

GEOCHEMICAL ANALYSIS REPORT

Well Nocs 30/11-4

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Date :

05.12.91

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Summary

A total of 424 samples was picked and described for the analytical program. The analytical program included screening analyses (lithology description, Rock-Eval pyrolysis and total organic carbon). Based on the screening data, samples were selected for detailed geochemical analyses (Pyrolysis Gas Chromatography, maturity measurements, solvent extraction, gas chromatography of the hydrocarbon fractions, isotope analysis of the C₁₅₊-fraction and biomarker analysis).

Source Rocks

The Upper Jurassic Viking Gp. marine shales (Draupne and Heather Fms.) have a fair to rich source rock potential. Thin coaly intervals in the Sleipner Fm. (Vestland Gp.) have very rich petroleum potentials. The Drake Fm. (Dunlin Gp.), interpreted to be a marine shale with a notable degree of land-plant input, presently has a poor to fair source rock potential. The Statfjord Fm. shales have a poor source rock potential, probably mainly caused by high maturity (condensate - gas generation maturity).

Maturity

The Draupne and Heather Fms., Viking Gp., are classified as early mature - mature source rocks (T_{max} and vitrinite reflectance measurements), however yet to start generation of hydrocarbons in significant yields. The top of the oil window is interpreted to occur at approximately 3080 m. The interval of peak oil generation (R_o 0.8% - 0.9%) is more or less identical with Vestland and Dunlin Gps. (3420 m - 4570 m), a 1150 m thick interval. The base of the oil window is estimated to occur at about 4570 m. Condensate maturity is therefore reached from the lowermost part of the Dunlin Gp. (Amundsen Fm.) and continues into the Statfjord Fm. The gas window may be reached in the lower part of the penetrated section of the Statfjord Fm.

Generation

Neither the Draupne nor Heather Fms. have generated significant yields of hydrocarbons, when maturity and Production Index-data are taken into consideration.

The Drake Fm. (Dunlin Gp.) has generated hydrocarbons, and has very likely passed peak oil generation (GC-MS Ro equivalent ~ 0.9%). The condensate - gas mature Statfjord Fm. shales have exhausted most of their potential, the earlier mentioned poor source rock potential being probably due mainly this over-maturity.

Migration

The presence of migrated hydrocarbons is limited to the upper part of the Hugin Fm. sandstone interval, identified by oil-staining and Rock-Eval S1-yields. GC-MS analyses suggest the oil to originate from a highly mature marine source rock with some contribution from land-plant material. Comparison with source rock solvent extract data (GC-MS, isotope data) suggests that the Drake Fm. is the most likely source, both in terms of maturity and biomarker composition (saturate and some aromatic compound distributions).

Chapter 1

Introduction

1.1 General Comments

Well NOCS 30/11-4 is located approximately 15km NE of the Frigg N.E. Field in the N. Viking Graben of the North Sea. This well has a T.D. at 5255m in the Lower Jurassic, having been drilled by Shell in 1984. The main objective of this well was the testing of the L. Jurassic Statfjord Fm as a reservoir. Limited shows were encountered, DSTs being performed at 4823-4875m and 5015-5029m in the Statfjord Fm. Several drilling problems occurred with this well, which was sidetracked from 1918m.

In this report emphasis is placed on both characterization of the free hydrocarbons in the reservoir lithologies and assessment of the source rock potential of the various Jurassic shales.

1.2 Analytical Program

The following analysis program was executed for well NOCS 30/11-4 in the section from 1020m to 5255m (TD):

<u>Analysis type</u>	<u>No of samples</u>	<u>Figures</u>	<u>Tables</u>
Lithology description	424	1	1
Rock-Eval pyrolysis	74	2,3,4	
Thermal extraction GC (GHM, S ₁)	24	5a-k	
Pyrolysis GC (GHM, S ₂)	24	6a-l,7	3
Soxhlet Extraction of organic matter	12		
MPLC/HPLC separation	12		4
Saturated hydrocarbon GC	12	8a-d	5
Aromatic hydrocarbon GC	12	9a-j	6
Vitrinite reflectance	18	10	7
Visual kerogen microscopy	19	11	8
Isotope composition C ₁₅₊ fractions	5	12,13	9a-b
GC - MS of saturated and aromatic HC	5	14a-r	10a-i

All samples were supplied by NPD as cuttings samples and core chips samples. Stratigraphy was also supplied by NPD and this report is based on the group and formation tops contained therein.

1.3 Stratigraphy

The following stratigraphic sub-division of the well has been used, this being based on published data from the Norwegian Petroleum Directorate (NPD).

Lithostratigraphic Unit	Age	Top RBK (m)	Thickness (m)
Nordland Group	Miocene - Pliocene	140	940
Hordaland Group	Eocene - Oligocene	1080	1080
Rogaland Group	Paleocene	2160	451
Shetland Group	Upper Cretaceous	2611	613
Cromer Knoll Group	Lower Cretaceous	3224	38
Viking Group	Upper Jurassic	3262	172
Draupne Formation	Upper Jurassic	3262	21
Heather Formation	Upper Jurassic	3283	151
Vestland Group	Middle Jurassic	3434	576
Hugin Formation	Middle Jurassic	3434	233
Sleipner Formation	Middle Jurassic	3667	343
Dunlin Group	L. - M. Jurassic	4010	630
Drake Formation	Middle Jurassic	4010	200
Cook Formation	Lower Jurassic	4210	63
Burton Formation	Lower Jurassic	4273	46
Amundsen Formation	Lower Jurassic	4319	321
Statfjord Formation	Lower Jurassic	4640	615
Target Depth (T.D.)		5255	

Note: L.: Lower

M.: Middle

Chapter 2

Screening Analyses

2.1 Lithology, TOC and Rock-Eval

A total of 424 cuttings samples and core chips samples were described. The detailed lithology descriptions are shown in Table 1 and plotted in Enclosure 1. The lithology is also shown in a more generalised form in Figure 1, in addition to the TOC data. Of the 424 described samples, 74 samples were analysed using Rock-Eval pyrolysis including TOC-analysis. The data are included in Table 2 and graphically shown in Enclosure 1. Figures 2 and 3 show production index and Tmax respectively versus depth. Figure 4 shows a plot of hydrogen index versus Tmax.

2.1.1 Source Rock Potential

The Eocene - Oligocene Hordaland Gp. consists of light brown calcareous siltstone in the upper approximately 150 m (1080-1230 m). Below this the lithology changes to a light brownish grey to pale yellowish brown claystone, however, with minor contributions of sand/sandstone in the upper approx. 100 m. In the lowest 100 m sand/sandstone emerges in increasing relative quantities. No screening analyses were carried out for the Hordaland Gp. samples.

The Rogaland Gp., with a total thickness of 451.5 m, consists mainly of medium grey shale/claystone with subordinate contributions of sandstone in the upper part. However, the sand could be caved material originating from the Hordaland Group. No screening analyses were carried out for the Rogaland Gp. samples.

The Upper Cretaceous Shetland Gp., a 613 m thick unit, consists of a white chalk in the upper 100 m (Jorsalfare Fm.) changing to a medium grey, calcareous shale, which

potential.

The thin Lower Cretaceous Cromer Knoll Gp. (3224.5-3262 m) consists of light grey marl with an increase in dark shale content with depth. No samples from the Cromer Knoll Gp. were analysed by Rock-Eval.

The Upper Jurassic Viking Gp. consists of the Draupne and Heather Fms. The dark grey to brownish black Draupne Fm. shale samples are organic-rich (Figure 1), containing type II kerogen, according to the Rock-Eval data. The petroleum potential is very rich, ranging from 16.6 to 19.5mg HC/g rock (Table 2), with the bulk of hydrocarbons yet to be generated from the source rock (S1 < S2).

The Heather Fm. consists of a medium to dark grey, brownish black or brownish grey shale throughout the entire 151 m interval. The 10 cuttings samples analysed have large variations in HI (Table 2), varying from 82-417mg HC/g TOC. The TOC-content varies from good to rich (Figure 1) (1.33 - 4.60% TOC). There is a pronounced increase in HI-values with depth, indicating a pronounced shift in organic matter source at 3330 m. Simultaneously, the petroleum potential changes from poor (upper 50 m) to good (lower 100 m), only one sample having a rich petroleum potential, (S1 < S2).

The Middle Jurassic Vestland Gp. is a 574m thick unit, consisting of kaolinitic, white to light grey to light orange coarse-grained sandstone, which from 100 m below the top is interbedded with medium to dark grey to black micaceous shale. Waxy coal occurs in subordinate quantities in the Hugin Fm. The Sleipner Fm. consists of sandstone interbedded with dark grey - brownish black shale. Subordinate quantities of black waxy coal occur throughout this unit. The source rock potential of the Vestland Gp. is limited to the coaly intervals, which have very rich source rock potentials (3687 m, 3885 m) (Table 2).

The Lower (to Middle) Jurassic Dunlin Gp., comprising the Drake, Cook, Burton and Amundsen Fms. has a total thickness of 630 m. The Drake Fm. consists of medium to dark grey micaceous shale which is locally silty. White to light-orange kaolinitic

sandstone is present. The five shale samples analysed by Rock-Eval have fair to good TOC-contents. However, the S1- and S2-yields are poor, giving a poor to fair petroleum potential. The Drake Fm. therefore has a poor source rock potential. The Cook Fm., a 63 m thick medium to dark grey micaceous shale, has a poor source rock potential, according to the petroleum potential data (Table 2). The medium grey shale in the Burton Fm. also has a poor source rock potential. Finally, the Amundsen Fm., a medium - dark grey shale or light brownish grey silty and micaceous shale with subordinate quantities of kaolin, marl and calcareous siltstone, has a fair to good TOC-content. However, the poor petroleum potential similarly classifies the Amundsen Fm. as a lithologic unit with poor source rock potential.

The Lower Jurassic Staffjord Fm. consists of white kaolinitic sandstone with local medium grey shale intervals. The three shale samples analysed give poor S1- and S2-yields and thus also reflect poor source rock potential.

2.1.2 Maturity

The thirteen samples analysed from the Viking Gp. have Tmax values ranging 430-439°C (Figure 3), suggesting that the Viking Gp. is within the early mature to mature range. However, even though the Heather Fm. samples are within the oil window ($\geq 435^\circ\text{C}$) peak oil generation has yet to be reached.

The Vestland Gp. from which six shale samples have been analysed, give Tmax values varying from 435°C to 443°C, which is within the oil window and continue the Tmax trend established from the Viking Gp. (Figure 3).

The Dunlin Gp. shale samples have a wide spread in Tmax-values, ranging from 441°C to 466°C. A single value of 431°C is so much lower than the main trend that it is not considered reliable. The Tmax trend is continuing to increase. The Dunlin Gp. is interpreted to be oil - condensate mature.

Three Staffjord Fm. shale samples have Tmax-values ranging from 489°C to 515°C,

suggesting that the Statfjord Fm. is within the dry gas maturity zone (Figure 3).

2.1.3 Generation

The Production Indices (PI) of the Viking Gp. samples are low (≤ 0.2) (Figure 2). These PI-values are considered reliable due to high S1- and S2-yields. There is a difference in PI-values, mainly as a function of changes in S2-yields and consequently also the HI-values. The Heather Fm.-samples with low HI-values have PI-values varying from 0.14 to 0.20 (Table 2), whereas the Draupne Fm. and Heather Fm. samples both have PI-values less than 0.14. Therefore no significant generation of hydrocarbons has yet taken place in the Viking Gp. due to early maturity.

The six Vestland Gp. shale samples have PI-values less than 0.20, indicating that the generally immature type III kerogen has generated only small amounts of hydrocarbons. Type III kerogen has peak oil generation at 445-450°C, whereas the Vestland Gp. samples have T_{max} at 443°C.

The Dunlin Gp. samples have PI-values (0.23 - 0.50) (Figure 2), suggesting that source rocks within Dunlin Gp. have generated hydrocarbons. This corresponds well with the T_{max}-maturity trend indicating that the analysed samples are within the oil - condensate generating zone (Figure 3) (section 2.1.2). The interpreted PI-trend in Figure 2 indicates, that a minor decrease is detectable.

The three shale samples analysed from the Statfjord Fm. all have low PI-values (≤ 0.16), due to the condensate maturity of the samples, indicating that the bulk of the hydrocarbons have been generated and expelled from the shales.

2.1.4 Migrated Hydrocarbons

The Rogaland Gp. sandstone samples all have low S1- and S2-yields (Table 2), giving no indications of the presence of free hydrocarbons in significant quantities. The relatively high PI-values (Figure 2) are not indicative of the presence of hydrocarbons, reflecting only low S1 and/or S2 values.

The two Shetland Gp. samples have very low S1- and S2-yields, giving unreliable PI-values. The analysed samples give no indications of presence of migrated hydrocarbons.

The eleven Vestland Gp. sandstone samples show a wide range of S1- and S2-yields (ranging from 0.02 - 3.35mg HC/g rock for S1 and 0.01 - 3.64mg HC/g rock for S2, respectively). The S1-, S2- and PI-values in the interval 3495 m - 3531.5 m suggest the presence of oilshows (Figure 2, Table 2). None of the other sandstone samples appear to have any hydrocarbons present in significant quantities.

The Statfjord sandstone samples analysed all have low S1- and S2-yields, showing the absence of oilshows within the unit. A single sample, 5025 m, has an S1-yield of 0.13mg/g rock, which is significantly more than the other samples (Table 2). The interval at 5025 m was subject to a drill stem.

Chapter 3

Detailed Geochemical Analyses

3.1 GHM - Thermal Extraction

A total of 24 samples, including 17 cuttings samples, 4 core chip samples and 3 composite bulk samples were analysed using the Geofina Hydrocarbon Meter (GHM) - combined thermal extraction and pyrolysis GC. The analysed samples were selected on the basis of Rock-Eval results. Both source rocks and reservoir rocks were analyzed. Exemplary chromatograms of the free hydrocarbons are shown in Figures 5a-k.

The single bulk composite sandstone sample from the Hordaland Gp. (Frigg Fm., 2121 m) has only small amounts of free hydrocarbons, which corresponds well with the low S1-yield from the Rock-Eval result (Table 2). The compounds present are of light molecular weight, probably mainly aromatic with no homologous series of n-alkanes evident (Figure 5a). These may represent contamination.

Similar to the Frigg Fm. sample, the single Rogaland Gp. (Heimdal Fm., 2280 m) bulk composite sample, consisting of sandstone, has only a minor yield of free light hydrocarbons with a composition similar to those in the Frigg Fm. sample. There are therefore no significant shows of migrated hydrocarbons in the Heimdal Fm.

Six Viking Gp. shale samples were analyzed. The free hydrocarbons in the Draupne Fm. samples (3267 m, 3279 m) consist of n-alkanes in the intermediate range (nC_{11} - nC_{26}), both samples having maxima at $n-C_{14}$ (Figure 5b). Isoprenoid(?) alkanes/alkenes emerge clearly between the n-alkanes suggesting an immature source rock. Short-chained n-alkanes are not present. The n-alkane distribution suggests a type II kerogen for the Draupne samples. The n-alkane distributions are unimodal suggesting

generation of free HC from source rocks with uniform composition. There appears to be a minor even over odd dominance for the heavier n-alkanes (nC_{20} - nC_{26} range), which together with a pristane/phytane ratio close to 1, suggests a marine source.

The four Heather Fm. shale samples represent source rocks of widely different qualities. Two samples (3297 m, 3315 m) have type III/IV kerogen (Rock-Eval data, Table 2) (Figure 5c) with a predominance of light and intermediate hydrocarbons (C_1 - C_{15} n-alkane range). The two other samples (3357 m, 3429 m), having types II and III kerogen respectively, have free hydrocarbons with compositions comparable to those in the Draupne Fm., n-alkanes in the nC_{11} - nC_{25} range with a maximum at nC_{14} . Sample 3357 m appears to have a bimodal distribution of n-alkanes, suggesting a heterogeneous source rock within the Heather Fm. at this level or staining by a different suite of hydrocarbons. Additionally, pristane is a major peak. The high Pr/Ph-ratio ($Pr/Ph \geq 2$) suggests a terrestrial source. Most of the Heather Fm. samples show minor unresolved "humps" under the intermediate n-alkane range, suggesting a presence of heavier compounds (NSO's and asphaltenes) (Figure 5d). Taking maturation into consideration, the free hydrocarbons present have been generated at an early mature stage.

The eight Vestland Gp. samples, consisting of five sandstone samples (potential reservoir rock), two coal-rich samples and one shale sample (potential source rocks), were analyzed. Two samples from the interval considered to contain migrated hydrocarbons (3514 m, 3531.5 m) were thermally extracted. Both samples are dominated by n-alkanes in the $nC_{16/17}$ - nC_{33+} range. However, the two samples have different distributions of n-alkanes. Sample 3514 m (Figure 5e) has a weak tendency for a bimodal n-alkane distribution, with the most significant population in the intermediate n-alkane range (nC_{14} - nC_{26}) and a maximum at nC_{18} , suggesting a marine source. The second population occurs in a heavier n-alkane range (nC_{26} - nC_{38}). The n-alkane distribution may suggest a heterogeneity of the migrated hydrocarbons which may be due to migration from two different sources, i.e. both marine and terrestrial origins. The apparent heterogeneity could however also be due to variations in porosity in the sandstones or to migration effects. The three other sandstone

samples (3465 m, 3633 m, 3927 m) from the Vestland Gp. have small yields of S1-hydrocarbons where light hydrocarbons are dominant. Aromatic hydrocarbons are present in all samples, while n-alkanes are present only in minor concentrations, giving irregular n-alkane distributions. All samples have high Pr/Ph ratios (> 2.0), suggesting terrestrial source(s) for the hydrocarbons in all three samples. The free hydrocarbon composition in the 3927 m sample (Figure 5f), consisting of paraffinic, mono- and poly-aromatic hydrocarbons, indicates a coaly source. The coal and shale samples (3441 m, 3597 m, 3687 m) contain a moderately mature type III/IV kerogen, while two type III kerogen coal samples have oil to condensate range maturity. The two coal samples have already generated hydrocarbons. The composition of the free hydrocarbons suggest generation of mainly wet gas and light oil (Figure 5g), with a high aromatic hydrocarbon content. The distribution of free hydrocarbons in the 3687 m sample, where light members are dominant, indicates a condensate mature type III coaly source rock.

The four Dunlin Gp. samples consist of shale (4149 m, 4263 m, 4311 m, 4455 m). The shale samples show uniform, unimodal distributions of free hydrocarbons, consisting mainly of n-alkanes in the nC_{12} - nC_{22} range, with a minor amount of isoprenoid alkanes (Figure 5h). The lack of light hydrocarbons could be due to migration effects and/or loss of these prior to analysis (drilling, storage). Sample 4149 m has a composition similar to the other S1-chromatograms within this group, however with the exception that pristane and phytane both are present in larger amounts compared to the other samples (Figure 5i). The high Pr/Ph-ratio suggests a terrestrial source rock for the Dunlin Gp. shales. The wider n-alkane range (nC_{11} - nC_{26}) for sample 4149 m compared to the other samples is probably due to richer S1-yield for sample 4149 m relative to the other samples.

The four Statfjord Fm. samples analysed (4645.75 m, 4743 m, 4899.4 m, 5025 m) include two shale samples (4743 m, 4899.4 m) and two sandstone samples (4645.75 m, 5025 m). The condensate mature shale samples have free, mainly light, hydrocarbons having a significant content of aromatic compounds (Figure 5j). The lower shale sample (4899.4 m) has only light gaseous compounds present,

corresponding with the late maturation stage, i.e. solely wet gas generation.

The two sandstone samples have very low S1-yields. The upper sample (4645.75 m) (Figure 5k) has n-alkanes ranging nC₁₂ - nC₂₆ in very low concentrations. The lowest sample (5025 m) has only very low concentrations of gaseous hydrocarbons, suggesting either migration of hydrocarbons at late HC-generation stage or cracking of HCs present in the sandstone. The presence of two minor "unresolved humps" might correspond to the heavier fractions of original migrated oil, taking the depth (5025 m) into consideration.

3.2 GHM - Pyrolysis Gas Chromatography

A total of 24 samples were analyzed using by pyrolysis GC. Representative pyrograms of the pyrolysis products (Rock-Eval's S2 equivalent) are shown in Figures 6a-l. In addition, the pyrolysis GC composition is shown as a ternary plot in Figure 7. The data are listed in Table 3.

The light hydrocarbons in the S1-chromatogram of the Hordaland Gp. sample (2121 m) give no indications concerning their origin. The corresponding S2-pyrogram (Figure 6a) suggests pyrolysis of asphaltenes (? from residual oil) or contaminant and the pyrolysis product data of the heavy fraction in the oil (i.e. NSOs and asphaltenes) can be classified as that representing a light oil, due to the predominance of light and intermediate compounds (C_1 - C_5 and C_6 - C_{14}) (Figure 7), whereas heavy compounds (C_{15+}) constitute approx. 10% (Table 3).

The Rogaland Gp. sample (2280 m) (Figure 6b) has a pyrolysate composition quite similar to that of the Hordaland Gp. sample, suggesting either the presence of asphaltenes from residual oil or contaminants.

The Viking Gp. shale samples show a relatively wide scatter in relative contents of C_{15+} -pyrolysate, whereas the relative distributions of C_1 - C_5 and C_6 - C_{14} are relatively uniform (Figure 7, Table 3). The two Draupne Fm. shales (3267 m, 3279 m) (Figure 6c) have a predominance of n-alkanes (Figure 6c), with a moderate to aromatic hydrocarbon content. The distribution of the aromatic and paraffinic hydrocarbons suggests an immature type II - II/III kerogen. The "unresolved hump" under the generated hydrocarbons is typical for type II - II/III kerogen. The Draupne shale is therefore classified an oil-prone source rock and to a minor relatively extent also gas-prone.

The Heather Fm. samples' pyrolysates (3297 m, 3315 m, 3357 m, 3429 m) have a larger scatter in molecular composition (Table 3), which correlates with the variations in S2-yields (Rock-Eval data, section 2.1.1). The type III/IV kerogen in sample 3315 m has a dominance of light and intermediate hydrocarbons, consisting of both

paraffinic and aromatic species (Figure 6d), showing mainly only gas potential. The sample from 3357 m (Figure 6e) contains richer type II - II/III kerogen, having a pyrolysate composition and pyrogram very similar to that of the Draupne Fm., so much so that this may be caved from the Draupne Fm.

The eight Vestland Gp. samples consist of three carbonaceous samples and five sandstone samples. The two coal samples and one shale sample (3441 m, 3597 m, 3687 m), which are within the oil - condensate windows, appear to be oil- and (? mainly) gas prone source rocks according to their pyrograms, having type III kerogen (e.g. 3441 m, Figure 6f). Mono- and diaromatic hydrocarbons contribute significantly to the pyrolysates, suggesting terrestrial source(s).

The three sandstone samples from the Hugin Fm. (3465 m, 3514 m, 3531.5 m) considered to belong to one continuous sequence, have relatively uniform pyrolysate compositions (Figure 7). Aromatic hydrocarbons are present in all samples, suggesting type III or type II/III kerogen as a source for the migrated hydrocarbons (Figure 6g). The dominance of alkenes over alkanes to C₁₈ however is indicative of pyrolysis of asphaltenes from residual oil. The two lower sandstone samples (3633 m, 3927 m) have lighter pyrolysate compositions compared to the upper three Hugin Fm. sandstone samples. Aromatic hydrocarbons and polar compounds constitute the bulk of the pyrolysate (e.g. 3633 m, Figure 6h). The pyrolysate here is suggestive of pyrolysis of mature coaly fragments, supporting the thermal extract chromatogram which shows typical generation products of coal. The lowest sandstone sample (3927 m) has a different composition, having a distinct population of heavier compounds. Monoaromatic hydrocarbons contribute significantly, suggesting a type III kerogen source rock.

The pyrolysed shale samples from the Dunlin Gp. (4263 m, 4311 m, 4455 m) have pyrolysate compositions biased towards C₁-C₅ and C₆-C₁₄ hydrocarbons (Figure 7), corresponding to a light oil generation potential, e.g. Cook Fm. (4263 m, Figure 6i). The biasing towards light hydrocarbons is believed to be an effect of maturation (condensate maturity stage) when compared with the Viking Gp. shale samples.

One sandstone S2-pyrogram from the Drake Fm. (4149 m, Figure 6j) consists of paraffinic and aromatic hydrocarbons, possibly derived from the asphaltene fraction of the migrated hydrocarbons. The composition of the pyrolyzed oil is divided into subequal yields of C_1 - C_5 , C_6 - C_{14} and C_{15+} fractions, suggesting generation of hydrocarbons from a mixed marine/terrestrial source rock (due to aromatic hydrocarbons) in the oil window maturation stage. A source rock - oil correlation of the Dunlin Gp. samples might suggest, that the Dunlin shales have generated (at an earlier maturation stage) the hydrocarbons present in sample 4149 m.

The two Statfjord Fm. shale samples (4743 m, 4899.4 m), at condensate to gas maturation stage, have pyrolysate compositions dominated by gaseous compounds (C_1 - C_5) and aromatics (Figures 6k, 7). The generation potential is now limited to minor gas (4743 m), which is in agreement with the maturation stage of the shales. The sandstone samples (4645.75 m, 5025 m) have pyrolysate compositions dominated by light and intermediate compounds (Figure 7, Table 3). The pyrolysate in sample 4645.75 m is dominated by n-alkanes (C_1 - C_{29}) but there is a dominance of alkenes to C_{16} suggesting pyrolysis of asphaltenes from residual oil (supported by the thermal extract chromatogram). Cracking at this depth might have altered the composition of the asphaltene fraction, thus shifting the n-alkane chain-length from longer chains to shorter chains. Cracking, if taking place, is more advanced in the lowest sample (5025 m), changing the pyrolysate composition towards lighter hydrocarbons. It is not possible to determine the source rock, based only on S2-pyrograms, though the thermal extract suggests a strongly terrestrially influenced source.

3.3 Solvent Extraction and Chromatography

A total of 12 samples, including 10 cuttings samples (of which 3 were composite samples) and 2 core chips samples, was extracted using the Soxhlet apparatus and the extracts were subsequently fractionated by MPLC. The results and composition of composite samples are shown in Tables 4a-e and the data are plotted in Enclosure 2 and 3. The hydrocarbon fractions (saturated and aromatic) were finally analysed using gas chromatography and the results are presented in Tables 5 and 6 respectively. All the chromatograms are included in the Appendix. Exemplary chromatograms are shown in Figures 8a-d and 9a-j.

3.3.1 Extraction

The 4 Viking Gp. shale samples have fair to rich extractable organic matter content (EOM: 1261 - 5719 ppm rock), with variations correlating with the S1-yields obtained from Rock-Eval analysis. The extractable hydrocarbons (EHC) constitute a fair to rich fraction of the EOM, varying from 507 to 3843 ppm rock. The relative contribution of EHC ranges from 14.9% to 67.2% of EOM, suggesting a wide spread in composition of the fractions. However, compared to the TOC-contents of the samples, the EOM content is slightly downgraded, ranging from poor to good, while the EHC content is poor to rich when normalized against TOC. The saturated:aromatic hydrocarbon ratios range 0.83 - 1.2. This data is fairly typical for early mature hydrocarbons generated in-situ.

The Vestland Gp. samples analysed consist of a composite sample (sandstone + coal), two sandstone core-chip samples, one shale sample and one coal sample. The two sandstone samples (3514 m, 3531.5 m) are from the interval with migrated hydrocarbons (Section 2.1.4). The EOM content varies from fair to rich (804, 4937 ppm rock). The EHC contents are good to rich (673, 2819 ppm), and constitute 57 - 84 % of EOM. When normalized against TOC the EOM and EHC contents are rich and good - rich respectively. The saturated:aromatic hydrocarbon ratios range 1.92 - 5.83. This data is consistent with the presence of mature migrated hydrocarbons in the

sandstones.

The potential source rocks, i.e. the shale and coal samples (3441 m, 3597 m, 3687 m) all have rich to very rich EOM contents (2632 - 47277 ppm) and rich to very rich EHC contents (1150 - 4950 ppm). However, relative to TOC the EOM-contents are fair (coaly samples) to good (shale sample). The EHC contents of the potential source rocks, when normalized against TOC become poor (coal) to good (shale and coal/sst). The free hydrocarbons in these samples have low saturate:aromatic hydrocarbon ratios, 0.16 - 0.28. This data can be expected for in-situ generated hydrocarbons from coaly kerogen.

The two Dunlin Gp. samples extracted, one shale and one composite shale sample (Table 4e) have fair to rich EOM contents (747, 2119 ppm). The EHC contents constitute large relative fractions (79 - 82 % of EOM), giving rich contents for both samples (609 - 1666 ppm). These hydrocarbons have high saturated:aromatic hydrocarbon ratios (3.40 - 3.47), inferring well mature hydrocarbons.

The single Statfjord Fm. composite shale sample has a good EOM-content (1594 ppm) and a rich EHC content (603ppm). When normalized against TOC these become poor however (~17 mg/g TOC and ~6 mg/g TOC). Hydrocarbons constitute ~38 % of EOM, and have a low saturated:aromatic ratio of 0.27. This is in agreement with a source rock with terrestrially derived organic matter, which has generated and expelled the bulk of the hydrocarbons.

3.3.2 Saturated Hydrocarbon Gas Chromatography

The twelve solvent extracted samples were separated by MPLC and the saturated and the aromatic fractions analysed by gas chromatography. The saturated hydrocarbon data presented in Table 5 include Pristane/ nC_{17} -, Pristane/Phytane-, Pristane+Phytane/ $nC_{17}+nC_{18}$ -, Phytane/ nC_{18} -ratios and the CPI-index. All saturated hydrocarbon chromatograms are found in Appendix 4. Exemplary chromatograms are shown in Figures 8a-d.

The two saturated hydrocarbon chromatograms from the Draupne Fm. have unimodal n-alkane distributions, with a predominance of n-alkanes in the short to intermediate range (nC_{13} - nC_{20}) (Figure 8a). The gradual decrease in intensity with increasing n-alkane chainlength supports a marine origin of the organic matter. The maturity parameters Pr/nC_{17} and Ph/nC_{18} both indicate early mature source rocks, as do the barely visible biomarker peaks.

The two Heather Fm. samples have differences in n-alkane distributions. The upper sample, 3297 m, has a bimodal distribution dominated by short-chained n-alkanes. The n-alkane distribution of the lower sample has a "weak" bimodal n-alkane distribution, however with a predominance of short-chained n-alkanes (Figure 8b). The CPI, 1.37 and 1.15 respectively, are both relatively high, indicating a terrestrial source, particularly in the upper sample. For the lower sample, caved cuttings from an interval above with a terrestrial source could influence the n-alkane composition for a type II - II/III kerogen. This hypothesis is supported by Rock-Eval (Table 2), where all Heather Fm. samples are type III or IV kerogens. The Pr/Ph -ratios are relatively high, supporting a strong input of terrestrial organic matter.

The Vestland Gp. source rock samples, 3441 m, 3597 m and 3687 m (Section 3.3.1) have a dominance of short-chained n-alkanes - a function of maturity of the samples (condensate maturity, Figures 3 and 4). The high intensities of Pristane and the high Pr/Ph -ratios are common for coal samples, indicative of a terrestrial source.

Migrated hydrocarbons from the two sandstone samples (core chips), at 3514 m and 3531.5 m, have different n-alkane distributions. The upper sample, 3514 m, has an overall maximum at nC_{18} and a generally greater content of shorter chained n-alkanes compared to 3531.5 m, which has an overall maximum at nC_{22-25} , suggesting a slightly more "waxy" oil (Figure 8c). Additionally, the Pr/nC_{17} -, Ph/nC_{18} - and $Pr+Ph/nC_{17}+nC_{18}$ -ratios are different, mainly due to great differences in the content of short-chained n-alkanes. These differences may be caused by several factors such as sandstone porosity and water-washing.

The two Dunlin Gp. shale samples, one cuttings sample and one composite sample (Table 4e), show similarities in overall compositions of saturates. These condensate-

mature source rocks have unimodal n-alkane distributions, the n-alkane distributions being biased towards the lighter n-alkanes, with a maximum around nC₁₃₋₁₆. A terrestrial origin is inferred by the relatively high Pr/Ph-ratios (3.07 and 2.90 respectively, while the isoprenoid/n-alkane ratios show the hydrocarbons to be well mature) (Figure 8d). The relatively uniform MPLC-data for the two samples support similar origins of the source rocks.

The single Statfjord Fm. shale composite sample, 4737-4743 m interval, is considered to be within the gas window. This has a chromatogram which is fundamentally similar to the Drake Fm. shale except that the content of n-alkanes relative to pristane and phytane are much lower and the "concave" profile of the n-alkane distribution reflects the high maturity of these shales.

3.3.4 Aromatic Hydrocarbon Gas Chromatography

The two Draupne Fm. shales have aromatic hydrocarbon distributions dominated by an unresolved "hump" or envelope. C₁- C₂-naphthalenes, phenanthrene and C₁-phenanthrenes are the major resolved components (Figure 9a). This, and the low ratios of 2/1 MN (C₁-naphthalenes) and 2,6+2,7/1,5 DMN (C₂-naphthalenes), suggests they are of fairly low maturity. The calculated vitrinite reflectance equivalent based on the MPI1 index is probably too high (> 0.8 % Ro). The low 3+2/1 and 4/1 C₁-dibenzothiophene ratios (see FPD trace - Figure 9b) also suggest a low mature highly anoxic source rock. As noted, the MN and DMN ratios are low (< 1 ~ 1.2 respectively) and suggest a maturity close to 0.6 % Ro. The high MPI1 index may in part be due to coelution of the 3- and 2-MP with a 1-methyl dibenzothiophene.

The two analysed Heather Fm. shales show slight differences to the Draupne Fm. shales. The main differences are the less prominent unresolved hump (particularly at long retention times) and the more prominent C₄-naphthalenes (Figure 9c) than in the Draupne Fm. samples. The sulphur aromatic distribution is fairly similar to that of the Draupne Fm. except for the higher 4/1 MDBT ratio (C₁-dibenzothiophene ratio) which is probably due to a less anoxic environment in the Heather Fm. compared to the

Draupne Fm. The calculated vitrinite reflectance value based on the MPI1 index value is about 0.7 % Ro. This is probably still too high.

Five samples were analysed in the Vestland Gp., one sandstone/coal bulk sample, two sandstones stained by migrated hydrocarbons and a shale, all from the Hugin Fm. and a coal from the underlying Sleipner Fm. The shale and two coals are very similar and show typical distributions of land-plant dominated source rocks. With a low unresolved hump and a pronounced naphthalene peak along with naphthalenes and phenanthrene with alkyl phenanthrenes (Figure 9d). The sulphur aromatic distribution seen in the FPD traces (Figure 9e) shows a much lower 3+2/1 MDBT ratio (C₁-dibenzothiophene ratio) which is partially due to increased maturity, but is mainly due to differences in depositional environment (lower sulphur content, less anoxic waters).

The oil-stained sandstones are dominated by phenanthrene and methyl phenanthrenes (e.g. Figure 9f). This is typical of an oil residue which tends to lose the lighter components, i.e. alkyl naphthalenes, through migration processes if it is a residual oil or through work up procedures if it is a "live" oil. MPI1 index suggests that the maturity of the source of this oil was close to 0.9 % Ro. If earlier observation that the MPI1 index is giving higher calculated vitrinite reflectance than the true value, then the source of the oil may also be of lower maturity than indicated. The sulphur aromatic trace (Figure 9g) is totally dominated by the 4-methyl dibenzothiophene. This is not typical of hydrocarbons sourced by normal early- to mid-mature Draupne Fm. shales which tend to have a lower 4-methyl dibenzothiophene relative to the other compounds.

The last three analysed samples come from the Lower Jurassic Dunlin Gp., one shale from each of the Drake, Burton and Amundsen Fms.

The uppermost shale, from the Drake Fm., is not dissimilar to the sandstone sample in aromatic hydrocarbon distribution from phenanthrene and at longer retention times. However, the alkyl naphthalenes dominate in this shale with C₁- and C₂-naphthalenes predominant, but with a more pronounced C₃-naphthalene distribution (Figure 9h) than

the overlying shales, probably due partly to maturity and expulsion processes and possibly partly to input difference.

The Burton and Amundsen Fm. shales show a marked decrease in C₁-naphthalenes and an increase in biphenyl, methyl biphenyl and 3+2 MP/9+1 MP (Figure 9i) due to a significant increase in maturity over the Vestland Gp. shales and coals. Thus the calculated vitrinite reflectance based on MPI1 index rises from 0.8 % Ro for the shale at 3597 m to 0.9 % Ro at 4149 m to 1.0 % Ro at 4317 m and 1.4 % Ro at 4743 m.

The sulphur aromatic trace of the Drake Fm. shale is typical of a highly mature source rock with 4-MDBT totally dominant (Figure 9j).

Summary

The main changes in aromatic hydrocarbon distributions are related to maturity changes. The estimated maturity is about 0.6 % Ro equivalent at 3300 m to 0.9 % Ro at 4200 m to 1.4 % Ro at 4700 m, i.e. peak oil generation is from about 3500 - 4000 m.

3.4 Vitrinite Reflectance

A total of 18 picked rock samples was examined for thermal maturity using vitrinite reflectance. The samples, from the depth interval 1260 - 5235 m, covered the stratigraphic range of Hordaland Gp. (Tertiary) down to Statfjord 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 first 4 samples analysed from the Hordaland Gp. (1260 - 2019 m) are claystones, occasionally silty claystones. The overall phytoclast content is generally low. The proportion of inertinite relative to vitrinite increases from about 40% in the top to 90% in the bottom. The quality of vitrinite is mostly moderate and bitumen staining is light to moderate.

The 2 samples from the Rogaland Gp. (2301 and 2580 m) are claystones with low to very low phytoclast contents. Inertinite is clearly the dominant maceral (80 to 100%) and low quality vitrinite is in traces (ca 20% in the 2301 m sample). Bitumen staining is low to very low.

The two samples from the Shetland Gp. (2841 and 3081 m) are claystones with moderate amounts of phytoclasts, almost all of which are inertinitic, vitrinite being almost absent. Bitumen staining is also very low. The sample from the Cromer Knoll Gp. (3261 m) is very similar to the overlying two samples, except that this sample has moderate staining.

The sample from the Upper Jurassic Draupne Fm. (3273 m) is a pyritic claystone with an unusually low phytoclast content. Almost all the phytoclasts are in the form of inertinite and low quality vitrinite is in traces. However, the bitumen staining is strong and the reflectance values are believed to have been depressed by staining. The sample from the Heather Fm. (3423 m) is a claystone and is very similar to the overlying Draupne Fm. sample, except that bitumen staining is slightly lower in the

Heather Fm. sample.

Of the two samples from the Sleipner Fm., one is a coal/coaly claystone (?) (3741 m) which predominantly contains moderate to good quality vitrinite and in which inertinite is only about 30% of the total content. The other sample (3945 m) is a claystone with abundant phytoclasts, nearly 30% of which are of low to moderate quality vitrinite. The particle size is also moderate, in addition to strong bitumen staining.

One siltstone sample was analysed from the Cook Fm. (4251 m). The overall phytoclast content is low, almost all of which is inertinite. Measurable vitrinite is in traces and bitumen staining is moderate. No determination was possible in the sample from the Amundsen Fm. (4503 m) due to the extremely low phytoclast content. Staining is moderate to strong.

Three samples from the Staffjord Fm. were examined for thermal maturity (4899.4 - 5235 m) and these were the deepest samples to be studied in the well. The first two samples are silty claystones containing low to moderate amounts of phytoclasts which are almost exclusively inertinitic. Poor quality vitrinite occurs only in traces and bitumen staining remains moderate to strong. The deepest sample (5235 m) however is a claystone with a low phytoclast content and very low vitrinite content. There is an apparent decrease in the extent of bitumen staining.

3.4.2 Maturity

Based on the vitrinite reflectance results obtained and other microscopic observations made during 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 2670 m (R_o less than 0.5%). The top of the oil window ($R_o = 0.6\%$) is expected to occur at around 3080 m, while the peak oil generation stage for type II kerogen is estimated to be at a depth of 3420 m. The base of the oil window ($R_o = 1.0\%$) is estimated to occur at a depth of around 4570 m, below which the well is thought to be in the condensate window (the bottom 200 - 300 m of the well until the total depth could well be in the gas window ?).

3.5 Visual Kerogen Microscopy

A total of 19 samples was optically examined, these covering the interval 2019 - 5235m of Tertiary to L. Jurassic age. The detailed kerogen compositions are presented in Table 8 while the gross compositions are plotted in a triangular diagram, Figure 11. Thermal maturity data (spore colour index, SCI) is included in table 7.

3.5.1 Kerogen Type

The single Hordaland Gp. shale sample consists practically only of liptinite (95%), though this is mainly reworked material and of poor quality (low fluorescence) amorphous matter probably including degraded/reworked material. Spore/pollen and algae are subordinate while dinoflagellates are common. Largely reworked inertinite and vitrinite occur in only trace to minor amounts. This assemblage indicates a marine (?distal) environment with mixed marine and terrestrial input, and probably has only a poor/fair potential for mainly gas.

The Rogaland Gp. shale is again mainly liptinitic (90%), though here the well preserved spore/pollen is so abundant that the assemblage could be termed sporinite. Traces of algae and dinoflagellates indicate a small degree of marine input. Reworked inertinite and vitrinite occur in only minor amounts. This terrestrially dominated kerogen composition indicates a fair - good potential for mixed oil and gas.

The Shetland Gp. shale yielded insufficient organic matter for reliable kerogen typing but appears to contain mainly detrital material with a poor (if any) hydrocarbon potential.

The single Draupne Fm. shale is strongly dominated by liptinite (90%) which consists mainly of good quality, olive to yellow brown fluorescent amorphinite and fine algal cysts, with common dinoflagellates. Spores are subordinate. Bituminite is also apparent. Mixed, partly woody vitrinite and inertinite occur in minor amounts. This pyrite-rich marine kerogen assemblage is fairly typical for Draupne Fm shale, indicating a very good potential for oil and gas.

The three Heather Fm. shales examined have quite variable kerogen compositions. The uppermost sample (3315m) contains only minor liptinite (5%), mainly of mixed spores and algae with subordinate amorphinite and dinoflagellates. This sample is dominated by mixed semifusinitic inertinitic and telinite/vitrodetrinitic vitrinite (40%, 55% respectively). This indicates a fair/moderate potential for clearly gas dominated hydrocarbons. The two underlying samples (3357m, 3429m) are quite different, having much more prolific kerogen overwhelmingly dominated by liptinite (85-100%). This is mainly of good quality, yellow brown fluorescent amorphinite with abundant algae and subordinate (though still abundant) spores - mainly as high hydrogen content air-sacks. Dinoflagellates and bituminite are also evident. Largely reworked inertinite and vitrinite occur in trace to accessory amounts. These samples indicate the mid-lower part of the Heather Fm. to have very good potential for oil and gas, though probably for heavier oils than the Draupne Fm. due to increased terrestrial input.

Two shales and two coal samples were examined from the Vestland Gp. The Hugin Fm. shale is strongly dominated by mainly amorphous/fine grained liptinite having dark brown fluorescence (?including degraded woody material). Spores (?oxidized) are subordinate, while mainly reworked inertinite and vitrinite occur in minor to accessory amounts. This assemblage suggests a fair - good potential for (?mainly gaseous) hydrocarbons. The hydrogen index is perhaps slightly high considering the observed kerogen, possibly due to asphaltene staining. The underlying Sleipner Fm. shale has decreased liptinite (60%), but fine algal cysts and dinoflagellates occur here (?including *Botryococcus*). Woody (telinitic) vitrinitic and semifusinitic inertinite are notably increased (20%). This (?nearshore marine) assemblage suggests a fair potential for mainly gaseous hydrocarbons. Bluish white fluorescent ?free hydrocarbons were recorded in this sample. The two Sleipner Fm. coals have very similar kerogen compositions to each other, being composed almost entirely of woody vitrinite (95%), with minor (5%) semifusinite. Only traces of liptinite are present, as spores. These coals have very good potential for gas.

The Dunlin Gp., Drake Fm. shale appears to be composed of mixed liptinite (mainly reworked), inertinite and dominant (55%), again mainly reworked vitrinite. This

assemblage indicates a poor petroleum potential.

The Dunlin Gp., Cook, Burton and Amundsen Fms.' shales likewise appear to have mainly detrital kerogen in very low amounts, i.e. little or no source potential.

Three shales were examined from the Statfjord Fm., these having variable compositions and textures. Liptinite occurs in minor (5%) to dominant (55%) amounts as mixed amorphous matter (?including degraded material), spores and cuticle. Mainly woody vitrinite and semifusinitic inertinite (partly due to high maturity) occur in moderate to dominant amounts (25-65%, 20-45% respectively), locally giving the assemblage a distinct "coaly" texture. These kerogen compositions suggest the Statfjord Fm to be dominated by terrestrial input and to have had a fair - poor potential for gas (taking into account the very variable TOC contents).

3.5.2 Maturity

The SCI data for the individual samples suggests the top of the oil window (SCI 6.0 for type II kerogen) to occur between 3357 m and 3429 m in the Heather Fm., with the base (SCI 10.0 for type II kerogen) to occur between 4149 m and 4263 m. The linear regression line for all data places the oil window top at approximately 3375 m and the base at about 4330 m.

3.6 Isotope Analysis of C₁₅₊ Fractions

Five samples were analysed, the same as analysed by GC-MS (section 3.7). Saturate - aromatic isotopic ratios for the five samples are shown in Figure 12. The Galimov plots are shown in Figure 13.

The three marine shale samples of the Draupne, Heather and Drake Fms. have significantly different isotope compositions (Figure 13). The Draupne Fm. is isotopically light (~ -30), which is typical of this marine anoxic formation in the Viking Graben. Both the Heather and Drake Fms. are heavier isotopically (less negative) probably due to their having a greater land-plant input. The Heather Fm. has isotopic data close to the coal suggesting that it has had the most land-plant input of the three shales (Figure 12). The isotopic composition of the oil is closest to that of the Drake Fm. shale, it being unlikely that this has been sourced by the Draupne or Heather Fm. shales.

3.7 Gas Chromatography - Mass Spectrometry

Five samples were analysed, these being one shale from the Draupne Fm., one shale from the Heather Fm., an oil-stained sandstone from the Hugin Fm., a coal from the Sleipner Fm. and a shale from the Drake Fm.

3.7.1 Potential Source Rocks

Saturated Hydrocarbons

The four source rock samples show wide variations in 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 terpanes. The Draupne Fm., Heather Fm. and Drake Fm. shales have high contents of steranes relative to hopanes (Figures 14a,b,c) with ratios of the dominant sterane (C_{27} diasterane peak A) to dominant hopane (C_{30} $\alpha\beta$ peak E) of 0.5 to greater than 1. In contrast the coal sample, which has small amounts of C_{29} diasteranes and only traces of C_{27} diasteranes, has ratio of less than 0.1. The abundant steranes in the shales is typical of marine source rocks. The different ratios of steranes to terpanes in the marine shales are due partly to maturity. Thus the lower sterane/hopane ratio for the Heather Fm. shale (0.3 - 0.5) than the Draupne Fm. (~ 2) is probably due to a less anoxic environment and/or higher land-plant input during deposition of the Heather Fm. shale compared to that for the Draupne Fm. shale. The Drake Fm. shale is more mature than these and has probably generated and expelled most biomarkers. Steranes tend to be more abundant in more mature samples where the hopanes have been mostly expelled.

The terpane distribution of the four potential source rock samples seen in the M/Z 191 fragmentograms show distinct differences in distribution related to input and maturity. The Draupne Fm., Heather Fm. and Sleipner Fm. sample terpanes are dominated by C_{27} and C_{29} - C_{35} $\alpha\beta$ hopanes. The main differences are that the Draupne Fm. has more C_{20} - C_{25} tricyclic terpanes, a very prominent bisnorhopane peak Z and more prominent C_{33} - C_{35} $\alpha\beta$ hopanes with $C_{35} > C_{34}$ (Figure 14e). This is typical of highly marine anoxic deposits. The other two show a more pronounced contribution for C_{27}

and C_{29} - C_{31} $\alpha\beta$ hopanes and the C_{24} tetracyclic terpane (peak S) typical of land-plant dominated kerogen (e.g. Figure 14f). Bisnorhopane, tricyclic terpanes and C_{33} - C_{35} $\alpha\beta$ hopanes are very minor components in these.

The Drake Fm. terpane distribution in the M/Z 191 fragmentogram (Figure 14g) is quite different to that of the other marine shales. Tricyclic terpanes from C_{20} - C_{25} dominate, and the main C_{27+} hopanes include the $18\alpha(H)$ trisnorneohopane (peak A or T_s), 25,28,30 trisnorhopane/moretane, C_{30} hopane peak X and the C_{30} $\alpha\beta$ hopane (peak E). This distribution is typical of late mature source rocks in which most $\alpha\beta$ hopanes have been thermally degraded and/or expelled. The high content of 25,28,30 trisnorhopane/moretane is typical of highly mature shales which had abundant 28,30 bisnorhopane at lower maturities. In fact, the 28,30 bisnorhopane (peak Z) is still prominent in this sample, suggesting it was a very prominent component at lower maturities.

The hopane maturity parameter % C_{32} $\alpha\beta$ 22S (peaks $J_1/J_1+J_2 \times 100$) have reached about maximum values of 60 % in the Draupne Fm., suggesting that maturity is roughly at the top of oil window at 3279 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) and $17\alpha(H)$ 22,29,30 trisnorhopane/ $18\alpha(H)$ 22,29,30 trisnorneohopane (T_m/T_s ratio of Seifert and Moldowan 1978, peaks B/A) of the Draupne Fm. are fairly high (> 0.1 and > 1 respectively) and indicate that the shale has not yet reached the main phase of oil generation. In the Drake Fm. the T_m/T_s is very low and the sequence is probably past the main oil generation phase. The high values of these T_m/T_s for the Heather Fm. shale and the Sleipner Fm. coal are due to a completely different input/environment in which land-plant remains dominate in a less anoxic environment.

The high value of the % C_{32} $\alpha\beta$ 22S and $\beta\alpha/\alpha\beta$ hopane ratio of the Drake shale are probably due to high maturity, thermal degradation and expulsion effects on the $\alpha\beta$ hopanes.

The sterane distribution of the four source rock samples is best seen from the M/Z 217

fragmentograms (Figures 14h-k). In all four samples the diasteranes are the major steranes, suggesting that they have all reached at least moderate maturity, i.e. > 0.5 % Ro.

The marine shales from the Draupne Fm., Heather Fm. and Drake Fm. show quite different sterane distributions. The diasteranes of the Draupne Fm. shale are predominantly C₂₇ compounds, whereas in the other two the C₂₉ compounds are more abundant than the C₂₇. This is probably due to larger land-plant input to the last two, compared with the Draupne Fm. shale. The coal sample (Figure 14k) is totally dominated by the C₂₉ compounds including regular and diasteranes. Sterane maturity parameters such as % C₂₉ ααα 20S (peaks q/q+t×100) and C₂₉ αββ/ααα+αββ (peaks r+s/q+r+s+t) are lower for the land-plant rich samples than for the marine shales of the Draupne Fm. and Drake Fm. shales. This is commonly 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 the first parameters are close to maximum in the Draupne Fm. (~ 50 % S max - value 46 %) and there is an increase in the second parameter from 0.49 in the Draupne Fm. to 0.62 in the Drake Fm. This indicates the analysed section is within the main oil window interval, i.e. 0.6 % - 1 % Ro equivalent (not necessarily reaching 1 % Ro in the Drake Fm.).

Aromatic Hydrocarbons

The main difference in the four source rock samples considered here is between the land-plant rich Heather Fm. shale and Sleipner Fm. coal and the more marine dominated input of the Drake Fm. and Draupne Fm. shales. The main differences are the more complex narrower range and lighter C₂- and C₄-alkyl benzenes (M/Z 106, 134), more anthracene and methyl anthracene, and large amounts of C₂₉ over C₂₇ monoaromatic steranes in the land-plant rich samples. Distributions are also affected by maturity, most notably that of the aromatic steranes. The typical distribution of triaromatic steranes (M/Z 231 fragmentogram) seen in marine anoxic siliciclastic deposits is only found in the Draupne Fm. sample and is absent from the Drake Fm.

due to high maturity (cf Figures 14l and m). In the coaly samples triaromatics are virtually absent due to different input. Variation in the monoaromatic steranes (M/Z 253, cf Figures 14n and o) follows a similar pattern.

3.7.2 Migrated Hydrocarbons

One sandstone sample from the Hugin Fm. which is stained with migrated hydrocarbons was analysed.

Saturated Hydrocarbons

The M/Z 163 fragmentogram (Figure 14p) of this sample shows a fairly typical distribution of a marine-sourced oil with roughly equal amounts of steranes to hopanes. The M/Z 191 fragmentogram (Figure 14q) shows a highly mature hopane distribution typical of a marine source rock - i.e. low T_m/T_s (B/A, peak A is high), abundant C_{29} neohopane (?) (peak just after the C_{29} $\alpha\beta$ hopane - peak C) and C_{30} triterpane (peak X) with abundant C_{33} - C_{35} $\alpha\beta$ hopanes. Minor, but significant peaks present are those due to C_{27} - C_{28} demethylated hopanes - 25,28,30 trisnorhopane and 28,30 bisnorhopane (peak Z). These are found in both the Draupne Fm. and Drake Fm. marine shales in this well.

The sterane distribution seen in the M/Z 217 fragmentogram (Figure 14r) shows C_{27} and C_{29} diasteranes about equal ($C_{27} \geq C_{29}$). This is unlikely to be sourced by the type of Draupne Fm. in this well which is much richer in C_{27} than C_{29} . Sterane maturity parameters listed previously are close to their maxima, suggesting a mature source rock.

Aromatic Hydrocarbons

The distribution of aromatics favours a mature marine rather than non-marine source rock. The alkyl benzenes (particularly C_4 -benzene distribution in the M/Z 134 fragmentogram), the alkyl dibenzothiopenes (M/Z 198) and monoaromatic sterane distribution (M/Z 253) suggest that the Drake Fm. shale is a more likely source for these hydrocarbons than the Draupne Fm. However, the Draupne Fm. shale has not

reached the main phase of oil generation and its aromatic distribution would be altered at higher maturity.

3.7.3 GC-MS Summary

The Draupne Fm. shale is the most oil-prone shale (see screening results), occurring in this well, having a biomarker composition typical of a moderate - early mature marine anoxic deposit. The Heather Fm. shale has a higher land-plant input than the Draupne Fm. shale and was probably deposited in a less anoxic marine environment. The Drake Fm. shale appears to be intermediate to the first two in input, but it is considerably more mature, probably late mature (~0.9 % to equivalent). The Sleipner Fm. coal has typical sterane (dominant C₂₉) and hopane profile of a totally land-plant dominated sample.

The migrated hydrocarbons in the Hugin Fm. sandstone are from a highly mature (estimate equivalent to 0.8 - 0.9 % Ro) marine source rock with an appreciable land-plant input. Saturate biomarker and some aromatic compound distributions suggest the Drake Fm. could be the source of the hydrocarbons.

Chapter 4

Conclusions

4.1 Source Rock Potential

The Draupne and Heather Fms., Viking Gp., are identified as potential source rocks. The oil-prone Draupne Fm. has a rich petroleum potential, whereas the oil- to gas-prone Heather Fm. has more variable petroleum potential, ranging from poor to rich. However, the main part has a good petroleum potential. Potential source rocks within the Vestland Gp. are confined to two thin coal intervals in the Sleipner Fm., which have very rich petroleum potential. Pyrolysis analyses indicate the coals to be oil- to gas-prone source rocks. The light oil-prone Dunlin Gp. shales have a poor to fair petroleum potential. The mainly marine Drake Fm. stands out as the source rock with the most promising petroleum potential (fair) in a narrow interval. The Statfjord Fm. shales have poor petroleum potentials, owing to late maturity. The remaining petroleum potential is limited to condensate or gas, depending on the depth (and maturity).

4.2 Maturity

The thermal maturity of the well has been established by application of Tmax-values (Rock-Eval), vitrinite reflectance data, spore colour index (SCI-data), GC data (saturated and aromatic hydrocarbon maturity parameters) and GC-MS data, giving a reliable maturity profile. Based on the vitrinite reflectance data, the well is considered to be immature ($R_o < 0.5\%$) until approx. 2670 m. The top of the oil window ($R_o = 0.6\%$) for type II kerogen is expected reached at around 3080 m. The base of the oil window ($R_o = 1.0\%$ for type II kerogen) is estimated to be reached at approx. 4570

m. Hereafter the well is believed to have reached condensate maturity (R_o 1.0 - 1.3%). It must be noted that discrepancies exist between the different maturity parameters, giving variations in the depth interval of oil-generation of a few hundreds of meters.

4.3 Generation

The earlier mentioned source rocks in the well are at different stages of maturity. The oil- to gas-prone Draupne and Heather Fms. have not yet reached the stage of maturity where significant yields of hydrocarbons have been generated or expelled. The Drake Fm. (Dunlin Gp.) is the only potential source rock which has reached the oil window (R_o : 0.8-0.9%) and probably passed peak oil generation. Thus it is likely that the Drake Fm. has generated and expelled hydrocarbons in significant amounts. The condensate mature Staffjord Fm. has generated most of the hydrocarbons present, leaving a "residual" potential for generation of condensate and gas.

4.4 Migration

Migrated hydrocarbons in the upper part of Hugin Fm. (Vestland Gp.) sandstone, judged by oil-staining and Rock-Eval data, suggests the presence of an oil show in this well. The follow-up analytical, program including GC, GC-MS and isotope analyses of the solvent extracts, shows that the oil is mature (GC-MS R_o -equivalent: 0.8 - 0.9%), probably originating from a marine source, this however having a distinctly high terrestrial input. Both GC-MS data and isotope data suggest that the Drake Fm. could very well be such a source rock. Maturity-data, organic facies and saturate - aromatic isotope data support this oil - source rock relationship. Other potential source rocks such as the Draupne and Heather Fms. as they occur in this well are not considered to have generated the oil occurring in the Hugin sandstone.

