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SOURCE ROCK EVALUATION OF WELL 31/6-1

CLIENT/ OPPDRAGSGIVER

Norsk Hydro A/S

RESPONSIBLE SCIENTIST/ PROSJEKTANSVARLIG

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SUMMARY/ SAMMENDRAG

Zonc A; 1250-1280m: Fair to good potential for gas. Immature type III kerogen.
Zone B; 1280-1325m: As above.
Zone C; 1325-1340m: Good to rich potential for oil and gas. Immature mixed type II/III kerogen.
Zone D; 1340-1395m: Predominately sandstones. Minor amounts of claystone. A dark grey claystone persists from the zone above, mixed type II/III kerogen. Minor amounts of coal at the bottom of the zone has a rich potential for gas. Immature type III kerogen.
Zone E; 1910-1957m: Good potential for oil and gas. Slightly more mature type II/III kerogen.
Zone F; 1970-2135m: Mainly sand. Minor amounts of claystone laminated with coal at the bottom of the zone. Immature-moderate mature type II/III kerogen.
Zone G; 2135-4070m: Various coloured claystones. Type IV kerogen.

KEY WORDS/ STIKKORD

Source Rock	Evaluation
Potential	Maturity

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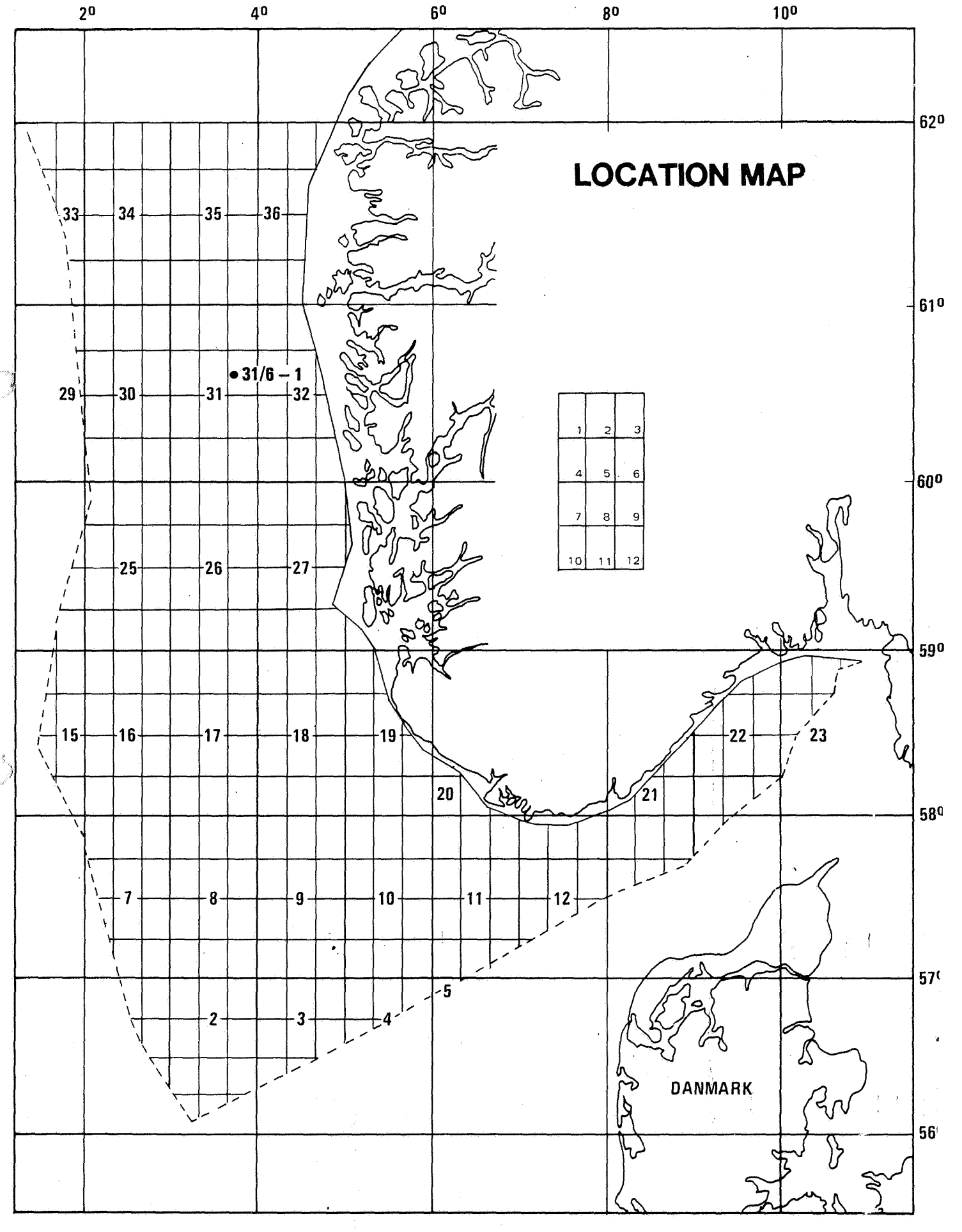
1. INTRODUCTION

Analysis on cuttings samples and in addition six sidewall cores, were carried out for source rocke evaluation of well 31/6-1 from the Troll field. Total depth of the well is 4070m. The analysed sequence was on the basis of mainly the lithology divided into 7 zones.

Based on the results of the screening analysis Norsk Hydro selected the samples to be used for the follow-up analysis.


LOCATION MAP
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DANMARK

2. EXPERIMENTAL AND DESCRIPTION OF INTERPRETATION LEVELS

2.1 Headspace Gas Analysis

One ml. of the headspace gas from each of the cans was analysed gas chromatographically for light hydrocarbons. The results are shown in Table 1a. The canned samples were washed with temperated water on 4, 2, 1 and 0.125 mm sieves to remove drilling mud and thereafter dried at 35°C.

2.2 Occluded Gas

An aliquot of the 1-2 mm fraction of each sample before drying was crushed in water using an airtight ball mill, and one ml. of the headspace analysed chromatographically. The results are shown in Table 1b.

The composite gas data are also plotted and shown in enclosure 1.

2.3 Total Organic Carbon

Bulk samples were crushed in a centrifugal mill. Aliquots of the samples were then weighed into Leco crucibles and treated with hot 2N HCl to remove carbonate, and washed twice with distilled water to remove traces of HCl. The crucibles were then placed in a vacuum oven at 50°C and evacuated to 20mm Hg for 12 hrs. The total organic carbon (TOC) content of the dried samples was determined using a Leco EC12 carbon analyser.

2.4 Rock-Eval Pyrolysis

Crushed sample (100mg) was weighed into a platinum crucible the base and cover of which are made of sintered steel, and analysed on a Rock-Eval pyrolyser.

2.5 Extractable Organic Matter

Powdered rock was extracted by a flowblending for 3 minutes using dichloromethane (DCM) 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.

2.6 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.

2.7 Molecular Sieve Adsorption

The sample containing 2mg of n-alkanes was dissolved in 35ml of cyclohexane and 1gs of Molecular Sive pellets (5Å) which had been activated at 300^{o}C in 24 hours, were added. This mixture was then refluzed for about 24 hours. While the solution was still hot, the sieve pellets were removed from the solution by filtering. The solvent was then removed on a Buchi Rotavapor. GC analysis were performed on the samples, using the same conditions as for the other GC analysis.

The normal alkanes were recovered from the Molecular Sieve pellets by destruction of the pellets with hydrofluoric acid. The solution was extracted with boric acid and hexan, and the solvent was then removed on a Buchi Rotavapor. GC analysis were performed on the samples, using the same conditions as for the other GC analysis.

2.8 Gas Chromatographic Analysis

The saturated hydrocarbon fractions were each diluted with n-hexane and analysed on a HP 5730A gas chromatograph, fitted with a 25m OV-101 fused silica capillary column. Hydrogen (0.7ml/min) was used as carrier gas.

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

2.9 Pyrolysis Gas Chromatography (Py-GC Programmed)

Thermal extraction

20-30 mg of whole rock sample was placed in a boat shaped sample probe and thermoextracted in a stream of helium at 320°C for 5 minutes.

Py-GC

20-30 mg of solvent- and thermally extracted whole rock sample was programmed pyrolysed in helium (320°C to 550°C at 35°C/min.) in a furnace type pyrolyzer. The outlet of the pyrolyzer was directly connected to a splitter (30:1) and a fused silica capillary column. The pyrolysis product was trapped in a cooled (liq. Nitrogen) U-shaped section at the front of the column.

The outlet of the splitter was directly connected to a FID detector and the course of the pyrolysis could be followed by the detector response of the bulk pyrolysis product (30:1) which was recorded as a broad peak. At the end of the pyrolysis the pyrolysis product was injected on to the capillary column at ambient temperature (by removing the nitrogen bath) and analysed under the GC conditions given below.

GC-conditions

Column: 25m OV-1, I.D. 0.3 mm, fused silica capillary column.
Carrier gas: Helium with inlet pressure 8 psi. Flow; ca. 1 ml/min.
Oven programme: 30° - 280°C at 4°C/min.

2.10 Vitrinite Reflectance

Vitrinite reflectance measurements of 25 of the samples, were done. The samples were mounted in Bakelite resin blocks; care being taken during the setting of the plastic to avoid temperatures in excess of 100°C. The samples were then ground, initially on a diamond lap followed by two grades of corundum paper. All grinding and subsequent polishing stages in the preparation were carried out using isopropyl alcohol as lubricant, since water leads to the swelling and disintegration of the clay fraction of the samples.

Polishing of the samples was performed on Selvyt cloths using three grades of alumina, 5/20, 3/50 and Gamma, followed by careful cleaning of the surface.

Reflectance determinations were carried out on a Leitz M.P.V. microphotometer under oil immersion, R.I. 1.518 at a wavelength of 546 nm. The surface of the polished block was searched by the operator for suitable areas of vitrinitic material in the sediment. The reflectance of the organic particle was determined relative to optical glass standards of known reflectance. Where possible, a minimum of twenty individual particles of vitrinite was measured.

The samples were also analysed in UV light, and the colour of the fluorescing material determined. Below, a scale comparing the vitrinite reflectance measurements and the fluorescence measurements is given.

VITRINITE REFLECTANCE R.AVER. 546 NM	0.20 1516	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10
% CARBON CONTENT DAF.	57	62	70	73	76	79	80.5	82.5	84	85.5
LIPTINITE FLUOR NM	725	750	790	820	840		860	890	940	
EXC. 400 nm BAR. 530 nm colour	G	$G/_Y$	Y	$Y/_O$	L.O	M.O.		).O.	$O/_R$	R
zone	1	2	3	4	5	6		7	8	9

NOTE: Liptinite NM*= Numerical measurements of overall spore colour and not peak fluorescence wavelength.

Relationship between liptinite fluorescence colour, vitrinite reflectance and carbon content is variable with depositional environment and catagenic history. The above is only a guide. Liptinite will often appear to process to deep orange colour and then fade rather than develop or O/R red shade. Termination of fluorescence is also variable.

114/O/jbl/4

2.11 Processing of Samples and Evaluation of Visual Kerogen

Crushed rock samples were treated with hydrochloric and hydrofluoric acids to remove the minerals. A series of microscopic slides contain strew mounts of the residue:

T-slide represents the total acid insoluble residue.
N-slide represents a screened residue (15µ mesh).
O-slide contains palynodebris remaining after flotation ($ZnBr_2$) to remove heavy minerals.
X-slides contain oxidized residues, (oxidizing may be required to remove sapropel which embeds palynomorphs, or where high coalification prevents the identification of the various groups).

T and/or O slides are necessary to evaluate kerogen composition/-palynofacies which is closely related to sample lithology.

Screened or oxidized residues are normally required to concentrate the larger fragments, and to study palynomorphs (pollen, spores and dino-flagellates) and cuticles for paleodating and colour evaluation.

So far visual evaluation of kerogen has been undertaken from residues mounted in glycerine jelly, and studied by Leitz Dialux in normal light (halogene) using x10 and x63 objectives. By x63 magnification it is possible to distinguish single particles of diameters about 2 and, if required, to make a more refined classification of the screened residues (particles >15µ).

The colour evaluation is based on colour tones of spores and pollen (preferably) with supporting evidence from colour tones of other types of kerogen (woody material, cuticles and sapropel). These colours are dependant upon the maturity, but are also influenced by the paleo-environment (lithology of the rock, oxidation and decay processes). The colours and the estimated colour index of an individual sample may therefore differ from those of the neighbouring samples. The techniques in visual kerogen studies are adopted from Staplin (1969) and Burgess (1974).

In interpretation of the maturity from the estimated colour indices we follow a general scheme that is calibrated against vitrinite reflectance values (R_o).

Ro	0.45	0.6	0.9	1.0	1.3
colour index	2-	2	2+	3-	3
Maturity intervals	Moderate mature	Mature (oil window)			Condensate window

3. RESULTS AND DISCUSSION

The analysed sequence, 1250-4070m has been divided into 7 zones based upon the lithology. The zones are as follows:

Zone A; 1250-1280m
Zone B; 1280-1325m
Zone C; 1325-1340m
Zone D; 1340-1895m
Zone E; 1910-1957m
Zone F; 1970-2135m
Zone G; 2135-4070m (T.D.)

In the following each method will be discussed separately zone by zone.

3.1 Light Hydrocarbons and Lithology

Light hydrocarbon values (µl/kg rock) are classified as follows:

C_1-C_4	C_5+		
<1000	<1000	:	poor source rock
1-3000	1-3000	:	fair source rock
>3000	>3000	:	good - rich source rock

Zone A; 1250-1280m: This zone within the Cretaceous, consists mainly of a dark grey claystone. The upper boundary of the zone may be higher up, but samples were only available from 2150m. The high methane content at the upper boundary is probably derived from indigenous organic matter in the dark grey claystone. The low wetness and high iC_4/nC_4 ratios indicate immature samples.

Zone B; 1280-1325m: This zone which is also in the Cretaceous consists mainly of light grey to grey marl with minor amounts of dark grey and pale brown claystones. The wetness is slightly lower, where the marls predominate than in zone A and increases towards the lower part of the zone. The low iC_4/nC_4 ratios indicates that the samples are immature.

Zone C; 1325-1340m: This zone coincides roughly with the top of the Jurassic at 1335m (as given by the client). The dominant lithology is a dark grey claystone and there are minor amounts of different coloured

claystones. Small amounts of sand appear at the bottom of the zone.

The light hydrocarbon abundances, both C_1 and C_2+ are good in the zone. The wetness is relatively higher than in zones A and B. iC_4/nC_4 ratios are similar to zone A. The light hydrocarbons are probably derived from the indigenous organic material in the dark grey claystones.

Zone D; 1340-1895m: The lithology in this zone is dominated by sandstone. The upper boundary has been set where the sandstone becomes dominant. Minor amounts of dark grey claystone persist from the zone above. Varying amounts of light grey to grey claystone appear throughout the zone and minor amounts of coal are seen at the bottom of the zone.

The abundance of light hydrocarbons in the thick sandstone sequence from 1340 to 1895m is poor at the top of the sequence and mostly fair to good in the rest of the section. Highest abundances occur as mentioned, in the section with minor coals/carbonaceous claystones between 1820-1895m, and also where grey claystone is recorded at 1625m. The iC_4/nC_4 ratio is very high (1.5-3) particularly in the sandstone section from 1400-1600m approximately, which also has the highest abundance of C_1-C_4 and highest wetness (20-60%). This is difficult to explain without knowledge of the location of the reservoir horizon. However, unlike the claystones in zone A, B and C, which show iC_4/nC_4 ratios (0.8-1.6) and wetness (10-20%) characteristic for immature samples the light hydrocarbon data for the sandstones suggest a different and more mature source for the gases (based on wetness), and possibly indicate that biodegradation has occurred (based on high iC_4/nC_4).

Zone E; 1910-1957m: The lithology in this zone is dominated by a grey claystone with minor amounts of sandstone. The abundance of light hydrocarbons is good. This is probably due to the indigenous organic matter in the grey claystone, since the wetness decreases within the zone, and the iC_4/nC_4 ratios increase, and indicate immature samples.

Zone F; 1970-2135m: This zone consists mostly of sand. At the upper boundary there is some input of cement and at the lower boundary some grey - pale brownish grey claystone.

In the interval with the claystone the abundance of light hydrocarbons is good. The abundance and wetness are very low in the sandstone domi-

nated samples and iC_4/nC_4 is high, suggesting only minor quantities of immature gas are present, derived perhaps from the adjacent claystones.

Zone G; 2150-4070m This lithology consists of Triassic sands and various coloured claystones.

The abundance of light hydrocarbons is poor. The wetness varies throughout the zone, but is generally less than 10%. Only a few iC_4/nC_4 ratios are obtained and they indicate immature samples.

3.2 Total Organic Carbon

Where claystones constitute 10% or more of a sample they were picked and analysed. Occasionally in samples which were dominated by marl were picked and analysed. Sandstones were not analysed. The classification used for the TOC data is as follows:

< 0.5%	:	poor source rock
0.5-1.0%	:	fair source rock
1.0-2.0%	:	good source rock
>2.0%	:	rich source rock

Zone A; 1250-1280m: The dark grey claystones from this zone show good to rich TOC values, while the greenish grey claystone from 1250-1265m has a fair TOC value.

Zone B; 1280-1325m: The TOC values of the dark grey claystone indicate a good source rock, whereas the marls which contain less than 0.5% TOC are a poor source.

Zone C; 1325-1340m: The main lithology in this zone, the dark grey claystones, show good to rich TOC abundances (1.76-2.91%).

Zone D; 1340-1895m: This zone is dominated by sandstone and the TOC-rich claystone at the upper boundary persists from the zone above. The coal/-carbonaceous claystone at 1820-1835m shows a rich TOC value.

Zone E; 1910-1957m: This zone is dominated by grey claystones which have mainly good TOC values (1.23-2.13%).

Zone F; 1970-2135m: This section of the well is dominated by sand and only one sample was analysed. This grey - pale brownish grey claystone shows a high TOC-value and this may be due to the presence of coal fragments, or laminae or streaks within the claystone.

Zone G; 2150-4070m: The variecoloured claystones from this section show poor TOC-values. A dark bluish grey claystone at 3875-3890m shows a higher TOC value with a fair potential.

3.3 Rock-Eval Pyrolysis

Nineteen cuttings samples were analysed by Rock-Eval pyrolysis for evaluation of the source rock potential in this well. The following classification is used:

Petroleum potential
(S1+S2)
< 1 : Poor source rock potential
1-5 : Fair source rock potential
>5 : Good source rock potential

Zone A; 1250-1280m: The hydrogen indices (HI) of the two samples are low, but varying, and also the oxygen indices (OI) are low. A kerogen type III is seen throughout the zone. The dark grey claystone has a fair to good potential for gas. The T_{max} values indicates immature samples.

Zone B; 1280-1325m: The grey dark grey claystone at the upper boundary shows a poor hydrogen index and indicates a type IV kerogen. The lowermost samples show low but varying hydrogen and oxygen indices, and indicates a type III kerogen.

The petroleum potential for the uppermost sample is low, while the lowermost samples show a fair to good potential for gas. The uppermost sample has a high production index which may be due to migrated hydrocarbons. T_{max} values suggest immature samples.

Zone C; 1325-1340m: Improved kerogen type is seen in this zone. The three samples were seen to have a mixed type II/III kerogen which therefore have a mainly good potential for oil and gas. The low production indices suggest no migrated or generated hydrocarbons, while the T_{max} values indicate that the zone is immature.

Zone D; 1340-1895m: The dark grey claystone at 1335-1350m persists from the zone above and contains mixed type II/III kerogen. The grey - light grey claystone at 1700-1715m also indicates a mixed type II/III kerogen with a good potential for oil and gas. The coal/carbonaceous claystone towards the bottom of the zone indicates a type III kerogen with a rich potential for gas. The T_{max} values indicate that the zone is immature.

Zone E; 1910-1957m: The hydrogen index increases towards the base of the zone, indicating that kerogen quality improves towards the base. The oxygen index is low. The claystones contain a type II/III kerogen with a fair to good potential for oil and gas. The production indices are low indicating no migrated hydrocarbons. T_{max} values indicate immature samples except of the grey claystone at 1927-1930m which is moderately mature.

Zone F; 1970-2135m: Only one sample was analysed in this zone. The hydrogen and oxygen index indicates a type II/III kerogen with a good potential for condensate and gas. The T_{max} value indicates that the sample is immature.

Zone G; 2150-4070m: A type IV kerogen is present in the dark bluish grey claystone in this zone. The relatively high T_{max} is mainly due to the low flat S2 peak which give a false reading.

3.4 Extractable Organic Matter and Saturated Hydrocarbons

Eleven cutting samples were extracted for evaluation of the source rock potential of the well. Two samples with IKU no. B-692 and B-1245, were not extracted because of too small sample amounts.

Table 4-7 show the distribution of the various chromatographic fractions, while Table 8 gives the ratios calculated from GC chromatograms. Table 9 gives the amount of branched/cyclic and normal alkane fractions. Source rock classification based on amount and composition of bitumen:

Extractable Organic Matter (EOM in ppm):

<200ppm : Poor source rock
200-500ppm : Fair source rock
500-1000ppm: Good source rock
>1000ppm : Rich source rock

Extractable Hydrocarbons (EHC in mgs per gram TOC):

< 10mgs/g : Poor source rock
10-20mgs/g : Fair source rock
20-100mgs/g: Good - rich source rock
>100mgs/g : Stain (depends on the kerogen type, type I kerogens can yield more than 100mgs/g).

Zone A; 1250-1280m: One dark grey claystone (B-686) was extracted from this zone. The sample contains fair amounts of extractable organic matter (EOM) and approximately 90% of the EOM consists of hydrocarbons. The SAT/ARO ratio is approximately four which is high. The Rock-Eval production index which are also relatively high could indicate migrated hydrocarbons.

The chromatogram of B-686 shows a bimodal n-alkane distribution with maxima at nC_{15} and nC_{25}. The high nC_{29} peak may be due to contamination. The chromatogram suggests a mixed terrestrial and marine input. The high molecular weight n-alkanes are the most abundant. The pristane/phytane ratio is 2.2, and the CPI-value of 1.1 is relatively low indicating a moderately mature extract. This value could be erraneous, because of contamination or the presence of migrated hydrocarbons.

Zone B; 1280-1325m: One dark grey claystone (B-690) was extracted from this zone. The sample contains fair amounts of extractable organic matter (EOM). Approximately 40% of the EOM consists of hydrocarbons and SAT/ARO ratio is one in this sample.

A bimodal n-alkane distribution with maxima at nC_{15} and nC_{29} is seen from the gas chromatogram. The pristane/phytane ratio (1.2) is lower and the CPI-value (1.8) is higher than in the zone above. The lower pristane/phytane ratio suggests a change in the depositional environment too perhaps more anoxic conditions compared with the sample from 1265m or that the low molecular weight hydrocarbons (less than nC_{20}) consist in part of migrated hydrocarbons.

Zone C; 1325-1340m: Three samples from this zone were extracted. All samples contain good amounts of extractable organic matter (EOM), but the abundance of hydrocarbons in the EOM is poor to fair. The amount of hydrocarbons in the EOM increase from approximately 25% to 45% downward in the zone.

The gas chromatograms of the three samples are quite similar. Phytane is more dominant in this zone than above, pristane/phytane ratios 0.8. This could suggest a change in depositional environment from the zones above to a more anoxic depositional environment. The CPI-values are fairly similar i.e. from 2.3-2.5 and indicate immature samples. The complex pattern in nC_{25}-nC_{32} area is common for immature samples, and this pattern could be seen more clearly from the branched/cyclic chromatograms and is due to the presence of steranes and triterpanes. The peak closest to nC_{25} could be a contaminant from the cyclohexane.

Zone D; 1340-1895m: No samples from this zone were extracted.

Zone E; 1910-1957m: From this zone four grey claystones were extracted. The grey claystone at 1900-1925m contains rich amounts of extractable organic matter (EOM) and the lower samples contain good to rich amounts. The amount of hydrocarbons in the extractable organic matter varies from approximately 28% to 54%.

The gas chromatograms are fairly similar, showing a bimodal n-alkane distribution. The pristane/phytane ratios decrease downwards from 1.9 to 1.3. The CPI values vary from 1.5 to 2.1. The grey claystone at

1900-1925m has the lowest CPI-value. This sample shows little or no complexity in the area of nC_{25}-nC_{32}, but this pattern becomes more prominent for the lowermost samples. In the top sample the n-alkane envelope with a maximum at nC_{29} dominates, whereas in the bottom sample in this zone the n-alkane envelope with a maximum at nC_{17} is dominant. This suggests a change in depositional environment with perhaps a decrease in anoxic conditions during deposition of the sequence. The terrestrial component survives best under more oxygenated conditions, hence the decrease in low molecular weight n-alkanes upwards through this zone.

Zone F; 1970-2135m: One sample at the lower boundary of the zone was extracted. The sample contain a good amount of extractable organic matter (EOM) and approximately 45% of the EOM consists of hydrocarbons.

The gas chromatogram suggests that the environment was different to samples above and of more terrestrial nature based on the higher pristane/phytane ratio (2.3). The CPI value (1.5) indicates a relatively low maturity. The n-alkane distribution is dominated by low molecular weight compounds, and particularly prominent are nC_{14} and nC_{15} alkanes. It is probable that these low molecular weight n-alkanes include a migrated component.

Zone G; 2150-4070m: One dark bluish grey claystone with a poor TOC content was extracted from this zone. This claystone contain poor amounts of extractable organic matter (EOM), and 25% of the EOM consists of hydrocarbons.

The gas chromatogram is different from the samples extracted in the zones above. The sample shows a smooth front-biased n-alkane distribution with a maximum at nC_{19}. The CPI-value of 1.3 suggests a moderate mature sample. The low pristane/phytane ratio might suggest, if the hydrocarbons are derived from the kerogen in the sample, that the organic matter was deposited in an anoxic environment. However, in such an organic poor sample (less than 0.1% TOC), it is more probable that the hydrocarbons have migrated into the claystone sequence.

3.5 Pyrolysis-gas Chromatography (Py-GC, Programmed)

13 solvent- and thermally extracted whole rock samples were analysed by Py-GC. The instrumental conditions are described in the experimental section. The peaks are identified on the basis of retention and mass spectrometric data of other kerogens.

Peak identities in the pyrograms:

1 = toluene
2 = (m+p)-xylenes
3 = o-xylene
4 = C_3-alkylbenzenes + phenol (P)
5 = C_4-alkylbenzenes + methylphenols (C_1P)
6 = C_4- and C_5-alkylbenzenes + naphthalene
7 = 2-methylnaphthalene
8 = 1-methylnaphthalene
9 = prist-1-ene
10 = prist-2-ene

C_7, C_9 etc. are n-alkene/n-alkane doublets of that carbon number.

B-686 (1265m): The pyrogram shows an n-alkene/n-alkane homology ranging from C_7 to ca. C_{28}. The abundance of phenol and aromatics is relatively high suggesting an input of material derived from higher plants. Generally the pyrogram shows a type III or mixed type III/II kerogen fingerprint.

B-690 (1325m): The pyrogram is very similar to B-686, i.e. a type III kerogen fingerprint.

B-1243 (1327m): The pyrogram is very similar to B-686, i.e. a type III or III/II kerogen fingerprint.

B-691 (1340m): The pyrogram is very similar to B-686, i.e. a type III or III/II kerogen fingerprint.

B-1244 (1340m): The pyrogram is very similar to B-686, i.e. a type III or III/II kerogen fingerprint.

B-692 (1355m): The pyrogram is very similar to B-1244, i.e. a type III or III/II kerogen fingerprint.

B-1245 (1912m): The pyrogram is very similar to B-1244, i.e. a type III or III/II kerogen fingerprint.

B-730 (1925m): The pyrogram shows an n-alkene/n-alkane homology ranging from C_7 to ca. C_{28} where the intensity of the doublet homology is decreasing sharply from C_7 to C_{20}. This is in contrast to the pyrogram of for example B-1244 which shows a much smoother distribution of the aliphatic homology. The sharply decreasing intensity is often observed in the pyrograms of type III kerogens. The abundance of aromatics is relatively high. Generally the pyrogram shows a type III or a mixed type III/II kerogen fingerprint.

B-1246 (1930m): The pyrogram is very similar to B-730, i.e. a type III or III/II kerogen fingerprint.

B-732 (1955m): The pyrogram shows an n-alkene/n-alkane homology ranging from C_7 to ca. C_{28}. The abundance of aromatics is relatively high and the pyrogram is very similar to that of B-1244, i.e. a type III or mixed type III/II kerogen fingerprint.

B-1247 (1957m): The pyrogram is very similar to B-732, i.e. a type III or III/II kerogen fingerprint.

B-744 (2135m): The pyrogram shows an n-alkene/n-alkane homology ranging from C_7 to C_{28}. The abundance of alkylbenzenes, naphthalenes and phenols is very high which is characteristic for coals and some type III kerogens derived from higher terrestrial plants.

B-861 (3890m): The pyrogram shows only low molecular weight gaseous compounds in the C_1 to C_7 range. This is in agreement with the very low hydrogen index of 26 suggesting that little pyrolysable material is left in the sample.

There is a general similarity in the pyrograms except for the last two samples from zones F and G in which the kerogens are clearly dominated by organic matter consisting of terrestrial woody debris in the case of the sample from zone F and by mainly inertinite material in the case of the sample from zone G. There are slight differences in the detailed pattern in the samples from the other zones, but the organic matter appears to be fairly similar in terms of source, and is probably mainly

derived from autochthonous aquatic organisms - algal lipids, cysts, etc. rather than terrestrial, woody debris.

There is an apparent disparity between the Rock-Eval data in the zone B sample and the assessment of the pyrogram from this zone which is similar to other nearby samples. It can probably be explained by the fact that although the zone B sample is poorer quality according to Rock-Eval compared with other samples above and below, a small contribution from a lipid-rich source similar to that in the other samples would tend to dominate the pyrogram.

3.6 Analyses in Reflected Light

Eighteen cuttings samples and six sidewall cores were analysed in reflected light. Kerogen concentrates were not made of the samples in the interval from 2210m down to 4070m because of the low TOC values and too small sample amounts.

B-686 (1250-1265m): Ro = 0.44%(18): Sp.Fl. = 5
This sample is mostly dark grey or brown claystones which show a moderate degree of pyritization. The organic matter is mostly inertinite and reworked vitrinite. A significant proportion of the indigenous vitrinite is associated with liptinite. Fluorescent liptinites are scarce and most have a dull, light orange fluorescence in UV light.

B-687 (1265-80m): Ro = 0.46%(15): Sp.Fl. = 4
This sample is largely similar to the overlying sample. Liptinite macerals are quite scarce, but when present show a yellow/orange fluorescence in UV light.

B-688 (1280-1295m): Ro = 0.68%(1): Sp.Fl. = 4
This sample is made up of fine grained sandstone or siltstone. No measurable indigenous vitrinite was observed and the reflectance value reflects the maturity of the least re-worked material. Trace amounts of liptinites were observed which have a yellow/orange fluorescence in UV light.

B-1242 (1317-1320m): Ro = 0.41%(2): Sp.Fl. = 3-5
This sample is mainly grey or brown claystone with a moderate degree of pyritization. The organic matter is largely inertinite and liptinite. The vitrinite tends to occur in close association with liptinite and is therefore difficult to measure. Fluorescing liptinites are abundant and show yellow to light orange colours in UV light. The yellow fluorescing spores may represent caved material.

B-690 (1310-1325m): Ro = 0.42%(3): Sp.Fl. = 4
The sample has a similar lithology to the previous sample with the addition of some siltstone and calcareous clasts. Some calcareous fossils were observed. The vitrinite mostly occurs as reworked vitrinite and the indigenous vitrinite is often closely associated with liptinite. A moderate amount of liptinite particles show a dull yellow/orange colour in UV light.

B-1243 (1325-2327m): Ro = 0.42%(3): Sp.Fl. = 4-5
Reflectance measurements were taken on mainly brown or grey claystone fragments. Most of the organic matter is inertinite and liptinite. The indigenous vitrinite is generally associated with liptinite. Moderate amounts of liptinite particles show a yellow/orange to light orange fluorescence.

B-691 (1325-1340m): Ro = 0.42%(8): Sp.Fl. = 4
This sample is similar to the overlying sample. Moderate to abundant numbers of tenuispores show yellow to light orange colours in UV light. The yellow material may be cave material.

B-1244 (1337-1340m): Ro = 0.43%(9): Sp.Fl. = 4-5
The sample is similar to the two previous samples, although the organic matter is mostly reworked vitrinite. Sporinite is common and shows yellow - orange to light orange fluorescence in UV light.

B-692 (1340-55m): Ro = 0.44%(7): Sp.Fl. = 4-5
The sample consists mostly of dark grey or brown claystone clasts. The most common macerals are liptinite and inertinite. Liptinite is often closely associated with indigenous vitrinite. In ultra-violet light, the liptinite macerals have a yellow/orange or light orange fluorescence.

B-716 (1700-1715): Ro = 0.37%(20): Sp.Fl. = 4-5
This sample consists of light brown claystone and a carbagillite. There is abundant vitrinite and liptinite in the carbargillite clasts. Inertinite tends to be predominant in the claystone clasts. Liptinite has a yellow/orange to light orange fluorescence in UV light. Traces of algal material are present.

B-2418 (1808.1m): Ro = 0.41(20): Sp.Fl. = 4-6
The sample is mostly light brown claystone clasts with fairly common vitrinite bands. The vitrinite is often affected by clay mineral inclusions and is difficult to measure. The trace amounts of liptinite present have a yellow/orange to middle orange fluorescence in UV light.

B-2419 (1818.5m): Ro = 0.40(14): Sp.Fl. = 4
This sample is dark grey or brown claystone with mostly inertinite and liptinite macerals present. Trace to moderate amounts of well preserved spores are present in some clasts. These show yellow/orange fluorescence in UV light.

B-724 (1820-1835m): Ro = 0.45%(11): Sp.Fl. = 3-4
This sample is a largely inertinitic coal. Vitrinite particles are scarce and often show clay mineral inclusions. Liptinites occur in bands and have a yellow to yellow/orange fluorescence in UV light. Traces of algal material are present.

B-2420 (1863m): Ro = 0.40(2): Sp.Fl. = 4-5
Red-brown sandstone/siltstone or claystone clasts dominate this sample. The vitrinite in the samples frequently shows evidence of alteration and liptinite affects. Liptinite macerals have a yellow/orange to light orange fluorescence in UV light.

B-1245 (1910-12m): Ro = 0.43%(24): Sp.Fl. = 4-5
Brown or dark grey claystone clasts are dominant with secondary sandstone/siltstone clasts. Liptinite is abundant, especially in the more arenaceous clasts. The liptinite has a yellow/orange to light orange fluorescence in UV light.

B-2421 (1813m): Ro = 0.40%(9): Sp.Fl. = 4-5
Brown claystone or siltstone clasts with small vitrinite stringers dominate. The vitrinite is often closely associated with liptinite and is not always suitable for measurement. The liptinite has a yellow/orange to light orange fluorescence in UV light.

B-730 (1910-25m): Ro = 0.43%(12): Sp.Fl. = 4-5
Mostly light grey or brown claystone clasts which contain common liptinite and reworked vitrinite. The liptinite macerals have yellow/orange to light orange fluorescence in UV light.

B-1246 (1927-30m): Ro = 0.48%(2): Sp.Fl. = 4-5
This sample has a similar lithology to that above. The clasts contain mostly closely associated liptinite and vitrinite with less common inertinite. The liptinite fluoresces with a yellow/orange or light orange colour in UV light.

B-732 (1940-55m): Ro = 0.42%(9): Sp.Fl. = 4-5
A grey-brown claystone lithology dominates this sample. Liptinite is particularly common in grey claystone clasts. This material shows a dull yellow/orange or light orange fluorescence in UV light..

B-2422 (1956m): Ro = 0.43%(6): Sp.Fl. = 4
This sample is similar to the overlying one. Vitrinite stringers with closely associated liptinite cause some difficulty in obtaining reflectance measurements. The liptinite particles have a yellow/orange fluorescence in UV light.

B-1247 (1955-57m): Ro = 0.45%(17): Sp.Fl. = 5
This sample is similar in lithology to the overlying interval and contains mostly reworked vitrinite and closely associated indigenous vitrinite and liptinite. The liptinite fragments mostly have a light orange fluorescence in UV light.

B-744 (2120-35m): Ro = 0.38%(8): Sp.Fl. = 4
Sandstone clasts make up most of this sample. Organic matter is generally scarce although liptinite material is abundant in some clasts. The liptinite material has a dull yellow/orange fluorescence in UV light.

B-746 (2150-65m): Ro = 0.52%(1): Sp.Fl. = 3-4
The sample is mostly a light grey claystone or siltstone in some of which are liptinite-rich. Vitrinite is largely absent. The liptinitic material has a yellow to yellow/orange fluorescence in UV light. Some of this material has an indistinct nature.

B-2423m (2182m): Ro = N.D.P.: Sp.Fl. = abs.
The sample consists of yellow/orange sandstone which is barren of organic matter.

B-853 (3875-90m): Ro = N.D.P.: Sp.Fl. = 4?
The sample is mostly grey or red/brown claystone clasts. Vitrinite is not present in the sample although traces of liptinite are present in the grey claystone clasts. This liptinite has a yellow or yellow/orange fluorescence in UV light, but may represent caved material).

3.7 Analyses in Transmitted Light

On request from Norsk Hydro A/S the organic material of well 31/6-1 was evaluated on the basis of 30 samples. Only 24 of then contained sufficient material to carry out visual kerogen analyses in addition to vitrinite reflectance measurements. The material was washed with konc. HNO_3 when sufficient material was left.

The samples are spaced in 4 main intervals:

1250-1355m (9 samples)	Colour index 1/1+
(450m not represented)	
1808.1-1957m (10 samples, 5 sidewall cores included)	Colour index 2-,
(160m not represented)	2-/2, 2
2120-2182m (3 samples, 1 sidewall core included)	
(1600m not represented)	
3755-3890m (2 samples)	

The descriptions of the organic residues are based on the semiquantitative estimates of relative proportions (volumes) of the main kerogen groups. The estimates are expressed by graphs in our maturation table (table 10).

