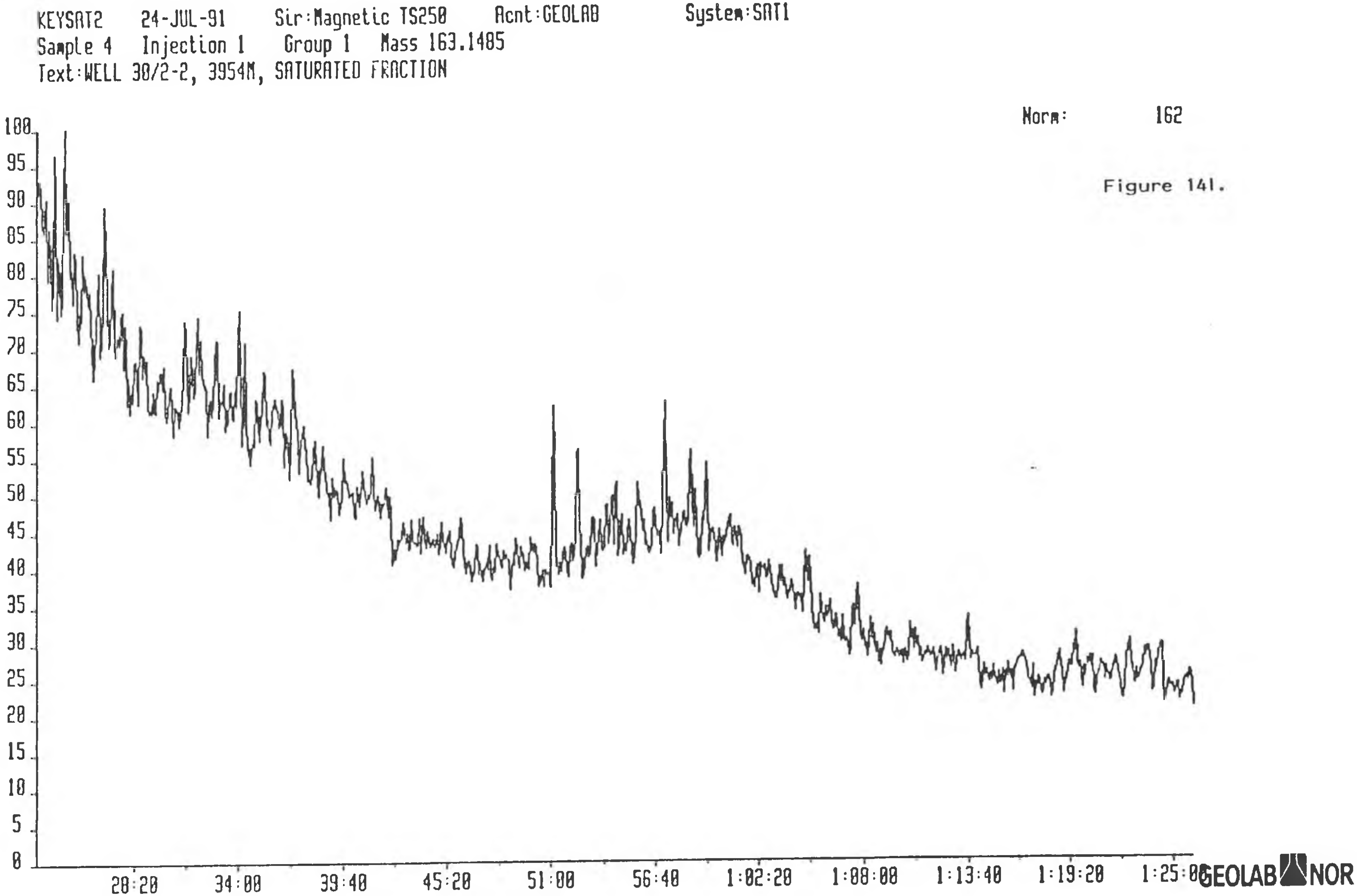

KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 4 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/2-2, 3954M, SATURATED FRACTION
Norm: 162
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
28:20
34:00
39:40
45:20
51:00
56:40
1:02:20
1:08:00
1:13:40
1:19:20
1:25:00
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Figure 141.

KEYSAT4   29-JUL-91   Sir:Magnetic TS250   Acnt:GEOLAB   System:SAT1
Sample 3   Injection 1   Group 1   Mass 191.1000
Text:WELL 30/2-2, 3939.05M, SATURATED FRACTION

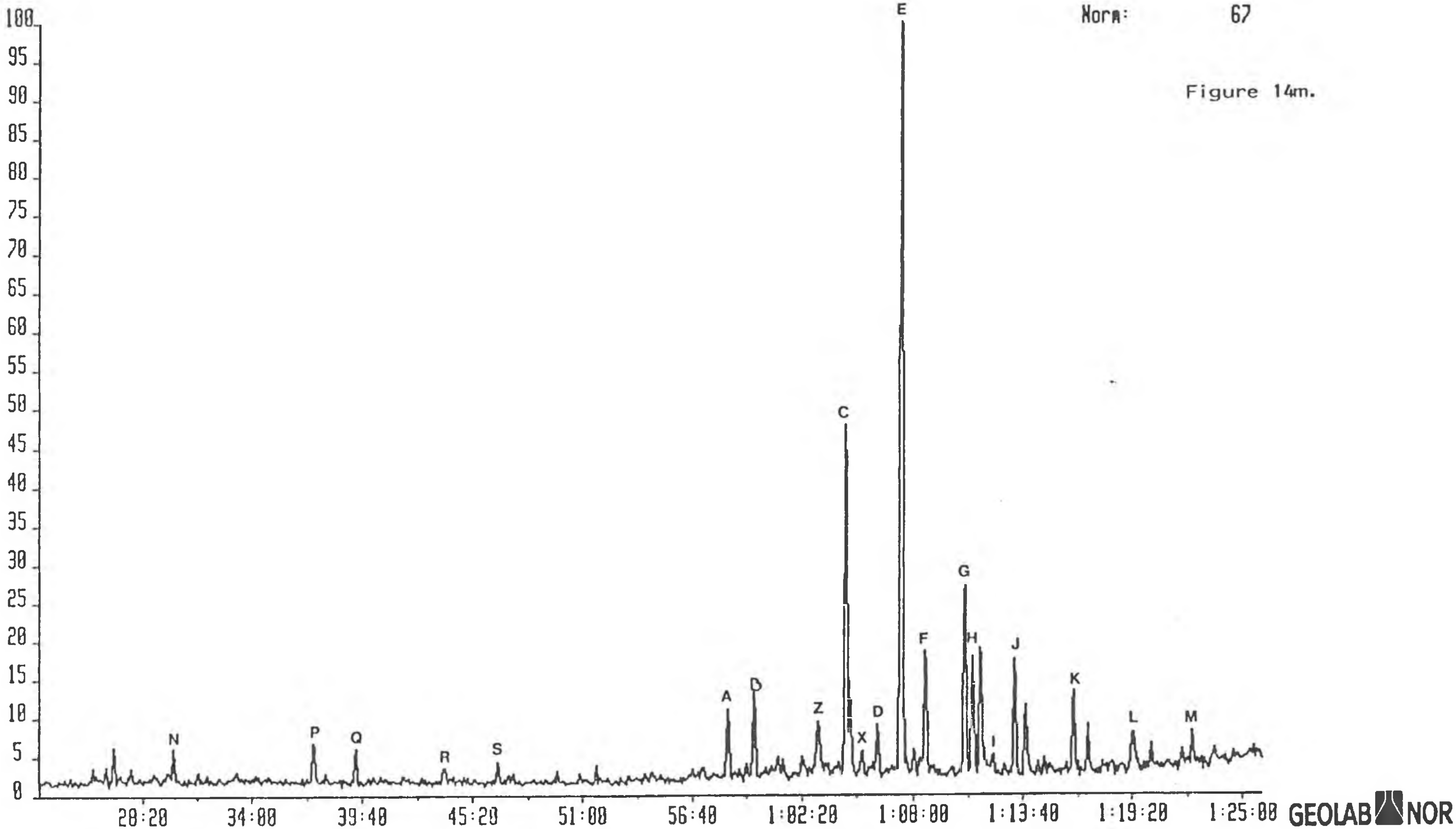


Figure 14m.

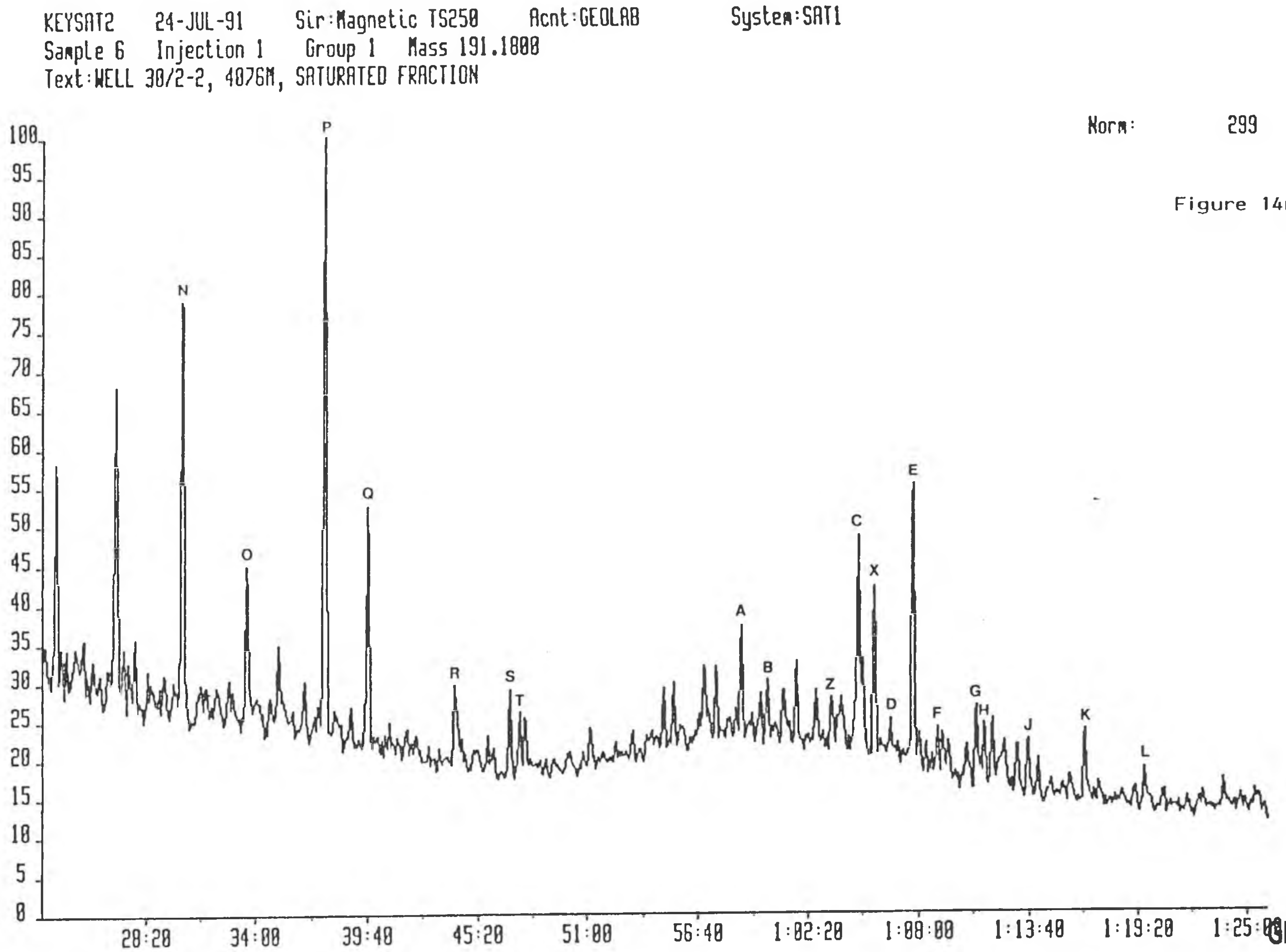


Figure 14n.

GEOLAB NOR

KEYSAT4 29-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 3 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/2-2, 3939.05M, SATURATED FRACTION .

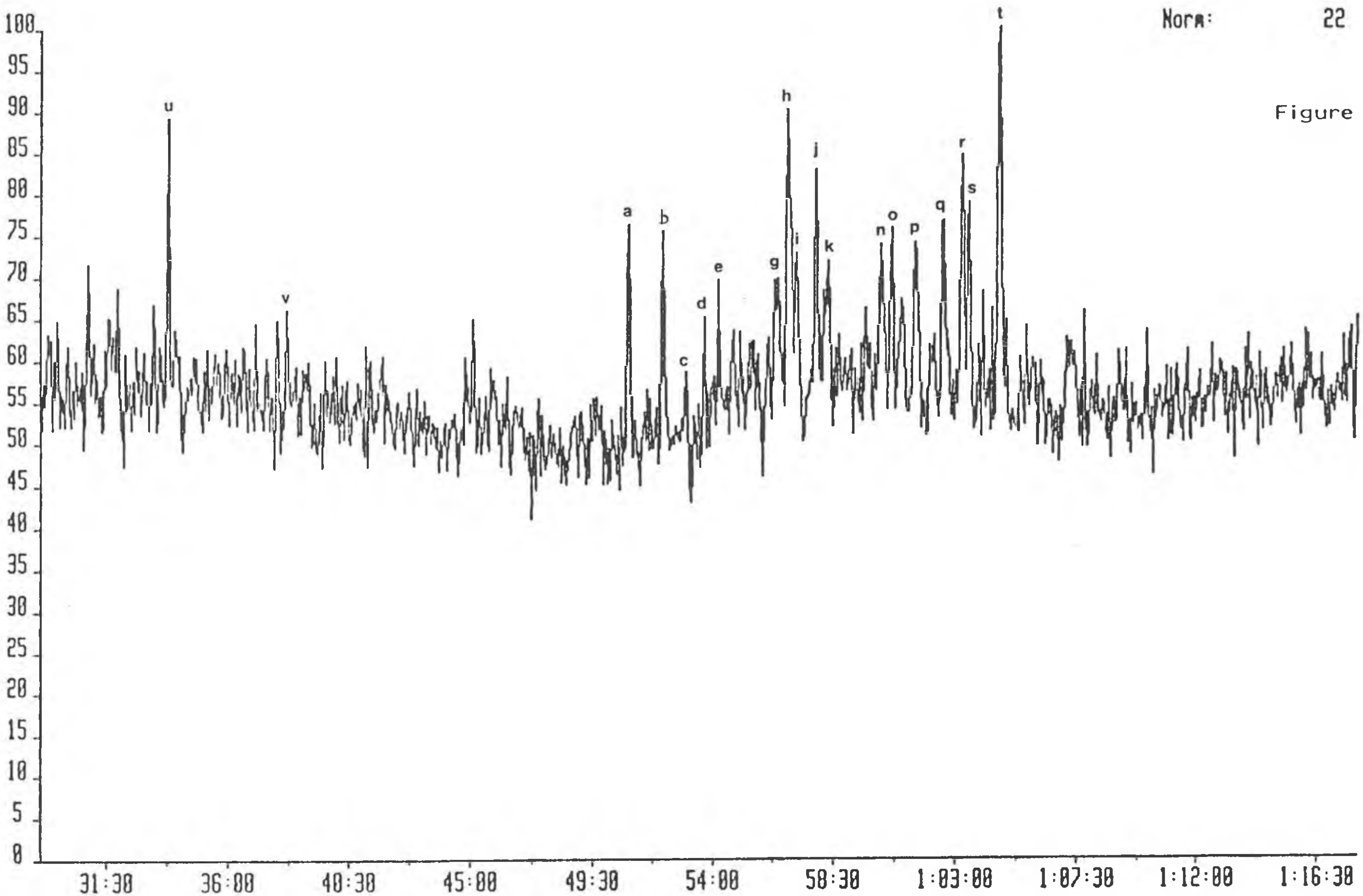
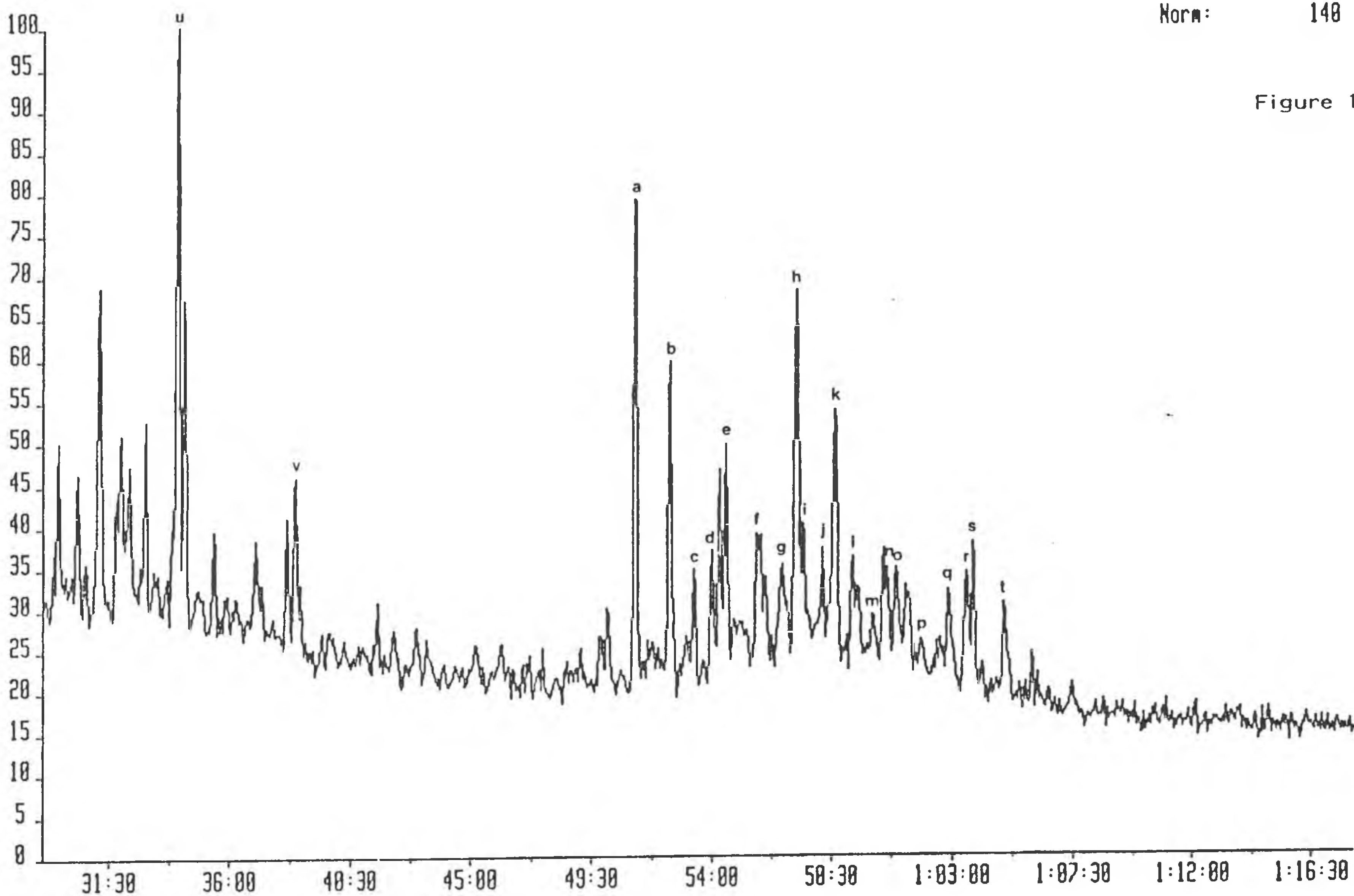


Figure 14o.

GEOLAB NOR

KEYSAT2 24-JUL-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 4 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/2-2, 3954M, SATURATED FRACTION

Figure 14p.



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Abbreviations

List of abbreviations used for lithology description
(sorted alphabetically)

ang	=	angular
bar	=	Baryte (mud additive)
bit	=	bituminous
bl	=	blue/blueish
blk	=	black
br	=	brittle
brn	=	brown/brownish
Ca	=	Carbonate (limestone/chalk/dolomite/siderite)
calc	=	calcareous
carb	=	carbonaceous
cem	=	cement used as additive (under "cont") or to describe cemented S/Sst
Chert	=	Chert
chk	=	Chalk/chalky
cly	=	clayey/shaly
cngl	=	conglomeratic
Coal	=	Coal
Coal-ad	=	Coal-like additive (e.g. chromlignosulfonate)
Congl	=	Conglomerat
Cont	=	Contamination(s)
crs	=	coarse grained
dd	=	dried drilling mud
dol	=	Dolomite/dolomitic
drk	=	dark (colour)
dsk	=	dusk/dusky (colour)
evap	=	Salt/Gypsum/Halite (natural "Other" or as additive "Cont"
f	=	fine grained
fe	=	ferruginous
fib	=	fibres (mud additive/contamination)
fis	=	fissile
fos	=	fossiliferous
glauc	=	glauconite/glauconitic
gn	=	green/greenish
gy	=	grey/greyish
hd	=	hard
ign	=	Igneous (material derived from igneous source)
Kaolin	=	Kaolin(ite)
kln	=	kaolinitic
l	=	loose
lam	=	laminated/laminae
lt	=	light (colour)
m	=	medium (colour or grain size)
Marl	=	Marl (calcareous claystone/mudstone)
mic	=	micaceous

Mica-ad	=	Mica used as mud additive
mrl	=	marly
No Mat.	=	No material left over after washing
ns	=	nutshells (mud additive)
ol	=	olive
ool	=	Oolite/oolitic
or	=	orange
Other	=	Other lithology/mineral, specified after this word
pi	=	pink/pinkish
pl	=	pale (colour)
prp	=	paint/rust/plastic contaminations/additives
pu	=	purple
pyr	=	Pyrite/pyritic
red	=	red/reddish
rnd	=	round/rounded
s	=	sandy
sft	=	soft
S/Sst	=	Sand and/or sandstone
Sh/Clst	=	Shale and/or claystone
sid	=	Siderite/sideritic
sil	=	siliceous/cherty
slt	=	silty
Sltst	=	siltstone
st	=	stained (with natural oil or oil-like additive)
tar-ad	=	Tar-like additive (e.g. "Black Magic")
trbfgs	=	turbodrilled fragments
Tuff	=	Tuff
tuff	=	tuffaceous
v col	=	various colours
w	=	white
wx	=	waxy
y	=	yellow/yellowish

List of abbreviations used for parameters, ratios and analytical methods
(sorted alphabetically)

CPI	=	Carbon Preference Index, $0.5 \times \left(\frac{C25+C27+C29+C31+C33}{C24+C26+C28+C30+C32} + \frac{C25+C27+C29+C31+C33}{C26+C28+C30+C32+C34}\right)$
EOM	=	Extractable Organic Matter
FID	=	Flame Ionisation Detector
FPD	=	Flame Photometric Detector
GC	=	Gas Chromatograph
GC-MS	=	Gas Chromatograph - Mass Spectrometer
GHM	=	Geofina Hydrocarbon Meter (combined thermal extraction - pyrolysis gas chromatograph)
HC	=	Hydrocarbons
HI	=	Hydrogen Index (100 x S2/TOC)
HPLC	=	High Pressure Liquid Chromatograph
MDBT(4/1)	=	Ratio of 4-/1-methyl dibenzothiophene
MNR	=	Ratio of 2-/1-methyl naphthalene
MP	=	Methyl phenanthrene
MPI1	=	Methyl phenanthrene Index, 1.5x(3MP+2MP) / P+9MP+1MP
MPLC	=	Medium Pressure Liquid Chromatograph
NSO	=	Nitrogen-, Sulphur- and Oxygen-compounds
OI	=	Oxygen Index (100 x S3/TOC)
P	=	Phenanthrene
PI	=	Production Index (S1/(S1+S2))
PP	=	Petroleum Potential (S1+S2)
Ro (%)	=	Measured Vitrinite Reflectance in Percent
Rock-Eval	=	Oil show and source rock evaluation instrument
S1	=	Amount of Free Hydrocarbons, Rock-Eval
S2	=	Amount of Kerogen pyrolysate, Rock-Eval
S3	=	Amount of Oxidised Organic Material
SCI	=	Spore Colour Index (maturity indicator)
TCD	=	Thermal Conductivity Detector
TAI	=	Thermal Alteration Index (maturity indicator)
Tmax	=	Temperature of maximum pyrolysate yield, Rock-Eval
TOC	=	Total Organic Carbon

Experimental Procedures

Total Organic Carbon (TOC) and Total Carbon Analysis

This analysis is performed using a LECO CS244 Carbon Analyser.