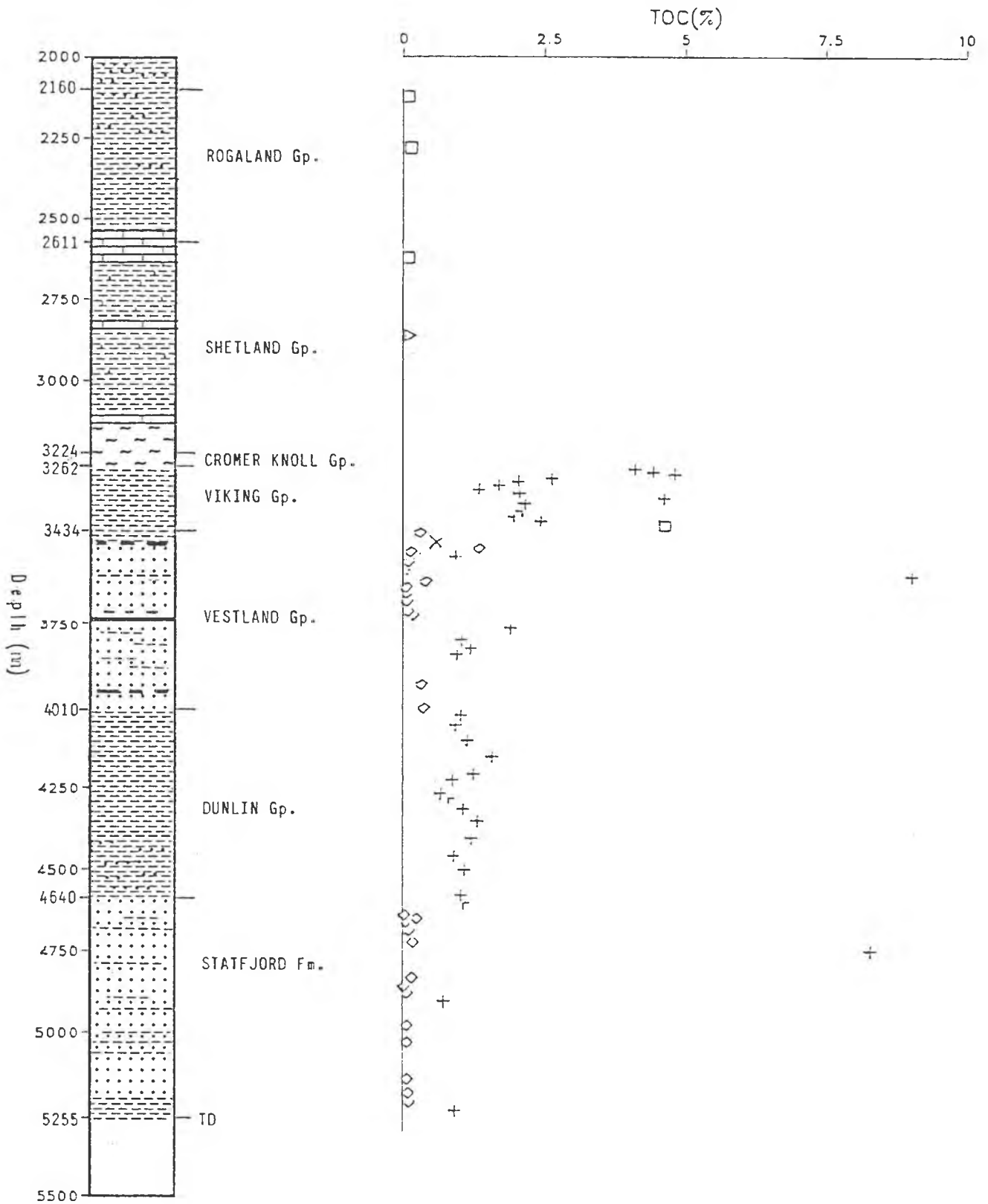
LEGEND TO FIGURES 1, 2 AND 3

+	Shales
X	Siltstones
○	Coals
▷	Carbonates
◇	Sandstones
□	Bulk

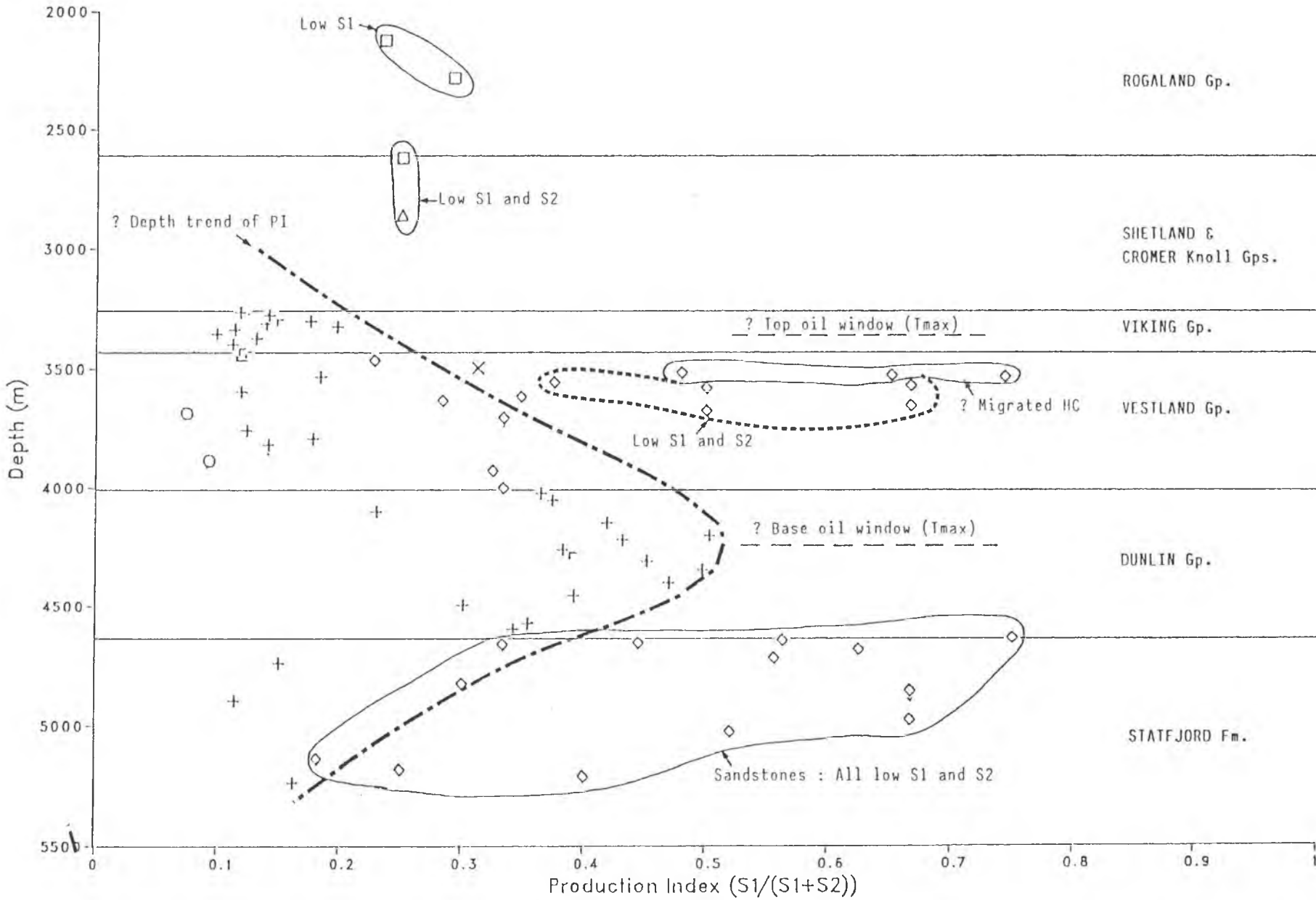
Figure: 1

Client: VARIOUS

TOC Data for Well NOCS 30/11-4



Production Index Data for Well NOCS 30/11-4



Geological NOR a.s. - Statens Geologiske Service

Tmax Data for Well NOCS 30/11-4

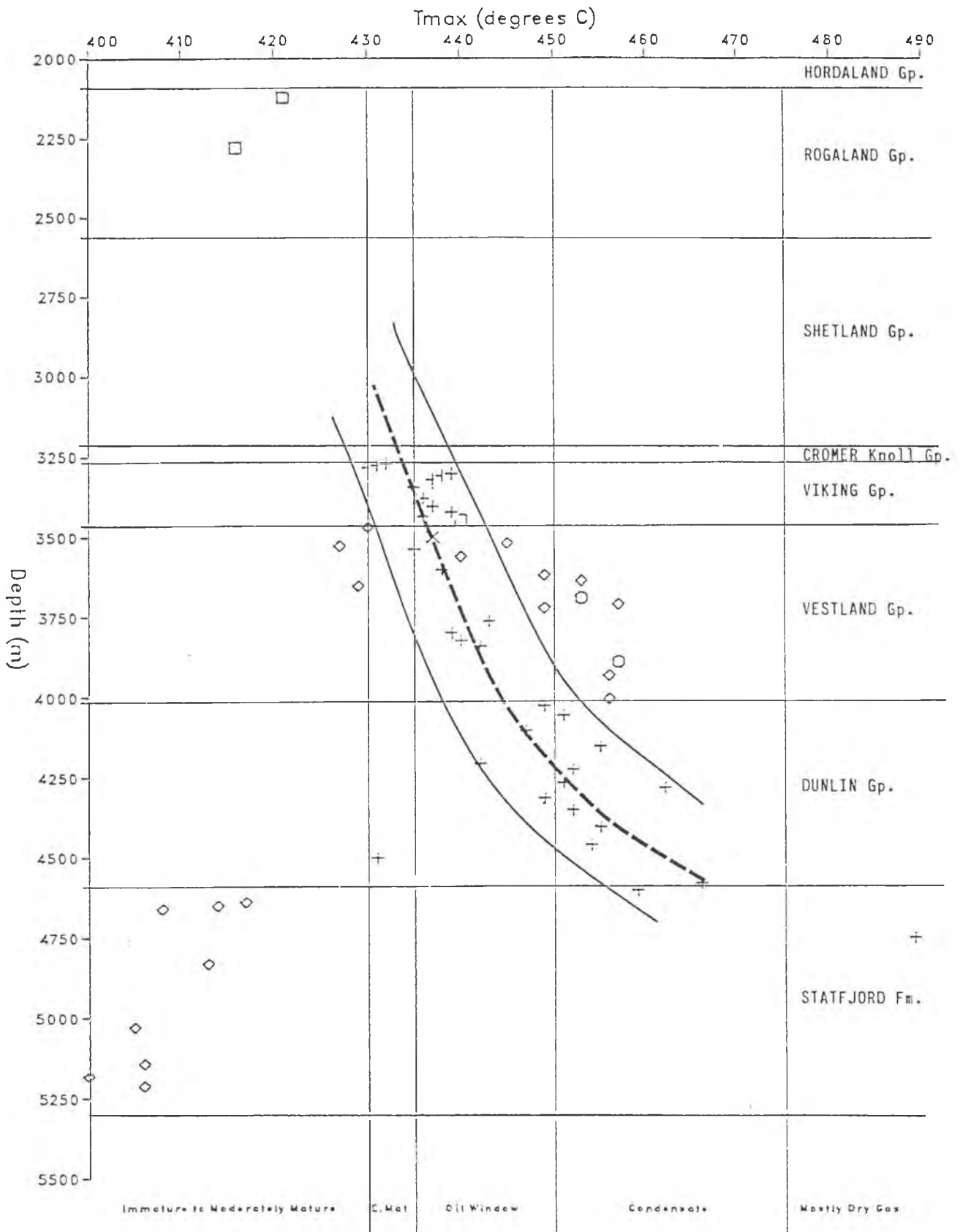
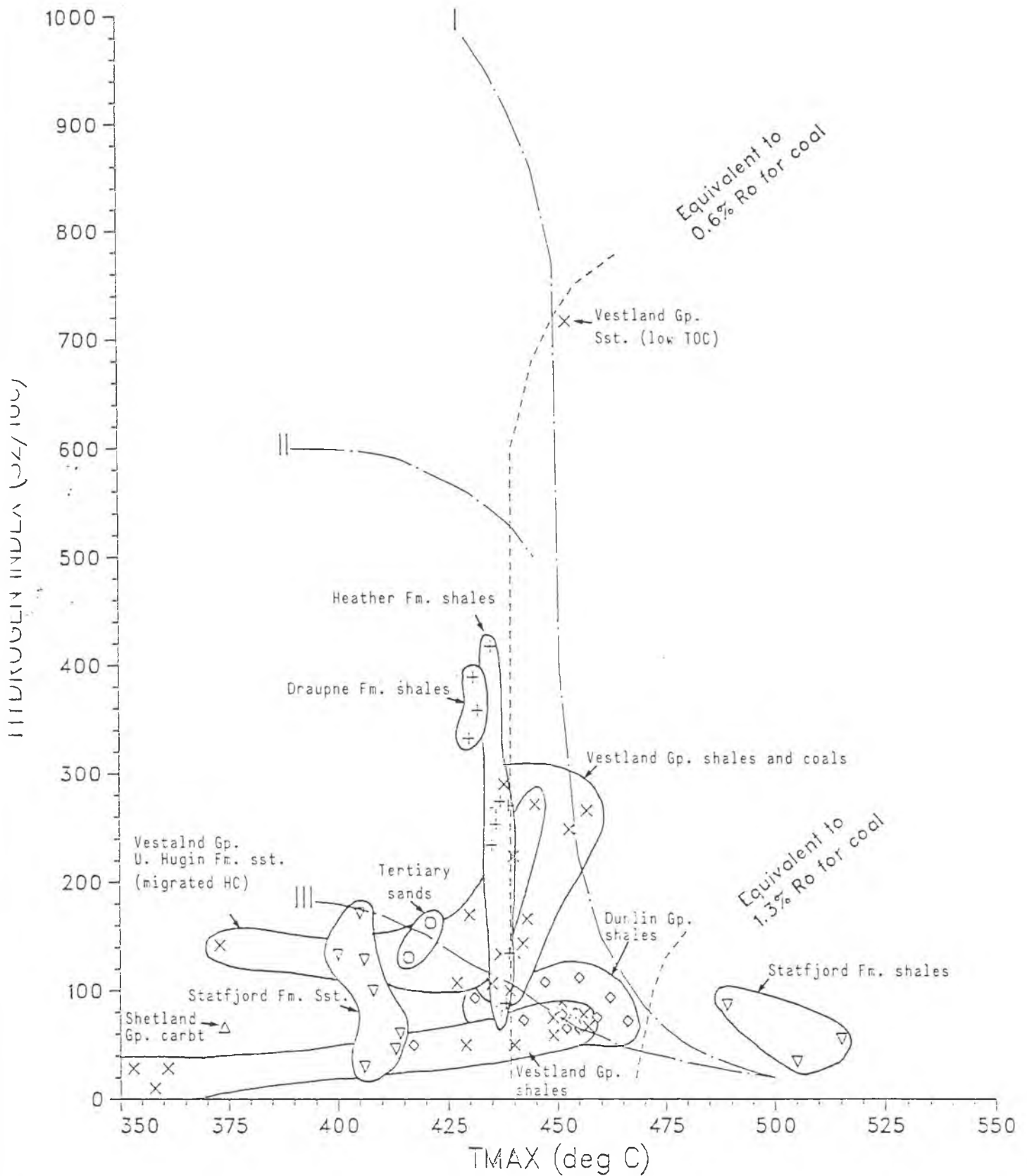


Figure 4 : Hydrogen Index v.s. Tmax values
Well NOCS 30/11-4



Analysis Name : [522006] 22 PF1204250.1.1.

Multichrom

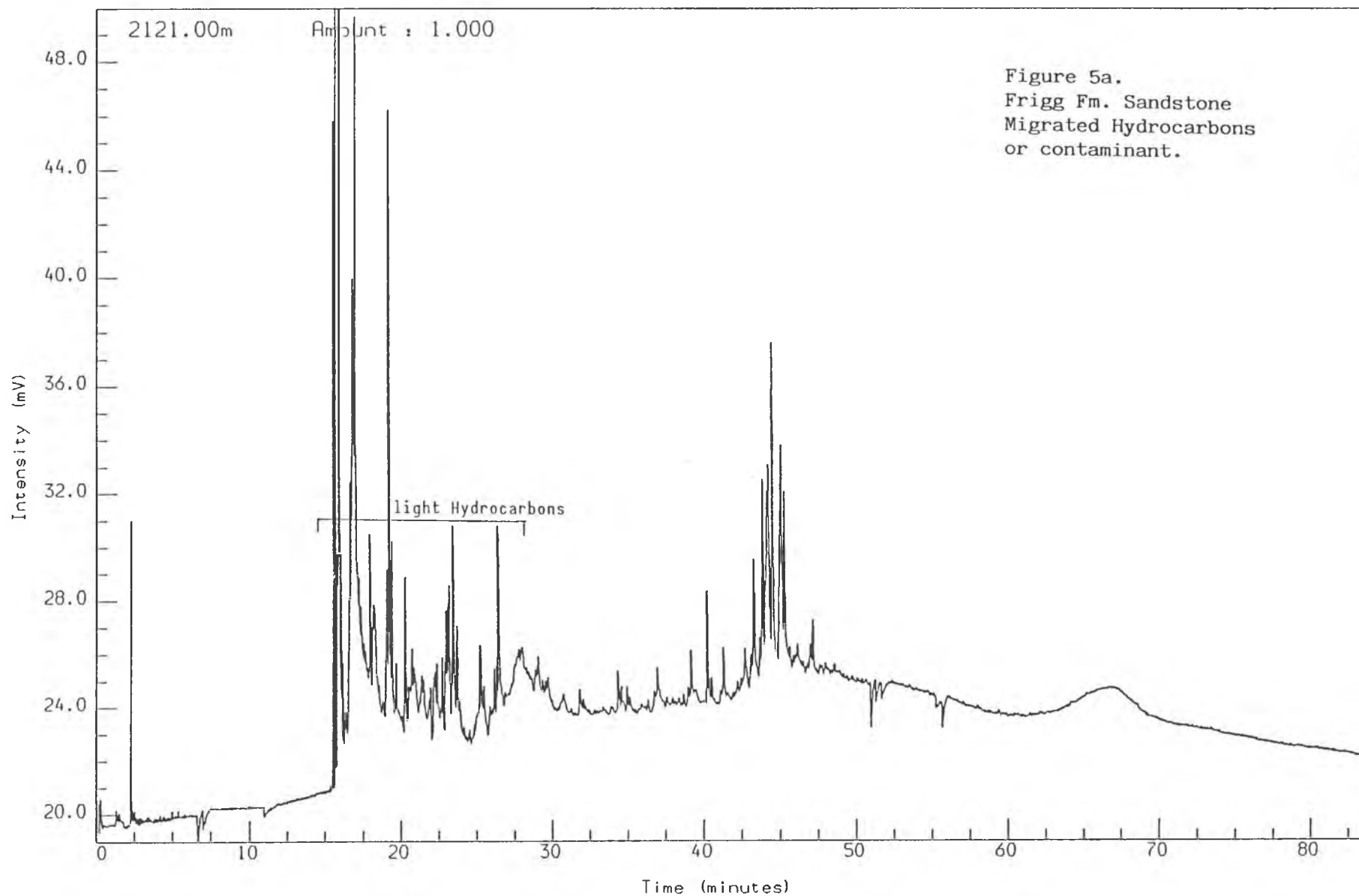
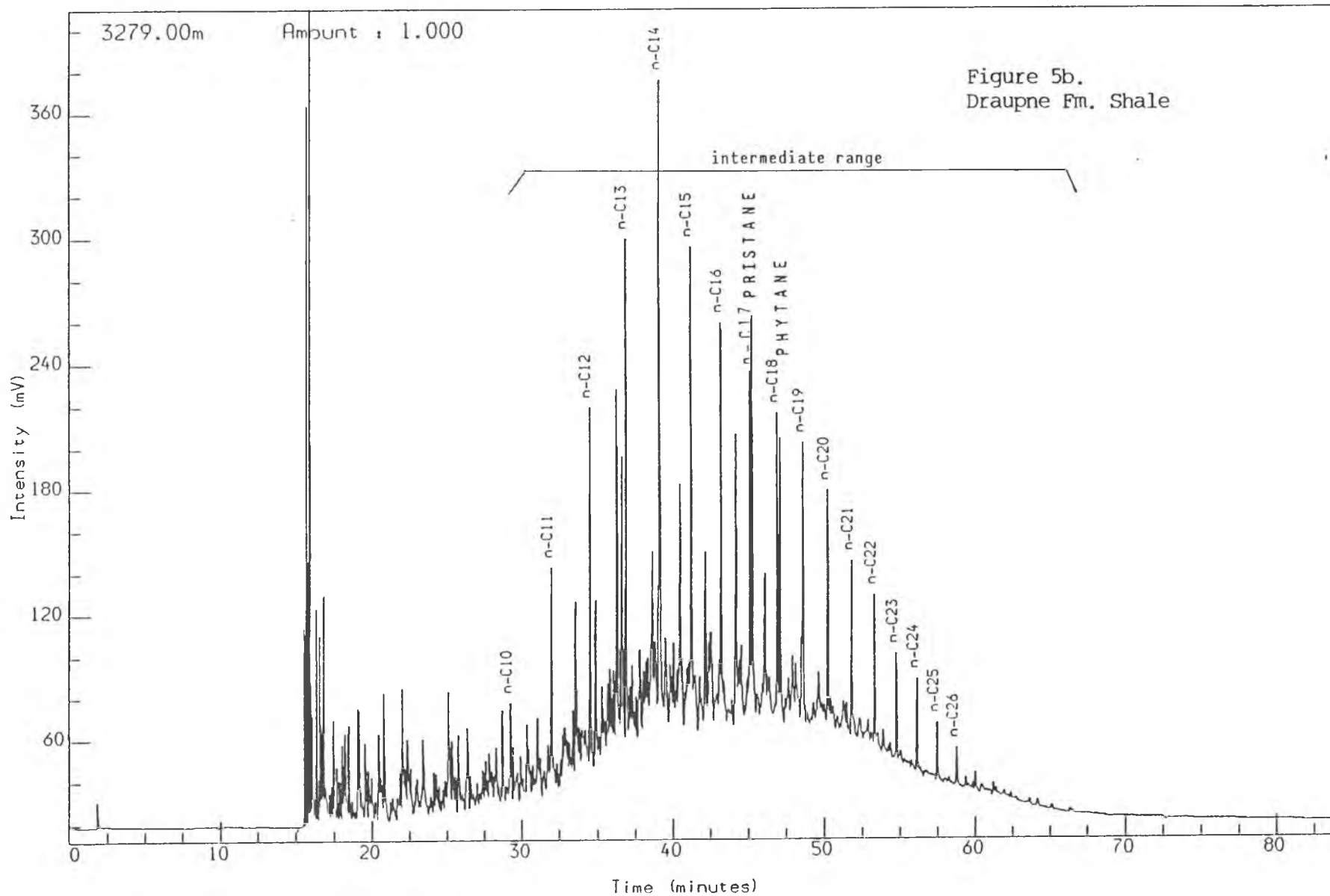


Figure 5a.
Frigg Fm. Sandstone
Migrated Hydrocarbons
or contaminant.

WELL NOCS 30/11-4 2121.00m com
THERMAL EXTRACTION GC (S1)
bulk

Reported on 23-OCT-1991 at 15:52

GEOLAB  NOR

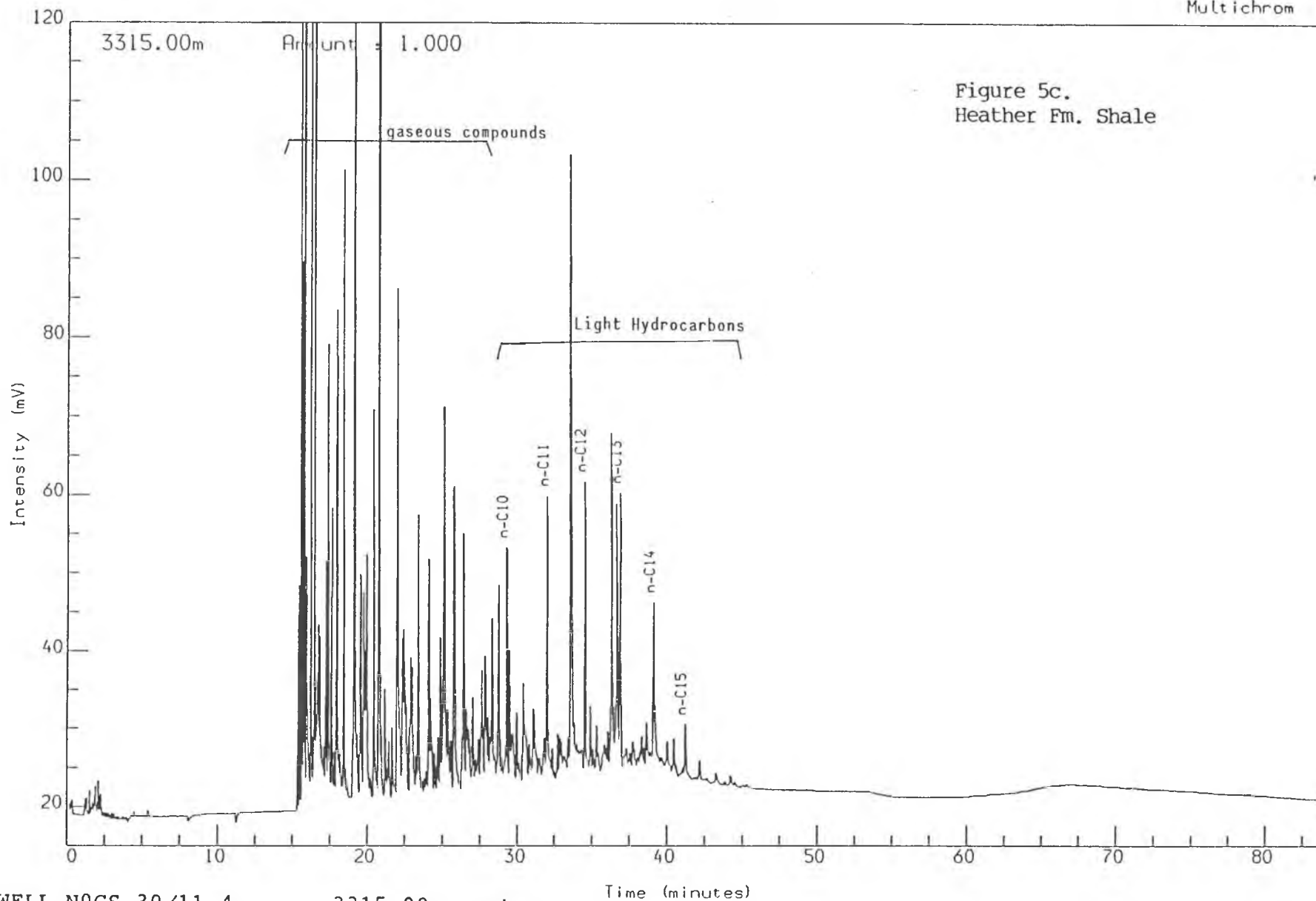


WELL NOCS 30/11-4 3279.00m cut
THERMAL EXTRACTION GC (S1)
Sh/Clst: drk gy to brn blk

Reported on 29-OCT-1991 at 15:41

Analysis Name : [522006] 22 PF12A,1,1.

Multichrom



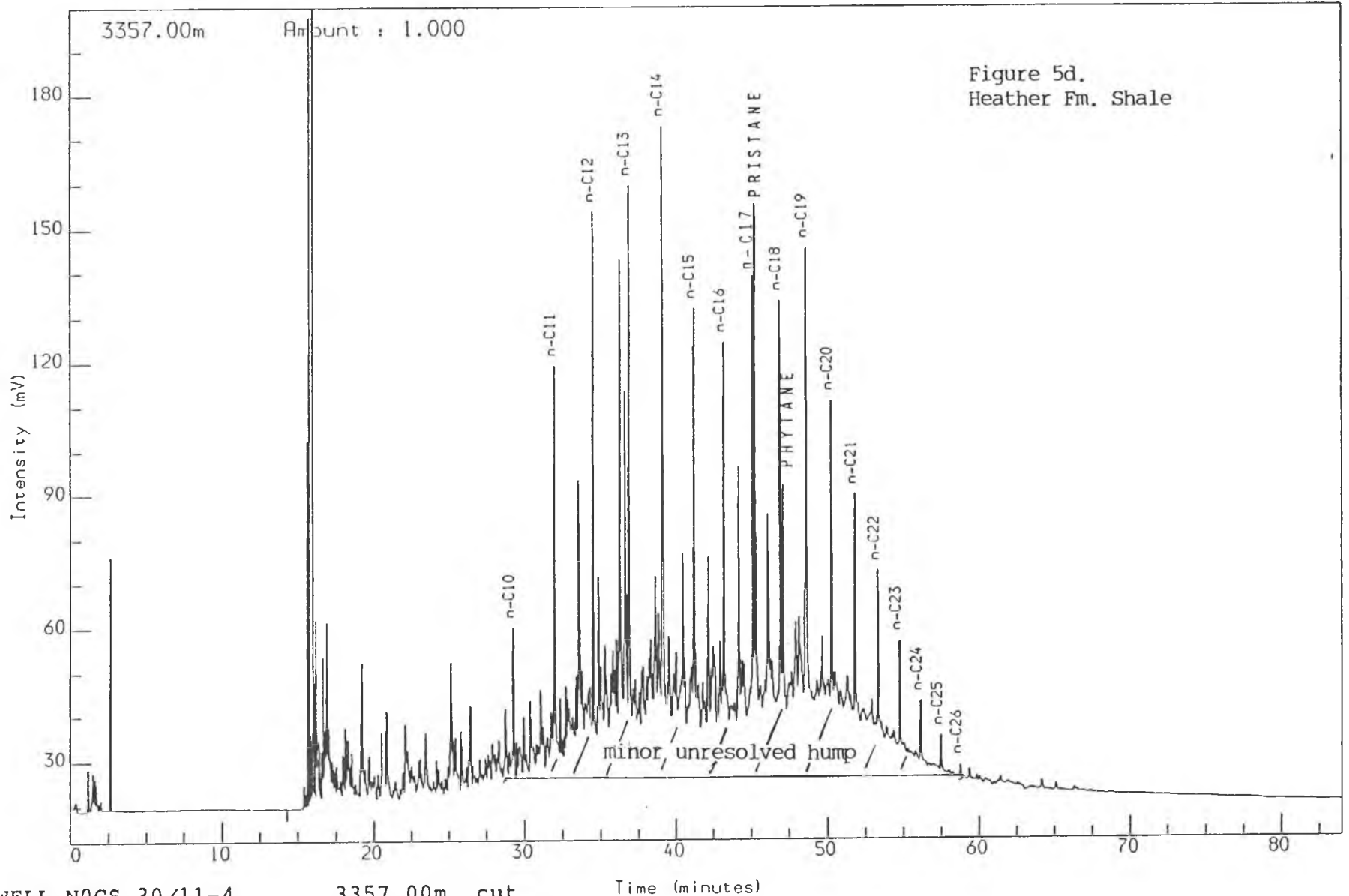
WELL NOCS 30/11-4 3315.00m cut
THERMAL EXTRACTION GC (S1)
Sh/C1st: m gy to drk gy

Reported on 24-OCT-1991 at 14:41

GEOLAB  NOR

Analysis Name : [522006] 22 PF12C,1,1.

Multichrom



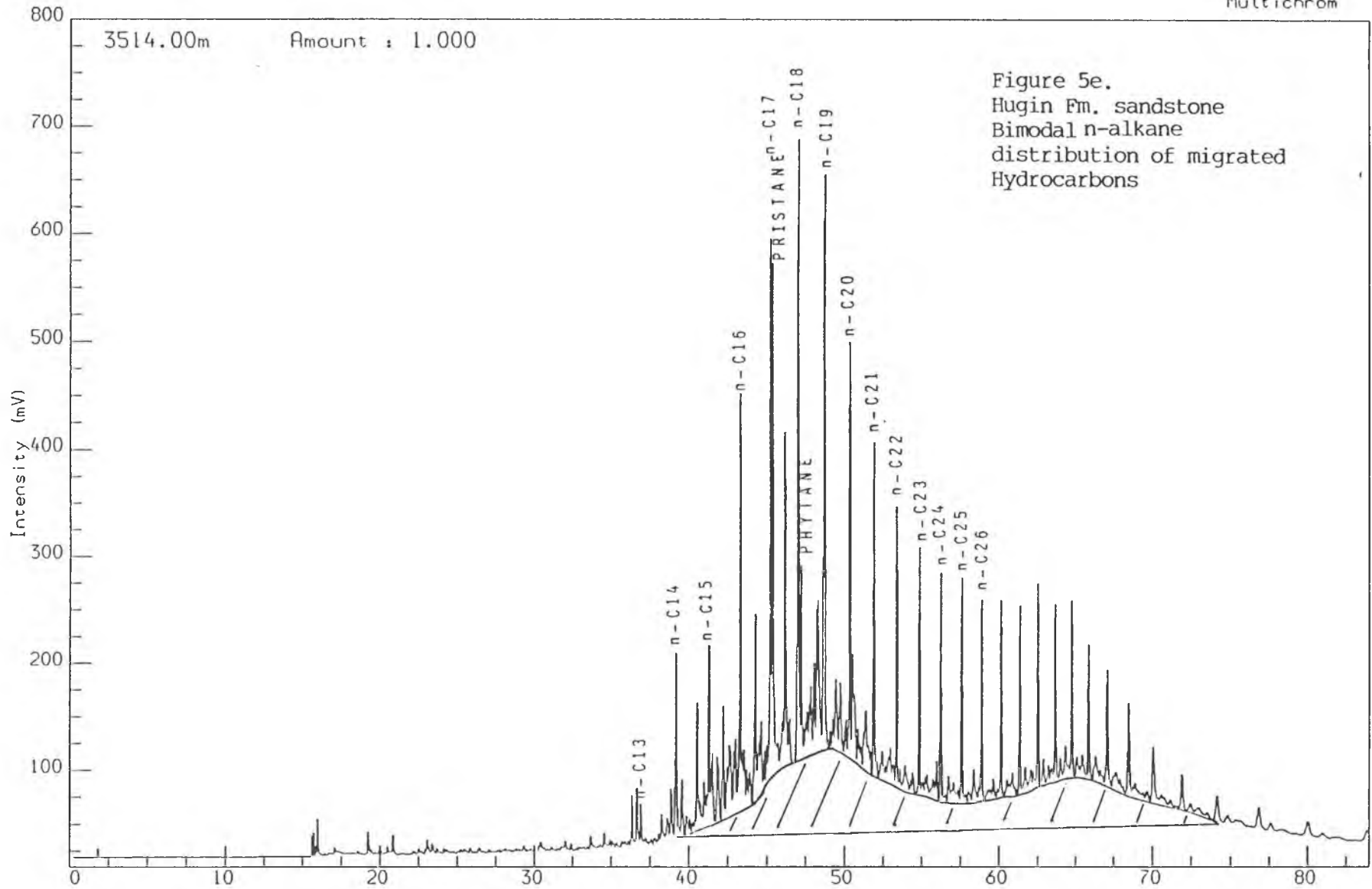
WELL NOCS 30/11-4 3357.00m cut
THERMAL EXTRACTION GC (S1)
Sh/Clst: drk gy to brn blk

Reported on 30-OCT-1991 at 12:52

GEOLAB NOR

Analysis Name : [522006] 22 PF12B,4,1.

Multichrom



WELL NOCS 30/11-4 3514.00m ccp
THERMAL EXTRACTION GC (S1)
S/Sst: brn gy

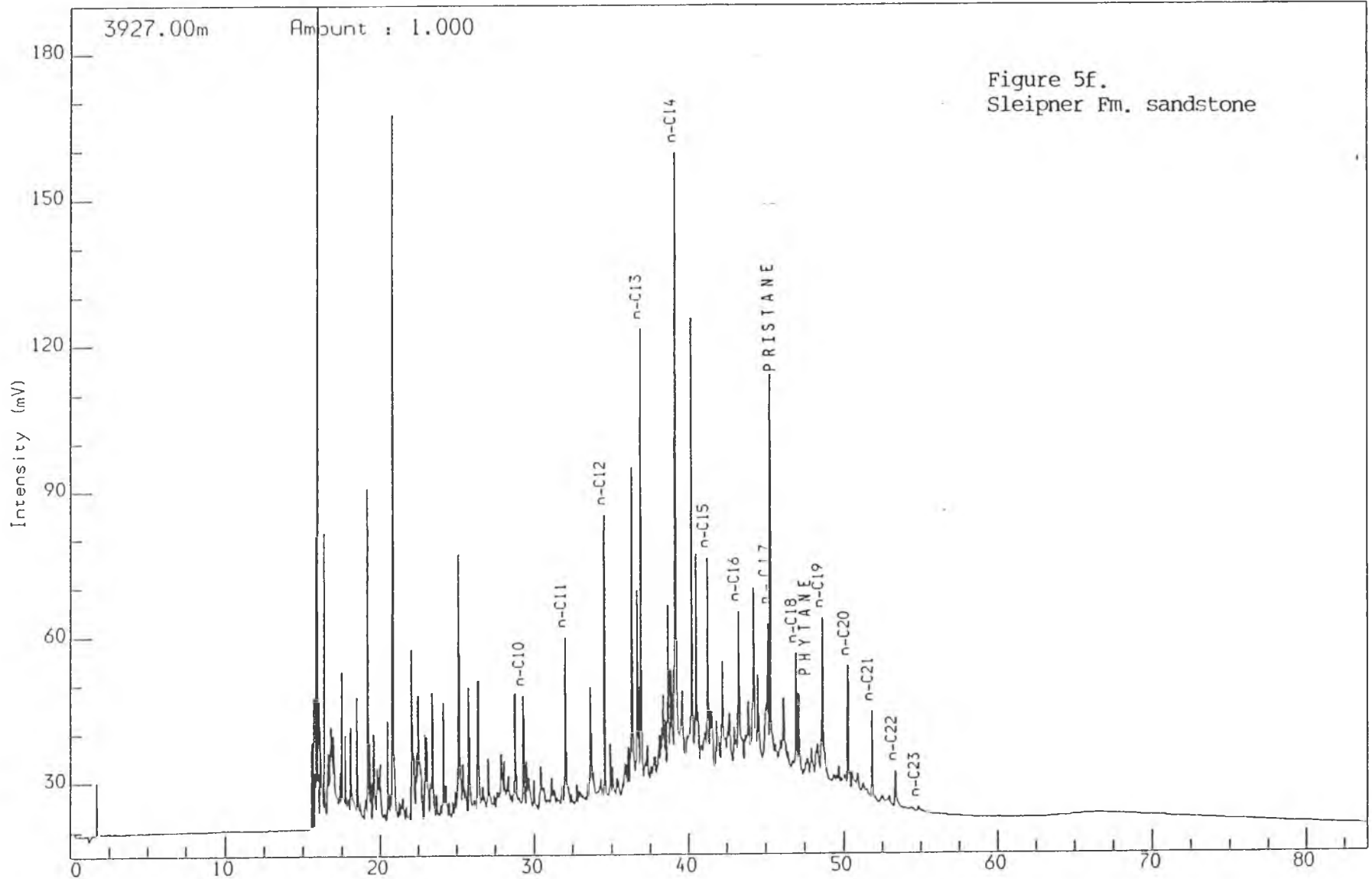
Time (minutes)

Reported on 25-OCT-1991 at 10:01

GEOLAB NOR

Analysis Name : [522006] 22 PF12A,5,1.

Multichrom



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THERMAL EXTRACTION GC (S1)
S/Sst: w to lt gy to lt or

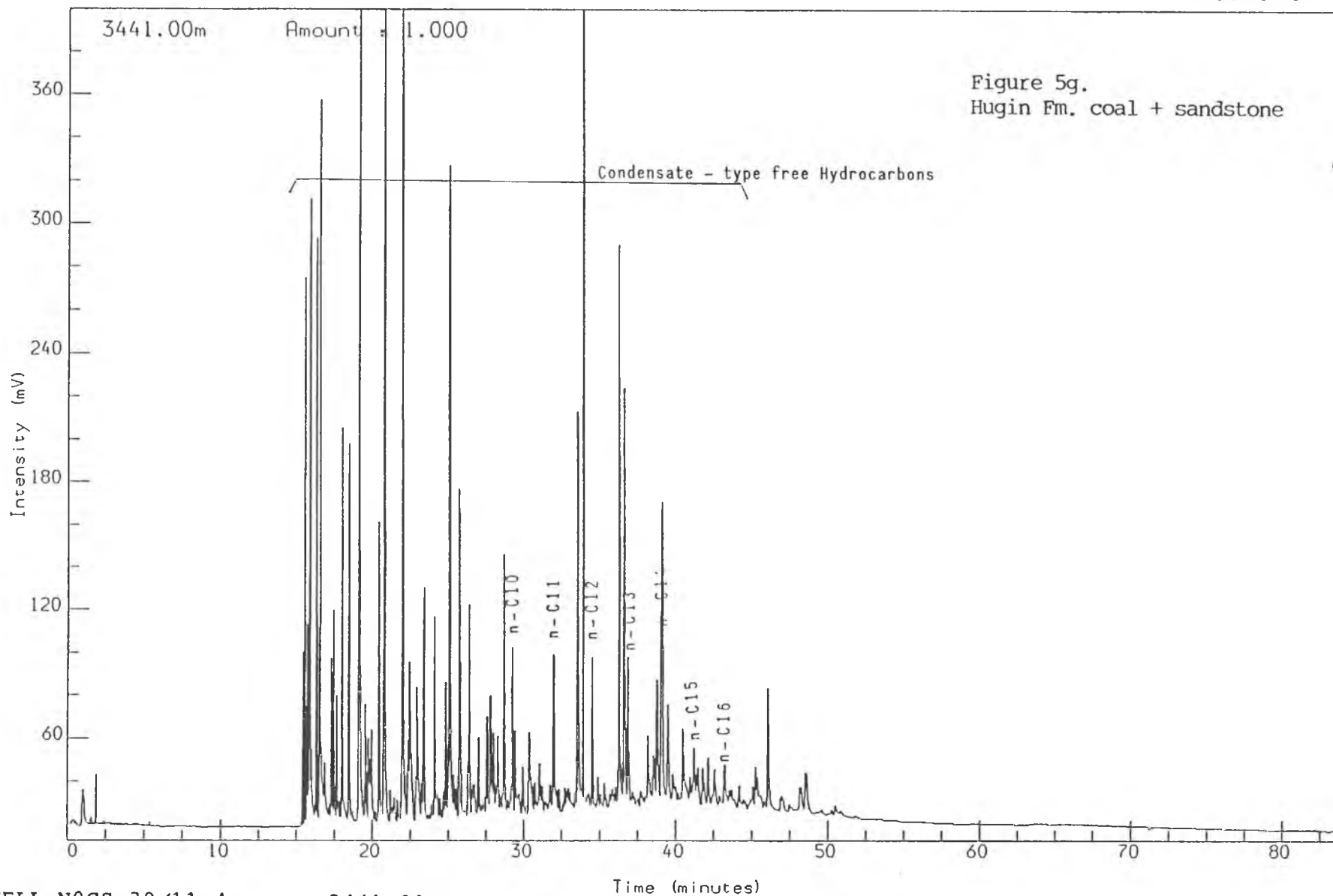
Time (minutes)

Reported on 24-OCT-1991 at 14:55

GEOLAB  NOR

Analysis Name : [522006] 22 PF1204280,1,1.

Multichrom



WELL NOCS 30/11-4 3441.00m com
THERMAL EXTRACTION GC (S1)
bulk

Reported on 30-OCT-1991 at 12:55

GEOLAB NOR

Analysis Name : [522006] 22 PF12A,7,1.

Multichrom

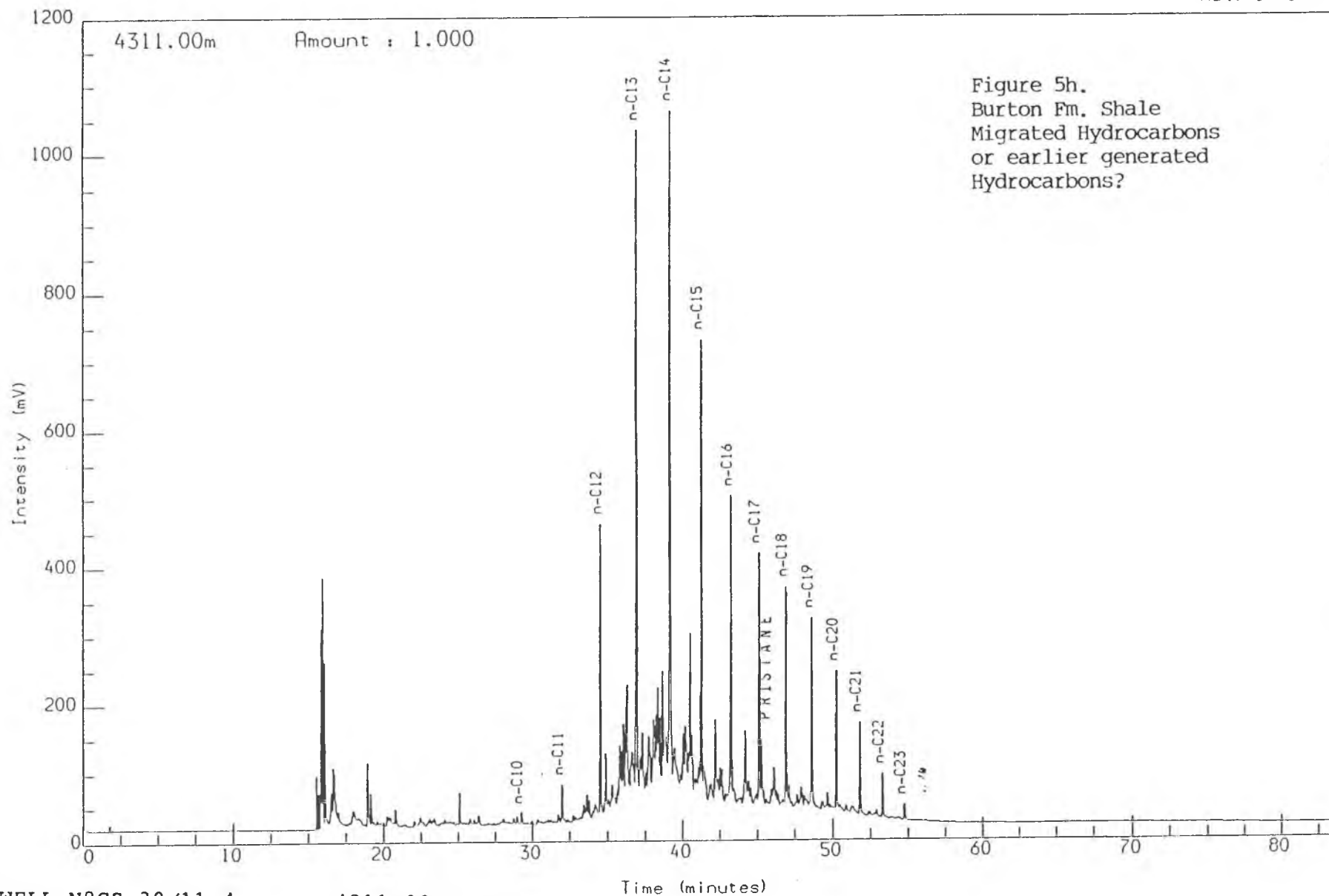


Figure 5h.
Burton Fm. Shale
Migrated Hydrocarbons
or earlier generated
Hydrocarbons?

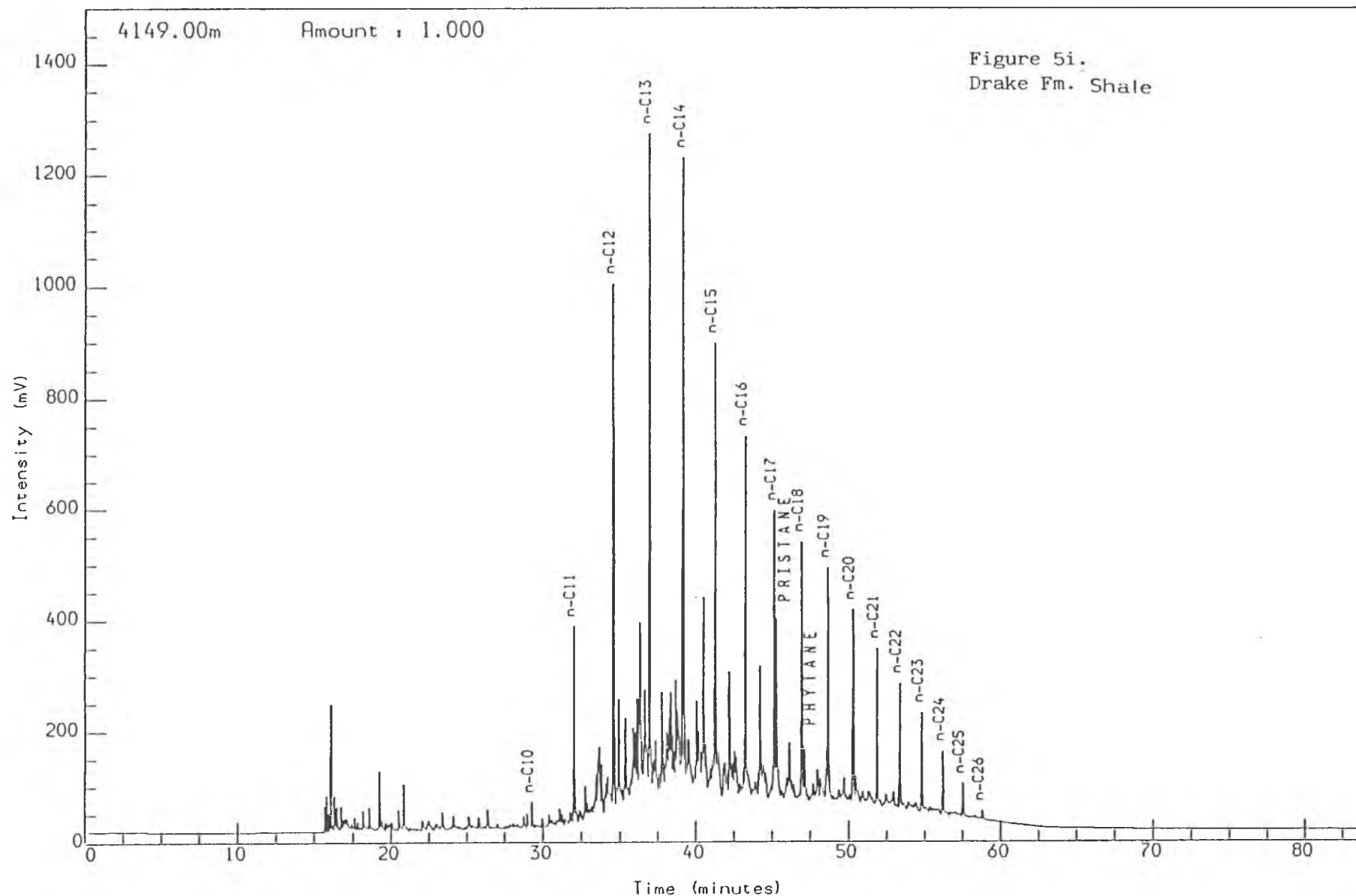
WELL NOCS 30/11-4 4311.00m cut
THERMAL EXTRACTION GC (S1)
Sh/C1st: m gy

Reported on 24-OCT-1991 at 14:59

GEOLAB NOR

Analysis Name : [522006] 22 PF12B,1,1.

Multichrom



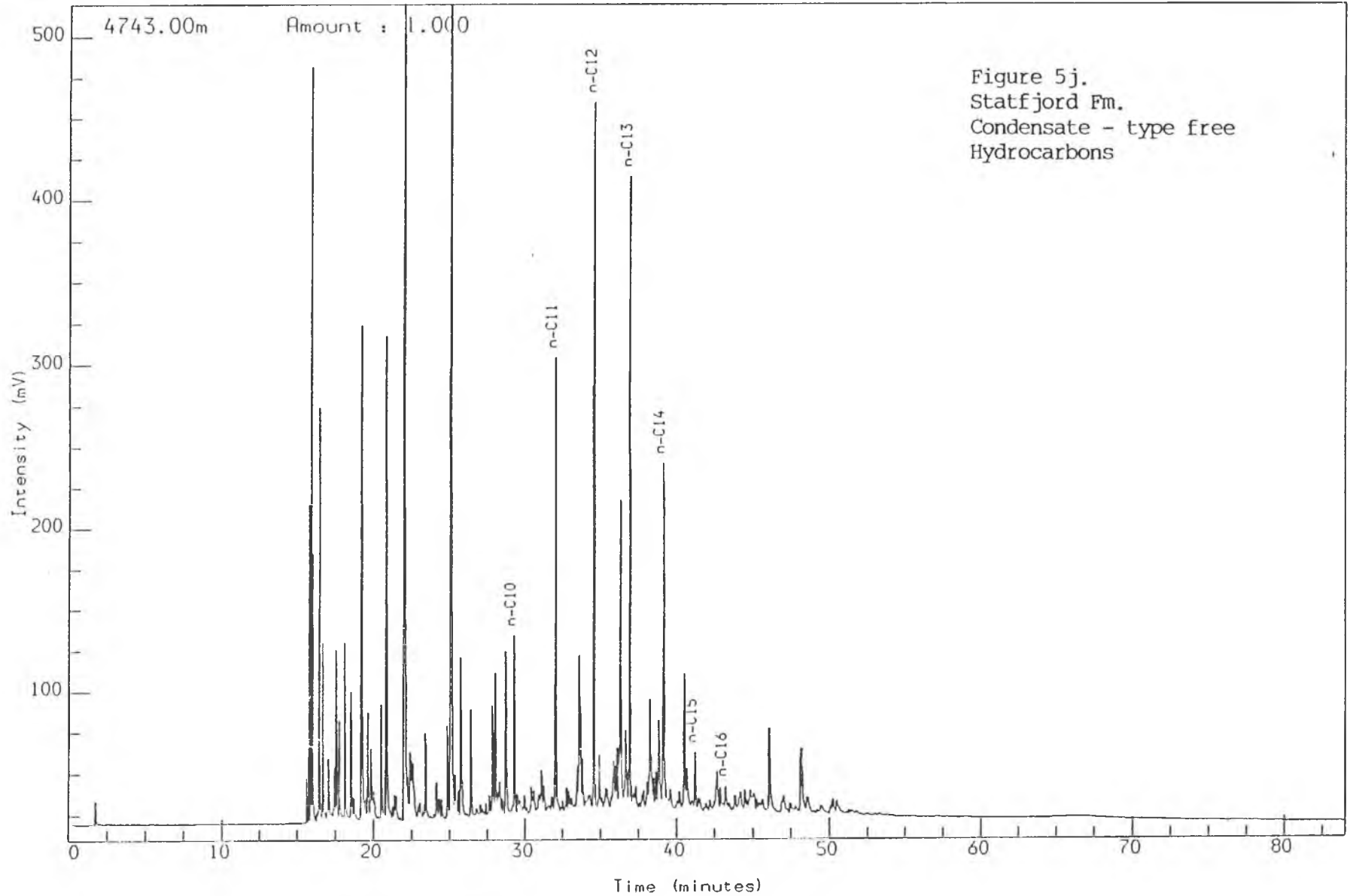
WELL NOCS 30/11-4 4149.00m cut
THERMAL EXTRACTION GC (S1)
Sh/Clst: brn gy to brn blk

Reported on 25-OCT-1991 at 10:03

GEOLAB NOR

Analysis Name : [522006] 22 PF12B,3,1.

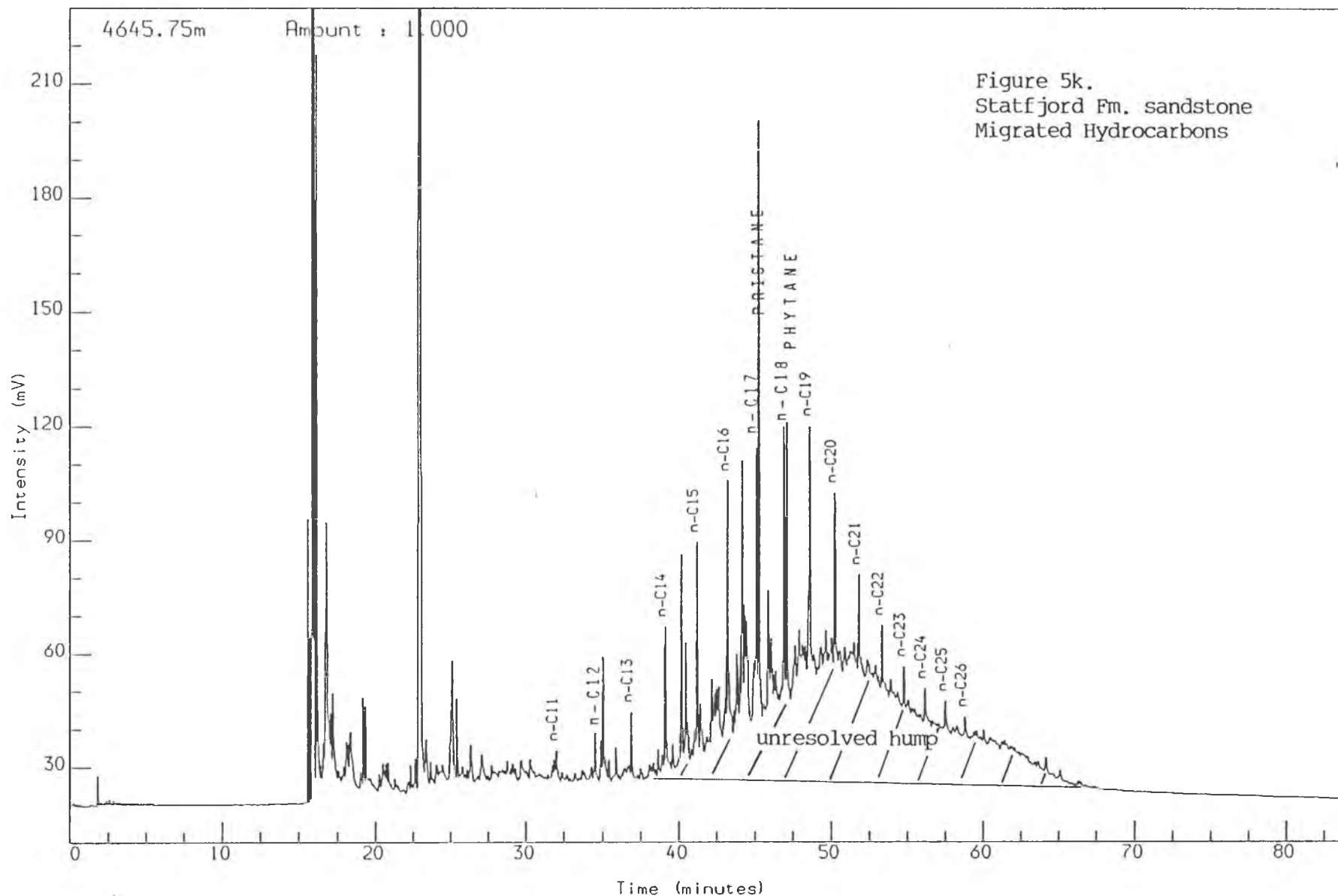
Multichrom



WELL NOCS 30/11-4 4743.00m cut
THERMAL EXTRACTION GC (S1)
Sh/Clst: m gy to drk gy to brn blk

Reported on 25-OCT-1991 at 10:04

GEOLAB NOR

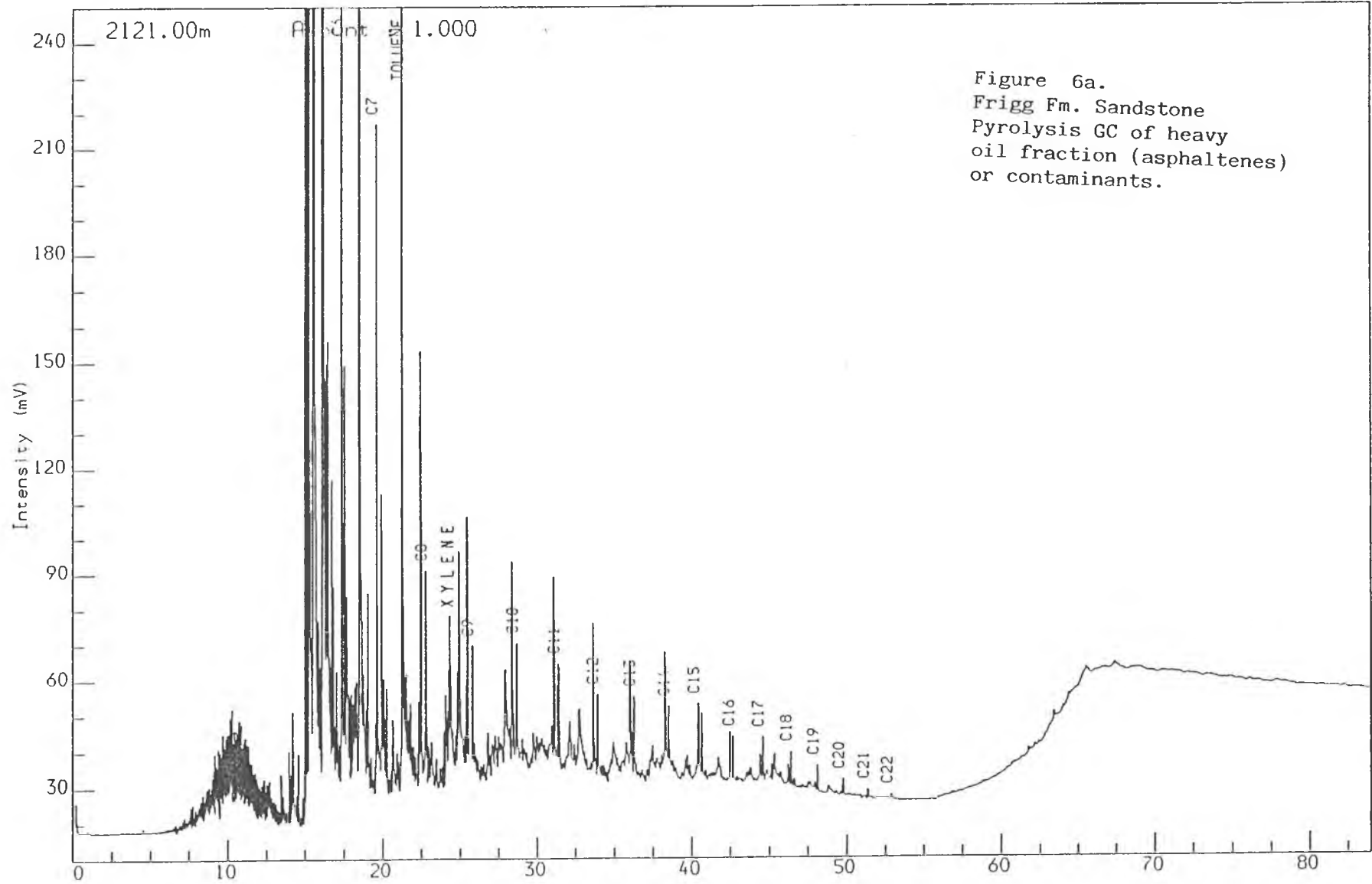


WELL NOCS 30/11-4 4645.75m ccp
THERMAL EXTRACTION GC (S1)
S/Sst: w to 1t gy

Reported on 24-OCT-1991 at 15:01

Analysis Name : [522006] 21 PF1204250,1,1.

Multichrom



WELL NOCS 30/11-4
PYROLYSIS GC (S2)
bulk

2121.00m com

Time (minutes)

Reported on 24-OCT-1991 at 09:46

GEOLAB NOR

Analysis Name : [522006] 21 PF1204260,1,1.

Multichrom

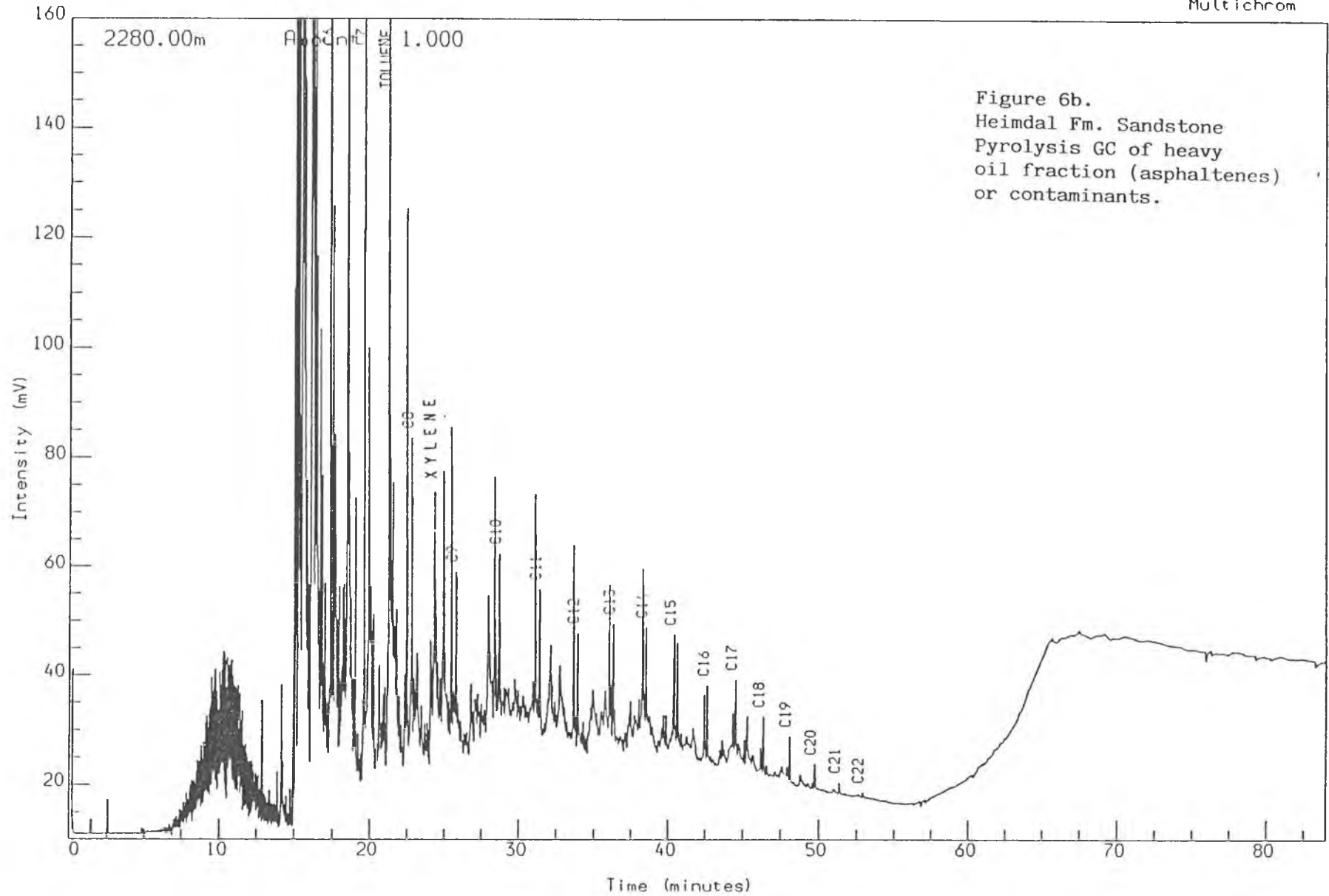


Figure 6b.
Heimdal Fm. Sandstone
Pyrolysis GC of heavy
oil fraction (asphaltenes)
or contaminants.

WELL NOCS 30/11-4
PYROLYSIS GC (S2)
bulk

2280.00m com

Reported on 24-OCT-1991 at 09:49

GEOLAB NOR

Analysis Name : [522006] 21 PF1201181,1,1.

Multichrom

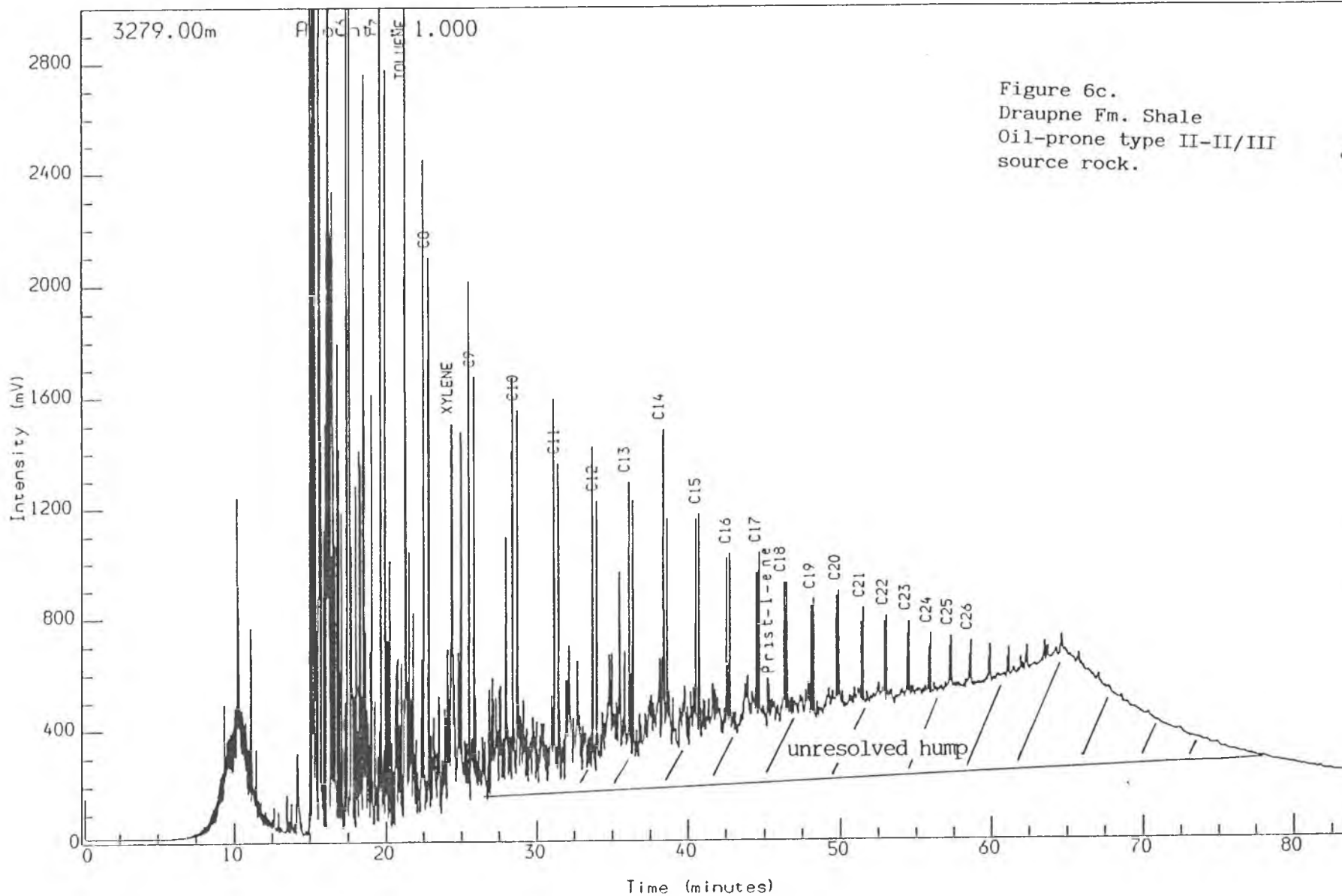


Figure 6c.
Draupne Fm. Shale
Oil-prone type II-II/III
source rock.

