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ANALYSIS OF RESERVOIR HYDROCARBONS, WELL 7121/7-1
OPEN CONTRACT T-4533, No. 3

CLIENT/ OPPDRAGSGIVER
Statoil

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SUMMARY/ SAMMENDRAG

Ten core samples and one oil were analysed to characterise and compare the content of hydrocarbons. The oil is a light crude oil of a high maturity, while all the cores contain an oil with a high wax content. The depth interval between 1699.68m and 1903.50m shows the highest hydrocarbon content. The content decreases both above and below this interval. The quantity of hydrocarbons indicates significant oil saturation, especially in the above mentioned interval (Hunt, 1979).

All the analyses indicate that the hydrocarbons were generated from a source rock with a high input of humic material, that is, a type III or possibly a mixed type II/III kerogen. The maturity of the hydrocarbons is high both in the fluid and in the cores. The hydrocarobns have a somewhat lower maturity in the shallowest, least hydrocarbon saturated cores.

KEY WORDS/ STIKKORD

Hydrocarbons	7121/7-1
Troms	Correlation

142/p/jbl/1

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TABLES

FIGURES

1. INTRODUCTION

This report presents the results from the analysis of the reservoir hydrocarbons in well 7121/7-1 from Tromsø-flaket.

The samples received for analysis were as follows:

IKU No.	Sample type	Depth (m)
B-8414	Core	1852.25
B-8415	Core	1862.47
B-8416	Core	1881.71
B-8258	Core	1899.68
B-8259	Core	1900.82
B-8260	Core	1901.70
B-8261	Core	1903.50
B-8417	Core	1913.00
B-8262	Core	1926.50
B-8418	Core	1930.25
B-8257	Oil, DST No. 2	1866-71

The samples were assigned the IKU job number 05.1749.00 and the analyses were carried out according to the terms of the open contract T.4533, Job No. 3 from Statoil.

The analyses were as follows:

1) Oil/Condensate, 1 sample
   - API gravity
   - GC of whole oil
   - C_2-C_8 hydrocarbons
   - Chromatographic separation into saturates and aromatics
   - Separation of saturated hydrocarbons by urea adduction
   - GC of saturates, branched/cyclic hydrocarbons and aromatics
   - GC-MS of saturates and aromatics
   - $\delta^{13}C$ isotope analysis of whole oil, saturates and aromatics

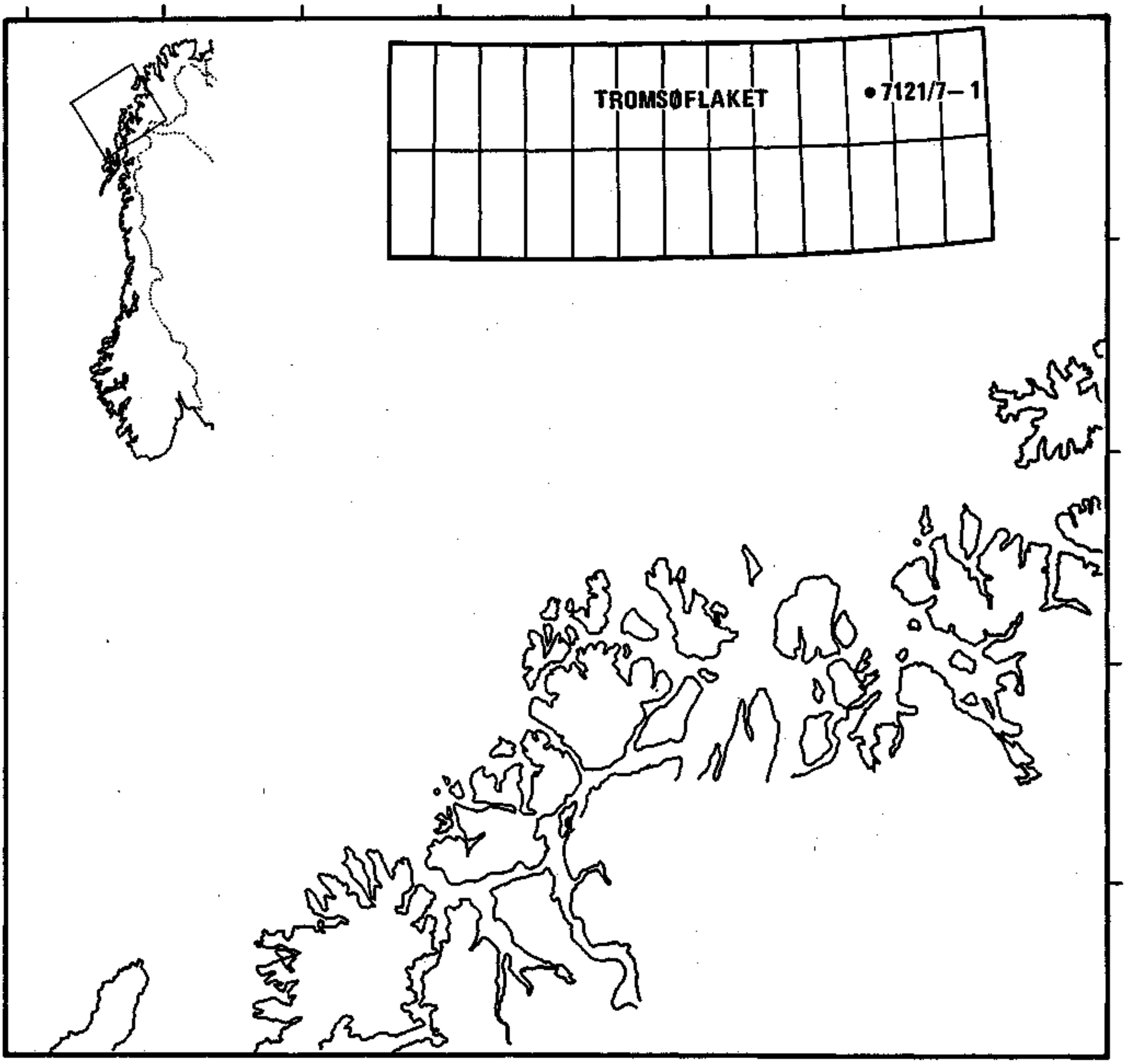
2) Core samples, 10 samples
   - Extraction
   - Chromatographic separation into saturates and aromatics

- GC of saturates and aromatics (calculation of MPI)
- GC-MS of saturates and aromatics (2 samples)
- $\delta^{13}C$ isotope analysis of extract, saturates and aromatics

The gas chromatograms are presented as Multichrom plots on a printer/-plotter system, and have a relatively poor resolution. This is especially obvious in Figure 1, where pristane (Pr) is seen as a shoulder on nC_{17}. These two peaks are resolved in the original data file and the Pr/nC_{17} ratio can be calculated from these data.

The predominance of odd over even carbon numbers, seen particularly in sample B-8414, (Figure 4) is real and is not caused by the data system.

Twenty copies of this final report have been made, Statoil has been sent ten, and ten are kept at IKU.


TROMSØFLAKET
7121/7-1

2. EXPERIMENTAL

2.1 Extractable Organic Matter

Powdered rock was extracted by flowblending for 3 minutes using dichloromethane (DCM) and methanol (1%) as solvent. The DCM used was of organic geochemical grade and blank analyses showed the occurrence of negligible amounts of contaminating hydrocarbons. Activated copper fillings were used to remove any free sulphur from the samples. After extraction the solvent was removed on a Buchi Rotavapor and the amount of extractable organic matter (EOM) was determined. Asphaltene precipitation was performed according to the procedure given by Statoil.

2.2 Chromatographic separation

The extractable organic matter (EOM) was separated into saturated fraction, aromatic fraction and non hydrocarbon fraction using a MPLC system with hexane as eluant (Radke et al., Anal. Chem., 1980). The various fractions were evaporated on a Buchi Rotavapor and transferred to glass vials and dried in stream of nitrogen.

The same separation procedure was applied to the fractions of oil/condensate samples boiling above 210°C.

2.3 Urea adduction

Urea-adduction was performed on the saturated hydrocarbon fraction. The sample containing 5 mg of n-alkanes was dissolved in 2 ml of n-hexane and 1 ml of acetone was added. A saturated solution of urea in methanol (1 ml) was then added dropwise. The solvent was removed (N_2) and the adduction step repeated twice. The white crystals were rinsed (3x5ml hexane) and the combined extract filtered (cotton wool plug covered with Al_2O_3), to afford a non-adduct. GC analyses were performed on the samples after the urea adduction, using the same conditions as for the other GC analyses.

2.4 Gas chromatographic analysis

Whole oil samples were analysed on a HP5730A GC, applying a temperature program from -50°C (2 min.) to 280°C at 4°C/min. The GC was fitted with a 15m DB-1 fused silica column. Hydrogen (2.5ml/min.) was used as carrier gas, and 0.02µl was injected in split mode (split ratio 1:10).

The C_2-C_8 hydrocarbon fraction was determined on a Carlo Erba Fractovap GC. The column used was a 30m fused silica capillary column coated with SE-54. The temperature program applied was $50^{o}C$ (2min.) to $180^{o}C$ at $4^{o}C$/min.

The saturated, the branched/cyclic and the aromatic hydrocarbon fractions were each diluted with n-hexane and analysed on a HP 5730A. The GC is equipped with a 15m DB-1 fused silica column and hydrogen (ca. 2.5 ml/min.) is used as carrier gas. Injections are performed in split mode (split ratio 1:10). The temperature program applied is $80^{o}C$ (2 min.) to $280^{o}C$ at $4^{o}C$/min.

The data processing for all the GC analyses was performed on a VG Multichrom lab data system.

2.5 Gas chromatography - mass spectrometry (GC-MS)

GC-MS analyses were performed on a VG Micromass 70-70H GC-MS-DS system. The Varian Series 3700 GC was fitted with a fused silica OV-1 capillary column (30m x 0.3mm i.d.). Helium (0.7kg/cm^2) was used as carrier gas and the injections were performed in split mode (1.5µl, split ratio 1:15). The GC oven was programmed from $70^{o}C$ to $280^{o}C$ at $4^{o}C$/min. after an initial isothermal period of 2 minutes.

The saturated hydrocarbons were analysed in multiple ion mode (MID) at a scan cycle time of approximately 2 secs. Full data collection was applied for the aromatic hydrocarbons at a scan time of 1 sec/decade. The mass spectrometer operated at 70eV electron energy and an ion source temperature of $200^{o}C$. Data acquisition was done by VG data systems.

Peak identification was performed applying knowledge of elution patterns in certain mass chromatograms. Calculation of peak ratios was done from peak height in the appropriate mass chromatograms.

2.6 $\delta^{13}C$ istotope analyis

The $\delta^{13}C$ isotope analysis was performed by mass spectrometry at Institute for Energy Technology (IFE) in Oslo according to their method. Their reference value for the standard NBS-22 is -29.8.

3. RESULTS AND DISCUSSION

3.1 API gravity

The API gravity of the oil (Table 1) was determined to be 52.4° API. This indicates that the oil is a light crude oil, with a high content of gasoline range hydrocarbons.

3.2 GC of whole oil

The gas chromatogram of the whole oil is presented in Figure 1. The normal alkanes in the range nC_6-nC_{15} are abundant. Cycloalkanes and aromatics such as benzene and toluene are also prominent. This suggests either a source rock with a high aromatic content, i.e. a terrestrial humic type, or possibly that biodegradation of the oil may have occurred.

3.3 C_2-C_8 hydrocarbons

The quantitative data and the gas chromatogram from the C_2-C_8 hydrocarbon analysis are presented in Table 2 and Figure 2, respectively. The gas chromatogram of the light hydrocarbons presents similar results to those obtained from gas chromatography of the whole oil and shows abundant cycloalkanes and aromatics in addition to the n-alkanes. The ratio between branched and normal alkanes is less than unity both for iC_4/nC_4 (0.33) and iC_5/nC_5 (0.67), suggesting that no heavy biodegradation has taken place. This would indicate that the high aromatic content is due to a type III or II/III source rock. The high aromatic content also indicates a highly mature condensate.

3.4 Extraction and separation

Ten core samples were extracted before chromatographic separation of the extractable organic matter. The light components of the oil, boiling below 210°C, were evaporated before chromatographic separation. The weights and relative amounts of the various chromatographic fractions are given in Tables 3-6.

All ten cores contain high amounts of extractable organic matter. The depth interval between 1899.68 to 1903.50m has the highest concentration of extractable organic matter. Based on the crossplot of organic carbon and ppm $C_{15}+$ hydrocarbons, most of the ten cores fall in the zone for reservoir rockss or very close to the borderline between this zone and the nonreservoir zone (Figure 3). The samples in the interval mentioned above, 1899.68-1903.50m, fall in the upper part of the reservoir zone. The two deepest cores at 1926.50-1930.25m, also have values in the reservoir zone. The light crude oil was taken approximately 30m above the depth interval of the richest cores.

The oil contains approximately 14% saturated and 6% aromatic hydrocarbons which gives a SAT/ARO ratio equal 2.4 and a hydrocarbons/non-hydrocarbons ratio of 0.2. The SAT/ARO ratios of nine of the cores are quite similar to that of the oil (1.6-2.7). Core B-8417 at 1913.00m, which also contains a poor amount of hydrocarbons, shows a lower SAT/ARO ratio of 1.3. The hydrocarbons/non-hydrocarbons ratios for four of the cores (B-8414, B-8415, B-8416 and B-8262) are similar to that of the oil. The other cores, except for B-8417, have a higher hydrocarbon content i.e. hydrocarbon/non-hydrocarbons ratios of 0.5-0.75. This high relative hydrocarbon content occurs in the interval with richest hydrocarbon content.

3.5 Gas chromatography of $C_{15}+$ saturated hydrocarbons

Gas chromatograms of the saturated hydrocarbon fractions are presented in Figure 4 and data from the gas chromatograms are given in Table 7.

The gas chromatogram of the oil shows a smooth, front-biased n-alkane distribution with a maximum at nC_{14} and poor development of the heavy molecular weight hydrocarbons.

The gas chromatograms of the ten cores are all very similar, and show a quite different pattern compared to that of the oil. A unimodal n-alkane distribution with a maximum at approximately nC_{22} is seen in the core extracts' gas chromatograms. Five of the cores show a low relative amount of internal standard which is due to the presence of a higher abundance of migrated hydrocarbons in these samples. This is supported by the high hydrocarbon/non-hydrocarbon ratios of the same samples. The distribution of n-alkanes suggests a waxy oil that has been generated from a source with high input of terrestrial humic material.

The pristane/nC_{17} ratios of the ten cores and the oil are all similar, while the pristane/phytane ratios show differences. The pristane/phytane ratios of the cores range from 1.4 to 1.7, (excluding the shallowest core which has a ratio of 0.9), while the pristane/phytane ratio of the oil has a higher value of 2.4. This would also indicate a source rock which has had a high input of terrestrial material, possibly a mixed type II/III kerogen. The differences between the oil and the core extracts may be due simply to the generally high content of lower molecular weight compounds in the oil.

The CPI values of the core extracts are low (0.9-1.1) and suggest that the samples are mature, with the possible exception of the shallowest core (B-8414) which has had an input of less mature hydrocarbons. Two explanations can be suggested for the origin of the hydrocarbons in the oil and the cores. One is that they have all been generated from the same source and the light oil has been separated from the rest through migration. This is a likely explanation since the light oil is reservoired at a shallower depth than the core intervals which have the highest quantity of hydrocarbons. The second explanation is that different type of source rocks have generated the oil and the core hydrocarbons.

3.6 Gas chromatography of C_{15}+ branched/cyclic hydrocarbons

The saturated hydrocarbon fraction of the oil, B-8257 was separated by urea adduction. The gas chromatogram of the branched/cyclic hydrocarbons is presented in Figure 5. The pristane/phytane ratio of 2.4 is the same as was obtained from the gas chromatogram of the saturated hydrocarbon fraction. The usual C_{15}-C_{20} isoprenoids are the main components and polycyclic compounds do not appear to be abundant. This indicates an oil of high maturity that has been sourced from terrestrial matter.

3.7 Gas chromatography of C_{15}+ aromatic hydrocarbons

Table 8 gives the MNR, DMNR, MPI 1 and MPI 2 ratios calculated from the gas chromatograms and Figure 6 presents the gas chromatograms of the aromatic hydrocarbons.

The methyl- and dimethyl-naphthalenes are most prominent in the gas chromatogram of the oil, while phenanthrene and it's alkylated homologs are not seen. The gas chromatograms of the ten core extracts are quite similar to each other. Dimethyl- and trimethyl-naphthalenes, phenanthrene and alkylated phenanthrenes are prominent. The abundance of the methyl-naphthalenes varies and these compounds are most prominent in the lowermost sample, B-8418 at 1930.25m. These differences could be due to small variations in the work-up procedure. This will affect the low molecular weight compounds and thus the relative abundance. The MNR ratios of the cores (1.1-1.6) and the oil (1.6) are similar. The DMNR ratios vary, but they are all high, and the oil shows the highest value (3.8). The MPI values of the cores are also high and generally fall between values of 0.8 and 1.0. These values suggest a maturity which is equivalent to a vitrinite reflectance of approximately 0.85-1.0% Ro. The MPI 2 values are similar to the values of the MPI 1 ratio. At this maturity level no information about type of source rock can be extracted from the aromatic chromatograms.

3.8 GC-MS analysis of saturated terpanes and steranes

Mass chromatograms representing terpanes (m/z 191) and steranes (m/z 217 and 218) are shown in Figure 7 and molecular ratios calculated from the chromatograms are given in Tables 9 and 10.

Only two of the core sample extracts were analysed by GC-MS, together with the oil sample. The general distribution of terpanes is dominated by the ubiquitous 17α,21β-hopanes in the two core extracts. The oil has a high relative abundance of tricyclic terpanes (P-T in m/z 191) in good agreement with a light crude/condensate type oil. The high abundance of the peak A is probably due to a contaminant. Squalene has been identified in other samples with low amounts of terpanes and has been seen to coelute with one of the trisnorhopanes, Ts (Peak A). Apart from the higher input of lower molecular weight terpanes in the oil, the distribution of terpanes in the oil is most similar to that of the extract from the deepest of the two cores at 1903.50m (B-8261). The other core extract seems to contain hydrocarbons of lower maturity. None of the samples contain the 28,30-bisnorhopane that is seen in many samples from the North Sea.

A lower maturity for the uppermost core sample at 1862.47m, is also suggested by the distribution of both the %ββ and %20S steranes. The sterane chromatogram of oil sample suggests the presence of the same contaminant as was seen in the m/z 191 trace, i.e. a squalene peak coeluting with peak j in the m/z 217 chromatogram. Apart from this peak the sterane trace of the oils is dominated by low molecular weight steranes (u, v in m/z 217) and rearranged steranes. This is in good agreement with the other data for the oil and indicates that the oil has been generated from a mature source rock. The distribution of 14β,17β-steranes (m/z 218) shows that both core sample extracts contain higher relative amounts of C_{29} steranes, suggesting a source rock with high input of terrestrial organic matter. A comparison of the oil sample with the core extracts is complicated by the higher amount of low molecular weight compounds in the oil. Based on these data it is not possible to say if one source is responsible for the hydrocarbons in the cores and for the oil. There is, however, no information in the GC-MS data that excludes one common source.

3.9 GC-MS analysis of aromatic hydrocarbons

Mass chromatograms are presented in Figure 8 and certain aromatic ratios are given in Table 11.

As was already discussed on the aromatic hydrocarbon GC's, the oil contains abundant naphthalenes and hardly any phenanthrenes or other higher molecular weight compounds. Both core extracts have a higher input of higher molecular weight aromatics. The main difference in the mass chromatograms are the shorter benzene alkyl chains that are seen in the oil. The internal distribution of naphthalenes, phenanthrenes and dibenzothiophenes is very similar in all three samples, while only the deepest core showed any content of aromatic steranes.

3.10 $\delta^{13}C$ isotope analysis

The results from $\delta^{13}C$ isotope analysis of extracts and hydrocarbon fractions are given in Table 12.

The maximum variations within the individual fractions are less than 1 unit for the ten core samples. The isotope values for the oil are for all three fractions slightly above the intervals seen for the same fractions of the core samples. This suggests that the source of the oil is isotopically fairly similar to the source of the core hydrocarbons. The low $\delta^{13}C$ values support the suggestion that a terrestrial source has generated the hydrocarbons.

4. CONCLUSION

Ten core samples and one oil were analysed to characterise and compare the content of hydrocarbons. The oil is a light crude oil of high maturity, while all the cores contain an oil with a high wax content. The depth interval between 1699.68m and 1903.50m shows the highest hydrocarbon content. The hydrocarbon content decreases both above and below this interval. The quantity of hydrocarbons indicates significant oil saturation, especially in the above mentioned interval (Hunt, 1979).

All the analyses indicate that the hydrocarbons were generated from a source rock with a high input of humic material, that is, a type III or possibly a mixed type II/III kerogen. The maturity of the hydrocarbons is high both in the fluid and in the cores. The hydrocarbons have a somewhat lower maturity in the shallowest, least hydrocarbon saturated cores.

It is difficult to say whether the same source rock is responsible for the oil and the core extracts, but none of the data excludes a common source.

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APPENDIX

Molecular ratios from terpane and sterane mass chromatograms applied as maturity and source characteristic parameters

Geochemical fossils or biological marker components are characteristic of the type of organic matter present at the time the sediments were deposited. The biological isomers of these components undergo changes due to increased maturity in particular, but also to a certain degree caused by migration and weathering processes.

Source characteristic parameters

In the m/z 191 mass chromatograms which represent the terpanes, the hopanes and moretanes are the major components in most extracts and oils. Of the hopanes the C_{27} and C_{29}-C_{35} homologs are ubiquitous, while the C_{28} bisnorhopane is believed to be typical of certain types of source rocks. This is also the case for the component, probably gammacerane, sometimes seen to coelute with the 22S isomer of the C_{31} 17α(H)-hopanes (H). In the sterane mass chromatograms, m/z 217 and m/z 218, the molecular weight distribution of the C_{27}-C_{29} regular steranes is believed to be representative of the original input of organic matter. The highest molecular weight compounds, the C_{29} steranes, represent organic matter of terrestrial origin, while the lower molecular weight analogs originate from more marine type environments.

Maturity dependant parameters

The biological isomers of the hopanes, the 17β(H), 21β(H)-hopanes, undergo structural changes during the maturation process. The isomerisation reactions are thought to be produced via the 17β(H), 21α(H)-hopanes (moretanes) to the most stable 17α(H), 21β(H)-hopanes. At equilibrium 100% of the 17α(H)-hopanes are seen. The ratio αβ/αβ+βα is used to describe this reaction. In the extended hopanes ($\geq C_{31}$), the thermally stable S configurations at C-22 become increasingly more abundant as compared to the biologically preferred R configurations at increased maturity level. The equilibrium ratio is approximately 60% of the 22S configuration. Another ratio that is known to change with maturity is the Tm/Ts (Seifert et al., 1978) of the C_{27} hopanes. The maturable 18α(H)-trisnorneohopane (Tm) is reduced in intensity relative to the more stable 17α(H)-trisnorneohopane (Ts), causing the Tm/Ts to decrease at increased maturity. This ratio is also believed to be source dependant, and this should be born in mind when applying the ratio for maturity comparison. The amount of tricyclic terpanes is also to a certain extent seen to be maturity dependant.

Two isomerisation reactions taking place in the steranes are most commonly applied for maturity assignments from the m/z 217 mass chromatograms. The biologically preferred 14α(H), 17α(H)-isomers of the regular steranes is transformed to the thermally stable 14β(H), 17β(H)-steranes, the %ββ approaching 75% at equilibrium. An equilibrium concentration of 50% is seen of the stable S configuration at C-20 as opposed to the 100% of the biological 20R epimer (Mackenzie et al., 1980). The abundance of rearranged steranes increased with increasingly maturity.

One of the reactions taking place at an early stage of diagenesis is the aromatisation of steranes, leading to the formation of mono- and tri-aromatic analogs. This process is measured as the abundance of tri-aromatic relative to mono-aromatic compounds (% tri/tri + mono) in the m/z 231 and 253 mass chromatograms, respectively. In addition the degree of side chain cracking, as $\%C_{20}/C_{26,27}$ and $\%C_{21}/C_{28,29}$ respectively, is applied. These cracking processes are also taking place during early diagenesis, and are used for maturity assignment together with the previously mentioned ratios.

Migration and weathering

The effect on the geochemical fossils of migration and weathering, is less apparent than the maturity induced changes. Migration is believed to cause an increase in the relative amounts of rearranged and 14β(H), 17β(H) regular steranes (Seifert and Moldowan, 1978, 1981). Severe biological alteration leads to the formation of desmethyl-hopanes (Seifert and Moldowan, 1979).

Table 1. API gravity.

IKU no.	Code	Depth (m)	Density	API gravity
B-8257	DST no.2	1866-71	0.7686	52.4^{o}

Table 2. Light hydrocarbons C_2-C_8.

B-8257

	% of total oil
C_2	
C_3	
MC_3 (iC_4)	0.3
nC_4	0.9
MC_4 (iC_5)	1.6
nC_5	2.4
CyC_5+2,3DMC_4+2MC_5	2.4
3MC_5	1.2
nC_6	3.7
$MCyC_5$	2.2
Benzene	1.9
CyC_6	2.6
2MC_6	1.5
2,3DMC_5	0.5
3MC_6	1.9
$DMCyC_5$	2.1
nC_7	4.4
$MCyC_6$	6.5
Toluene	4.9
2MC_7	1.8
3MC_7	1.4
$DMCyC_6$	1.3
nC_8	4.2
(m+p)-xylene	2.3
o-xylene	2.0

Abbreviations

C_2	ethane
C_3	propane
MC_3 (iC_4)	methylpropane
nC_4	butane
MC_4 (iC_5)	methylbutane
nC_5	pentane
$CyC_5+2,3DMC_4+2MC_5$	cyclopentane+2,3dimethylbutane+2methylpentane
$3MC_5$	3-methylpentane
nC_6	hexane
$MCyC_5$	methylcyclopentane
CyC_6	cyclohexane
$2MC_6$	2-methylhexane
$2,3DMC_5$	2,3-dimethylpentane
$3MC_6$	3-methylhexane
$DMCyC_5$	1cis3dimethylcyclopentane+2tr2dimethylcyclopentane
nC_7	heptane
$MCyC_6$	methylcyclohexane
$2MC_7$	2-methylheptane
$3MC_7$	3-methylheptane
$DMCyC_6$	dimethylcyclohexane
nC_8	octane

TABLE : 3.

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKU-No	DEPTH (m)	Rock Extr. (g)	EOM (mg)	Sat. (mg)	Aro. (mg)	HC (mg)	Non HC (mg)	TOC (%)
B 8414	1852.25	28.3	67.5	8.0	4.0	12.0	55.5	0.41
B 8415	1862.47	36.0	92.8	9.1	4.0	13.1	79.7	0.19
B 8416	1881.71	27.2	61.4	7.2	2.8	10.0	51.4	0.15
B 8258	1899.68	26.9	172.5	40.6	15.7	56.3	116.2	0.41
B 8259	1900.82	28.3	381.6	87.6	48.5	136.1	245.5	0.68
B 8260	1901.70	21.8	299.9	87.8	32.0	119.9	180.0	0.62
B 8261	1903.50	28.9	319.4	80.2	37.8	118.0	201.4	0.45
B 8417	1913	50.5	126.1	6.2	4.9	11.2	114.9	0.18
B 8262	1926.50	25.8	72.2	10.9	4.9	15.8	56.4	0.17
B 8418	1930.25	33.4	101.5	29.2	14.4	43.6	57.9	0.45
B 8257 oil	1866-71 DST-2	938.7*	301.6**	42.5	17.6	60.1	241.5	0.00

DATE : 7 - 1 - 85.

* Amount of crude oil (mg).

** Amount of oil boiling above $210^{\circ}C$.

TABLE : 4.

WEIGHT OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm OF rock)

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
B 8414	1852.25	2384	284	140	424	1960
B 8415	1862.47	2576	253	110	363	2214
B 8416	1881.71	2255	264	101	366	1889
B 8258	1899.68	6420	1509	585	2095	4325
B 8259	1900.82	13484	3095	1714	4809	8675
B 8260	1901.70	13757	4029	1470	5499	8258
B 8261	1903.50	11063	2777	1310	4087	6976
B 8417	1913	2500	124	98	221	2278
B 8262	1926.50	2800	423	191	614	2185
B 8418	1930.25	3035	872	431	1303	1733
B 8257 oil	1866-71 DST-2					

DATE : 7 - 1 - 85.

TABLE : 5.

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
B 8414	1852.25	581.5	69.3	34.1	103.4	478.2
B 8415	1862.47	1356.7	133.3	57.9	191.2	1165.5
B 8416	1881.71	1503.2	176.3	67.6	243.8	1259.4
B 8258	1899.68	1565.8	368.2	142.7	510.9	1054.9
B 8259	1900.82	1983.0	455.2	252.0	707.2	1275.7
B 8260	1901.70	2218.9	649.9	237.1	886.9	1331.9
B 8261	1903.50	2458.5	617.2	291.0	908.2	1550.3
B 8417	1913	1388.6	68.7	54.2	122.9	1265.7
B 8262	1926.50	1646.8	249.1	112.2	361.3	1285.5
B 8418	1930.25	674.5	193.8	95.7	289.5	385.0
B 8257 oil	1866-71 DST-2					

DATE : 7 - 1 - 85.

TABLE : 6.

COMPOSITION IN % OF MATERIAL EXTRACTED FROM THE ROCK

IKU-No	DEPTH (m)	Sat / EOM	Aro / EOM	HC / EOM	SAT / Aro	Non HC / EOM	HC / Non HC
B 8414	1852.25	11.9	5.9	17.8	203.0	82.2	21.6
B 8415	1862.47	9.8	4.3	14.1	230.3	85.9	16.4
B 8416	1881.71	11.7	4.5	16.2	260.9	83.8	19.4
B 8258	1899.68	23.5	9.1	32.6	258.0	67.4	48.4
B 8259	1900.82	23.0	12.7	35.7	180.6	64.3	55.4
B 8260	1901.70	29.3	10.7	40.0	274.2	60.0	66.6
B 8261	1903.50	25.1	11.8	36.9	212.1	63.1	58.6
B 8417	1913	4.9	3.9	8.9	126.8	91.1	9.7
B 8262	1926.50	15.1	6.8	21.9	222.0	78.1	28.1
B 8418	1930.25	28.7	14.2	42.9	202.5	57.1	75.2
B 8257 oil	1866-71 DST-2	14.1	5.8	19.9	241.5	80.1	24.9

DATE : 7 - 1 - 85.

TABLE 7

TABULATION OF DATA FROM THE GASCHROMATOGRAMS

IKU No.	DEPTH (m)	PRISTANE / n-C17	PRISTANE / PHYTANE	CPI-1	CPI-2
B 8414	1852.25	0.8	0.9	1.1	1.3
B 8415	1862.47	0.6	1.7	1.1	1.2
B 8416	1881.71	0.6	1.7	1.1	1.2
B 8258	1899.68	0.8	1.4	1.0	1.0
B 8259	1900.82	0.8	1.5	1.0	1.0
B 8260	1901.70	0.8	1.4	0.9	1.0
B 8261	1903.50	0.8	1.4	1.0	1.0
B 8417	1913	0.6	1.7	1.0	1.1
B 8262	1926.50	0.6	1.7	1.1	1.1
B 8418	1930.25	0.8	1.5	1.0	1.1
B 8257 oil	1866-71 DST-2	0.7	2.4	-	-

DATE : 7 - 1 - 85.

Table 8. Aromatic ratios.

IKU no.	Depth (m)	MNR	DMNR	MPI 1	MPI 2
B-8414	1852.25	1.2	2.5	0.83	0.83
B-8415	1862.47	1.3	2.8	0.84	0.88
B-8416	1881.71	1.1	3.1	0.87	0.88
B-8258	1899.68	1.4	3.6	0.92	0.94
B-8259	1900.82	1.5	3.4	0.93	0.93
B-8260	1901.70	1.4	3.2	1.02	1.04
B-8261	1903.50	1.4	3.0	0.95	0.95
B-8417	1913.00	1.2	2.4	0.85	0.85
B-8262	1926.50	1.2	3.0	0.90	0.95
B-8418	1930.25	1.6	3.3	0.81	0.81
B-8257 oil	1866-71	1.6	3.8	-	-

Table 9.
Molecular ratios calculated from terpane and sterane mass chromatograms.
Maturity ratios.

