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HYDRO

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PETROLEUM GEOCHEMISTRY

WELL: 30/6-24S

BA-92-1207-1

Summary/Conclusion//Recommendation

The sections penetrated by this well are immature in the top of the Tertiary and at peak oil generation at T.D. in Triassic sediments. The hydrocarbon generation threshold for type II kerogens commences at 2600m RKB and the peak oil generation threshold starts at 3550m RKB.

Source rock screening data and further geochemical analysis do not classify the analysed Dunlin Gr. section as a significant source rock for hydrocarbon generation. The organic material in the Dunlin Gr. is dominated by terrestrially derived material.

Analysed coals from the Dunlin Gr. and the Statfjord Fm. are primarily of continental origin and have at most a potential for gas production.

Analysed sandstones in Statfjord Fm do not contain migrated hydrocarbons.

Keywords

Petroleum Geochemistry, Maturity, Source Rocks, Migrated Hydrocarbons.

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1. INTRODUCTION.

Well 30/6-24S is located in the north-western part of Block 30/6 on the flank of the Viking Graben. The well was spudded 13 October 1991 and reached T.D. at 3991m MD RKB in sediments of Triassic age. Well location map and well summary are given in Figure 1.1, and a geological well summary with formation tops is given in Figure 1.2.

The aims of this study were to obtain a maturity profile of the well using vitrinite reflectance and to identify and characterize potential source rocks and migrated hydrocarbons in the interval 3400 - 3985m in Cretaceous and Jurassic sediments using RockEval/TOC.

This report comprises the results from petroleum geochemical analysis of 43 samples, both ditch cuttings and conventional core samples.

Based on the screening results, 9 samples (4 shales, 1 coal and 4 sandstones) have been selected for further geochemical analysis, Table 1.2.

Vitrinite reflectance measurements were undertaken by Geooptics, Newcastle, UK. Visual kerogen was measured by Geochem Labs., Chester, UK. The isotope analyses have been carried out by GeolabNor, Norway. All other analytical work, interpretation of data and compilation of this report was done at Norsk Hydro Research Center, Bergen, Norway.

2. THERMAL MATURITY.

The thermal maturity of well 30/6-24S has been established using vitrinite reflectance. T_{max} from RockEval has been used in the Lower Cretaceous and the Jurassic sections.

2.1 Vitrinite reflectance.

The average vitrinite reflectance values are listed in Table 2.1, and are plotted versus depth in Figure 2.1. The individual measurements are given in Appendix I.

The vitrinite reflectance values increase from around R_o 0.30% in the upper Tertiary (1000-1100m) to around R_o 0.75% near the T.D in the Lower Jurassic.

In the analysed Tertiary section (1040-2425m) of well 30/6-24S vitrinite reflectance values (R_o) increase from around 0.30% to 0.45%. This indicates that this section is immature with respect to oil generation.

The Cretaceous section (2425-3525m) have R_o values ranging from 0.47% to 0.65% and is early mature for oil generation in the lower 600m.

The Jurassic sediments are in a maturity interval from R_o 0.65% to 0.8%. For oil prone marine type II kerogen this suggests that the Jurassic sediments are at present in the upper part of the peak oil generation zone. The kerogens containing gas prone material may have generated gas in the lovermost part of the Jurassic section.

The hydrocarbon generation threshold for oilprone marine type kerogens, R_o = 0.5%, is at approximately 2600m depth. The peak oil generation threshold, R_o=0.65% at 3550m is shown in Figure 2.1. The thresholds are observed at depths comparable with other wells in the area.

The vitrinite reflectance trend is smooth both in the upper and lower part of the well. A section from 2000 to 3100m has a more uneven trend and the measured values tend to be lowered relative to the general trend suggested in

Figure 2.1. This section was therefore not taken into account when the trend in Figure 2.1 was calculated. The lowering of the R_o readings in this section may be due to staining of migrated hydrocarbons. Variable degrees of the observed staining is also shown by the production indices (PI) measured in the Creataceous section (Table 3.1, 3400 - 3575m. This effect may also be present in the section above where the vitrinite reflection readings are most depressed. The observed effect of depression can also solely, or partly, be affected by caved material or mud additives such as lignite.

2.2 T_{max} from RockEval.

T_{max} values are measured from 3400m (Cretaceous) to 3940m (Trias). The results are listed together with other source rock screening parameters in Table 3.1, and are plotted versus depth in Figure 3.1.

Screening results from RockEval indicate a fairly smooth and steady increase towards depth indicating that the analysed Cretaceous section is in the zone of early oil generation (Tmax >435 °C).

The Jurassic section is at present located in the upper part of the peak oil generation zone as the Tmax values are larger than 445 °C.

2.3 Maturity summary.

The two methods used for maturity assessments in this well tend to support each other. Both methods show that the peak generation threshold (R_o=0.65% and Tmax=445°C) is at about 3550m. The threshold for the early mature zone is set to 2500m based on vitrinite reflectance, R_o=0.5% (no Tmax results were aquired at this depth). This threshold is similar to observations in other wells in the area.

3. SOURCE ROCK EVALUATION AND ANALYSIS OF POSSIBLE MIGRATED HYDROCARBONS

The samples investigated in this study are from the lower part of the Cretaceous (from 3400m). The Dunlin Group and Statfjord Formation from 3682.5 to 3940.0m. The samples analysed were primarily ditch cuttings (DCW), except from corechips samples (COCH) from four sandstones in the Statfjord Fm. The sandstone samples were selected for identification and characterization of migrated hydrocarbons.

3.1 RockEval/TOC screening data

Source rock horizons are usually identified using RockEval pyrolysis and total organic carbon (TOC) measurements. The results of RockEval/TOC analysis are listed in Table 3.1, and are plotted versus depth in Figure 3.1.

The marginal mature samples (3400-3575m) of Cretaceous age are all very lean in organic matter. They show an average S_2 of 0.26 kg/tonne, TOC of 0.6% and Hydrogen Index of 42 mgHC/gTOC. Therefore this section can not be classified as a source rock.

Seven samples from the Dunlin Group have been analysed (3575-3680m) with 15m intervals. The lowermost sample contained coal particles that were isolated and analysed. The average S_2, TOC and Hydrogen Indeces for the section are respectively 1.1 kg/tonne, 1.05% and 91 mgHC/gTOC. (The coal sample is not included in these average figures). The average values and the individual measurements for the Dunlin Gr. in Table 3.1 suggest that this sedimentary section in general cannot be classified as a source rock. The diluted organic material is mainly of humic/terrestrial origin and deposited in a marine environment. One sample, however, shows some potential (S_2=3.77 kg HC/tonne rock) for hydrocarbon production, most likely gas. This sample contained coal fragments which may have caused enhancement of the source potential in this particular sample.

The four upper sandstones samples (corechips) in the Statfjord Fm were analysed to detect migrated hydrocarbons. However, the S_1 values are too low to indicate any migrated material. The S_2 values indicate a slight source potential of indigenous organic material acting as impurities in the sandstones.

Coals at depths 3760 and 3775m has a considerable potential for hydrocarbons (180 and 183 kg HC/t rock, respectively). The Hydrogen Indeces are 281 and 246 respectively and indicates coal with some minor liquid potential.

The remaining Statfjord Fm. samples (from 3790m and deeper), together with the Triassic samples have very low potential for hydrocarbon generation and are classified as non source rocks.

It is important to note that the Dunlin Gr., Statfjord Fm. and the Triassic rocks are all in the hydrocarbon generation zone. Therefore thus, will have lost a proportion of their original generating potential. Restoration of their original potential will, however, not change the general conclusion that these sediments originally have not been source rocks.

3.2 Combined pyrolysis - gas chromatograpy of sediments

Pyrolysis-GC has been carried out on five samples from extracted Dunlin Gr. samples and the Statfjord Fm. coal. The pyrograms are shown in Appendix II. The interpretation of the pyrograms support the results from the RockEval/TOC data. The organic material is primarily gas prone due to a high content of terrestrially derived material. One sample (3620-3622m) has a slight potential for light liquid hydrocarbon production. The coal sample pyrolysate contains primarily gas and aromatic material which do not have any potential for liquid hydrocarbon production. Although the sediments have undergone a considerable thermal stress it has apparently not been large enough to extinguish the source of long chained alkanes which are indicative of the sediments liquid

potential.

3.3 Extraction data

Selected samples from the Dunlin Gr. and the Statfjord Fm. have been solvent extracted and group type separated. These samples are compiled from two DC samples to get enough material for extraction. The results are listed in Table 3.2. The yields are fair in the Dunlin Gr. and poor in the Statfjord Fm. The data suggest that no or very little migrated hydrocarbons are present in these sandstones. The extraction yields give apparent better source richness than the RockEval results at the same depths due to the elevated maturities of these samples. The group type separation results show high abundance for polar (NSO) and asphaltenic components relative to saturated (SAT) and aromatic (ARO) compounds. This is indicative of relatively high abundance of humic type material also suggested by the RockEval and TOC data. This is expressed particularly well in the Statfjord Fm. coal sample at 3742-3745m which has 66.5% asphaltenes and only 2.9% SAT. Again, these results also support the relatively low liquid potential in these rocks as the NSO's and asphaltenes are more apt to be retained in the rock matrix and crack to gas at a late maturity stage.

3.4 Properties of the saturated fraction.

The saturated fractions (SAT) from the extracted samples have been analysed with respect to their alkane distributions on capillary gas chromatograpy. The chromatograms are compiled in Appendix III. Visual inspection of the chromatograms from the Dunlin Gr. suggest organic material with high paraffinic content and a slight odd over even n-alkane dominance. This indicates a terristrial herbaceous component in the sediments. Molecular parameters (Table 3.3) have been calculated from the chromatograms. The carbon preference index (CPI) is >1.0 supporting the visual impression of an odd carbon preference. The pristane - phytane ratio (pr/ph) is clearly larger than

1.0 in all the Dunlin Gr. samples which show that these sediments have a significant terrestrial component. The Statfjord coal has pr/ph=2.49 and is clearly terrestrial as expected for most coals. Pristane/n-C17 is in the order of 0.58-0.80 and supports the maturity level suggested above.

The mud and DC sample at 2040-2050m has a similar alkane distribution as the Dunlin Gr. extracts. This, however, does not infer that these hydrocarbons, if they are migrated, are produced from a Dunlin Gr. equivalent.

The hydrocarbons in the Statfjord Fm. sandstones have a different distribution from those in the Dunlin Gr. extracts. The uppermost sample, 3688m, has a high content of long chained alkanes with a clear odd over even dominance. It does not resemble a migrated oil. The samples at 3701m, 3702m and 3704m has a smooth unimodal distribution probably derived from indeginous dispersed organic matter with a likely contaminant eluting at n-C22.

3.5 Biological markers in saturated fractions

The fragmentograms of the hopane type triterpanes (m/z 191) and the steranes (m/z 217) are compiled in Appendix IV. Molecular ratios are listed in Tables 3.4 and 3.5. The C32 triterpanes (%22S) have all reached equilibrium which is expected at this level of maturity. The Ts/Tm ratios (a combined maturity and source parameter) suggest some minor source input variations in the Dunlin Gr. where the 3665m sample is different from the others.

The sterane maturity parameter %20S is varying from 45 to 56. This is considered to be a large variation within this moderate thick sequence with only minor changes in maturity. However, the biomarker values in general suggest a maturity of about 0.6-0.7% R_o. This is similar to the vitrinite reflectance values measured at this depth. The mud and DC sample is clearly less mature than the Dunlin Gr. extracts, whilst the Statfjord Fm. sandstone extracts have approximately the same maturity as the Dunlin Gr. samples.

Based on the relative distribution of C27, C28 and C29 steranes (from visual inspection) it seems like all samples contain a mixture of two kerogen components because significant amounts of all the steranes are present. The C30 steranes, indicative of marine algal material, are only present in very small amounts in all the samples. The combined sample 3620m plus 3622m has the highest abundance of these components and consequently has had the highest marine contribution. The Statfjord Fm. coal sample and the sandstone at 3688m have a clear dominance of C29 steranes and contains consequently primarily continentally derived organic matter.

3.6 Stable carbon isotope distribution

The stable carbon isotope distribution in all four bulk fractions for the Dunlin Gr.samples and the Statfjord Fm. coal is listed in Table 3.6. Galimov plots are shown in Figure 3.6. The saturated fractions from the Dunlin Gr. are isotopically fairly light; as light as the oils in the Oseberg area. The aromatic and the NSO fractions have similar isotope values, but are considerably heavier than the SAT fractions. The aromatic and the NSO fractions are also much heavier than in the equivalent fractions of the Oseberg oils. The asphaltenes are more than one promille-unit heavier than the NSO's. In relation to general expression of isotope fractions in the Galimov plots, it appears that the bitumen consists of a marine component giving light SAT fractions and a terrestrial component giving heavy AROM and NSO+Asphaltene fractions, as suggested by the sterane molecular distribution. The Statfjord Fm. coal sample does not show much variations in its isotopical composition. The fractions from the coal (the SAT is lacking due to low extraction yield) are as heavy as the Dunlin Gr. asphaltenes and supports to some extent the suggestion of two kerogen components. This sample was primarily continental in origin according to the sterane distribution.

The isotope composition of the extracted fractions from the mud and DC (2045-2058m) sample and the Statfjord Fm. sandstones are listed in Table 3.6 and plotted in Figure 3.6. The saturated fractions in this sample suite are isotopically sligthly heavier than the Dunlin Gr. samples. One sample (3704m) has a very light SAT fraction in contrast to the heavy AROM, NSO and ASPH fractions. This may be due to mixed material in this sample. One component is rich in saturated hydrocarbons and the other component is dominated by terrigenous components rich in aromatic and polar compounds. The alifatic component may be derived from insignificant amounts of migrated hydrocarbons. The other two Statfjord Fm. samples resembles the Dunlin Gr. extracts and probably reflect bitumen from the terrigene organic material dispersed in the sandstone. The aromatic fraction of the mud sample is isotopically lighter than in any of the other extracts and have a more "oil-like" expression as shown in the Galimov plot, which may suggest a migrated oil superimposed on indigenous bitumen.

4. KEROGEN COMPOSITION.

Five samples, the four extracted Dunlin Gr. samples and the extracted Statfjord Fm. coal (Table 3.2) have visually been analysed for kerogen components after demineralization. The results are listed in Table 3.7. The data suggest no marine components apart from a small indication in the Dunlin sample at 3617-3620m. This sample has the highest content of the marine indicators; C30 steranes. The coal sample is completely dominated by woody material, which is in line with the Py-GC and biomarker data.

The visual kerogen analysis correlates well with the other geochemical analysis suggesting the Dunlin Gr. sediments to be dominated by primarily continentally derived material.

5. CONCLUSIONS.

The sediments penetrated by this well range from immature in the top of the Tertiary to peak oil generation at T.D. in Triassic sediments. The hydrocarbon generation threshold for type II kerogens commences at 2600m RKB and the peak oil generation at 3550m RKB.

Source rock screening data and further geochemical analysis do not classify the analysed Dunlin Gr. shales as source rocks for hydrocarbons. The organic material in the Dunlin Gr. are dominated by terrestrially derived material.

Analysed coals from the Dunlin Gr. and the Statfjord Fm. are primarily of continental origin and have primarily potential for gas production.

Analysed sandstones in Statfjord Fm. do not contain migrated hydrocarbons.

HYDRO

LIST OF ABBREVIATIONS AND TERMS

Kerogen

Insoluble organic matter which is preserved in sedimentary rocks. Under the increasing influence of temperature and time (maturation), most kerogen produce hydrocarbons.

TOC

Total Organic Carbon: a measure of the organic carbon in a rock, expressed as weight per cent. Used as a fundamental parameter in source rock classification.

RockEval

A commercial technique for the anhydrous pyrolysis of source rocks developed by IFP. It enables the chemical composition of kerogen and hence its hydrocarbon potential, to be determined.

S_1

This is a measure of the already generated oil in source rocks, or oil content in a reservoir. In units of kg/t rock.

S_2

This is a measure of the remaining hydrocarbon potential. In units of kg/t rock.

Tmax

The temperature, in ^0C at which the pyrolytic yield of hydrocarbons from a rock sample reaches its maximum using RockEval.

Hydrogen Index (HI)

A parameter derived from RockEval which measures the hydrogen richness of kerogen. $HI = 100 * S_2/TOC$. It has a direct relationship with the H/C ratio, and is measured in mg of hydrocarbons/g TOC

Production Index (PI)

A maturity parameter derived from RockEval, which is the ratio of already generated hydrocarbons (or migrated hydrocarbons) to potential hydrocarbons. $PI = S_1/S_1 + S_2$

Immature samples have values of 0.1 or less mature samples 0.1 to 0.4. The PI is high in reservoirs.

Maturation

The process of chemical change in sedimentary organic matter induced by increasing time and temperature. These chemical reactions produce oil and hydrocarbon gases from the appropriate organic matter. The major maturity subdivisons are:

-immature
-early mature
-peak mature
-late mature
-post mature

Vitrinite

The type of organic matter derived from the lignified tissues of higher land plants.

Vitrinite reflectance

A maturity parameter based on the change in the reflectance of polished vitrinite particles with increasing time and temperature. Widely used values for maturity zones are:

<0.55 %. immature
0.55-1.3 % mature for oil generation
>1.3 % post mature for oil generation
0.7-3.0 % mature for gas generation

EOM (Extractable Organic Matter)

Oil and oil-like products removed from rock samples using organic solvents. The amount of extract may be used to determine the level of maturation.

Saturated Hydrocarbons

Hydrocarbons which contain only carbon-carbon single bonds (alkanes).

Aromatic hydrocarbons

Unsaturated hydrocarbons and containing one or more rings with conjugated carbon-carbon double and single bonds.

NSO compounds

Fraction of oils or extracts containing heteroatoms like sulphur, oxygen and nitrogen.

Asphaltenes

The heavy molecular weight components of crude oils and sediment extracts which is soluble in CS_2 and insoluble in n-pentane.

n-C_{17}

n-alkane with 17 carbon atoms

n-alkane carbon number maximum

n-C_{17} maximum indicates algal input

n-C_{16} to n-C_{24} indicates bacterial input

n-C_{27}, n-C_{29}, n-C_{31} indicates higher plant input

Isoprenoids

Isoprenoids are branched and/or cyclic hydrocarbons built from multiples of the isoprene unit and are dominantly derived from plant and bacterial sources.

Pristane

C_{19} regular acyclic isoprenoid derived from the side chain of chlorophyll.

Phytane

C_{20} regular acyclic isoprenoid derived mainly from the side chain in chlorophyll. but have also been found in methanogenic bacteria and archaebacteria.

Pristane/phytane ratio

>3 = oxic conditions

<0.5 = anoxic conditions

The ratio may be affected by many factors

CPI (Carbon Preference Index)

The ratio of abundance of odd carbon number n-alkanes to even number n-alkanes. The preference decreases with increasing maturity until CPI = 1.0.

CPI $>$ 1.1 means oil or extract is of low maturity.

CPI $<$ 1.0 in carbonate source rocks.

Biodegradation

Degradation of oils by bacteria. Normal alkanes are generally the first to be attacked and removed.

GC-MS (Gas chromatography-mass spectrometry)

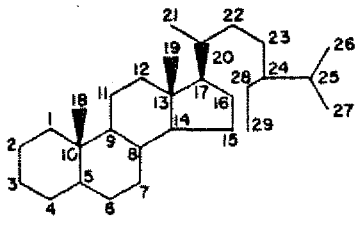
Method for identification of constituents in complex mixtures or for analysis of trace components using Single Ion Monitoring (SIM).

Biomarkers

Compounds found in petroleum or rock extracts which indicate an unambiguous link with a natural product.

Steranes

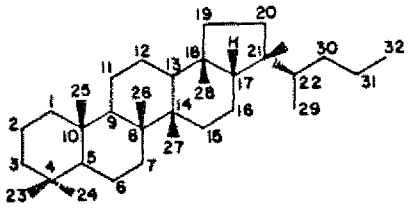
The alkanes derived from steroid natural products. Monitored by GC-MS of M/z 217 and 218.



Sterane

Triterpanes

C_{27} to C_{35} five ring cyclic alkanes derived from triterpenoid hydrocarbons in bacteria, fungi, algae and higher plants. Monitored by GC-MS of M/z 191.



Pentacyclic triterpane

Hopanes

C_{27} to C_{35} pentacyclic alkanes which dominate the triterpanes found in sediments and crude oils. They originate from bacteria.

M/z, m/e

The mass to charge ratio of fragment of molecules from GC-MS.

HYDRO WELL SUMMARY

FIG. 1.1

Coord: 60°42'02.737"N 02°41'34.297"E
UTM: 6 729 655.5mN 483 231.2mE

Zone: ED50 UTM 31 CM 3°E

Line: (Target) NH8504-112 Sp.185

Rig: Vildkat Explorer

Water Depth: 120m RKB elev:25m

Stopped in: Triassic Lunde Formation

On location: 12th October 1991
Spudded: 13th October 1991
At T.D.: 25th November 1991
Completed: 6th December 1991
T.D. Driller: 3986m
T.D. Logger: 3991m
Wireline Logging: Schlumberger
Mud Logging: Exlog Norge A.S.

WELL: 30/6-24S

COUNTRY: Norway

OPERATOR: Norsk Hydro LICENCE: 170

OWNED BY: Norsk Hydro, Statoil, Total

TARGET
Primary: Statfjord Formation

RESULTS
Poor oil shows from the Jurassic

Plugged and abandoned as a dry hole

CASING

30" at	231m
133/8" at	1004m
9 5/8" at	3052m

CORES

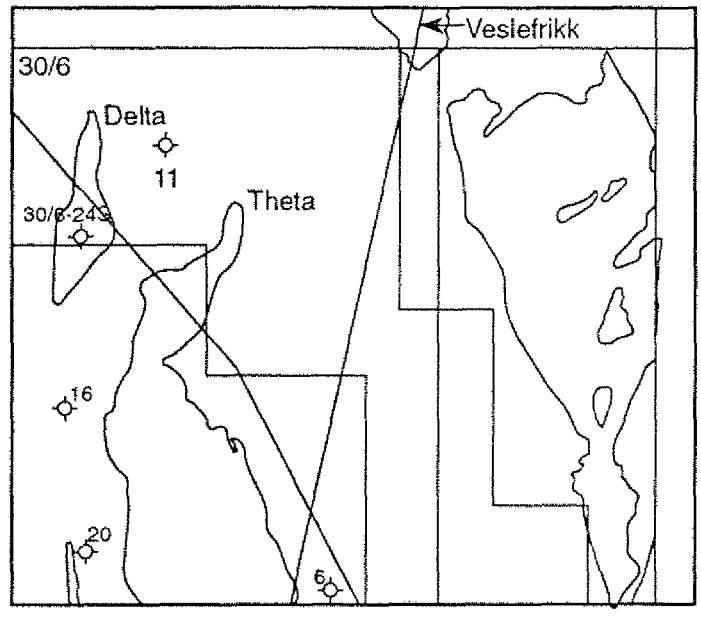
No.	C = Cut (m) R = Recovered	Rec %
1	C: 3682-3696.5m R: 3682-3691.93m	68
2	C: 3696.5-3712m R: 3696.5-3712.1m	100

GAS RECORD

145-1017m	Returns to seabed
1017-1340m	0.01-0.02% C_1
1340-1660m	0.0%
1660-1850m	0.01% C_1
1850-2230m	0.02-0.06% C_1
2230-2430m	0.01-0.03% C_1-C_3
2430-2650m	0.15-0.21% C_1-nC_4
2650-2740m	0.06-0.10% C_1-nC_4
2740-3070m	0.12-0.20% C_1-nC_4
3070-3390m	0.30-0.50% C_1-C_2
3390-3530m	0.20-0.46% C_1-nC_4
3530-3682m	0.15-0.22% C_1-nC_4
3682-3986m	0.08-0.10% C_1-C_3

CST

Run	Interval	Rec
	None taken	



LOGS

DIL/LSS/LDL/SP/GR/AMS 2987.5-970.0m	1A	VSP 3040-1400m	2A
DIL/LSS/GR/SP/AMS 3989-3056.6m	2B	3960-3940m 3560-3000m	2B
LDL/CNL/GR/AMS 3990-3056.6m	2B		
FMS-4/GR/AMS 3990-3056.6m	2A	MWD 145-3978m	
RFT-HP/GR/AMS 3687.5-3783m	2A		

OIL SHOWS

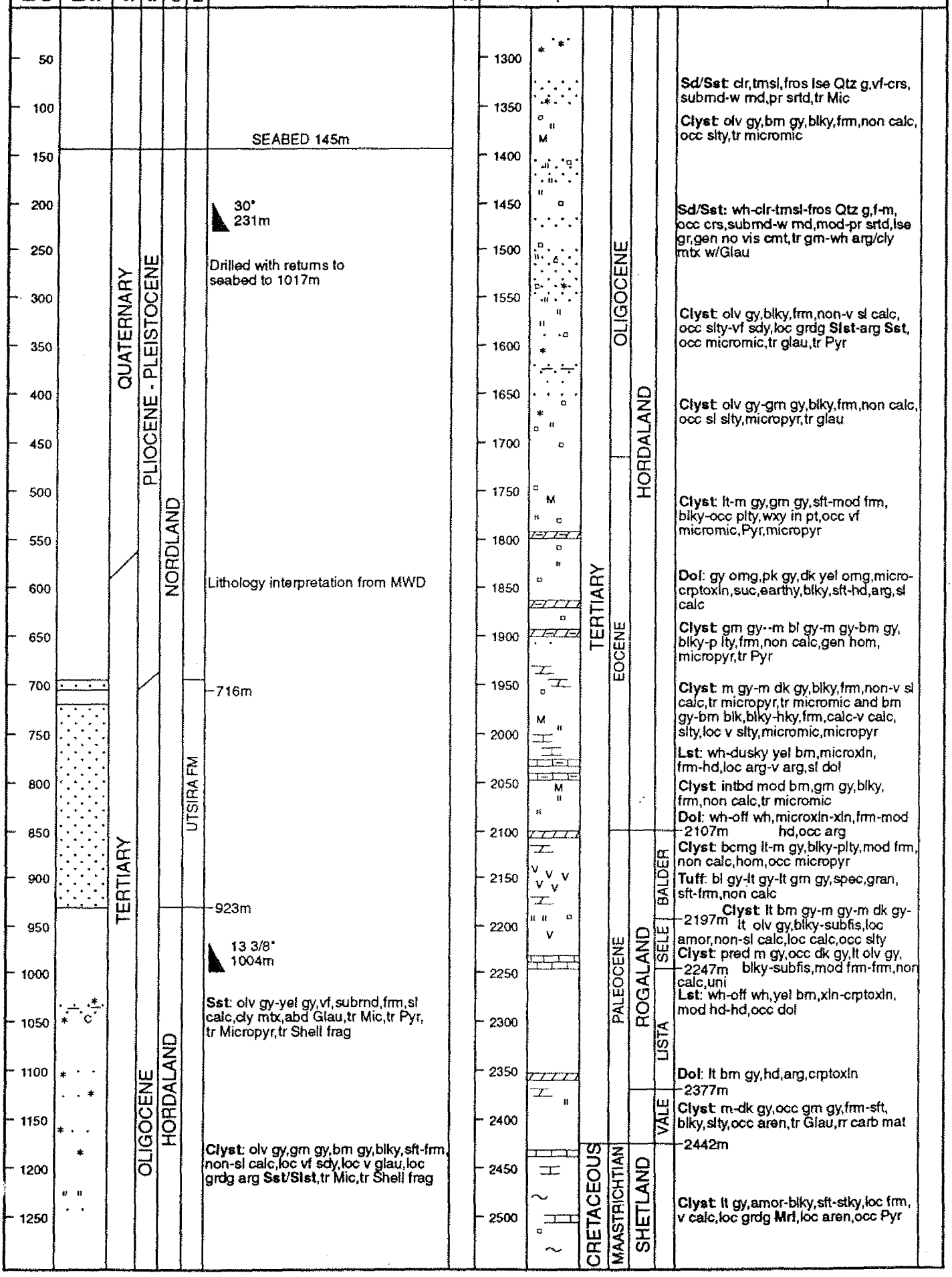
2505m	on Lst:m brn oil stn,bri yel wh dir flu,inst strmg yel wh cut flu,lt brn vis cut,bri yel wh resd flu,lt brn vis resd
3686m	on Sst in Core#1: tr br yel wh dir fluor,fst strmg bl wh cut flu,no vis resd, bl wh resd flu
3688m	on Sst in Core#1: bri yel dir fluor,no vis cut, v weak yel wh crush cut flu,no vis resd,v weak pl yel wh resd flu