WELL NOCS 30/11-4 3279.00m cut
PYROLYSIS GC (S2)
Sh/Clst: drk gy to brn blk

Reported on 29-OCT-1991 at 15:44

GEOLAB  NOR

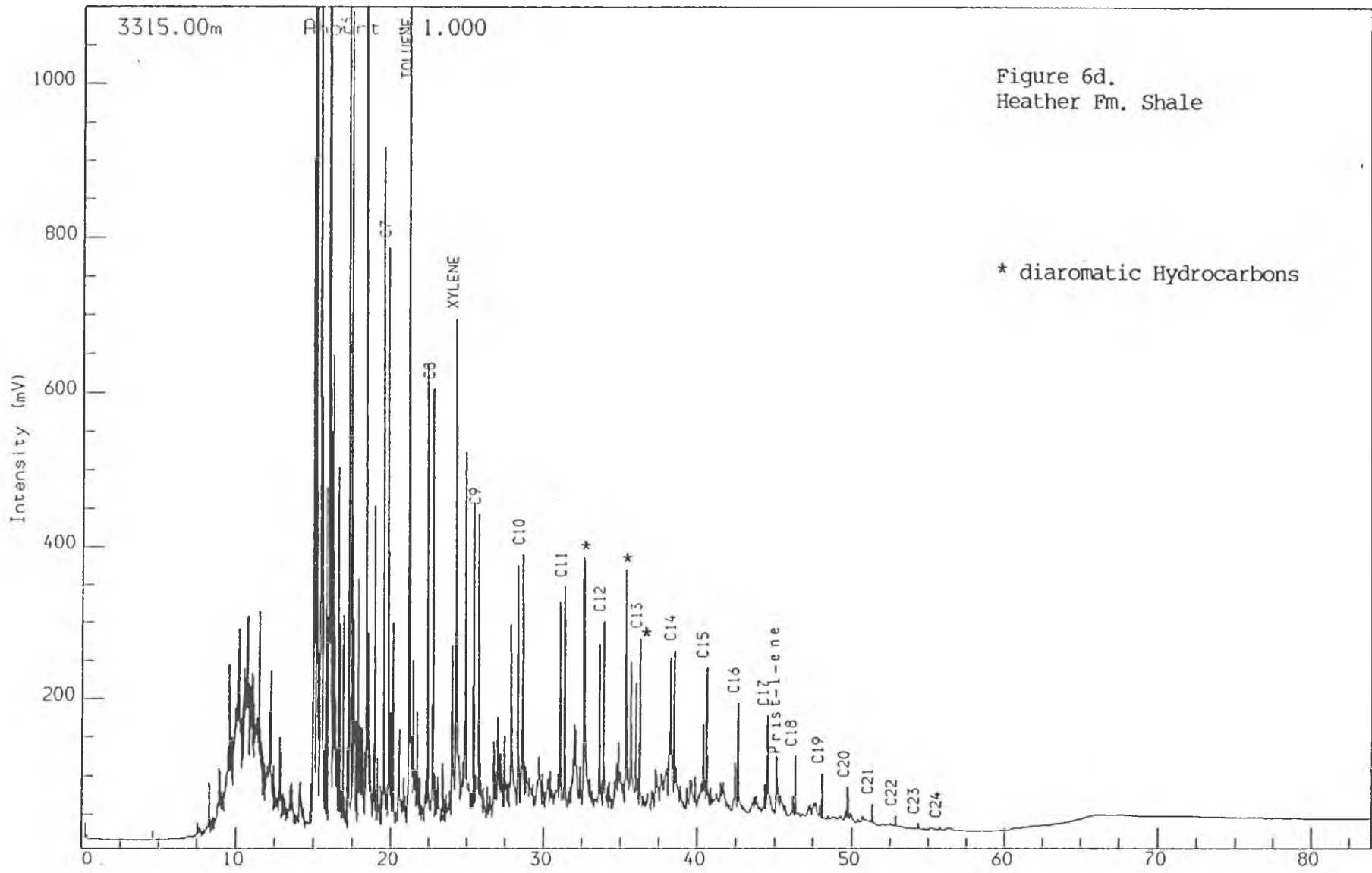


Figure 6d.
Heather Fm. Shale

WELL NOCS 30/11-4
PYROLYSIS GC (S2)
Sh/Clst: m gy to drk gy

Reported on 24-OCT-1991 at 09:52

Analysis Name : [522006] 21 PF12C,1,1.

Multichrom

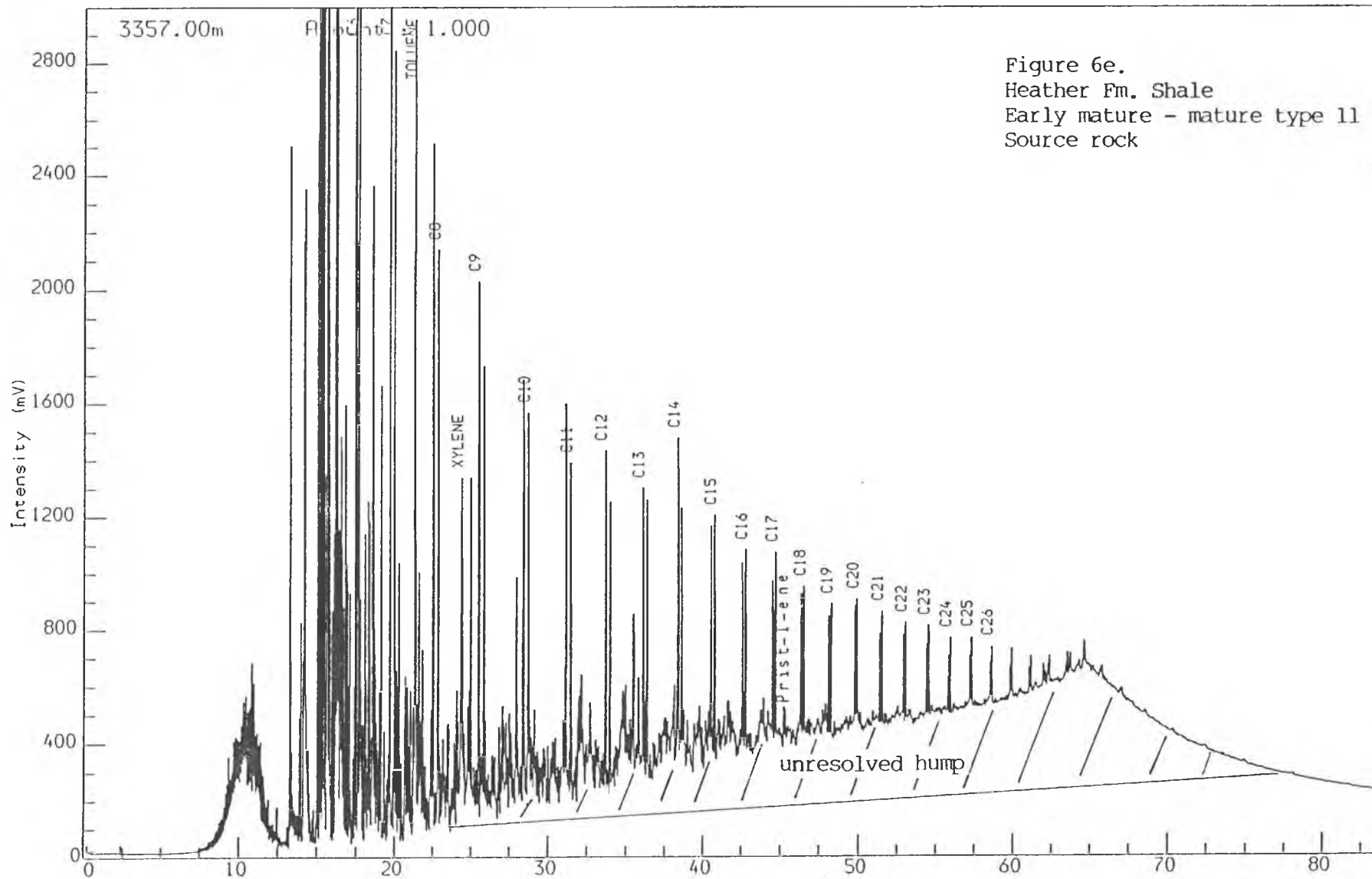


Figure 6e.
Heather Fm. Shale
Early mature - mature type 11
Source rock

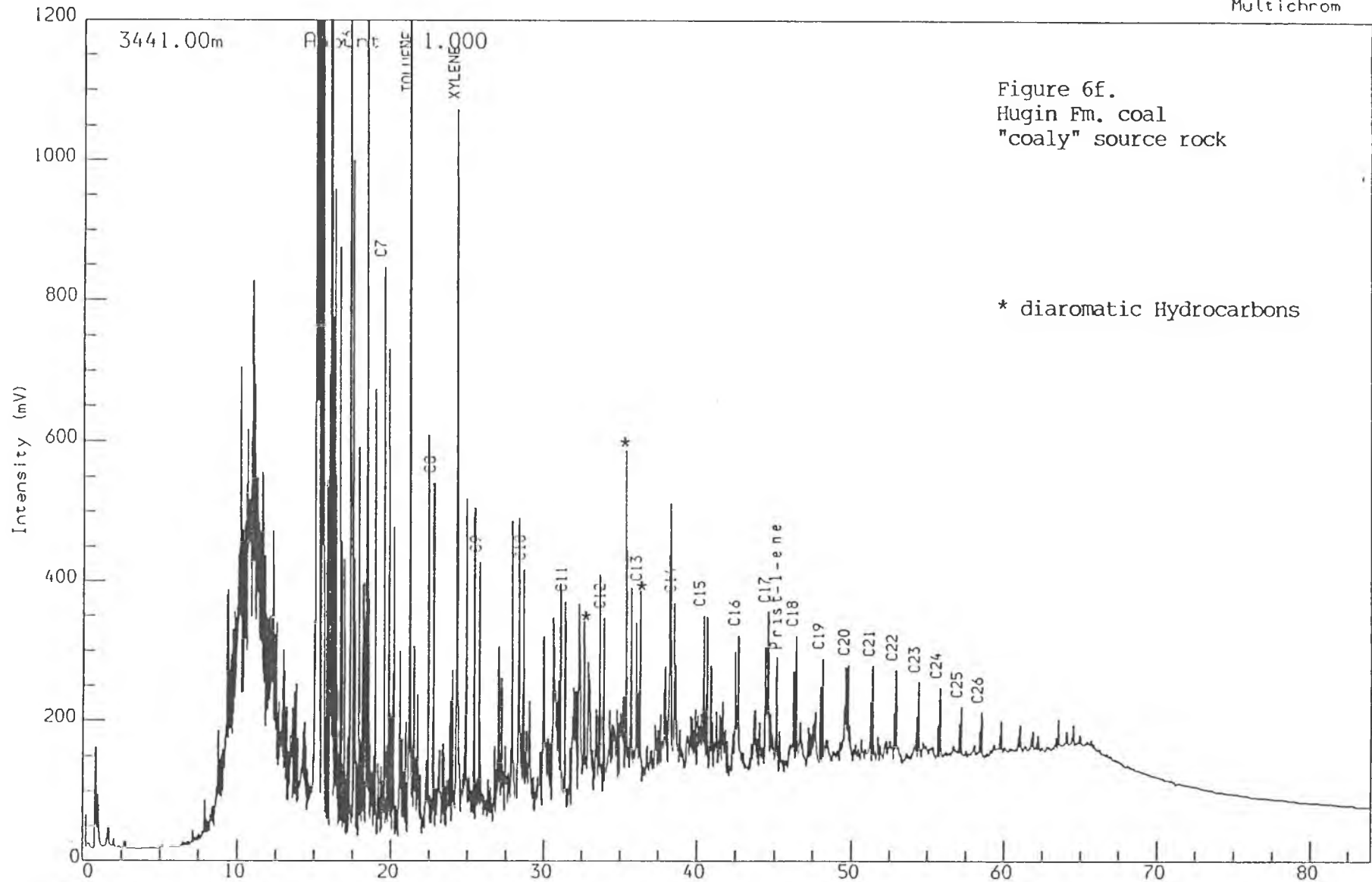
WELL NOCS 30/11-4
PYROLYSIS GC (S2)
Sh/Clst: drk gy to brn blk

Time (minutes)

Reported on 29-OCT-1991 at 15:30

Analysis Name : [522006] 21 PF1204280,1,1.

Multichrom



WELL NOCS 30/11-4
PYROLYSIS GC (S2)
bulk.

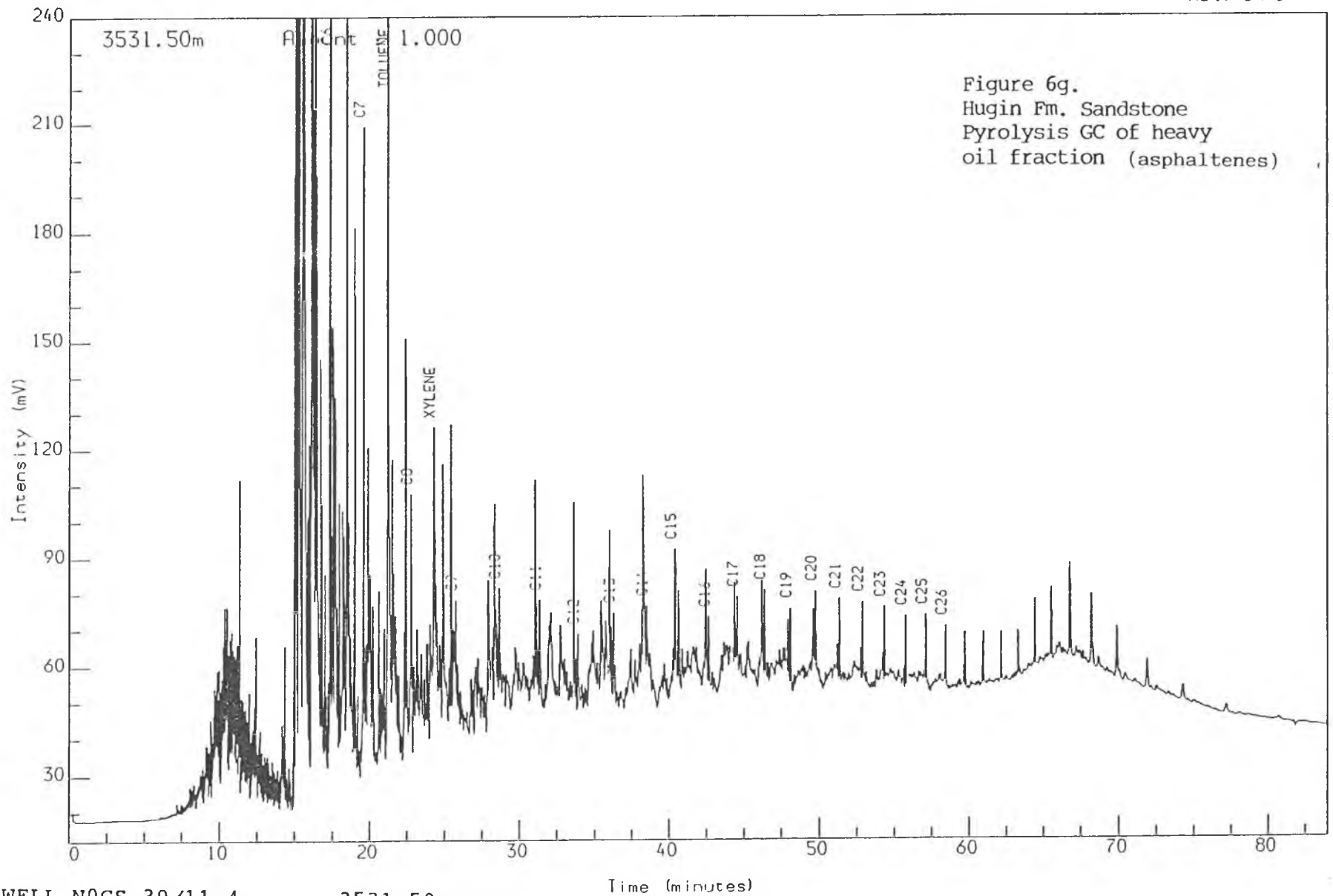
3441.00m com

Time (minutes)

Reported on 30-OCT-1991 at 12:38

Analysis Name : [522006] 21 PF12A,3,1.

Multichrom



WELL NOCS 30/11-4
PYROLYSIS GC (S2)
S/Sst: lt gy to lt brn gy

3531.50m ccp

Time (minutes)

Reported on 24-OCT-1991 at 10:00

GEOLAB NOR

Analysis Name : [522006] 21 PF12A,4,1.

Multichrom

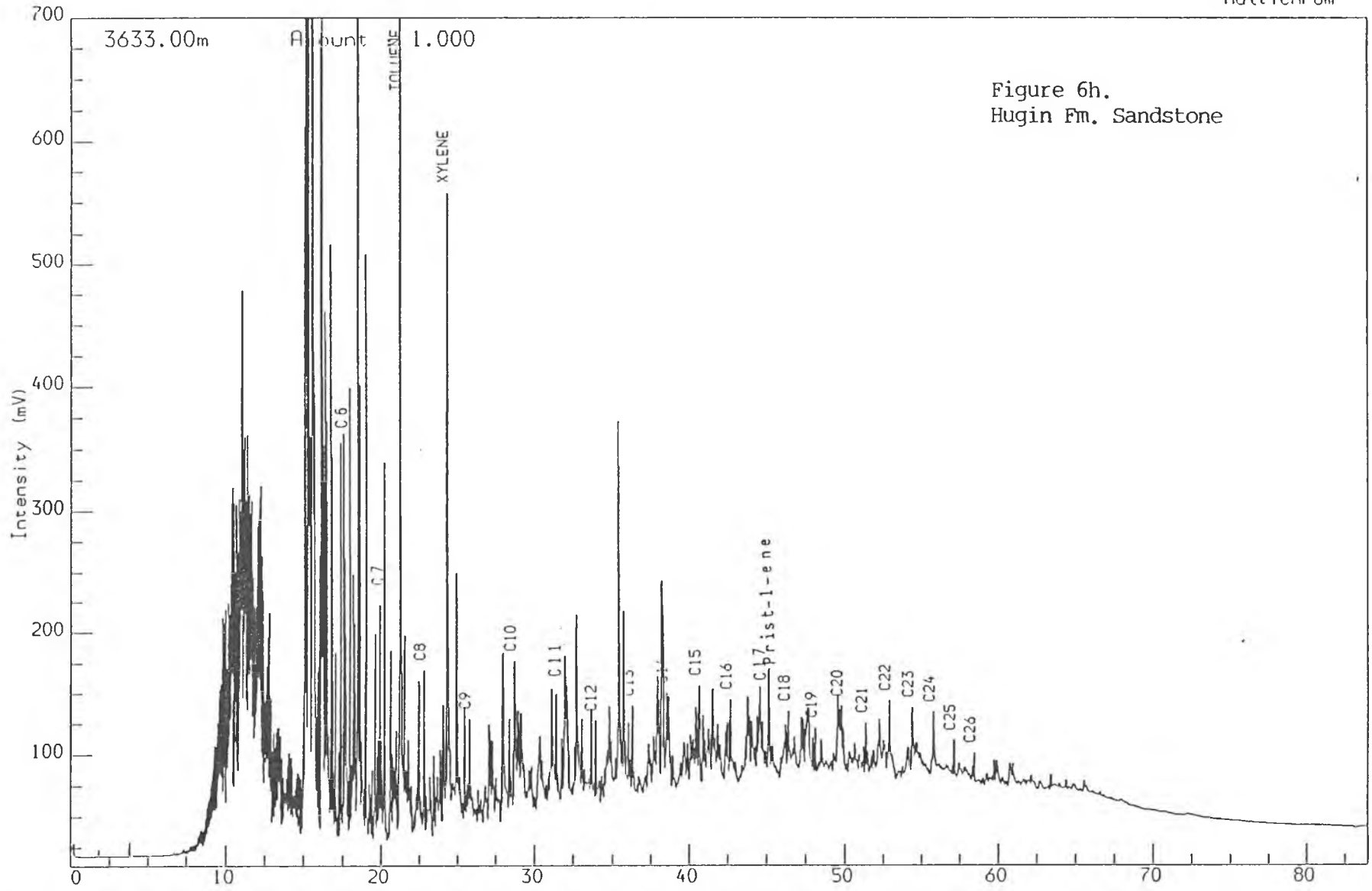


Figure 6h.
Hugin Fm. Sandstone

WELL NOCS 30/11-4
PYROLYSIS GC (S2)
S/Sst: 1t gy to 1t or

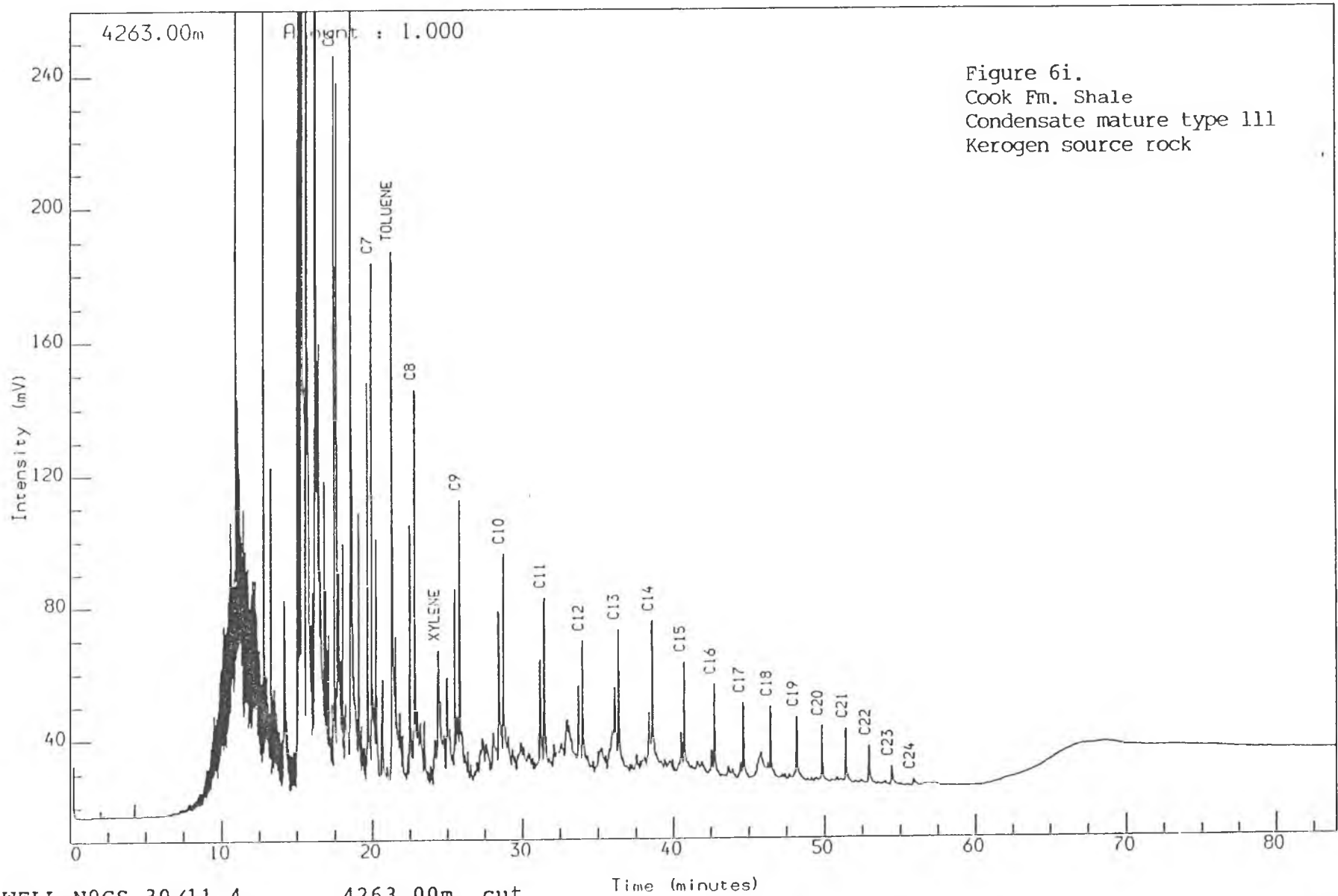
3633.00m cut

Time (minutes)

Reported on 24-OCT-1991 at 10:01

Analysis Name : [522006] 21 PF12A,6,1.

Multichrom



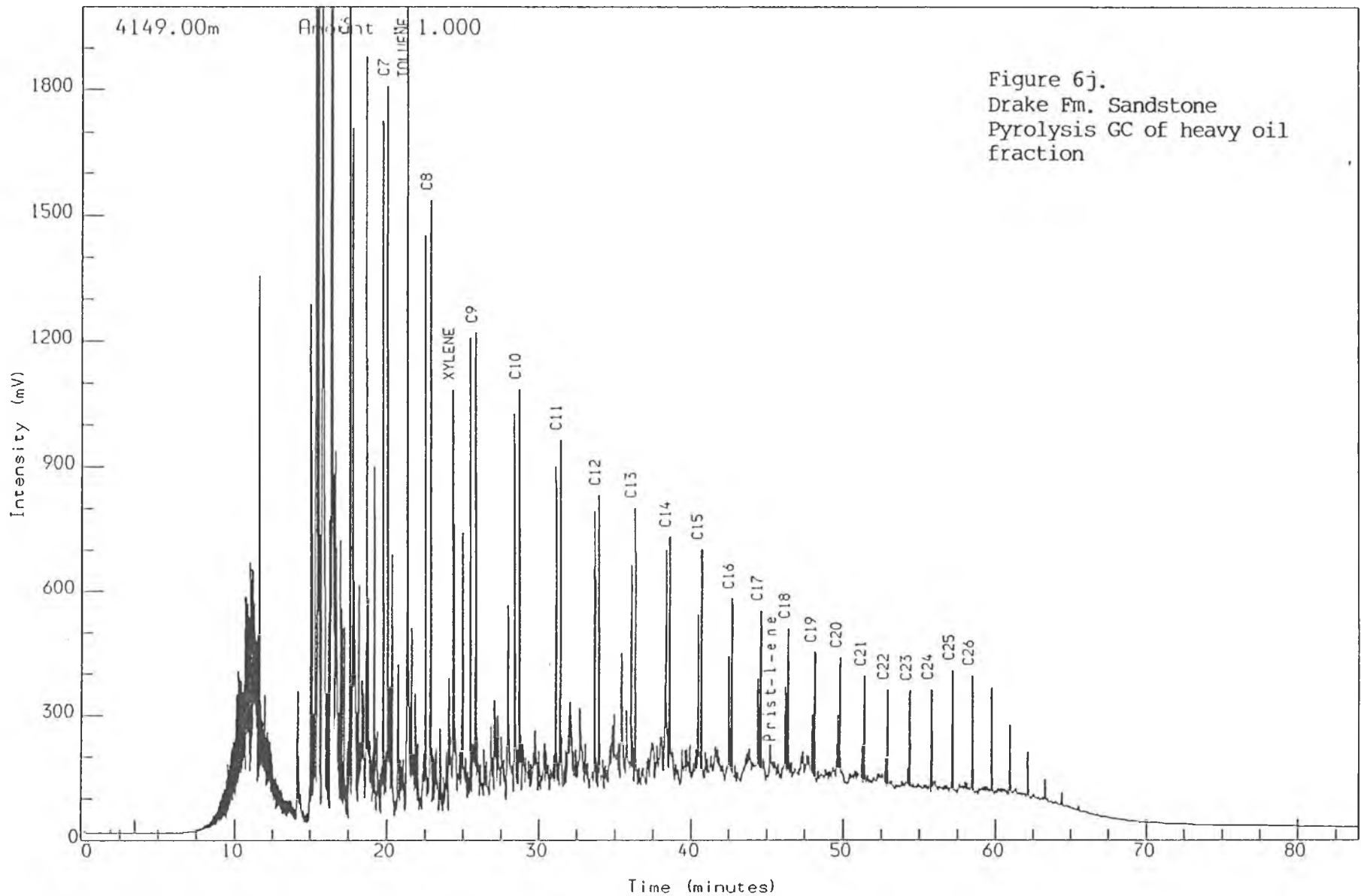
WELL NOCS 30/11-4
PYROLYSIS GC (S2)
Sh/Clst: m gy to drk gy

4263.00m cut

Time (minutes)

Reported on 24-OCT-1991 at 10:07

GEOLAB NOR



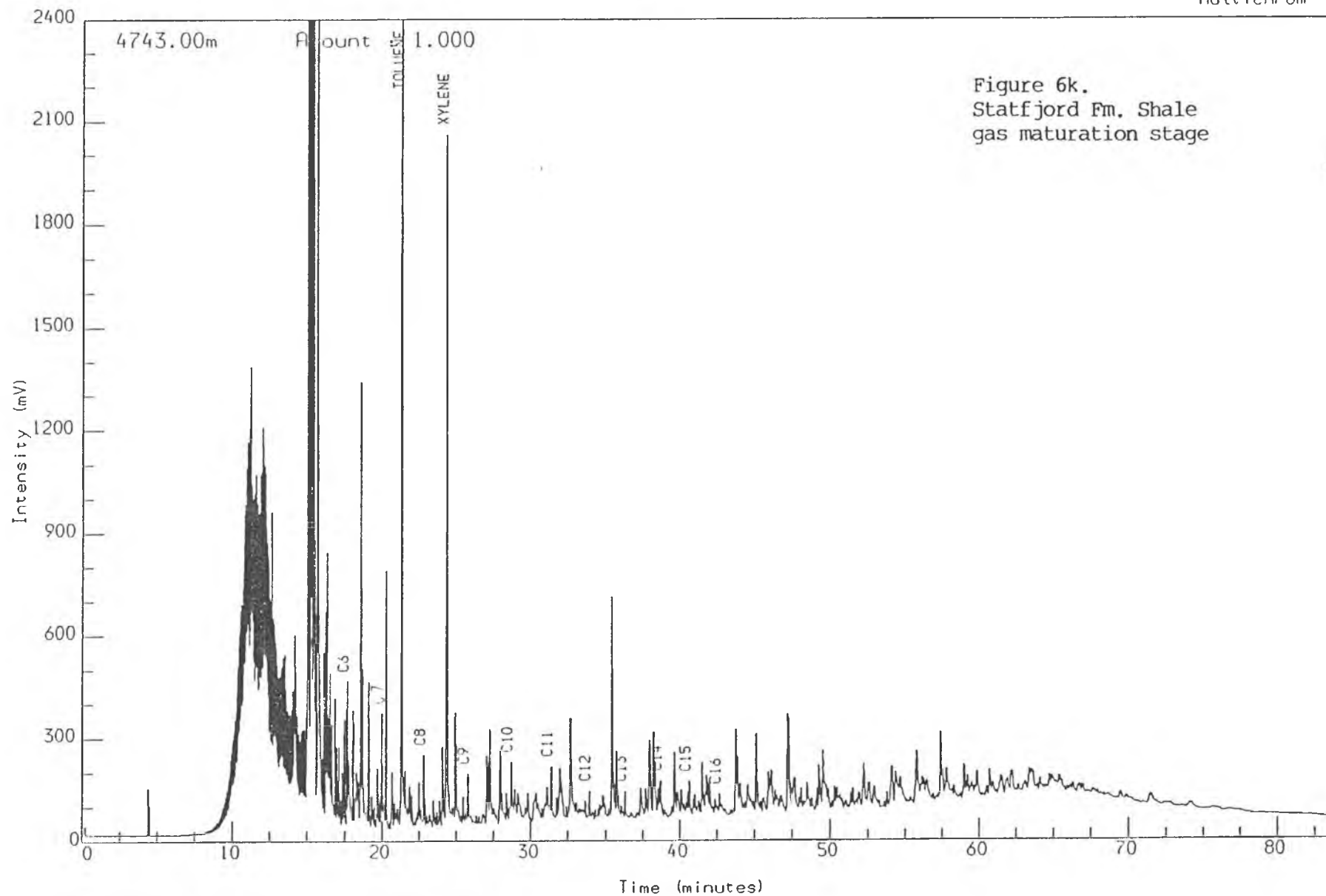
WELL NOCS 30/11-4
PYROLYSIS GC (S2)
S/Sst: w to lt or

4149.00m cut

Reported on 25-OCT-1991 at 09:29

Analysis Name : [522006] 21 PF12B,3,1.

Multichrom



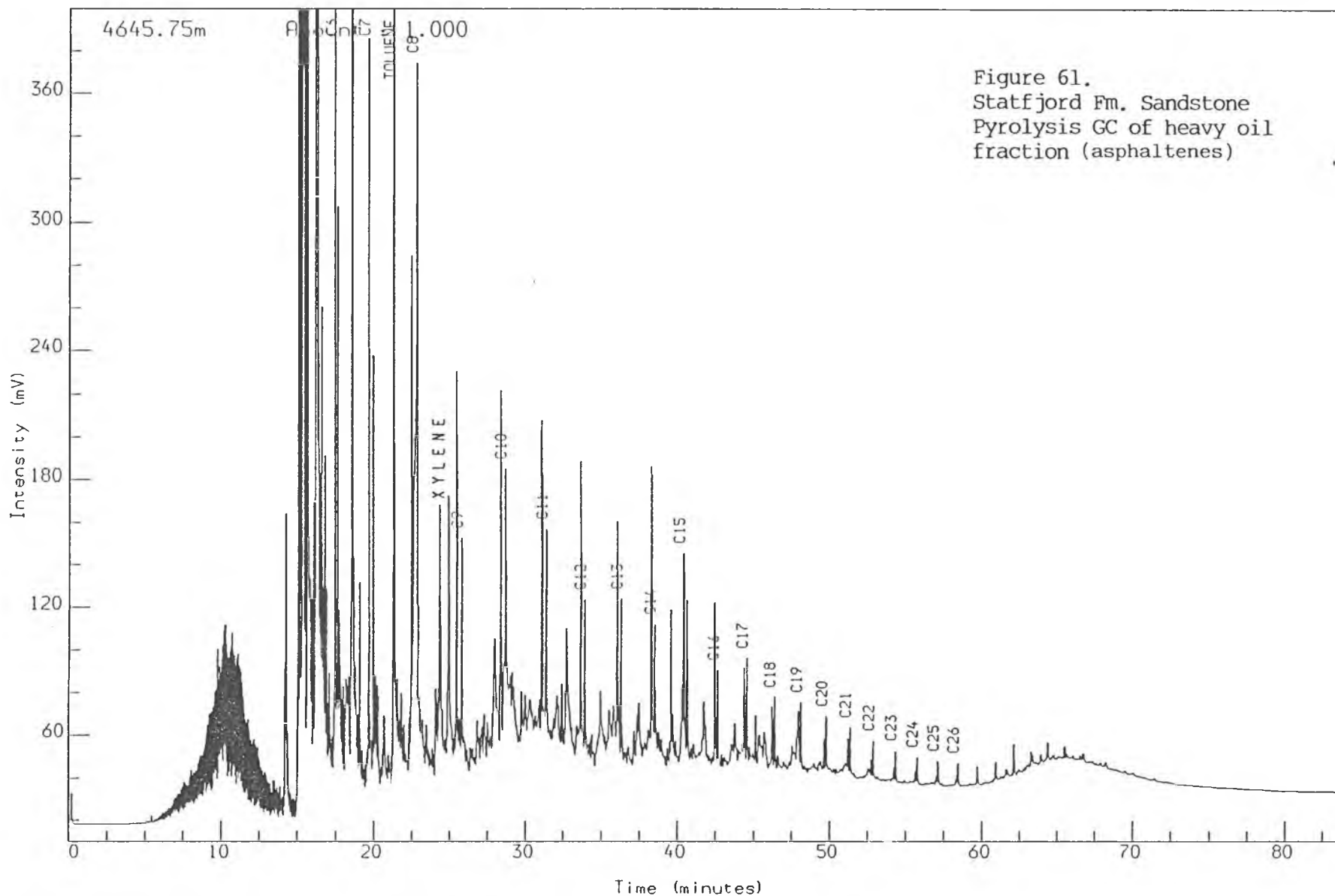
WELL NOCS 30/11-4 4743.00m cut
PYROLYSIS GC (S2)
Sh/Clst: m gy to drk gy to brn blk

Reported on 1-NOV-1991 at 11:11

GEOLAB  NOR

Analysis Name : [522006] 21 PF12A,9,1.

Multichrom



WELL NOCS 30/11-4
PYROLYSIS GC (S2)
S/Sst: w to 1t gy

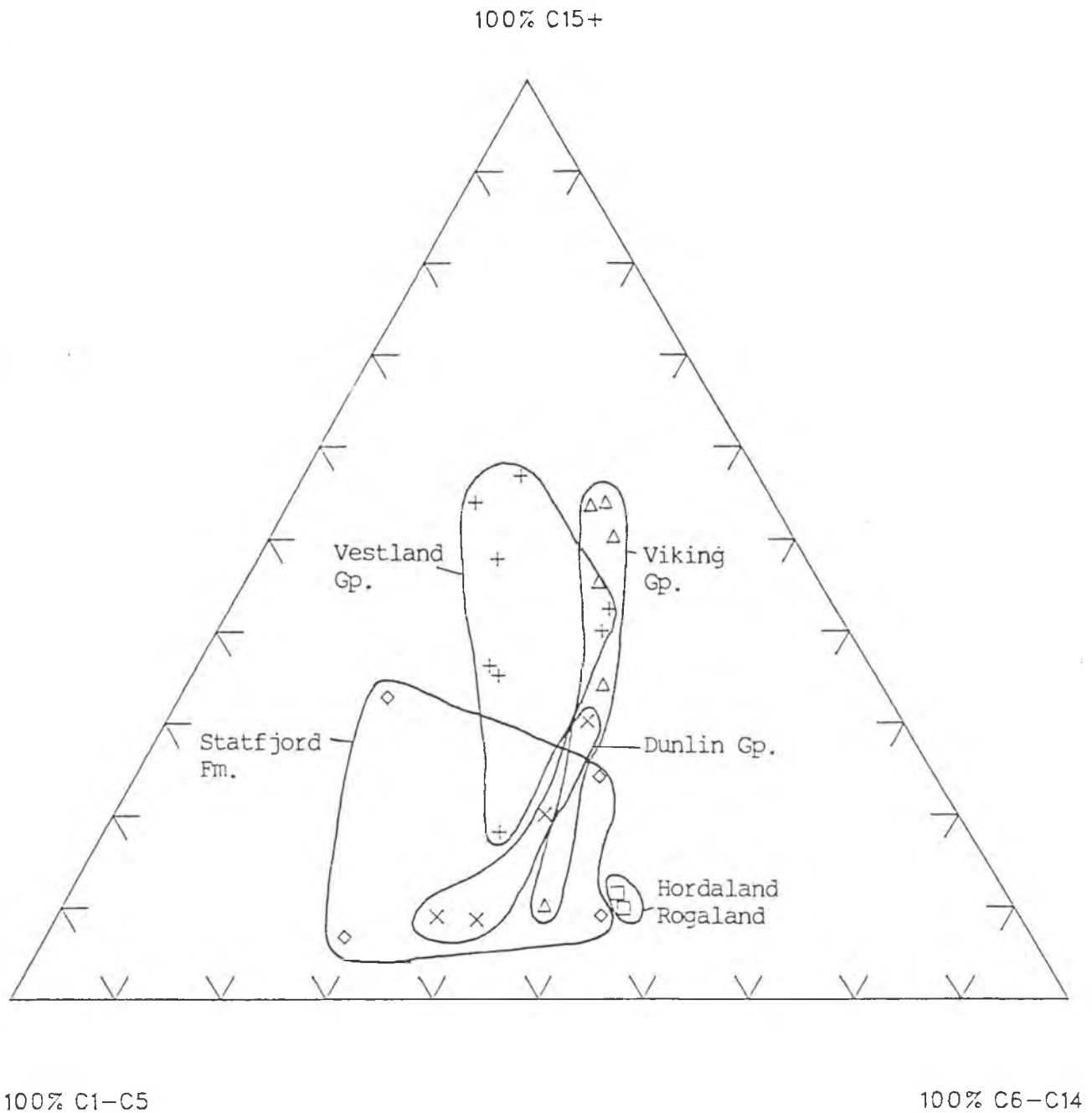
4645.75m ccp

Reported on 24-OCT-1991 at 10:13

GEOLAB NOR

Figure 7 : Pyrolysis GC Composition

Well NOCS 30/11-4



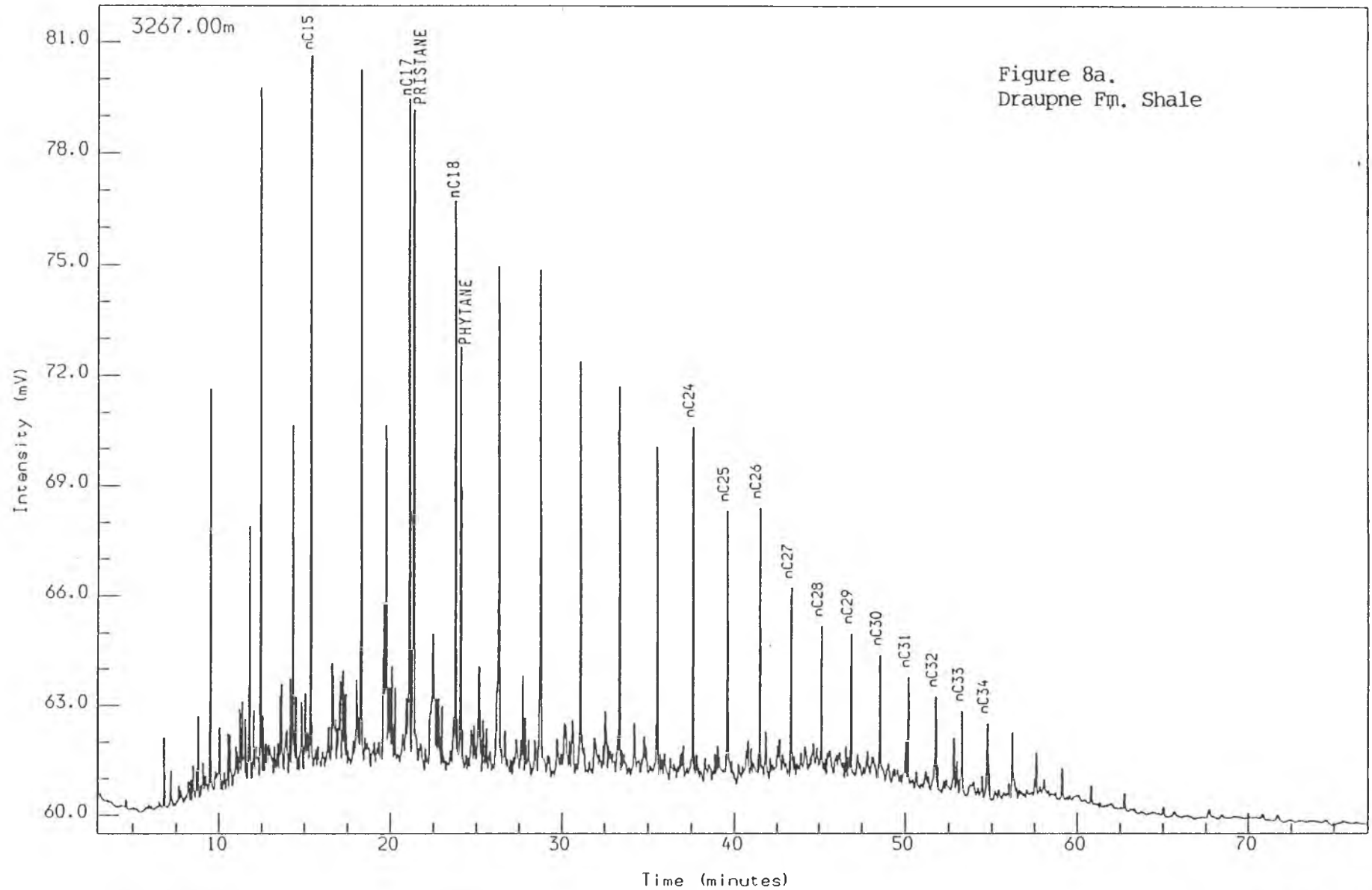


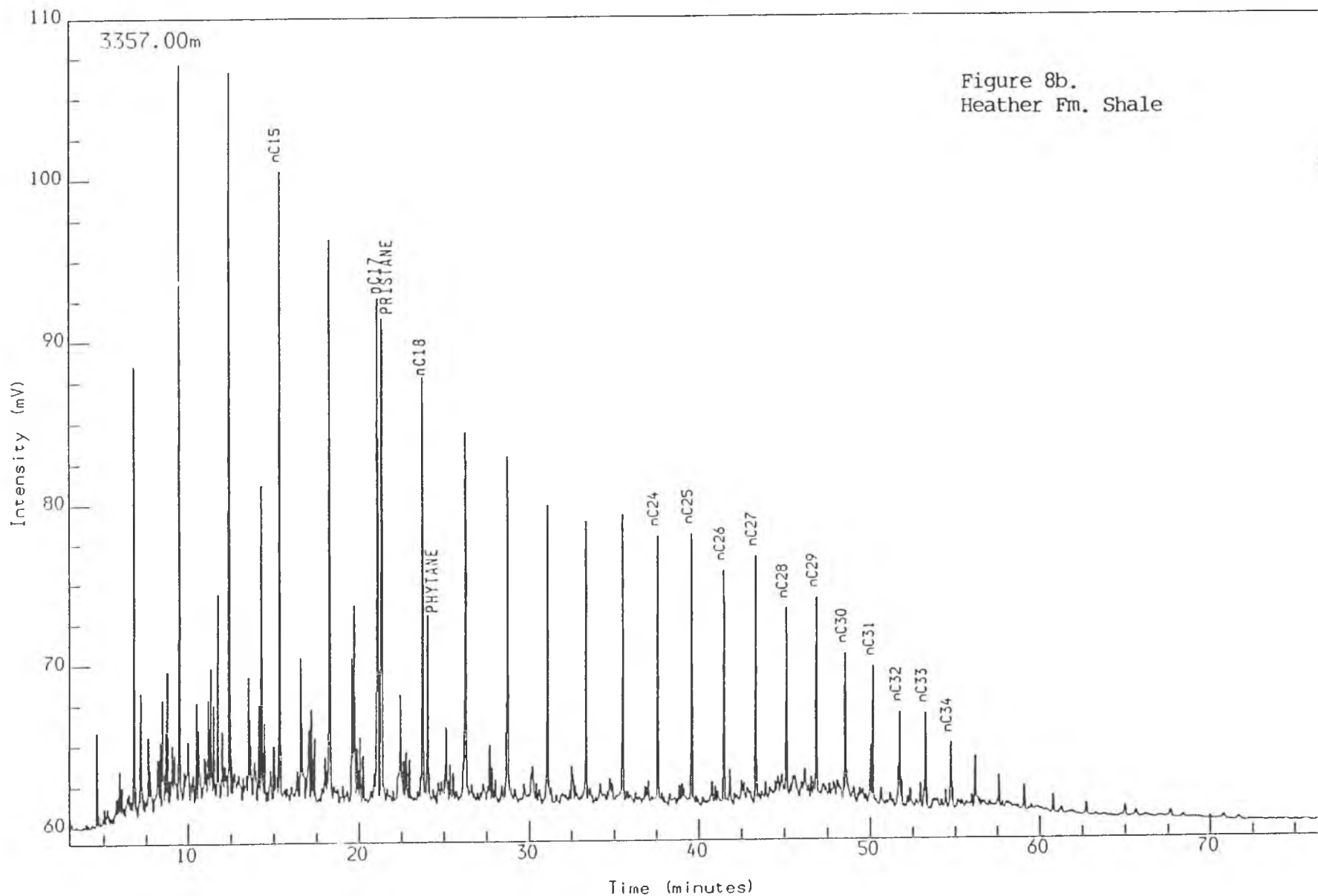
Figure 8a.
Draupne Fm. Shale

WELL NOCS 30/11-4 3267.00m cut
SATURATED GC
Sh/Clst: drk gy to brn blk

Reported on 4-OCT-1991 at 12:53

Analysis Name : [522006] 11 SF1201311L,1,1.

Multichrom



WELL NOCS 30/11-4 3357.00m cut
SATURATED GC
Sh/Clst: drk gy to brn blk

Reported on 7-OCT-1991 at 09:19

GEOLAB NOR

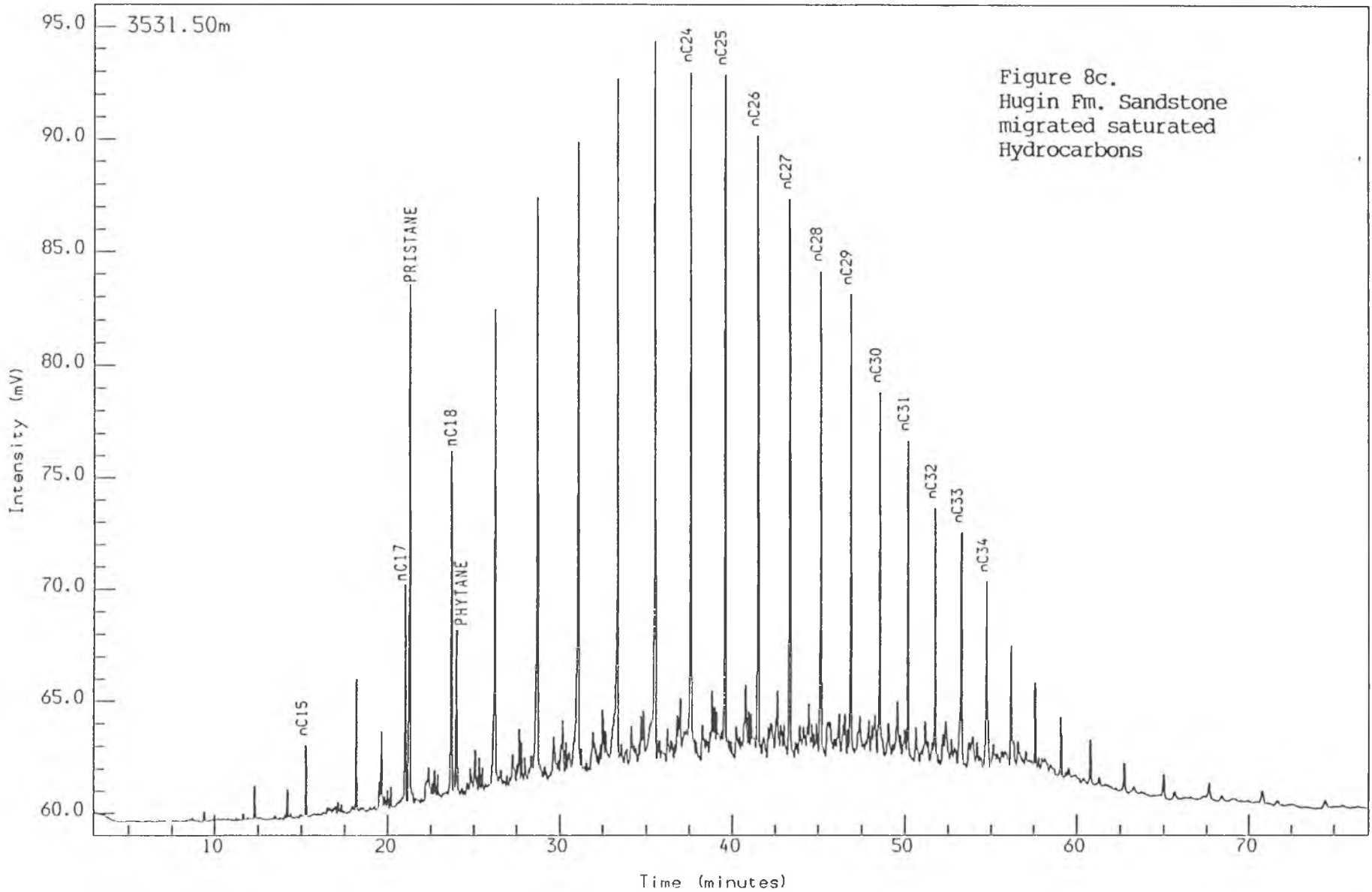


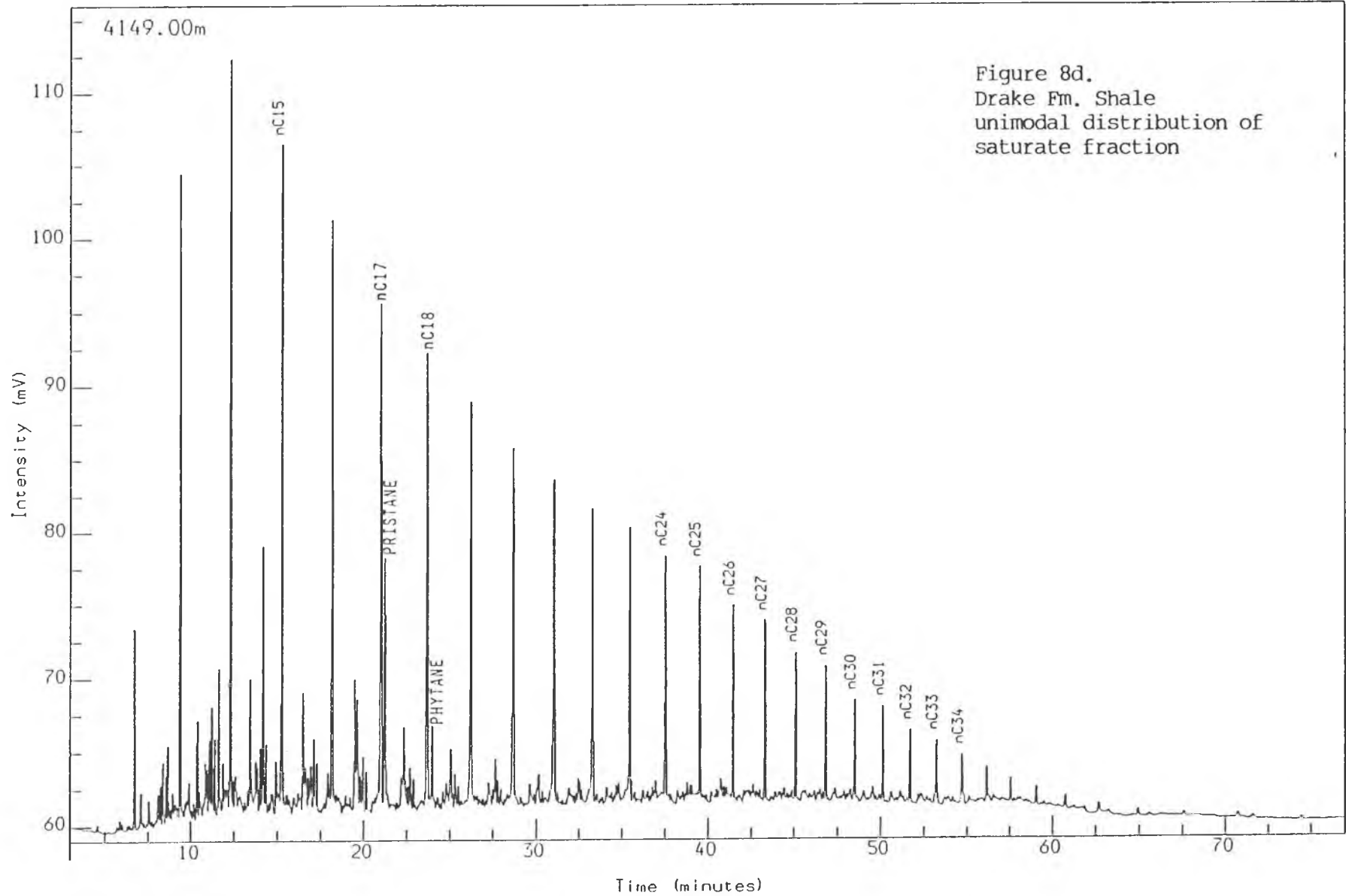
Figure 8c.
Hugin Fm. Sandstone
migrated saturated
Hydrocarbons

WELL NOCS 30/11-4 3531.50m ccp
SATURATED GC
S/Sst: 1t gy to 1t brn gy

Reported on 7-OCT-1991 at 13:53

Analysis Name : [522006] 11 SF1202601L,1,1.

Multichrom



WELL NOCS 30/11-4 4149.00m cut
SATURATED GC
Sh/Clst: brn gy to brn blk

Reported on 8-OCT-1991 at 12:08

GEOLAB  NOR

Analysis Name : [522006] 29 AF1201161LB,2,1.

Multichrom

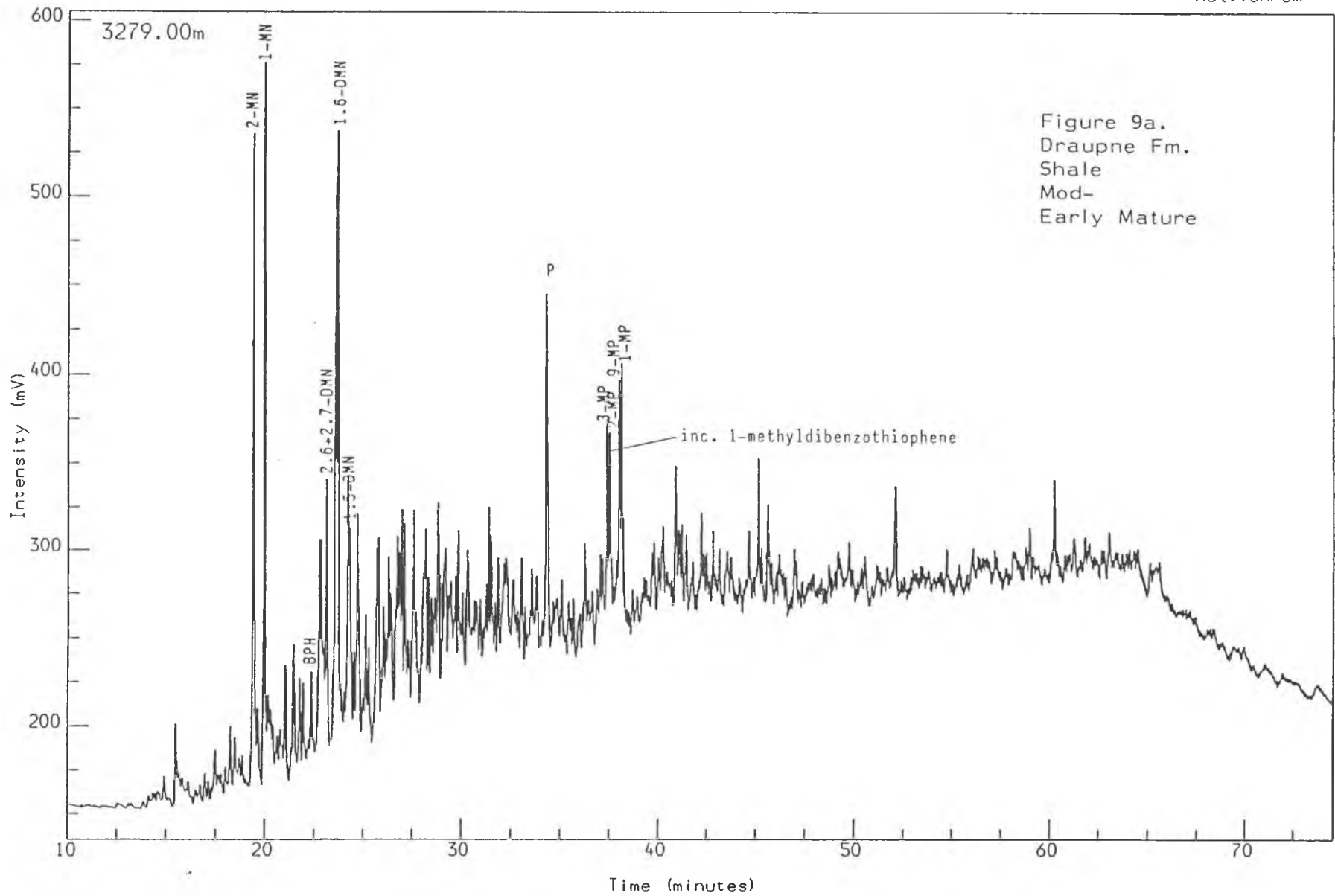


Figure 9a.
Draupne Fm.
Shale
Mod-
Early Mature

WELL NOCS 30/11-4 3279.00m cut
AROMATIC GC (FID)
Sh/Clst: drk gy to brn blk

Reported on 21-OCT-1991 at 14:27

GEOLAB  NOR

Analysis Name : [522006] 30 AF1201161LB.2,1.

Multichrom

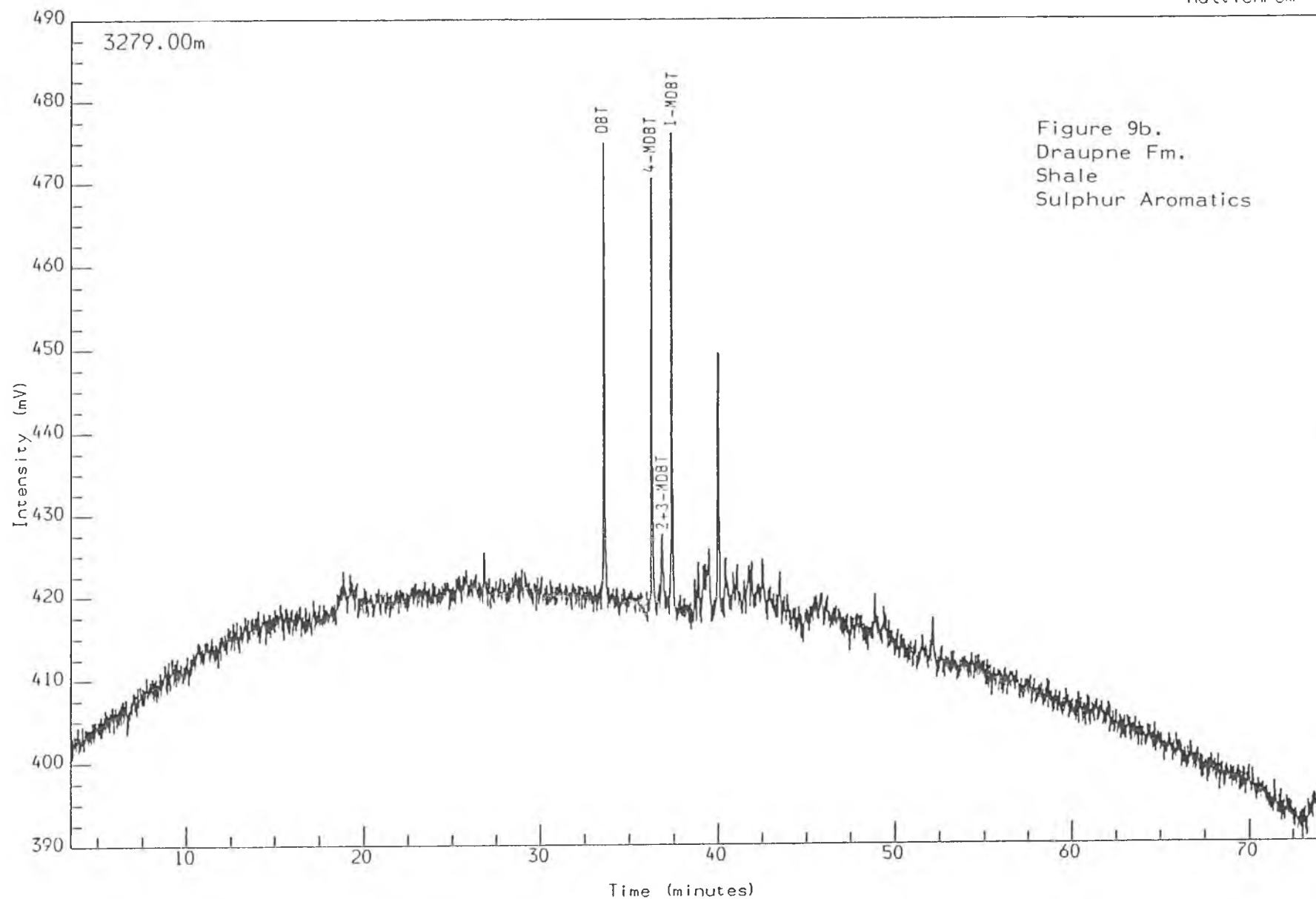


Figure 9b.
Draupne Fm.
Shale
Sulphur Aromatics

WELL NOCS 30/11-4 3279.00m cut
AROMATIC GC (FPD)
Sh/Clst: drk gy to brn blk

Reported on 21-OCT-1991 at 15:44

GEOLAB NOR

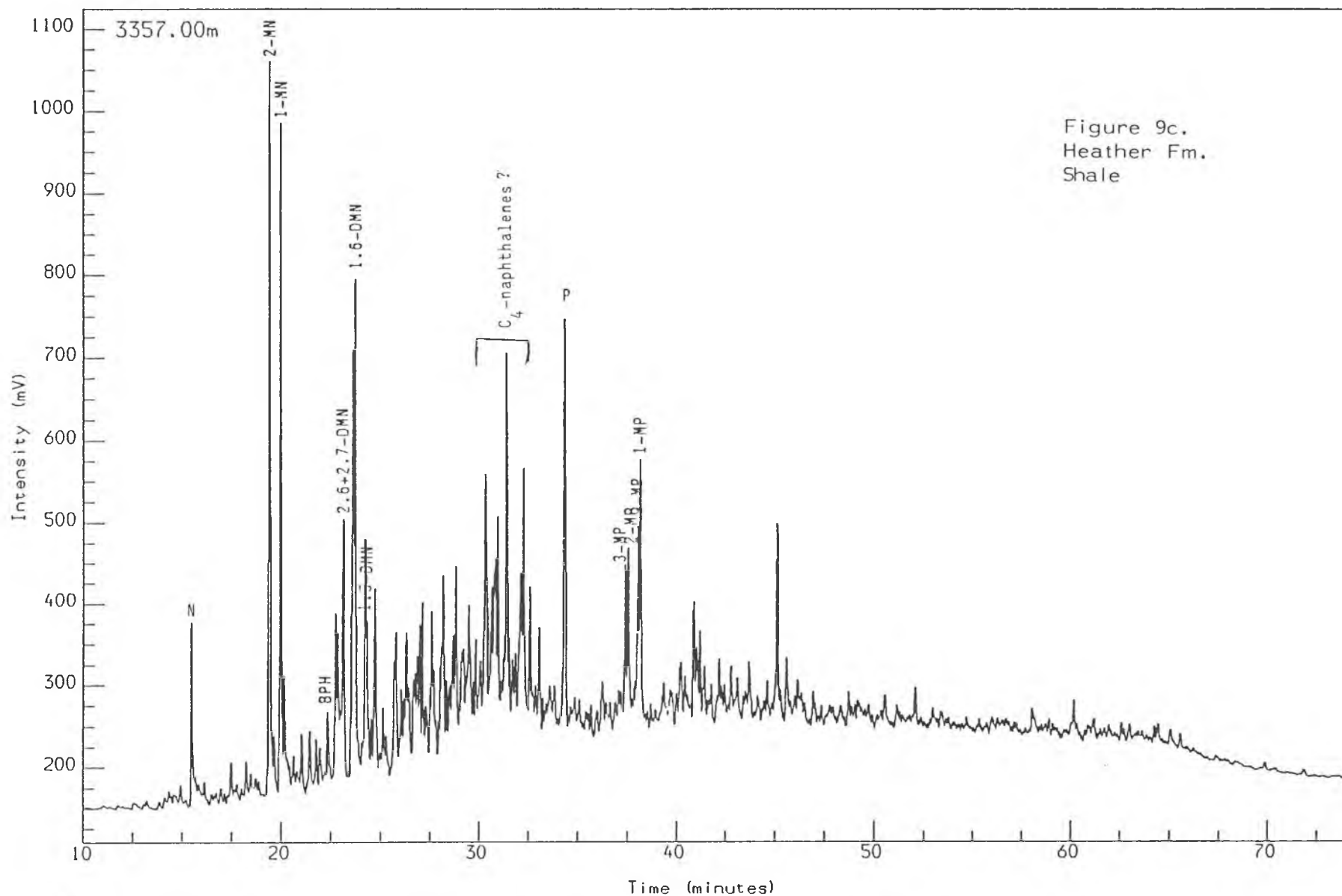


Figure 9c.
Heather Fm.
Shale

WELL NOCS 30/11-4 3357.00m cut
AROMATIC GC (FID)
Sh/Clst: drk gy to brn blk

Reported on 21-OCT-1991 at 14:32

Analysis Name : [522006] 29 AF1201161LB,8,1.