IKU No.	DEPTH (m)	1) $\alpha\beta/\alpha\beta+\beta\alpha$	2) %22S	3) % $\beta\beta$	4) %20S
88415	1862.47	0.84	60.00	45.45	25.69
88261	1903.50	0.91	61.11	74.00	52.88
88257	oil	0.91	62.50	77.42	57.14

1) E/E+F in m/z 191.
2) % distribution between first and second elution isomers of doublet J (m/z 191)
3) 2(r+s)/(q+t+2(r+s)) in m/z 217.
4) q/q+t in m/z 217.

Table 10.

Molecular ratios calculated from terpane
and sterane mass chromatograms.
Source characteristic and maturity ratios.

IKU No.	DEPTH (m)	1) Q/E	2) Tm/Ts	3) X/E	4) a/a+j	5) Z/E
B8415	1862.47	0.03	1.29	0.03	0.42	0.00
B8261	1903.50	0.05	0.94	0.09	0.65	0.00
B8257	oil	1.18	0.23	0.04	0.52	0.00

1) Relative abundance of tricyclic terpanes(Q/E in m/z 191).
2) B/A in m/z 191.
3) Relative abundance of unknown(X/E in m/z 191).
4) Relative abundance of C27 rearranged steranes(a/a+j).
5) Relative abundance of bisnorhopane(Z/E in m/z 191).

Table 11. Maturity ratios from aromatic steranes.

Sample	Depth (m)	m/z 253 $\%C_{21}/C_{21}+C_{28,29}$	m/z 231 $\%C_{20}/C_{20}+C_{26,27}$	%TRI/TRI+MONO
B-8257	Oil	-	-	-
B-8415	1862.47	25.0	-	61.1
B-8261	1903.50	30.8	23.6	70.2

Table 12. $\delta^{13}C$ isotope data.

Sample	Depth (m)	SAT	ARO	Extract/Oil
B-8214	1852.25	-30.2	-28.0	-29.3
B-8215	1862.47	-29.6	-28.6	-28.8
B-8216	1881.71	-29.6	-28.4	-29.2
B-8258	1899.68	-29.7	-28.3	-29.4
B-8259	1900.82	-29.9	-28.7	-29.0
B-8260	1901.70	-29.5	-28.4	-29.1
B-8261	1903.50	-29.7	-28.9	-29.2
B-8417	1913.00	-	-28.4	-29.2
B-8262	1926.50	-29.7	-	-29.1
B-8418	1930.50	-29.6	-28.3	-29.3
B-8257 (oil)	1866-71	-29.4	-27.7	-28.8
Mean values cores		-29.7	-28.4	-29.2
Max. variation		0.7	0.9	0.6

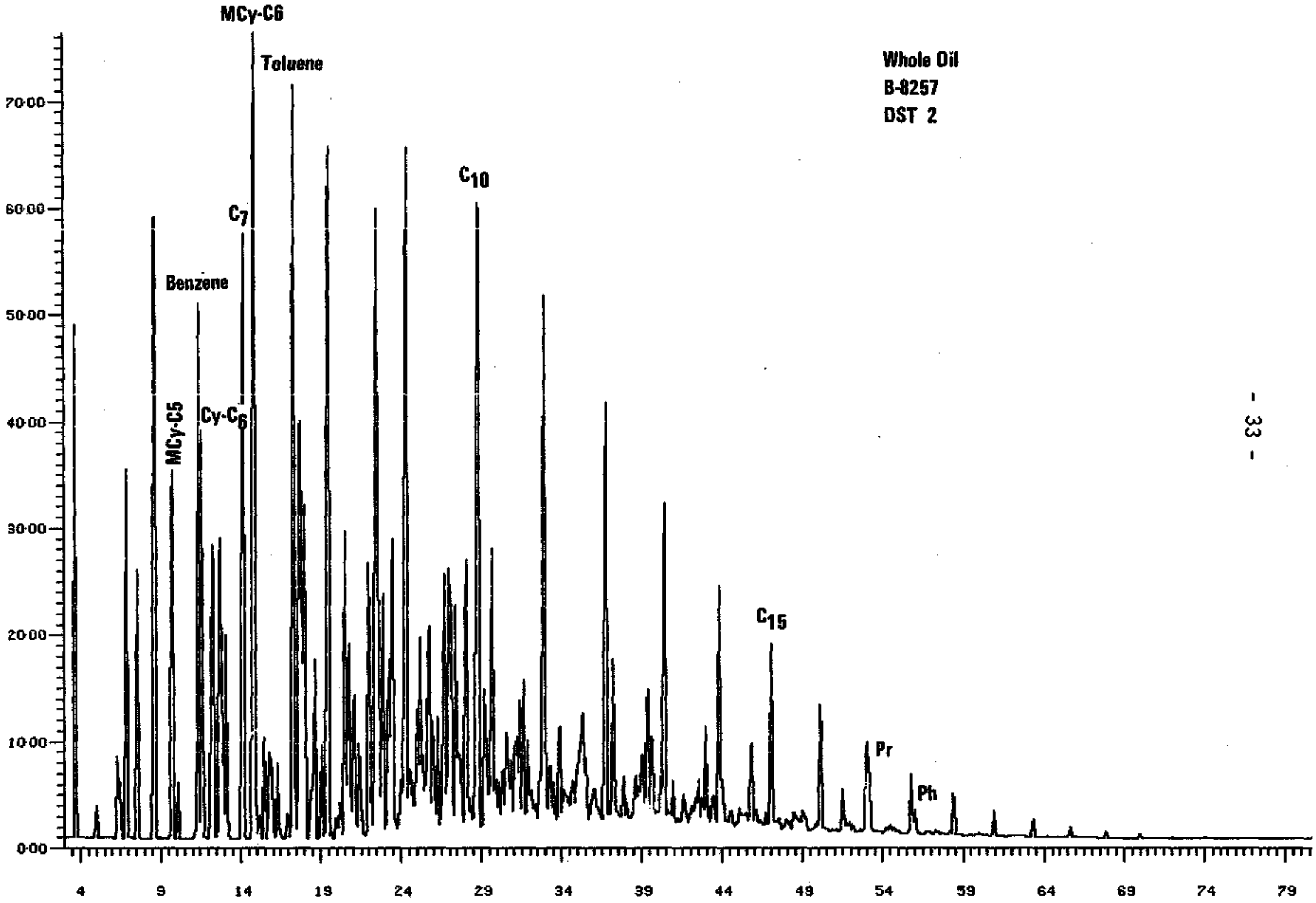
Figure 1

Whole oil GC

reated at 19:23 on 14/Nov/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Data Scale Plot

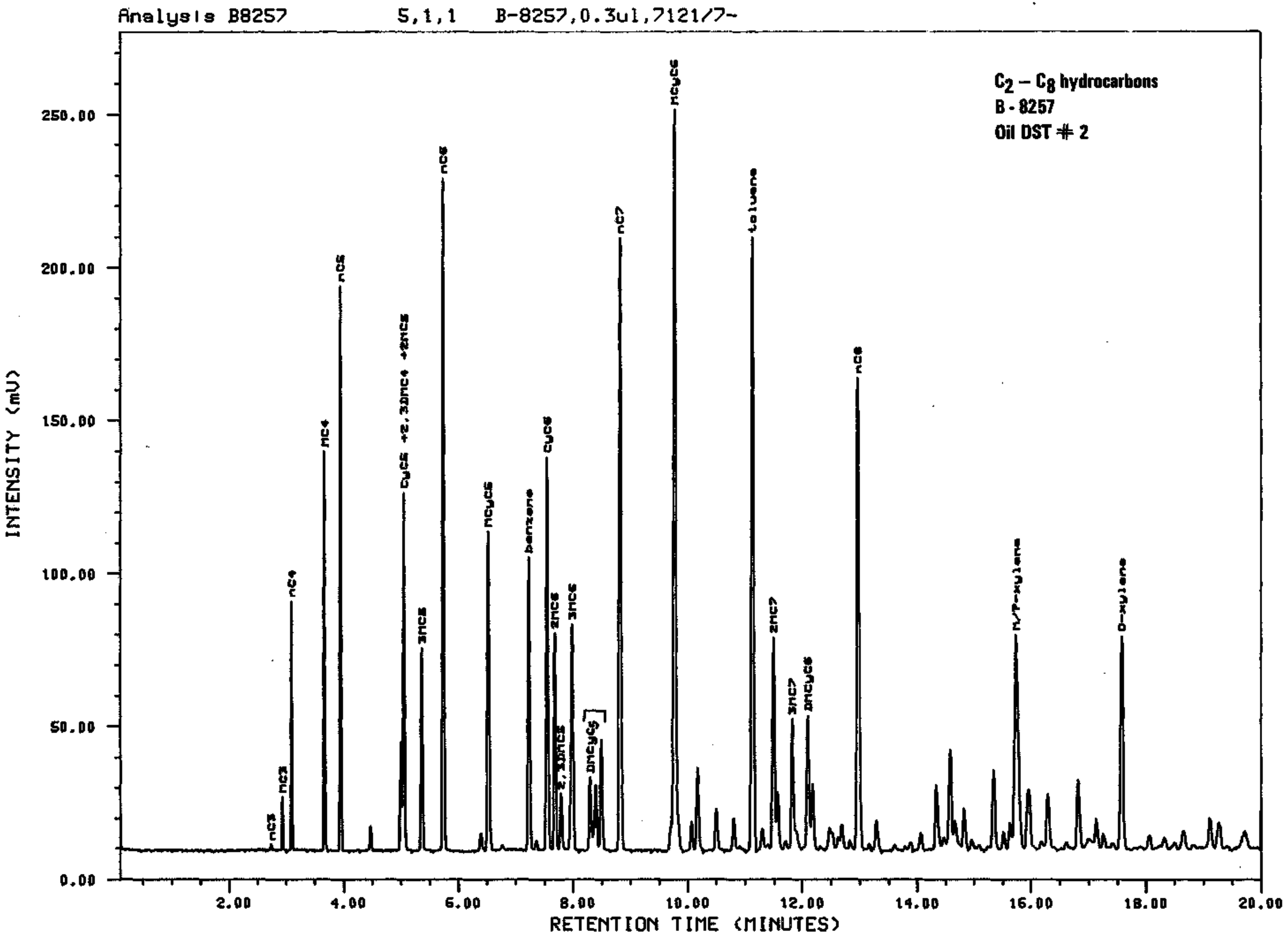
Analysis :749B8257T Sample £: 1 Injection £: 1
Sample Name :B-8257,TOT.OIL,GH Maximum signal (%) :76.408



Whole Oil
B-8257
DST 2

Figure 2

C_2-C_8 hydrocarbon GC


Analysis B8257 5,1,1 B-8257,0.3ul,7121/7-
C_2 – C_8 hydrocarbons
B - 8257
Oil DST # 2
INTENSITY (mV)
250.00
200.00
150.00
100.00
50.00
0.00
RETENTION TIME (MINUTES)
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
nC3
MC3
nC4
MC4
nC5
CyC5 +2,3DMC4 +2MC5
3MC5
nC6
MCyC5
benzene
CyC6
2MC6
2,3DMC5
3MC6
DMCyC5
nC7
MCyC6
toluene
2MC7
3MC7
DMCyC6
nC8
M/P-xylene
O-xylene

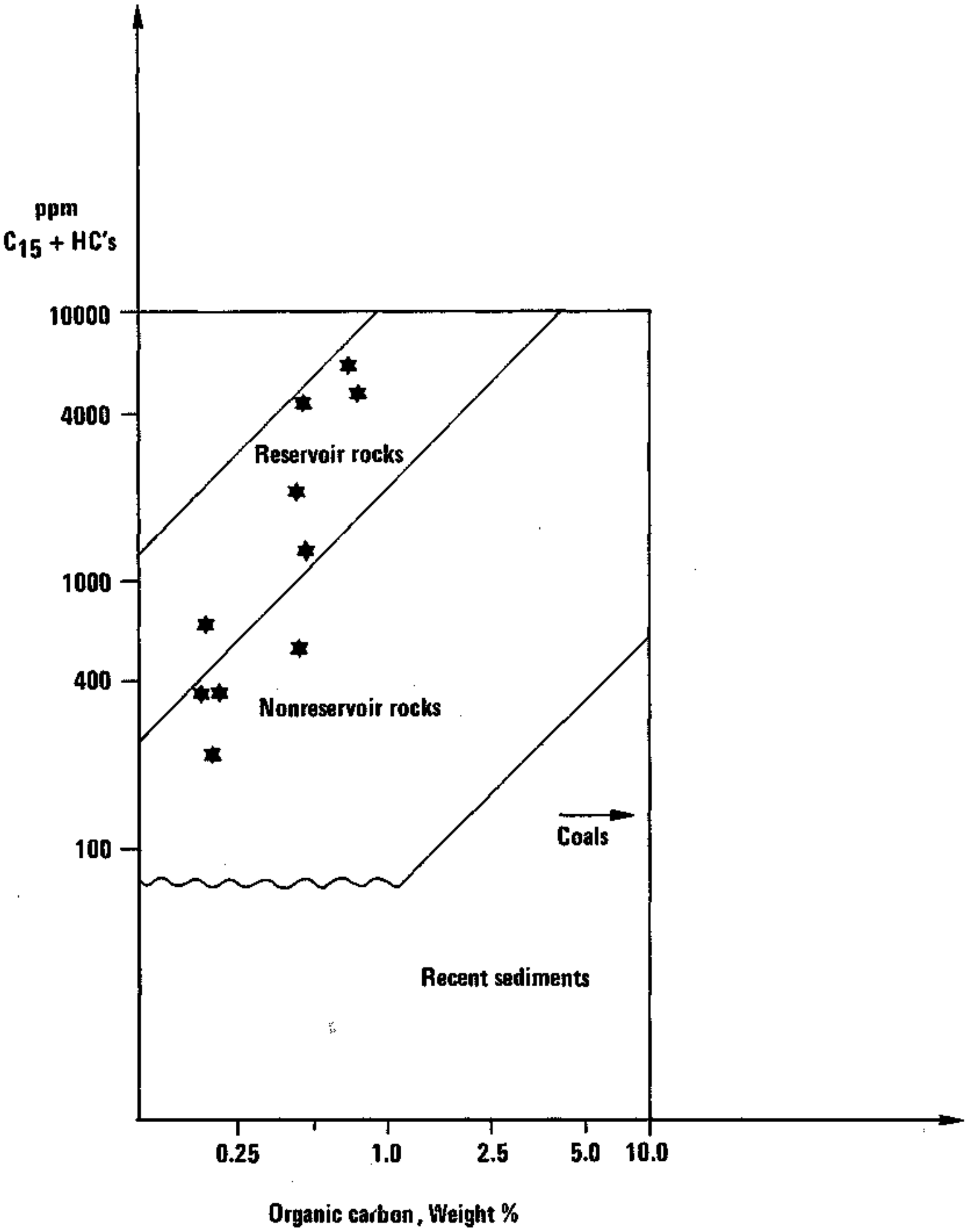
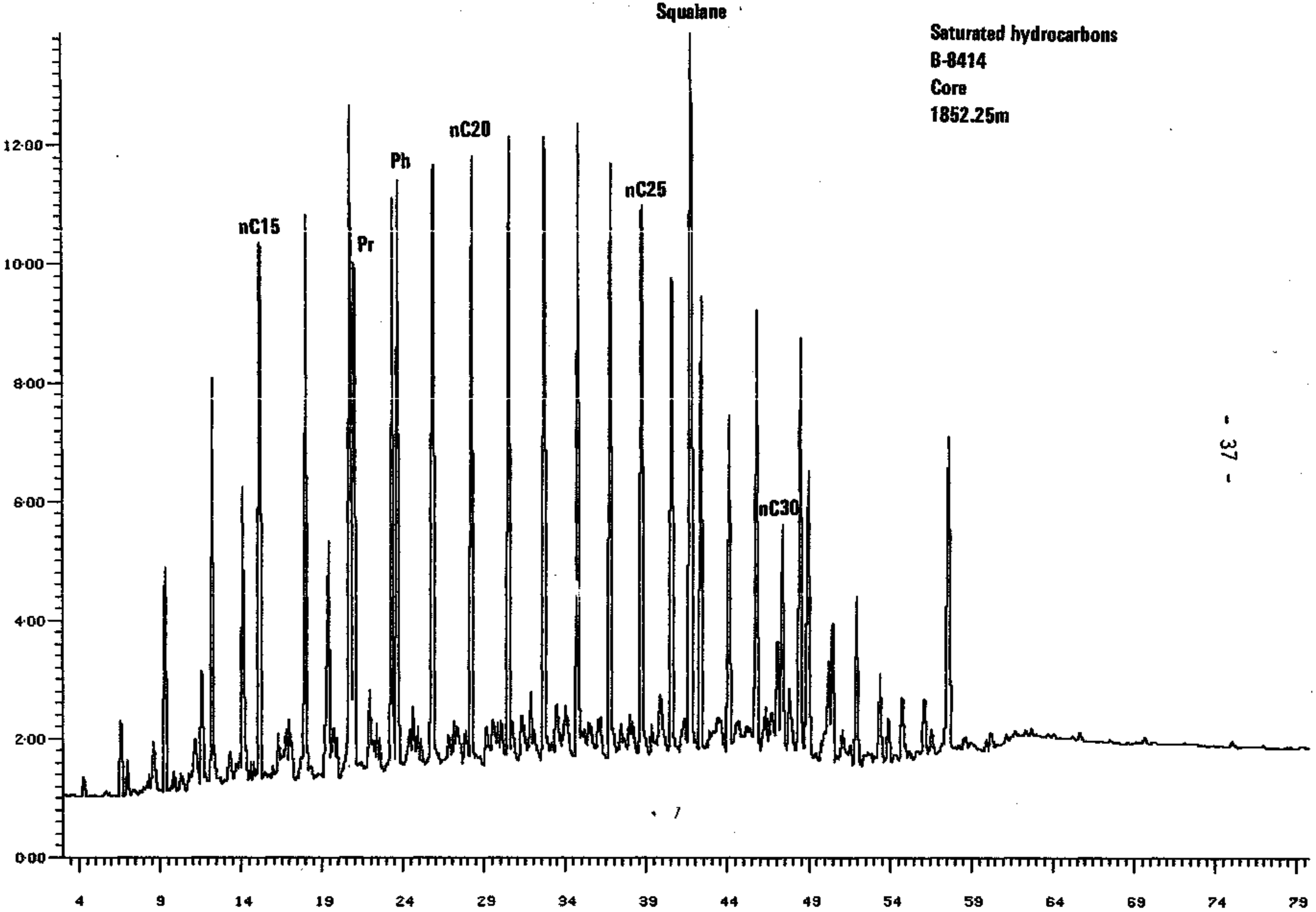


Figure 3. Quantity of organic carbon and extractable C_{15} + hydrocarbons in sediments (after Hunt, 1979)

reated at 14:42 on 21/Nov/84

DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot

Analysis :749BB414S Sample £: 1 Injection £: 1
Sample Name :B-8414,7121/7-1,GH Maximum signal (%) :13.886

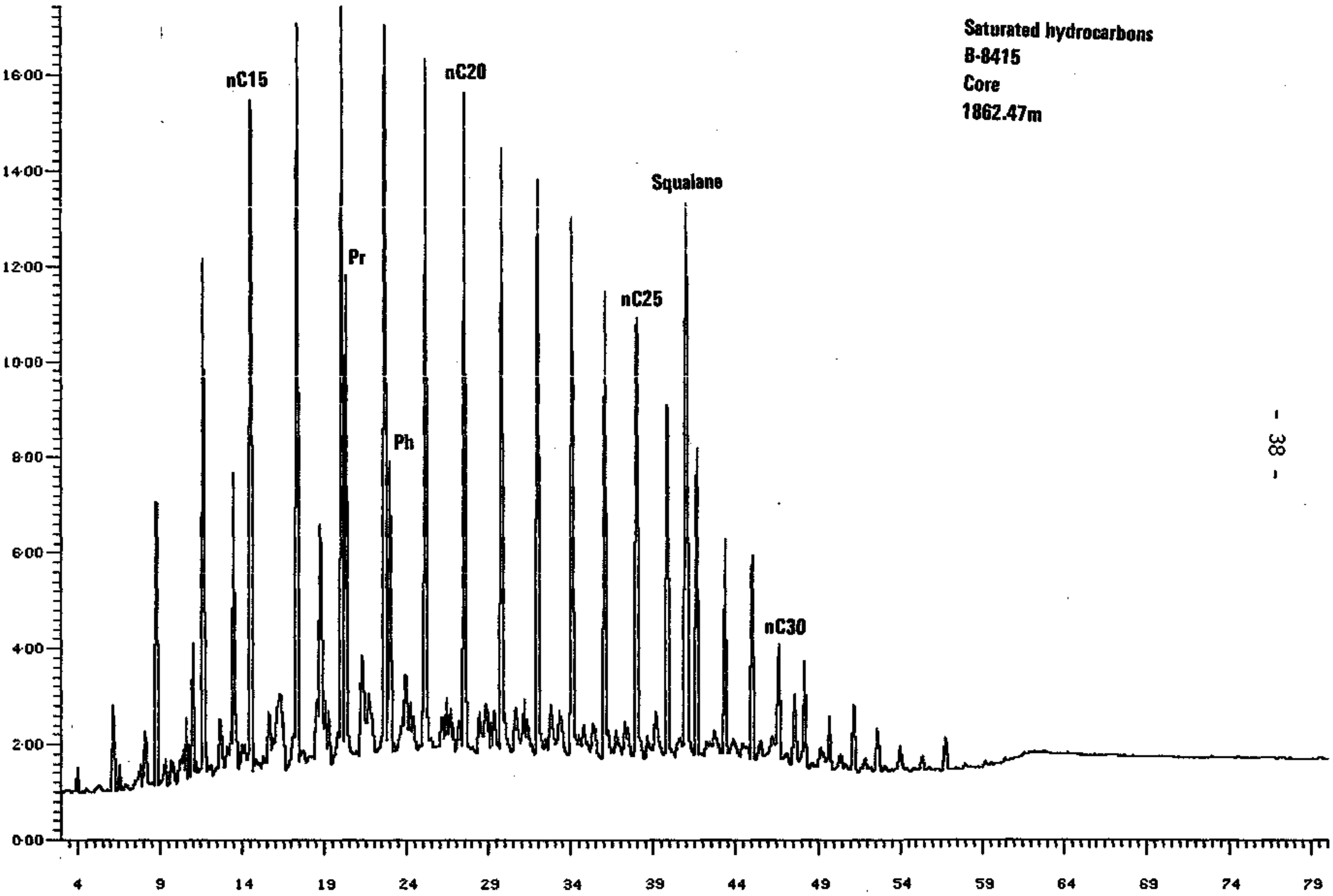


Saturated hydrocarbons
B-8414
Core
1852.25m

reated at 16:59 on 26/Nov/84

DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot

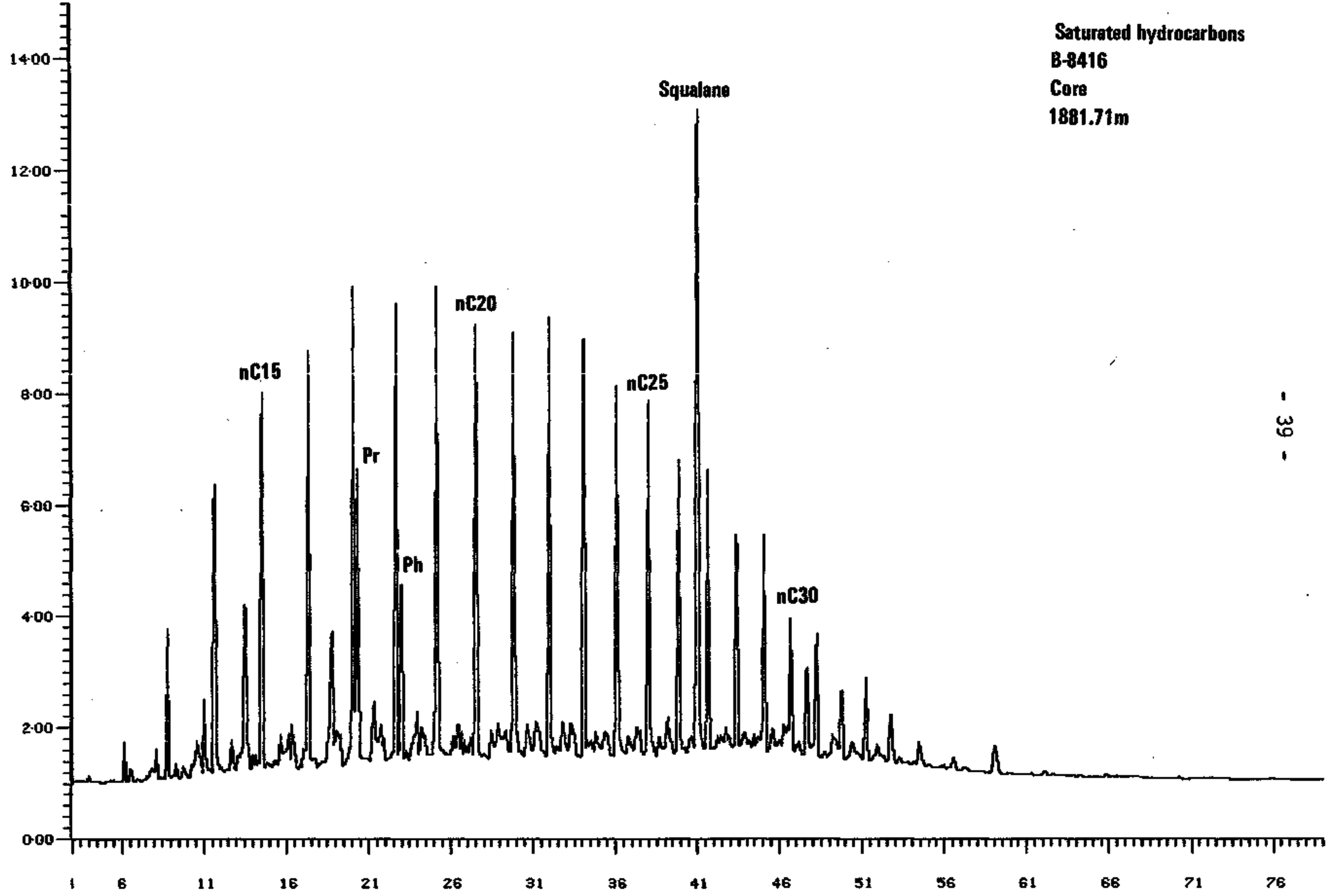
Analysis :749B8415S Sample £: 1 Injection £: 1
Sample Name :B-8415,7121/7-1,GH Maximum signal (%) :17.411



reated at 17:43 on 05/Dec/84

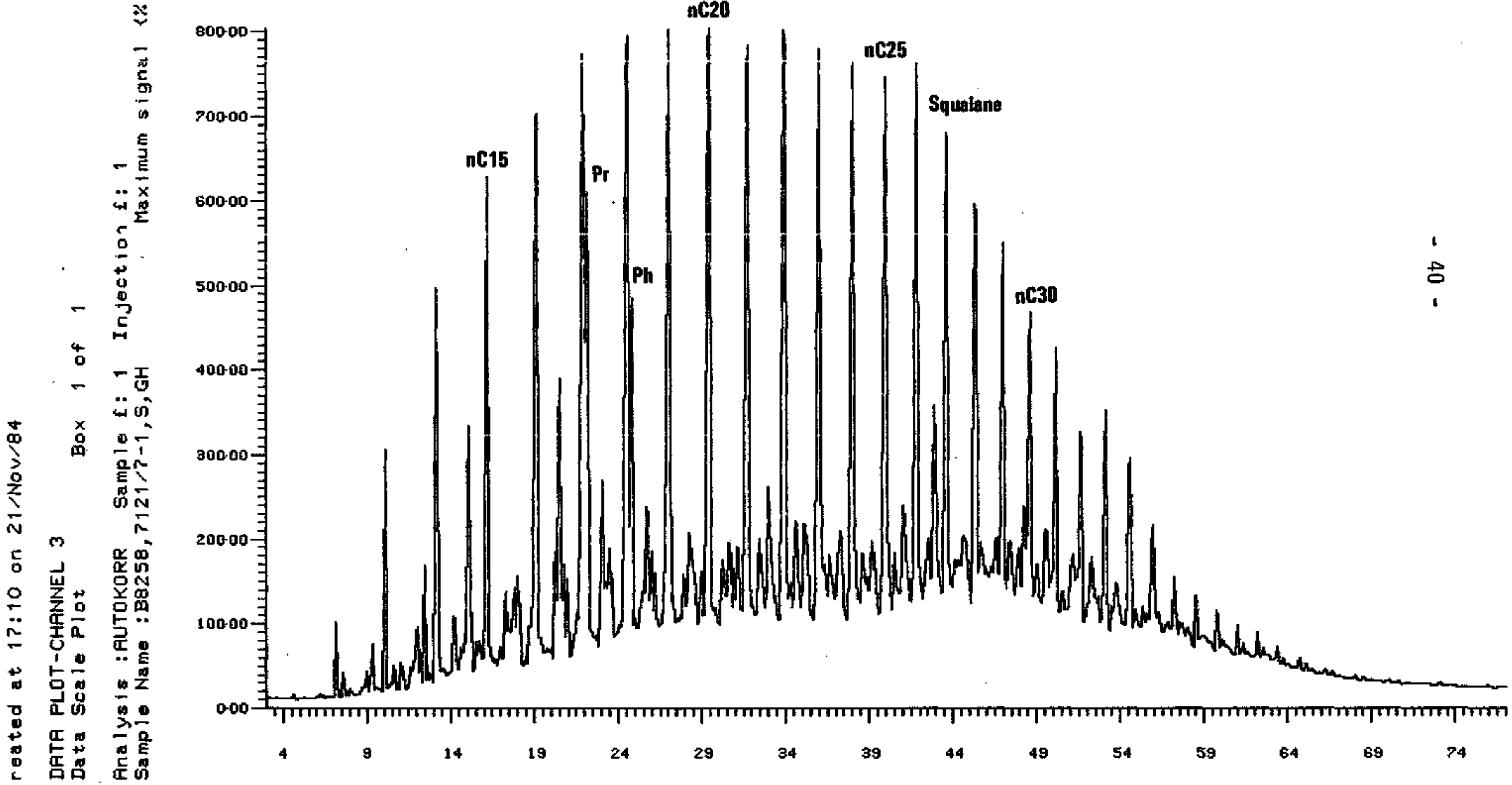
DATA PLOT-CHANNEL 3 Box 1 of 1
Full Scale Plot

Analysis :749B8416S Sample £: 1 Injection £: 1
Sample Name :B-8416,7121/7-1,GH Maximum signal (%) :100.000