HYDRO GEOLOGICAL WELL SUMMARY Fig. 1.2

Located on: NH 8504 - 112 sp 185 (target)

Water depth: 120m RKB elev: 25m

WELL 30/6-24S



HYDRO GEOLOGICAL WELL SUMMARY Fig. 1.2

Located on: NH8504-112 Sp.185 (Target)

Water depth: 120m RKB elev:25m

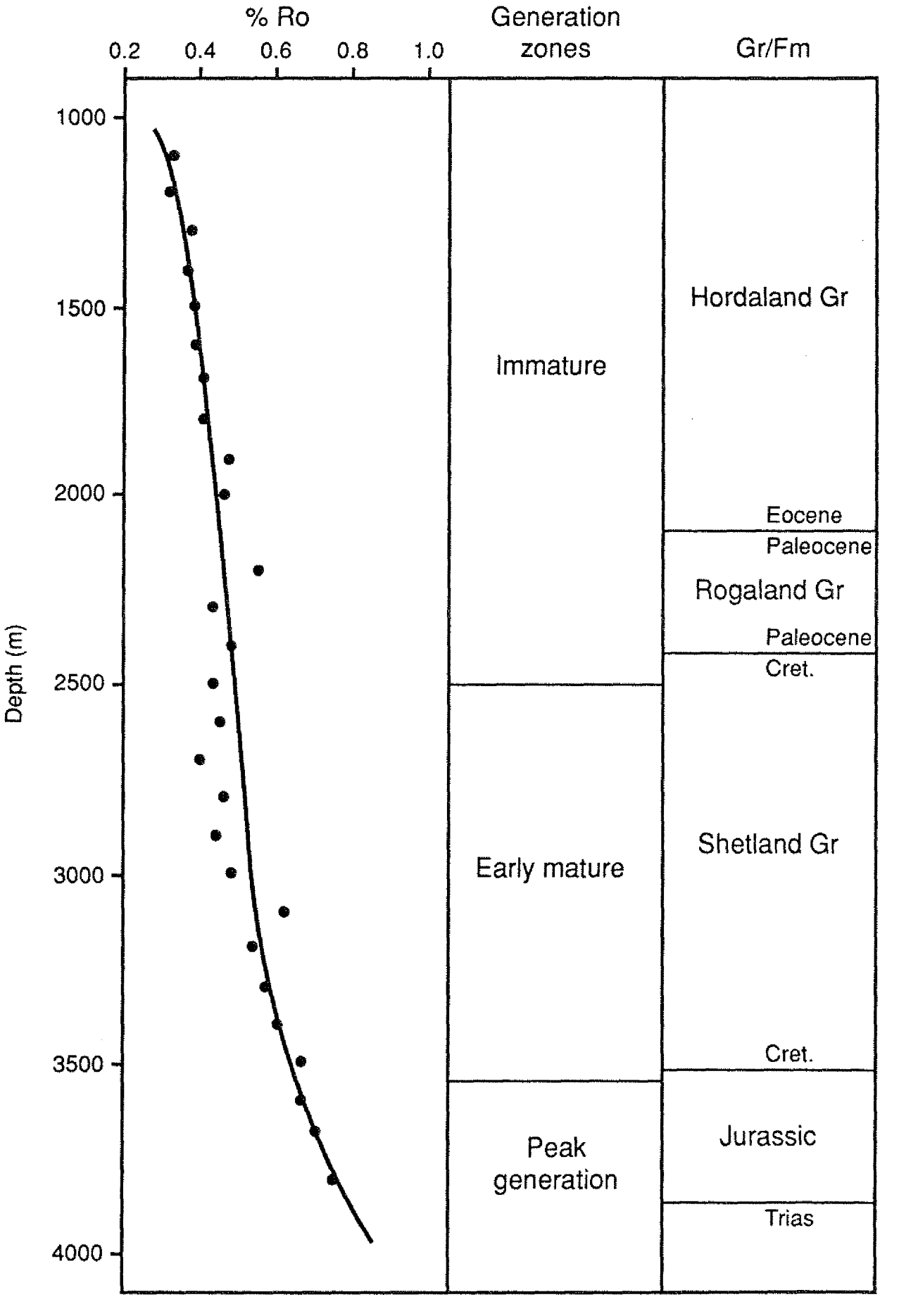
WELL 30/6-24S

DEPTH m MD RKB	LITHO SECTION	SYSTEM	SERIES/STAGE	GROUP	FORMATION	DESCRIPTION	SHOWS
2500		CRETACEOUS	MAASTRICHTIAN	SHETLAND		**Clyst:** lt gy,occ m olv gy,sft-frm,slky, blky,occ slty,non-v calc,tr Pyr,tr Glau	
2550							
2600							
2650						**Clyst:** lt-m gy,sft-frm,amor,hom,v calc, loc grdg **Mrl**	
2700							
2750						**Lst:** wh,lt brn,frm-hd,microxln,occ xln, tr Glau	
2800						**Clyst:** lt-m gy,blky,occ wxy,frm-mod hd,calc,occ slty,tr Pyr	
2850			CAMPANIAN				
2900						**Clyst:** m gy,occ m grn gy,sft-frm, amor-blky,occ plty,sl-mod calc, tr Pyr,rr sl slty,rr Glau	
2950							
3000						**Dol:** dk gy brn,ang,crptoxln-microxln, hd-v hd,loc arg g 5/8" 3052m	
3050						**Clyst:** lt-m gy,blky,rr subplty,frm-mod hd,sl-mod calc,rr sl slty	
3100							
3150			SANTONIAN			**Lst:** tr,lt yel gy,ang,microxln,hd,rr Pyr, v pr vis por	
3200							
3250							
3300						**Clyst:** m gy-m dkgy-dk gy,blky-plty, frm-mod hd,occ hd,calc-v calc,tr Glau, occ tr micromic,rr tr micropyr,rr tr vf sdy	
3350			CONIACIAN				
3400							
3450			TURONIAN			**Lst:** wh-off wh,m gy,ang-hk,crpto-microxln,hd,pure,loc sl arg,com forams tr Glau,no vis por	
3500							
3550	M					**Clyst:** m dk gy,subfis-hk,mod hd, mod-v slty,mod micromic,sl calc 3575m	
3581m							
3600		JURASSIC	E.PLIEN-SINEMURIAN	DUNLIN	AMUNDSEN	**Clyst:** dk gy brn,blky-plty,mod hd sl-mod slty,non-sl calc,micromic in pt	
3650	M						
3682m							
3700	M K				STATFJ.	**Sst:** lt-gy-off wh,Qtz,tmsl,f-crs,submd-md,sph-subelong,mod-w srtd,hd, stmg silic cmt pr vis por	

DEPTH m MD RKB							
3750		JURASSIC	SINEMUR-HETTANG	STATFJORD		**Sst:** off wh,lse,Qtz,tmsl,m-crs,ang-subang,subsph,mod w srtd,mod hd, occ fri,mod silic cmt,loc tr calc ovgth,kaol mtx,occ Mic,pr-gd vis por **Clyst:** olv gy,plty,hd,loc slty-v f sdy,rr tr micromic	
3800							
3850							
3900		TRIASSIC	RHAETIAN-NORIAN			**Sst:** lt gy,Qtz,tmsl,f-v crs,subang-submd,subelong-sph,pr-w srtd,hd, mod silic cmt,tr pyr cmt,pr vis por	
3940m							
3950			HEGRE	LUNDE		**Clyst:** m red brn,tr m grn gy,plty-subfis,mod hd,occ slty	
4000						**T.D:** 3986m MD RKB 3742m TVD	
4050							
4100							
4150							
4200							
4250							
4300							
4350							
4400							
4450							
4500							
4550							
4600							
4650							
4700							
4750							
4800							
4850							
4900							
4950							

Well	Formation	St.Depth	En.Depth
30/6-24S	EOCENE	1721.00	2107.00
30/6-24S	BALDER	2107.00	2197.00
30/6-24S	SELE	2197.00	2247.00
30/6-24S	LISTA	2247.00	2377.00
30/6-24S	VÅLE	2377.00	2442.00
30/6-24S	SHETLAND	2442.00	3575.00
30/6-24S	CROMER KNOLL	3575.00	3581.00
30/6-24S	DUNLIN	3581.00	3682.50
30/6-24S	STATFJORD	3682.50	3940.00
30/6-24S	LUNDE	3940.00	3986.00

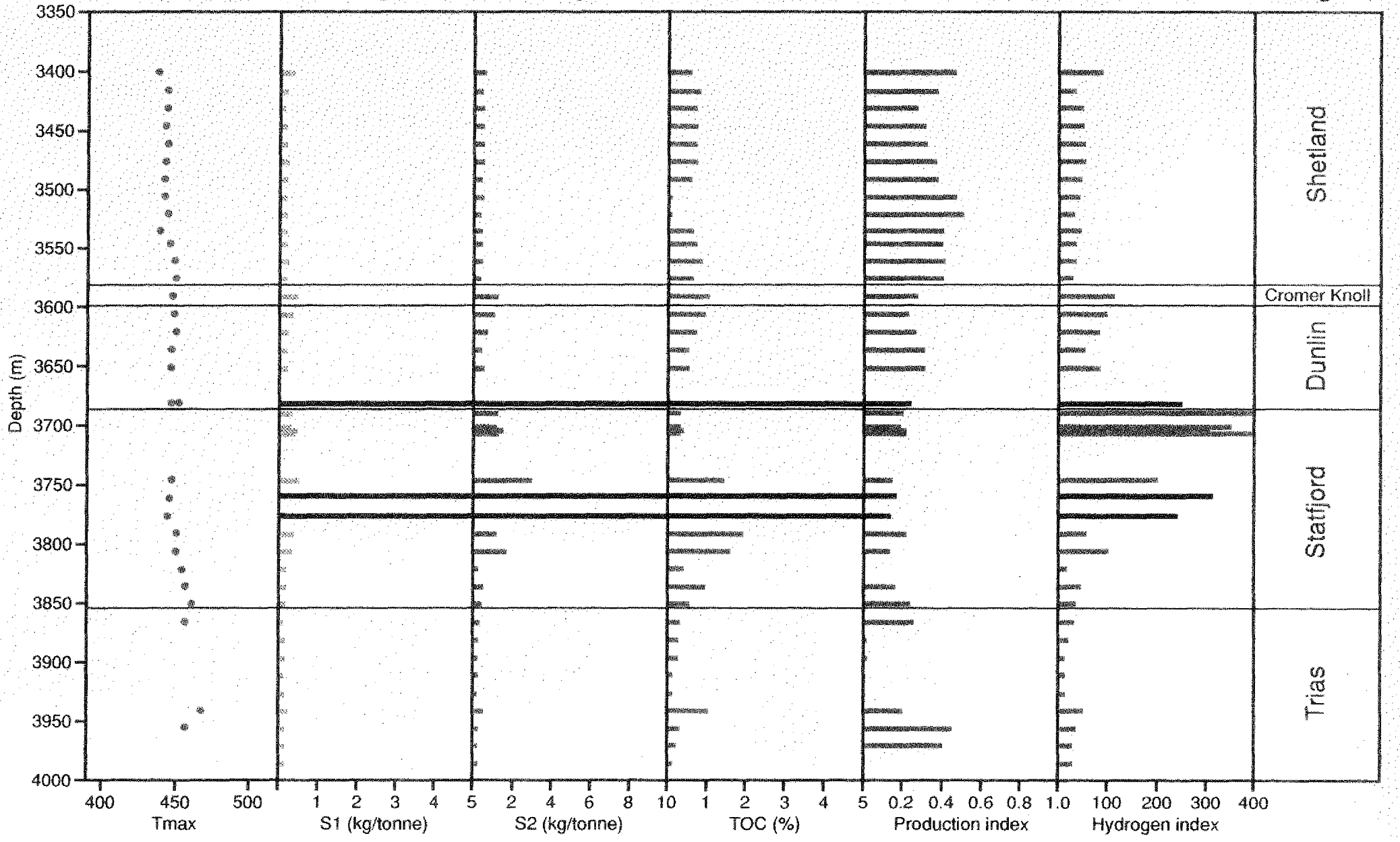
Vitrinite reflectance vs. depth, well 30/6-24S **Fig. 2.1**



F/Geo/1023a/MacF/LAa/05.92

Rock eval/TOC screening data versus depth, well 30/6-24S

Fig. 3.1

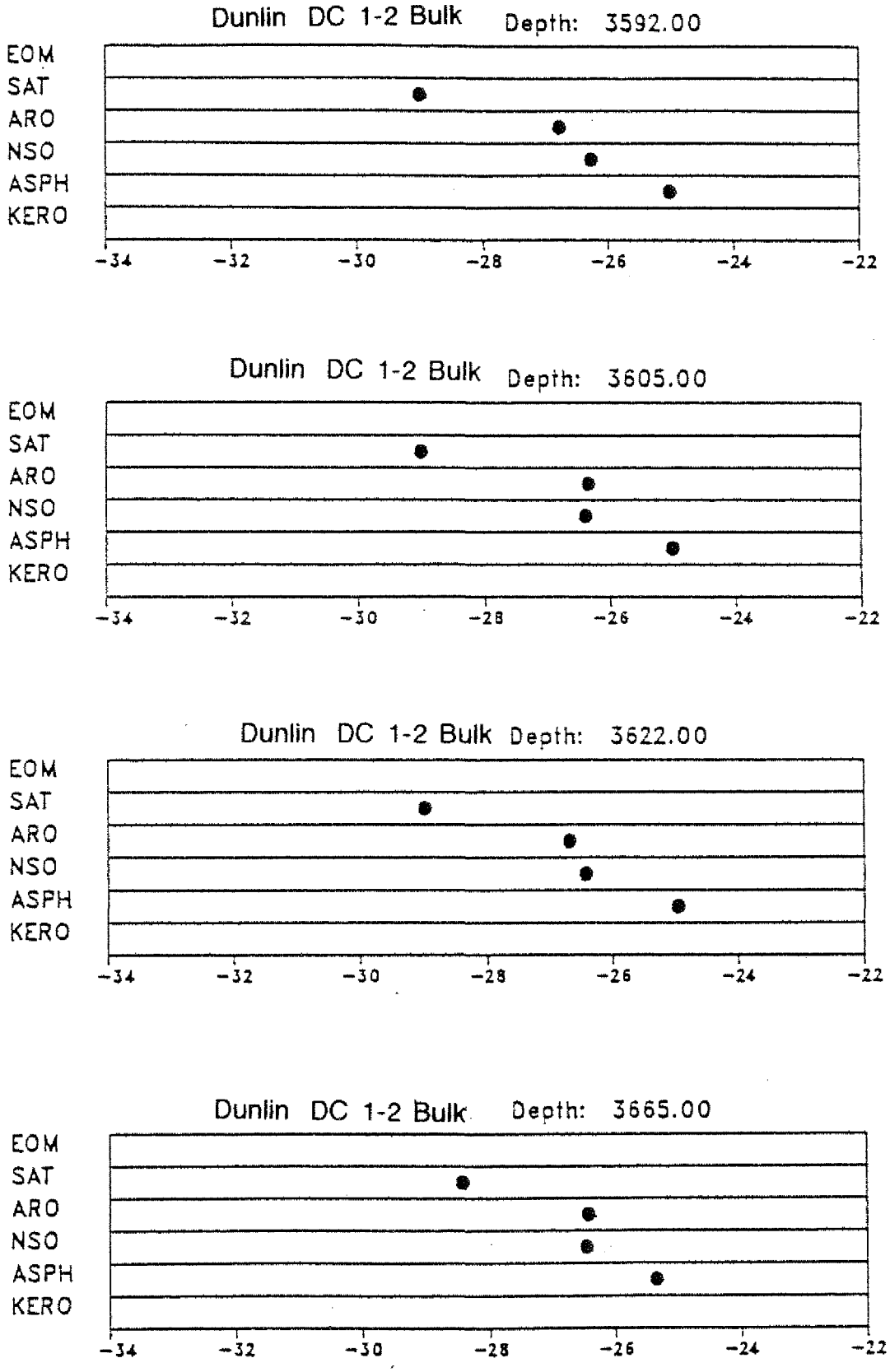


F/GEO/1023b/MacF/LAa/05.92

GALIMOV PLOTS OF STABLE CARBON ISOTOPE DISTRIBUTION

WELL 30/6-24s

Figure 3.6



GALIMOV PLOTS OF STABLE CARBON ISOTOPE DISTRIBUTION

WELL 30/6-24s

Figure 3.6

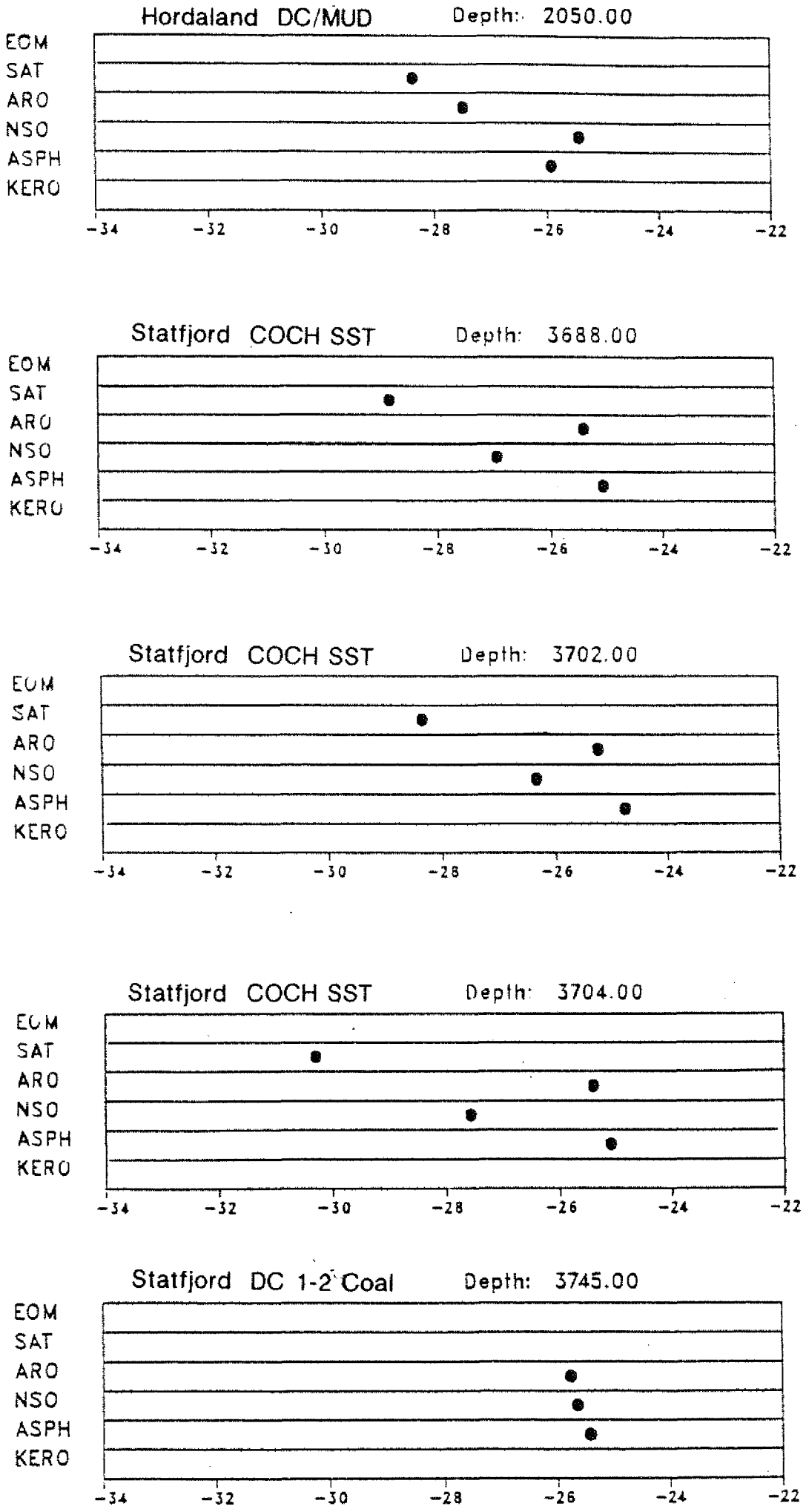


TABLE 1.1

Well	Formation	St.Depth	En.Depth
30/6-24S	EOCENE	1721.00	2107.00
30/6-24S	BALDER	2107.00	2197.00
30/6-24S	SELE	2197.00	2247.00
30/6-24S	LISTA	2247.00	2377.00
30/6-24S	VÅLE	2377.00	2442.00
30/6-24S	SHETLAND	2442.00	3575.00
30/6-24S	CROMER KNOLL	3575.00	3581.00
30/6-24S	DUNLIN	3581.00	3682.50
30/6-24S	STATFJORD	3682.50	3940.00
30/6-24S	LUNDE	3940.00	3986.00

LIST OF SAMPLES ANALYSED - WELL 30/6-[illegible]4S

TABLE 1.2

Depth (end depth)	Sample Type	Lith.	Gr/Fm	Vitr. Refl.	Rock Eval/ TOC	Extr. Deasph.	Group Sep. (MLPC)	C[illegible] SAT	Biom. MSD SAT	Stable Isotope δ 13 C	PyGC	Vis. Kerogen
1040.00	DC	Bulk		*								
1100.00	"	"		*								
1200.00	"	"		*								
1300.00	"	"		*								
1500.00	"	"		*								
1600.00	"	"		*								
1700.00	"	"		*								
1800.00	"	"	Eocen	*								
1900.00	"	"	"	*								
2000.00	"	"	"	*								
2050.00	"	"	"		x							
2050.00	DC/Mud	"	"			x	x	x	x	o		
2100.00	DC	"	"	*								
2200.00	"	"	Sele	*								
2300.00	"	"	Lista	*								
2400.00	"	"	Våle	*								
2500.00	"	"	Shetland	*								
2600.00	"	"	"	*								
2700.00	"	"	"	*								
2800.00	"	"	"	*								
2900.00	"	"	"	*								
3000.00	"	"	"	*								
3100.00	"	"	"	*								
3195.00	"	"	"	*								
3300.00	"	"	"	*								
3400.00	"	"	"	*	x							
3415.00	"	"	"		x							
3430.00	"	"	"		x							
3445.00	"	"	"		x							
3460.00	"	"	"		x							
3475.00	"	"	"		x							
3490.00	"	"	"		x							
3500.00	"	"	"	*								
3505.00	"	"	"		x							
3520.00	"	"	"		x							
3535.00	"	"	"		x							
3545.00	"	"	"		x							
3560.00	"	"	"		x							
3575.00	"	"	"		x							

o = Geolab Nor A/S, Trondheim
# = Geochem Labs, Chester, UK
* = GeoOptics, Newcastle, UK
x = Norsk Hydro, Research Centre, Bergen

LIST OF SAMPLES ANALYSED - WELL 30/6-24S

TABLE 1.2 cont.

Depth (m) end depth)	Sample Type	Lith.	Gr/Fm	Vitr. Refl.	Rock Eval/ TOC	Extr. Deasph.	Group Sep. (MLPC)	G C SAT	Biom. MSD SAT	Stable Isotope δ 13 C	PyGC	Vis. Kerogen
3590.00	DC	Bulk	Dunlin		x	x	x	x	x	o	x	#
3600.00	"	"	"	*								
3605.00	"	"	"		x	x	x	x	x	o	x	#
3620.00	"	"	"		x	x	x	x	x	o	x	#
3635.00	"	"	"		x							
3650.00	"	"	"		x							
3665.00	"	"	"		x	x	x	x	x	o	x	#
3680.00	"	"	"		x							
3680.00	"	Coal	"	*	x							
3688.00	CCCH	SST	Statfjord		x	x	x	x	x	o		
3701.00	"	"	"		x	x	x	x				
3702.00	"	"	"		x	x	x	x	x	o		
3704.00	"	"	"		x	x	x	x	x	o		
3745.00	DC	Bulk	"		x							#
3745.00	"	Coal	"			x	x	x	x	o	x	
3760.00	"	Bulk	"		x							
3760.00	"	Coal	"		x							
3775.00	"	Coal	"		x							
3790.00	"	SH/SLST	"		x							
3800.00	"	Bulk	"	*								
3805.00	"	SH/SLST	"		x							
3820.00	"	"	"		x							
3835.00	"	"	"		x							
3850.00	"	"	"		x							
3865.00	"	"	"		x							
3880.00	"	"	"		x							
3895.00	"	"	"		x							
3900.00	"	Bulk	"	*								
3910.00	"	SH/SLST	"		x							
3927.00	"	"	"		x							
3940.00	"	"	"		x							
3955.00	"	"	Lunde		x							
3970.00	"	"	"		x							
3985.00	"	"	"		x							

o = Geolab Nor A/S, Trondheim
# = Geochem Labs, Chester, UK
* = GeoOptics, Newcastle, UK
x = Norsk Hydro, Research Centre, Bergen

Table 2.1 **VITRINITE REFLECTANCE DATA WELL 30/6-24S**
Average values

Petroleum Geochemistry Group
Research Centre Bergen
HYDRO

Depth	Group/Fm.	%	Lithology	Type	Population I	Population II	Population III	SCI
1040.00		90	MRL	DC	0.28 (20)			
1100.00		100	CALC.CLYST	DC	0.32 (20)			
1200.00		100	CALC.CLYST	DC	0.32 (20)			
1300.00		100	SH/SLST	DC	0.37 (20)			
1400.00		100	CALC.CLYST	DC	0.36 (20)			
1500.00		100	SLTY.SH	DC	0.38 (20)			
1600.00		100	SH	DC	0.38 (20)			
1700.00		100	SH	DC	0.40 (20)			
1800.00	EOCENE	100	SH	DC	0.41 (5)			
1900.00	EOCENE	100	SH	DC	0.47 (4)			
2000.00	EOCENE	100	SH	DC	0.46 (3)			
2100.00	EOCENE	100	SH	DC				
2200.00	SELE	100	CHERT	DC	0.55 (3)			
2300.00	LISTA	80	SH	DC	0.43 (5)			
2400.00	VELE	100	SH	DC	0.48 (4)			
2500.00	SHETLAND	100	SH	DC	0.43 (7)			
2600.00	SHETLAND	60	SH	DC	0.45 (4)			
2700.00	SHETLAND	80	SH	DC	0.40 (4)			

Table 2.1 **VITRINITE REFLECTANCE DATA WELL 30/6-24S** (cont'd)
Average values

Petroleum Geochemistry Group
Research Centre Bergen
HYDRO

Depth	Group/Fm.	%	Lithology	Type	Population I	Population II	Population III	SCI
2800.00	SHETLAND	90	SH	DC	0.46 (4)			
2900.00	SHETLAND	100	CLYST	DC	0.44 (6)			
3000.00	SHETLAND	100	SH	DC	0.48 (7)			
3100.00	SHETLAND	100	SH	DC	0.62 (2)			
3195.00	SHETLAND	100	SH	DC	0.54 (7)			
3300.00	SHETLAND	100	SH	DC	0.57 (5)			
3400.00	SHETLAND	100	SH	DC	0.60 (6)			
3500.00	SHETLAND	60	LST	DC	0.66 (2)			
3600.00	DUNLIN	100	SLTY.SH	DC	0.66 (14)			
3680.00	DUNLIN	50	SH	DC	0.70 (20)			
3800.00	STATFJORD	90	SST	DC	0.75 (11)			
3900.00	STATFJORD	100	SH	DC				