Description of samples

B-686, B-687, B-688, B-690, B-1242, B-1243, B-691, B-1244 (1250-1340m): Particles, dominantly woody and black woody material dominate and are embedded in grey amorphous matrix of variable density. Acid resistant minerals are common.

The residues are fairly small and in B-690, B-1242, B-1243, B-691 and B-1244 (1310 -1340m) show presence also of more yellow-brown amorphous substance.

Palynomorphs include well preserved dinoflagellate cysts (1250-1295m) as well as more variably preserved material (1310-1340).
Colour index: 1/1+.

B-692 (1340-1355m): Pyritic aggregates consisting of an amorphous matrix dominated by degraded, woody material. Palynomorphs are poorly preserved.
Colour index: 1/1+.

B-2418 (1808.1m) swc: Undissolved minerals were removed by heavy liquid separation. The organic remains are mainly different types of woody material, cuticles of variable thickness and well preserved spores and pollen. The material seems mechanically fragmented.
Colour index: 2-/2, 2. The index may be under control from an oxidative environment and too high as a parameter of maturation.

B-724 (1820-1835m): Cuttings sample show resemblance with B-2418.

B-2419 (1818.5m) swc: Strongly sapropelised material dominated by cuticles pollen and spores, some algal. Woody material seems subordinate.
Colour index: 2-, 2-/2, 2.

B-2420 (1863m) swc: Woody material of different categories and cuticles of variable thickness, apparently mechanically fragmented. Pollen and spores are well preserved. (Resemblance with B-2418).
Colour index: 2-, 2-/2.

B-730, B-1246, B-732, B-1247 (1910-1957m): Pyritic residues of poorly sorted thinwalled organic remains, either dispersed material or as aggregates. Cuticles are very abundant, together with spores and pollen accounting for 40-70% of the material. Woody degraded material 40-20%. The palynomorphs are generally well preserved.
Colour index: 2-, 2-/2, 2.

B-2421 (1913m, swc): The residue suits with the interval described above.

B-2422 (1956m, swc): Dispersed organic material with abundant pyrite and other acid resistant minerals. Wood and cuticles dominate. Algae are well represented but subordinate. The residue suits with the interval 1910-1957m.
Colour index: 2-, 2-/2.

B-744, B-746, B-2423 (2120-2182m): Very small residues. Degraded woody or supposed woody material dominates. The material has a grey brown colour and often etched surfaces. Internal structures have been dissolved. Acid resistant minerals are common and all residues has to be treated by $ZuBr_2$ solution. No colour evaluation was possible. But material in B-746 indicates an increase of maturation from the interval described above.

B-853, B-861 (3755-3790m): Very small residues dominated by pyrite and other acid resistant minerals. Minor traces of black oxidised woody fragments and supposed cuticles. The reason for the greyish coloured thin cuticles seems to be the type of depositional environment.
Colour index could not be evaluated.

4. CONCLUSION

The maturity of this well is mainly based on the T_{max} values obtained from Rock-Eval pyrolysis, vitrinite reflectance, spore fluorescence colours and spore colour in transmitted light. In the following each zone will be discussed separately.

Zone A; 1250-1280m: This zone within the Cretaceous, consists mainly of dark grey claystones with good to rich TOC-values (1.79%-2.84%). The results from light hydrocarbon analysis show a high methane content at the upper boundary, probably derived from indigenous organic matter in the dark grey claystone. The abundance of extractable hydrocarbons is high and the Rock-Eval production index for this sample is relatively high and could indicate the presence of migrated hydrocarbons. The organic matter is mostly inertinite and reworked vitrinite. A kerogen type III is seen throughout the zone with a fair to good potential for gas. All data suggest immature samples.

Zone B; 1280-1325m: This zone which is also in the Cretaceous consists mainly of light grey to grey marls with poor TOC-values, and minor amounts of dark grey claystone and pale brown claystone. The dark grey claystones have fair to good TOC-values (0.81%-1.62%). The Rock-Eval data indicates a type III kerogen, but the quality of the kerogen is poorer than in the zones above and below. The dark grey claystone shows a fair to good potential for gas. The abundance of extractable hydrocarbons is fair. The presence of migrated hydrocarbons are suggested from the low pristane/phytane ratios and all data suggest immature samples.

Zone C; 1325-1340m: The dominant lithology in this zone which coincides roughly with the top of Jurassic, is a dark grey claystone with good to rich TOC abundances (1.76%-2.91%). The abundance of light hydrocarbons is good in the zone, whereas the abundance of C_{15}^{+} extractable hydrocarbons in the organic matter is good. The kerogen quality improves downwards in the zone, and consists of a mixed type II/III kerogen with a mainly good potential for oil and gas. Low production indices suggest no migrated hydrocarbons. The organic matter has probably been deposited in more anoxic conditions than in the zones above. The analysed samples indicate that the zone is immature.

Zone D; 1340-1895m: This zone which is also in Jurassic, is dominated by sandstones. A dark grey claystone is similar to the samples from zone C and is probably caved from the zone above. Varying amounts of light grey to grey claystone appear throughout the zone and minor amounts of coal/carbonaceous claystone with rich TOC-content appear at the bottom of the zone. The abundance of light hydrocarbons in the sandstone sequence is poor at the top end fair to good in the rest of the section. Highest abundance occur in the section with minor coal/carbonaceous claystones. The wetness of the sandstones indicates a more mature source for the gases. The coal/carbonaceous claystone have a type III kerogen with a rich potential for gas. All data suggest that the zone is immature.

Zone E; 1910-1957m: This zone is dominated by grey claystones with good to rich TOC values (1.23%-2.13%) and minor amounts of sand. The abundance of light hydrocarbons is good and the abundance of hydrocarbons in the extractable organic matter is fair to good. The kerogen quality improves in the zone and the claystones contain a mixed type II/III kerogen with a fair to good potential for oil and gas. The production indices are low indicating no migrated hydrocarbons. A change in depositional environments with perhaps a decrease in anoxic conditions during deposition may have occurred. The whole zone seems to be slightly more mature than the zones above.

Zone F; 1970-2135m: Sand is the most dominant lithology in this zone with some input of grey-pale brownish grey claystones with a rich TOC-content (11.82%) at the lower boundary. In the interval with the claystone the abundance of light hydrocarbons is good and also the abundance of hydrocarbons in the extractable organic matter is good. The environment of deposition was different to the samples in the zone above, and was more terrestrial. The Rock-Eval data suggest a type II/III kerogen with a good potential for condensate and gas, but with a low maturity.

Zone G; 2150-4070m: The lithology consists mostly of Triassic sands and various coloured claystones with poor TOC-content. The abundance of light hydrocarbons is poor. The $C_{15}+$ extractable hydrocarbons may have migrated into the claystone sequence. A kerogen type IV is seen in the zone and it is dominated by terrestrial woody debris. The maturity in this sequence is difficult to assess, since the kerogens consists

exclusively of reworked or oxidised material, and the EOM is mainly derived from non-indigenous sources i.e. consists of migrated or contaminant hydrocarbons.

IKU

TABLE I a.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN HEADSPACE.

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
B	686	1265	13120	1966	666	104	62	33	15918	2798	17.58	1.66
B	687	1280	3837	622	237	43	27	19	4766	929	19.48	1.57
B	688	1295	5854	540	206	39	33	21	6672	818	12.26	1.17
B	689	1310	4610	524	190	39	32	19	5394	785	14.55	1.22
B	690	1325	4810	1104	461	123	90	45	6587	1777	26.98	1.37
B	691	1340	34569	8880	2558	937	426	489	47370	12801	27.02	2.20
B	692	1355										
B	694	1385	1070	207	117	88	34	126	1515	445	29.37	2.61
B	696	1415	3573	607	277	295	75	746	4827	1254	25.97	3.94
B	698	1445										
B	699	1460	2754	410	224	183	76	434	3647	893	24.48	2.40
B	700	1475	1490	305	169	115	47	218	2126	636	29.93	2.44
B	701	1490	6326	649	286	241	99	677	7602	1276	16.79	2.43
B	702	1505	3121	1719	760	375	151	496	6127	3006	49.06	2.48
B	706	1565	752	168	182	200	106	606	1408	656	46.57	1.88
B	708	1595	1414	421	165	51	33	175	2084	670	32.16	1.54
B	710	1625	16537	3933	1417	310	232	326	22429	5892	26.27	1.34
B	712	1655	1047	263	122	28	19	32	1480	432	29.22	1.45
B	714	1685	4933	1179	760	193	175	183	7240	2307	31.87	1.10
B	716	1715	1687	349	187	48	40	43	2311	624	27.01	1.19
B	718	1745	427	102	63	15	15	5	622	196	31.42	1.03
B	720	1775	299	75	37	10	8	7	429	130	30.34	1.29
B	722	1805	9861	2212	788	135	106	93	13102	3241	24.74	1.27

DATE : 28 - 12 - 83.

IKU

TABLE I a.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN HEADSPACE.

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4
B	724	1835	15782	2062	490	77	50	32	18462	2679	14.51	1.52
B	726	1865	8913	1716	719	121	89	48	11559	2645	22.89	1.36
B	728	1895	1615	390	212	44	32	39	2292	677	29.55	1.39
B	730	1925	2854	617	444	109	69	134	4094	1240	30.28	1.57
B	732	1955	5001	953	385	88	47	88	6474	1473	22.76	1.87
B	734	1985	135	58	54	17	8	16	272	137	50.19	2.10
B	736	2015	89	12	10	4	2	5	116	28	23.82	1.82
B	738	2045	34	2	1				37	3	7.97	
B	741	2090	14	2	5	3		15	24	10	42.78	
B	742	2105	82	13	16	9	3		123	41	33.08	2.77
B	744	2135	1401	99	39	13	5		1557	156	10.00	2.86
B	746	2165	1193	105	58	24	10	14	1389	197	14.15	2.49
B	749	2210	72	8	6	2			88	16	18.06	
B	752	2255	95	7	4	1			107	12	11.31	
B	755	2300	28	3	2				32	5	14.10	
B	758	2345	9	1	1				11	2	20.02	
B	761	2390	14	2	1				17	3	20.32	
B	763	2420	16	3	2				22	5	24.96	
B	767	2460	25	3	2				30	5	16.76	1.00
B	770	2525	1087	25	6				1118	31	2.75	
B	773	2570	98	4	1				104	5	5.09	
B	776	2615	2	0					2	0	5.03	
B	779	2660	10	1	1				12	1	12.82	

DATE : 28 - 12 - 83.

IKU

TABLE I a.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN HEADSPACE.

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
B	781	2690									58.76	1.00
B	782	2705	O P E N L I D									
B	785	2750	27	5	2			13	34	7	19.77	
B	789	2810	3	0					3	0	7.99	
B	791	2840	2	0					2	0	8.83	
B	794	2882	3	0					3	0	9.11	
B	797	2930	5						5		0.00	
B	801	2990	22	2	1				24	3	11.42	
B	805	3030	7	1	0			1	8	1	12.27	
B	809	3110	11						11		0.00	
B	813	3170	3	1	0				4	1	19.54	
B	817	3230	9	2					11	2	17.74	
B	821	3290	13	1					15	1	8.37	
B	825	3350	17	2					18	2	8.40	
B	829	3410	14						14		0.00	
B	833	3470	5	0					5	0	7.48	
B	837	3530	9						9		0.00	
B	841	3590	9						9		0.00	
B	846	3665	11						11		0.00	
B	849	3710	12						12		0.00	

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TABLE I a.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN HEADSPACE.

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4
B	853	3770	23	3	1				28	5	17.55	
B	857	3830	26	3					29	3	9.00	
B	861	3890	18						18		0.00	
B	865	3950	14						14		0.00	
B	869	4010	73	18	10				101	28	27.93	
B	873	4070	14	2	2				18	4	20.13	

DATE : 28 - 12 - 83.

IKU

TABLE I b.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN CUTTINGS .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4
B	686	1265										
B	687	1280	6						6		0.00	
B	688	1295	36	20	34	12	21	89	123	87	70.61	0.59
B	689	1310	33	23	63	32	56	90	206	173	84.11	0.57
B	690	1325	16	5	34	29	43	130	126	110	87.49	0.67
B	691	1340	111	1103	1859	1573	1055	1784	5702	5591	98.05	1.49
B	692	1355	183	85	60	77	68	1194	472	289	61.31	1.12
B	694	1385	187	63	162	319	260	3029	991	805	81.16	1.22
B	696	1415	171	56	54	120	64	1452	465	294	63.28	1.88
B	698	1445	138	61	53	79	57	1326	387	250	64.44	1.38
B	699	1460	120	42	62	116	80	1783	419	300	71.45	1.45
B	700	1475	131	33	30	38	28	292	261	129	49.68	1.36
B	701	1490	162	34	39	57	39	1349	331	169	50.95	1.48
B	702	1505	22	3	14	17	11	77	68	46	67.29	1.46
B	706	1565	122	27	35	78	54	2284	317	194	61.41	1.44
B	708	1595	43	14	18	10	8	320	93	50	54.09	1.28
B	710	1625	240	432	560	215	258	765	1705	1465	85.94	0.83
B	712	1655	403	58	93	40	56	293	651	247	37.97	0.71
B	714	1685	218	29	56	7	13	183	323	105	32.45	0.54
B	716	1715	206	36	70	34	50	201	396	190	48.05	0.67
B	718	1745	467	19	37	25	39	158	587	120	20.42	0.64
B	720	1775	213	12	21	10	14	132	269	57	21.11	0.74
B	722	1805	493	259	288	84	128	446	1252	758	60.59	0.66

DATE : 28 - 12 - 83.

TABLE I b.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN CUTTINGS .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
B	724	1835	10762	10307	5710	1423	1340	1093	29543	18780	63.57	1.06
B	726	1865	440	588	797	239	322	472	2386	1945	81.55	0.74
B	728	1895	2962	1502	2901	989	1362	4023	9715	6753	69.51	0.73
B	730	1925	157	173	419	171	201	626	1120	963	86.02	0.85
B	732	1955	461	698	955	387	324	818	2824	2363	83.66	1.19
B	734	1985	60	20	72	48	44	200	244	184	75.32	1.09
B	736	2015	88		7			41	94	7	7.11	
B	738	2045	400						400		0.00	
B	741	2090	501	6	5	8	10	103	530	29	5.49	0.78
B	742	2105	333	6	8	10		65	357	24	6.81	
B	744	2135	1324	806	787	306	204	282	3427	2102	61.35	1.50
B	746	2165	187	101	190	90	73	158	642	455	70.86	1.23
B	749	2210	40	4	6				50	10	20.03	
B	752	2255	45						45		0.00	
B	755	2300	80						80		0.00	
B	758	2345	84						84		0.00	
B	761	2390	40						40		0.00	
B	763	2420	36						36		0.00	
B	767	2480										
B	770	2525	20						20		0.00	
B	773	2570	19						19		0.00	
B	776	2615									0.00	
B	779	2660	10						10		0.00	

DATE : 28 - 12 - 83.

TABLE I b.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN CUTTINGS .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4
B	781	2690	73	6					79	6	7.76	
B	782	2705	O P E N L I D									
B	785	2750	32	3					36	3	9.41	
B	789	2810	43						43		0.00	
B	791	2840	40						40		0.00	
B	794	2882	30	3				16	32	3	8.67	
B	797	2930	52	3	3				57	5	9.29	
B	801	2990	50		5				55	5	9.84	
B	805	3030	46		3				49	3	6.44	
B	809	3110	34						34		0.00	
B	813	3170	48		6				53	6	10.54	
B	817	3230	54		8			33	63	8	13.08	
B	821	3290	65	5	3				73	8	11.05	
B	825	3350	57	5					62	5	7.69	
B	829	3410	51	9					60	9	14.90	
B	833	3470	53						53		0.00	
B	837	3530	58	9	10				77	19	24.99	
B	841	3590	53	2					55	2	3.33	
B	846	3665	68	2.					70	2	2.99	
B	849	3710	61		8				69	8	11.27	

DATE : 28 - 12 - 83.

TABLE I b.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS IN CUTTINGS .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4
B	853	3770	65		7				72	7	9.16	
B	857	3830	55						55		0.00	
B	861	3890		O P E N		L I D						
B	865	3950	116	17	23			216	156	40	25.61	
B	869	4010	89	8	12				109	21	18.77	
B	873	4070	66		10				76	10	12.95	

DATE : 28 - 12 - 83.

IKU

TABLE I c.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS (Ia + Ib) .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4	
B	686	1265	13120	1966	666	104	62	33	15918	2798	17.58	1.66	
B	687	1280	3844	622	237	43	27	19	4772	929	19.46	1.57	
B	688	1295	5890	560	240	51	54	109	6795	905	13.32	0.95	
B	689	1310	4642	547	253	70	87	108	5600	958	17.11	0.80	
B	690	1325	4826	1109	494	151	133	175	6713	1887	28.11	1.14	
B	691	1340	34680	9983	4417	2510	1482	2273	53072	18392	34.65	1.69	
B	692	1355	183	85	60	77	68	1194	472	289	61.31	1.12	
B	694	1385	1257	270	279	407	294	3155	2507	1250	49.85	1.38	
B	696	1415	3744	663	331	415	139	2198	5291	1548	29.25	2.99	
B	698	1445	138	61	53	79	57	1326	387	250	64.44	1.38	
B	699	1460	2874	452	286	299	156	2216	4066	1192	29.33	1.91	
B	700	1475	1621	337	199	154	75	510	2387	766	32.08	2.04	
B	701	1490	6488	683	325	299	138	2027	7933	1445	18.22	2.16	
B	702	1505	3143	1723	774	392	162	573	6194	3051	49.26	2.41	
B	706	1565	875	195	217	278	160	2890	1725	850	49.29	1.73	
B	708	1595	1456	435	182	61	41	494	2176	720	33.09	1.49	
B	710	1625	16777	4365	1977	525	490	1090	24134	7357	30.48	1.07	
B	712	1655	1451	320	215	69	76	326	2130	679	31.89	0.90	
B	714	1685	5151	1207	816	200	188	367	7563	2412	31.89	1.06	
B	716	1715	1893	385	258	81	90	244	2707	815	30.09	0.90	
B	718	1745	894	121	101	40	54	164	1209	315	26.08	0.75	
B	720	1775	511	88	58	20	21	138	698	187	26.78	0.94	
B	722	1805	10354	2471	1076	219	234	538	14354	4000	27.87	0.93	

DATE : 28 - 12 - 83.

TABLE I c.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS (Ia + Ib) .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4	
B	724	1835	26544	12369	6199	1500	1391	1124	48004	21460	44.70	1.08	
B	726	1865	9353	2304	1516	360	411	520	13944	4591	32.92	0.87	
B	728	1895	4576	1892	3112	1033	1393	4062	12007	7430	61.88	0.74	
B	730	1925	3011	790	862	280	270	761	5214	2203	42.25	1.04	
B	732	1955	5462	1650	1340	475	371	906	9298	3836	41.26	1.28	
B	734	1985	196	78	126	65	52	216	516	321	62.08	1.24	
B	736	2015	176	12	17	4	2	47	211	34	16.34	1.82	
B	738	2045	435	2	1				438	3	0.68		
B	741	2090	514	9	9	11	10	118	554	39	7.10	1.10	
B	742	2105	415	19	24	19	3	65	480	65	13.52	6.08	
B	744	2135	2726	905	827	319	208	282	4984	2258	45.31	1.53	
B	746	2165	1380	206	248	114	83	172	2031	651	32.07	1.38	
B	749	2210	112	12	11	2			138	26	18.77		
B	752	2255	140	7	4	1			152	12	7.97		
B	755	2300	107	3	2				112	5	4.06		
B	758	2345	93	1	1				95	2	2.26		
B	761	2390	53	2	1				57	3	6.10		
B	763	2420	53	3	2				58	5	9.34		
B	767	2480	25	3	2				30	5	16.76	1.00	
B	770	2525	1107	25	6				1138	31	2.70		
B	773	2570	117	4	1				122	5	4.31		
B	776	2615	2	0					2	0	5.02		
B	779	2660	20	1	1				22	1	6.77		

DATE : 28 - 12 - 83.

IKU

TABLE I c.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS (Ia + Ib) .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
B	781	2690	73	6					79	6	7.80	1.00
B	782	2705	O P E N L I D									
B	785	2750	60	8	2			13	70	10	14.43	
B	789	2810	46	0					46	0	0.59	
B	791	2840	43	0					43	0	0.48	
B	794	2882	32	3				16	36	3	8.71	
B	797	2930	57	3	3				63	5	8.51	
B	801	2990	71	2	6				80	8	10.32	
B	805	3030	53	1	4			1	58	4	7.27	
B	809	3110	46						46		0.00	
B	813	3170	51	1	6				57	6	11.17	
B	817	3230	63	2	8			33	73	10	13.75	
B	821	3290	78	7	3				88	9	10.61	
B	825	3350	74	6					80	6	7.85	
B	829	3410	65	9					74	9	12.03	
B	833	3470	57	0					57	0	0.64	
B	837	3530	66	9	10				86	19	22.50	
B	841	3590	62	2					64	2	2.87	
B	846	3665	79	2					81	2	2.59	
B	849	3710	73		8				81	8	9.64	

DATE : 28 - 12 - 83.

IKU

TABLE I c.

CONCENTRATION (ul Gas / kg Rock) OF C1 - C7 HYDROCARBONS (Ia + Ib) .

	IKU no.	DEPTH m/ft	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
B	853	3770	88	3	8				99	11	11.49	
B	857	3830	82	3					84	3	3.09	
B	861	3890	18						18		0.00	
B	865	3950	131	17	23			216	171	40	23.44	
B	869	4010	162	27	22				211	49	23.18	
B	873	4070	81	2	11				94	13	14.33	

DATE : 28 - 12 - 83.

IKU

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-686	1250-65	2.84	85% Claystone, dark grey
		0.55	10% Claystone, greenish grey
			5% Limestone
B-687	1265-80	1.79	60% Claystone, dark grey
			35% Marl, grey
			5% Limestone
B-688	1280-95	0.45	95% Marl, grey
			5% Claystone, pale brown
B-689	1295-1310		95% Marl, grey-light grey
		0.81	3% Claystone, grey-dark grey
			2% Claystone, pale brown
B-1242	1317-20	1.59	35% Claystone, dark grey
			10% Claystone, pale brownish grey, greenish grey
			50% Marl, light grey
			5% Limestone
B-690	1310-1325	1.62	10% Claystone, dark grey
		0.42	90% Marl, light grey
B-1243	1325-27	1.76	90% Claystone, dark grey
			10% Claystone, light grey, olive grey, greenish grey
B-691	1325-40	2.91	90% Claystone, dark grey-black
			5% Marl, light grey
			5% Claystone, pale green

IKU

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-1244	1337-40	2.89	85% Claystone, dark grey
			10% Claystone, brownish grey, greenish grey
			5% Sandstone
B-692	1340-55		80% Sand
		2.40	10% Claystone, dark grey
		0.70	10% Claystone, olive grey-pale green
B-694	1370-85		100% Sand
B-696	1400-15		95% Sand
			5% Claystone, grey
B-698	1445-60		70% Sand
			30% ?Core-bit affected lithologies
B-700	1460-75		80% Sand
			20% ?Core-bit affected lithologies
B-701	1475-90		30% Sand
			70% ?Core-bit affected lithologies/mud
B-702	1490-1505		70% Sand
			30% ?Core-bit affected lithologies/mud
B-706	1550-65		35% Sand
			65% ?Core-bit affected lithologies/mud
B-708	1580-95		10% Sand
			90% ?Core-bit affected lithologies/mud
B-710	1610-25		90% Sand/Sandstone
			5% Claystone, grey
			5% ?Lithologies affected by drilling

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-712	1640-55		100% Sand
B-714	1670-85		100% Sand/Sandstone
B-716	1700-15	2.40	95% Sand/Sandstone 5% Claystone, grey-light grey
B-718	1730-45		100% Sand/Sandstone
B-720	1760-75		100% Sand/Sandstone
B-722	1790-1805		100% Sand/Sandstone
B-2418 SWC	1808.1		Claystone, brownish grey - olive grey, waxy, non-calcareous
B-2419 SWC	1818.5		Claystone, brownish black, slightly silty, partly micropyritic, non-calcareous
B-724	1820-1835	31.90	85% Sand 10% Coal/carbonaceous claystone 5% Claystone, pale brownish grey, pale bluish green
B-726	1850-65		95% Sand/Sandstone 5% Claystone, grey
B-2420 SWC	1863		Mudstone, olive grey, sandy (very fine), slight micromicaceous, non-calcareous
B-728	1880-95		100% Sand/Sandstone

IKU

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-1245	1910-12	1.24	10% Claystone, grey, sandy 5% Claystone, pale brown 85% Sand/Sandstone
B-2421 SWC	1913		Mudstone, light olive grey - olive grey, sandy, interlaminated with Sandstone, light brownish grey, argillaceous
B-730	1910-25	1.46	30% Sandstone/Sand 70% Claystone, grey
B-1246	1927-30	1.23	65% Claystone, grey (slightly brownish) 35% Sand/Sandstone
B-732	1940-55	2.13	95% Claystone, grey 5% Limestone
B-2422 SWC	1956		Claystone, dark olive grey, silty, partly sandy (very fine), non-calcareous
B-1247	1955-57	1.74	80% Claystone, grey 5% Marl/Claystone, light greyish white 15% Sand/Sandstone
B-734	1970-85		40% Cement 60% Sand
B-736	2000-15		5% Cement 95% Sand
B-738	2030-45		100% Sand
B-741	2075-90		100% Sand

IKU

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-742	2090-2105		90% Sand/Sandstone
			10% Limestone
B-744	2120-35		95% Sand/Sandstone
		11.82	5% Claystone, grey-pale brownish grey
B-746	2150-65		40% Sand
		0.14	60% Claystone, pale bluish green-pale green, pale brown
B-2423 SWC	2182		Claystone, yellowish brown, non-calcareous
B-749	2195-2210		30% Sand
		0.05	65% Claystone, pale green, pale brown, redbrown, purple, yellowish brown
			5% Marl/Limestone
B-752	2240-55		45% Sand
		0.06	55% Variecoloured claystones as above
B-755	2285-2300		30% Sand
		0.01	70% Claystone, redbrown, pale green-green
B-758	2330-45		30% Sand
		0.10	60% Claystones as above
			10% Limestone
B-761	2375-90		20% Sand
		0.02	65% Claystones, as above
			15% Limestone
B-763	2405-20		10% Sand
			10% Sandy claystone, purple-redbrown
		0.01	80% Claystone as above

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-767	2465-80		10% Sand
		0.06	90% Claystone, sandy, redbrown, brown, pale green, pale purple, pale brownish grey
B-770	2510-25		15% Sand
		0.06	85% Claystone, sandy, as above
B-773	2555-70		15% Sand
		0.02	85% Claystone, sandy, as above
B-776	2600-15		25% Sand
		0.06	75% Claystone, sandy as above
B-779	2645-60		35% Sand
		0.01	65% Claystone, sandy as above
B-781	2675-90		40% Sand
		0.01	60% Claystone, sandy as above
B-785	2735-50		40% Sand
		0.02	60% Claystone, sandy, mostly redbrown, brown, pale green, pale bluish green
B-789	2795-2810		85% Sand
		0.01	15% Claystone, sandy, as above
B-791	2825-40		90% Sand
		0.00	10% Claystone, sandy, as above
B-794	2870-85		90% Sand
		0.00	10% Claystone, sandy, as above
B-797	2915-30		95% Sand
			5% Claystone, sandy, as above

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-801	2975-90		95% Sand 5% Claystone, sandy, as above
B-805	3035-50		95% Sand 5% Claystone, sandy, as above
B-809	3095-3110	0.00	85% Sand 15% Claystone, sandy, redbrown-brown, pale green
B-813	3155-70	0.01	60% Sand 40% Claystone, pale green, olive, redbrown, grey
B-817	3215-30		100% Sand/Sandstone
B-821	3275-90	0.01	90% Sand/Sandstone 10% Claystone, redbrown, yellowish green
B-825	3335-50	0.00	55% Sandstone/Sand 45% Claystone, brown, pale green, pale bluish green
B-829	3395-3410	0.02	10% Sandstone/Sand 90% Claystone, brown-dark brown
B-833	3455-70	0.00	50% Sandstone/Sand 50% Claystone, brown-dark brown
B-837	3515-30	0.00	40% Sandstone/Sand 60% Claystone, brown-dark brown, green
B-841	3575-90	0.00	35% Sandstone/Sand 65% Claystone, brown-dark brown, green

IKU

Lithology and Total Organic Carbon measurements

TABLE NO.: 2.
WELL NO.: 31/6-1

Sample	Depth (m)	TOC	Lithology
B-845	3635-50		90% Sand/Sandstone
		0.06	10% Claystone, brown-dark brown, green
B-849	3695-3710		90% Sand/Sandstone
			5% Claystone, dark brown
			5% Marl, white-redbrown
B-853	3755-70		40% Sandstone/Sand
		0.13	60% Claystone, brickred, dark brown, pale bluish green
B-857	3815-30		25% Sand/Sandstone
		0.04	75% Claystone, dark brown, brickred, greyish brown, bluish green
B-861	3875-90		5% Sand
		0.00	55% Claystone, dark brown
		0.73	40% Claystone, dark bluish grey
B-865	3935-50		10% Sandstone
		0.07	85% Claystone, dark brown
			5% Claystone, dark bluish grey
B-869	3995-4010		10% Sandstone/Sand
		0.02	80% Claystone, dark brown green
			5% Marl, white-redbrown
			5% Coal
B-873	4065-70		75% Crystalline Quartzite, basement lithology
		0.01	25% Claystone, redbrown, brickred, green, white

TABLE 3.

D A T A F R O M R O C K E V A L P Y R O L Y S I S

IKU No.	DEPTH m/ft	S1	S2	S3	TOC (%)	HYDR. INDEX	OXYGEN INDEX	PETROLEUM POTENTIAL S1+S2	PROD. INDEX S1/(S1+S2)	TEMP. MAX (C)
B 686	1265	0.60	4.02	1.05	2.84	142	37	4.62	0.13	428
		Clst dk - gy								
B 687	1280	0.21	1.04	1.13	1.79	58	63	1.25	0.17	430
		Clst dk - gy								
B 689	1310	0.08	0.05	0.67	0.81	6	83	0.13	0.62	426
		Clst gy - dk - gy								
B 1242	1320	0.21	1.58	0.69	1.52	104	45	1.79	0.12	432
		Clst dk - gy								
B 690	1325	0.29	1.32	2.08	1.62	81	128	1.61	0.18	429
		Clst dk - gy								
B 1243	1327	0.29	3.77	0.64	1.76	214	36	4.06	0.07	434
		Clst dk - gy								
B 691	1340	0.37	7.72	1.93	2.91	265	66	8.09	0.05	427
		Clst dk - gy								
B 1244	1340	0.77	10.68	0.79	2.89	370	27	11.45	0.07	429
		Clst dk - gy								
B 692	1350	0.38	5.19	2.24	2.40	216	93	5.57	0.07	426
		Clst dk - gy								
B 692	1350	0.18	0.22	2.94	0.70	31	420	0.40	0.45	415
		Clst olv - gy								
B 716	1715	0.88	5.08	1.77	2.40	212	74	5.96	0.15	426
		Clst gy - lt - gy								
B 724	1835	2.64	51.44	4.44	31.91	161	14	54.08	0.05	420
		Coal								
B 1245	1912	0.55	3.69	0.58	1.24	298	47	4.24	0.13	433
		Clst gy								
B 730	1925	0.31	3.92	1.23	1.46	268	84	4.23	0.07	430
		Clst gy								
B 1246	1930	0.31	2.65	0.65	1.23	215	53	2.96	0.10	437
		Clst gy								
B 732	1955	0.40	7.10	1.38	2.13	333	65	7.50	0.05	428
		Clst gy								
B 1247	1957	0.34	6.20	0.47	1.74	356	27	6.54	0.05	431
		Clst gy								
B 744	2135	1.26	34.39	2.62	11.82	291	22	35.65	0.04	424
		Clst								
B 861	3890	0.22	0.19	1.22	0.73	26	167	0.41	0.54	454
		Clst dk - bl - gy								

DATE : 7 - 3 - 84.

T A B L E : 4.

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 686	1265	8.7	3.6	2.6	0.6	3.2	0.4	2.84
B 690	1325	9.6	4.1	0.8	0.8	1.6	2.5	1.38
B 1243	1327	10.0	5.1	0.8	0.5	1.3	3.8	1.76
B 691	1340	11.5	7.0	1.5	1.0	2.5	4.5	2.37
B 1244	1340	8.2	4.6	1.2	0.9	2.1	2.5	2.39
B 730	1925	1.4	3.1	0.6	0.8	1.4	1.7	1.28
B 1246	1930	8.6	6.1	1.1	0.6	1.7	4.4	1.31
B 732	1955	15.3	10.6	2.5	3.2	5.7	4.9	2.13
B 1247	1957	10.9	6.2	1.0	1.0	2.0	4.2	1.29
B 744	2135	15.3	10.6	2.1	2.7	4.8	5.8	0.76
B 861	3890	49.6	9.2	1.8	0.5	2.3	6.9	0.03

DATE : 22 - 3 - 84.

T A B L E : 5.

WEIGHT OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm OF rock)

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
B 686	1265	414	299	69	368	46
B 690	1325	425	83	83	166	259
B 1243	1327	510	80	50	130	380
B 691	1340	610	131	87	218	392
B 1244	1340	561	146	110	256	305
B 730	1925	2263	438	584	1022	1241
B 1246	1930	713	129	70	199	514
B 732	1955	693	163	209	373	320
B 1247	1957	570	92	92	184	386
B 744	2135	691	137	176	313	378
B 861	3890	186	36	10	46	139

DATE : 22 - 3 - 84.

T A B L E : 6.

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
B 686	1265	14.6	10.5	2.4	13.0	1.6
B 690	1325	30.8	6.0	6.0	12.0	18.8
B 1243	1327	29.0	4.5	2.8	7.4	21.6
B 691	1340	25.7	5.5	3.7	9.2	16.5
B 1244	1340	23.5	6.1	4.6	10.7	12.8
B 730	1925	176.8	34.2	45.6	79.8	96.9
B 1246	1930	54.4	9.8	5.4	15.2	39.2
B 732	1955	32.5	7.7	9.8	17.5	15.0
B 1247	1957	44.2	7.1	7.1	14.2	29.9
B 744	2135	90.9	18.0	23.2	41.2	49.7
B 861	3890	618.7	121.0	33.6	154.7	464.0

DATE : 22 - 3 - 84.

T A B L E : 7.

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 686	1265	72.2	16.7	88.9	433.3	11.1	800.0
B 690	1325	19.5	19.5	39.0	100.0	61.0	64.0
B 1243	1327	15.7	9.8	25.5	160.0	74.5	34.2
B 691	1340	21.4	14.3	35.7	150.0	64.3	55.6
B 1244	1340	26.1	19.6	45.7	133.3	54.3	84.0
B 730	1925	19.4	25.8	45.2	75.0	54.8	82.4
B 1246	1930	18.0	9.8	27.9	183.3	72.1	38.6
B 732	1955	23.6	30.2	53.8	78.1	46.2	116.3
B 1247	1957	16.1	16.1	32.3	100.0	67.7	47.6
B 744	2135	19.8	25.5	45.3	77.8	54.7	82.8
B 861	3890	19.6	5.4	25.0	360.0	75.0	33.3

DATE : 22 - 3 - 84.

T A B L E 8.

TABULATION OF DATA FROM THE GASCHROMATOGRAMS

IKU No.	DEPTH (m)	PRISTANE / n-C17	PRISTANE / PHYTANE	CPI
B 686	1265	0.9	2.2	1.1
B 690	1325	0.9	1.2	1.8
B 1243	1327	0.9	0.8	2.5
B 691	1340	1.1	0.8	2.3
B 1244	1340	0.8	0.8	2.4
B 730	1925	0.8	1.9	1.5
B 1246	1930	0.9	1.4	2.1
B 732	1955	1.4	1.3	1.9
B 1247	1957	1.2	1.3	1.9
B 744	2135	0.9	2.3	1.5
B 861	3890	0.4	1.0	1.3

DATE : 2 - 3 - 84.

Table 9: Concentration of C_{15}+ saturated hydrocarbons, branched/cyclic hydrocarbons and normal alkanes.

IKU No.	Depth (m)	Sat. (mg)	Branched/cyclic (mg)	normal alkanes (mg)
B-686	1265	2.6	0.7	0.2
B-690	1325	0.8	0.7	0.4
B-1243	1327	0.8	0.1	0.8
B-691	1340	1.5	1.0	0.6
B-1244	1340	1.2	0.7	0.5
B-730	1925	0.6	0.4	0.2
B-1246	1930	1.1	1.0	0.4
B-732	1955	2.5	0.9	-
B-1247	1957	1.0	0.8	-
B-744	2135	2.1	1.1	0.4
B-861	3890	1.8	0.9	0.2

T A B L E 10.

TABULATION OF MATURITY DATA

IKU No.	DEPTH (m/ft)	VITRINITE REFLECTANCE Ro(%) and Counts	MATURATION INDEX (TAI)	FLUOR-ESCENCE
B 686	1265	0.44(18)	1/1+	5
B 687	1280	0.46(15)	1/1+	4
B 688	1295	0.68(1)	1/1+	4
B 1242	1320	0.41(2)	1/1+ 2-	3/5
B 690	1325	0.42(3)	1/1+	4
B 1243	1327	0.42(3)	1/1+	4/5
B 691	1340	0.42(8)	1/1+	4
B 1244	1340	0.43(9)	1/1+	4/5
B 692	1355	0.44(7)	1/1+	4/5
B 716	1715	0.37(20)	N.A.	4/5
B 2418	1808.10	0.41(20) SWC	2-/2 2	4/6
B 2419	1818.50	0.40(14) SWC	2- 2-/2 2	4
B 724	1835	0.45(11)	1/1+ 2 2-/2	3/4
B 2420	1863	0.40(2) SWC	2-/2 2-	4/5
B 1245	1912	0.43(24)	N.A.	4/5
B 2421	1913	0.40(9) SWC	2- 2-/2	4/5
B 730	1925	0.43(12)	2-/2 2	4/5
B 1246	1930	0.48(2)	2-/2 2+ 2	4/5
B 732	1955	0.42(9)	1+ 2-	4/5
B 2422	1956	0.43(6) SWC	2- 2-/2	4
B 1247	1957	0.45(17)	1+ 2-	5
B 744	2135	0.38(8)	+	4
B 746	2165	0.52(1)	+	3/4

DATE : 29 - 3 - 84.