Saturated hydrocarbons
B-8416
Core
1881.71m

Saturated hydrocarbons
B-8258
Core
1899.68m



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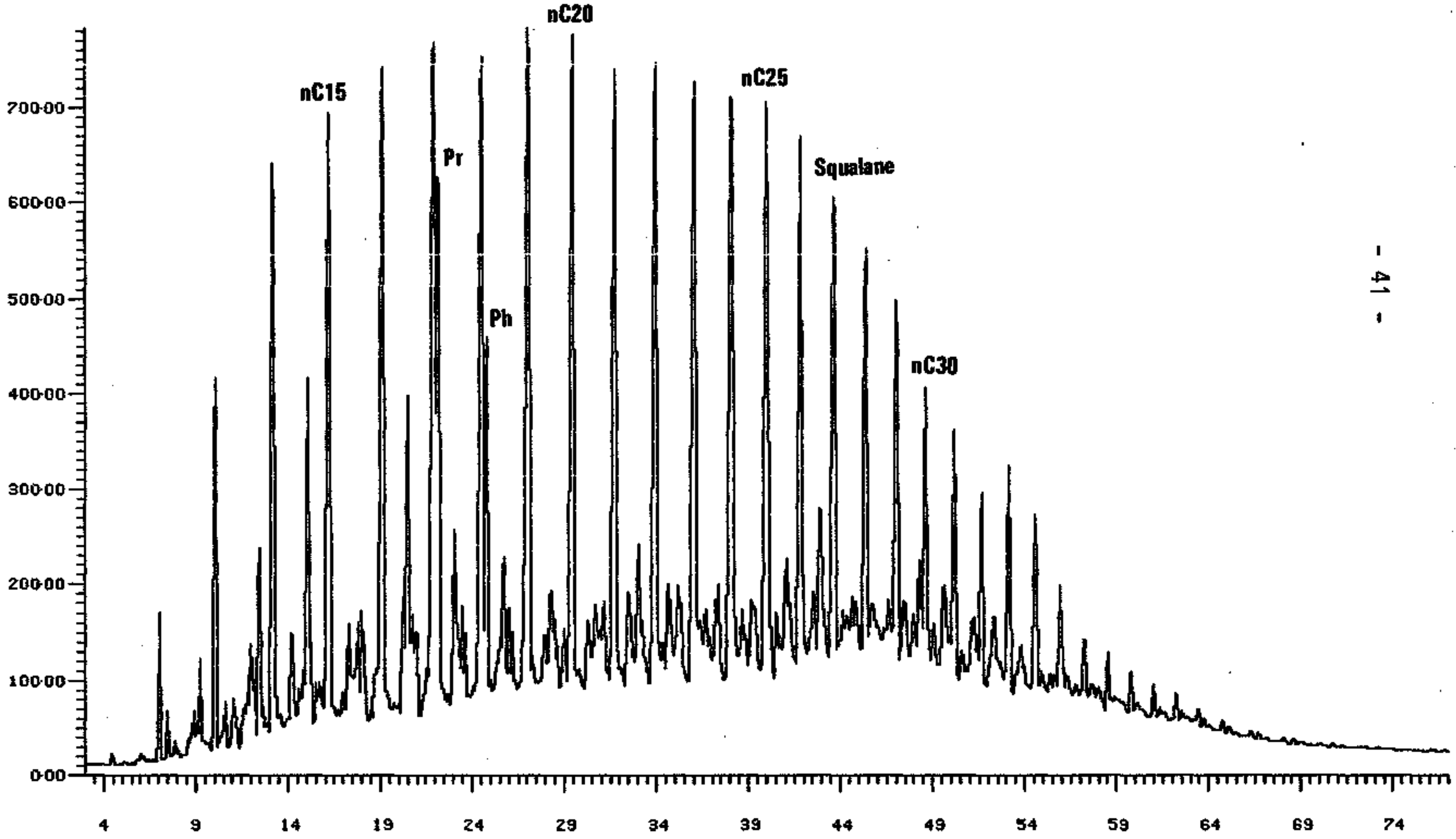
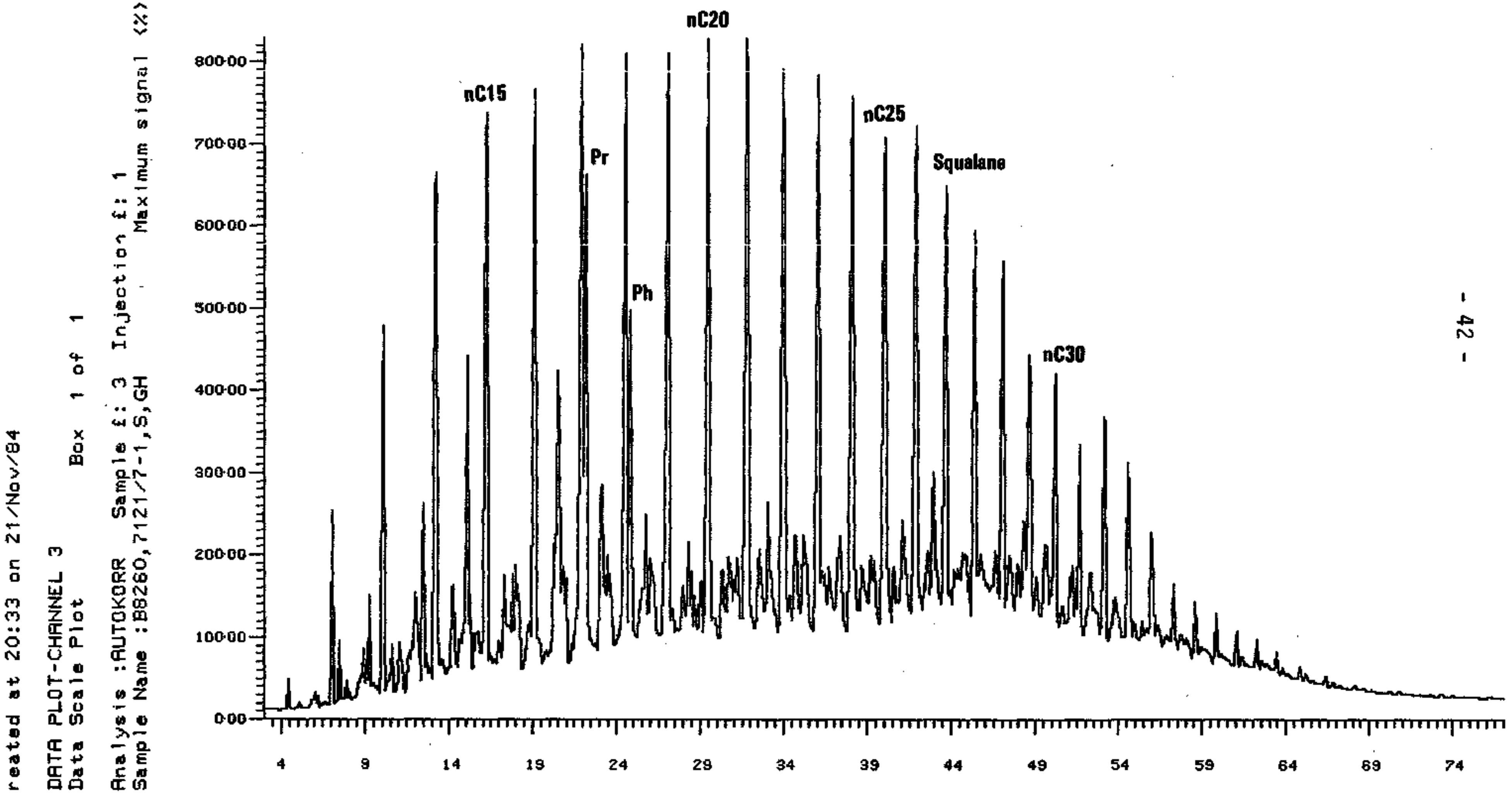
reated at 18:52 on 21/Nov/84

DATA PLOT-CHANNEL 3
Data Scale Plot            Box   1 of  1

Analysis :AUTOKORR    Sample £: 2  Injection £: 1
Sample Name :B8259,7121/7-1,S,GH        Maximum signal (%) :78.295
```

Saturated hydrocarbons
B-8259
Core
1900.82m





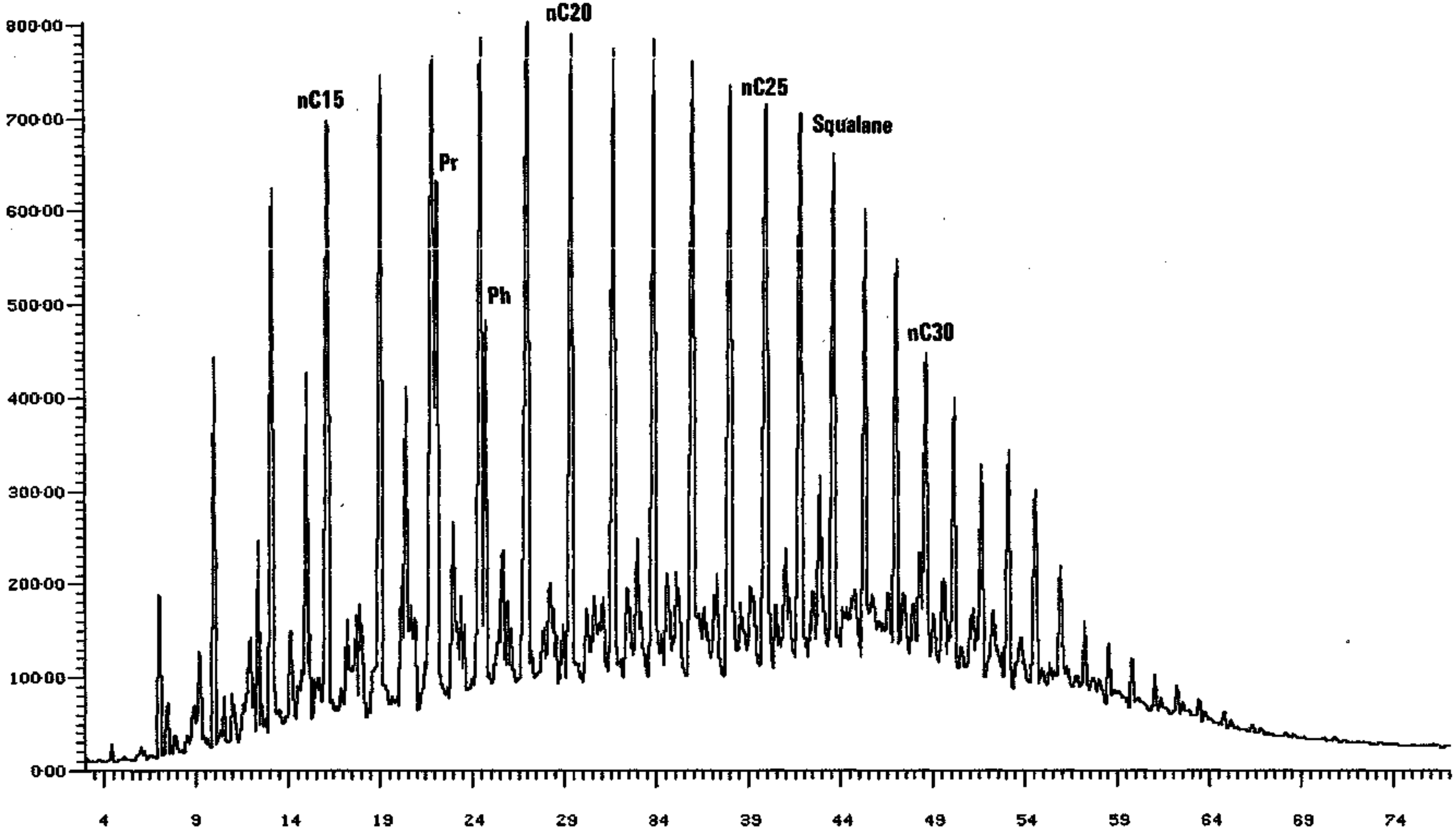
Saturated hydrocarbons
B-8260
Core
1901.70m

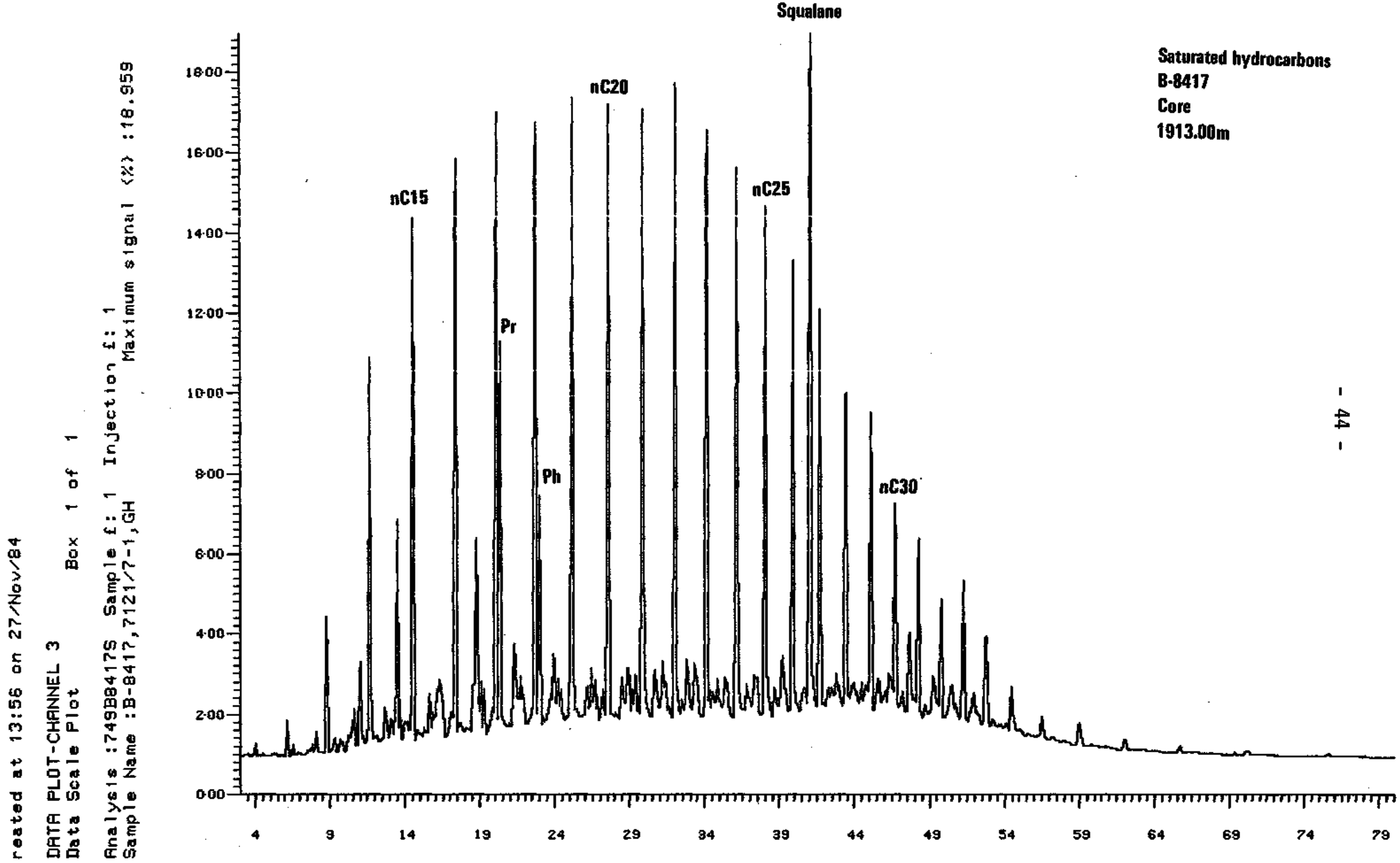
Saturated hydrocarbons
B-8261
Core
1903.50m

Created at 09:23 on 22/Nov/84

DATA PLOT-CHANNEL 3   Box 1 of 1
Data Scale Plot

Analysis :AUTOKORR   Sample £: 4 Injection £: 1
Sample Name :B8261,7121/7-1,S,GH   Maximum signal (%) :80.321

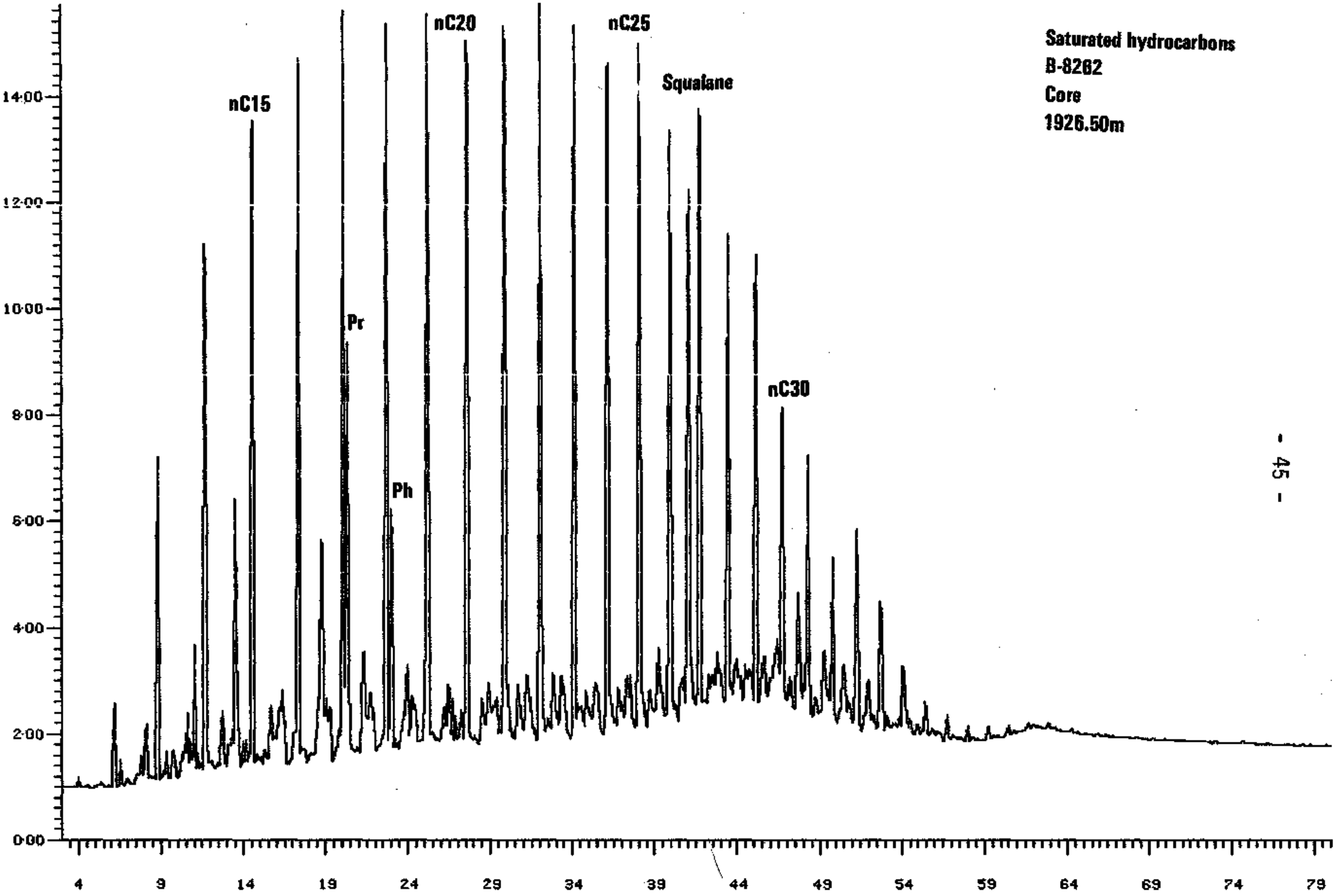



reated at 13:56 on 27/Nov/84
DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot
Analysis :749B8417S Sample £: 1 Injection £: 1
Sample Name :B-8417,7121/7-1,GH Maximum signal (%) :18.959
Saturated hydrocarbons
B-8417
Core
1913.00m
Squalane
nC15
nC20
nC25
nC30
Pr
Ph
18·00
16·00
14·00
12·00
10·00
8·00
6·00
4·00
2·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79

reated at 14:53 on 26/Nov/84

DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot

Analysis :749B8262S Sample £: 1 Injection £: 1
Sample Name :B-8262,7121/7-1,GH Maximum signal (%) :15.719

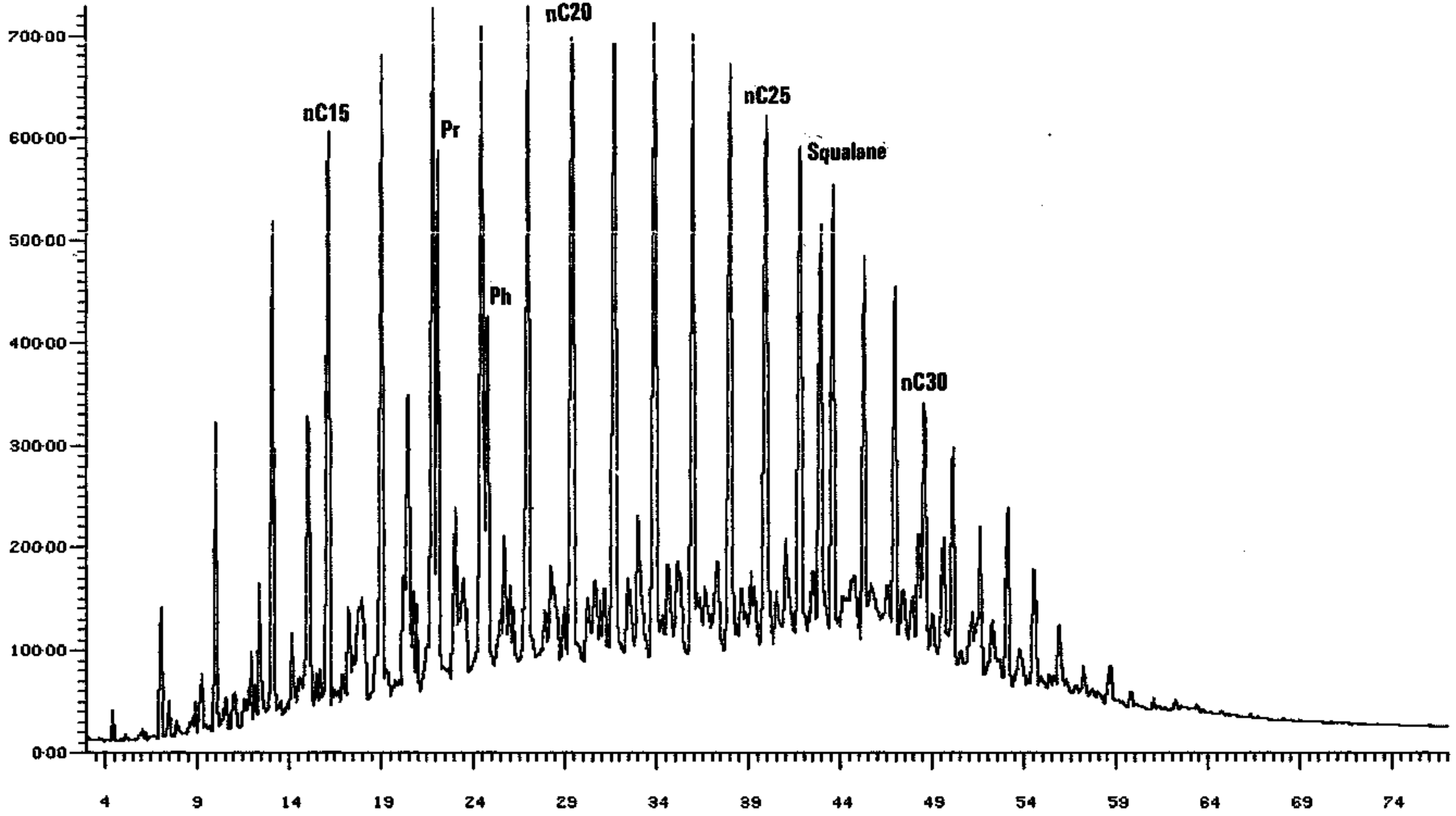