Table 3.1 **SOURCE ROCK SCREENING DATA WELL 30/6-24S**

Petroleum Geochemistry Group
Research Centre Bergen
HYDRO

Depth (m)	Group/Fm.	%	Lithology	Type	S1 kg/t	S2 kg/t	TOC %	HI	PI	Tmax DegC	Company
2050.00	EOCENE		BULK	DCW	0.01	0.19	0.3	73		431	F-BERGEN
3400.00	CRETACOUS		BULK	DCW	0.38	0.43	0.5	86	0.47	436	F-BERGEN
3415.00	CRETACOUS		BULK	DCW	0.15	0.25	0.7	36	0.38	442	F-BERGEN
3430.00	CRETACOUS		BULK	DCW	0.11	0.30	0.7	43	0.27	442	F-BERGEN
3445.00	CRETACOUS		BULK	DCW	0.13	0.30	0.7	43	0.30	441	F-BERGEN
3460.00	CRETACOUS		BULK	DCW	0.17	0.36	0.7	51	0.32	442	F-BERGEN
3475.00	CRETACOUS		BULK	DCW	0.19	0.33	0.7	47	0.37	441	F-BERGEN
3490.00	CRETACOUS		BULK	DCW	0.13	0.21	0.5	42	0.38	440	F-BERGEN
3505.00	CRETACOUS		BULK	DCW	0.16	0.18	0.5	36	0.47	440	F-BERGEN
3520.00	CRETACOUS		BULK	DCW	0.09	0.09	0.3	30	0.50	442	F-BERGEN
3535.00	CRETACOUS		BULK	DCW	0.17	0.25	0.6	42	0.40	437	F-BERGEN
3545.00	CRETACOUS		BULK	DCW	0.15	0.23	0.7	33	0.39	444	F-BERGEN
3560.00	CRETACOUS		BULK	DCW	0.19	0.27	0.8	34	0.41	447	F-BERGEN
3575.00	CRETACOUS		BULK	DCW	0.11	0.17	0.6	28	0.39	448	F-BERGEN
3590.00	DUNLIN		BULK	DCW	0.40	1.07	1.0	107	0.27	446	F-BERGEN
3605.00	DUNLIN		BULK	DCW	0.24	0.84	0.9	95	0.22	447	F-BERGEN
3620.00	DUNLIN		BULK	DCW	0.19	0.55	0.7	79	0.26	448	F-BERGEN
3635.00	DUNLIN		BULK	DCW	0.11	0.25	0.5	50	0.31	445	F-BERGEN

Table 3.1 **SOURCE ROCK SCREENING DATA WELL 30/6-24S** (cont'd)

Depth (m)	Group/Fm.	%	Lithology	Type	S1 kg/t	S2 kg/t	TOC %	HI	PI	Tmax DegC	Company
3650.00	DUNLIN		BULK	DCW	0.17	0.39	0.5	78	0.30	445	F-BERGEN
3665.00	DUNLIN		BULK	DCW	0.19	0.64	0.6	107	0.23	447	F-BERGEN
3680.00	DUNLIN		BULK	DCW	1.16	3.77	3.2	118	0.24	445	F-BERGEN
3680.00	DUNLIN		COAL	DCW	38.88	202.42	79.9	253	0.16	450	F-BERGEN
3688.00	STATFJORD		SST	COCH	0.25	1.00	0.3	400	0.20		
3701.00	STATFJORD		SST	COCH	0.23	0.96	0.3	356	0.19		
3702.00	STATFJORD		SST	COCH	0.37	1.42	0.5	309	0.21		
3704.00	STATFJORD		SST	COCH	0.29	1.06	0.3	393	0.21		
3745.00	STATFJORD		BULK	DCW	0.41	2.78	1.4	199	0.13	446	F-BERGEN
3760.00	STATFJORD		BULK	DCW	2.97	27.22	8.6	317	0.10	442	F-BERGEN
3760.00	STATFJORD		COAL	DCW	22.57	180.85	64.4	281	0.11	445	F-BERGEN
3775.00	STATFJORD		COAL	DCW	22.03	183.39	74.6	246	0.11	442	F-BERGEN
3790.00	STATFJORD		SH/SLST	DCW	0.26	1.00	1.9	54	0.21	449	F-BERGEN
3805.00	STATFJORD		SH/SLST	DCW	0.23	1.57	1.6	101	0.13	449	F-BERGEN
3820.00	STATFJORD		SH/SLST	DCW	0.01	0.03	0.3	12		453	F-BERGEN
3835.00	STATFJORD		SH/SLST	DCW	0.07	0.38	0.9	41	0.16	455	F-BERGEN
3850.00	STATFJORD		SH/SLST	DCW	0.05	0.17	0.5	32	0.23	459	F-BERGEN
3865.00	TRIAS		SH/SLST	DCW	0.03	0.09	0.3	28		455	F-BERGEN
3880.00	TRIAS		SH/SLST	DCW	0.01	0.03	0.2	16			F-BERGEN

Table 3.1 **SOURCE ROCK SCREENING DATA WELL 30/6-24S** (cont'd)

Depth (m)	Group/Fm.	%	Lithology	Type	S1 kg/t	S2 kg/t	TOC %	HI	PI	Tmax DegC	Company
3895.00	TRIAS		SH/SLST	DCW	0.01	0.01	0.2	6			F-BERGEN
3910.00	TRIAS		SH/SLST	DCW	0.01	0.01	0.1	7			F-BERGEN
3927.00	TRIAS		SH/SLST	DCW	0.01	0.01	0.1	7			F-BERGEN
3940.00	TRIAS		SH/SLST	DCW	0.11	0.43	1.0	42	0.20	466	F-BERGEN
3955.00			SH/SLST	DCW	0.09	0.11	0.3	31	0.45	455	F-BERGEN
3970.00			SH/SLST	DCW	0.04	0.06	0.2	26			F-BERGEN
3985.00			SH/SLST	DCW	0.01	0.03	0.1	25			F-BERGEN

TABLE 3.2

EXTRACTION DATA WELL 30/6-24

TOTAL EXTRACTED MATTER (EOM) AND GROUP TYPE SEPARATION BY MPLC

SAMPLE DEPTH M	SAMPLE TYPE	FM./GR.	% EOM	% SAT	% ARO	% NSO	% ASPH.	HYDROCARBONS (SAT+ARO)	NON-HYDROCARBONS (NSO+ASPH)
3587-92	DC 1-2 BULK	DUNLIN	0.11	23.8	23.8	16.4	36.0	47.6	52.4
3602-05	DC 1-2 BULK	"	0.09	25.7	23.6	19.9	30.8	49.3	50.7
3617-22	DC 1-2 BULK	"	0.10	28.8	23.4	17.1	30.7	52.2	47.8
3662-65	DC 1-2 BULK	"	0.07	29.5	22.9	22.9	24.7	52.4	47.6
3742-45	DC 1-2 COAL	STATFJORD	3.27	2.9	21.1	9.8	66.2	24.0	76.0
2045-50	DC+MUD	HORDALAND	-	37.4	15.3	34.0	13.3	52.7	47.3
3688	COCH SST	STATFJORD	0.03	25.6	20.8	31.7	21.9	46.4	53.6
3701	COCH SST	"	0.02	6.0	10.9	42.4	40.7	16.9	83.1
3702	COCH ST	"	0.08	11.6	36.6	18.3	33.5	48.2	51.8
3704	COCH SST	"	0.02	12.7	12.7	44.4	30.2	25.4	74.6

MOLECULAR RATIOS FROM CHROMATOGRAMS OF THE SATURATED FRACTIONS

WELL 30/6-24S

DEPTH	FM./GR.	SAMPLE TYPE	LITHOLOGY	PRIS/PHYT	PRIS/n-C17	CPI	CPI(P)
3587-92	DUNLIN	DC 1-2 mm	BULK	1.84	0.67	1.21	1.19
3602-05	"	DC 1-2 mm	BULK	2.14	0.58	1.18	1.16
3617-22	"	DC 1-2 mm	BULK	1.67	0.60	1.16	1.11
3662-65	"	DC 1-2 mm	BULK	1.53	0.59	1.17	1.11
3742-45	STATFJORD	DC 1-2 mm	COAL	2.49	0.80	1.17	1.01
2045-50	HORDALAND	DC+MUD	BULK	1.40	0.86	1.12	0.98
3688	STATFJORD	COCH	SST	2.66	1.64	1.22	1.09
3701	"	COCH	SST	1.03	0.73	1.09	0.99
3702	"	COCH	SST	1.71	0.99	1.05	0.93
3704	"	COCH	SST	1.25	0.88	1.03	0.98
BIOM.STD.		OIL 30/6-13		1.48	0.58	1.03	0.95
BIOM.STD.		OIL 30/6-13		1.72	0.60	1.00	0.98

TABLE 3.4

TRITERPANE RATIOS AND ISOMERISATION

WELL 30/6-24S

DEPTH	FM./GR.	TYPE	LITHOLOGY	Ts/ Tm	NOR/ NOR+HOP	BNOR/ BNOR+NOR	MORETAN/ HOPAN	% 22S BISHOMOHOP	25-NORHOP/ HOPAN
3590+92	DUNLIN	DC 1-2mm	BULK	0.65	0.33		0.15	58	0.06
3605	"	DC 1-2mm	BULK	0.76	0.28		0.13	58	0.06
3620+22	"	DC 1-2mm	BULK	0.85	0.32		0.15	60	0.05
3665	"	DC 1-2mm	BULK	1.15	0.27		0.14	60	0.10
3745	STATFJORD	DC 1-2mm	COAL	0.24	0.40		0.14	58	0.15
2050	HORDALAND	MUD+DC		0.82	0.29	0.20	0.18	60	0.05
3688	STATFJORD	COCH	SST	0.36	0.39		0.12	59	0.08
3701	"	COCH	SST	0.70	0.36		0.13	60	0.05
3702	"	COCH	SST	1.32	0.50		0.11	58	0.07
3704	"	COCH	SST	1.14	0.39		0.13	58	0.06
BIOM.STD.		OIL (30/6-13)		1.20	0.30	0.35	0.14	57	0.11
BIOM.STD.		OIL (30/6-13)		1.27	0.29	0.36	0.13	58	0.11

TABLE 3.5

S T E R A N E I S O M E R I S A T I O N

W E L L 30/6-24S

DEPTH	FM./GR.	TYPE	LITHOLOGY	20S % aaa	20S+R % abb
3590+92	DUNLIN	DC 1-2mm	BULK	46	57
3605	"	DC 1-2mm	BULK	55	62
3620+22	"	DC 1-2mm	BULK	45	59
3665	"	DC 1-2mm	BULK	56	63
3745	STATFJORD	DC 1-2mm	COAL	51	59
2050	HORDALAND	MUD+DC		40	56
3688	STATFJORD	COCH	SST	54	58
3701	"	COCH	SST	49	60
3702	"	COCH	SST	47	59
3704	"	COCH	SST	44	61
BIOM.STD.		OIL (30/6-13)		45	58
BIOM.STD.		OIL (30/6-13)		44	56

STABLE CARBON ISOTOPE VALUES

WELL 30/6-24S

SOURCE ROCK

Depth m	Fm./Gr.	Lithology	Saturated	Aromatic	NSO	Asphaltenes
3587-3592.00	Dunlin	Bulk	-29.01	-26.79	-26.28	-25.01
3602-3605.00	"	"	-29.01	-26.35	-26.40	-25.00
3617-3622.00	"	"	-28.99	-26.69	-26.43	-24.96
3662-3665.00	"	"	-28.44	-26.43	-26.46	-25.34
3742-3745.00	Statfjord	Coal	-	-25.78	-25.66	-25.43
SANDSTONE						
Depth m	Fm./Gr.	Lithology	Saturated	Aromatic	NSO	Asphaltenes
2045-2050.00	Hordaland	Mud	-28.38	-27.49	-25.44	-25.94
3688-3688.00	Statfjord	Sst	-28.85	-25.42	-26.96	-25.08
3702-3702.00	"	"	-28.34	-25.24	-26.34	-24.77
3704-3704.00	"	"	-30.29	-25.40	-27.57	-25.10

TABLE 3.7

K E R O G E N C O M P O S I T I O N

W E L L 30/6-24S

Depth m	Fm./Gr	Lithology	KEROGEN COMPOSITION %				
			AM	Al	H	W	I
3587-3590	Dunlin	Bulk	-	-	23	37	40
3602-3605	"	"	-	-	34	44	22
3617-3620	"	"	1	2	27	35	35
3662-3665	"	"	-	-	36	26	38
3742-3745	Statfjord	Coal	-	-	5	94	1

Well I.D.: 30/6-24S 1040-3900m

T.D.	B.D.	Ravg.	N
40	-	0.28	20
1100	-	0.32	20
1200	-	0.32	20
1300	-	0.37	20
1400	-	0.36	20
1500	-	0.38	20
1600	-	0.38	20
1700	-	0.40	20
1800	-	0.41	5
1900	-	0.47	4
2000	-	0.46	3
2100	-	NDP	-
2200	-	0.55	3
2300	-	0.43	5
2400	-	0.48	4
2500	-	0.43	7
2600	-	0.45	4
2700	-	0.40	4
2800	-	0.46	4
00	-	0.44	6
3000	-	0.48	7
3100	-	0.62	2
3195	-	0.54	7
3300	-	0.57	5
3400	-	0.60	6
3500	-	0.66	2
3600	-	0.66	14
3680	-	0.70	20
3800	-	0.75	11
3900	-	NDP	-

Sample ID: 30/6-24S 1040m
R.o. Aver.: 0.28 (20)
Lithology: Marl 90%, cement 10%
Phytoclast Content: Trace
    Vitrinite: 100%
    Inertinite: -
    Exinite: -
UV fluorescence: Dino. - tr. - g/y; carb. - low - g/y;
spores - tr. - y
Bitumen: Stain. - light; wisps - trace
VR populations: 1
Mineralogy: Rich in shell + foram debris; glauconite
General Comments: -
0.25
0.24
0.32
0.27
0.25
0.28
0.34
0.26
0.25
0.30
0.27
.29
0.26
0.30
0.25
0.30
0.34
0.25
0.27
0.30

?

Sample ID: 30/6-24S 1100m
R.o. Aver.: 0.32 (20)
Lithology: Calcareous shale 100%
Phytoclast Content: Trace
Vitrinite: 70%
Inertinite: 30%
Exinite: -
UV fluorescence: Dino. - low - g/y; spores - tr. - y
Bitumen: Stain. - light; wisps - low
VR populations: 1
Mineralogy: Rich in shell + foram. debris; glauconite
General Comments: -
0.34
0.35
0.38
0.36
0.38
0.35
0.33
0.29
0.31
0.32
0.29
0.28
.30
0.36
0.34
0.27
0.31
0.33
0.35
0.33

Sample ID: 30/6-24S 1200m
R.o. Aver.: 0.32 (20)
Lithology: Calcareous shale 100%
Phytoclast Content: Low
Vitrinite: 50%
Inertinite: 50%
Exinite: -
UV fluorescence: Dino. - mod. - g/y; carb. - mod. - m.o.;
spores - tr. - y
Bitumen: Stain. - light; wisps - low/mod.
VR populations: 1
Mineralogy: Rich in shell + foram. debris; glauconite
General Comments: -
0.31
0.27
0.28
0.30
0.29
0.33
0.30
0.32
0.33
0.34
0.34
.37
0.40
0.32
0.33
0.38
0.28
0.30
0.33
0.26

?

Sample ID: 30/6-24S 1300m
R.o. Aver.: 0.37 (20)
Lithology: Shaly siltstone 100%
Phytoclast Content: Low
    Vitrinite: 70%
    Inertinite: 30%
    Exinite: -
UV fluorescence: Dino. - low - g/y; spores - low - y
Bitumen: Stain. - trace; wisps - mod.
VR populations: 1
Mineralogy: Forams
General Comments: -
0.45
0.43
0.45
0.41
0.40
0.38
0.40
0.37
0.42
0.32
0.39
0.32
.34
0.31
0.39
0.30
0.35
0.35
0.33
0.34

Sample ID: 30/6-24S 1400m
R.o. Aver.: 0.36 (20)
Lithology: Calcareous shale 100%
Phytoclast Content: Low
Vitrinite: 100%
Inertinite: Tr.
Exinite: -
UV fluorescence: Dino. - tr. - g/y; spores - low - y-y/o
Bitumen: Stain. - light/mod.; wisps - low/mod.
VR populations: 1
Mineralogy: Shell + foram. debris
General Comments: -

0.35
0.28
0.37
0.31
0.39
0.32
0.39
0.37
0.38
0.33
0.36
0.38
.40
0.34
0.40
0.38
0.36
0.34
0.38
0.36

Sample ID: 30/6-24S 1500m
R.o. Aver.: 0.38 (20)
Lithology: Silty shale 100%
Phytoclast Content: Low
    Vitrinite: 100%
    Inertinite: Tr.
    Exinite: -
UV fluorescence: Dino. - tr. - g/y+y; spores - low - y-y/o
Bitumen: Stain. - mod.; wisps - low/mod.
VR populations: 1
Mineralogy: -
General Comments: -
0.41
0.49
0.43
0.35
0.37
0.47
0.45
0.37
0.35
0.35
0.37
.31
0.30
0.31
0.41
0.38
0.45
0.36
0.32
0.36

?

Sample ID: 30/6-24S 1600m
R.o. Aver.: 0.38 (20)
Lithology: Shale 100%
Phytoclast Content: Low
Vitrinite: 80%
Inertinite: 20%
Exinite: -
UV fluorescence: Spores - low - y
Bitumen: Stain. - light/mod.; wisps + blebs - mod./rich
VR populations: 1
Mineralogy: Shell + foram. debris; glauconite
General Comments: -
0.36
0.35
0.33
0.35
0.41
0.38
0.37
0.38
0.37
0.44
0.49
0.48
.37
0.27
0.31
0.34
0.35
0.39
0.38
0.38

Sample ID: 30/6-24S 1700m
R.o. Aver.: 0.40 (20)
Lithology: Shale 100%
Phytoclast Content: Very low
Vitrinite: 70%
Inertinite: 30%
Exinite: -
UV fluorescence: Spores - tr. - y+y/o
Bitumen: Stain. - light; wisps + blebs - mod./rich
VR populations: 1
Mineralogy: -
General Comments: -
0.40
0.37
0.41
0.33
0.33
0.44
0.44
0.43
0.47
0.45
0.38
0.35
.35
0.43
0.42
0.45
0.36
0.44
0.42
0.42

Sample ID: 30/6-24S 1800m
R.o. Aver.: 0.41 (5)
Lithology: Shale 100%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - tr. - y/o
Bitumen: Stain. - trace; wisps + blebs - mod.
VR populations: 1
Mineralogy: Iron oxide specks
General Comments: -
0.41
0.45
0.52
0.33
0.34

?

Sample ID: 30/6-24S 1900m
R.o. Aver.: 0.47 (4)
Lithology: Shale 100%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - low - y+y/o
Bitumen: Stain. - trace; wisps - trace
VR populations: 1
Mineralogy: Iron oxide specks; marly
General Comments: -
0.43
0.45
0.46
0.52

?

Sample ID: 30/6-24S 2000m
R.o. Aver.: 0.46 (3)
Lithology: Shale 100%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: Tr.
    Exinite: -
UV fluorescence: Spores - low/mod. - y+y/o
Bitumen: Wisps + blebs - low/mod.
VR populations: 1
Mineralogy: Iron oxide specks

General Comments: -
0.49
0.43
0.46

?

Sample ID: 30/6-24S 2100m
R.o. Aver.: NDP
Lithology: Shale 100%
Phytoclast Content: Virtually barren
    Vitrinite: -
    Inertinite: Tr.
    Exinite: -
UV fluorescence: Carbonate - tr. - y
Bitumen: Wisps - trace
VR populations: 1
Mineralogy: 50% haematitic cuttings + haematite specks
General Comments: -

Sample ID: 30/6-24S 2200m
R.o. Aver.: 0.55 (3)
Lithology: Shaly chert 100%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: Tr.
    Exinite: -
UV fluorescence: Spores - mod. - y-y/o
Bitumen: Wisps - mod.
VR populations: 1
Mineralogy: Rather pyritic
General Comments: Phytoclasts degraded; tentative result
0.61
0.50
0.54

?

Sample ID: 30/6-24S 2300m
R.o. Aver.: 0.43 (5)
Lithology: Shale 80%; carbonate 20%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Hydrocarbon specks - low - y
Bitumen: Wisps - trace
VR populations: 1
Mineralogy: Light haematite staining
General Comments: Measurements probably on cavings
0.35
0.50
0.38
0.45
0.47

Sample ID: 30/6-24S 2400m
R.o. Aver.: 0.48 (4)
Lithology: Shale 100%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Carbonate - low - y/o; spores - low - y/o
Bitumen: Stain. - light; wisps - trace
VR populations: 1
Mineralogy: Iron oxide specks
General Comments: -
0.41
0.50
0.53
0.46

?

Sample ID: 30/6-24S 2500m
R.o. Aver.: 0.43 (7)
Lithology: Shale 100%
Phytoclast Content: Low
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - trace - y/o
Bitumen: Stain. - light; wisps - trace
VR populations: 1
Mineralogy: Iron oxide specks
General Comments: Phytoclasts degraded
0.41
0.37
0.40
0.38
0.50
0.44
0.50

?

Sample ID: 30/6-24S 2600m
R.o. Aver.: 0.45 (4)
Lithology: Shale 60%, marl 40%
Phytoclast Content: Low
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - trace - y/o+l.o.
Bitumen: Stain. - light; wisps - low
VR populations: 1
Mineralogy: Iron oxide specks
General Comments: -
0.49
0.44
0.45
0.43

Sample ID: 30/6-24S 2700m
R.o. Aver.: 0.40 (4)
Lithology: Shale 80%, marl 20%
Phytoclast Content: Low
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - trace - y/o; dino. - trace - y
Bitumen: Stain. - trace; wisps - low
VR populations: 1
Mineralogy: Some haematitic cuttings
General Comments: Caved?
0.42
0.38
0.37
0.43

?

Sample ID: 30/6-24S 2800m
R.o. Aver.: 0.46 (4)
Lithology: Shale 90%, marl 10%
Phytoclast Content: Low
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - low - y/o
Bitumen: Stain. - trace; wisps - low
VR populations: 1
Mineralogy: Iron oxide specks
General Comments: -
0.43
0.47
0.45
0.47

?

Sample ID: 30/6-24S 2900m
R.o. Aver.: 0.44 (6)
Lithology: Mixed shale lithologies 100%
Phytoclast Content: Low
Vitrinite: Tr.
Inertinite: 100%
Exinite: -
UV fluorescence: Spores - tr. - y/o
Bitumen: Stain. - trace; wisps - low
VR populations: 1
Mineralogy: A few haematitic cuttings
General Comments: Caved?
0.40
0.47
0.45
0.46
0.42
0.44

?

Sample ID: 30/6-24S 3000m
R.o. Aver.: 0.48 (7)
Lithology: Shale 100%
Phytoclast Content: Low
Vitrinite: Tr.
Inertinite: 100%
Exinite: -
UV fluorescence: Spores - tr. - y/o
Bitumen: Stain. - light; wisps - low
VR populations: 1
Mineralogy: -
General Comments: -
0.44
0.47
0.48
0.49
0.43
0.54
0.52

Sample ID: 30/6-24S 3100m
R.o. Aver.: 0.62 (2)
Lithology: Shale 100%, cement tr.
Phytoclast Content: Low-moderate
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - low - y/o; algae - tr. - y
Bitumen: Stain. - light; wisps - trace
VR populations: 1
Mineralogy: -
General Comments: Phytoclasts degraded
0.64
0.60

?

Sample ID: 30/6-24S 3195m
R.o. Aver.: 0.54 (7)
Lithology: Shale 100%
Phytoclast Content: Low-moderate
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - mod. - y/o; algae - low - y
Bitumen: Stain. - light/ mod.; wisps - mod.
VR populations: 1
Mineralogy: -
General Comments: Phytoclasts degraded
0.48
0.50
0.56
0.61
0.62
0.52
0.50

?

Sample ID: 30/6-24S 3300m
R.o. Aver.: 0.57 (5)
Lithology: Shale 100%
Phytoclast Content: Low-moderate
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - low - l.o.; dino. - tr. - y-y/o
Bitumen: Stain. - light/ mod.; wisps - low
VR populations: 1
Mineralogy: -
General Comments: Phytoclasts degraded
0.58
0.54
0.55
0.62
0.56

Sample ID: 30/6-24S 3400m
R.o. Aver.: 0.60 (6)
Lithology: Shale 100%
Phytoclast Content: Low-moderate
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - low - l.o.; dino. - tr. - y-y/o
Bitumen: Stain. - light; wisps - v. low
VR populations: 1
Mineralogy: -
General Comments: Phytoclasts very degraded
0.57
0.51
0.67
0.62
0.65
0.57

Sample ID: 30/6-24S 3500m
R.o. Aver.: 0.66 (2)
Lithology: Shale 40%, carbonate 60%
Phytoclast Content: Low
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Carbonate - low - m.o.; dino. - low - y/o; spores - low - m.o.
Bitumen: Stain. - light-mod.; wisps - mod.
VR populations: 1
Mineralogy: Forams
General Comments: Phytoclasts very degraded, very tentative result
0.72
0.60

Sample ID: 30/6-24S 3600m
R.o. Aver.: 0.66 (14)
Lithology: Silty shale 100%
Phytoclast Content: Moderate
    Vitrinite: Tr.
    Inertinite: 100%
    Exinite: -
UV fluorescence: Spores - tr. - l-m.o.; h/c specks - low - y+y/o
Bitumen: Stain. - mod.; wisps - mod./rich
VR populations: 1
Mineralogy: -
General Comments: -
0.68
0.72
0.69
0.67
0.70
0.58
0.62
0.56
0.73
0.67
0.64
.63
0.65
0.68

Sample ID: 30/6-24S 3680m
R.o. Aver.: 0.70 (20)
Lithology: Sandstone 40%, shale 50%, coal 10%
Phytoclast Content: Moderate-rich
    Vitrinite: 70%
    Inertinite: 30%
    Exinite: -
UV fluorescence: Spores - mod. - m.o.
Bitumen: Stain. - mod.; wisps - mod.
VR populations: 1
Mineralogy: -
General Comments: Coal vitrinitic with strong cell structures and variable R.o.