Hand-picked lithologies from cuttings samples are crushed with a mortar and pestle and approximately 200 mg (50 mg for coals) are accurately weighed into LECO crucibles. The samples are then treated three times with 10 % hydrochloric acid to remove oxidized (carbonate) carbon, and washed four times with distilled water. The samples are dried on a hotplate at 60 - 70°C before analysis of total organic carbon. Total carbon is also analysed on the same instrument using approximately 200 mg of untreated crushed whole rock. Oxidized (carbonate) carbon is calculated by weight difference.
Total organic carbon can also be analysed on the Rock-Eval II Pyrolyser during the normal run of the instrument.

Rock-Eval Pyrolysis

This analysis is performed by using a Rock-Eval II Pyrolyser. Approximately 100 mg crushed whole rock is analysed. The sample is first heated at 300°C for three min in an atmosphere of helium to release the free hydrocarbons present (S1 peak) and then pyrolysed by increasing the temperature from 300°C to 600°C (temp. gradient 25°C/min) (S2 peak). Both the S1 and S2 yields are measured using a flame ionization detector (FID). In the temperature interval between 300°C and 390°C, the released gases are split and a proportion passed through a carbon dioxide trap, which is connected to a thermal conductivity detector (TCD). The value obtained from the TCD corresponds to the amount of oxygen contained in the kerogen of the sample and is reported as the S3 peak.

The Rock-Eval II Pyrolyser also analyses the TOC of each sample during the normal run of the instrument.

Thermal Extraction/Pyrolysis Gas Chromatography

The instrument used for this analysis is a Varian 3400 Gas Chromatograph interfaced to a pyrolysis oven (the pyrolyser). Up to 15 mg of whole rock sample is loaded on the pyrolyser and heated isothermally, at 300°C, for 4 min, during which time thermal extraction of the free hydrocarbons occurs (equivalent to the S1 peak of the Rock-Eval). The released gases pass to a 25 m OV1 column with a liquid nitrogen-cooled trap.

After 4 min the pyrolysis oven is temperature programmed up to 530°C, at a rate of 37°C/min, causing bound hydrocarbons to be released from the kerogen (equivalent to the S2 peak of the Rock-Eval). The released gases pass to a 25 m OV1 column with a liquid nitrogen-cooled trap.

The temperature program of the gas chromatograph oven, in which the columns are housed is -10°C to 290°C at a rate of 6°C/min.
Both the columns are linked to a FID.

Solvent Extraction of Organic Matter (EOM)

The samples are extracted using a Tecator Soxtec HT-System. Carefully weighed samples are taken in a pre-extracted thimble. Some activated copper is added to the extraction cup and dichloromethane is used as an extraction solvent. The samples are boiled for 1 hour and then rinsed for 2 hours. If the samples contain more than 10 % TOC, then the whole procedure is repeated once. The resulting solution is filtered and the solvent removed by rotary evaporation (200 mb, 30°C). The amount of EOM is gravimetrically established.

Removal of Asphaltenes

Asphaltenes are removed from the EOM by precipitation in n-pentane. N-pentane is added to the EOM and the solution is then stored in the dark and at ambient temperature for at least 8 hours. The solution is then filtered (Baker 10-spe system) and the precipitated asphaltenes dissolved in dichloromethane are returned to the original flask. The solvent is removed by rotary evaporation (200 mb and 30°C).

Chromatographic Separation of deasphaltened EOM

Chromatographic separation is performed using an MPLC system developed by the company. The EOM (minus asphaltenes) is injected into the MPLC and separated using hexane as an eluent. The saturated and aromatic hydrocarbon fractions are collected and the solvent removed using a rotary evaporator at 30°C. The fractions are then transferred to small pre-weighed vials and evaporated to dryness in a stream of nitrogen. The vials are re-weighed to obtain the weights of both the saturated and the aromatic fractions. The weight of the NSO fraction which is retained on the column, is obtained by weight difference.

Gas Chromatographic Analyses

Saturated hydrocarbon fractions:

The instrument used for this analysis is a PERKIN ELMER 8320 Gas Chromatograph equipped with an FID detector and an OV1 column. The carrier gas is helium and the temperature program runs from 80°C to 300°C at a rate of 4°C/min. Final hold time is 20 mins. The saturated hydrocarbon fraction is diluted by 1:30 and a 1 microlitre aliquot of this is injected into the instrument.

Aromatic hydrocarbon fractions:

The instrument used is a Varian 3400 Gas Chromatograph with a 25 m SE 54 capillary column, split injector and a column splitter leading to FID and FPD detectors, which allows simultaneous analysis of co-eluting hydrocarbons and sulphur compounds. The carrier gas is helium and the temperature program runs from 40°C to 290°C at a rate of 4°C/min. Final hold time is 10 mins. The aromatic hydrocarbon fraction is diluted by 1:30 and a 1 microlitre aliquot of this is injected into the instrument.

Whole Oil/Whole Extract

Whole oil chromatograms are determined on a Perkin Elmer Sigma 2000 gas chromatograph fitted with a split injector, 25 m SE54 capillary column and effluent splitter connected to FID and FPD detectors allowing simultaneous determination of hydrocarbons and sulphur compounds. Approximately 0.1 microlitres of whole oil are injected and the temperature program on the chromatograph runs from -10°C to 300°C at 4°C/min.

Vitrinite Reflectance Analysis

Samples to be analysed for vitrinite reflectance are ground to small granules (if necessary) using a pestle and mortar and are then mounted in a fast setting resin. The resin blocks are first ground flat using a coarse corundum paper to expose the rock granule surfaces and then with three finer grades of corundum paper to improve these surfaces and reduce scratches. The blocks are finally polished on a rotating Selvyt-covered lap using three grades of diamond suspension fluid. An appropriate lubricant is used when necessary.

Reflectance measurements are made under oil immersion at 546 nm using a Zeiss Universal Photo microscope II equipped with a HP 9000 series computer system. The polished blocks are mounted on the microscope stage and scanned manually in order to locate and measure particles of vitrinite. An attempt is made to obtain readings from 15-20 individual particles per sample, but this is not always possible in samples with low amounts of phytoclasts.

Visual Kerogen Misroscopy

Kerogen concentrates are obtained from samples prepared by HCl and HF digestion followed by zinc bromide flotation to remove pyrite and other heavy mineral residues. The cleaned concentrates are mounted on slides by smearing, these being analysed microscopically in transmitted white light and UV light (530 nm barrier filter) to determine the Spore Colour or Thermal Alteration Indices (SCI or TAI) and the colour and intensity of spore fluorescence. The spore colour index, backed by spore fluorescence, is used as an alternative maturity parameter to verify the results obtained from vitrinite reflectance.

Fluorescence Colour	Colour Index	Corresp. Vitrinite Reflectance
Green	1	0.2 %
Green/yellow	2	0.2-0.3 %
Yellow	3	0.3 %
Yellow/orange	4	0.4 %
Light orange		50.5 %
Moderate-orange	6	0.6 %
Dark orange		70.8 %
Dark orange/red	8	1.0 %
Spore fluorescence extinction	9	1.3 %

NB. This table only provides a rudimentary correlation as vitrinite reflectance and spore fluorescence colour are both independently affected by factors such as depositional environment and categanic history.

Combined Gas Chromatography - Mass Spectrometry (GC-MS)

The GC-MS analyses are performed on a VG TS250 system interfaced to a Hewlett Packard 5890 gas chromatograph. The GC is fitted with a fused silica SE54 capillary column (40 m x 0.22 mm i.d.) directly into the ion source. Helium (12 psi) is used as carrier gas and the injections are performed in splitless mode. The GC oven is programmed from 45°C to 150°C at 35°C/min, at which point the programme rate is 2°C/min up to 310°C where the column is held isothermally for 15 min. For the aromatic hydrocarbons, the GC oven is programmed from 50°C to 310°C at 5°C/min. and held isothermally at 310oC for 15 min. The mass spectrometer is operated in electron impact (EI) mode at 70 eV electron energy, a trap current of 500 uA and a source temperature of 220°C. The instrument resolution used is 1500 (10 % value).

The data system used is a VG PDP11/73 for acquiring data, and a Vax station 3100

for peak processing the data. The samples are analysed in multiple ion detection mode (MID) at a scan cycle time of approximately 1.1 sec.
Calculation of peak ratios is performed from peak heights in the appropriate mass fragmentograms.

Saturated Fractions

Terpanes

The most commonly used fragment ions for detection of terpanes are M/Z 163 for detection of 25,28,30 trisnormoretane or 25,28,30 trisnorhopane, M/Z 177 for detection of demethylated hopanes or moretanes, M/Z 191 for detection of tricyclic, tetracyclic- and pentacyclic terpanes and M/Z 205 for methylated hopanes or moretanes. The molecular ions M/Z 370 and 384 are also recorded for identification of C_{27} and C_{28} triterpanes respectively.

Steranes

The most commonly used fragment ions for detection of steranes are M/Z 149 to distinguish between 5α and 5β steranes, M/Z 189 and 259 for detection of rearranged steranes, M/Z 217 for detection of rearranged and normal steranes and M/Z 218 for detection of 14β(H) 17β(H) steranes.

The M/Z 231 fragment ion is used to detect possible aromatic contamination of the saturated fraction. It is also used for detection of methyl steranes.

Aromatic Fractions

Alkyl-substituted Benzenes

The M/Z 106 fragment ion is often used to detect the alkyl-substituted benzenes. It is especially useful for the detection of di-substituted benzenes. M/Z 134 can also be used for the detection of C_4-alkylbenzenes, but benzothiophene will also give a signal with this fragment ion.

Naphthalenes

Methyl naphthalenes are normally detected by the M/Z 142 fragment ion, while C_2-naphthalenes are detected by M/Z 156 and C_3-naphthalenes by M/Z 170.

Benzothiophenes and Dibenzothiophenes

Benzothiophene can be detected, as mentioned above, by M/Z 134. The M/Z 198 and M/Z 212 fragment ions are used for methyl-substituted dibenzothiophenes and dimethyl-substituted dibenzothiophenes respectively.

Phenanthrenes

Phenanthrene is detected using the M/Z 178 fragment ion. Anthracene will, if present, also give a signal in the M/Z 178 fragment ion. Methyl-substituted phenanthrenes give signals in the M/Z 192 fragment ion, while the M/Z 206 fragment ion shows the dimethyl-substituted phenanthrenes and the M/Z 220 fragment ion shows the C_3 substituted phenanthrenes.

Aromatic Steranes

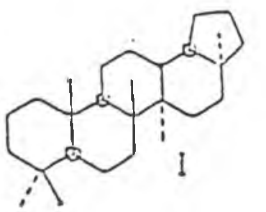
Monoaromatic steranes are detected using the M/Z 253 fragment ion, while the triaromatic steranes are detected using the M/Z 231 fragment ion.

Mass Fragmentograms representing Terpanes
(M/Z 163, 177, 191, 205, 370, 384, 398, 412 and 426)

Peak Identification: (α and β refer to hydrogen atoms at C-17 and C-21 respectively unless indicated otherwise)

A.	18α trisnorneohopane (T_s)	$C_{27}H_{44}$	(I)
B.	17α trisnorhopane (T_m)	$C_{27}H_{46}$	(II, R=H)
Z.	Bisnorhopane	$C_{28}H_{48}$	(IV)
C.	αβ norhopane	$C_{29}H_{50}$	(II, R=C_2H_5)
D.	βα norhopane	$C_{29}H_{50}$	(III, R=C_2H_5)
E.	αβ hopane	$C_{30}H_{52}$	(II, R=i-C_3H_7)
F.	βα hopane	$C_{30}H_{52}$	(III, R=i-C_3H_7)
G.	22S αβ homohopane	$C_{31}H_{54}$	(II, R=i-C_4H_9)
H.	22R αβ homohopane	$C_{31}H_{54}$	(II, R=i-C_4H_9)
I.	βα homohopane	$C_{31}H_{54}$	(III, R=i-C_4H_9)
J.	22S αβ bishomohopane	$C_{32}H_{56}$	(II, R=i-C_5H_{11})
	22R αβ bishomohopane	$C_{32}H_{56}$	(II, R=i-C_5H_{11})
K.	22S αβ trishomohopane	$C_{33}H_{58}$	(II, R=i-C_6H_{13})
	22R αβ trishomohopane	$C_{33}H_{58}$	(II, R=i-C_6H_{13})
L.	22S αβ tetrakishomohopane	$C_{34}H_{60}$	(II, R=i-C_7H_{15})
	22R αβ tetrakishomohopane	$C_{34}H_{60}$	(II, R=i-C_7H_{15})
M.	22S αβ pentakishomohopane	$C_{35}H_{62}$	(II, E=i-C_8H_{17})
	22R αβ pentakishomohopane	$C_{35}H_{62}$	(II, R=i-C_8H_{17})
P.	Tricyclic terpane	$C_{23}H_{42}$	(V, R=i-C_4H_9)
Q.	Tricyclic terpane	$C_{24}H_{44}$	(V, R=i-C_5H_{11})
R.	Tricyclic terpane (17R, 17S)	$C_{25}H_{66}$	(V, R=i-C_6H_{13})
S.	Tetracyclic terpane	$C_{24}H_{42}$	(VI)
T.	Tricyclic terpane (17R, 17S)	$C_{26}H_{48}$	(V, R=i-C_7H_{15})
N.	Tricyclic terpane	$C_{21}H_{38}$	(V, R=C_2H_5)
O.	Tricyclic terpane	$C_{22}H_{40}$	(V, R=C_3H_7)
Y.	25,28,30-trisnorhopane/moretane	$C_{27}H_{46}$	(VII)
X.	αβ diahopane	$C_{30}H_{52}$	(VIII)

STRUCTURES REPRESENTING TERPANES



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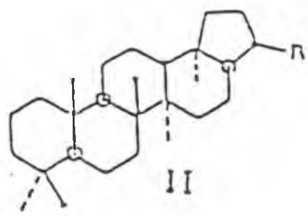

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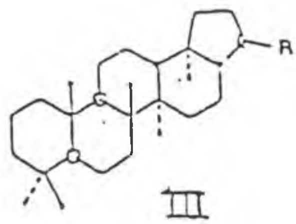

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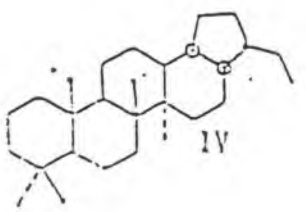

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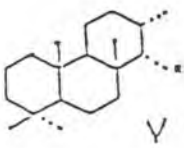

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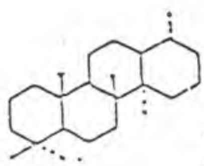

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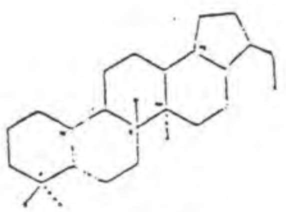

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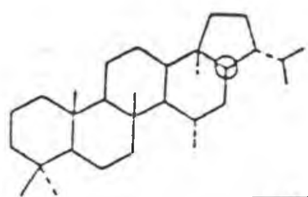


VIII

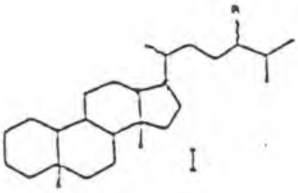
Mass Fragmentograms representing Steranes

(M/Z 149, 189, 217, 218, 259, 372, 386, 400 and 414)

Peak Identifications: α and β refer to hydrogen atoms at C-5, C-14 and C-17 in regular steranes and at C-13 and C-17 in diasteranes).

a.	20S βα diacholestane	$C_{27}H_{48}$	(I, R=H)
b.	20R βα diacholestane	$C_{27}H_{48}$	(I, R=H)
c.	20S αβ diacholestane	$C_{27}H_{48}$	(II, R=H)
d.	20R αβ diacholestane	$C_{27}H_{48}$	(II, R=H)
e.	20S βα 24-methyl-diacholestane	$C_{28}H_{50}$	(I, $R=CH_3$)
f.	20R βα 24-methyl-diacholestane	$C_{28}H_{50}$	(I, $R=CH_3$)
g.	20S αβ 24-methyl-diacholestane	$C_{28}H_{50}$	(II, $R=CH_3$)
	+ 20S ααα cholestane	$C_{27}H_{48}$	(III, R=H)
h.	20S βα 24-ethyl-diacholestane	$C_{29}H_{52}$	(II, $R=C_2H_5$)
	+ 20R αββ cholestane	$C_{27}H_{48}$	(IV, R=H)
i.	20S αββ cholestane	$C_{27}H_{48}$	(IV, R=H)
	+ 20R αβ 24-methyl-diacholestane	$C_{28}H_{50}$	(II, $R=CH_3$)
j.	20R ααα cholestane	$C_{27}H_{48}$	(III, R=H)
k.	20R βα 24-ethyl-diacholestane	$C_{29}H_{52}$	(I, $R=C_2H_5$)
l.	20R αβ 24-ethyl-diacholestane	$C_{29}H_{52}$	(II, $R=C_2H_5$)
m.	20S ααα 24-methyl-cholestane	$C_{28}H_{50}$	(III, $R=CH_3$)
n.	20R αββ 24-methyl-cholestane	$C_{28}H_{50}$	(IV, $R=CH_3$)
	+ 20R αβ 24-ethyl-diacholestane	$C_{29}H_{52}$	(II, $R=C_2H_5$)
o.	20S αββ 24-methyl-cholestane	$C_{28}H_{50}$	(IV, $R=CH_3$)
p.	20R ααα 24-methyl-cholestane	$C_{28}H_{50}$	(III, $R=CH_3$)
q.	20S ααα 24-ethyl-cholestane	$C_{29}H_{52}$	(III, $R=C_2H_5$)
r.	20R αββ 24-ethyl-cholestane	$C_{29}H_{52}$	(IV, $R=C_2H_5$)
s.	20S αββ 24-ethyl-cholestane	$C_{29}H_{52}$	(IV, $R=C_2H_5$)
t.	20R ααα 24-ethyl-cholestane	$C_{29}H_{52}$	(III, $R=C_2H_5$)
u.	5α sterane	$C_{21}H_{36}$	(VI, $R=C_2H_5$)
v.	5α sterane	$C_{22}H_{38}$	(VI, $R=C_3H_7$)

STRUCTURES REPRESENTING STERANES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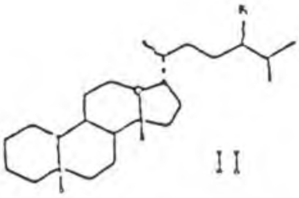
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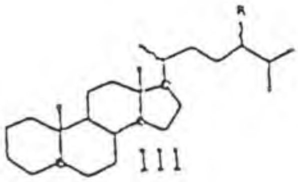
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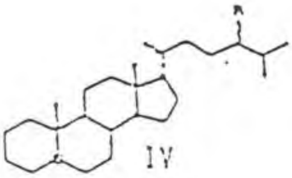
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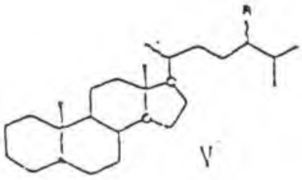
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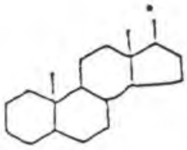
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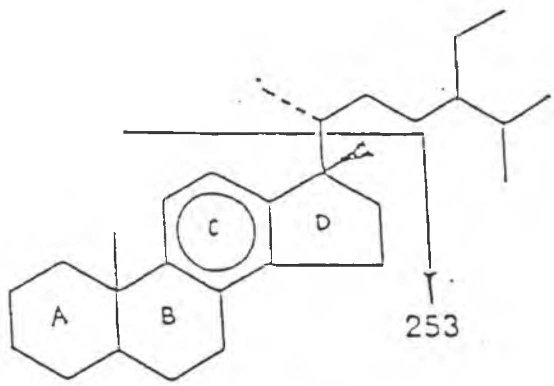
Mass Fragmentograms representing Monoaromatic Steranes (M/Z 253)