```
reated at 09:28 on 22/Nov/84

DATA PLOT-CHANNEL 3
Data Scale Plot                Box  1 of  1

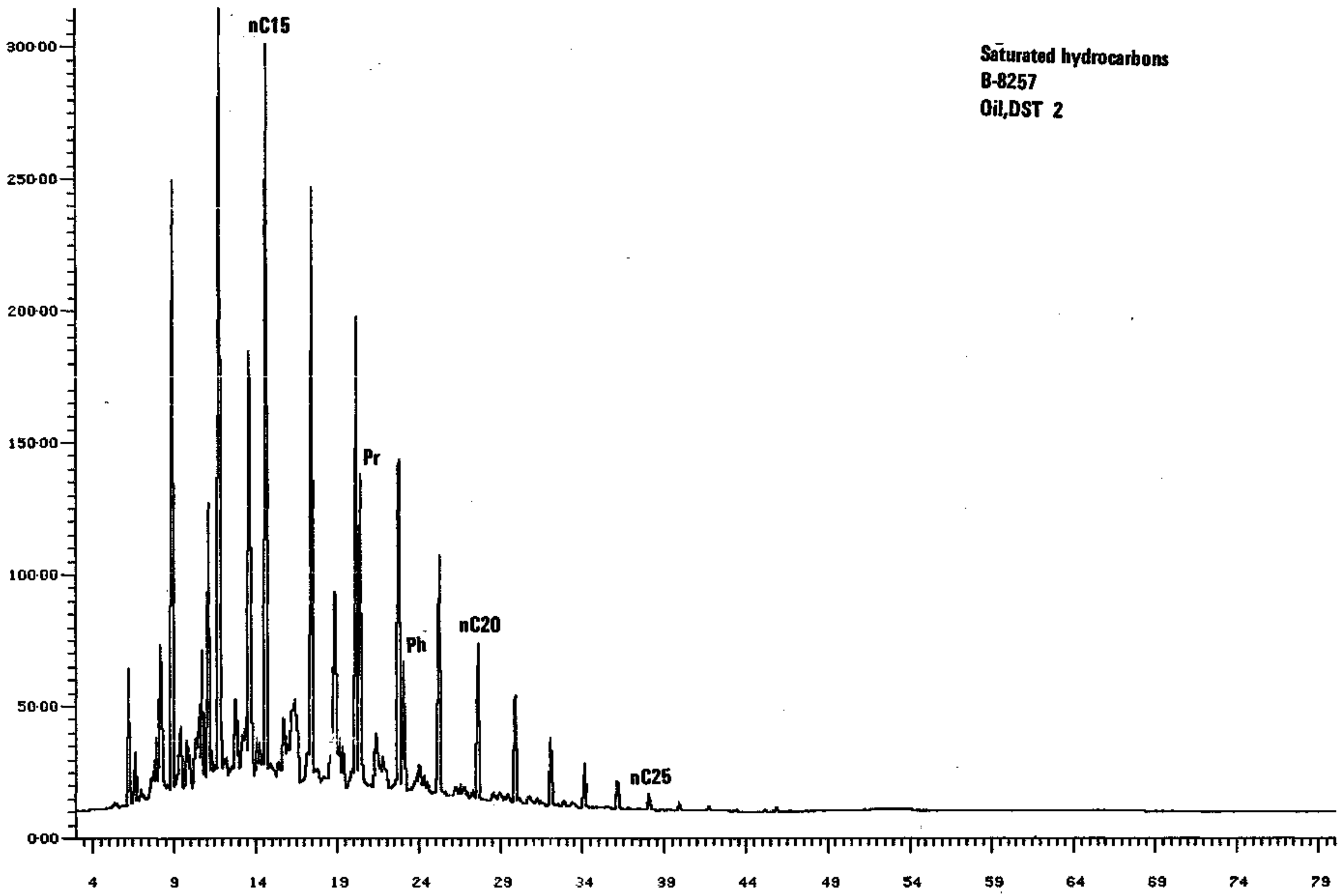
Analysis :AUTOKORR    Sample £: 5  Injection £: 1
Sample Name :B8418,7121/7-1,S,GH            Maximum signal (%) :72.856
```

Saturated hydrocarbons
B-8418
Core
1930.25m



DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot

Analysis :749B8257S Sample £: 1 Injection £: 1
Sample Name :B-8257,7121/7-1,GH Maximum signal (%) :31.447



Saturated hydrocarbons
B-8257
Oil,DST 2

Figure 5

Branched/cyclic hydrocarbon GC

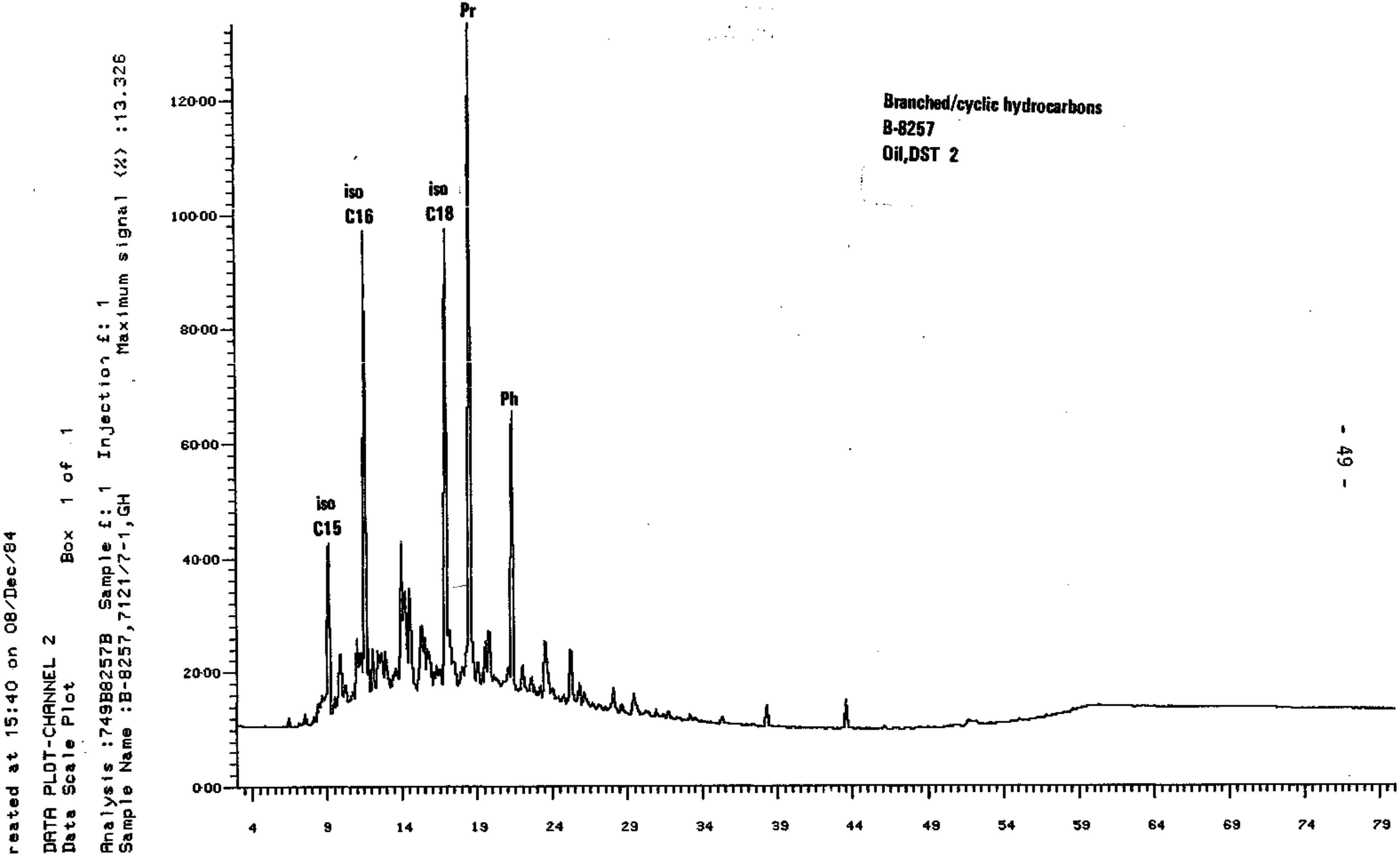

Branched/cyclic hydrocarbons
B-8257
Oil,DST 2

Figure 6

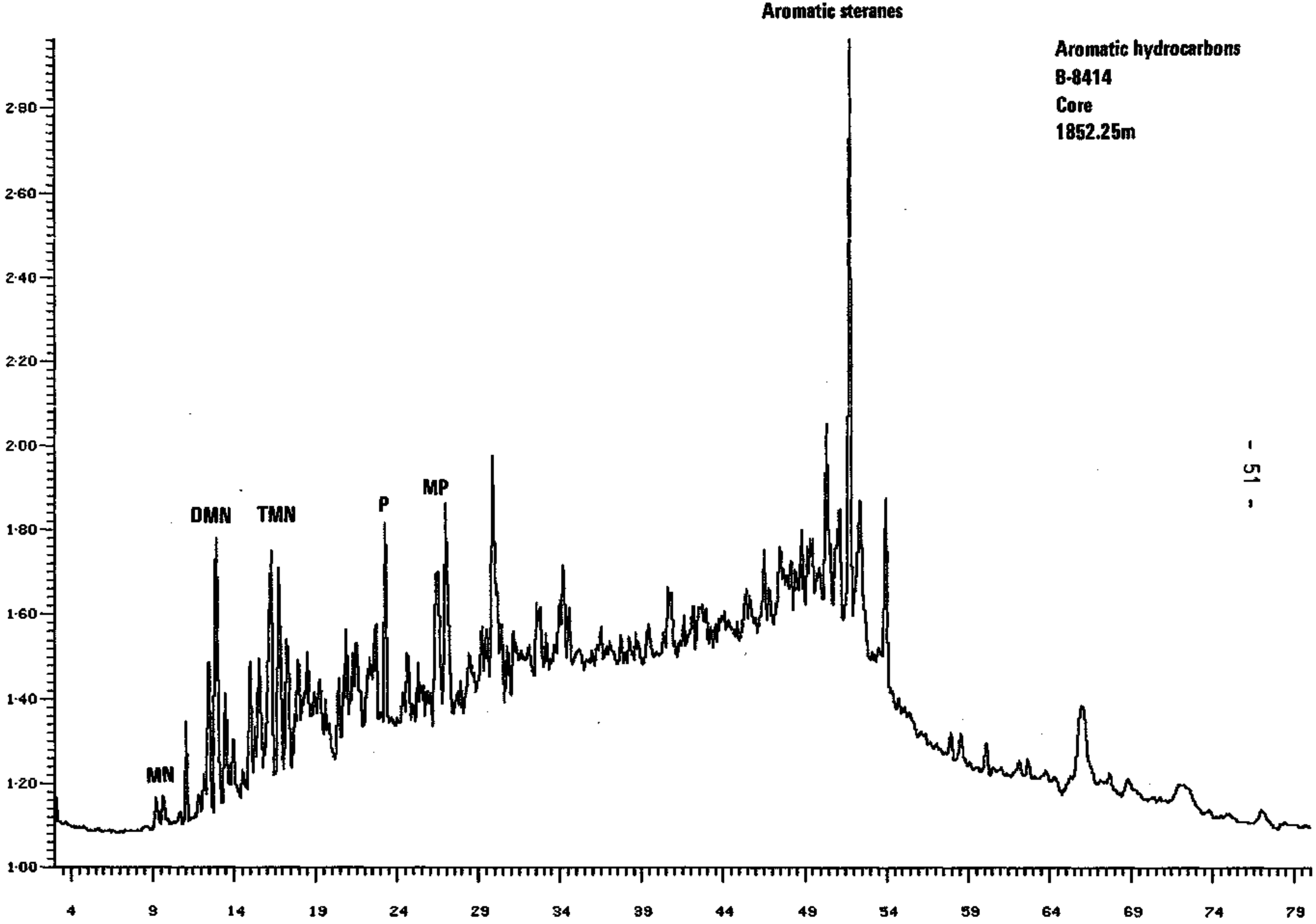
Aromatic hydrocarbon GC

MN, DMN, TMN - alkylated naphthalenes
P, MP, DMP - phenanthrene and alkylated phenanthrenes

reated at 15:51 on 05/Dec/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Full Scale Plot

Analysis :749B8414A Sample £: 1 Injection £: 1
Sample Name :B-8414,7121/7-1,GH Maximum signal (%) :2.964

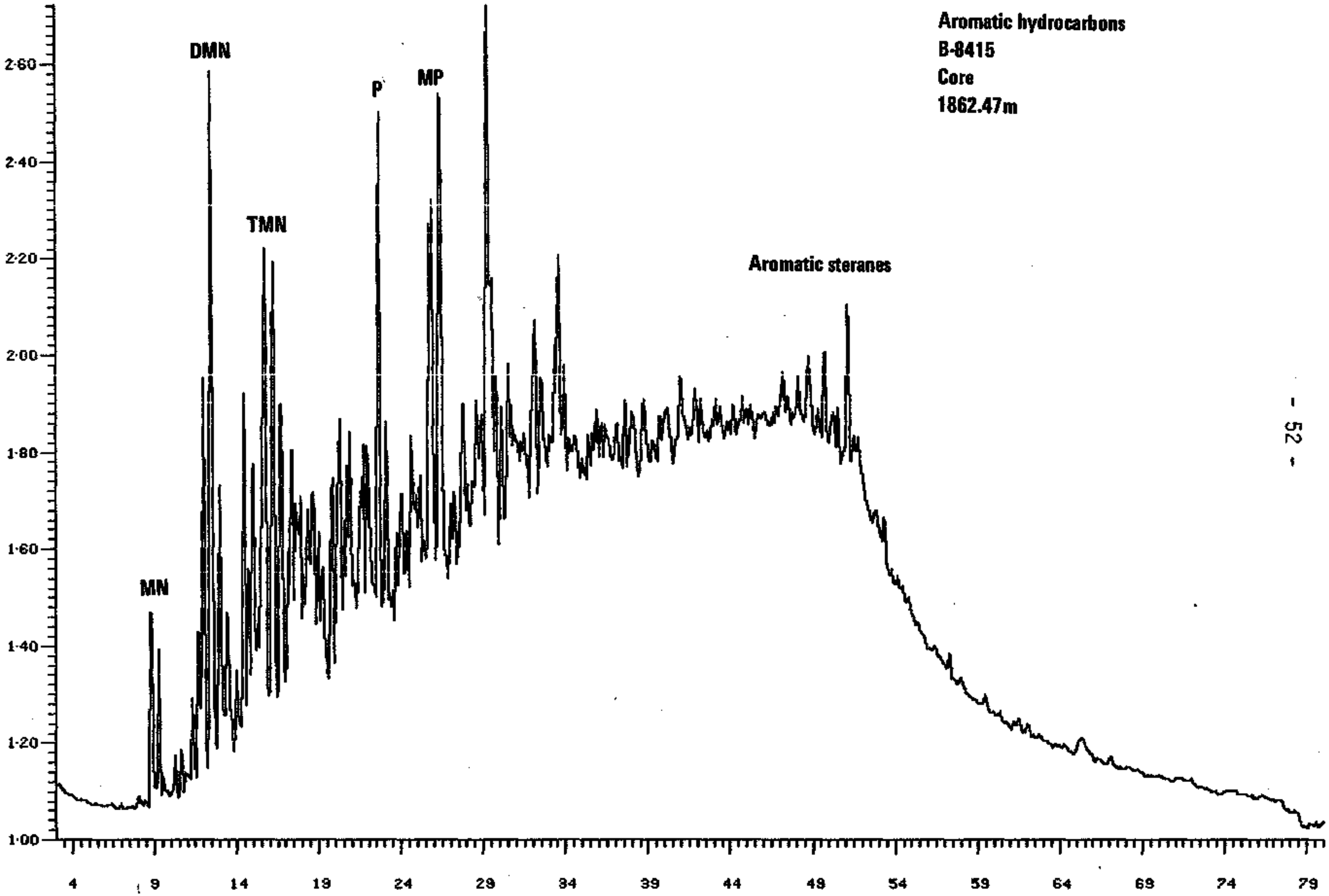


Aromatic hydrocarbons
B-8414
Core
1852.25m

reated at 16:11 on 05/Dec/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Full Scale Plot

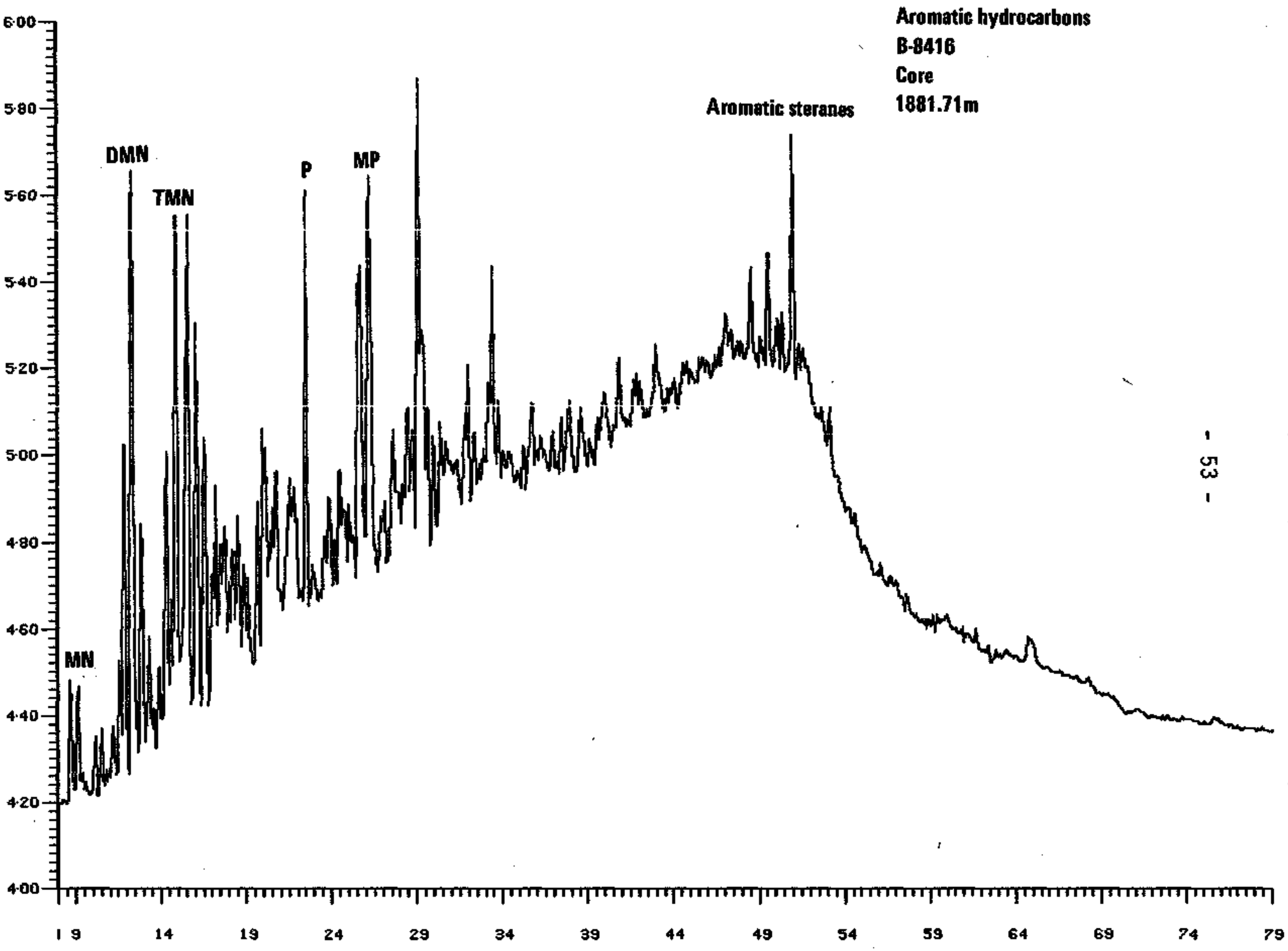
Analysis :749B8415A Sample £: 1 Injection £: 1
Sample Name :B-8415,7121/7-1,GH Maximum signal (%) :2.723

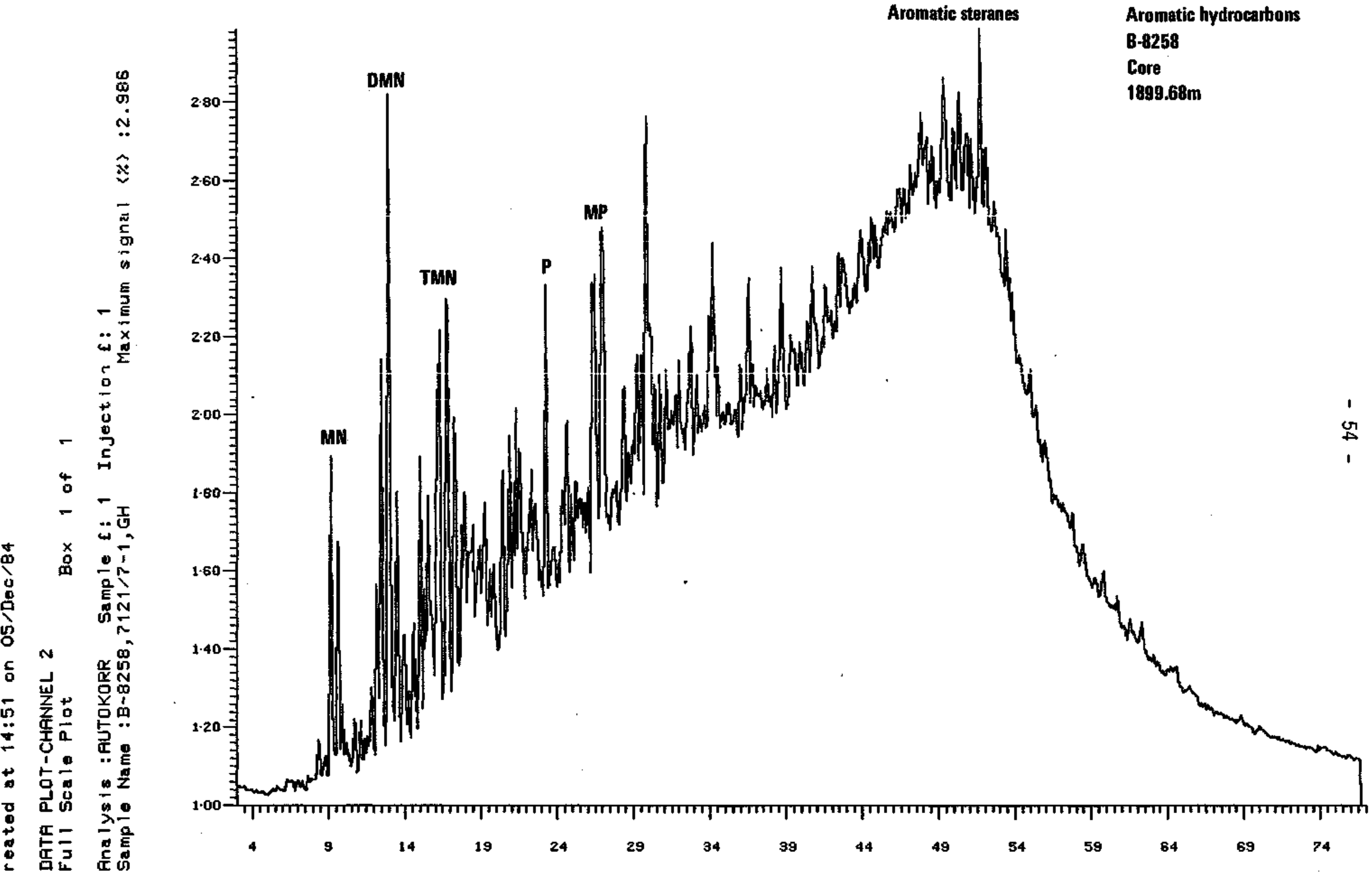


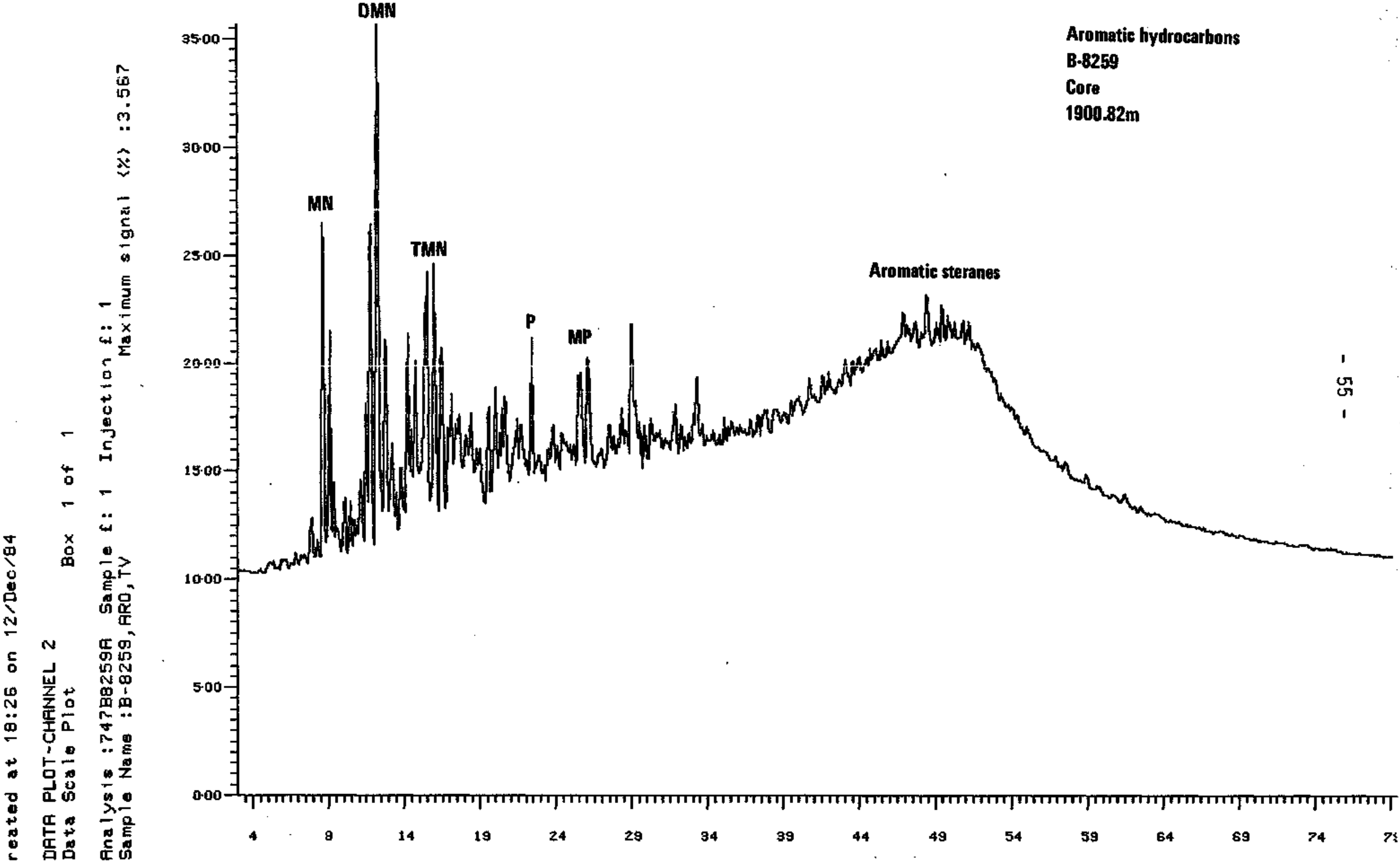
reated at 16:35 on 05/Dec/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Full Scale Plot

Analysis :749B8416A Sample £: 1 Injection £: 1
Sample Name :B-8416,7121/7-1,GH Maximum signal (%) :37.746


Aromatic hydrocarbons
B-8416
Core
1881.71m

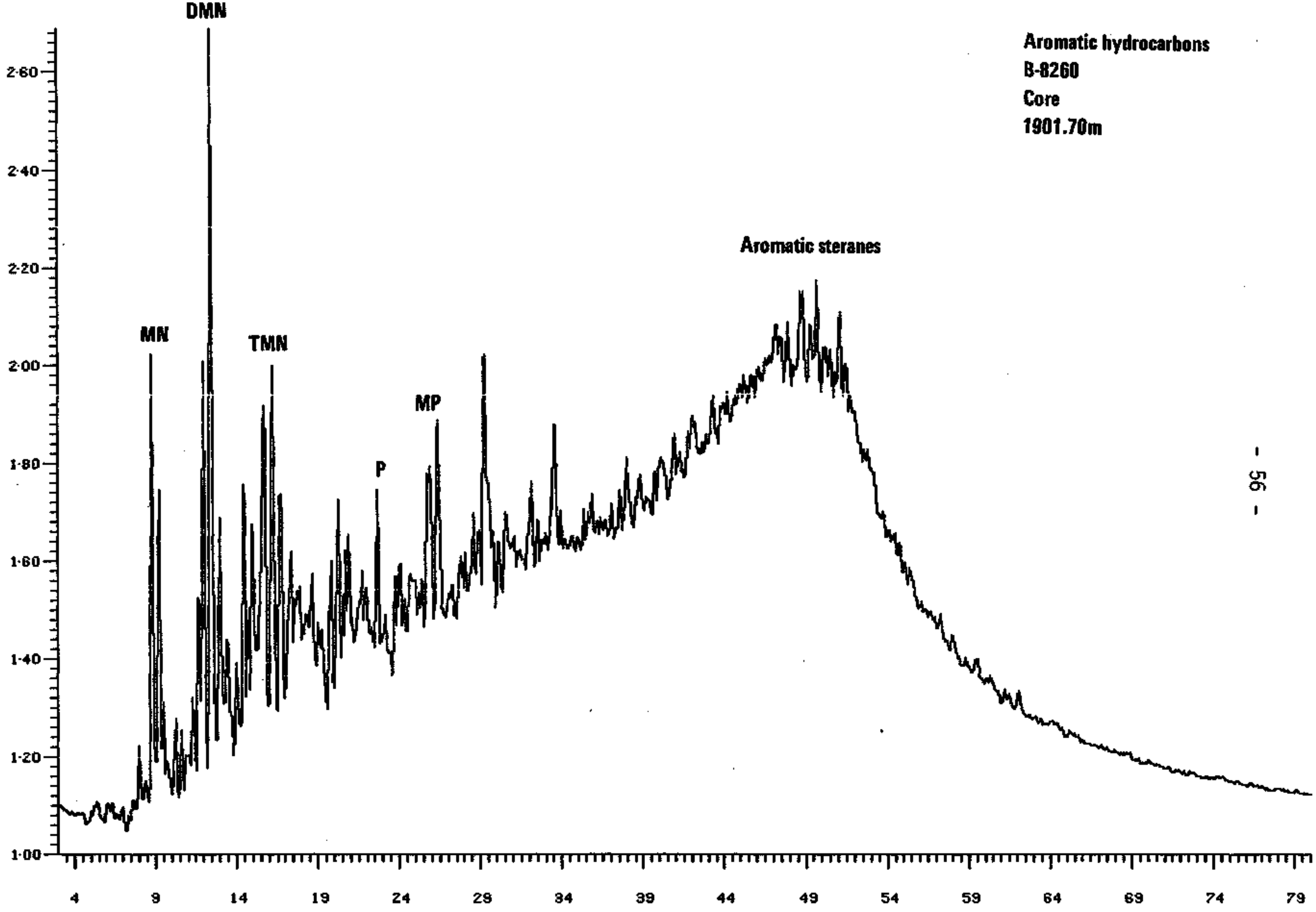

reated at 14:51 on 05/Dec/84
DATA PLOT-CHANNEL 2
Box 1 of 1
Full Scale Plot
Analysis :AUTOKORR
Sample £: 1
Injection £: 1
Sample Name :B-8258,7121/7-1,GH
Maximum signal (%) :2.986
Aromatic steranes
Aromatic hydrocarbons
B-8258
Core
1899.68m
MN
DMN
TMN
P
MP
2·80
2·60
2·40
2·20
2·00
1·80
1·60
1·40
1·20
1·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74


reated at 18:26 on 12/Dec/84
DATA PLOT-CHANNEL 2
Data Scale Plot
Box 1 of 1
Analysis :747B8259A
Sample £: 1
Injection £: 1
Sample Name :B-8259,ARO,TV
Maximum signal (%) :3.567
Aromatic hydrocarbons
B-8259
Core
1900.82m
DMN
MN
TMN
P
MP
Aromatic steranes
35·00
30·00
25·00
20·00
15·00
10·00
5·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
7

reated at 15:43 on 05/Dec/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Full Scale Plot

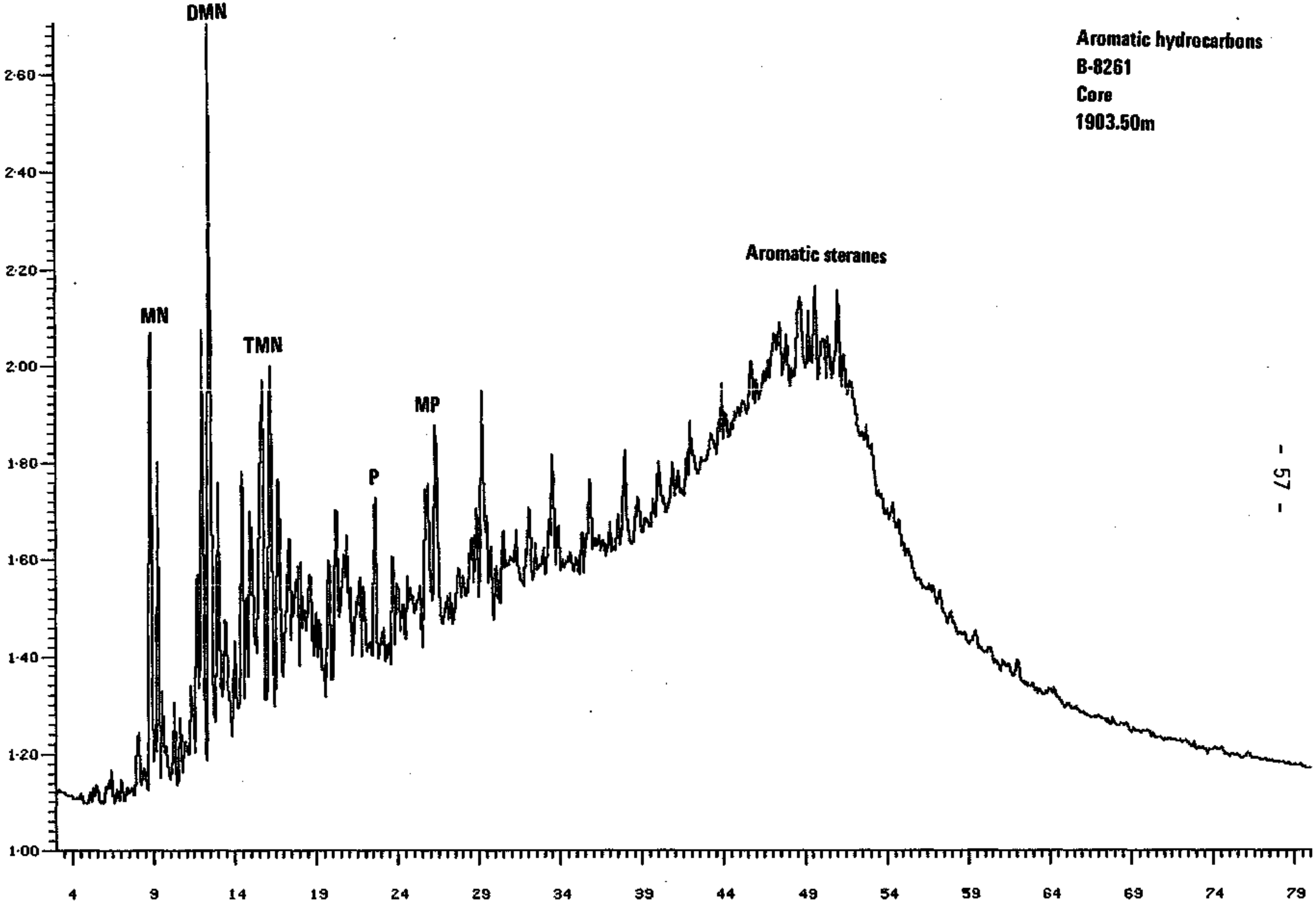
Analysis :749B8260A Sample £: 1 Injection £: 1
Sample Name :B-8260,7121/7-1,GH Maximum signal (%) :2.689



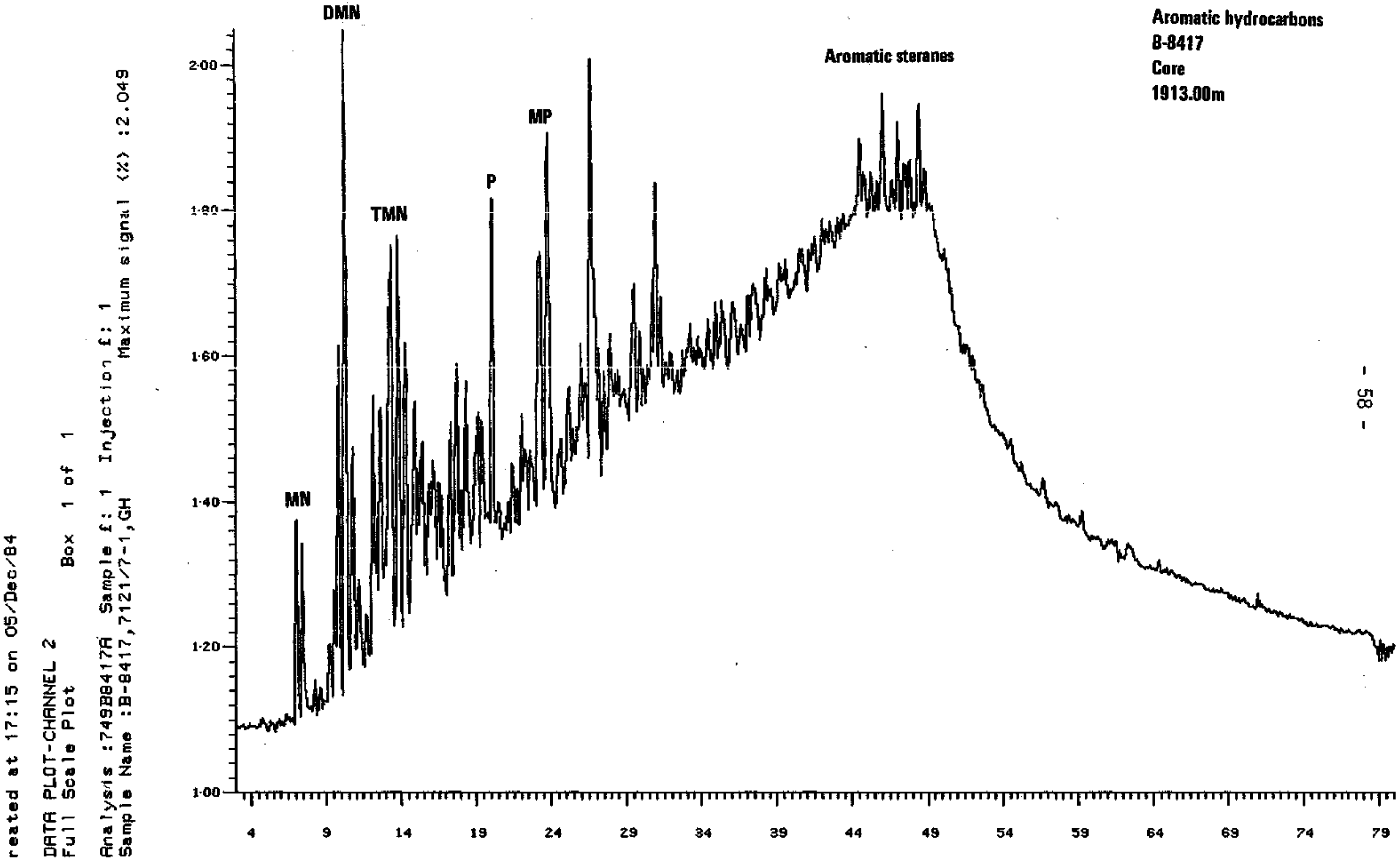
reated at 15:16 on 05/Dec/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Full Scale Plot

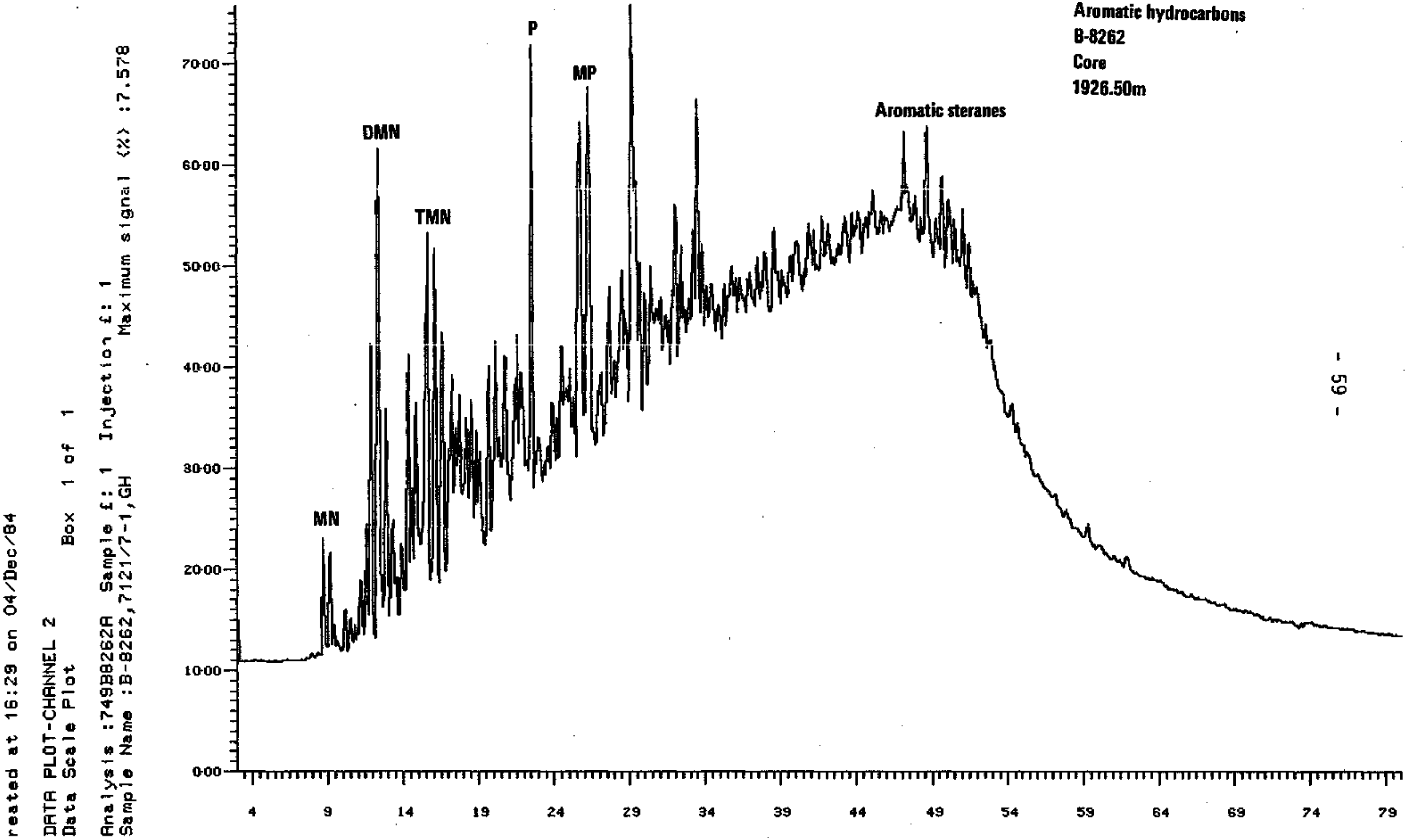
Analysis :749B8261A Sample £: 1 Injection £: 1
Sample Name :B-8261,7121/7-1,GH Maximum signal (%) :2.707



Aromatic hydrocarbons
B-8261
Core
1903.50m



Aromatic hydrocarbons
B-8417
Core
1913.00m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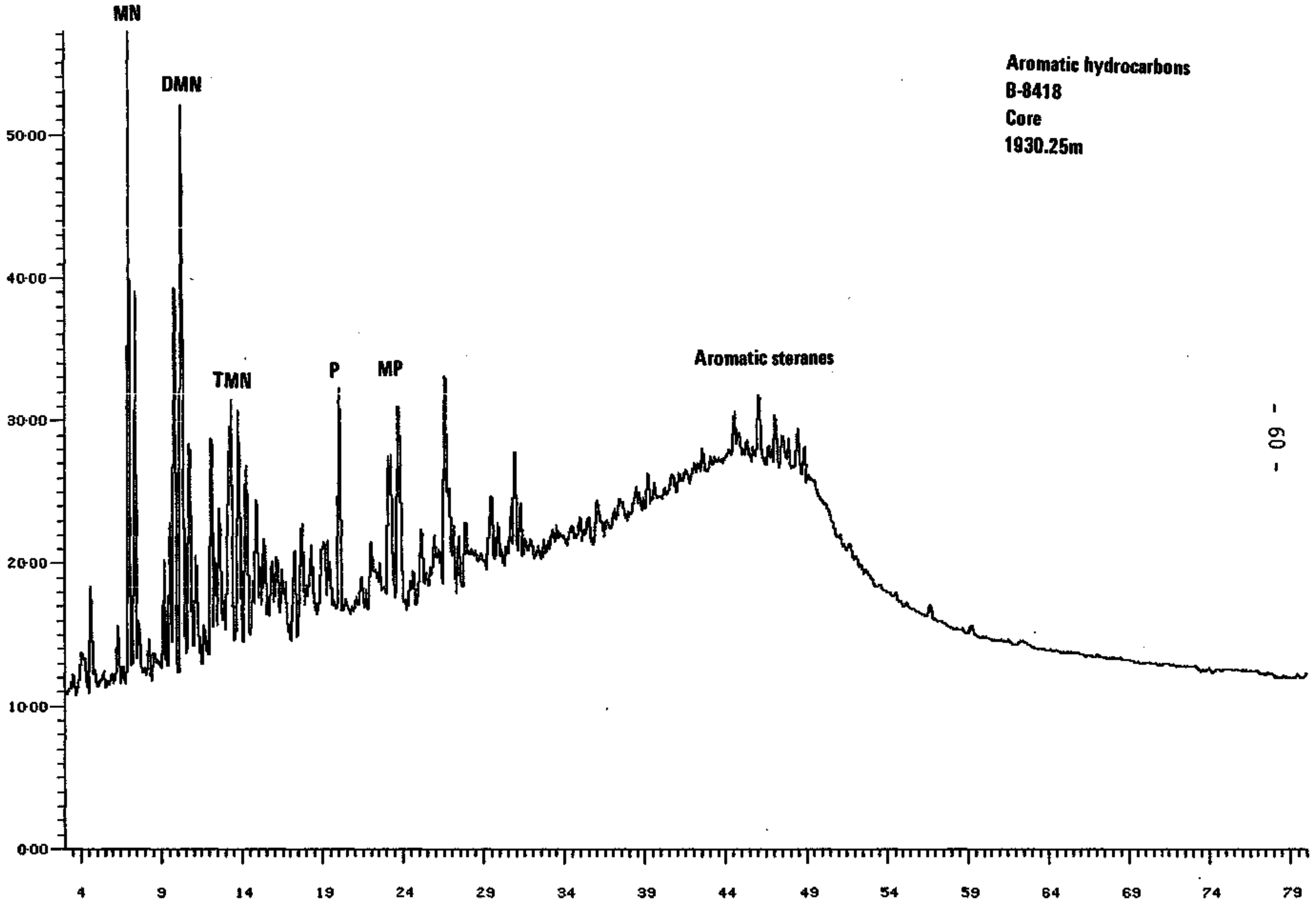
DATA PLOT-CHANNEL 2 Box 1 of 1
Data Scale Plot
Analysis :749B8262A Sample £: 1 Injection £: 1
Sample Name :B-8262,7121/7-1,GH Maximum signal (%) :7.578
Aromatic hydrocarbons
B-8262
Core
1926.50m
MN
DMN
TMN
P
MP
Aromatic steranes
70·00
60·00
50·00
40·00
30·00
20·00
10·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79