Multichrom

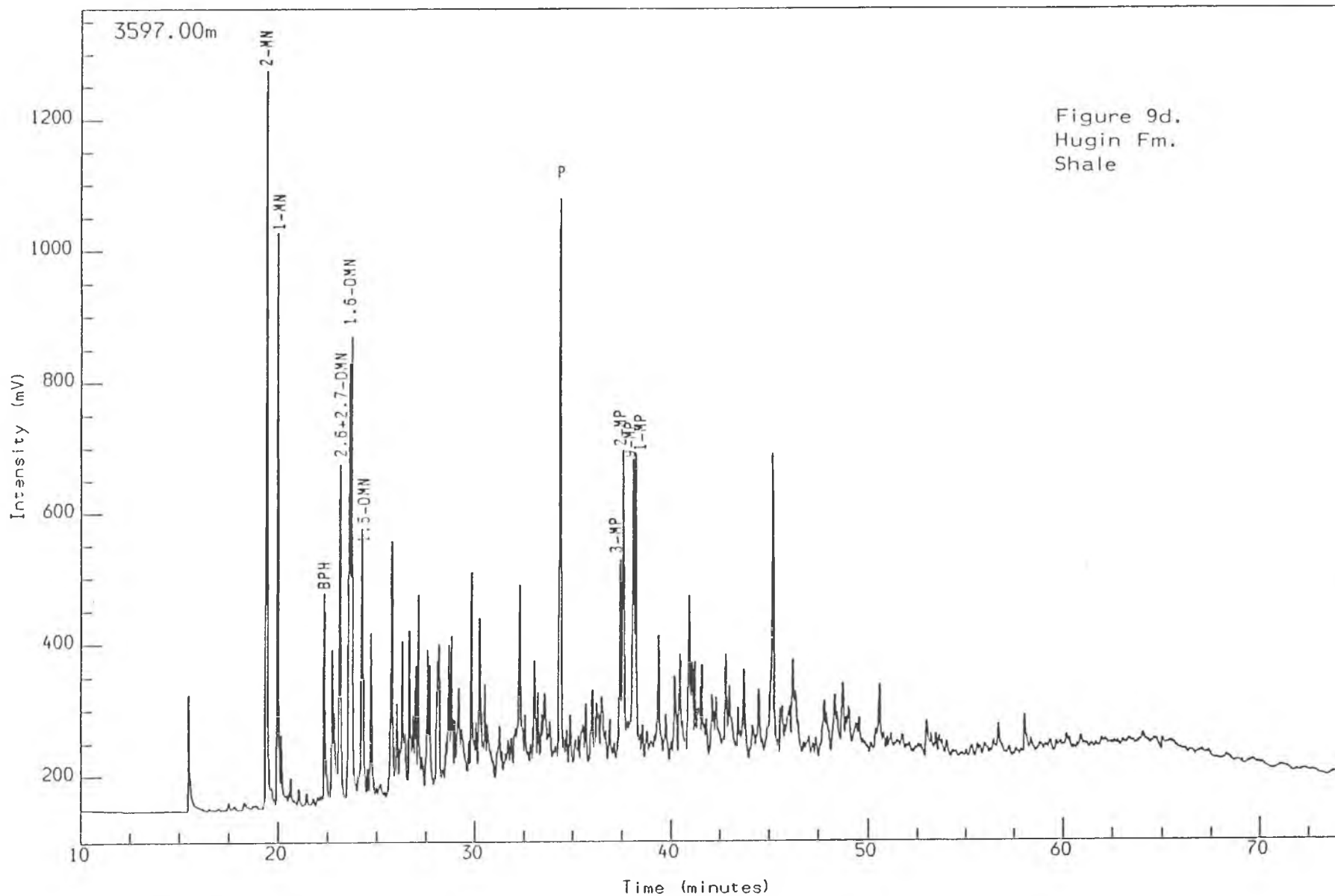


Figure 9d.
Hugin Fm.
Shale

WELL NOCS 30/11-4 3597.00m cut
AROMATIC GC (FID)
Sh/Clst: m gy to drk gy to brn blk

Reported on 21-OCT-1991 at 15:20

GEOLAB  NOR

Analysis Name : [522006] 30 AF1201161LB,8,1.

Multichrom

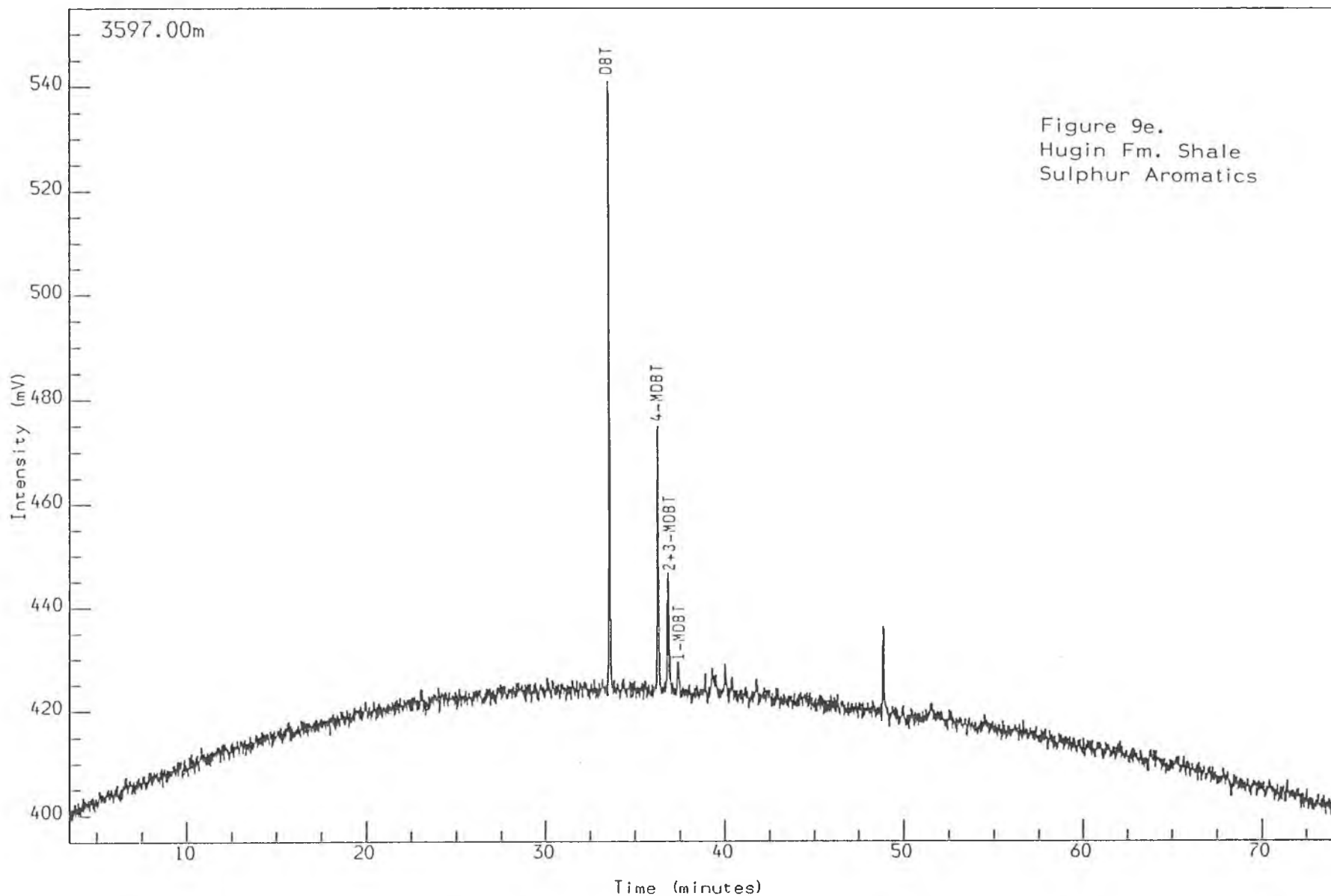


Figure 9e.
Hugin Fm. Shale
Sulphur Aromatics

WELL NOCS 30/11-4 3597.00m cut
AROMATIC GC (FPD)
Sh/Clst: m gy to drk gy to brn blk

Reported on 22-OCT-1991 at 08:31

Analysis Name : [522006] 29 AF1201161LB,6,1.

Multichrom

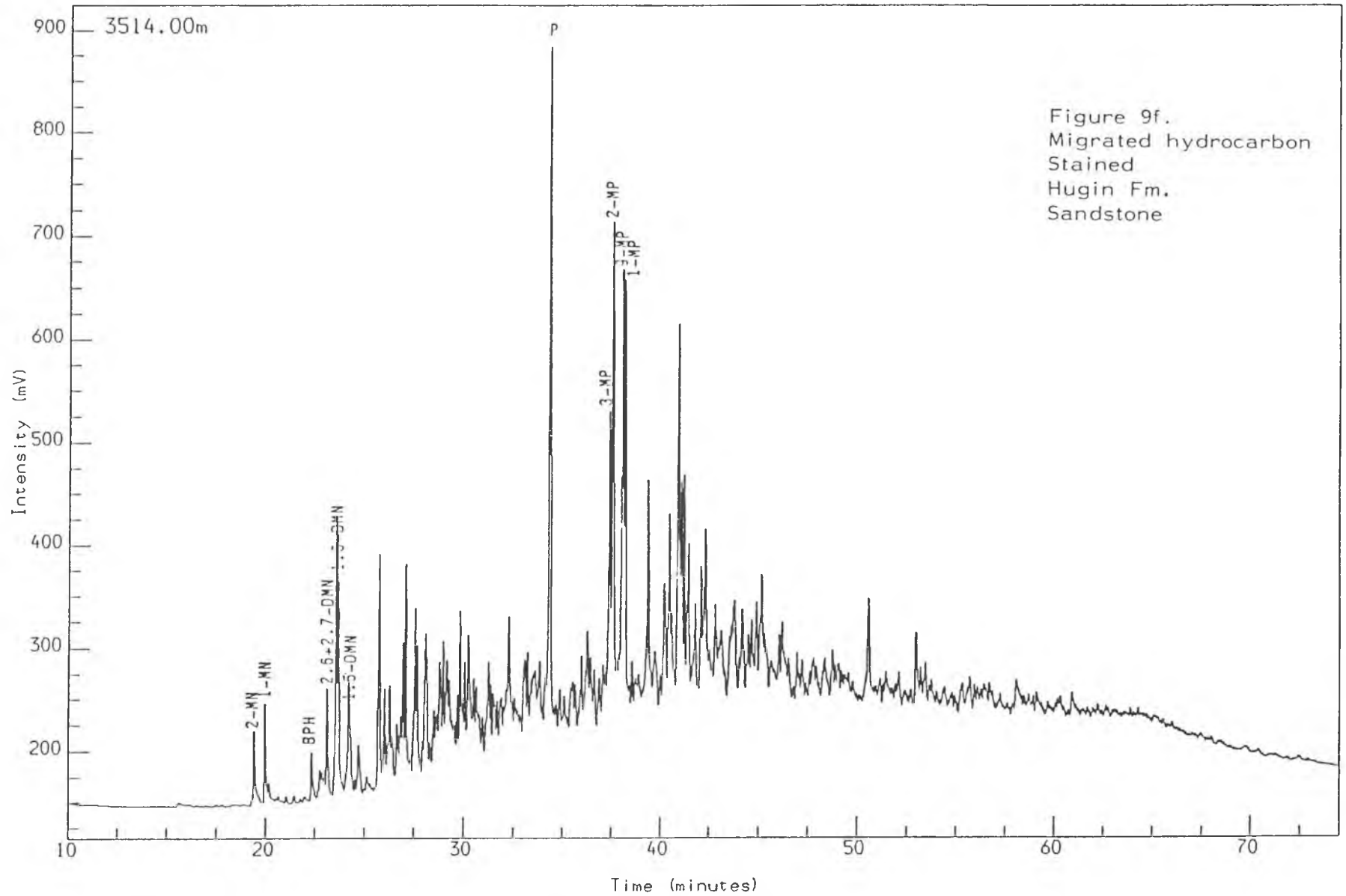


Figure 9f.
Migrated hydrocarbon
Stained
Hugin Fm.
Sandstone

WELL NOCS 30/11-4
AROMATIC GC (FID)
S/Sst: brn gy

3514.00m ccp

Reported on 21-OCT-1991 at 14:58

GEOLAB  NOR

Analysis Name : [522006] 30 AF1201161LB,6,1.

Multichrom

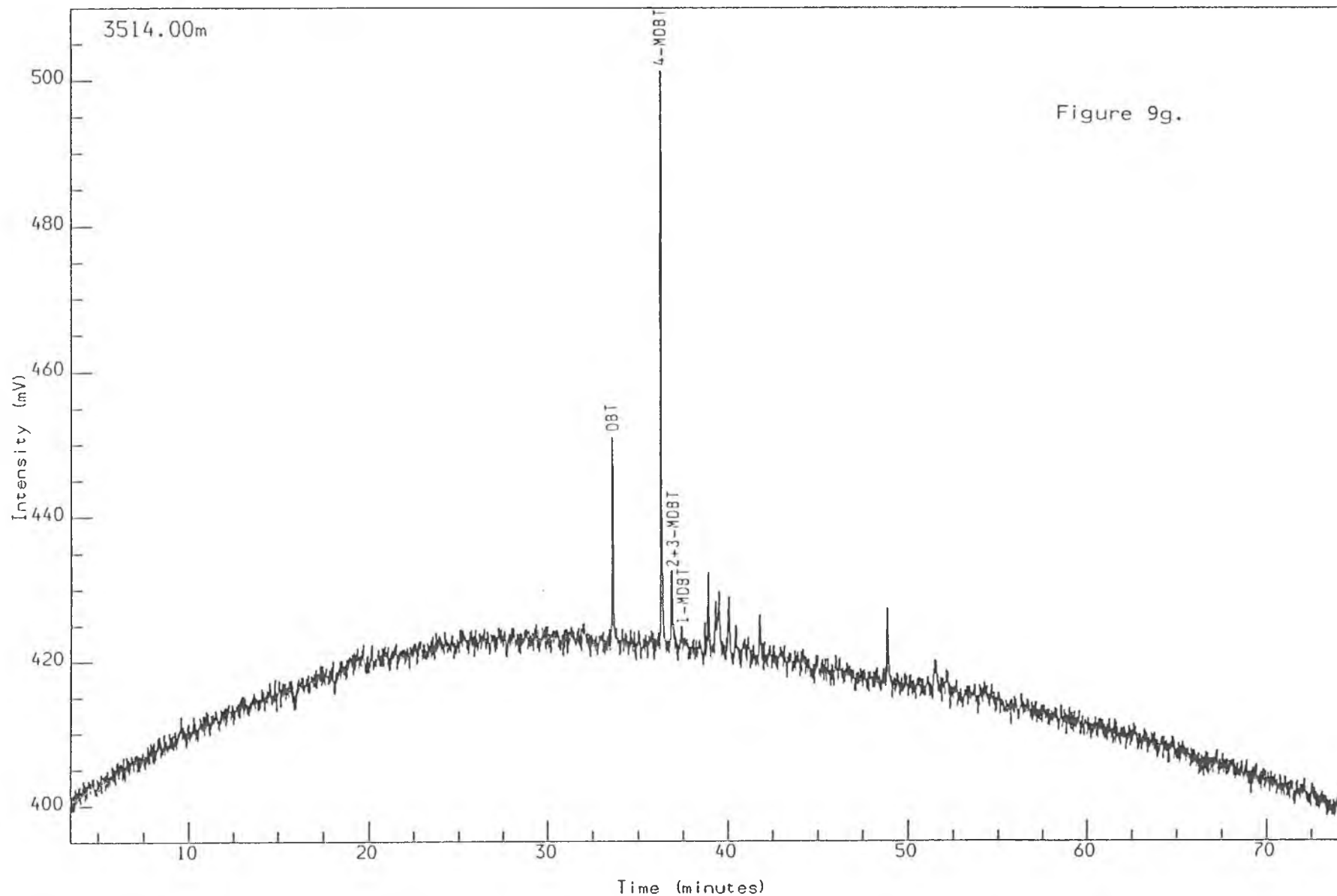


Figure 9g.

WELL NOCS 30/11-4
AROMATIC GC (FPD)
S/Sst: brn gy

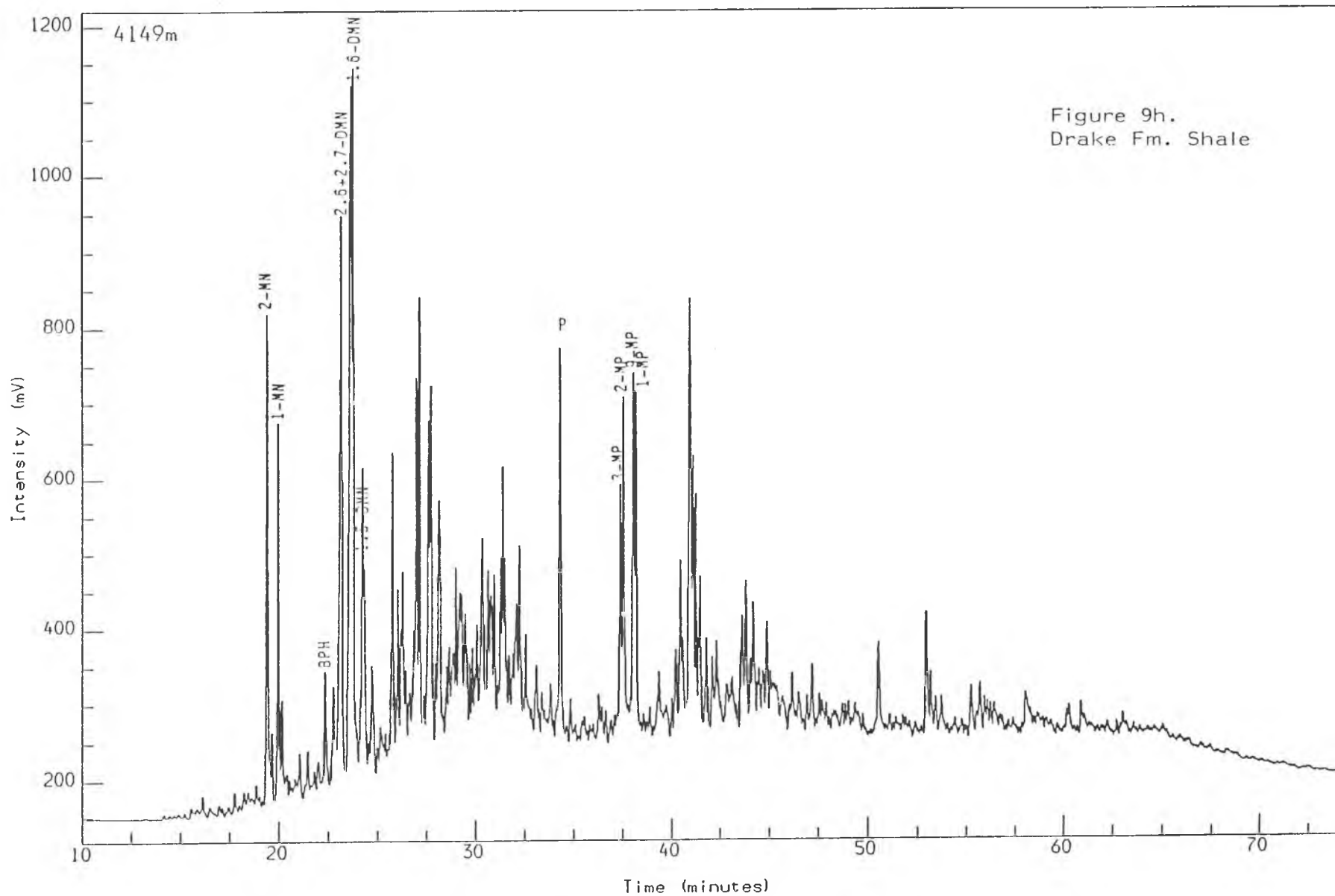
3514.00m ccp

Reported on 22-OCT-1991 at 08:26

GEOLAB  NOR

Analysis Name : [522006] 29 AF1201161LB.10.1.

Multichrom



WELL NOCS 30/11-4 4149.00m cut
AROMATIC GC (FID)
Sh/Clst: brn gy to brn blk

Reported on 21-OCT-1991 at 15:30

GEOLAB  NOR

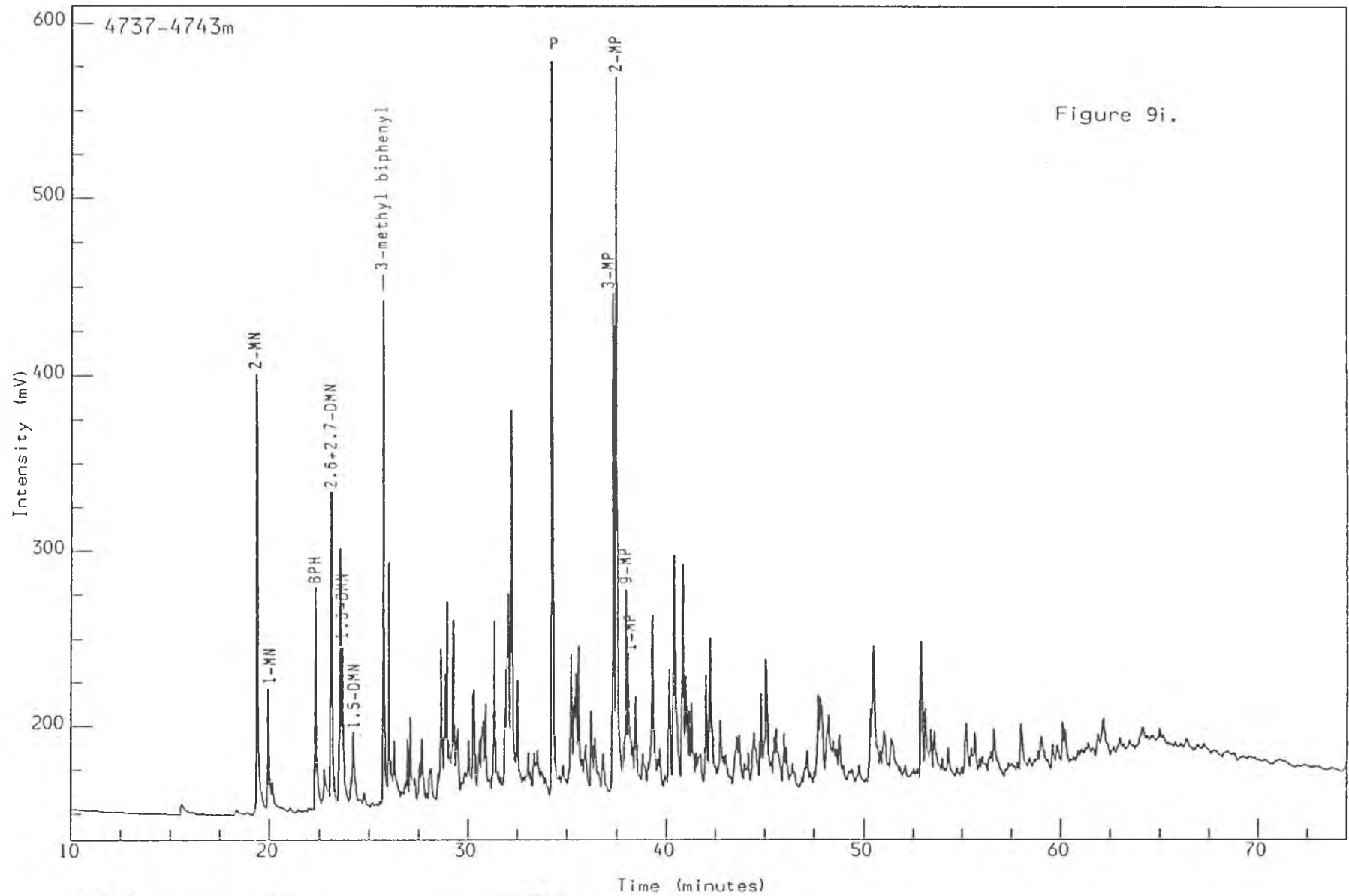


Figure 9i.

WELL NOCB 30/11-4 4737-4743m
AROMATIC GC (FID)
BR/6121m by to dek by to ben
616

Reported on 21-OCT-1991 at 15:37

Analysis Name : [522006] 30 AF1201161LB,10,1.

Multichrom

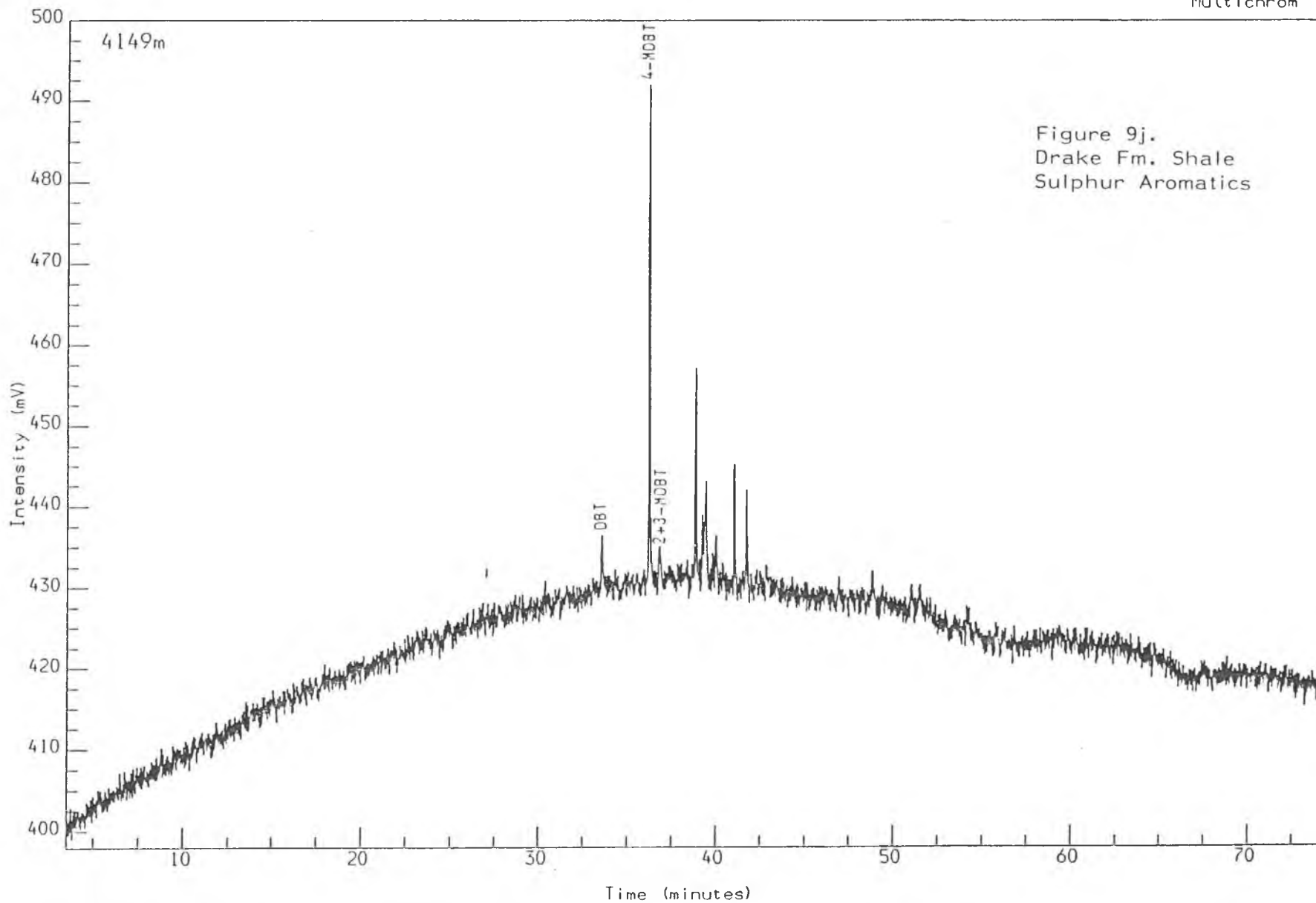


Figure 9j.
Drake Fm. Shale
Sulphur Aromatics

WELL NOCS 30/11-4 4149.00m cut
AROMATIC GC (FPD)
Sh/Clst: brn gy to brn blk

Reported on 22-OCT-1991 at 08:38

Figure 10: Vitrinite Reflectance versus Depth
 . Well NOCS 30/11-4

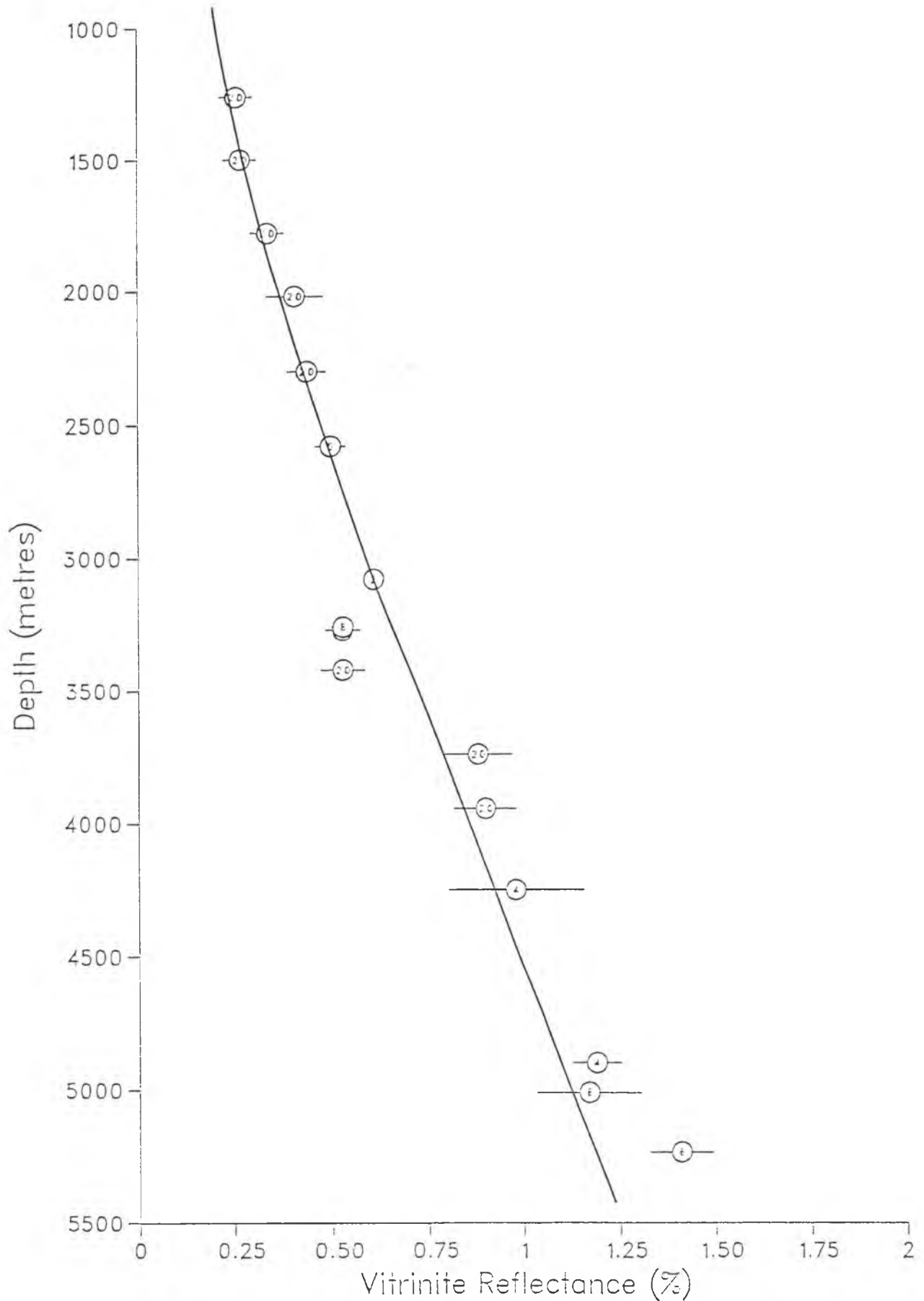


Figure 11: Kerogen Composition and Potential Hydrocarbon Products

Well NOCS 30/11-4

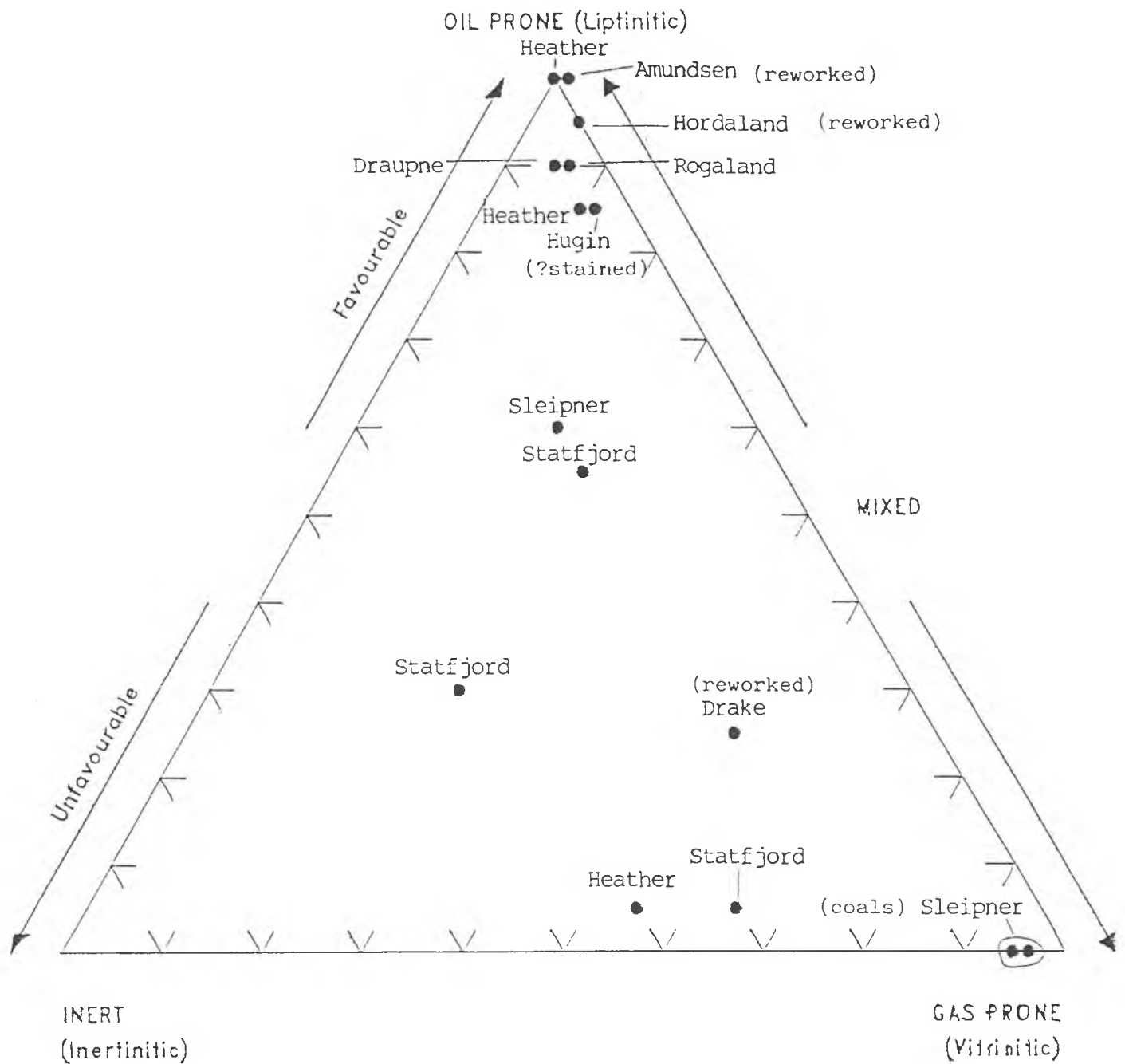
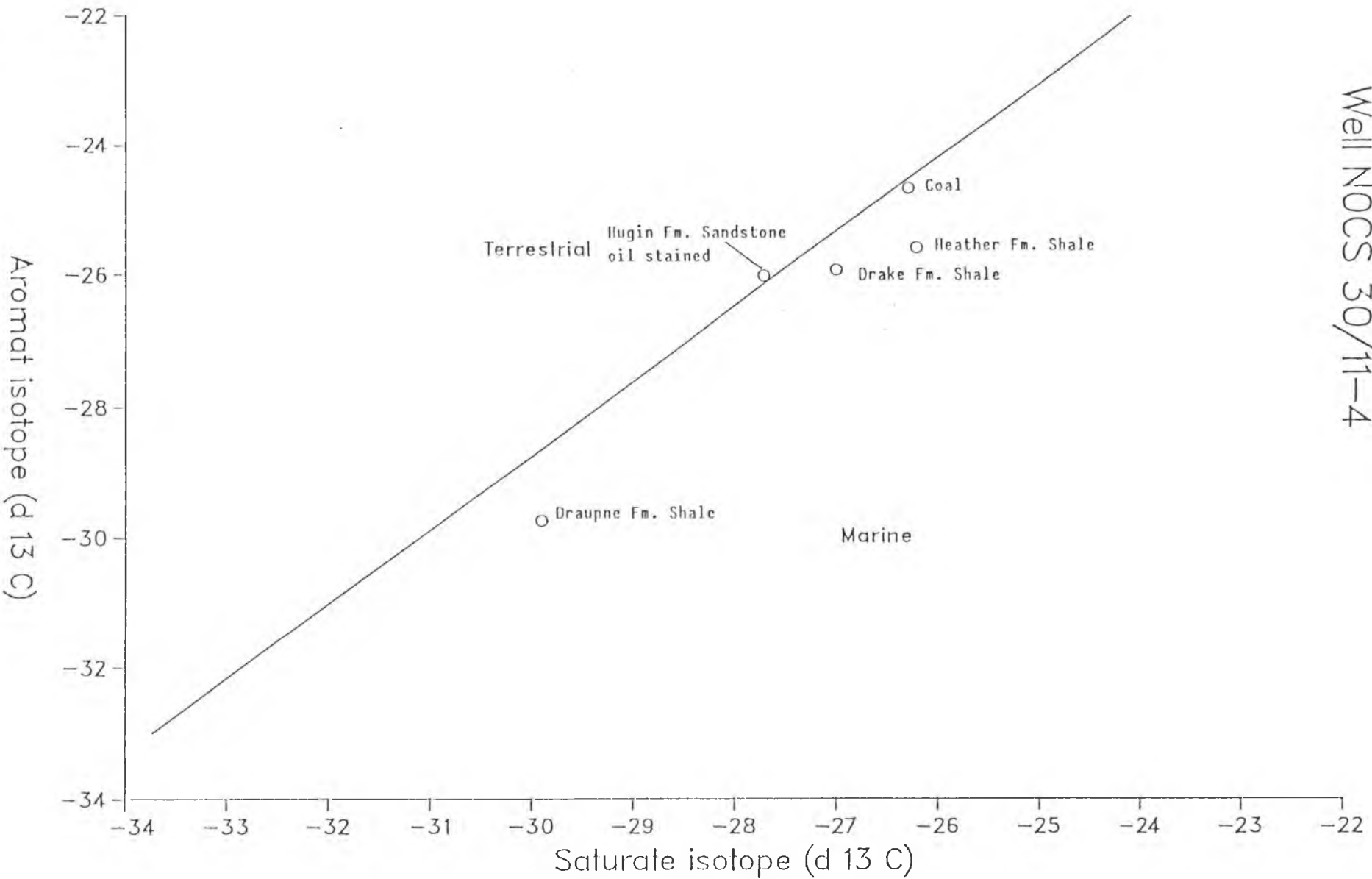


Figure 12: Aromatic v.s. saturate isotope values
Well NOCS 30/11-4



GEOLAB NOR a.s. - Geochemical Laboratories of Norway

Figure 13: $^{13}\text{C}/^{12}\text{C}$ isotope ratios. Galimov plot.
Well NOCS 30/11-4

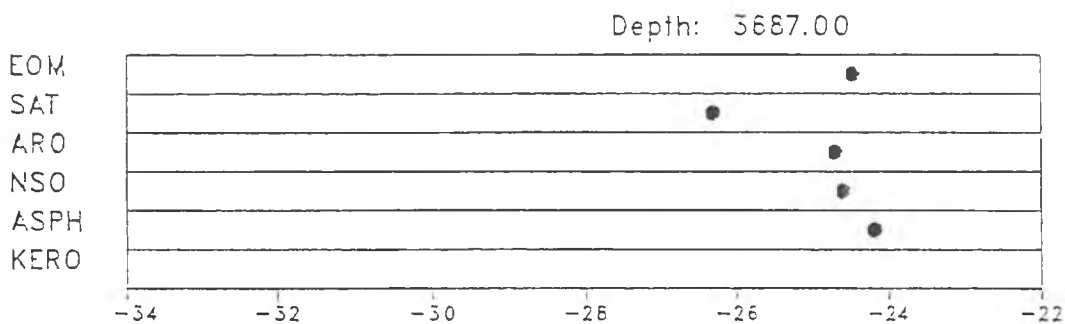
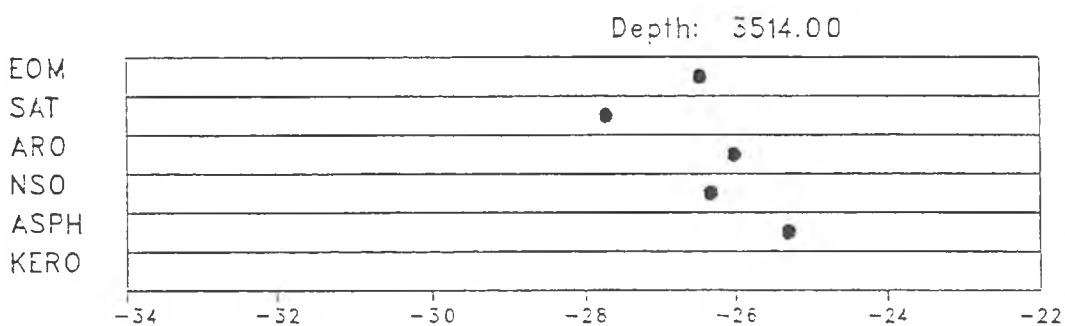
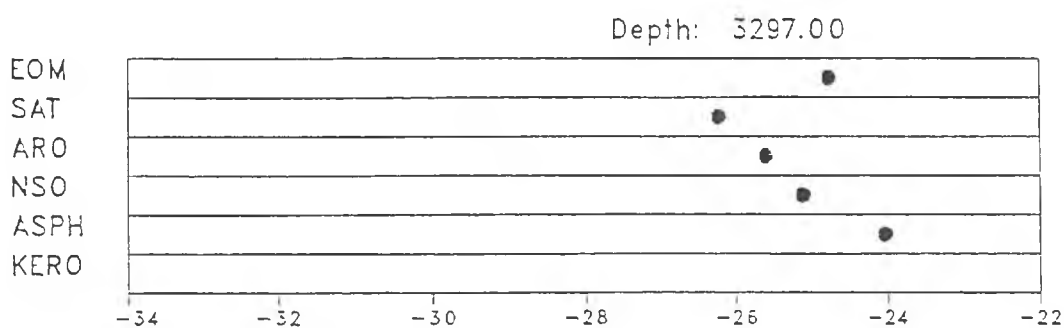
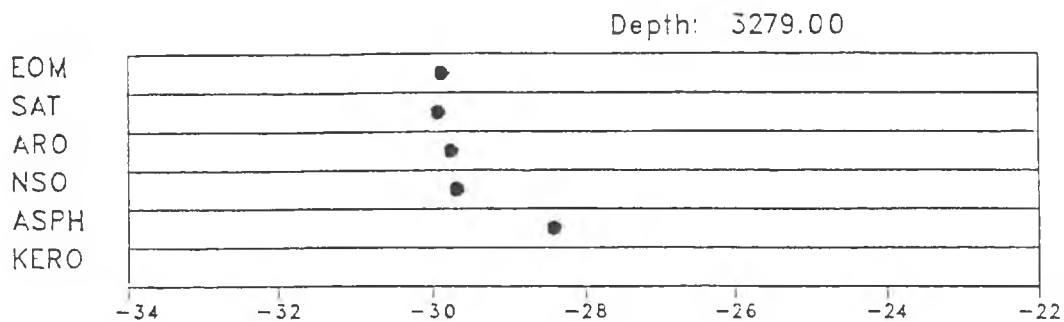
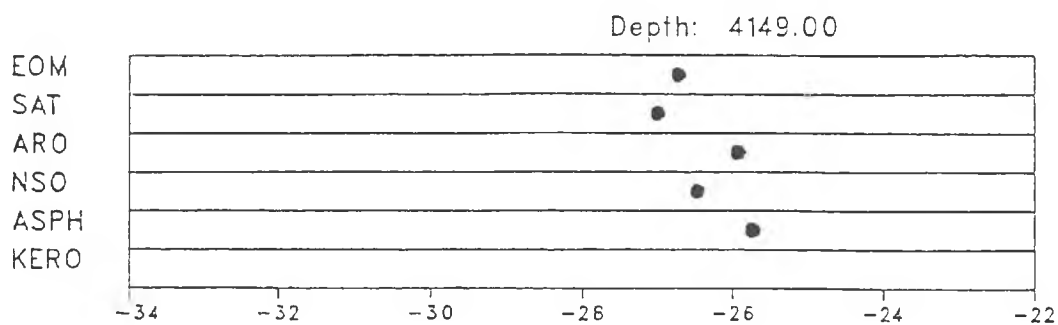


Figure 13: $^{13}\text{C}/^{12}\text{C}$ isotope ratios. Galimov plot.

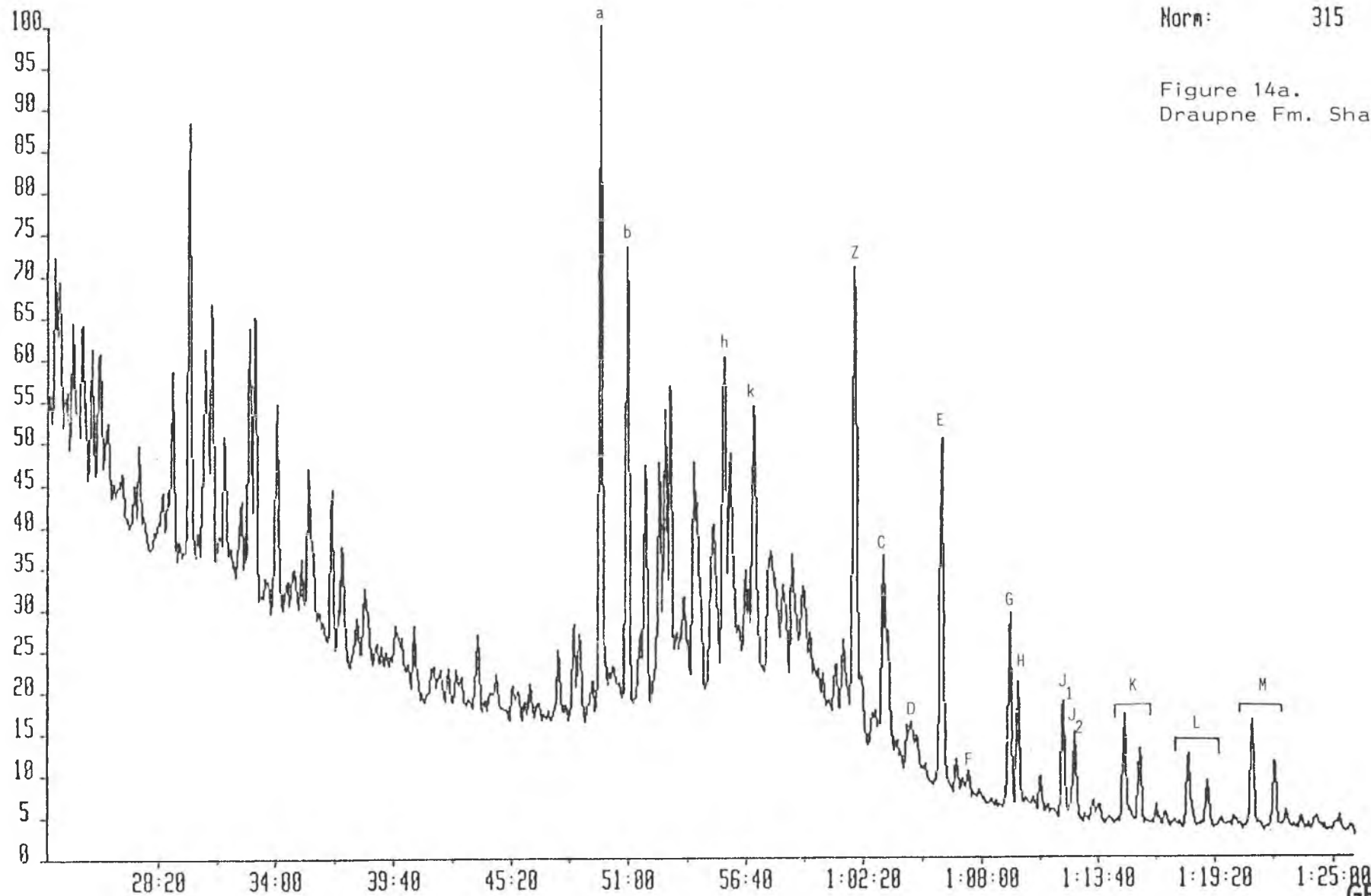
Well NOCS 30/11-4



KEYSAT9 18-OCT-31 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 6 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/11-4, 3279M, SATURATED FRACTION Mainly Diasteranes

Norm: 315

Figure 14a.
Draupne Fm. Shale

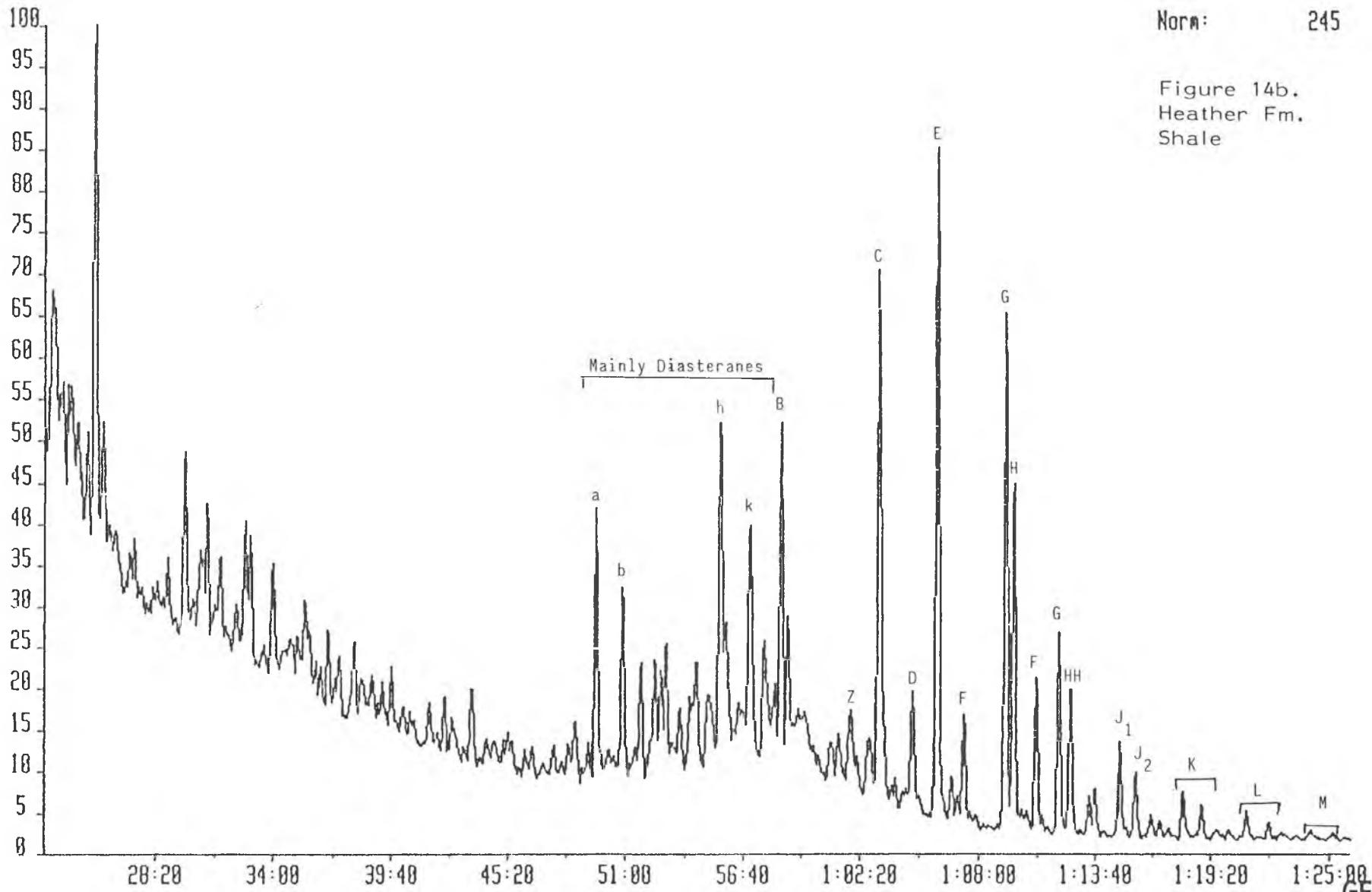


KEYSAT9 18-OCT-91 Site:Magnetic TS250 Acnt:GEOLAB
Sample 7 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/11-4, 3297M, SATURATED FRACTION

System:SAT1

Norm: 245

Figure 14b.
Heather Fm.
Shale

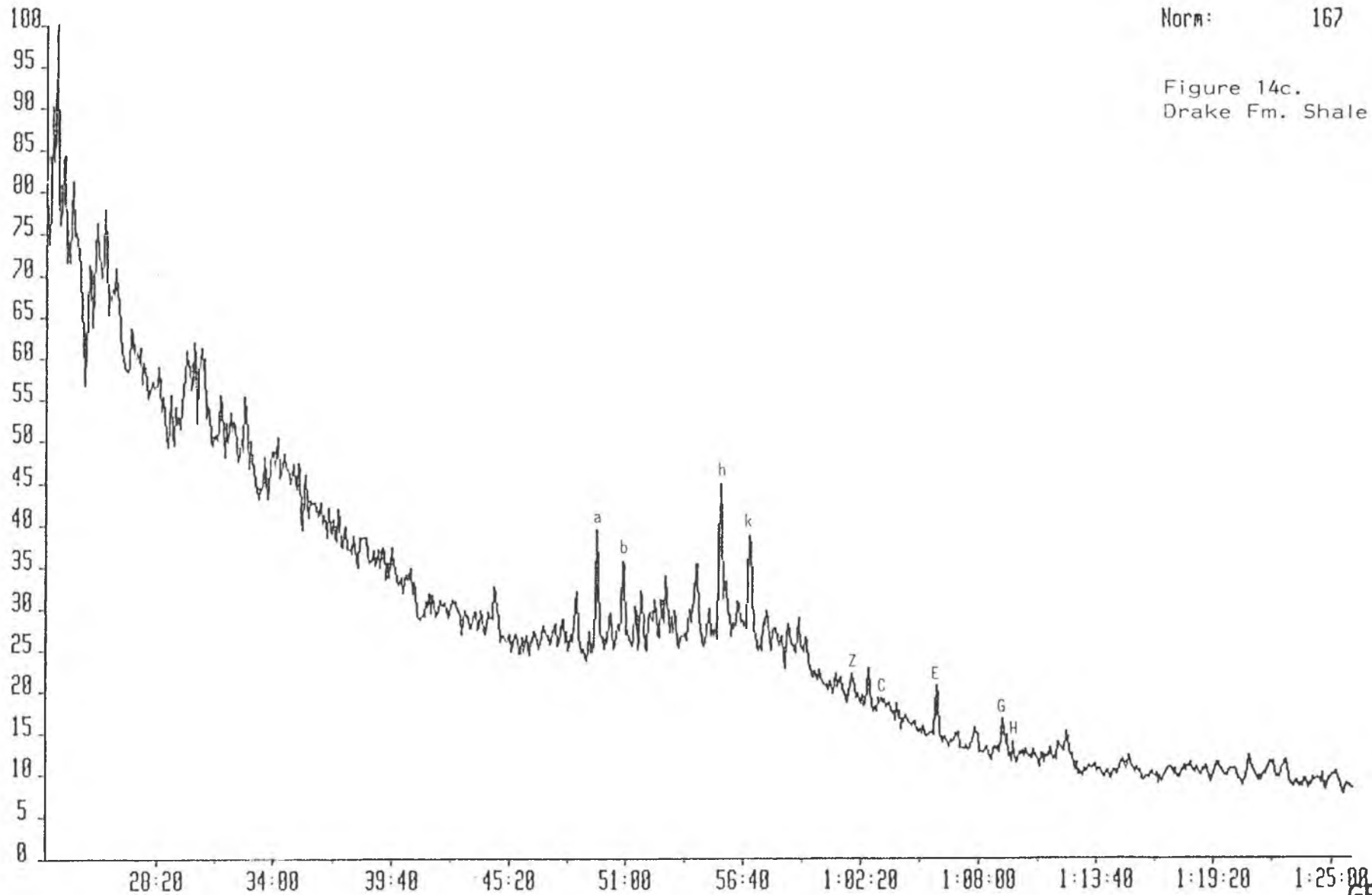


KEYSAT9 10-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 10 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/11-4, 4149M, SATURATED FRACTION

System:SAT1

Norm: 167

Figure 14c.
Drake Fm. Shale

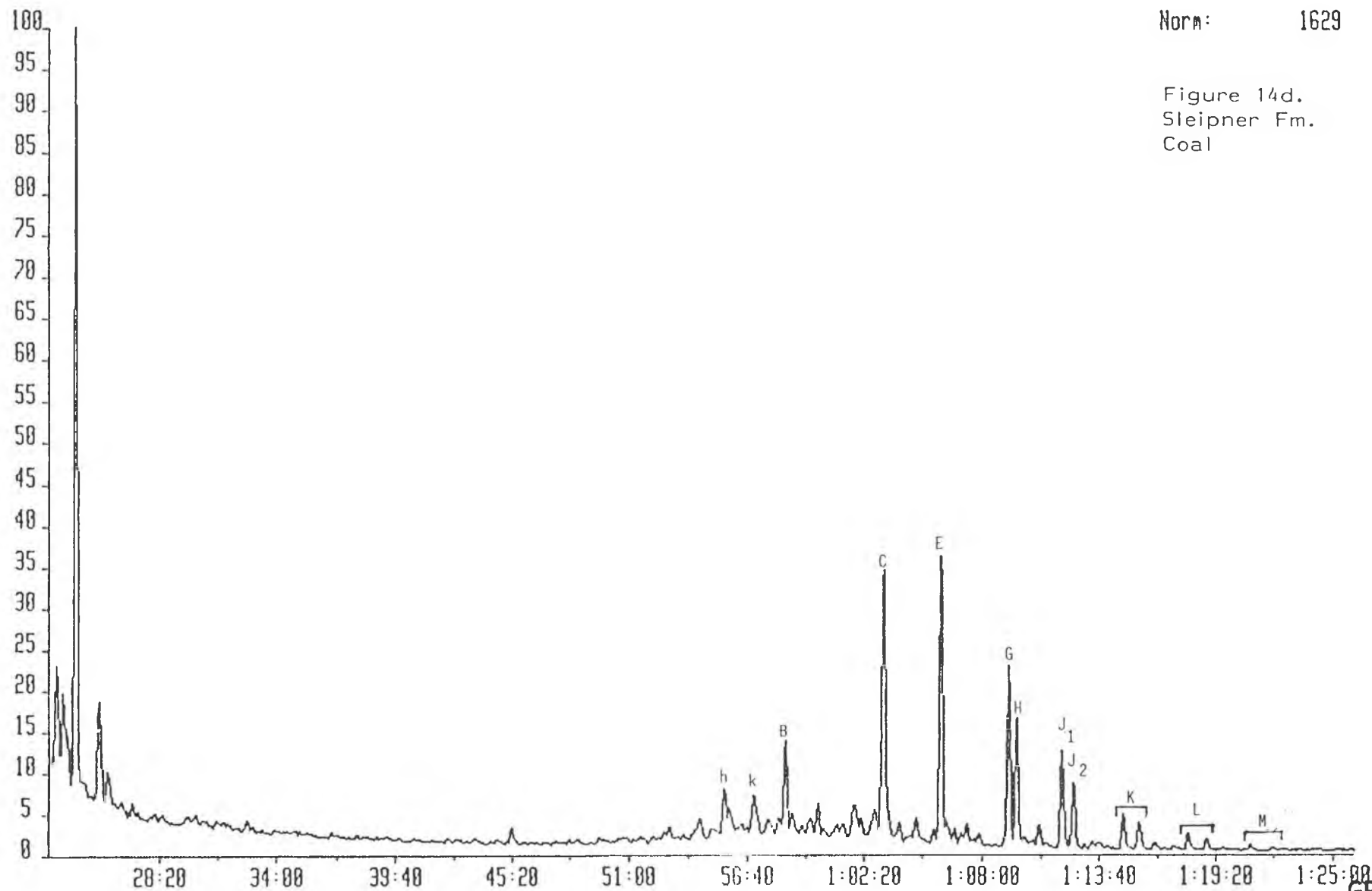


KEYSAT9 18-OCT-91 Sir:Magnetic TS258 Rent:GEOLAB
Sample 9 Injection 1 Group 1 Mass 163.1485
Text:WELL 38/11-4, 3687M, SATURATED FRACTION