Description of C-ring monoaromatic steroid hydrocarbons

Peak	Substituents R_1	R_2	R_3	R_4	Abbreviation of Compound
A1					$C_{21}M$
B1					$C_{22}MA$
C1	β(H)	CH_3	S(CH_3)	H	β$SC_{27}MA$
	β(H)	CH_3	R(CH_3)	H	β$RC_{27}MA$
D1	CH_3	H	R(CH_3)	H	$RC_{27}DMA$
	α(H)	CH_3	S(CH_3)	H	α$SC_{27}MA$
E1	β(H)	CH_3	S(CH_3)	CH_3	β$SC_{28}MA$
	CH_3	H	S(CH_3)	CH_3	$SC_{28}DMA$
F1	α(H)	CH_3	R(CH_3)	H	α$RC_{27}MA$
	α(H)	CH_3	S(CH_3)	CH_3	α$SC_{28}MA$
	β(H)	CH_3	R(CH_3)	CH_3	β$RC_{28}MA$
G1	CH_3	H	R(CH_3)	CH_3	$RC_{28}DMA$
	β(H)	CH_3	S(CH_3)	C_2H_5	β$SC_{29}MA$
	CH_3	H	S(CH_3)	C_2H_5	$SC_{29}DMA$
	α(H)	CH_3	R(CH_3)	CH_3	α$RC_{28}MA$
H1	β(H)	CH_3	R(CH_3)	C_2H_5	β$RC_{29}MA$
	CH_3	H	R(CH_3)	C_2H_5	$RC_{29}DMA$
I1	α(H)	CH_3	R(CH_3)	C_2H_5	α$RC_{29}MA$

STRUCTURES REPRESENTING MONOAROMATIC STERANES



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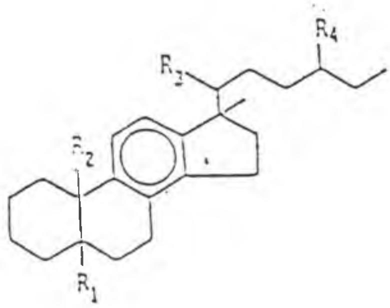
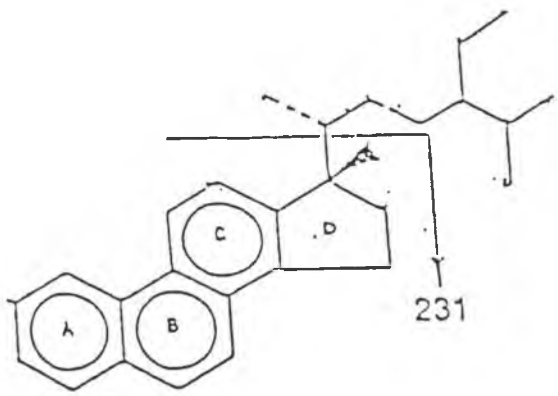


Mass Fragmentograms representing Triaromatic Steranes (M/Z 231)

Description of ABC-ring triaromatic steroid hydrocarbons

	Substituents		Abbreviation
Peak	R_1	R_2	of Compound
a1	CH_3	H	$C_{20}TA$
b1	CH_3	CH_3	$C_{21}TA$
c1	$S(CH_3)$	C_6H_{1-3}	$SC_{26}TA$
d1	$R(CH_3)$	C_6H_{13}	$RC_{26}TA$
	$S(CH_3)$	C_7H_{15}	$SC_{27}TA$
e1	$S(CH_3)$	C_8H_{17}	$SC_{28}TA$
f1	$S(CH_3)$	C_7H_{15}	$RC_{27}TA$
g1	$R(CH_3)$	C_8H_{17}	$RC_{28}TA$

STRUCTURES REPRESENTING TRIAROMATIC STERANES



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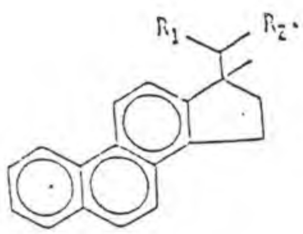

Stable Carbon Isotope Ratio Mass Spectrometry

Carbon isotope analysis is performed on a dual inlet VG SIRA 10 instrument. The combustion of the samples is performed by a Carlo Erba EA 1108 element analyser directly connected to the inlet system of the mass spectrometer.

The combustion temperature is 1020°C and the carrier gas used was Helium. After the combustion H_2O and CO_2 are trapped in individual cool traps. The CO_2 gas is then heated up before admission into the mass spectrometer. The whole operation is controlled by an IBM PC50 computer system.

δ-values

The isotope ratios are given as δ-values in ‰ versus the PDB-standard:

$$\delta^{13}C = (R\ sample - R\ standard/R\ standard) \times 1000$$
$$R = {}^{13}C/{}^{12}C$$

The PDB-standard (a marine chalk of the Pee Dee-formation, USA) was created by Craig 1957. All results of $^{13}C/^{12}C$-analysis of organic matter today are calculated (Craig correction) against this international standard.

Reproducibility

The precision of the combustion system and the mass spectrometer is controlled by determination of an international calibrated standard, NBS22 oil and a house standard carbon. Replicate analyses are also performed on samples.