T A B L E 10.

TABULATION OF MATURITY DATA

IKU No.	DEPTH (m/ft)	VITRINITE REFLECTANCE Ro(%) and Counts	MATURATION INDEX (TAI)	FLUOR-ESCENCE
B 2423	2182	N.D.P.	+	
		SWC —		
B 853	3870	N.D.P.	+	4
		—		

DATE : 29 - 3 - 84.

IKU

Visual Kerogen Analysis

TABLE NO.: 11.
WELL NO.: 31/6-1

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index	Remarks
B-686	1250-65	W,WR!,Cut,P/Am,Cy	F-M-L	good to fair	1/1+	Pyritic, loose aggregates. Woody and reworked woody material.
B-687	1265-80	WR!,W,Cut,P,/Am,Cy	F-M	variable	1/1+	Some admixtures of the above material. Mainly grey amorphous often flaky aggregates. Woody material greyish etched app.
B-688	1280-95	WR!,W,P/Am,Cy	F-M	good	1/1+	Grey amorphous. Good cyst assemblage. Small residue.
B-690	1310-25	W,WR!,P/Am,Cy	F-M	variable	1/1+	Probably material from different lithologies. Amorphous material as aggregates and grey amorphous mixed with inorganic acid resistant remains. Very small residue.
B-1242	1317-20	W,WR!,P/Am,Cy	F-M	variable	1/1+, 2-	Pyritic residue. Abundance of grey amorphous with small degraded particles, probably of woody origin. Forams.

ABBREVATIONS

Am	Amorphous	Cy	Cysts, algae	W	Woody material	F	Fine
He	Herbaceous	P	Pollen grains	C	Coal	M	Medium
Cut	Cuticles	S	Spores	R!	Reworked	L	Large

Visual Kerogen Analysis

TABLE NO.: 11.
WELL NO.: 31/6-1

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index	Remarks
B-1243	1325-27	W,WR!,P,Cut/Am,Cy	F-M-L	fair to good	1/1+	Firm pyritic aggregates, partly grey amorphous material. Embedded palynomorphs often hidden but well preserved Tasmanites, Classopollis and brown aggregates in sieved residues (Mixed lithologies).
B-691	1325-40	W,WR!,P/Am,Cy	F-M	fair	1/1+	Aggregates and dispersed material mostly grey amorphous. Strongly degraded remains embed structured particles.
B-1244	1337-40	W,WR!,P/Am,Cy	F-M	fair	1/1+	As above.
B-692	1340-55	W,WR!,P/Am,Cy, Algal	F-M-L	poor to fair	1/1+	Fairly dense yellow/brown, pyritic aggregates of degraded material. Abundant globular organic bodies and small woody fragments. Tasmanites.
B-724	1820-35	*W,WR!,Cut,P,S/Am,Cy	M-L	variable	1/1+,2, 2-/2	*Sieved residue. Structured woody material. Callialasporites.

ABBREVATIONS

Am	Amorphous	Cy	Cysts, algae	W	Woody material	F	Fine
He	Herbaceous	P	Pollen grains	C	Coal	M	Medium
Cut	Cuticles	S	Spores	R!	Reworked	L	Large

IKU

Visual Kerogen Analysis

TABLE NO.: 11.
WELL NO.: 31/6-1

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index	Remarks
B-730	1910-25	W,Cut,P,S/Am	F-M-L	fair to good	2-/2, 2	Pyritic mostly dispersed, poorly sorted remains. Thin-walled material.
B-1246	1927-30	Cut,W,P,S/Am,Cy	F-M-L	good	2-/2, 2+, 2	As above, Thicker walls. Better preservation. Nannoceratopsis graciles. Classopollis. Tasmanites.
B-732	1940-55	Cut,W,P,S/Am,Cy	F-M-L	variable	1+, 2-	As above, aggregates. Strongly pyritic sample. Very light coloured thinwalled material. Abundant small spherical bodies.
B-1247	1955-57	Cut,W,P,S/Am,Cy	F-M-L	variable	1+, 2-	As B-732.
B-744	2120-35	*W?	M	-	?	Screened residue. Some aggregates as in layers above, mixed with brown-grey, etched woody, amorphous fragments.

ABBREVATIONS

Am	Amorphous	Cy	Cysts, algae	W	Woody material	F	Fine
He	Herbaceous	P	Pollen grains	C	Coal	M	Medium
Cut	Cuticles	S	Spores	R!	Reworked	L	Large

IKU

Visual Kerogen Analysis

TABLE NO.: 11.
WELL NO.: 31/6-1

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index	Remarks
B-744	2150-65	*W	M-L	-	-	Structured woody material and amorphous etched, grey-brown woody fragments. Rare palynomorphs, indicate increase in maturation from B-1247 or an oxidative environment.
B-853	3755-70	W,Am	M-L	-	-	Minerals, occasional black woody fragments and rare coarse supposed cuticles.
B-861	3875-90	WR!,Cut/Am	M-L	-	-	Very poor residue. Pyrite. Amorphous material. Grey etched material probably of cuticular nature. Some woody material.

ABBREVATIONS

Am	Amorphous	Cy	Cysts, algae	W	Woody material	F	Fine
He	Herbaceous	P	Pollen grains	C	Coal	M	Medium
Cut	Cuticles	S	Spores	R!	Reworked	L	Large

Visual Kerogen Analysis

TABLE NO.: 11.
WELL NO.: 31/6-1

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index	Remarks
B-2418	1808.1 swc	*W,Cut,S,P/	F-M	good	2-/2, 2	*Sieved/screened residue. Different types of woody material. Coarse cuticles and very thin ones. Poor sorting, partly mechanically fragmented material. Ischyosporites.
B-2419	1818.5 swc	Cut,W,P,S/Am	F-M-L	fair to good	2-, 2-/2, 2	Strongly degraded, fragmented, sapropelised material.
B-2420	1863 swc	W,Cut,P,S/Am	F-M-L	good	2-/2, 2-	Some resemblance in quality of preservation with B-2418 (mechanically fragmented).
B-2421	1913 swc	Cut,W,P,S/Am,Cy	F-M-L	good to fair	2-, 2-/2	Aggregates of sapropelised material.
B-2422	1956 swc	W,Cut,P,S/	F-M-L	good to fair	2-, 2-/2	Dispersed material rich in pyrite and other minerals. Algae (especially Botryococcus).
B-2423	2182	*W	F-M-L	-	-	*Screened residue. Degraded probably woody material, non-structured, etched amorphous fragments.

ABBREVATIONS

Am	Amorphous	Cy	Cysts, algae	W	Woody material	F	Fine
He	Herbaceous	P	Pollen grains	C	Coal	M	Medium
Cut	Cuticles	S	Spores	R!	Reworked	L	Large

FIGURE 1

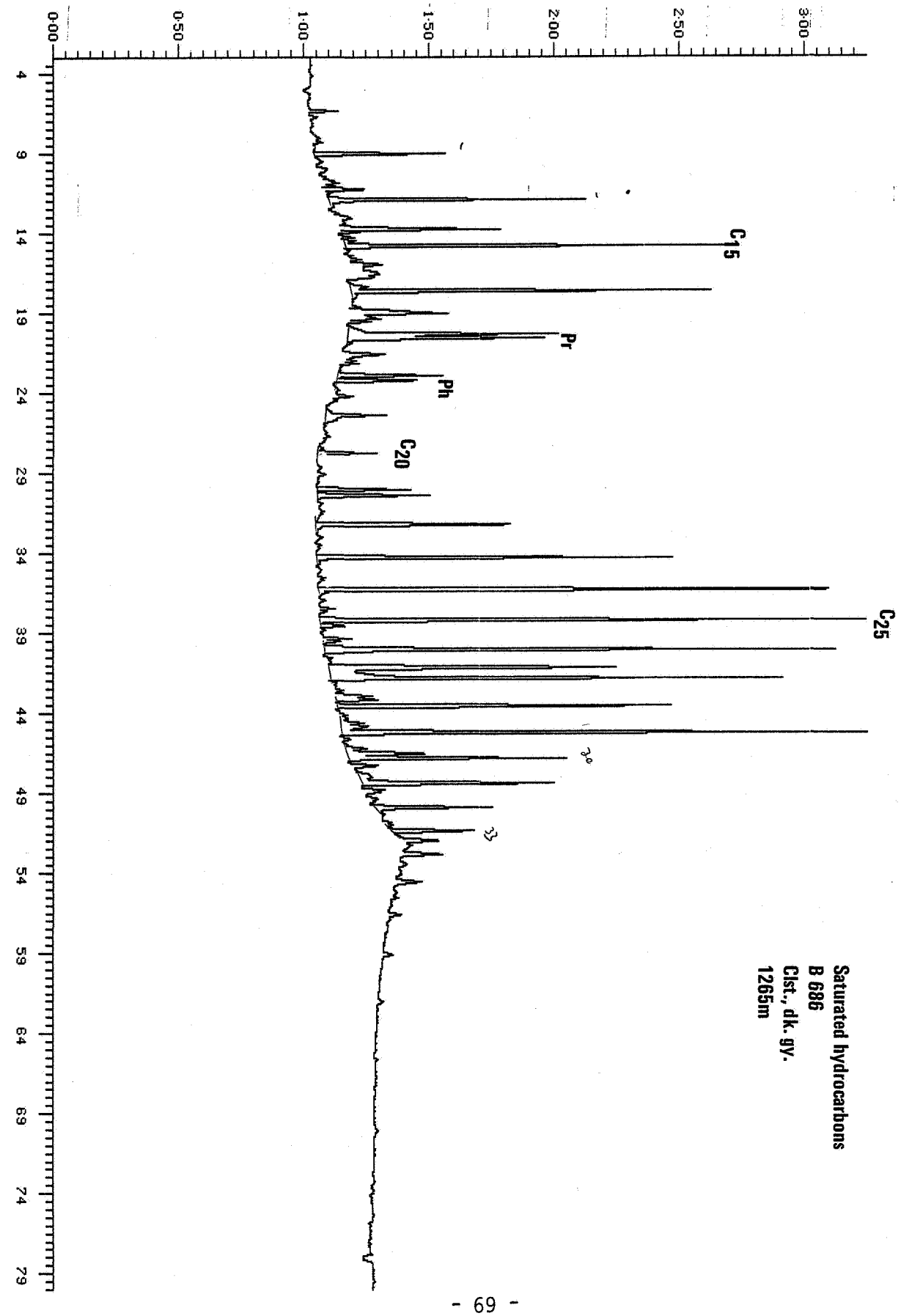
Gas chromatograms of C_{15}^{+} saturated hydrocarbons

Pr - pristane
Ph - phytane

Created at 12:37 on 27/Feb/84

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

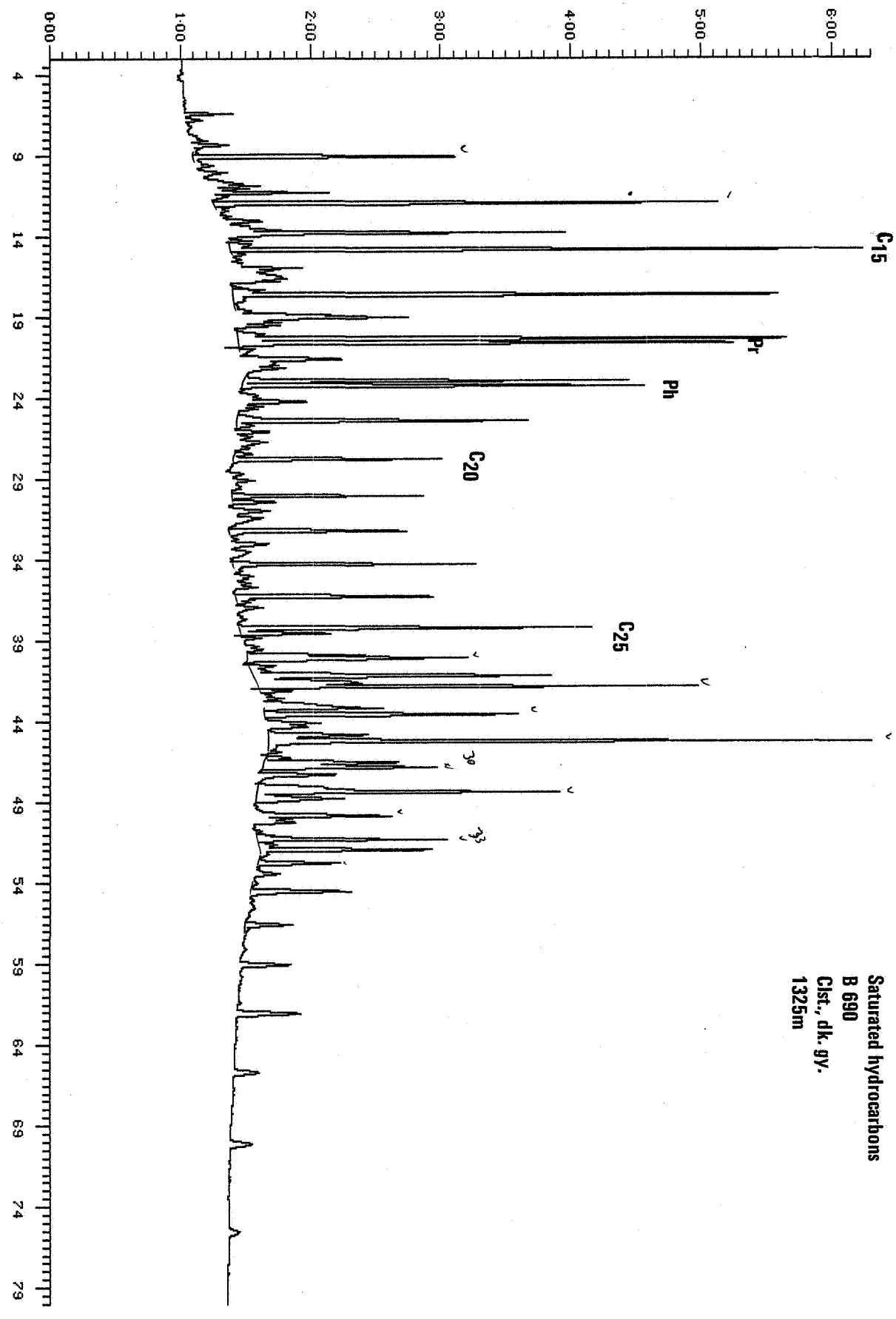
Analysis :198B686 Sample £: 1 Injection £: 1
Sample Name :B-686,31/6-1,SAT,JA Maximum signal (%) :3.249



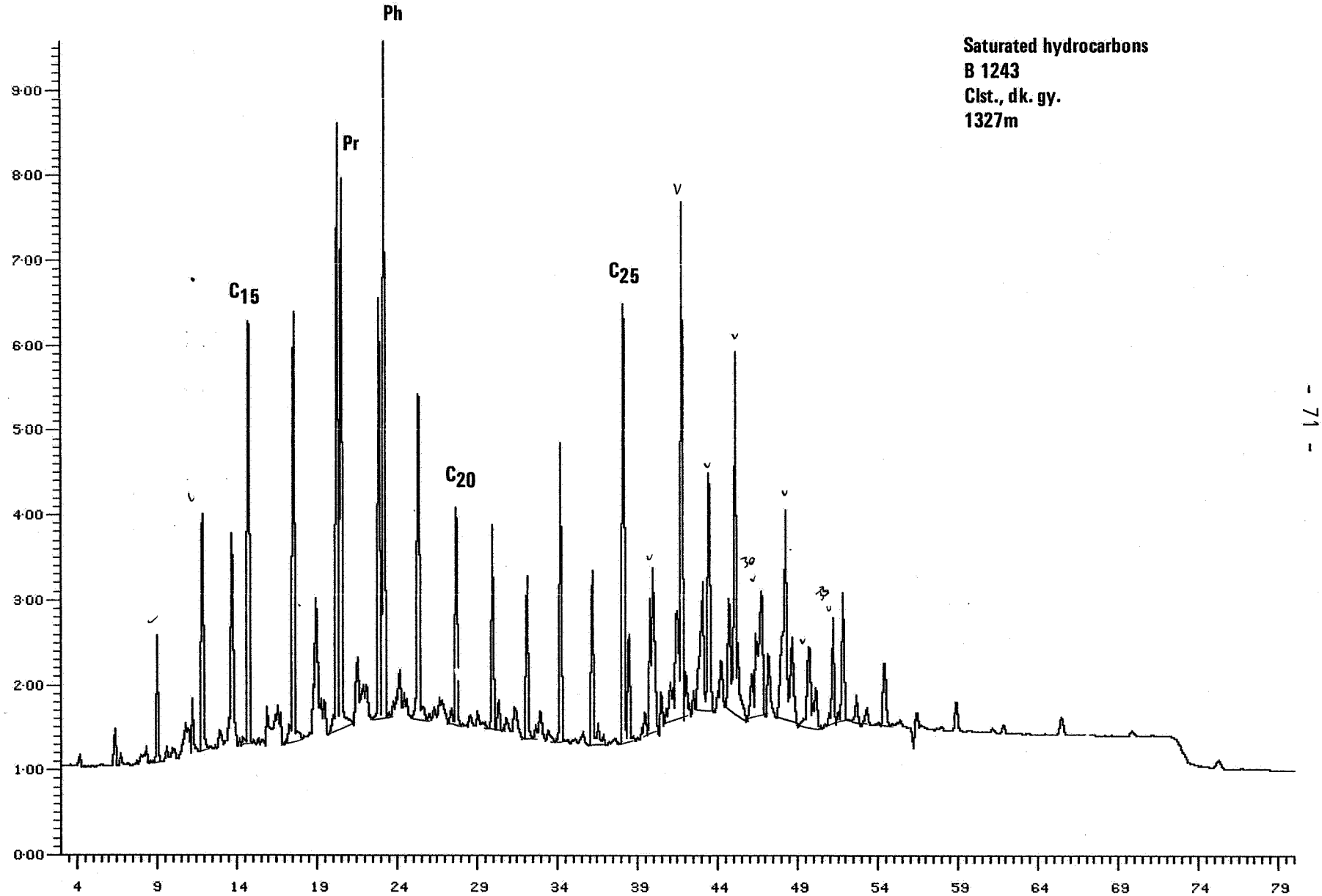
Created at 14:38 on 27/Feb/84

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

Analysis :198B690 Sample f: 1 Injection f: 1
Sample Name :B-690,31/6-1,SAT,JA Maximum signal (%) :6.302



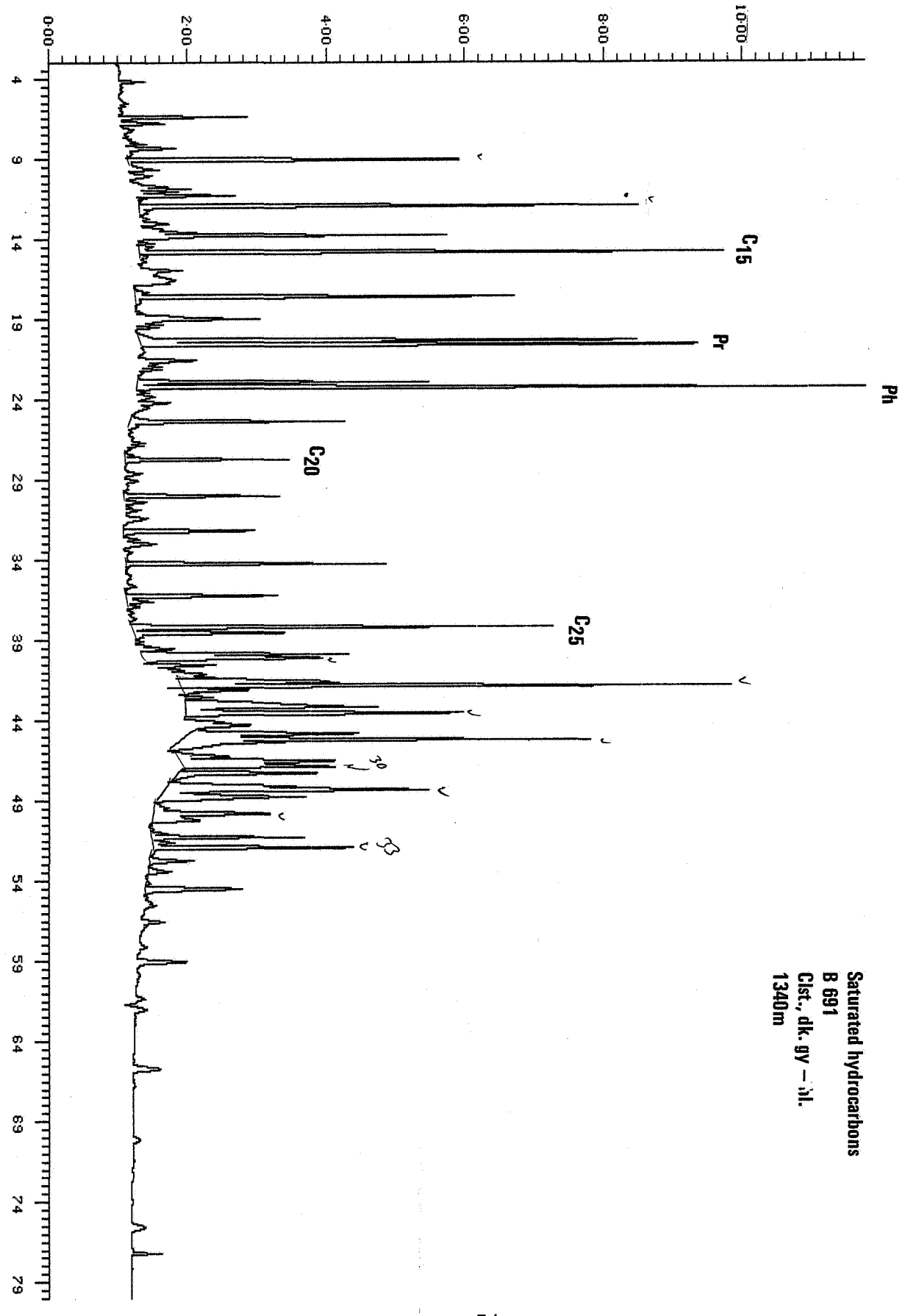
Created at 08:48 on 29/Feb/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1
Analysis :198B1243 Sample £: 1 Injection £: 1
Sample Name :B-1243,31/6-1,SAT,JR Maximum signal (%) :9.575



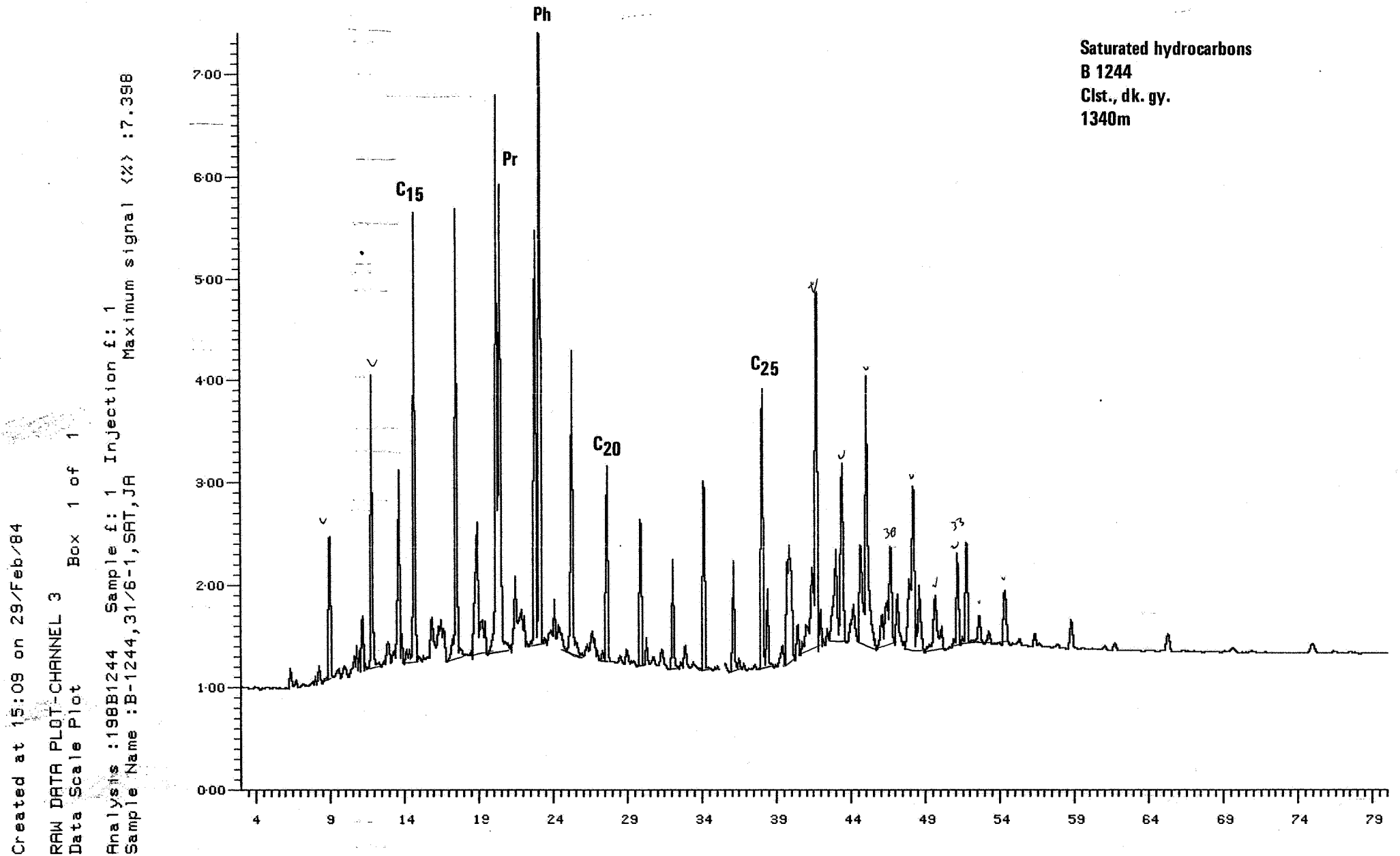
Created at 08:29 on 28/Feb/84

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

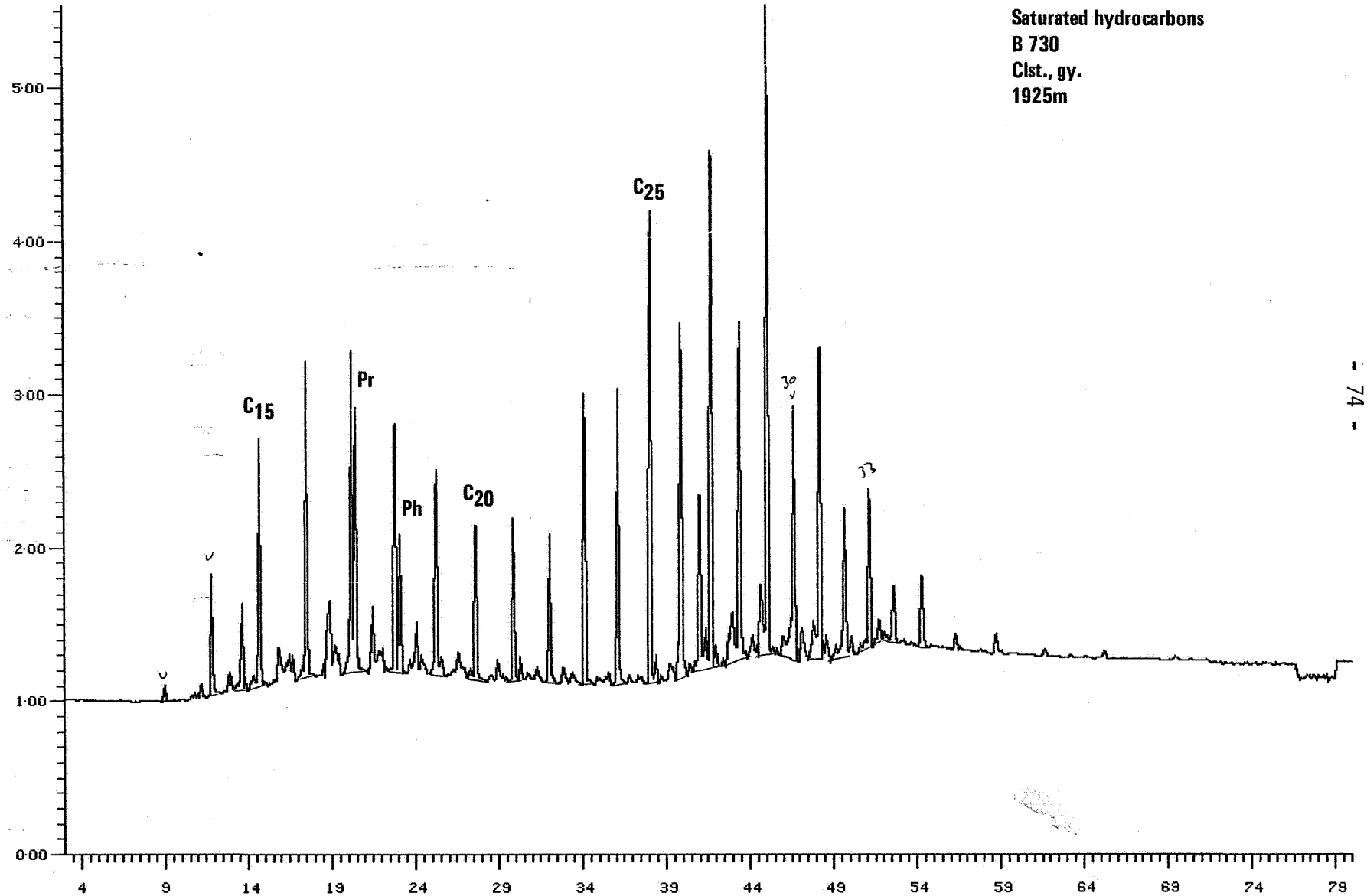
Analysis :198B691 Sample £: 1 Injection £: 1
Sample Name :B-691,31/6-1,SAT,JA Maximum signal (%) :11.767



Saturated hydrocarbons
B 691
Clst., dk. gy – bl.
1340m


Ph
Pr
C15
C20
C25
Saturated hydrocarbons
B 1244
Clst., dk. gy.
1340m
7·00
6·00
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79
Created at 15:09 on 29/Feb/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B1244 Sample £: 1 Injection £: 1
Sample Name :B-1244,31/6-1,SAT,JA
Maximum signal (%) :7.398

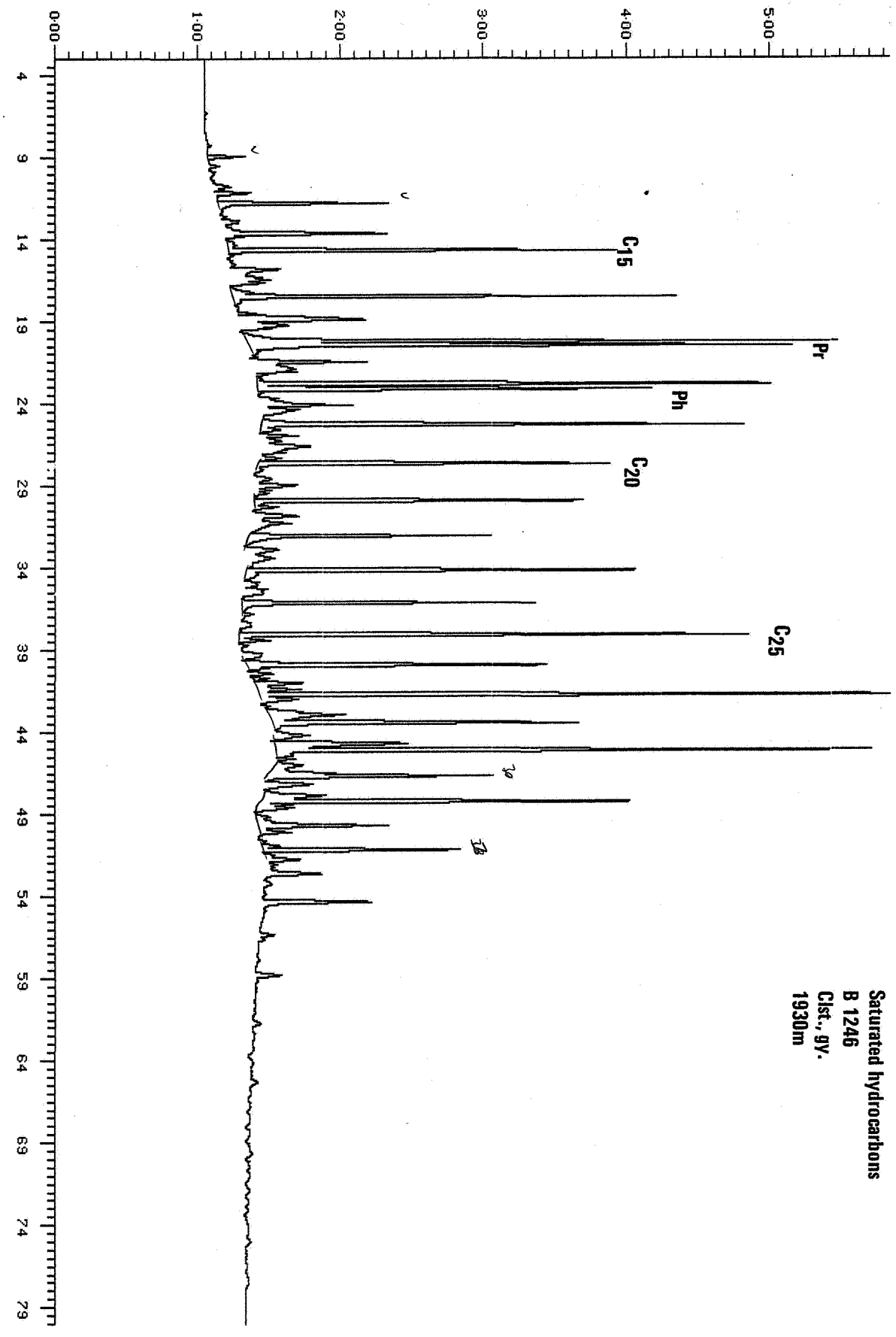
Created at 10:44 on 28/Feb/84
RAW DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot
Analysis :19B8730 Sample £: 1 Injection £: 1
Sample Name :B-730,31/6-1,SAT,JA Maximum signal (%) :5.538



Created at 15:06 on 29/Feb/84

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

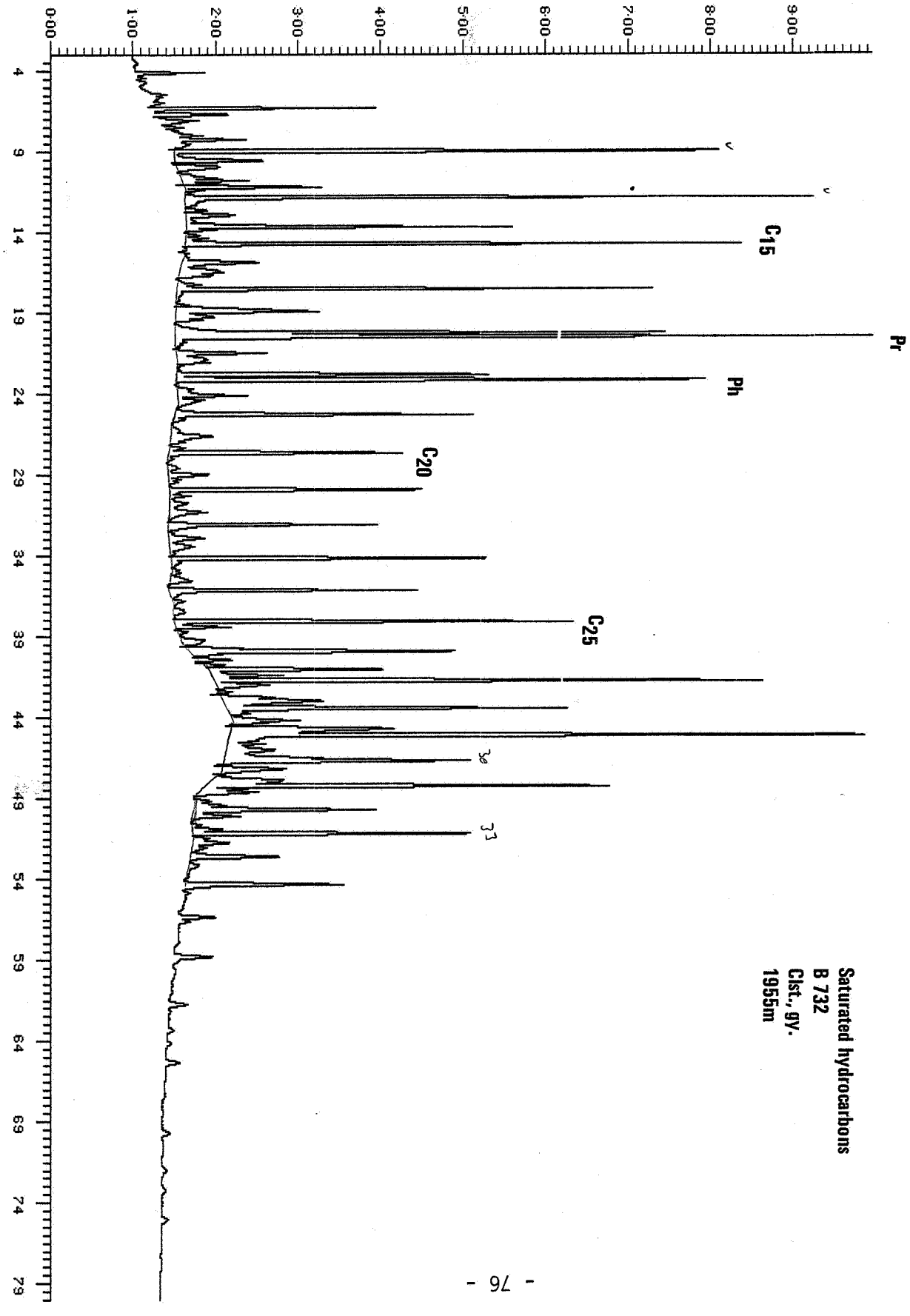
Analysis :198B1246 Sample £: 1 Injection £: 1
Sample Name :B-1246,31/6-1,SAT,JA Maximum signal (%) :5.843