```
reated at 12:21 on 05/Dec/84

DATA PLOT-CHANNEL 2
Data Scale Plot                  Box  1 of  1

Analysis :749B8418A  Sample £: 1  Injection £: 1
Sample Name :B-8418,7121/7-1,GH           Maximum signal (%) :5.724
```

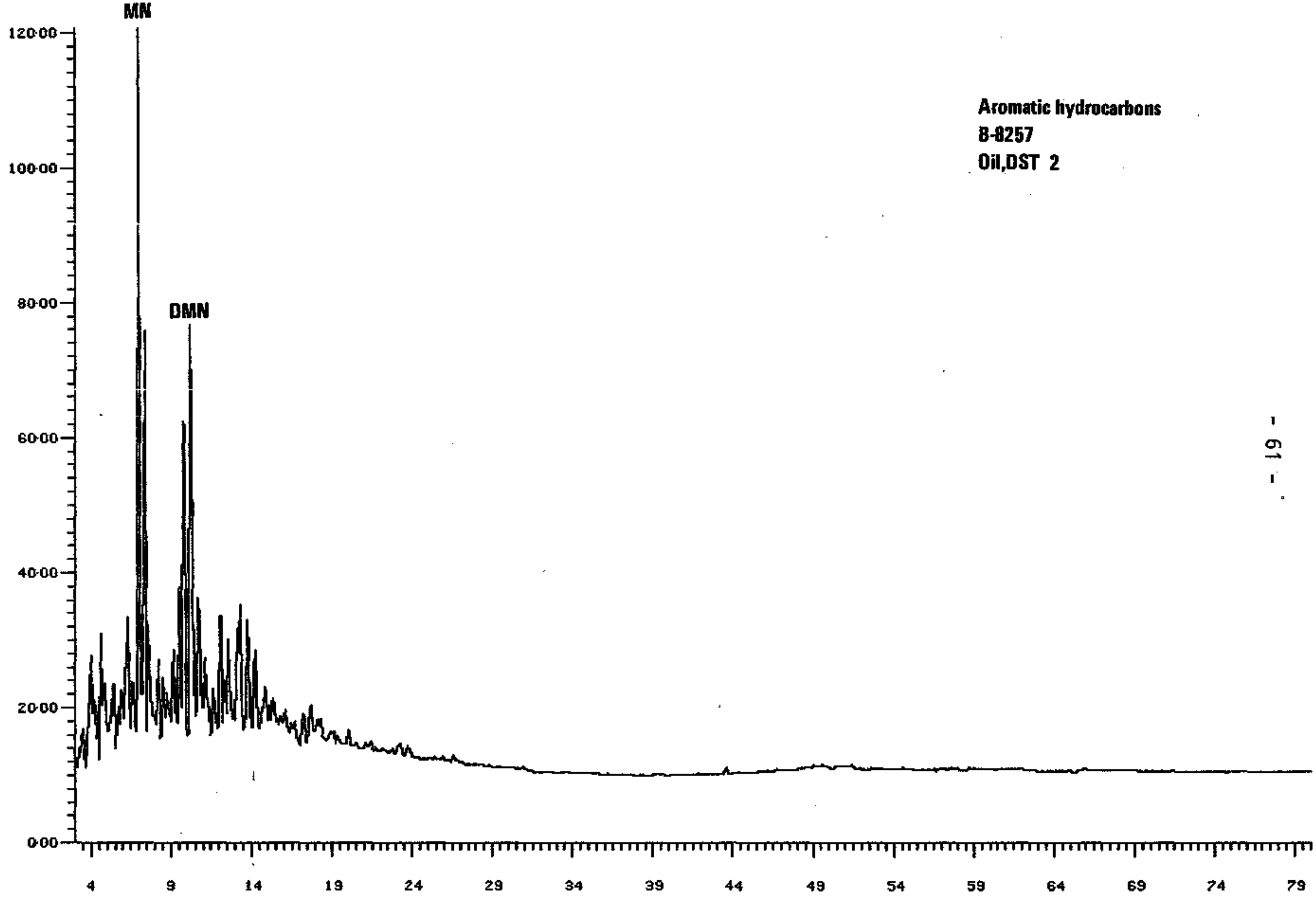


Aromatic hydrocarbons
B-8418
Core
1930.25m

reated at 14:14 on 05/Dec/84

DATA PLOT-CHANNEL 2 Box 1 of 1
Data Scale Plot

Analysis :749B8257A Sample £: 1 Injection £: 1
Sample Name :B-8257,7121/7-1,GH Maximum signal (%) :12.057

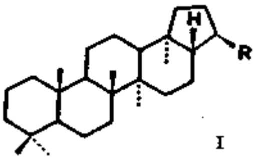


Aromatic hydrocarbons
B-8257
Oil,DST 2

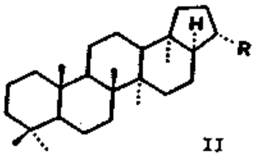
Figure 7a.

Mass chromatograms representing terpanes (m/z 191)

A	T_s, 18α(H)-trisnorneohopane	$C_{27}H_{46}$	(III)
B	T_m, 17α(H)-trisnorhopane	$C_{27}H_{46}$	(I,R=H)
C	17α(H)-norhopane	$C_{29}H_{50}$	(I,R=C_2H_5)
D	17β(H)-normoretane	$C_{29}H_{50}$	(II,R=C_2H_5)
E	17α(H)-hopane	$C_{30}H_{52}$	(I,R=C_3H_7)
F	17β(H)-moretane	$C_{30}H_{52}$	(II,R=C_3H_7)
G	17α(H)-homohopane (22S)	$C_{31}H_{54}$	(I,R=C_4H_9)
H	17α(H)-homohopane (22R) + unknown triterpane (gammacerane?)	$C_{31}H_{54}$	(I,R=C_4H_9)
I	17β(H)-homomoretane	$C_{31}H_{54}$	(II,R=C_4H_9)
J	17α(H)-bishomohopane (22S,22R)	$C_{32}H_{56}$	(I,R=C_5H_{11})
K	17α(H)-trishomohopane (22S,22R)	$C_{33}H_{58}$	(I,R=C_6H_{13})
L	17α(H)-tetrakishomohopane (22S,22R)	$C_{34}H_{60}$	(I,R,=C_7H_{15})
M	17α(H)-pentakishomohopane (22S,22R)	$C_{35}H_{62}$	(I,R=C_8H_{17})
Z	bisnorhopane	$C_{28}H_{48}$	
X	unknown triterpane	$C_{30}H_{52}$	
P	tricyclic terpane	$C_{23}H_{42}$	(IV,R=C_4H_9)
Q	tricyclic terpane	$C_{24}H_{44}$	(IV,R=C_5H_{11})
R	tricyclic terpane (17R,17S)	$C_{25}H_{46}$	(IV,R=C_6H_{13})
S	tetracyclic terpane	$C_{24}H_{42}$	(V)
T	tricyclic terpane (17R,17S)	$C_{26}H_{48}$	(IV,R=C_7H_{15})



I



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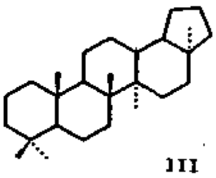

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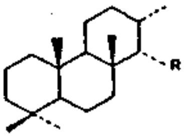
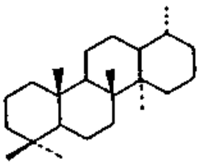
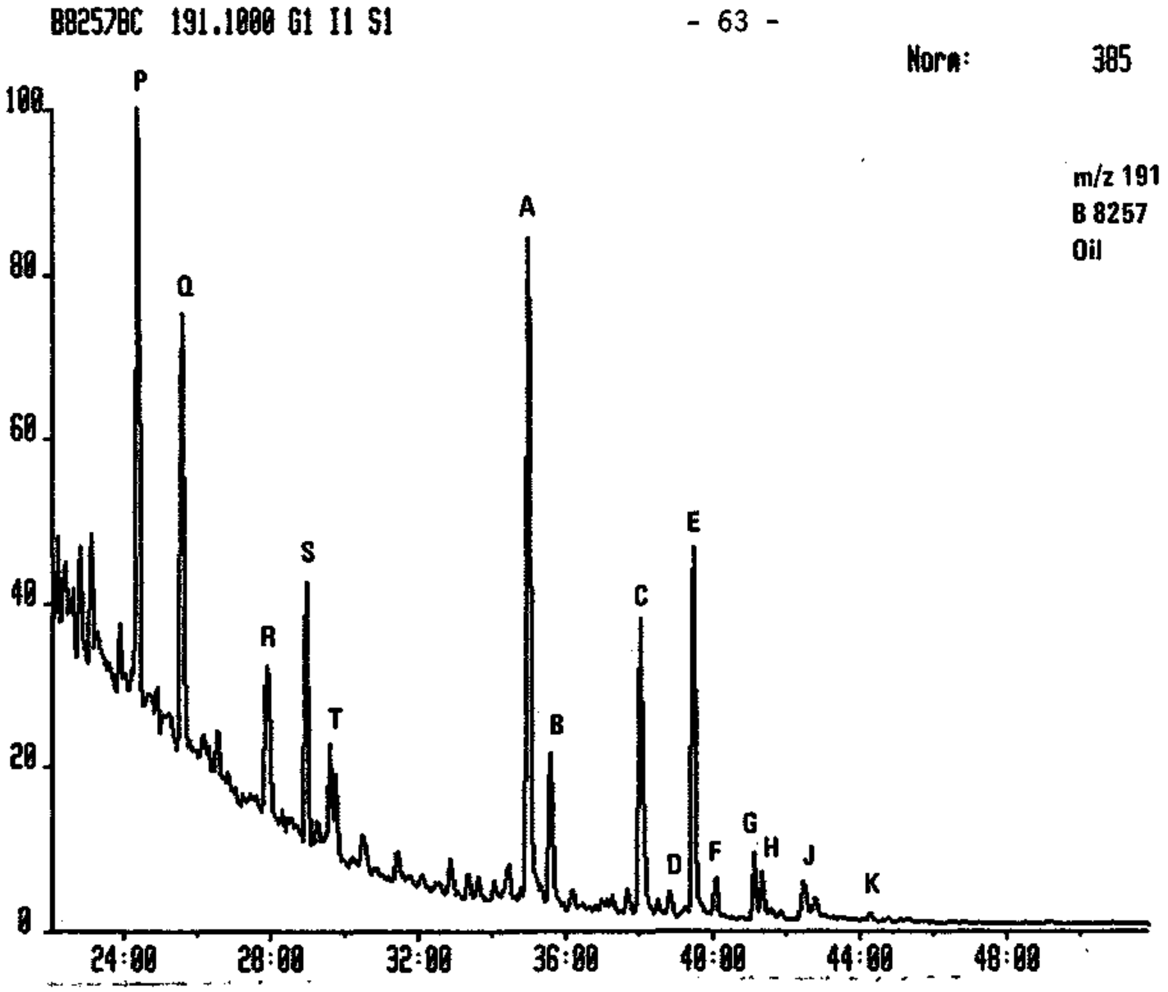
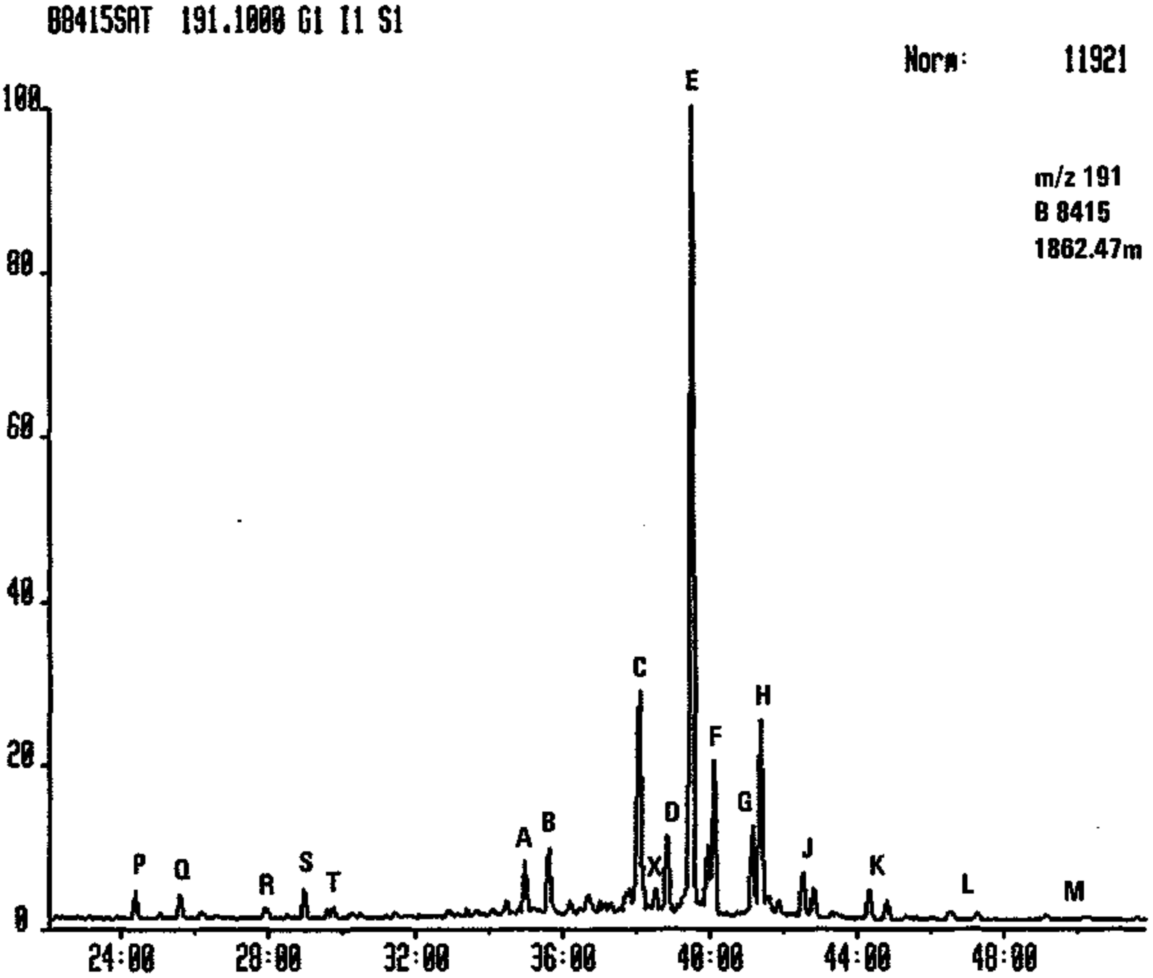





B8257BC 191.1000 G1 I1 S1
Norm: 385
m/z 191
B 8257
Oil
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
P
Q
R
S
T
A
B
C
D
E
F
G
H
J
K


B8415SAT 191.1000 G1 I1 S1
Norm: 11921
m/z 191
B 8415
1862.47m
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
P
Q
R
S
T
A
B
C
X
D
E
F
G
H
J
K
L
M

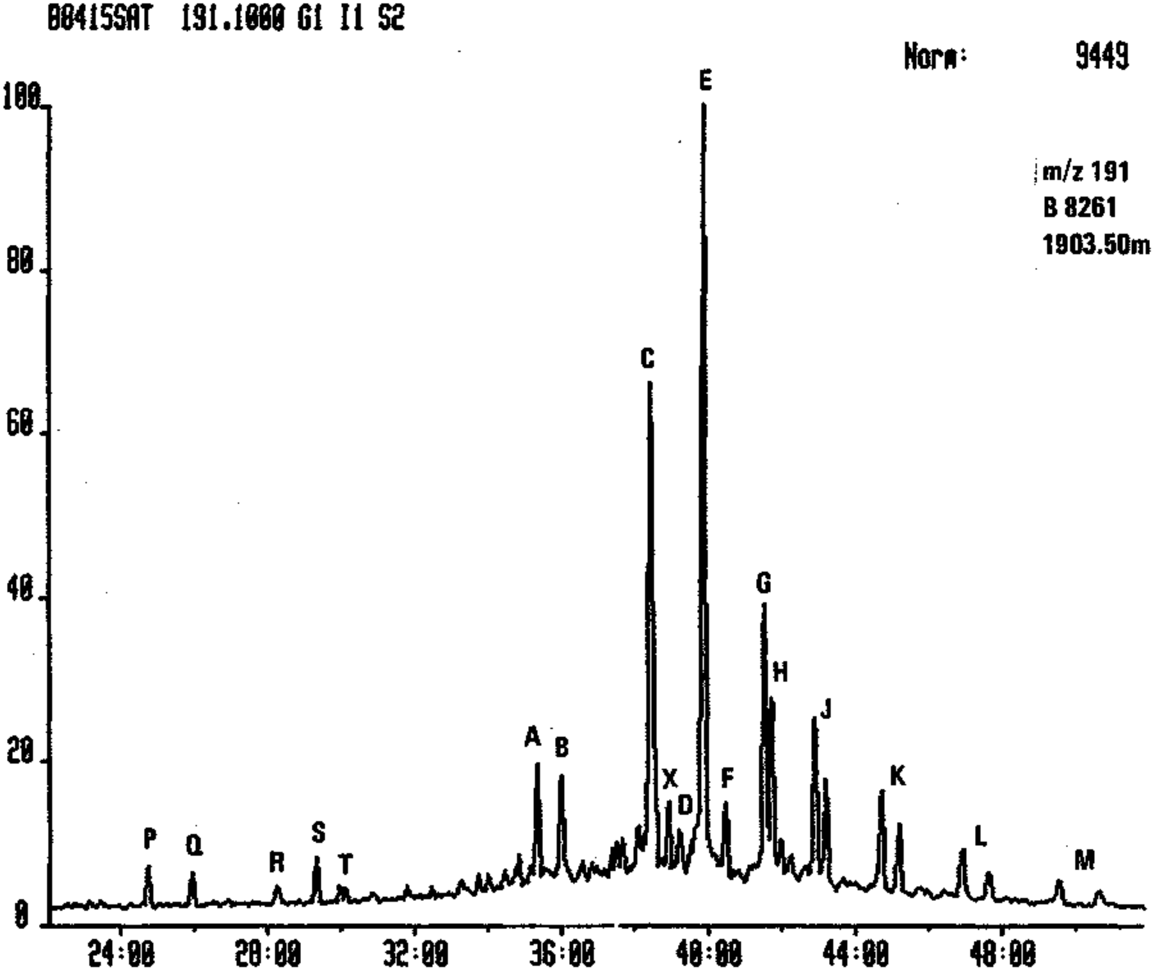
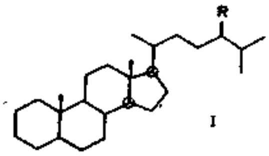

B8415SAT 191.1000 G1 I1 S2
Norm: 9449
m/z 191
B 8261
1903.50m
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
P
Q
R
S
T
A
B
C
X
D
E
F
G
H
J
K
L
M

Figure 7b.

Mass chromatograms representing steranes (m/z 217 and 218)

a	13β(H),17α(H)-diasterane (20S)	$C_{27}H_{48}$	(III,R=H)
b	13β(H),17α(H)-diasterane (20R)	$C_{27}H_{48}$	(III,R=H)