Appendix 1

Tables

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int)	Depth (Cvd)	Type / TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
1000.00				Hrdl		Oligocene-Eocene		0037
			60	S/Sst : w to lt gy, crs, l				0037-1L
			35	Sh/Clst: ol gy to lt or, slt				0037-2L
			5	Sh/Clst: drk gn gy to gn blk, glauc				0037-3L
1020.00				Hrdl		Oligocene-Eocene		0104
			75	Cont : cem, dd, prp				0104-1L
			20	Sh/Clst: gn gy to lt gy, glauc				0104-2L
			5	S/Sst : w to lt gy, crs, l				0104-3L
1040.00				Hrdl		Oligocene-Eocene		0105
			100	Sh/Clst: ol gy to lt gy, glauc				0105-1L
			tr	S/Sst : w to lt gy, crs, l				0105-2L
			tr	Sh/Clst: pl brn				0105-3L
1060.00				Hrdl		Oligocene-Eocene		0106
			60	Sh/Clst: lt brn gy to pl y brn				0106-1L
			30	S/Sst : w to lt gy, crs, l				0106-2L
			10	Sh/Clst: ol gy to gn gy to dsk y gn, glauc				0106-3L
			tr	Cont : prp				0106-4L
1080.00				Hrdl		Oligocene-Eocene		0107
			80	Sh/Clst: ol gy to lt ol gy to lt brn gy to pl y brn				0107-1L
			15	S/Sst : w to lt gy, crs, l				0107-2L
			5	Sh/Clst: drk gn gy to dsk y gn, glauc				0107-3L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
1100.00				Hrdl		Oligocene-Eocene		0038
			85			Sh/Clst: ol gy to lt or to lt brn gy, slt		0038-2L
			15			S/Sst : w to lt gy, crs, l, f, kln		0038-1L
			tr			Sh/Clst: drk gn gy to gn blk, glauc		0038-3L
			tr			Cont : prp		0038-4L
1120.00				Hrdl		Oligocene-Eocene		0039
			90			Sh/Clst: ol gy to lt or to lt brn gy, slt		0039-2L
			10			S/Sst : w to lt gy, crs, l, f, kln		0039-1L
			tr			Sh/Clst: drk gn gy to gn blk, glauc		0039-3L
			tr			Cont : prp		0039-4L
1140.00				Hrdl		Oligocene-Eocene		0040
			100			Sh/Clst: ol gy to lt brn gy to brn gy, slt		0040-1L
			tr			S/Sst : w to lt gy, crs, l, f, kln		0040-2L
			tr			Cont : prp		0040-3L
1160.00				Hrdl		Oligocene-Eocene		0041
			80			Sh/Clst: ol gy to lt brn gy to brn gy, slt		0041-1L
			20			S/Sst : w to lt gy, crs, l, f, kln		0041-2L
			tr			Sh/Clst: drk gn gy to gn blk, glauc		0041-3L
			tr			Cont : prp		0041-4L
1180.00				Hrdl		Oligocene-Eocene		0042
			75			Sh/Clst: lt brn gy to brn gy, slt		0042-1L
			20			S/Sst : w to lt gy, crs, l, f, kln		0042-2L
			5			Cont : prp		0042-4L
			tr			Sh/Clst: drk gn gy to gn blk, glauc		0042-3L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
1200.00				Hrdl		Oligocene-Eocene		0043
			75	Sh/Clst: lt brn gy to brn gy, slt				0043-1L
			25	S/Sst : w to lt gy, crs, l, f, kln				0043-2L
			tr	Sh/Clst: drk gn gy to gn blk, glauc				0043-3L
			tr	Cont : prp				0043-4L
1220.00				Hrdl		Oligocene-Eocene		0044
			75	Sh/Clst: lt brn gy to brn gy, slt				0044-1L
			25	S/Sst : w to lt gy, crs, l, f, kln				0044-2L
			tr	Sh/Clst: drk gn gy to gn blk, glauc				0044-3L
			tr	Cont : dd, prp				0044-4L
1240.00				Hrdl		Oligocene-Eocene		0108
			70	Sh/Clst: lt brn gy to brn gy, slt				0108-1L
			30	S/Sst : w to lt gy, crs, l				0108-2L
			tr	Sh/Clst: drk gn gy, glauc				0108-3L
			tr	Cont : prp				0108-4L
1260.00				Hrdl		Oligocene-Eocene		0045
			85	Sh/Clst: lt brn gy to brn gy, slt, pyr				0045-1L
			10	S/Sst : w to lt gy, crs, l, f, kln				0045-2L
			5	Ca : w to lt or, fos				0045-3L
			tr	Sh/Clst: drk gn gy to gn blk, glauc				0045-4L
			tr	Cont : dd, prp				0045-5L
1280.00				Hrdl		Oligocene-Eocene		0046
			60	Sh/Clst: lt brn gy to brn gy, slt, pyr				0046-1L
			40	S/Sst : w to lt gy, crs, l, f, kln				0046-2L
			tr	Ca : w to lt or				0046-3L
			tr	Sh/Clst: drk gn gy to gn blk, glauc				0046-4L
			tr	Cont : dd, prp				0046-5L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
1300.00			Hrdl		Oligocene-Eocene		0047
		60	Sh/Clst: lt brn gy to brn gy, slt, pyr				0047-1L
		40	S/Sst : w to lt gy, crs, l, f, kln				0047-2L
		tr	Sh/Clst: drk gn gy to gn blk, glauc				0047-3L
		tr	Cont : dd, prp				0047-4L
1310.00			Hrdl		Oligocene-Eocene		0048
		60	Sh/Clst: lt brn gy to brn gy, slt, pyr				0048-1L
		40	S/Sst : w to lt gy, crs, l, f, kln				0048-2L
		tr	Sh/Clst: drk gn gy to gn blk, glauc				0048-3L
		tr	Cont : dd, prp				0048-4L
1420.00			Hrdl		Oligocene-Eocene		0049
		75	S/Sst : w to lt gy, crs, l				0049-1L
		25	Sh/Clst: lt brn gy to brn gy, slt				0049-2L
		tr	Sh/Clst: drk gn gy to gn blk, glauc				0049-3L
1440.00			Hrdl		Oligocene-Eocene		0050
		80	S/Sst : w to lt gy, crs, l				0050-1L
		20	Sh/Clst: lt brn gy to brn gy, slt				0050-2L
		tr	Sh/Clst: drk gn gy to gn blk, glauc				0050-3L
1460.00			Hrdl		Oligocene-Eocene		0051
		90	S/Sst : w to lt gy, crs, l				0051-1L
		10	Sh/Clst: lt brn gy to brn gy, slt				0051-2L
		tr	Sh/Clst: drk gn gy to gn blk, glauc				0051-3L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
1480.00				Hrdl		Oligocene-Eocene		0052
			95	Sh/Clst:		lt brn gy to brn gy, slt		0052-1L
			5	S/Sst :		w to lt gy, crs, l		0052-2L
1500.00				Hrdl		Oligocene-Eocene		0053
			100	Sh/Clst:		lt brn gy to brn gy		0053-1L
			tr	S/Sst :		w to lt gy, crs, l		0053-2L
1520.00				Hrdl		Oligocene-Eocene		0054
			100	Sh/Clst:		lt brn gy to brn gy, pyr		0054-1L
			tr	S/Sst :		w to lt gy, crs, l		0054-2L
1540.00				Hrdl		Oligocene-Eocene		0055
			95	Sh/Clst:		lt brn gy to brn gy, pyr		0055-1L
			5	S/Sst :		w to lt gy, crs, l		0055-2L
1560.00				Hrdl		Oligocene-Eocene		0056
			100	Sh/Clst:		lt brn gy to brn gy, pyr		0056-1L
			tr	S/Sst :		w to lt gy, crs, l		0056-2L
1580.00				Hrdl		Oligocene-Eocene		0057
			100	Sh/Clst:		lt brn gy to brn gy, pyr		0057-1L
			tr	S/Sst :		w to lt gy, crs, l		0057-2L
			tr	Ca :		lt or, fos		0057-3L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
1600.00				Hrdl		Oligocene-Eocene		0058
			100	Sh/Clst:		lt brn gy to brn gy, pyr		0058-1L
			tr	S/Sst :		w to lt gy, crs, l		0058-2L
1620.00				Hrdl		Oligocene-Eocene		0059
			100	Sh/Clst:		lt brn gy to brn gy, pyr		0059-1L
			tr	S/Sst :		w to lt gy, crs, l		0059-2L
			tr	Ca :		lt or, fos		0059-3L
			tr	Cont :		prp, dd		0059-4L
1640.00				Hrdl		Oligocene-Eocene		0060
			100	Sh/Clst:		pl ol to lt brn gy to brn gy		0060-1L
			tr	S/Sst :		w to lt gy, crs, l, f, kln		0060-2L
			tr	Ca :		w to lt or		0060-3L
			tr	Cont :		prp, dd		0060-4L
1660.00				Hrdl		Oligocene-Eocene		0061
			95	Sh/Clst:		pl ol to lt brn gy to brn gy		0061-1L
			5	S/Sst :		w to lt gy, crs, l, f, kln		0061-2L
			tr	Ca :		w to lt or, fos		0061-3L
			tr	Cont :		prp, dd		0061-4L
1680.00				Hrdl		Oligocene-Eocene		0062
			95	Sh/Clst:		gn gy to lt brn gy to brn gy		0062-1L
			5	S/Sst :		w to lt gy, crs, l, f, kln, pyr		0062-2L
			tr	Ca :		w to lt or, fos		0062-3L
			tr	Cont :		prp, dd, Coal-ad		0062-4L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int)	Depth (Cvd)	Type (TOC%)	%	Grp / Lithology description	Frm	Age	Trb	Sample
1700.00				Hrdl		Oligocene-Eocene		0063
			100	Sh/Clst: gn gy to brn gy				0063-1L
			tr	S/Sst : w to lt gy, f, kln, pyr				0063-2L
			tr	Ca : w to lt or				0063-3L
1720.00				Hrdl		Oligocene-Eocene		0064
			100	Sh/Clst: gn gy to brn gy				0064-1L
			tr	Cont : dd				0064-2L
1740.00				Hrdl		Oligocene-Eocene		0065
			100	Sh/Clst: gn gy to brn gy				0065-1L
			tr	Cont : dd				0065-2L
1760.00				Hrdl		Oligocene-Eocene		0066
			100	Sh/Clst: gn gy to lt gy to brn gy				0066-1L
			tr	S/Sst : lt gy to w, f, kln, pyr				0066-2L
1780.00				Hrdl		Oligocene-Eocene		0067
			100	Sh/Clst: lt y gn to pl ol				0067-1L
			tr	S/Sst : lt gy to w, f, kln, pyr				0067-2L
			tr	Ca : lt or, fos				0067-3L
1800.00				Hrdl		Oligocene-Eocene		0068
			100	Sh/Clst: lt y gn to pl ol				0068-1L
			tr	S/Sst : lt gy to w, f, kln, pyr				0068-2L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
1820.00				Hrdl		Oligocene-Eocene		0069
			100			Sh/Clst: lt y gn to pl ol to lt gy		0069-1L
			tr			S/Sst : lt gy to w, f, kln, pyr, crs, l		0069-2L
1840.00				Hrdl		Oligocene-Eocene		0070
			100			Sh/Clst: pl ol to drk y brn		0070-1L
			tr			S/Sst : lt gy to w, f, kln, pyr, crs, l		0070-2L
			tr			Ca : lt or, fos		0070-3L
1860.00				Hrdl		Oligocene-Eocene		0071
			100			Sh/Clst: pl ol to drk y brn		0071-1L
1880.00				Hrdl		Oligocene-Eocene		0072
			95			Sh/Clst: pl ol to brn gy to lt gy		0072-1L
			5			S/Sst : lt gy to m gy to gy brn, crs, l, f, kln		0072-2L
1900.00				Hrdl		Oligocene-Eocene		0073
			95			Sh/Clst: pl ol to lt brn gy to lt gy		0073-1L
			5			S/Sst : lt gy to m gy to gy brn, crs, l, f, kln		0073-2L
1920.00				Hrdl		Oligocene-Eocene		0074
			90			Sh/Clst: pl ol to lt brn gy to lt gy		0074-1L
			5			Sh/Clst: pl brn		0074-2L
			5			Marl : or gy		0074-3L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
1940.00				Hrdl		Oligocene-Eocene		0075
			50	Sh/Clst:		pl ol to lt brn gy to lt gy		0075-1L
			45	Sh/Clst:		pl brn		0075-2L
			5	Marl :		or gy		0075-3L
			tr	S/Sst :		lt gy, crs, l		0075-4L
1960.00				Hrdl		Oligocene-Eocene		0076
			60	Sh/Clst:		pl ol to lt brn gy to lt gy		0076-1L
			40	Sh/Clst:		pl brn		0076-2L
			tr	Marl :		or gy		0076-3L
1980.00				Rogl	Bald	Paleocene		0077
			75	Sh/Clst:		pl ol to lt brn gy to lt gy		0077-1L
			25	Sh/Clst:		pl brn		0077-2L
			tr	Marl :		or gy		0077-3L
			tr	Cont :		prp		0077-4L
2000.00				Rogl	Bald	Paleocene		0078
			85	Sh/Clst:		pl ol to lt brn gy to lt gy		0078-1L
			10	Sh/Clst:		pl brn		0078-2L
			5	Cont :		prp		0078-3L
2018.00				Rogl	Bald	Paleocene		0079
			80	Sh/Clst:		pl ol to lt brn gy to lt gy to m gy		0079-1L
			10	Sh/Clst:		pl brn		0079-2L
			10	Ca :		lt gy to lt or, mrl		0079-3L
			tr	Cont :		dd		0079-4L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
2042.00				Rogl Bald Paleocene		0080
			80	Sh/Clst: pl ol to lt brn gy to lt gy to m gy		0080-1L
			10	Sh/Clst: pl brn		0080-2L
			5	Ca : lt gy to lt or, mrl		0080-3L
			5	Cont : dd		0080-4L
			tr	S/Sst : w to lt gy, crs, l		0080-5L
2060.00				Rogl Bald Paleocene		0081
			85	Sh/Clst: pl ol to lt brn gy to lt gy to m gy		0081-1L
			5	Sh/Clst: pl brn		0081-2L
			5	Ca : lt gy to lt or, mrl		0081-3L
			5	Cont : dd		0081-4L
			tr	S/Sst : w to lt gy, crs, l		0081-5L
2078.00				Rogl List Paleocene		0082
			45	Sh/Clst: brn to pl brn		0082-1L
			45	Sh/Clst: pl ol to lt gy		0082-2L
			5	Ca : w to lt or, mrl		0082-3L
			5	Cont : dd		0082-4L
2102.00				Rogl List Paleocene		0083
			85	Sh/Clst: pl ol to lt gy to lt brn gy		0083-2L
			10	Sh/Clst: brn to pl brn		0083-1L
			5	Ca : w to lt or, mrl		0083-3L
2120.00				Rogl List Paleocene		0084
			90	Sh/Clst: lt gy to m gy to pl ol		0084-2L
			5	Sh/Clst: brn to pl brn		0084-1L
			5	Ca : w to lt or, mrl		0084-3L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2138.00				Rogl	List	Paleocene		0085
			90			Sh/Clst: lt gy to m gy to pl ol		0085-2L
			5			Sh/Clst: brn to pl brn		0085-1L
			5			Ca : w to lt or, mrl		0085-3L
			tr			S/Sst : lt gy, f, kln		0085-4L
2162.00				Rogl	List	Paleocene		0086
			95			Sh/Clst: lt gy to m gy to pl ol		0086-2L
			5			Sh/Clst: brn to pl brn		0086-1L
			tr			S/Sst : lt gy, f, kln		0086-3L
			tr			Cont : dd		0086-4L
2180.00				Rogl	List	Paleocene		0087
			95			Sh/Clst: lt gy to m gy to pl ol		0087-2L
			5			Sh/Clst: brn to pl brn to brn gy		0087-1L
			tr			S/Sst : lt gy, f, kln		0087-3L
			tr			Cont : dd		0087-4L
2201.00				Rogl	List	Paleocene		0088
			80			Sh/Clst: lt gy to m gy to pl ol		0088-2L
			5			Sh/Clst: brn to pl brn to brn gy		0088-1L
			5			S/Sst : lt gy, f, kln		0088-3L
			5			Cont : dd, prp		0088-4L
			5			Ca : lt or to or gy, mrl		0088-5L
2219.00				Rogl	List	Paleocene		0089
			90			Sh/Clst: lt gy to m gy to pl ol		0089-2L
			5			Sh/Clst: brn to pl brn to brn gy		0089-1L
			5			Cont : dd, prp		0089-4L
			tr			S/Sst : lt gy, f, kln		0089-3L
			tr			Ca : lt or to or gy, mrl		0089-5L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2240.00				Shet		U.Cretaceous		0090
			70	Sh/Clst: lt gy to lt ol gy to pl ol				0090-1L
			30	Sh/Clst: lt brn gy to brn to pl brn				0090-2L
2261.00				Shet		U.Cretaceous		0091
			85	Sh/Clst: lt gy to lt ol gy to pl ol				0091-1L
			10	Sh/Clst: lt brn gy to brn to pl brn				0091-2L
			5	Cont : dd				0091-3L
2279.00				Shet		U.Cretaceous		0092
			80	Sh/Clst: lt gy to lt ol gy to pl ol				0092-1L
			10	Sh/Clst: lt brn gy to brn to pl brn				0092-2L
			10	Cont : dd				0092-3L
2300.00				Shet		U.Cretaceous		0109
			90	Sh/Clst: lt gy to pl ol to lt brn gn				0109-1L
			10	Marl : ol gy to lt or				0109-2L
			tr	S/Sst : w to lt gy, crs, l				0109-3L
			tr	Cont : prp				0109-4L
2321.00				Shet		U.Cretaceous		0093
			75	Sh/Clst: lt gy to lt ol gy to pl ol				0093-1L
			10	Marl : lt or to or gy				0093-3L
			10	Cont : prp, dd				0093-4L
			5	Sh/Clst: lt brn gy to brn to pl brn				0093-2L
2342.00				Shet		U.Cretaceous		0094
			75	Sh/Clst: lt gy to lt ol gy to pl ol				0094-1L
			15	Cont : prp, dd				0094-4L
			5	Sh/Clst: lt brn gy to brn to pl brn				0094-2L
			5	Marl : lt or to or gy				0094-3L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int Cvd)	Type (TOC%)	%	Grp / Lithology description	Frm	Age	Trb	Sample
2360.00			Shet		U.Cretaceous		0095
		85	Sh/Clst: pl ol to lt gy to m gy				0095-1L
		5	Sh/Clst: brn to pl brn				0095-2L
		5	S/Sst : lt gy, crs, l				0095-3L
		5	Marl : lt or to or gy				0095-4L
		tr	Cont : prp				0095-5L
2381.00			Shet		U.Cretaceous		0096
		100	Sh/Clst: lt gy to m gy, calc				0096-1L
		tr	Sh/Clst: brn to pl brn				0096-2L
		tr	Marl : lt or to or gy				0096-3L
		tr	Cont : prp				0096-4L
2402.00			Shet		U.Cretaceous		0110
		90	Sh/Clst: lt gy to m gy, calc				0110-1L
		5	Marl : or gy to lt or				0110-2L
		5	Cont : dd				0110-4L
		tr	S/Sst : w to lt gy, crs, l				0110-3L
		tr	Kaolin : w				0110-5L
2420.00			Shet		U.Cretaceous		0097
		95	Sh/Clst: lt gy to m gy, calc				0097-1L
		5	Cont : prp				0097-4L
		tr	Sh/Clst: brn to pl brn				0097-2L
		tr	Marl : lt or to or gy				0097-3L
		tr	S/Sst : w to lt gy, crs, l				0097-5L
2441.00			Shet		U.Cretaceous		0111
		100	Sh/Clst: lt gy to m gy, calc				0111-1L
		tr	S/Sst : w to lt gy, crs, l				0111-2L
		tr	Sh/Clst: pl y brn to pl brn, hd				0111-3L
		tr	Cont : prp, dd				0111-4L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2459.00				Shet		U.Cretaceous		0112
			100	Sh/Clst: lt gy to m gy, pyr				0112-1L
			tr	S/Sst : w to lt gy, crs, l				0112-2L
			tr	Sh/Clst: pl y brn to pl brn, hd				0112-3L
			tr	Cont : prp, dd				0112-4L
2480.00				Shet		U.Cretaceous		0113
			100	Sh/Clst: lt gy to m gy, calc				0113-1L
			tr	S/Sst : w to lt gy, crs, l				0113-2L
			tr	Sh/Clst: pl y brn to pl brn, hd				0113-3L
			tr	Cont : dd, prp				0113-4L
2500.00				Shet		U.Cretaceous		0114
			95	Sh/Clst: lt gy to m gy, calc				0114-1L
			5	Cont : dd, prp				0114-2L
			tr	Marl : lt or to or gy				0114-3L
			tr	Sh/Clst: or gy to lt brn, slt				0114-4L
2519.00				Shet		U.Cretaceous		0115
			60	Sh/Clst: lt gy to m gy, calc				0115-1L
			20	Cont : dd, prp				0115-2L
			20	Sh/Clst: brn to m brn, mrl				0115-3L
			tr	Marl : or gy				0115-4L
2540.00				Shet		U.Cretaceous		0116
			60	Sh/Clst: gn gy to lt gy to m gy, calc, pyr				0116-1L
			25	Marl : or gy to lt or				0116-2L
			10	Cont : dd, prp				0116-3L
			5	Sh/Clst: gy red to pl brn, mrl				0116-4L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int Cvd)	Type (TOC%)	%	Grp / Lithology description	Frm	Age	Trb	Sample
2561.00			Shet		U.Cretaceous		0117
		70	Sh/Clst: gn gy to lt gy to m gy, calc, pyr				0117-1L
		15	Marl : or gy to lt or				0117-2L
		15	Cont : dd, prp				0117-3L
		tr	S/Sst : w to lt gy, crs, l				0117-4L
2579.00			Shet		U.Cretaceous		0118
		50	Sh/Clst: lt gy to m gy, calc				0118-1L
		40	Marl : or gy to lt or				0118-2L
		5	Cont : dd, prp				0118-3L
		5	Sh/Clst: pl y brn to pl brn, hd				0118-5L
		tr	S/Sst : w to lt gy, crs, l				0118-4L
2600.00			Shet		U.Cretaceous		0098
		95	Sh/Clst: lt gy to m gy				0098-1L
		5	Marl : lt or to or gy				0098-2L
2620.00			Shet		U.Cretaceous		0119
		90	Sh/Clst: gn gy to lt gy to m gy				0119-1L
		10	Cont : dd, prp				0119-3L
		tr	Marl : or gy to lt or				0119-2L
		tr	S/Sst : w to lt gy, crs, l				0119-4L
2639.00			Shet		U.Cretaceous		0120
		90	Sh/Clst: gn gy to lt gy to m gy				0120-1L
		5	Marl : or gy to lt or				0120-2L
		5	Cont : dd, prp				0120-3L
		tr	S/Sst : w to lt gy, crs, l				0120-4L
		tr	Sh/Clst: pl y brn to pl brn, hd				0120-5L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2660.00				Shet		U.Cretaceous		0121
			90	Sh/Clst: gn gy to lt gy to m gy				0121-1L
			5	Marl : or gy to lt or				0121-2L
			5	Cont : dd, prp				0121-3L
			tr	S/Sst : w to lt gy, crs, l				0121-4L
			tr	Sh/Clst: pl y brn to pl brn, hd				0121-5L
2681.00				Shet		U.Cretaceous		0122
			100	Sh/Clst: lt gy to m gy				0122-1L
			tr	Sh/Clst: pl pu to pl brn				0122-2L
			tr	Marl : lt or to or gy				0122-3L
			tr	Cont : prp, dd				0122-4L
2702.00				Shet		U.Cretaceous		0123
			100	Sh/Clst: lt gy to m gy				0123-1L
			tr	Sh/Clst: pl pu to pl brn				0123-2L
			tr	Cont : prp, dd				0123-3L
2720.00				Shet		U.Cretaceous		0124
			90	Sh/Clst: lt gy to m gy				0124-1L
			5	Sh/Clst: pl pu to pl brn				0124-2L
			5	Cont : prp, dd				0124-3L
			tr	Marl : lt or to or gy				0124-4L
			tr	S/Sst : w to lt gy, crs, l				0124-5L
2741.00				Shet		U.Cretaceous		0125
			75	Sh/Clst: lt gy to m gy				0125-1L
			10	Sh/Clst: pl y brn				0125-2L
			5	Cont : prp, dd				0125-3L
			5	Marl : lt or to or gy				0125-4L
			5	S/Sst : w to lt gy, crs, l				0125-5L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2759.00				Shet		U.Cretaceous		0126
			75	Sh/Clst:		lt gy to m gy		0126-1L
			10	Sh/Clst:		pl y brn		0126-2L
			10	Marl :		lt or to or gy		0126-4L
			5	Cont :		prp, dd		0126-3L
			tr	S/Sst :		w to lt gy, crs, l		0126-5L
2780.00				Shet		U.Cretaceous		0127
			90	Sh/Clst:		lt gy to m gy		0127-1L
			5	Sh/Clst:		pl y brn		0127-2L
			5	Cont :		prp, dd		0127-3L
			tr	Marl :		lt or to or gy		0127-4L
2801.00				Shet		U.Cretaceous		0128
			95	Sh/Clst:		lt gy to m gy		0128-1L
			5	Cont :		prp, dd		0128-2L
2819.00				Shet		U.Cretaceous		0099
			100	Sh/Clst:		lt gy to m gy		0099-1L
2840.00				Shet		U.Cretaceous		0100
			100	Sh/Clst:		lt gy to m gy		0100-1L
			tr	Marl :		lt or to or gy		0100-2L
			tr	Cont :		dd, prp		0100-3L
2861.00				Shet		U.Cretaceous		0101
			100	Sh/Clst:		lt gy to m gy		0101-1L
			tr	Marl :		lt or to or gy		0101-2L
			tr	Cont :		dd, prp		0101-3L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
2879.00				Shet		U.Cretaceous		0129
			95	Sh/Clst: lt gy to m gy				0129-1L
			5	Cont : prp, dd				0129-2L
			tr	Marl : lt or to or gy				0129-3L
2900.00				Shet		U.Cretaceous		0130
			100	Sh/Clst: lt gy to m gy				0130-1L
			tr	Cont : prp, dd				0130-2L
			tr	Marl : lt or to or gy				0130-3I
2921.00				Shet		U.Cretaceous		0102
			100	Sh/Clst: lt gy to m gy				0102-1L
			tr	Cont : dd, prp				0102-2L
2939.00				Shet		U.Cretaceous		0131
			100	Sh/Clst: lt gy to m gy				0131-1L
			tr	Cont : prp, dd				0131-2L
2960.00				Shet		U.Cretaceous		0132
			95	Sh/Clst: lt gy to m gy				0132-1L
			5	Cont : prp, dd				0132-2L
2981.00				Shet		U.Cretaceous		0103
			100	Sh/Clst: lt gy to m gy				0103-1L
			tr	Cont : dd, prp				0103-2L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
2999.00				Shet		U.Cretaceous		0133
			100	Sh/Clst:		lt gy to m gy		0133-1L
			tr	Cont		: prp, dd		0133-2L
3020.00				Shet		U.Cretaceous		0134
			95	Sh/Clst:		lt gy to m gy		0134-1L
			5	Cont		: prp, dd		0134-2L
			tr	Sh/Clst:		pl brn to dsk brn, hd		0134-3L
3041.00				Shet		U.Cretaceous		0135
			90	Sh/Clst:		lt gy to m gy		0135-1L
			10	Cont		: prp, dd		0135-2L
3059.00				Shet		U.Cretaceous		0136
			95	Sh/Clst:		lt gy to m gy		0136-1L
			5	Sh/Clst:		or gy to m y brn, calc		0136-2L
			tr	Cont		: prp		0136-3L
3080.00				Shet		U.Cretaceous		0137
			95	Sh/Clst:		lt gy to m gy		0137-1L
			5	Cont		: dd, prp		0137-2L
3101.00				Shet		U.Cretaceous		0138
			95	Sh/Clst:		lt gy to m gy		0138-1L
			5	Cont		: dd, prp		0138-2L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type / TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
3119.00				Shet		U.Cretaceous		0139
			100	Sh/Clst: lt gy to m gy				0139-1L
			tr	Sh/Clst: pl brn, calc				0139-2L
			tr	Cont : prp, dd				0139-3L
3140.00				Shet		U.Cretaceous		0140
			100	Sh/Clst: m gy to drk gy, calc				0140-1L
			tr	Cont : prp, dd				0140-2L
3161.00				Shet		U.Cretaceous		0141
			100	Sh/Clst: m gy				0141-1L
3179.00				Shet		U.Cretaceous		0142
			100	Sh/Clst: m gy to drk gy, calc				0142-1L
3200.00				Shet		U.Cretaceous		0143
			100	Sh/Clst: m gy to drk gy				0143-1L
3221.00				Shet		U.Cretaceous		0144
			100	Sh/Clst: m gy to drk gy				0144-1L
			tr	Cont : prp				0144-2L
3239.00				Shet		U.Cretaceous		0145
			100	Sh/Clst: m gy, calc				0145-1L
			tr	Cont : prp, dd				0145-2L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp / Lithology	Frm	Age / Lithology description	Trb	Sample
3260.00				Shet		U.Cretaceous		0146
			100	Sh/Clst:		m gy to lt gy, calc		0146-1L
3281.00				Shet		U.Cretaceous		0147
			100	Sh/Clst:		m gy to lt gy, calc		0147-1L
			tr	Marl :		lt or to or gy		0147-2L
			tr	Cont :		prp		0147-3L
3299.00				Shet		U.Cretaceous		0148
			95	Sh/Clst:		lt gy to m gy to lt brn gy		0148-1L
			5	Cont :		dd		0148-2L
3320.00				Shet		U.Cretaceous		0149
			95	Sh/Clst:		m gy		0149-1L
			5	Cont :		prp, dd		0149-2L
3338.00				Shet		U.Cretaceous		0150
			100	Sh/Clst:		m gy		0150-1L
			tr	Cont :		prp, dd		0150-2L
3359.00				Shet		U.Cretaceous		0151
			95	Sh/Clst:		m gy		0151-1L
			5	Cont :		prp, dd		0151-2L
3380.00				Shet		U.Cretaceous		0152
			85	Sh/Clst:		m gy to lt gy, calc		0152-1L
			10	Ca :		or gy to lt or, mrl		0152-2L
			5	Cont :		dd, prp		0152-3L
			tr	Sh/Clst:		pl y brn		0152-4L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
3401.00				Shet		U.Cretaceous		0153
			80	Sh/Clst: m gy to lt gy, calc				0153-1L
			10	Ca : or gy to lt or, mrl				0153-2L
			10	Cont : dd, prp				0153-3L
			tr	Sh/Clst: pl y brn				0153-4L
3419.00				Shet		U.Cretaceous		0154
			85	Sh/Clst: m gy to lt gy, calc				0154-1L
			15	Cont : dd, prp				0154-2I
3440.00				Shet		U.Cretaceous		0155
			95	Sh/Clst: m gy, calc				0155-1L
			5	Cont : dd, prp				0155-2L
3461.00				Shet		U.Cretaceous		0156
			95	Sh/Clst: m gy to drk gy, calc				0156-1L
			5	Cont : dd, prp				0156-2L
3479.00				Shet		U.Cretaceous		0157
			95	Sh/Clst: m gy to drk gy, calc				0157-1L
			5	Cont : dd, prp				0157-2L
3500.00				Shet		U.Cretaceous		0158
			100	Sh/Clst: m gy to drk gy, calc				0158-1L
			tr	Marl : or gy to lt or				0158-2L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
3520.00				Shet		U.Cretaceous		0159
			100	Sh/Clst:		m gy to drk gy, calc		0159-1L
			tr	Ca :		w to lt gy, mrl		0159-2L
3542.00				Shet		U.Cretaceous		0160
			100	Sh/Clst:		m gy to drk gy, calc		0160-1L
			tr	Ca :		w to lt gy, mrl		0160-2L
3560.00				Shet		U.Cretaceous		0161
			100	Sh/Clst:		m gy to drk gy, calc		0161-1L
			tr	Ca :		w to lt gy, mrl		0161-2L
3580.00				Shet		U.Cretaceous		0162
			100	Sh/Clst:		m gy to drk gy, calc		0162-1L
			tr	Ca :		w to lt gy, mrl		0162-2L
			tr	Cont :		dd, prp		0162-3L
3599.00				Shet		U.Cretaceous		0163
			100	Sh/Clst:		m gy to drk gy, calc		0163-1L
			tr	Ca :		w to lt gy, mrl		0163-2L
			tr	Cont :		dd, prp		0163-3L
3620.00				Shet		U.Cretaceous		0164
			100	Sh/Clst:		m gy to drk gy to brn blk, calc		0164-1L
			tr	Cont :		dd, prp		0164-2L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
3641.00				Shet		U.Cretaceous		0165
			100	Sh/Clst:		m gy to drk gy to brn blk, calc		0165-1L
			tr	Cont :		dd, prp		0165-2L
3659.00				Shet		U.Cretaceous		0166
			100	Sh/Clst:		m gy to drk gy to brn blk, calc		0166-1L
			tr	Cont :		dd, prp		0166-2L
3680.00				Shet		U.Cretaceous		0167
			100	Sh/Clst:		m gy, calc, mic		0167-1L
			tr	Ca :		lt or to or gy		0167-2L
			tr	Cont :		prp, dd		0167-3L
3701.00				Crom		L.Cretaceous		0168
			95	Sh/Clst:		lt gy to m gy to drk gy, slt, calc		0168-1L
			5	Cont :		dd		0168-2L
			tr	S/Sst :		w to lt gy, crs, l		0168-3L
3719.00				Crom		L.Cretaceous		0169
			95	Sh/Clst:		lt gy to m gy to drk gy, slt, calc		0169-1L
			5	Cont :		dd		0169-2I
			tr	S/Sst :		w to lt gy, crs, l		0169-3L
3740.00				Crom		L.Cretaceous		0170
			75	Sh/Clst:		lt gy to m gy to drk gy, slt, calc		0170-1L
			15	Ca :		lt or to or gy, mrl		0170-2L
			5	S/Sst :		w to lt gy to lt or, crs, l		0170-3L
			5	Cont :		dd, prp		0170-4L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int)	Depth (Cvd)	Type (TOC%)	%	Grp / Lithology description	Frm	Age	Trb	Sample
3749.00				Crom		L.Cretaceous		0171
			100	Sh/Clst: m gy				0171-1L
3752.00				Crom		L.Cretaceous		0172
			100	Sh/Clst: m gy				0172-1L
			tr	Marl : or gy				0172-2L
			tr	S/Sst : w to lt gy to lt or, crs, l				0172-3L
3758.00				Crom		L.Cretaceous		0173
			95	Sh/Clst: lt gy to m gy to drk gy, pyr				0173-1L
			5	Cont : prp, dd				0173-2L
			tr	S/Sst : w to lt or, crs, l				0173-3L
3764.00				Crom		L.Cretaceous		0174
			100	Sh/Clst: lt gy to m gy to drk gy, pyr				0174-1L
			tr	Cont : prp, dd				0174-2L
3770.00				Crom		L.Cretaceous		0175
			100	Sh/Clst: lt gy to m gy to drk gy, pyr				0175-1L
			tr	Marl : or gy to lt or				0175-2L
			tr	S/Sst : w to lt gy, crs, l				0175-3L
3776.00				Crom		L.Cretaceous		0176
			95	Sh/Clst: lt gy to m gy to drk gy, pyr				0176-1L
			5	Cont : dd, prp				0176-2L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Frm / Age / Lithology description	Trb	Sample
3782.00				Viki Drau U.Jurassic		0177
			60	Sh/Clst: drk gy to brn blk		0177-1L
			20	Cont : dd		0177-2L
			15	Marl : or gy to pl y brn		0177-3L
			5	Sh/Clst: lt gy to m gy		0177-4L
3788.00				Viki Drau U.Jurassic		0178
			90	Sh/Clst: drk gy to brn blk		0178-1L
			5	Marl : lt or to lt gy		0178-2I
			5	Sh/Clst: gn gy to m gy, pyr		0178-3L
3794.00				Viki Drau U.Jurassic		0179
			70	Sh/Clst: drk gy to brn blk		0179-1L
			20	Cont : dd		0179-2L
			10	Sh/Clst: lt gy to m gy, mic		0179-3L
			tr	Marl : lt or to or gy		0179-4L
3800.00				Viki Drau U.Jurassic		0180
			60	Sh/Clst: drk gy to brn blk		0180-1L
			35	Cont : cem, dd, prp		0180-2L
			5	Sh/Clst: lt gy to m gy		0180-3L
3806.00				Viki Heat U.Jurassic		0181
			95	Cont : cem, dd, prp		0181-2L
			5	Sh/Clst: drk gy to brn blk		0181-1L
3812.00				Viki Heat U.Jurassic		0182
			85	Cont : cem, dd		0182-2L
			15	Sh/Clst: drk gy to brn blk		0182-1L
			tr	Sh/Clst: m gy		0182-3L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
3818.00				Viki	Heat	U.Jurassic		0183
			95			Sh/Clst: drk gy to brn blk		0183-1L
			5			Cont : dd, prp, cem		0183-2L
3824.00				Viki	Heat	U.Jurassic		0184
			85			Sh/Clst: drk gy to brn blk		0184-1L
			10			Cont : dd, prp, cem		0184-2L
			5			Sh/Clst: lt gy to m gy		0184-3L
3830.00				Viki	Heat	U.Jurassic		0185
			90			Sh/Clst: drk gy to brn blk		0185-1L
			5			Cont : dd, prp, cem		0185-2L
			5			Marl : pl brn to lt gy		0185-3L
3836.00				Viki	Heat	U.Jurassic		0186
			70			Sh/Clst: drk gy to brn blk, mic		0186-1L
			30			Cont : dd, prp, cem		0186-2L
3842.00				Viki	Heat	U.Jurassic		0187
			100			Sh/Clst: drk gy to brn blk, mic		0187-1L
			tr			Cont : dd, prp, cem		0187-2L
			tr			Marl : or gy to pl y brn		0187-3L
3848.00				Viki	Heat	U.Jurassic		0188
			75			Sh/Clst: drk gy to brn blk, mic		0188-1L
			25			Cont : dd, prp		0188-2L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int)	Depth (Cvd)	Type / TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
3854.00				Viki Heat U.Jurassic		0189
			40	Sh/Clst: drk gy to brn blk, mic		0189-1L
			20	Cont : dd, prp		0189-2L
			20	Marl : or gy to pl y brn		0189-3L
			20	Sh/Clst: lt gy to m gy, mic		0189-4L
			tr	S/Sst : w to lt gy, crs, l		0189-5L
3860.00				Viki Heat U.Jurassic		0190
			50	Sh/Clst: drk gy to brn blk, mic		0190-1I
			35	Cont : dd, prp		0190-2L
			10	Sh/Clst: lt gy to m gy, mic		0190-4L
			5	Marl : or gy to pl y brn		0190-3L
			tr	S/Sst : w to lt gy, crs, l		0190-5L
3866.00				Viki Heat U.Jurassic		0191
			45	Cont : dd, prp		0191-2L
			40	Sh/Clst: drk gy to brn blk, mic		0191-1L
			10	Marl : or gy to pl y brn		0191-3L
			5	Sh/Clst: lt gy to m gy, mic		0191-4L
			tr	S/Sst : w to lt gy, crs, l		0191-5L
3872.00				Viki Heat U.Jurassic		0192
			60	Sh/Clst: drk gy to brn blk, mic		0192-1L
			40	Cont : dd, prp		0192-2L
			tr	Marl : or gy to pl y brn		0192-3
			tr	Sh/Clst: lt gy to m gy, mic		0192-4L
			tr	S/Sst : w to lt gy, crs, l		0192-5L
3878.00				Viki Heat U.Jurassic		0193
			60	Sh/Clst: drk gy to brn blk, mic		0193-1L
			40	Cont : dd, prp, fib		0193-2L
			tr	Sh/Clst: lt gy to m gy, mic		0193-3L
			tr	S/Sst : w to lt gy, crs, l		0193-4L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
3884.00				Viki Heat U.Jurassic		0194
			70	Sh/Clst: drk gy to brn blk, mic		0194-1L
			20	Cont : dd, prp, fib		0194-2L
			10	Sh/Clst: lt gy to m gy to drk y brn		0194-3L
			tr	S/Sst : w to lt gy, crs, l		0194-4L
3890.00				Viki Heat U.Jurassic		0195
			100	Sh/Clst: drk gy to brn blk, mic		0195-1L
			tr	Cont : dd, prp, fib		0195-2L
3896.00				Viki Heat U.Jurassic		0196
			100	Sh/Clst: drk gy to brn blk, mic		0196-1L
			tr	Cont : dd, prp, fib		0196-2L
3903.00				Viki Heat U.Jurassic		0197
			75	Sh/Clst: drk gy to dsk brn, mic		0197-1L
			15	Cont : dd, prp, fib		0197-2L
			10	Sh/Clst: m gy to drk y brn		0197-3L
			tr	S/Sst : w to lt gy, crs, l		0197-4L
3908.10		ccp		Viki Heat U.Jurassic		0001
			100	Sh/Clst: drk gy to brn blk, mic		0001-1L
3909.00				Viki Heat U.Jurassic		0198
			70	S/Sst : lt gy to lt brn gy, f, kln, l		0198-1L
			30	Sh/Clst: drk gy to brn blk, mic		0198-2L
			tr	Cont : prp		0198-3L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp Frm Age / Lithology description	Trb	Sample
3912.50		ccp		Viki Heat U.Jurassic		0002
			100	Sh/Clst: drk gy to brn blk, mic		0002-1L
3939.05		ccp		Brnt Ness M.Jurassic		0003
			100	S/Sst : lt gy to lt brn to lt brn gy, f, hd, mic		0003-1L
3944.00		ccp		Brnt Ness M.Jurassic		0004
			100	S/Sst : brn gy, f, slt, hd		0004-1L
3949.00		ccp		Brnt Ness M.Jurassic		0005
			100	S/Sst : lt gy to brn gy, crs, mic, hd		0005-1L
3954.00		ccp		Brnt Ness M.Jurassic		0006
			100	S/Sst : lt gy to m gy to brn gy, f, mic, hd		0006-1L
3959.00		ccp		Brnt Ness M.Jurassic		0007
			100	S/Sst : lt gy to brn gy, f, hd		0007-1L
3964.00		ccp		Brnt Ness M.Jurassic		0008
			100	Sltst : lt gy to m gy to drk gy to brn blk, pyr, mic, hd, lam		0008-1L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
3969.00		ccp		Brnt	Ness	M.Jurassic		0009
			100	S/Sst		: lt gy to lt brn to pl brn, crs, hd		0009-1L
3974.00		ccp		Brnt	Ness	M.Jurassic		0010
			100	S/Sst		: lt gy to lt brn to pl brn, crs, hd, pyr, slt, lam		0010-1L
3979.00		ccp		Brnt	Ness	M.Jurassic		0011
			100	Sh/Clst		: dsk brn to brn gy, wx		0011-1L
			tr	Coal		: blk		0011-2L
3984.00		ccp		Brnt	Ness	M.Jurassic		0012
			100	S/Sst		: lt gy to pl brn, mic, f, hd		0012-1L
3989.60		ccp		Brnt	Ness	M.Jurassic		0013
			100	Sh/Clst		: lt gy to drk gy		0013-1L
3994.00		ccp		Brnt	Ness	M.Jurassic		0014
			100	Sh/Clst		: drk gy to brn blk, carb		0014-1L
			tr	Coal		: blk		0014-2L
4014.00		ccp		Brnt	Ness	M.Jurassic		0015
			100	Sltst		: lt gy to drk y brn, mic, lam		0015-1L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
4019.10		ccp		Brnt	Ness	M.Jurassic		0016
			100			Sh/Clst: drk gy to brn blk, mic		0016-1L
4024.00		ccp		Brnt	Ness	M.Jurassic		0017
			100			Sltst : lt gy to lt brn gy, hd		0017-1L
4029.00		ccp		Brnt	Ness	M.Jurassic		0018
			100			Sh/Clst: brn gy to pl brn, carb		0018-1L
4034.00		ccp		Brnt	Ness	M.Jurassic		0019
			100			Sltst : lt brn gy, mic, hd		0019-1L
4039.00		ccp		Brnt	Ness	M.Jurassic		0020
			100			Sltst : w to lt gy to m gy, cly, mic, hd		0020-1L
4044.00		ccp		Brnt	Ness	M.Jurassic		0021
			100			Sltst : w to lt gy to m gy, cly, mic, hd		0021-1L
4049.00		ccp		Brnt	Ness	M.Jurassic		0022
			100			Coal : blk, wx		0022-1L
4052.28		ccp		Brnt	Ness	M.Jurassic		0023
			100			Sh/Clst: pl y brn to drk y brn, slt, mic		0023-1L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp / Lithology description	Frm	Age	Trb	Sample
4055.00				Brnt	Ness	M.Jurassic		0199
			85	Sh/Clst: blk, wx				0199-1L
			10	S/Sst : w to lt gy, f, kln, l				0199-2L
			5	Cont : prp, dd				0199-3L
4061.00				Brnt	Ness	M.Jurassic		0200
			90	Sh/Clst: blk, wx				0200-1L
			5	S/Sst : w to lt gy, f, kln, l				0200-2L
			5	Cont : prp, dd				0200-3L
4067.00				Brnt	Ness	M.Jurassic		0201
			60	S/Sst : w to lt gy to lt brn gy, f, crs, kln, l				0201-1L
			35	Sh/Clst: blk, wx				0201-2L
			5	Sh/Clst: pl y brn, wx				0201-3L
			tr	Cont : prp				0201-4L
4073.00				Brnt	Ness	M.Jurassic		0202
			40	S/Sst : w to lt gy to lt brn gy, f, crs, kln, l				0202-1L
			30	Sh/Clst: blk, wx				0202-2L
			25	Sh/Clst: pl y brn, wx				0202-3L
			5	Cont : prp				0202-4L
4076.00		ccp		Brnt	Ness	M.Jurassic		0024
			100	S/Sst : lt gy to gy brn, crs, hd				0024-1L

Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Depth Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
4080.00		ccp		Brnt	Ness	M.Jurassic		0025
			100	S/Sst		: lt gy to gy brn, mic, crs, hd		0025-1L
4085.00		ccp		Brnt	Ness	M.Jurassic		0026
			100	S/Sst		: w to lt gy, mic, crs, hd		0026-1L
4090.00		ccp		Brnt	Ness	M.Jurassic		0027
			100	S/Sst		: lt gy to brn gy to pl y brn, mic, crs, hd		0027-1L
4095.00		ccp		Brnt	Ness	M.Jurassic		0028
			100	Sltst		: drk y brn to pl brn, cly, mic, s, lam		0028-1L
4100.00		ccp		Brnt	Etiv	M.Jurassic		0029
			100	S/Sst		: lt gy to drk gy, crs		0029-1L
4105.00		ccp		Brnt	Etiv	M.Jurassic		0030
			100	S/Sst		: lt gy to drk gy, crs		0030-1L
4110.00		ccp		Brnt	Etiv	M.Jurassic		0031
			100	S/Sst		: lt gy to lt brn gy, crs		0031-1L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth Int	Cvd	Type TOC%	%	Grp	Frm	Age / Lithology description	Trb	Sample
4115.00		ccp		Brnt	Etiv	M.Jurassic		0032
			100	S/Sst		: w to lt gy to lt brn gy, crs		0032-1L
4120.00		ccp		Brnt	Etiv	M.Jurassic		0033
			100	S/Sst		: w to lt gy to lt brn gy, crs		0033-1L
4125.00		ccp		Brnt	Etiv	M.Jurassic		0034
			100	S/Sst		: w to lt gy to lt brn gy, crs		0034-1L
4130.00		ccp		Brnt	Etiv	M.Jurassic		0035
			100	Congl		: lt gy to lt brn gy to drk gy		0035-1L
4135.00		ccp		Brnt	Etiv	M.Jurassic		0036
			100	Congl		: w to lt gy to drk gy to brn blk, hd		0036-1L
4139.00				Dunl	Drak	L.Jurassic		0203
			100	S/Sst		: w to lt gy, crs, l		0203-1L
			tr	Sh/Clst		: drk gy, mic, wx		0203-2L
			tr	Cont		: m gy		0203-3L
4145.00				Dunl	Drak	L.Jurassic		0204
			100	S/Sst		: w to lt gy, crs, l		0204-1L
			tr	Sh/Clst		: drk gy, mic, wx		0204-2L

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Table 1 : Lithology description for well NOCS 30/2-2

Depth unit of measure: m

Depth (Int Cvd)	Type (TOC%)	%	Grp Frm Age / Lithology description	Trb	Sample
4151.00			Dunl Drak L.Jurassic		0205
		85	S/Sst : w to lt gy, crs, l		0205-1L
		15	Sh/Clst: m gy to drk gy, mic, wx		0205-2L
		tr	Cont : dd, prp		0205-3L
4157.00			Dunl Drak L.Jurassic		0206
		65	S/Sst : w to lt gy, crs, l		0206-1L
		20	Sh/Clst: m gy to drk gy, mic, wx		0206-2L
		10	Sh/Clst: or gy, calc		0206-4L
		5	Cont : dd, prp		0206-3L
4163.00			Dunl Drak L.Jurassic		0207
		70	S/Sst : w to lt gy, crs, l, kln		0207-1L
		30	Sh/Clst: m gy to drk gy, mic, wx		0207-2L
		tr	Cont : dd, prp		0207-3L
4169.00			Dunl Drak L.Jurassic		0208
		45	S/Sst : w to lt gy, crs, l, kln		0208-1L
		45	Sh/Clst: m gy to drk gy, mic, wx		0208-2L
		5	Cont : dd, prp		0208-3L
		5	Sh/Clst: or gy, calc		0208-4L
4172.00			Dunl Drak L.Jurassic		0209
		75	S/Sst : w to lt gy, crs, l, kln		0209-1L
		20	Sh/Clst: m gy to drk gy to brn gy, mic		0209-2L
		5	Cont : dd, prp		0209-3L
		tr	Sh/Clst: or gy, calc		0209-4L

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

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1440.00	cut	S/Sst : w to lt gy	0.02	0.03	0.05	0.60	0.04	75	125	0.1	0.40	300	0050-1L
3782.00	cut	Sh/Clst: drk gy to brn blk	2.39	3.49	0.61	5.72	4.06	86	15	5.9	0.41	442	0177-1L
3788.00	cut	Sh/Clst: drk gy to brn blk	2.63	3.40	0.79	4.30	4.11	83	19	6.0	0.44	440	0178-1L
3794.00	cut	Sh/Clst: drk gy to brn blk	3.53	5.07	0.71	7.14	4.76	107	15	8.6	0.41	444	0179-1L
3800.00	cut	Sh/Clst: drk gy to brn blk	3.07	3.56	0.94	3.79	4.60	77	20	6.6	0.46	441	0180-1L
3818.00	cut	Sh/Clst: drk gy to brn blk	2.52	3.66	1.36	2.69	4.82	76	28	6.2	0.41	444	0183-1L
3830.00	cut	Sh/Clst: drk gy to brn blk	3.84	3.92	0.95	4.13	3.93	100	24	7.8	0.49	448	0185-1L
3842.00	cut	Sh/Clst: drk gy to brn blk	2.77	3.54	0.92	3.85	4.10	86	22	6.3	0.44	451	0187-1L
3854.00	cut	Sh/Clst: drk gy to brn blk	2.53	4.34	0.88	4.93	4.02	108	22	6.9	0.37	451	0189-1L
3866.00	cut	Sh/Clst: drk gy to brn blk	1.84	1.79	1.12	1.60	2.57	70	44	3.6	0.51	450	0191-1L
3878.00	cut	Sh/Clst: drk gy to brn blk	1.55	2.39	0.91	2.63	2.41	99	38	3.9	0.39	448	0193-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	1.60	2.34	0.95	2.46	2.06	114	46	3.9	0.41	453	0195-1L
3903.00	cut	Sh/Clst: drk gy to dsk brn	1.67	2.88	0.85	3.39	2.51	115	34	4.6	0.37	452	0197-1L
3908.10	ccp	Sh/Clst: drk gy to brn blk	0.91	1.75	0.72	2.43	1.39	126	52	2.7	0.34	461	0001-1L
3909.00	cut	S/Sst : lt gy to lt brn gy	0.26	0.22	0.91	0.24	0.21	105	433	0.5	0.54	408	0198-1L

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

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3912.50	ccp	Sh/Clst: drk gy to brn blk	1.10	1.85	0.64	2.89	1.63	113	39	3.0	0.37	461	0002-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	1.24	0.28	0.92	0.30	0.27	104	341	1.5	0.82	377	0003-1L
3944.00	ccp	S/Sst : brn gy	0.82	0.25	0.68	0.37	0.26	96	262	1.1	0.77	347	0004-1L
3949.00	ccp	S/Sst : lt gy to brn gy	1.25	0.23	0.45	0.51	0.30	77	150	1.5	0.84	349	0005-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	1.05	0.62	0.34	1.82	1.04	60	33	1.7	0.63	456	0006-1L
3964.00	ccp	Sltst : lt gy to m gy to drk gy to brn blk	0.65	1.58	0.49	3.22	1.70	93	29	2.2	0.29	464	0008-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	0.51	0.28	0.38	0.74	0.26	108	146	0.8	0.65	435	0010-1L
3979.00	ccp	Sh/Clst: dsk brn to brn gy	0.45	1.67	0.23	7.26	1.47	114	16	2.1	0.21	464	0011-1L
3989.60	ccp	Sh/Clst: lt gy to drk gy	0.15	0.28	0.32	0.88	0.25	112	128	0.4	0.35	466	0013-1L
4014.00	ccp	Sltst : lt gy to drk y brn	0.20	0.60	0.88	0.68	0.59	102	149	0.8	0.25	451	0015-1L
4024.00	ccp	Sltst : lt gy to lt brn gy	0.13	0.25	0.80	0.31	0.28	89	286	0.4	0.34	454	0017-1L
4034.00	ccp	Sltst : lt brn gy	0.04	0.04	0.43	0.09	0.06	67	717	0.1	0.50	384	0019-1L
4044.00	ccp	Sltst : w to lt gy to m gy	0.15	0.42	1.12	0.38	0.43	98	260	0.6	0.26	466	0021-1L
4049.00	ccp	Coal : blk	10.20	87.55	3.26	26.86	53.21	165	6	97.8	0.10	468	0022-1L

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Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4076.00	ccp	S/Sst : lt gy to gy brn	0.51	0.30	0.35	0.86	0.16	188	219	0.8	0.63	409	0024-1L
4085.00	ccp	S/Sst : w to lt gy	0.04	0.05	0.60	0.08	0.07	71	857	0.1	0.44	463	0026-1L
4095.00	ccp	Sltst : drk y brn to pl brn	0.07	0.23	0.78	0.29	0.37	62	211	0.3	0.23	480	0028-1L
4105.00	ccp	S/Sst : lt gy to drk gy	0.08	0.10	0.27	0.37	0.07	143	386	0.2	0.44	454	0030-1L
4120.00	ccp	S/Sst : w to lt gy to lt brn gy	0.03	0.05	0.05	1.00	0.06	83	83	0.1	0.38	395	0033-1L
4130.00	ccp	Congl : lt gy to lt brn gy to drk gy	0.11	0.13	0.11	1.18	0.15	87	73	0.2	0.46	466	0035-1L
4139.00	cut	S/Sst : w to lt gy	0.04	0.01	0.04	0.25	0.03	33	133	0.1	0.80	374	0203-1L
4151.00	cut	S/Sst : w to lt gy	0.05	0.05	0.07	0.71	0.06	83	117	0.1	0.50	362	0205-1L
4163.00	cut	S/Sst : w to lt gy	0.02	0.02	0.05	0.40	0.04	50	125	–	0.50	323	0207-1L
4169.00	cut	Sh/Clst: m gy to drk gy	1.41	2.01	0.18	11.17	1.71	118	11	3.4	0.41	454	0208-2L
4172.00	cut	S/Sst : w to lt gy	0.03	0.03	0.07	0.43	0.06	50	117	0.1	0.50	457	0209-1L

Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
3782.00	cut	Sh/Clst: drk gy to brn blk	11.59	32.89	44.77	10.76	3.49	0177-1L
3794.00	cut	Sh/Clst: drk gy to brn blk	12.56	27.11	46.07	14.26	5.07	0179-1L
3842.00	cut	Sh/Clst: drk gy to brn blk	11.93	22.12	38.99	26.96	3.54	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	13.22	21.25	39.35	26.17	2.34	0195-1L
3908.10	ccp	Sh/Clst: drk gy to brn blk	33.64	13.35	37.04	15.97	1.75	0001-1L
3909.00	cut	S/Sst : lt gy to lt brn gy	6.84	28.94	47.63	16.59	0.22	0198-1L
3912.50	ccp	Sh/Clst: drk gy to brn blk	16.29	26.32	39.25	18.14	1.85	0002-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	6.45	14.72	37.57	41.25	0.28	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	22.11	28.96	38.57	10.36	0.62	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	23.93	31.78	39.14	5.16	0.28	0010-1L
3979.00	ccp	Sh/Clst: dsk brn to brn gy	19.43	24.60	50.05	5.91	1.67	0011-1L
4014.00	ccp	Sltst : lt gy to drk y brn	24.25	23.78	38.35	13.61	0.60	0015-1L
4049.00	ccp	Coal : blk	20.71	17.07	21.87	40.35	87.55	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	14.28	28.26	45.90	11.56	0.30	0024-1L

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Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
4130.00	ccp	Congl : lt gy to lt brn gy to drk gy	24.89	31.25	37.59	6.26	0.13	0035-1L
4169.00	cut	Sh/Clst: m gy to drk gy	12.75	30.96	41.09	15.19	2.01	0208-2L

Table 4 a: Weight of EOM and Chromatographic Fraction for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Rock Extracted (g)	EOM (mg)	Sat (mg)	Aro (mg)	Asph (mg)	NSO (mg)	HC (mg)	Non-HC (mg)	TOC(e) (%)	Sample
3788.00	com	Composite sample - see table 4 e	1.7	6.3	2.8	1.4	0.9	1.2	4.2	2.1	5.02	0210-0B
3800.00	com	Composite sample - see table 4 e	1.7	11.7	4.4	2.5	1.1	3.7	6.9	4.8	5.07	0214-0B
3842.00	cut	Sh/Clst: drk gy to brn blk	3.4	18.4	7.3	3.3	1.9	5.9	10.6	7.8	4.92	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	4.9	19.3	12.1	3.1	1.2	2.9	15.2	4.1	2.90	0195-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	7.5	4.6	1.2	1.1	0.5	1.8	2.3	2.3	0.34	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	7.6	13.2	6.8	2.3	1.0	3.1	9.1	4.1	1.44	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	7.2	7.4	3.9	1.4	0.6	1.5	5.3	2.1	0.71	0010-1L
4049.00	ccp	Coal : blk	2.2	89.4	3.7	6.3	77.4	2.0	10.0	79.4	57.10	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	7.3	7.2	3.8	0.8	0.5	2.1	4.6	2.6	0.21	0024-1L
4169.00	com	Composite sample - see table 4 e	1.7	5.4	2.7	1.2	0.8	0.7	3.9	1.5	2.52	0215-0B

Table 4 b: Concentration of EOM and Chromatographic Fraction (wt ppm rock) for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3788.00	com	Composite sample - see table 4 e	3750	1666	833	535	714	2500	1250	0210-0B
3800.00	com	Composite sample - see table 4 e	6802	2558	1453	639	2151	4011	2790	0214-0B
3842.00	cut	Sh/Clst: drk gy to brn blk	5380	2134	964	555	1725	3099	2280	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	3898	2444	626	242	585	3070	828	0195-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	612	159	146	66	239	306	306	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	1741	897	303	131	408	1200	540	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	1027	541	194	83	208	736	291	0010-1L
4049.00	ccp	Coal : blk	41581	1720	2930	36000	930	4651	36930	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	989	521	109	68	288	631	357	0024-1L
4169.00	com	Composite sample - see table 4 e	3233	1616	718	479	419	2335	898	0215-0B

Table 4 c: Concentration of EOM and Chromatographic Fraction (mg/g TOC(e)) for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3788.00	com	Composite sample - see table 4 e	74.70	33.20	16.60	10.67	14.23	49.80	24.90	0210-0B
3800.00	com	Composite sample - see table 4 e	134.17	50.46	28.67	12.61	42.43	79.12	55.04	0214-0B
3842.00	cut	Sh/Clst: drk gy to brn blk	109.35	43.38	19.61	11.29	35.06	63.00	46.36	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	134.45	84.29	21.60	8.36	20.20	105.89	28.56	0195-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	180.15	47.00	43.08	19.58	70.49	90.08	90.08	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	120.93	62.30	21.07	9.16	28.40	83.37	37.56	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	144.76	76.29	27.39	11.74	29.34	103.68	41.08	0010-1L
4049.00	ccp	Coal : blk	72.82	3.01	5.13	63.05	1.63	8.15	64.68	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	470.96	248.56	52.33	32.71	137.36	300.89	170.07	0024-1L
4169.00	com	Composite sample - see table 4 e	128.31	64.16	28.51	19.01	16.63	92.67	35.64	0215-0B