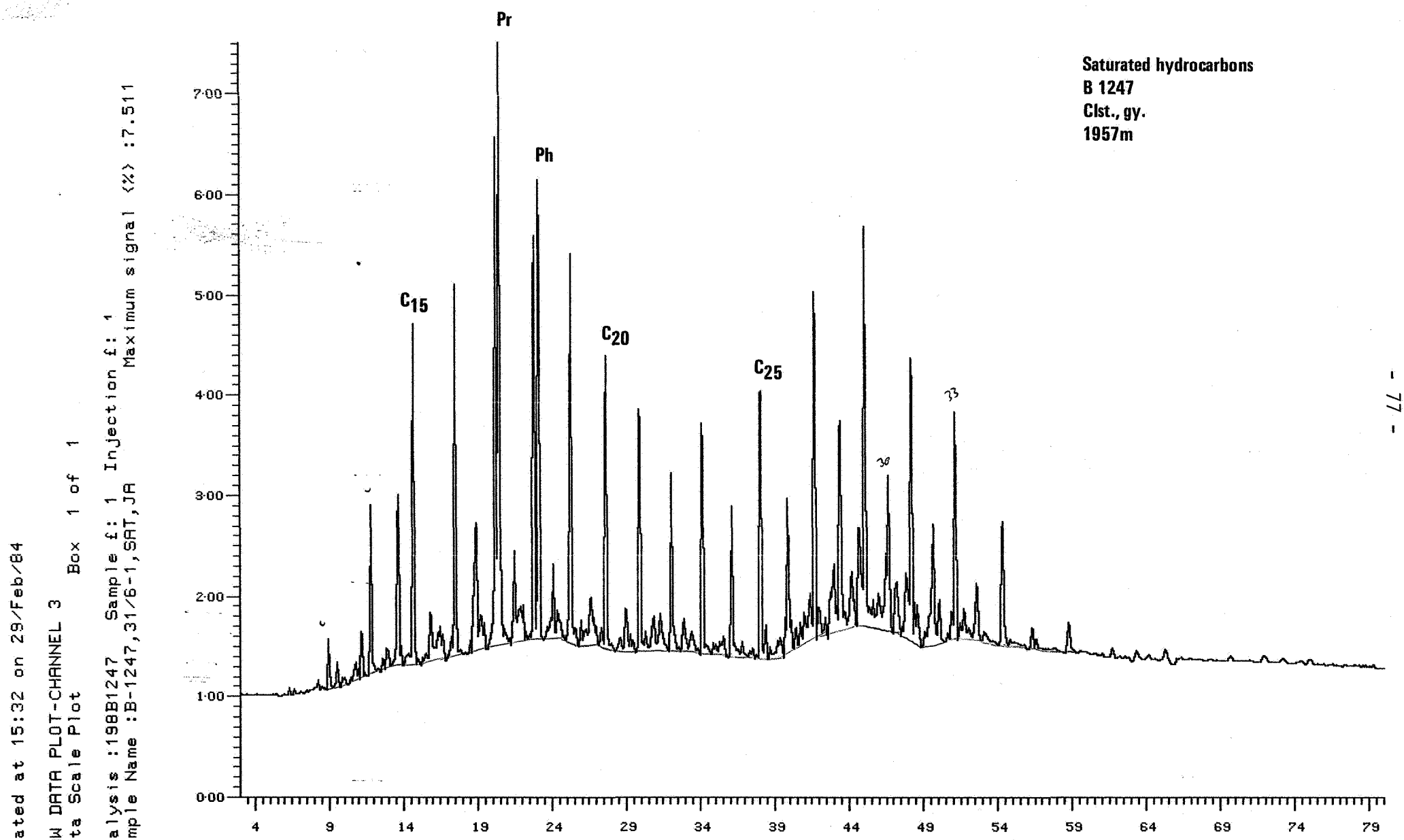


Created at 12:54 on 28/Feb/84

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

Analysis :198B732 Sample £: 1 Injection £: 1
Sample Name :B-732,31/6-1,SAT,JA Maximum signal (%) :9.955

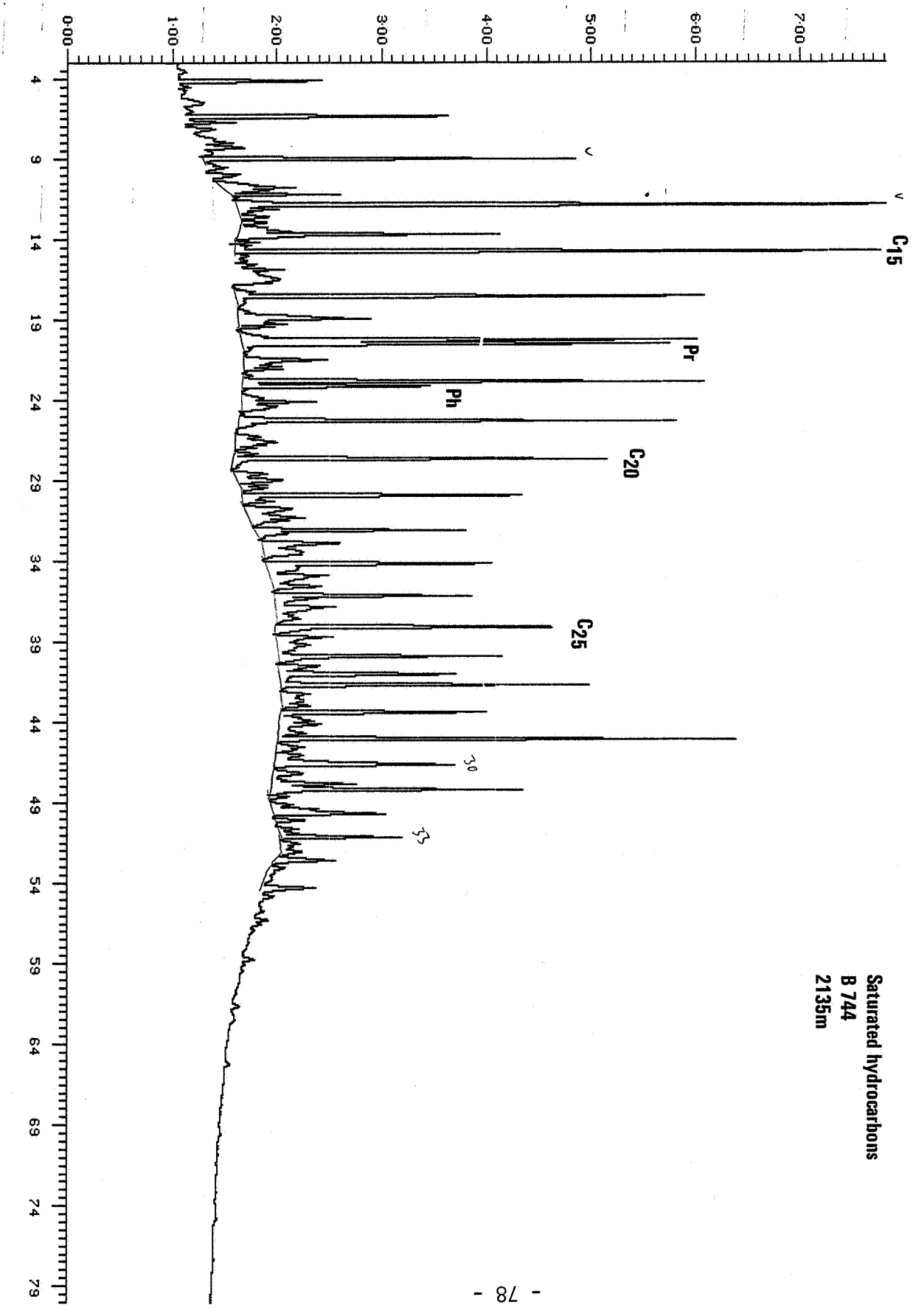



reated at 15:32 on 29/Feb/84
RAW DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot
Analysis :1988B1247 Sample £: 1 Injection £: 1
Sample Name :B-1247,31/6-1,SAT,JA Maximum signal (%) :7.511
Pr
Ph
C15
C20
C25
30
33
Saturated hydrocarbons
B 1247
Clst., gy.
1957m
7·00
6·00
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79

Created at 09:45 on 01/Mar/84

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

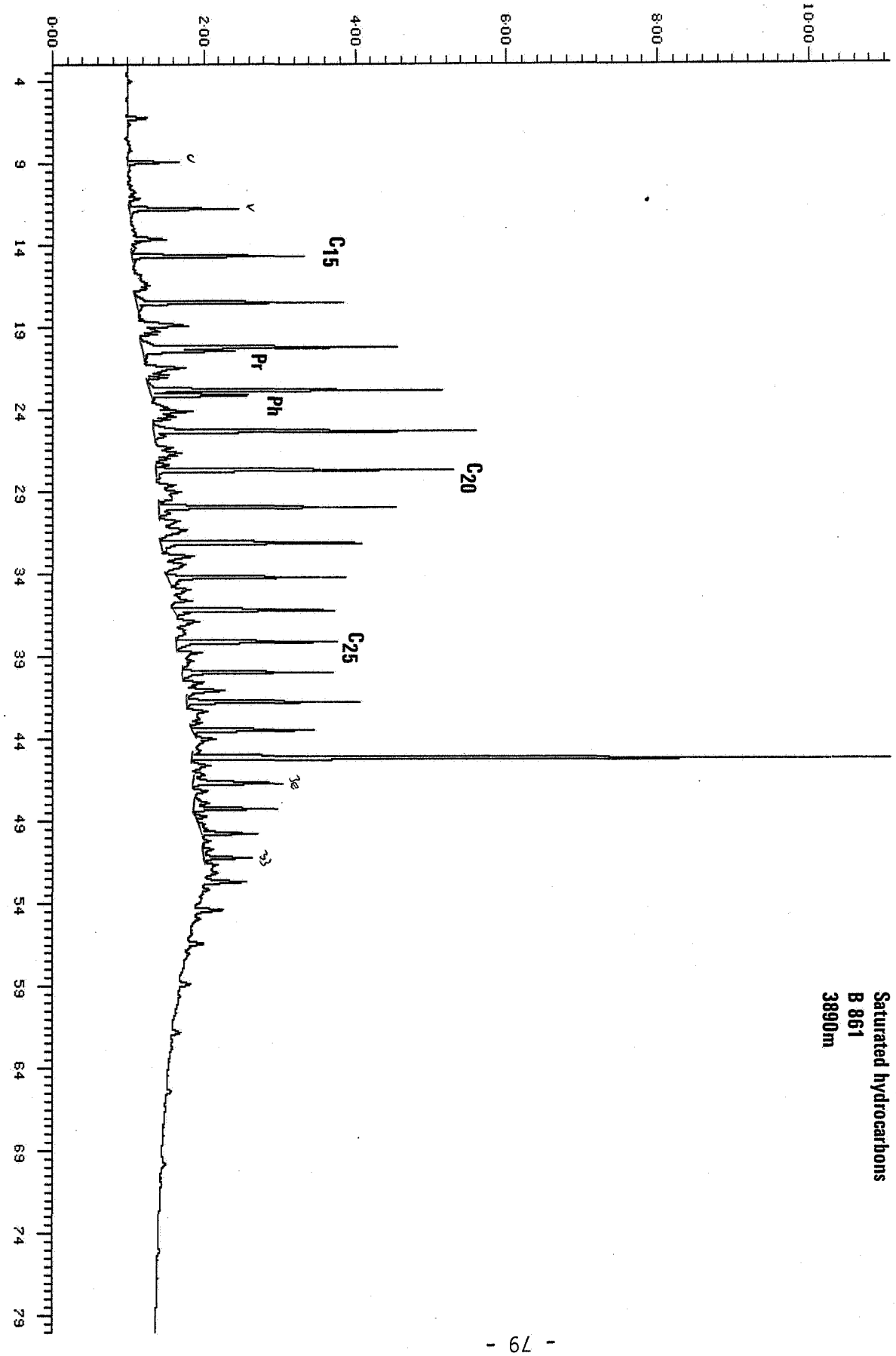
Analysis :198B744 Sample £: 1 Injection £: 1
Sample Name :B-744,31/6-1,SAT,JA Maximum signal (%) :7.815



Created at 08:21 on 01/Mar/84

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

Analysis :198B861 Sample £: 1 Injection £: 1
Sample Name :B-861,31/6-1,SAT,JA Maximum signal (%) :11.072

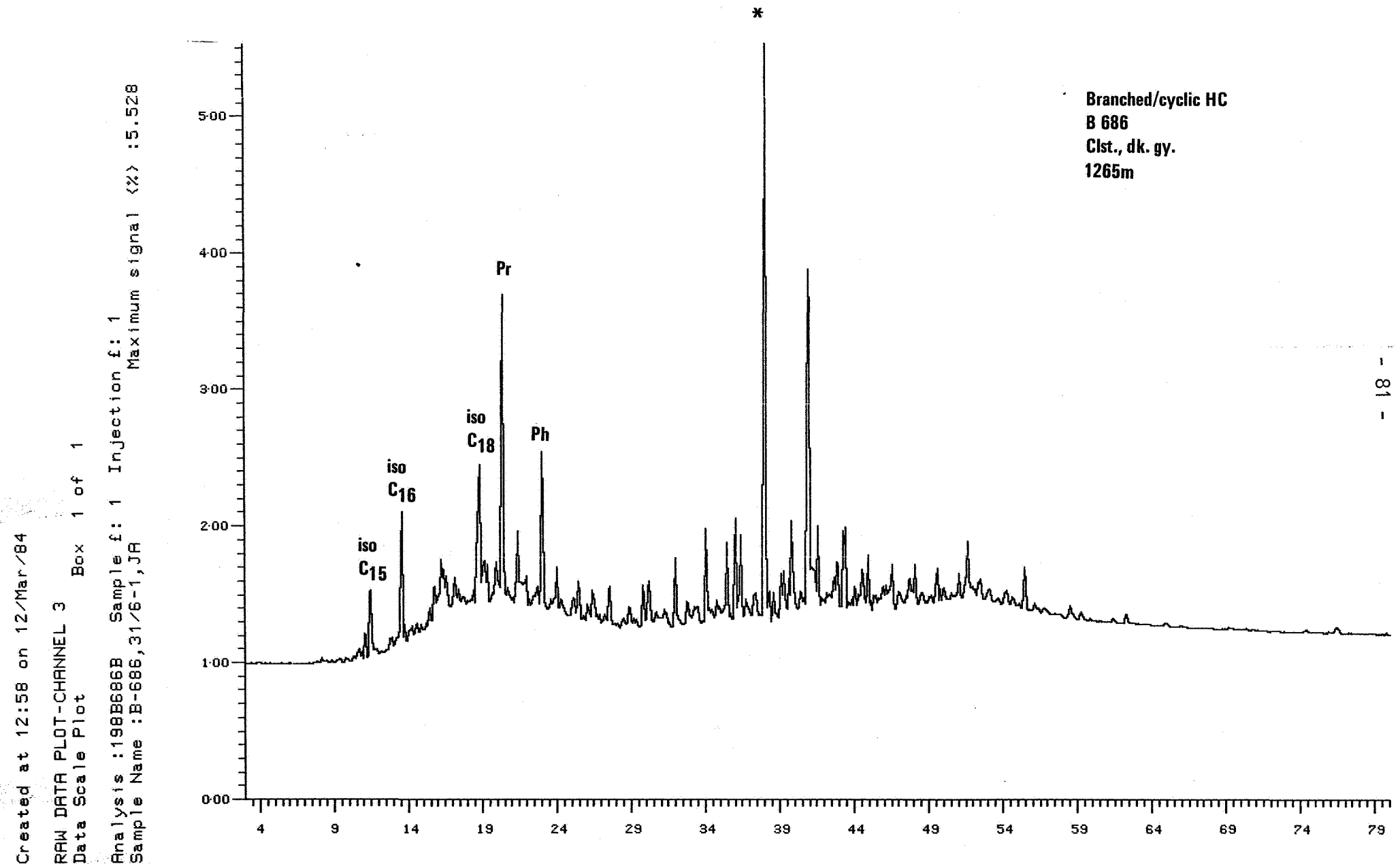


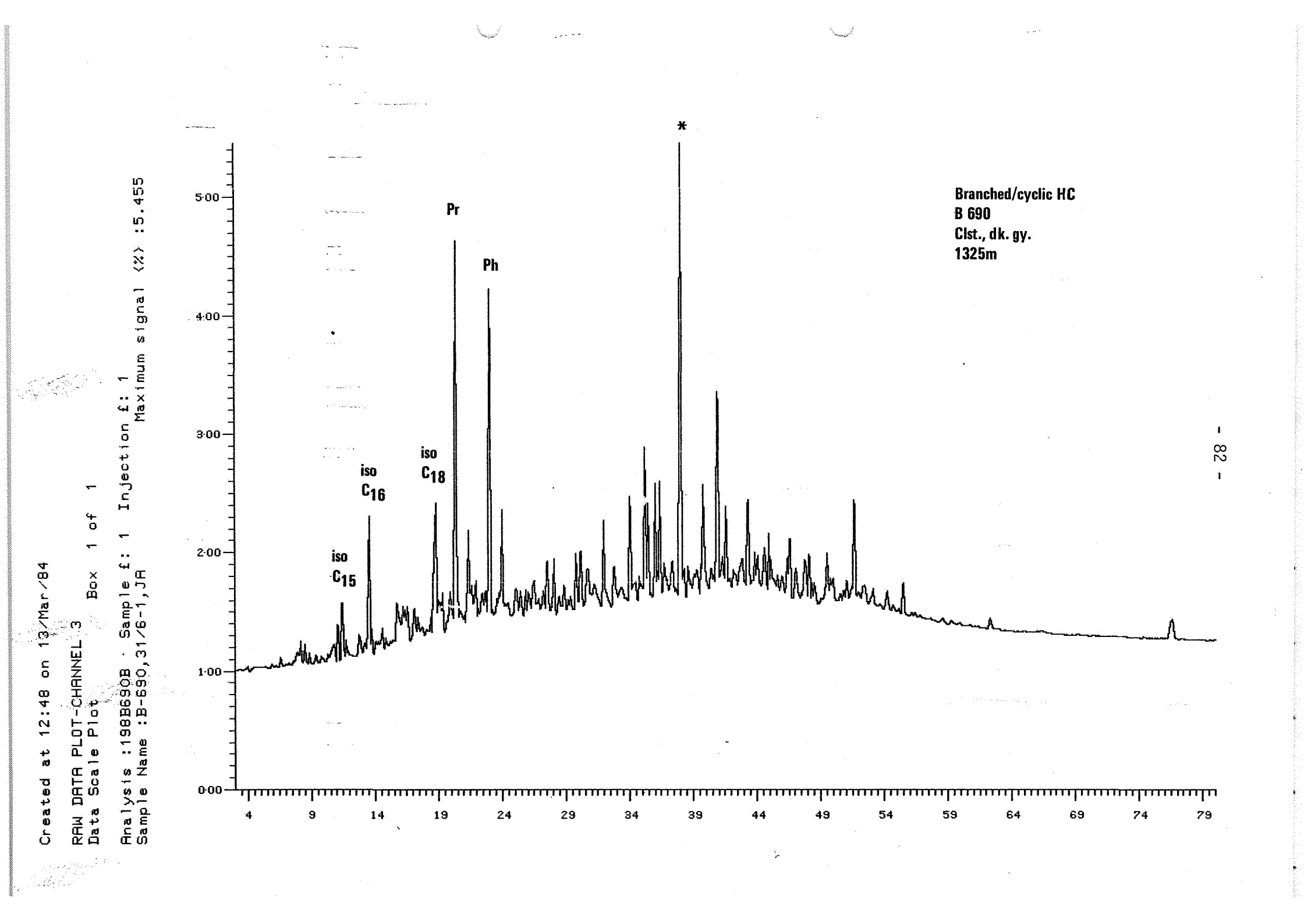
Saturated hydrocarbons
B 861
3890m

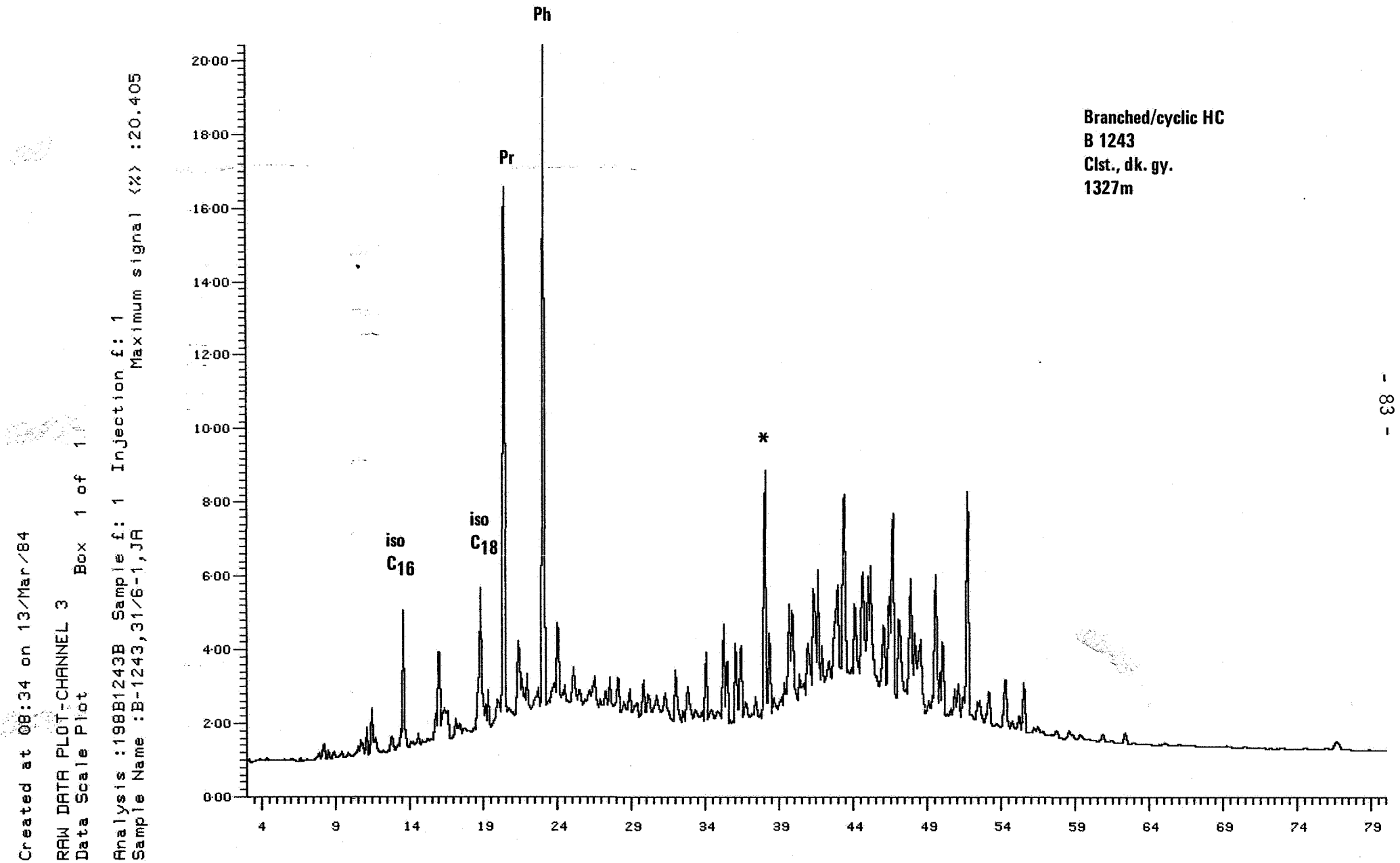
FIGURE 2

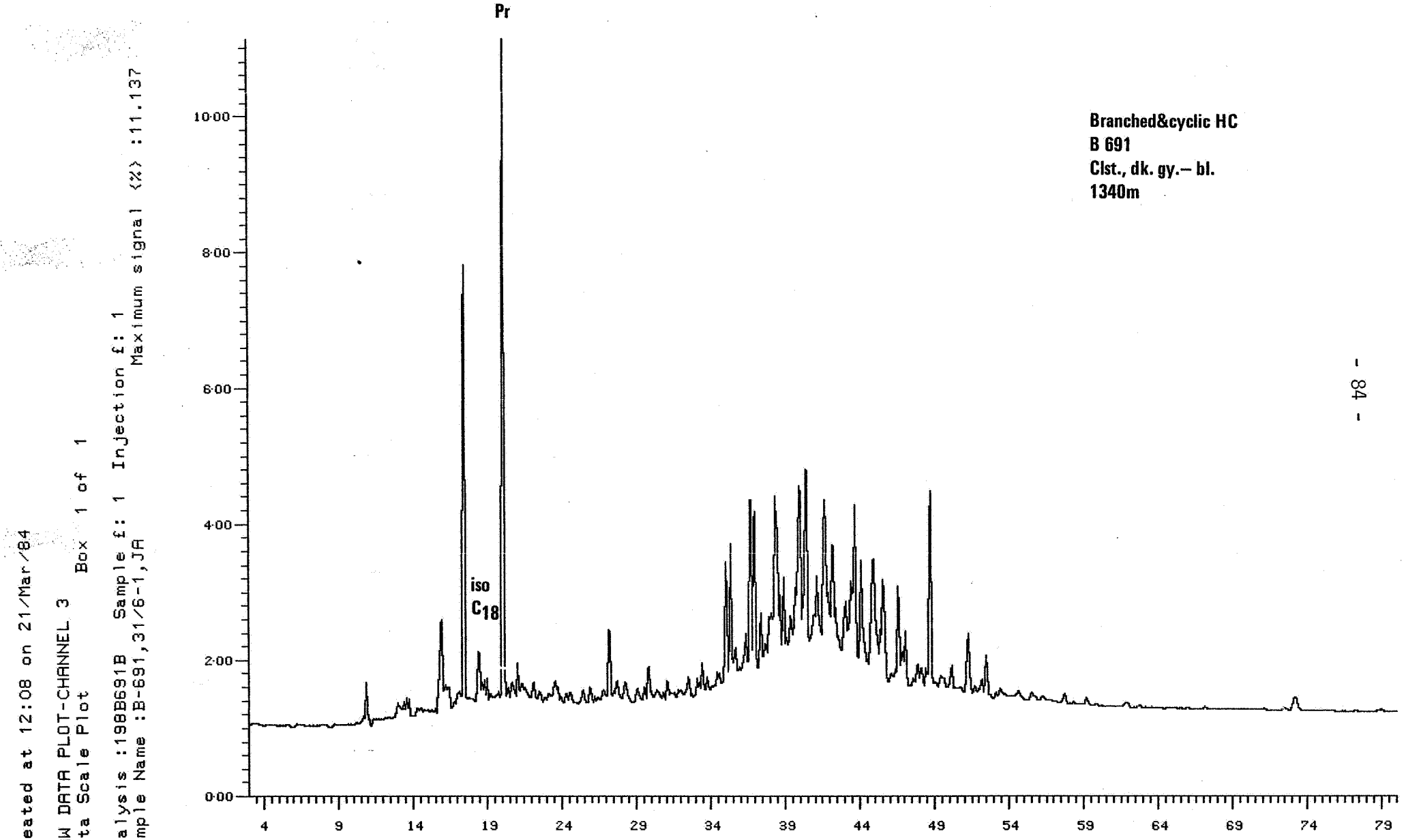
Gas chromatograms of C_{15}+ branched/cyclic hydrocarbons

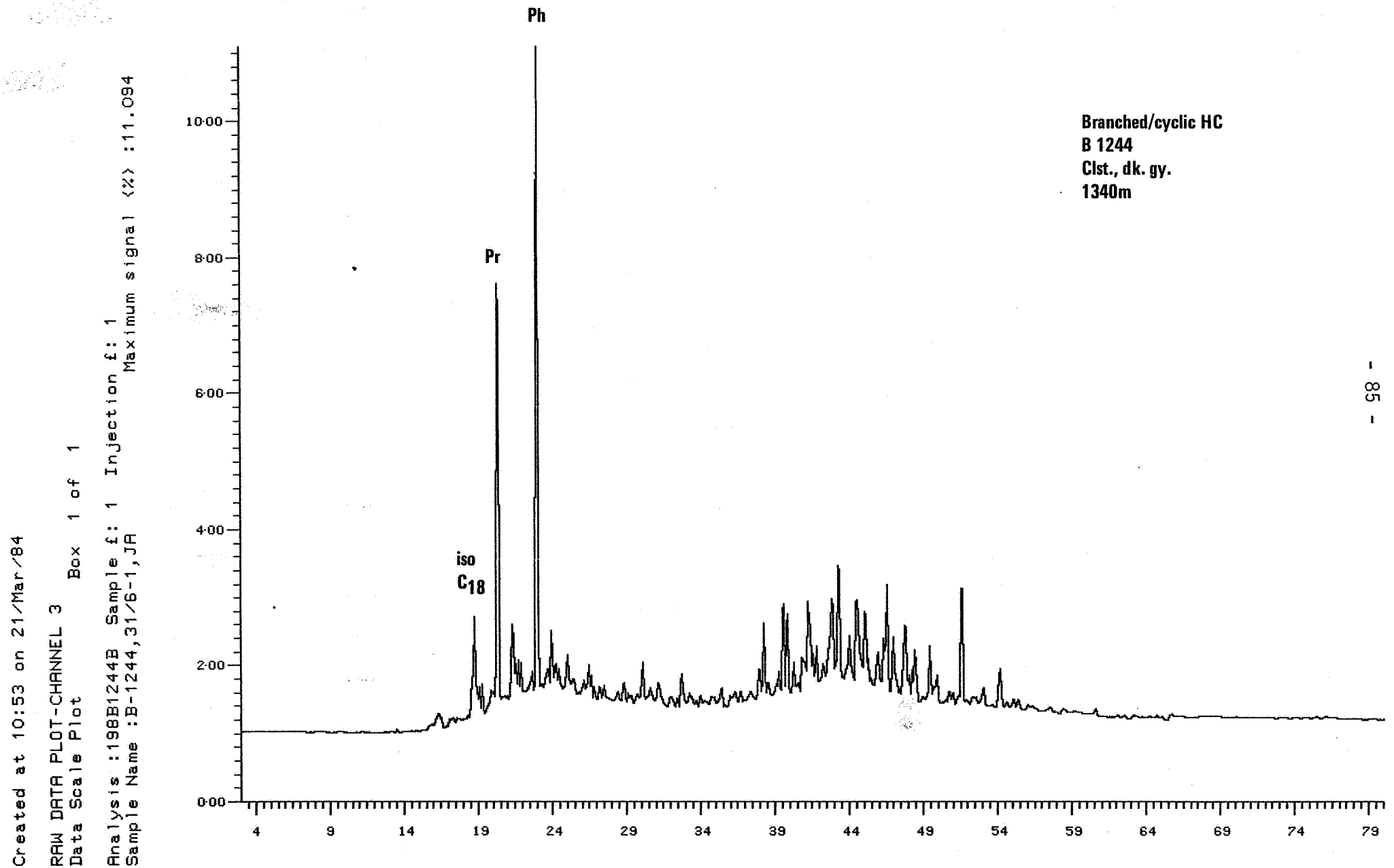
Pr - pristane
Ph - phytane
iso-C_{15} - isoprenoids with the respective numbers of C-atoms.
* - contamination


Created at 12:58 on 12/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B686B Sample £: 1 Injection £: 1
Sample Name :B-686,31/6-1,JA
Maximum signal (%) :5.528
Branched/cyclic HC
B 686
Clst., dk. gy.
1265m
iso C15
iso C16
iso C18
Pr
Ph
*
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79

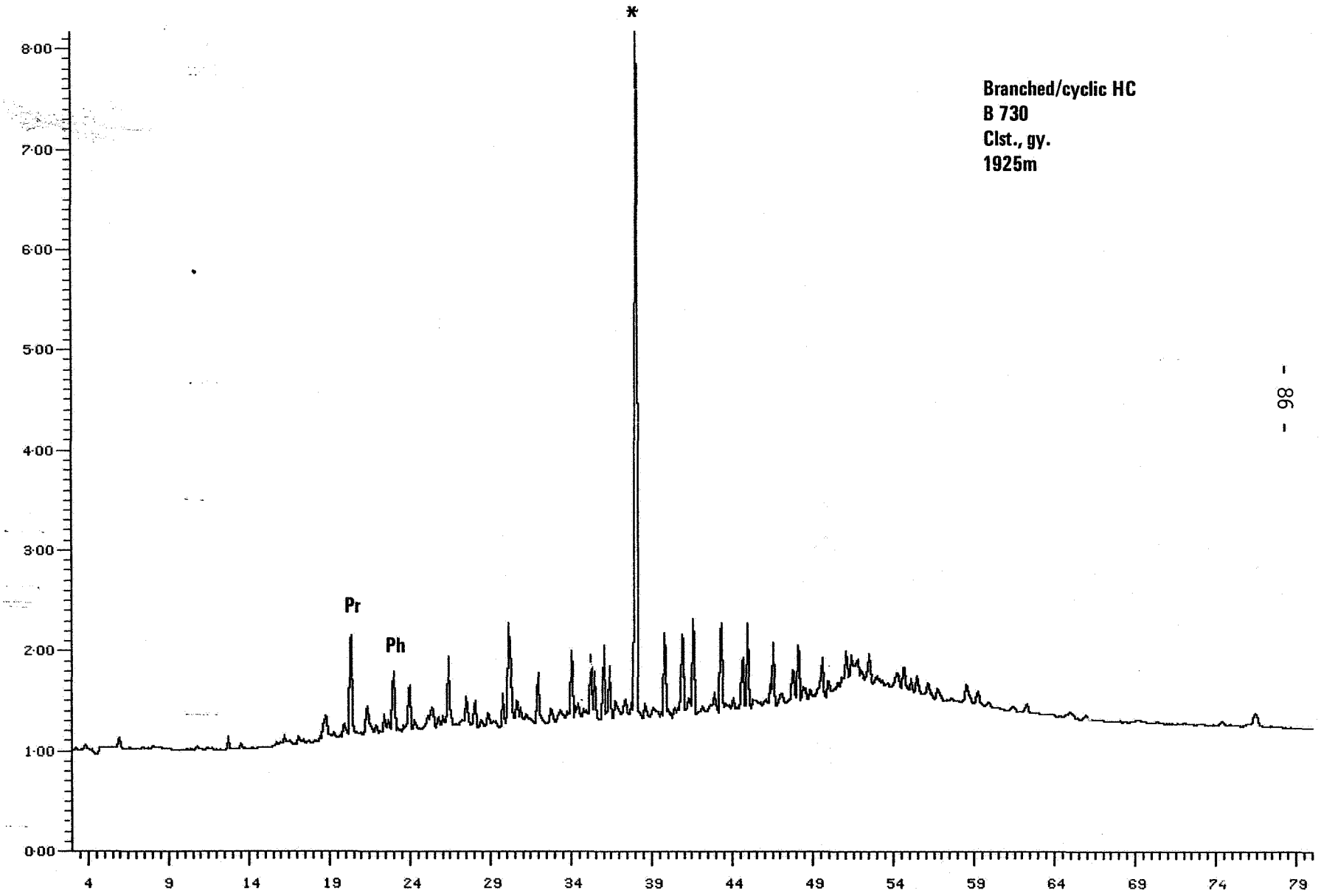

Created at 12:48 on 13/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1
Analysis :198B690B · Sample £: 1 Injection £: 1
Sample Name :B-690,31/6-1,JA
Maximum signal (%) :5.455
Branched/cyclic HC
B 690
Clst., dk. gy.
1325m
iso C15
iso C16
iso C18
Pr
Ph
*
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79


Created at 08:34 on 13/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B1243B Sample £: 1 Injection £: 1
Sample Name :B-1243,31/6-1,JA
Maximum signal (%) :20.405
Ph
Pr
iso C16
iso C18
*
Branched/cyclic HC
B 1243
Clst., dk. gy.
1327m
20.00
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


Created at 12:08 on 21/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B691B Sample £: 1 Injection £: 1
Sample Name :B-691,31/6-1,JA
Maximum signal (%) :11.137
Pr
iso
C18
Branched&cyclic HC
B 691
Clst., dk. gy.– bl.
1340m
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


Ph
Pr
iso
C18
Branched/cyclic HC
B 1244
Clst., dk. gy.
1340m
Created at 10:53 on 21/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B1244B Sample £: 1 Injection £: 1
Sample Name :B-1244,31/6-1,JA
Maximum signal (%) :11.094
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

Created at 10:13 on 13/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1
Analysis :198B730B Sample £: 1 Injection £: 1
Sample Name :B-730,31/6-1,JA Maximum signal (%) :8.169