c	13α(H),17β(H)-diasterane (20S)	$C_{27}H_{48}$	(IV,R=H)
d	13α(H),17β(H)-diasterane (20R)	$C_{27}H_{48}$	(IV,R=H)
e	13β(H),17α(H)-diasterane (20S)	$C_{28}H_{50}$	(III,R=CH_3)
f	13β(H),17α(H)-diasterane (20R)	$C_{28}H_{50}$	(III,R=CH_3)
g	13α(H),17β(H)-diasterane (20S)	$C_{28}H_{50}$	(IV,R=CH_3)
	+ 14α(H),17α(H)-sterane (20S)	$C_{27}H_{48}$	(I,R=H)
h	13β(H),17α(H)-diasterane (20S)	$C_{29}H_{52}$	(III,R=C_2H_5)
	+ 14β(H),17β(H)-sterane (20R)	$C_{27}H_{48}$	(II,R=H)
i	14β(H),17β(H)-sterane (20S)	$C_{27}H_{48}$	(II,R=H)
	+ 13α(H),17β(H)-diasterane (20R)	$C_{28}H_{50}$	(IV,R=CH_3)
j	14α(H),17α(H)-sterane (20R)	$C_{27}H_{48}$	(I,R=H)
k	13β(H),17α(H)-diasterane (20R)	$C_{29}H_{52}$	(III,R=C_2H_5)
l	13α(H),17β(H)-diasterane (20S)	$C_{29}H_{52}$	(III,R=C_2H_5)
m	14α(H),17α(H)-sterane (20S)	$C_{28}H_{50}$	(I,R=CH_3)
n	13α(H),17β(H)-diasterane (20R)	$C_{29}H_{52}$	(III,R=C_2H_5)
	+ 14β (H),17β (H)-sterane (20R)	$C_{28}H_{50}$	(II,R=CH_3)
o	14β(H),17β(H)-sterane (20S)	$C_{28}H_{50}$	(II,R=CH_3)
p	14α(H),17α(H)-sterane (20R)	$C_{28}H_{50}$	(I,R=CH_3)
q	14α(H),17α(H)-sterane (20S)	$C_{29}H_{52}$	(I,R=C_2H_5)
r	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$	(II,R=C_2H_5)
	+ unknown sterane		
s	14β(H),17β(H)-sterane (20S)	$C_{29}H_{52}$	(II,R=C_2H_5)
t	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$	(I,R=C_2H_5)
u	5α(H)-sterane	$C_{21}H_{36}$	(V,R=C_2H_5)
v	5α(H)-sterane	$C_{22}H_{38}$	(IV,R=C_3H_7)



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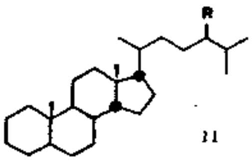
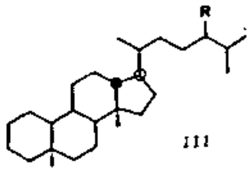
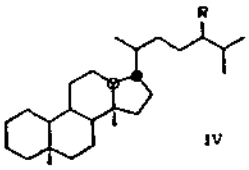


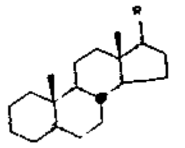
II

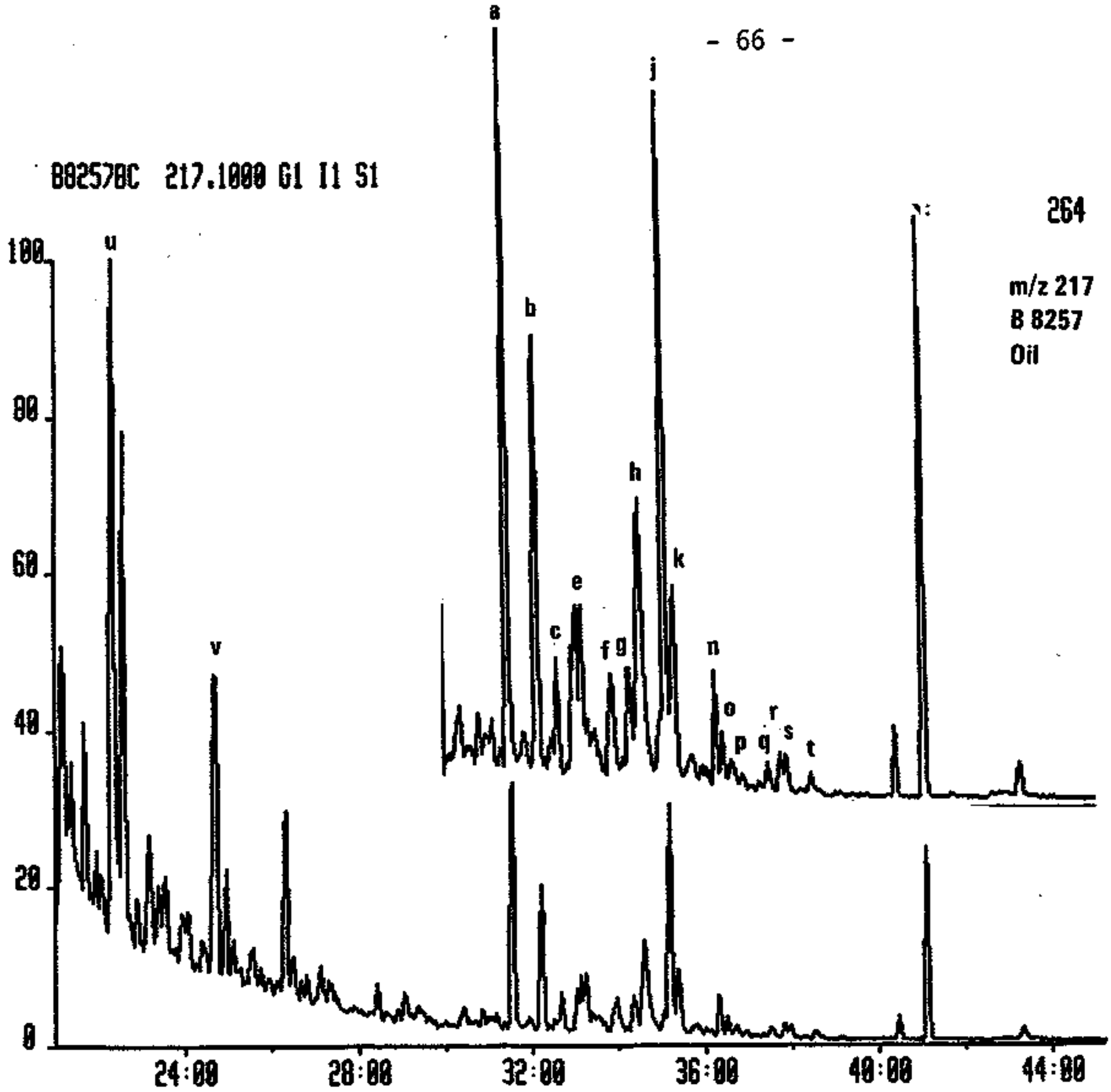


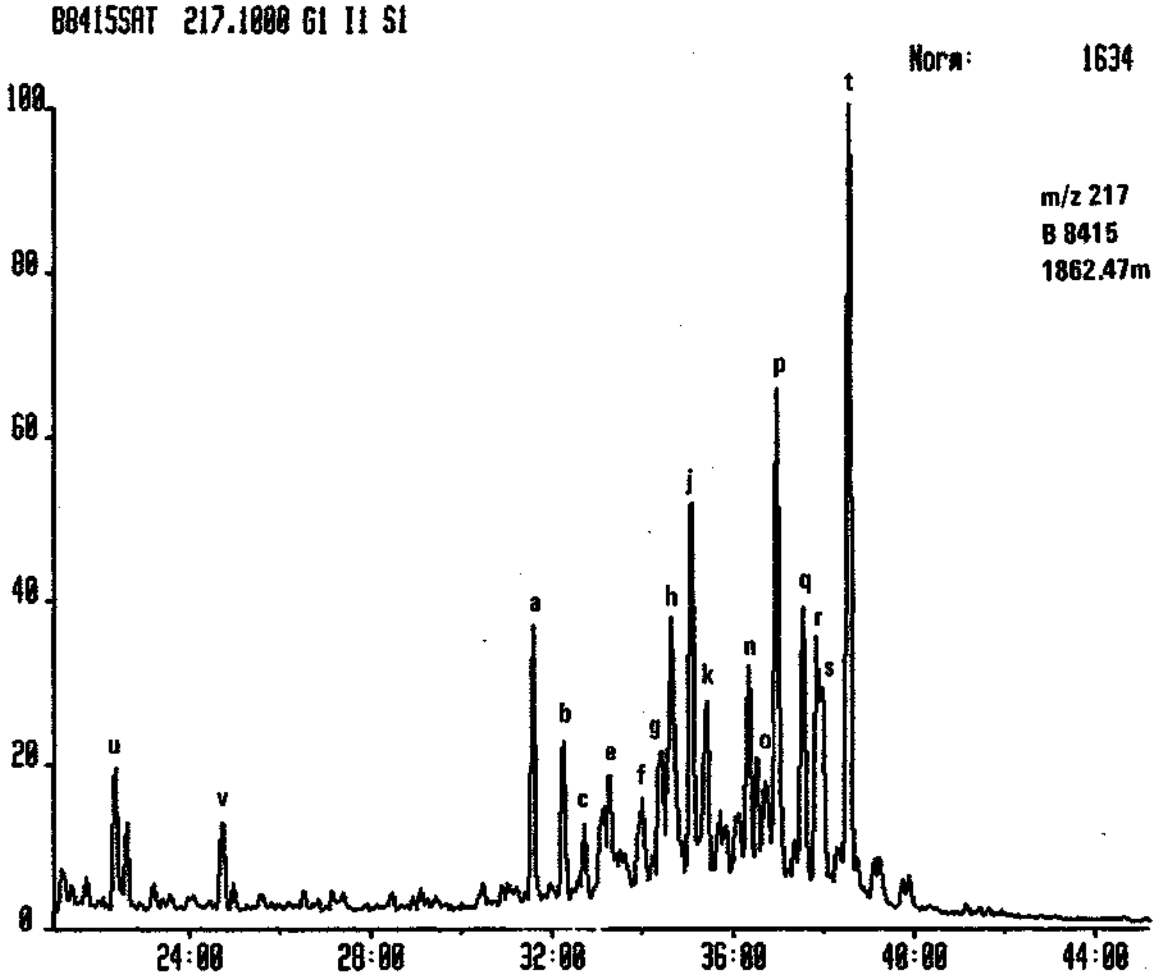
III

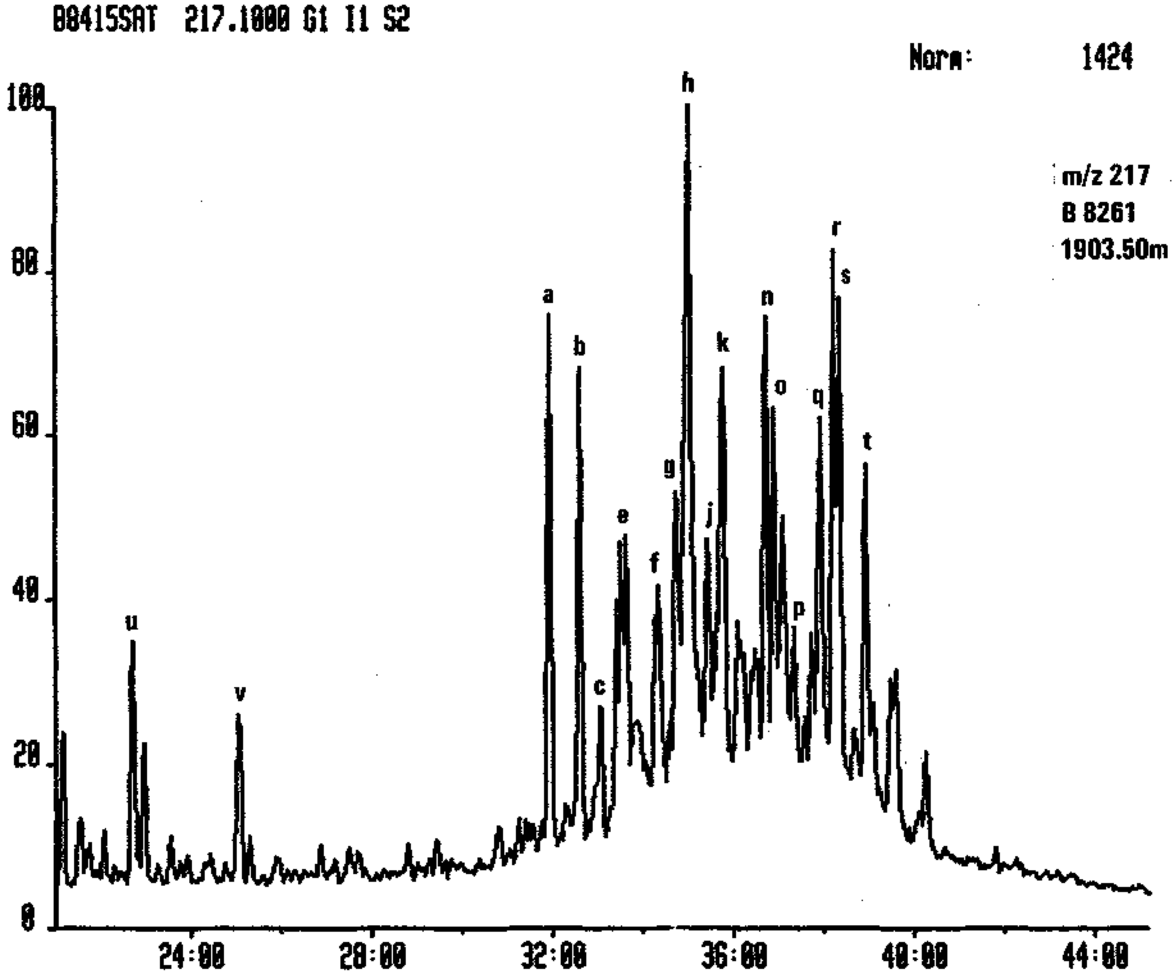


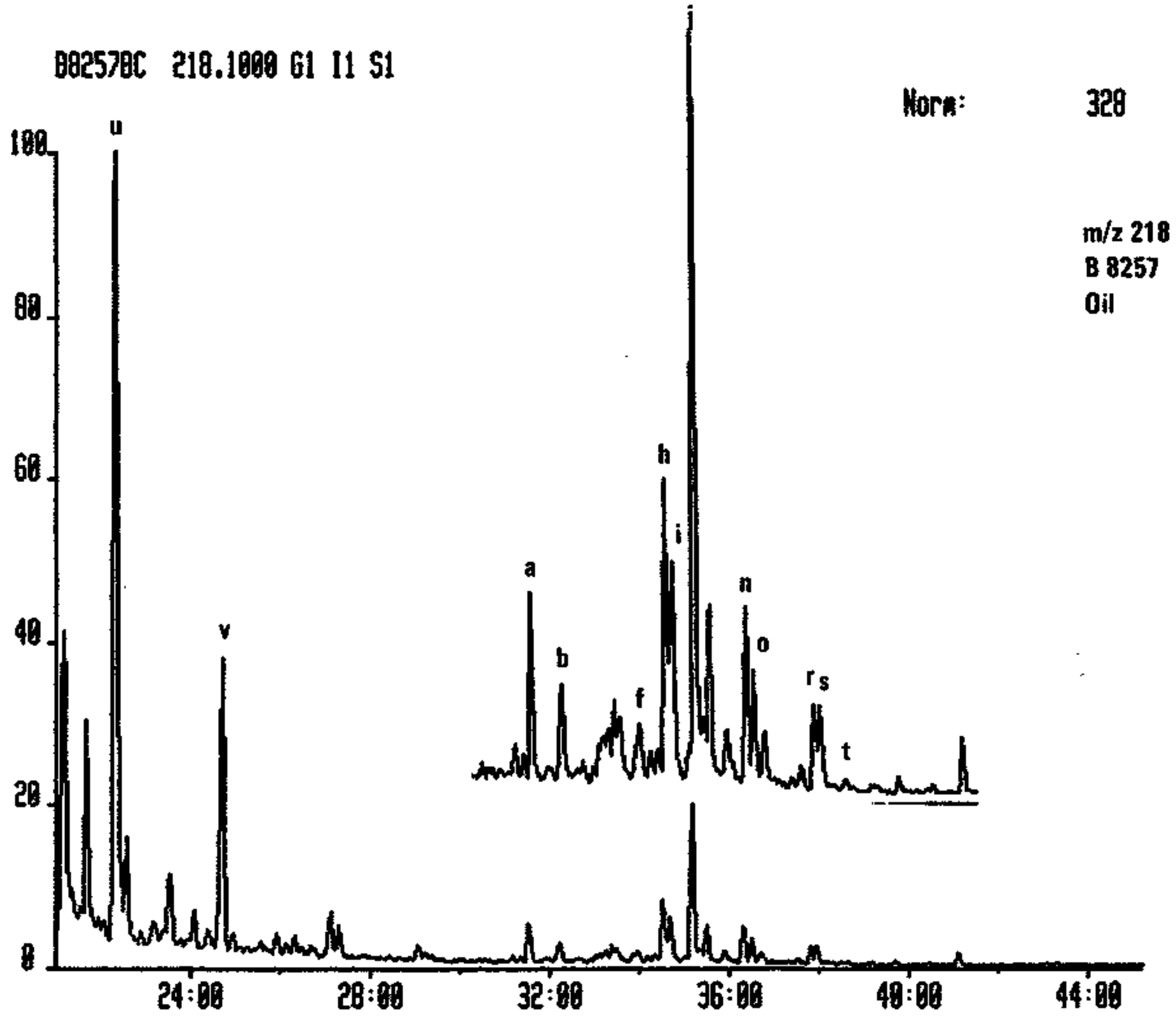
IV

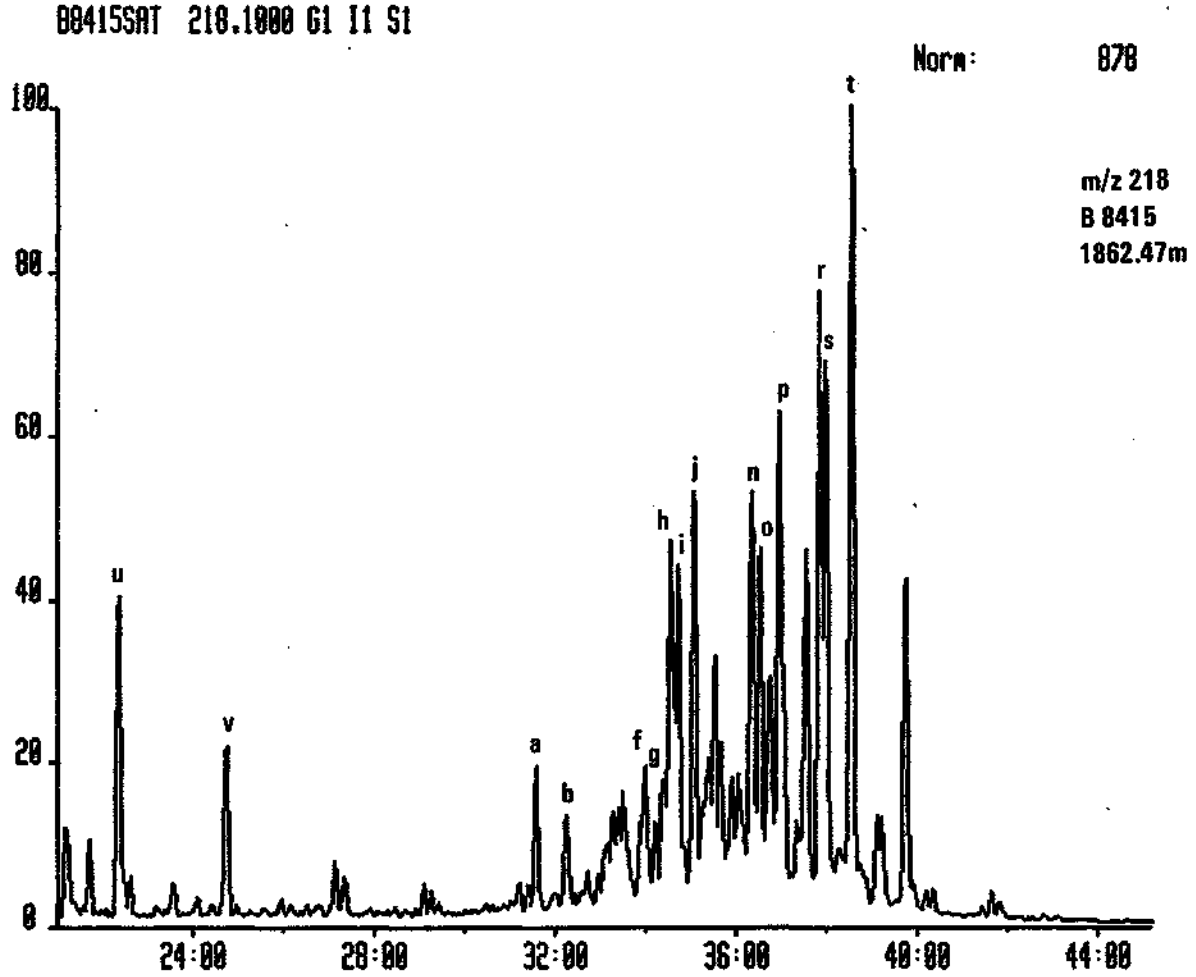



B8257BC 217.1000 G1 I1 S1
264
m/z 217
B 8257
Oil
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
a
b
c
e
f
g
h
j
k
n
o
p
q
r
s
t
u
v


B8415SAT 217.1000 G1 I1 S1
Norm: 1634
m/z 217
B 8415
1862.47m
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
u
v
a
b
c
e
f
g
h
j
k
n
o
p
q
r
s
t


B8415SAT 217.1000 G1 I1 S2
Norm: 1424
m/z 217
B 8261
1903.50m
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
u
v
a
b
c
e
f
g
h
j
k
n
o
p
q
r
s
t


B8257BC 218.1000 G1 I1 S1
Norm: 328
m/z 218
B 8257
Oil
100
80
60
40
20
0
u
v
a
b
f
h
i
j
n
o
r
s
t
24:00
28:00
32:00
36:00
40:00
44:00


B8415SAT 218.1000 G1 I1 S1
Norm: 870
m/z 218
B 8415
1862.47m
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
u
v
a
b
f
g
h
i
j
n
o
p
r
s
t

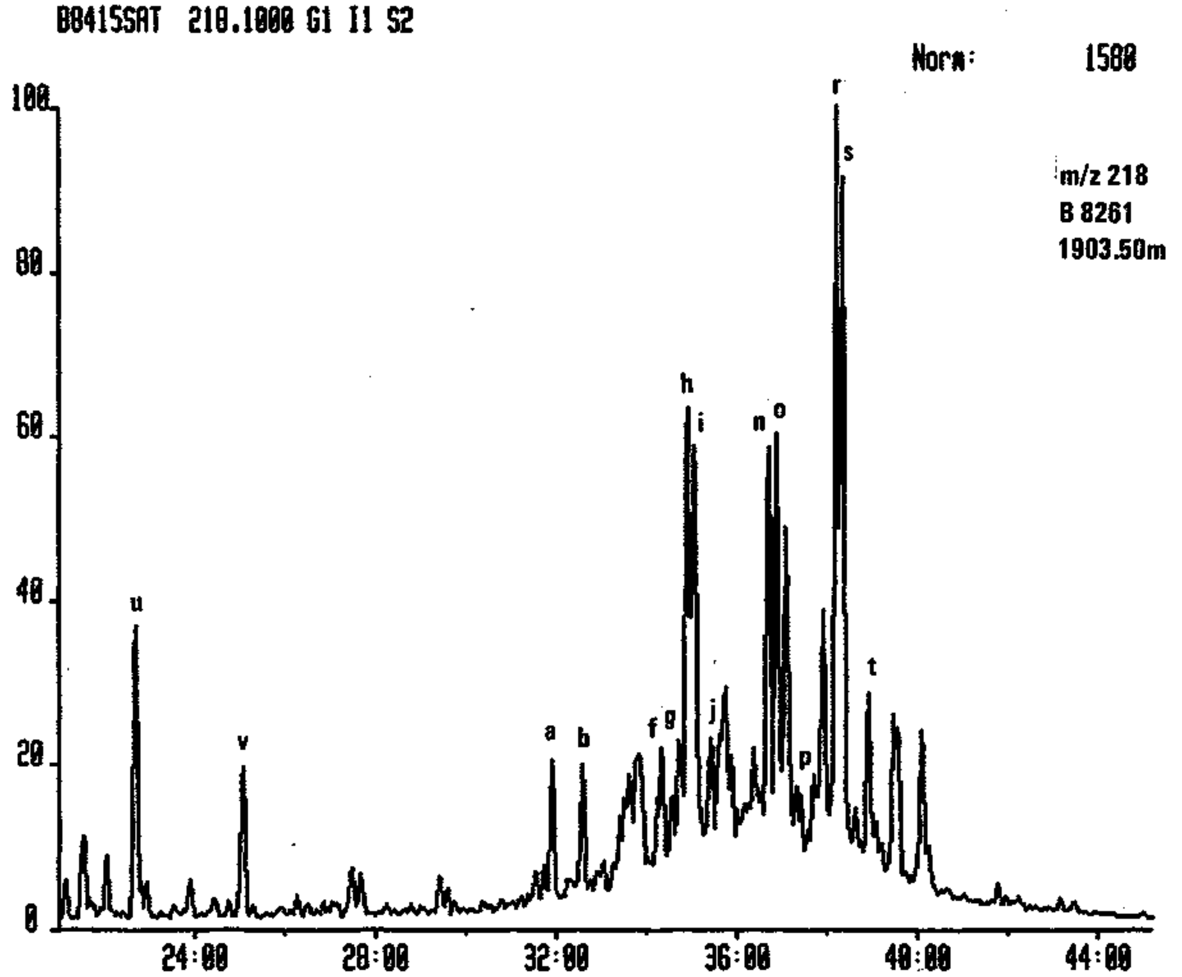
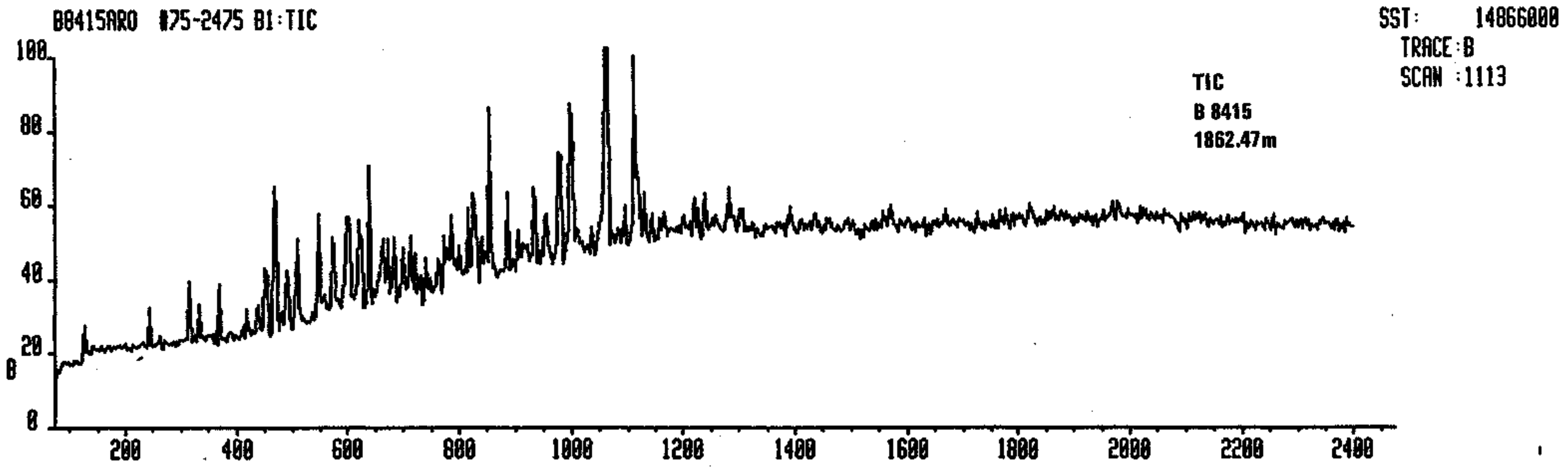

B8415SAT 218.1000 G1 I1 S2
Norm: 1500
m/z 218
B 8261
1903.50m
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
u
v
a
b
f
g
h
i
j
n
o
p
r
s
t

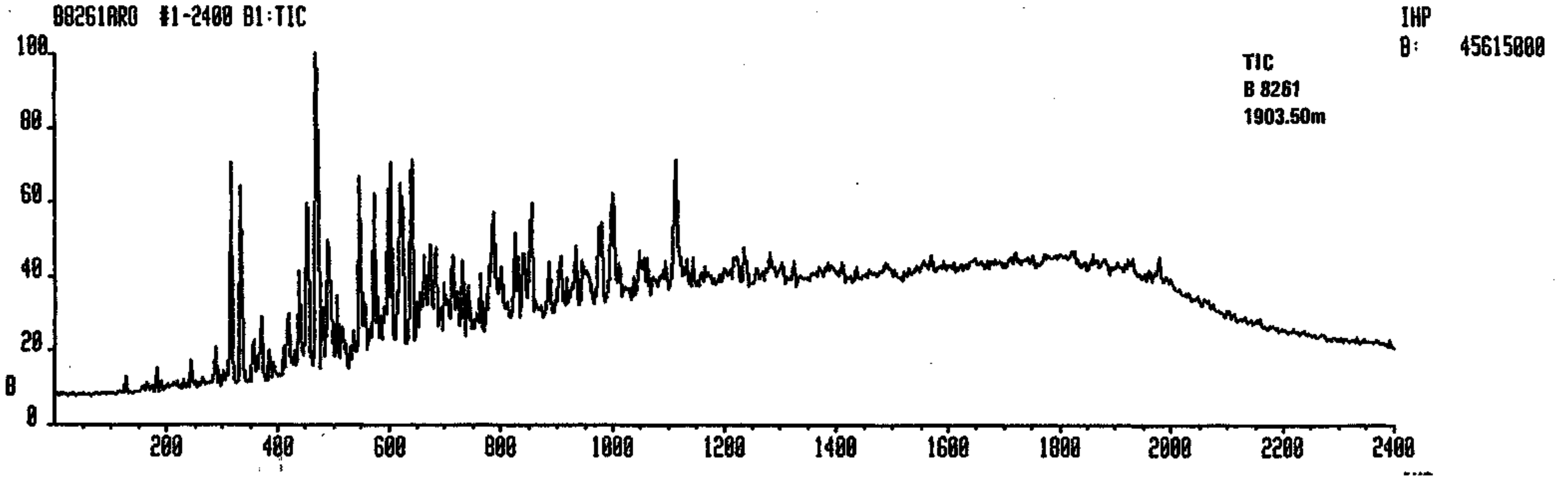