System:SAT1

Norm: 1629

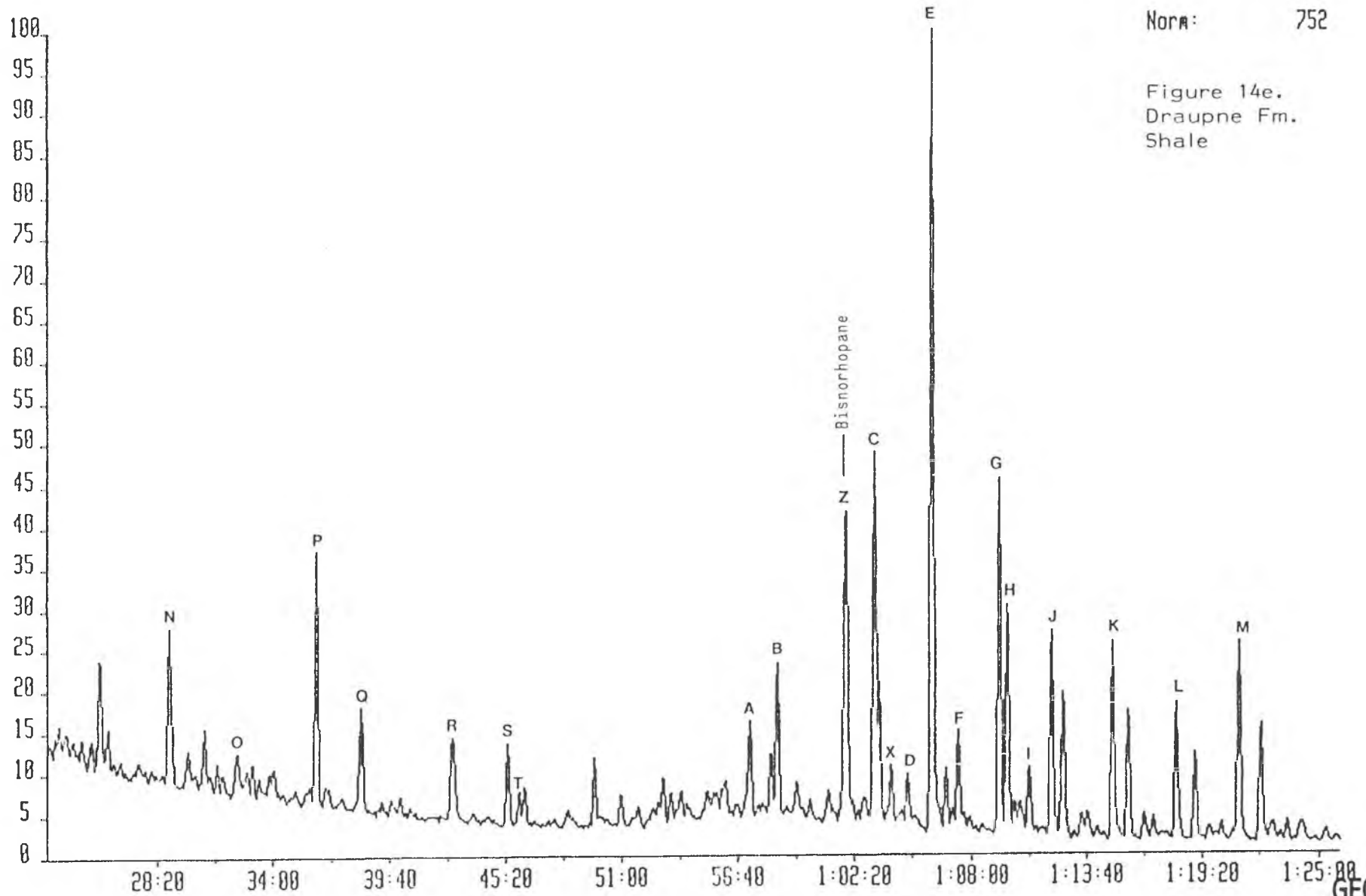
Figure 14d.
Sleipner Fm.
Coal



KEYSAT9 18-OCT-91 Site:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 6 Injection 1 Group 1 Mass 191.1000
Text:WELL 30/11-4, 3279M, SATURATED FRACTION

Norm: 752

Figure 14e.
Draupne Fm.
Shale

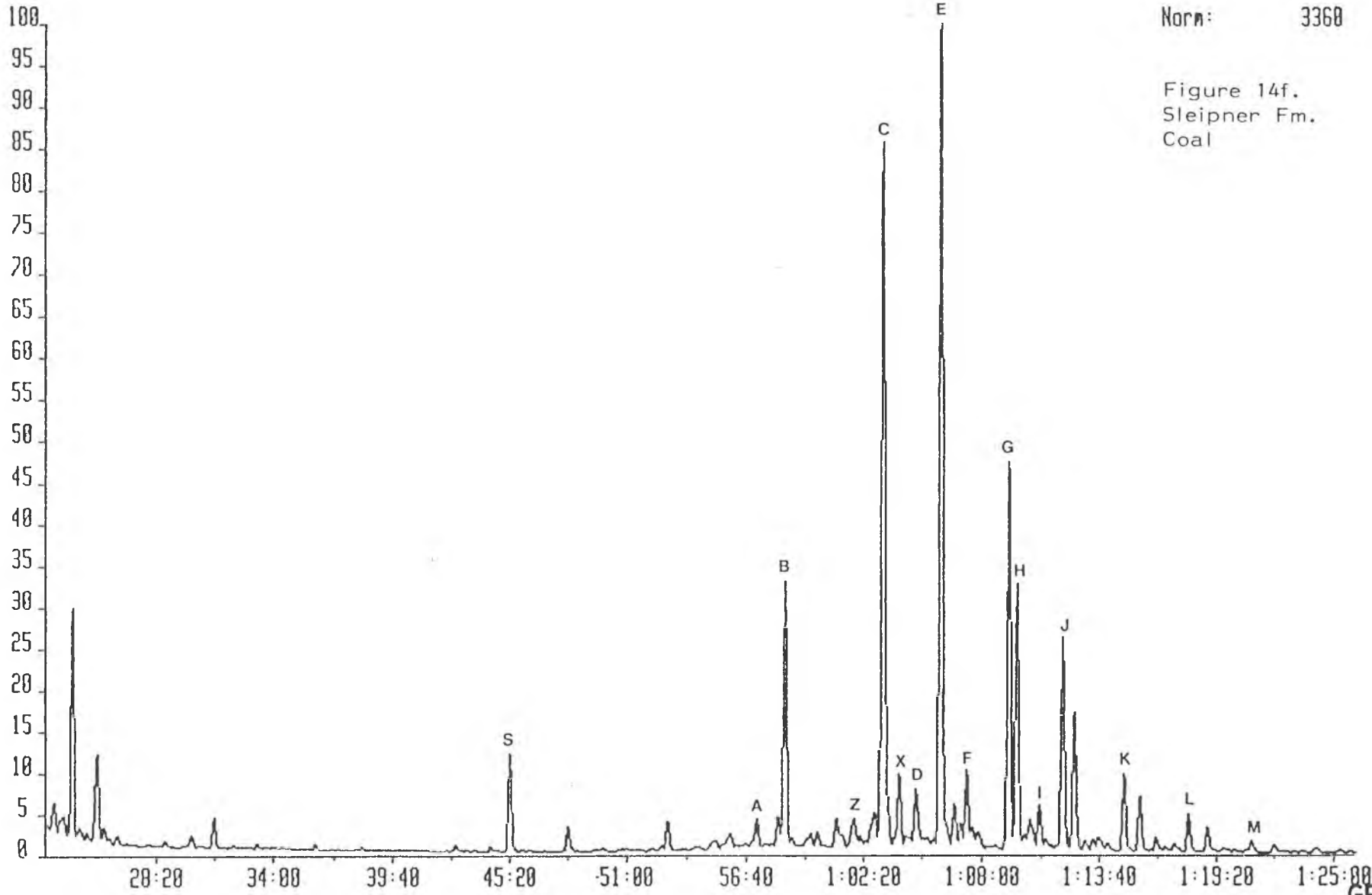


KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 9 Injection 1 Group 1 Mass 191.1000
Text:WELL 30/11-4, 3607M, SATURATED FRACTION

System:SAT1

Norm: 3360

Figure 14f.
Sleipner Fm.
Coal

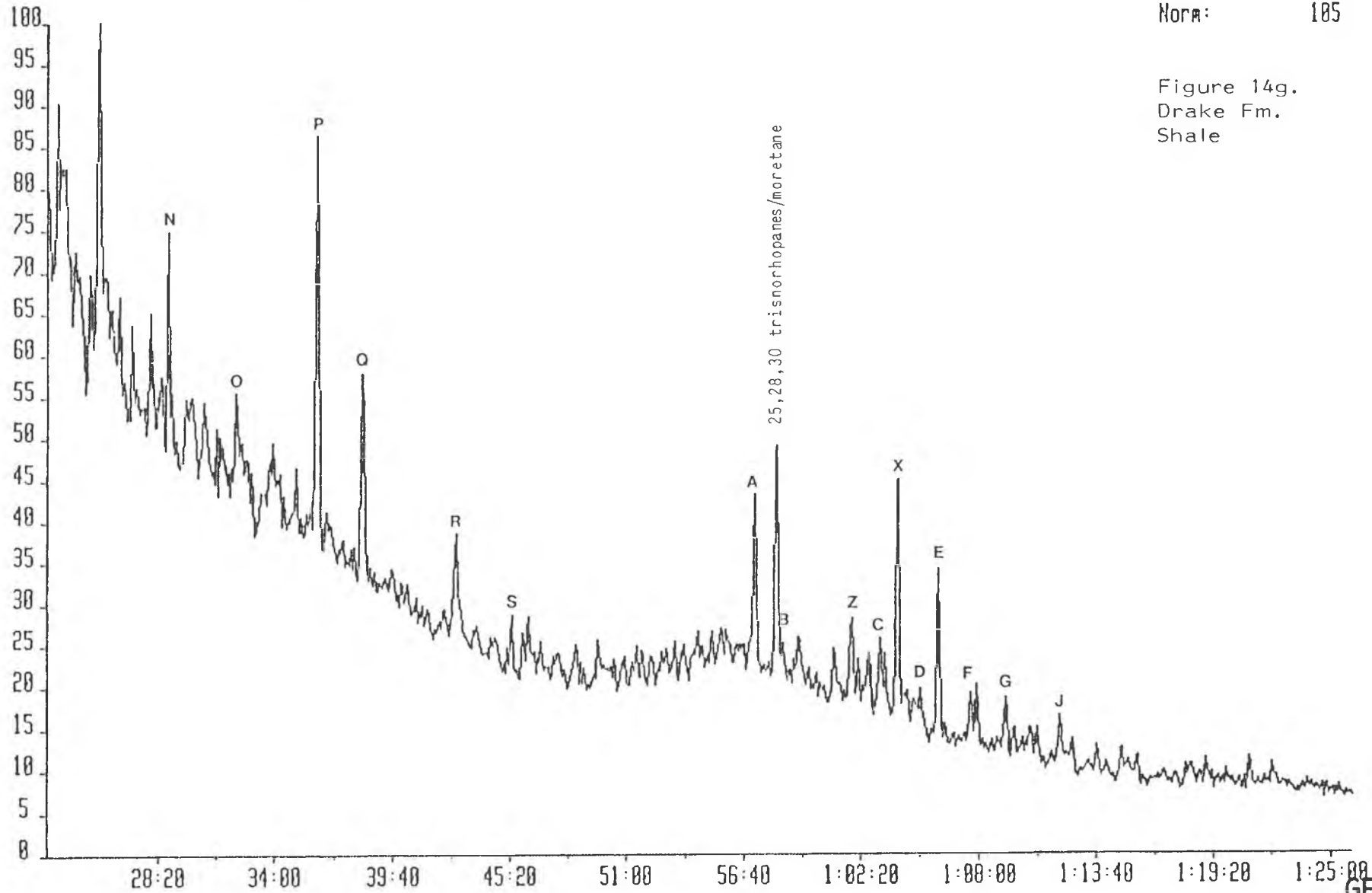


KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 10 Injection 1 Group 1 Mass 191.1000
Text:WELL 30/11-4, 4149M, SATURATED FRACTION

System:SAT1

Norm: 105

Figure 14g.
Drake Fm.
Shale

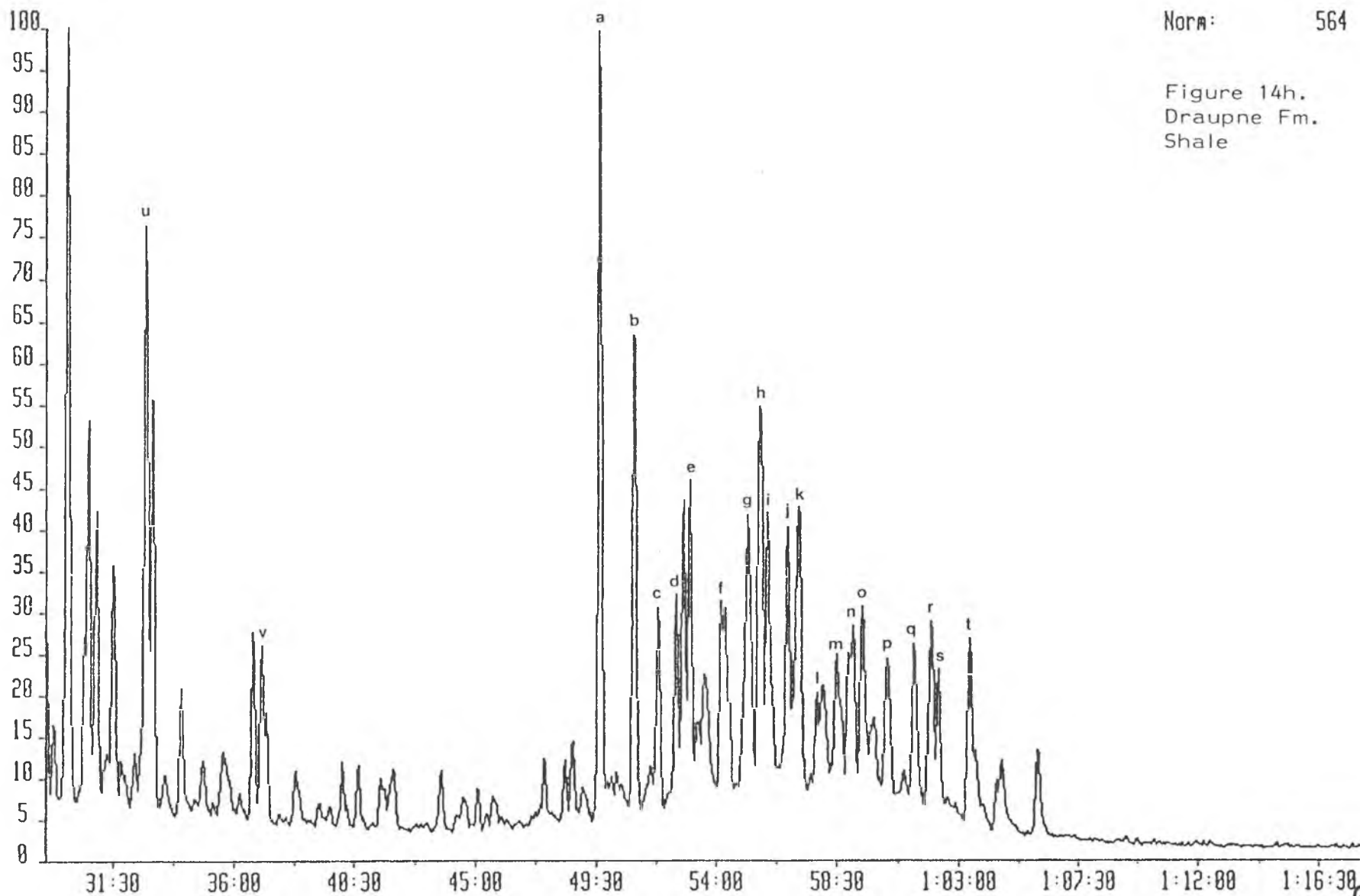


KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Rcnt:GEOLAB
Sample 6 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/11-4, 3279M, SATURATED FRACTION

System:SAT1

Norm: 564

Figure 14h.
Draupne Fm.
Shale

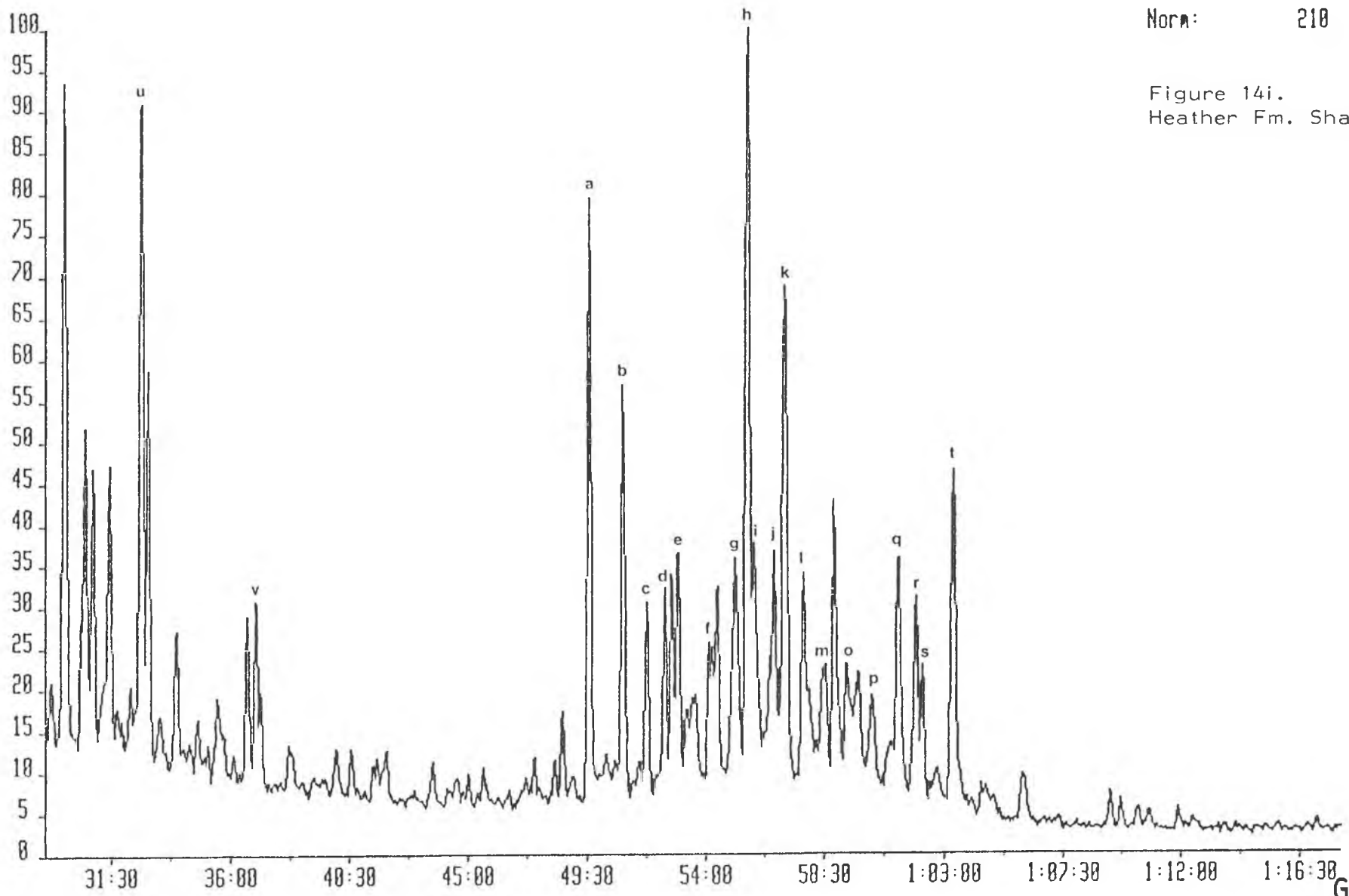


KEYSAT9 10-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 7 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/11-4, 3297M, SATURATED FRACTION

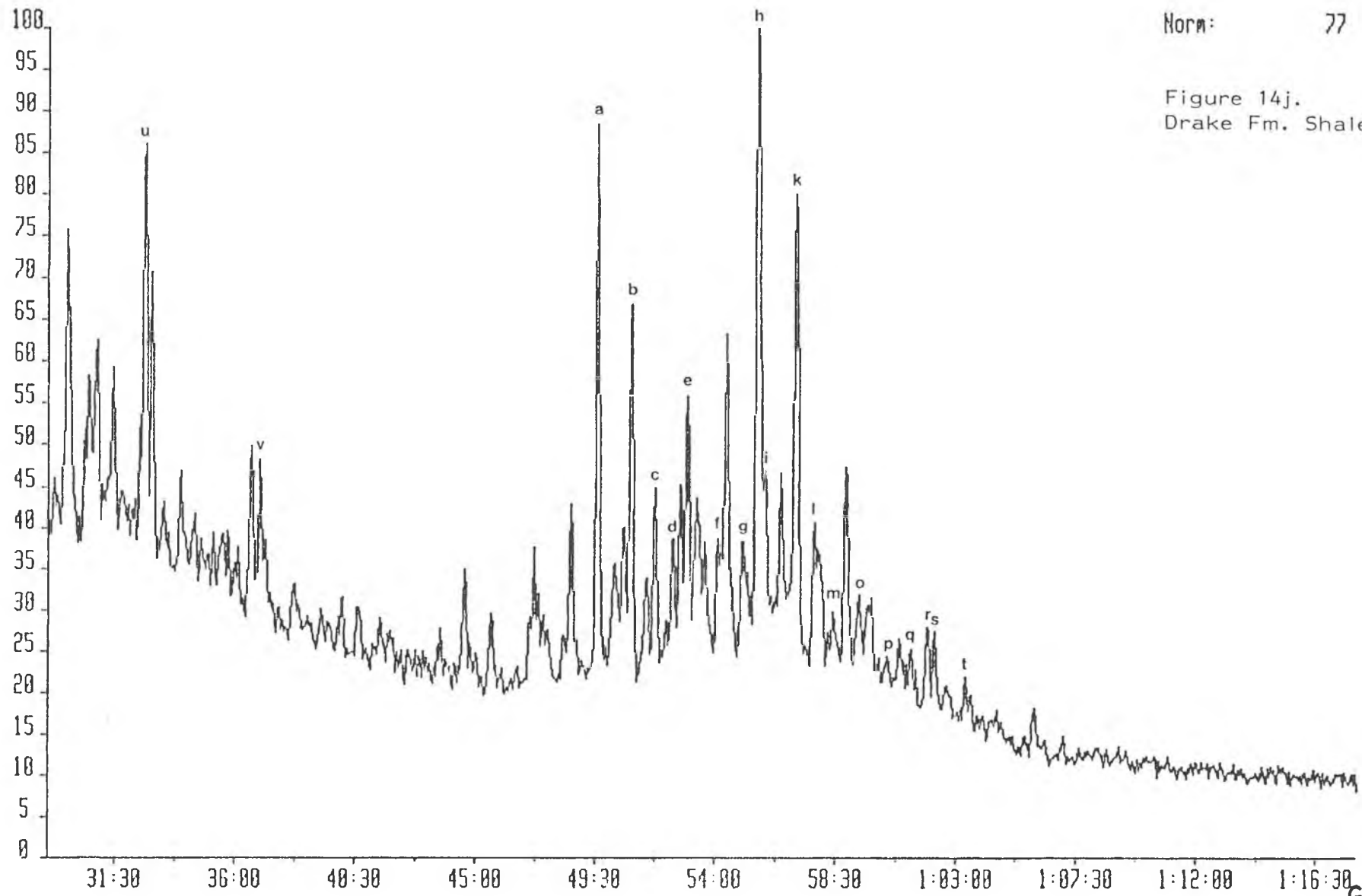
System:SAT1

Norm: 210

Figure 14i.
Heather Fm. Shale



KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 10 Injection 1 Group 1 Mass 217.1956
Text:WELL 38/11-4, 4149M, SATURATED FRACTION



Norm: 77

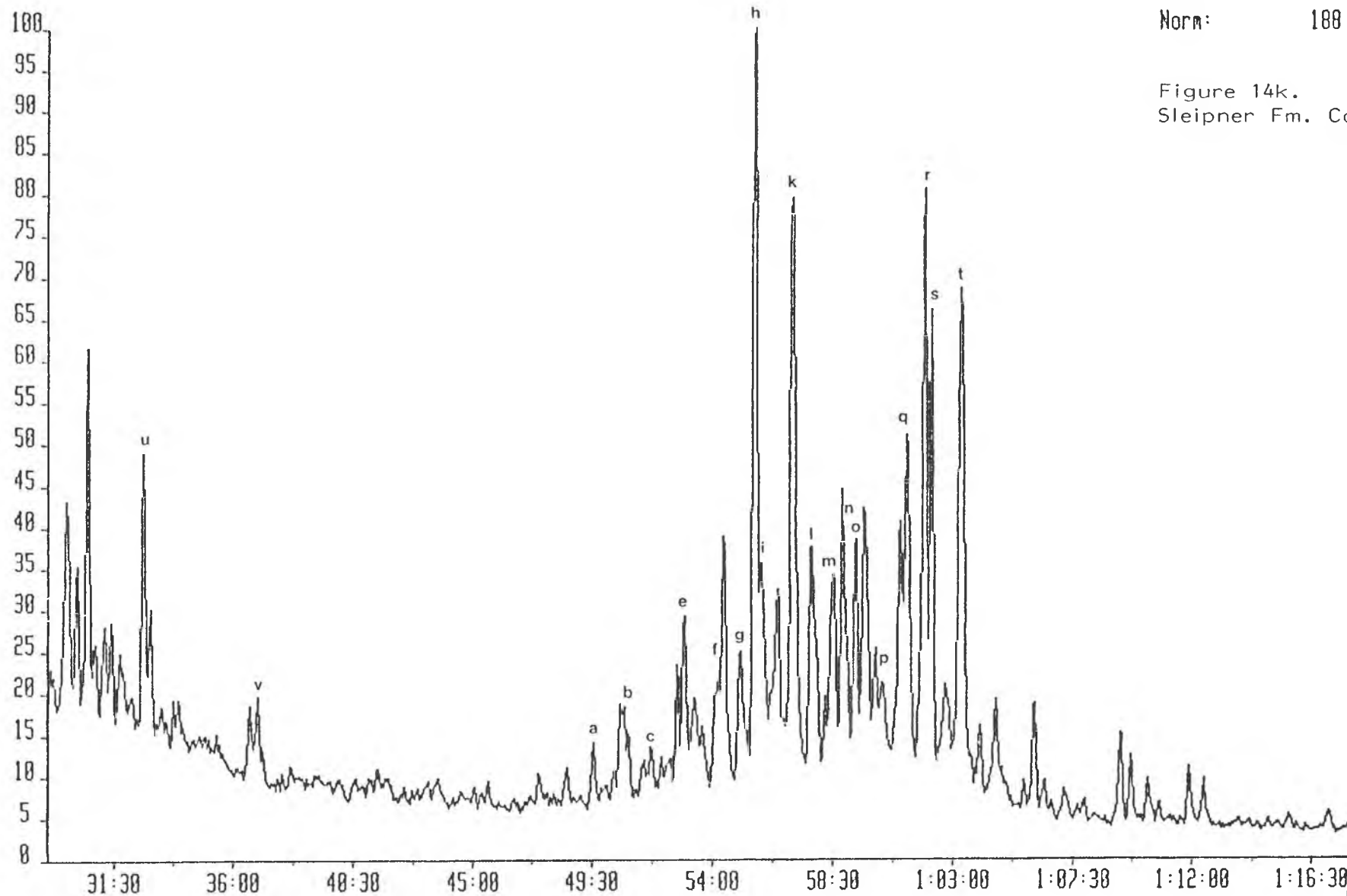
Figure 14j.
Drake Fm. Shale

KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 9 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/11-4, 3607M, SATURATED FRACTION

System:SAT1

Norm: 100

Figure 14k.
Sleipner Fm. Coal

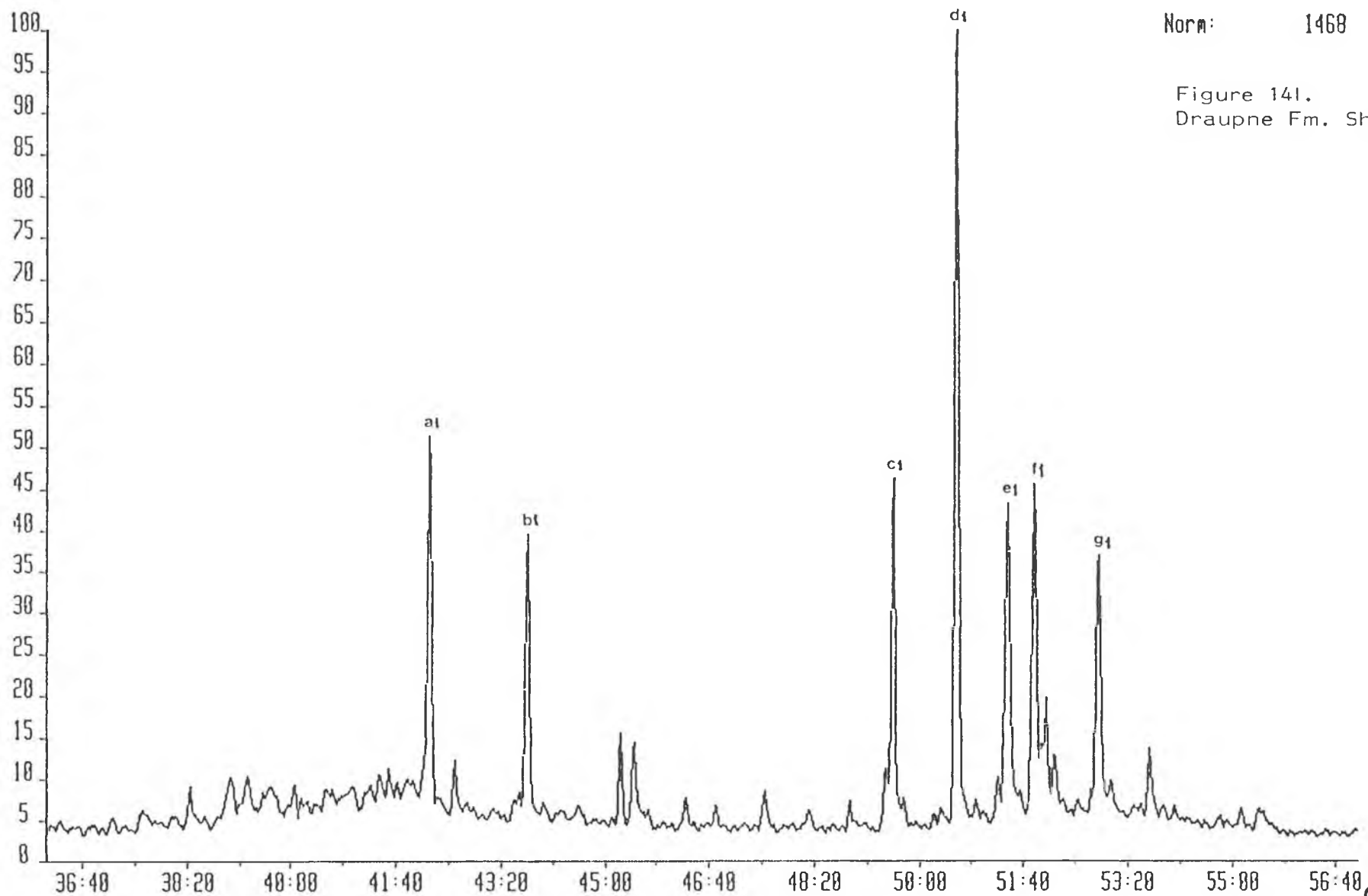


KEYAR09 21-OCT-91 Site:Magnetic TS258 Acnt:GEOLAB
Sample 6 Injection 1 Group 1 Mass 231.1174
Text:WELL 30/11-4, 3279M, AROMATIC FRACTION

System:AR01

Norm: 1468

Figure 141.
Draupne Fm. Shale

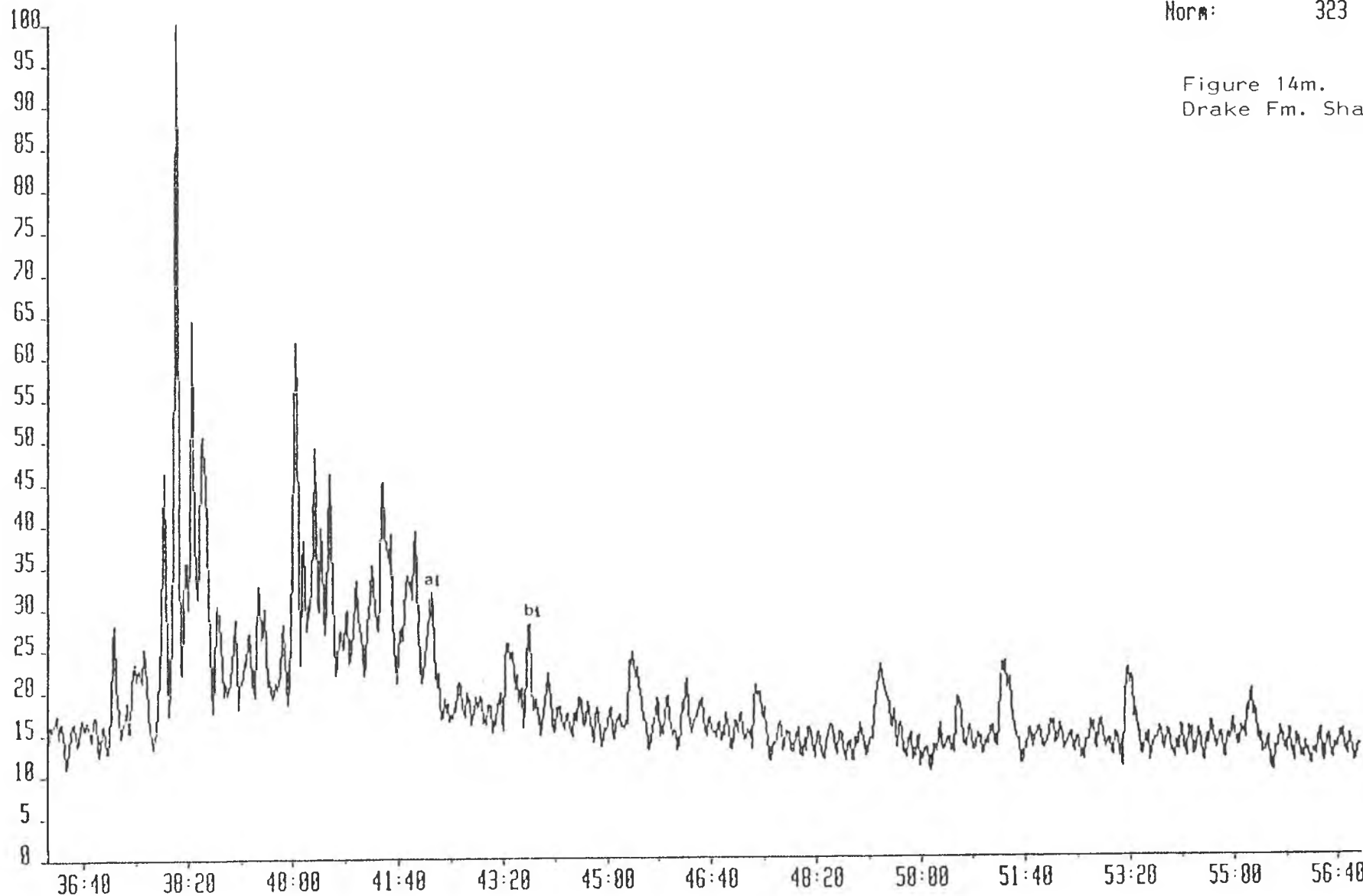


KEYAR09 21-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 10 Injection 1 Group 1 Mass 231.1174
Text:WELL 38/11-4, 4149M, AROMATIC FRACTION

System:AK01

Norm: 323

Figure 14m.
Drake Fm. Shale

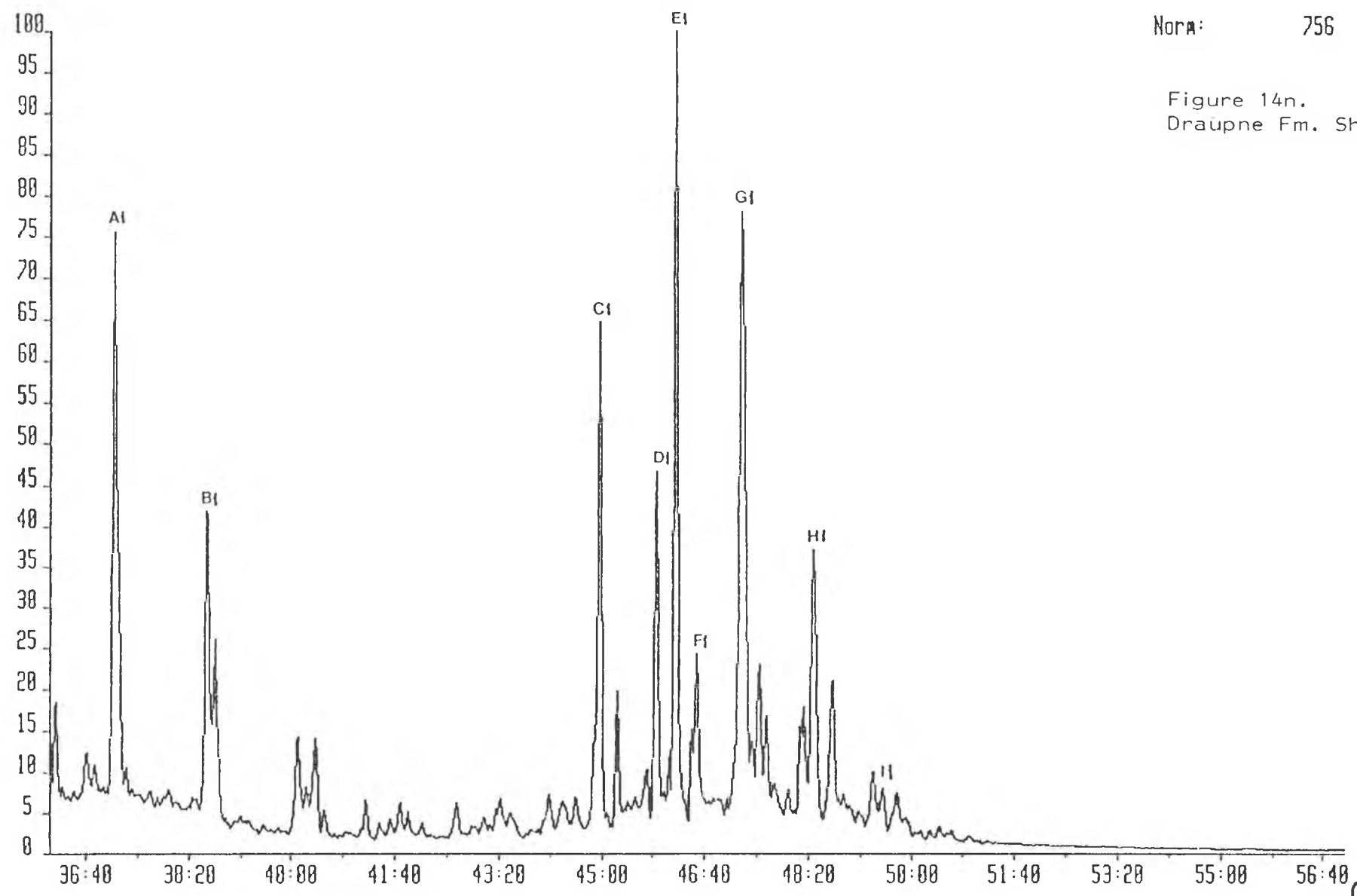


KEYAR09 21-OCT-91 Site:Magnetic TS250 Acnt:GEOLAB
Sample 6 Injection 1 Group 1 Mass 253.1956
Text:WELL 30/11-4, 3279M, AROMATIC FRACTION

System:AR01

Norm: 756

Figure 14n.
Draupne Fm. Shale

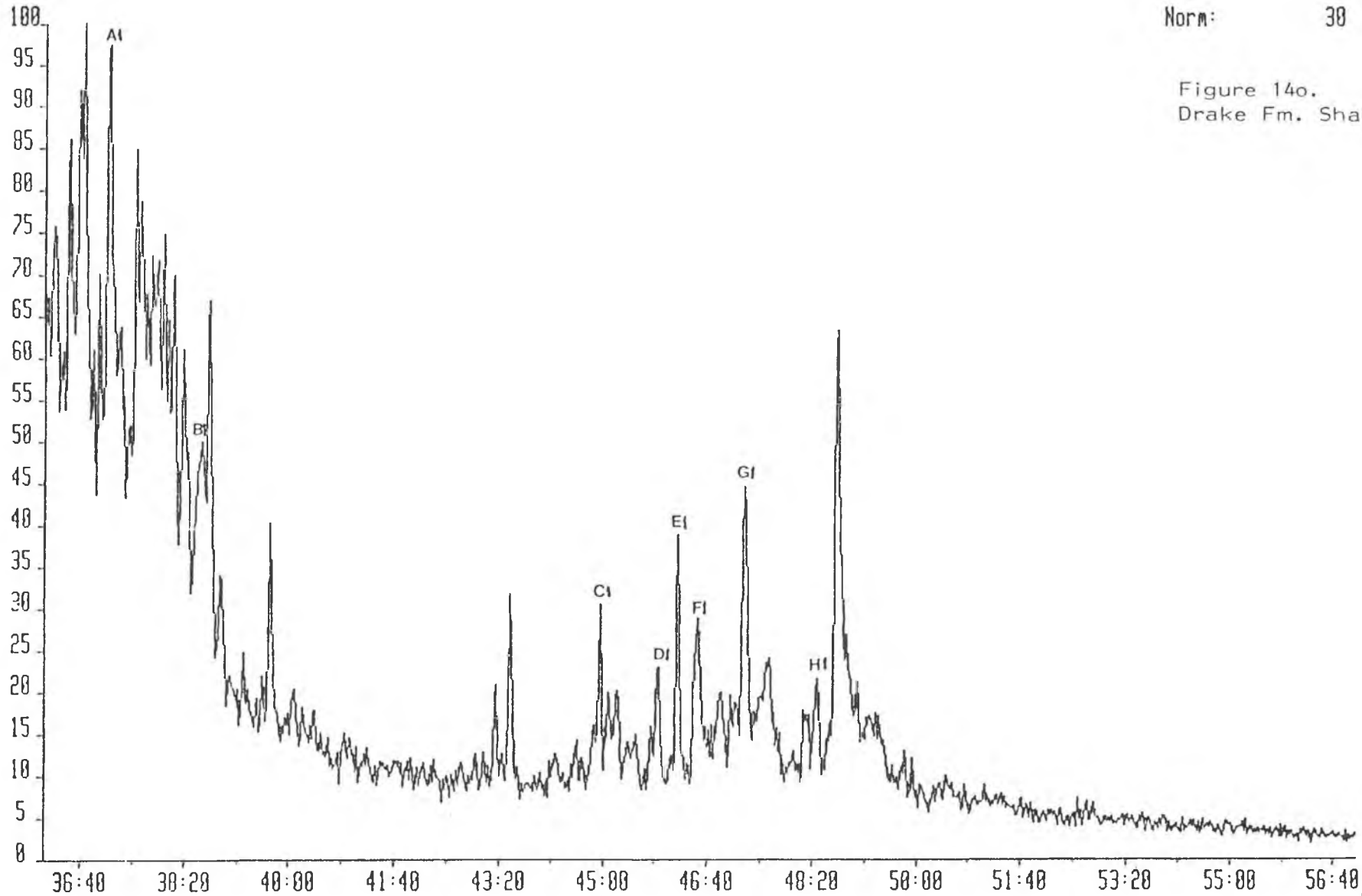


KEYAR09 21-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 18 Injection 1 Group 1 Mass 253.1956
Text:WELL 30/11-4, 4149M, AROMATIC FRACTION

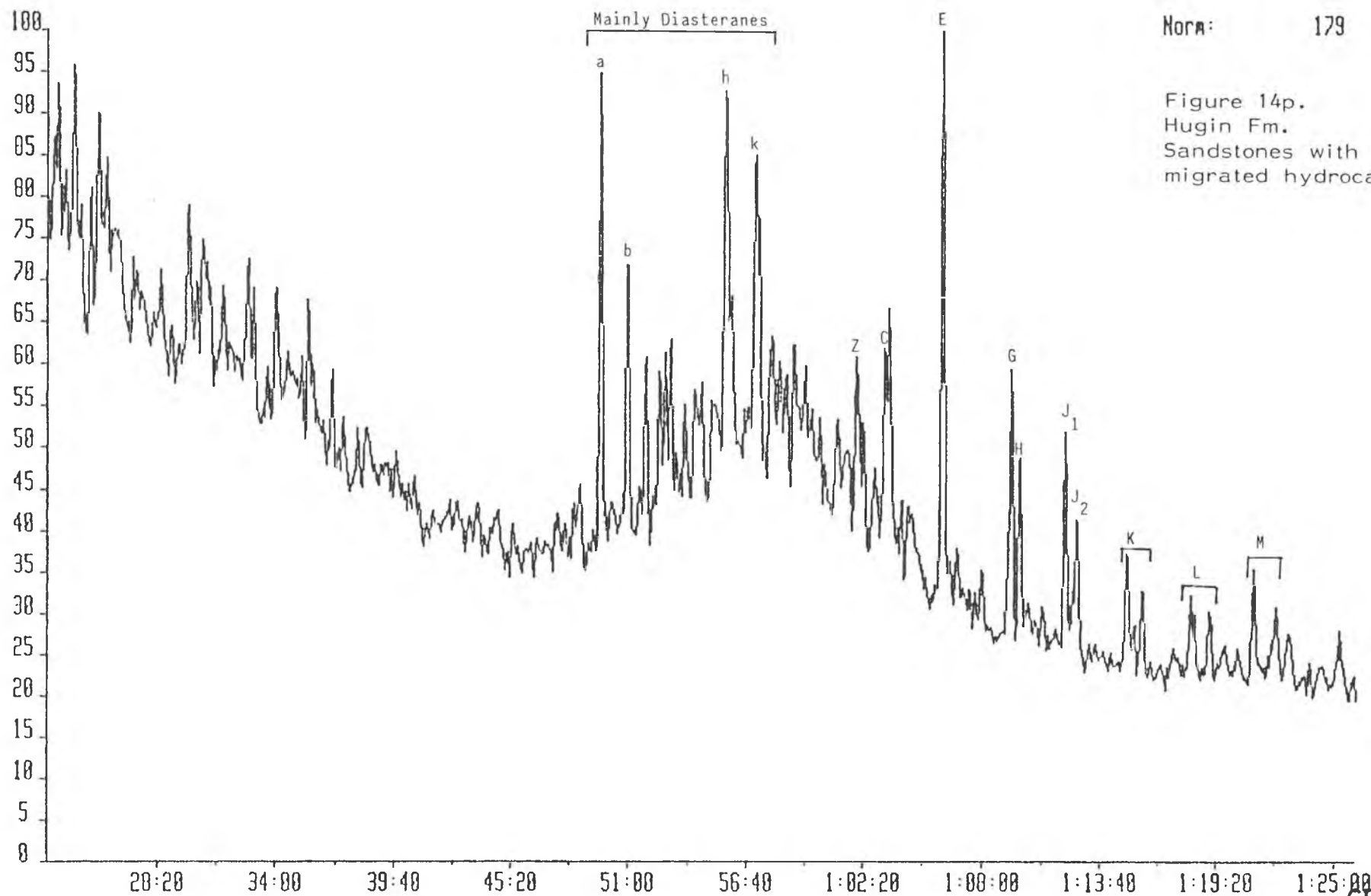
System:AR01

Norm: 30

Figure 14o.
Drake Fm. Shale



KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB System:SAT1
Sample 8 Injection 1 Group 1 Mass 163.1485
Text:WELL 30/11-4, 3514M, SATURATED FRACTION



Nora: 179

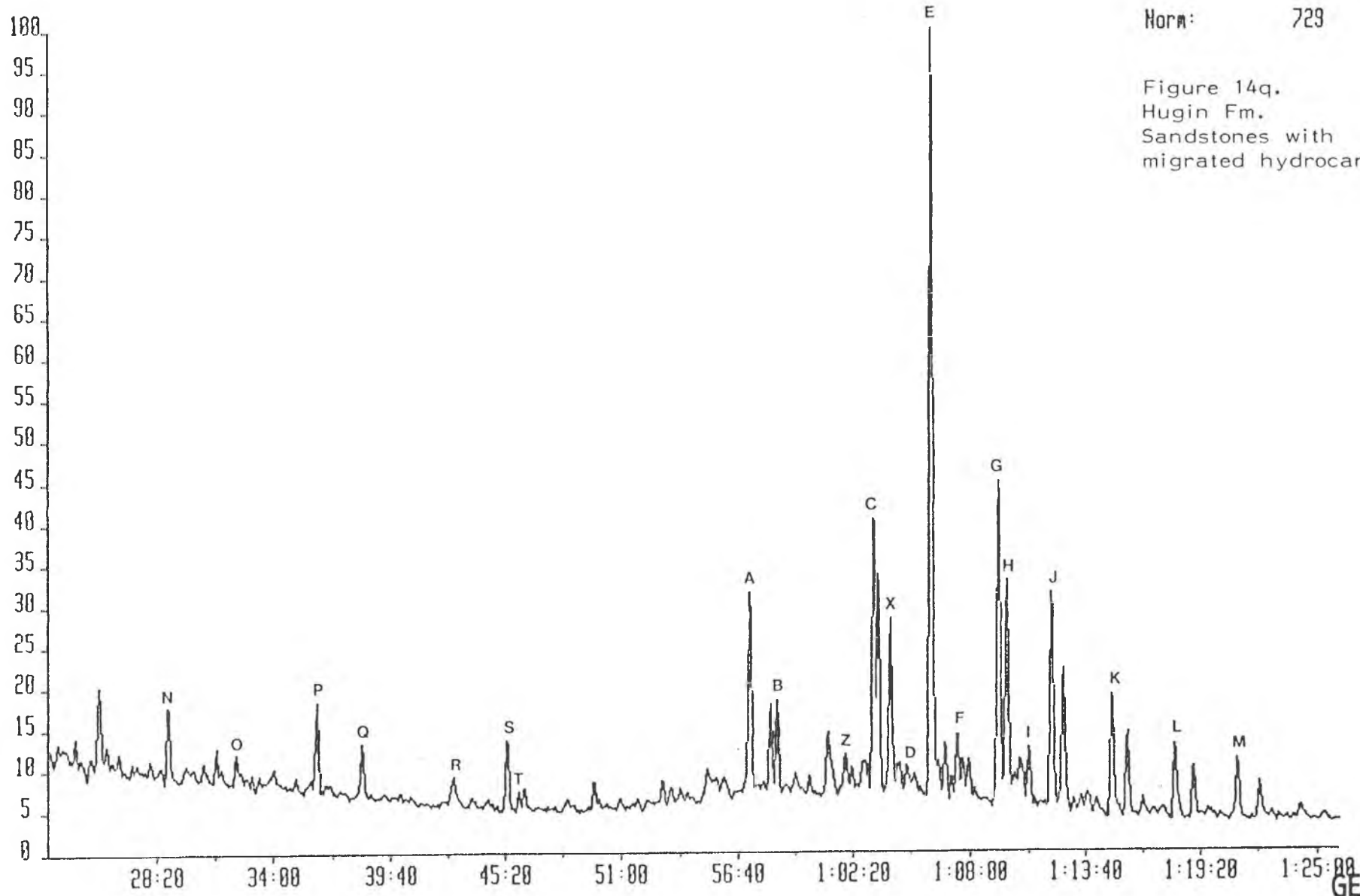
Figure 14p.
Hugin Fm.
Sandstones with
migrated hydrocarbons

KEYSAT9 18-OCT-91 Sir:Magnetic TS250 Acnt:GEOLAB
Sample 8 Injection 1 Group 1 Mass 191.1000
Text:WELL 30/11-4, 3514M, SATURATED FRACTION

System:SAT1

Norm: 729

Figure 14q.
Hugin Fm.
Sandstones with
migrated hydrocarbons

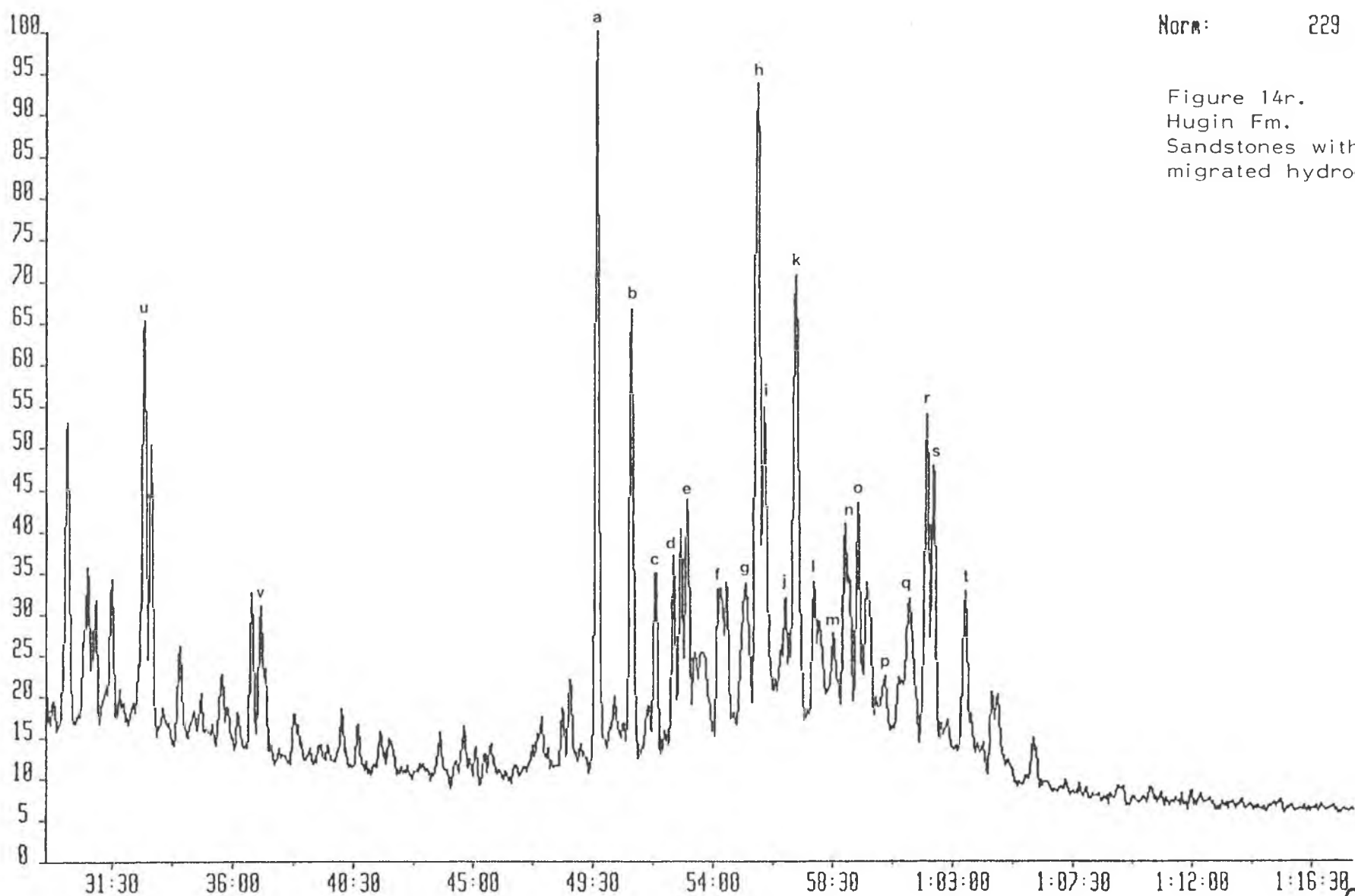


KEYSAT9 18-OCT-91 Site:Magnetic TS258 Acnt:GEOLAB
Sample 8 Injection 1 Group 1 Mass 217.1956
Text:WELL 30/11-4, 3514M, SATURATED FRACTION

System:SAT1

Norm: 229

Figure 14r.
Hugin Fm.
Sandstones with
migrated hydrocarbons



Experimental Procedures

Headspace Gas Analysis

The analysis is performed using a PERKIN ELMER 8310 gas chromatograph with a 2 mm PORA PAK Q 80/100 packed column and a loop injector. The carrier gas used is nitrogen and the column is run isothermally at 150°C, with back-flush.

From each sample can, 2 ml of headspace gas is taken and injected into the gas chromatograph for analysis of the C1 to C7 range of hydrocarbons. Correlation and quantitation is achieved by use of external standards.

Occluded Gas Analysis

The gas chromatograph used for this analysis is identical to that used for headspace gas analysis and is operated under the same conditions.

The canned samples are washed in tempered water to remove drilling contaminants and sieved on a 2 mm mesh sieve to remove large, caved rock fragments. Approximately 25 mg of sieved sample is then immersed in 25 ml of water and crushed in an airtight ball mill. After crushing, 2 ml of the emitted gas is taken from the ball mill and injected into the gas chromatograph.

Total Organic Carbon (TOC) Analysis

This analysis is performed using a LECO CS244 Carbon Analyzer.

Hand-picked lithology(ies) from cuttings samples is(are) crushed using a pestle and mortar and approximately 200 mg (50 mg for coals) is 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 100°C and then loaded into the instrument for analysis of total organic carbon. Total carbon is also analyzed using the same instrument but approximately 200 mg of whole rock is used instead. The oxidized (carbonate) carbon can be calculated by weight difference.

Total organic carbon can also be analyzed on the ROCK-EVAL II Pyrolyser during the normal run of the instrument.

Rock-Eval Pyrolysis

This analysis is performed using a ROCK-EVAL II Pyrolyser into which approximately 100 mg of whole rock is loaded. Analysis involves heating the sample, from 300°C to 600°C, in an inert atmosphere (helium) to release the free hydrocarbons present (the S1 peak) and then pyrolysed (the S2 peak), both of which are detected by a 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 subsequent to pyrolysis.

Thermal Extraction/Pyrolysis Gas Chromatography

The instrument used for this analysis is a Varian 3200/3500 Gas Chromatograph interfaced to a pyrolysis oven (the pyrolyser). A very small amount (< 2 mg) of whole rock sample is loaded on the pyrolyser and heated isothermally, at 300°C, for 4 minutes, during which time thermal extraction of the free hydrocarbons occurs (equivalent to the S1 peak of Rock-Eval). The released gases pass to a 25 m OV1 column with a nitrogen-cooled trap.

After 4 minutes the pyrolysis oven heats up to 550°C, at a rate of 37°C per minute, causing bound hydrocarbons to be released from the kerogen (equivalent to the S2 peak of Rock-Eval). These gases are passed through a 25 m OV1 column with a nitrogen-cooled trap.

The temperature program of the oven, in which the columns are housed is 0°C to 290°C at a rate of 4°C/min. Both the columns are linked to a FID detector.

Solvent Extraction of Organic Matter (EOM)

The samples are extracted using a Tecator Soxtec HT-System. Carefully weighed sample is 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 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 use of a rota-vaporator (200mb, 30°C). The amount of EOM is gravimetrically established.

Removal of Asphaltenes

Asphaltenes are removed from the EOM by precipitation in n-pentane. The amount of n-hexane to be used is prescribed by the formula:

$$\frac{\text{weight of EOM}(g) \times 40}{\text{density of n-hexane (g/cc)} \times 1000} = \text{amount of n-hexane (ml)}$$

The resulting solution and the precipitate is then poured into a pre-weighed plastic column containing a small amount of activated silica. The solution+precipitate is allowed to run through the column. The separated precipitate is collected, dried and weighed. The amount of asphaltenes recovered is calculated by weight difference. The solvent from the resulting solution is evaporated using a rotary evaporator, at 35°C and the dried sample either processed immediately, or stored in a freezer.

Chromatographic Separation of deasphalted 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 35°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 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 isothermally at 80°C for 2 minutes and then rises to 300°C at a rate of 4°C/min. Final hold time is 20 minutes. 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 PERKIN ELMER SIGMA 2000 Gas Chromatograph with a

50 m SE-54 packed column, split injector and a column splitter leading to an FID and an FPD detector, which allows simultaneous analysis of co-eluting hydrocarbons and sulphur compounds. The carrier gas is helium and the temperature program runs from 80°C to 280°C at a rate of 4°C/min. Final hold time is 25 minutes. The aromatic hydrocarbon fraction is diluted by 1:30 and a 1 microlitre aliquot of this is injected into the instrument.

Combined Gas Chromatography - Mass Spectrometry (GC-MS)

The GC-MS analyses were performed on a VG TS250 system interfaced to a Hewlett Packard 5890 gas chromatograph. The GC was fitted with a fused silica SE54 capillary column (50 m x 0.22 mm i.d.) directly into the ion source. Helium (12 psi) was used as carrier gas and the injections were performed in splitless mode. The GC oven was programmed from 45°C to 150°C at 35°C/min, at which point the programme rate was 2°C/min up to 310°C where the column was held isothermally for 15 min. For the aromatic hydrocarbons, the GC oven was programmed from 50°C to 310°C at 5°C/min. and held isothermally at 310°C for 15 min. The mass spectrometer was 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 was 1500 (10 % value).

The data system used was a VG PDP11/73 system. The samples were analysed in multiple ion detection mode (MID) at a scan cycle time of approximately 1.1 sec. Calculation of peak ratios was done 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 C₂₇ and C₂₈ triterpanes respectively.

Steranes

The most commonly used fragment ions for detection of steranes are M/Z 149 to distinguish between 5 α and 5 β 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 14 α (H) 17 β (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 C₄-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 C₂-naphthalenes are detected by M/Z 156 and C₃-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 dibenzo-thiophenes 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 C₃ substituted phenanthrenes.

Aromatic Steranes

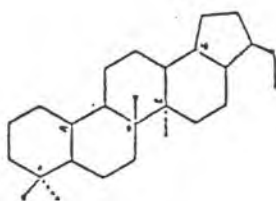
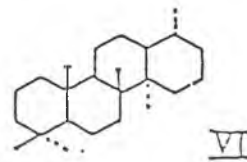
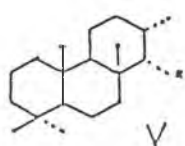
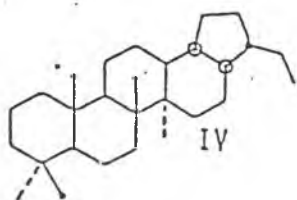
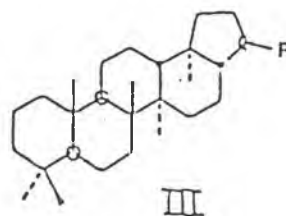
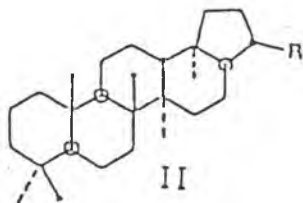
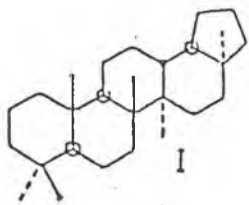
Monoaromatic steranes are detected using the M/Z 253 fragment ion, while the triaromatic steranes are detected using the M/Z 231 fragment ion.