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Table 4 d: Composition of material extracted from the rock (%) for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Sat / EOM	Aro / EOM	Asph / EOM	NSO / EOM	HC / EOM	Non-HC / EOM	Sat / Aro	HC / Non-HC	Sample
3788.00	com	Composite sample - see table 4 e	44.44	22.22	14.29	19.05	66.67	33.33	200.00	200.00	0210-0B
3800.00	com	Composite sample - see table 4 e	37.61	21.37	9.40	31.62	58.97	41.03	176.00	143.75	0214-0B
3842.00	cut	Sh/Clst: drk gy to brn blk	39.67	17.93	10.33	32.07	57.61	42.39	221.21	135.90	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	62.69	16.06	6.22	15.03	78.76	21.24	390.32	370.73	0195-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	26.09	23.91	10.87	39.13	50.00	50.00	109.09	100.00	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	51.52	17.42	7.58	23.48	68.94	31.06	295.65	221.95	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	52.70	18.92	8.11	20.27	71.62	28.38	278.57	252.38	0010-1L
4049.00	ccp	Coal : blk	4.14	7.05	86.58	2.24	11.19	88.81	58.73	12.59	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	52.78	11.11	6.94	29.17	63.89	36.11	475.00	176.92	0024-1L
4169.00	com	Composite sample - see table 4 e	50.00	22.22	14.81	12.96	72.22	27.78	225.00	260.00	0215-0B

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Table 4 e: List of composite samples appearing in the extraction tables for well NOCS 30/2-2

Depth unit of measure: m

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

Upper depth	Lower depth	Typ	Sample	Depth	Typ	Lithology	Sample
3782.00	3788.00	com	0210-0B is composed of:	3782.00	cut	Sh/Clst: drk gy to brn blk	0177-1L
				3788.00	cut	Sh/Clst: drk gy to brn blk	0178-1L
3794.00	3800.00	com	0214-0B is composed of:	3794.00	cut	Sh/Clst: drk gy to brn blk	0179-1L
				3800.00	cut	Sh/Clst: drk gy to brn blk	0180-1L
4157.00	4169.00	com	0215-0B is composed of:	4157.00	cut	Sh/Clst: m gy to drk gy, mic, wx	0206-2L
				4163.00	cut	Sh/Clst: m gy to drk gy, mic, wx	0207-2L
				4169.00	cut	Sh/Clst: m gy to drk gy, mic, wx	0208-2L

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Table 5 : Saturated Hydrocarbon Ratios for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Pristane / nC17	Pristane / Phytane	Pristane + Phytane / nC17 + nC18	Phytane / nC18	CPI	Sample
3788.00	com	bulk	0.49	1.48	0.44	0.39	1.02	0210-0B
3800.00	com	bulk	0.53	1.34	0.49	0.44	1.10	0214-0B
3842.00	cut	Sh/Clst: drk gy to brn blk	0.55	1.86	0.45	0.34	1.07	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	0.54	2.15	0.42	0.28	1.07	0195-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	0.45	1.75	0.36	0.27	1.07	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	0.43	1.87	0.35	0.26	1.09	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	0.45	1.89	0.36	0.25	1.08	0010-1L
4049.00	ccp	Coal : blk	0.49	3.88	0.32	0.14	1.03	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	0.43	2.03	0.32	0.22	1.03	0024-1L
4169.00	com	bulk	0.53	1.85	0.44	0.33	1.09	0215-0B

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Table 6 : Aromatic Hydrocarbon Ratios for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	Rc	DBT/P	4/1MDBT	(3+2) /1MDBT	Sample
3788.00	com	bulk	0.64	1.69	0.13	0.69	0.63	0.64	0.78	-	-	-	0210-0B
3800.00	com	bulk	0.99	2.03	0.18	0.77	0.69	0.69	0.81	0.17	58.28	1.63	0214-0B
3842.00	cut	Sh/Clst: drk gy to brn blk	1.18	2.42	0.27	0.79	0.70	0.70	0.82	0.13	38.96	2.18	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	1.22	2.36	0.21	0.85	0.73	0.74	0.84	0.12	53.01	2.38	0195-1L
3939.05	ccp	S/Sst : lt gy to lt brn to lt brn gy	-	2.58	-	1.27	0.99	1.05	0.99	-	-	-	0003-1L
3954.00	ccp	S/Sst : lt gy to m gy to brn gy	1.69	4.04	0.50	1.25	0.87	0.95	0.92	0.12	34.09	3.40	0006-1L
3974.00	ccp	S/Sst : lt gy to lt brn to pl brn	1.95	5.57	0.38	1.43	0.98	1.05	0.99	0.15	-	-	0010-1L
4049.00	ccp	Coal : blk	1.73	4.32	0.48	1.29	1.00	1.10	1.00	0.24	60.92	16.51	0022-1L
4076.00	ccp	S/Sst : lt gy to gy brn	-	2.30	-	1.85	1.32	1.31	1.19	-	-	-	0024-1L
4169.00	com	bulk	0.86	2.42	0.15	1.04	0.83	0.86	0.90	0.17	12.80	1.59	0215-0B

Table 7 : Thermal Maturity Data for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
1080.00	cut	bulk	0.33	8	0.04	3-4	-	-	0107-0B
1200.00	cut	bulk	0.33	9	0.05	3+4	-	-	0043-0B
1500.00	cut	bulk	NDP	-	-	-	-	-	0053-0B
1800.00	cut	bulk	NDP	-	-	-	-	-	0068-0B
2000.00	cut	bulk	0.36	9	0.06	4	-	-	0078-0B
2000.00	cut	Sh/Clst: pl ol to lt brn gy to lt gy	-	-	-	-	4.5	-	0078-1L
2180.00	cut	bulk	0.34	2	0.01	3-4	-	-	0087-0B
2381.00	cut	bulk	0.40	4	0.04	4+5	-	-	0096-0B
2621.00	cut	bulk	0.43	1	0.00	4	-	-	0119-0B
2621.00	cut	Sh/Clst: gn gy to lt gy to m gy	-	-	-	-	4.5-5.0(??)	-	0119-1L
2840.00	cut	bulk	0.42	8	0.04	3+4	-	-	0100-0B
2999.00	cut	bulk	0.41	3	0.03	3-5	-	-	0133-0B
2999.00	cut	Sh/Clst: lt gy to m gy	-	-	-	-	5.0	-	0133-1L

Table 7 : Thermal Maturity Data for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
3338.00	cut	bulk	0.45	4	0.04	4-5	-	-	0150-0B
3338.00	cut	Sh/Clst: m gy	-	-	-	-	5.5-6.0	-	0150-1L
3560.00	cut	bulk	NDP	-	-	-	-	-	0161-0B
3782.00	cut	bulk	0.82	15	0.11	0	-	-	0177-0B
3794.00	cut	bulk	0.73	4	0.05	-	-	-	0179-0B
3794.00	cut	Sh/Clst: drk gy to brn blk	-	-	-	-	6.5-7.0	444	0179-1L
3842.00	cut	Sh/Clst: drk gy to brn blk	-	-	-	-	7.0	451	0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	-	-	-	-	7.5-8.0	453	0195-1L
3908.10	ccp	bulk	NDP	-	-	-	-	-	0001-0B
3979.00	ccp	Sh/Clst: dsk brn to brn gy	-	-	-	-	7.5-8.0	464	0011-1L
4049.00	ccp	bulk	NDP	-	-	-	-	-	0022-0B
4049.00	ccp	Coal : blk	-	-	-	-	7.5(??)	468	0022-1L
4095.00	ccp	Sltst : drk y brn to pl brn	-	-	-	-	8.5(?)	480	0028-1L
4169.00	cut	bulk	0.85	10	0.16	-	-	-	0208-0B

Table 7 : Thermal Maturity Data for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	Tmax (°C)	Sample
4169.00	cut	Sh/Clst: m gy to drk gy	-	-	-	-	8.0-8.5	454	0208-2L

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Table 8 : Visual Kerogen Composition Data for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	LIPT %	AmorL	LipDet	Sp/Pol	Cuticl	Resin	Algae	Dinofl	Acrit	BitL	INERT %	Fusin	SemFus	IntDet	Micrin	Sclero	BitI	VITR %	Telin	Collin	VitDet	AmorV	BitV	Sample
2000.00	cut	Sh/Clst: pl ol to lt brn gy to lt gy	NDP	*	*	**			*	*			NDP			*				NDP			*			0078-1L
2621.00	cut	Sh/Clst: gn gy to lt gy to m gy	70		**	*			*	*			10			*				20			*			0119-1L
2999.00	cut	Sh/Clst: lt gy to m gy	NDP		*	*			*				NDP			*				NDP	*		*			0133-1L
3338.00	cut	Sh/Clst: m gy	10		**	*			*				10		*	*				80	*		*			0150-1L
3794.00	cut	Sh/Clst: drk gy to brn blk	80	**		*			*				5		*					15	*					0179-1L
3842.00	cut	Sh/Clst: drk gy to brn blk	35	**		**	*		*				15		*					50	**	*				0187-1L
3890.00	cut	Sh/Clst: drk gy to brn blk	50	**		**			*				10		*					40	**	*				0195-1L
3979.00	ccp	Sh/Clst: dsk brn to brn gy	15			**	*						20		*					65	**	*				0011-1L
4049.00	ccp	Coal : blk	TR			*			?				5		*					95	*	*		*		0022-1L
4095.00	ccp	Sltst : drk y brn to pl brn	TR			**	*						60		*					40	**	*				0028-1L
4169.00	cut	Sh/Clst: m gy to drk gy	60			**	*						30		*					10	**	*				0208-2L

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Table 9a : Tabulation of carbon isotope data for EOM/EOM - fractions or Oils for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	EOM/Oil	Saturated	Aromatic	NSO	Asphaltenes	Kerogen	Sample
3800.00	com	Composite sample	-27.99	-27.28	-27.46	-27.74	-27.27	-	0214-0B
3954.00	ccp		-26.90	-27.56	-25.91	-26.44	-25.06	-	0006-1L
4049.00	ccp		-25.36	-26.38	-26.72	-25.51	-25.23	-	0022-1L
4076.00	ccp		-	-27.21	-25.67	-26.29	-26.10	-	0024-1L
4169.00	com	Composite sample	-	-26.28	-25.81	-25.92	-25.75	-	0215-0B

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Table 9b : Tabulation of cv values from carbon isotope data for well NOCS 30/2-2

Depth unit of measure: m

Depth	Typ	Lithology	Saturated	Aromatic	cv value	Interpretation	Sample
3800.00	com	Composite sample	-27.28	-27.46	-3.59	Marine	0214-0B
3954.00	ccp		-27.56	-25.91	0.56	Terrigenous	0006-1L
4049.00	ccp		-26.38	-26.72	-4.23	Marine	0022-1L
4076.00	ccp		-27.21	-25.67	0.20	Marine	0024-1L
4169.00	com	Composite sample	-26.28	-25.81	-2.46	Marine	0215-0B

Table 10A: Variation in Triterpane Distribution (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	B/A	B/B+A	B / B+E+F	C/E	C/C+E	X/E	Z/E	Z/C	Z/Z+E	Q/E	E/E+F	C+D / C+D+E+F	D+F/C+E	J1 / J1+J2%	Sample
3788.00	Sh/Clst	0.20	0.17	0.15	0.51	0.34	0.49	0.06	0.12	0.06	0.35	0.91	0.35	0.12	66.29	0178-1
3800.00	bulk	0.17	0.14	0.12	0.45	0.31	0.72	0.12	0.27	0.11	0.42	0.88	0.33	0.16	62.75	0214-0
3939.05	S/Sst	1.19	0.54	0.08	0.46	0.32	0.02	0.06	0.13	0.06	0.05	0.87	0.31	0.14	62.23	0003-1
3954.00	S/Sst	0.45	0.31	0.20	0.61	0.38	0.57	0.09	0.15	0.08	0.62	0.88	0.39	0.15	59.46	0006-1
4049.00	Coal	0.16	0.14	0.24	0.63	0.39	7.41	0.40	0.63	0.29	0.25	1.00	0.60	0.52	100.00	0022-1
4076.00	S/Sst	0.45	0.31	0.13	0.77	0.44	0.62	0.20	0.26	0.17	0.89	0.84	0.44	0.21	59.87	0024-1
4169.00	Sh/Clst	0.38	0.27	0.19	0.59	0.37	0.48	0.09	0.15	0.08	0.20	0.88	0.38	0.16	57.56	0208-2

Table 10B: Variation in Sterane Distribution (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Ratio10	Sample
3788.00	Sh/Clst	0.93	47.73	79.56	1.76	0.80	0.72	0.61	0.66	0.91	3.72	0178-1
3800.00	bulk	0.91	58.46	76.72	1.76	0.74	0.57	0.44	0.62	1.41	3.97	0214-0
3939.05	S/Sst	0.49	34.09	63.13	1.12	0.72	0.28	0.24	0.46	0.52	1.30	0003-1
3954.00	S/Sst	0.85	48.86	74.75	1.32	0.75	0.64	0.53	0.60	0.96	2.89	0006-1
4049.00	Coal	0.45	38.95	75.15	0.83	0.80	0.32	0.28	0.60	0.64	2.48	0022-1
4076.00	S/Sst	0.81	47.30	79.56	1.22	0.80	0.58	0.48	0.66	0.90	3.69	0024-1
4169.00	Sh/Clst	0.83	51.65	69.26	1.37	0.69	0.53	0.41	0.53	1.07	2.33	0208-2

Ratio1: a / a + j
Ratio2: q / q + t * 100%
Ratio3: 2(r + s)/(q + t + 2(r + s)) * 100%
Ratio4: a + b + c + d / h + k + l + n
Ratio5: r + s / r + s + q
Ratio6: u + v / u + v + q + r + s + t
Ratio7: u + v / u + v + i + m + n + q + r + s + t
Ratio8: r + s / q + r + s + t
Ratio9: q / t
Ratio10: r + s / t

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Table 10C: Variation in Triaromatic Sterane Distribution for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
3788.00	Sh/Clst	1.00	1.00	1.00	1.00	1.00	0178-1
3800.00	bulk	1.00	1.00	1.00	1.00	1.00	0214-0
3939.05	S/Sst	-	-	-	-	-	0003-1
3954.00	S/Sst	-	-	-	-	-	0006-1
4049.00	Coal	-	-	-	-	-	0022-1
4076.00	S/Sst	-	-	-	-	-	0024-1
4169.00	Sh/Clst	-	-	-	-	-	0208-2

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

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Table 10D: Variation in Monoaromatic Sterane Distribution for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Sample
3788.00	Sh/Clst	0.74	0.60	0.50	0.45	0178-1
3800.00	bulk	0.74	0.50	0.52	0.42	0214-0
3939.05	S/Sst	0.78	0.60	0.64	0.47	0003-1
3954.00	S/Sst	0.67	0.31	0.23	0.12	0006-1
4049.00	Coal	1.00	-	0.10	0.02	0022-1
4076.00	S/Sst	1.00	1.00	0.70	0.66	0024-1
4169.00	Sh/Clst	0.68	0.48	0.46	0.38	0208-2

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

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Table 10E: Aromatisation of Steranes for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Sample
3788.00	Sh/Clst	1.00	-	0178-1
3800.00	bulk	1.00	-	0214-0
3939.05	S/Sst	1.00	-	0003-1
3954.00	S/Sst	1.00	-	0006-1
4049.00	Coal	1.00	-	0022-1
4076.00	S/Sst	1.00	-	0024-1
4169.00	Sh/Clst	1.00	-	0208-2

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 10F: Raw GCMS triterpane data (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	p	q	r	s	t	a	b	z	c	Sample
3788.00	Sh/Clst	24.69	19.46	7.59	12.86	7.80	51.77	10.58	3.56	28.58	0178-1
3800.00	bulk	67.54	47.70	22.83	24.53	19.94	110.62	18.28	14.11	51.98	0214-0
3939.05	S/Sst	3.30	2.95	1.34	1.87	0.80	5.79	6.89	3.99	29.89	0003-1
3954.00	S/Sst	154.74	65.30	26.13	33.79	20.34	67.68	30.51	9.40	64.14	0006-1
4049.00	Coal	16.42	9.47	0.00	38.26	0.00	75.03	11.79	15.15	23.91	0022-1

Depth	x	d	e	f	g	h	i	j1
3788.00	27.74	4.96	56.06	5.29	14.01	8.12	3.74	10.03
3800.00	82.92	11.36	114.46	15.75	41.40	21.83	14.46	36.30
3939.05	1.60	3.40	64.93	9.75	16.59	9.14	1.18	9.64
3954.00	59.25	11.07	104.84	14.40	36.54	21.91	8.76	22.37
4049.00	281.16	32.21	37.96	0.00	10.51	5.47	20.14	11.21

Depth	j2	k1	k2	l1	l2	m1	m2
3788.00	5.10	7.23	4.84	3.69	2.65	3.81	3.17
3800.00	21.55	35.62	16.88	19.12	10.43	18.04	9.92
3939.05	5.85	6.82	3.64	3.25	2.23	3.08	1.47
3954.00	15.25	14.89	8.34	12.06	2.46	6.73	0.00
4049.00	0.00	6.32	0.00	0.00	0.00	0.00	0.00

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Table 10F: Raw GCMS triterpane data (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	p	q	r	s	t	a	b	z	c	x	d	e	f	g	h	i	j1	j2	k1	k2	l1	l2	m1	m2	Sample
4076.00	S/Sst	233.15	97.69	30.94	34.16	22.08	43.70	19.85	22.43	85.19	68.11	19.50	110.37	20.66	32.40	21.61	10.47	22.68	15.20	28.85	11.66	17.87	10.47	0.00	0.00	0024-1
4169.00	Sh/Clst	91.70	54.19	22.88	48.57	21.86	192.92	72.77	23.62	161.00	132.78	31.95	275.13	36.37	72.29	47.04	24.05	47.22	34.82	35.99	20.73	18.14	13.65	14.11	9.46	0208-2

Table 10G: Raw GCMS sterane data (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	u	v	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	Sample
3788.00	Sh/Clst	61.86	13.74	57.35	30.39	11.71	10.89	18.99	15.19	8.50	29.14	10.78	4.19	19.99	5.83	0.00	7.64	9.06	4.47	4.73	8.86	10.43	5.18	0178-1
3800.00	bulk	110.67	29.11	176.47	111.50	45.21	44.62	72.46	51.03	28.36	91.22	32.62	17.79	67.16	29.77	10.41	26.88	36.47	9.03	23.47	34.59	31.57	16.68	0214-0
3939.05	S/Sst	7.97	3.53	6.29	6.29	1.88	3.45	4.13	0.00	3.73	8.15	4.39	6.55	4.11	0.00	0.00	3.70	3.13	4.60	5.38	7.36	6.15	10.40	0003-1
3954.00	S/Sst	94.69	27.18	82.82	52.71	19.86	20.97	37.75	19.15	13.76	58.83	15.77	14.49	40.47	17.77	9.51	16.36	13.28	4.75	13.51	17.85	23.08	14.14	0006-1
4049.00	Coal	45.89	10.79	5.94	31.60	4.15	6.26	8.33	7.11	6.41	18.64	6.09	7.32	21.58	6.65	7.06	10.56	21.82	5.25	18.39	33.99	37.40	28.82	0022-1

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Depth unit of measure: m

Depth	Lithology	u	v	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	Sample
4076.00	S/Sst	151.42	32.91	121.09	74.55	32.08	35.97	60.19	41.82	15.62	94.32	26.82	28.10	71.46	25.31	12.26	24.97	39.80	6.20	21.35	43.17	44.69	23.79	0024-1
4169.00	Sh/Clst	84.52	18.80	104.51	67.24	33.00	30.52	45.04	32.12	17.69	81.24	32.61	21.80	51.92	20.25	10.88	17.86	23.34	11.55	21.93	24.58	23.25	20.53	0208-2

Table 10H: Raw GCMS trioaromatic sterane data (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	Sample
3788.00	Sh/Clst	473.44	359.53	0.00	0.00	0.00	0.00	0.00	0178-1
3800.00	bulk	456.51	368.86	0.00	0.00	0.00	0.00	0.00	0214-0
3939.05	S/Sst	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0003-1
3954.00	S/Sst	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0006-1
4049.00	Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0022-1
4076.00	S/Sst	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0024-1
4169.00	Sh/Clst	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0208-2

Table 10I: Raw GCMS monoaromatic sterane data (peak height) for Well NOCS 30/2-2

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	h1	i1	Sample
3788.00	Sh/Clst	83.39	43.50	16.21	16.86	29.12	25.38	53.77	13.96	0.00	0178-1
3800.00	bulk	94.21	32.60	24.99	22.35	32.26	27.24	54.41	16.46	0.00	0214-0
3939.05	S/Sst	16.71	7.14	2.90	7.07	4.81	3.92	4.41	3.71	0.00	0003-1
3954.00	S/Sst	19.31	4.38	9.67	38.12	9.64	54.70	54.18	4.79	0.00	0006-1
4049.00	Coal	2.10	0.00	5.44	55.58	0.00	36.68	19.48	0.00	0.00	0022-1
4076.00	S/Sst	12.85	3.69	0.00	3.12	0.00	0.00	5.46	0.00	0.00	0024-1
4169.00	Sh/Clst	15.13	6.79	4.12	5.52	7.25	7.47	10.72	0.00	0.00	0208-2