0.80
0.74
0.67
0.76
0.61
0.74
0.62
0.75
0.74
0.63
0.74
0.73
0.64
0.61
0.68
0.71
0.77
0.75
0.65
0.72

Sample ID: 30/6-24S 3800m
R.o. Aver.: 0.75 (11)
Lithology: Sandstone 90%, shale 10%
Phytoclast Content: Trace
    Vitrinite: Tr.
    Inertinite: Tr.
    Exinite: -
UV fluorescence: Hydrocarbon specks - low - y-y/o
Bitumen: Stain. - mod./strong in shale; wisps - trace
VR populations: 1
Mineralogy: -
General Comments: -
0.71
0.77
0.71
0.72
0.83
0.77
0.83
0.81
0.74
0.68
0.66

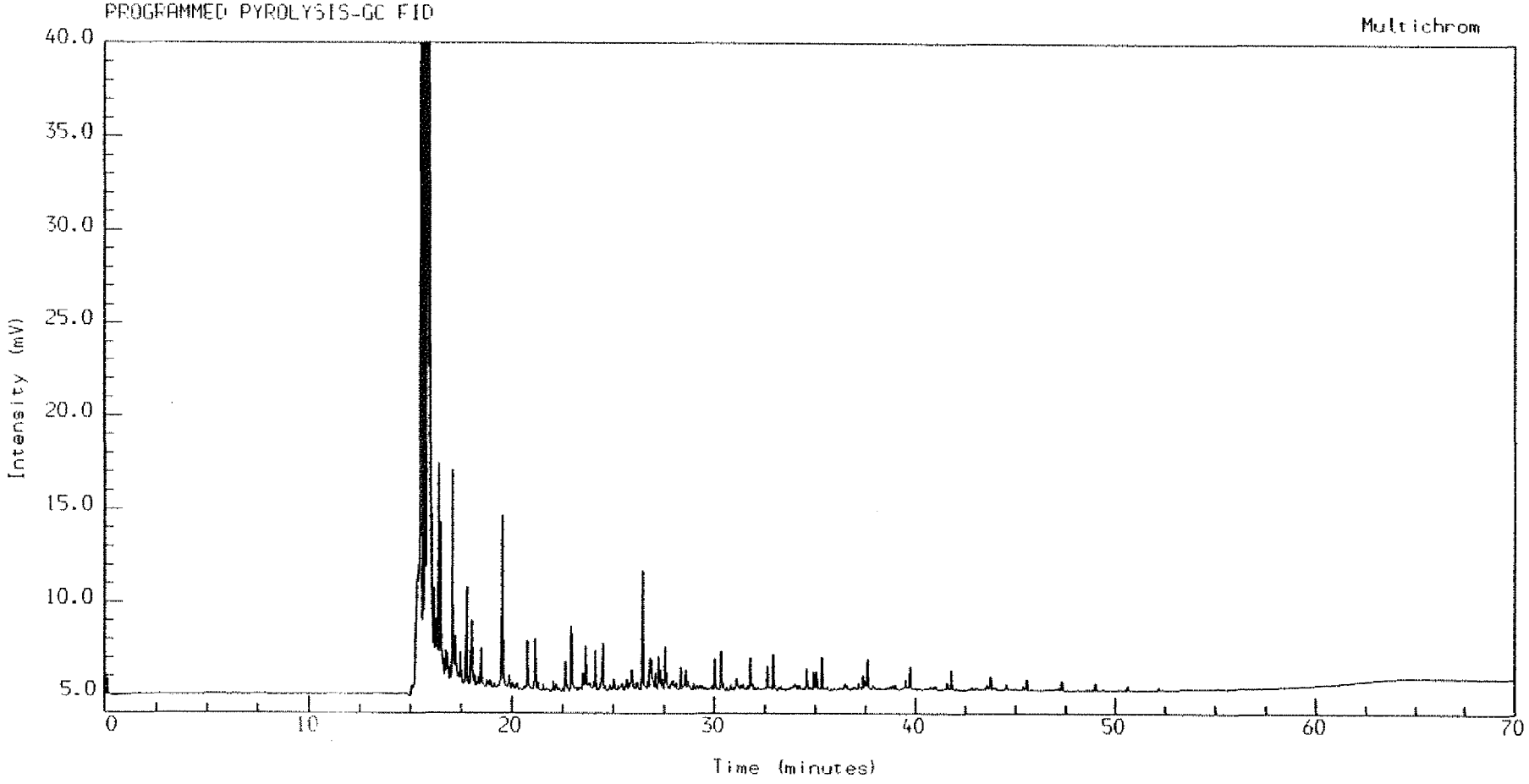
Sample ID: 30/6-24S 3900m
R.o. Aver.: NDP
Lithology: Shale 100%
Phytoclast Content: Virtually barren
    Vitrinite: -
    Inertinite: Tr.
    Exinite: -
UV fluorescence: Spores - tr. - m.o.; h/c specks - tr. -
y
Bitumen: Stain. - light; wisps - low
VR populations: -
Mineralogy: Haematite specks
General Comments: -

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 6 A300624SP,2.1.

3590+3592 M DC BULK Amount : 107.300

PROGRAMMED PYROLYSIS-GC FID



Instrument : V 700

Channel Title : P LYSIS FID

Lims ID :

Acquired on 15-FEB 992 at 12:43

Reported on 15-F 992 at 14:29

Method : PYRO

Calibration : PYRO

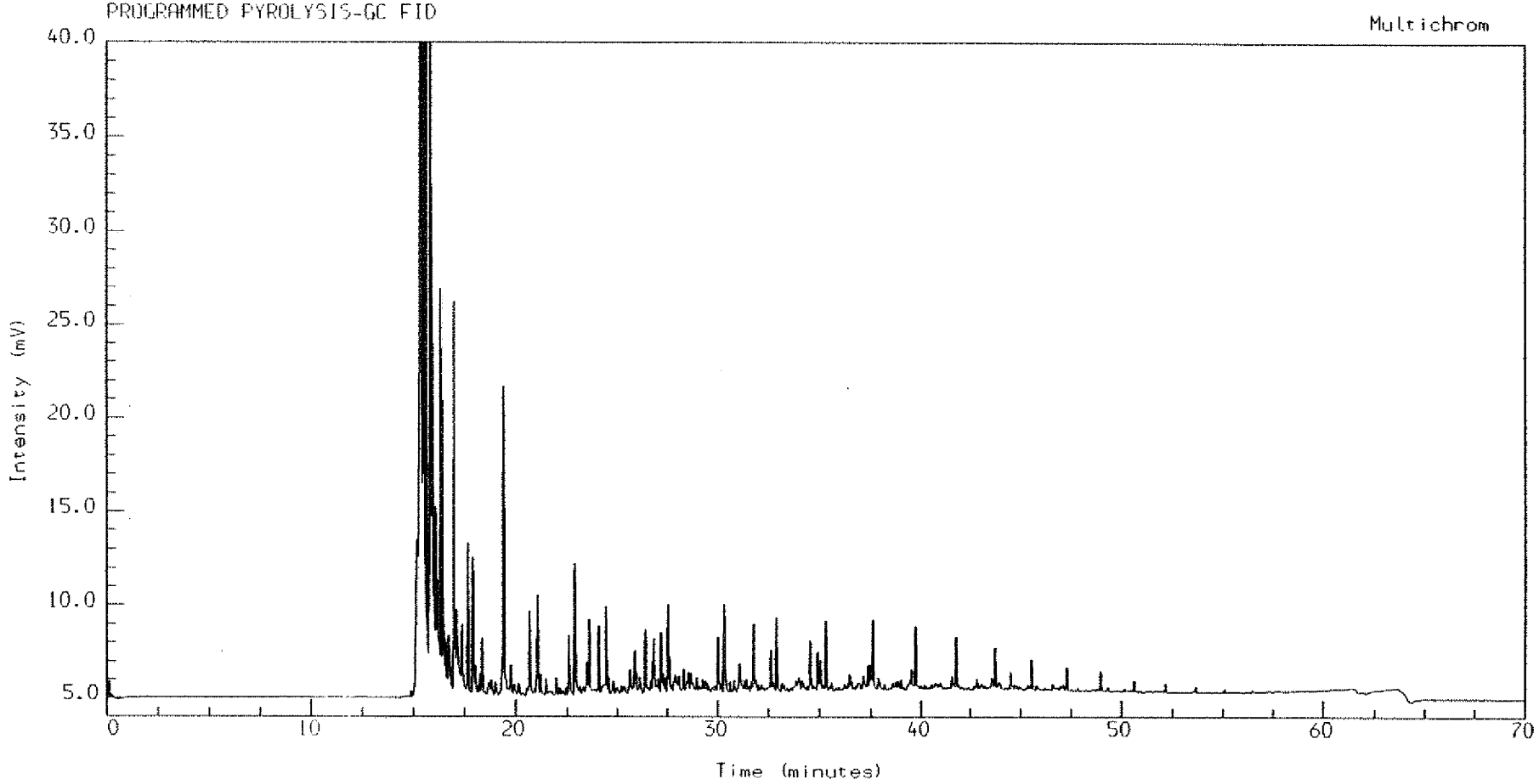
Run Sequence : PYRO

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 6 A300624SP.3.1.

3605 M DC BULK Amount : 110.500

PROGRAMMED PYROLYSIS-GC FID



Instrument : V 2100

Channel Title : PYROLYSIS FID

Lims ID :

Acquired on 13-FEB-1992 at 14:26

Reported on 14-FEB-1992 at 12:58

Method : PYRO

Calibration : PYRO

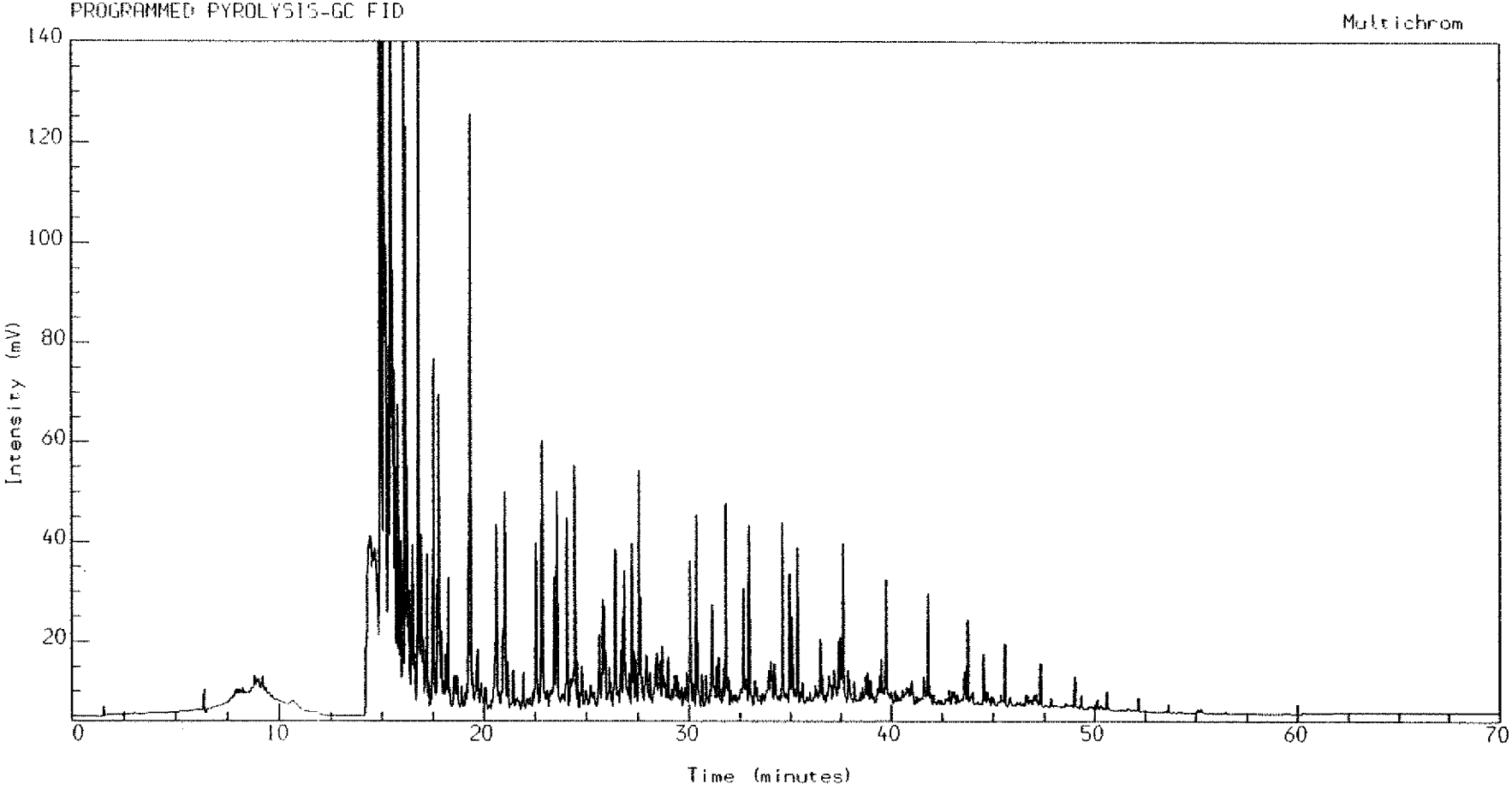
Run Sequence : PYRO

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 6 A300624SP.4.1.

3620 + 3622 M DC BULK Amount : 124.600

PROGRAMMED PYROLYSIS-GC FID



Instrument : V 3700

Channel Title : PYROLYSIS FID

Lims ID :

Acquired on 14-FEB-1992 at 09:37

Reported on 16-FEB-1992 at 14:31

Method : PYRO

Calibration : PYRO

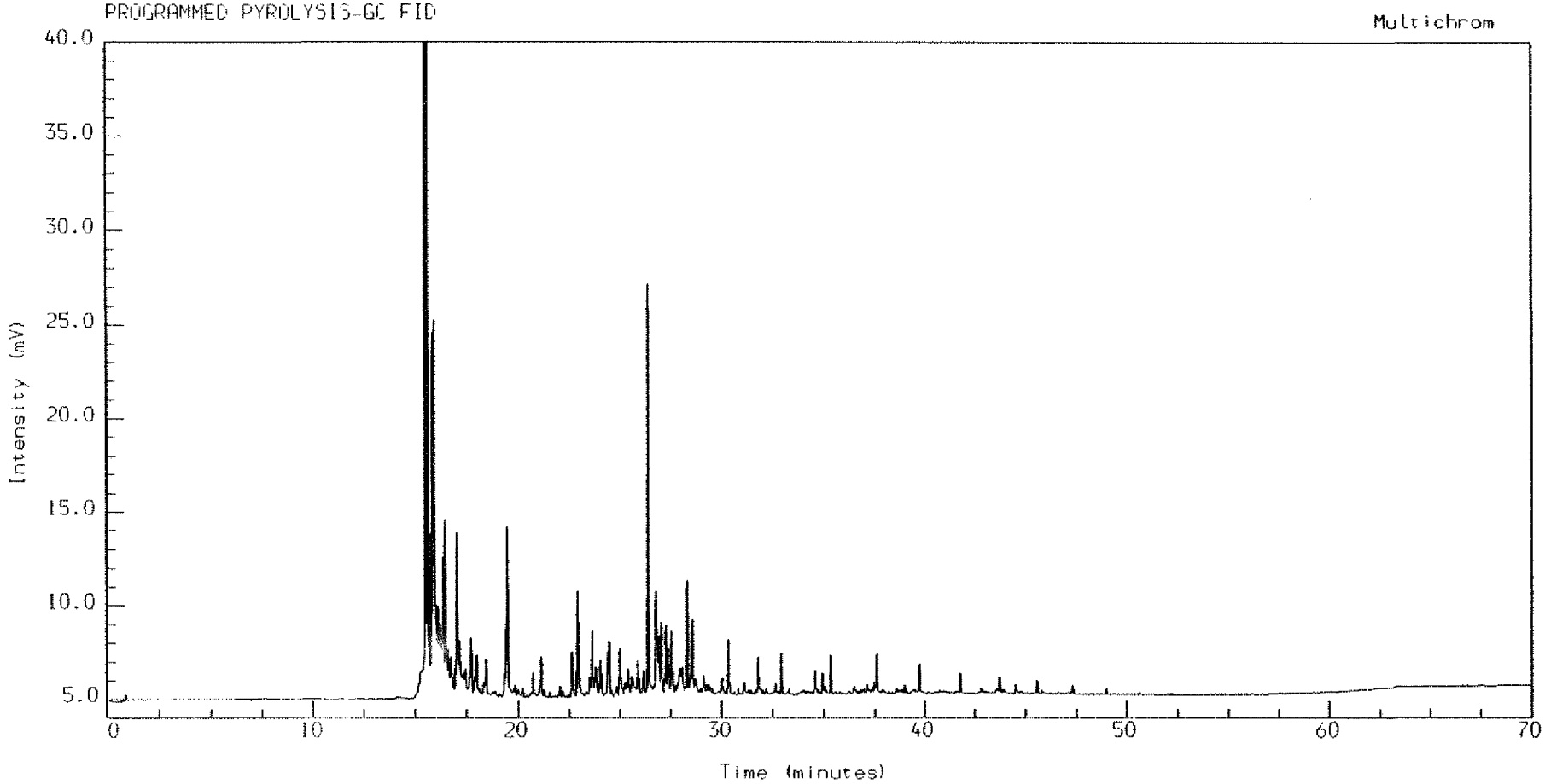
Run Sequence : PYRO

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 6 A300624SP.5.1.

3665 M DC BULK Amount : 115.800

PROGRAMMED PYROLYSIS-GC FID



Instrument : V 700

Channel Title : PYROLYSIS FID

Lims ID :

Acquired on 14-FEB-1992 at 11:31

Reported on 14-FEB-1992 at 14:04

Method : PYRO

Calibration : PYRO

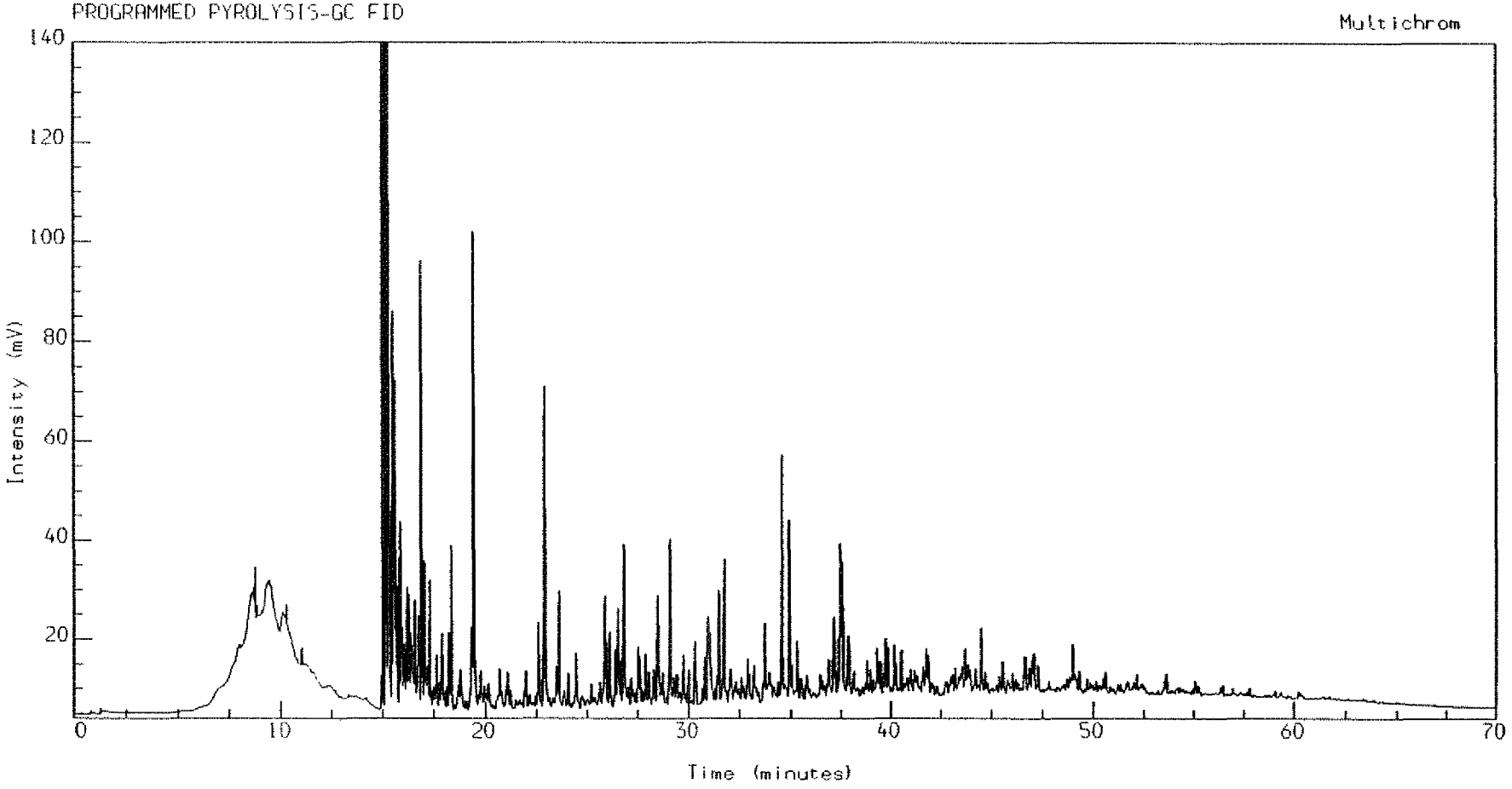
Run Sequence : PYRO

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 6 A300624SP.6,1.

3745 M DC KULL Amount : 1.200

PROGRAMMED PYROLYSIS-GC FID



Instrument : V 3700

Channel Title : PYROLYSIS FID

Lims ID :

Acquired on 14-FEB-1992 at 13:16

Reported on 16-FEB-1992 at 14:39

Method : PYRO

Calibration : PYRO

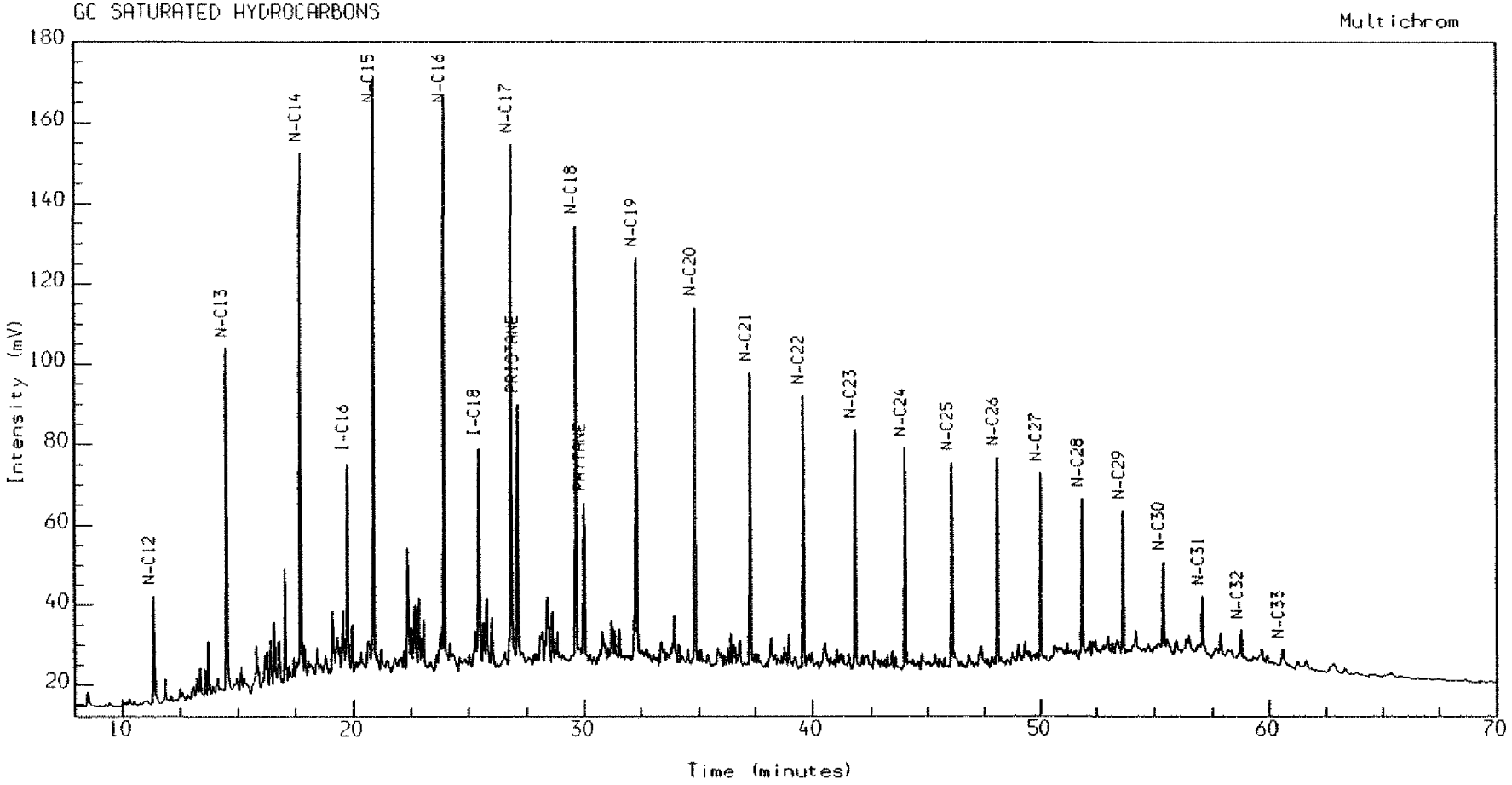
Run Sequence : PYRO

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 A300624SS,8.1.

BIOM.STD.

GC SATURATED HYDROCARBONS



Instrument : HP5890

Channel Title : MSD

Lims ID :

Acquired on 17-JAN-1992 at 11:15

Reported on 20-JAN-1992 at 13:18

Method : MSDS

Calibration : MSDS

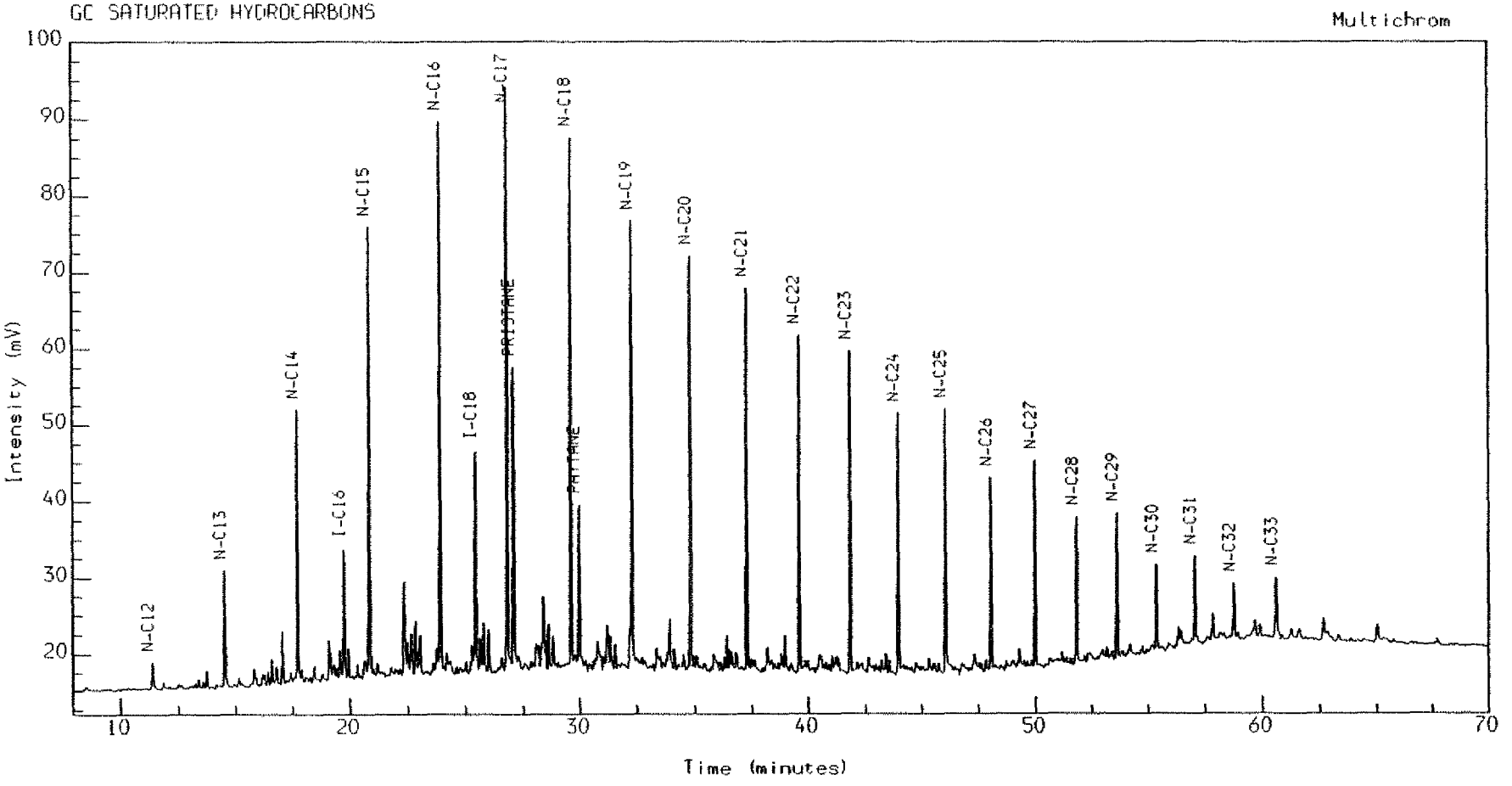
Run Sequence :

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 A30062455,9.1.