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

STRUCTURES REPRESENTING TERPANES

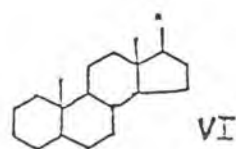
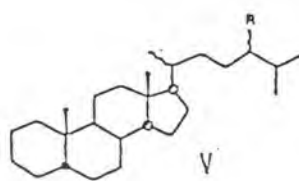
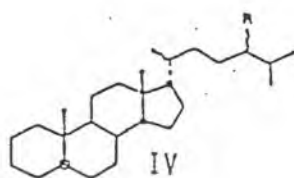
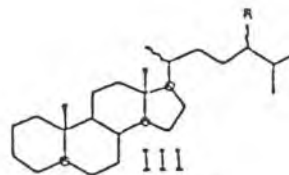
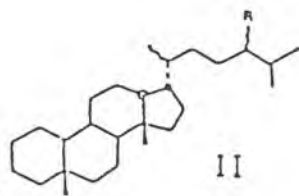
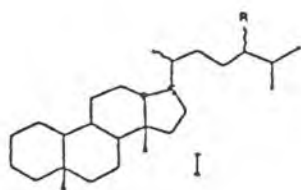


Mass Fragmentograms representing Steranes
(M/Z 149, 189, 217, 218, 259, 372, 386, 400 and 414)

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 $\beta\alpha$ diacholestane	$C_{27}H_{48}$	(I, R=H)
b.	20R $\beta\alpha$ diacholestane	$C_{27}H_{48}$	(I, R=H)
c.	20S $\alpha\beta$ diacholestane	$C_{27}H_{48}$	(II, R=H)
d.	20R $\alpha\beta$ diacholestane	$C_{27}H_{48}$	(II, R=H)
e.	20S $\beta\alpha$ 24-methyl-diacholestane	$C_{28}H_{50}$	(I, R=CH ₃)
f.	20R $\beta\alpha$ 24-methyl-diacholestane	$C_{28}H_{50}$	(I, R=CH ₃)
g.	20S $\alpha\beta$ 24-methyl-diacholestane	$C_{28}H_{50}$	(II, R=CH ₃)
	+ 20S $\alpha\alpha\alpha$ cholestane	$C_{27}H_{48}$	(III, R=H)
h.	20S $\beta\alpha$ 24-ethyl-diacholestane	$C_{29}H_{52}$	(II, R=C ₂ H ₅)
	+ 20R $\alpha\beta\beta$ cholestane	$C_{27}H_{48}$	(IV, R=H)
i.	20S $\alpha\beta\beta$ cholestane	$C_{27}H_{48}$	(IV, R=H)
	+ 20R $\alpha\beta$ 24-methyl-diacholestane	$C_{28}H_{50}$	(II, R=CH ₃)
j.	20R $\alpha\alpha\alpha$ cholestane	$C_{27}H_{48}$	(III, R=H)
k.	20R $\beta\alpha$ 24-ethyl-diacholestane	$C_{29}H_{52}$	(I, R=C ₂ H ₅)
l.	20R $\alpha\beta$ 24-ethyl-diacholestane	$C_{29}H_{52}$	(II, R=C ₂ H ₅)
m.	20S $\alpha\alpha\alpha$ 24-methyl-cholestane	$C_{28}H_{50}$	(III, R=CH ₃)
n.	20R $\alpha\beta\beta$ 24-methyl-cholestane	$C_{28}H_{50}$	(IV, R=CH ₃)
	+ 20R $\alpha\beta$ 24-ethyl-diacholestane	$C_{29}H_{52}$	(II, R=C ₂ H ₅)
o.	20S $\alpha\beta\beta$ 24-methyl-cholestane	$C_{28}H_{50}$	(IV, R=CH ₃)
p.	20R $\alpha\alpha\alpha$ 24-methyl-cholestane	$C_{28}H_{50}$	(III, R=CH ₃)
q.	20S $\alpha\alpha\alpha$ 24-ethyl-cholestane	$C_{29}H_{52}$	(III, R=C ₂ H ₅)
r.	20R $\alpha\beta\beta$ 24-ethyl-cholestane	$C_{29}H_{52}$	(IV, R=C ₂ H ₅)
s.	20S $\alpha\beta\beta$ 24-ethyl-cholestane	$C_{29}H_{52}$	(IV, R=C ₂ H ₅)
t.	20R $\alpha\alpha\alpha$ 24-ethyl-cholestane	$C_{29}H_{52}$	(III, R=C ₂ H ₅)
u.	5 α sterane	$C_{21}H_{36}$	(VI, R=C ₂ H ₅)
v.	5 α sterane	$C_{22}H_{38}$	(VI, R=C ₃ H ₇)

STRUCTURES REPRESENTING STERANES

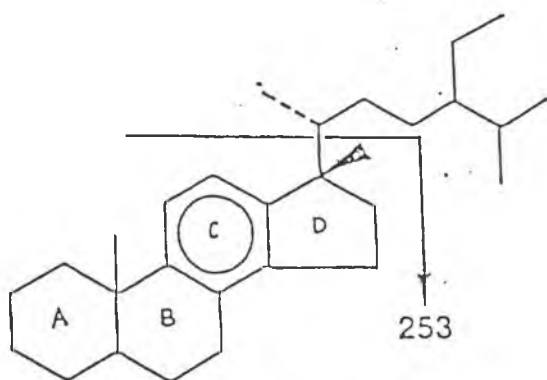


**Mass Fragmentograms representing Monoaromatic Steranes
(M/Z 253)**

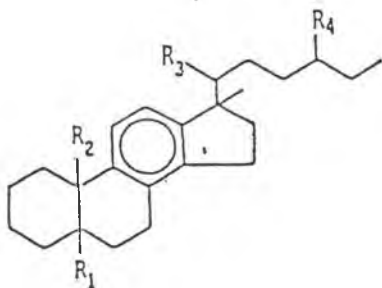
Description of C-ring monoaromatic steroid hydrocarbons

Peak	Substituents				Abbreviation of Compound
	R ₁	R ₂	R ₃	R ₄	
A1					C ₂₁ M
B1					C ₂₂ MA
C1	β(H)	CH ₃	S(CH ₃)	H	βSC ₂₇ MA
	β(H)	CH ₃	R(CH ₃)	H	βRC ₂₇ MA
D1	CH ₃	H	R(CH ₃)	H	RC ₂₇ DMA
	α(H)	CH ₃	S(CH ₃)	H	αSC ₂₇ MA
E1	β(H)	CH ₃	S(CH ₃)	CH ₃	βSC ₂₈ MA
	CH ₃	H	S(CH ₃)	CH ₃	SC ₂₈ DMA
F1	α(H)	CH ₃	R(CH ₃)	H	αRC ₂₇ MA
	α(H)	CH ₃	S(CH ₃)	CH ₃	αSC ₂₈ MA
	β(H)	CH ₃	R(CH ₃)	CH ₃	βRC ₂₈ MA
G1	CH ₃	H	R(CH ₃)	CH ₃	RC ₂₈ DMA
	β(H)	CH ₃	S(CH ₃)	C ₂ H ₅	βSC ₂₉ MA
	CH ₃	H	S(CH ₃)	C ₂ H ₅	SC ₂₉ DMA
	α(H)	CH ₃	R(CH ₃)	CH ₃	αRC ₂₈ MA
H1	β(H)	CH ₃	R(CH ₃)	C ₂ H ₅	βRC ₂₉ MA
	CH ₃	H	R(CH ₃)	C ₂ H ₅	RC ₂₉ DMA
I1	α(H)	CH ₃	R(CH ₃)	C ₂ H ₅	αRC ₂₉ MA

STRUCTURES REPRESENTING MONOAROMATIC STERANES:



I

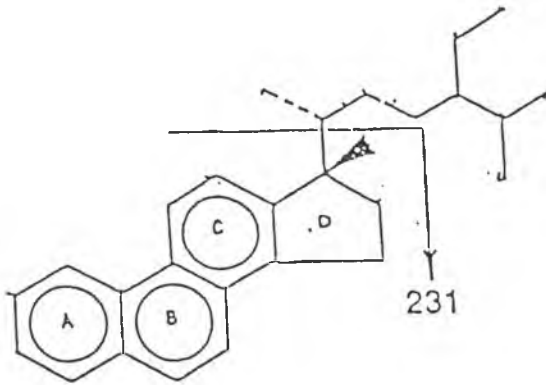


**Mass Fragmentograms representing Triaromatic Steranes
(M/Z 231)**

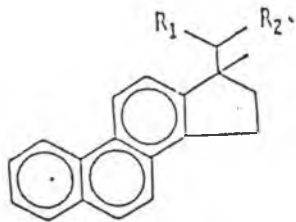
Description of ABC-ring triaromatic steroid hydrocarbons

Peak	Substituents		Abbreviation of Compound
	R ₁	R ₂	
a1	CH ₃	H	C ₂₀ TA
b1	CH ₃	CH ₃	C ₂₁ TA
c1	S(CH ₃)	C ₆ H _{1,3}	SC ₂₆ TA
d1	R(CH ₃)	C ₆ H ₁₃	RC ₂₆ TA
	S(CH ₃)	C ₇ H ₁₅	SC ₂₇ TA
e1	S(CH ₃)	C ₈ H ₁₇	SC ₂₈ TA
f1	S(CH ₃)	C ₇ H ₁₅	RC ₂₇ TA
g1	R(CH ₃)	C ₈ H ₁₇	RC ₂₈ TA

STRUCTURES REPRESENTING TRIAROMATIC STERANES



II



Isotope Ratio Mass Spectrometry

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

The combustion temperature was 1020°C and the carrier gas used was Helium. After the combustion H₂O and CO₂ were trapped in different cool traps. The CO₂ gas was then heated up before it was admitted to the mass spectrometer. The whole operation was controlled by an IBM PC50 computer system.

δ-values

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

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

The PDB-standard (a marine chalk of the Pee Dee-formation, USA) was created by Craig 1957. All results of ¹³C/¹²C-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. Double analysis on samples are also done.

Abbreviations

List of abbreviations used for lithology description

(sorted alphabetically)

ang	=	angular
bar	=	Baryte (mud additive)
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/shaley
cngl	=	conglomeratic
Coal	=	Coal
Coal-ad	=	Coal-like additive (e.g. chromlignosulfonate)
Congl	=	Conglomerate
Cont	=	Contaminant(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
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
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")
Tuff	=	Tuff
tuff	=	tuffaceous
v col	=	various colours
w	=	white
wx	=	waxy
y	=	yellow/yellowish

Appendix 1

Tables

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1020.00				Nrdl Utsi Miocene		0001
				70 S/Sst : w, f, kln, l		0001-1L
				30 S/Sst : w to lt gy, crs, l		0001-2L
				tr Cont : prp		0001-3L
1040.00				Nrdl Utsi Miocene		0002
				85 Sltst : y brn to pl y brn, s		0002-1L
				15 S/Sst : w to lt gy, f, crs, l		0002-2L
				tr Other : dsk y gn, glauc		0002-3L
1060.00				Nrdl Utsi Miocene		0003
				80 S/Sst : w to lt gy, f, crs, l, kln		0003-1L
				20 Sltst : pl y brn, calc		0003-2L
				tr Other : dsk y gn, glauc		0003-3L
1080.00				Hrdl Oligocene-Eocene		0004
				90 Sltst : y brn to pl y brn, calc		0004-1L
				10 S/Sst : w, f, kln		0004-2L
				tr S/Sst : w to lt gy, crs, l		0004-3L
				tr Cont : prp		0004-4L
1100.00				Hrdl Oligocene-Eocene		0005
				95 Sltst : lt brn gy to pl y brn, calc		0005-1L
				5 S/Sst : w to lt gy, f, crs, l		0005-2L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
1120.00		Hrdl		Oligocene-Eocene		0006	
		100	Sltst	: lt brn gy to pl y brn, calc		0006-1L	
1140.00		Hrdl		Oligocene-Eocene		0007	
		100	Sltst	: lt brn gy to pl y brn, calc		0007-1L	
			tr S/Sst	: w, f, kln		0007-2L	
1160.00		Hrdl		Oligocene-Eocene		0008	
		100	Sltst	: lt brn gy to pl y brn, calc		0008-1L	
1180.00		Hrdl		Oligocene-Eocene		0009	
		100	Sltst	: lt brn gy to pl y brn, calc		0009-1L	
1200.00		Hrdl		Oligocene-Eocene		0010	
		100	Sltst	: lt brn gy to pl y brn, calc		0010-1L	
1220.00		Hrdl		Oligocene-Eocene		0011	
		100	Sltst	: lt brn gy to pl y brn, calc		0011-1L	
1240.00		Hrdl		Oligocene-Eocene		0012	
		100	Sh/Clst:	lt brn gy to pl y brn, slt, calc		0012-1L	
1260.00		Hrdl		Oligocene-Eocene		0013	
		100	Sh/Clst:	lt brn gy to pl y brn		0013-1L	

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
1280.00		Hrdl		Oligocene-Eocene		0014
		100	Sh/Clst: lt brn gy to pl y brn			0014-1L
1300.00		Hrdl		Oligocene-Eocene		0015
		100	Sh/Clst: lt brn gy to pl y brn			0015-1L
1320.00		Hrdl		Oligocene-Eocene		0016
		85	Sh/Clst: lt brn gy to pl y brn			0016-1L
		15	S/Sst : w to lt gy, crs, l			0016-2L
1340.00		Hrdl		Oligocene-Eocene		0017
		80	Sh/Clst: lt brn gy to pl y brn			0017-1L
		20	S/Sst : w to lt gy, crs, l			0017-2L
1360.00		Hrdl		Oligocene-Eocene		0018
		80	Sh/Clst: lt brn gy to pl y brn			0018-1L
		20	S/Sst : w to lt gy, crs, l			0018-2L
1380.00		Hrdl		Oligocene-Eocene		0019
		80	Sh/Clst: lt brn gy to brn gy			0019-1L
		20	S/Sst : w to lt gy, crs, l			0019-2L
1400.00		Hrdl		Oligocene-Eocene		0020
		95	Sh/Clst: lt brn gy to pl y brn			0020-1L
		5	S/Sst : w to lt gy, crs, l			0020-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
1420.00			Hrdl		Oligocene-Eocene	0021	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0021-1L	
1440.00			Hrdl		Oligocene-Eocene	0022	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0022-1L	
1460.00			Hrdl		Oligocene-Eocene	0023	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0023-1L	
1480.00			Hrdl		Oligocene-Eocene	0024	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0024-1L	
1500.00			Hrdl		Oligocene-Eocene	0025	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0025-1L	
1520.00			Hrdl		Oligocene-Eocene	0026	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0026-1L	
1540.00			Hrdl		Oligocene-Eocene	0027	
		100	Sh/Clst: lt brn gy to pl y brn, slt			0027-1L	
1560.00			Hrdl		Oligocene-Eocene	0028	
		100	Sh/Clst: lt brn gy to pl y brn			0028-1L	

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology	description	
1580.00			Hrdl	Oligocene-Eocene		0029
			100	Sh/Clst: lt brn gy to pl y brn		0029-1L
1600.00			Hrdl	Oligocene-Eocene		0030
			100	Sh/Clst: lt brn gy to pl y brn		0030-1L
1620.00			Hrdl	Oligocene-Eocene		0031
			100	Sh/Clst: lt brn gy to pl y brn		0031-1L
1640.00			Hrdl	Oligocene-Eocene		0032
			100	Sh/Clst: lt brn gy to y gy to dsk y		0032-1L
1660.00			Hrdl	Oligocene-Eocene		0033
			100	Sh/Clst: brn gy to drk y brn		0033-1L
1680.00			Hrdl	Oligocene-Eocene		0034
			100	Sh/Clst: brn gy to drk y brn		0034-1L
1700.00			Hrdl	Oligocene-Eocene		0035
			100	Sh/Clst: brn gy to drk y brn		0035-1L
1720.00			Hrdl	Oligocene-Eocene		0036
			100	Sh/Clst: brn gy to drk y brn		0036-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology	description	
1740.00			Hrdl	Oligocene-Eocene		0037
			100	Sh/Clst: lt ol gy		0037-1L
1760.00			Hrdl	Oligocene-Eocene		0038
			100	Sh/Clst: y gy		0038-1L
1780.00			Hrdl	Oligocene-Eocene		0039
			100	Sh/Clst: lt ol gy		0039-1L
1800.00			Hrdl	Oligocene-Eocene		0040
			100	Sh/Clst: lt ol gy		0040-1L
1821.00			Hrdl	Oligocene-Eocene		0041
			100	Sh/Clst: lt ol gy		0041-1L
1839.00			Hrdl	Oligocene-Eocene		0042
			100	Sh/Clst: lt ol gy		0042-1L
1860.00			Hrdl	Oligocene-Eocene		0043
			100	Sh/Clst: lt ol gy		0043-1L
1881.00			Hrdl	Oligocene-Eocene		0044
			100	Sh/Clst: lt ol gy		0044-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
1899.00		Hrdl		Oligocene-Eocene		0045
		100	Sh/Clst: lt ol gy			0045-1L
1920.00		Hrdl		Oligocene-Eocene		0046
		100	Sh/Clst: lt ol gy			0046-1L
1941.00		Hrdl		Oligocene-Eocene		0047
		100	Sh/Clst: pl ol			0047-1L
1959.00		Hrdl		Oligocene-Eocene		0048
		100	Sh/Clst: lt ol gy			0048-1L
1980.00		Hrdl		Oligocene-Eocene		0049
		100	Sh/Clst: lt ol gy to pl ol			0049-1L
2001.00		Hrdl	Frig	Eocene		0050
		100	Sh/Clst: lt ol gy to pl ol			0050-1L
2019.00		Hrdl	Frig	Eocene		0051
		100	Sh/Clst: lt ol gy to pl ol			0051-1L
			tr S/Sst : w to lt or, crs, l			0051-2L
2040.00		Hrdl	Frig	Eocene		0052
		95	Sh/Clst: lt ol gy to pl ol			0052-1L
		5	S/Sst : w to lt or, crs, l			0052-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2061.00				Hrdl Frig Eocene		0053
				60 Sh/Clst: lt ol gy to pl ol		0053-1L
				40 S/Sst : w to lt or, crs, l		0053-2L
2079.00				Hrdl Frig Eocene		0054
				60 Sh/Clst: lt ol gy to pl ol to lt brn to pl y brn		0054-1L
				40 S/Sst : w to lt or, crs, l		0054-2L
2100.00				Hrdl Frig Eocene		0055
				60 Sh/Clst: lt ol gy to pl ol to lt brn		0055-1L
				40 S/Sst : w to lt or, crs, l		0055-2L
2121.00				Hrdl Frig Eocene		0056
				85 S/Sst : w to lt or, crs, l		0056-2L
				15 Sh/Clst: lt ol gy to pl ol to lt brn		0056-1L
2139.00				Hrdl Frig Eocene		0057
				75 S/Sst : w to lt or, crs, l		0057-2L
				25 Sh/Clst: lt ol gy to pl y brn to lt brn		0057-1L
				tr Cont : prp		0057-3L
2160.00				Rogl Bald Paleocene		0058
				90 Sh/Clst: lt brn gy to lt ol gy		0058-1L
				10 S/Sst : w to lt gy, crs, kln, l		0058-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2181.00				Rogl Bald Paleocene		0059
				70 Sh/Clst: lt gy to m gy to lt ol gy		0059-1L
				30 S/Sst : w to lt gy, crs, kln, l		0059-2L
2199.00				Rogl Heim Paleocene		0060
				90 Sh/Clst: lt gy to m gy		0060-1L
				10 S/Sst : w to lt gy, crs, kln, l		0060-2L
2220.00				Rogl Heim Paleocene		0061
				80 Sh/Clst: lt gy to m gy		0061-1L
				20 S/Sst : w to lt gy, crs, kln, l		0061-2L
2241.00				Rogl Heim Paleocene		0062
				90 Sh/Clst: lt gy to m gy		0062-1L
				10 S/Sst : w to lt gy, crs, kln, l		0062-2L
2259.00				Rogl Heim Paleocene		0063
				75 Sh/Clst: lt gy to m gy		0063-1L
				25 S/Sst : w to lt gy, crs, kln, l		0063-2L
2280.00				Rogl Heim Paleocene		0064
				75 S/Sst : w to lt gy, crs, kln, l		0064-2L
				25 Sh/Clst: lt gy to m gy		0064-1L
2300.00				Rogl Heim Paleocene		0065
				95 Sh/Clst: lt gy to m gy		0065-1L
				5 S/Sst : w to lt gy, crs, kln, l		0065-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2322.00				Rogl Heim Paleocene		0066
				80 Sh/Clst: lt gy to m gy		0066-1L
				20 S/Sst : w to lt gy, crs, kln, l		0066-2L
2340.00				Rogl Heim Paleocene		0067
				80 Sh/Clst: lt gy to m gy		0067-1L
				20 S/Sst : w to lt gy, crs, kln, l		0067-2L
2361.00				Rogl List Paleocene		0068
				100 Sh/Clst: m gy		0068-1L
				tr S/Sst : w to lt gy, crs, l		0068-2L
2379.00				Rogl List Paleocene		0069
				100 Sh/Clst: m gy		0069-1L
				tr S/Sst : w to lt gy, crs, l, kln		0069-2L
2403.00				Rogl List Paleocene		0070
				100 Sh/Clst: m gy		0070-1L
				tr Ca : or gy, mrl		0070-2L
2421.00				Rogl List Paleocene		0071
				100 Sh/Clst: m gy		0071-1L
				tr Ca : lt or to or gy		0071-2L
				tr S/Sst : w, f, kln		0071-3L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2439.00				Rogl List Paleocene		0072
				85 Sh/Clst: m gy		0072-1L
				10 S/Sst : w to lt gy, crs, l		0072-2L
				5 Sh/Clst: pl brn		0072-3L
				tr Cont : prp		0072-4L
2460.00				Rogl List Paleocene		0073
				95 Sh/Clst: m gy		0073-1L
				5 S/Sst : w to lt gy, crs, l		0073-2L
				tr Sh/Clst: pl brn		0073-3L
2481.00				Rogl List Paleocene		0074
				100 Sh/Clst: m gy		0074-1L
				tr Cont : dd		0074-2L
2499.00				Rogl List Paleocene		0075
				100 Sh/Clst: m gy		0075-1L
				tr Cont : dd, prp		0075-2L
2520.00				Rogl List Paleocene		0076
				100 Sh/Clst: m gy		0076-1L
				tr Cont : dd, prp		0076-2L
2541.00				Rogl List Paleocene		0077
				100 Sh/Clst: m gy		0077-1L
				tr Sh/Clst: pl brn		0077-2L
				tr Cont : cem, dd		0077-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2559.00				Rogl List Paleocene		0078
			100	Sh/Clst: m gy		0078-1L
			tr	Sh/Clst: pl brn		0078-2L
			tr	Cont : cem, dd		0078-3L
2580.00				Rogl List Paleocene		0079
			100	Sh/Clst: m gy		0079-1L
			tr	Sh/Clst: pl brn		0079-2L
			tr	Cont : prp, dd		0079-3L
2601.00				Rogl Våle Paleocene		0080
			85	Ca : w		0080-1L
			15	Sh/Clst: m gy		0080-2L
2619.00				Shet Jors U.Cretaceous		0081
			95	Ca : w		0081-1L
			5	Sh/Clst: m gy		0081-2L
2640.00				Shet Jors U.Cretaceous		0082
			85	Ca : w		0082-1L
			15	Sh/Clst: m gy		0082-2L
2661.00				Shet Jors U.Cretaceous		0083
			95	Ca : w		0083-1L
			5	Sh/Clst: m gy		0083-2L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2679.00				Shet Jors U.Cretaceous		0084
			95	Ca : w		0084-1L
			5	Sh/Clst: m gy		0084-2L
2700.00				Shet Jors U.Cretaceous		0085
			80	Ca : w		0085-1L
			20	Sh/Clst: m gy		0085-2L
2721.00				Shet Jors U.Cretaceous		0086
			90	Sh/Clst: m gy, calc		0086-2L
			5	Ca : w		0086-1L
			5	Cont : dd		0086-3L
2739.00				Shet Jors U.Cretaceous		0087
			100	Sh/Clst: m gy, calc		0087-2L
			tr	Ca : w		0087-1L
			tr	Cont : dd		0087-3L
2760.00				Shet Jors U.Cretaceous		0088
			100	Ca : w to lt or		0088-1L
			tr	Sh/Clst: m gy		0088-2L
2781.00				Shet Jors U.Cretaceous		0089
			70	Sh/Clst: m gy, calc		0089-2L
			30	Ca : lt or to or gy		0089-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2799.00				Shet Jors U.Cretaceous		0090
			90	Sh/Clst: m gy, calc		0090-2L
			10	Ca : lt or to or gy		0090-1L
2820.00				Shet Jors U.Cretaceous		0091
			95	Sh/Clst: m gy, calc		0091-2L
			5	Ca : lt or to or gy		0091-1L
2841.00				Shet Jors U.Cretaceous		0092
			100	Sh/Clst: m gy, calc		0092-2L
			tr	Ca : lt or to or gy		0092-1L
2859.00				Shet Jors U.Cretaceous		0093
			100	Ca : lt or to or gy		0093-1L
2880.00				Shet Kyrr U.Cretaceous		0094
			100	Marl : gy red		0094-1L
2901.00				Shet Kyrr U.Cretaceous		0095
			80	Marl : m gy		0095-2L
			15	Marl : gy red		0095-1L
			5	Ca : lt or to or gy		0095-3L
2919.00				Shet Kyrr U.Cretaceous		0096
			80	Sh/Clst: m gy, calc		0096-2L
			10	Cont : dd		0096-4L
			5	Marl : gy red		0096-1L
			5	Ca : lt or to or gy		0096-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
2940.00				Shet Kyrr U.Cretaceous		0097
				70 Ca : lt or to or gy		0097-1L
				30 Sh/Clst: m gy		0097-2L
				tr Marl : m brn		0097-3L
				tr Cont : dd		0097-4L
2961.00				Shet Kyrr U.Cretaceous		0098
				85 Sh/Clst: m gy		0098-2L
				10 Cont : dd		0098-3L
				5 Ca : lt or to or gy		0098-1L
				tr Marl : m brn		0098-4L
2979.00				Shet Kyrr U.Cretaceous		0099
				80 Sh/Clst: m gy, calc		0099-2L
				20 Ca : lt or to or gy		0099-1L
3000.00				Shet Kyrr U.Cretaceous		0100
				95 Sh/Clst: m gy, calc		0100-2L
				5 Cont : dd		0100-3L
				tr Ca : lt or to or gy		0100-1L
3021.00				Shet Kyrr U.Cretaceous		0101
				100 Sh/Clst: m gy, calc		0101-2L
				tr Ca : or gy to lt brn, mrl		0101-1L
				tr Cont : dd, prp		0101-3L
3039.00				Shet Kyrr U.Cretaceous		0102
				100 Sh/Clst: m gy, calc		0102-2L
				tr Ca : lt or to or gy		0102-1L
				tr Cont : dd, prp		0102-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3060.00				Shet Kyrr U.Cretaceous		0103
			100	Sh/Clst: m gy		0103-1L
3081.00				Shet Kyrr U.Cretaceous		0104
			100	Sh/Clst: m gy		0104-1L
3099.00				Shet Kyrr U.Cretaceous		0105
			100	Sh/Clst: m gy		0105-1L
				tr Marl : or gy to lt brn		0105-2L
				tr Cont : prp		0105-3L
3120.00				Shet Kyrr U.Cretaceous		0106
			90	Sh/Clst: m gy		0106-1L
			10	Cont : dd		0106-2L
3141.00				Shet Kyrr U.Cretaceous		0107
			95	Sh/Clst: m gy		0107-1L
			5	Cont : dd, cem		0107-2L
3159.00				Shet Tryg U.Cretaceous		0108
			60	Ca : lt or to or gy		0108-1L
			25	Marl : pl pu to pl red, slt		0108-2L
			15	Sh/Clst: m gy		0108-3L
3180.00				Shet Tryg U.Cretaceous		0109
			100	Ca : w		0109-1L
				tr Sh/Clst: m gy		0109-2L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3201.00			Shet	Svar	U.Cretaceous	0110
		100	Marl	: lt gy		0110-1L
3219.00			Shet	Svar	U.Cretaceous	0111
		100	Marl	: lt gy		0111-1L
3240.00			Crom		L.Cretaceous	0112
		100	Marl	: lt gy to m gy		0112-1L
3249.00			Crom		L.Cretaceous	0113
		100	Marl	: lt gy to m gy		0113-1L
3255.00			Crom		L.Cretaceous	0114
		75	Marl	: m gy		0114-1L
		15	Sh/Clst:	gy red to pl brn, calc		0114-2L
		10	Ca	: lt or to or gy		0114-3L
3261.00			Crom		L.Cretaceous	0115
		100	Sh/Clst:	drk gy		0115-1L
		tr	Ca	: lt or		0115-2L
3267.00			Viki	Drau	U.Jurassic	0116
		100	Sh/Clst:	drk gy to brn blk		0116-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3273.00				Viki Drau U.Jurassic		0117
		100		Sh/Clst: drk gy to brn blk		0117-1L
			tr Ca	: w to lt or		0117-2L
3279.00				Viki Drau U.Jurassic		0118
		100		Sh/Clst: drk gy to brn blk		0118-1L
			tr Ca	: w to lt or		0118-2L
3284.00				Viki Heat U.Jurassic		0119
		90		Sh/Clst: drk gy to brn blk, calc		0119-1L
		10	Ca	: lt or to lt gy		0119-2L
3291.00				Viki Heat U.Jurassic		0120
		95		Sh/Clst: drk gy to brn blk, calc		0120-1L
		5	Ca	: lt or to lt gy		0120-2L
3297.00				Viki Heat U.Jurassic		0121
		95		Sh/Clst: drk gy to brn blk, calc		0121-1L
		5	Ca	: lt or to lt gy		0121-2L
3303.00				Viki Heat U.Jurassic		0122
		90		Sh/Clst: drk gy, calc		0122-1L
		10	Ca	: or gy to lt or		0122-2L
3309.00				Viki Heat U.Jurassic		0124
		90		Sh/Clst: m gy to drk gy		0124-1L
		10	Cont	: dd, prp		0124-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3315.00				Viki Heat U.Jurassic		0125
				95 Sh/Clst: m gy to drk gy		0125-1L
				5 Cont : dd, prp		0125-2L
				tr Sh/Clst: m brn		0125-3L
3321.00				Viki Heat U.Jurassic		0126
				75 Sh/Clst: m gy to drk gy		0126-1L
				15 Sh/Clst: lt brn to m brn		0126-3L
				10 Cont : dd, prp		0126-2L
3327.00				Viki Heat U.Jurassic		0123
				90 Sh/Clst: m gy to drk gy, calc		0123-1L
				10 Ca : or gy to lt or		0123-2L
3333.00				Viki Heat U.Jurassic		0127
				95 Sh/Clst: m gy to drk gy		0127-1L
				5 Ca : lt or to or gy		0127-2L
3339.00				Viki Heat U.Jurassic		0128
				95 Sh/Clst: brn gy to m gy to dsk brn		0128-1L
				5 Ca : lt or to or gy		0128-2L
3345.00				Viki Heat U.Jurassic		0129
				100 Sh/Clst: brn gy to m gy to dsk brn		0129-1L
				tr Ca : lt or to or gy		0129-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3351.00				Viki Heat U.Jurassic		0130
		100		Sh/Clst: brn gy to m gy to drk gy		0130-1L
				tr Ca : lt or to or gy		0130-2L
3357.00				Viki Heat U.Jurassic		0131
		100		Sh/Clst: drk gy to brn blk		0131-1L
				tr Ca : lt or to or gy		0131-2L
3363.00				Viki Heat U.Jurassic		0132
		100		Sh/Clst: drk gy to brn blk		0132-1L
				tr Ca : lt or to or gy		0132-2L
				tr Cont : dd		0132-3L
3369.00				Viki Heat U.Jurassic		0133
		100		Sh/Clst: m gy to drk gy		0133-1L
				tr Cont : dd		0133-2L
3375.00				Viki Heat U.Jurassic		0134
		100		Sh/Clst: m gy to drk gy		0134-1L
				tr Ca : w to lt or		0134-2L
				tr Cont : dd		0134-3L
3381.00				Viki Heat U.Jurassic		0135
		100		Sh/Clst: m gy to drk gy		0135-1L
				tr Ca : w to lt or		0135-2L
				tr Cont : dd		0135-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3387.00				Viki Heat U.Jurassic		0136
			100	Sh/Clst: m gy to drk gy		0136-1L
				tr Ca : w to lt or		0136-2L
				tr Cont : dd		0136-3L
3393.00				Viki Heat U.Jurassic		0137
			100	Sh/Clst: m gy to drk gy		0137-1L
				tr Ca : w to lt or		0137-2L
				tr Cont : dd		0137-3L
3399.00				Viki Heat U.Jurassic		0138
			95	Sh/Clst: m gy to drk gy		0138-1L
			5	Ca : w to lt or		0138-2L
				tr Cont : dd		0138-3L
3405.00				Viki Heat U.Jurassic		0139
			100	Sh/Clst: m gy to drk gy		0139-1L
				tr Ca : w to lt or		0139-2L
				tr Cont : dd		0139-3L
3411.00				Viki Heat U.Jurassic		0140
			95	Sh/Clst: m gy to drk gy		0140-1L
			5	Ca : w to lt or		0140-2L
				tr Cont : dd		0140-3L
3417.00				Viki Heat U.Jurassic		0141
			85	Sh/Clst: m gy to drk gy		0141-1L
			10	Cont : dd		0141-3L
			5	Ca : w to lt or		0141-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3423.00				Viki Heat U.Jurassic		0142
			90	Sh/Clst: m gy to drk gy		0142-1L
			5	Ca : w to lt or		0142-2L
			5	Cont : dd		0142-3L
3429.00				Viki Heat U.Jurassic		0143
			90	Sh/Clst: m gy to drk gy		0143-1L
			5	Ca : w to lt or		0143-2L
			5	Cont : dd		0143-3L
3435.00				Vstl Hugi M.Jurassic		0144
			100	Sh/Clst: m gy to drk gy		0144-1L
			tr	S/Sst : lt gy, crs, l		0144-2L
			tr	Ca : w to lt or		0144-3L
			tr	Coal : blk, wx		0144-4L
3441.00				Vstl Hugi M.Jurassic		0145
			40	Sh/Clst: drk gy to brn blk		0145-1L
			25	Sh/Clst: m gy		0145-2L
			20	S/Sst : w to lt or, f, slt, kln		0145-3L
			15	Coal : blk, wx		0145-4L
3447.00				Vstl Hugi M.Jurassic		0146
			85	Sh/Clst: m brn		0146-1L
			10	S/Sst : lt gy, crs, l		0146-2L
			5	Coal : blk, wx		0146-3L
			tr	Sh/Clst: pl brn to gy brn		0146-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3453.00				Vstl Hugi M.Jurassic		0147
			80	S/Sst : lt gy to lt or, crs, kln, l		0147-2L
			20	Sh/Clst: m brn		0147-1L
			tr	Coal : blk, wx		0147-3L
			tr	Sh/Clst: pl brn to gy brn		0147-4L
3459.00				Vstl Hugi M.Jurassic		0148
			80	S/Sst : lt gy to lt or, crs, kln, l		0148-2L
			15	Sh/Clst: m brn		0148-1L
			5	Coal : blk, wx		0148-3L
			tr	Sh/Clst: pl brn to gy brn		0148-4L
3465.00				Vstl Hugi M.Jurassic		0149
			85	S/Sst : lt gy, f, slt		0149-1L
			10	Sh/Clst: m gy to drk gy, mic		0149-2L
			5	Cont : dd		0149-3L
			tr	Coal : blk, wx		0149-4L
3471.00				Vstl Hugi M.Jurassic		0150
			95	S/Sst : w to lt or, f, kln		0150-1L
			5	Sh/Clst: m gy		0150-2L
			tr	Cont : dd, prp		0150-3L
3477.00				Vstl Hugi M.Jurassic		0151
			80	S/Sst : w to lt or, f, kln		0151-1L
			20	Sh/Clst: m gy		0151-2L
			tr	Cont : dd, prp		0151-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3483.00				Vstl Hugi M.Jurassic		0152
				90 S/Sst : w to lt or, f, slt, kln		0152-1L
				10 Sh/Clst: m gy, calc		0152-2L
				tr Ca : lt or		0152-3L
3489.00				Vstl Hugi M.Jurassic		0153
				85 S/Sst : lt gy, f, slt, l, kln		0153-1L
				10 Sh/Clst: m gy to drk gy, mic		0153-2L
				5 Cont : dd		0153-3L
3495.00				Vstl Hugi M.Jurassic		0154
				80 Sltst : lt brn gy to lt gy, l, kln		0154-1L
				15 Cont : dd		0154-3L
				5 Sh/Clst: m gy to drk gy, mic		0154-2L
3501.00				Vstl Hugi M.Jurassic		0155
				75 Sltst : lt brn gy to lt gy, l, kln		0155-1L
				20 Cont : dd, prp		0155-3L
				5 Sh/Clst: m gy to drk gy, mic		0155-2L
3504.00				Vstl Hugi M.Jurassic		0156
				90 Sltst : lt brn gy to lt gy, l, kln		0156-1L
				5 Sh/Clst: m gy to drk gy, mic		0156-2L
				5 Cont : dd, prp		0156-3L
3510.00				Vstl Hugi M.Jurassic		0157
				90 Sltst : or gy, l, kln		0157-1L
				5 Sh/Clst: m gy to drk gy, mic		0157-2L
				5 Cont : dd, prp		0157-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3514.00	ccp			Vst1 Hugi M.Jurassic		0411
			100	S/Sst : brn gy, crs, hd		0411-1L
3519.00	ccp			Vst1 Hugi M.Jurassic		0412
			100	S/Sst : lt brn gy to drk y brn, crs, hd		0412-1L
3524.00	ccp			Vst1 Hugi M.Jurassic		0413
			100	S/Sst : lt brn gy to drk y brn, crs, kln, hd		0413-1L
3529.00	ccp			Vst1 Hugi M.Jurassic		0414
			100	S/Sst : lt gy to lt brn gy, f, crs, hd		0414-1L
3531.50	ccp			Vst1 Hugi M.Jurassic		0415
			100	S/Sst : lt gy to lt brn gy, f, crs, hd		0415-1L
3534.00				Vst1 Hugi M.Jurassic		0158
			60	Sh/Clst: m gy		0158-1L
			40	S/Sst : lt gy to lt or, crs, l, f, kln		0158-2L
			tr	Cont : dd		0158-3L
3540.00				Vst1 Hugi M.Jurassic		0159
			70	S/Sst : lt gy to lt or, crs, l, f, kln		0159-2L
			30	Sh/Clst: m gy		0159-1L
			tr	Cont : dd		0159-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3546.00				Vstl Hugi M.Jurassic		0160
				70 S/Sst : lt gy to lt or, crs, l, f, kln		0160-2L
				30 Sh/Clst: m gy		0160-1L
				tr Cont : prp		0160-3L
3555.00				Vstl Hugi M.Jurassic		0161
				80 S/Sst : w to lt or, crs, f, kln		0161-2L
				20 Sh/Clst: m gy		0161-1L
3561.00				Vstl Hugi M.Jurassic		0162
				85 S/Sst : w to lt or, crs, f, kln		0162-2L
				15 Sh/Clst: m gy		0162-1L
3567.00				Vstl Hugi M.Jurassic		0163
				85 S/Sst : w to lt or, crs, f, kln		0163-2L
				15 Sh/Clst: m gy		0163-1L
3573.00				Vstl Hugi M.Jurassic		0164
				80 S/Sst : w to lt or, crs, f, kln		0164-2L
				20 Sh/Clst: m gy		0164-1L
				tr Ca : lt or		0164-3L
3579.00				Vstl Hugi M.Jurassic		0165
				90 S/Sst : w to lt or, crs, f, kln		0165-2L
				10 Sh/Clst: m gy		0165-1L
				tr Ca : lt or		0165-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3585.00				Vstl Hugi M.Jurassic		0166
				60 S/Sst : w to lt or, crs, f, kln		0166-2L
				40 Sh/Clst: drk gy to brn blk, mic		0166-1L
				tr Ca : lt or		0166-3L
3591.00				Vstl Hugi M.Jurassic		0167
				85 S/Sst : w to lt or, crs, f, kln		0167-2L
				15 Sh/Clst: m gy to drk gy to brn blk, mic		0167-1L
3597.00				Vstl Hugi M.Jurassic		0168
				50 Sh/Clst: m gy to drk gy to brn blk, mic		0168-1L
				50 S/Sst : w to lt or, crs, f, kln		0168-2L
3603.00				Vstl Hugi M.Jurassic		0169
				70 Sh/Clst: m gy to drk gy to brn blk, mic		0169-1L
				30 S/Sst : w to lt or, crs, f, kln		0169-2L
3609.00				Vstl Hugi M.Jurassic		0170
				70 Sh/Clst: m gy to drk gy to brn blk, mic, wx		0170-1L
				25 S/Sst : w to lt or, crs, f, kln		0170-2L
				5 Coal : blk, wx		0170-3L
3615.00				Vstl Hugi M.Jurassic		0171
				75 S/Sst : w to lt or, crs, f, kln		0171-2L
				20 Sh/Clst: m gy to drk gy to brn blk, mic, wx		0171-1L
				5 Coal : blk, wx		0171-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3621.00				Vstl Hugi M.Jurassic		0172
				85 S/Sst : lt gy to lt or, crs, l, kln		0172-2L
				10 Sh/Clst: m gy to drk gy to brn blk, mic, wx		0172-1L
				5 Coal : blk, wx		0172-3L
3627.00				Vstl Hugi M.Jurassic		0173
				55 S/Sst : lt gy to lt or, crs, l, kln		0173-2L
				45 Sh/Clst: brn gy, mic		0173-1L
3633.00				Vstl Hugi M.Jurassic		0174
				75 S/Sst : lt gy to lt or, crs, l, kln		0174-2L
				25 Sh/Clst: brn gy, mic		0174-1L
				tr Coal : blk, wx		0174-3L
3639.00				Vstl Hugi M.Jurassic		0175
				90 S/Sst : lt gy to lt or, crs, l, kln		0175-2L
				5 Sh/Clst: brn gy, mic		0175-1L
				5 Coal : blk, wx		0175-3L
3645.00				Vstl Hugi M.Jurassic		0176
				95 S/Sst : w to lt gy to lt or, crs, l, kln		0176-2L
				5 Coal : blk, wx		0176-3L
				tr Sh/Clst: brn gy, mic		0176-1L
3651.00				Vstl Hugi M.Jurassic		0177
				100 S/Sst : w to lt gy to lt or, crs, l, kln		0177-2L
				tr Sh/Clst: brn gy, mic		0177-1L
				tr Coal : blk, wx		0177-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3663.00				Vstl Hugi M.Jurassic		0178
				60 S/Sst : w to lt gy to lt or, crs, l, kln		0178-2L
				35 Sh/Clst: brn gy, mic		0178-1L
				5 Coal : blk, wx		0178-3L
3669.00				Vstl Slpn M.Jurassic		0179
				75 S/Sst : w to lt or, f, kln, crs, l		0179-1L
				25 Sh/Clst: m gy to drk gy to brn blk, mic		0179-2L
				tr Kaolin : w		0179-3L
				tr Cont : prp		0179-4L
3675.00				Vstl Slpn M.Jurassic		0180
				85 S/Sst : w to lt or, f, kln, crs, l		0180-1L
				15 Sh/Clst: m gy to drk gy to brn blk, mic		0180-2L
				tr Coal : blk, wx		0180-3L
				tr Cont : prp		0180-4L
3681.00				Vstl Slpn M.Jurassic		0181
				45 Sh/Clst: brn blk		0181-1L
				45 Coal : blk, wx		0181-2L
				10 S/Sst : w to lt or, f, kln		0181-3L
3687.00				Vstl Slpn M.Jurassic		0182
				45 Coal : blk, wx		0182-2L
				40 S/Sst : w to lt or, f, kln, crs, l		0182-3L
				15 Sh/Clst: drk gy to brn blk		0182-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3693.00				Vstl Slpn M.Jurassic		0183
				80 S/Sst : w to lt or, f, kln, mic, crs, l		0183-3L
				10 Sh/Clst: drk gy to brn blk		0183-1L
				10 Coal : blk, wx		0183-2L
3699.00				Vstl Slpn M.Jurassic		0184
				90 S/Sst : w to lt or, f, kln, mic, crs, l		0184-3L
				5 Sh/Clst: m gy to drk gy		0184-1L
				5 Coal : blk, wx		0184-2L
3705.00				Vstl Slpn M.Jurassic		0185
				85 S/Sst : w to lt or, f, kln, mic, crs, l		0185-3L
				10 Coal : blk, wx		0185-2L
				5 Sh/Clst: m gy to drk gy		0185-1L
3711.00				Vstl Slpn M.Jurassic		0186
				95 S/Sst : w to lt or, f, kln, mic, crs, l		0186-3L
				5 Coal : blk, wx		0186-2L
				tr Sh/Clst: m gy to drk gy		0186-1L
3717.00				Vstl Slpn M.Jurassic		0187
				95 S/Sst : w to lt or, f, kln, mic, crs, l		0187-3L
				5 Sh/Clst: m gy to drk gy		0187-1L
				tr Coal : blk, wx		0187-2L
3723.00				Vstl Slpn M.Jurassic		0188
				85 S/Sst : w to lt or, f, kln, mic, crs, l		0188-3L
				10 Sh/Clst: m gy		0188-1L
				5 Coal : blk, wx		0188-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3729.00				Vstl Slpn M.Jurassic		0189
				70 Coal : blk, wx		0189-2L
				20 S/Sst : w to lt or, f, kln, mic		0189-3L
				10 Sh/Clst: m gy to drk gy		0189-1L
				tr Cont : prp		0189-4L
3735.00				Vstl Slpn M.Jurassic		0190
				75 S/Sst : w to lt or, f, crs, mic, kln		0190-3L
				20 Sh/Clst: m gy		0190-1L
				5 Coal : blk, wx		0190-2L
3741.00				Vstl Slpn M.Jurassic		0191
				90 Coal : blk, wx		0191-2L
				10 S/Sst : w to lt or, f, crs, mic, kln		0191-3L
				tr Sh/Clst: m gy		0191-1L
3747.00				Vstl Slpn M.Jurassic		0192
				60 Coal : blk, wx		0192-2L
				30 S/Sst : w to lt or, f, crs, mic, kln, l		0192-3L
				10 Sh/Clst: m gy		0192-1L
3753.00				Vstl Slpn M.Jurassic		0193
				50 Coal : blk, wx		0193-1L
				35 S/Sst : w to lt or, f, crs, mic, kln, l		0193-2L
				15 Sh/Clst: m gy to drk gy		0193-3L
				tr Cont : dd, prp		0193-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3759.00				Vstl Slpn M.Jurassic		0194
				65 S/Sst : w to lt or, f, crs, mic, kln, l		0194-2L
				30 Sh/Clst: m gy to drk gy		0194-3L
				5 Coal : blk, wx		0194-1L
				tr Kaolin : w		0194-4L
				tr Cont : dd, prp		0194-5L
3765.00				Vstl Slpn M.Jurassic		0195
				40 S/Sst : w to lt or, f, crs, mic, kln, l		0195-2L
				30 Coal : blk, wx		0195-1L
				30 Sh/Clst: m gy to drk gy		0195-3L
				tr Kaolin : w		0195-4L
				tr Cont : dd, prp		0195-5L
3771.00				Vstl Slpn M.Jurassic		0196
				65 S/Sst : w to lt or, f, crs, mic, kln, l		0196-2L
				20 Sh/Clst: m gy to drk gy		0196-3L
				15 Coal : blk, wx		0196-1L
				tr Cont : dd, prp		0196-4L
3777.00				Vstl Slpn M.Jurassic		0197
				85 S/Sst : w to lt or, f, crs, mic, kln, l		0197-2L
				10 Sh/Clst: m gy to drk gy		0197-3L
				5 Coal : blk, wx		0197-1L
3783.00				Vstl Slpn M.Jurassic		0198
				75 S/Sst : w to lt or, f, crs, mic, kln, l		0198-2L
				10 Sh/Clst: m gy to drk gy		0198-3L
				10 Cont : dd, prp		0198-4L
				5 Coal : blk, wx		0198-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3789.00				Vstl Slpn M.Jurassic		0199
				35 S/Sst : w to lt or, f, crs, mic, kln, l		0199-2L
				30 Coal : blk, wx		0199-1L
				30 Sh/Clst: m gy to drk gy		0199-3L
				5 Cont : dd, prp		0199-4L
3795.00				Vstl Slpn M.Jurassic		0200
				70 S/Sst : w to lt or, f, crs, mic, kln, l		0200-2L
				25 Sh/Clst: m gy to drk gy		0200-3L
				5 Cont : dd, prp		0200-4L
				tr Coal : blk, wx		0200-1L
				tr Kaolin : w		0200-5L
3801.00				Vstl Slpn M.Jurassic		0201
				80 S/Sst : w to lt or, f, crs, mic, kln, l		0201-2L
				10 Coal : blk, wx		0201-1L
				10 Sh/Clst: m gy to drk gy		0201-3L
				tr Cont : dd, prp		0201-4L
3807.00				Vstl Slpn M.Jurassic		0202
				85 S/Sst : w to lt or, f, kln, mic, crs, l		0202-1L
				15 Sh/Clst: m gy to drk gy		0202-2L
				tr Coal : blk, wx		0202-3L
3813.00				Vstl Slpn M.Jurassic		0203
				70 S/Sst : w to lt or, f, kln, mic, crs, l		0203-1L
				25 Sh/Clst: m gy to drk gy		0203-2L
				5 Cont : dd		0203-4L
				tr Coal : blk, wx		0203-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
3819.00			Vstl Slpn M.Jurassic			0204
			75	Sh/Clst: m gy to drk gy		0204-2L
			20	S/Sst : w to lt or, f, kln, mic, crs, l		0204-1L
			5	Cont : dd		0204-3L
3825.00			Vstl Slpn M.Jurassic			0205
			55	S/Sst : w, f, kln		0205-1L
			40	Sh/Clst: m gy to drk gy		0205-2L
			5	Kaolin : w		0205-3L
3831.00			Vstl Slpn M.Jurassic			0206
			70	Sh/Clst: m gy to drk gy		0206-2L
			30	S/Sst : w, f, kln		0206-1L
			tr	Kaolin : w		0206-3L
			tr	Coal : blk, wx		0206-4L
3837.00			Vstl Slpn M.Jurassic			0207
			60	Sh/Clst: m gy to drk gy		0207-2L
			40	S/Sst : w, f, kln		0207-1L
			tr	Kaolin : w		0207-3L
			tr	Coal : blk, wx		0207-4L
			tr	Cont : dd		0207-5L
3843.00			Vstl Slpn M.Jurassic			0208
			50	S/Sst : w, f, kln, crs, l		0208-1L
			50	Sh/Clst: m gy to drk gy to gy brn		0208-2L
			tr	Kaolin : w		0208-3L
			tr	Coal : blk, wx		0208-4L
			tr	Cont : dd, prp		0208-5L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
3849.00			Vstl	Slpn	M.Jurassic	0209
			50	Sh/Clst:	m gy to drk gy to gy brn	0209-2L
			40	S/Sst	: w, f, kln, crs, l	0209-1L
			10	Cont	: dd, prp	0209-5L
			tr	Kaolin	: w	0209-3L
			tr	Coal	: blk, wx	0209-4L
3855.00			Vstl	Slpn	M.Jurassic	0210
			60	Coal	: blk, wx	0210-1L
			40	Sh/Clst:	m gy	0210-2L
			tr	S/Sst	: w, f, kln, crs, l	0210-3L
			tr	Cont	: dd	0210-4L
3861.00			Vstl	Slpn	M.Jurassic	0211
			50	S/Sst	: w to lt or, f, kln	0211-1L
			45	Sh/Clst:	lt gy to m gy to drk gy	0211-2L
			5	Coal	: blk, wx	0211-3L
3867.00			Vstl	Slpn	M.Jurassic	0212
			90	Sh/Clst:	lt gy to m gy to drk gy	0212-2L
			5	S/Sst	: w to lt or, f, kln	0212-1L
			5	Coal	: blk, wx	0212-3L
3873.00			Vstl	Slpn	M.Jurassic	0213
			50	Cont	: dd	0213-1L
			30	Sh/Clst:	m gy to drk gy	0213-2L
			20	S/Sst	: lt or, f, slt, kln	0213-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3879.00				Vstl Slpn M.Jurassic		0214
				70 Sh/Clst: m gy to drk gy		0214-2L
				15 Cont : dd		0214-1L
				10 Coal : blk, wx		0214-4L
				5 S/Sst : lt or to lt brn gy, f, slt, kln		0214-3L
3885.00				Vstl Slpn M.Jurassic		0215
				50 Sh/Clst: m gy		0215-1L
				30 Coal : brn blk to blk, wx		0215-2L
				20 S/Sst : w to lt or, f, kln		0215-3L
				tr Cont : dd, prp		0215-4L
3891.00				Vstl Slpn M.Jurassic		0216
				70 Sh/Clst: m gy		0216-1L
				20 Coal : brn blk to blk, wx		0216-2L
				10 Cont : dd, prp		0216-4L
				tr S/Sst : w to lt or, f, kln		0216-3L
3897.00				Vstl Slpn M.Jurassic		0217
				75 Sh/Clst: m gy to brn gy to drk gy		0217-1L
				15 Coal : blk, wx		0217-2L
				5 S/Sst : w to lt or, f, kln		0217-3L
				5 Cont : dd, prp		0217-4L
3903.00				Vstl Slpn M.Jurassic		0218
				75 Sh/Clst: m gy to drk gy to dsk y brn, wx		0218-1L
				15 S/Sst : w to lt or, f, kln, crs, l		0218-3L
				5 Coal : blk, wx		0218-2L
				5 Cont : dd, prp		0218-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3909.00				Vstl Slpn M.Jurassic		0219
				70 S/Sst : w to lt or, f, kln, crs, l		0219-3L
				25 Sh/Clst: m gy to drk gy		0219-1L
				5 Coal : blk, wx		0219-2L
3915.00				Vstl Slpn M.Jurassic		0220
				90 S/Sst : w to lt or, f, kln, crs, l		0220-3L
				10 Sh/Clst: m gy to drk gy		0220-1L
				tr Coal : blk, wx		0220-2L
3921.00				Vstl Slpn M.Jurassic		0221
				90 S/Sst : w to lt or, f, kln, crs, l		0221-3L
				5 Sh/Clst: m gy to drk gy		0221-1L
				5 Coal : blk, wx		0221-2L
				tr Cont : dd		0221-4L
3927.00				Vstl Slpn M.Jurassic		0222
				70 S/Sst : w to lt gy to lt or, f, kln, crs, l		0222-3L
				10 Sh/Clst: m gy to drk gy to dsk brn, mic		0222-1L
				10 Coal : blk, wx		0222-2L
				10 Cont : dd, cem		0222-4L
3933.00				Vstl Slpn M.Jurassic		0223
				80 Sh/Clst: m gy to drk gy to dsk brn, mic		0223-1L
				10 S/Sst : w to lt gy to lt or, f, kln, crs, l		0223-3L
				5 Coal : blk, wx		0223-2L
				5 Cont : dd, cem		0223-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
3939.00			Vstl Slpn M.Jurassic			0224
			75	Sh/Clst: m gy to drk gy to dsk brn, mic		0224-1L
			10	S/Sst : w to lt gy to lt or, f, kln, crs, 1		0224-3L
			10	Cont : dd, cem		0224-4L
			5	Coal : blk, wx		0224-2L
3945.00			Vstl Slpn M.Jurassic			0225
			70	Sh/Clst: m gy to drk gy to dsk brn, mic		0225-1L
			15	Coal : blk, wx		0225-2L
			10	Cont : dd, cem		0225-4L
			5	S/Sst : w to lt gy to lt or, f, kln, crs, 1		0225-3L
3951.00			Vstl Slpn M.Jurassic			0226
			50	Sh/Clst: m gy to drk gy to dsk brn, mic		0226-1L
			40	S/Sst : w to lt gy to lt or, f, kln, crs, 1		0226-3L
			10	Coal : blk, wx		0226-2L
			tr	Cont : dd, cem		0226-4L
3957.00			Vstl Slpn M.Jurassic			0227
			75	Sh/Clst: m gy to drk gy to dsk brn, mic, slt		0227-1L
			25	S/Sst : w to lt gy to lt or, f, kln, crs, 1		0227-3L
			tr	Coal : blk, wx		0227-2L
			tr	Cont : dd, cem		0227-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3963.00				Vstl Slpn M.Jurassic		0228
			75	Sh/Clst: m gy to drk gy to dsk brn, mic, slt		0228-1L
			25	S/Sst : w to lt gy to lt or, f, kln		0228-3L
			tr	Coal : blk, wx		0228-2L
			tr	Cont : dd		0228-4L
3969.00				Vstl Slpn M.Jurassic		0229
			60	Sh/Clst: drk gy to brn blk		0229-1L
			30	S/Sst : w to lt or, f, kln		0229-2L
			10	Coal : blk, wx		0229-3L
			tr	Cont : dd		0229-4L
3975.00				Vstl Slpn M.Jurassic		0230
			75	Sh/Clst: drk gy to brn blk to dsk brn		0230-1L
			15	S/Sst : w to lt or, f, kln		0230-2L
			10	Coal : blk, wx		0230-3L
			tr	Cont : dd		0230-4L
3981.00				Vstl Slpn M.Jurassic		0231
			65	S/Sst : w to lt or, f, kln		0231-2L
			20	Sh/Clst: drk gy to brn blk to dsk brn		0231-1L
			15	Coal : blk, wx		0231-3L
			tr	Cont : dd		0231-4L
3987.00				Vstl Slpn M.Jurassic		0232
			85	S/Sst : w to lt or, f, kln		0232-2L
			10	Sh/Clst: drk gy to brn blk to dsk brn		0232-1L
			5	Coal : blk, wx		0232-3L
			tr	Cont : dd		0232-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
3993.00				Vstl Slpn M.Jurassic		0233
				65 S/Sst : w to lt or to lt brn gy, f, kln		0233-2L
				35 Sh/Clst: drk gy to brn blk to dsk brn		0233-1L
3999.00				Vstl Slpn M.Jurassic		0234
				80 S/Sst : w to lt or to lt brn gy, f, kln		0234-2L
				20 Sh/Clst: m gy to pl y brn		0234-1L
				tr Coal : blk, wx		0234-3L
4005.00				Vstl Slpn M.Jurassic		0235
				80 Sh/Clst: lt gy to m gy, mic		0235-1L
				20 S/Sst : w to lt or to lt brn gy, f, kln		0235-2L
				tr Coal : blk, wx		0235-3L
4011.00				Dunl Drak L.Jurassic		0237
				100 Sh/Clst: m gy, mic		0237-1L
				tr S/Sst : w, f, kln		0237-2L
4017.00				Dunl Drak L.Jurassic		0238
				80 Sh/Clst: m gy to dsk brn		0238-1L
				15 Coal : blk, wx		0238-2L
				5 S/Sst : w to lt or, f, kln		0238-3L
				tr Cont : prp, dd		0238-4L
4023.00				Dunl Drak L.Jurassic		0239
				90 Sh/Clst: lt gy to m gy to dsk brn		0239-1L
				10 S/Sst : w to lt or, f, kln		0239-3L
				tr Coal : blk, wx		0239-2L
				tr Cont : prp, dd		0239-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4029.00				Dunl Drak L.Jurassic		0240
				90 Sh/Clst: lt gy to m gy to dsk brn		0240-1L
				5 Coal : blk, wx		0240-2L
				5 S/Sst : w to lt or, f, kln		0240-3L
				tr Cont : prp, dd		0240-4L
4035.00				Dunl Drak L.Jurassic		0241
				90 Sh/Clst: lt gy to m gy		0241-1L
				5 S/Sst : w to lt or, f, kln		0241-3L
				5 Cont : prp, dd		0241-4L
				tr Coal : blk, wx		0241-2L
4041.00				Dunl Drak L.Jurassic		0242
				85 Sh/Clst: lt gy to m gy		0242-1L
				10 S/Sst : w to lt or, f, kln		0242-3L
				5 Cont : prp, dd		0242-4L
				tr Coal : blk, wx		0242-2L
4047.00				Dunl Drak L.Jurassic		0243
				90 Sh/Clst: lt gy to m gy		0243-1L
				10 Cont : prp, dd		0243-3L
				tr S/Sst : w to lt or, f, kln		0243-2L
4053.00				Dunl Drak L.Jurassic		0244
				90 Sh/Clst: lt gy to m gy		0244-1L
				10 Cont : prp, dd		0244-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4059.00				Dunl Drak L.Jurassic		0245
				85 Sh/Clst: lt gy to m gy		0245-1L
				15 Cont : prp, dd		0245-2L
				tr S/Sst : w to lt or, f, kln		0245-3L
4065.00				Dunl Drak L.Jurassic		0246
				100 Sh/Clst: lt gy to m gy, mic		0246-1L
				tr S/Sst : w to lt or, f, kln, crs, l		0246-2L
				tr Cont : prp, dd		0246-3L
4071.00				Dunl Drak L.Jurassic		0247
				100 Sh/Clst: lt gy to m gy, mic		0247-1L
				tr S/Sst : w to lt or, f, kln, crs, l		0247-2L
				tr Cont : prp, dd		0247-3L
4077.00				Dunl Drak L.Jurassic		0248
				85 Sh/Clst: lt gy to m gy, mic		0248-1L
				15 Cont : prp, dd		0248-2L
4083.00				Dunl Drak L.Jurassic		0249
				95 Sh/Clst: lt gy to m gy, mic		0249-1L
				5 Cont : prp, dd		0249-2L
4089.00				Dunl Drak L.Jurassic		0250
				75 Sh/Clst: lt gy to m gy, mic		0250-1L
				25 Cont : prp, dd		0250-2L
				tr Coal : blk, wx		0250-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4095.00				Dunl Drak L.Jurassic		0251
				85 Sh/Clst: lt gy to m gy, mic		0251-1L
				15 Cont : prp, dd		0251-2L
				tr Coal : blk, wx		0251-3L
4101.00				Dunl Drak L.Jurassic		0252
				85 Sh/Clst: lt gy to m gy to dsk brn		0252-1L
				15 Cont : dd, prp		0252-2L
				tr Coal : blk, wx		0252-3L
4107.00				Dunl Drak L.Jurassic		0253
				85 Sh/Clst: lt gy to m gy to dsk brn		0253-1L
				10 Cont : dd, prp		0253-2L
				5 S/Sst : w to lt or, f, kln		0253-3L
				tr Coal : blk, wx		0253-4L
4113.00				Dunl Drak L.Jurassic		0254
				85 Sh/Clst: lt gy to m gy to dsk brn		0254-1L
				10 Cont : dd, prp		0254-2L
				5 S/Sst : w to lt or, f, kln		0254-3L
4119.00				Dunl Drak L.Jurassic		0255
				85 Sh/Clst: lt gy to m gy to dsk brn		0255-1L
				5 Cont : dd, prp		0255-2L
				5 S/Sst : w to lt or, f, kln		0255-3L
				5 Coal : blk, wx		0255-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4125.00				Dunl Drak L.Jurassic		0256
				90 Sh/Clst: m gy to drk gy to dsk brn, mic, slt		0256-1L
				10 S/Sst : w to lt or, f, kln, crs, l		0256-3L
				tr Cont : dd, prp		0256-2L
				tr Coal : blk, wx		0256-4L
4131.00				Dunl Drak L.Jurassic		0257
				85 Sh/Clst: lt brn gy		0257-1L
				10 Cont : dd, prp		0257-3L
				5 Coal : blk, wx		0257-2L
4137.00				Dunl Drak L.Jurassic		0258
				75 Sh/Clst: lt brn gy to brn gy		0258-1L
				15 Sh/Clst: m gy to drk gy, mic		0258-4L
				10 Cont : dd, prp		0258-3L
				tr Coal : blk, wx		0258-2L
4143.00				Dunl Drak L.Jurassic		0259
				95 Sh/Clst: brn gy to brn blk, mic		0259-1L
				5 S/Sst : w to lt or, f, kln		0259-2L
4149.00				Dunl Drak L.Jurassic		0260
				100 Sh/Clst: brn gy to brn blk, mic		0260-1L
				tr S/Sst : w to lt or, f, kln		0260-2L
4155.00				Dunl Drak L.Jurassic		0261
				100 Sh/Clst: brn gy to brn blk, mic		0261-1L
				tr S/Sst : w to lt or, f, kln		0261-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4161.00				Dunl Drak L.Jurassic		0262
			100	Sh/Clst: drk gy to brn gy, mic tr S/Sst : w to lt or, f, kln		0262-1L 0262-2L
4167.00				Dunl Drak L.Jurassic		0263
			100	Sh/Clst: drk gy to brn gy, mic tr S/Sst : w to lt or, f, kln		0263-1L 0263-2L
4173.00				Dunl Drak L.Jurassic		0264
			100	Sh/Clst: drk gy to brn blk, mic		0264-1L
4179.00				Dunl Drak L.Jurassic		0265
			100	Sh/Clst: drk gy to brn gy		0265-1L
4185.00				Dunl Drak L.Jurassic		0266
			100	Sh/Clst: drk gy to brn gy		0266-1L
4191.00				Dunl Drak L.Jurassic		0267
			100	Sh/Clst: m gy to drk gy to brn gy		0267-1L
4197.00				Dunl Drak L.Jurassic		0268
			100	Sh/Clst: m gy to drk gy to brn gy		0268-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4203.00				Dunl Drak L.Jurassic		0269
			100	Sh/Clst: m gy to drk gy to brn gy		0269-1L
4209.00				Dunl Drak L.Jurassic		0270
			60	Sh/Clst: m gy to drk gy		0270-1L
			40	Cont : cem, prp, dd		0270-2L
4215.00				Dunl Cook L.Jurassic		0271
			60	Cont : dd, prp		0271-1L
			25	Sh/Clst: m gy to drk gy, mic		0271-2L
			15	Sh/Clst: pl brn		0271-3L
4221.00				Dunl Cook L.Jurassic		0272
			95	Sh/Clst: m gy to drk gy to brn gy, mic		0272-1L
			5	Cont : prp		0272-2L
4227.00				Dunl Cook L.Jurassic		0273
			70	Sh/Clst: m gy to drk gy, mic		0273-1L
			30	Cont : cem, prp		0273-2L
4233.00				Dunl Cook L.Jurassic		0274
			85	Sh/Clst: m gy to drk gy, mic		0274-1L
			15	Cont : cem, prp		0274-2L
4239.00				Dunl Cook L.Jurassic		0275
			70	Sh/Clst: m gy to drk gy, mic		0275-1L
			30	Cont : cem, prp, dd		0275-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4245.00				Dunl Cook L.Jurassic		0276
			65	Sh/Clst: m gy to drk gy, mic		0276-1L
			30	Cont : cem, prp, dd		0276-2L
			5	Kaolin : w to lt gy		0276-3L
4251.00				Dunl Cook L.Jurassic		0277
			80	Sh/Clst: m gy to drk gy, mic		0277-1L
			10	Cont : cem, prp, dd		0277-2L
			10	Kaolin : w to lt gy		0277-3L
4257.00				Dunl Cook L.Jurassic		0278
			75	Sh/Clst: m gy to drk gy, mic		0278-1L
			15	Cont : dd, prp		0278-2L
			10	Kaolin : w to lt gy		0278-3L
4263.00				Dunl Cook L.Jurassic		0279
			80	Sh/Clst: m gy to drk gy, mic		0279-1L
			15	Cont : dd, prp		0279-2L
			5	Kaolin : w to lt gy		0279-3L
4269.00				Dunl Cook L.Jurassic		0280
			90	Sh/Clst: m gy to drk gy, mic		0280-1L
			10	Cont : dd, prp		0280-2L
			tr	Kaolin : w to lt gy		0280-3L
4275.00				Dunl Burt L.Jurassic		0281
			90	Sh/Clst: m gy to drk gy to brn blk		0281-1L
			10	Cont : dd, prp		0281-2L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4281.00				Dunl Burt L.Jurassic		0282
				90 Sh/Clst: m gy to drk gy to brn blk		0282-1L
				10 Cont : dd, prp		0282-2L
4287.00				Dunl Burt L.Jurassic		0283
				85 Sh/Clst: m gy		0283-1L
				15 Cont : dd, prp		0283-2L
4293.00				Dunl Burt L.Jurassic		0284
				80 Sh/Clst: m gy		0284-1L
				20 Cont : prp, dd		0284-2L
4299.00				Dunl Burt L.Jurassic		0285
				75 Sh/Clst: m gy		0285-1L
				25 Cont : prp, dd		0285-2L
4305.00				Dunl Burt L.Jurassic		0286
				75 Sh/Clst: m gy		0286-1L
				25 Cont : prp, dd		0286-2L
4311.00				Dunl Burt L.Jurassic		0287
				90 Sh/Clst: m gy		0287-1L
				10 Cont : prp, dd		0287-2L
4317.00				Dunl Burt L.Jurassic		0288
				95 Sh/Clst: m gy		0288-1L
				5 Cont : prp, dd		0288-2L
				tr Kaolin : w to lt gy		0288-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4323.00				Dunl Amun L.Jurassic		0289
				85 Sh/Clst: m gy to drk gy		0289-1L
				15 Cont : dd, prp		0289-2L
4329.00				Dunl Amun L.Jurassic		0290
				80 Sh/Clst: m gy to drk gy		0290-1L
				20 Cont : dd, prp		0290-2L
4335.00				Dunl Amun L.Jurassic		0291
				90 Sh/Clst: m gy to drk gy		0291-1L
				10 Cont : dd, prp		0291-2L
4341.00				Dunl Amun L.Jurassic		0292
				90 Sh/Clst: m gy to drk gy		0292-1L
				10 Cont : dd, prp		0292-2L
				tr S/Sst : w, crs, l		0292-3L
4347.00				Dunl Amun L.Jurassic		0293
				95 Sh/Clst: m gy to drk gy		0293-1L
				5 Cont : dd, prp		0293-2L
				tr S/Sst : w, crs, l		0293-3L
4353.00				Dunl Amun L.Jurassic		0294
				80 Sh/Clst: m gy to drk gy		0294-1L
				15 Kaolin : w to lt gy		0294-4L
				5 Cont : dd, prp		0294-2L
				tr S/Sst : w, crs, l		0294-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
4359.00			Dunl	Amun	L.Jurassic		0295
			60	Sh/Clst:	m gy to drk gy		0295-1L
			25	Kaolin :	w to lt gy		0295-4L
			10	S/Sst :	w, f, kln, crs, l		0295-3L
			5	Cont :	dd, prp		0295-2L
4365.00			Dunl	Amun	L.Jurassic		0296
			70	Sh/Clst:	m gy to drk gy		0296-1L
			15	Kaolin :	w to lt gy		0296-4L
			10	S/Sst :	w, f, kln, crs, l		0296-3L
			5	Cont :	dd, prp		0296-2L
4371.00			Dunl	Amun	L.Jurassic		0297
			80	Sh/Clst:	m gy to drk gy		0297-1L
			10	Kaolin :	w to lt gy		0297-4L
			5	Cont :	dd, prp		0297-2L
			5	S/Sst :	w, f, kln, crs, l		0297-3L
4377.00			Dunl	Amun	L.Jurassic		0298
			60	Sh/Clst:	m gy to drk gy		0298-1L
			30	Kaolin :	w to lt gy		0298-4L
			5	Cont :	dd, prp		0298-2L
			5	S/Sst :	w, f, kln, crs, l		0298-3L
4383.00			Dunl	Amun	L.Jurassic		0299
			50	Sh/Clst:	m gy to drk gy		0299-1L
			40	Kaolin :	w to lt gy, s		0299-4L
			5	Cont :	dd, prp		0299-2L
			5	S/Sst :	w, f, kln, crs, l		0299-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4389.00				Dunl Amun L.Jurassic		0300
				70 Sh/Clst: m gy to drk gy		0300-1L
				25 Kaolin : w to lt gy, s		0300-4L
				5 Cont : dd, prp		0300-2L
				tr S/Sst : w, f, kln, crs, l		0300-3L
4395.00				Dunl Amun L.Jurassic		0301
				80 Sh/Clst: m gy to drk gy		0301-1L
				15 Kaolin : w to lt gy, s		0301-4L
				5 Cont : dd, prp		0301-2L
				tr S/Sst : w, f, kln, crs, l		0301-3L
4401.00				Dunl Amun L.Jurassic		0302
				80 Sh/Clst: m gy to drk gy		0302-1L
				15 Kaolin : w to lt gy, s		0302-4L
				5 Cont : dd, prp		0302-2L
				tr S/Sst : w, f, kln, crs, l		0302-3L
4407.00				Dunl Amun L.Jurassic		0303
				80 Sh/Clst: m gy to drk gy		0303-1L
				10 Marl : lt gy		0303-2L
				10 Cont : dd, prp		0303-3L
4413.00				Dunl Amun L.Jurassic		0304
				60 Sh/Clst: m gy to drk gy		0304-1L
				20 Marl : lt gy		0304-2L
				20 Cont : dd, prp		0304-3L
				tr S/Sst : w, crs, l		0304-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4419.00				Dunl Amun L.Jurassic		0305
				65 Sh/Clst: m gy to drk gy		0305-1L
				25 Marl : lt gy, slt		0305-2L
				10 Cont : dd, prp		0305-3L
				tr S/Sst : w, f, kln		0305-4L
4425.00				Dunl Amun L.Jurassic		0306
				75 Sh/Clst: m gy to drk gy, mic		0306-1L
				20 Sltst : lt gy, calc		0306-2L
				5 Cont : dd, prp		0306-3L
4431.00				Dunl Amun L.Jurassic		0307
				75 Sh/Clst: m gy to drk gy, mic		0307-1L
				20 Sltst : lt gy, calc		0307-2L
				5 Cont : dd, prp		0307-3L
4437.00				Dunl Amun L.Jurassic		0308
				70 Sh/Clst: m gy to drk gy, mic		0308-1L
				15 Sltst : lt gy, calc		0308-2L
				10 Coal : blk		0308-3L
				5 Cont : dd, prp		0308-4L
				tr S/Sst : w to lt gy, crs, l		0308-5L
4443.00				Dunl Amun L.Jurassic		0309
				50 Sh/Clst: m gy to drk gy, mic		0309-1L
				30 S/Sst : w to lt or to lt gy, f, kln		0309-4L
				15 Coal : blk		0309-2L
				5 Cont : dd, prp		0309-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4449.00				Dunl Amun L.Jurassic		0310
				65 Sh/Clst: m gy to drk gy, mic		0310-1L
				20 S/Sst : w to lt or to lt gy, f, kln		0310-4L
				10 Cont : dd, prp		0310-3L
				5 Coal : blk		0310-2L
4455.00				Dunl Amun L.Jurassic		0311
				75 Sh/Clst: m gy to drk gy, mic		0311-1L
				10 Cont : dd, prp		0311-3L
				10 S/Sst : w to lt or to lt gy, f, kln		0311-4L
				5 Coal : blk		0311-2L
4461.00				Dunl Amun L.Jurassic		0312
				80 Sh/Clst: m gy to drk gy		0312-1L
				10 Cont : dd, prp		0312-2L
				10 S/Sst : w to lt or to lt gy, f, kln, crs, l		0312-3L
4467.00				Dunl Amun L.Jurassic		0313
				100 Sh/Clst: pl y brn, slt		0313-1L
4473.00				Dunl Amun L.Jurassic		0314
				100 Sh/Clst: pl y brn, slt		0314-1L
4479.00				Dunl Amun L.Jurassic		0315
				100 Sh/Clst: pl y brn, slt		0315-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4485.00				Dunl Amun L.Jurassic		0316
			100	Sh/Clst: pl y brn, slt		0316-1L
4491.00				Dunl Amun L.Jurassic		0317
			100	Sh/Clst: pl y brn, slt		0317-1L
4497.00				Dunl Amun L.Jurassic		0318
			100	Sh/Clst: pl y brn, slt		0318-1L
4503.00				Dunl Amun L.Jurassic		0319
			100	Sh/Clst: pl y brn, slt		0319-1L
4509.00				Dunl Amun L.Jurassic		0320
			100	Sh/Clst: pl y brn, slt		0320-1L
4515.00				Dunl Amun L.Jurassic		0321
			100	Sh/Clst: pl y brn, slt		0321-1L
4521.00				Dunl Amun L.Jurassic		0322
			80	Sh/Clst: pl y brn, slt, s		0322-1L
			20	Sh/Clst: m gy to drk gy		0322-2L
4527.00				Dunl Amun L.Jurassic		0323
			80	Sh/Clst: lt brn gy		0323-1L
			20	Cont : dd, prp		0323-2L
			tr	S/Sst : w to lt gy, crs, l		0323-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4533.00				Dunl Amun L.Jurassic		0324
				75 Sh/Clst: lt brn gy to pl y brn		0324-1L
				25 Sh/Clst: m gy to drk gy, mic		0324-2L
				tr S/Sst : w, crs, l		0324-3L
				tr Cont : prp		0324-4L
4539.00				Dunl Amun L.Jurassic		0325
				70 Sh/Clst: m gy to drk gy, mic		0325-2L
				30 Sh/Clst: lt brn gy to pl y brn		0325-1L
				tr S/Sst : w, crs, l		0325-3L
				tr Cont : prp		0325-4L
4545.00				Dunl Amun L.Jurassic		0326
				90 Sh/Clst: lt brn gy to m gy, calc		0326-1L
				10 Cont : Coal-ad, dd		0326-2L
				tr S/Sst : w, crs, l		0326-3L
4551.00				Dunl Amun L.Jurassic		0327
				95 Sh/Clst: lt brn gy to m gy, calc		0327-1L
				5 Cont : Coal-ad, dd, prp		0327-2L
4557.00				Dunl Amun L.Jurassic		0328
				95 Sh/Clst: lt brn gy to m gy, slt, mic		0328-1L
				5 Cont : dd, prp		0328-2L
				tr Cont : w to lt gy, crs, l		0328-3L
4563.00				Dunl Amun L.Jurassic		0329
				90 Sh/Clst: brn gy to m gy to drk gy, mic		0329-1L
				10 Cont : prp		0329-3L
				tr S/Sst : w, crs, l		0329-2L
				tr Sh/Clst: pl ol to gn gy		0329-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4569.00				Dunl Amun L.Jurassic		0330
			100	Sh/Clst: drk y brn, slt		0330-1L
4575.00				Dunl Amun L.Jurassic		0331
			100	Sh/Clst: lt brn gy to drk gy to dsk brn		0331-1L
				tr S/Sst : w, crs, l		0331-2L
				tr Cont : prp		0331-3L
4581.00				Dunl Amun L.Jurassic		0332
			100	Sh/Clst: lt brn gy to drk gy to dsk brn		0332-1L
				tr S/Sst : w, crs, l		0332-2L
				tr Cont		0332-3L
4587.00				Dunl Amun L.Jurassic		0333
			100	Sh/Clst: m gy to drk gy		0333-1L
				tr S/Sst : w, crs, l		0333-2L
				tr Cont		0333-3L
4593.00				Dunl Amun L.Jurassic		0334
			100	Sh/Clst: m gy to drk gy		0334-1L
				tr S/Sst : w to lt gy, crs, l		0334-2L
				tr Cont : prp		0334-3L
4599.00				Dunl Amun L.Jurassic		0335
			100	Sh/Clst: m gy to drk gy		0335-1L
				tr S/Sst : w to lt gy, crs, l		0335-2L
				tr Cont : prp		0335-3L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4605.00				Dunl Amun L.Jurassic		0336
				75 Sh/Clst: m gy to drk gy		0336-1L
				25 Cont : dd		0336-2L
4611.00				Dunl Amun L.Jurassic		0337
				60 Sh/Clst: m gy to drk gy		0337-1L
				40 Cont : dd		0337-2L
4617.00				Dunl Amun L.Jurassic		0338
				60 Cont : dd		0338-2L
				40 Sh/Clst: m gy to drk gy		0338-1L
				tr S/Sst : w to lt gy, crs, l		0338-3L
4623.00				Dunl Amun L.Jurassic		0339
				50 Sh/Clst: m gy to drk gy		0339-1L
				50 Cont : dd		0339-2L
				tr S/Sst : w to lt gy, crs, l		0339-3L
4629.00				Dunl Amun L.Jurassic		0340
				70 Sh/Clst: m gy to drk gy		0340-1L
				30 Cont : dd		0340-2L
				tr S/Sst : w to lt gy, crs, l		0340-3L
4635.00	ccp			Dunl Amun L.Jurassic		0416
				100 S/Sst : w, crs, kln, hd		0416-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
4641.00	ccp			Stat L.Jurassic		0417
		100	S/Sst	: w to lt gy, crs, kln, hd		0417-1L
4645.75	ccp			Stat L.Jurassic		0418
		100	S/Sst	: w to lt gy, crs, l		0418-1L
4652.00	ccp			Stat L.Jurassic		0419
		100	S/Sst	: lt gy, f, hd		0419-1L
4657.00	ccp			Stat L.Jurassic		0420
		100	S/Sst	: lt gy, crs, kln		0420-1L
4661.00	ccp			Stat L.Jurassic		0421
		100	S/Sst	: lt gy, crs, hd		0421-1L
4664.87	ccp			Stat L.Jurassic		0422
		100	S/Sst	: w, crs, kln		0422-1L
4671.00				Stat L.Jurassic		0341
		95	S/Sst	: w to lt gy, crs, l, kln, mic		0341-1L
		5	Sh/Clst:	m gy		0341-2L
			tr Cont	: prp, dd		0341-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4677.00				Stat L.Jurassic		0342
			100	S/Sst : w to lt gy, crs, l, kln, mic		0342-1L
				tr Sh/Clst: m gy		0342-2L
				tr Cont : prp, dd		0342-3L
4683.00				Stat L.Jurassic		0343
			95	S/Sst : w to lt gy to lt brn gy, crs, l, f, kln, mic		0343-1L
			5	Sh/Clst: m gy to drk gy		0343-2L
				tr Cont : prp, dd		0343-3L
4689.00				Stat L.Jurassic		0344
			60	S/Sst : w to lt gy to lt brn gy, crs, l, f, kln		0344-1L
			35	Sh/Clst: m gy to drk gy, mic, wx		0344-2L
			5	Cont : dd, prp		0344-3L
4695.00				Stat L.Jurassic		0345
			50	S/Sst : w to lt gy, crs, kln, l		0345-1L
			50	Sh/Clst: drk gy to dsk brn, mic, wx		0345-2L
4701.00				Stat L.Jurassic		0346
			85	S/Sst : lt gy to lt brn gy, f, kln, crs, l		0346-1L
			10	Sh/Clst: m gy to drk gy, mic		0346-2L
			5	Cont : dd, prp		0346-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4707.00				Stat L.Jurassic		0347
			85	S/Sst : lt gy to lt brn gy, f, kln, crs, l		0347-1L
			10	Sh/Clst: m gy to drk gy, mic		0347-2L
			5	Cont : dd, prp		0347-3L
4713.00				Stat L.Jurassic		0348
			95	S/Sst : lt gy to lt brn gy, f, kln, crs, l		0348-1L
			5	Sh/Clst: m gy to drk gy, mic		0348-2L
			tr	Cont : dd, prp		0348-3L
4719.00				Stat L.Jurassic		0349
			95	S/Sst : lt gy to lt brn gy, f, kln, crs, l		0349-1L
			5	Sh/Clst: m gy to drk gy, mic		0349-2L
			tr	Cont : dd, prp		0349-3L
4725.00				Stat L.Jurassic		0350
			70	S/Sst : lt gy to lt brn gy, f, kln, crs, l		0350-1L
			30	Sh/Clst: m gy to drk gy, mic		0350-2L
			tr	Cont : dd, prp		0350-3L
4731.00				Stat L.Jurassic		0351
			70	S/Sst : w to lt gy to lt brn gy, f, kln, crs, l		0351-1L
			30	Sh/Clst: drk gy to brn blk, wx		0351-2L
			tr	Kaolin : w		0351-3L
			tr	Cont : dd, prp		0351-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4737.00				Stat L.Jurassic		0352
				60 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l		0352-1L
				35 Sh/Clst: m gy to drk gy to brn blk, wx		0352-2L
				5 Cont : dd, prp		0352-3L
4743.00				Stat L.Jurassic		0353
				70 Sh/Clst: m gy to drk gy to brn blk, wx		0353-2L
				25 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l		0353-1L
				5 Cont : dd, prp		0353-3L
4749.00				Stat L.Jurassic		0354
				75 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l, mic		0354-1L
				20 Sh/Clst: m gy to drk gy to brn blk, wx, mic		0354-2L
				5 Cont : dd, prp		0354-3L
				tr Kaolin : w		0354-4L
4755.00				Stat L.Jurassic		0355
				80 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l, mic		0355-1L
				15 Sh/Clst: m gy to drk gy to brn blk, wx, mic		0355-2L
				5 Cont : dd, prp		0355-3L
4761.00				Stat L.Jurassic		0356
				80 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l, mic		0356-1L
				20 Sh/Clst: m gy to drk gy to brn blk, wx, mic		0356-2L
				tr Cont : dd, prp		0356-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
4767.00			Stat L.Jurassic			0357
			75 S/Sst	: w to lt gy to lt brn gy, f, kln, crs, l, mic		0357-1L
			25 Sh/Clst:	m gy to drk gy to brn blk, wx, mic		0357-2L
			tr Cont	: dd, prp		0357-3L
4773.00			Stat L.Jurassic			0358
			80 Sh/Clst:	m gy to drk gy to brn blk, wx, mic		0358-2L
			20 S/Sst	: w to lt gy to lt brn gy, f, kln, crs, l, mic		0358-1L
			tr Cont	: dd, prp		0358-3L
4778.00			Stat L.Jurassic			0359
			65 Sh/Clst:	m gy to drk gy to brn blk, wx, mic		0359-2L
			35 S/Sst	: w to lt gy to lt brn gy, f, kln, crs, l		0359-1L
			tr Kaolin	: w		0359-3L
			tr Cont	: dd, prp		0359-4L
4785.00			Stat L.Jurassic			0360
			60 Sh/Clst:	m gy to drk gy to brn blk, wx, mic		0360-2L
			35 S/Sst	: w to lt gy to lt brn gy, f, kln, crs, l		0360-1L
			5 Cont	: dd, prp		0360-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4791.00				Stat L.Jurassic		0361
				70 Sh/Clst: drk gy to brn blk, wx, mic		0361-2L
				25 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l		0361-1L
				5 Cont : dd, prp		0361-3L
4797.00				Stat L.Jurassic		0362
				65 Sh/Clst: drk gy to brn blk, mic		0362-2L
				20 S/Sst : lt gy to lt brn gy, f, kln		0362-1L
				15 Coal : blk, wx		0362-3L
				tr Cont : dd, prp		0362-4L
4803.00				Stat L.Jurassic		0363
				90 Sh/Clst: drk gy to brn blk, mic, wx		0363-2L
				5 S/Sst : lt gy to lt brn gy, f, kln		0363-1L
				5 Coal : blk, wx		0363-3L
				tr Cont : dd, prp		0363-4L
4809.00				Stat L.Jurassic		0364
				90 Sh/Clst: drk gy to brn blk, mic, wx		0364-2L
				10 S/Sst : lt gy to lt brn gy, f, kln		0364-1L
				tr Coal : blk, wx		0364-3L
				tr Cont : dd, prp		0364-4L
4815.00				Stat L.Jurassic		0365
				80 Sh/Clst: drk gy to brn blk, mic, wx		0365-2L
				15 S/Sst : w to lt gy to lt brn gy, f, kln, crs, l		0365-1L
				5 Coal : blk, wx		0365-3L
				tr Cont : dd, prp		0365-4L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
4821.00				Stat L.Jurassic		0366
				80 Sh/Clst: drk gy to brn blk, mic, wx		0366-2L
				20 S/Sst : w to lt gy to lt brn gy, f, kln,		0366-1L
				crs, l		
				tr Cont : dd, prp		0366-3L
4827.00				Stat L.Jurassic		0367
				90 S/Sst : lt brn gy to pl brn, crs, l, kln		0367-1L
				10 Sh/Clst: drk gy to brn blk, wx, carb		0367-2L
				tr Cont : dd, prp		0367-3L
4833.00				Stat L.Jurassic		0368
				60 S/Sst : lt brn gy to pl brn, crs, l, kln		0368-1L
				40 Sh/Clst: drk gy to brn blk, wx, carb		0368-2L
				tr Coal : blk, wx		0368-3L
				tr Cont : prp		0368-4L
4845.00				Stat L.Jurassic		0369
				85 Sh/Clst: drk gy to brn blk, wx, carb		0369-2L
				15 S/Sst : lt gy to lt brn gy, crs, l, kln		0369-1L
				tr Cont : prp		0369-3L
4854.00				Stat L.Jurassic		0370
				80 S/Sst : w to lt gy to lt brn gy, crs, l,		0370-1L
				kln		
				15 Sh/Clst: drk gy to brn blk, wx		0370-2L
				5 Coal : blk, wx		0370-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
4863.00			Stat L.Jurassic			0371
		75	S/Sst	: w to lt gy to lt brn gy, crs, 1, kln		0371-1L
		25	Sh/Clst:	drk gy to brn blk, mic		0371-2L
			tr Coal	: blk, wx		0371-3L
			tr Cont	: prp		0371-4L
4875.00			Stat L.Jurassic			0372
		75	S/Sst	: w to lt gy to lt brn gy, crs, 1, kln		0372-1L
		25	Sh/Clst:	drk gy to brn blk, mic, carb		0372-2L
			tr Coal	: blk, wx		0372-3L
			tr Cont	: prp		0372-4L
4884.00			Stat L.Jurassic			0373
		55	S/Sst	: w to lt gy to lt brn gy, crs, 1, kln		0373-1L
		45	Sh/Clst:	drk gy to brn blk, mic, carb		0373-2L
			tr Coal	: blk, wx		0373-3L
			tr Cont	: prp		0373-4L
4896.00			Stat L.Jurassic			0374
		50	S/Sst	: w to lt gy to lt brn gy, crs, 1, kln		0374-1L
		50	Sh/Clst:	drk gy to brn blk, mic, wx		0374-2L
			tr Coal	: blk, wx		0374-3L
			tr Cont	: prp, dd		0374-4L
4899.40	ccp		Stat L.Jurassic			0423
		100	Sh/Clst:	drk gy to brn blk		0423-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
4908.00				Stat L.Jurassic		0375	
			75 S/Sst	: w to lt gy to lt brn gy, crs, l, kln		0375-1L	
			25 Sh/Clst:	drk gy to brn blk, mic, wx		0375-2L	
			tr Coal	: blk, wx		0375-3L	
			tr Cont	: prp, dd		0375-4L	
4917.00				Stat L.Jurassic		0376	
			60 Sh/Clst:	drk gy to brn blk, mic, wx, carb		0376-2L	
			30 S/Sst	: w to lt gy to lt brn gy, crs, l, kln		0376-1L	
			10 Coal	: blk, wx		0376-3L	
			tr Cont	: prp, dd		0376-4L	
4926.00				Stat L.Jurassic		0377	
			95 Sh/Clst:	brn blk to blk, wx, carb		0377-2L	
			5 S/Sst	: w to lt gy to lt brn gy, crs, l, kln		0377-1L	
			tr Cont	: dd		0377-3L	
4935.00				Stat L.Jurassic		0378	
			90 Sh/Clst:	brn blk to blk, wx, carb		0378-2L	
			10 S/Sst	: w to lt gy to lt brn gy, crs, l, kln		0378-1L	
			tr Cont	: dd		0378-3L	
4947.00				Stat L.Jurassic		0379	
			85 Sh/Clst:	drk gy to brn blk to blk, wx, carb		0379-2L	
			15 S/Sst	: w to lt gy to lt brn gy, crs, l, kln		0379-1L	
			tr Cont	: dd		0379-3L	