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APPENDIX 2

Histograms

Vitrinite Reflectance Histogram

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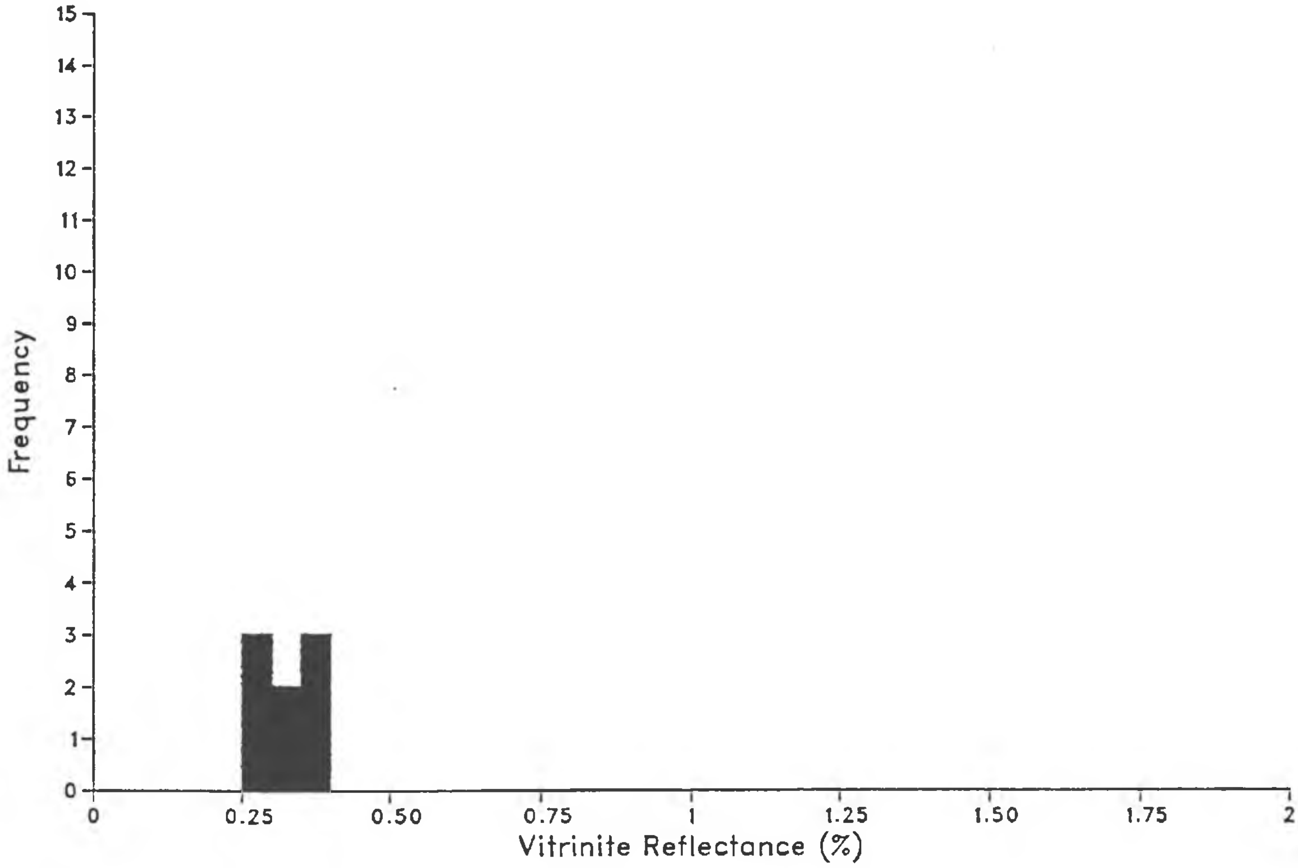
Well: NOCS 30/2-2
Depth: 1080.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.250 to 0.400):	0.33	0.04	8

Readings:

0.270 0.280 0.290 0.330 0.340 0.360 0.370 0.390

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Vitrinite Reflectance Histogram

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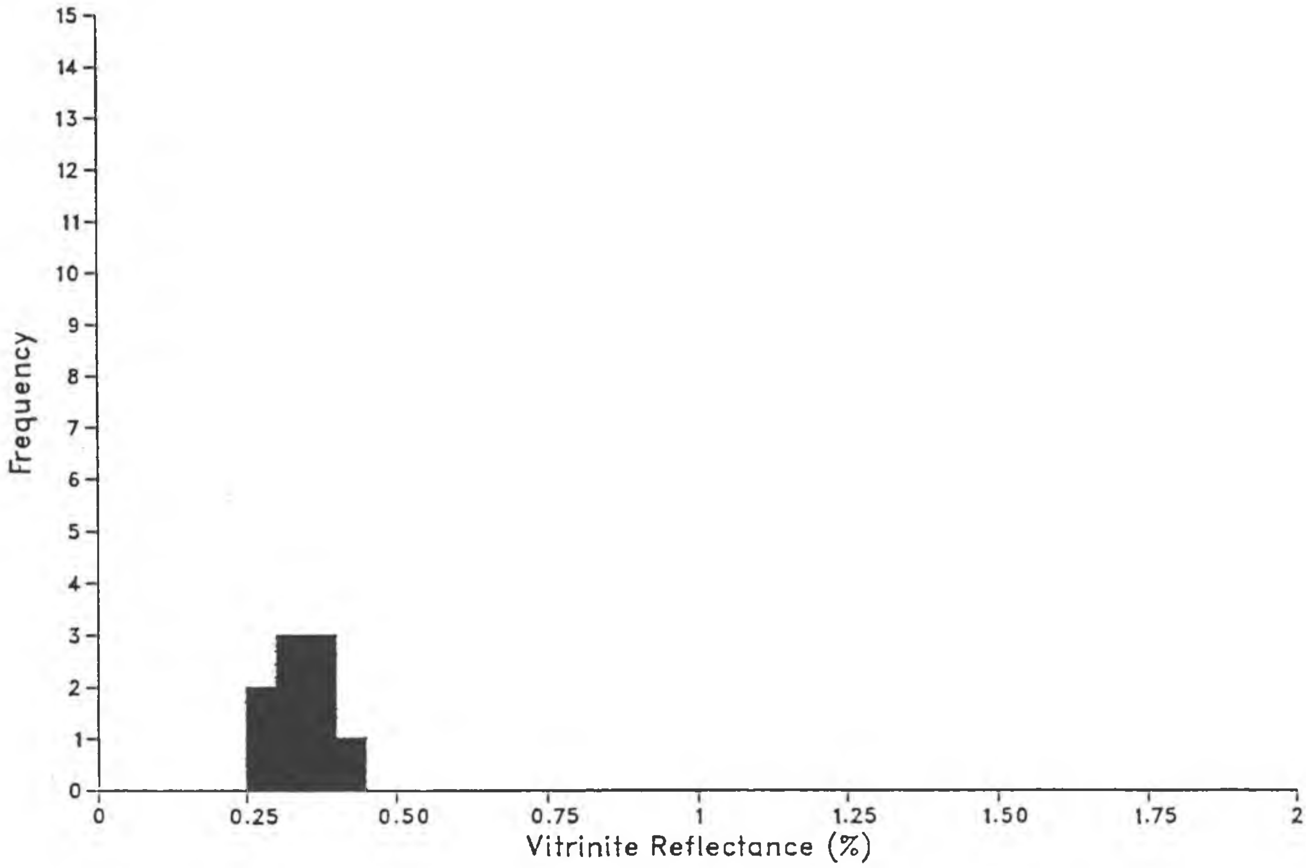
Well: NOCS 30/2-2
Depth: 1200.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.250 to 0.450):	0.33	0.05	9

Readings:

0.260 0.270 0.310 0.320 0.340 0.350 0.360 0.370 0.410

Vitrinite Reflectance Histogram

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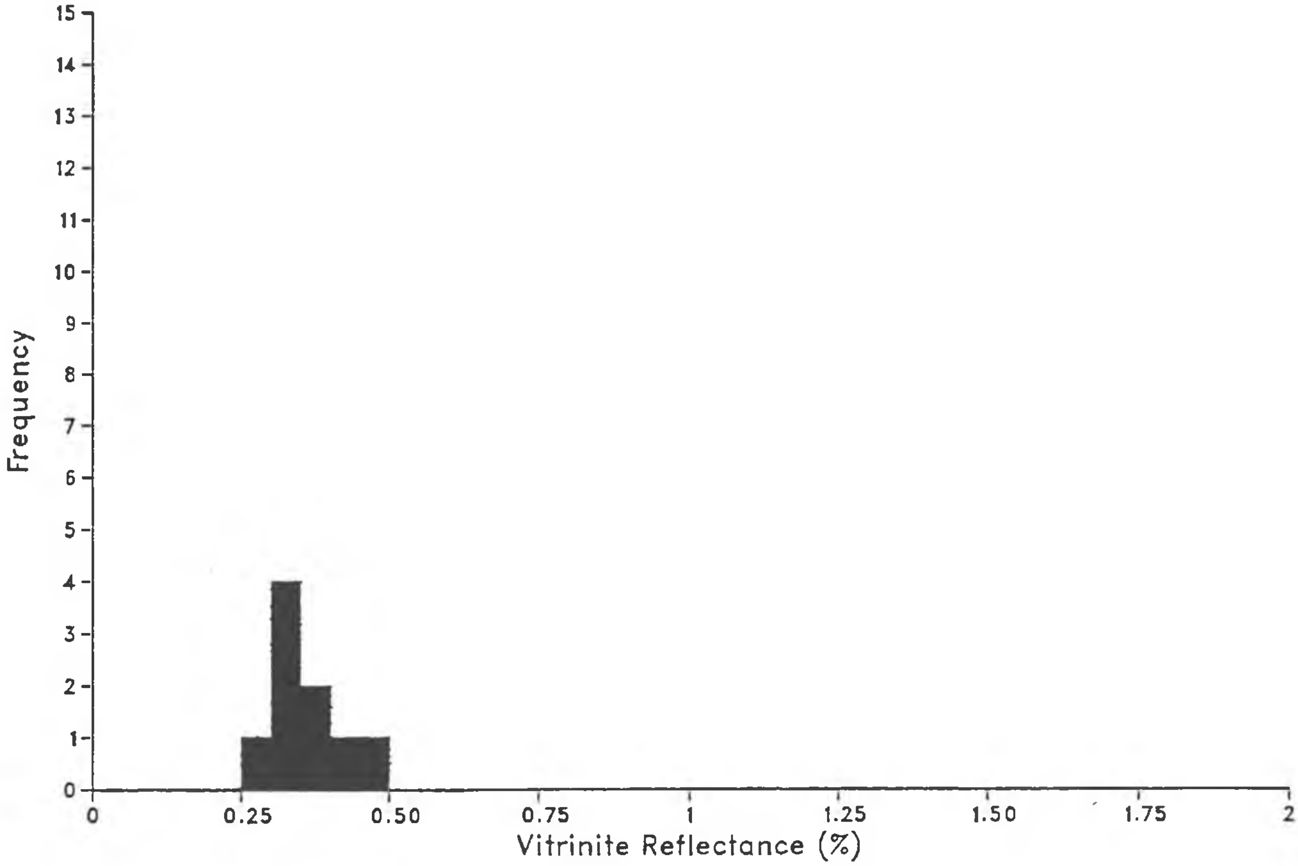
Well: NOCS 30/2-2
Depth: 2000.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.250 to 0.500):	0.36	0.06	9

Readings:

0.270 0.310 0.320 0.330 0.340 0.350 0.370 0.440 0.470

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Vitrinite Reflectance Histogram

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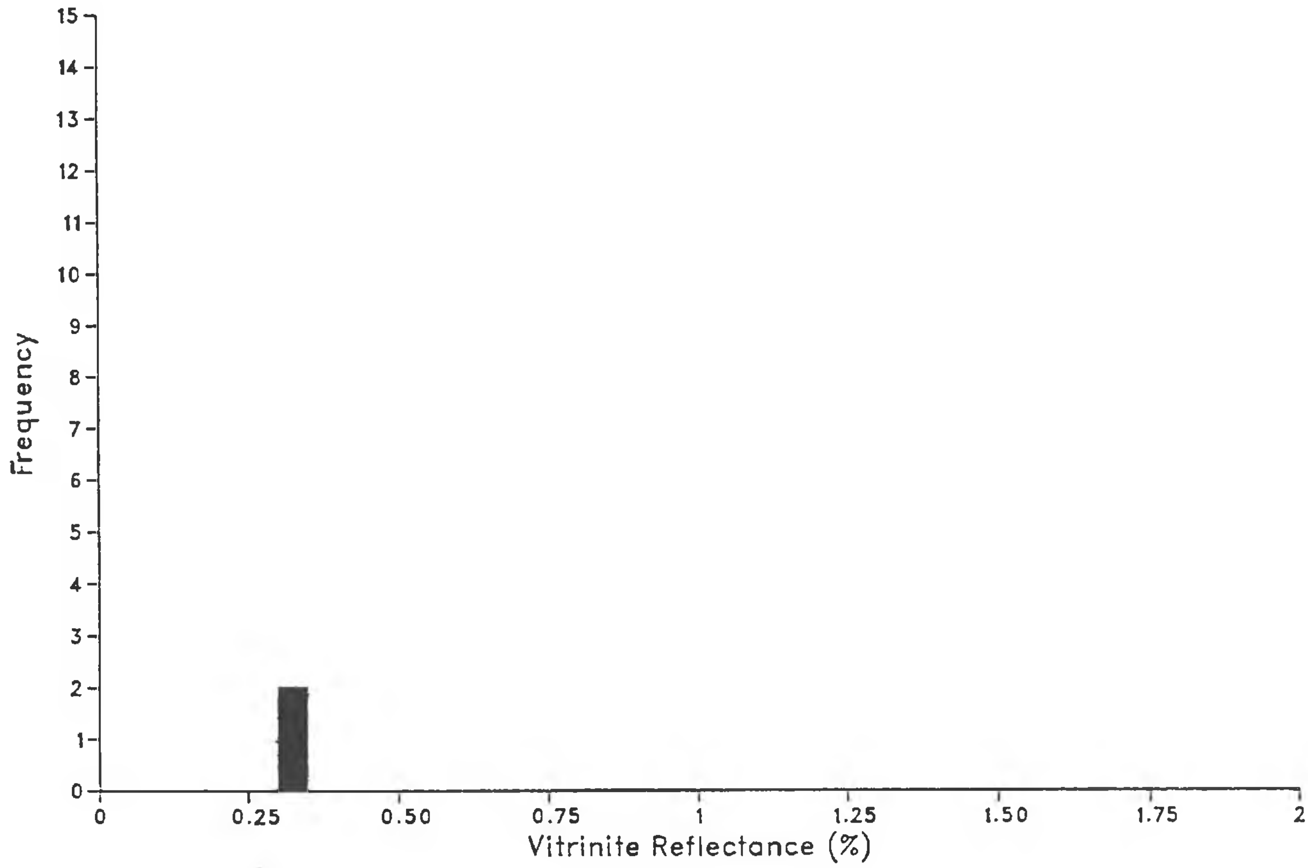
Well: NOCS 30/2-2
Depth: 2180.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.300 to 0.350):	0.34	0.01	2

Readings:

0.330 0.340

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Vitrinite Reflectance Histogram

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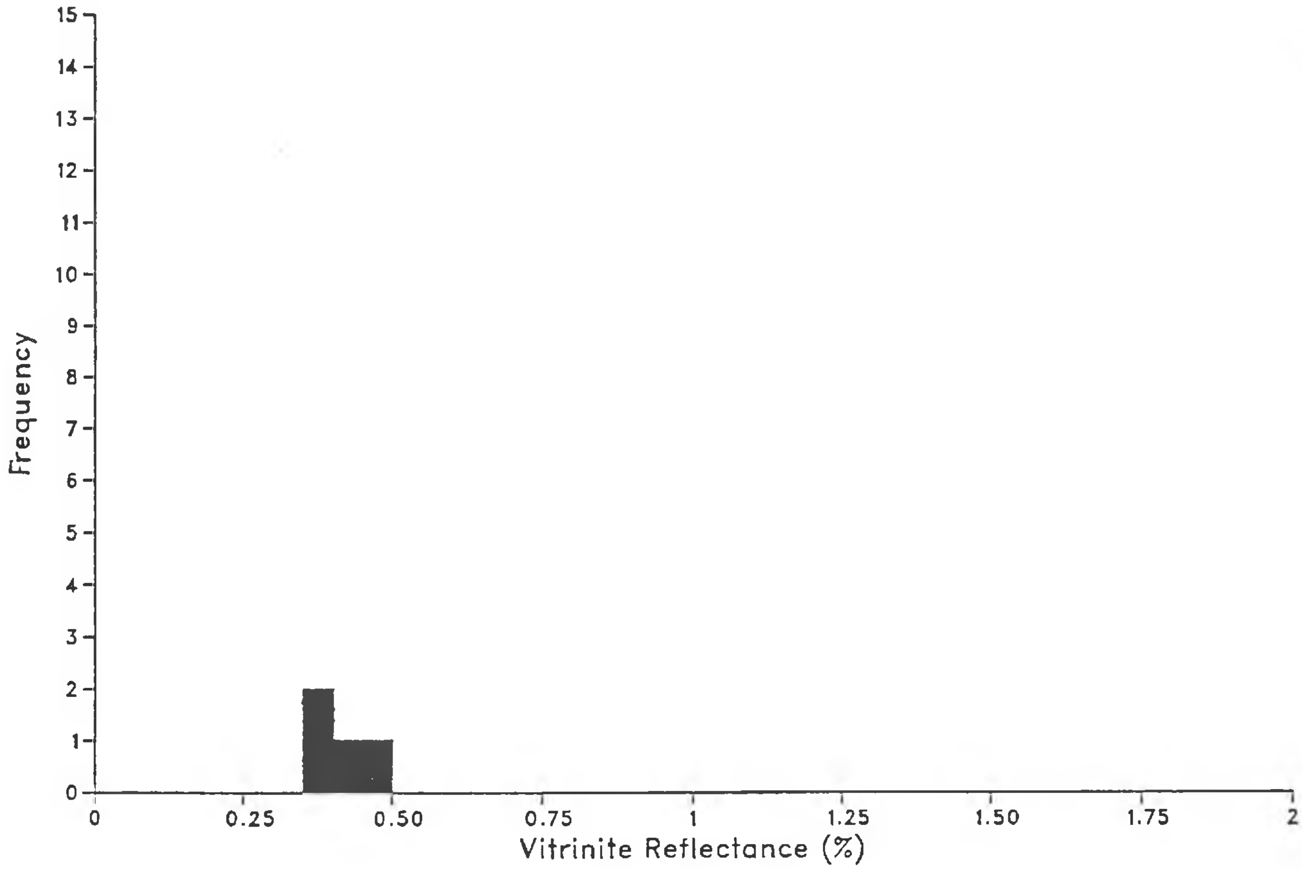
Well: NOCS 30/2-2
Depth: 2381.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.500):	0.40	0.04	4

Readings:

0.370 0.380 0.400 0.450

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Vitrinite Reflectance Histogram

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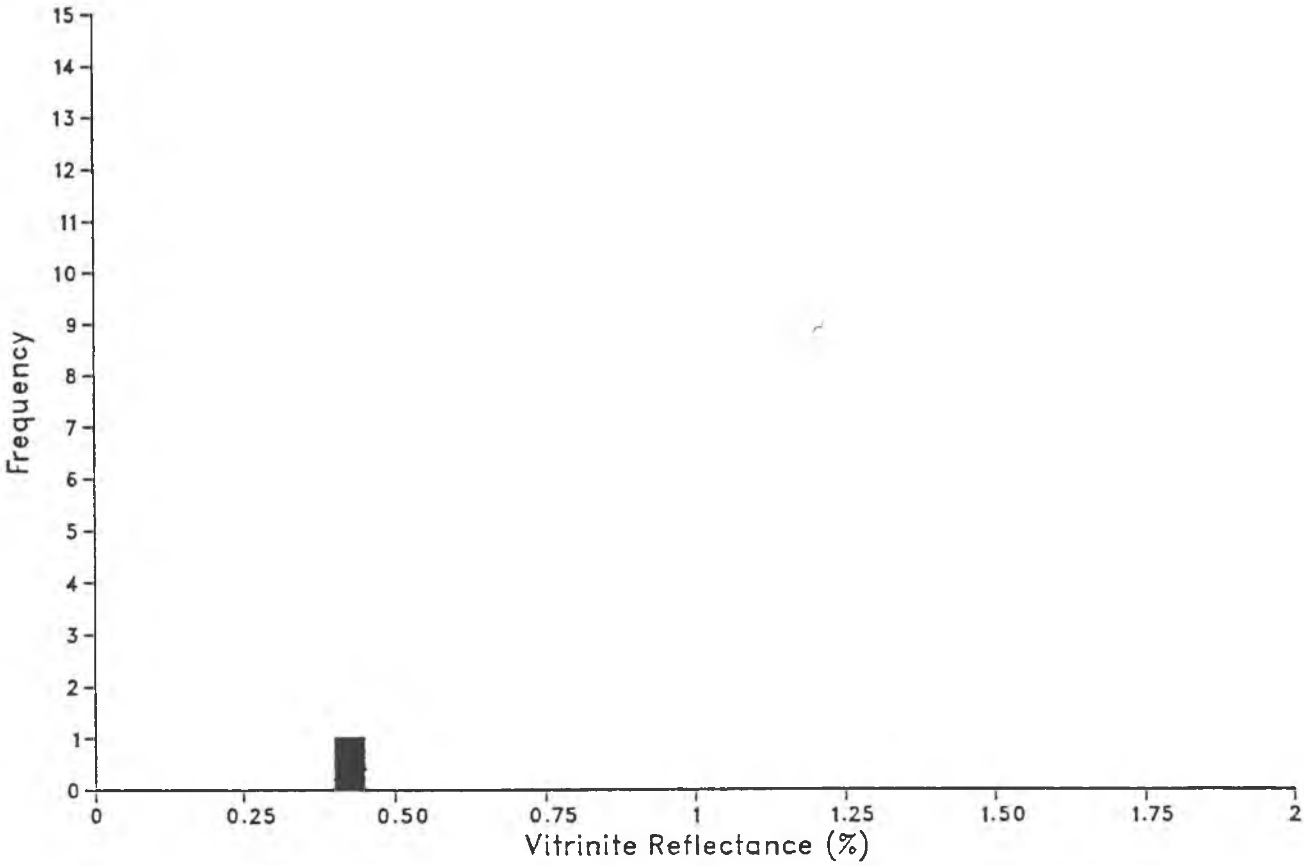
Well: NOCS 30/2-2
Depth: 2621.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.450):	0.43	0.00	1

Readings:

0.430

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Vitrinite Reflectance Histogram