DC 3590+3592 M

GC SATURATED HYDROCARBONS



Instrument : HP5890

Channel Title : MSD

Lims ID :

Acquired on 17-JAN-1992 at 16:11

Reported on 20-JAN-1992 at 13:51

Method : MSDS

Calibration : MSDS

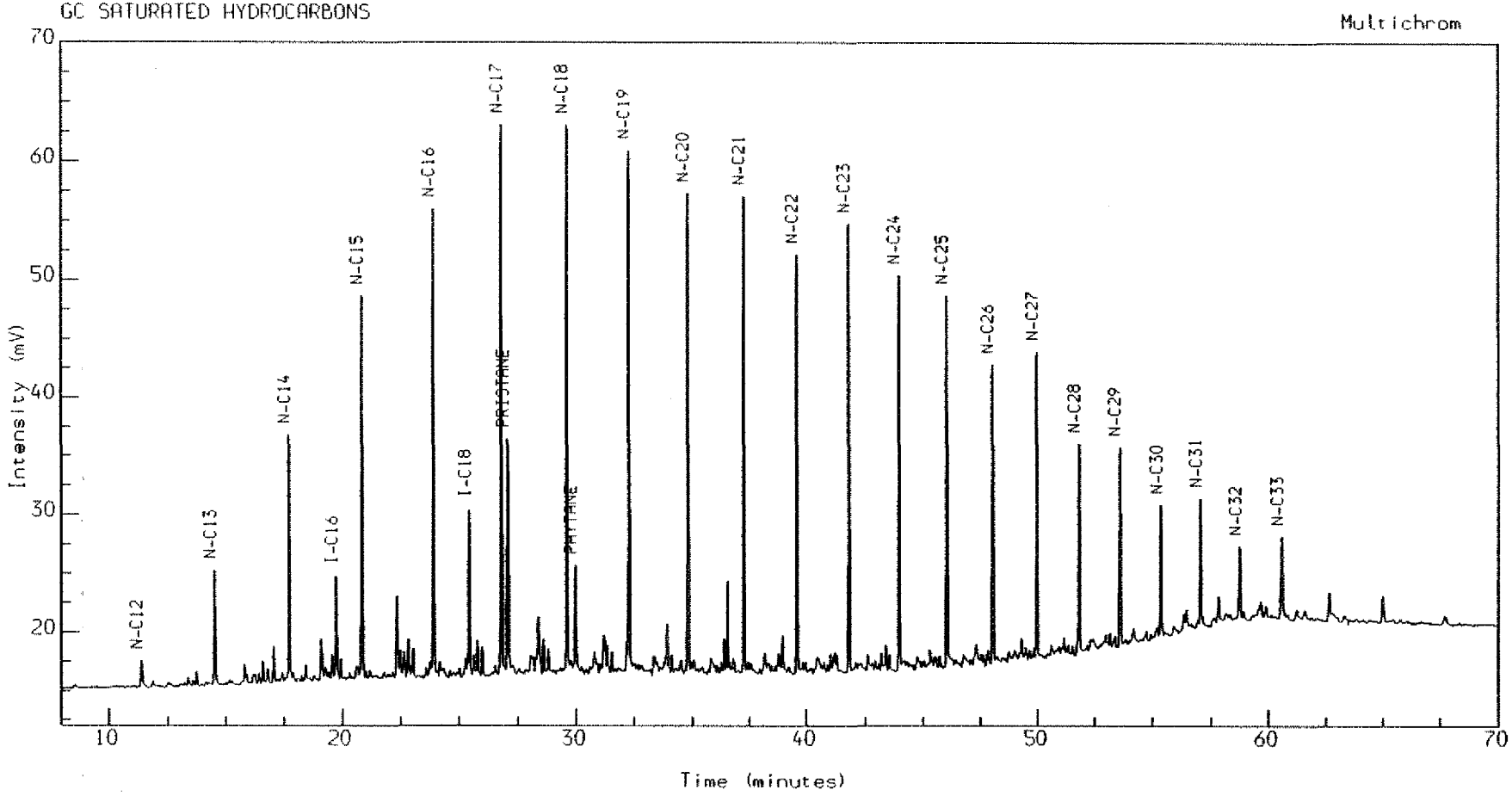
Run Sequence :

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 A300624SS,10.1.

DC 3605 M

GC SATURATED HYDROCARBONS



Instrument : HP5890

Channel Title : MSD

Lims ID :

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Reported on 20-JAN-1992 at 14:03

Method : MSDS

Calibration : MSDS

Run Sequence :

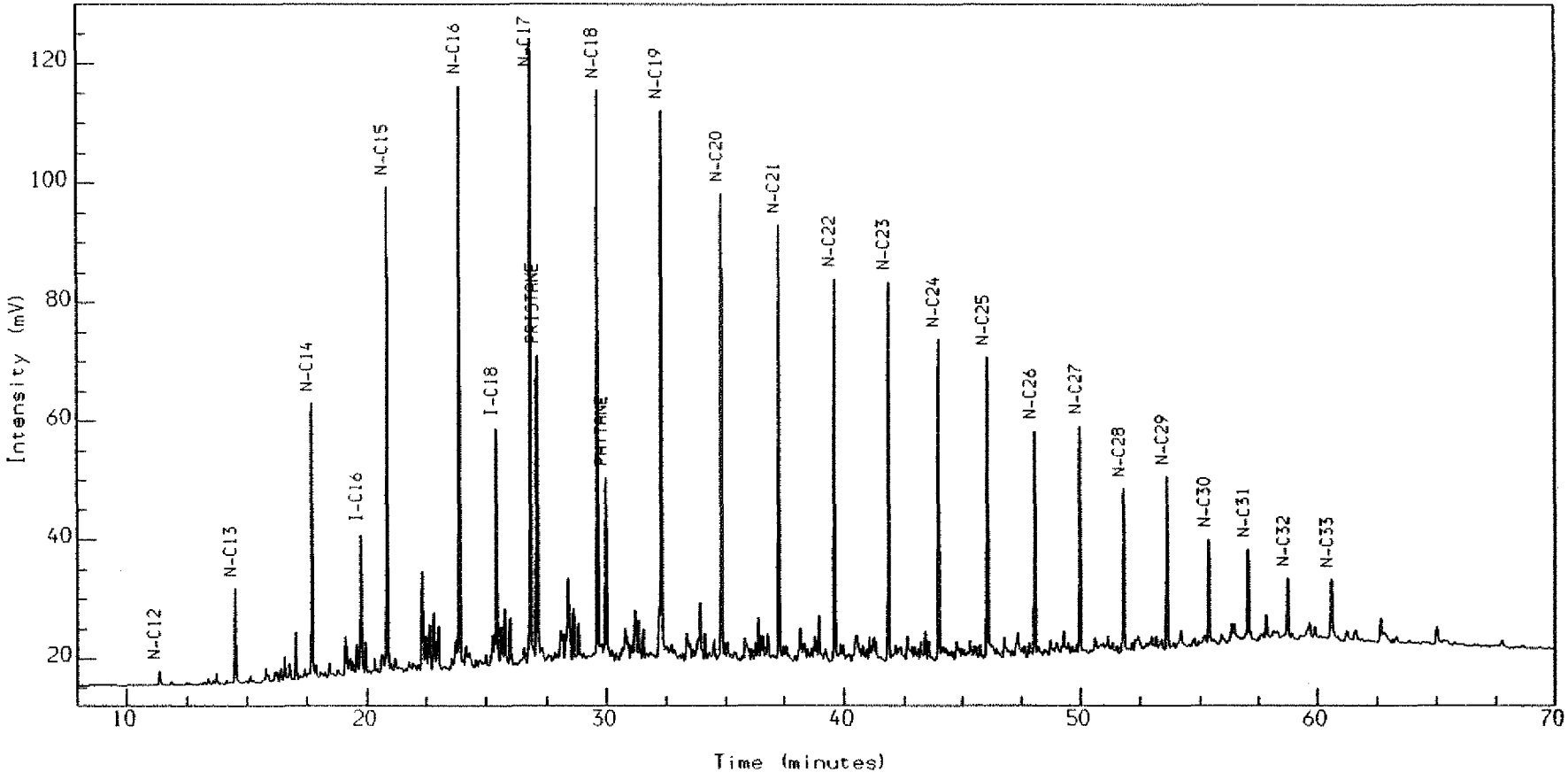
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 A30062455,4,1.

DC 3620m+3622m

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP5890

Channel Title : MSD

Lims ID :

Acquired on 16-JAN-1992 at 15:25

Reported on 17-JAN-1992 at 09:49

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

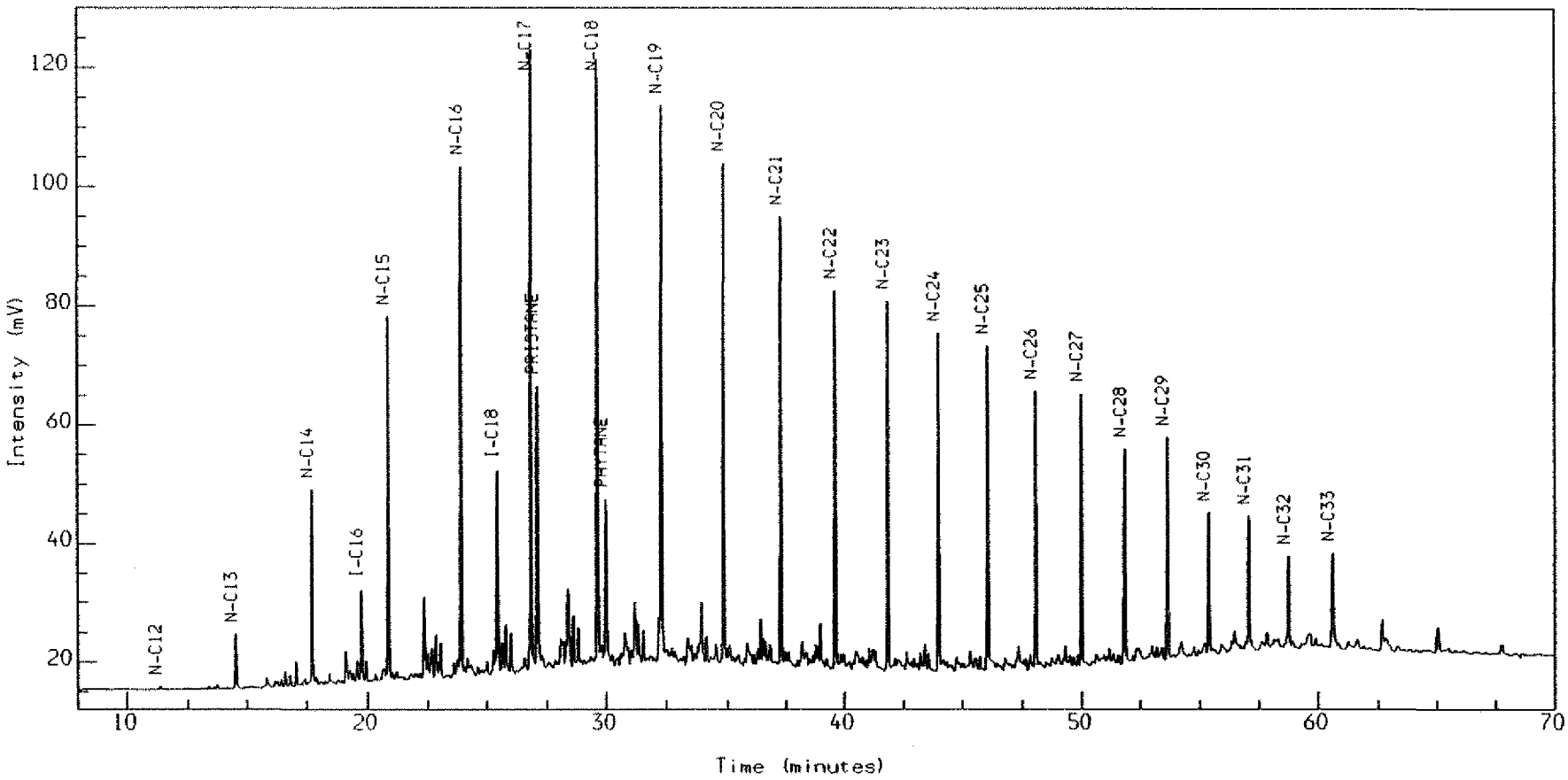
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 A300624SS,5.1.

DC 3665m

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP5890

Channel Title : MSD

Lims ID :

Acquired on 16-JAN-1992 at 16:55

Reported on 17-JAN-1992 at 09:51

Method : MSDS

Calibration : MSDS

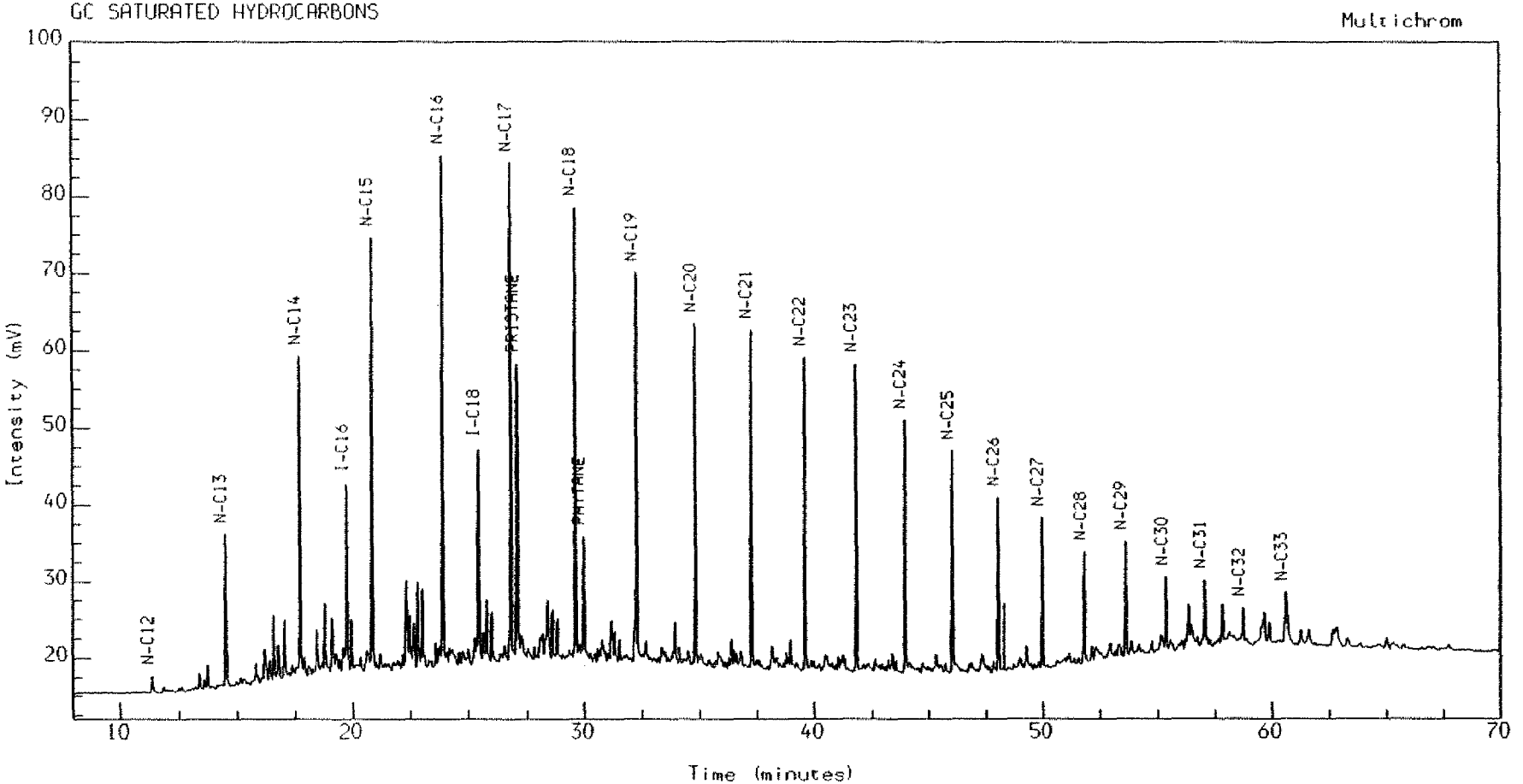
Run Sequence : MSDS

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 A30062455.6.1.

DC 3745m Kull

GC SATURATED HYDROCARBONS



Instrument : HP5890

Channel Title : MSD

Lims ID :

Acquired on 16-JAN-1992 at 18:26

Reported on 17-JAN-1992 at 10:02

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

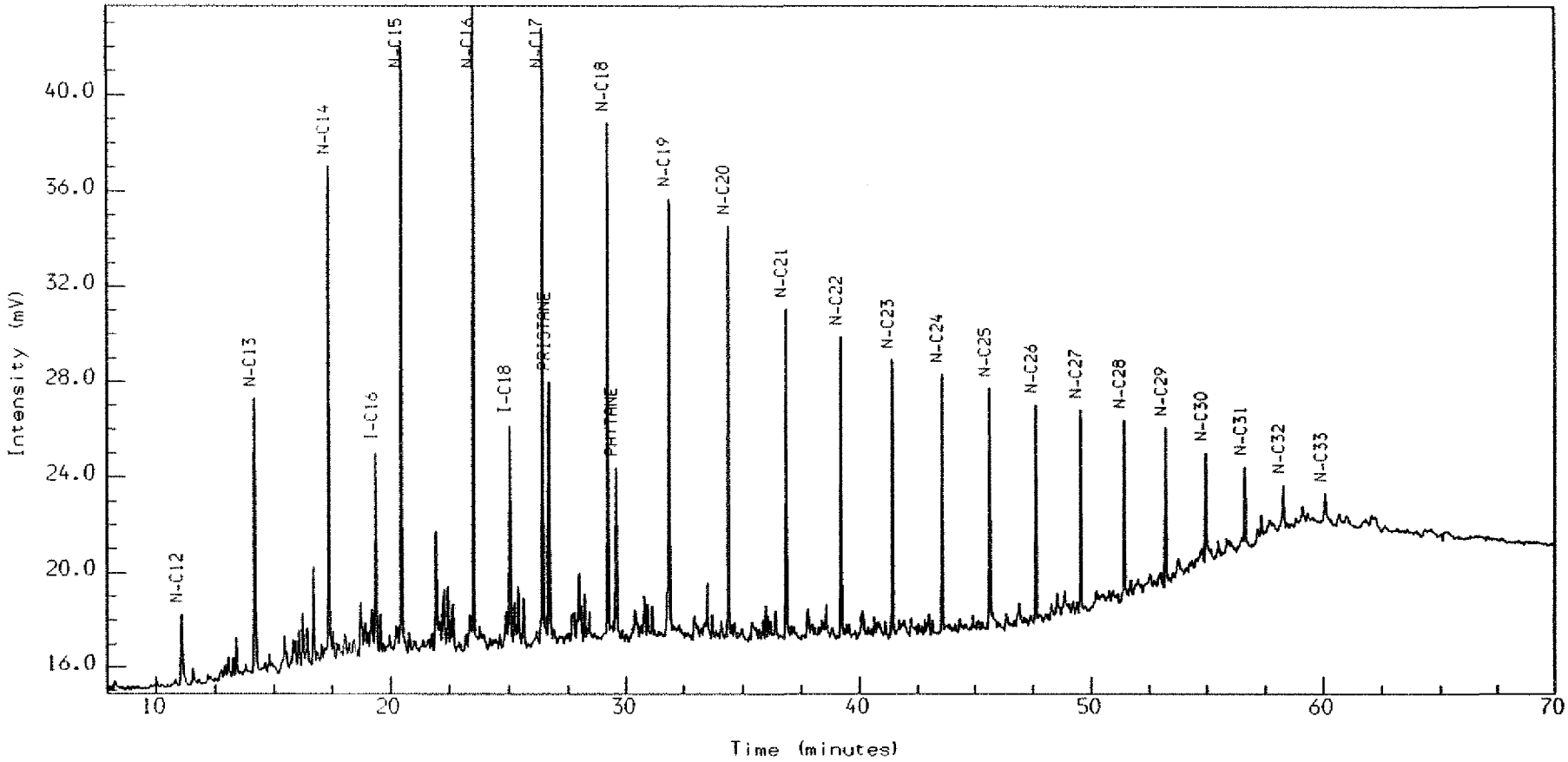
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 AOSEBERGMORE.20.I.

BIOMSTD.

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP5890

Channel Title : NH

Lims ID :

Acquired on 21-FEB-1992 at 08:08

Reported on 3-MAR-1992 at 12:03

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

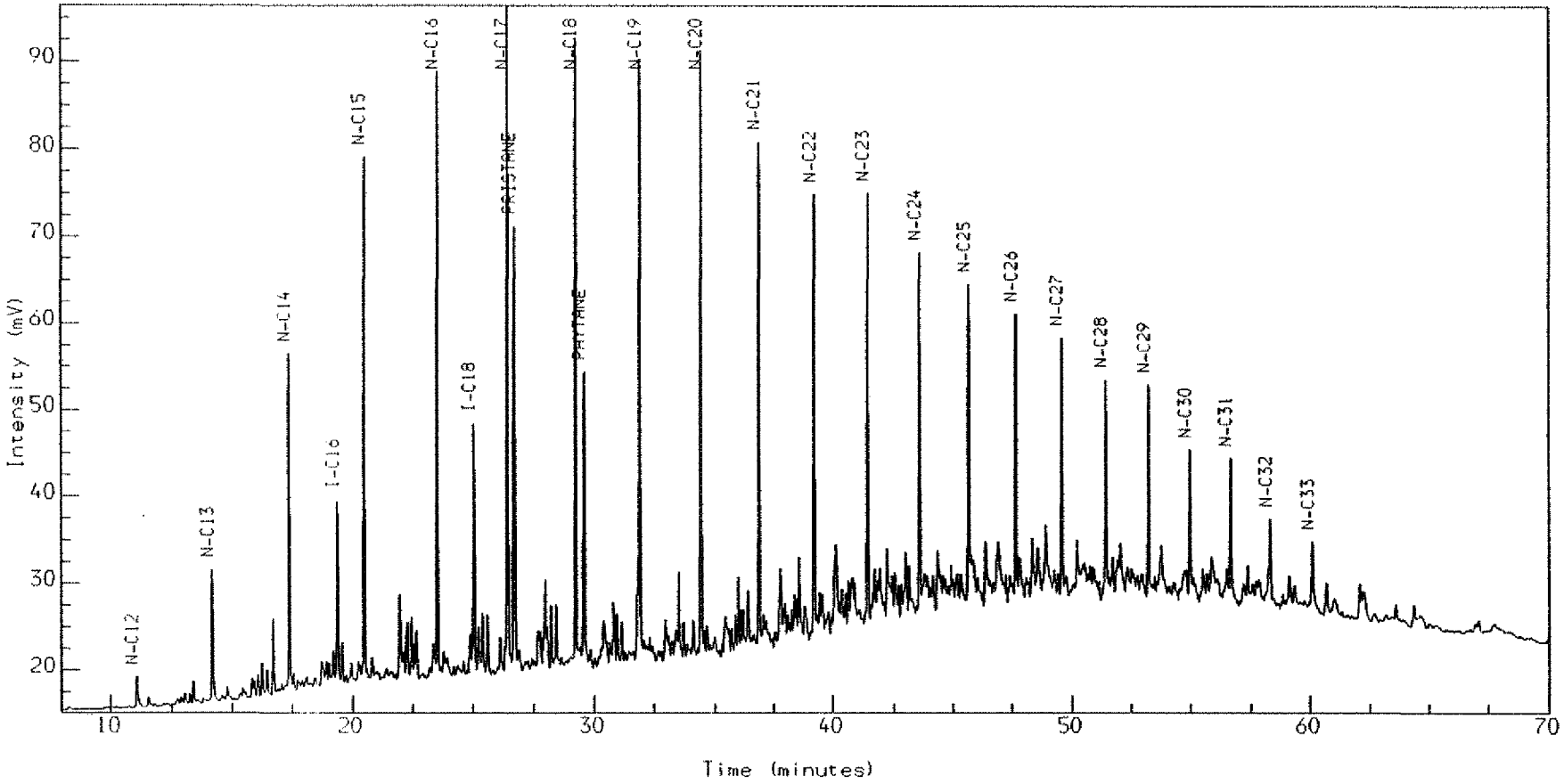
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 AOSEBERGMORE.19.1.

30/6-24S DC+MUD 2050 M

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP 5890

Channel Title : MAI

Lims ID :

Acquired on 21-FEB-1992 at 06:38

Reported on 21-FEB-1992 at 08:01

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

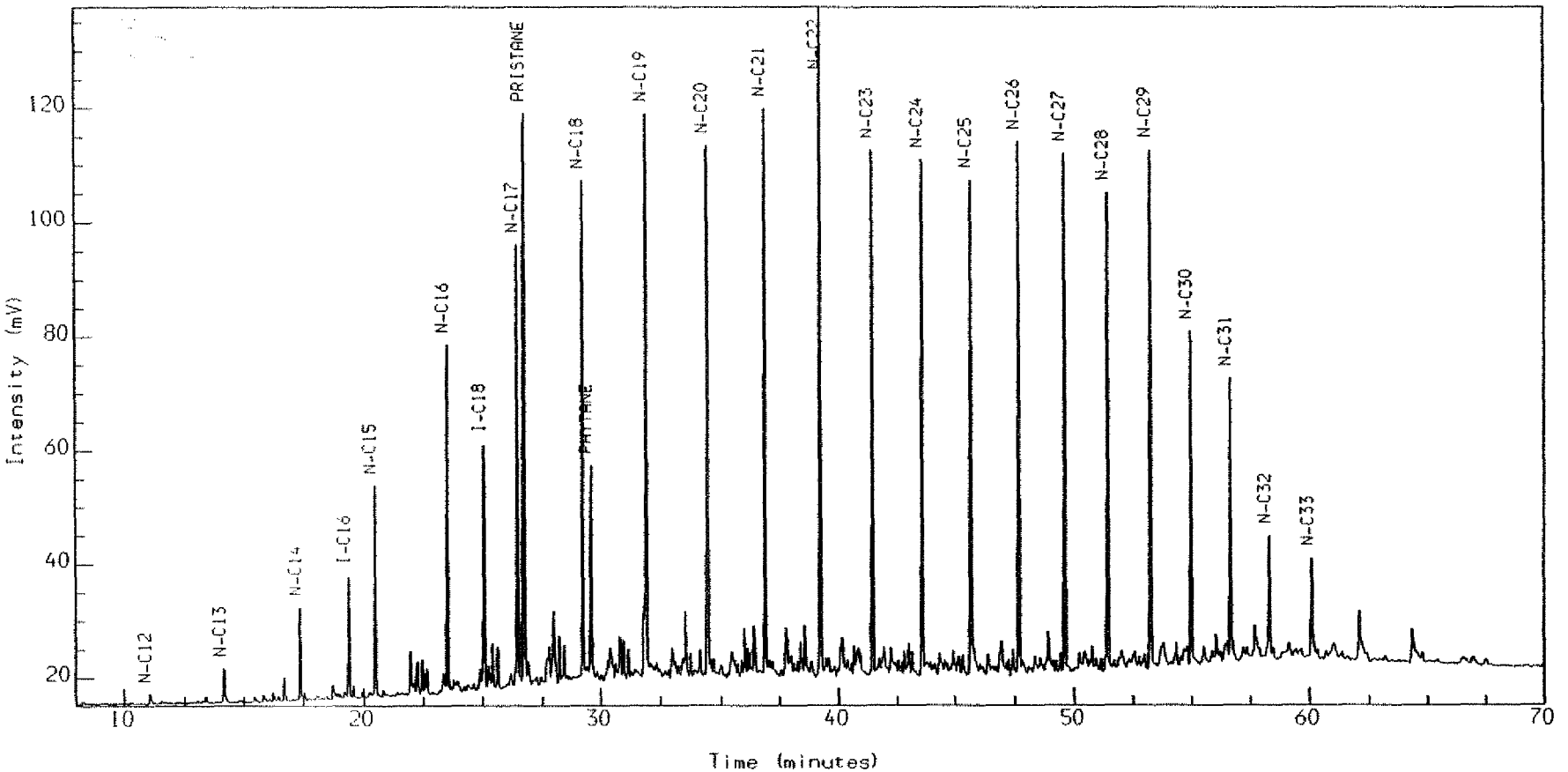
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 AOSEBERGMORE.15.1.