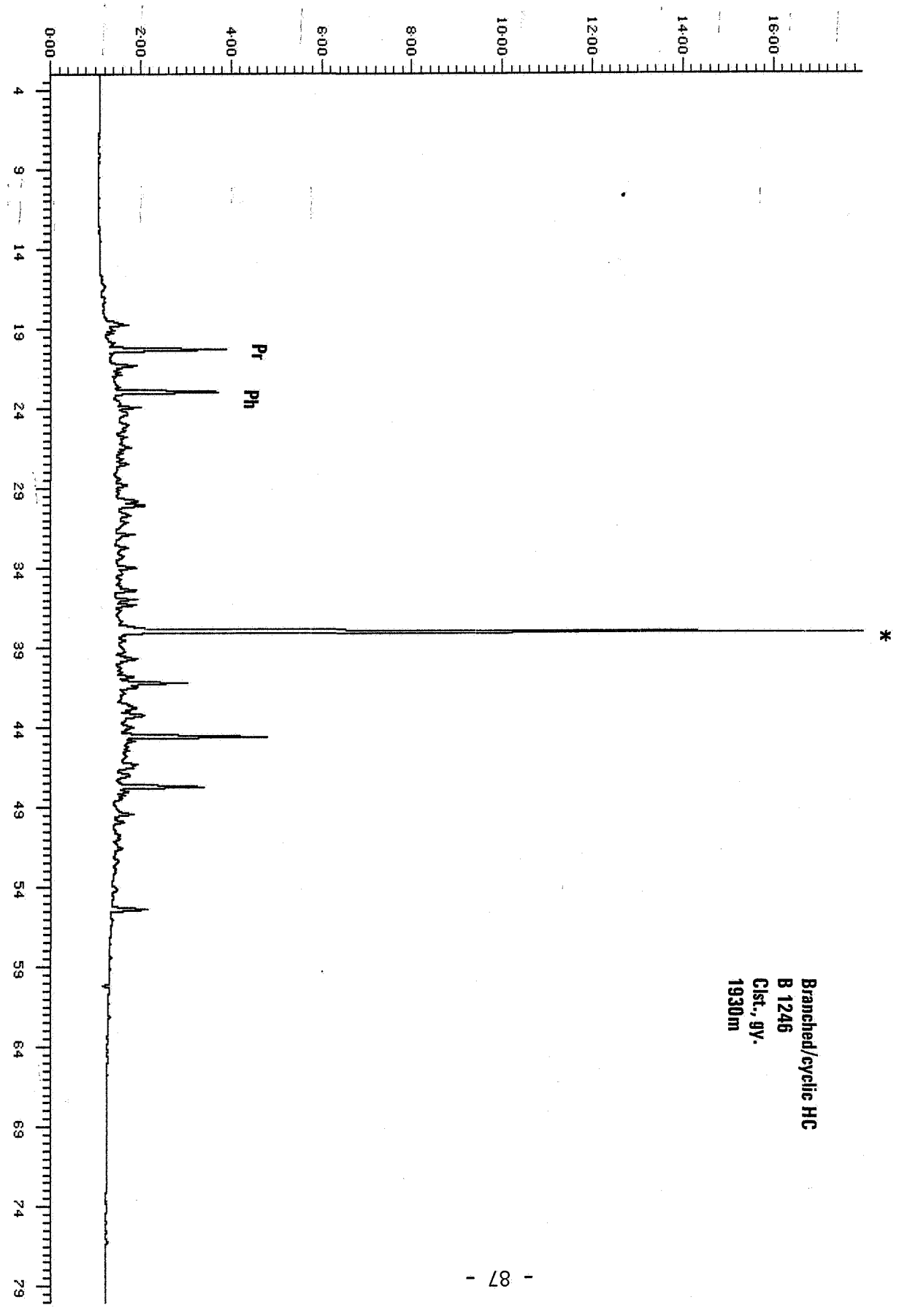


Branched/cyclic HC
B 730
Clst., gy.
1925m

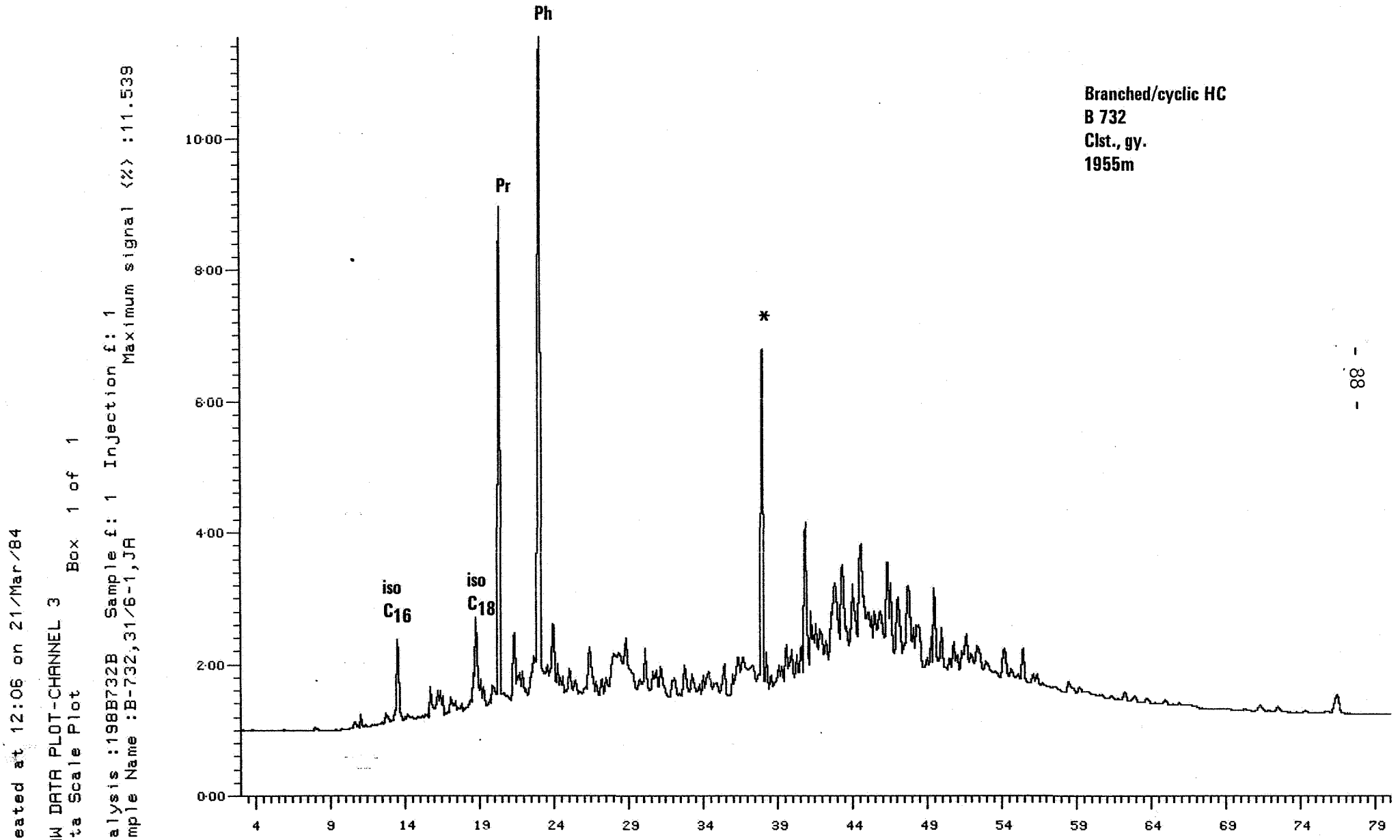
Created at 08:21 on 20/Mar/84

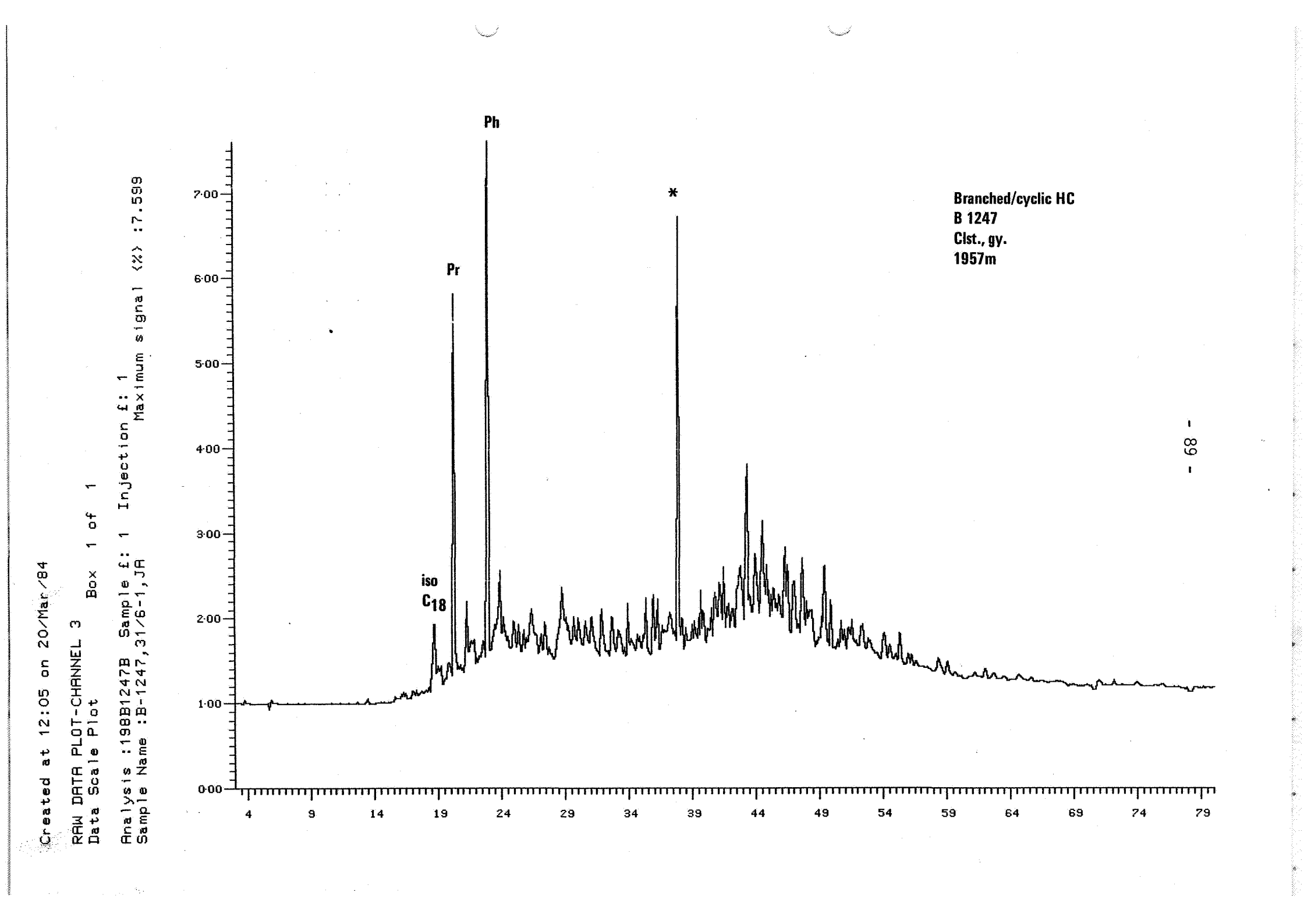
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1

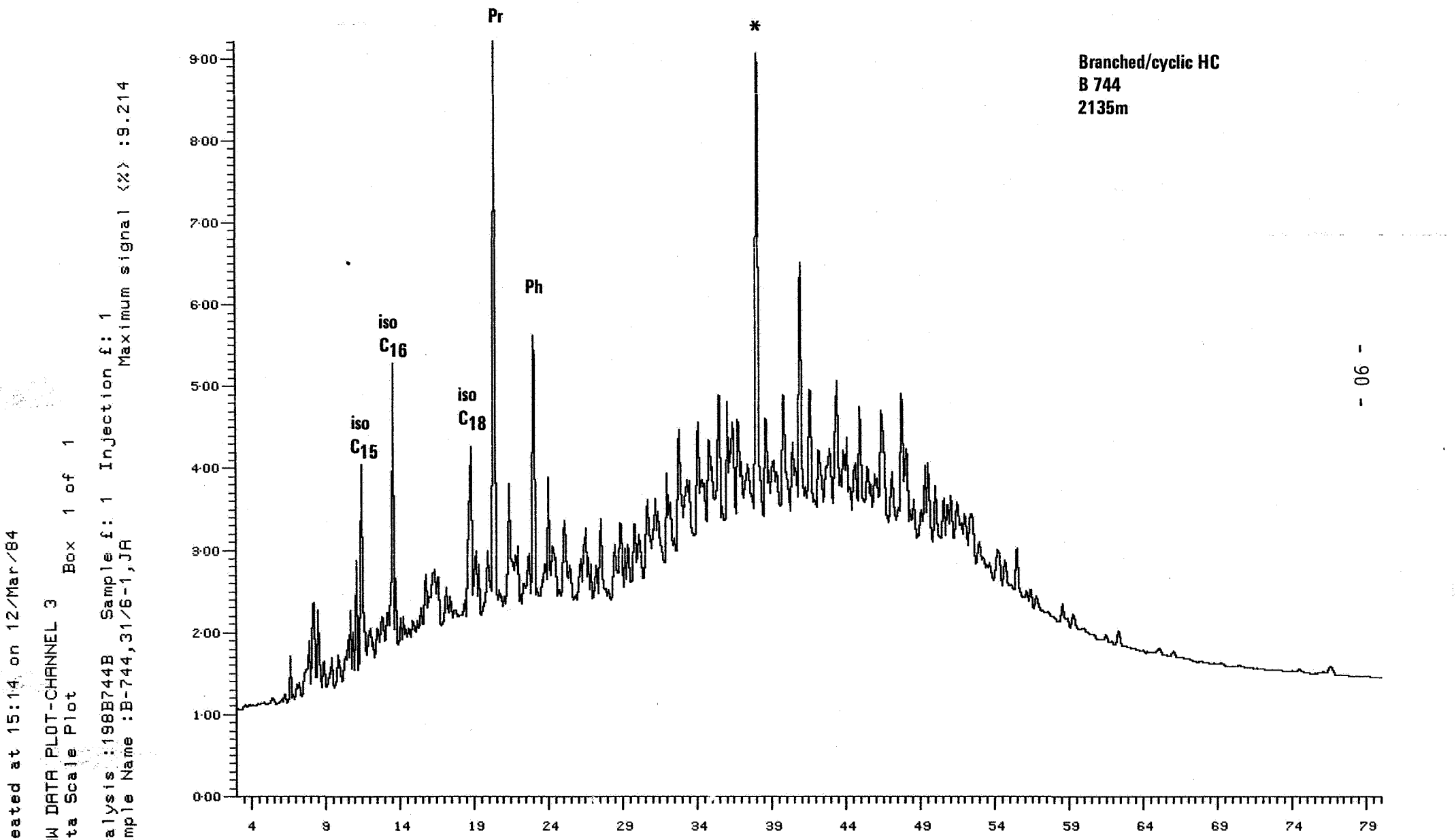
Analysis :198B1246B Sample f: 1 Injection f: 1
Sample Name :B-1246,31/6-1,JA Maximum signal (%) :17.952



Branched/cyclic HC
B 1246
Clst., gy.
1930m


Created at 12:06 on 21/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B732B Sample £: 1 Injection £: 1
Sample Name :B-732,31/6-1,JA
Maximum signal (%) :11.539
Ph
Pr
iso C16
iso C18
*
Branched/cyclic HC
B 732
Clst., gy.
1955m
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


Created at 12:05 on 20/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B1247B Sample £: 1 Injection £: 1
Sample Name :B-1247,31/6-1,JA
Maximum signal (%) :7.599
Ph
Pr
*
iso
C18
Branched/cyclic HC
B 1247
Clst., gy.
1957m
- 68 -
7·00
6·00
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79


Created at 15:14 on 12/Mar/84
RAW DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot
Analysis :198B744B Sample £: 1 Injection £: 1
Sample Name :B-744,31/6-1,JA Maximum signal (%) :9.214
Pr
*
Ph
iso C16
iso C15
iso C18
Branched/cyclic HC
B 744
2135m
- 06 -
9·00
8·00
7·00
6·00
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79

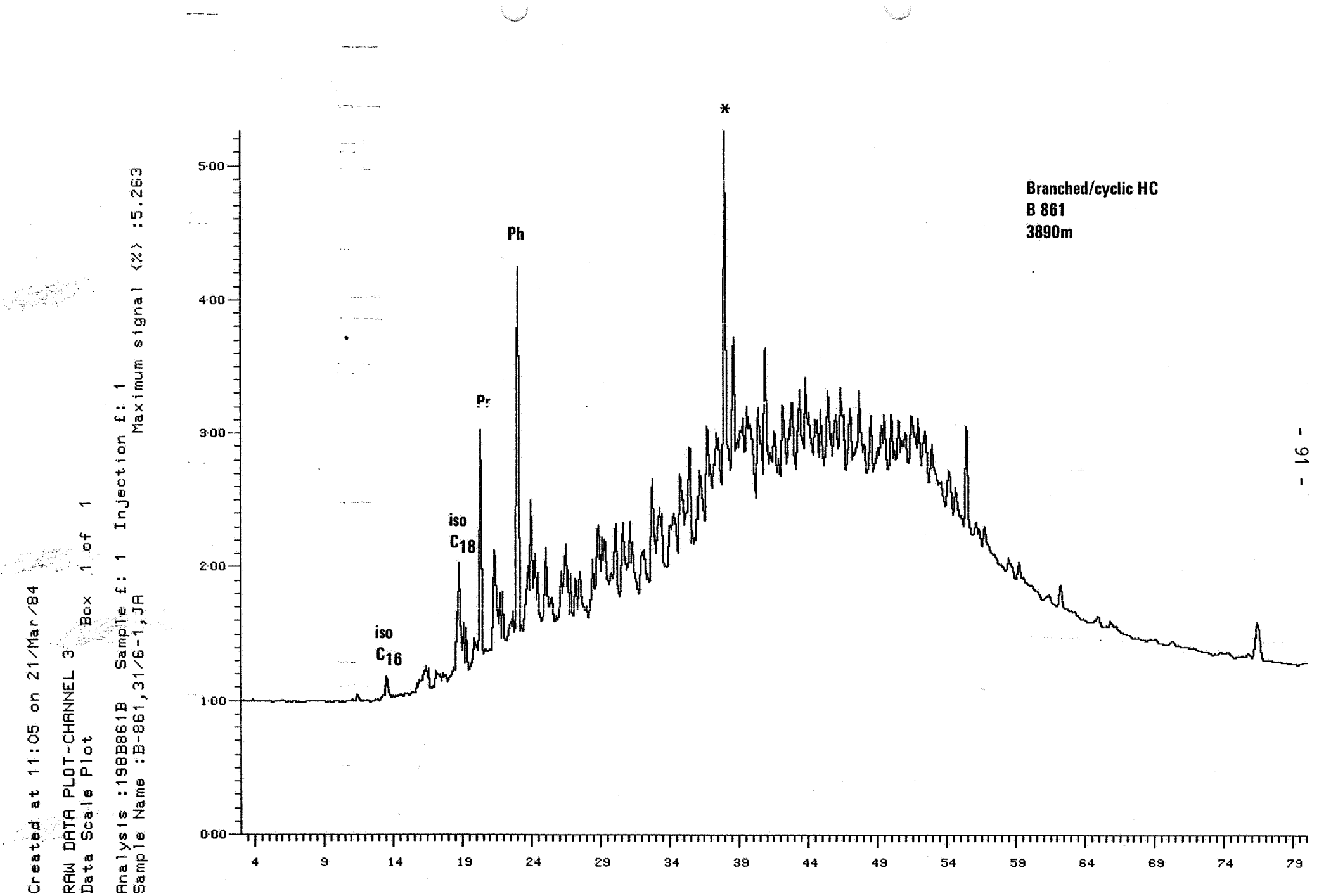
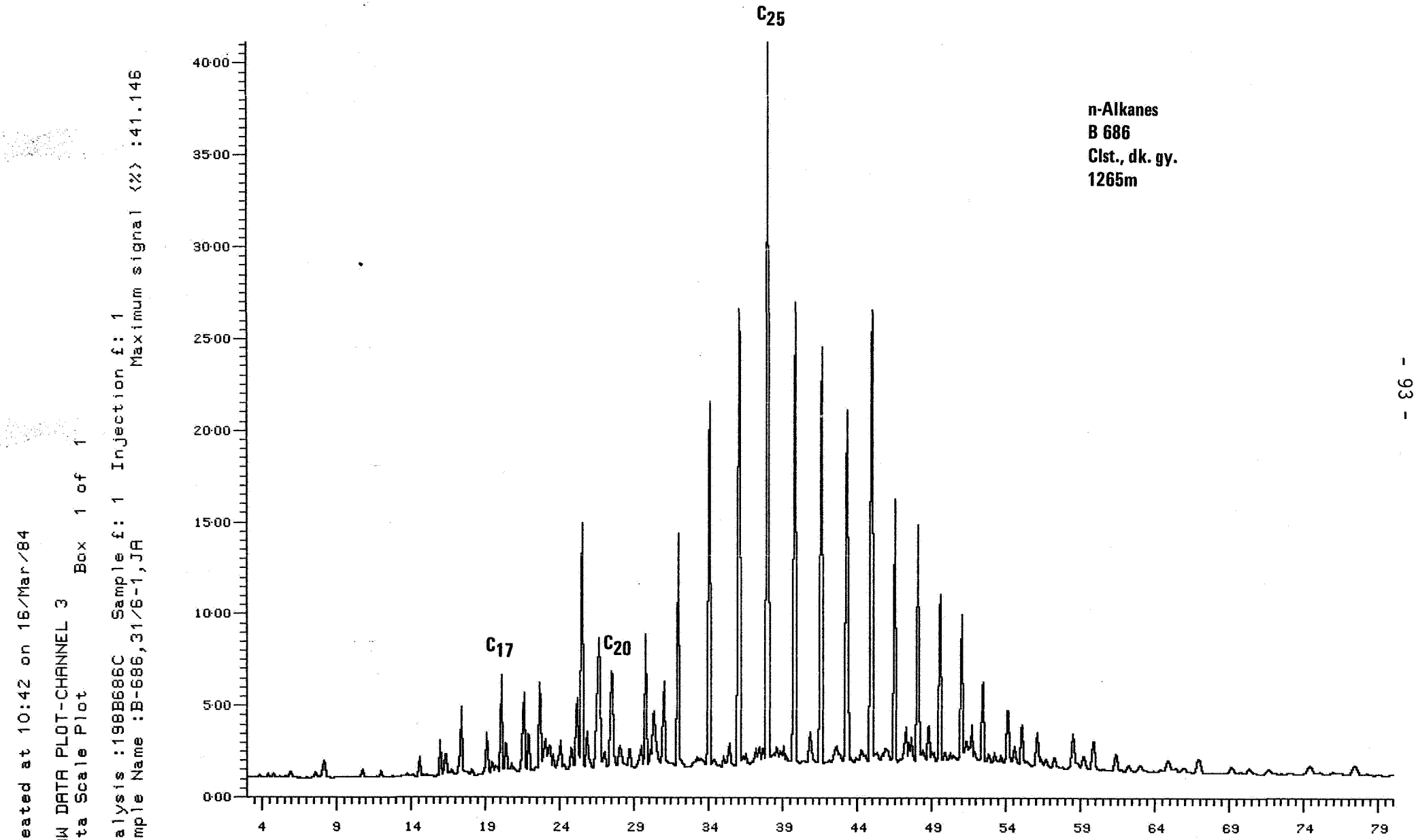

Created at 11:05 on 21/Mar/84
RAW DATA PLOT-CHANNEL 3 Box 1 of 1
Data Scale Plot
Analysis :19BB861B Sample f: 1 Injection f: 1
Sample Name :B-861,31/6-1,JA Maximum signal (%) :5.263
5·00
4·00
3·00
2·00
1·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79
iso C16
iso C18
Pr
Ph
*
Branched/cyclic HC
B 861
3890m
- 16 -

FIGURE 3

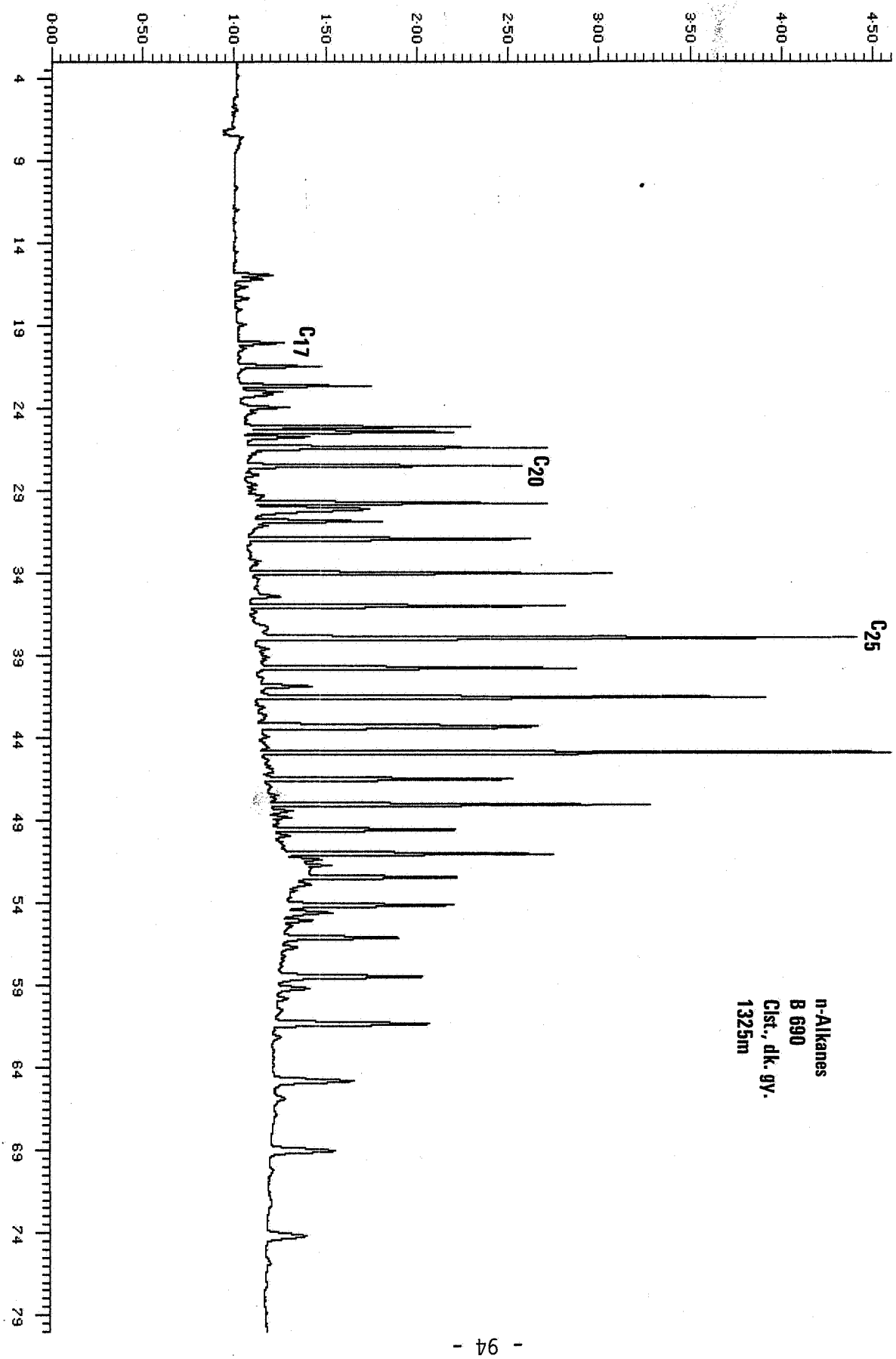
Gas chromatograms of C_{15}^{+} normal alkanes


Created at 10:42 on 16/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B686C Sample £: 1 Injection £: 1
Sample Name :B-686,31/6-1,JA
Maximum signal (%) :41.146
40·00
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
79
C25
C17
C20
n-Alkanes
B 686
Clst., dk. gy.
1265m

Created at 15:09 on 17/Mar/84

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

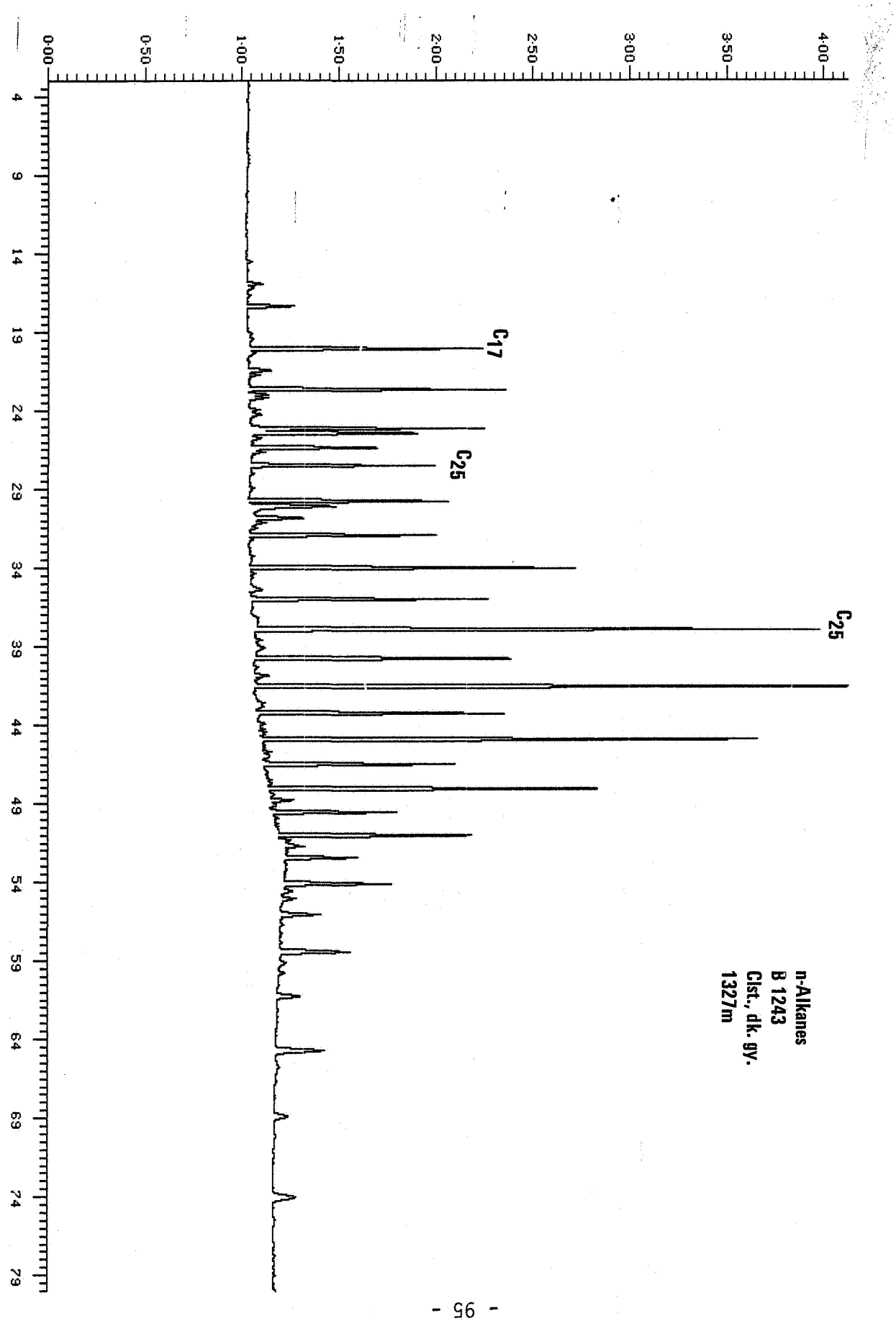
Analysis :198B690C Sample f: 1 Injection f: 1
Sample Name :B-690,31/6-1,JASA Maximum signal (%) :4.602

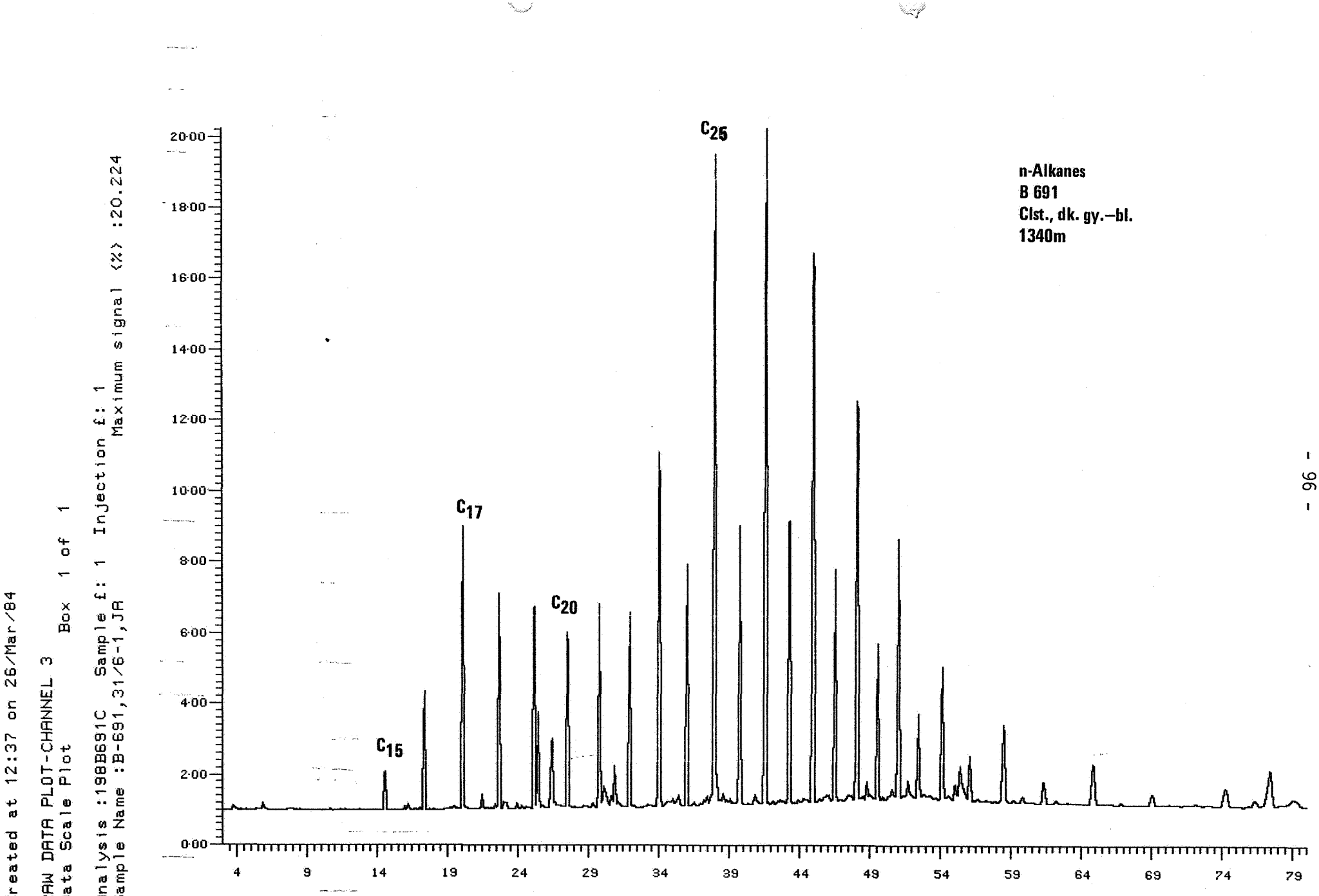


Created at 13:27 on 19/Mar/84

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

Analysis :198B1243C Sample £: 1 Injection £: 1
Sample Name :B-1243,31/6-1,JA Maximum signal (%) :4.124

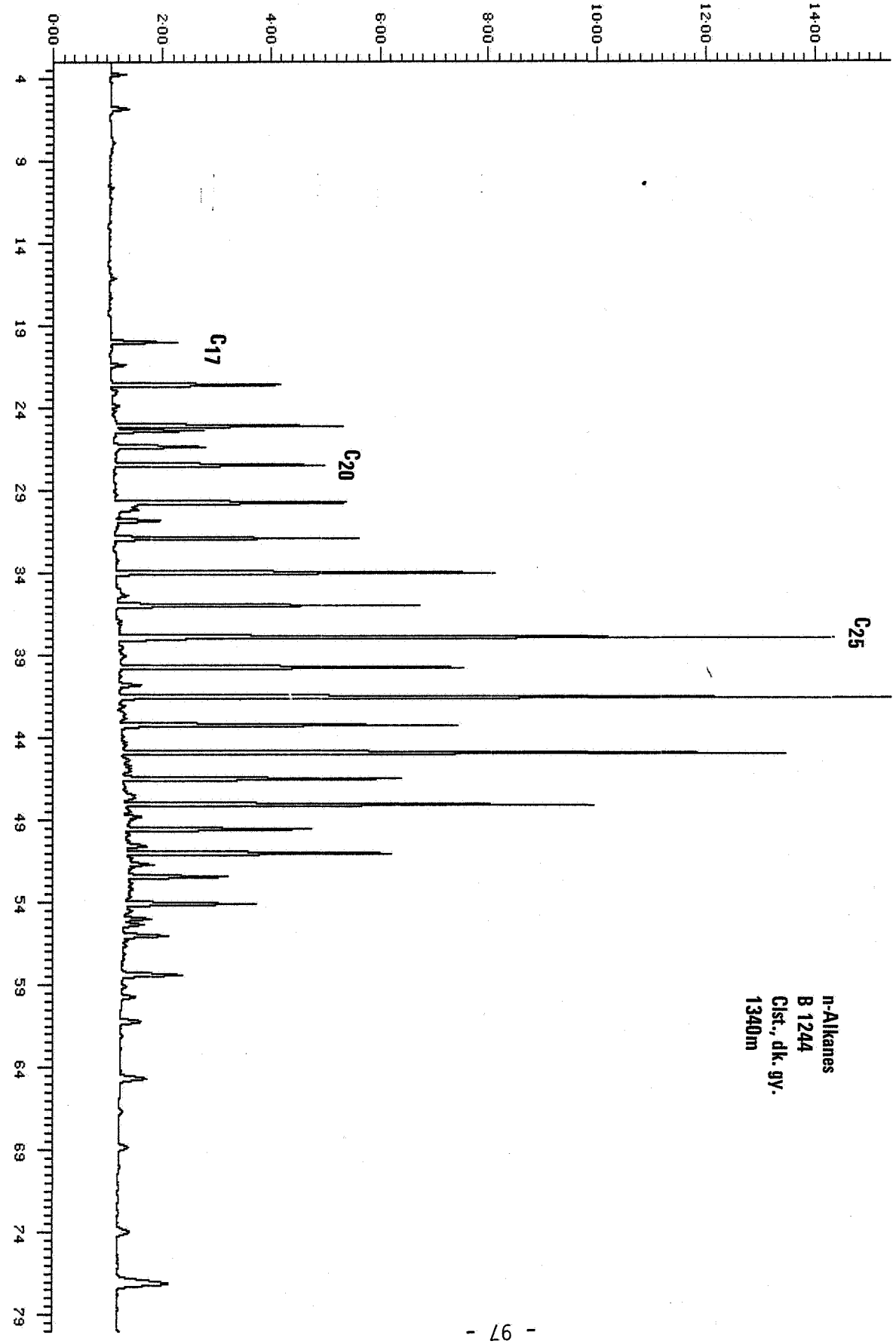



Created at 12:37 on 26/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1
Analysis :198B691C Sample £: 1 Injection £: 1
Sample Name :B-691,31/6-1,JA Maximum signal (%) :20.224
20·00
18·00
16·00
14·00
12·00
10·00
8·00
6·00
4·00
2·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79
C15
C17
C20
C25
n-Alkanes
B 691
Clst., dk. gy.–bl.
1340m