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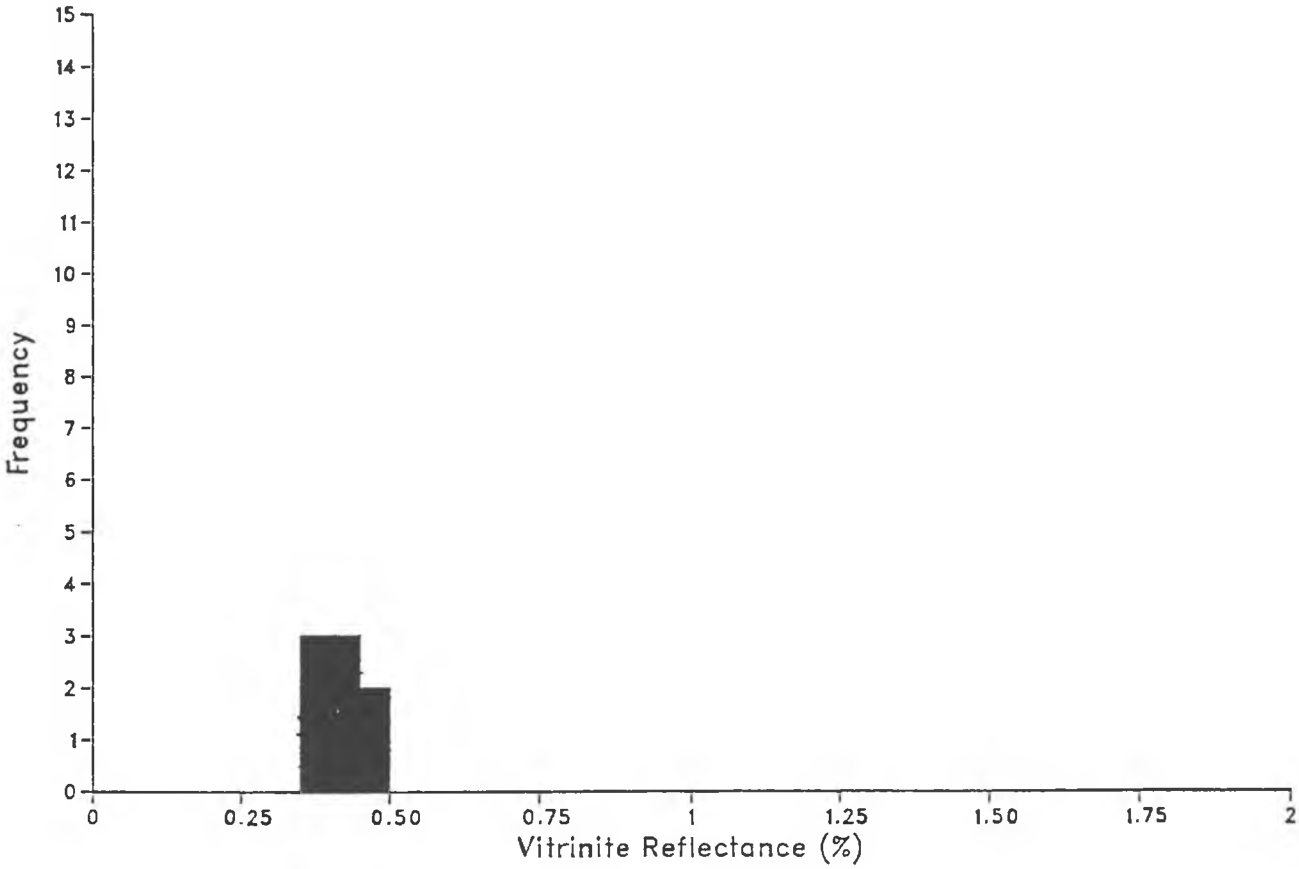
Well: NOCS 30/2-2
Depth: 2840.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.500):	0.42	0.04	8

Readings:

0.360 0.370 0.390 0.420 0.430 0.440 0.460 0.470

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Vitrinite Reflectance Histogram

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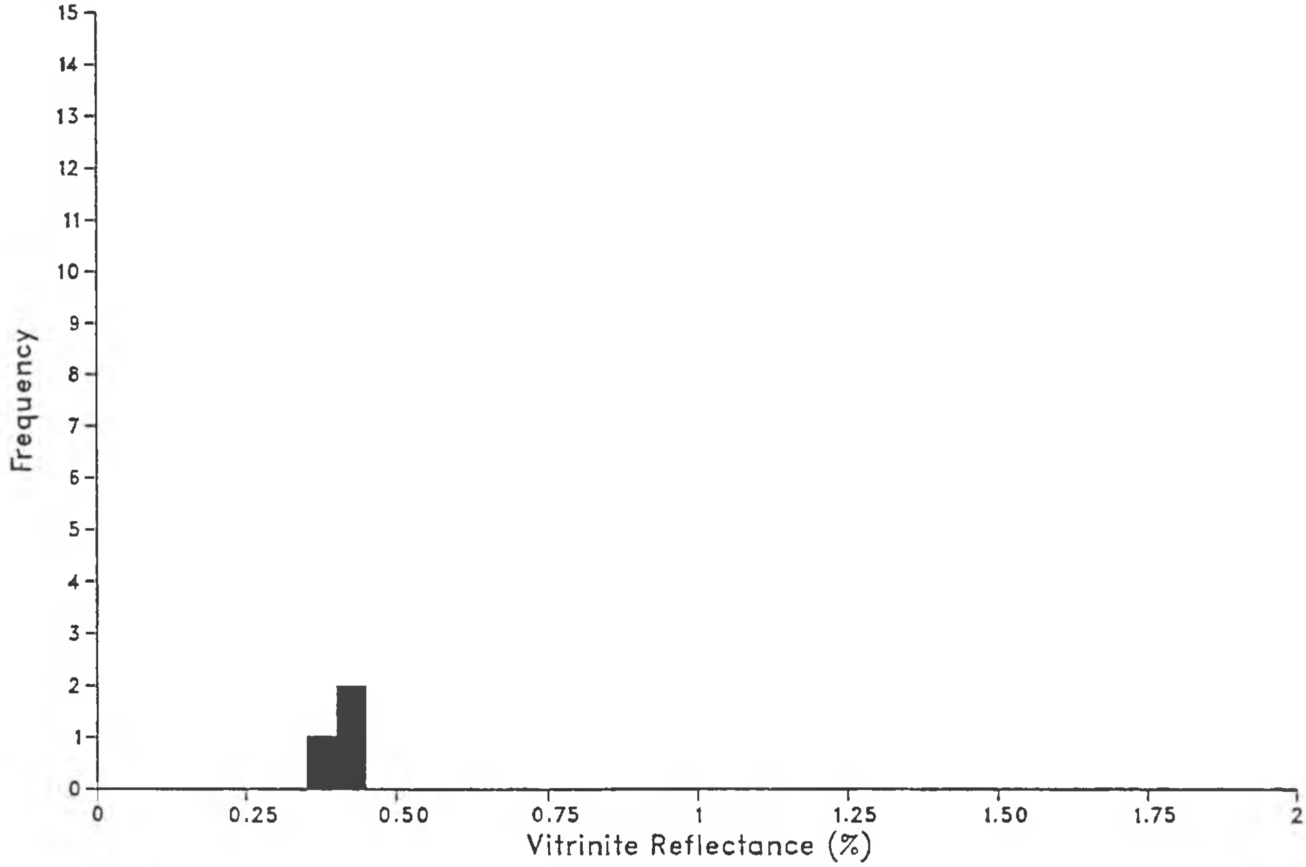
Well: NOCS 30/2-2
Depth: 2999.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.350 to 0.450):	0.41	0.03	3

Readings:

0.380 0.420 0.440

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Vitrinite Reflectance Histogram

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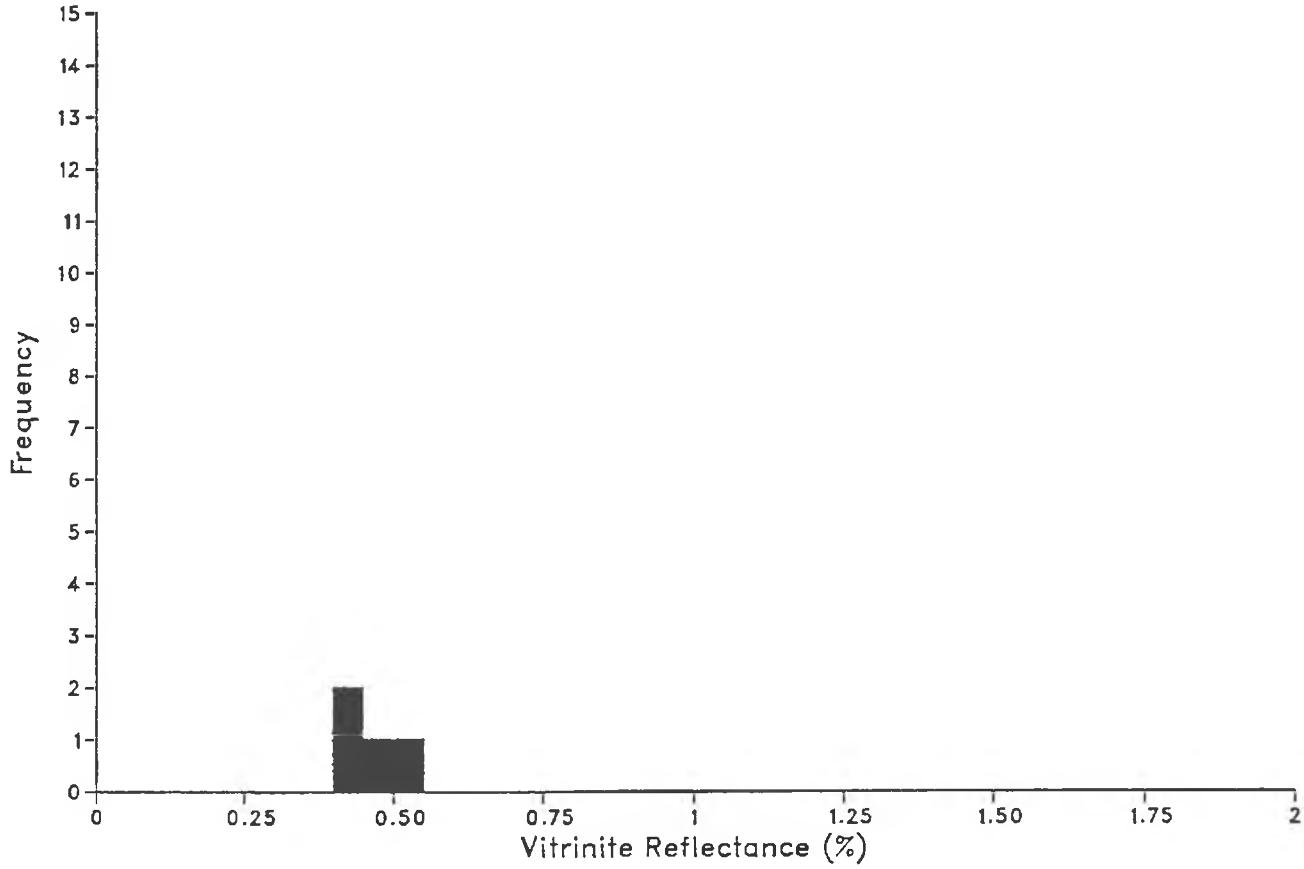
Well: NOCS 30/2-2
Depth: 3338.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.550):	0.45	0.04	4

Readings:

0.410 0.430 0.460 0.510

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Vitrinite Reflectance Histogram

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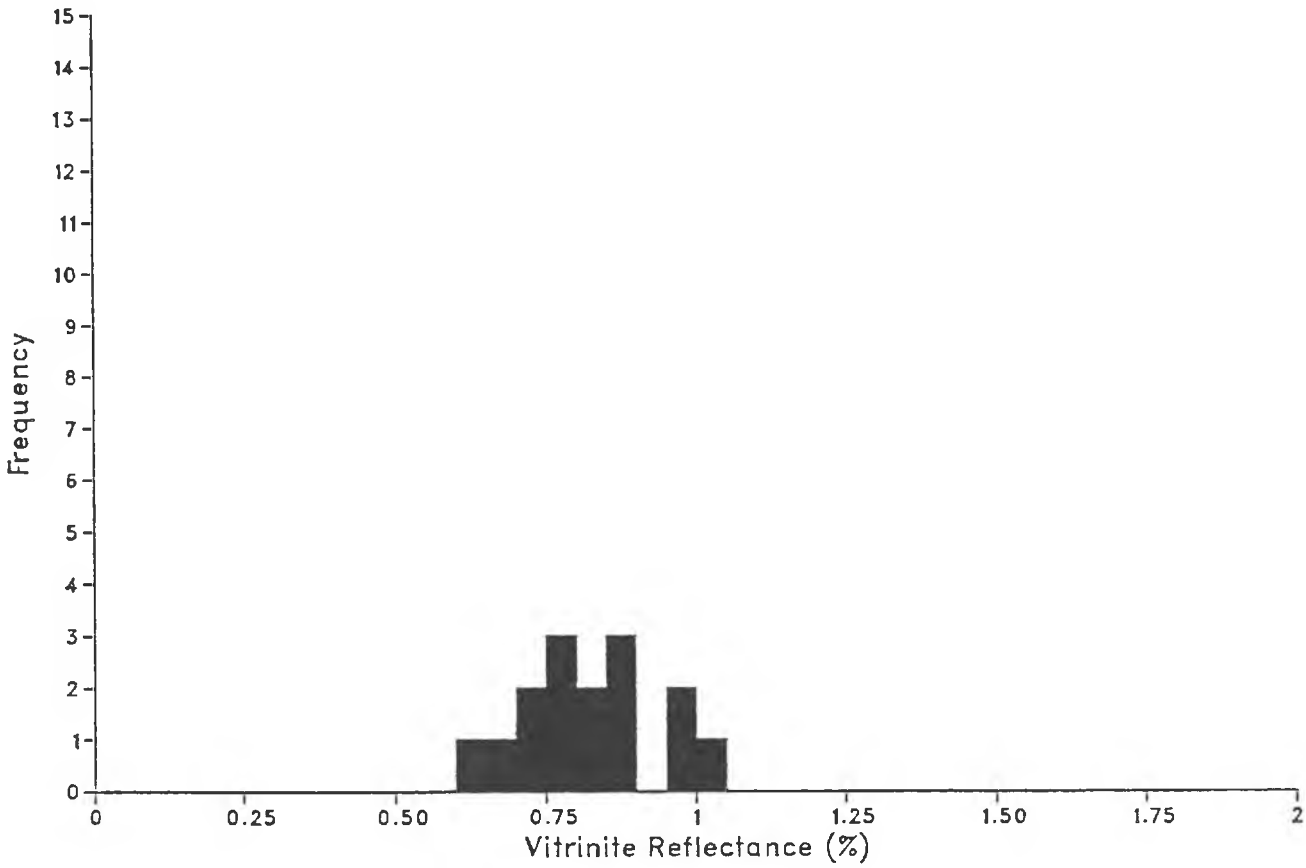
Well: NOCS 30/2-2
Depth: 3782.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.600 to 1.500):	0.82	0.11	15

Readings:

0.650	0.680	0.700	0.720	0.760	0.770	0.790	0.820	0.840	0.850
0.860	0.870	0.950	0.970	1.030					

Vitrinite Reflectance Histogram

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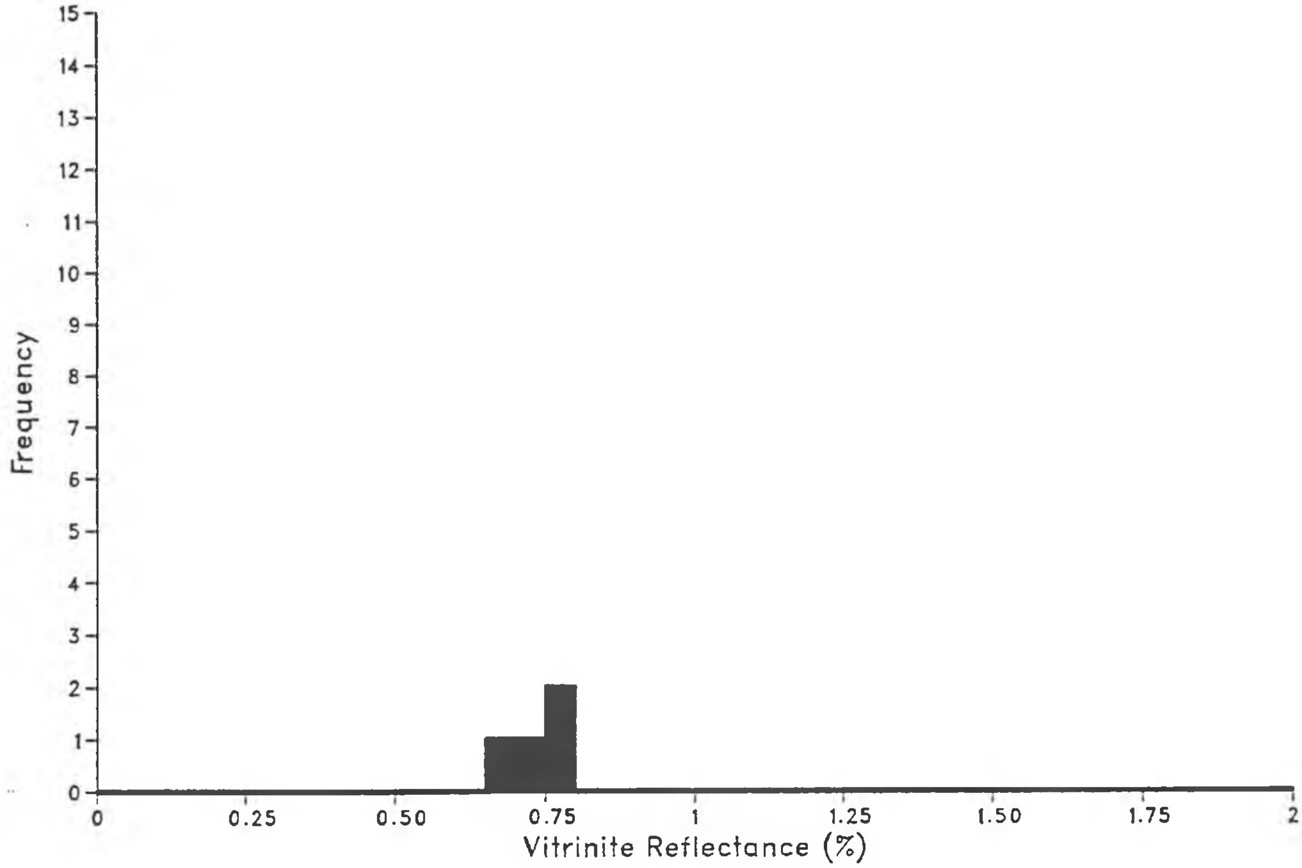
Well: NOCS 30/2-2
Depth: 3794.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.650 to 0.800):	0.74	0.05	4

Readings:

0.670 0.740 0.760 0.770

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Vitrinite Reflectance Histogram

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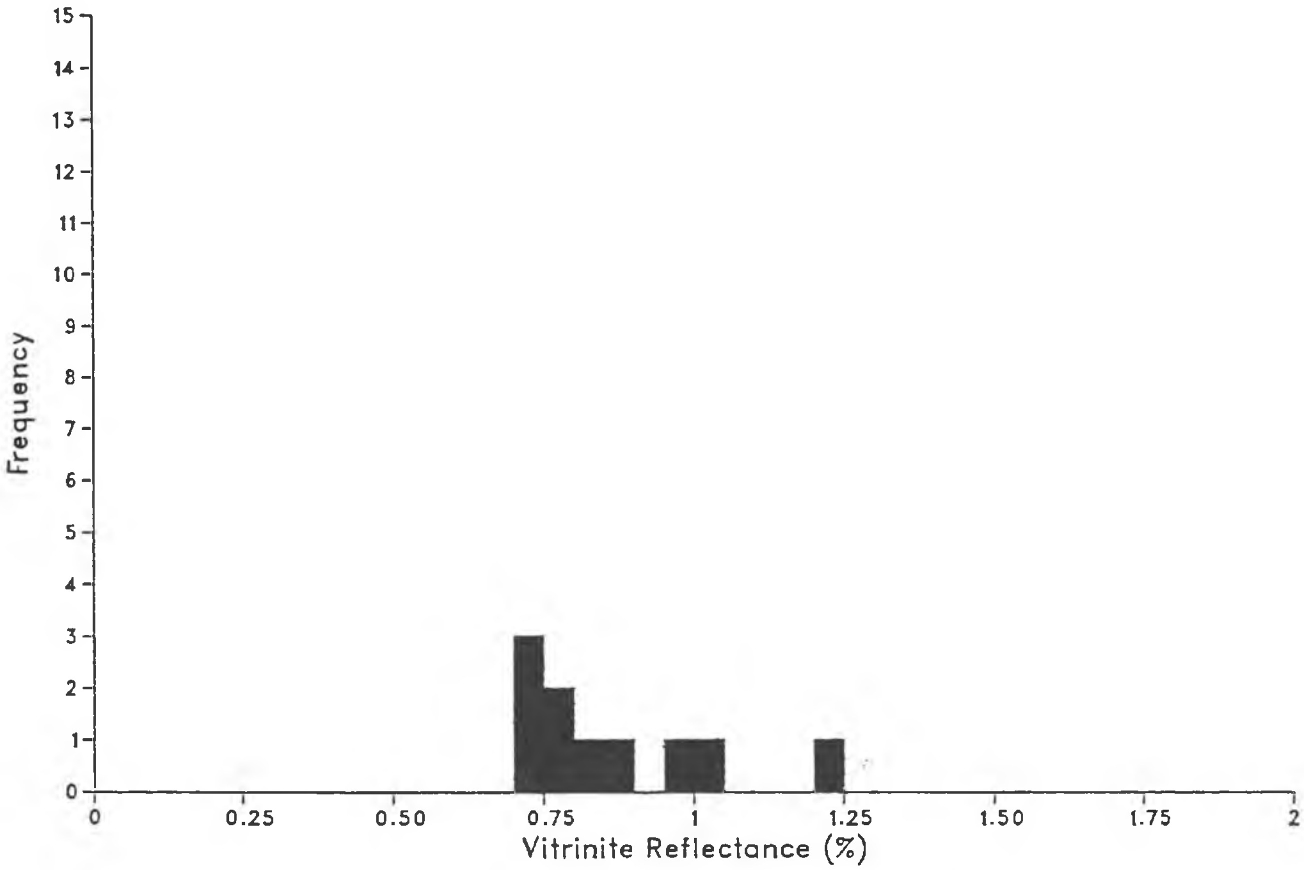
Well: NOCS 30/2-2
Depth: 4169.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.650 to 1.300):	0.85	0.16	10

Readings:

0.700	0.710	0.730	0.750	0.760	0.800	0.890	0.990	1.000	1.200

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