30/6-24S SST COCH 3688 M

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP5890

Channel Title : MFI

Lims ID :

Acquired on 21-FEB-92 at 00:37

Reported on 21-FEB-92 at 01:59

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

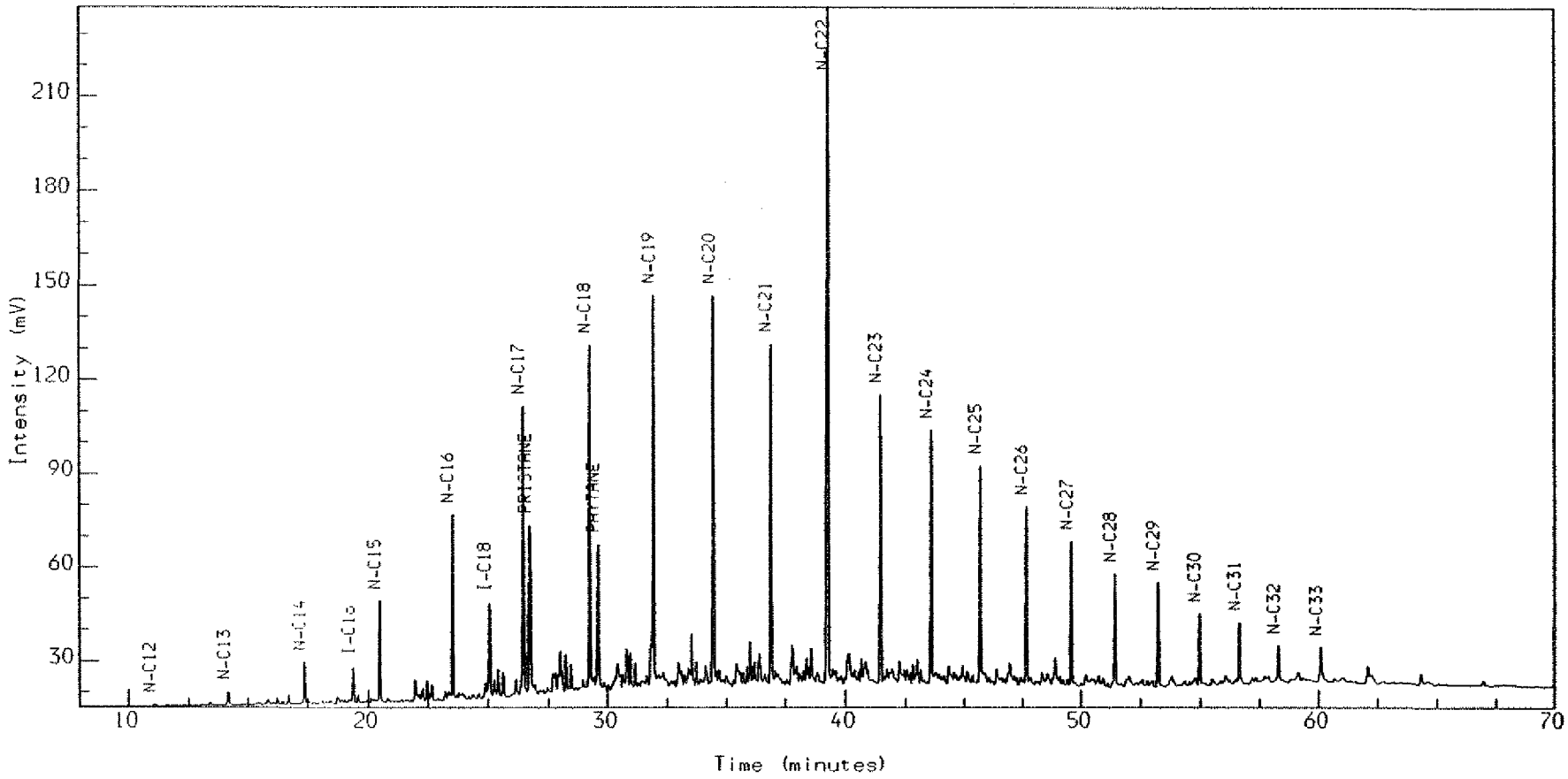
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 AOSEBERGMORE.16,1.

30/6-24S SST COCH 3701 M

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP5890

Channel Title : MS

Lims ID :

Acquired on 21-FEB-1992 at 02:07

Reported on 21-FEB-1992 at 03:29

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

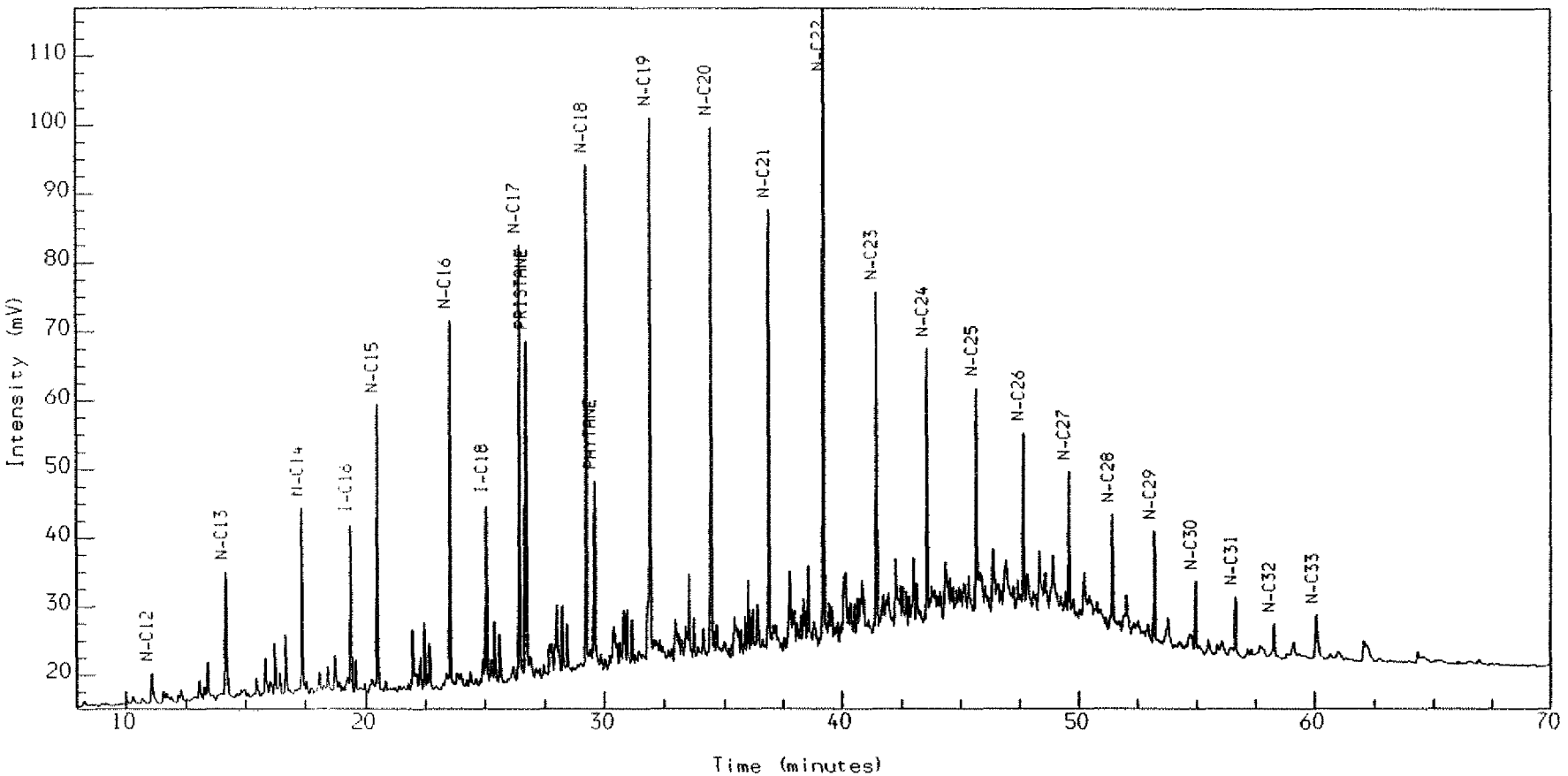
NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 AOSEBERGMORE.17.1.

30/6-24S SST COCH 3702 M

GC SATURATED HYDROCARBONS

Multichrom



Instrument : HP5890

Channel Title : MFI

Lims ID :

Acquired on 21-FEB-1992 at 03:37

Reported on 21-FEB-1992 at 05:00

Method : MSDS

Calibration : MSDS

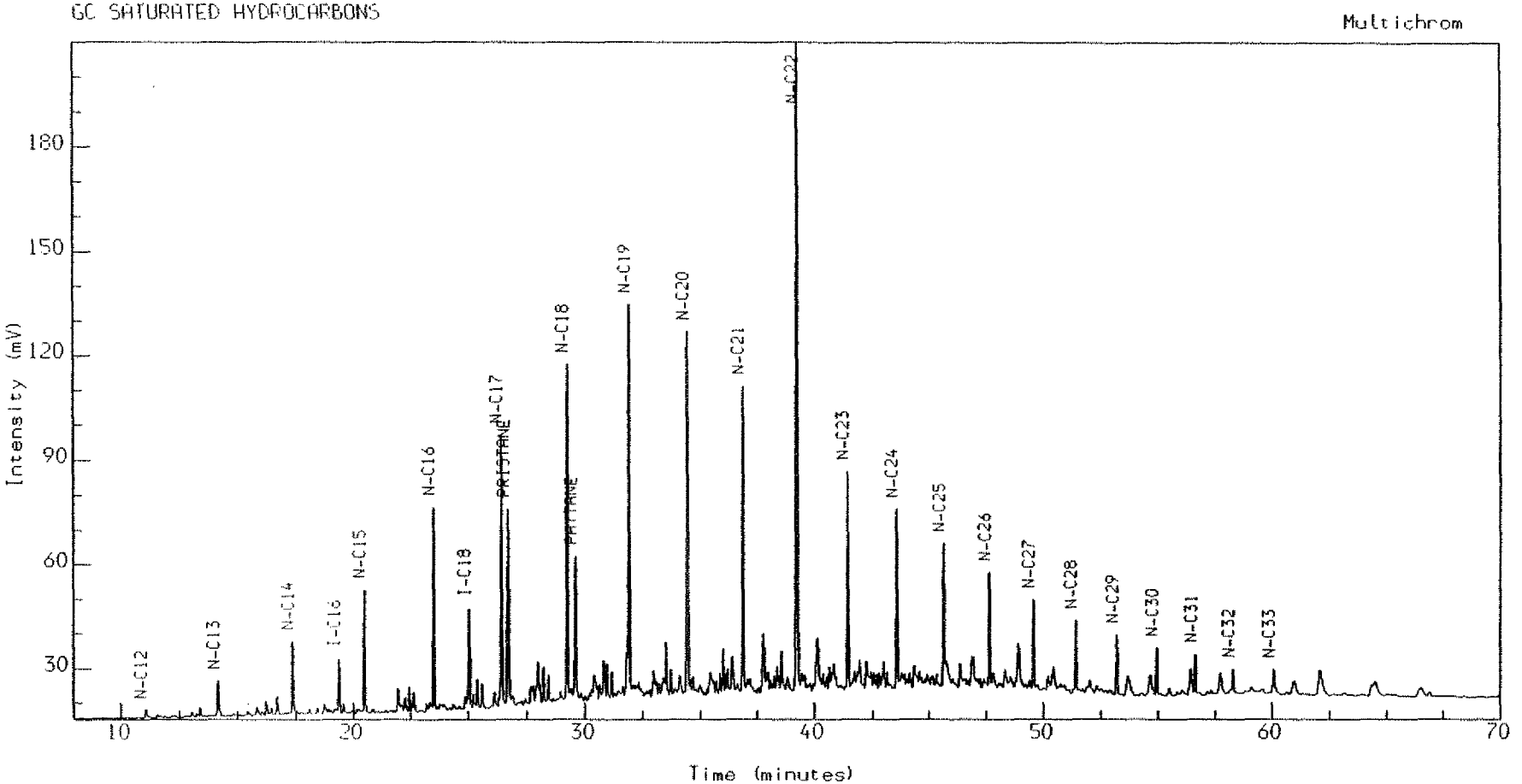
Run Sequence : MSDS

NORSK HYDRO RESEARCH CENTRE

Analysis Name : [PETRO] 7 AOSEBERGMORE.18.1.

30/6-24S SST COCH 3704 M

GC SATURATED HYDROCARBONS



Instrument : HP5-90

Channel Title : M1

Lims ID :

Acquired on 21-FEB-92 at 05:08

Reported on 21-FEB-92 at 06:30

Method : MSDS

Calibration : MSDS

Run Sequence : MSDS

IDENTIFICATION OF BIOLOGICAL MARKERS

Triterpanes (m/z 191):

Numbers from 18 to 35 corresponds to the carbon number of the molecule, the following capital letter identifies the stereochemistry and/or the number of rings.

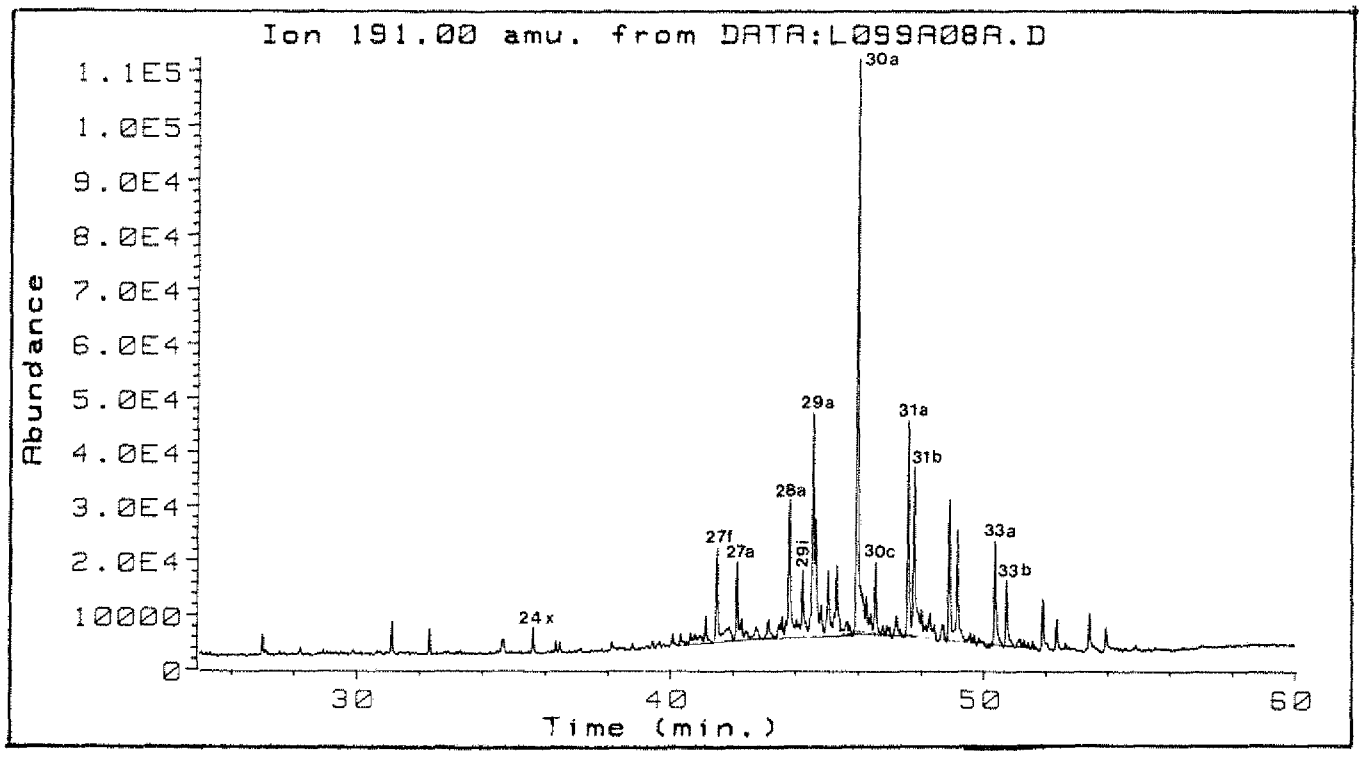
A 17α(H)-hopanes (I) 22S
B 17α(H)-hopanes 22R
C 17β(H)-moretanes (II) 22S
D 17β(H)-moretanes 22R
E 17β(H)-hopanes (III)
F Neohopanes (IV)
G Gammacerane (V)
H $\Delta^{13,18}$-hopenes (VI)
I 25-norhopanes (VII)
L Lupane (VIII)
O 18α(H)-oleanane (IX)
X Tetracyclic terpanes (X)
Y Tricyclic terpanes (XI)

Steranes (m/z 217):

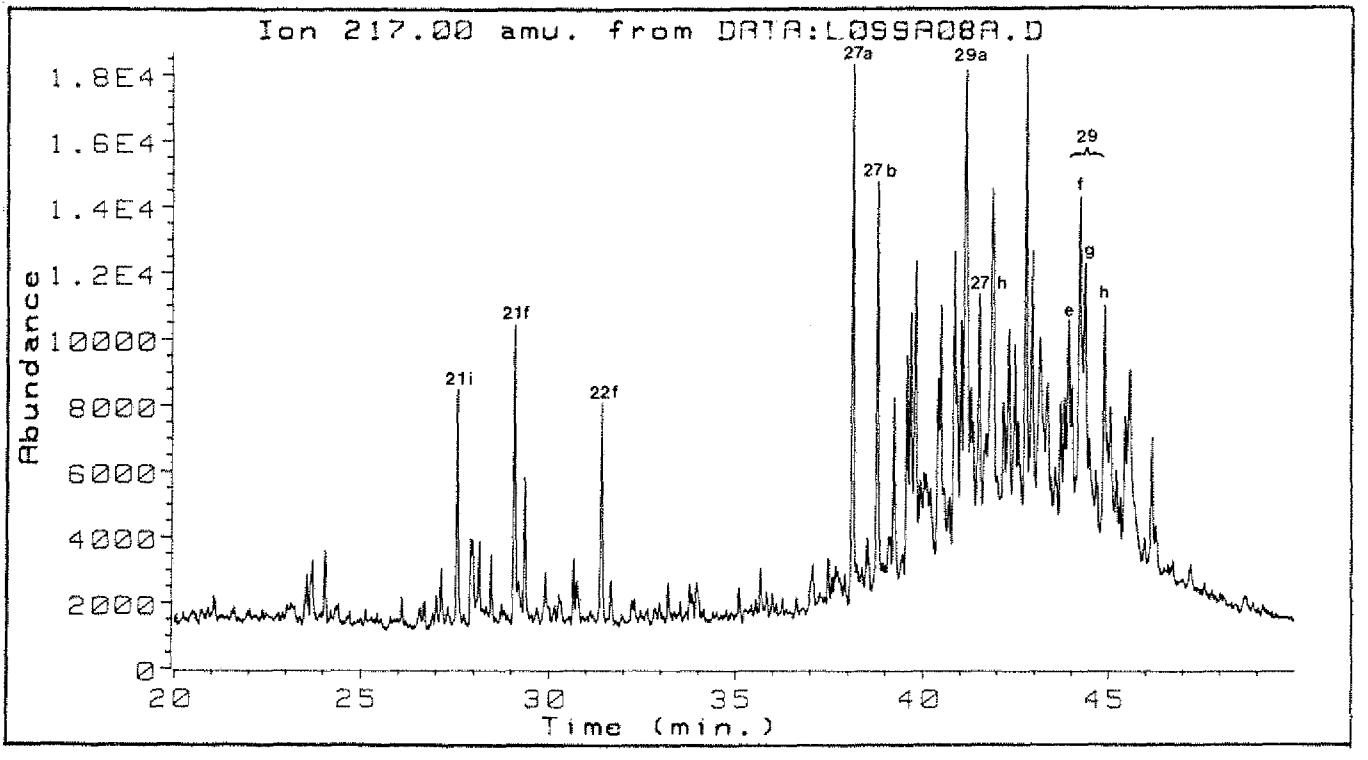
Numbers from 20 to 30 corresponds to the carbon number of the molecules, the following small letter identifies the stereochemistry.

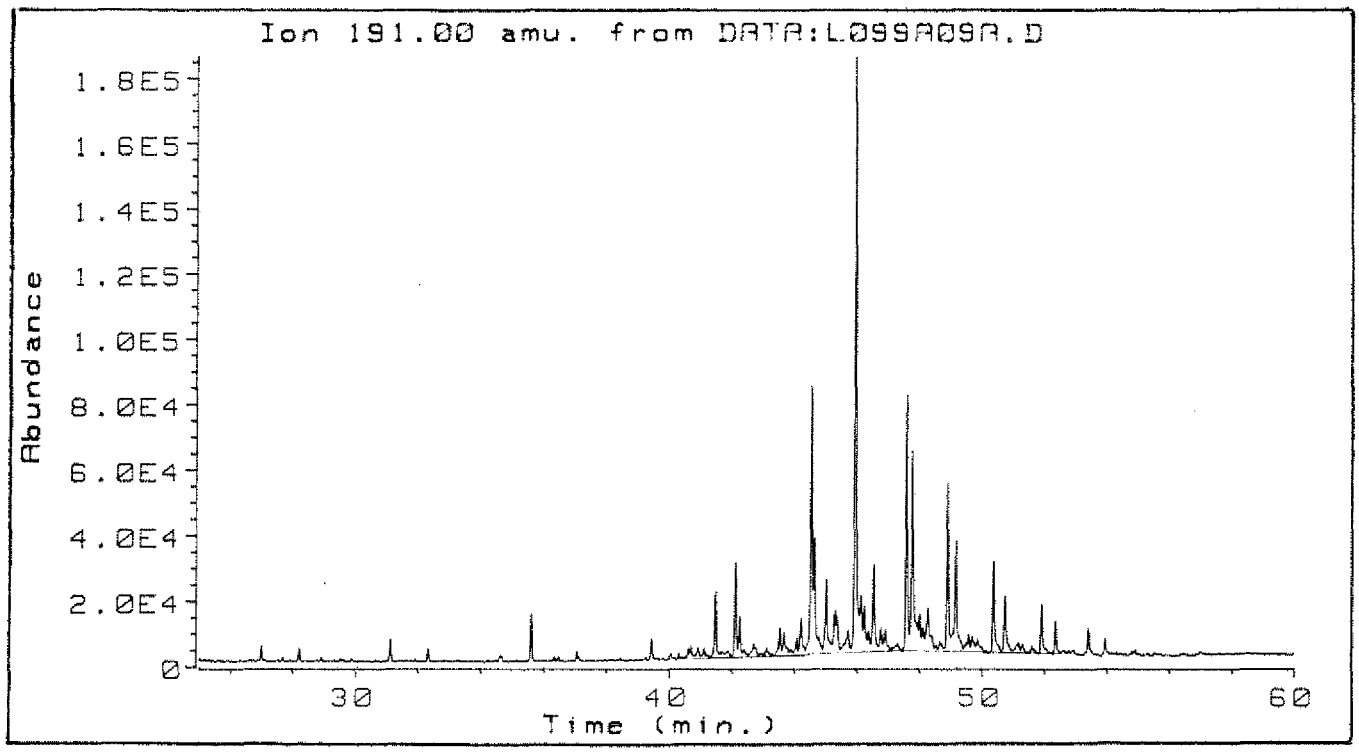
a 13β(H),17α(H)-diasteranes 20S (1)
b 13β(H),17α(H)-diasteranes 20R (2)
c 13α(H),17β(H)-diasteranes 20S (3)
d 13α(H),17β(H)-diasteranes 20R (4)
e 5α(H),14α(H),17α(H)-steranes 20S (5)
f 5α(H),14β(H),17β(H)-steranes 20R (6)
g 5α(H),14β(H),17β(H)-steranes 20S (7)
h 5α(H),14α(H),17α(H)-steranes 20R (8)
i 5β(H),14α(H),17α(H)-steranes (9)
k 4-methylsteranes (10)

Examples: 31B corresponds to 17α(H)-homohopane 22R
29e corresponds to ααα-ethylcholestane 20S