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology	description	
4956.00				Stat L.Jurassic		0380
			50	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0380-1L
			50	Sh/Clst: drk gy to brn blk, mic, wx		0380-2L
4965.00				Stat L.Jurassic		0381
			50	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0381-1L
			50	Sh/Clst: drk gy to brn blk, mic, wx		0381-2L
4974.00				Stat L.Jurassic		0382
			75	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0382-1L
			25	Sh/Clst: drk gy to brn blk, mic, wx		0382-2L
4986.00				Stat L.Jurassic		0383
			80	Sh/Clst: drk gy to brn blk, mic, wx		0383-2L
			20	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0383-1L
4995.00				Stat L.Jurassic		0384
			90	Sh/Clst: drk gy to brn blk, wx, carb		0384-2L
			10	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0384-1L
5004.00				Stat L.Jurassic		0385
			80	Sh/Clst: drk gy to brn blk, wx, carb		0385-2L
			20	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0385-1L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
5011.00	ccp			Stat L.Jurassic		0424	
		100	Sh/Clst: drk gy to brn blk			0424-1L	
5016.00				Stat L.Jurassic		0386	
		75	S/Sst : w to lt gy, crs, l, kln			0386-1L	
		25	Sh/Clst: drk gy to brn blk, wx, carb			0386-2L	
			tr Cont : prp			0386-3L	
5025.00				Stat L.Jurassic		0387	
		50	S/Sst : w to lt gy to lt brn gy, crs, l, kln			0387-1L	
		50	Sh/Clst: drk gy to brn blk, wx, carb			0387-2L	
			tr Cont : prp			0387-3L	
5034.00				Stat L.Jurassic		0388	
		70	Sh/Clst: drk gy to brn blk, mic			0388-2L	
		25	S/Sst : w to lt gy to lt brn gy, crs, l, kln			0388-1L	
		5	Coal : blk, wx			0388-4L	
			tr Cont : prp			0388-3L	
5043.00				Stat L.Jurassic		0389	
		55	Sh/Clst: drk gy to brn blk, mic, carb			0389-2L	
		40	S/Sst : w to lt gy to lt brn gy, crs, l, kln			0389-1L	
		5	Coal : blk, wx			0389-4L	
			tr Cont : prp			0389-3L	

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
5052.00				Stat L.Jurassic		0390
			65	Sh/Clst: brn gy to drk gy to brn blk, mic, carb		0390-2L
			30	S/Sst : w to lt gy to lt brn gy, crs, l, kln		0390-1L
			5	Coal : blk, wx		0390-4L
			tr	Cont : prp		0390-3L
5061.00				Stat L.Jurassic		0391
			85	Sh/Clst: lt brn		0391-1L
			15	Sh/Clst: drk gy		0391-2L
5073.00				Stat L.Jurassic		0392
			45	Sh/Clst: drk gy		0392-2L
			35	Sh/Clst: lt brn		0392-1L
			20	S/Sst : lt gy to lt brn gy, crs, kln, l		0392-3L
			tr	Cont : prp		0392-4L
5082.00				Stat L.Jurassic		0393
			55	Sh/Clst: drk gy		0393-2L
			40	Sh/Clst: lt brn		0393-1L
			5	S/Sst : lt gy to lt brn gy, crs, kln, l		0393-3L
			tr	Cont : prp		0393-4L
5091.00				Stat L.Jurassic		0394
			60	S/Sst : lt gy to lt brn gy, crs, f, kln		0394-1L
			35	Sh/Clst: brn gy to drk gy		0394-2L
			5	Cont : dd, prp		0394-3L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
5100.00				Stat L.Jurassic		0395
			80	Sh/Clst: brn gy to drk gy		0395-2L
			15	Cont : prp		0395-3L
			5	S/Sst : lt gy to lt brn gy, crs, f, kln		0395-1L
5109.00				Stat L.Jurassic		0396
			80	Sh/Clst: brn gy to drk gy		0396-2L
			15	Cont : prp		0396-3L
			5	S/Sst : lt gy to lt brn gy, crs, f, kln		0396-1L
5118.00				Stat L.Jurassic		0397
			80	Sh/Clst: brn gy to drk gy		0397-2L
			20	Cont : prp		0397-3L
			tr	S/Sst : lt gy to lt brn gy, crs, f, kln		0397-1L
5127.00				Stat L.Jurassic		0398
			70	Sh/Clst: brn gy to drk gy		0398-2L
			30	Cont : prp		0398-3L
			tr	S/Sst : lt gy to lt brn gy, crs, f, kln		0398-1L
5139.00				Stat L.Jurassic		0399
			85	S/Sst : lt gy to w, crs, l		0399-1L
			10	Sh/Clst: brn gy to drk gy		0399-2L
			5	Cont : prp		0399-3L
5148.00				Stat L.Jurassic		0400
			80	S/Sst : lt gy to w, crs, l		0400-1L
			10	Sh/Clst: m gy to drk gy		0400-2L
			10	Cont : prp		0400-3L

Table 1 : Lithology description for well N0CS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
5160.00				Stat L.Jurassic		0401
				85 S/Sst : lt gy to w, crs, l		0401-1L
				10 Cont : prp		0401-3L
				5 Sh/Clst: m gy to drk gy		0401-2L
5172.00				Stat L.Jurassic		0402
				75 S/Sst : lt gy to w, crs, l		0402-1L
				20 Cont : prp		0402-3L
				5 Sh/Clst: m gy to drk gy		0402-2L
5181.00				Stat L.Jurassic		0403
				95 S/Sst : lt gy to w, crs, l		0403-1L
				5 Cont : prp		0403-3L
				tr Sh/Clst: m gy to drk gy		0403-2L
5193.00				Stat L.Jurassic		0404
				100 S/Sst : lt gy, crs, l		0404-1L
				tr Sh/Clst: m gy to drk gy		0404-2L
				tr Cont : prp		0404-3L
5208.00				Stat L.Jurassic		0405
				100 S/Sst : lt gy, crs, l, kln		0405-1L
				tr Sh/Clst: m gy to drk gy		0405-2L
				tr Kaolin : w		0405-3L
				tr Cont : prp, dd		0405-4L
5217.00				Stat L.Jurassic		0406
				60 Sh/Clst: m gy to drk gy		0406-2L
				40 S/Sst : lt gy, crs, l, kln		0406-1L
				tr Cont : prp, dd		0406-3L

Table 1 : Lithology description for well NOCS 30/11-4

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
5226.00				Stat L.Jurassic		0407
				85 Sh/Clst: m gy to drk gy		0407-2L
				10 S/Sst : lt gy, crs, l, kln		0407-1L
				5 Sh/Clst: lt brn to m gy		0407-4L
				tr Cont : prp, dd		0407-3L
5235.00				Stat L.Jurassic		0408
				95 Sh/Clst: m gy to drk gy		0408-2L
				5 Cont : prp, dd		0408-3L
				tr S/Sst : lt gy, crs, l, kln		0408-1L
				tr Sh/Clst: lt brn to m gy		0408-4L
5244.00				Stat L.Jurassic		0409
				65 Sh/Clst: m gy to drk gy		0409-2L
				30 S/Sst : lt gy, crs, l, kln		0409-1L
				5 Cont : prp, dd		0409-3L
5255.00				Stat L.Jurassic		0410
				70 Sh/Clst: m gy to drk gy		0410-2L
				15 S/Sst : lt gy, crs, l, kln		0410-1L
				15 Cont : prp, dd		0410-3L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2121.00	com	bulk	0.04	0.13	0.23	0.57	0.08	163	288	0.2	0.24	421	0425-0B
2280.00	com	bulk	0.07	0.17	0.21	0.81	0.13	131	162	0.2	0.29	416	0426-0B
2619.00	com	bulk	0.02	0.06	0.61	0.10	0.09	67	678	0.1	0.25	374	0427-0B
2859.00	cut	Ca : lt or to or gy	0.01	0.03	0.90	0.03	0.12	25	750	-	0.25	337	0093-1L
3267.00	cut	Sh/Clst: drk gy to brn blk	1.95	14.66	1.03	14.23	4.09	358	25	16.6	0.12	432	0116-1L
3273.00	cut	Sh/Clst: drk gy to brn blk	2.34	17.15	0.68	25.22	4.41	389	15	19.5	0.12	431	0117-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	2.63	15.96	0.75	21.28	4.80	333	16	18.6	0.14	430	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	0.61	3.52	0.80	4.40	2.62	134	31	4.1	0.15	439	0121-1L
3303.00	cut	Sh/Clst: drk gy	0.38	1.79	0.97	1.85	2.03	88	48	2.2	0.18	438	0122-1L
3315.00	cut	Sh/Clst: m gy to drk gy	0.22	1.37	0.83	1.65	1.68	82	49	1.6	0.14	437	0125-1L
3327.00	cut	Sh/Clst: m gy to drk gy	0.28	1.14	0.87	1.31	1.33	86	65	1.4	0.20	437	0123-1L
3339.00	cut	Sh/Clst: brn gy to m gy to dsk brn	0.61	4.80	0.66	7.27	2.05	234	32	5.4	0.11	435	0128-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	2.09	19.20	0.77	24.94	4.60	417	17	21.3	0.10	435	0131-1L
3375.00	cut	Sh/Clst: m gy to drk gy	0.82	5.44	0.50	10.88	2.15	253	23	6.3	0.13	436	0134-1L
3399.00	cut	Sh/Clst: m gy to drk gy	0.72	5.76	0.69	8.35	2.10	274	33	6.5	0.11	437	0138-1L

Table 2 : Rock-Eval table for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3417.00	cut	Sh/Clst: m gy to drk gy	0.70	5.27	0.74	7.12	1.95	270	38	6.0	0.12	439	0141-1L
3429.00	cut	Sh/Clst: m gy to drk gy	0.91	6.53	0.62	10.53	2.43	269	26	7.4	0.12	436	0143-1L
3441.00	com	bulk	1.39	10.33	0.79	13.08	4.62	224	17	11.7	0.12	440	0428-0B
3465.00	cut	S/Sst : lt gy	0.15	0.51	1.00	0.51	0.30	170	333	0.7	0.23	430	0149-1L
3495.00	cut	Sltst : lt brn gy to lt gy	0.34	0.75	1.45	0.52	0.56	134	259	1.1	0.31	437	0154-1L
3514.00	ccp	S/Sst : brn gy	3.35	3.64	0.21	17.33	1.34	272	16	7.0	0.48	445	0411-1L
3524.00	ccp	S/Sst : lt brn gy to drk y brn	0.28	0.15	0.25	0.60	0.14	107	179	0.4	0.65	427	0413-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	0.78	0.27	0.19	1.42	0.19	142	100	1.0	0.74	373	0415-1L
3534.00	cut	Sh/Clst: m gy	0.22	0.98	0.55	1.78	0.92	107	60	1.2	0.18	435	0158-1L
3555.00	cut	S/Sst : w to lt or	0.03	0.05	0.33	0.15	0.10	50	330	0.1	0.38	440	0161-2L
3567.00	cut	S/Sst : w to lt or	0.02	0.01	0.43	0.02	0.10	10	430	-	0.67	358	0163-2L
3579.00	cut	S/Sst : w to lt or	0.02	0.02	0.17	0.12	0.07	29	243	-	0.50	361	0165-2L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	3.50	26.10	0.54	48.33	8.99	290	6	29.6	0.12	438	0168-1L
3615.00	cut	S/Sst : w to lt or	0.16	0.30	0.24	1.25	0.40	75	60	0.5	0.35	449	0171-2L
3633.00	cut	S/Sst : lt gy to lt or	0.17	0.43	0.32	1.34	0.06	717	533	0.6	0.28	453	0174-2L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
3651.00	cut	S/Sst : w to lt gy to lt or	0.06	0.03	0.10	0.30	0.06	50	167	0.1	0.67	429	0177-2L
3675.00	cut	S/Sst : w to lt or	0.02	0.02	0.19	0.11	0.07	29	271	-	0.50	353	0180-1L
3687.00	cut	Coal : blk	12.07	151.32	0.94	160.98	60.80	249	2	163.4	0.07	453	0182-2L
3705.00	cut	S/Sst : w to lt or	0.03	0.06	0.25	0.24	0.09	67	278	0.1	0.33	457	0185-3L
3717.00	cut	S/Sst : w to lt or	0.05	0.10	0.26	0.38	0.17	59	153	0.2	0.33	449	0187-3L
3759.00	cut	Sh/Clst: m gy to drk gy	0.44	3.14	0.36	8.72	1.89	166	19	3.6	0.12	443	0194-3L
3795.00	cut	Sh/Clst: m gy to drk gy	0.22	1.02	0.66	1.55	1.02	100	65	1.2	0.18	439	0200-3L
3819.00	cut	Sh/Clst: m gy to drk gy	0.26	1.59	0.25	6.36	1.18	135	21	1.9	0.14	440	0204-2L
3837.00	cut	Sh/Clst: m gy to drk gy	0.22	1.35	0.28	4.82	0.94	144	30	1.6	0.14	442	0207-2L
3885.00	cut	Coal : brn blk to blk	13.33	131.00	1.83	71.58	49.26	266	4	144.3	0.09	457	0215-2L
3927.00	cut	S/Sst : w to lt gy to lt or	0.12	0.25	0.42	0.60	0.32	78	131	0.4	0.32	456	0222-3L
3999.00	cut	S/Sst : w to lt or to lt brn gy	0.12	0.24	0.38	0.63	0.36	67	106	0.4	0.33	456	0234-2L
4023.00	cut	Sh/Clst: lt gy to m gy to dsk brn	0.43	0.75	0.65	1.15	1.01	74	64	1.2	0.36	449	0239-1L
4053.00	cut	Sh/Clst: lt gy to m gy	0.43	0.72	0.91	0.79	0.92	78	99	1.2	0.37	451	0244-1L
4101.00	cut	Sh/Clst: lt gy to m gy to dsk brn	0.36	1.21	0.58	2.09	1.12	108	52	1.6	0.23	447	0252-1L

Table 2 : Rock-Eval table for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4149.00	cut	Sh/Clst: brn gy to brn blk	1.26	1.75	0.60	2.92	1.56	112	38	3.0	0.42	455	0260-1L
4203.00	cut	Sh/Clst: m gy to drk gy to brn gy	0.91	0.90	1.12	0.80	1.23	73	91	1.8	0.50	442	0269-1L
4221.00	cut	Sh/Clst: m gy to drk gy to brn gy	0.50	0.66	0.47	1.40	0.86	77	55	1.2	0.43	452	0272-1L
4263.00	cut	Sh/Clst: m gy to drk gy	0.34	0.55	0.61	0.90	0.65	85	94	0.9	0.38	451	0279-1L
4275.00	cut	Sh/Clst: m gy to drk gy to brn blk	0.47	0.74	0.82	0.90	0.79	94	104	1.2	0.39	462	0281-1L
4311.00	cut	Sh/Clst: m gy	0.65	0.79	1.45	0.54	1.05	75	138	1.4	0.45	449	0287-1L
4347.00	cut	Sh/Clst: m gy to drk gy	0.84	0.85	1.21	0.70	1.30	65	93	1.7	0.50	452	0293-1L
4401.00	cut	Sh/Clst: m gy to drk gy	0.69	0.78	1.03	0.76	1.20	65	86	1.5	0.47	455	0302-1L
4455.00	cut	Sh/Clst: m gy to drk gy	0.45	0.70	0.62	1.13	0.88	80	70	1.1	0.39	454	0311-1L
4497.00	cut	Sh/Clst: pl y brn	0.43	1.00	2.55	0.39	1.07	93	238	1.4	0.30	431	0318-1L
4575.00	cut	Sh/Clst: lt brn gy to drk gy to dsk brn	0.40	0.73	0.74	0.99	1.01	72	73	1.1	0.35	466	0331-1L
4599.00	cut	Sh/Clst: m gy to drk gy	0.41	0.79	0.52	1.52	1.05	75	50	1.2	0.34	459	0335-1L
4635.00	ccp	S/Sst : w	0.03	0.01	0.14	0.07	0.02	50	700	-	0.75	417	0416-1L
4645.75	ccp	S/Sst : w to lt gy	0.18	0.14	0.43	0.33	0.23	61	187	0.3	0.56	414	0418-1L

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
4657.00	ccp	S/Sst : lt gy	0.04	0.05	0.14	0.36	0.05	100	280	0.1	0.44	408	0420-1L
4664.87	ccp	S/Sst : w	0.01	0.02	0.10	0.20	0.07	29	143	-	0.33	330	0422-1L
4683.00	cut	S/Sst : w to lt gy to lt brn gy	0.05	0.03	0.11	0.27	0.10	30	110	0.1	0.63	300	0343-1L
4719.00	cut	S/Sst : lt gy to lt brn gy	0.05	0.04	0.20	0.20	0.17	24	118	0.1	0.56	334	0349-1L
4743.00	cut	Sh/Clst: m gy to drk gy to brn blk	1.27	7.20	0.30	24.00	8.26	87	4	8.5	0.15	489	0353-2L
4827.00	cut	S/Sst : lt brn gy to pl brn	0.03	0.07	0.21	0.33	0.15	47	140	0.1	0.30	413	0367-1L
4854.00	cut	S/Sst : w to lt gy to lt brn gy	0.02	0.01	0.14	0.07	0.01	100	1400	-	0.67	300	0370-1L
4875.00	cut	S/Sst : w to lt gy to lt brn gy	0.02	0.01	0.14	0.07	0.07	14	200	-	0.67	300	0372-1L
4899.40	ccp	Sh/Clst: drk gy to brn blk	0.05	0.39	0.07	5.57	0.70	56	10	0.4	0.11	515	0423-1L
4974.00	cut	S/Sst : w to lt gy to lt brn gy	0.02	0.01	0.15	0.07	0.07	14	214	-	0.67	-	0382-1L
5025.00	cut	S/Sst : w to lt gy to lt brn gy	0.13	0.12	0.11	1.09	0.07	171	157	0.3	0.52	405	0387-1L
5139.00	cut	S/Sst : lt gy to w	0.02	0.09	0.32	0.28	0.07	129	457	0.1	0.18	406	0399-1L
5181.00	cut	S/Sst : lt gy to w	0.04	0.12	0.35	0.34	0.09	133	389	0.2	0.25	400	0403-1L
5208.00	cut	S/Sst : lt gy	0.02	0.03	0.15	0.20	0.10	30	150	0.1	0.40	406	0405-1L
5235.00	cut	Sh/Clst: m gy to drk gy	0.06	0.31	0.48	0.65	0.90	34	53	0.4	0.16	505	0408-2L

Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well N0CS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
2121.00	com	bulk	6.93	29.83	53.41	9.83	0.13	0425-0B
2280.00	com	bulk	6.66	29.88	51.98	11.47	0.17	0426-0B
3267.00	cut	Sh/Clst: drk gy to brn blk	3.82	12.14 13.29	32.63	87.8 50.26	14.66	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	3.71	15.94 12.23	30.05	84.05 54.01	15.96	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	6.72	26.3 19.59	39.44	73.6 34.25	3.52	0121-1L
3315.00	cut	Sh/Clst: m gy to drk gy	13.71	44.16 30.45	45.65	55.85 10.20	1.37	0125-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	5.48	17.5 12.02	28.79	87.5 53.71	19.20	0131-1L
3429.00	cut	Sh/Clst: m gy to drk gy	6.01	21.04 15.03	33.63	78.96 45.33	6.53	0143-1L
3441.00	com	bulk	15.64	20.45	27.64	36.27	10.33	0428-0B
3465.00	cut	S/Sst : lt gy	5.06	18.38	36.53	40.03	0.51	0149-1L
3514.00	ccp	S/Sst : brn gy	11.52	17.95	22.68	47.85	3.64	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	4.89	16.64	36.10	42.36	0.27	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	10.38	12.21	20.55	56.85	26.10	0168-1L
3633.00	cut	S/Sst : lt gy to lt or	13.77	22.03	28.95	35.24	0.43	0174-2L

16.53 / 83.48

27.25 / 72.75

Table 3 : Pyrolysis GC Data (S2 peak) as Percentage of Total Area for Well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2-C5	C6-C14	C15+	S2 from Rock-Eval	Sample
3687.00	cut	Coal : blk	13.32	28.30 15.07	17.67	21.61 53.94	151.32	0182-2L
3927.00	cut	S/Sst : w to lt gy to lt or	14.84	29.59	37.42	18.16	0.25	0222-3L
4149.00	cut	S/Sst : w to lt or	8.12	21.73	39.89	30.26	-	0260-2L
4263.00	cut	Sh/Clst: m gy to drk gy	17.78	56.44 33.66	39.95	48.55 8.60	0.55	0279-1L
4311.00	cut	Sh/Clst: m gy	11.92	39.11 27.19	40.80	60.89 20.09	0.79	0287-1L
4455.00	cut	Sh/Clst: m gy to drk gy	19.56	54.97 35.41	36.06	45.03 8.97	0.70	0311-1L
4645.75	ccp	S/Sst : w to lt gy	7.86	23.95	44.03	24.16	0.14	0418-1L
4743.00	cut	Sh/Clst: m gy to drk gy to brn blk	24.99	22.43	19.65	32.93	7.20	0353-2L
4899.40	ccp	Sh/Clst: drk gy to brn blk	29.88	34.85	28.46	6.81	0.39	0423-1L
5025.00	cut	S/Sst : w to lt gy to lt brn gy	8.41	30.97	51.59	9.03	0.12	0387-1L

Table 4 a: Weight of EOM and Chromatographic Fraction for well NOCS 30/11-4

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
3267.00	cut	Sh/Clst: drk gy to brn blk	1.9	6.7	0.5	0.5	0.6	5.1	1.0	5.7	6.27	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	5.5	31.4	11.6	9.5	2.6	7.7	21.1	10.3	5.66	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	6.5	8.2	1.5	1.8	2.2	2.7	3.3	4.9	3.63	0121-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	4.9	17.0	5.7	5.0	1.5	4.8	10.7	6.3	5.03	0131-1L
3441.00	com	Composite sample - see table 4 e	4.9	91.3	4.7	17.1	39.1	30.4	21.8	69.5	31.40	0428-0B
3514.00	ccp	S/Sst : brn gy	8.0	39.4	14.8	7.7	9.8	7.1	22.5	16.9	1.40	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	6.1	4.9	3.5	0.6	0.2	0.6	4.1	0.8	0.29	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	4.5	11.9	0.7	4.5	5.4	1.3	5.2	6.7	4.56	0168-1L
3687.00	cut	Coal : blk	2.0	95.5	1.8	8.2	83.0	2.5	10.0	85.5	54.40	0182-2L
4149.00	cut	Sh/Clst: brn gy to brn blk	6.2	13.1	8.0	2.3	0.7	2.1	10.3	2.8	1.95	0260-1L
4317.00	com	Composite sample - see table 4 e	3.6	2.7	1.7	0.5	0.2	0.3	2.2	0.5	1.51	0429-0B
4743.00	com	Composite sample - see table 4 e	2.3	3.7	0.3	1.1	2.0	0.3	1.4	2.3	9.39	0430-0B

Table 4 b: Concentration of EOM and Chromatographic Fraction (wt ppm rock) for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3267.00	cut	Sh/Clst: drk gy to brn blk	3621	270	270	324	2756	540	3081	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	5719	2112	1730	473	1402	3843	1876	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	1261	230	276	338	415	507	753	0121-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	3441	1153	1012	303	971	2165	1275	0131-1L
3441.00	com	Composite sample - see table 4 e	18670	961	3496	7995	6216	4458	14212	0428-0B
3514.00	ccp	S/Sst : brn gy	4937	1854	964	1228	889	2819	2117	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	804	574	98	32	98	673	131	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	2632	154	995	1194	287	1150	1482	0168-1L
3687.00	cut	Coal : blk	47277	891	4059	41089	1237	4950	42326	0182-2L
4149.00	cut	Sh/Clst: brn gy to brn blk	2119	1294	372	113	339	1666	453	0260-1L
4317.00	com	Composite sample - see table 4 e	747	470	138	55	83	609	138	0429-0B
4743.00	com	Composite sample - see table 4 e	1594	129	474	862	129	603	991	0430-0B

Table 4 c: Concentration of EOM and Chromatographic Fraction (mg/g TOC(e)) for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
3267.00	cut	Sh/Clst: drk gy to brn blk	57.76	4.31	4.31	5.17	43.97	8.62	49.14	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	101.05	37.33	30.57	8.37	24.78	67.90	33.15	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	34.75	6.36	7.63	9.32	11.44	13.99	20.77	0121-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	68.42	22.94	20.12	6.04	19.32	43.06	25.35	0131-1L
3441.00	com	Composite sample - see table 4 e	59.46	3.06	11.14	25.46	19.80	14.20	45.26	0428-0B
3514.00	ccp	S/Sst : brn gy	352.67	132.47	68.92	87.72	63.55	201.40	151.27	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	277.45	198.18	33.97	11.32	33.97	232.15	45.30	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	57.74	3.40	21.83	26.20	6.31	25.23	32.51	0168-1L
3687.00	cut	Coal : blk	86.91	1.64	7.46	75.53	2.28	9.10	77.81	0182-2L
4149.00	cut	Sh/Clst: brn gy to brn blk	108.70	66.38	19.09	5.81	17.43	85.47	23.23	0260-1L
4317.00	com	Composite sample - see table 4 e	49.53	31.19	9.17	3.67	5.50	40.36	9.17	0429-0B
4743.00	com	Composite sample - see table 4 e	16.98	1.38	5.05	9.18	1.38	6.43	10.56	0430-0B

Table 4 d: Composition of material extracted from the rock (%) for well N0CS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	Sat	Aro	Asph	NSO	HC	Non-HC	Sat	HC	Sample
			EOM	EOM	EOM	EOM	EOM	EOM	EOM	Aro	
3267.00	cut	Sh/Clst: drk gy to brn blk	7.46	7.46	8.96	76.12	14.93	85.07	100.00	17.54	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	36.94	30.25	8.28	24.52	67.20	32.80	122.11	204.85	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	18.29	21.95	26.83	32.93	40.24	59.76	83.33	67.35	0121-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	33.53	29.41	8.82	28.24	62.94	37.06	114.00	169.84	0131-1L
3441.00	com	Composite sample - see table 4 e	5.15	18.73	42.83	33.30	23.88	76.12	27.49	31.37	0428-0B
3514.00	ccp	S/Sst : brn gy	37.56	19.54	24.87	18.02	57.11	42.89	192.21	133.14	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	71.43	12.24	4.08	12.24	83.67	16.33	583.33	512.50	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	5.88	37.82	45.38	10.92	43.70	56.30	15.56	77.61	0168-1L
3687.00	cut	Coal : blk	1.88	8.59	86.91	2.62	10.47	89.53	21.95	11.70	0182-2L
4149.00	cut	Sh/Clst: brn gy to brn blk	61.07	17.56	5.34	16.03	78.63	21.37	347.83	367.86	0260-1L
4317.00	com	Composite sample - see table 4 e	62.96	18.52	7.41	11.11	81.48	18.52	340.00	440.00	0429-0B
4743.00	com	Composite sample - see table 4 e	8.11	29.73	54.05	8.11	37.84	62.16	27.27	60.87	0430-0B

Depth unit of measure: m

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

<u>Upper depth</u>	<u>Lower depth</u>	<u>Typ</u>	<u>Sample</u>	<u>Depth</u>	<u>Typ</u>	<u>Lithology</u>	<u>Sample</u>
3441.00	3441.00	com	0428-0B is composed of:	3441.00	cut	S/Sst : w to lt or, f, slt, kln	0145-3L
				3441.00	cut	Coal : blk, wx	0145-4L
4305.00	4317.00	com	0429-0B is composed of:	4305.00	cut	Sh/Clst: m gy	0286-1L
				4311.00	cut	Sh/Clst: m gy	0287-1L
				4317.00	cut	Sh/Clst: m gy	0288-1L
4737.00	4743.00	com	0430-0B is composed of:	4737.00	cut	Sh/Clst: m gy to drk gy to brn blk, wx	0352-2L
				4743.00	cut	Sh/Clst: m gy to drk gy to brn blk, wx	0353-2L

Table 5 : Saturated Hydrocarbon Ratios for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	Pristane	Pristane	Pristane + Phytane	Phytane	CPI	Sample
			nC17	Phytane	nC17 + nC18	nC18		
3267.00	cut	Sh/Clst: drk gy to brn blk	0.98	1.54	0.87	0.75	0.98	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	0.97	1.44	0.87	0.75	0.93	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	1.32	3.43	0.89	0.42	1.31	0121-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	0.96	2.61	0.72	0.44	1.15	0131-1L
3441.00	com	bulk	1.86	5.96	1.15	0.35	1.09	0428-0B
3514.00	ccp	S/Sst : brn gy	0.61	2.52	0.42	0.23	1.04	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	2.39	3.19	1.22	0.47	1.08	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	2.48	4.54	1.43	0.49	1.18	0168-1L
3687.00	cut	Coal : blk	3.05	5.03	1.64	0.49	1.08	0182-2L
4149.00	cut	Sh/Clst: brn gy to brn blk	0.49	3.07	0.34	0.18	1.09	0260-1L
4317.00	com	bulk	0.28	2.90	0.19	0.10	1.16	0429-0B
4743.00	com	bulk	0.55	1.88	0.45	0.34	1.10	0430-0B

Table 6 : Aromatic Hydrocarbon Ratios for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	Rc	DBT/P	4/1MDBT	(3+2) /1MDBT	Sample
3267.00	cut	Sh/Clst: drk gy to brn blk	0.80	1.04	0.12	0.77	0.82	0.63	0.89	0.34	0.95	0.21	0116-1L
3279.00	cut	Sh/Clst: drk gy to brn blk	0.90	1.26	0.16	0.77	0.72	0.71	0.83	0.25	0.90	0.17	0118-1L
3297.00	cut	Sh/Clst: drk gy to brn blk	0.87	1.25	-	0.79	0.52	0.57	0.71	-	-	-	0121-1L
3357.00	cut	Sh/Clst: drk gy to brn blk	1.09	1.69	0.15	0.68	0.60	0.62	0.76	0.10	1.32	0.40	0131-1L
3441.00	com	bulk	1.15	2.08	0.31	0.88	0.67	0.80	0.80	0.12	9.27	2.55	0428-0B
3514.00	ccp	S/Sst : brn gy	0.75	0.97	0.23	1.14	0.77	0.95	0.86	0.09	18.70	2.81	0411-1L
3531.50	ccp	S/Sst : lt gy to lt brn gy	0.95	1.24	0.21	1.18	0.90	1.10	0.94	0.11	8.94	3.71	0415-1L
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	1.29	1.25	0.45	1.01	0.66	0.80	0.80	0.12	8.12	3.60	0168-1L
3687.00	cut	Coal : blk	1.29	1.94	0.56	-	1.29	1.60	1.17	0.18	-	-	0182-2L
4149.00	cut	Sh/Clst: brn gy to brn blk	1.30	2.86	0.16	0.99	0.81	0.93	0.89	-	-	-	0260-1L
4317.00	com	bulk	0.73	2.34	-	1.54	1.06	1.16	1.04	-	-	-	0429-0B
4743.00	com	bulk	3.65	4.56	1.43	5.17	1.70	1.99	1.42	0.05	-	-	0430-0B

Table 7 : Thermal Maturity Data for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	T _{max} (°C)	Sample
1260.00	cut		0.26	20	0.04	3+6	-	-	0013-0B
1500.00	cut		0.27	20	0.04	3	-	-	0025-0B
1780.00	cut		0.34	20	0.04	3+4	-	-	0039-0B
2019.00	cut		0.41	20	0.07	3+4	-	-	0051-0B
2019.00	cut		-	-	-	-	4.0	-	0051-1L
2301.00	cut		0.44	20	0.05	3+4	-	-	0065-0B
2301.00	cut		-	-	-	-	3.5	-	0065-1L
2580.00	cut		0.50	5	0.04	4	-	-	0079-0B
2841.00	cut		NDP	-	-	3	-	-	0092-0B
2841.00	cut		-	-	-	-	5.0-5.5(??)	-	0092-2L
3081.00	cut		0.61	2	0.01	3-4	-	-	0104-0B
3261.00	cut		0.53	8	0.03	4	-	-	0115-0B
3267.00	cut		-	-	-	-	5.5	-	0116-1L
3273.00	cut		0.53	9	0.04	4	-	-	0117-0B

Table 7 : Thermal Maturity Data for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	T _{max} (°C)	Sample
3315.00	cut		-	-	-	-	5.5-6.0	-	0125-1L
3357.00	cut		-	-	-	-	5.5	-	0131-1L
3423.00	cut		0.53	20	0.06	5	-	-	0142-0B
3429.00	cut		-	-	-	-	6.0	-	0143-1L
3597.00	cut		-	-	-	-	6.5-7.0(?)	-	0168-1L
3687.00	cut		-	-	-	-	6.5-7.0	-	0182-2L
3741.00	cut		0.88	20	0.09	0	-	-	0191-0B
3759.00	cut		-	-	-	-	6.5	-	0194-3L
3885.00	cut		-	-	-	-	6.5(?)	-	0215-2L
3945.00	cut		0.90	20	0.08	0	-	-	0225-0B
4149.00	cut		-	-	-	-	7.5(?)	-	0260-2L
4251.00	cut		0.98	4	0.18	0	-	-	0277-0B
4263.00	cut		-	-	-	-	8.0-8.5	-	0279-1L
4311.00	cut		-	-	-	-	8.5	-	0287-1L

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	T _{max} (°C)	Sample
4455.00	cut		-	-	-	-	8.5(?)	-	0311-1L
4503.00	cut		NDP	-	-	0	-	-	0319-0B
4599.00	cut		-	-	-	-	9.0(?)	-	0335-1L
4743.00	cut		-	-	-	-	8.5-9.0(?)	-	0353-2L
4899.40	ccp		1.19	4	0.06	0	-	-	0423-0B
4899.40	ccp		-	-	-	-	9.0-9.5	-	0423-1L
5011.00	ccp		1.17	6	0.13	0	-	-	0424-0B
5235.00	cut		1.41	6	0.08	0	-	-	0408-0B
5235.00	cut		-	-	-	-	9.0(+)	-	0408-2L

Table 8 : Visual Kerogen Composition Data for well NOCS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	L	A	L	S	C	D			I	S	I	M	S	V	C	V	A	Sample					
			I	m	i	p	u	R	A	i	A	B	N	F	e	n	i	c	B		I	T	o	i	m
			P	r	D	P	i	s	g	o	r	t	S	F	D	r	e	t	T	e	l	l	D	r	
			T	e	o	c	i	a	f	i	t	L	T	i	u	e	i	r	I	n	n	t	V	V	
			%	L	t	l	l	n	e	l	t	L	%	n	s	t	n	o	I	%	n	n	t	V	V
2019.00	cut	Sh/Clst: lt ol gy to pl ol	95	**	**	*		*	*			TR		*				5	*	**				0051-1L	
2301.00	cut	Sh/Clst: lt gy to m gy	90		*	**		*	*			5		*				5		*				0065-1L	
2841.00	cut	Sh/Clst: m gy	NDP		**	*						NDP		*				NDP	*	**				0092-2L	
3267.00	cut	Sh/Clst: drk gy to brn blk	90	**		*		**	*			5		*	*			5	**	*				0116-1L	
3315.00	cut	Sh/Clst: m gy to drk gy	5	*		**		**	*			40	*	**	*			55	*	*				0125-1L	
3357.00	cut	Sh/Clst: drk gy to brn blk	100	**		*		*	*	*		TR		*				TR		*				0131-1L	
3429.00	cut	Sh/Clst: m gy to drk gy	85	**		*		**	*			5		*				10	*	**				0143-1L	
3597.00	cut	Sh/Clst: m gy to drk gy to brn blk	85	**		*						5		*				10	*	*				0168-1L	
3687.00	cut	Coal : blk	TR			*						5		*				95	**	*		*		0182-2L	
3759.00	cut	Sh/Clst: m gy to drk gy	60	**	*	*	?	*	*			20	**	*				20	**	*				0194-3L	
3885.00	cut	Coal : brn blk to blk	TR			*						5		*				95	**	*		*		0215-2L	
4149.00	cut	S/Sst : w to lt or	25	*	**	*		*				20	*	*				55	*	**				0260-2L	

Depth unit of measure: m

Depth	Typ	Lithology	LIP T %	A m r D e l	L i p / P o l	S u t P i o l	C u t e s i n	R e l g a l	D i n o f l	A c r i t L	I N E T %	F u s i n	S e m F u s	I n t D e t	M i c r e i r	S c l e t o I	V I T R %	T e l l i n	C o l l i e	V i t D r V	A m D r t V	Sample
4263.00	cut	Sh/Clst: m gy to drk gy	NDP	*	*	?	?				NDP	*					NDP	*	*			0279-1L
4311.00	cut	Sh/Clst: m gy	NDP	*	*						NDP	*					NDP	*	*			0287-1L
4455.00	cut	Sh/Clst: m gy to drk gy	NDP	*	*						NDP	*					NDP	*	*			0311-1L
4599.00	cut	Sh/Clst: m gy to drk gy	100	**	*						TR	*					TR	*	*			0335-1L
4743.00	cut	Sh/Clst: m gy to drk gy to brn blk	55	*	*		?				20	*					25	*	*			0353-2L
4899.40	ccp	Sh/Clst: drk gy to brn blk	5		*	?					30	**	*				65	**	*			0423-1L
5235.00	cut	Sh/Clst: m gy to drk gy	30	*	*	*				?	45	**	*				25	**	*			0408-2L

Table 9a : Tabulation of carbon isotope data for EOM/Oil - fractions or Oils for well N0CS 30/11-4

Depth unit of measure: m

Depth	Typ	Lithology	EOM/Oil	Saturated	Aromatic	NSO	Asphaltenes	Kerogen	Sample
3279.00	cut		-29.86	-29.91	-29.74	-29.67	-28.39	-	0118-1L
3297.00	cut		-24.74	-26.22	-25.58	-25.08	-24.02	-	0121-1L
3514.00	ccp		-26.46	-27.71	-26.01	-26.32	-25.27	-	0411-1L
3687.00	cut		-24.44	-26.30	-24.67	-24.57	-24.17	-	0182-2L
4149.00	cut		-26.72	-27.00	-25.92	-26.47	-25.73	-	0260-1L

Table 9b : Tabulation of cv values from carbon isotope data for well NOCS 30/11-4

Depth unit of measure: m

<u>Depth</u>	<u>Typ</u>	<u>Lithology</u>	<u>Saturated</u>	<u>Aromatic</u>	<u>cv value</u>	<u>Interpretation</u>	<u>Sample</u>
3279.00	cut		-29.91	-29.74	-2.00	Marine	0118-1L
3297.00	cut		-26.22	-25.58	-2.10	Marine	0121-1L
3514.00	ccp		-27.71	-26.01	0.71	Terrigenous	0411-1L
3687.00	cut		-26.30	-24.67	0.12	Marine	0182-2L
4149.00	cut		-27.00	-25.92	-0.88	Marine	0260-1L

Table 10A: Variation in Triterpane Distribution (peak height) for Well NOCS 30/11-4

Depth unit of measure: m

Depth	Lithology	B/A	B/B+A	B		C/E	C/C+E	X/E	Z/E	Z/C	Z/Z+E	Q/E	C+D		J1		Sample
				B+E+F									E/E+F	C+D+E+F	D+F/C+E	J1+J2%	
3279.00	Sh/Clst	1.54	0.61	0.14		0.47	0.32	0.07	0.38	0.81	0.28	0.13	0.89	0.32	0.12	59.36	0118-1
3297.00	Sh/Clst	17.20	0.95	0.30		0.70	0.41	0.05	0.03	0.04	0.03	0.04	0.79	0.41	0.26	59.71	0121-1
3514.00	S/Sst	0.49	0.33	0.10		0.37	0.27	0.22	0.05	0.15	0.05	0.07	0.92	0.27	0.08	60.60	0411-1
3687.00	Coal	10.39	0.91	0.23		0.85	0.46	0.08	0.03	0.03	0.02	-	0.92	0.46	0.08	60.62	0182-2
4149.00	Sh/Clst	0.18	0.15	0.12		0.38	0.27	1.36	0.47	1.24	0.32	1.10	0.83	0.30	0.26	100.00	0260-1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Ratio10	Sample
3279.00	Sh/Clst	0.77	46.43	65.83	1.84	0.67	0.52	0.38	0.49	0.87	1.80	0118-1
3297.00	Sh/Clst	0.75	40.07	54.63	0.90	0.60	0.47	0.39	0.38	0.67	1.00	0121-1
3514.00	S/Sst	0.91	47.02	80.23	1.16	0.81	0.37	0.28	0.67	0.89	3.83	0411-1
3687.00	Coal	0.35	40.94	72.26	0.10	0.76	0.16	0.14	0.57	0.69	2.21	0182-2
4149.00	Sh/Clst	1.00	48.17	76.60	0.99	0.77	0.69	0.52	0.62	0.93	3.16	0260-1

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: $r + s / t$

Table 10C: Variation in Triaromatic Sterane Distribution for Well NOCS 30/11-4

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
3279.00	Sh/Clst	0.59	0.53	0.24	0.29	0.32	0118-1
3297.00	Sh/Clst	-	-	-	-	-	0121-1
3514.00	S/Sst	0.80	0.80	0.63	0.57	0.81	0411-1
3687.00	Coal	-	-	-	-	-	0182-2
4149.00	Sh/Clst	1.00	1.00	1.00	1.00	1.00	0260-1

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: $a1 / a1 + d1$

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Sample</u>
3279.00	Sh/Clst	0.42	0.28	0.29	0.24	0118-1
3297.00	Sh/Clst	0.45	0.23	0.27	0.22	0121-1
3514.00	S/Sst	0.67	0.53	0.48	0.40	0411-1
3687.00	Coal	-	-	-	-	0182-2
4149.00	Sh/Clst	0.64	0.43	0.45	0.38	0260-1

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

Table 10E: Aromatisation of Steranes for Well NOCS 30/11-4

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Sample</u>
3279.00	Sh/Clst	0.40	0.92	0118-1
3297.00	Sh/Clst	1.00	-	0121-1
3514.00	S/Sst	0.40	1.00	0411-1
3687.00	Coal	-	-	0182-2
4149.00	Sh/Clst	1.00	-	0260-1