Figure 8

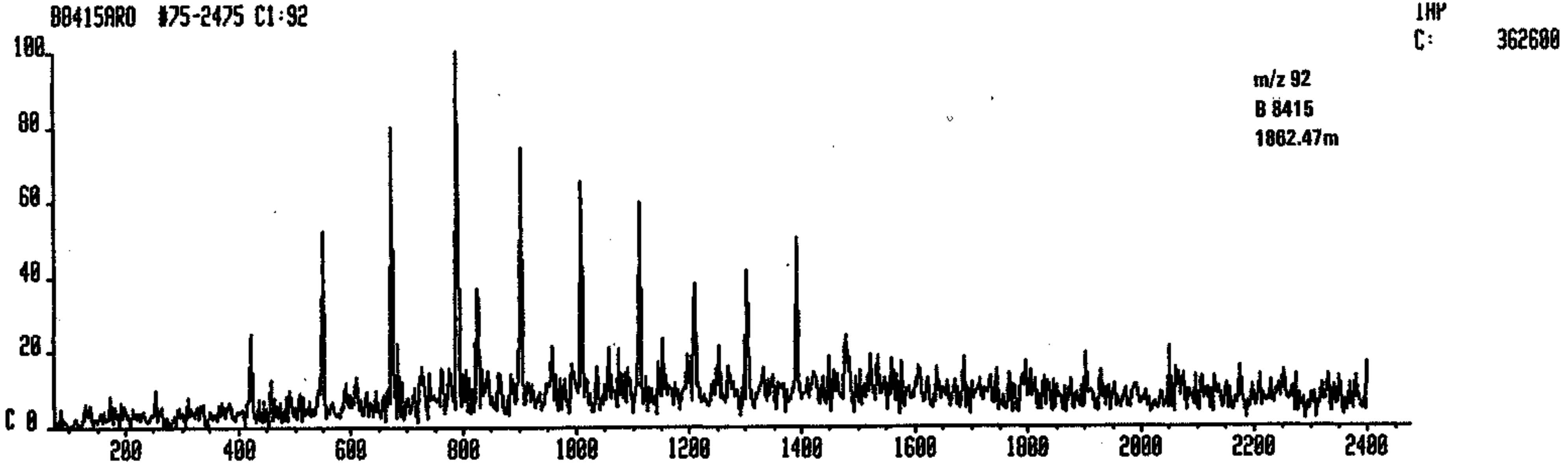
Mass chromatograms of aromatic hydrocarbons

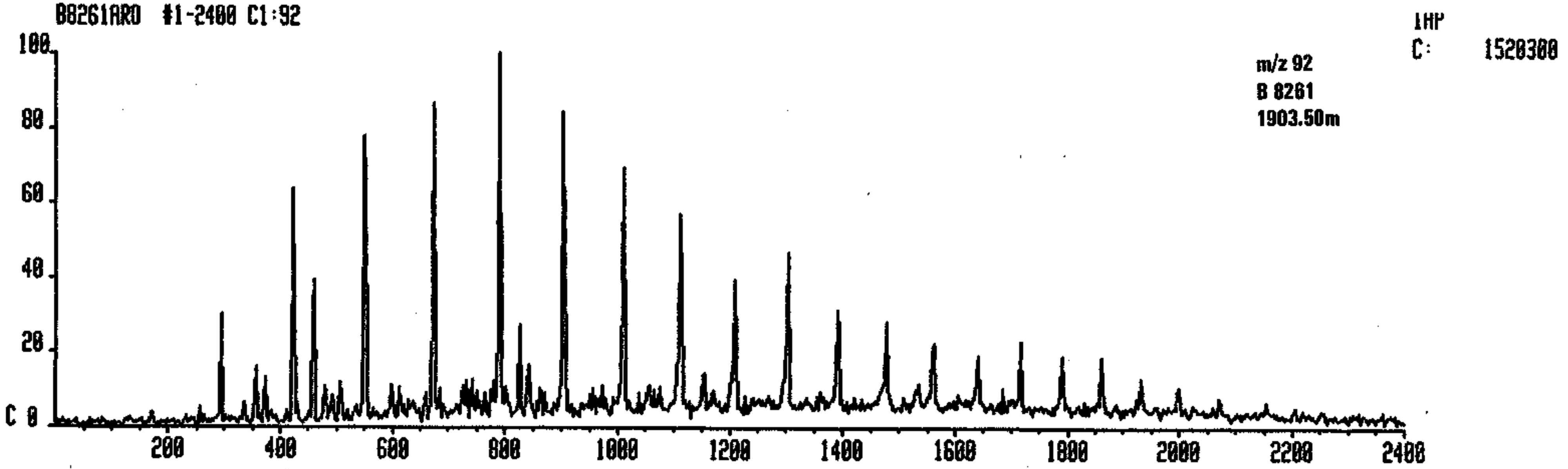
TIC - total ion chromatograms
m/z 92,106 - alkyl benzenes
m/z 142,156,170 - alkyl naphthalenes
m/z 178,192,206 - alkyl phenanthrenes
m/z 184,198,212 - alkyl dibenzothiophenes
m/z 231 - triaromatic steranes
m/z 253 - monoaromatic steranes

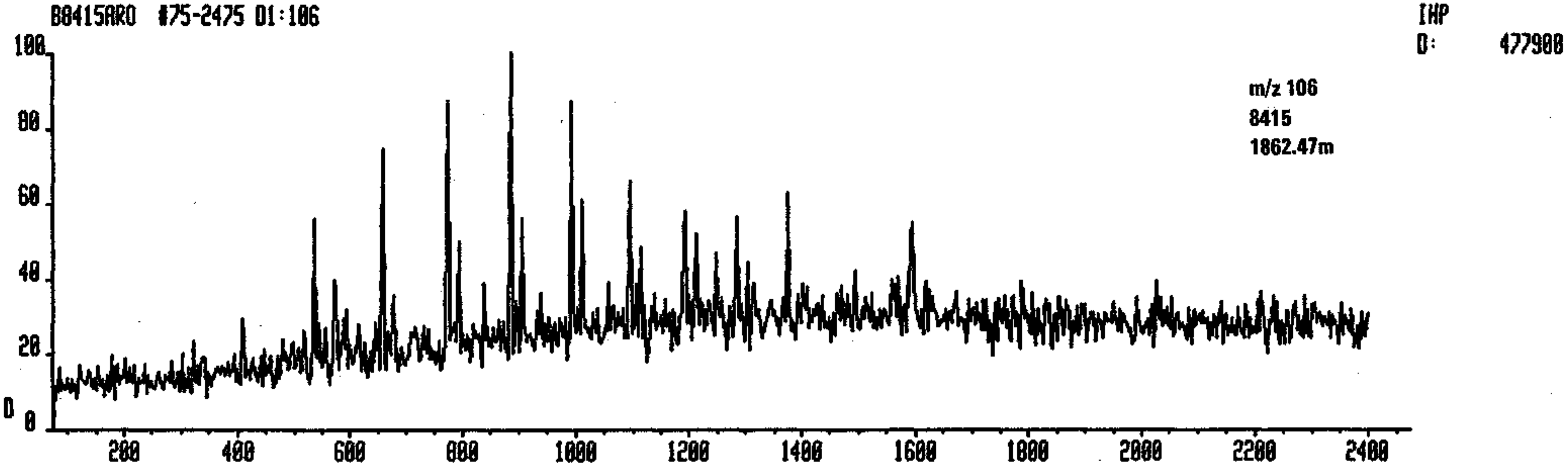
Core samples

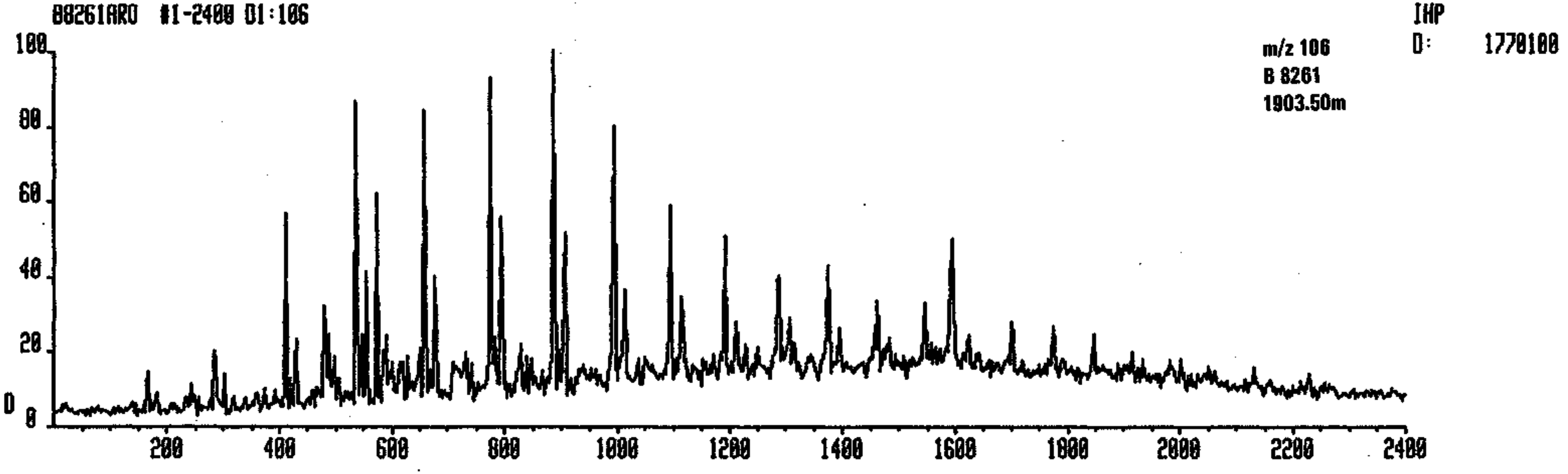

B8415ARO #75-2475 B1:TIC
SST: 14866000
TRACE:B
SCAN :1113
TIC
B 8415
1862.47m
100
80
60
40
20
B
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

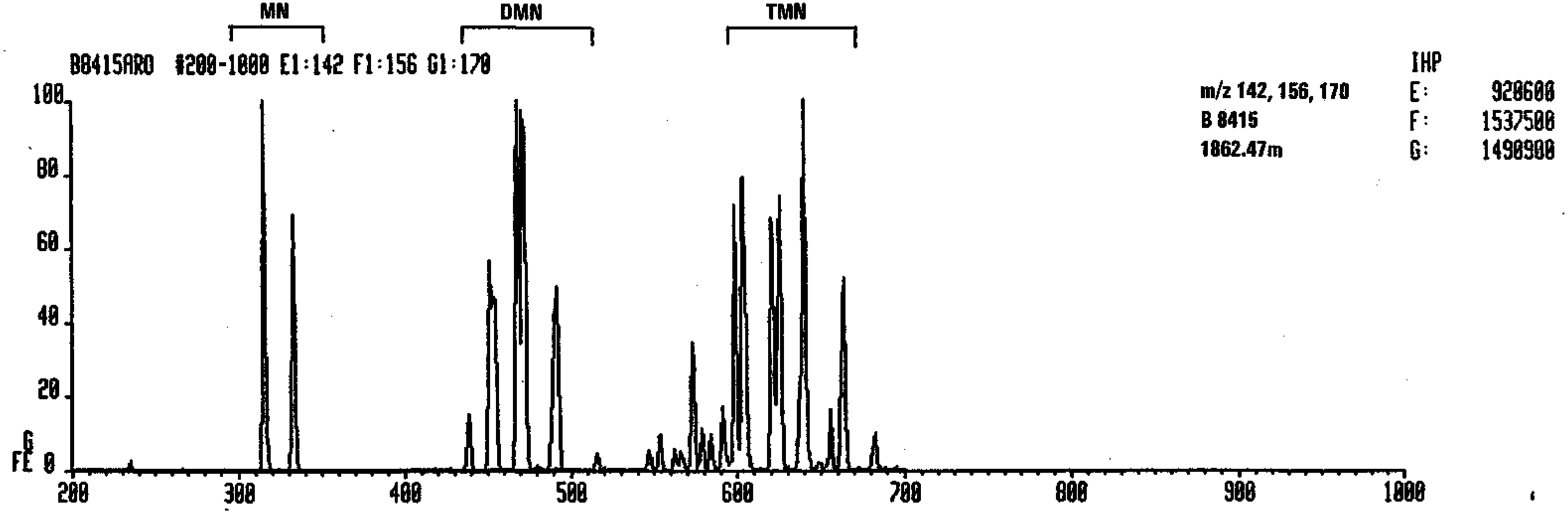

B8261ARO #1-2400 B1:TIC
IHP
B: 45615000
TIC
B 8261
1903.50m
100
80
60
40
20
B
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

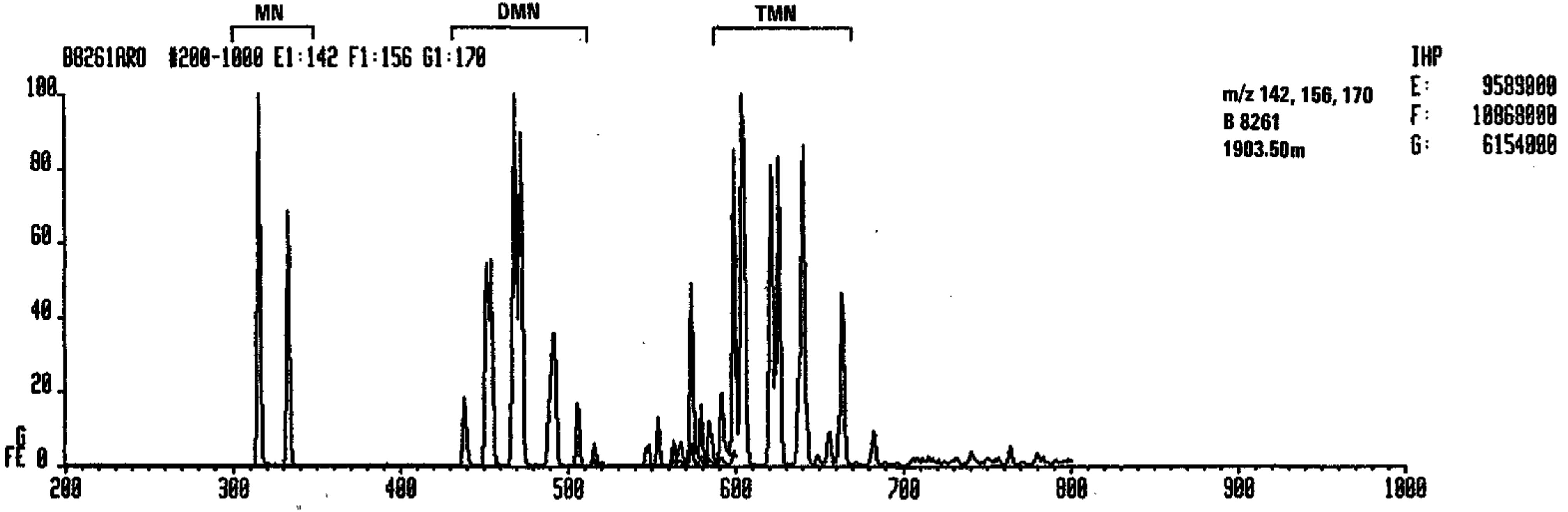

B8415ARO #75-2475 C1:92
1HP
C: 362600
m/z 92
B 8415
1862.47m
100
80
60
40
20
C 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

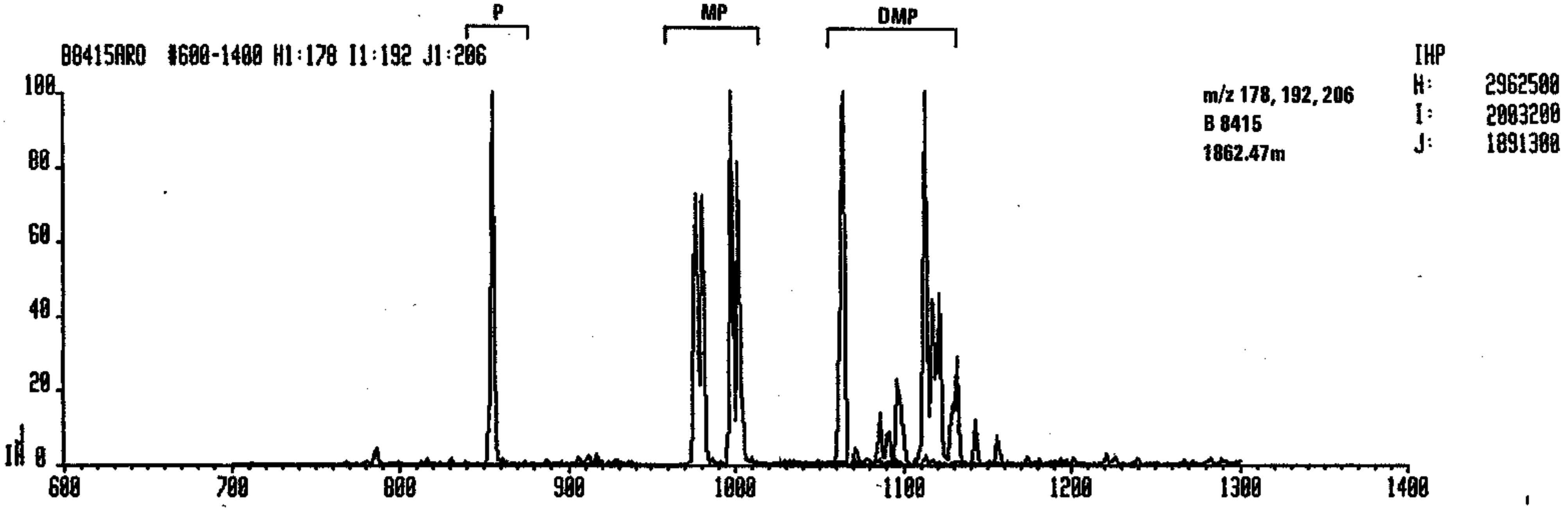

B8261ARO #1-2400 C1:92
1HP
C: 1520300
m/z 92
B 8261
1903.50m
100
80
60
40
20
C 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

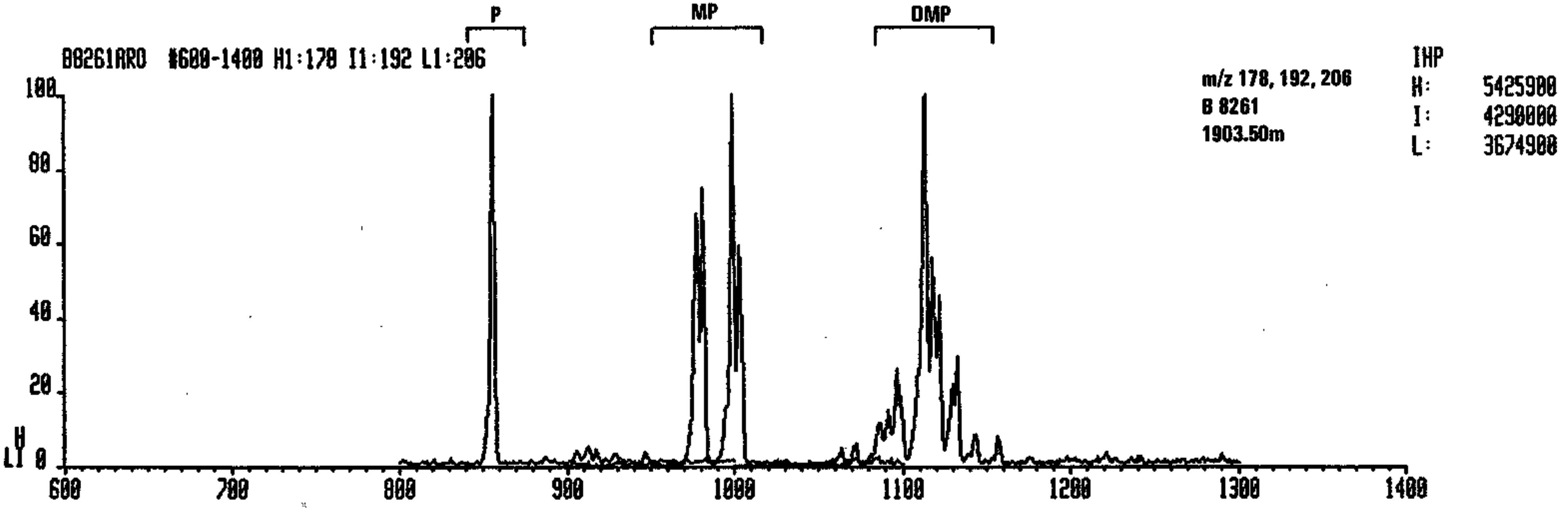

B8415ARO #75-2475 DI:106
IHP
D: 477900
m/z 106
8415
1862.47m
100
80
60
40
20
D 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

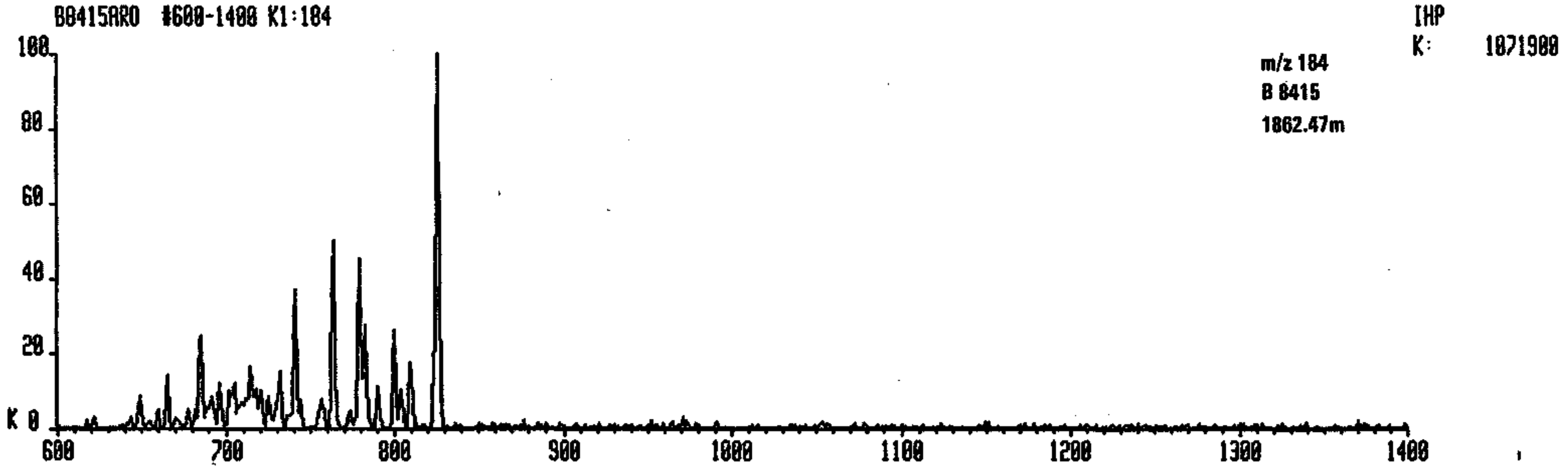

B8261ARO #1-2400 DI:106
IHP
D: 1770100
m/z 106
B 8261
1903.50m
100
80
60
40
20
D 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

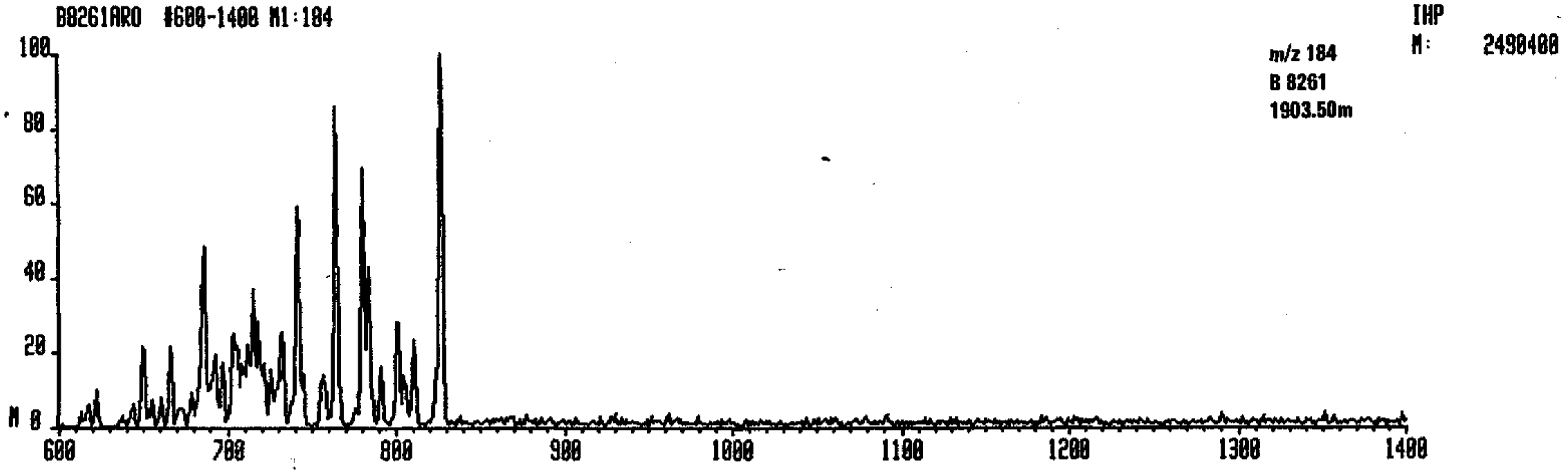

MN
DMN
TMN
B8415AR0 #200-1000 E1:142 F1:156 G1:170
m/z 142, 156, 170
B 8415
1862.47m
IHP
E: 920600
F: 1537500
G: 1490900
100
80
60
40
20
G
FE 0
200
300
400
500
600
700
800
900
1000

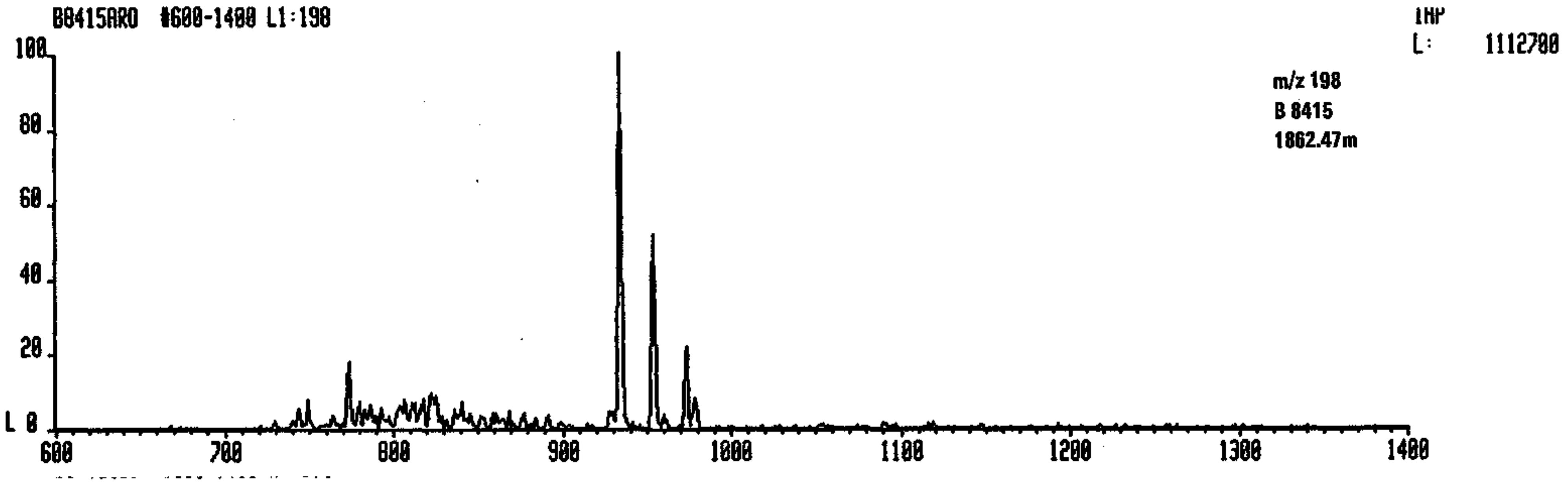

MN
DMN
TMN
B8261AR0 #200-1000 E1:142 F1:156 G1:170
m/z 142, 156, 170
B 8261
1903.50m
IHP
E: 9589000
F: 10068000
G: 6154000
100
80
60
40
20
G
FE 0
200
300
400
500
600
700
800
900
1000

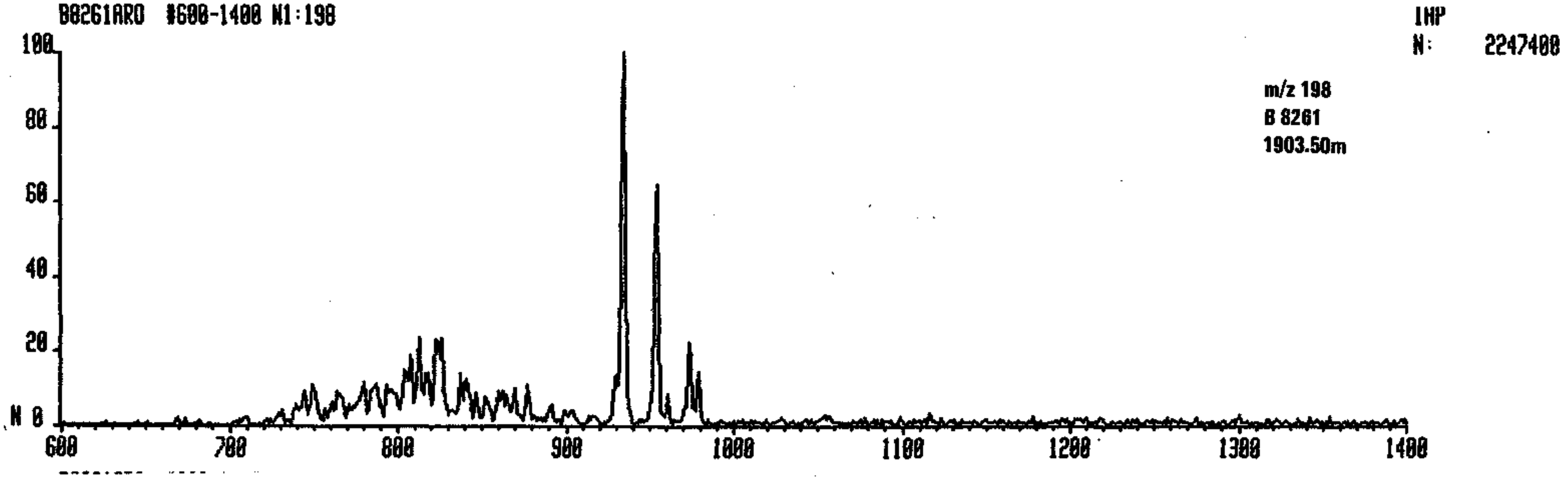

P
MP
DMP
B8415ARO #600-1400 H1:178 I1:192 J1:206
m/z 178, 192, 206
B 8415
1862.47m
IHP
H: 2962500
I: 2003200
J: 1891300
100
80
60
40
20
0
IH J
600
700
800
900
1000
1100
1200
1300
1400

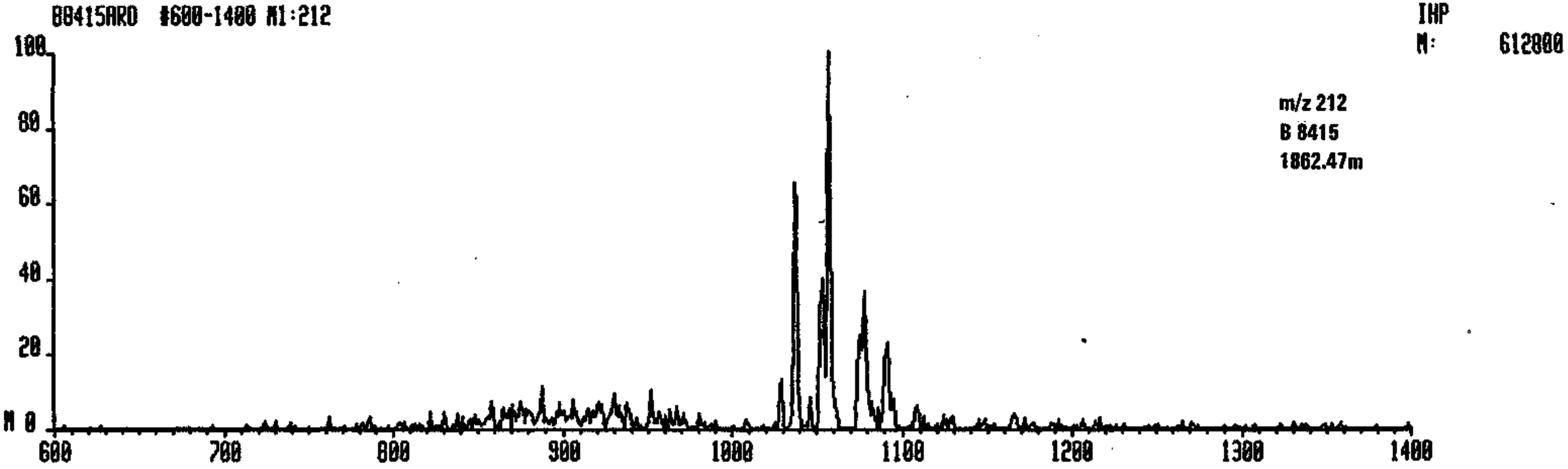

P
MP
DMP
B8261ARO #600-1400 H1:178 I1:192 L1:206
m/z 178, 192, 206
B 8261
1903.50m
IHP
H: 5425900
I: 4290000
L: 3674900
100
80
60
40
20
0
LI H
600
700
800
900
1000
1100
1200
1300
1400

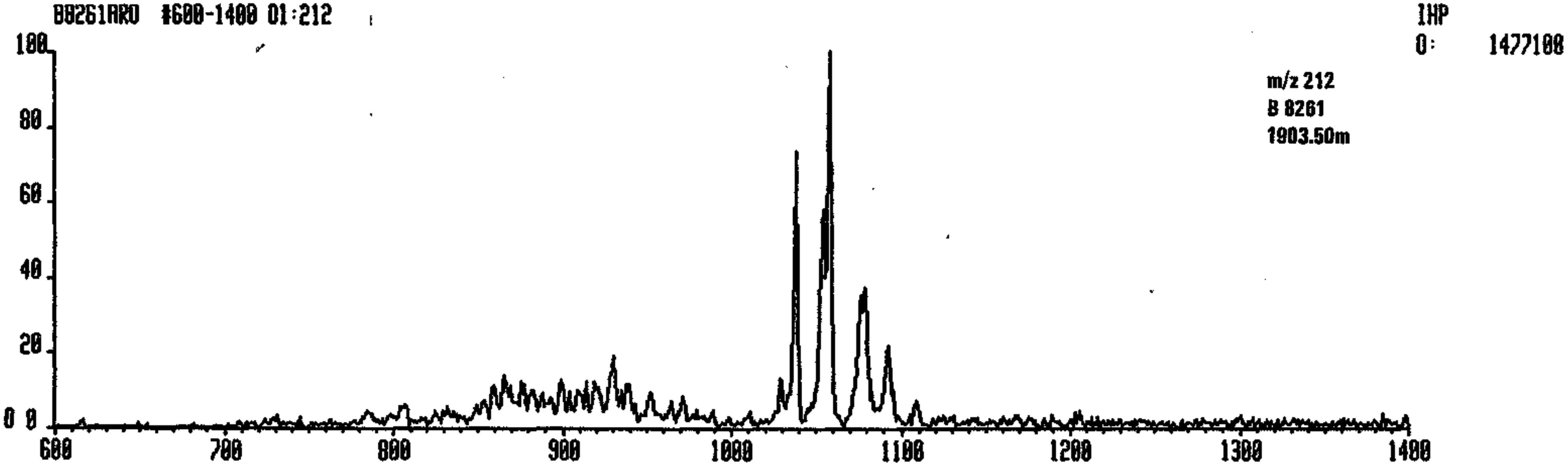

B8415ARO #600-1400 K1:184
IHP
K: 1071900
m/z 184
B 8415
1862.47m
100
80
60
40
20
K 0
600
700
800
900
1000
1100
1200
1300
1400

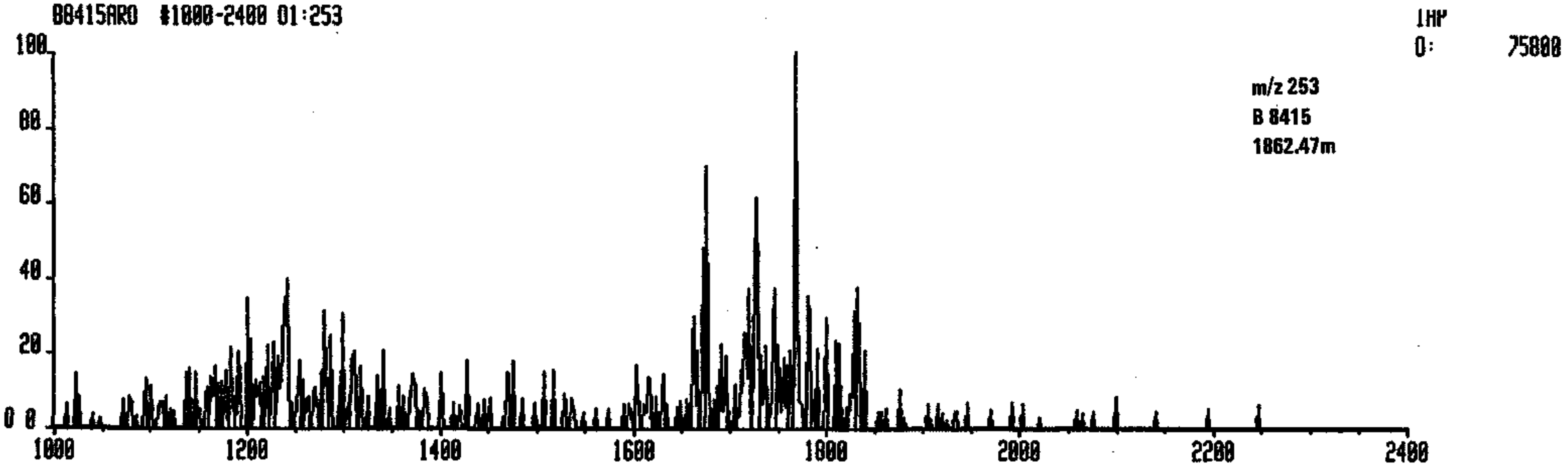

B8261ARO #600-1400 M1:184
IHP
M: 2490400
m/z 184
B 8261
1903.50m
100
80
60
40
20
M 0
600
700
800
900
1000
1100
1200
1300
1400

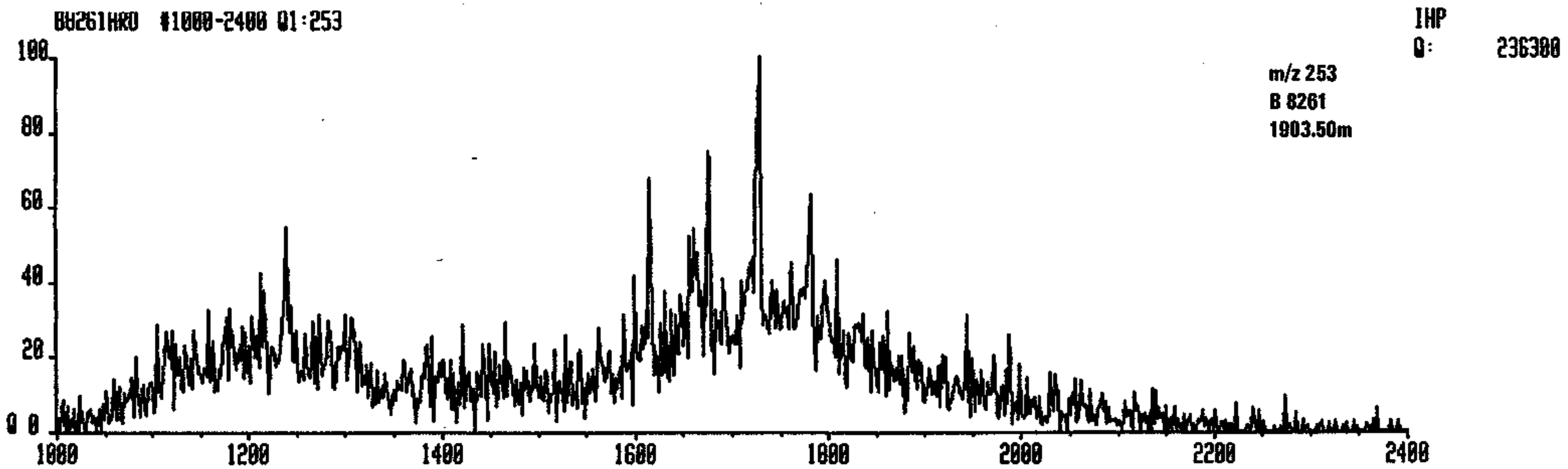

B0415ARO #600-1400 L1:198
INP
L: 1112700
m/z 198