Created at 04:41 on 14/Feb/84

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

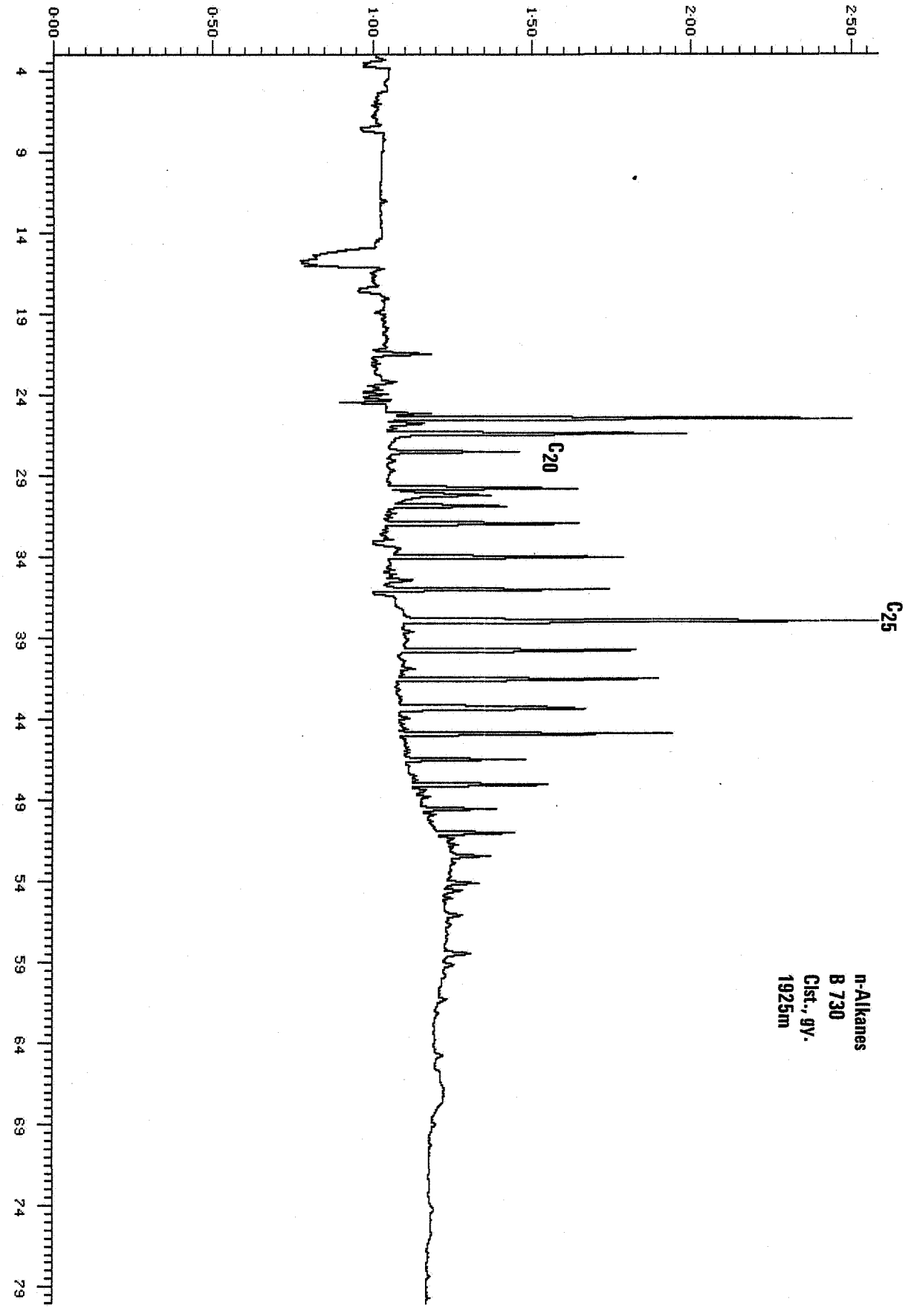
Analysis :198B1244C Sample £: 1 Injection £: 1
Sample Name :B1244,31/6-1,JA Maximum signal (%) :15.382

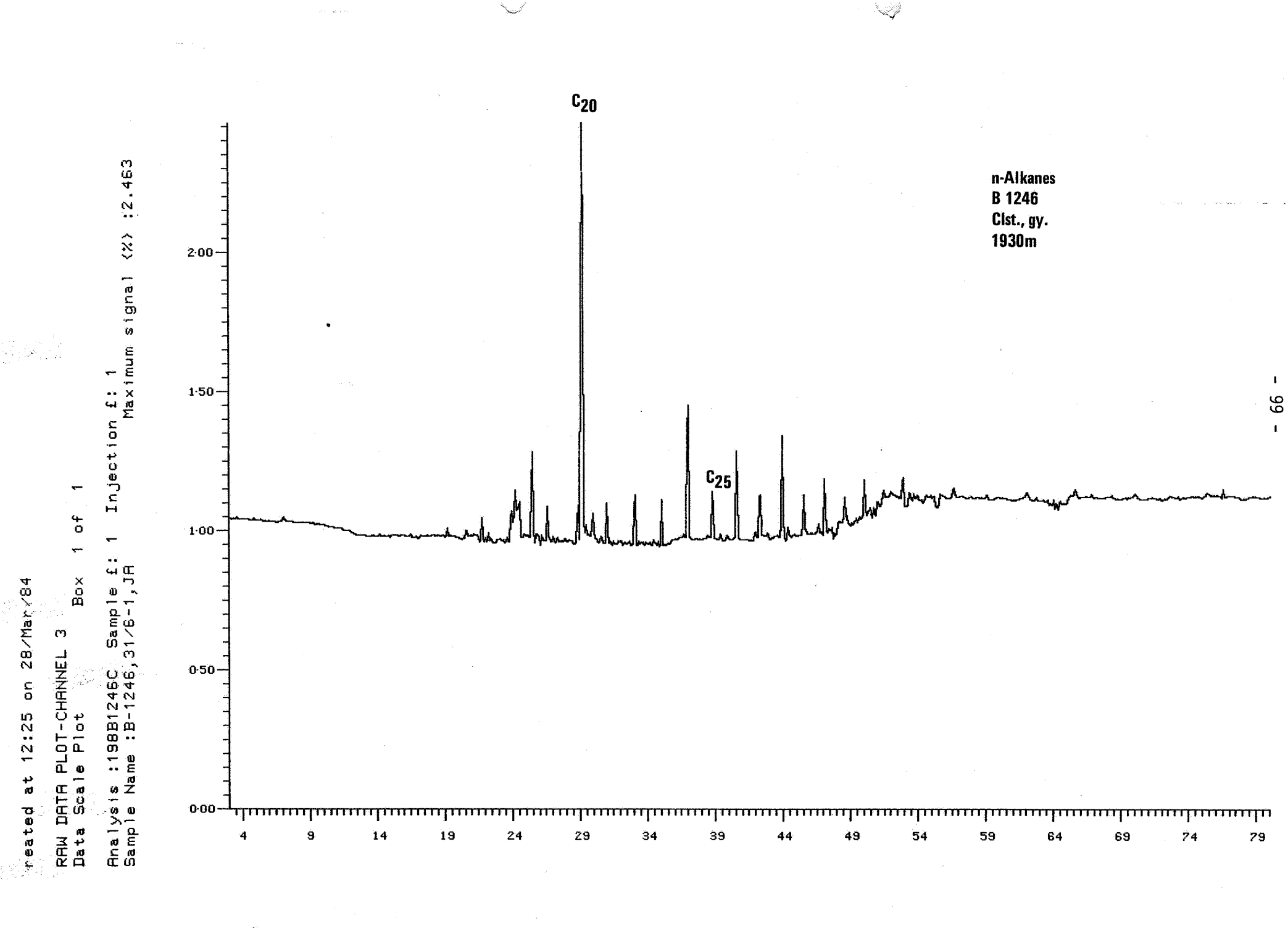


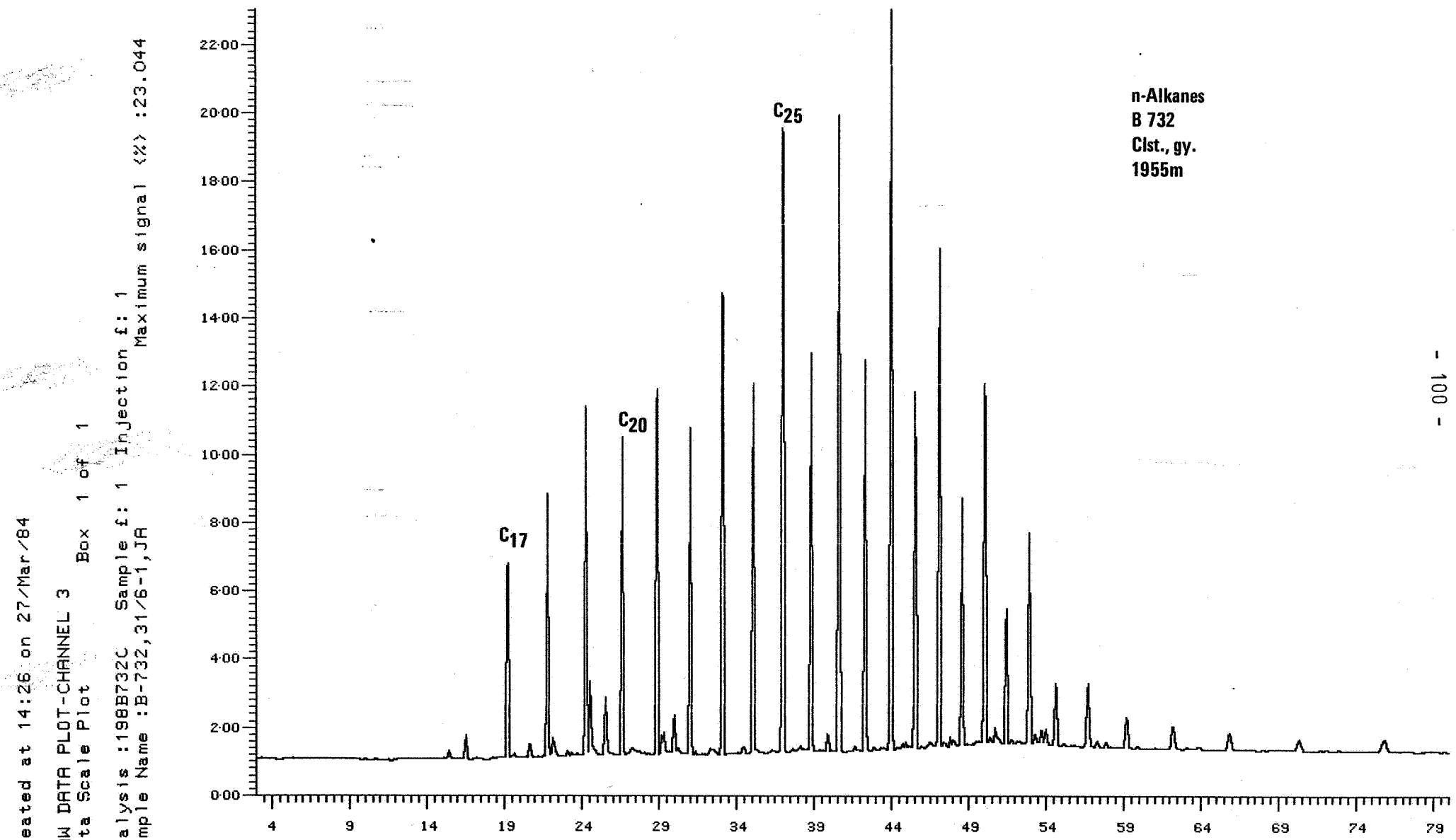
Created at 12:40 on 16/Mar/84

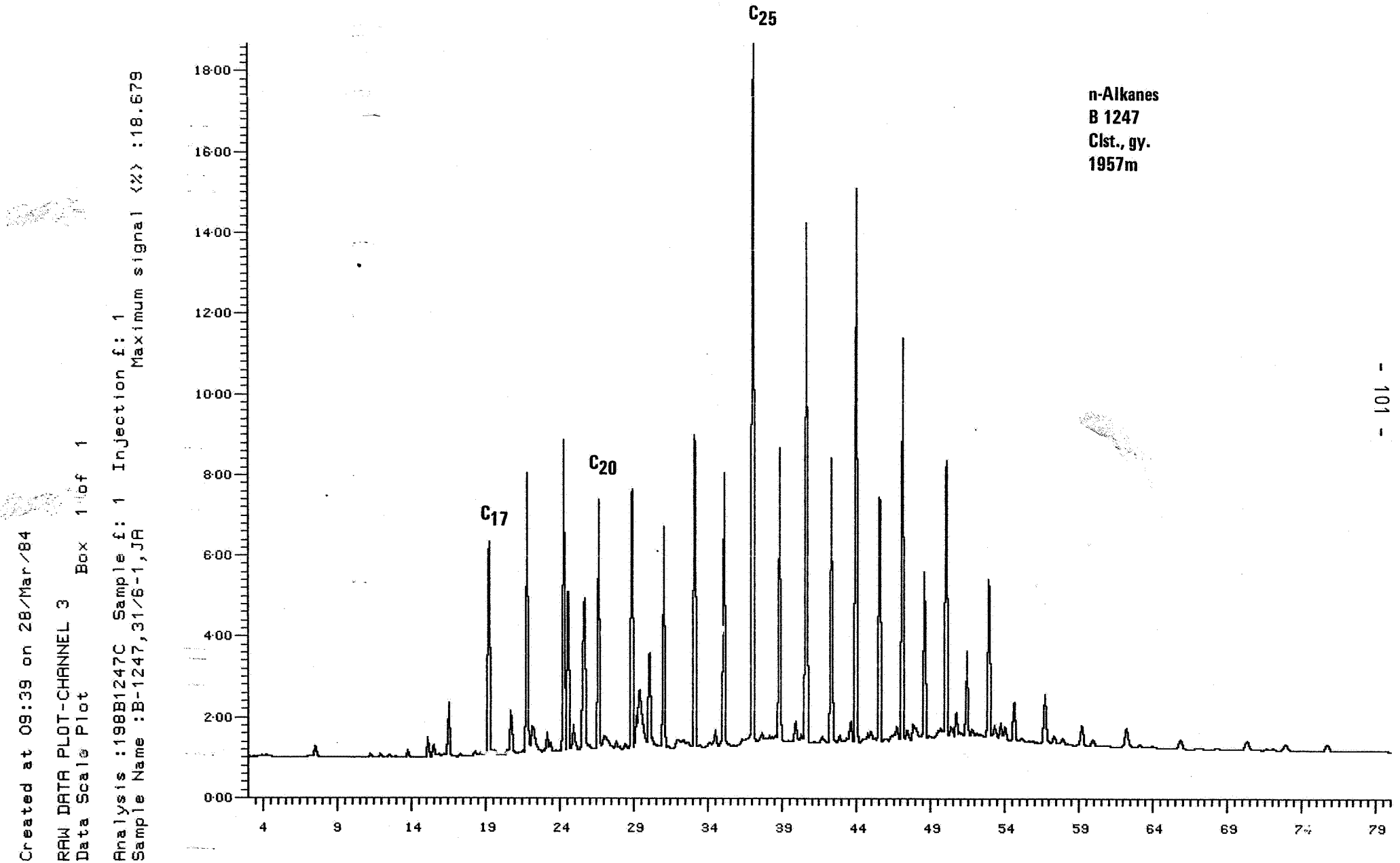
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1

Analysis :198B730C Sample £: 1 Injection £: 1
Sample Name :B-730,31/6-1,JA Maximum signal (%) :2.584




C20
C25
n-Alkanes
B 1246
Clst., gy.
1930m
- 66 -
2·00
1·50
1·00
0·50
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79
Created at 12:25 on 28/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1
Analysis :198B1246C Sample £: 1 Injection £: 1
Sample Name :B-1246,31/6-1,JA
Maximum signal (%) :2.463

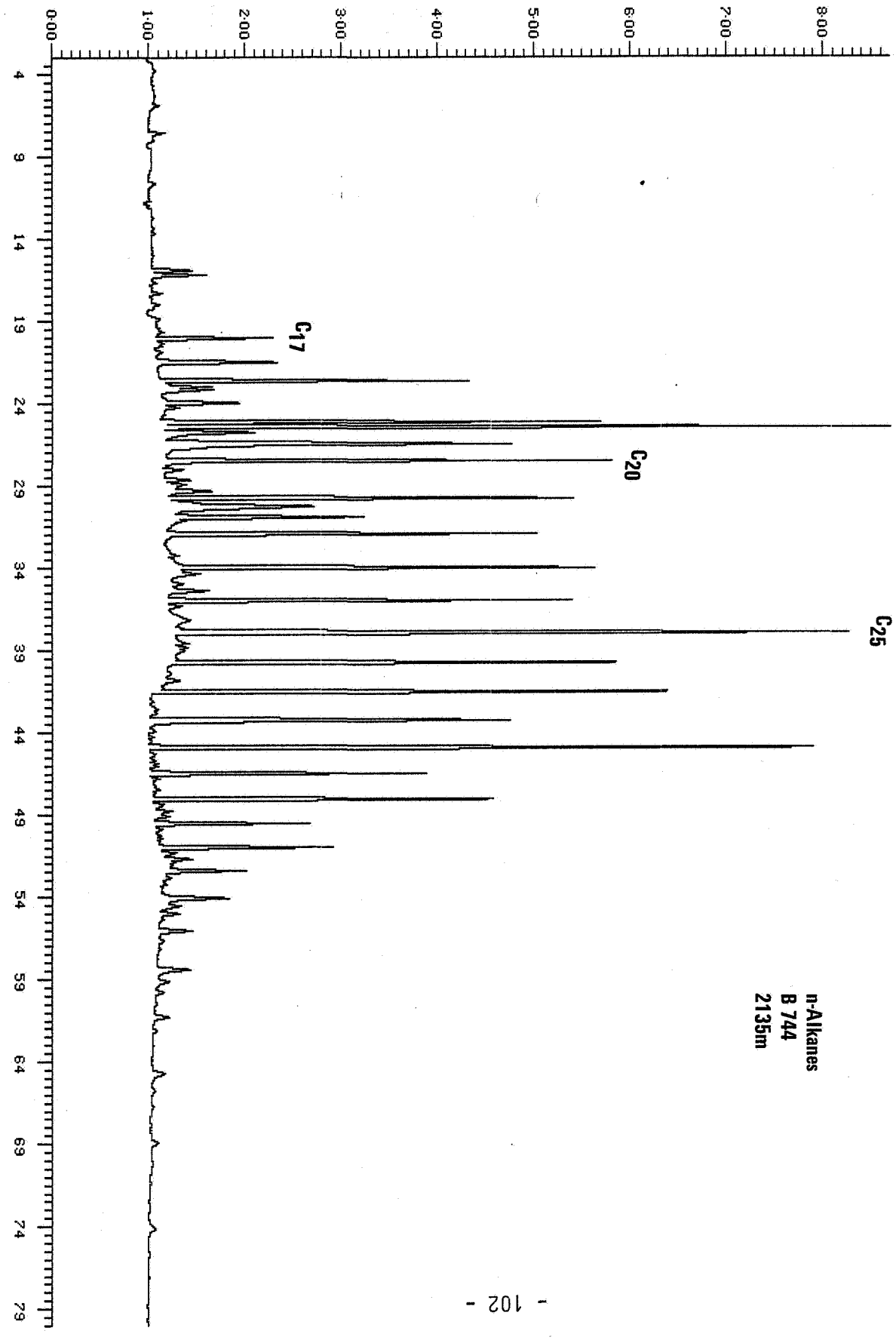

Created at 14:26 on 27/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot
Box 1 of 1
Analysis :198B732C Sample £: 1 Injection £: 1
Sample Name :B-732,31/6-1,JR
Maximum signal (%) :23.044
22·00
20·00
18·00
16·00
14·00
12·00
10·00
8·00
6·00
4·00
2·00
0·00
4
9
14
19
24
29
34
39
44
49
54
59
64
69
74
79
C17
C20
C25
n-Alkanes
B 732
Clst., gy.
1955m
- 100 -


Created at 09:39 on 28/Mar/84
RAW DATA PLOT-CHANNEL 3
Data Scale Plot Box 1 of 1
Analysis :198B1247C Sample £: 1 Injection £: 1
Sample Name :B-1247,31/6-1,JA Maximum signal (%) :18.679
C25
C20
C17
n-Alkanes
B 1247
Clst., gy.
1957m
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
79

Created at 13:57 on 16/Mar/84

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

Analysis :98B744C Sample £: 1 Injection £: 1
Sample Name :B-744,31/6-1,JA Maximum signal (%) :8.689



Created at 12:49 on 27/Mar/84

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

Analysis :198B861C Sample f: 1 Injection f: 1
Sample Name :B-861,31/6-1,JA Maximum signal (%) :41.482

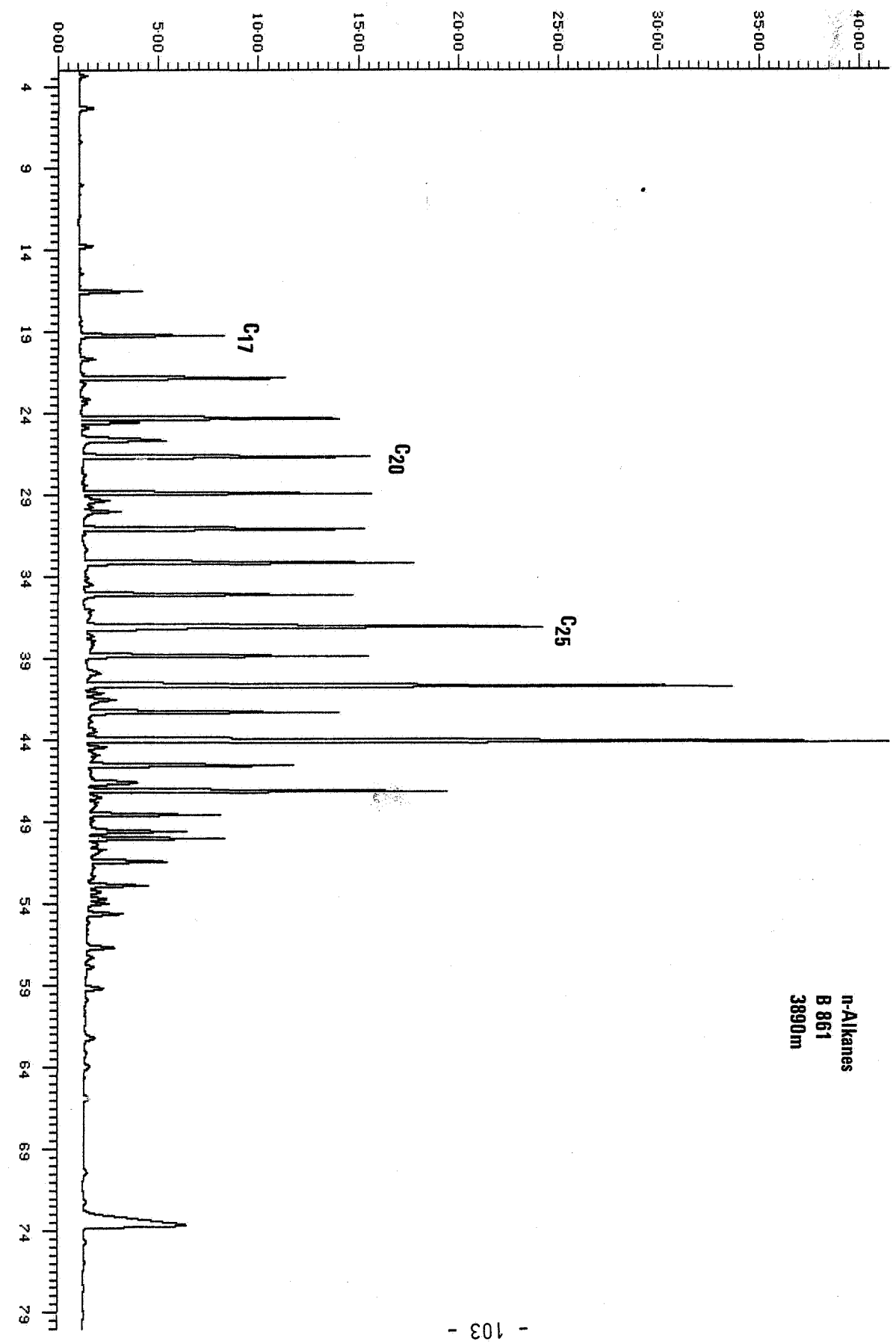
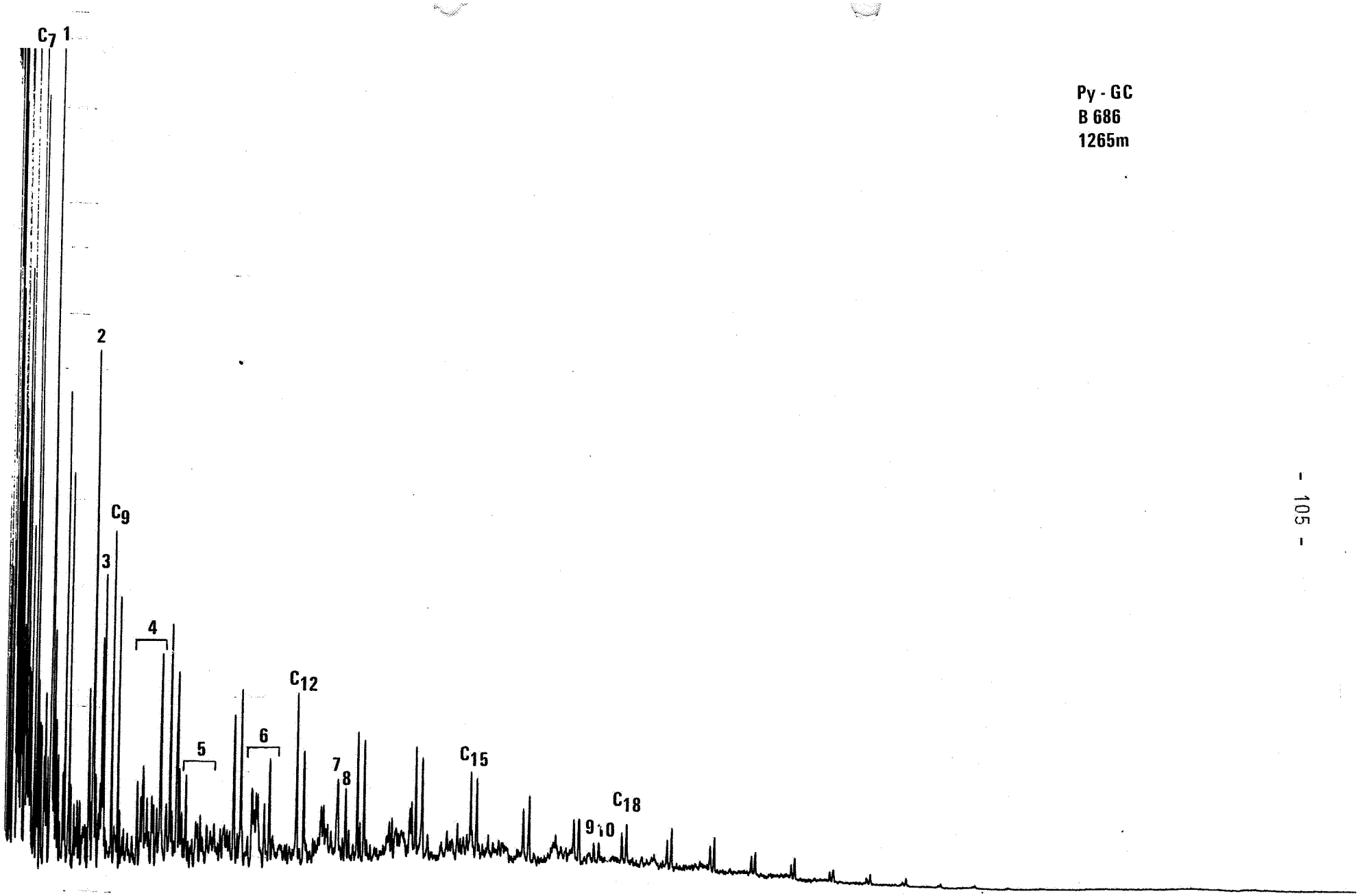
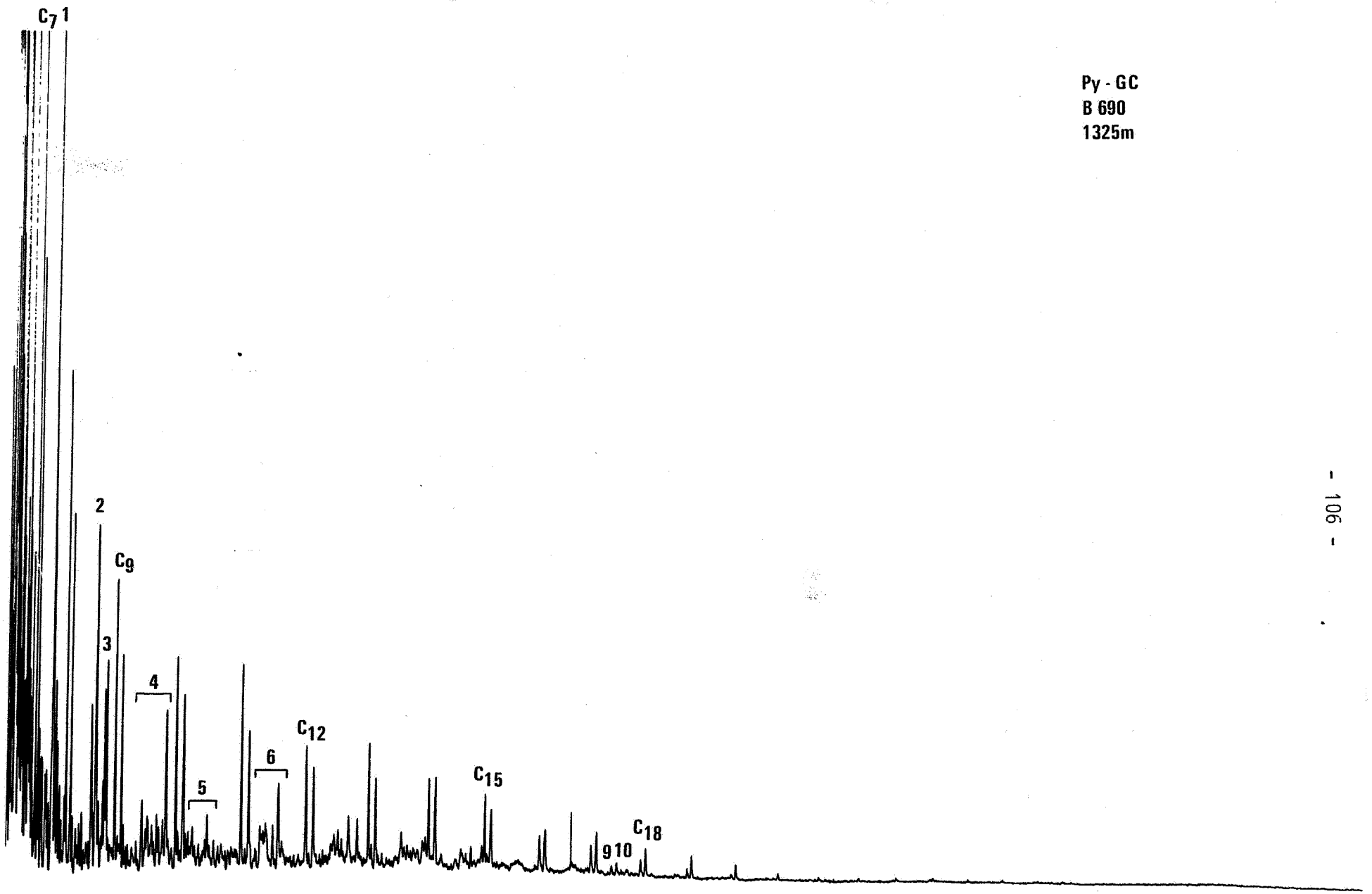


FIGURE 4

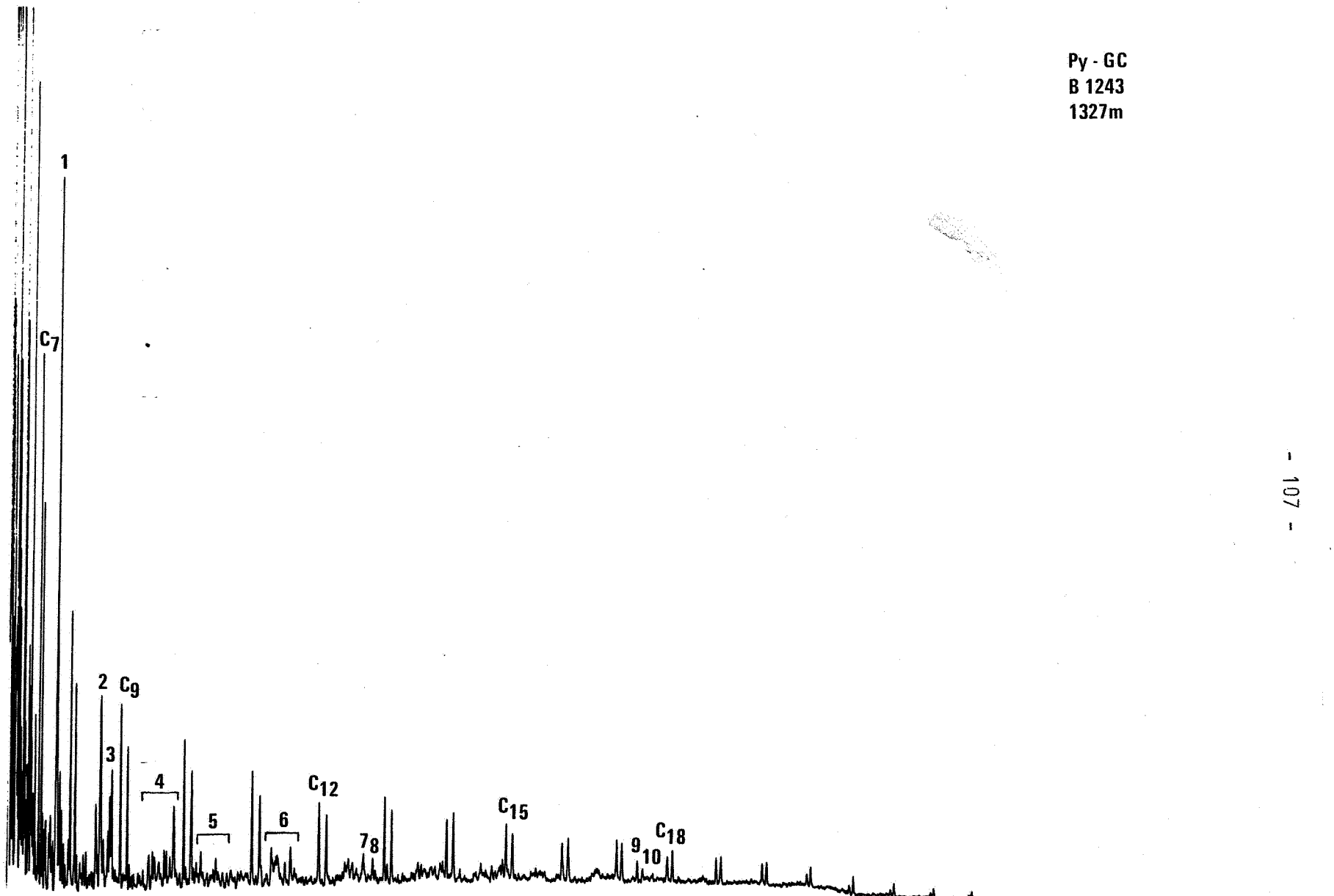
Pyrolysis gas chromatograms

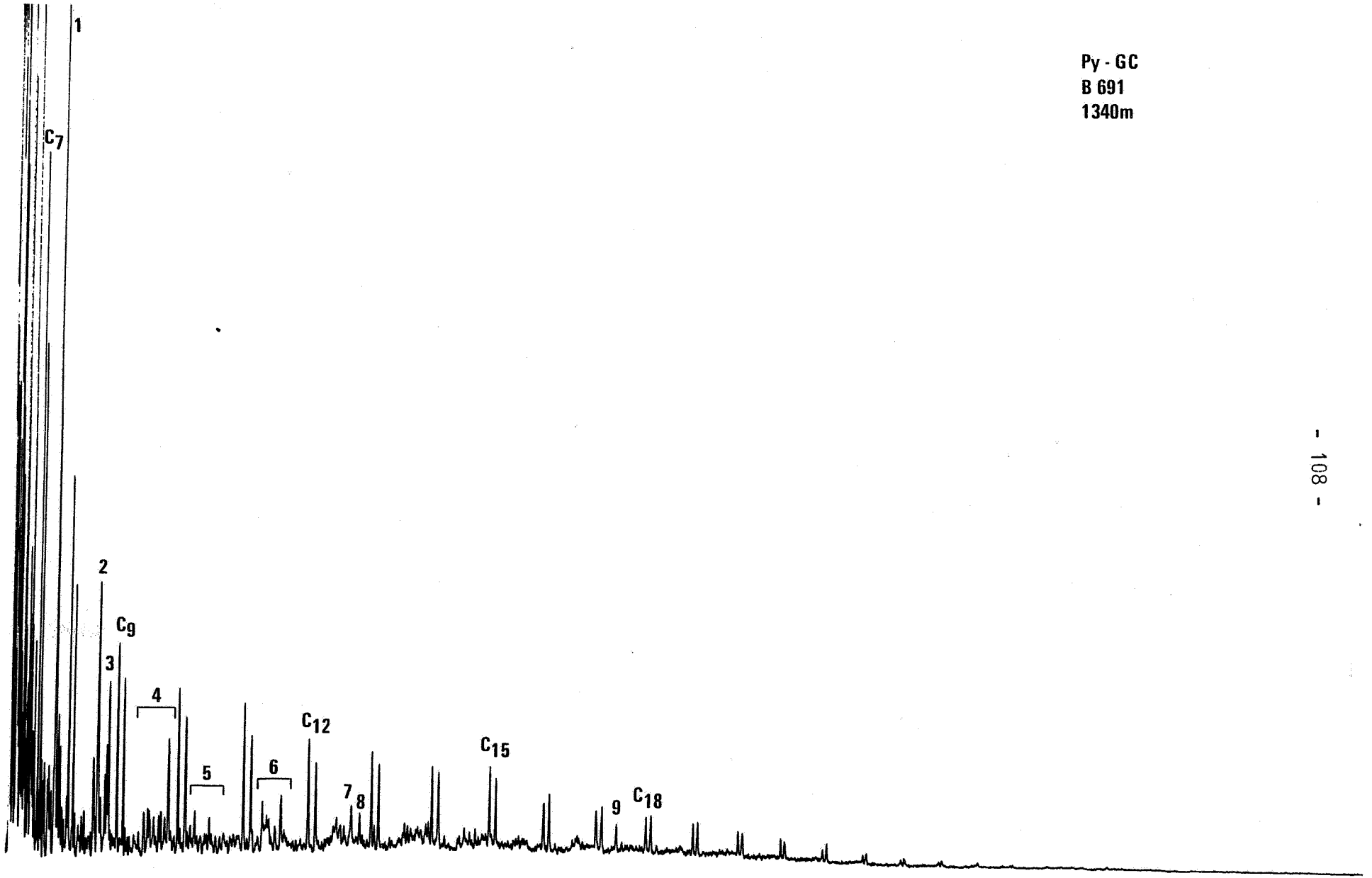
1 - toluene
2 - (m+p)-xylenes
3 - o-xylene
4 - C_3-alkylbenzenes + phenol (P)
5 - C_4-alkylbenzenes + methylphenols (C_1P)
6 - C_4- and C_5 alkylbenzenes + naphthalene
7 - 2-methylnaphthalene
8 - 1-methylnaphthalene
9 - prist-1-ene
10 - prist-2-ene