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

$$\text{Ratio2: } \text{g1} / \text{g1} + \text{I1}$$

Depth unit of measure: m

Depth	Lithology	p	q	r	s	t	a	b	z	c	Sample
		x	d	e	f	g	h	i	j1		
		j2	k1	k2	l1	l2	m1	m2			
3279.00	Sh/Clst	228.55	91.85	72.79	73.30	29.37	88.27	135.85	275.11	337.94	0118-1
		48.97	45.31	722.21	86.23	320.37	203.44	54.71	184.69		
		126.42	178.00	115.79	118.44	76.55	175.22	103.39			
3297.00	Sh/Clst	116.82	41.58	18.65	120.54	4.56	35.40	608.86	35.09	797.73	0121-1
		53.87	197.96	1141.66	298.79	679.74	442.04	195.95	259.95		
		175.40	125.27	83.17	73.23	48.89	34.05	23.70			
3514.00	S/Sst	80.59	46.22	25.10	62.36	16.08	171.49	83.50	35.79	245.07	0411-1
		149.21	21.36	671.19	56.37	280.08	191.15	48.88	192.36		
		125.09	104.39	75.87	58.58	45.06	47.73	30.52			
3687.00	Coal	0.00	0.00	0.00	390.90	0.00	100.83	1048.04	84.10	2821.63	0182-2
		267.41	198.71	3301.97	274.49	1537.54	1038.46	156.35	843.75		
		548.01	308.01	214.28	145.73	93.21	39.65	24.66			
4149.00	Sh/Clst	52.13	24.58	11.65	7.27	4.78	19.98	3.63	10.39	8.35	0260-1
		30.23	3.43	22.26	4.65	6.73	3.80	4.20	5.58		
		0.00	0.00	0.00	0.00	0.00	0.00	0.00			

Table 10G: Raw GCMS sterane data (peak height) for Well N0CS 30/11-4

Depth unit of measure: m

Depth	Lithology	u	v	a	b	c	d	e	f	g	Sample
		h	i	j	k	l	m	n	o		
		p	q	r	s	t					
3279.00	Sh/Clst	371.64	121.95	528.05	325.03	135.54	121.01	199.44	133.69	181.42	0118-1
		246.22	176.15	161.44	185.62	68.02	85.96	103.10	116.81		
		91.28	106.03	126.58	93.43	122.34					
3297.00	Sh/Clst	151.54	41.93	150.88	101.50	47.03	27.32	53.97	34.36	53.30	0121-1
		186.20	54.56	49.73	120.97	49.96	25.71	5.98	24.85		
		20.40	54.07	49.13	32.12	80.86					
3514.00	S/Sst	113.45	37.49	199.78	123.77	52.81	46.18	61.61	38.29	35.78	0411-1
		171.92	81.06	20.30	116.72	36.97	19.33	38.63	55.74		
		13.06	39.75	93.13	78.40	44.78					
3687.00	Coal	62.57	17.09	14.27	13.21	7.18	0.00	32.65	19.11	26.94	0182-2
		163.42	39.66	26.99	123.10	47.97	36.58	24.60	43.79		
		10.95	72.67	129.28	101.85	104.82					
4149.00	Sh/Clst	35.86	13.36	52.66	32.67	15.53	11.05	20.71	9.13	7.85	0260-1
		54.90	13.72	0.00	38.22	12.46	3.27	7.10	6.05		
		3.38	3.95	6.88	6.54	4.25					

Table 10H: Raw GCMS trioaromatic sterane data (peak height) for Well NOCS 30/11-4

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	Sample
3279.00	Sh/Clst	650.34	508.00	628.09	1398.81	565.29	593.23	455.10	0118-1
3297.00	Sh/Clst	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0121-1
3514.00	S/Sst	153.37	152.91	27.42	35.53	60.67	16.99	37.92	0411-1
3687.00	Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0182-2
4149.00	Sh/Clst	49.43	40.59	0.00	0.00	0.00	0.00	0.00	0260-1

Table 10I: Raw GCMS monoaromatic sterane data (peak height) for Well NOCS 30/11-4

Depth unit of measure: m

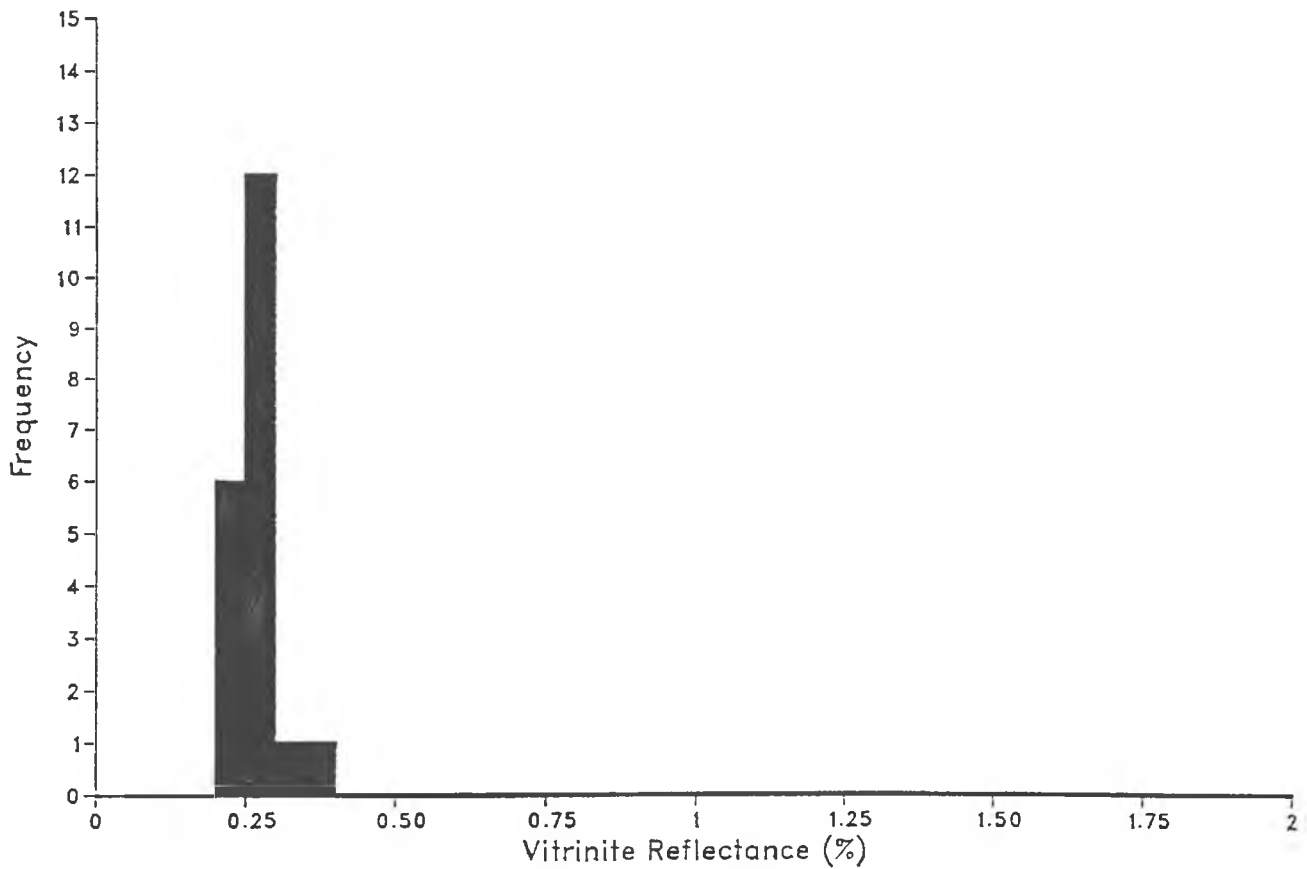
Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	h1	i1	Sample
3279.00	Sh/Clst	515.66	280.62	459.33	313.50	710.06	148.23	547.23	246.92	38.11	0118-1
3297.00	Sh/Clst	25.48	9.27	14.57	8.88	30.83	8.64	39.63	19.01	1.97	0121-1
3514.00	S/Sst	50.45	28.03	20.00	15.77	24.75	12.10	29.40	15.18	0.00	0411-1
3687.00	Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0182-2
4149.00	Sh/Clst	13.97	5.90	5.14	3.53	7.86	4.82	8.95	2.76	0.00	0260-1

Appendix 2

Vitrine Reflectance Histograms

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 1260.00(m)

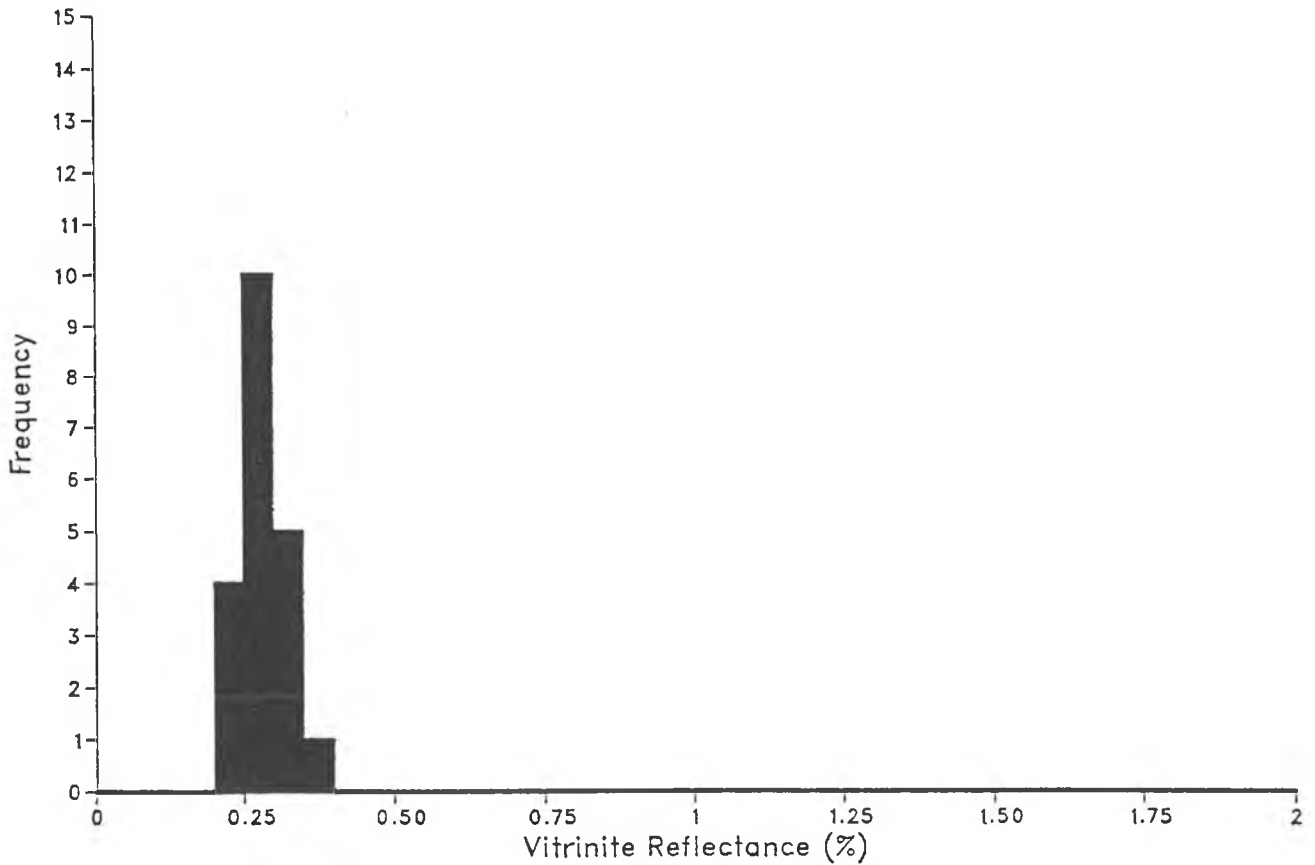


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.200 to 0.400):	0.26	0.04	20

Readings:									
0.200	0.201	0.202	0.220	0.240	0.241	0.250	0.251	0.252	0.253
0.260	0.261	0.270	0.271	0.280	0.281	0.290	0.291	0.310	0.380

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 1500.00(m)

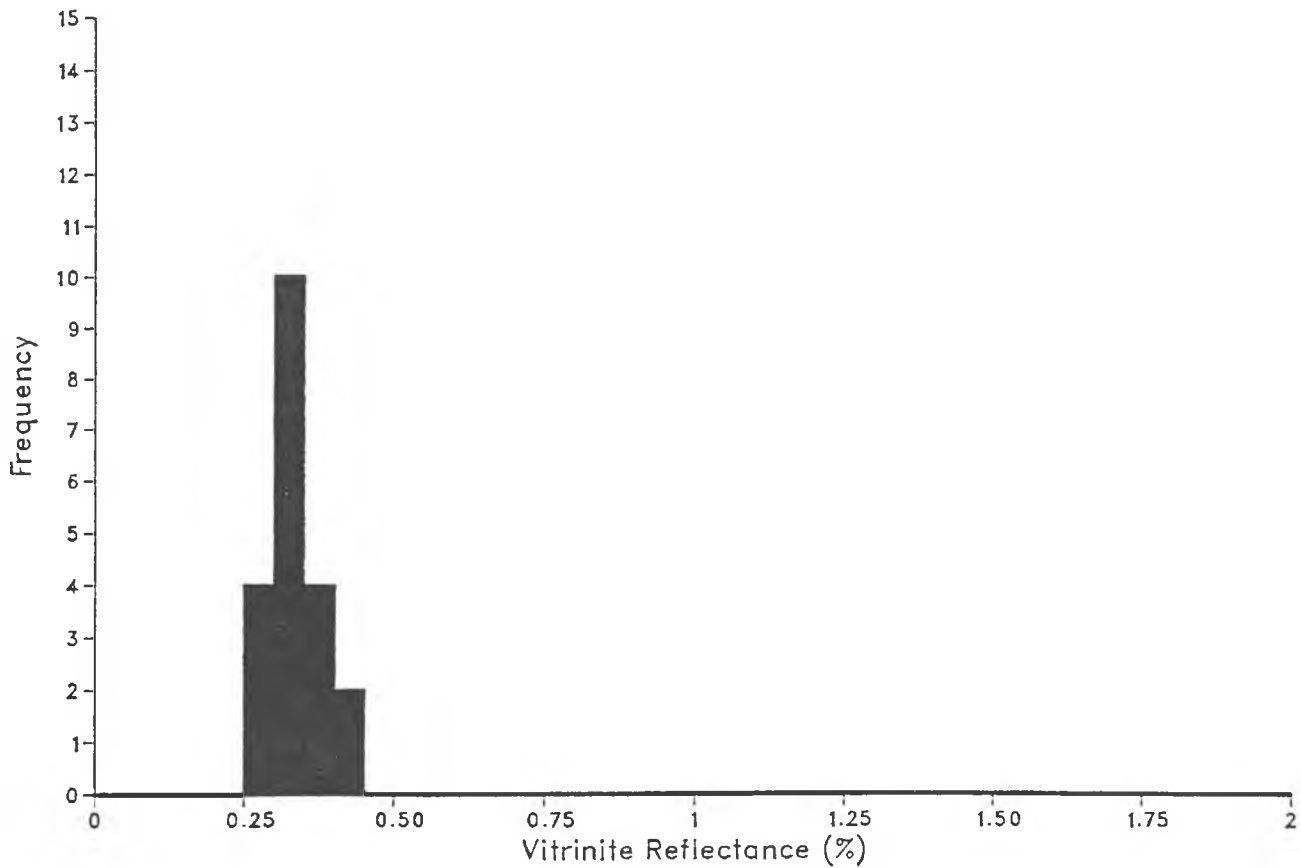


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.200 to 0.400):	0.27	0.04	20

Readings:									
0.210	0.211	0.212	0.230	0.250	0.251	0.252	0.270	0.271	0.272
0.273	0.280	0.281	0.290	0.300	0.310	0.311	0.320	0.330	0.370

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 1780.00(m)

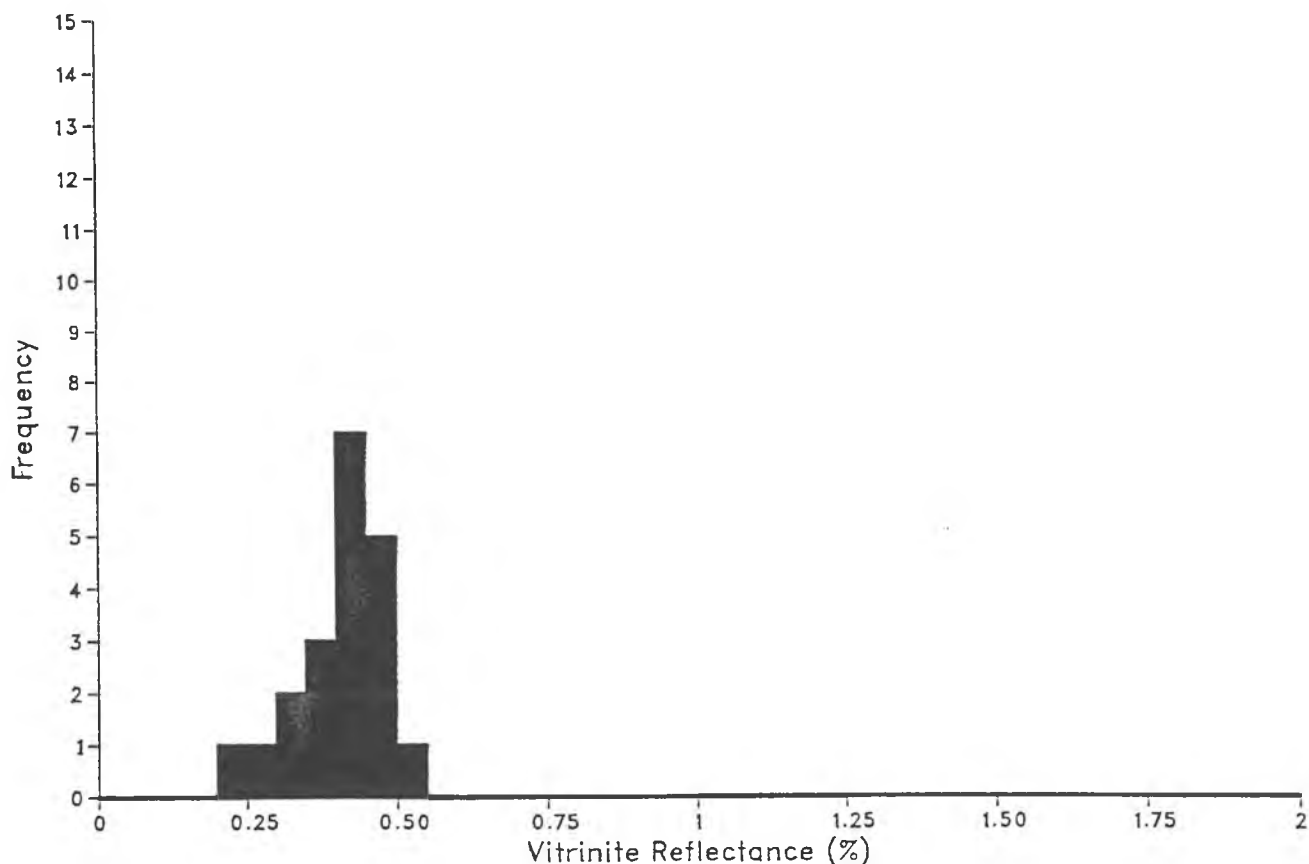


Statistics:	Mean	St.Dev.	n
Indigenous Pcpulation (from 0.250 to 0.450):	0.34	0.04	20

Readings:									
0.270	0.280	0.281	0.282	0.300	0.310	0.320	0.321	0.330	0.331
0.332	0.340	0.341	0.342	0.370	0.380	0.390	0.391	0.400	0.410

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 2019.00(m)

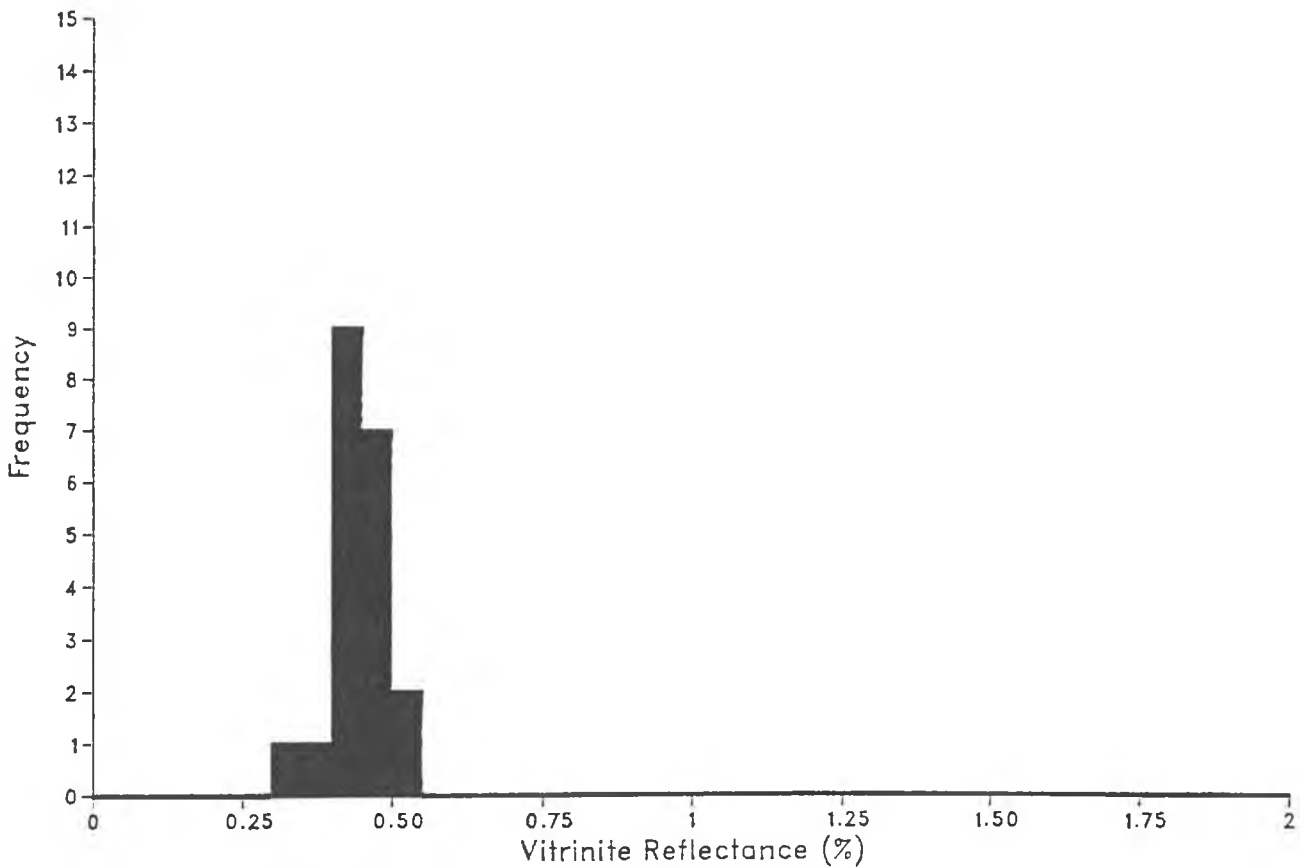


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.200 to 0.550):	0.41	0.07	20

Readings:									
0.240	0.270	0.340	0.341	0.380	0.390	0.391	0.400	0.401	0.420
0.421	0.430	0.440	0.441	0.460	0.461	0.470	0.490	0.491	0.530

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 2301.00(m)



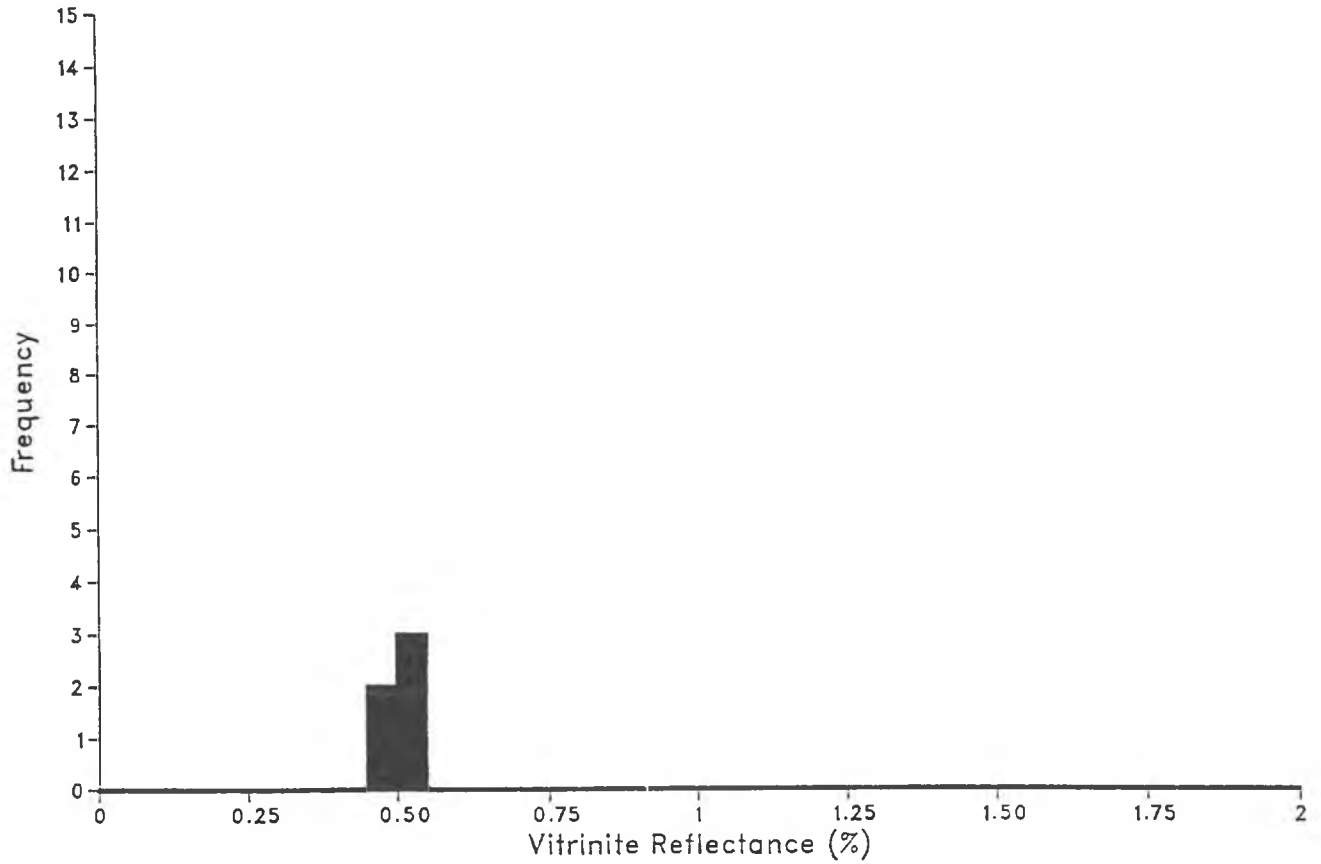
Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.300 to 0.550):	0.44	0.05	20

Readings:									
0.320	0.370	0.400	0.410	0.411	0.420	0.421	0.422	0.423	0.440
0.441	0.450	0.460	0.470	0.480	0.481	0.490	0.491	0.510	0.511

Vitrinite Reflectance Histogram

GEOLAB  NOR

Well: NOCS 30/11-4
Depth: 2580.00(m)

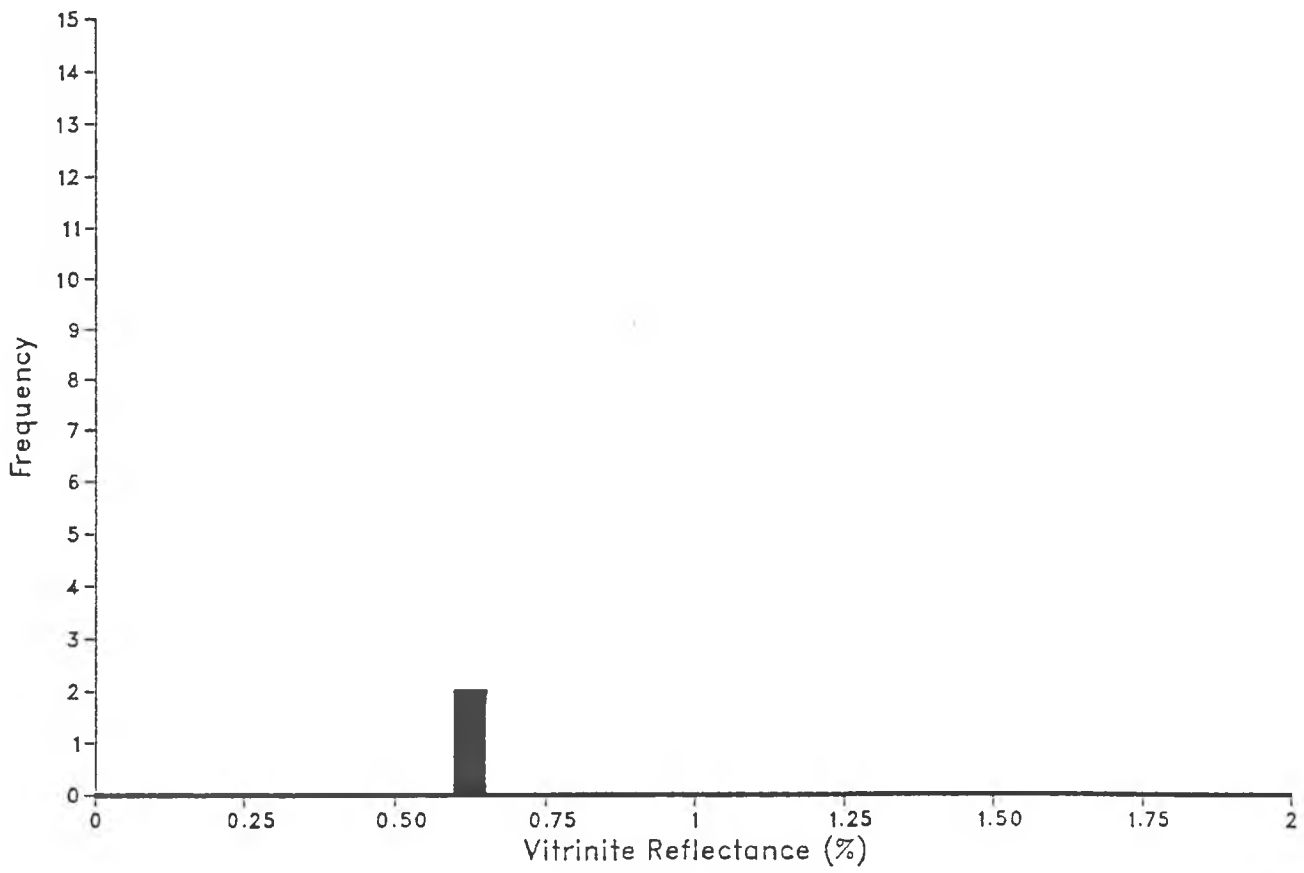


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.550):	0.50	0.04	5

Readings:
0.450 0.480 0.520 0.530 0.540

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 3081.00(m)

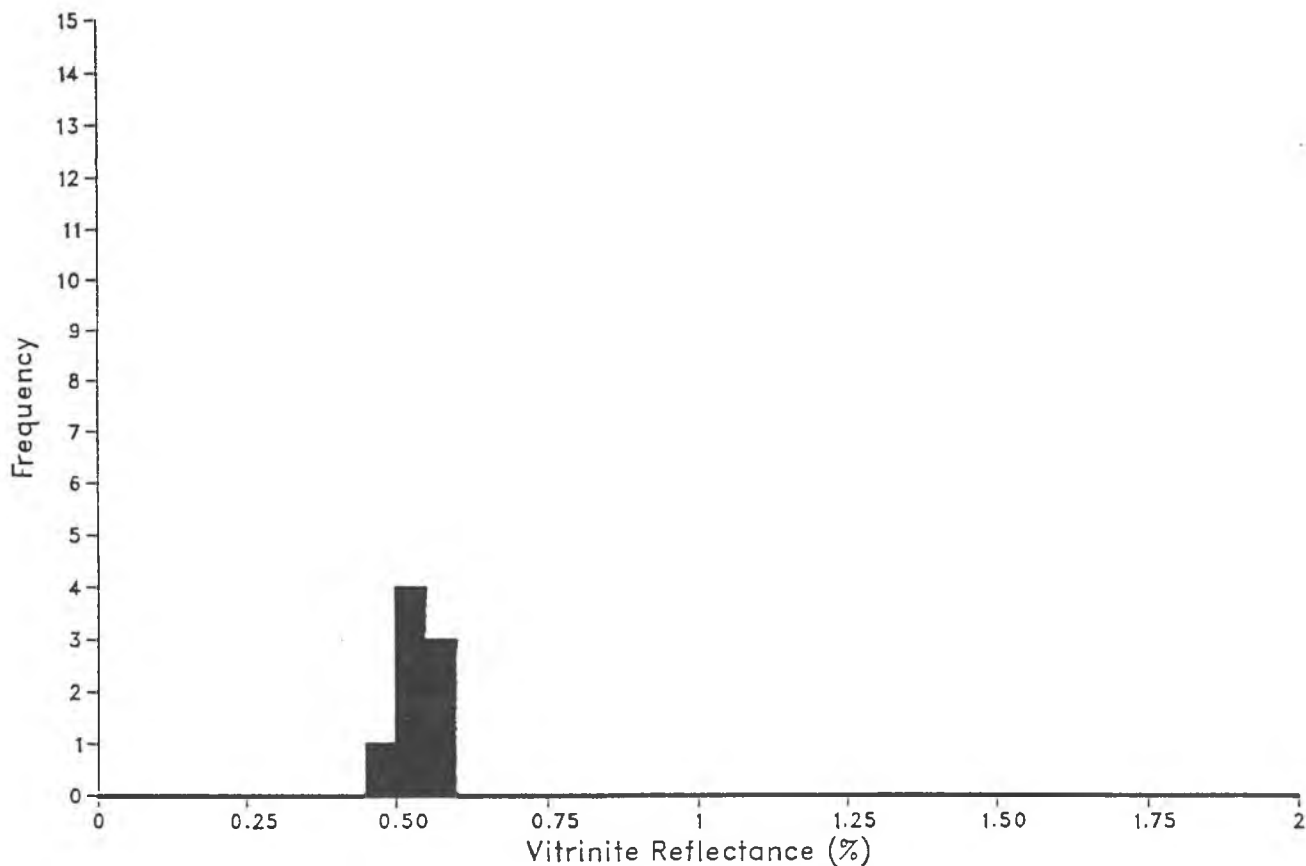


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.600 to 0.650):	0.61	0.01	2

Readings:
0.600 0.620

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 3261.00(m)

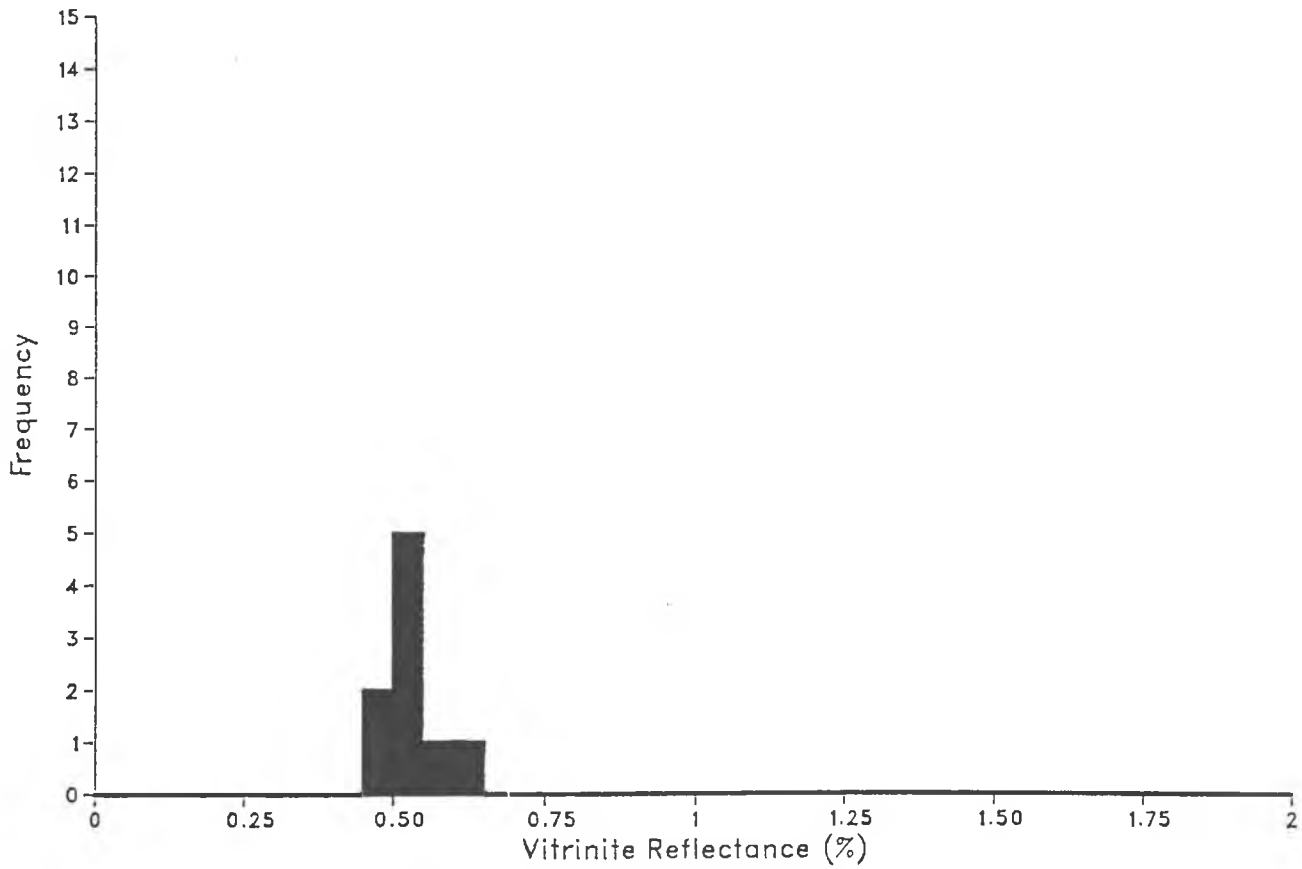


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.600):	0.53	0.03	8

Readings:
0.490 0.500 0.501 0.540 0.541 0.550 0.551 0.570

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 3273.00(m)

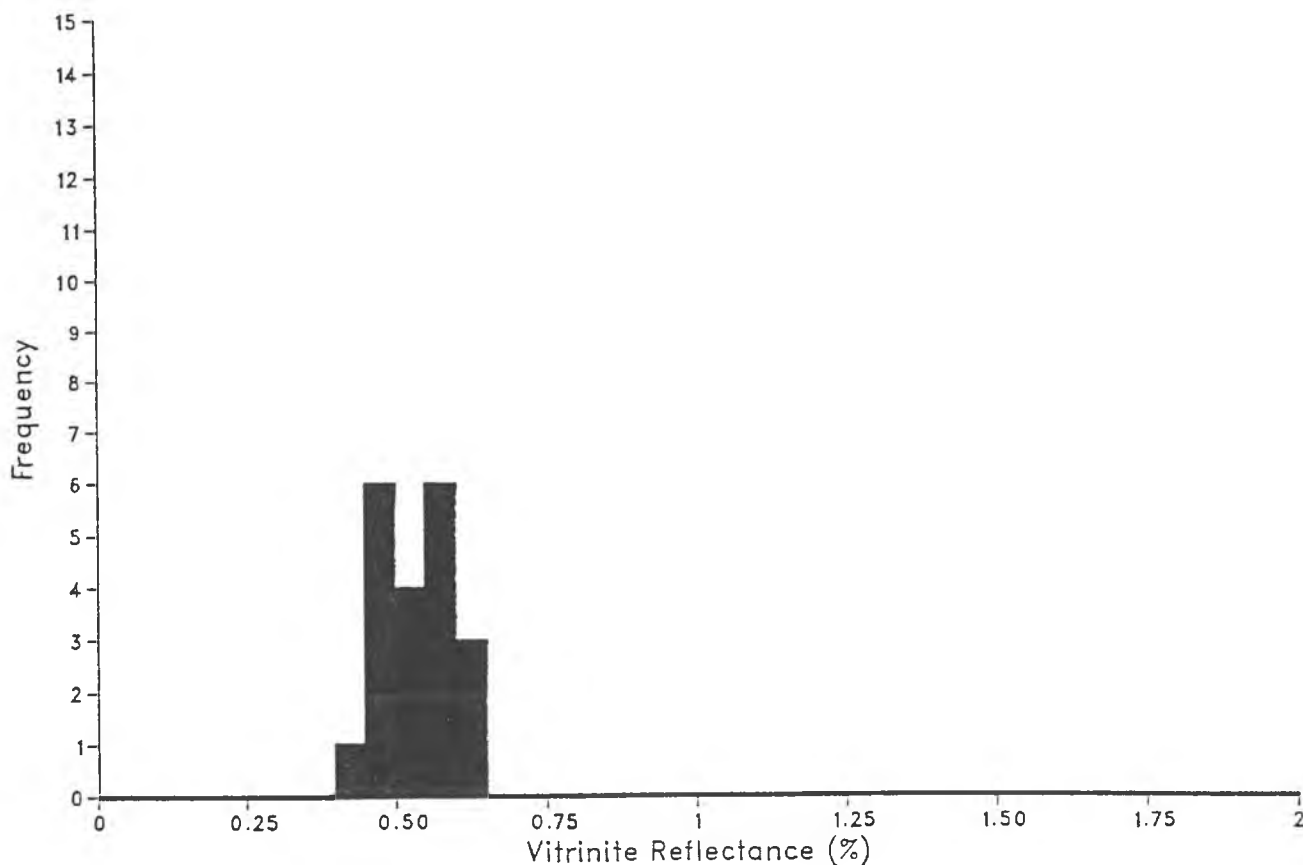


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.450 to 0.600):	0.53	0.04	9

Readings:
0.460 0.490 0.510 0.511 0.520 0.530 0.540 0.590 0.600

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 3423.00(m)

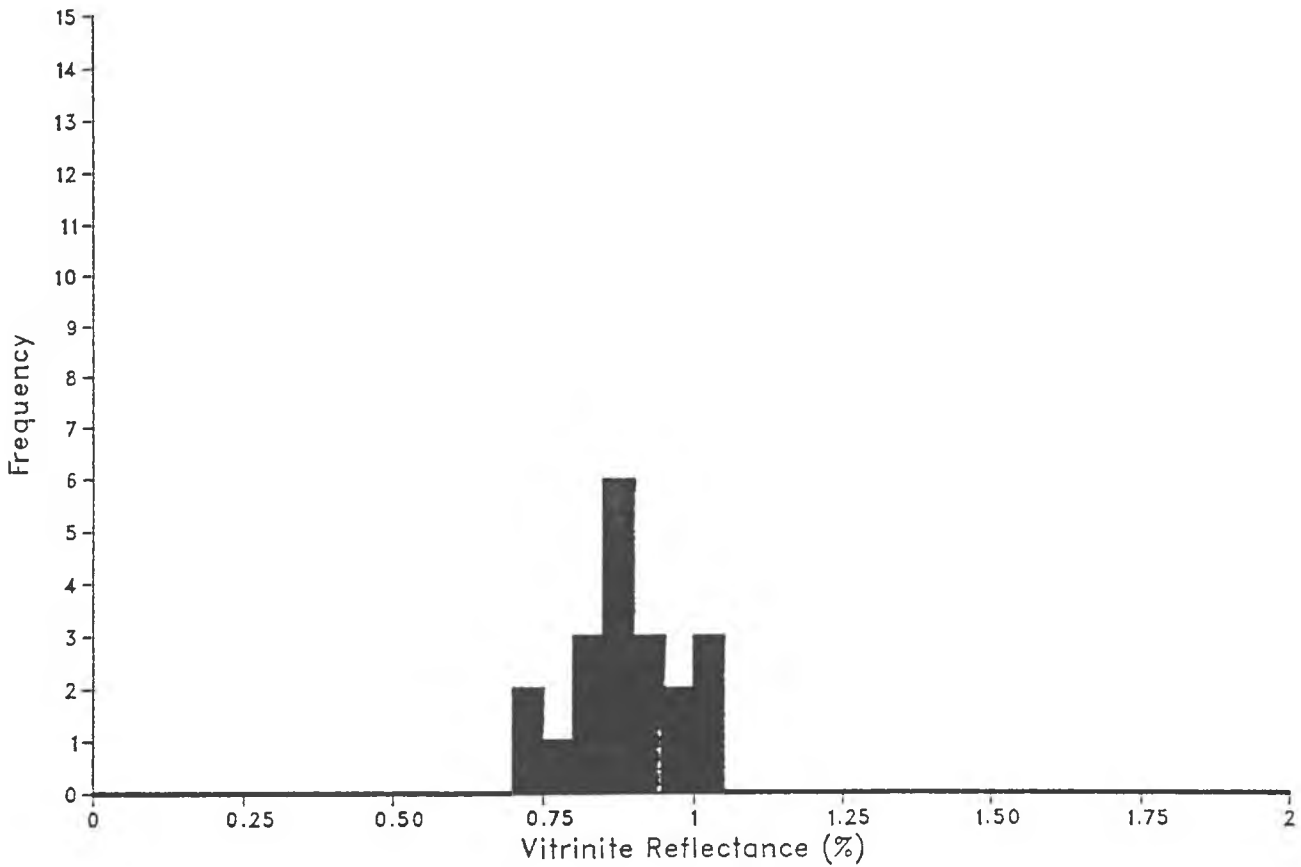


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.400 to 0.650):	0.53	0.06	20

Readings:									
0.440	0.460	0.461	0.470	0.480	0.490	0.491	0.500	0.510	0.530
0.531	0.550	0.551	0.560	0.570	0.590	0.591	0.600	0.610	0.630

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 3741.00(m)

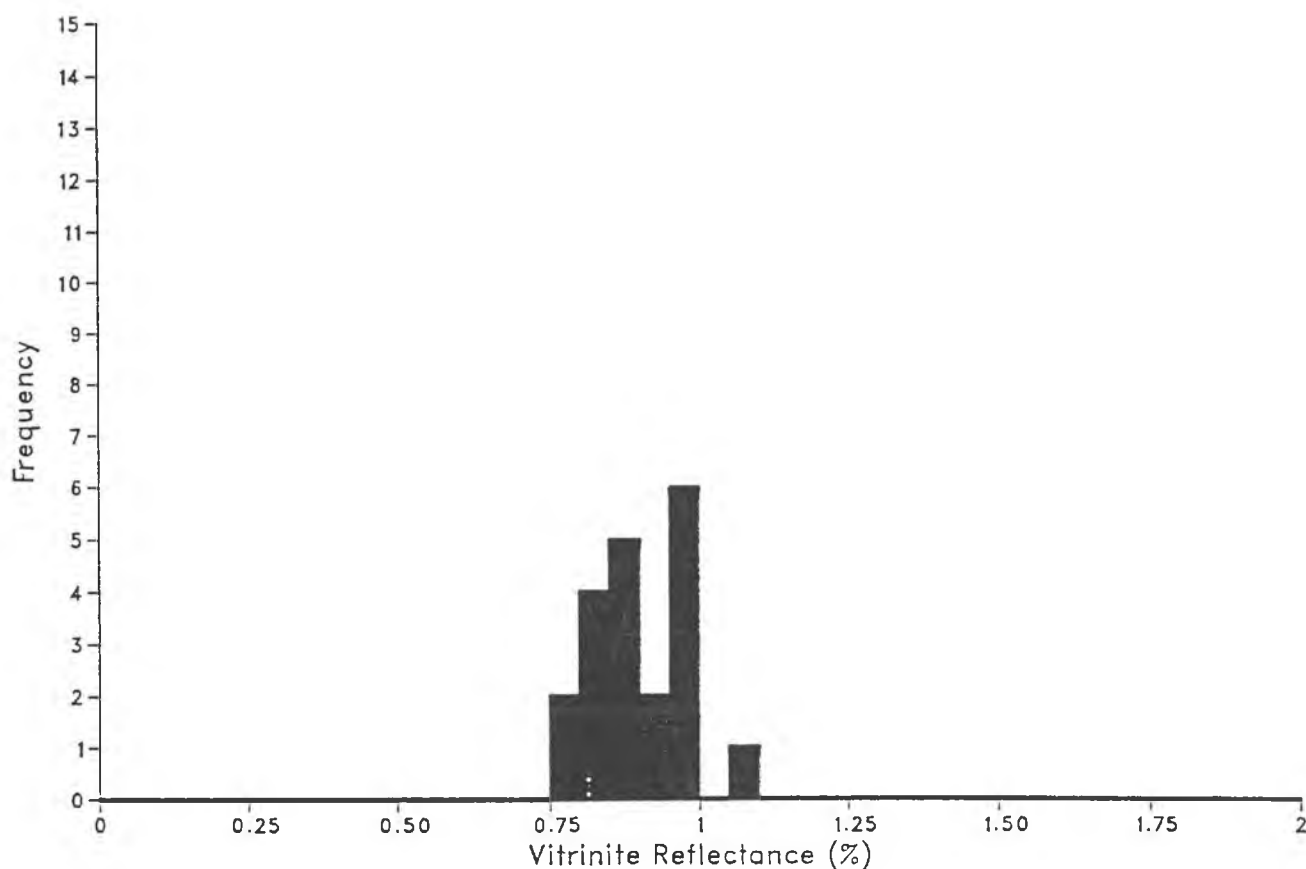


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.700 to 1.050):	0.88	0.09	20

Readings:									
0.720	0.740	0.750	0.800	0.801	0.840	0.850	0.851	0.860	0.870
0.880	0.890	0.900	0.930	0.940	0.960	0.980	1.000	1.010	1.020

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 3945.00(m)

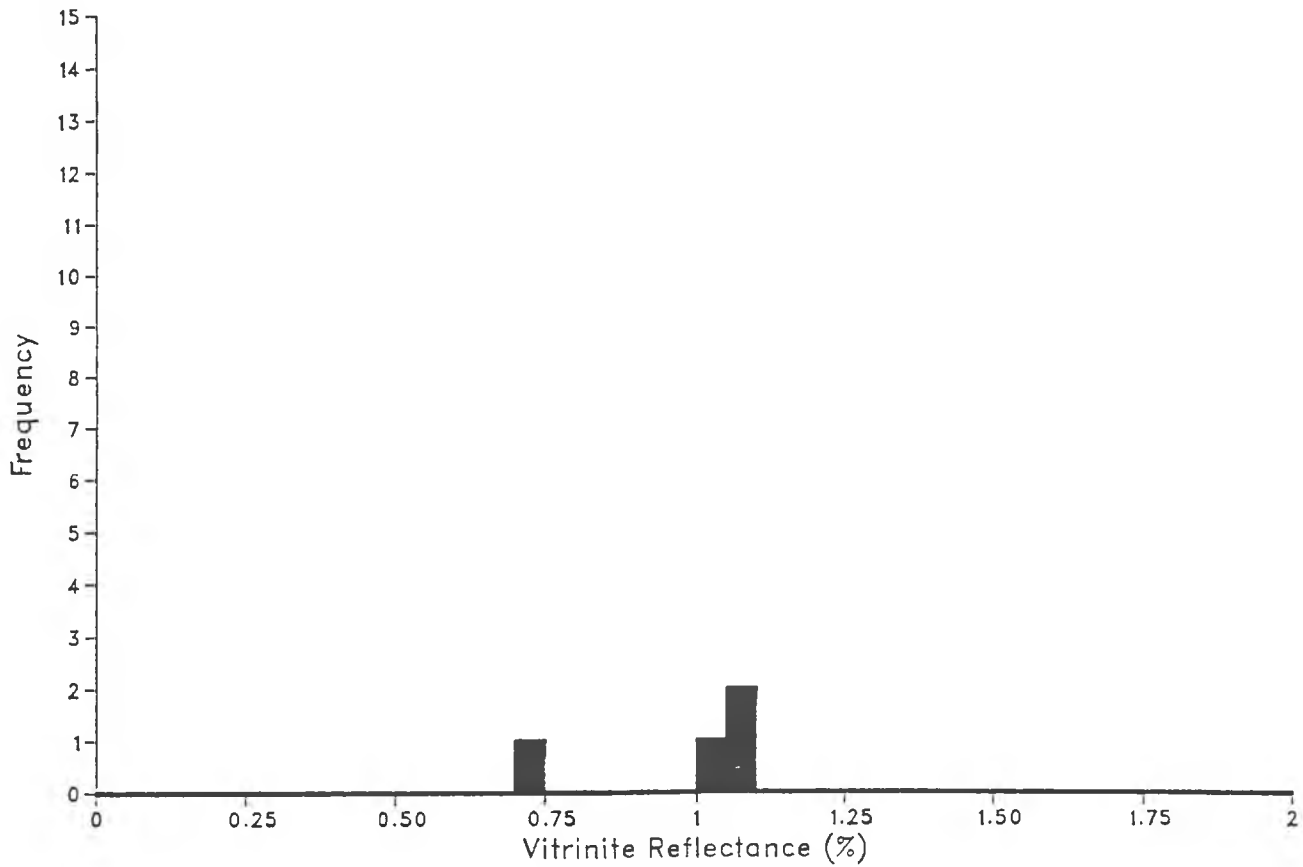


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.750 to 1.100):	0.90	0.08	20

Readings:									
0.760	0.780	0.800	0.810	0.830	0.840	0.850	0.880	0.881	0.882
0.890	0.910	0.940	0.950	0.970	0.980	0.981	0.982	0.990	1.060

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 4251.00(m)

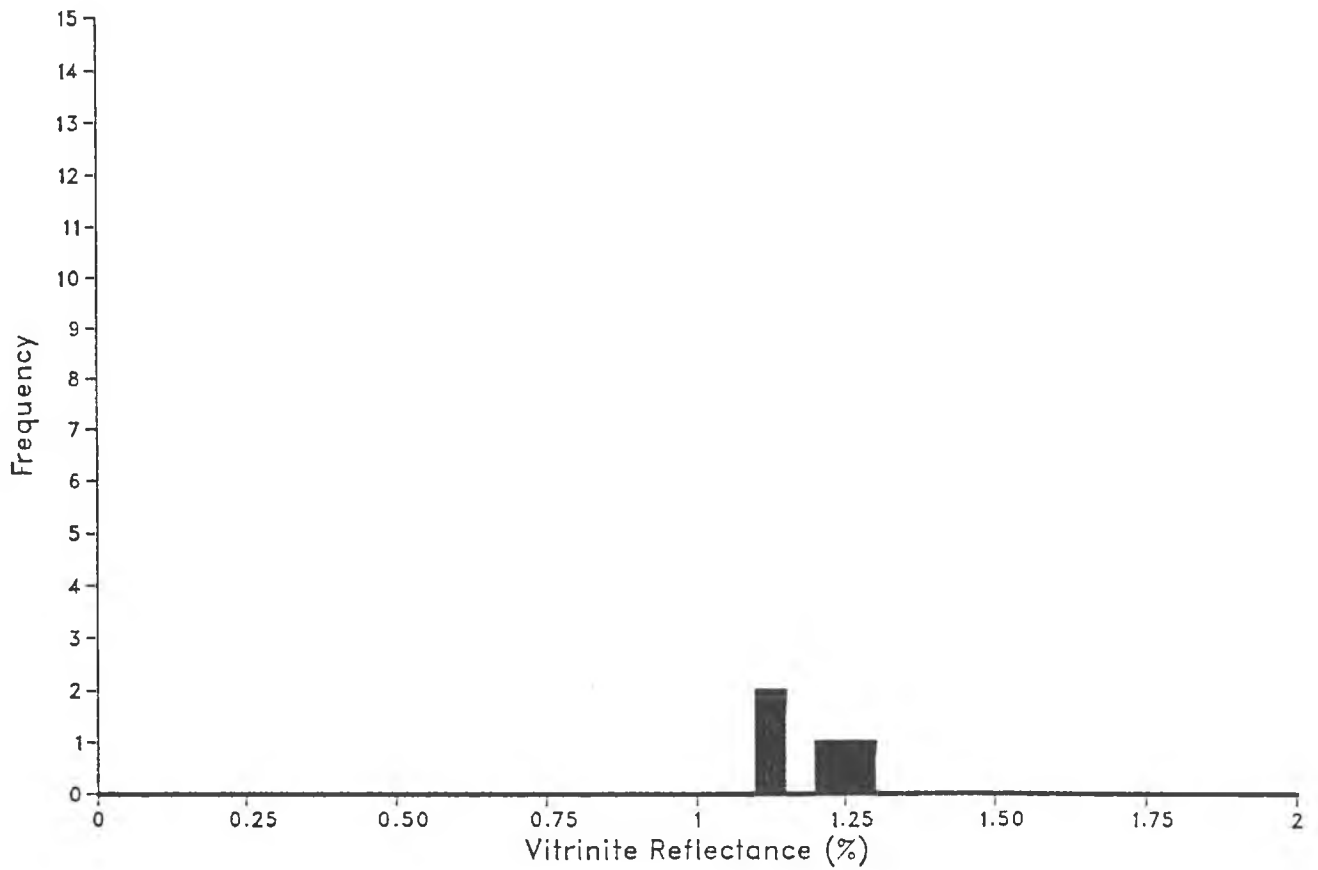


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 0.700 to 1.100):	0.98	0.18	4

Readings:
0.710 1.030 1.070 1.090

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 4899.40(m)

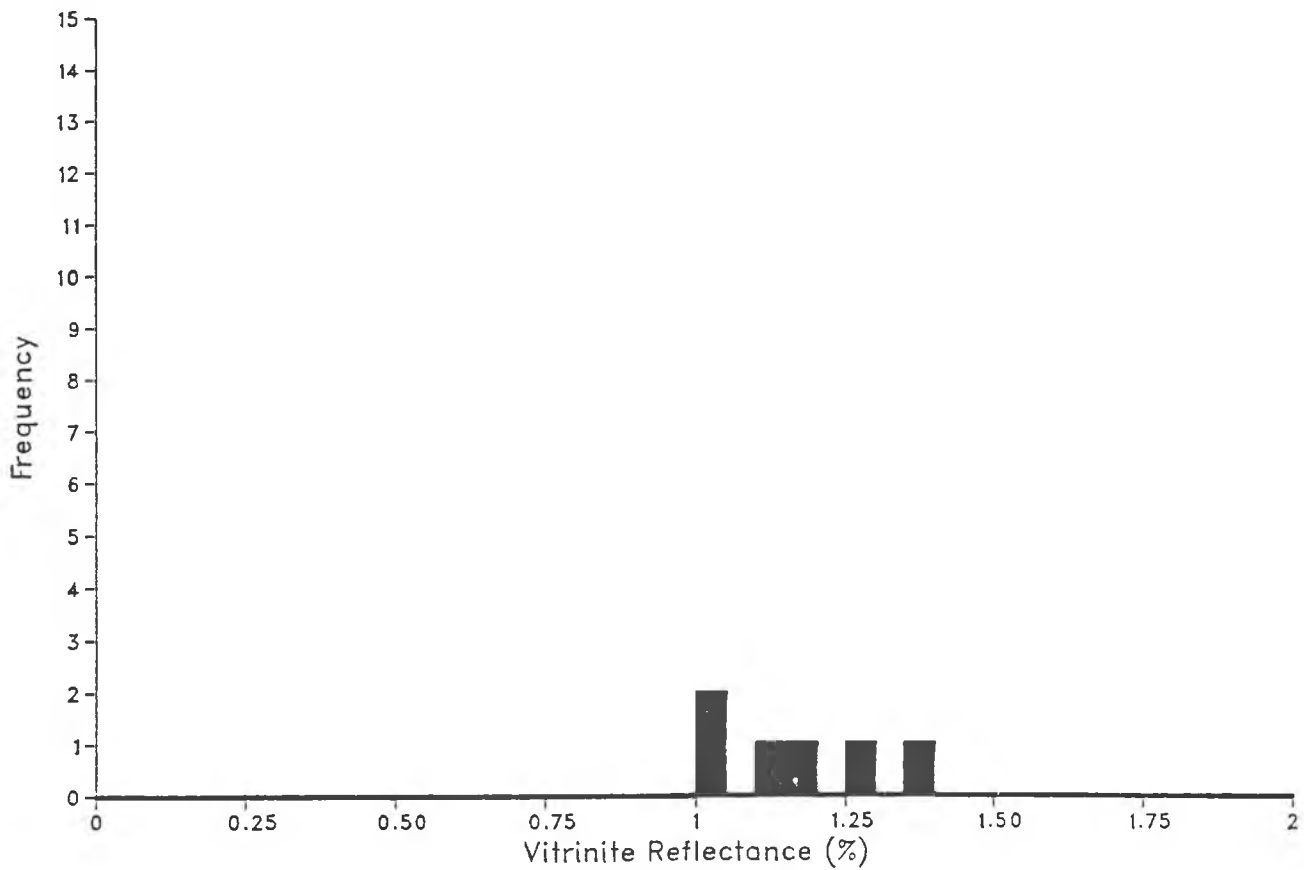


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 1.100 to 1.300):	1.19	0.06	4

Readings:
1.140 1.141 1.220 1.270

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 5011.00(m)

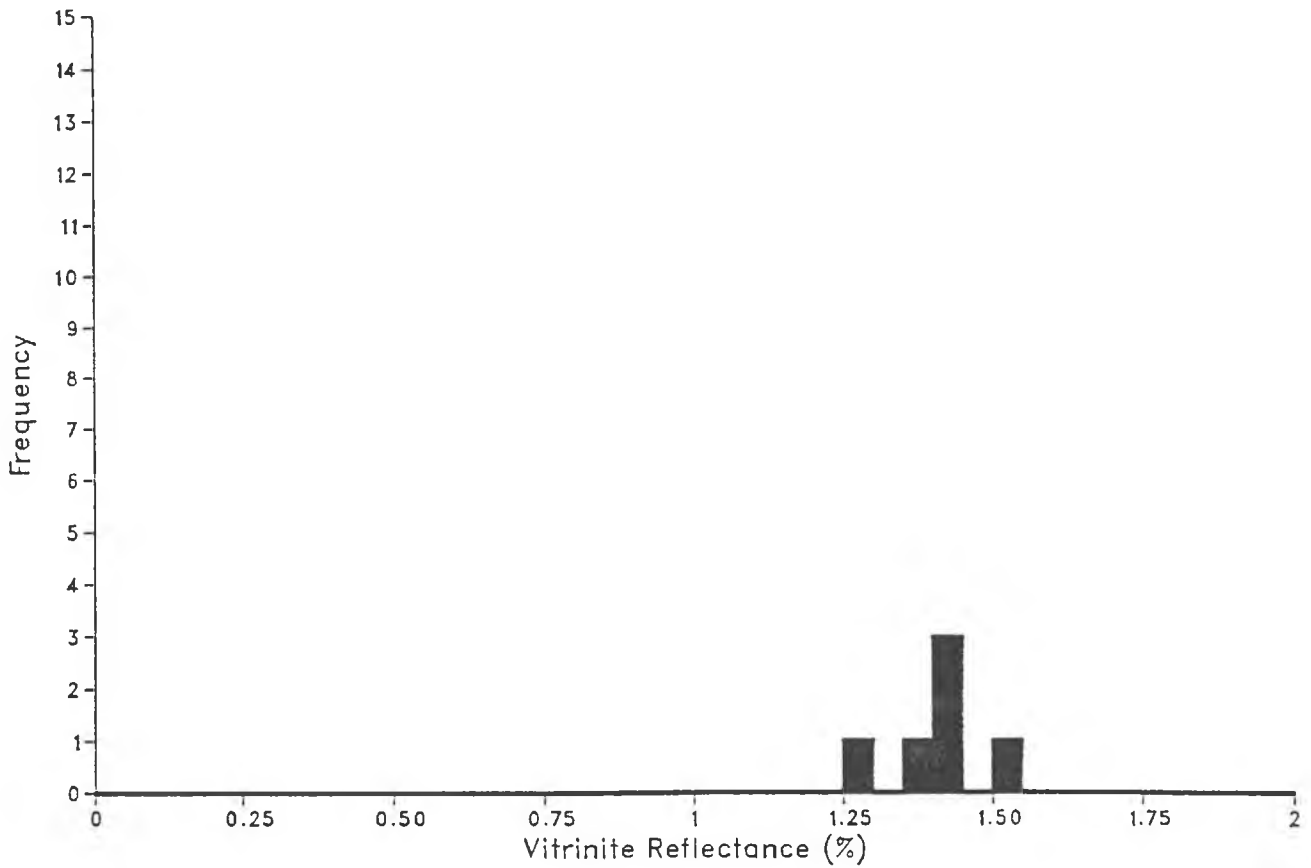


Statistics:	Mean	St.Dev.	n
Indigenous Population (from 1.000 to 1.400):	1.17	0.13	6

Readings:
1.030 1.031 1.140 1.170 1.290 1.360

Vitrinite Reflectance Histogram

Well: NOCS 30/11-4
Depth: 5235.00(m)



Statistics:	Mean	St.Dev.	n
Indigenous Population (from 1.250 to 1.500):	1.41	0.08	6

Readings:
1.260 1.370 1.430 1.440 1.441 1.500