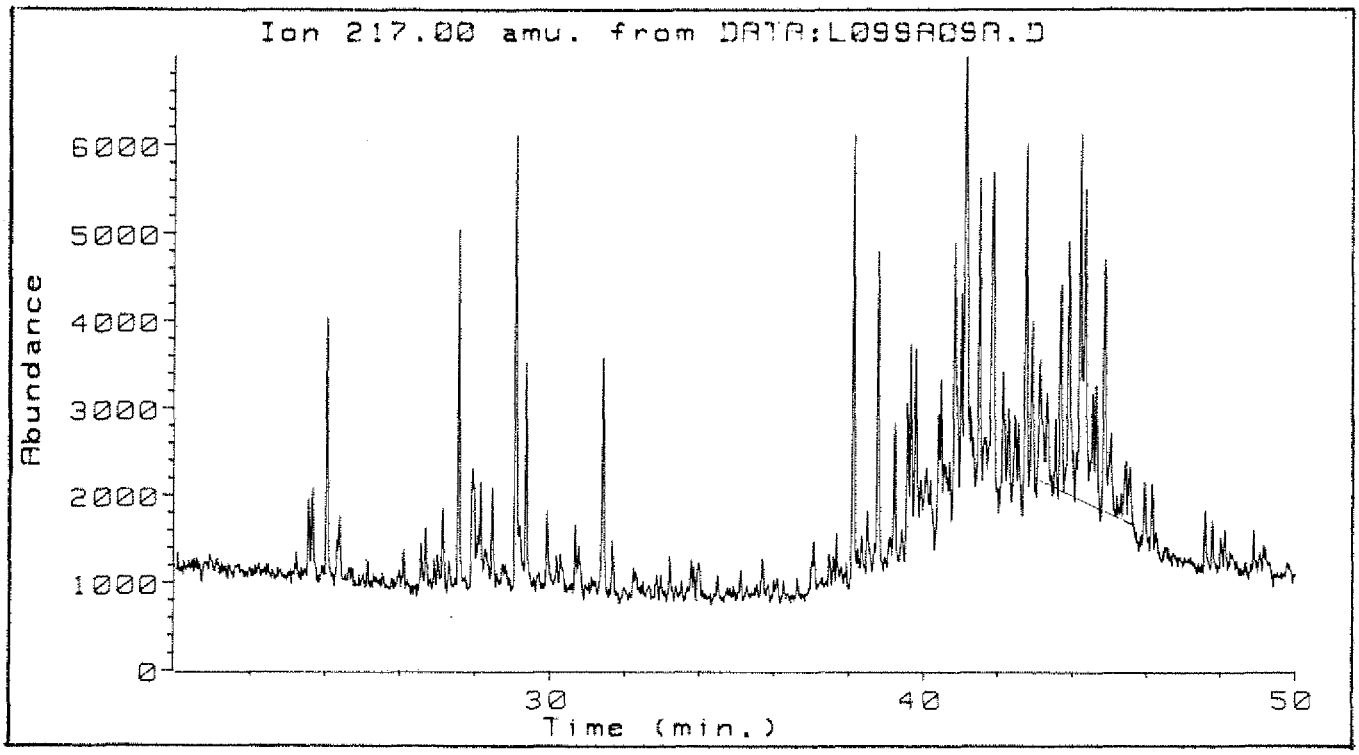


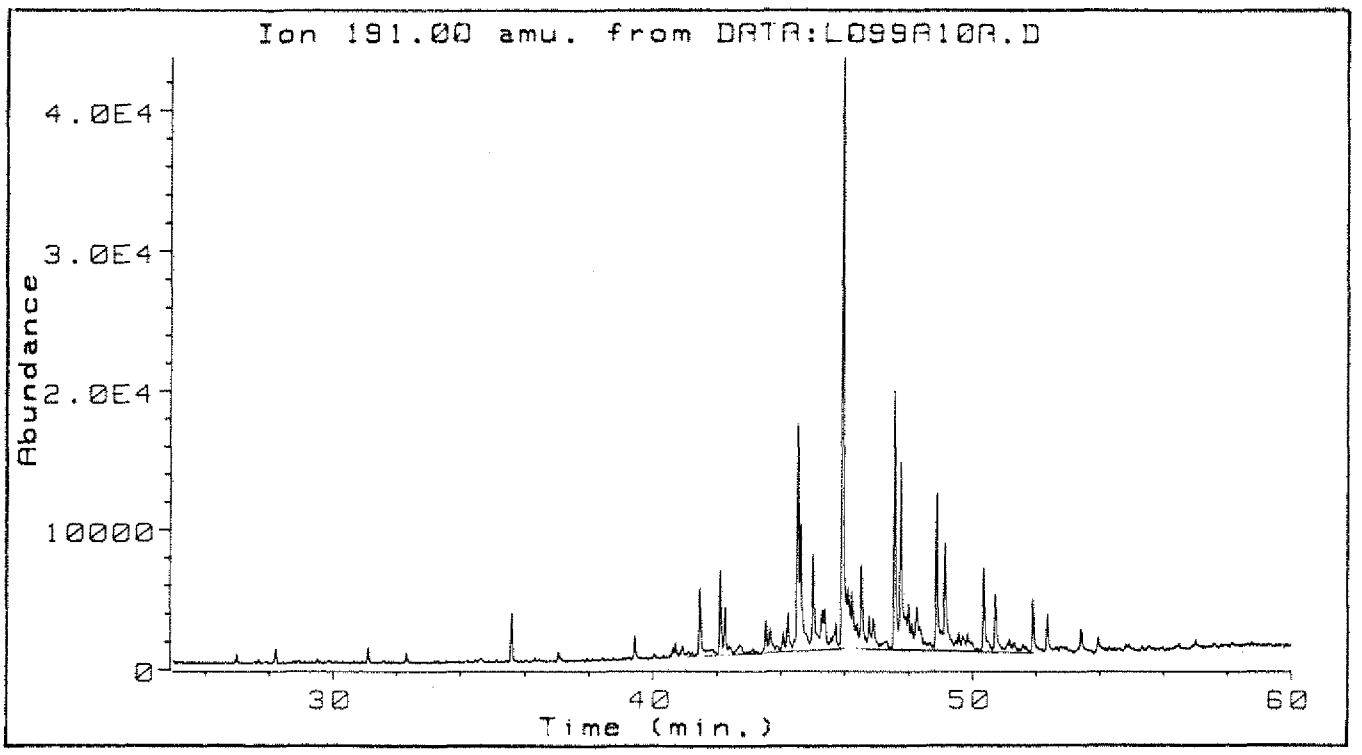
BIOM.STANDARD



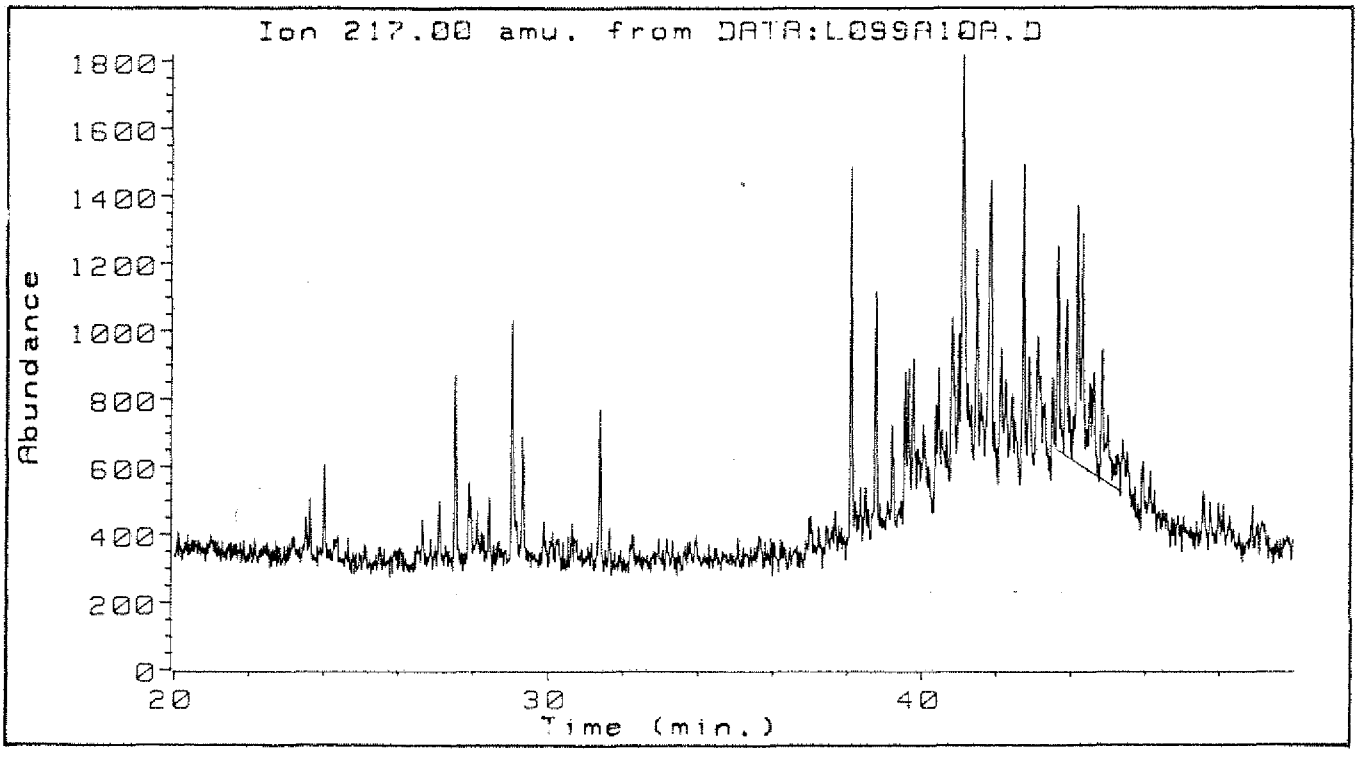


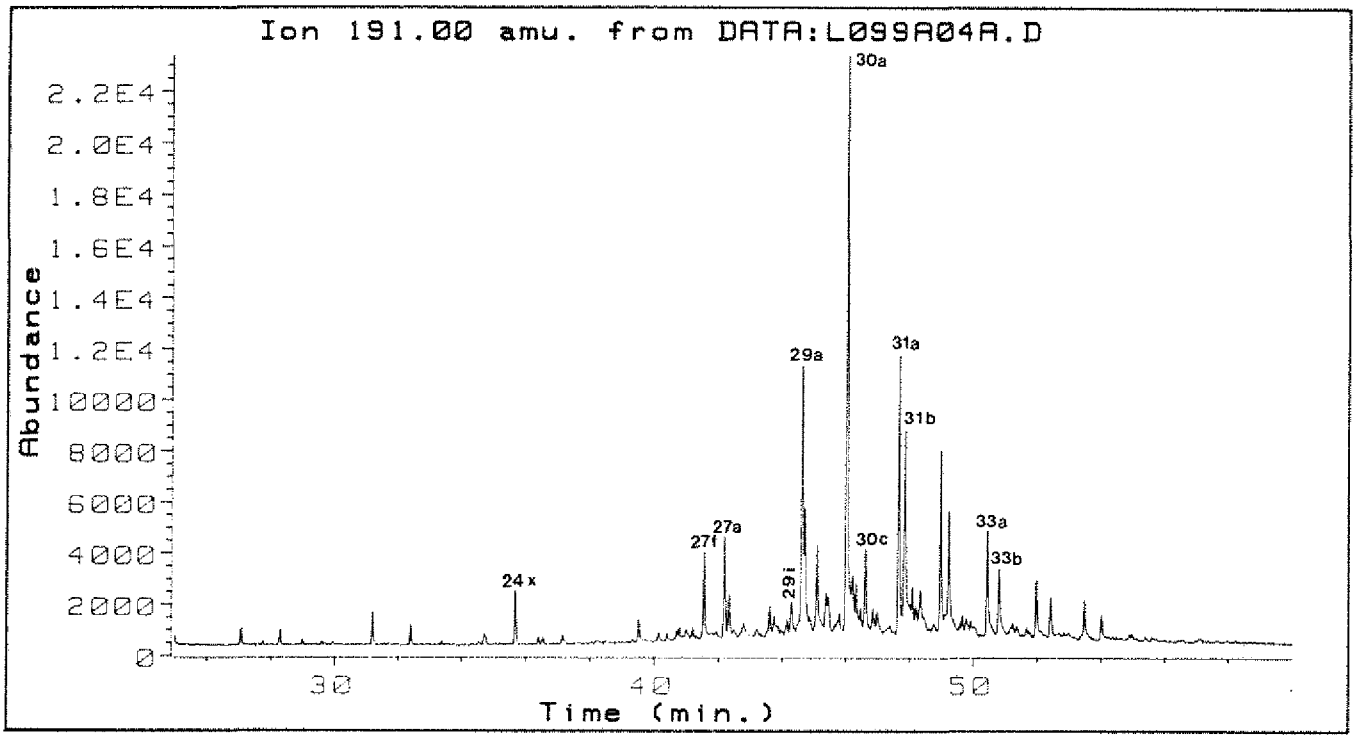
30/6-24s 3590+3592 m DC 1-2mm



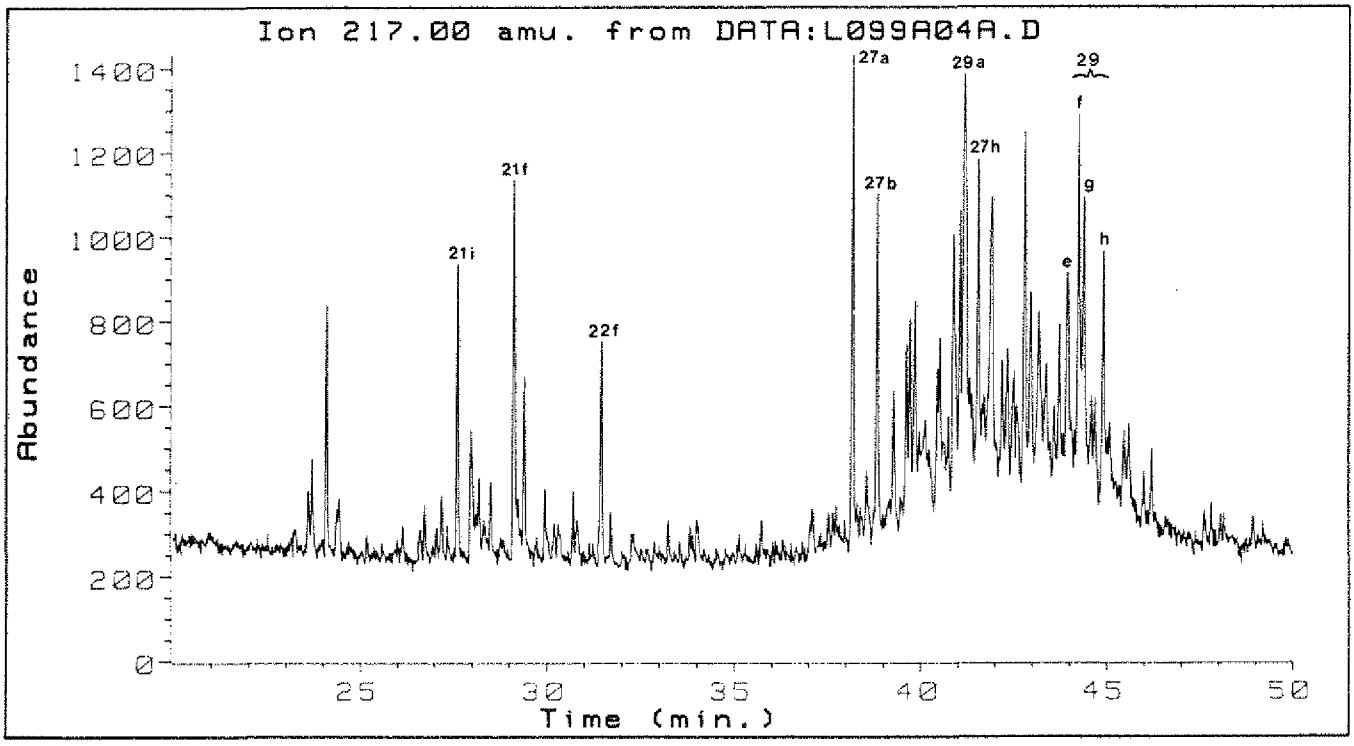


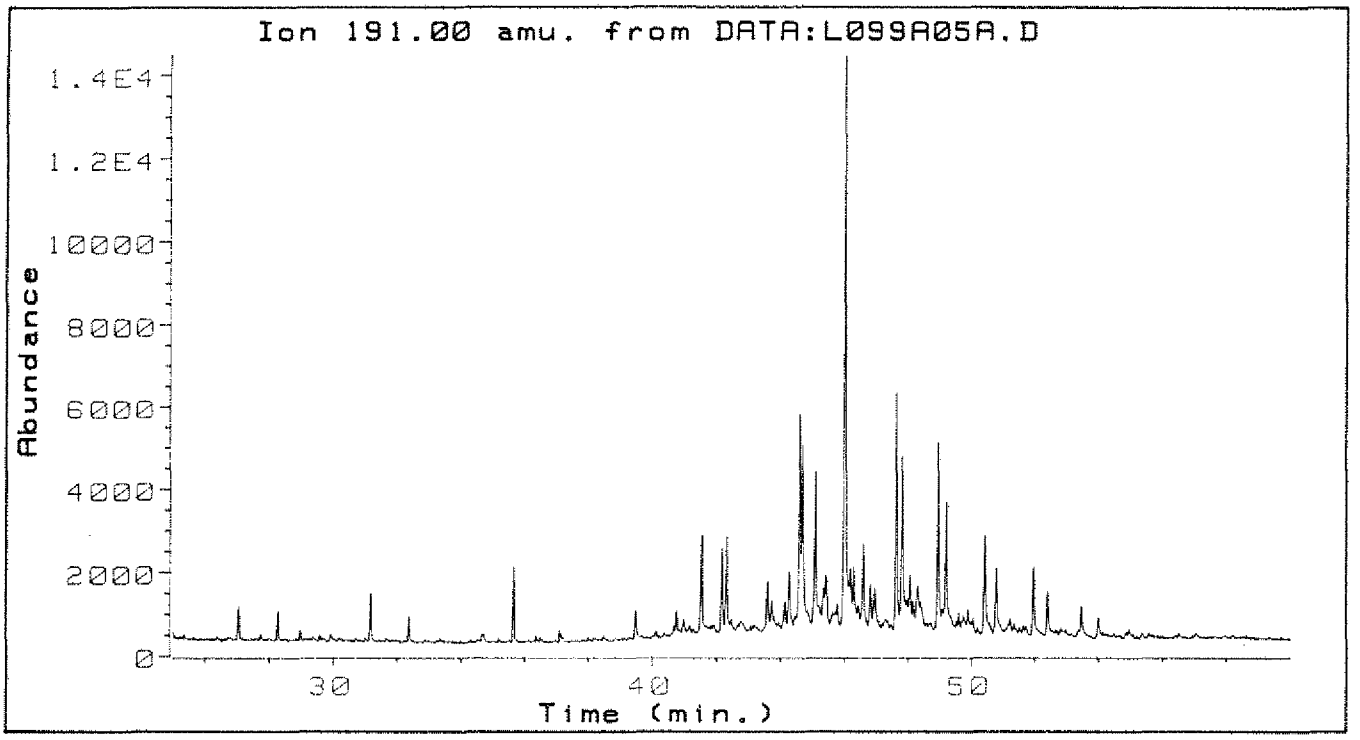
30/6-24s 3605 m DC 1-2mm



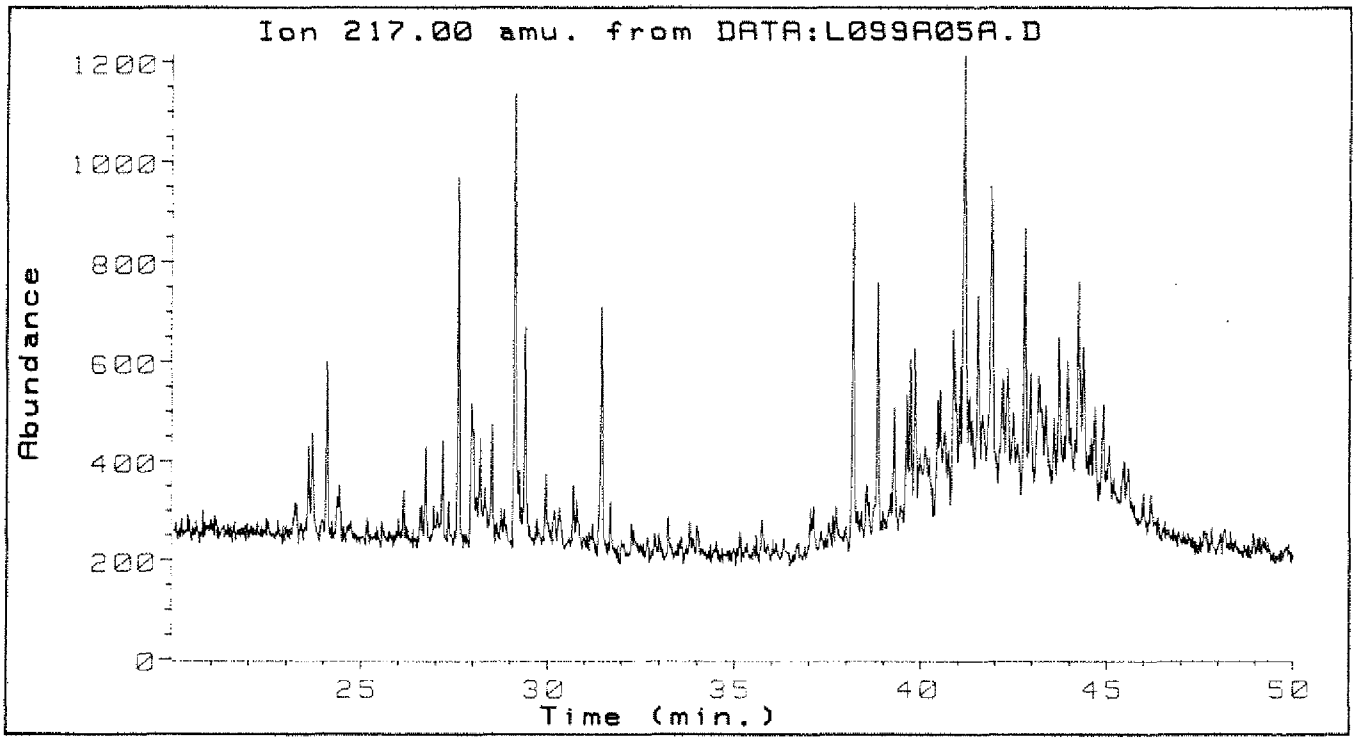


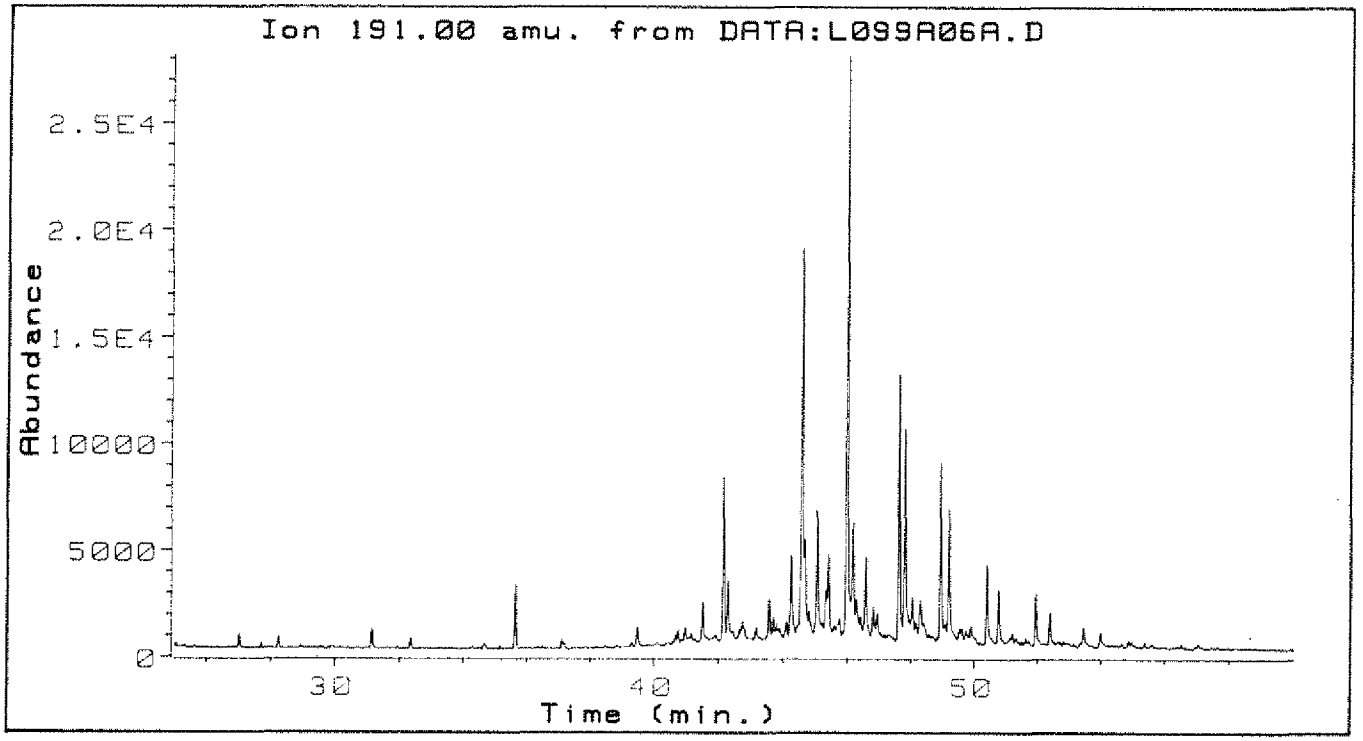
30/6-24s 3620+3622 m DC 1-2mm



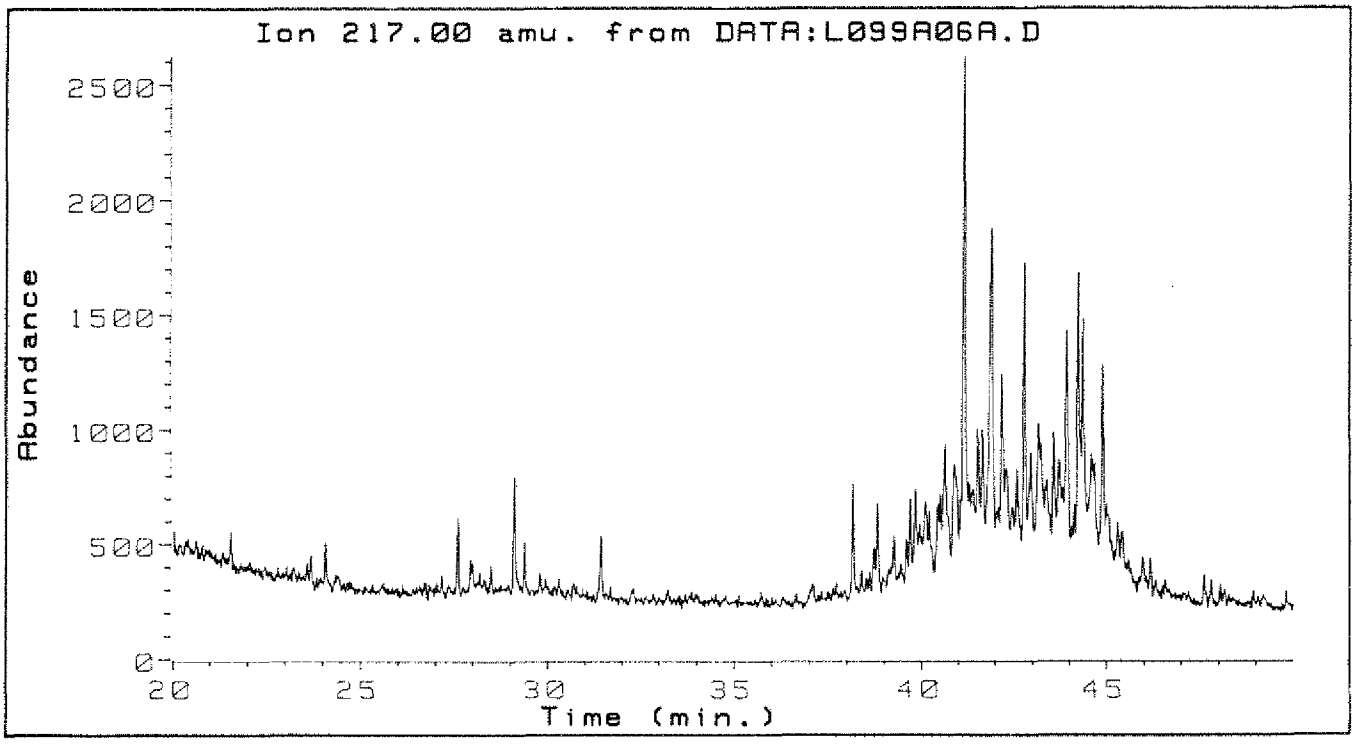


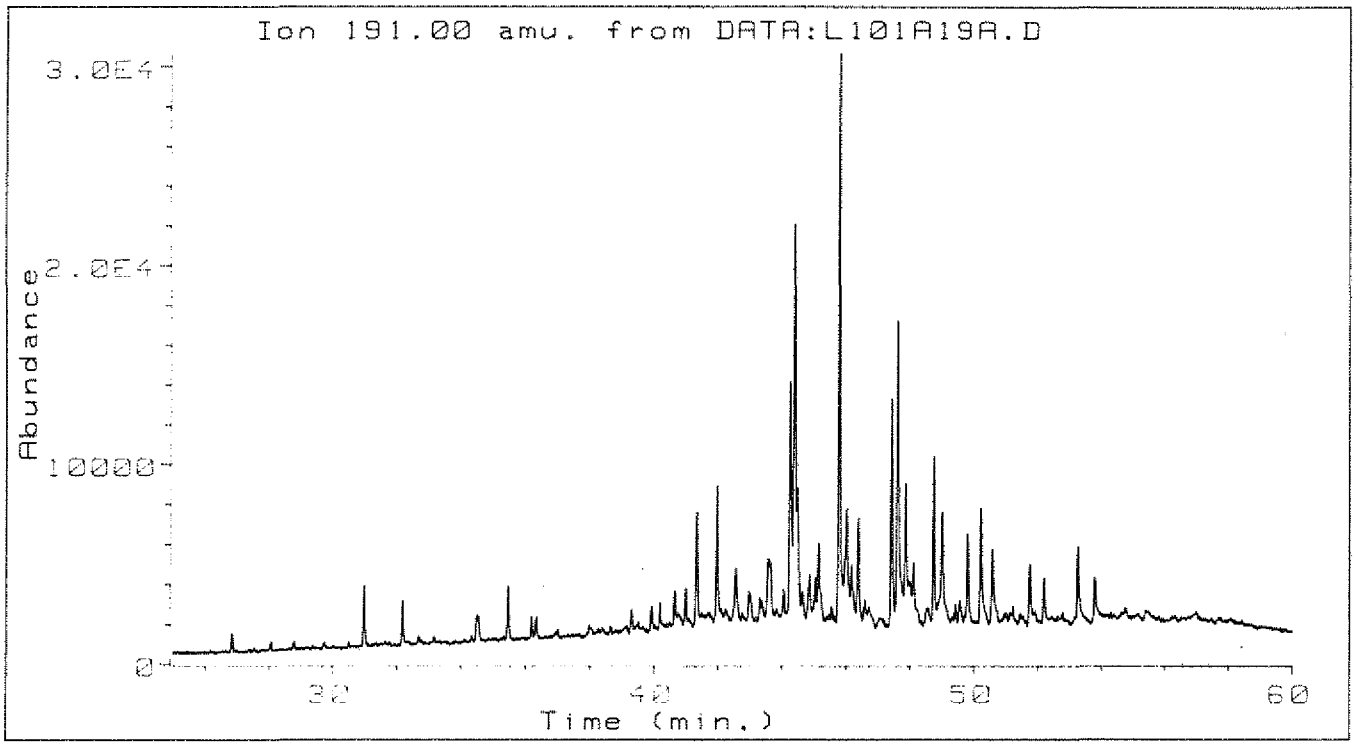