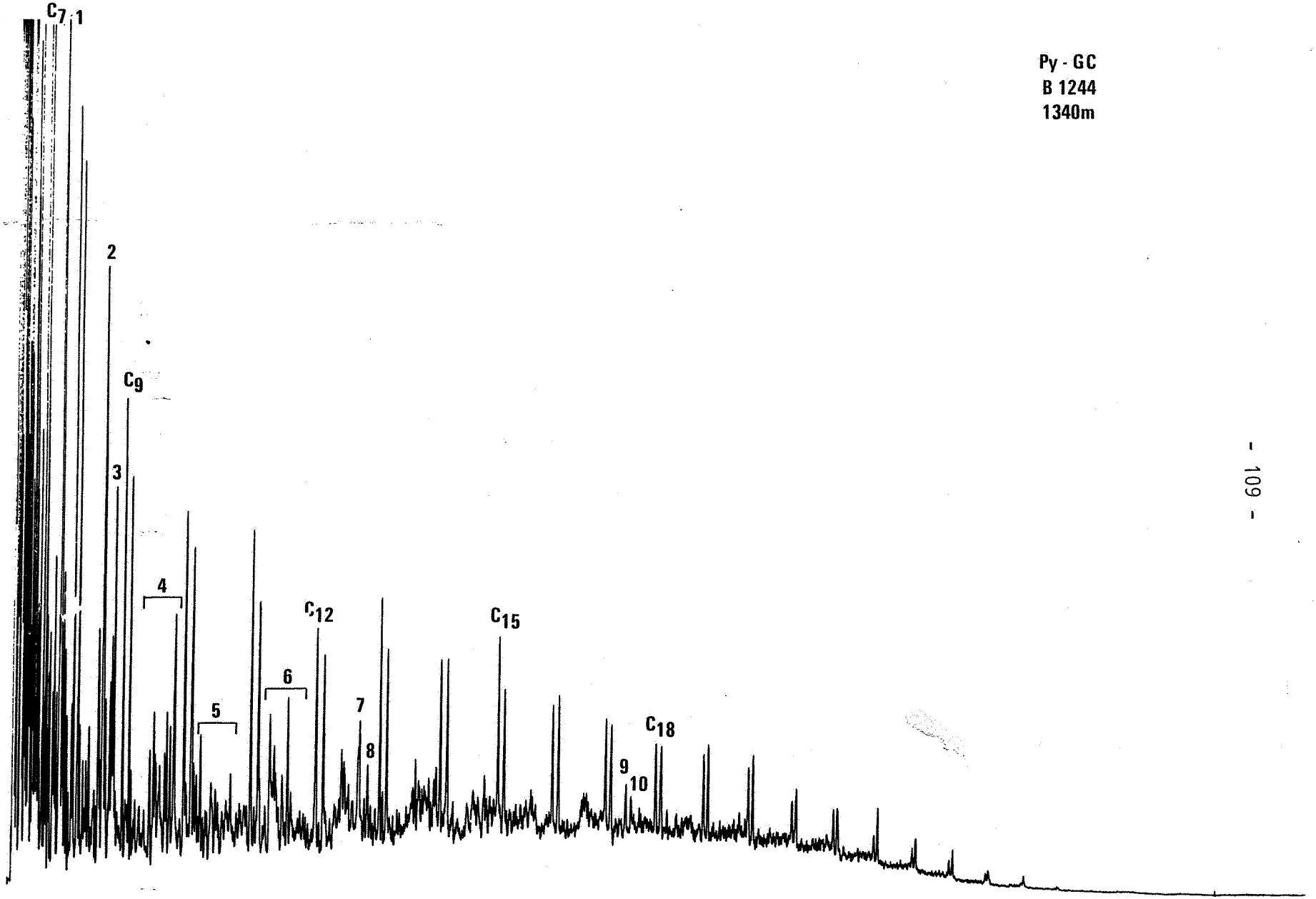

Py - GC
B 686
1265m
C7
1
2
C9
3
4
5
C12
6
7
8
C15
C18
9
10

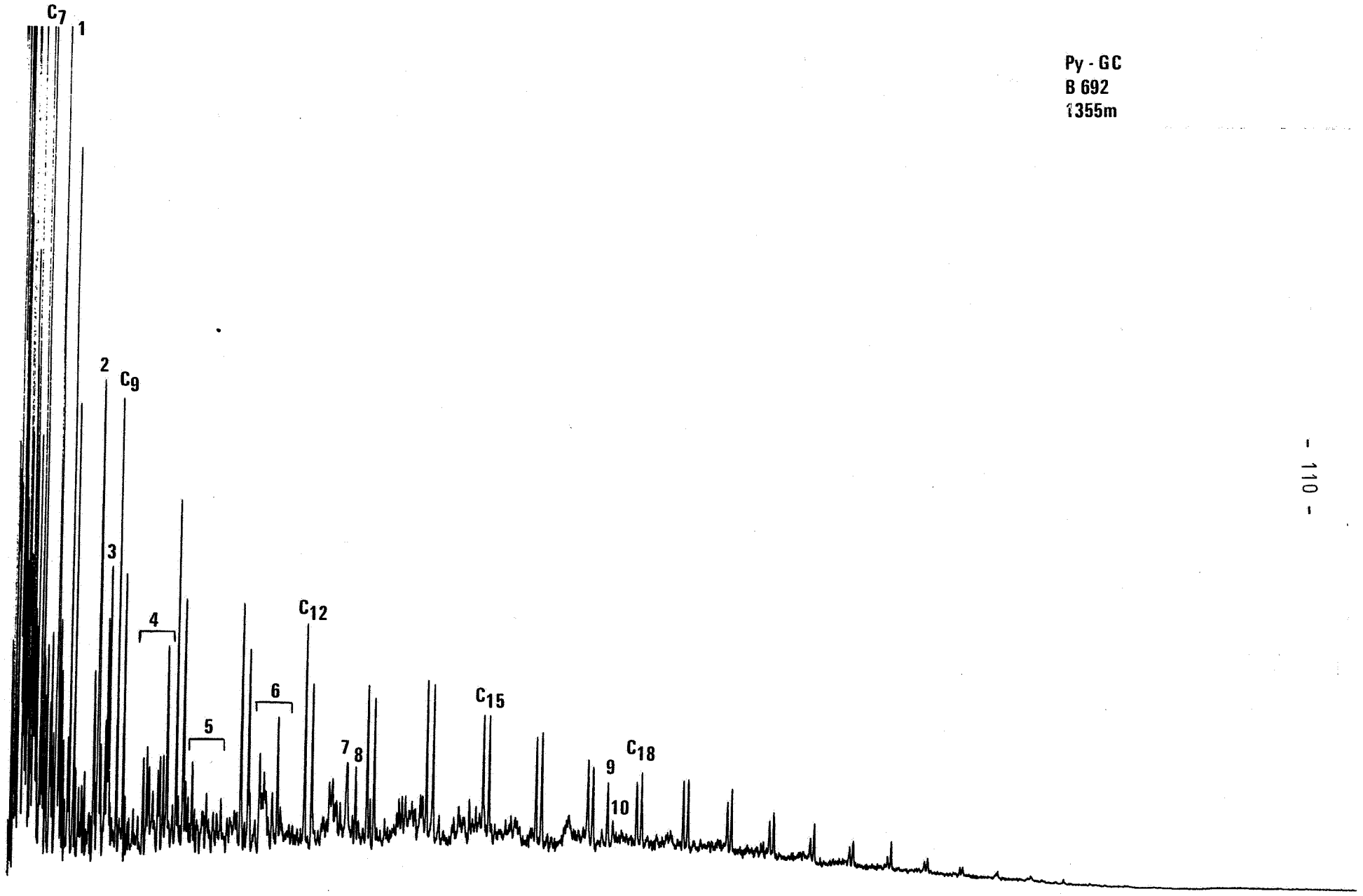


Py - GC
B 690
1325m

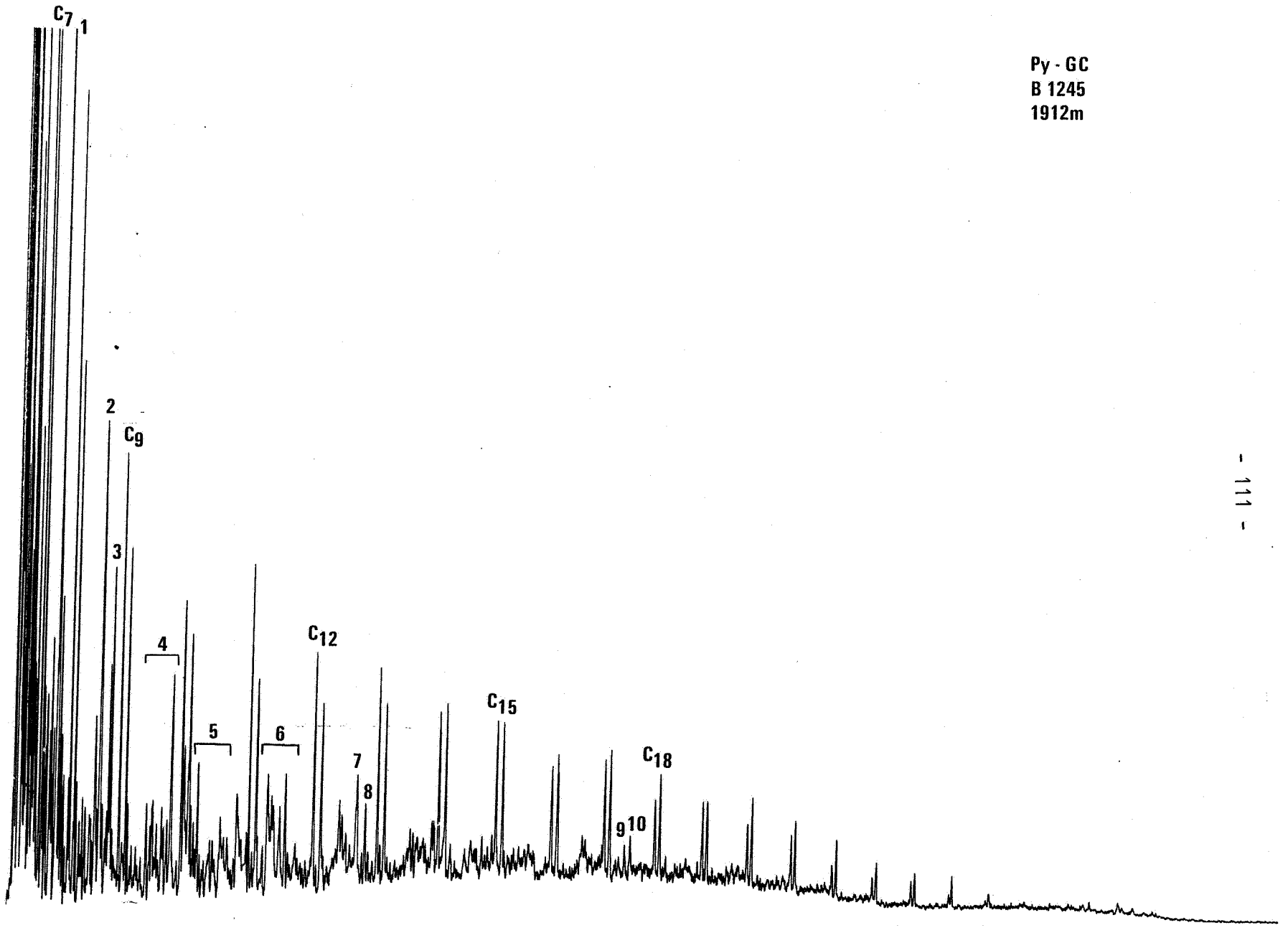

Py - GC
B 1243
1327m
1
C7
2
C9
3
4
5
6
C12
7
8
C15
9
10
C18

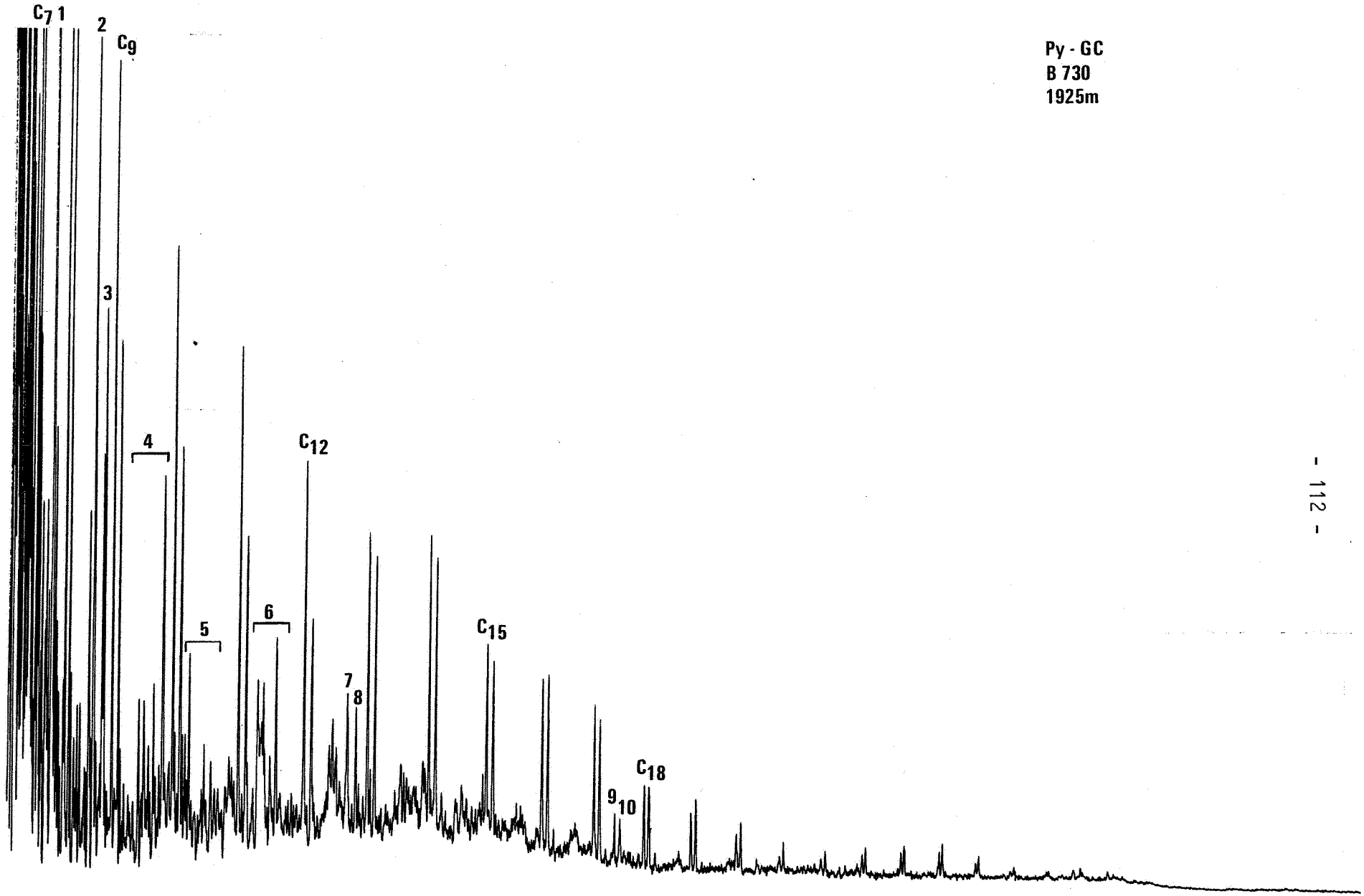

Py - GC
B 691
1340m
1
C7
2
C9
3
4
5
6
C12
7
8
C15
9
C18


Py - GC
B 1244
1340m
C7
1
2
C9
3
4
5
6
C12
7
8
C15
9
10
C18

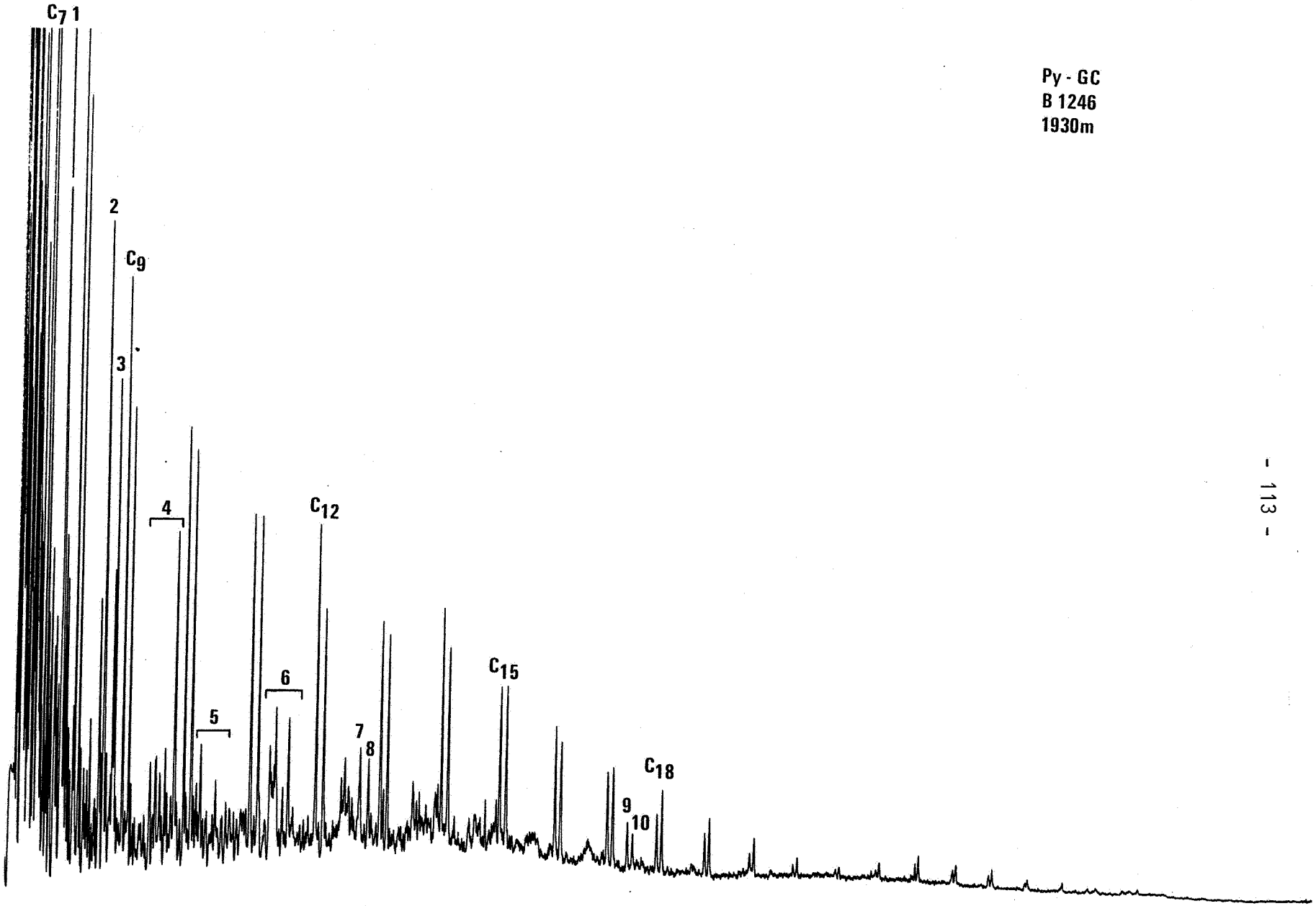


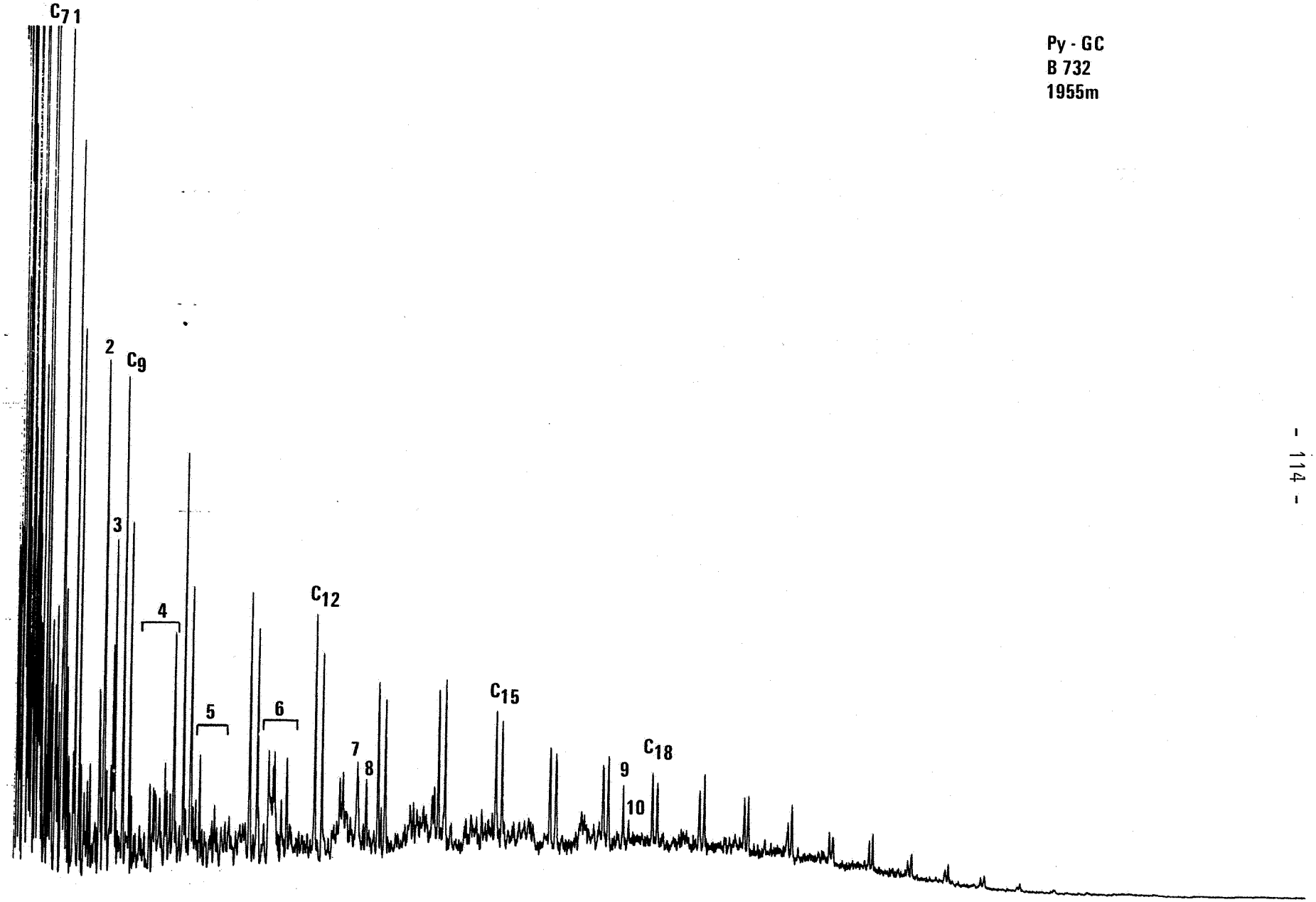
Py - GC
B 692
1355m


Py - GC
B 1245
1912m
C7
1
2
C9
3
4
C12
5
6
7
8
C15
C18
9
10

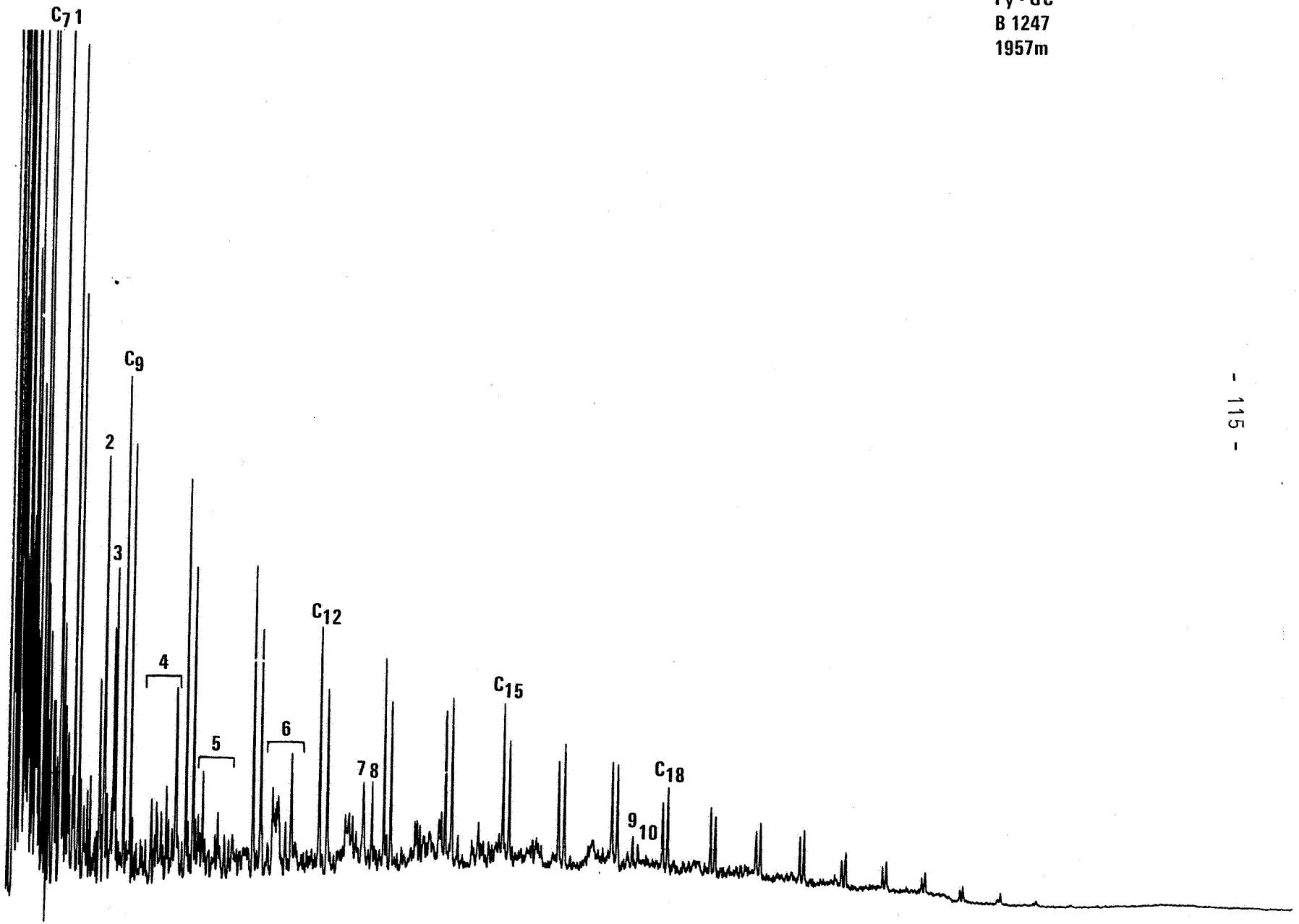


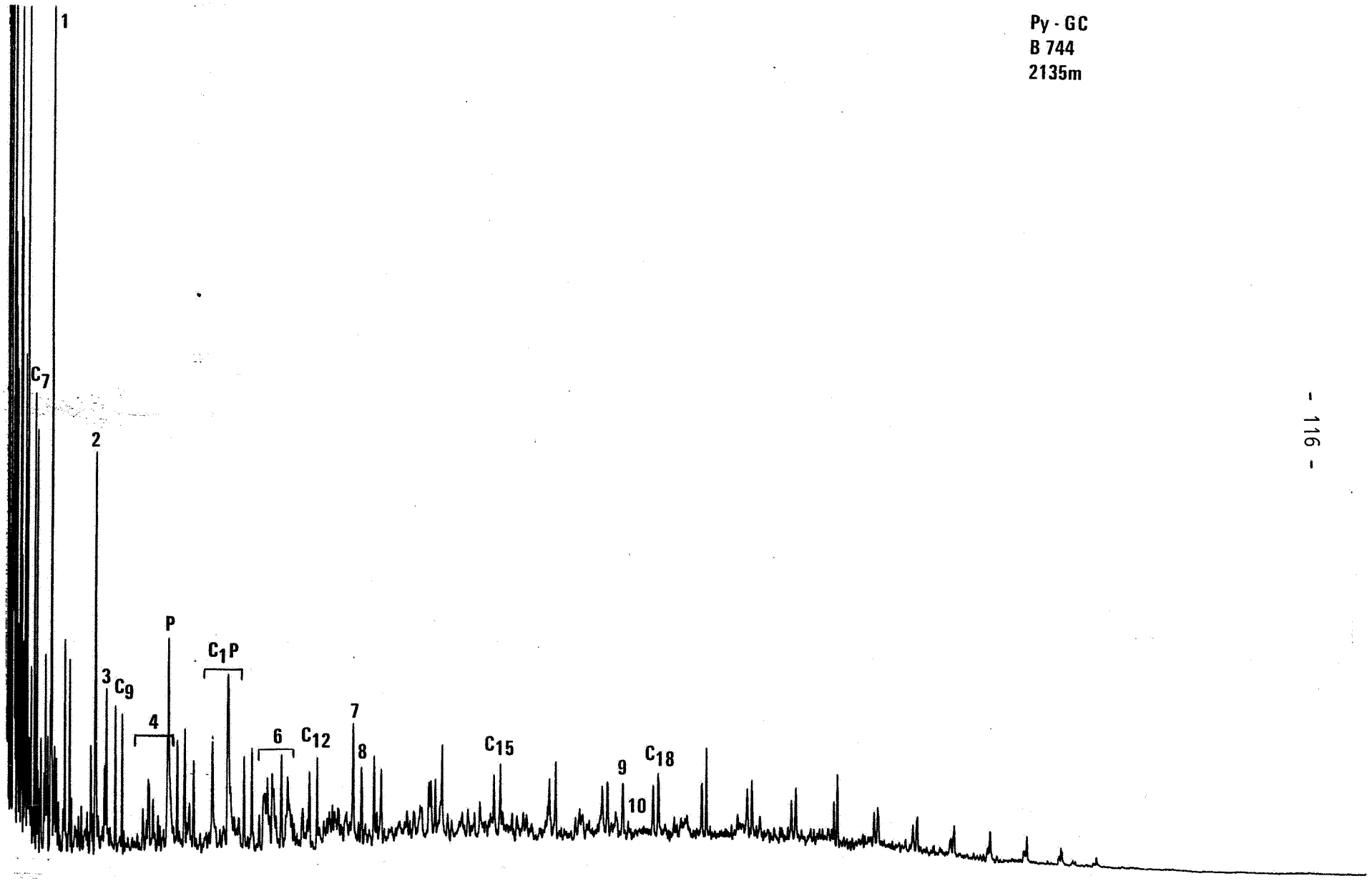
Py - GC
B 730
1925m

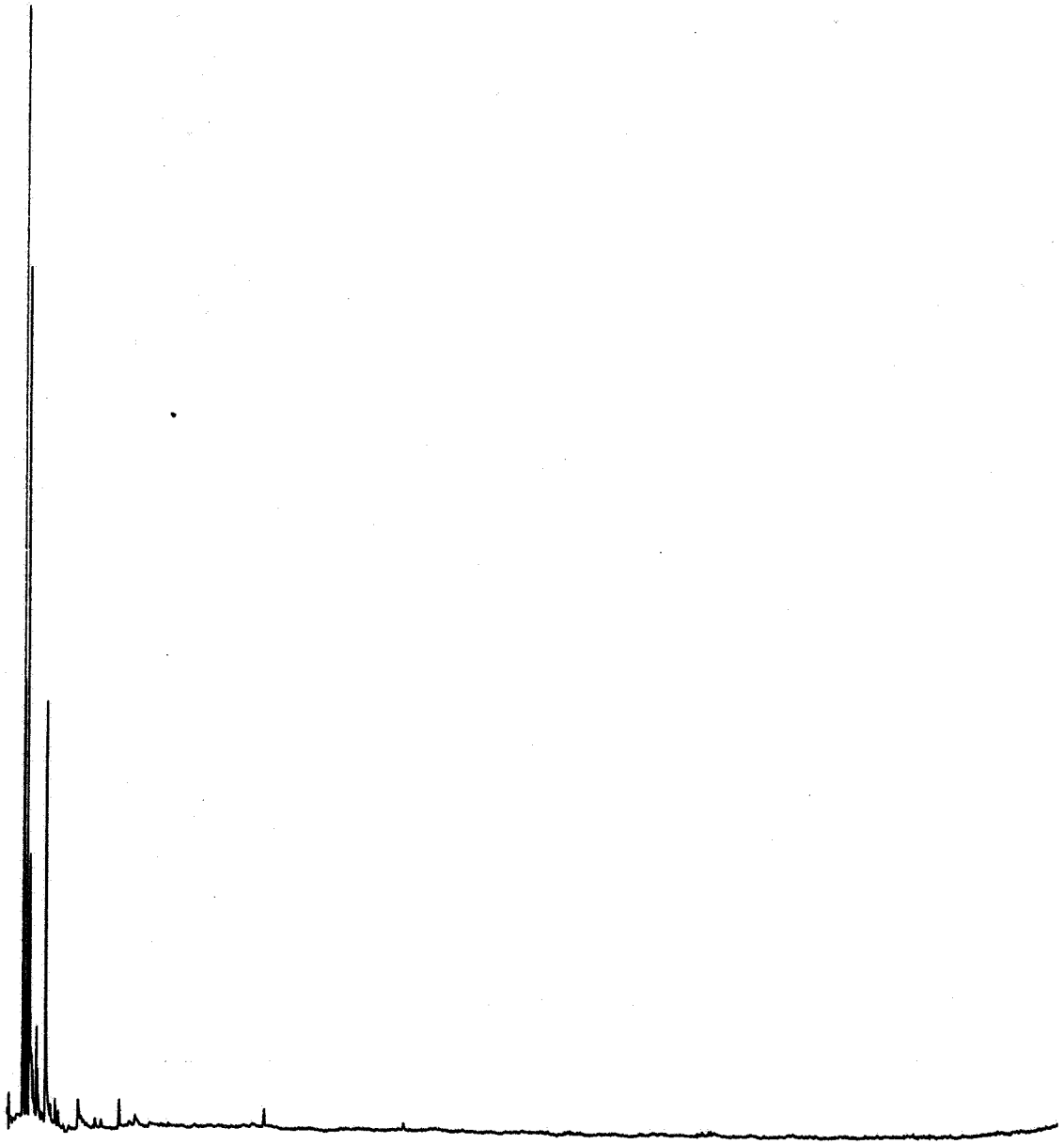

Py - GC
B 1246
1930m
C7
1
2
C9
3
4
C12
5
6
C15
7
8
C18
9
10


Py - GC
B 732
1955m
C7
1
2
C9
3
4
C12
5
6
7
8
C15
9
C18
10

Py - GC
B 1247
1957m




Py - GC
B 744
2135m
1
C7
2
3
C9
4
P
C1P
6
C12
7
8
C15
9
10
C18



Py - GC
B 861
3890m

FIGURE 5

Vitrinite reflectance histograms

FIGURE 5

VITRINITE REFLECTANCE HISTOGRAMS

Key:- A = Grey-black-brown claystone. Lower case letter is used when there is some uncertainty about whether the value is representative.

PP = Primary population

Y = Relevant population considered reasonably representative.

N = Not representative (caving, reworked, contaminant, drilling effects).