B 8415
1862.47m
100
80
60
40
20
L 0
600
700
800
900
1000
1100
1200
1300
1400

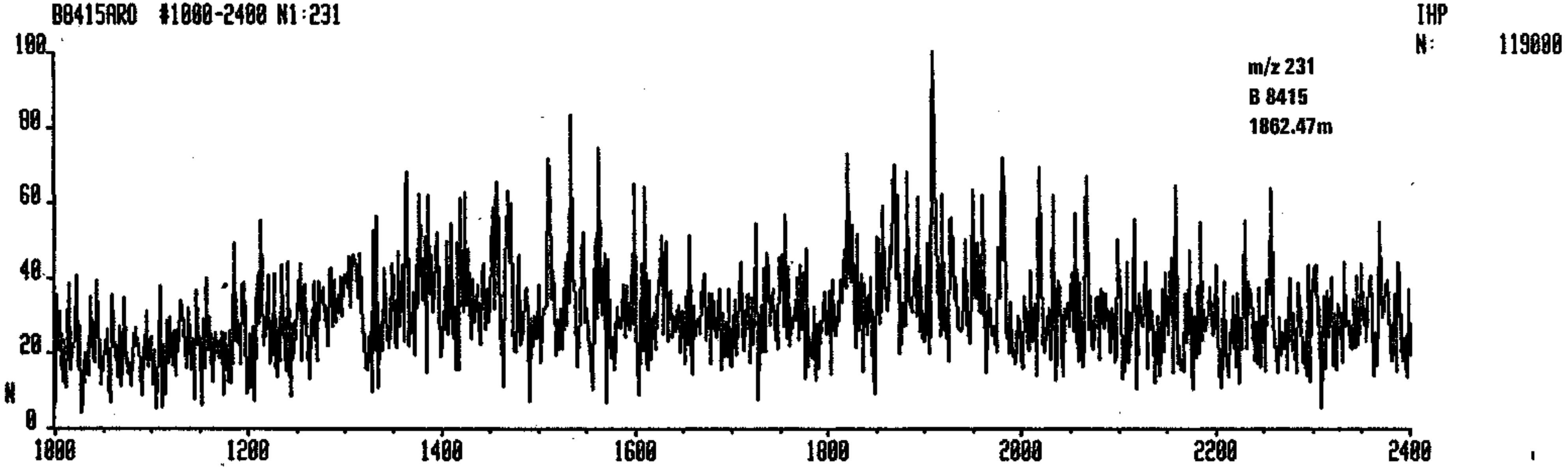

B0261ARO #600-1400 N1:198
INP
N: 2247400
m/z 198
B 8261
1903.50m
100
80
60
40
20
N 0
600
700
800
900
1000
1100
1200
1300
1400

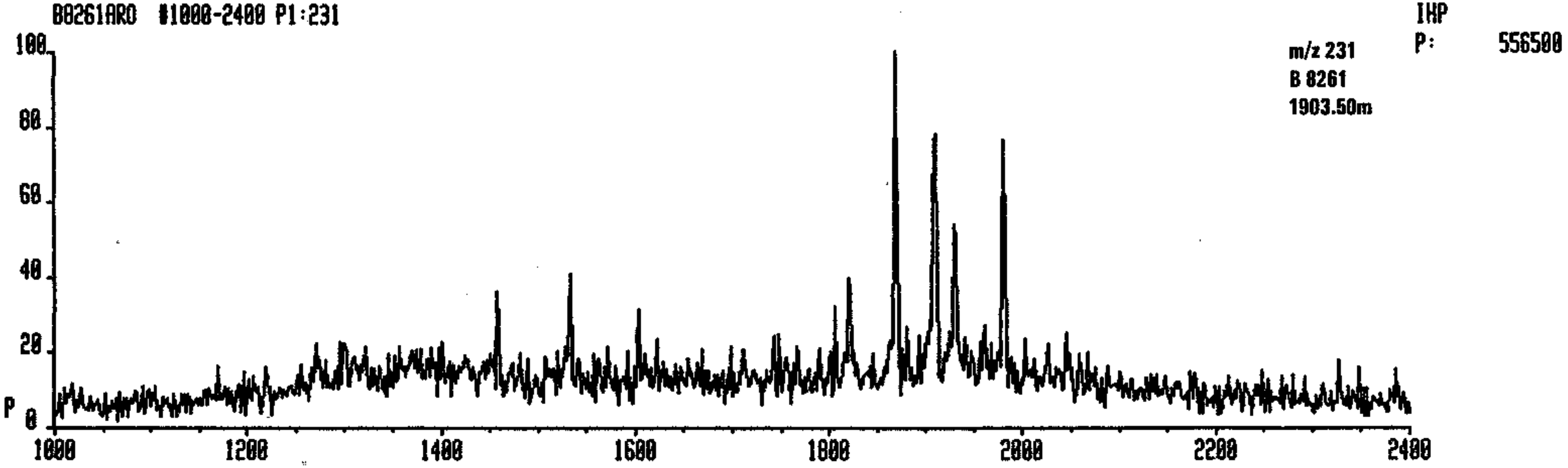

B8415ARO #600-1400 M1:212
IHP
M: 612800
m/z 212
B 8415
1862.47m
100
80
60
40
20
M 0
600
700
800
900
1000
1100
1200
1300
1400


B8261ARO #600-1400 O1:212
IHP
O: 1477100
m/z 212
B 8261
1903.50m
100
80
60
40
20
O 0
600
700
800
900
1000
1100
1200
1300
1400

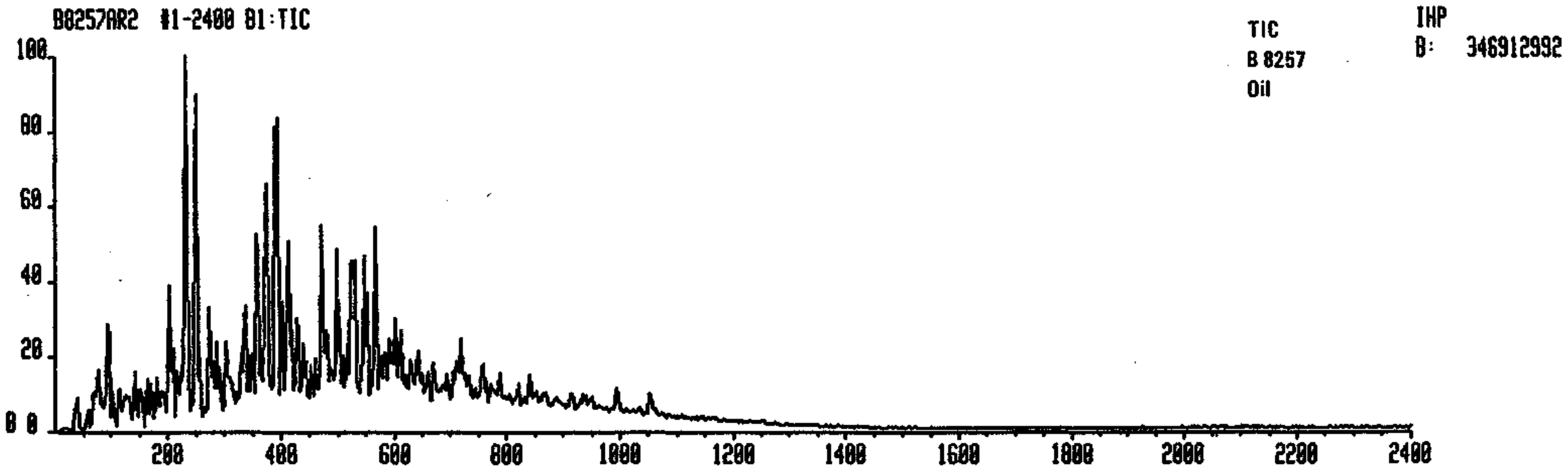

B8415ARO #1000-2400 01:253
IHP
0: 75800
m/z 253
B 8415
1862.47m
100
80
60
40
20
0 0
1000
1200
1400
1600
1800
2000
2200
2400

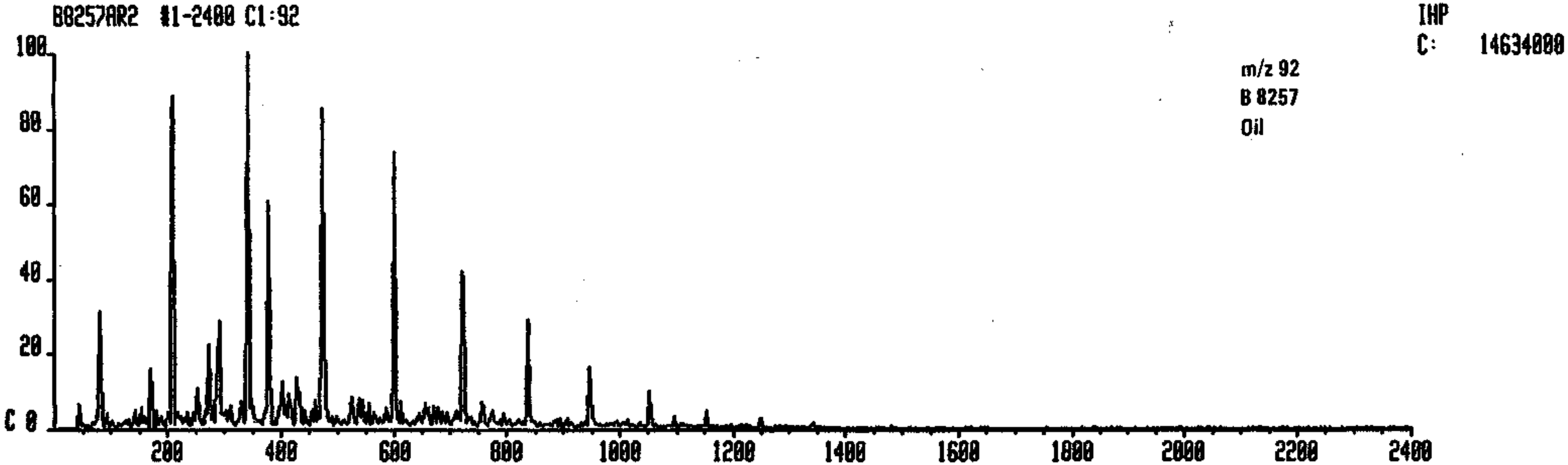

B8261ARO #1000-2400 01:253
IHP
0: 236300
m/z 253
B 8261
1903.50m
100
80
60
40
20
0 0
1000
1200
1400
1600
1800
2000
2200
2400

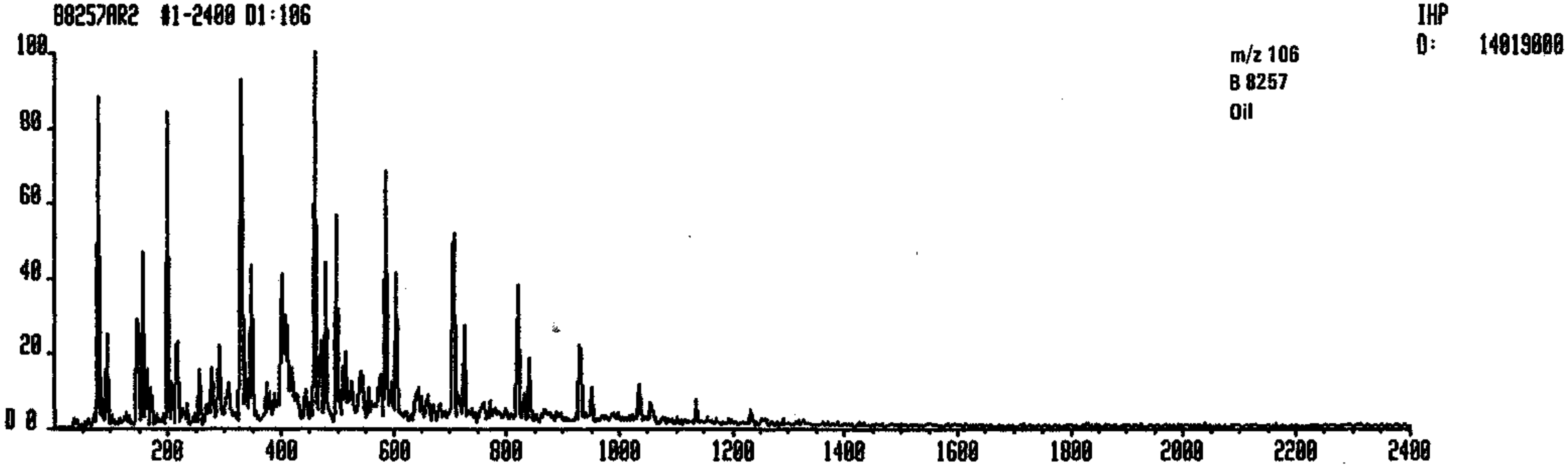

B8415ARO #1000-2400 N1:231
IHP
N: 119000
m/z 231
B 8415
1862.47m
100
80
60
40
20
N
0
1000
1200
1400
1600
1800
2000
2200
2400

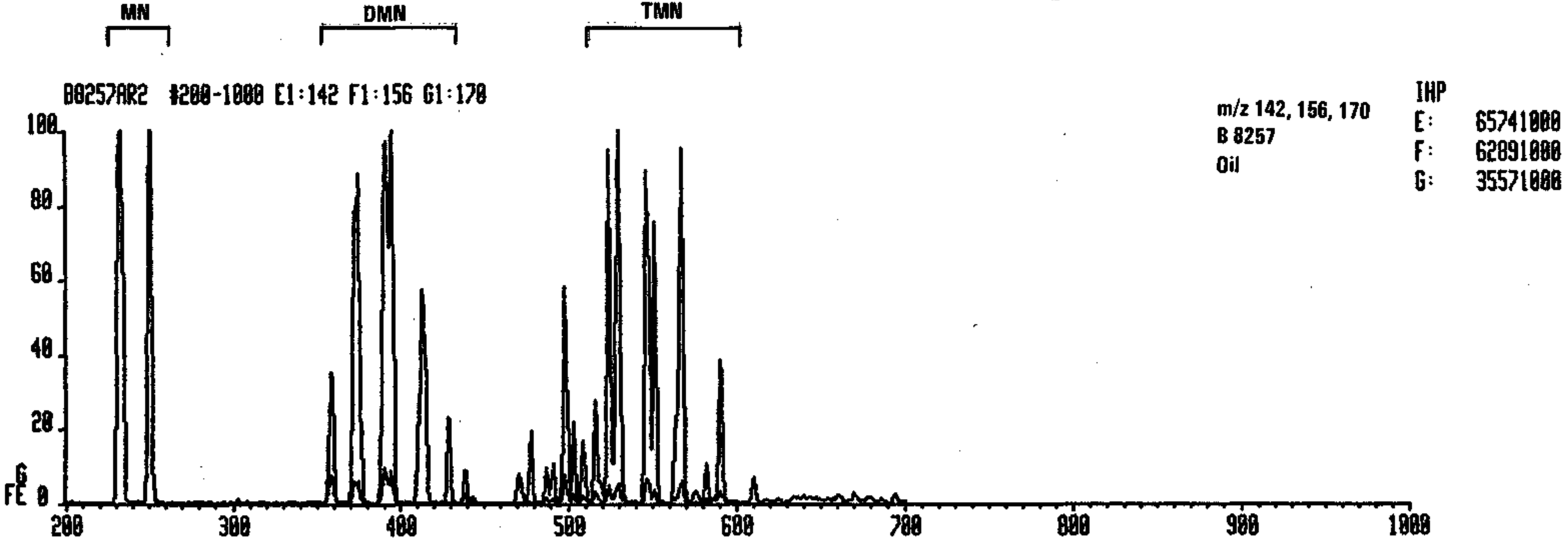

B8261ARO #1000-2400 P1:231
IHP
P: 556500
m/z 231
B 8261
1903.50m
100
80
60
40
20
P
0
1000
1200
1400
1600
1800
2000
2200
2400

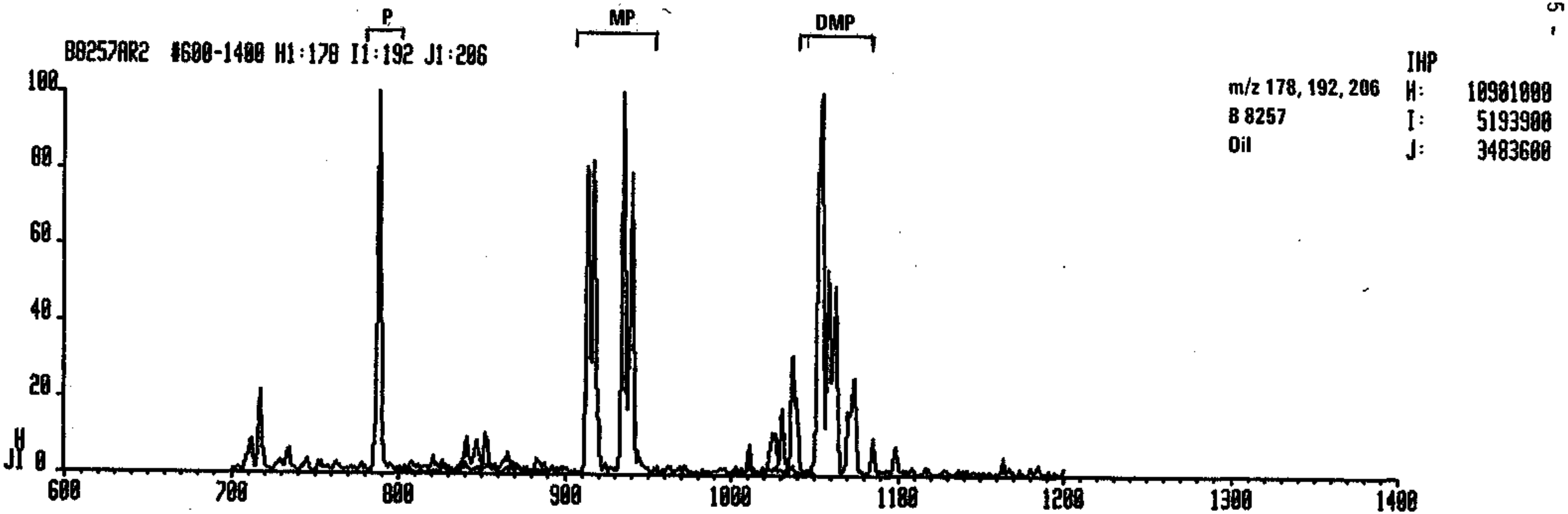
Oil sample

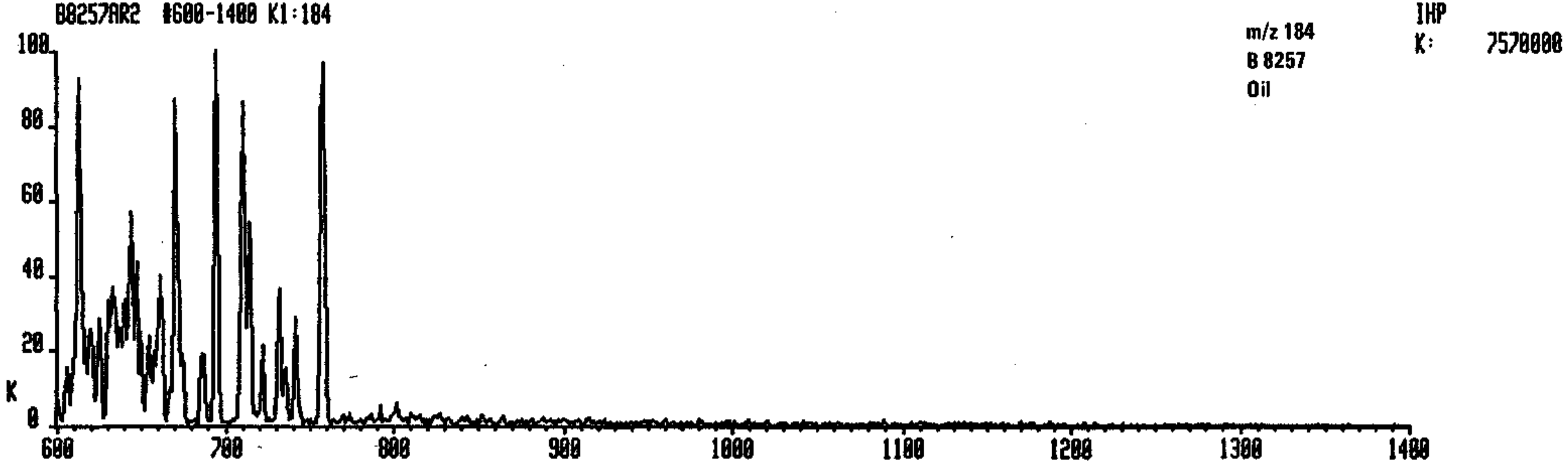

B0257AR2 #1-2400 B1:TIC
TIC
B 8257
Oil
IHP
B: 346912992
100
80
60
40
20
0 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

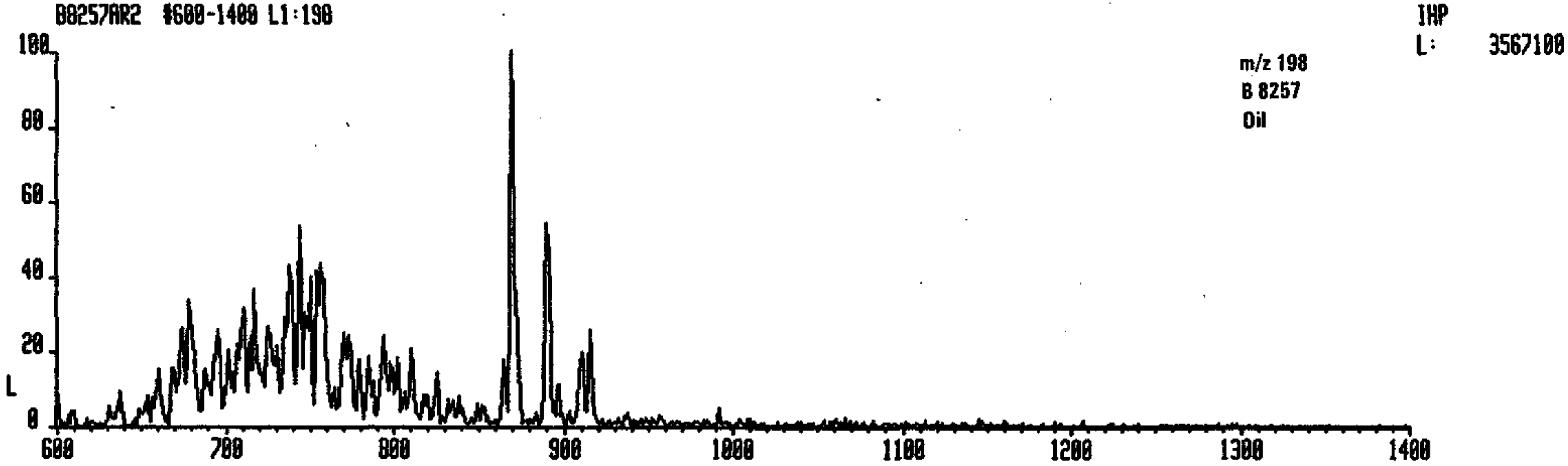

B8257AR2 #1-2400 C1:92
IHP
C: 14634000
m/z 92
B 8257
Oil
100
80
60
40
20
C 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

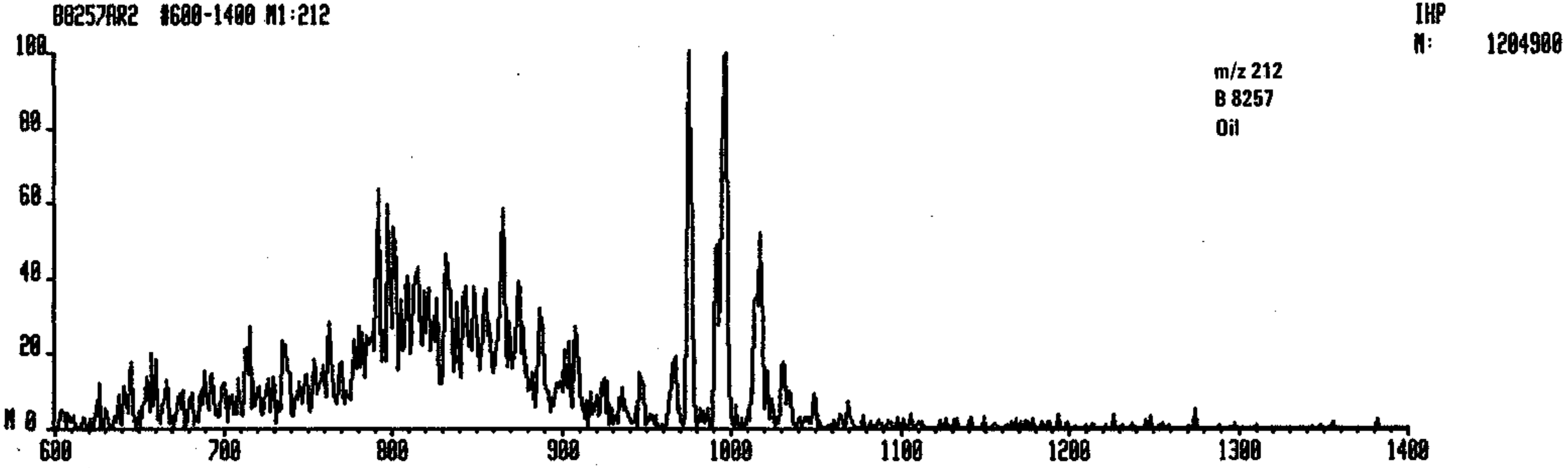

B8257AR2 #1-2400 D1:106
IHP
D: 14019000
m/z 106
B 8257
Oil
100
80
60
40
20
D 0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

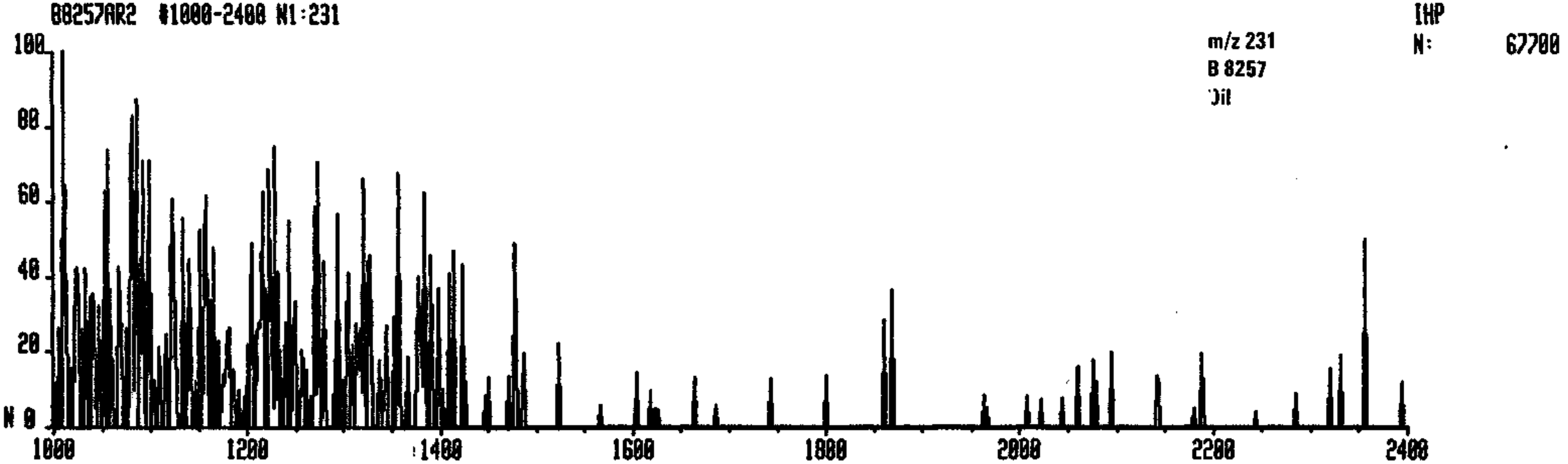

MN
DMN
TMN
B0257AR2 #200-1000 E1:142 F1:156 G1:170
m/z 142, 156, 170
B 8257
Oil
IHP
E: 65741000
F: 62891000
G: 35571000
100
80
60
40
20
G
FE 0
200
300
400
500
600
700
800
900
1000

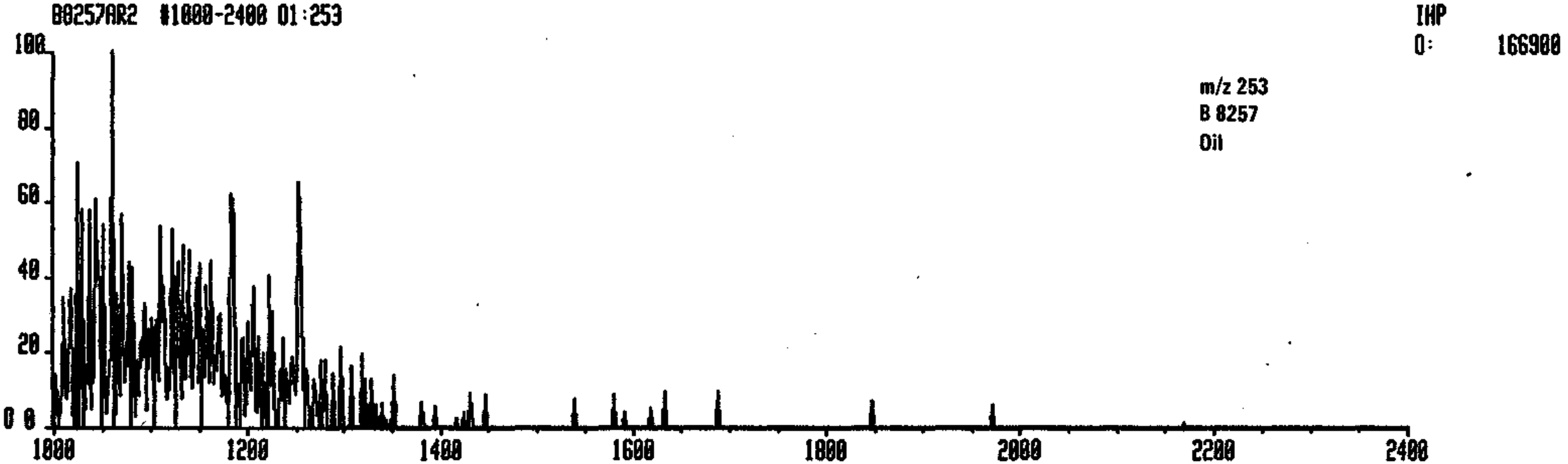

P
MP
DMP
B0257AR2 #600-1400 H1:178 I1:192 J1:206
m/z 178, 192, 206
B 8257
Oil
IHP
H: 10981000
I: 5193900
J: 3483600
100
80
60
40
20
H
JI 0
600
700
800
900
1000
1100
1200
1300
1400


B8257AR2 #600-1400 K1:184
IHP
K: 7570000
m/z 184
B 8257
Oil
100
80
60
40
20
0
K
600
700
800
900
1000
1100
1200
1300
1400


B8257AR2 #600-1400 L1:198
IHP
L: 3567100
m/z 198
B 8257
Oil
100
80
60
40
20
0
L
600
700
800
900
1000
1100
1200
1300
1400


B8257AR2 #600-1400 M1:212
IHP
M: 1204900
m/z 212
B 8257
Oil
100
80
60
40
20
M 0
600
700
800
900
1000
1100
1200
1300
1400


B8257AR2 #1000-2400 N1:231
IHP
N: 67700
m/z 231
B 8257
Oil
100
80
60
40
20
N 0
1000
1200
1400
1600
1800
2000
2200
2400


B8257AR2 #1000-2400 O1:253
IHP
O: 166900
m/z 253
B 8257
Oil
100
80
60
40
20
O 0
1000
1200
1400
1600
1800
2000
2200
2400