30/6-24s 3665 m DC 1-2mm



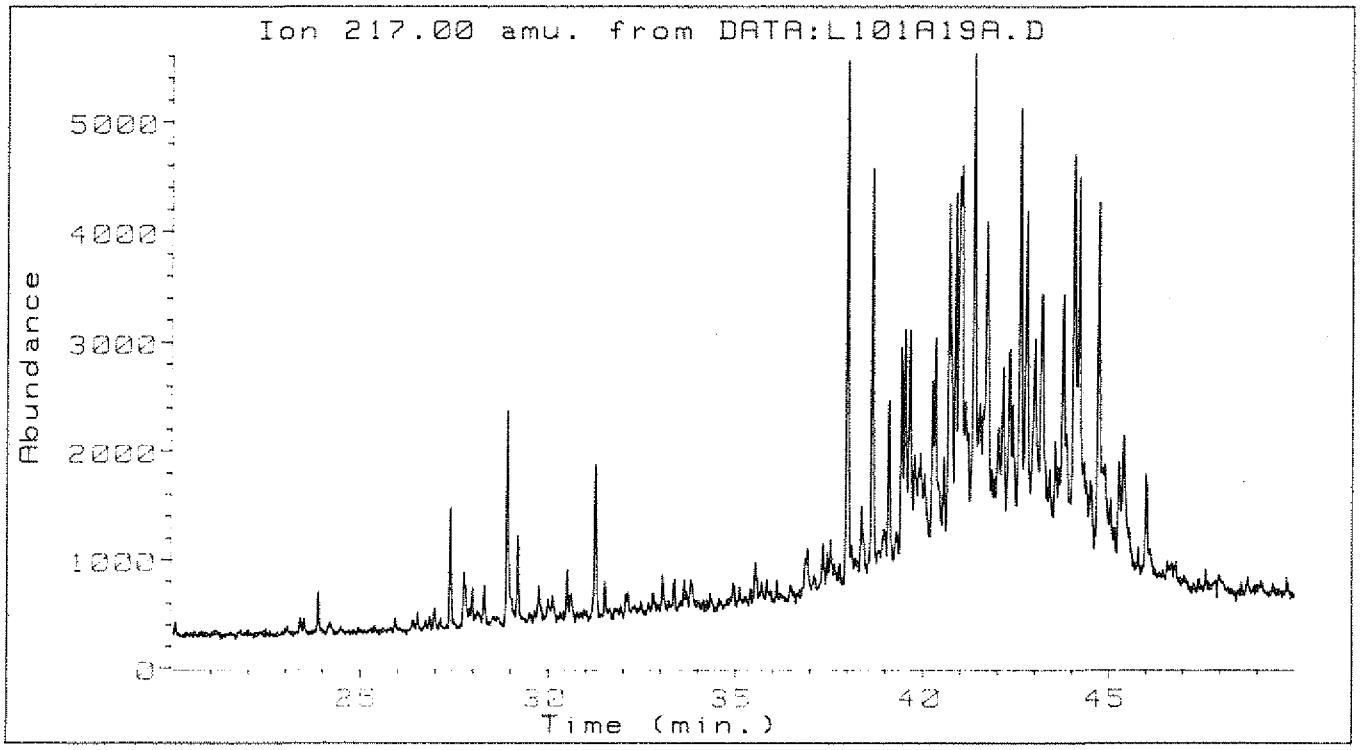


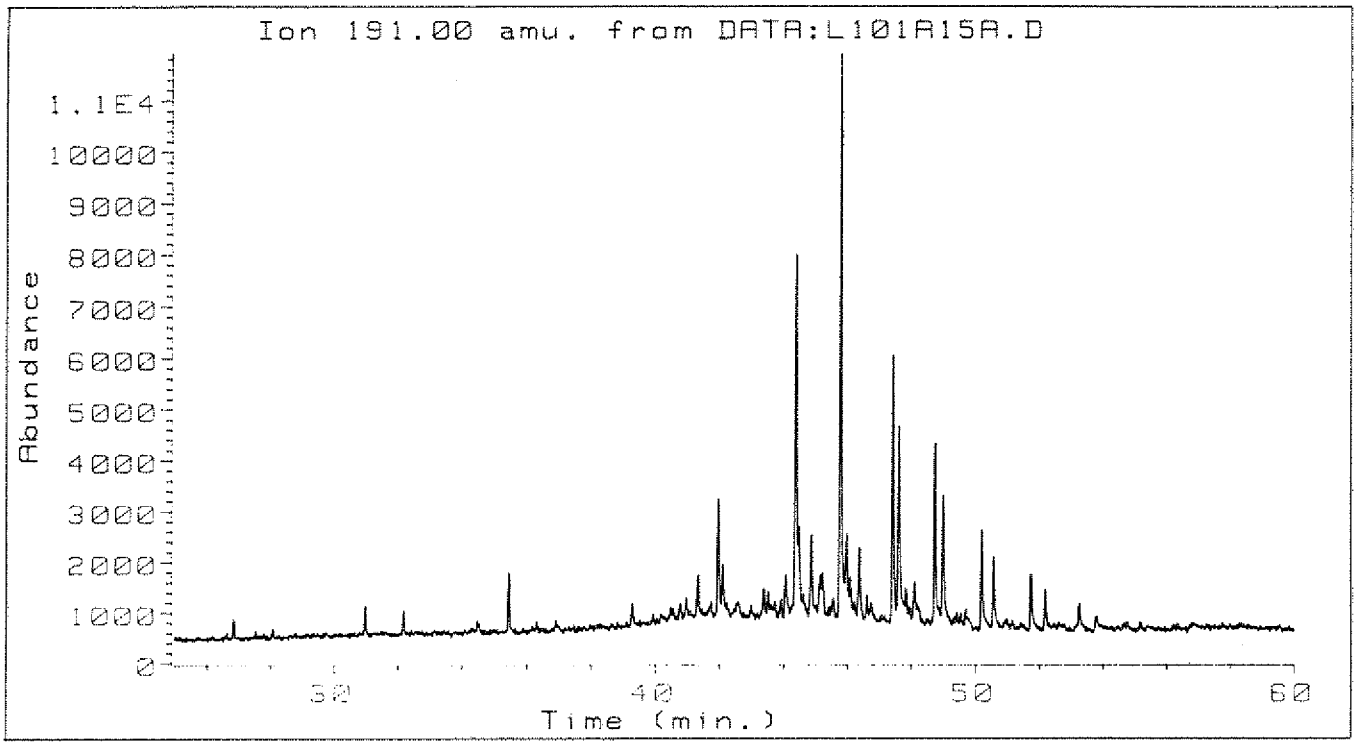
30/6-24s 3745 m COAL DC 1-2mm



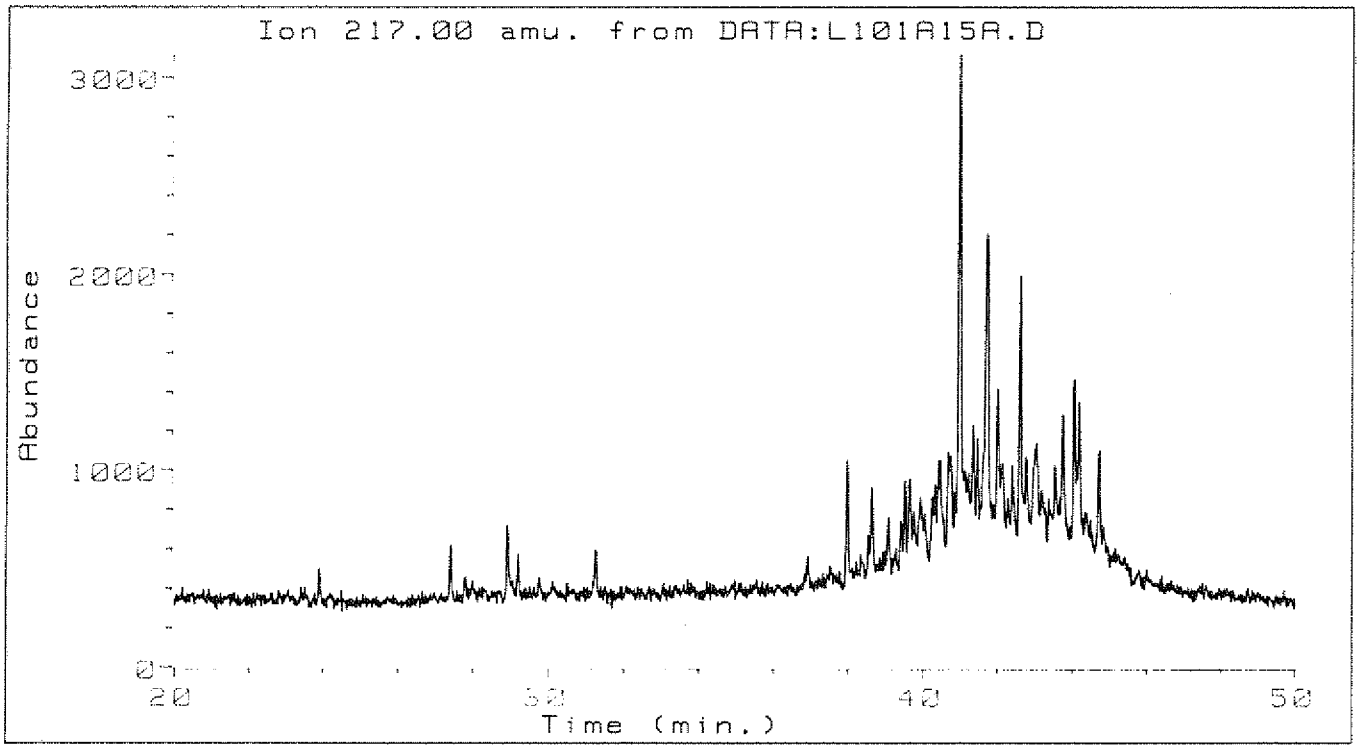


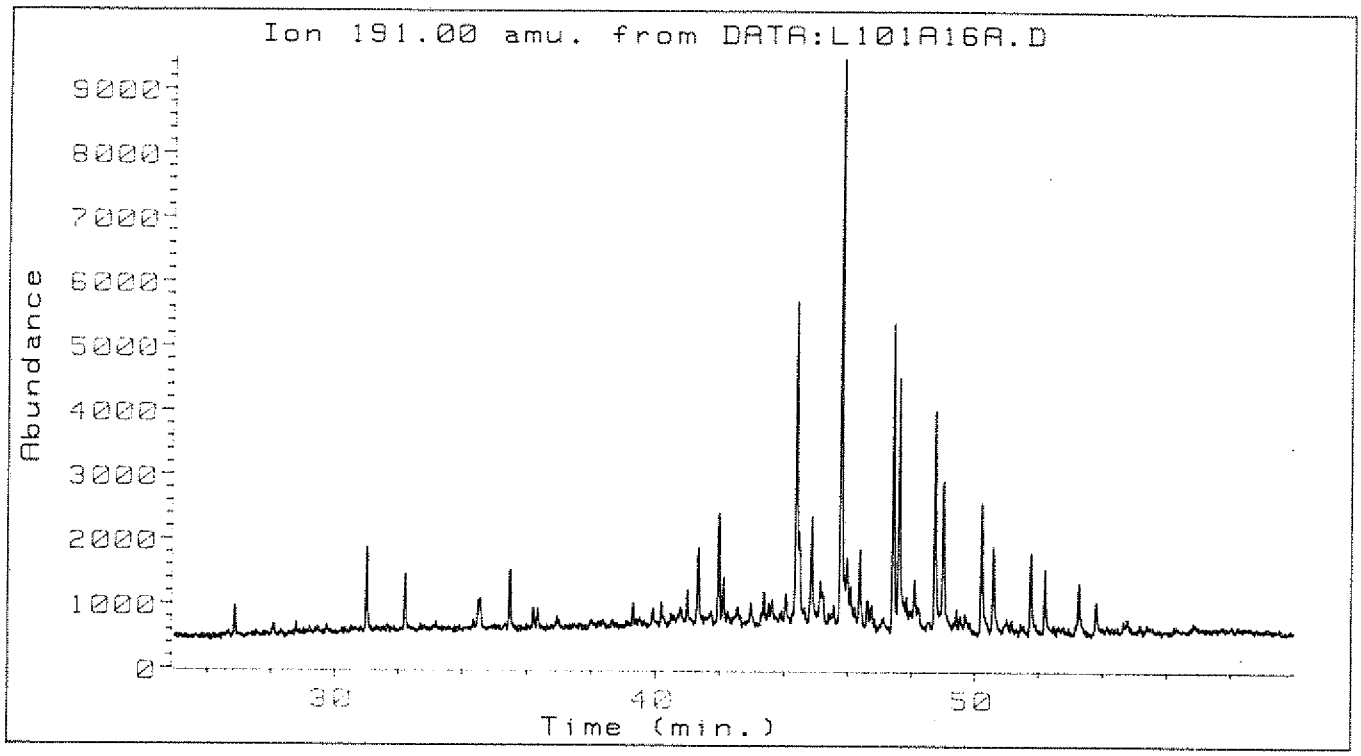
30/6-24s 2050 m DC+MUD



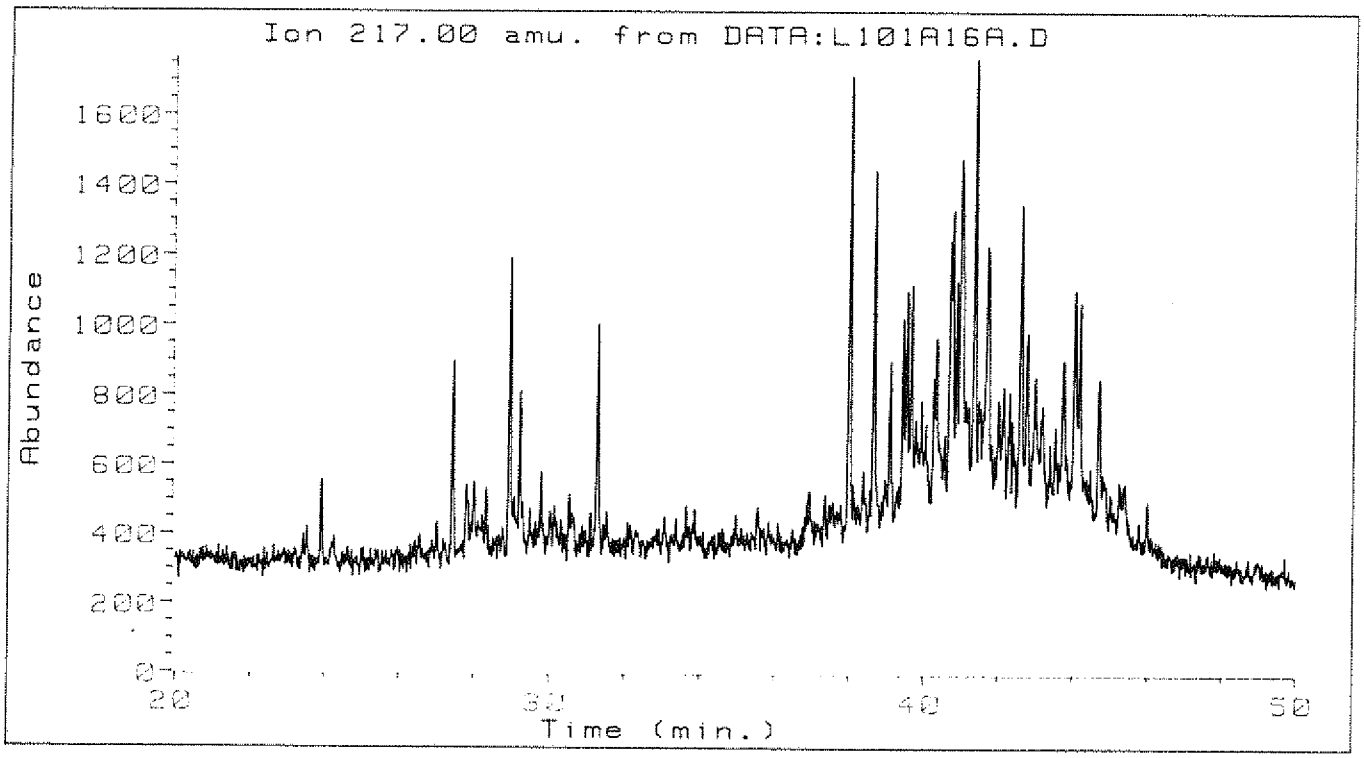


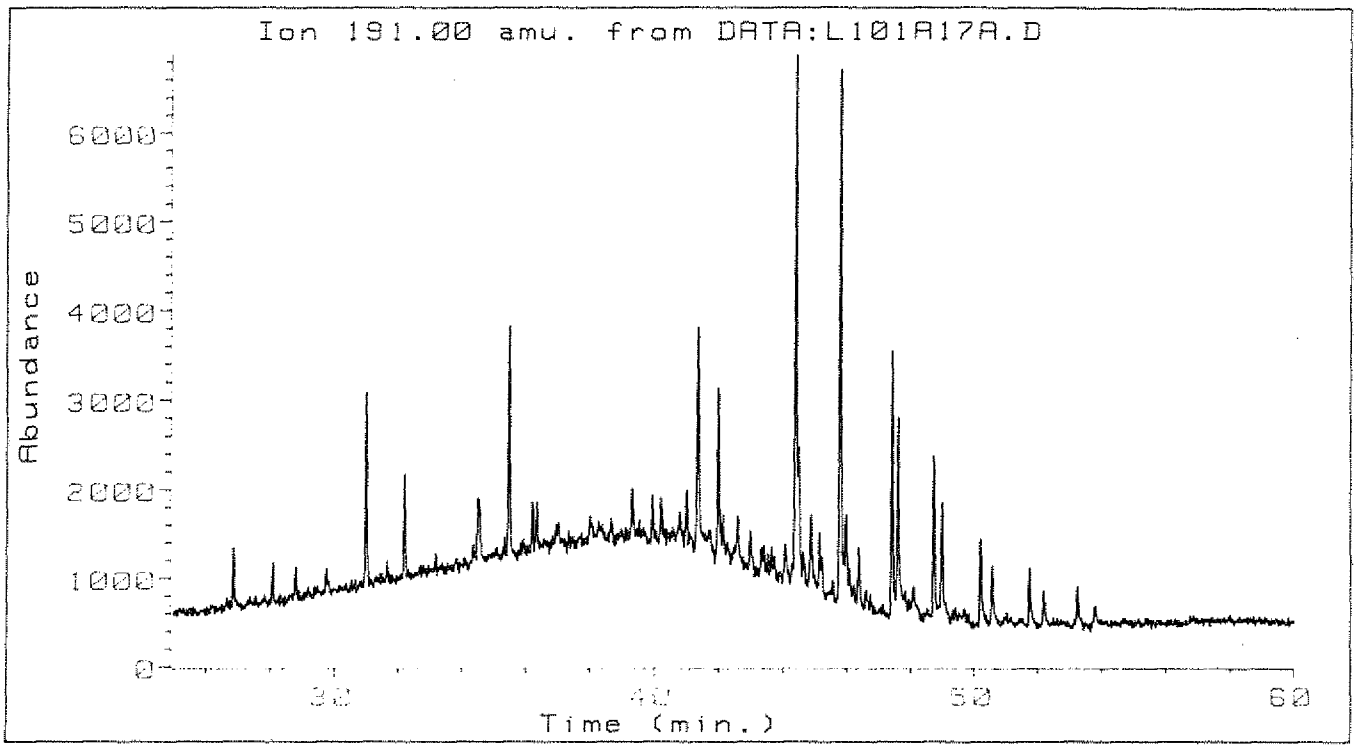
30/6-24s 3688 m SST COCH



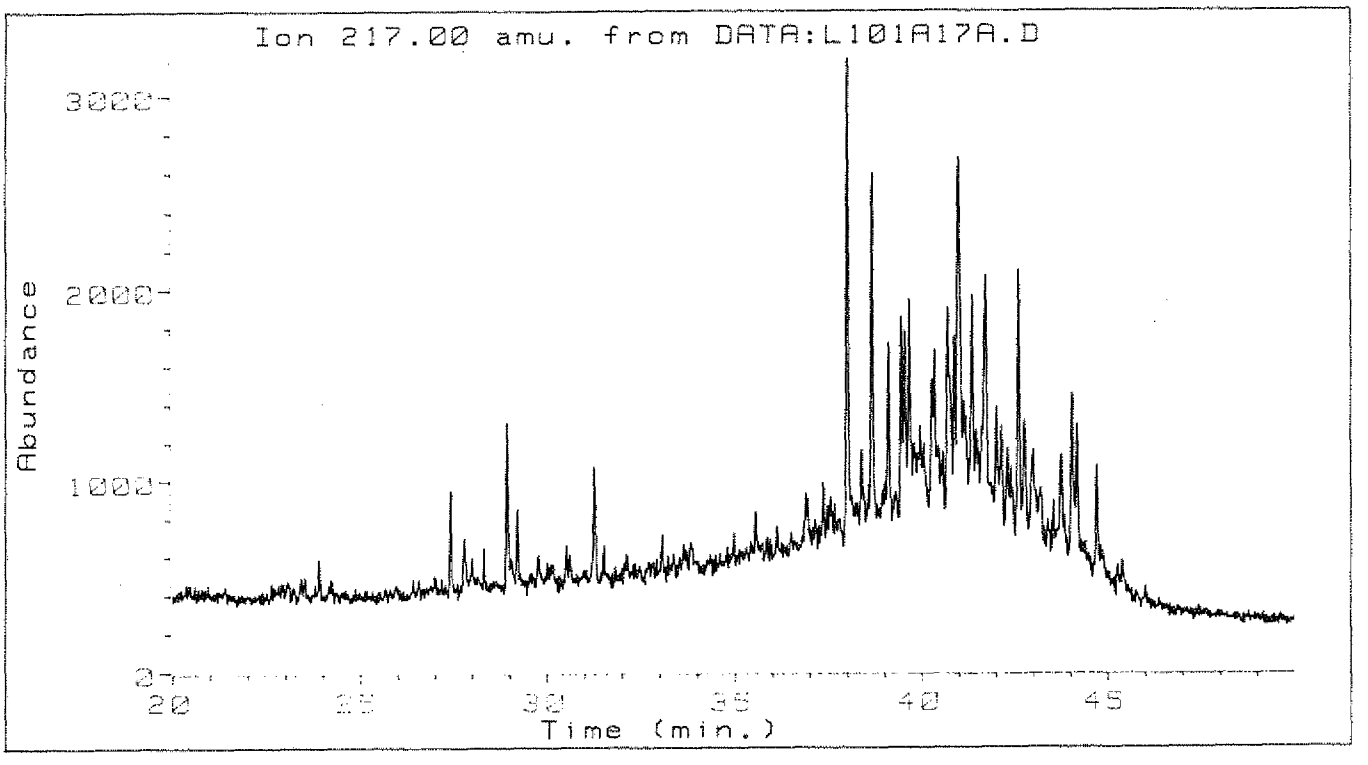


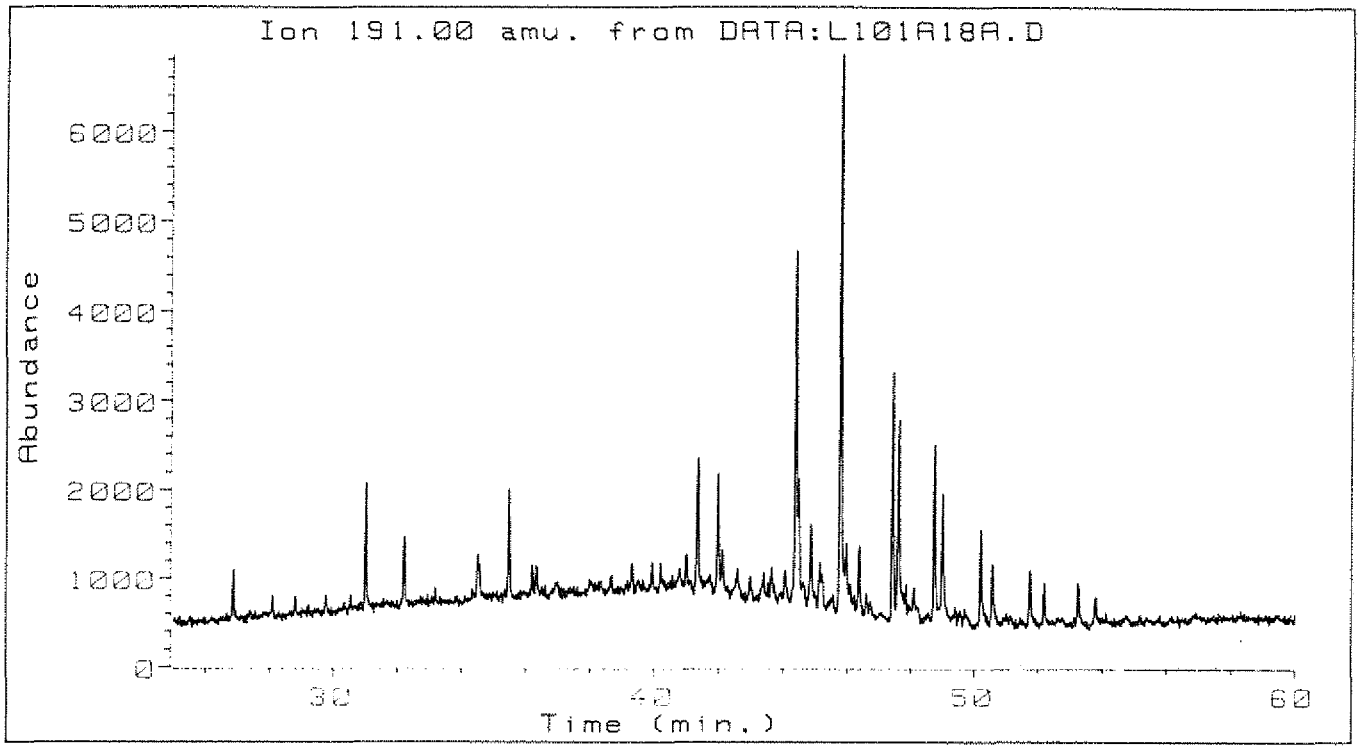
30/6-24s 3701 m SST COCH





30/6-24s 3702 m SSST COCH





30/6-24s 3704 m SST COCH