LOW+ HIGH = Population limits

#VAL. = Number of measurements in that population.

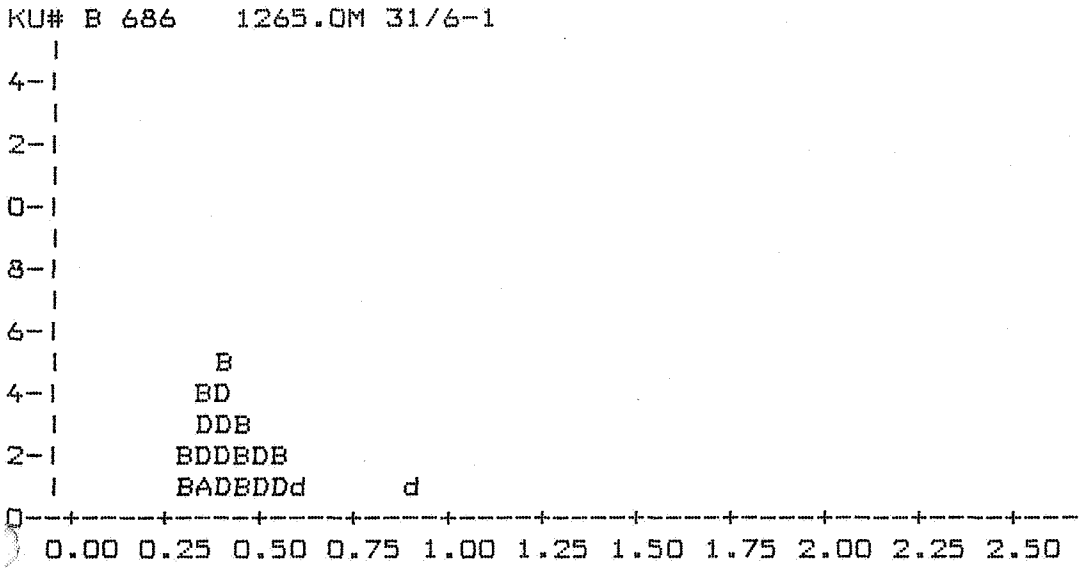
Lithology cross-reference table

A = Clst. gy
B = Clst. dk gy
C = Clst. gn
D = Clst. bn
E = Clst. rd
F = Clst. calc.
G = Clst. carb.
H = Shale
I = Sandstone
J = Limestone
K = Coal
L = Lignite
M = Carbargillite
N = Siltstone
O = Bit
P = X

a,b etc. = same lithology as above but value not included in any population, possibly because suspected caving, reworking, contamination or other erroneous recordings.

115/q/ah/8

KU# B 686 1265.0M 31/6-1



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.34	0.60	ALL	18	0.44	0.08
			OVERALL	20	0.47	0.14

RDERED VALUES FOLLOW:

0.34B 0.34B 0.36D 0.36A 0.38D 0.38B 0.41D 0.41D 0.41B 0.41D 0.43D 0.46B 0.47B
0.48B 0.51D 0.54D 0.57D 0.59B 0.60d 0.93d

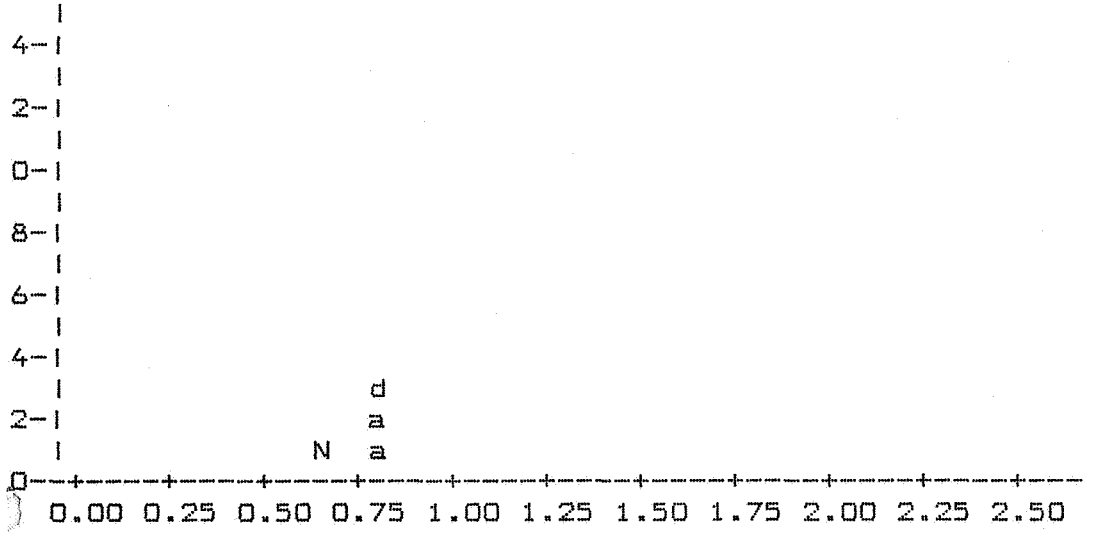
```
IKU# B 687    1280.0M 31/6-1
   !
14-!
   !
12-!
   !
10-!
   !
 8-!
   !
 6-!
   !
 4-!
   !          B B  b
 2-!       D  B B  d
   !       DB B Bd d  d d
 0-+----+----+----+----+----+----+----+----+----+----+---
   0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

'P LOW HIGH LIT #VAL MEAN STDV
' 0.32 0.58 ALL    9 0.46 0.10
           OVERALL 15 0.58 0.19

)RDERED VALUES FOLLOW:

0.32D 0.33D 0.36B 0.45B 0.49B 0.49B 0.55B 0.57B 0.57B 0.60d 0.72b 0.73d 0.73d
0.89d 0.96d
```

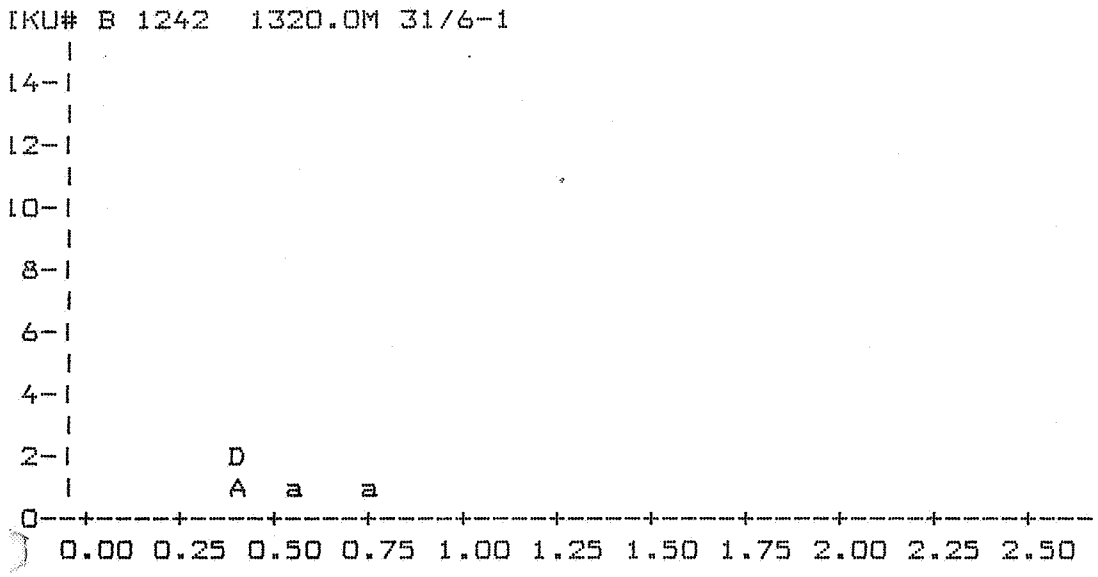
KU# B 688 1295.0M 31/6-1



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.68	0.69	ALL	1	0.68	0.00
			OVERALL	4	0.78	0.07

RDERED VALUES FOLLOW:

0.68N 0.81d 0.82a 0.83a

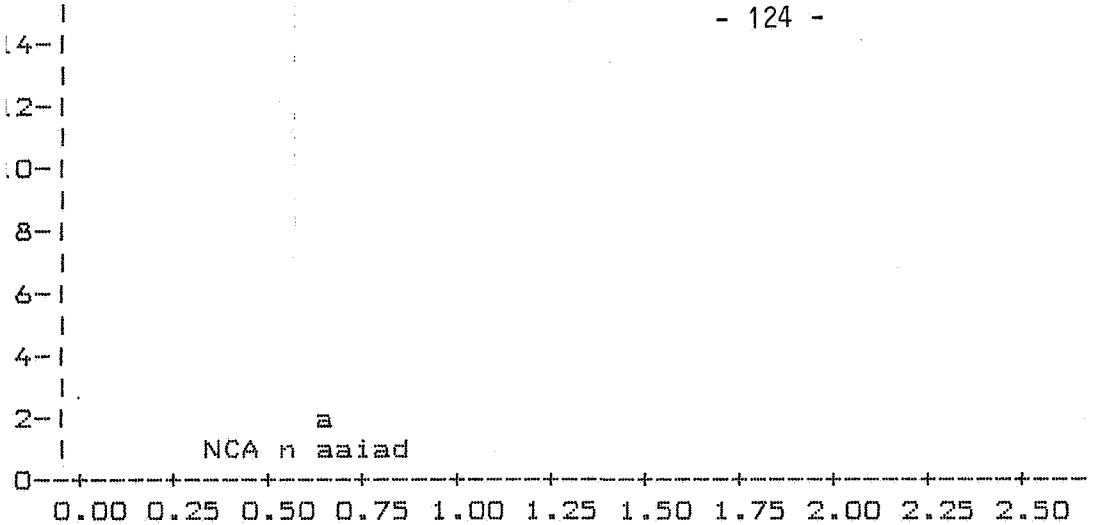


PP LOW HIGH LIT #VAL MEAN STDV
/ 0.40 0.42 ALL 2 0.41 0.01
OVERALL 4 0.54 0.17

ORDERED VALUES FOLLOW:

0.40A 0.41D 0.59a 0.76a

[KU# B 690 1325.0M 31/6-1



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
'	0.37	0.49	ALL	3	0.42	0.06
			OVERALL	10	0.64	0.18

RDERED VALUES FOLLOW:

0.37N 0.40C 0.48A 0.57n 0.67a 0.68a 0.70a 0.78i 0.82a 0.89d

```
KU# B 1243   1327.0M 31/6-1
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.4-|
   |
.2-|
   |
.0-|
   |
.8-|
   |
.6-|
   |
.4-|
   |
.2-|
   |       A  DA   a
0--+-----+----+----+----+----+----+----+----+----+----+---
  0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

)P LOW HIGH LIT #VAL MEAN STDV
' 0.30 0.52 ALL    3 0.42 0.11
           OVERALL  4 0.50 0.18

)RDERED VALUES FOLLOW:

 0.30A 0.46D 0.51A 0.73a
```
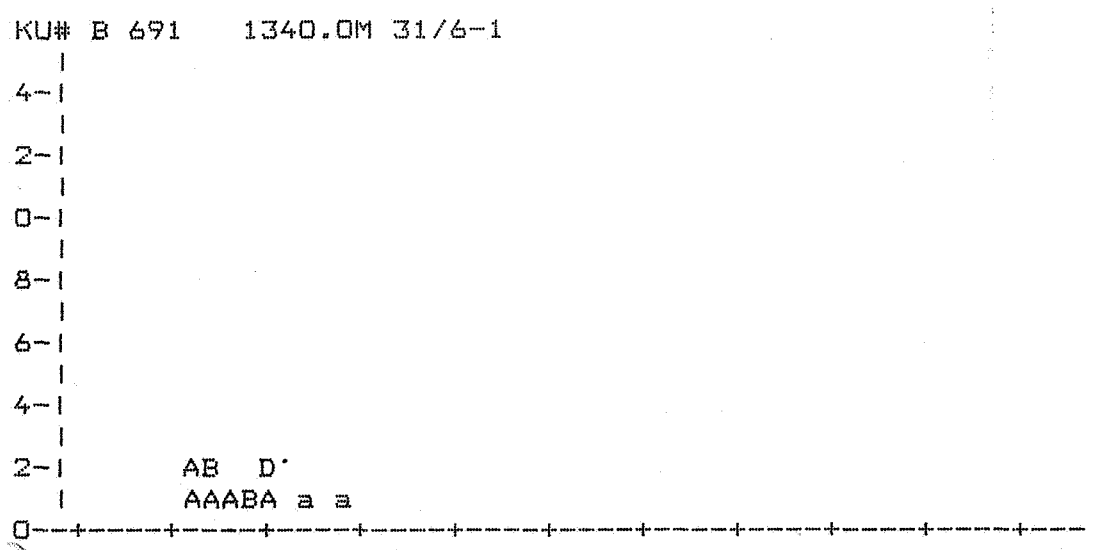
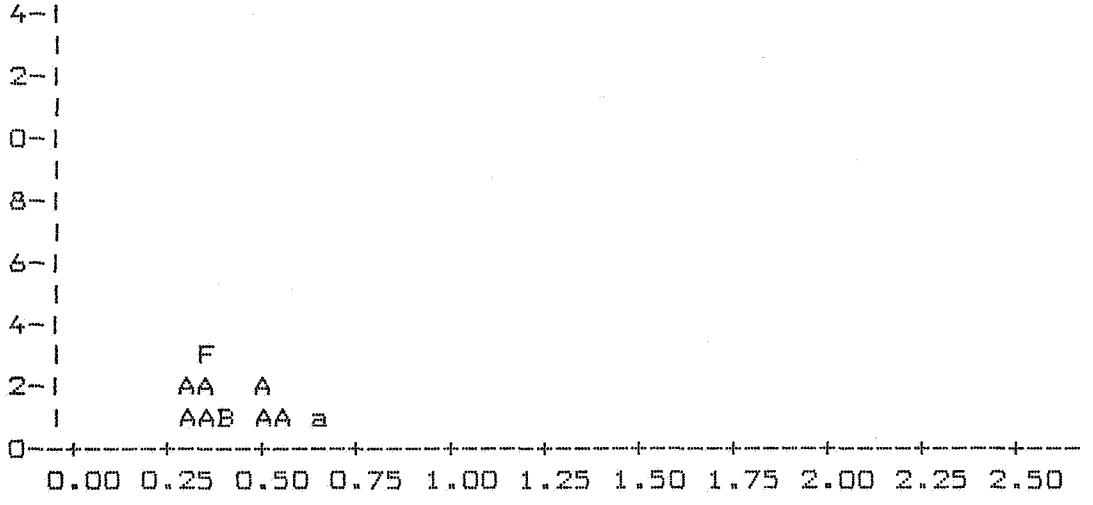



P LOW HIGH LIT #VAL MEAN STDV
0.33 0.52 ALL 8 0.42 0.08
OVERALL 10 0.47 0.13

RDERED VALUES FOLLOW:

0.33A 0.33A 0.36B 0.37A 0.42A 0.49B 0.51A 0.51D 0.64a 0.71a

KU# B 1244 1340.0M 31/6-1

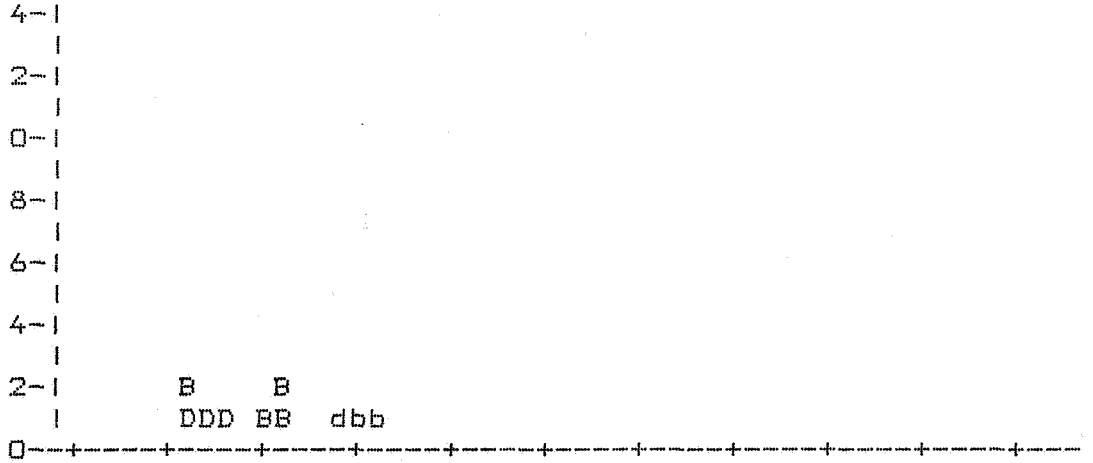


P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.30	0.60	ALL	9	0.43	0.10
			OVERALL	10	0.45	0.12

RDERED VALUES FOLLOW:

0.30A 0.33A 0.35A 0.37A 0.39F 0.44B 0.53A 0.53A 0.59A 0.67a

KU# B 692 1355.0M 31/6-1

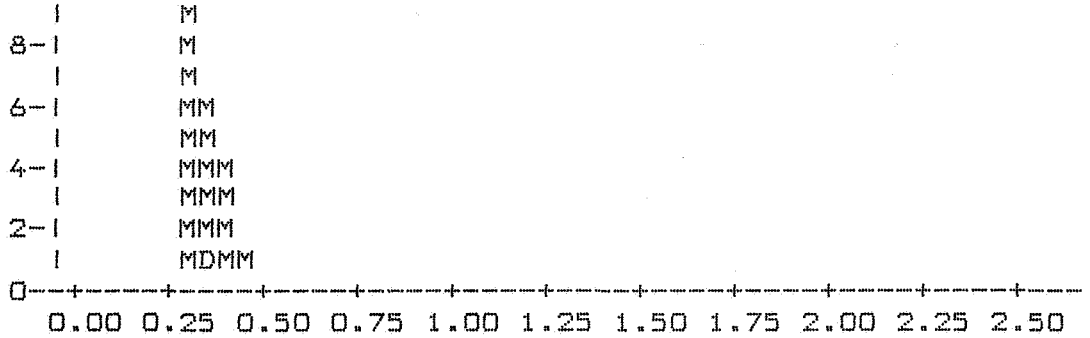


P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.31	0.58	ALL	7	0.44	0.11
			OVERALL	10	0.54	0.19

RDERED VALUES FOLLOW:

0.31B 0.32D 0.39D 0.40D 0.53B 0.56B 0.57B 0.74d 0.77b 0.83b

KU# B 716 1715.0M 31/6-1



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.31	0.47	ALL	20	0.37	0.04
			OVERALL	20	0.37	0.04

RDERED VALUES FOLLOW:

0.31M 0.32M 0.33M 0.33M 0.33M 0.33M 0.34M 0.34M 0.34M 0.35M 0.36D 0.37M 0.38M
0.38M 0.38M 0.40M 0.41M 0.42M 0.43M 0.46M

```
[KU# B 2418   1808.1M 31/6-1
   |
[4-|
   |
[2-|
   |
[0-|
   |
 8-|
   |
 6-|
   |        DDN
 4-|        DDD
   |        DDDD
 2-|        DDDDD
   |        DDDDD
 0-+----+----+----+----+----+----+----+----+----+----+---
  0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

?P LOW HIGH LIT #VAL MEAN STDV
/ 0.32 0.55 ALL   20 0.41 0.06
           OVERALL 20 0.41 0.06

)RDERED VALUES FOLLOW:

 0.32D 0.32D 0.34D 0.34D 0.34D 0.36D 0.36D 0.38D 0.39D 0.39D 0.40D 0.41N 0.41D
 0.43D 0.44D 0.47D 0.47D 0.49D 0.50D 0.54D
```

```
KU# B 2419  1818.5M 31/6-1
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.4-|
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.2-|
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.0-|
   |
.8-|
   |
.6-|         B
   |         B
.4-|         BB
   |         BB
.2-|        BBB
   |        DADDD                  d
.0-+----+----+----+----+----+----+----+----+----+----+----
  0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

P LOW HIGH LIT #VAL MEAN STDV
 0.30 0.54 ALL   14 0.40 0.06
           OVERALL 15 0.46 0.24

RDERED VALUES FOLLOW:

0.30D 0.34B 0.35B 0.35B 0.38B 0.38B 0.39B 0.39A 0.42D 0.42B 0.42B 0.44B 0.47D
0.53D 1.29d
```
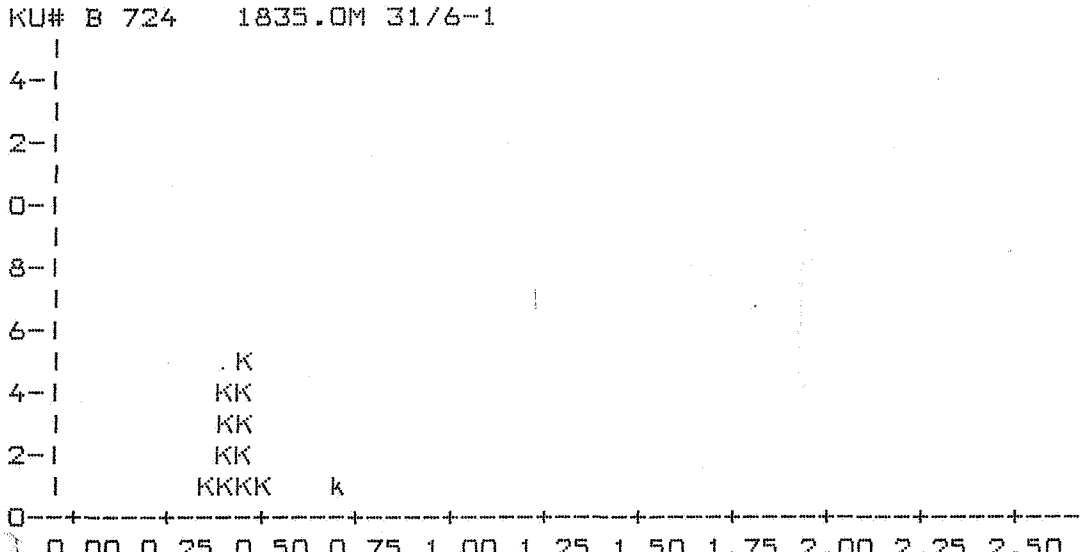



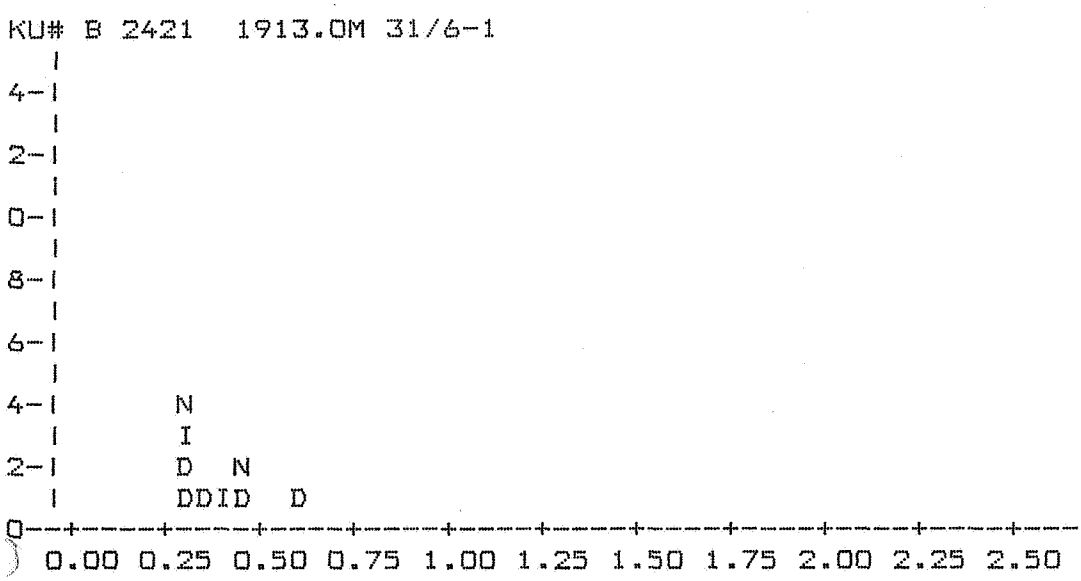
P LOW HIGH LIT #VAL MEAN STDV
0.35 0.51 ALL 11 0.45 0.04
OVERALL 12 0.47 0.09

RDERED VALUES FOLLOW:

0.35K 0.42K 0.43K 0.43K 0.44K 0.46K 0.46K 0.46K 0.48K 0.49K 0.50K 0.74k

```
:KU# B 2420   1863.0M 31/6-1
    |
.4-|
    |
.2-|
    |
.0-|
    |
8-|
    |
6-|
    |
4-|
    |
2-|
    |         IN    nii
0--+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
  0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

'P LOW HIGH LIT #VAL MEAN STDV
' 0.37 0.43 ALL     2 0.40 0.04
           OVERALL  5 0.56 0.15

)RDERED VALUES FOLLOW:

0.37I 0.42N 0.60n 0.68i 0.71i
```

```
:KU# B 1245  1912.0M 31/6-1
   |
.4-|
   |
.2-|
   |
.0-|
   |
 8-|
   |         G
 6-|         G I
   |         G I
 4-|         DBG
   |         DGGI
 2-|        GDAGI
   |        ADADA D    a
 0-+----+----+----+----+----+----+----+----+----+----+----
   0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

'P LOW HIGH LIT #VAL MEAN STDV
' 0.33 0.62 ALL   23 0.43 0.07
           OVERALL 24 0.45 0.10

)RDERED VALUES FOLLOW:

0.33A 0.34G 0.35D 0.36D 0.36D 0.37G 0.38D 0.38G 0.39G 0.42G 0.43A 0.43A 0.44B
0.45I 0.46G 0.47G 0.48D 0.48I 0.49G 0.51A 0.51I 0.51I 0.61D 0.80a
```



P LOW	HIGH	LIT	#VAL	MEAN	STDV
0.30	0.62	ALL	9	0.40	0.11
		OVERALL	9	0.40	0.11

RDERED VALUES FOLLOW:

0.30I 0.30N 0.31D 0.34D 0.38D 0.42I 0.49D 0.49N 0.61D

KU# B 730 1925.0M 31/6-1

```
   |
4-|
   |
2-|
   |
0-|
   |
8-|
   |
6-|
   |
4-|
   |          D   d
2-|        D D   d
   |        DAA DDd n
0--+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
   0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50
```

P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.32	0.59	ALL	8	0.43	0.09
			OVERALL	12	0.50	0.13

RDERED VALUES FOLLOW:

0.32D 0.32D 0.39A 0.42A 0.42D 0.43D 0.54D 0.58D 0.60d 0.62d 0.64d 0.70n

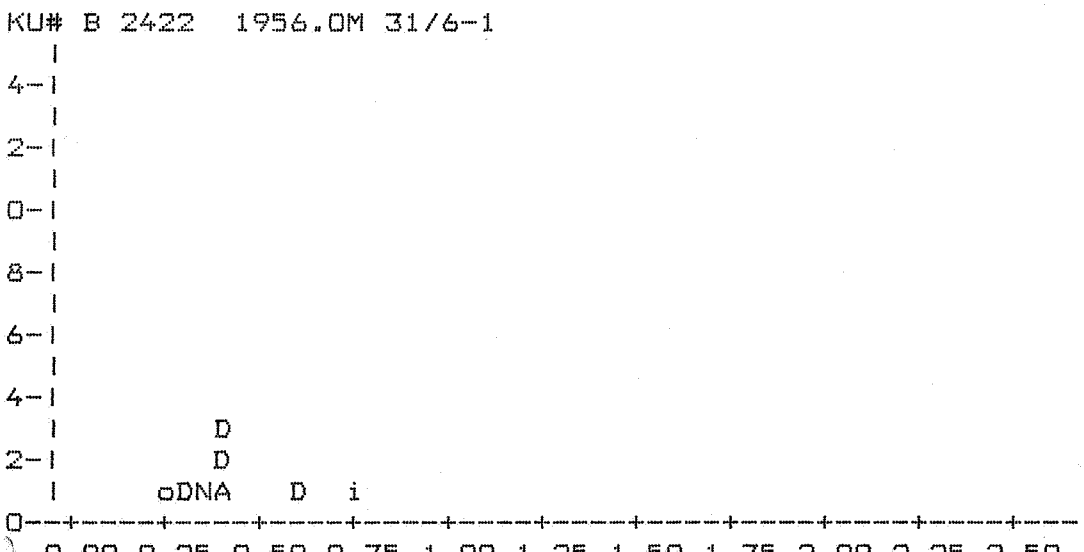
KU# B 1246 1930.0M 31/6-1

P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.43	0.54	ALL	2	0.48	0.07
			OVERALL	4	0.68	0.24

RDERED VALUES FOLLOW:

0.43A 0.53N 0.84n 0.92d

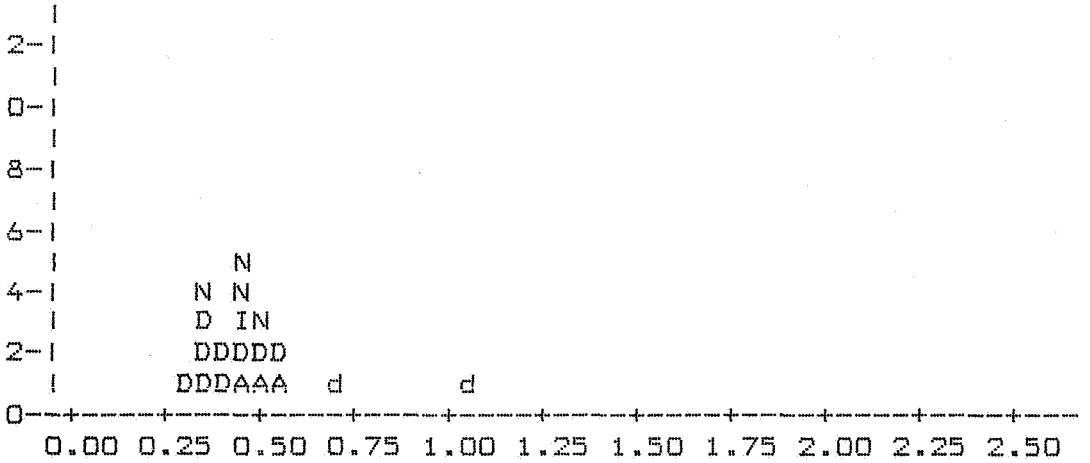
```
KU# B 732    1955.0M 31/6-1
   |
4-|
   |
2-|
   |
0-|
   |
8-|
   |
6-|
   |        D
4-|        D
   |        A
2-|        A    D
   |        AA   A    A       a
0--+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
  0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

'P LOW HIGH LIT #VAL MEAN STDV
 0.30 0.75 ALL     9 0.42 0.15
           OVERALL 10 0.48 0.25

)RDERED VALUES FOLLOW:

0.30A 0.30D 0.32D 0.32A 0.34A 0.39A 0.52D 0.52A 0.74A 1.07a
```



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.30	0.65	ALL	6	0.43	0.12
			OVERALL	8	0.45	0.18

RDERED VALUES FOLLOW:

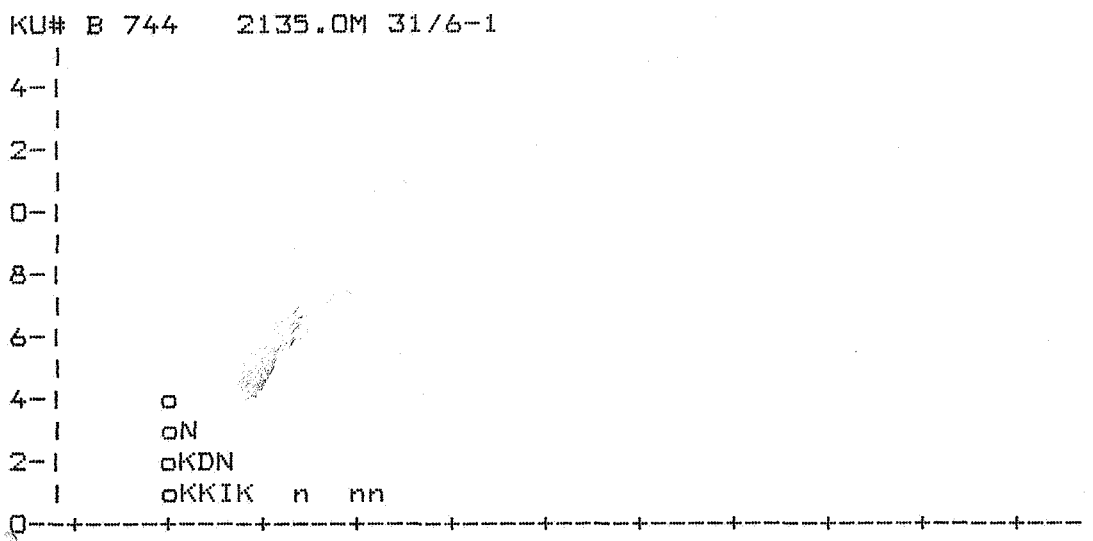
0.28o 0.30D 0.36N 0.40D 0.42A 0.44D 0.64D 0.79i



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.31	0.57	ALL	17	0.45	0.07
			OVERALL	19	0.50	0.17

ORDERED VALUES FOLLOW:

0.31D 0.37D 0.37N 0.39D 0.39D 0.40D 0.44D 0.45D 0.45N 0.49A 0.49I 0.49N 0.51N
0.52D 0.53A 0.55D 0.56A 0.74d 1.09d

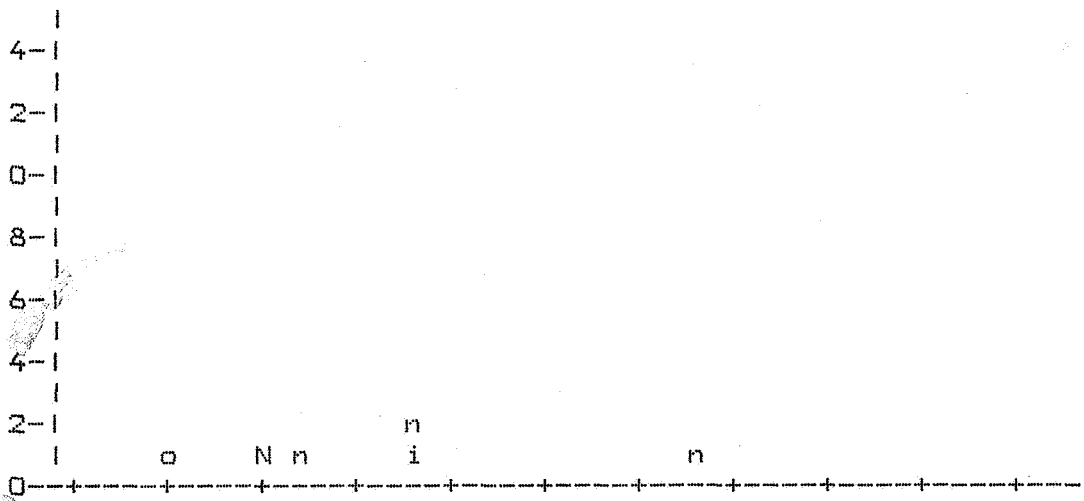


P LOW HIGH LIT #VAL MEAN STDV
0.31 0.50 ALL 8 0.38 0.07
OVERALL 15 0.43 0.18

RDERED VALUES FOLLOW:

0.28o 0.28o 0.29o 0.29o 0.31N 0.31K 0.34K 0.35D 0.36K 0.43I 0.44N 0.49K 0.62n
0.79n 0.80n

KU# B 746 2165.0M 31/6-1



P	LOW	HIGH	LIT	#VAL	MEAN	STDV
	0.52	0.53	ALL	1	0.52	0.00
			OVERALL	6	0.82	0.49

RDERED VALUES FOLLOW:

0.25o 0.52N 0.61n 0.94i 0.94n 1.65n

```
:KU# B 2423  2182.0M 31/6-1
   |
.4-|
   |
.2-|
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.0-|
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 8-|
   |
 6-|
   |
 4-|
   |
 2-|
   |
 0--+----+----+----+----+----+----+----+----+----+----
   0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

'P LOW HIGH LIT #VAL MEAN STDV
          OVERALL  0 0.00 0.00

)RDERED VALUES FOLLOW:
```
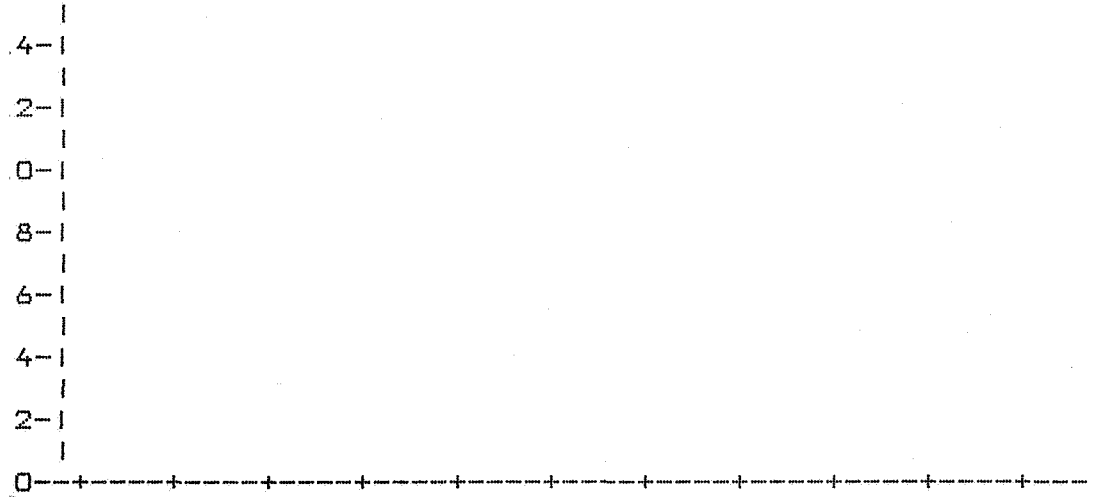

KU# B 853 3770.0M 31/6-1



P LOW HIGH LIT #VAL MEAN STDV
OVERALL 0 0.00 0.00

RDERED VALUES FOLLOW: