THE ROBERTSON GROUP plc

REPORT NO. 6390/Ic

A PETROLEUM GEOCHEMICAL EVALUATION OF PHILLIPS WELL 2/7-20X AND 2/7-20X SIDETRACK 2, NORWEGIAN NORTH SEA

by

S. Betts
P. C. Barnard

PROJECT NO. RGPD/889/Ic/25616

Prepared by:

The Robertson Group plc
Petroleum Division
Llandudno
Gwynedd LL30 1SA
United Kingdom

Prepared for:

Phillips Petroleum Company Norway
Box 200
N4056 Tananger
Norway

NOVEMBER 1988

Robertson Group

CONTENTS

		Page No.
1	SUMMARY	1
2	INTRODUCTION	2
3	MATURITY	4
3.1	VITRINITE REFLECTANCE	4
3.2	SPORE COLOUR INDEX	4
3.3	BURIAL HISTORY AND TTI MODELLING	5
3.4	DISCUSSION OF MATURITY RESULTS	6
4	SOURCE ROCK QUALITY	7
4.1	TERTIARY	7
4.1.1	Nordland Group	7
4.1.2	Hordaland Group	7
4.1.3	Rogaland Group	8
4.2	CRETACEOUS	8
4.2.1	Chalk Group	8
4.2.2	Cromer Knoll Group	9
4.3	JURASSIC	10
4.3.1	Tyne Group (identified 13319' to 13322')	10
4.4	UNASSIGNED SECTION	10
4.4.1	Sequence A	10
4.4.2	Sand X	11
4.4.3	Sequence B	11
4.4.4	Sand Y	11
5	HYDROCARBONS	13
5.1	GAS CHROMATOGRAPHY	13
5.1.1	Nordland/Hordaland Groups	13
5.1.2	Ekofisk Formation	13
5.1.3	Sequence A	13
5.1.4	Sand X	14
5.1.5	Sand Y	14
5.2	GAS CHROMATOGRAPHY - MASS SPECTROMETRY	15
5.2.1	Maturity	15
5.2.2	Source	19

Robertson Group

6 CONCLUSIONS 17

7 REFERENCES 20

TABLES

1 (A-D) Maturity and kerogen composition data
2 (A-B) Airspace gaseous hydrocarbon analysis data
3 Gasoline hydrocarbon analysis data
4 Gasoline hydrocarbon ratios
5 (A-G) Organic carbon and screening pyrolysis data
6 (A-P) Summary of chemical analysis data
7 Alkane gas chromatography data
8 Gas chromatography - mass spectrometry ratios
9 Maturity calculations (TTI, p values)

FIGURES

1 Spore colour indices against depth
2 Vitrinite reflectance against depth
3 Airspace (C_1-C_4) hydrocarbons against depth
4 Composition of C_7 hydrocarbons in terms of straight chain, branched chain and cyclic components
5 (1-7) Gasoline hydrocarbon gas chromatograms
6 (1-7) Whole extract gas chromatograms
7 (1-31) Alkane gas chromatograms
8 (8.1.1-8.6.2) Mass fragmentograms m/e 191, 217, 218, 231 and 259 (Scan no's 0-2000)
9 (1-7) Pyrolysis-gas chromatograms
10 Percentage composition of 5α(H), 14α(H), 17α(H), 20R C_{27}, C_{28} and C_{29} steranes
11 Burial history curve

APPENDICES

1 Abbreviations used in analytical data sheets
2 Analytical procedures and techniques
3(1-13) Histograms, data and statistics for vitrinite reflectivity

ENCLOSURES

1 Geochemical maturity summary log
2 Geochemical source potential summary log

Robertson Group

1 SUMMARY

This report contains the results of a petroleum geochemical evaluation of Phillips Petroleum Company Norway well 2/7-20X and its sidetrack, drilled in the Norwegian North Sea.

The samples analysed comprise composited cuttings, sidewall cores and cores. Samples from the main hole were analysed above 8110' and in cores from the Ekofisk Formation. The remainder of the samples are from the sidetrack.

Spore colour index and vitrinite reflectance data indicate that the analysed section is early mature with respect to oil generation below 9200', middle mature below approximately 12800', and late mature below 13200'. Both sets of data show non-linear profiles at approximately 12800' to 13000' which are attributed to the presence of overpressuring in the section beneath the chalk.

No mature oil or gas source rocks have been identified in the analysed section. In the Tertiary, Hordaland Group, a zone between 6010' and 7270' shows fair to good oil source potential and a zone, 5258' to 6010', shows very good oil source potential, but neither are sufficiently mature in the vicinity of the well to have generated hydrocarbons. The remainder of the Tertiary section shows only marginal gas source potential but is immature with respect to gas generation. None of the sediments analysed in the Cretaceous, Jurassic and Unassigned sections show any significant hydrocarbon generation potential.

Several horizons show evidence of the presence of migrant hydrocarbons, particularly the upper unassigned sand unit (Sand X). Minor migrant hydrocarbon staining is seen in some of the Nordland and Hordaland Group samples analysed. Core chips from the Ekofisk Formation show patchy oil staining in hand specimen. They contain moderate amounts of mature migrant hydrocarbons similar to Upper Jurassic sourced oils from neighbouring fields. Airspace gas analysis also indicates the presence of mature migrant hydrocarbons in the upper part of the Hod Formation. Both of the unassigned sand units were observed in hand specimen to contain migrant hydrocarbons; all of the upper sand samples showed oil staining and core samples from the lower sand samples showed bitumen, infilling fractures. Gas chromatography-mass spectrometry data from extracts indicates that the upper sand contains a middle mature, live oil, with a minor, severely biodegraded component. The lower sand contains minor amounts of the same oil and biodegraded components as the upper sand and an earlier phase of migrant hydrocarbons represented by the high maturity bitumen seen infilling the fractures. Comparison with published data and our own in-house database indicates an Upper Jurassic source for the middle mature migrant hydrocarbons. The source of the bitumen in the lower sand cannot be established on the basis of the data available. Further analysis on a separated bitumen sample would be necessary and insufficient material was available for this.

2 INTRODUCTION

This report contains the results of a petroleum geochemical evaluation of the Phillips 2/7-20X and 2/7-20X (ST2) well, Norwegian North Sea.

A total of 263 samples have been analysed. These arrived at The Robertson Group plc North Wales laboratories in a total of 9 batches between 20th December 1987 and 16th May 1988.

The following data were supplied by the client from the original hole; a computer printout of the daily drilling operations, the formation evaluation log and the drilling data pressure log. With the exception of two bottom hole temperatures, no drilling data was supplied from the sidetrack.

The analytical programme was carried out in accordance with work order 2660 dated 17th August 1987, with modifications agreed to by the client to incorporate the greater than expected number of samples. In addition, dichloromethane washing and extraction of some of the cuttings samples from the sidetrack were necessary prior to analysis to remove oil based mud contamination. Analyses carried out include total organic carbon content, screening pyrolysis, kerogen preparation and spore colour index determination, vitrinite reflectance measurement, pyrolysis - gas chromatography, solvent extraction, extract fractionation, whole extract and alkane fraction gas chromatography, and alkane fraction gas chromatography - mass spectrometry. Preliminary results have been despatched to the client at various times during the project. In addition, Mr P.C. Barnard of The Robertson Group met with Mr Rudi Kleiber and Mr Jim Davies of Phillips Norway on the 6th May 1988 to discuss the preliminary results and to inspect the cores cut in the lower part of the unassigned sequence.

The total number of analyses carried out was as follows:

Airspace gas	33
TOC	313
Screening pyrolysis	126
Extraction	29
DCM extraction to remove oil based mud	87
Fractionation	26
Whole oil gas chromatography	7
Alkane gas chromatography	22
Kerogen preparation	52
Spore colour index	52
Vitrinite reflectance	55
Pyrolysis - gas chromatography	7
Gas chromatography - mass spectrometry	6

In this report the following formation tops have been used. They have been taken from The Robertson Group plc report no. 6353/IIa.

Lithostratigraphic Unit	Depth
Nordland Group	3550'
Hordaland Group	5258'
Rogaland Group	9634'

Chalk Group	
Ekofisk Formation	10060
Tor Formation	10320'
Hod Formation	11282'
Plenus Marl Formation	12792'
Hidra Formation	12814'
Cromer Knoll Group	12967'
Tyne Group	13319'
Mandal Formation	
Unassigned	
Sequence A	13322'
Sand X	13436'
Sequence B	14006'
Sand Y	14425' to TD at 14792'

The names used for the unassigned sequence are for convenience and are based on lithostratigraphic divisions. They are not intended to imply any relationship or age for the undated units.

The abbreviations used in this report are listed in Appendix 1 and the analytical procedures and techniques used are listed in Appendix 2.

The principal contact with the client in the Phillips Petroleum Company Norway office in Stavanger has been Mr Rudi Kleiber.

The Robertson Group plc personnel involved in this study were as follows:

P.C. Barnard	:	Project co-ordination
S. Betts	:	Interpretation and report preparation
J. Milner, P.C. Barnard	:	Data collection
N. Owen	:	Supervisor, chemical analyses
S. Betts, J. Milner, S. Martin	:	Microscopy.

indicating that the main zone of oil generation starts at approximately 12800'. Some of the values in the lower part of the section are rather high in comparison to the vitrinite reflectance. In many of these samples the SCI data are based on a very small number of non-age diagnostic palynomorphs (often only one or two readings were obtained). In addition there has been some difficulty in identification of the indigenous vitrinite due to the presence of high maturity, high reflecting bitumen.

3.3 BURIAL HISTORY AND TTI MODELLING

A burial history curve was constructed for the base Cromer Knoll Group/Top Mandal Formation horizon (present day depth 13319'). It was not possible to model the horizons below this depth as their stratigraphic age has not yet been established. The burial curve is presented in Figure 11. A sharp increase in the rate of burial occurs during the Upper Cretaceous and Tertiary.

The geothermal gradient was constructed from temperature data supplied by the client. For the main hole, estimated bottom hole temperatures from the temperature log sent by the client were used. The method of derivation and nature of corrections applied to these values is not known. Two sets of bottom hole temperatures from the sidetrack were supplied. These have been corrected by the method used by Carstens and Finstad, 1981. The plotted temperatures show a geothermal gradient of 27°C per km in the upper parts of the well down to a depth of approximately 9450', with an increase in gradient below this to 49°C per km. The change in temperature gradient, if real and not an artifact of bottom hole temperature estimation, indicates that the present day overpressured zone is a much wider interval than that indicated by the break in SCI and vitrinite reflectance maturity profiles (12800'-13200' approximately). It may be that the zone indicated by the maturity profiles reflects a previous, narrower overpressured zone. Due to the uncertainties about the temperature data several gradients were used in modelling;

1. 27°C throughout the section
2. 27°C to 12800' and 49°C km below this
3. 27°C to 9450' and 49°C km below this

The temperature gradient in the zone of higher gradient is typical of values observed in overpressured zones, however, in order to model the sharp increase in maturity observed in the vitrinite reflectance and SCI data a much higher gradient within the overpressured zone would be required. Such a gradient cannot be accommodated, given the relatively low bottom hole temperature values below the overpressured zone.

Subsidence curves for the analysed well sections have been used, together with the corrected temperature gradients, to calculate theoretical maturity, using the method of Royden et al., (1980).

The basis of the maturity model used is that chemical reaction rates double for each 10°C increase in temperature. The following equation describes the thermal exposure, p, of a bed in passing from temperature A to B in 10°C increments:

> $p + \S(A,B)\ (t.\beta^{T/10})$ where § is the 'sum of', t is time spent in passing through a 10°C increment, ß is a constant, usually 2, T is temperature (°C).

Several correlations of p with Ro (vitrinite reflectivity) have been proposed, the preferred one being derived from the data of Goff (1983).

$$Ro + 0.0565 (P+250)^{0.21}$$

For each point plotted to give the subsidence curve, values are adopted for sea bottom temperature and temperature gradient so that the distribution of temperature with depth can be calculated. Times at which 10°C, 20°C, 30°C etc. are achieved are interpolated into these data and the time-temperature integrals summed. A history of change in maturity is then available for the selected horizon and may be compared with those measured in the well section.

Table 9 shows the results from modelling using gradient 3. This gradient produced the highest maturity at the base of the section of the three gradients modelled ; however, it still does not give a high enough calculated vitrinite reflectance. The most likely source of error seems to be the temperature gradient in this well. Geothermal data from the surrounding wells indicate a much higher average geothermal gradient, usually between 33° and 36°C per km. The low gradient, 27°C/km, seen in the upper part of the well may be due to the blanketing effect of the overpressured zone. This effect has also been observed in other wells in the vicinity.

3.4 DISCUSSION OF MATURITY RESULTS

Both SCI and vitrinite reflectance data show similar maturity profiles, with a low maturity gradient in the upper part of the section and a rapid increase in maturity below approximately 12800'. This maturity break may be attributed to the presence of overpressuring in the Cromer Knoll Group and lower part of the Chalk Group due to the sealing effect of the relatively unfractured chalk in the area of this well which is located on the eastern edge of the Grensen Nose. This model assumes firstly that the Chalk is acting as a seal and secondly, that there has been migration of fluids sourced in the thick Jurassic shales of the Feda Graben to the east. Similar overpressuring has been noted in other wells in this area and to the south in the Danish Central Graben, but these are normally associated with the presence of a thick sequence of Upper Jurassic shales. According to the available lithostratigraphic and biostratigraphic data there is no thick Jurassic shale section in 2/7-20X. The Mandal Formation is only 3' thick and is underlain by a sequence of claystone, siltstone and sandstone of, at present, indeterminate age. This well is known to be overpressured in the Lower Cretaceous, Jurassic and upper part of the unassigned sequence. This interpretation does not preclude the presence of a major unconformity within or near the top of the unassigned sequence as any maturity break associated with such an unconformity is likely to have been masked by the effects of the overpressuring. In addition, the lithologies present in the lower part of the well are unlikely to have been suitable for the preservation of organic matter at the time of deposition. Consequently it is very unlikely that any reliable organic maturity data can be derived from this interval.

4 SOURCE ROCK QUALITY

The results of source rock analyses are listed in Tables 2 to 6 and illustrated in Figures 2 to 5 and 9. The results are discussed below on a lithostratigraphic basis. The formation tops used have been taken from The Robertson Group plc report no. 6353/IIa.

4.1 TERTIARY

4.1.1 Nordland Group (top of analysed section to 5258')

The cuttings samples analysed consist predominantly of olive-grey, silty mudstone, with minor amounts of medium to light grey mudstone and coal. The bulk samples are moderately rich in organic carbon with TOC contents between 1.02% and 2.74%. Screening pyrolysis data (Table 5) show low S2 concentrations ranging from 620 to 6620 ppm. In general the samples show poor to fair hydrocarbon potential with the exception of the sample from 5170'-5230' which shows good potential. Visual kerogen analyses (Table 1) indicate a predominance of humic organic matter, often degraded amorphous material, indicating mainly gas source potential. The pyrolysis production indices are high considering the low maturity of the samples and may indicate minor hydrocarbon staining for example at 3670'-3730' where the production index is .22.

4.1.2 Hordaland Group (5258' to 9634')

All of the samples analysed are composited cuttings. The group can be divided into four sub-units on the basis of lithology;

Interval 5258' to 6010':
Samples in this section consist mainly of olive-grey mudstone, with minor amounts of coal and light olive-grey mudstone. The olive-grey mudstone is organically rich. A picked sample shows a TOC content of 5.63% (5290'-5350'). The light, olive-grey mudstone shows a lower value of 1.99%. Bulk samples show TOC values between 2.23% and 4.25%. Screening pyrolysis data show good to very good hydrocarbon source potential for the olive grey mudstone, however, the high production indices for these samples indicate the presence of migrant or contaminant hydrocarbons. Visual kerogen examination indicates a predominantly gas prone humic kerogen. Sapropelic kerogen is present in subordinate amounts, up to 25%, and the more organically rich samples may have minor oil source potential.

Interval 6010' to 7270':
This section consists of dusky, olive-grey mudstone and dusky, yellow-brown mudstone, with minor amounts of light grey mudstone. Where picked samples have been analysed the yellow-browm mudstone shows rich TOC values; 4.38% to 5.42%. Bulk samples over this section contain 1.93% to 4.25% organic carbon. The yellow-brown mudstone shows good hydrocarbon source potential on the basis of the screening pyrolysis and the olive-grey mudstone has fair to good potential. Visual kerogen analyses indicate a mixed humic and sapropelic kerogen, with up to 35% amorphous sapropel. At higher levels of maturity this unit would be a fair to good quality oil source.

Interval 7270' to 8110':
This section is dominated by olive-grey mudstone with the TOC contents of the bulk samples ranging from 1.33% to 2.62%. Many of the samples contain minor amounts of bitumen. Inspection of the mud log over this interval shows the use of 'soltex' (asphaltic additive) and the 'bitumen' reported in these samples is suspected to be an additive. Screening pyrolysis S2 yields indicate fair to good hydrocarbon source potential. This potential is for gas on the basis of the visual kerogen examination which shows a predominantly humic kerogen.

Interval 8110' to 9634':
The lowest unit of the Hordaland Group consists of light olive-grey mudstone with minor amounts of chalk, 'bitumen' (as above) and brown-grey mudstone. The TOC content of the bulk samples ranges between 0.75% and 2.19%. Pyrolysis data indicate poor to fair hydrocarbon source potential, decreasing towards the base of the section. Production indices indicate minor oil staining. Visual kerogen examination shows a predominance of gas prone humic organic matter.

In the vicinity of 2/7-20X source rocks of the Hordaland Group sediments are unlikely to have generated any significant quantities of hydrocarbons as they are immature with respect to oil and gas generation.

4.1.3 Rogaland Group (9634' to 10060')

The samples analysed are all cuttings. They consist of light, olive-grey mudstone with minor amounts of chalk and brown-grey mudstone. The TOC contents are relatively low, 0.90% to 1.15%. Screening pyrolysis data show low S2 concentrations, indicating poor hydrocarbon source potential. Visual kerogen examination shows a dominance of gas prone humic organic matter. The pyrolysis production indices suggest the presence of minor oil staining.

4.2 CRETACEOUS

4.2.1 Chalk Group (10060' to 12967')

Several types of samples from the Chalk Group have been analysed. Most of the samples are composited cuttings from the sidetrack (samples 10090'-10120' to 12910'-12960'). These were received wet and, from the presence of an oily residue on the top of the samples, are thought to be contaminated with oil-based drilling mud. No mud log from the sidetrack was available at the time of analysis to check this. Three sidewall cores, 12715', 12795' and 12832', also from the sidetrack were analysed. In addition, 7 core chips from between 10075' and 10104' from the Ekofisk Formation in the original hole have been analysed.

The dominant lithologies in the Ekofisk, Tor and Hod Formations are limestone and chalk, with low organic content; 0.15% to 1.25% TOC, and no significant hydrocarbon source potential. Some higher TOC values were recorded in some of the samples due to the presence of caved, more organically rich Tertiary mudstones. Samples from the Plenus Marl (12792' to 12814') and Hidra Formation (12814' to 12967') consist predominantly of light grey, calcareous claystone, with TOC contents between 0.45% and 0.55% (after extraction). They are unlikely to show any significant hydrocarbon source potential.

The emphasis of the analyses on Chalk Group samples has been on the identification of migrant hydrocarbons. The 7 Ekofisk core samples were extracted with dichloromethane. Extract concentrations range from 140 ppm to 10725 ppm with the greatest abundance in the sample from 10104'. These abundances suggest the presence of moderate amounts of migrant hydrocarbons. The extracts consist predominantly of hydrocarbons; 83% to 91%, of which alkanes form 72% to 76%. The composition of these migrant hydrocarbons is discussed in Section 5 of this report.

The gasoline hydrocarbon content of the core samples was also analysed. The total abundances of gasoline range hydrocarbons are fairly low, ranging from 675 to 13130 ppb (Table 3). The highest concentrations are from the two upper samples (10075' and 10081') of which only the sample from 10075' showed visible signs of hydrocarbon staining. The gasoline abundance data and compositional ratios (Tables 3 and 4, Figure 4) show considerable variation which is surprising considering the close spacing of the samples and likely common source of the migrant hydrocarbons. It is suspected that, due to the method of sample storage and small size of the core chips, differential evaporation of the light hydrocarbons has produced the observed range of compositional ratios, although no direct correlation of ratio values to abundance is seen. As there is visual evidence of patchy hydrocarbon staining in most of these core samples, higher gasoline abundances might have been expected.

Cuttings samples from the Hod Formation (11282' to 12792') have been analysed for airspace gas (Table 2, samples 12370' to 12720'). The upper two samples show high, light hydrocarbon concentrations; up to 45770 ppm. This gas is very wet with only 22.9-27.8% C_1 and may indicate the presence of mature migrant hydrocarbons in the upper part of the Hod Formation. The $\underline{i}$-C_4/$\underline{n}$-C_4 ratios also indicate the presence of mature hydrocarbons. Screening pyrolysis data for cuttings samples from the Hod Formation (Table 5) show a relatively high proportion of S1 hydrocarbons which may indicate the presence of either migrant or contaminant (from mud) hydrocarbons.

4.2.2 Cromer Knoll Group (12967' to 13319')

The samples consist mainly of composited cuttings plus 2 sidewall cores from 13130' to 13165'; all samples are from the sidetrack.

All TOC data used in this section refer to the samples after extraction as they appear to be contaminated by oil based mud. The dominant lithology in these samples is a medium-dark grey, calcareous mudstone, with caved Chalk Group lithologies and minor amounts of light grey, calcareous mudstone. The extracted bulk samples show TOC contents between 0.51 and 0.97%. Screening pyrolysis data indicate poor to fair hydrocarbon source potential. Visual kerogen analyses show a predominance of gas prone humic organic matter, indicating the Cromer Knoll Group samples have marginal gas source potential. Pyrolysis gas chromatography data (Figures 9.1 and 9.2) confirm the presence of a hydrogen poor kerogen. The pyrograms are dominated by aromatic and naphthenic compounds and show a low overall concentration of pyrolysate.

Airspace gas analysis (samples 13000' to 13280') shows low, light hydrocarbon abundances; 60 to 2150 ppm. The gas is relatively dry in composition compared to that from the Hod Formation, with 77.6% to 87.4% C_1 (except the sample from 13120' which shows only 44.3% C_1). ISO $\underline{i}$-C_4/$\underline{n}$-C_4 ratios show that these hydrocarbons are mature, however, the low total abundance indicates that significant amounts of migrant light hydrocarbons are absent.

4.3 JURASSIC

4.3.1 Tyne Group (identified 13319' to 13322')

In 2/7-20X the Tyne Group comprises only the Mandal Formation (13319' to 13322'). It is of very limited thickness. One cuttings sample covers this interval, 13320'-13330'. The Mandal Formation is believed to be represented by the dark grey calcareous mudstone (30% of the sample). The extracted bulk sample shows a TOC content of 1.57%. The picked shale shows a much higher organic content, 5.09% TOC (after solvent extraction to remove contaminants). Screening pyrolysis indicates fair hydrocarbon source potential, however, this may not be representative of the Mandal Formation due to the very limited thickness of the formation and poor sample quality. No visual kerogen data are available for this sample. Pyrolysis - gas chromatography indicates a hydrogen poor kerogen. The pyrogram (Figure 9.3) is dominated by naphthenic and aromatic compounds. These data are not typical of the Mandal Formation 'hot' shale (this horizon is marked by a sharp spike on the gamma ray log) but this may, in part, be due to poor sample quality and to the high level of thermal maturity.

4.4 UNASSIGNED SECTION

This section consists of 4 lithological units; a mixed claystone, mudstone and sandstone unit (13322' to 13436') referred to in this report as Sequence A, a sand unit (13436' to 14006') referred to as Sand X, a mudstone unit (14006' to 14425') referred to as Sequence B and a lower sand unit (14425' to TD-14792') referred to as Sand Y. The age of these units has not been established. They are described separately in this report for lithological reasons and it is not the intention of this report to imply anything about their chronostratigraphic relationship. The age of the whole unassigned sequence (13322' to 14792') is still under review.

4.4.1 Sequence A (13322' to 13436')

The samples analysed consist mainly of cuttings drilled with oil based mud. These samples show mixed lithologies; grey-black claystone, light grey, calcareous mudstone and sandstone, becoming more arenaceous towards the base of the section. Extracted bulk samples show organic contents ranging from 0.58% to 1.11% TOC. Four sidewall cores 13349', 13370', 13395' and 13430' were also analysed (maturity and visual kerogen only). The visual kerogen analyses on samples from 13370' and 13450' show a predominance of gas prone humic organic matter. No TOC or pyrolysis data from the sidewall cores were available but those from the cuttings samples over the same interval indicate no hydrocarbon source potential. The airspace gas content of samples from this section is relatively low; abundances range from 670 to 6490 ppm. The gas is fairly wet, with 26% to 34% C_2-C_4 hydrocarbons. This may indicate either the presence of minor amounts of mature migrant hydrocarbons or reflect oil base mud contamination.

Pyrolysis gas chromatography was carried out on a cuttings sample from 13340'-13350' and a sidewall core from 13349'. The pyrograms (Figures 9.4 and 9.5) show a very low pyrolysate yield and a predominance of aromatic unidentified naphthenic compounds. This is consistent with the poor gas source potential observed from the visual kerogen and screening pyrolysis data.

4.4.2 Sand X (13436' to 14006')

The samples analysed consist of cuttings (drilled with oil base mud) and 8 sidewall cores. The unit shows no significant hydrocarbon source potential. The relatively high TOC contents recorded for the bulk samples reflect the presence of caved mudstones. The presence of oil staining is noted throughout the section. Airspace gas data for this section show relatively low abundances of light hydrocarbons, 990 to 5250 ppm. The gas shows considerable variation in wetness; C_2-C_4 ranges from 10.9% to 49.9%, with the greatest wetness recorded in the upper part of the unit. The $\underline{i}$-C_4/$\underline{n}$-C_4 ratios indicate that the hydrocarbons are mature. Six sidewall cores (13480', 13545', 13634', 13705', 13753', and 13985') have been extracted and the samples show high extract yields (36255 to 55490 ppm), indicating the presence of migrant or contaminant hydrocarbons. The extract composition data also suggest the presence of migrant hydrocarbons or a contaminant. Gas chromatography was carried out on these extracts and the results are discussed in detail in Section 5.

4.4.3 Sequence B (14006' to 14425')

The samples analysed are cuttings. They consist of varicoloured mudstones; predominantly a light to medium grey, calcareous mudstone, but occasionally a yellow-brown mudstone and pale or dark red-brown mudstone. Picked, extracted samples of the light to medium dark grey mudstone show low organic carbon contents; 0.46 to 0.56% TOC. The yellow-brown mudstone sample at 14040'-14070' shows a high TOC content; 8.8%. Although the pyrolysis data for this sample show very high S1 and S2 concentrations some form of contamination is suspected because the visual kerogen analysis indicates a predominantly inertinitic kerogen with a very high proportion (90%) of some form of highly fluorescent hydrocarbon residue or additive. Screening pyrolysis data for the rest of the mudstone samples indicate very poor hydrocarbon source potential. The high production index may be partly a function of the low S2 pyrolysate concentration, but may also reflect contamination by oil based mud. Pyrolysis gas chromatography data (Figures 9.6 and 9.7) on two extracted composite samples; 14000'-14010' and 14040'-14070' show a predominance of aromatic and naphthenic compounds, indicating the presence of a hydrogen poor kerogen.

4.4.4 Sand Y (14425' to TD at 14792')

The samples from this section consist of cuttings samples (drilled with oil based mud) and 10 core samples between 14444' and 14792'TD. The composited cuttings samples consist of sand, with minor amounts of caved mudstone. The TOC content of the extracted bulk samples seems rather high; 0.75% to 3.63%, considering that the caved lithologies are organically poor and therefore, the presence of small amounts of bitumen in these samples is suspected.

The core samples consist of fractured sandstone and small amounts of claystone. Visual inspection of the core samples showed the presence of fractures, often infilled with bitumen, carbonaceous/bituminous laminae and occasional patchy bitumen or heavy oil staining e.g. sample at 14744'. Bitumen, infilling fractures, is only noted below 14700'. Seven of the core samples have been extracted and gave low concentrations, ranging from 280 ppm to 1865 ppm. The extract abundance is high with respect to the low TOC content (EPOC Table 6) and may indicate the presence of migrant hydrocarbons or be derived from the bitumen present (although the latter is unlikely as the bitumen is a highly mature pyrobitumen which would not yield significant extract). These extracts were also analysed by gas chromatography and gas chromatography-mass spectrometry, the results of which are discussed in Section 5.

This unit is not considered to have any hydrocarbon source potential, but appears to contain at least two phases of migrant hydrocarbons, the possible origins of which are discussed in Section 5.

5 HYDROCARBONS

Samples from the lower Tertiary Nordland/Hordaland Group, Cretaceous Ekofisk Formation, Unassigned Sequence A, Sand X and Sand Y have been extracted. The results of extraction were discussed in Section 4. This section contains a discussion of the results of gas chromatography and gas chromatography - mass spectrometry analyses on selected extracts.

5.1 GAS CHROMATOGRAPHY

5.1.1 Nordland/Hordaland Groups

Two samples 5230'-5290' and 5770'-5830' have been extracted (Table 6). The upper sample (base Nordland/top Hordaland Group) shows a rich abundance of extracted hydrocarbons. The very high percentage of hydrocarbons in relation to organic carbon indicates the presence of migrant hydrocarbons. The alkane fraction gas chromatogram (Figure 7.1) shows a predominance of $\underline{n}$-C_{12} to $\underline{n}$-C_{19} alkanes, and naphthenic compounds superimposed on an envelope of unresolved material. These samples appear to contain migrant light hydrocarbons and also biodegraded ?residual hydrocarbons.

The gas chromatogram of the deeper sample (Figure 7.2) shows a similar alkane distribution, but with a greater abundance of isoprenoids and naphthenic compounds.

5.1.2 Ekofisk Formation

Seven samples from the Ekofisk Formation have been extracted as discussed in Section 4. Most of the samples show visible signs of patchy oil staining.

Whole extract chromatograms (Figures 6.1 to 6.7) show a relatively smooth alkane envelope (with the exception of the sample from 10075'). The alkane gas chromatograms (Figures 7.3 to 7.9) are similar except for the sample from 10075'. They show a relatively smooth alkane envelope and are dominated by alkanes in the range $\underline{n}$-C_{18}-$\underline{n}$-C_{23}. They also show odd dominance, especially of the $\underline{n}$-C_{21} and $\underline{n}$-C_{23} alkanes. The Pr/Ph ratios are between 0.92 and 1.06, indicating a moderately reducing source environment. The sample from 10075' shows a higher Pr/Ph ratio (1.55) and shows a bimodal alkane distribution, with maxima at $\underline{n}$-C_{16} and $\underline{n}$-C_{21}. It appears to contain a light migrant hydrocarbon component not seen in the other samples. Pristane and the C_{16} isoprenoid are also prominent in this sample and may indicate some degree of mild biodegradation in the light component. In the rest of the samples Pr/$\underline{n}$-C_{17} and Ph/$\underline{n}$-C_{18} are relatively low, indicating that the migrant hydrocarbons are mature. No further analyses have been carried out on these samples, however, the gas chromatograms are similar to those published from reservoired oils in the neighbouring Ekofisk and Eldfisk fields and presumably have a similar Upper Jurassic source.

5.1.3 Sequence A

Two sidewall cores from 13349' and 13395' from Sequence A of the unassigned unit have been extracted with dichloromethane and both show relatively abundant extract (see Section 4). The alkane gas chromatograms (Figures 7.10 to 7.13) show the presence of contaminant light hydrocarbons (cuttings samples from this interval were seen to be heavily contaminated by oil based mud). The contaminant hydrocarbons are characterised by a narrow range of alkanes C_{12}-C_{18} which occur along with naphthenic and unresolved compounds in the same molecular weight range. The samples also show the presence of a smooth envelope of higher molecular weight alkanes. These are shown enhanced in Figures 7.11 to 7.13. These appear to represent mature migrant hydrocarbons. Both samples show very similar enhanced alkane distributions. Pr/Ph ratios are 1.4 and 1.3 for the upper and lower samples respectively (higher than is seen in the Ekofisk core samples). The Pr/$\underline{n}$-C_{17} and Ph/$\underline{n}$-C_{18} are low, indicating that the hydrocarbons are mature.

A sample of the oil based mud used in the sidetrack was also supplied for analysis. The alkane gas chromatograms can be seen in Figures 7.30 and 7.31 (enhanced). It is not known whether the mud sample represents circulated or unused mud. It shows an almost identical gas chromatogram to the two sequence A extracts, including the presence of higher molecular weight alkanes which were presumably picked up from the formation during circulation.

5.1.4 Sand X

Six samples from the upper unassigned sand unit have been analysed 13480', 13545', 13634', 13705', 13753' and 13985'. Visual observation of sidewall cores and cuttings in this interval has shown them to be oil stained.

The alkane gas chromatograms for samples 13480', 13545', 13634' and 13705' (Figures 7.14 to 7.25) are very similar to that from Sequence A (13349'). They show a predominance of contaminant, oil based mud derived, low molecular weight alkanes. They also show a similar distribution of higher molecular weight alkanes ($\underline{n}$-C_{16+}). Pr/Ph ratios are between 1.3 and 1.4, Pr/$\underline{n}$-C_{17} values are all 0.6 and Ph/$\underline{n}$-C_{18} between 0.5 and 0.6.

The sample from 13753' shows a greater abundance of migrant hydrocarbons, but still contains significant amounts of contaminant. The bottom sample, 13985', is dominated by migrant hydrocarbons. The chromatogram shows a smooth alkane envelope with a maximum at $\underline{n}$-C_{19}. The Pr/Ph ratio is 1.2 and Pr/$\underline{n}$-C_{17}:0.6. The low CPI also indicates that the hydrocarbons are mature. As these values from the uncontaminated sample are almost identical to those from the rest of the sidewall cores analysed in Sand X and Sequence A it appears likely that the migrant hydrocarbon component in all of these extracts is from the same source.

5.1.5 Sand Y

Seven samples were extracted from core samples from the lower unassigned sand unit. Four of the extracts were analysed by gas chromatography 14468', 14744', 14767' and 14773' (Figures 7.26 to 7.29). The upper sample 14468' shows a smooth alkane envelope with a maximum at $\underline{n}$-C_{21}. The Pr/Ph ratio is 1.03. Pr/$\underline{n}$-C_{17} and Ph/$\underline{n}$-C_{18} ratios are relatively low; 0.81 to 0.71 respectively and indicate that the hydrocarbons are mature. This sample is very similar to that from the lower part of Sand X (13985') apart from a minor difference in Pr/Ph ratio, and is likely to have the same source. The chromatograms from 14744' and 14767' (Figures 7.27 to 7.28) are very similar. In addition to the hydrocarbon distribution seen in 14468' these also show the presence of a light hydrocarbon component in the $\underline{n}$-C_{14} - $\underline{n}$-C_{15} range. The bottom sample, 14773', also contains the same migrant hydrocarbon as 14468', but shows a more prominent Pr peak (Pr/Ph 1.50).

On the basis of visual observation and gas chromatography data there appear to be at least three phases of hydrocarbons present in Sand Y; a mature live oil (minor amounts), a light hydrocarbon component and, seen in hand specimens, a heavy bitumen, infilling fractures.

5.2 GAS CHROMATOGRAPHY - MASS SPECTROMETRY

Extracts from three samples from Sand X, 13480', 13753' and 13985' (SWC's) and three samples from Sand Y, 14468', 14767' and 14773' (cores) have been further analysed by gas chromatography - mass spectrometry. Mass fragmentograms for m/e 191, 217, 218, 231 and 259 can be found in Figures 8.1.1 to 8.6.2. Tabulated compositional ratios can be found in Table 8.

5.2.1 Maturity

The biomarker ratios show rather contradictory maturity values. For Sand X 18α(H) trisnorneohopane/17α(H) trisnorhopane ratios (Ratio 1) indicate a moderately mature source. In Sand Y the values show a greater range 1.07 to 2.33). This may be due to variations in maturity levels of the source rocks from which these migrant hydrocarbons were generated.

The C_{31} homohopane ratio (ratio 3) reaches an equilibrium value of 1.4 to 1.6 at early maturity. From the data available it does not appear to have reached this value in any of the samples analysed, which indicates that either the ratio has been altered by coelution or that the samples are of relatively low maturity. A more reliable maturity parameter is the percentage composition of the C_{29} sterane 20S isomer (ratio 4). This reaches a maximum of approximately 60% at peak oil window maturity. Sand X extracts show values between 43% and 50%, indicating a middle mature source. Lower values are recorded in Sand Y; 33% to 37%, indicating an early to middle mature source. This would indicate that the main contribution to the biomarker content of the Sand Y extracts is not from the mature bitumen fracture fill as this shows measured reflectances of up to 1.29% (equivalent to about 0.8 to 0.9% Ro vitrinite) and would be expected to show higher percentages of C_{29} 20S steranes. The ratio of $\alpha\beta\beta$ C_{29} steranes/ $\alpha\beta\beta$ plus $\alpha\alpha\alpha$ C_{29} steranes also indicates that the migrant hydrocarbons present are middle mature. This ratio reaches an equilibrium of approximately 63% at late oil window maturity. Values for the samples analysed range between 30.1% and 51.6%.

Both Sand X and Sand Y show a greater abundance of tricyclic than pentacyclic terpanes, especially in the Sand X extracts. Such a predominance is normally associated with biodegradation or with high levels of maturity.

Extracts from both Sand X and Sand Y show the presence of C_{28} and the C_{29} demethylated hopanes. These are normally associated with severe biodegradation. These compounds appear in relatively small concentrations compared to the regular pentacyclic triterpanes and appear to represent either biodegraded migrant hydrocarbons or a biodegraded phase picked up during migration by the migrant live oil.

5.2.2 Source

Hopane/sterane ratio (ratio 6) values under 2.0 are normally associated with a marine algal sapropelic source. Values for the analysed samples range from 0.57 to 1.2, all indicating a predominantly algal sapropelic source for the

Sand X and Sand Y extracts. The percentage compositions of C_{27}, C_{28}, C_{29} $5\alpha(H)14\alpha(H)17\alpha(H)$ 20R steranes show a predominance of C_{27} 20R steranes. The compositions are plotted in Figure 10. With the exception of the extract from 13480' (Sand X) the samples plot in one group, indicating the same or very similar source rock type. The sample from 13480' shows a greater abundance of C_{27} steranes than the rest. This probably indicates source rock facies variation rather than a separate source. The composition of a typical Ekofisk oil with a known Upper Jurassic source has also been plotted (Point 7) for comparison. The live oil components of the migrant hydrocarbons in both sands appear to have a similar source to each other and to the Ekofisk oil, probably derived from the Mandal/Farsund Formation which is known to be mature to the east in the Feda Graben.

On the basis of the available data it appears that Sand X contains two phases of hydrocarbons; 1) a migrant live oil from a middle mature, predominantly marine algal sapropelic source, probably Upper Jurassic shales in the Feda Graben, and 2) a severely biodegraded component rich in tricyclic terpanes and containing C_{28} and C_{29} demethylated hopanes, possibly also of higher maturity.

Sand Y appears to contain at least three phases: both of the above, albeit in lower concentrations than in Sand X, plus a late mature bitumen. It is possible that the bitumen has supplied some of the demethylated hopanes and tricyclic terpanes in the extract, however, these also appear in greater concentrations in Sand X where no bitumen was recorded and from this it appears that the bitumen is not making a major contribution to the biomarker content of the Sand Y extracts. From the gas chromatography data, a fourth phase of low molecular weight hydrocarbons is also believed to be present. This phase may represent migrant or contaminant hydrocarbons.

6 CONCLUSION

From the foregoing report the following conclusions concerning 2/7-20X and its sidetrack have been made:

1. On the basis of the interpreted SCI and vitrinite reflectance data the analysed section is immature to a depth of approximately 9200m and early mature below this to 12850m. The section is middle mature with respect to oil generation below approximately 12800', and late mature below 13200'. Both the SCI and vitrinite reflectance data show a marked break in maturity profile at approximately 12800' to 13000'. This has been attributed to the development of overpressuring in the section underlying the Chalk Group.

2. No mature source rocks with significant oil or gas potential are present in this well. The source potential of the lithostratigraphic units analysed is summarised below:

a) TERTIARY

Nordland Group (3550' to 5258') these sediments show poor to fair gas source potential.

Hordaland Group (5258' to 9634')
5258'-6010'. This unit contains a mixed humic and sapropelic kerogen with good to very good hydrocarbon source potential. It is predominantly a gas source, but also shows minor oil source potential. It is immature for hydrocarbon generation.

6010' to 7270' - this unit shows fair to good oil source potential, but is immature for hydrocarbon generation.

7270' to 8110' - this unit shows fair to good gas source potential.

8110' to 9634' - this unit shows only poor gas source potential.

b) CRETACEOUS

Rogaland Group (9634' to 10060') - these sediments show poor gas source potential.

Chalk Group (10060' to 12967') - these sediments show no significant oil or gas source potential.

Cromer Knoll Group (12967' to 13319') - this unit shows poor to fair gas source potential, but is immature for gas generation.

c) JURASSIC

Tyne Group/Mandal Formation (13319' to 13322') - this unit appears to contain a humic and inertinitic, hydrogen poor kerogen, with poor gas source potential. It is not typical of the Mandal 'hot shale' seen elsewhere in this area.

d) UNASSIGNED

Sequence A (13322' to 13436') - this unit contains a hydrogen poor, humic kerogen, with poor gas source potential.

Sand X (13436' to 14006') - no hydrocarbon source potential.

Sequence B (14006' to 14425') - this unit also contains a humic, inertinitic kerogen, with poor gas source potential.

Sand Y (14425' to 14792'TD) - no hydrocarbon source potential.

3. Many of the samples analysed showed evidence of varying degrees of hydrocarbon staining which can be summarised as follows:

Nordland Group/Hordaland Group - 2 cuttings samples, 5230'-5290' and 5770'-5830' analysed, show hydrocarbon staining by migrant or contaminant light hydrocarbons, plus a trace of biodegraded hydrocarbons. Evidence of varying degrees of staining by migrant or contaminant hydrocarbons is seen in the pyrolysis data.

Ekofisk Formation - 7 core samples (10075' to 10104') show visible evidence of patchy hydrocarbon staining. Extraction, fractionation and gas chromatography data indicate the presence of moderate amounts of mature migrant hydrocarbons. The gas chromatograms give similar results.

Hod Formation - Airspace gas data indicate the presence of migrant mature hydrocarbons in the upper part of the Hod Formation.

Sequence A - The two sidewall core samples extracted show evidence of severe oil based mud contamination. They also appear to contain mature migrant hydrocarbons.

Sand X - All of the samples show visible signs of oil staining. Extraction, fractionation and gas chromatography show the same contamination as is seen in the SWC's from Sequence A. Gas chromatography - mass spectrometry biomarker ratios indicate the presence of a middle mature migrant oil which also contains minor amounts of a severely biodegraded component. Biomarker ratios indicate that the live oil has a predominantly marine, algal, sapropelic source and is similar to reservoired oils from an Upper Jurassic source in neighbouring fields. The biodegraded component may either represent a separate migration phase or have been picked up by the live oil during migration.

Sand Y - This unit appears to contain at least three phases of migrant hydrocarbons. It contains the same live oil and biodegraded component as seen in Sand X, but in much lower concentrations. It is also seen, in hand specimens, to contain bitumen, infilling fractures. From the reflectance data this bitumen is known to be highly mature and because the biomarker ratios for the sandy extracts indicate predominantly middle mature hydrocarbons the bitumen is not believed to have made a large contribution to the biomarker content of the extract. The bitumen reflectance data indicate a similar level of maturity to that of the indigenous vitrinite in Sand Y, implying relatively early emplacement and a subsequent common maturation history. The bitumen appears to reflect an early phase of hydrocarbon migration, probably with a different source to that of the middle mature live oil seen in both sand units. In order to comment on the possible source of the bitumen an isolated sample would be required. Insufficient material was available to carry this out for this study. A possible fourth light hydrocarbon phase is present in Sand Y. This may represent either migrant or contaminant light hydrocarbons.

7 REFERENCES

CARSTENS, H. and FINSTAD, K.G., 1981. Geothermal gradients in the northern North Sea Basin, 59°-62°N. In Illing, L.V. and Hobson, G.D. (eds.), Petroleum geology of the continental shelf of Northwest Europe. Proc. 2nd Conf., Inst. Pet., Heyden & Son Ltd., London, p. 152-161.

GOFF, J.C., 1983. Hydrocarbon generation and migration from Jurassic source rocks in the East Shetland Basin and Viking Graben of the Northern North Sea. J. Geol. Soc. v. 140, p. 445-475.

HUGHES, W.B., HOLBA, A.G., MILLER, D.E. and RICHARDSON, J.S., 1985. Geochemistry of the Greater Ekofisk crude oils. In Thomas, B.M. *et al.* (eds.), Petroleum geochemistry in exploration of the Norwegian Shelf. Graham and Trotman, London, p. 75-92.

ROYDEN, L., SCLATER, J.R. and VAN HERZEN, R.P., 1980. Continental margin subsidence and heat flow: important parameters in formation of petroleum hydrocarbons. Bull. Am. Assoc. Pet. Geol., v. 64, no. 2, p. 173-187.

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			MATURITY DATA		KEROGEN COMPOSITION DATA						
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	SPORE COLOUR INDEX	VITR. REFL. R oil av %	% (Visual, from microscopy) INERTINITE	VITRINITE	SAPROPEL	% (Calculated) INERT	VIT	ALG SAP	WXY SAP
3550-610	Ctgs	MDST, ol-gy+ 30% MDST, med gy, sndy+ 10% LST, pnk-gy+ tr pyr	2.5 4.0-4.5 R	.24(18) .14(1)L .47(10)R .78(4)R	20?	60?	20?				
3850-910	Ctgs	MDST, ol-gy, slty	2.5 4.0-4.5 R	.29(43) .19(1)L .45(11)R	20?	70?	10?				
4150-210	Ctgs	MDST, ol-gy, slty+ mnr LST, yel-gy	2.5 4.0-4.5 R	.24(45) .40(5)R	10	70	20				
4450-510	Ctgs	MDST, ol-gy, slty+ tr LST, yel-gy+ tr MDST, med-lt gy	2.5-3.0	.29(35) .16(3)L .44(2)R	10	70	20				
4750-810	Ctgs	MDST, ol-gy, slty	2.5 4.0-4.5 R	.25(10) .43(1)R	10	60	30				
5050-110	Ctgs	MDST, lt ol-gy, calc + 30% MDST, ol-gy+ tr COAL	2.5 4.0-4.5 R	.25(6)	5	70	25				
5350-410	Ctgs	MDST, ol-gy+ mnr SND + tr COAL	2.5 4.0-4.5 R	.28(27) .48(4)R	5	70	25				
5650-710	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy+ tr SND+ tr MDST, brn-blk	2.5-3.0 4.0-4.5 R	.30(18) .14(1)L .42(1)R	5	70	25				
5950-6010	Ctgs	MDST, ol-gy+ mnr MDST, lt ol-gy+ mnr LST, yel-gy	2.5-3.0 4.5 R	.29(19) .48(2)R	5	70	25				
6250-310	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ 10% MDST, lt ol-gy+ tr LST, yel-gy	2.5-3.0 4.5 R	.33(19)	5	65	30				
6550-610	Ctgs	MDST, dsk yel-brn+ 20% MDST, ol-gy+ tr LST, yel-gy	3.0 5.0 R	.36(24) .23(1)L .51(2)R	10	65	25				
6850-910	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, lt ol-gy	3.0 4.5-5.0 R	.36(44) .23(2)L .50(9)R	10	55	35				
7150-210	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ tr LST, yel-gy	3.0 4.5-5.0 R	.35(29) .21(3)C .50(4)R	10	70	20				
7450-510	Ctgs	MDST, ol-gy+ mnr LST yel-gy+ tr BIT	3.0 4.5-5.0 R	.39(15) .25(11)L .54(3)R	5	65	30				
7750-810	Ctgs	MDST, ol-gy+ 10% LST yel-gy+ tr BIT	3.5 4.5 R	.34(33) .24(2)C .46(1)R	10	70	20				
8050-110	Ctgs	MDST, ol-gy+ 20% LST yel-gy+ tr BIT	3.5 4.5 R	.33(8) .23(15)L .54(7)R	10	65	25				

MATURITY AND KEROGEN COMPOSITION DATA

TABLE : 1A

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			MATURITY DATA		KEROGEN COMPOSITION DATA						
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	SPORE COLOUR INDEX	VITR. REFL. R oil av %	% (Visual, from microscopy) INERTINITE	VITRINITE	SAPROPEL	% (Calculated) INERT	VIT	ALG SAP	WXY SAP
8350-380	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK+ tr LCM	3.0-3.5 4.5-5.0 R	.37(3) .30(8)L .59(2)R	5	75	20				
8650-680	Ctgs	MDST, lt ol-gy+ tr CHK+ tr BIT	3.5 4.5-5.0 R	.31(1) .52(3)R	5	75	20				
8950-980	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr BIT	3.5 4.5-5.0 R	.34(24) .25(20)L .44(11)R	5	75	20				
9250-280	Ctgs	MDST, lt ol-gy+ mnr CHK+ tr BIT	3.5 4.5-5.0 R	.36(19) .25(3)L .55(5)R	5	75	20				
9550-580	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr BIT	3.5-4.0 5.0 R	.40(23) .26(2)L .53(29)R	5	65	30				
9850-880	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy	3.5-4.0 5.0 R	.38(26) .28(3)L .54(13)R	5	75	20				
10150-180	Ctgs	CHK+ 20% MDST, lt ol-gy+ 10% MDST, dk gn-gy+ mnr MDST, brn-gy	3.5-4.0 5.0 R	.40(11) .32(3)L .53(8)R	10	60	30				
11350-380	Ctgs	CHK+ 30% MDST, gn-gy + tr MDST, brn-gy	4.0	.44(10) .63(1)R	10	65	25				
11590-620	Ctgs	CHK+ 10% MDST, gn-gy	4.0 5.5-6.0 R	.43(7) .29(2)L .68(2)R	10	60	30				
11830-860	Ctgs	CHK+ mnr MDST, gn-gy	3.5-4.0 5.5 R		5	60	35				
12070-100	Ctgs	CHK+ 10% MDST, gn-gy	4.0 2.5-3.0 C	.37(41)	10	65	25				
12310	Ctgs	CHK+ 10% MDST, gn-gy + tr MDST, brn-gy	4.0 5.0 R	.43(4) .32(11)L .57(2)R .73(1)R	15	65	20				
12610-640	Ctgs	CHK+ 20% LST, med gy	4.0-4.5	-	15	75	10				
12715.0	Swc	LST, lt gy	*	*	*	*	*				
12795.0	Swc	CLYST, med-dk gy	7.0 ?	.49(9) .91(4)R	10?	40?	50?				
12832.0	Swc	CLYST, lt gy, calc+ tr LST, lt gy	7.0	.50(5) .29(2)L .80(8)R	20?	40?	40?				
12910-960	Ctgs	LST, v lt gy+ mnr MDST, dk gy, calc	7.0 ? 4.5 ?	.67(2) .93(4)R 1.30(9)R	20?	65?	15?				
13100-110	Ctgs	MDST, med-dk gy, calc+ 20% LST, v lt gy	7.0 ?	.83(1) 1.32(9)R	20?	70?	10?				
13130.0	Swc	LST, med-dk gy, arg	7.5	*	20	70	10				

MATURITY AND KEROGEN COMPOSITION DATA

TABLE : 1B

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2   LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			MATURITY DATA		KEROGEN COMPOSITION DATA						
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	SPORE COLOUR INDEX	VITR. REFL. R oil av %	% (Visual, from microscopy)			% (Calculated)			
					INERTINITE	VITRINITE	SAPROPEL	INERT	VIT	ALG SAP	WXY SAP
13165.0	Swc	CLYST, med-dk gy	*	.78(2) .46(13)L	20	60	20				
13300-310	Ctgs	MDST, v lt gy, calc + mnr MDST, dk gy, calc	7.0-7.5	.68(21) .89(12)R 1.28(5)R	5?	90?	5?				
13370.0	Swc	CLYST, med-lt gy, sndy	8.0 ?	1.03(2)R	30?	60?	10?				
13430.0	Swc	CLYST, med-lt gy, slty	*	.74(12)L	20?	60?	20?				
13500-510	Ctgs	SND, OS	7.5 ?	.73(2) .48(6)L 1.01(8)R 1.25(3)R	25?	65?	10?				
13657.0	Swc	SST, lt brn-gy, arg	*	*	20?	60?	20?				
13700-710	Ctgs	SND, OS+ mnr mic	*	.62(1) .95(8)R 1.76(8)R	25?	70?	5?				
13838.0	Swc	SST, lt brn-gy, arg	*	.74(3) .41(4)L .90(1)R 1.38(7)R	*	*	*				
13900-910	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	7.5	1.26(4)R	10	90	*				
14040-070	Ctgs	MDST, med yel-brn, calc+ 20% MDST, lt gy, calc+ mnr mic + mnr MDST, pal red-brn, calc	*	.73(2) .95(7)R 1.26(23)R	100	Mnr	Mnr				
14200-230	Ctgs	MDST, lt gy, calc+ mnr SND+ tr MDST, pal red-brn, calc+ tr LCM	*	.77(3) .88(4)R 1.09(10)R 1.32(5)R	20	80	Mnr				
14400-430	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 20% SND+ tr LCM	*	.75(2) .93(4)R 1.26(9)R 1.90(3)R	20?	50?	30?				
14444.0	Core	SST, gn-gy, f+ tr BIT	8.0 ?		55?	45?	?				
14640-670	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM+ mnr MDST, med gy, calc	*	.71(2) .99(8)R 1.23(8)R 1.51(2)R	I N D E	T E R M I	N A T E				
14744.00	Core	SST, dk red-brn+ mnr CLYST, frgs+ tr BIT									
	P	SST, dk red-brn+ mnr CLYST, frgs+ tr BIT		.84(4) .98(2)R 1.48(1)R							

MATURITY AND KEROGEN COMPOSITION DATA

TABLE : 1C

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2   LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			MATURITY DATA		KEROGEN COMPOSITION DATA						
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	SPORE COLOUR INDEX	VITR. REFL. R oil av %	% (Visual, from microscopy)			% (Calculated)			
					INERTINITE	VITRINITE	SAPROPEL	INERT	VIT	ALG SAP	WXY SAP
14747.0	Core	CLYST, gy-gn, mic+ mnr SLTST, carb+ tr BIT	8.0 ?		20?	80?	?				
14753.00	Core	SST, mod yel-brn+ tr BIT									
	P	SST, mod yel-brn+ tr BIT		.81(4) .98(6)R 1.17(6)B 1.63(1)R							
14760-790	Ctgs	SND+ 10% MDST, med gy, calc+ mnr MDST, v lt gy, calc + mnr LCM	9.0 ?	.78(6) .94(8)R 1.14(18)R 1.42(14)R	I N D E	T E R M I	N A T E				
14764.0	Core	SST, dk red-brn, mic + mnr CLYST, BIT	8.0 ?	.83(8) .65(6)L 1.01(17)R 1.29(2)B	70?	30?	?				
	P	SST, dk red-brn, mic + tr BIT		.81(2) .95(2)R 1.13(6)B 1.36(2)R							
14767.00	Core	SST, dk red-brn, mic + tr BIT									
	P	SST, dk red-brn, mic + tr BIT		.90(14)R 1.14(31)B							
14773.00	Core	SST, mod red-brn, mic+ tr BIT									
	P	SST, mod red-brn, mic+ tr BIT		.80(13) .99(5)R 1.28(3)B							
14788.00	Core	SST, mod red-brn, mic+ mnr CLYST, gy-yel-gn, mic+ tr BIT									
	P	SST, mod red-brn, mic+ mnr CLYST, gy-yel-gn, mic+ tr BIT		.87(3) 1.27(52)B							

MATURITY AND KEROGEN COMPOSITION DATA

TABLE : 1D

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X + 2/7-20X ST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			AIRSPACE GASEOUS HYDROCARBON DATA							
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	RELATIVE GASEOUS HYDROCARBON COMP.ABUND. %					TOTAL ABUNDANCE (ppm)	TOTAL C2-C4 (%)	RATIO i-C4/n-C4
			C1	C2	C3	i-C4	n-C4			
12370	Ctgs		27.8	18.9	27.4	8.1	17.9	45770	72.2	.5
12460	Ctgs		22.9	16.6	29.4	9.3	21.8	23880	77.1	.4
12550	Ctgs		84.2	9.1	4.0	.8	1.9	2070	15.8	.4
12640	Ctgs		74.4	14.4	8.0	1.2	2.0	3930	25.6	.6
12720	Ctgs		67.2	18.2	10.4	1.5	2.6	6360	32.8	.6
12820	Ctgs		82.7	10.9	4.4	.7	1.4	1600	17.3	.5
12910	Ctgs		80.6	10.0	5.5	1.1	2.8	160	19.4	.4
13000	Ctgs		79.6	11.2	5.0	1.1	3.1	100	20.4	.4
13040	Ctgs		81.6	9.7	4.8	.8	3.2	60	18.4	.3
13080	Ctgs		82.8	13.5	2.7	.3	.8	230	17.2	.4
13120	Ctgs		44.3	19.0	17.4	.4	18.9	150	55.7	.0
13160	Ctgs		84.9	10.2	3.2	.5	1.1	2150	15.1	.5
13200	Ctgs		77.6	11.6	6.6	1.2	2.9	65	22.4	.4
13240	Ctgs		82.7	10.3	4.3	1.0	1.6	190	17.3	.6
13280	Ctgs		87.4	7.5	2.9	.5	1.7	210	12.6	.3
13320	Ctgs		68.7	20.6	8.0	1.0	1.7	1230	31.3	.6
13360	Ctgs		74.0	15.4	6.9	1.3	2.4	670	26.0	.5
13398	Ctgs		66.0	22.3	8.5	1.2	2.1	6490	34.0	.6
13440	Ctgs		70.6	16.7	8.3	1.5	2.9	2300	29.4	.5
13480	Ctgs		63.8	17.4	11.1	2.6	5.1	1860	36.2	.5
13480	Ctgs		50.1	21.7	15.6	4.0	8.7	990	49.9	.5
13520	Ctgs		77.4	13.5	5.8	1.0	2.3	3160	22.6	.4
13560	Ctgs		56.7	16.6	13.8	3.8	9.1	3310	43.3	.4
13600	Ctgs		78.5	10.8	5.4	1.7	3.6	5250	21.5	.5
13640	Ctgs		73.8	13.0	7.0	1.4	4.9	3080	26.2	.3
13680	Ctgs		77.9	11.8	5.6	1.3	3.4	1900	22.1	.4
13720	Ctgs		78.3	12.9	5.4	1.0	2.5	1180	21.7	.4
13760	Ctgs		75.0	15.0	6.7	1.1	2.2	1230	25.0	.5
13800	Ctgs		86.6	8.7	3.0	.8	1.0	2460	13.4	.8
13840	Ctgs		85.0	9.0	3.5	.5	2.0	3600	15.0	.3
13880	Ctgs		89.1	7.2	2.4	.4	.9	2630	10.9	.4
13920	Ctgs		79.6	12.7	4.9	.8	2.0	1910	20.4	.4
13960	Ctgs		87.8	8.3	2.7	.4	.8	1990	12.2	.5

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

TABLE : 2A

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X + 2/7-20X ST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			AIRSPACE GASEOUS HYDROCARBON DATA							
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	RELATIVE GASEOUS HYDROCARBON COMP.ABUND. %					TOTAL ABUNDANCE (ppm)	TOTAL C2-C4 (%)	RATIO i-C4/ n-C4
			C1	C2	C3	i-C4	n-C4			
14000	Ctgs		68.8	11.1	8.1	3.2	8.9	2260	31.2	.4

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

TABLE : 2B

WELL: 2/7-20X + 2/7-20X ST-2

COMPANY: PHILLIPS NORWAY LOCATION: NORWEGIAN NORTH SEA

DEPTH: FEET	10075	10081	10090	10096	10099	10102	10104
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (%)						
i-BUTANE	2.2	0.3	0.6	4.9	5.6	7.6	11.2
n-BUTANE	0.9	0.4	0.6	4.4	17.8	10.8	12.1
i-PENTANE	2.0	0.7	1.0	5.1	4.7	8.4	12.6
n-PENTANE	3.5	1.3	1.3	3.5	5.9	5.7	5.6
2,2-DIMETHYL BUTANE	0.9	0.1	0.1	1.6	1.0	0.5	3.1
CYCLOPENTANE	1.1	0.3	0.2	0.7	0.5	0.7	0.9
2,3-DIMETHYL BUTANE	0.2	0.2	0.2	0.4	0.4	0.5	0.3
2-METHYL PENTANE	1.5	1.6	1.7	2.2	1.9	2.7	1.7
3-METHYL PENTANE	1.2	1.2	1.3	1.5	2.2	2.2	1.6
n-HEXANE	4.3	5.5	6.2	5.5	5.6	7.0	3.2
2,2-DIMETHYL PENTANE / METHYL CYCLOPENTANE	4.1	3.5	3.0	2.7	2.0	2.7	2.9
2,4-DIMETHYL PENTANE	0.2	0.3	0.4	0.4	2.0	0.5	0.1
BENZENE	11.5	0.6	0.6	4.2	6.4	1.3	4.9
3,3-DIMETHYL PENTANE	0.1	0.1	0.1	0.1	0.1	0.1	0.1
CYCLOHEXANE	5.5	5.6	4.4	3.1	2.7	3.3	3.5
2-METHYL HEXANE	1.2	4.1	5.0	3.6	1.5	3.6	0.7
1,1-DIMETHYL CYCLOPENTANE	0.4	0.8	0.8	0.5	0.4	0.5	0.1
3-METHYL HEXANE	1.0	4.0	4.8	3.0	1.3	3.1	0.7
1, *cis*-3-DIMETHYL CYCLOPENTANE	0.6	1.4	1.6	0.9	0.6	1.0	0.4
1, *trans*-3-DIMETHYL CYCLOPENTANE	0.5	1.4	1.6	0.7	0.5	0.9	0.3
1, *trans*-2-DIMETHYL CYCLOPENTANE	1.0	2.9	3.1	1.4	1.2	2.1	0.8
3-ETHYL PENTANE							
n-HEPTANE	3.0	16.8	20.0	13.5	4.0	11.4	1.7
1, *cis*-2-DIMETHYL CYCLOPENTANE / METHYL CYCLOHEXANE	7.6	23.4	25.0	11.8	5.1	12.6	4.3
ETHYL CYCLOPENTANE	0.4	1.4	1.5	0.6	0.3	0.9	0.3
TOLUENE	45.1	22.3	15.2	23.6	26.1	10.3	26.8
TOTAL ABUNDANCE (ppb)	13130	12275	9750	1440	4655	675	2135
ORGANIC CARBON (%)	-	-	-	-	-	-	-
GASOLINE ABUNDANCE AT 1% ORGANIC CARBON	-	-	-	-	-	-	-

Note: Total gasoline abundance values are expressed as weight of gas relative to weight of wet rock.

TABLE 3 Gasoline Hydrocarbon Analysis Data

COMPANY: PHILLIPS WELL: 2/7-20X and 2/7-20X (ST2) LOCATION: NORWEGIAN N. SEA

TABLE 4 GASOLINE HYDROCARBON RATIOS

SAMPLE DEPTH	TYPE	1	2	3	4	5	6	7	8	9
10075	core	14	1.07	9.36	15.23	0.57	1.25	0.17	1.51	19/18/63
10081	core	27.14	1.6	14.46	1.33	0.56	1.34	1.05	0.03	30/17/53
10090	core	29.57	1.77	14.42	0.76	0.77	1.37	1.65	0.02	31/19/50
10096	core	34.45	2.35	12.96	1.75	1.44	1.47	0.5	0.36	37/21/42
10099	core	22.85	1.26	19.91	6.47	0.79	0.89	0.2	1.25	24/32/44
10102	core	29.04	1.93	12.96	0.90	1.49	1.22	1.22	0.10	31/23/46
10104	core	13.16	1.18	7.78	15.96	2.24	1.04	0.16	1.14	18/21/61
Mud		38.49	3.91	8.81	0.52	1.16	1.12	0.94	0.35	43/20/37

1. Heptane values
2. Isoheptane value
3. Kerogen type index
4. Aromaticity index
5. *i*-pentane/*n*-pentane
6. 2-methylpentane/3-methylpentane
7. Methylcyclonexone/toluene
8. late mature index
9. C_7 composition normal branched cyclic

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
3550-610	Ctgs	MDST, ol-gy+ 30% MDST, med gy, sndy+ 10% LST, pnk-gy+ tr pyr	1.22	100	620	.14
3670-730	Ctgs	MDST, lt ol-gy+ mnr SST	1.55	300	1060	.22
3850-910	Ctgs	MDST, ol-gy, slty	2.08	300	1800	.14
4030-090	Ctgs	MDST, ol-gy, slty+ mnr LST, yel-gy	1.69	180	1440	.11
4150-210	Ctgs	MDST, ol-gy, slty+ mnr LST, yel-gy	2.01	200	1600	.11
4270-330	Ctgs	MDST, ol-gy, slty+ mnr MDST, med-lt gy	2.74	260	2600	.09
4390-450	Ctgs	MDST, ol-gy, slty+ mnr MDST, med-lt gy+ tr COAL	2.00	180	1980	.08
4510-570	Ctgs	MDST, ol-gy, slty+ mnr MDST, med-lt gy+ tr pyr	2.45	240	1360	.15
4690-750	Ctgs	MDST, ol-gy, slty	1.43	140	1120	.11
4870-930	Ctgs	MDST, ol-gy, slty+ tr COAL+ tr pyr	1.39	100	1020	.09
4990-5050	Ctgs	MDST, lt ol-gy, calc+ 30% MDST ol-gy	1.25	100	1000	.09
5170-230	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy	2.41	460	6620	.06
5230-290	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy+ tr DOL, pal ol	4.25	7640	17160	.31
5290-350	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy	3.38	5280	13640	.28
	P	MDST, ol-gy	5.63	9040	23500	.28
	P	MDST, lt ol-gy	2.66	3660	9420	.28
5350-410	Ctgs	MDST, ol-gy+ mnr SND+ tr COAL	3.40	3260	10560	.24
5410-470	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy	3.09	2600	10360	.20
5470-530	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy+ mnr MDST, brn-blk	3.23	1040	8020	.11
	P	MDST, ol-gy	3.40	700	6340	.10
	P	MDST, lt ol-gy	1.99	580	4540	.11
5530-590	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy+ mnr MDST, brn-blk	3.02	760	6940	.10
5590-650	Ctgs	MDST, ol-gy+ 10% SND+ mnr MDST lt ol-gy	2.23	680	4440	.13
5650-710	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy+ tr SND+ tr MDST, brn-blk	2.43	500	4540	.10
	P	MDST, ol-gy	2.44	400	46360	.01

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5A

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
5710-770	Ctgs	MDST, ol-gy+ tr MDST, lt ol-gy	2.83	1340	6960	.16
5770-830	Ctgs	MDST, ol-gy+ mnr MDST, lt ol-gy+ tr MDST, brn-blk	3.23	2200	10300	.18
5830-890	Ctgs	MDST, ol-gy+ tr MDST, lt ol-gy + tr MDST, ol-blk	2.50	340	5260	.06
5890-950	Ctgs	MDST, ol-gy+ tr MDST, lt ol-gy	2.71	360	5940	.06
5950-6010	Ctgs	MDST, ol-gy+ mnr MDST, lt ol-gy+ mnr LST, yel-gy	3.22	280	6240	.04
6010-070	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, yel-gy	3.75	480	8240	.06
6070-130	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ tr LST, yel-gy	3.92	380	8260	.04
	P	MDST, ol-gy	3.60	340	7380	.04
6130-190	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ 10% MDST, lt ol-gy+ mnr LST, yel-gy	3.47	580	7520	.07
6190-250	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ 10% MDST, lt ol-gy	3.51	460	7200	.06
6250-310	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ 10% MDST, lt ol-gy+ tr LST, yel-gy	3.78	280	7460	.04
6310-370	Ctgs	MDST, dsk yel-brn+ 30% MDST, ol-gy	4.22	360	8460	.04
	P	MDST, ol-gy	3.34	300	7260	.04
6370-430	Ctgs	MDST, ol-gy+ 40% MDST, dsk yel-brn+ tr LST, yel-gy	3.85	300	7260	.04
	P	MDST, ol-gy	3.05	220	5960	.04
	P	MDST, dsk yel-brn	5.42	400	11160	.03
6430-490	Ctgs	MDST, ol-gy+ mnr MDST, dsk yel-brn+ tr COAL	4.25	340	10540	.03
6490-550	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, yel-gy	4.00	280	8100	.03
	P	MDST, ol-gy	3.15	220	6000	.04
6550-610	Ctgs	MDST, dsk yel-brn+ 20% MDST, ol-gy+ tr LST, yel-gy	3.67	260	7040	.04
6610-670	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ mnr LST, yel-gy	3.98	200	7380	.03
	P	MDST, ol-gy	3.28	120	6040	.02
	P	MDST, dsk yel-brn	4.47	180	9040	.02
6670-730	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ mnr MDST, lt ol-gy+ tr LST, yel-gy	3.32	280	6080	.04

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5B

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
6730-790	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ 10% LST, yel-gy	3.31	240	5480	.04
6790-850	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr COAL+ tr LST, yel-gy	3.46	220	6560	.03
6850-910	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, lt ol-gy	2.26	120	2640	.04
	P	MDST, dsk yel-brn	4.38	200	8220	.02
6910-970	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, lt ol-gy	2.40	60	3380	.02
7030-090	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, yel-gy	2.22	80	3100	.03
7090-150	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ tr LST, yel-gy	2.62	200	4920	.04
7150-210	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ tr LST, yel-gy	2.37	160	4380	.04
7270-330	Ctgs	MDST, ol-gy+ mnr MDST, dsk yel-brn+ tr BIT+ tr LST, yel-gy	1.98	160	3400	.04
7390-450	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ mnr LST, yel-gy+ tr OS	2.27	160	4160	.04
7450-510	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr BIT	2.55	200	6500	.03
7570-630	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr BIT	2.56	180	8000	.02
7630-690	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	2.62	240	8600	.03
7810-870	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	1.45	100	1360	.07
7930-990	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	1.70	180	3300	.05
8050-110	Ctgs	MDST, ol-gy+ 20% LST, yel-gy+ tr BIT	1.51	80	1000	.07
8110-140	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK	1.24	170	1600	.10
8170-200	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK+ tr LCM	1.95	370	5160	.07
8230-260	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK+ tr LCM	1.21	160	1520	.10
8290-320	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK+ tr LCM	2.19	370	5800	.06
8350-380	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK+ tr LCM	1.51	180	2430	.07

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5C

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
8410-440	Ctgs	MDST, lt ol-gy+ 10% CHK+ tr BIT+ tr LCM	1.28	150	1350	.10
8470-500	Ctgs	MDST, lt ol-gy+ 10% CHK+ tr LCM+ tr BIT	1.04	130	860	.13
8530-560	Ctgs	MDST, lt ol-gy+ 10% CHK+ tr BIT	.94	140	710	.16
8590-620	Ctgs	MDST, lt ol-gy+ 10% CHK+ tr BIT+ tr LCM	1.11	150	10300	.01
8650-680	Ctgs	MDST, lt ol-gy+ tr CHK+ tr BIT	.75	100	350	.22
8710-740	Ctgs	MDST, lt ol-gy+ 20% CHK+ tr BIT	1.08	160	1100	.13
8770-800	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr BIT	.98	100	660	.13
8830-860	Ctgs	MDST, lt ol-gy+ mnr CHK+ tr MDST, brn-gy+ tr BIT	1.01	110	4720	.02
8890-920	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr BIT+ tr MDST, brn-gy	1.09	170	1660	.09
8950-980	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr BIT	.96	120	780	.13
9010-040	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr BIT	1.16	140	1100	.11
9070-100	Ctgs	MDST, lt ol-gy+ mnr BIT+ mnr CHK	1.44	200	2490	.07
9130-160	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr BIT	.85	80	490	.14
9190-220	Ctgs	MDST, lt ol-gy+ mnr CHK+ tr BIT	.93	120	810	.13
9250-280	Ctgs	MDST, lt ol-gy+ mnr CHK+ tr BIT	.97	120	850	.12
9310-340	Ctgs	MDST, lt ol-gy+ mnr CHK+ tr BIT	.87	90	700	.11
9370-400	Ctgs	MDST, lt ol-gy+ mnr MDST, brn-gy+ mnr CHK+ tr BIT	.80	80	440	.15
9430-460	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr BIT	.84	90	660	.12
9490-520	Ctgs	MDST, lt ol-gy+ mnr CHK+ tr MDST, brn-gy+ tr BIT	.98	90	490	.16
9550-580	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr BIT	1.08	130	980	.12
9610-640	Ctgs	MDST, lt ol-gy+ 10% MDST, brn-gy+ mnr CHK	1.02	140	930	.13
9670-700	Ctgs	MDST, lt ol-gy+ 10% MDST, brn-gy+ mnr CHK	1.15	250	1250	.17

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5D

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
9730-760	Ctgs	MDST, lt ol-gy+ 10% MDST, brn-gy+ mnr CHK	.95	110	650	.14
9790-820	Ctgs	MDST, lt ol-gy+ 10% MDST, brn-gy+ mnr CHK	.93	130	930	.12
9850-880	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy	.93	100	740	.12
9910-940	Ctgs	MDST, lt ol-gy+ mnr CHK+ mnr MDST, brn-gy+ tr MDST, med gy	.70	80	440	.15
9970-10000	Ctgs	MDST, lt ol-gy+ 10% MDST, brn-gy+ mnr CHK+ mnr MDST, med gy	.71	80	440	.15
10090-120	Ctgs	CHK+ 30% MDST, lt ol-gy+ mnr MDST, brn-gy	.71	910	840	.52
12010-040	Ctgs	CHK+ 30% MDST, gn-gy+ mnr MDST brn-gy	.74	160	540	.23
12550-580	Ctgs	CHK+ 10% LST, med gy				
	Ctgs	After extraction	.94	30	1070	.03
13000-010	Ctgs	LST, v lt gy+ 30% MDST, dk gy, calc				
	Ctgs	After extraction	.73	140	2270	.06
13020-030	Ctgs	LST, v lt gy+ 40% MDST, dk gy, calc				
	Ctgs	After extraction	.70	120	1830	.06
13060-070	Ctgs	MDST, med-dk gy, calc+ 20% LST v lt gy				
	Ctgs	After extraction	.85	200	2250	.08
13080-090	Ctgs	MDST, med-dk gy, calc+ 20% LST v lt gy				
	Ctgs	After extraction	.82	220	1710	.11
13100-110	Ctgs	MDST, med-dk gy, calc+ 20% LST v lt gy				
	Ctgs	After extraction	.71	150	1580	.09
13140-150	Ctgs	MDST, med-dk gy, calc+ 30% LST v lt gy				
	Ctgs	After extraction	.70	130	1590	.08
13160-170	Ctgs	LST, v lt gy+ 10% MDST, med-dk gy, calc				
	Ctgs	After extraction	.97	210	3240	.06
13300-310	Ctgs	MDST, v lt gy, calc+ mnr MDST, dk gy, calc				
	Ctgs	After extraction	.84	190	2450	.07

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5E

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
13320-330	Ctgs	MDST, v lt gy, calc+ 30% MDST, dk gy, calc+ tr SND				
	Ctgs	After extraction	1.57	120	2060	.06
13420-430	Ctgs	SND+ 20% MDST, v lt gy, calc+ tr OS				
	Ctgs	After extraction	1.11	60	840	.07
13440-450	Ctgs	SND, OS				
	Ctgs	After extraction	2.42	100	2900	.03
14000-010	Ctgs	MDST, med-dk gy, calc+ 40% SND OS+ mnr mic				
	Ctgs	After extraction	.86	100	740	.12
14040-070	Ctgs	MDST, mod yel-brn, calc+ 20% MDST, lt gy, calc+ mnr mic+ mnr MDST, pal red-brn, calc				
	Ctgs	After extraction	8.80	15360	25220	.38
14120-150	Ctgs	MDST, lt gy, calc+ 10% SND+ 10% MDST, pal red-brn, calc+ mnr LCM				
	Ctgs	After extraction	.79	130	1090	.11
14160-190	Ctgs	MDST, lt gy, calc+ 20% SND+ mnr MDST, pal red-brn, calc+ tr LCM				
	Ctgs	After extraction	.74	80	330	.20
14200-230	Ctgs	MDST, lt gy, calc+ mnr SND+ tr MDST, pal red-brn, calc+ tr LCM				
	Ctgs	After extraction	.70	110	330	.25
14240-270	Ctgs	SND+ 30% MDST, lt gy, calc+ mnr MDST, v lt gy, calc+ tr LCM				
	Ctgs	After extraction	.77	210	940	.18
14320-350	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 10% SND+ tr LCM				
	Ctgs	After extraction	.96	60	550	.10
14360-390	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 10% SND+ tr LCM				
	Ctgs	After extraction	.83	100	670	.13
14400-430	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 20% SND+ tr LCM				
	Ctgs	After extraction	1.20	120	860	.12
14440-470	Ctgs	SND+ 20% MDST, v lt gy, calc+ mnr LCM				

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5F

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA			
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	SCREENING PYROLYSIS		
				S1 (ppm)	S2 (ppm)	S1/ S1 + S2
14440-470	Ctgs	After extraction	.98	130	1430	.08
14480-510	Ctgs	SND+ 10% MDST, v lt gy, calc+ mnr LCM				
	Ctgs	After extraction	1.59	220	1960	.10
14520-550	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM				
	Ctgs	After extraction	3.63	280	1220	.19
14600-630	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM				
	Ctgs	After extraction	1.59	90	1530	.06
14680-710	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr MDST, med gy, calc+ mnr LCM				
	Ctgs	After extraction	1.03	110	1010	.10
14760-790	Ctgs	SND+ 10% MDST, med gy, calc+ mnr MDST, v lt gy, calc+ mnr LCM				
	Ctgs	After extraction	.80	210	910	.19

ORGANIC CARBON AND SCREENING PYROLYSIS DATA

TABLE : 5G

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %OC	HC %EX	ALK. %HC
3550-610	Ctgs	MDST, ol-gy+ 30% MDST, med gy, sndy+ 10% LST, pnk-gy+ tr pyr	1.22											
	P	MDST, ol-gy	1.24											
3610-670	Ctgs	MDST, ol-gy+ 20% MDST, med gy+ 10% SST, lt ol-gy+ mnr LST, pnk-gy	1.02											
3670-730	Ctgs	MDST, lt ol-gy+ mnr SST	1.55											
3730-790	Ctgs	MDST, ol-gy, slty+ tr LST, pnk-gy	1.48											
3790-850	Ctgs	MDST, ol-gy, slty	1.69											
3850-910	Ctgs	MDST, ol-gy, slty	2.08											
3910-970	Ctgs	MDST, ol-gy, slty+ tr LST, yel-gy	1.82											
3970-4030	Ctgs	MDST, ol-gy, slty	1.42											
4030-090	Ctgs	MDST, ol-gy, slty+ mnr LST, yel-gy	1.69											
4090-150	Ctgs	MDST, ol-gy, slty+ tr LST, yel-gy	1.66											
4150-210	Ctgs	MDST, ol-gy, slty+ mnr LST, yel-gy	2.01											
4210-270	Ctgs	MDST, ol-gy, slty+ 20% MDST, med-lt gy	1.43											
	P	MDST, ol-gy, slty	1.50											
4270-330	Ctgs	MDST, ol-gy, slty+ mnr MDST, med-lt gy	2.74											
4330-390	Ctgs	MDST, ol-gy, slty+ tr MDST, med-lt gy+ tr SST + tr LST, yel-gy	1.71											
4390-450	Ctgs	MDST, ol-gy, slty+ mnr MDST, med-lt gy+ tr COAL	2.00											
4450-510	Ctgs	MDST, ol-gy, slty+ tr LST, yel-gy+ tr MDST, med-lt gy	1.74											
4510-570	Ctgs	MDST, ol-gy, slty+ mnr MDST, med-lt gy+ tr pyr	2.45											
4570-630	Ctgs	MDST, ol-gy, slty	1.77											
4630-690	Ctgs	MDST, ol-gy, slty	1.42											
4690-750	Ctgs	MDST, ol-gy, slty	1.43											
4750-810	Ctgs	MDST, ol-gy, slty	1.41											
4810-870	Ctgs	MDST, ol-gy, slty+ tr COAL	1.26											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6A

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
4870-930	Ctgs	MDST, ol-gy, slty+ tr COAL+ tr pyr	1.39											
4930-990	Ctgs	MDST, ol-gy, slty+ 30% MDST, lt ol-gy, calc	1.30											
	P	MDST, ol-gy, slty	1.39											
4990-5050	Ctgs	MDST, lt ol-gy, calc+ 30% MDST, ol-gy	1.25											
5050-110	Ctgs	MDST, lt ol-gy, calc+ 30% MDST, ol-gy+ tr COAL	1.48											
5110-170	Ctgs	MDST, ol-gy+ 30% MDST, lt ol-gy+ tr LST, yel-gy	1.75											
5170-230	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy	2.41											
5230-290	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy+ tr DOL, pal ol	4.25						20015	17590	47.1	413	88	63
5290-350	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy	3.38											
	P	MDST, ol-gy	5.63											
	P	MDST, lt ol-gy	2.66											
5350-410	Ctgs	MDST, ol-gy+ mnr SND+ tr COAL	3.40											
5410-470	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy	3.09						7050		22.8			
5470-530	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy+ mnr MDST, brn-blk	3.23											
	P	MDST, ol-gy	3.40											
	P	MDST, lt ol-gy	1.99											
5530-590	Ctgs	MDST, ol-gy+ 20% MDST, lt ol-gy+ mnr MDST, brn-blk	3.02											
5590-650	Ctgs	MDST, ol-gy+ 10% SND+ mnr MDST, lt ol-gy	2.23											
5650-710	Ctgs	MDST, ol-gy+ 10% MDST, lt ol-gy+ tr SND+ tr MDST, brn-blk	2.43											
	P	MDST, ol-gy	2.44											
5710-770	Ctgs	MDST, ol-gy+ tr MDST, lt ol-gy	2.83											
5770-830	Ctgs	MDST, ol-gy+ mnr MDST, lt ol-gy+ tr MDST, brn-blk	3.23						6980	5910	21.6	183	85	62

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6B

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
5830-890	Ctgs	MDST, ol-gy+ tr MDST, lt ol-gy+ tr MDST, ol-blk	2.50											
5890-950	Ctgs	MDST, ol-gy+ tr MDST, lt ol-gy	2.71											
5950-6010	Ctgs	MDST, ol-gy+ mnr MDST, lt ol-gy+ mnr LST, yel-gy	3.22											
6010-070	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, yel-gy	3.75											
6070-130	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ tr LST, yel-gy	3.92											
	P	MDST, ol-gy	3.60											
6130-190	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ 10% MDST, lt ol-gy+ mnr LST, yel-gy	3.47						1935		5.6			
6190-250	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ 10% MDST, lt ol-gy	3.51											
6250-310	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ 10% MDST, lt ol-gy+ tr LST, yel-gy	3.78											
6310-370	Ctgs	MDST, dsk yel-brn+ 30% MDST, ol-gy	4.22											
	P	MDST, ol-gy	3.34											
6370-430	Ctgs	MDST, ol-gy+ 40% MDST, dsk yel-brn+ tr LST, yel-gy	3.85											
	P	MDST, ol-gy	3.05											
	P	MDST, dsk yel-brn	5.42											
6430-490	Ctgs	MDST, ol-gy+ mnr MDST, dsk yel-brn+ tr COAL	4.25						2260	1190	5.3	28	53	73
6490-550	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, yel-gy	4.00											
	P	MDST, ol-gy	3.15											
6550-610	Ctgs	MDST, dsk yel-brn+ 20% MDST, ol-gy+ tr LST, yel-gy	3.67											
6610-670	Ctgs	MDST, ol-gy+ 30% MDST, dsk yel-brn+ mnr LST, yel-gy	3.98						1090		2.7			
	P	MDST, ol-gy	3.28											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6C

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2   LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
6610-670	P	MDST, dsk yel-brn	4.47											
6670-730	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ mnr MDST, lt ol-gy+ tr LST, yel-gy	3.32											
6730-790	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ 10% LST, yel-gy	3.31											
6790-850	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr COAL+ tr LST, yel-gy	3.46											
6850-910	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, lt ol-gy	2.26											
	P	MDST, ol-gy	1.91											
	P	MDST, dsk yel-brn	4.38											
6910-970	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, lt ol-gy	2.40											
6970-7030	Ctgs	MDST, ol-gy+ tr MDST, dsk yel-brn	1.95											
7030-090	Ctgs	MDST, ol-gy+ 20% MDST, dsk yel-brn+ tr LST, yel-gy	2.22											
7090-150	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ tr LST, yel-gy	2.62											
7150-210	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ tr LST, yel-gy	2.37											
	P	MDST, ol-gy	1.50											
7210-270	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ tr LST, yel-gy+ tr OS	1.93											
7270-330	Ctgs	MDST, ol-gy+ mnr MDST, dsk yel-brn+ tr BIT+ tr LST, yel-gy	1.98											
7330-390	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr MDST, dsk yel-brn+ tr OS	1.84											
7390-450	Ctgs	MDST, ol-gy+ 10% MDST, dsk yel-brn+ mnr LST, yel-gy+ tr OS	2.27											
7450-510	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr BIT	2.55											
7510-570	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr BIT	1.67											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6D

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
7570-630	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr BIT	2.56											
7630-690	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	2.62						2820	2035	10.8	77	72	74
7690-750	Ctgs	MDST, ol-gy+ mnr LST, yel-gy+ tr SST+ tr BIT+ tr OS	1.92											
7750-810	Ctgs	MDST, ol-gy+ 10% LST, yel-gy+ tr BIT	1.33											
7810-870	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	1.45											
7870-930	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	1.39											
7930-990	Ctgs	MDST, ol-gy+ tr LST, yel-gy+ tr BIT	1.70											
7990-8050	Ctgs	MDST, ol-gy+ 10% LST, yel-gy+ tr BIT	1.40											
8050-110	Ctgs	MDST, ol-gy+ 20% LST, yel-gy+ tr BIT	1.51											
	P	MDST, ol-gy	1.14											
	P	LST, yel-gy	1.17											
8110-140	Ctgs	MDST, lt ol-gy+ mnr BIT + mnr CHK	1.24											
8170-200	Ctgs	MDST, lt ol-gy+ mnr BIT + mnr CHK+ tr LCM	1.95											
8230-260	Ctgs	MDST, lt ol-gy+ mnr BIT + mnr CHK+ tr LCM	1.21											
8290-320	Ctgs	MDST, lt ol-gy+ mnr BIT + mnr CHK+ tr LCM	2.19											
8350-380	Ctgs	MDST, lt ol-gy+ mnr BIT + mnr CHK+ tr LCM	1.51											
8410-440	Ctgs	MDST, lt ol-gy+ 10% CHK + tr BIT+ tr LCM	1.28											
8470-500	Ctgs	MDST, lt ol-gy+ 10% CHK + tr LCM+ tr BIT	1.04											
8530-560	Ctgs	MDST, lt ol-gy+ 10% CHK + tr BIT	.94											
8590-620	Ctgs	MDST, lt ol-gy+ 10% CHK + tr BIT+ tr LCM	1.11											
8650-680	Ctgs	MDST, lt ol-gy+ tr CHK+ tr BIT	.75											
8710-740	Ctgs	MDST, lt ol-gy+ 20% CHK + tr BIT	1.08											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6E

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA												
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION						
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC	
8770-800	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr MDST, brn-gy+ tr BIT	.98												
8830-860	Ctgs	MDST, lt ol-gy+ mnr CHK + tr MDST, brn-gy+ tr BIT	1.01												
8890-920	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr BIT+ tr MDST, brn-gy	1.09												
8950-980	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr MDST, brn-gy+ tr BIT	.96												
9010-040	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr BIT	1.16												
9070-100	Ctgs	MDST, lt ol-gy+ mnr BIT + mnr CHK	1.44												
9130-160	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr BIT	.85												
9190-220	Ctgs	MDST, lt ol-gy+ mnr CHK + tr BIT	.93												
9250-280	Ctgs	MDST, lt ol-gy+ mnr CHK + tr BIT	.97												
9310-340	Ctgs	MDST, lt ol-gy+ mnr CHK + tr BIT	.87												
9370-400	Ctgs	MDST, lt ol-gy+ mnr MDST brn-gy+ mnr CHK+ tr BIT	.80												
9430-460	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr MDST, brn-gy+ tr BIT	.84												
9490-520	Ctgs	MDST, lt ol-gy+ mnr CHK + tr MDST, brn-gy+ tr BIT	.98												
9550-580	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr MDST, brn-gy+ tr BIT	1.08												
9610-640	Ctgs	MDST, lt ol-gy+ 10% MDST brn-gy+ mnr CHK	1.02												
9670-700	Ctgs	MDST, lt ol-gy+ 10% MDST brn-gy+ mnr CHK	1.15												
9730-760	Ctgs	MDST, lt ol-gy+ 10% MDST brn-gy+ mnr CHK	.95												
9790-820	Ctgs	MDST, lt ol-gy+ 10% MDST brn-gy+ mnr CHK	.93												
9850-880	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr MDST, brn-gy	.93												

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6F

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
9910-940	Ctgs	MDST, lt ol-gy+ mnr CHK + mnr MDST, brn-gy+ tr MDST, med gy	.70											
9970-10000	Ctgs	MDST, lt ol-gy+ 10% MDST brn-gy+ mnr CHK+ mnr MDST, med gy	.71											
10030-060	Ctgs	MDST, lt ol-gy+ mnr MDST brn-gy+ mnr CHK+ tr MDST med gy	.64											
10075.0	Core	LST, med-lt gy, arg	-						140	120			83	76
10081.0	Core	LST, v lt gy+ tr PYR	-						2980	2590			87	74
10090-120	Ctgs	CHK+ 30% MDST, lt ol-gy + mnr MDST, brn-gy	.71											
10090.0	Core	LST, yel-gy	-						2685	2415			90	74
10096.0	Core	LST, yel-gy, xln	-						9040	8065			89	73
10099.0	Core	LST, yel-gy, micr+ tr xln	-						9490	8655			91	73
10102.0	Core	LST, yel-gy, micr	-						6610	5970			90	74
10104.0	Core	LST, yel-gy, micr	-						10725	9405			88	72
10150-180	Ctgs	CHK+ 20% MDST, lt ol-gy + 10% MDST, dk gn-gy+ mnr MDST, brn-gy	.50											
10210-240	Ctgs	CHK+ 20% MDST, dk gn-gy + mnr MDST, brn-gy	.64											
10270-300	Ctgs	CHK+ 30% MDST, dk gn-gy + mnr MDST, brn-gy+ tr LCM	.68											
10330-360	Ctgs	CHK+ 20% MDST, dk gn-gy + tr MDST, brn-gy	.48											
10390-420	Ctgs	CHK+ 10% MDST, dk gn-gy	.31											
10450-480	Ctgs	CHK+ mnr MDST, gn-gy	.20											
10510-540	Ctgs	CHK+ mnr MDST, gn-gy	.20											
10570-600	Ctgs	CHK+ mnr MDST, gn-gy	.15											
10630-660	Ctgs	CHK+ mnr MDST, gn-gy	.17											
10690-720	Ctgs	CHK+ mnr MDST, gn-gy	.17											
10750-780	Ctgs	CHK+ mnr MDST, gn-gy	.18											
10810-840	Ctgs	CHK+ 10% MDST, gn-gy+ mnr MDST, brn-gy	.32											
10870-900	Ctgs	CHK+ mnr MDST, gn-gy	.31											
10930-960	Ctgs	CHK+ 20% MDST, gn-gy+ tr MDST, brn-gy	.37											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6G

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
10990-11020	Ctgs	CHK+ 20% MDST, gn-gy+ mnr MDST, brn-gy	.36											
11050-080	Ctgs	CHK+ 20% MDST, gn-gy+ mnr MDST, brn-gy	.31											
11110-140	Ctgs	CHK+ 20% MDST, gn-gy+ tr MDST, brn-gy	.32											
11170-200	Ctgs	CHK+ 20% MDST, gn-gy+ tr MDST, brn-gy	.27											
11230-260	Ctgs	CHK+ 20% MDST, gn-gy+ tr MDST, brn-gy	.41											
11290-320	Ctgs	CHK+ tr MDST, brn-gy	.42											
11350-380	Ctgs	CHK+ 30% MDST, gn-gy+ tr MDST, brn-gy	.65											
11410-440	Ctgs	CHK+ 10% MDST, gn-gy+ tr MDST, brn-gy	.37											
11470-500	Ctgs	CHK+ 10% MDST, gn-gy	.44											
11530-560	Ctgs	CHK+ 10% MDST, gn-gy	.43											
11590-620	Ctgs	CHK+ 10% MDST, gn-gy	.28											
11650-680	Ctgs	CHK+ 10% MDST, gn-gy	.35											
11710-740	Ctgs	CHK+ mnr MDST, gn-gy	.30											
11770-800	Ctgs	CHK+ mnr MDST, gn-gy	.31											
11830-860	Ctgs	CHK+ mnr MDST, gn-gy	.37											
11890-920	Ctgs	CHK+ mnr MDST, gn-gy	.40											
11950-980	Ctgs	CHK+ 10% MDST, gn-gy	.45											
12010-040	Ctgs	CHK+ 30% MDST, gn-gy+ mnr MDST, brn-gy	.74											
12070-100	Ctgs	CHK+ 10% MDST, gn-gy	.47											
12130-160	Ctgs	CHK+ 20% MDST, gn-gy+ tr MDST, brn-gy	.46											
12190-220	Ctgs	CHK+ 20% MDST, gn-gy+ tr MDST, brn-gy	.35											
12250-280	Ctgs	CHK+ 10% MDST, gn-gy+ tr MDST, brn-gy	.34											
12310	Ctgs	CHK+ 10% MDST, gn-gy+ tr MDST, brn-gy	.34											
12370-400	Ctgs	CHK+ 10% SH, med gy+ tr OS	.39						*		*			
	Ctgs	After extraction	.26											
12430-460	Ctgs	CHK+ mnr SH, med gy+ mnr OS	.41						*		*			

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6H

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
12430-460	Ctgs	After extraction	.27											
12490-520	Ctgs	CHK+ 30% MDST, med gy, calc+ mnr SH, dk gy	.86						*		*			
	Ctgs	After extraction	.48											
12550-580	Ctgs	CHK+ 10% LST, med gy	1.25						*		*			
	Ctgs	After extraction	.94											
12610-640	Ctgs	CHK+ 20% LST, med gy	.52						*		*			
	Ctgs	After extraction	.35											
12670-720	Ctgs	CHK+ 10% LST, med gy	.54						*		*			
	Ctgs	After extraction	.32											
12715.0	Swc	LST, lt gy	-											
12740-780	Ctgs	LST, v lt gy+ mnr MDST, dk gy, calc	.80						*		*			
	Ctgs	After extraction	.40											
12790-840	Ctgs	LST, v lt gy+ 20% MDST, dk gy, calc	1.18						*		*			
	Ctgs	After extraction	.67											
12795.0	Swc	CLYST, med-dk gy	-											
12832.0	Swc	CLYST, lt gy, calc+ tr LST, lt gy	-											
12850-900	Ctgs	LST, v lt gy+ 10% MDST, dk gy, calc	.92						*		*			
	Ctgs	After extraction	.55											
12910-960	Ctgs	LST, v lt gy+ mnr MDST, dk gy, calc	.91						*		*			
	Ctgs	After extraction	.45											
12970-990	Ctgs	LST, v lt gy+ 10% MDST, med-dk gy, calc	.99						*		*			
	Ctgs	After extraction	.51											
13000-010	Ctgs	LST, v lt gy+ 30% MDST, dk gy, calc	1.28						*		*			
	Ctgs	After extraction	.73											
13020-030	Ctgs	LST, v lt gy+ 40% MDST, dk gy, calc	1.24						*		*			
	Ctgs	After extraction	.70											
13040-050	Ctgs	LST, v lt gy+ 40% MDST, med-dk gy, calc	1.79						*		*			
	Ctgs	After extraction	.64											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6I

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
13060-070	Ctgs	MDST, med-dk gy, calc+ 20% LST, v lt gy	1.83						*		*			
	Ctgs	After extraction	.85											
13080-090	Ctgs	MDST, med-dk gy, calc+ 20% LST, v lt gy	1.14						*		*			
	Ctgs	After extraction	.82											
13100-110	Ctgs	MDST, med-dk gy, calc+ 20% LST, v lt gy	1.33						*		*			
	Ctgs	After extraction	.71											
13120-130	Ctgs	MDST, med-dk gy, calc+ 20% LST, v lt gy	1.01						*		*			
	Ctgs	After extraction	.60											
13130.0	Swc	LST, med-dk gy, arg	-											
13140-150	Ctgs	MDST, med-dk gy, calc+ 30% LST, v lt gy	1.18						*		*			
	Ctgs	After extraction	.70											
13160-170	Ctgs	LST, v lt gy+ 10% MDST, med-dk gy, calc	1.41						*		*			
	Ctgs	After extraction	.97											
13165.0	Swc	CLYST, med-dk gy	-											
13180-190	Ctgs	LST, v lt gy	1.09						*		*			
	Ctgs	After extraction	.61											
13200-210	Ctgs	LST, v lt gy+ tr LST, dk gy	1.07						*		*			
	Ctgs	After extraction	.63											
13220-230	Ctgs	LST, v lt gy+ tr LST, dk gy	1.08						*		*			
	Ctgs	After extraction	.54											
13240-250	Ctgs	MDST, v lt gy	1.03						*		*			
	Ctgs	After extraction	.54											
13260-270	Ctgs	MDST, v lt gy, calc	1.08						*		*			
	Ctgs	After extraction	.64											
13280-290	Ctgs	MDST, v lt gy+ mnr MDST, dk gy, calc	1.07						*		*			
	Ctgs	After extraction	.61											
13300-310	Ctgs	MDST, v lt gy, calc+ mnr MDST, dk gy, calc	1.53						*		*			
	Ctgs	After extraction	.84											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6J

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2   LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
13320-330	Ctgs	MDST, v lt gy, calc+ 30% MDST, dk gy, calc+ tr SND	2.15						*		*			
	Ctgs	After extraction	1.57											
	P	MDST, dk gy, calc	5.70											
	P	After extraction	5.09											
13340-350	Ctgs	MDST, v lt gy, calc+ 30% MDST, med-dk gy, calc+ mnr SND	1.29						*		*			
	Ctgs	After extraction	.67											
13349.0	Swc	CLYST, gy-blk, mtl	.90						40985	30740	455.	3415	75	83
	Swc	After extraction	.63											
13360-370	Ctgs	MDST, v lt gy, calc+ 20% MDST, med-dk gy, calc+ mnr SND	.98						*		*			
	Ctgs	After extraction	.58											
13370.0	Swc	CLYST, med-lt gy, sndy	-											
13380-390	Ctgs	SND+ 30% MDST, v lt gy, calc+ 20% MDST, med-dk gy, calc	1.11						*		*			
	Ctgs	After extraction	.63											
13395.0	Swc	SST, med-dk gy, slty+ tr SND, arg	-						28605	21025			74	83
13398-410	Ctgs	SND+ 20% MDST, v lt gy, calc+ 20% MDST, med-dk gy, calc+ 20% mic	.99						*		*			
	Ctgs	After extraction	.68											
13420-430	Ctgs	SND+ 20% MDST, v lt gy, calc+ tr OS	1.64						*		*			
	Ctgs	After extraction	1.11											
13430.0	Swc	CLYST, med-lt gy, slty	-											
13440-450	Ctgs	SND, OS	3.38						*		*			
	Ctgs	After extraction	2.42											
13460-470	Ctgs	SND, OS	.39						*		*			
	Ctgs	After extraction	.39											
13480-490	Ctgs	SND, OS	.42						*		*			
13480.0	Swc	SND, gy-brn, slty	-						36255	24475			68	83
	Ctgs	After extraction	.29											
13500-510	Ctgs	SND, OS	.39						*		*			

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6K

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %OC	HC %EX	ALK. %HC
13500-510	Ctgs	After extraction	.22											
13520-530	Ctgs	SND, OS	.35						*		*			
	Ctgs	After extraction	.25											
13540-550	Ctgs	SND, OS	.36						*		*			
	Ctgs	After extraction	.20											
13545.0	Swc	SND, dsk brn, fr+ tr SLTST	-						39090	29550			76	83
13560-570	Ctgs	SND, OS+ 20% mic	.46						*		*			
	Ctgs	After extraction	.30											
13580-590	Ctgs	SND, OS+ 20% mic	.58						*		*			
	Ctgs	After extraction	.49											
13600-610	Ctgs	SND, OS+ 20% mic	.63						*		*			
	Ctgs	After extraction	.47											
13620-630	Ctgs	SND, OS+ 20% mic	.54						*		*			
	Ctgs	After extraction	.41											
13634.0	Swc	SND, brn-gy, fr+ tr SLTST	-						55490	32765			70	85
13640-650	Ctgs	SND, OS+ 20% mic	.54						*		*			
	Ctgs	After extraction	.53											
13657.0	Swc	SST, lt brn-gy, arg	-											
13660-670	Ctgs	SND, OS+ 20% mic	.58						*		*			
	Ctgs	After extraction	.37											
13680-690	Ctgs	SND, OS+ 10% mic	.55						*		*			
	Ctgs	After extraction	.34											
13700-710	Ctgs	SND, OS+ mnr mic	.35						*		*			
	Ctgs	After extraction	.28											
13705.0	Swc	SND, gy-blk, fr+ tr SLTST, arg	-						55335	32765			84	44
13720-730	Ctgs	SND, OS+ mnr mic+ tr MDST, med-dk gy, calc	.46						*		*			
	Ctgs	After extraction	.31											
13740-750	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.38						*		*			
	Ctgs	After extraction	.30											
13753.0	Swc	SND, dsk brn, fr+ tr SLTST, arg	-						43140	29120			68	85

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6L

COMPANY: PHILLIPS NORWAY   WELL: 2/7-20X+2/7-20XST-2   LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
13760-770	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.36						*		*			
	Ctgs	After extraction	.25											
13780-790	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.38						*		*			
	Ctgs	After extraction	.23											
13800-810	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.36						*		*			
	Ctgs	After extraction	.29											
13820-830	Ctgs	SND, OS+ mnr MDST, med gy, calc	.45						*		*			
	Ctgs	After extraction	.32											
13838.0	Swc	SST, lt brn-gy, arg	-											
13840-850	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.38						*		*			
	Ctgs	After extraction	.27											
13860-870	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.46						*		*			
	Ctgs	After extraction	.30											
13880-890	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.46						*		*			
	Ctgs	After extraction	.32											
13900-910	Ctgs	SND, OS+ tr MDST, med-dk gy, calc	.44						*		*			
	Ctgs	After extraction	.25											
13920-930	Ctgs	SND, OS+ mnr MDST, med-dk gy, calc	.48						*		*			
	Ctgs	After extraction	.38											
13940-950	Ctgs	SND, OS+ mnr MDST, med-dk gy, calc	.54						*		*			
	Ctgs	After extraction	.38											
13960-970	Ctgs	SND, OS+ mnr MDST, med-dk gy, calc	.52						*		*			
	Ctgs	After extraction	.42											
13980-990	Ctgs	SND, OS+ 20% MDST, med-dk gy, calc+ mnr mic	.83						*		*			
	Ctgs	After extraction	.50											
13985.0	Swc	SND, dsk brn, arg+ tr SLTST	-						41735	29090			70	83

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6M

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
14000-010	Ctgs	MDST, med-dk gy, calc+ 40% SND, OS+ mnr mic	1.24						*		*			
	Ctgs	After extraction	.86											
14020	Ctgs	MDST, gy-red, calc+ 10% SND, OS+ 20% mic+ mnr MDST, med-dk gy, calc	.95						*		*			
	Ctgs	After extraction	.47											
14040-070	Ctgs	MDST, mod yel-brn, calc + 20% MDST, lt gy, calc + mnr mic+ mnr MDST, pal red-brn, calc	-						*					
	Ctgs	After extraction	8.80											
14080-110	Ctgs	MDST, pal red-brn, calc + 20% MDST, lt brn-gy, calc+ 10% SND+ 10% MDST, med-lt gy, calc+ tr LCM	-						*					
	Ctgs	After extraction	.67											
14120-150	Ctgs	MDST, lt gy, calc+ 10% SND+ 10% MDST, pal red-brn, calc+ mnr LCM	-						*					
	Ctgs	After extraction	.79											
	P	MDST, lt gy, calc	.94						*		*			
	P	After extraction	.46											
14160-190	Ctgs	MDST, lt gy, calc+ 20% SND+ mnr MDST, pal red-brn, calc+ tr LCM	-						*					
	Ctgs	After extraction	.74											
	P	MDST, lt gy, calc	1.16						*		*			
	P	After extraction	.55											
14200-230	Ctgs	MDST, lt gy, calc+ mnr SND+ tr MDST, pal red-brn, calc+ tr LCM	-						*					
	Ctgs	After extraction	.70											
	P	MDST, lt gy, calc	1.06						*		*			
	P	After extraction	.56											
14240-270	Ctgs	SND+ 30% MDST, lt gy, calc+ mnr MDST, v lt gy, calc+ tr LCM	-						*					
	Ctgs	After extraction	.77											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6N

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
14280-310	Ctgs	MDST, med-lt gy, calc+ 10% MDST, mod yel-brn, calc+ 10% MDST, v lt gy, calc+ mnr SND+ tr LCM	-						*					
	Ctgs	After extraction	.63											
14320-350	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 10% SND+ tr LCM	-						*					
	Ctgs	After extraction	.96											
	P	MDST, med gy, calc	.85						*		*			
	P	After extraction	.48											
14360-390	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 10% SND+ tr LCM	-						*					
	Ctgs	After extraction	.83											
14400-430	Ctgs	MDST, med gy, calc+ 20% MDST, v lt gy, calc+ 20% SND+ tr LCM	-						*					
	Ctgs	After extraction	1.20											
	P	MDST, med gy, calc	.89						*		*			
	P	After extraction	.48											
14440-470	Ctgs	SND+ 20% MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	.98											
14444.0	Core	SST, gn-gy, f+ tr BIT	-											
14468.0	Core	SST, pal brn+ mnr CLYST, frac+ tr BIT	.59						1865	1560	31.6	264	84	83
14480-510	Ctgs	SND+ 10% MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	1.59											
14520-550	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	3.63											
14560-590	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	1.12											
14600-630	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	1.59											
14640-670	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr LCM+ mnr MDST, med gy, calc	-						*					

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 60

COMPANY: PHILLIPS NORWAY WELL: 2/7-20X+2/7-20XST-2 LOCATION: NORWEGIAN NORTH SEA

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				Tmax °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %oOC	HC %EX	ALK. %HC
14640-670	Ctgs	After extraction	1.31											
14680-710	Ctgs	SND+ mnr MDST, v lt gy, calc+ mnr MDST, med gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	1.03											
14720-750	Ctgs	SND+ 10% MDST, med gy, calc+ mnr MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	.75											
14744.0	Core	SST, dk red-brn+ mnr CLYST, frgs+ tr BIT	.46						475	320	10.3	69	67	79
14747.0	Core	CLYST, gy-gn, mic+ mnr SLTST, carb+ tr BIT	-											
14753.0	Core	SST, mod yel-brn+ tr BIT	.50						400	325	8.0	65	81	77
14760-790	Ctgs	SND+ 10% MDST, med gy, calc+ mnr MDST, v lt gy, calc+ mnr LCM	-						*					
	Ctgs	After extraction	.80											
14764.0	Core	SST, dk red-brn, mic+ mnr CLYST, BIT	.38						280	185	7.4	48	66	82
14767.0	Core	SST, dk red-brn, mic+ tr BIT	.54						790	655	14.6	121	83	80
14773.0	Core	SST, mod red-brn, mic+ tr BIT	1.60						725	480	4.5	30	66	86
14788.0	Core	SST, mod red-brn, mic+ mnr CLYST, gy-yel-gn, mic+ tr BIT	.51						320	210	6.3	40	65	71
14792.0	Core	SST, pal red, mic+ CLYST, lt gn-gy, carb+ CLYST, gy-blk, carb+ tr BIT	-											

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 6P

COMPANY: PHILLIPS   WELL: 2/7-20X and 2/7-20X (ST2)   LOCATION: NORWEGIAN N. SEA

TABLE 7 ALKANE GAS CHROMATOGRAPHY DATA

SAMPLE DEPTH (feet)	TYPE	Pr/Ph	Pr/n-C_{17}	Ph/n-C_{18}	CPI
5230-5290	Ctgs	1.03	0.69	0.69	1.31
5570-5830	Ctgs	0.81	1.39	1.78	1.07
10075	Core	1.55	1.51	1.05	1.03
10081	Core	0.96	0.74	0.75	1.06
10090	Core	0.92	0.85	0.82	1.05
10096	Core	0.99	0.73	0.74	1.08
10099	Core	1.06	0.73	0.72	1.00
10102	Core	1.03	0.81	0.74	1.09
10104	Core	0.98	0.67	0.71	1.05
13349 (ST2)	SWC	1.4	0.6	0.6	1.7
13395 (ST2)	SWC	1.3	0.6	0.6	1.0
13480 (ST2)	SWC	1.4	0.6	0.5	1.5
13545 (ST2)	SWC	1.4	0.6	0.6	1.1
13634 (ST2)	SWC	1.3	0.6	0.6	1.1
13705 (ST2)	SWC	1.3	0.6	0.6	1.1
13753 (ST2)	SWC	1.2	0.6	0.6	1.0
13985 (ST2)	SWC	1.2	0.6	0.6	1.0
14468 (ST2)	Core	1.03	0.81	0.71	0.99
14744 (ST2)	Core	1.15	0.70	0.60	1.07
14767 (ST2)	Core	1.09	0.65	0.58	1.06
14773 (ST2)	Core	1.50	0.97	0.62	1.05
OIL BASED MUD SAMPLE *		1.21	0.57	0.59	0.85

* it is assumed that this sample was collected after having been circulated.

COMPANY: PHILLIPS WELL: 2/7-20X and 2/7-20X (ST2) LOCATION: NORWEGIAN N. SEA

TABLE 8 GAS CHROMATOGRAPHY-MASS SPECTROMETRY RATIOS

SAMPLES	1	2	3	4	5			6	7
13480'(SWC)	1.34	0.14	1.27	50.2	58	12	30	0.57	45.4
13753'(SWC)	1.28	0.17	1.37	43.0	44	20	36	1.01	51.2
13985'(SWC)	1.14	0.12	1.20	44.7	48	16	36	0.89	49.3
14468' (ST2) (core)	2.33	0.16	1.25	37.2	46	21	33	0.77	30.1
14767' (ST2) (core)	1.15	0.17	1.15	33.6	41	23	36	1.01	51.6
14773' (ST2) (core)	1.07	0.21	1.31	33.6	43	19	38	1.2	43.2

KEY TO RATIOS

1. C_{27} 18α(H) trisnorneohopane/17α(H) trisnorhopane (Ts/Tm) (m/e 191).
2. C_{30} 17β(H)21β(H) moretane/17α(H)21β(H) hopane (m/e 191).
3. 22S/22R ratio of C_{31} 17α(H)21β(H) homohopanes (m/e 191).
4. % 20S of (20S + 20R) 5α(H)14α(H)17α(H) C_{29} steranes (m/e 217).
5. Percentage composition of C_{27}, C_{28} and C_{29} 5α(H)14α(H)17α(H) 20R Steranes (m/e 217).
6. C_{30} 17α(H) hopane (m/e 191)/total C_{29} steranes (m/e 217, m/e 218).
7. $\frac{\beta\beta}{\alpha\alpha + \beta\beta}$ of C_{29} Steranes

MATURITY CALCULATIONS

COMPANY : PHILLIPS PROJECT :
WELL : 2/7-20X
LOCATION : HORIZON :

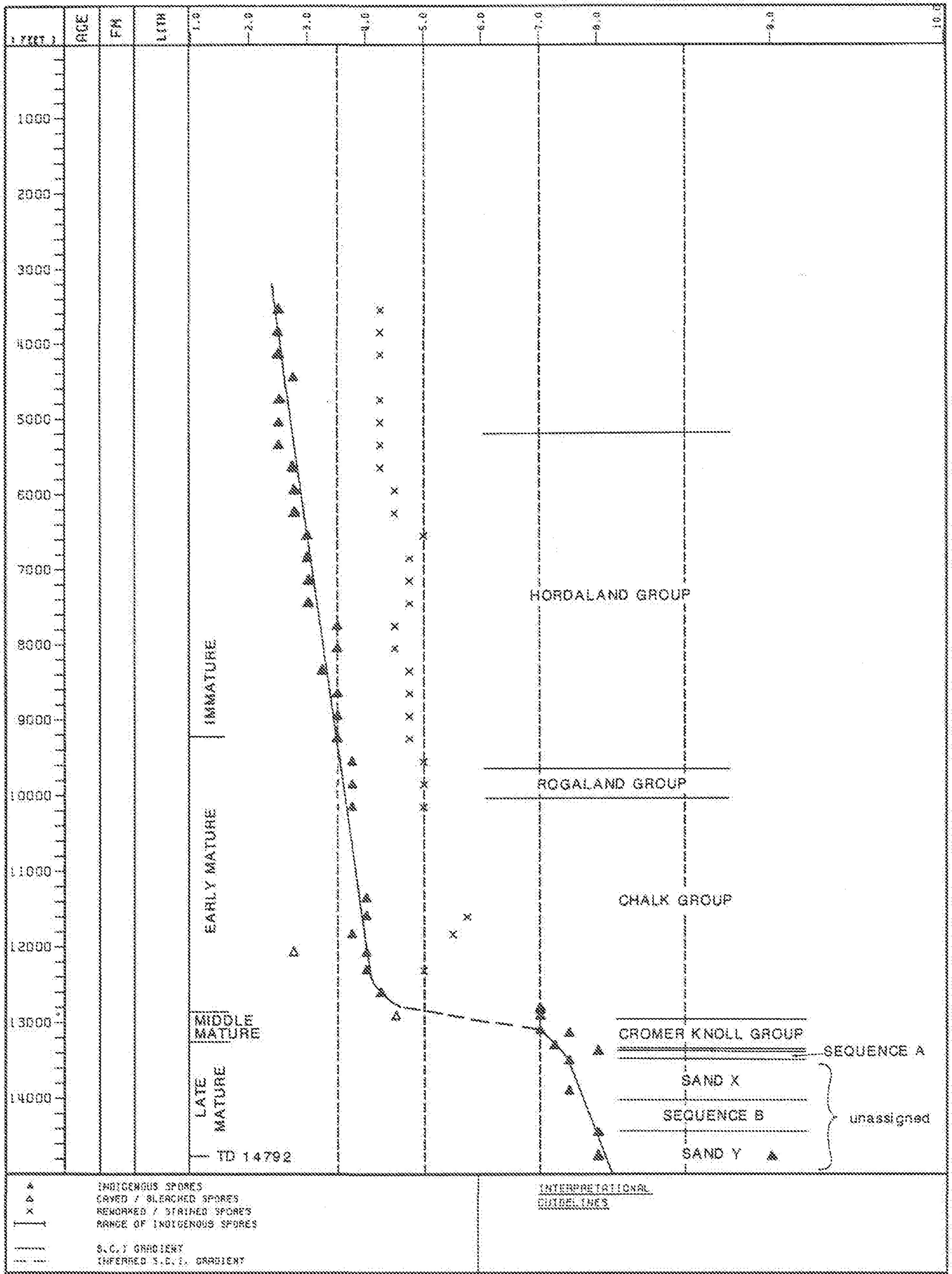
Temperature degrees C	Time myBP	P-Value	TTI-Value	VR (P)	VR (TTI)
0	150	******	0	*****	*****
10	98	4.30	0	*****	*****
20	81	4.80	0	*****	*****
30	68	5.27	0	*****	*****
40	50	5.99	0	*****	*****
50	43	6.32	0	*****	*****
60	31	7.00	1	*****	*****
70	20	7.65	1	*****	*****
80	12	8.17	2	*****	*****
90	8	8.52	3	.37	*****
100	5	8.88	5	.39	*****
110	4	9.06	6	.41	*****
120	3	9.35	8	.43	.43
130	2	9.76	12	.47	.48
140	1	10.27	20	.53	.55

Times of reaching key reflectances

VR from P	.50	.55	.75	1.2	VR from TTI	.50	.55	.75	1.2
Time	1	***	***	***	Time	2	***	***	***

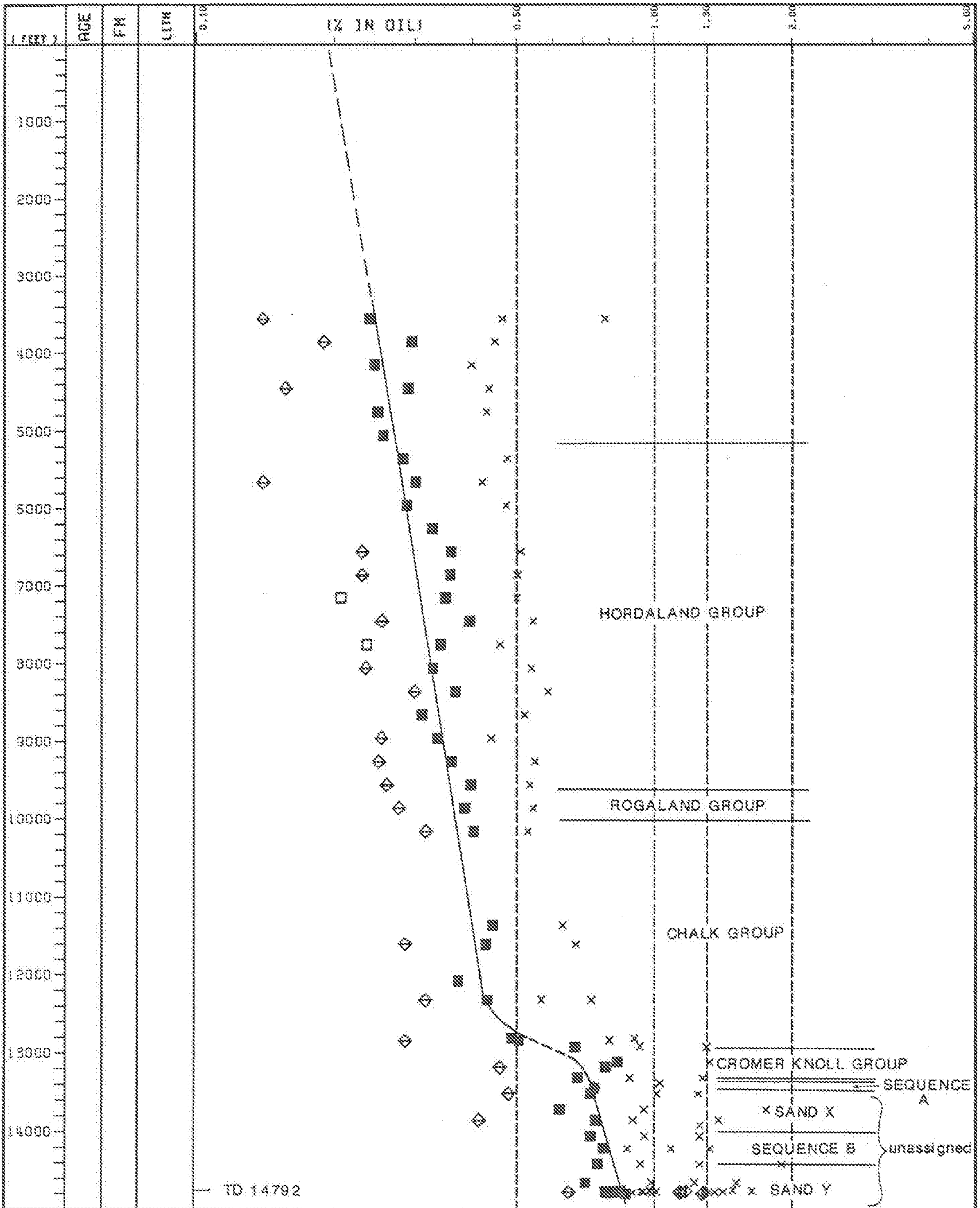
*** : No relevant data

TABLE 9



SPORE COLOUR INDICES AGAINST DEPTH

SCALE 1 : 20000 2/7-20X (&ST.2) FIGURE NO. 1



IN SITU VITRINITE
CAVED VITRINITE
SEMIFUSINITE/REWORKED VITRINITE
LOW REFLECTING "VITRINITE"
BITUMEN

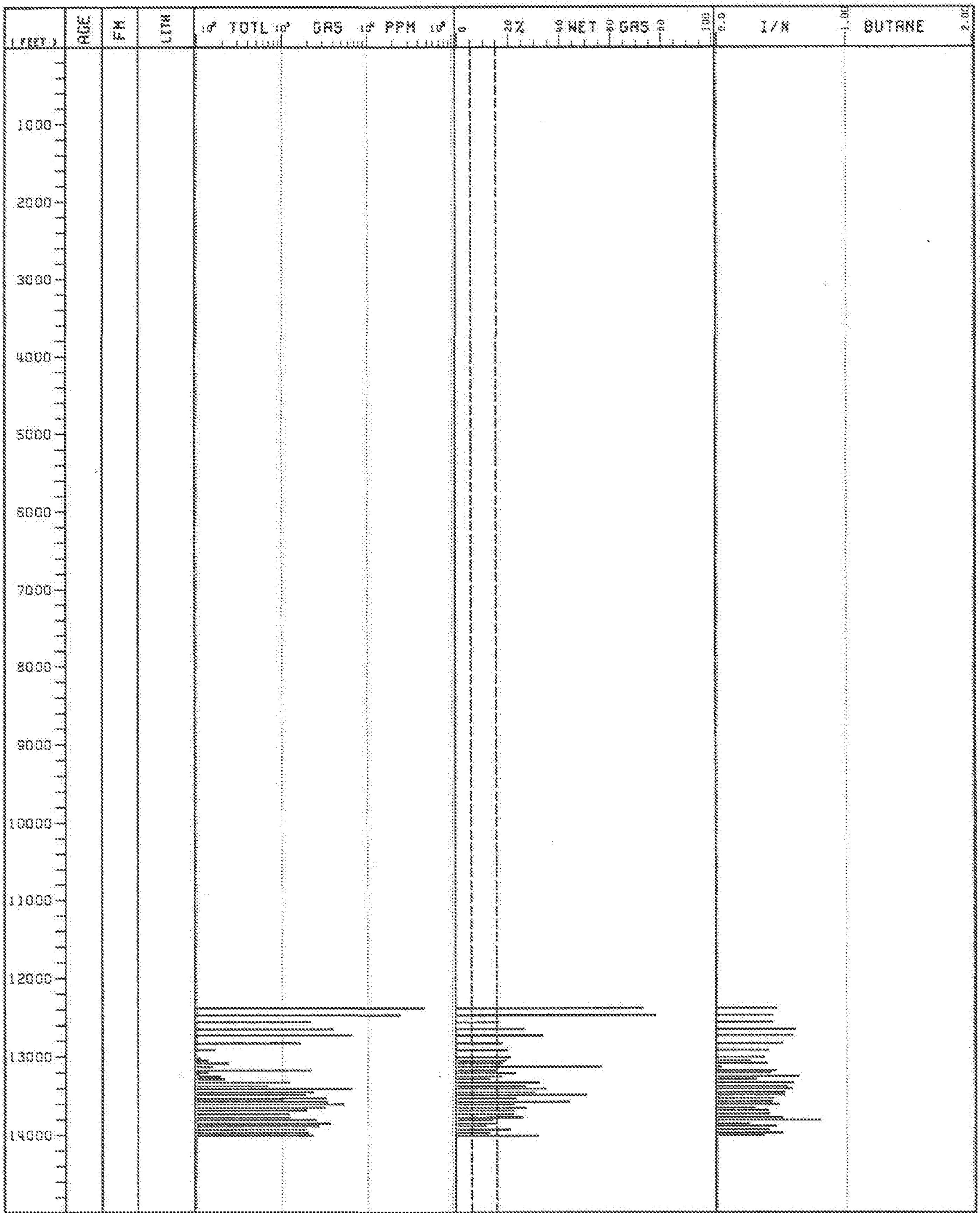
REFLECTIVITY GRADIENT
INFERRED REFLECTIVITY GRADIENT

INTERPRETATIONAL

GUIDELINES

VITRINITE REFLECTIVITY AGAINST DEPTH

SCALE 1 : 20000 2/7-20X (&ST.2) FIGURE NO. 2



DEPTH, CASING AND CORING DETAILS
CASING POINT
CORED INTERVAL
CORED INTERVAL (NO RECOVERY)
SIDEWALL CORE

INTERPRETATIONAL GUIDELINES

AIRSPACE (C1-C4) HYDROCARBONS AGAINST DEPTH

SCALE 1 : 20000 — 2/7-20X (&ST.2) — FIGURE NO. 3

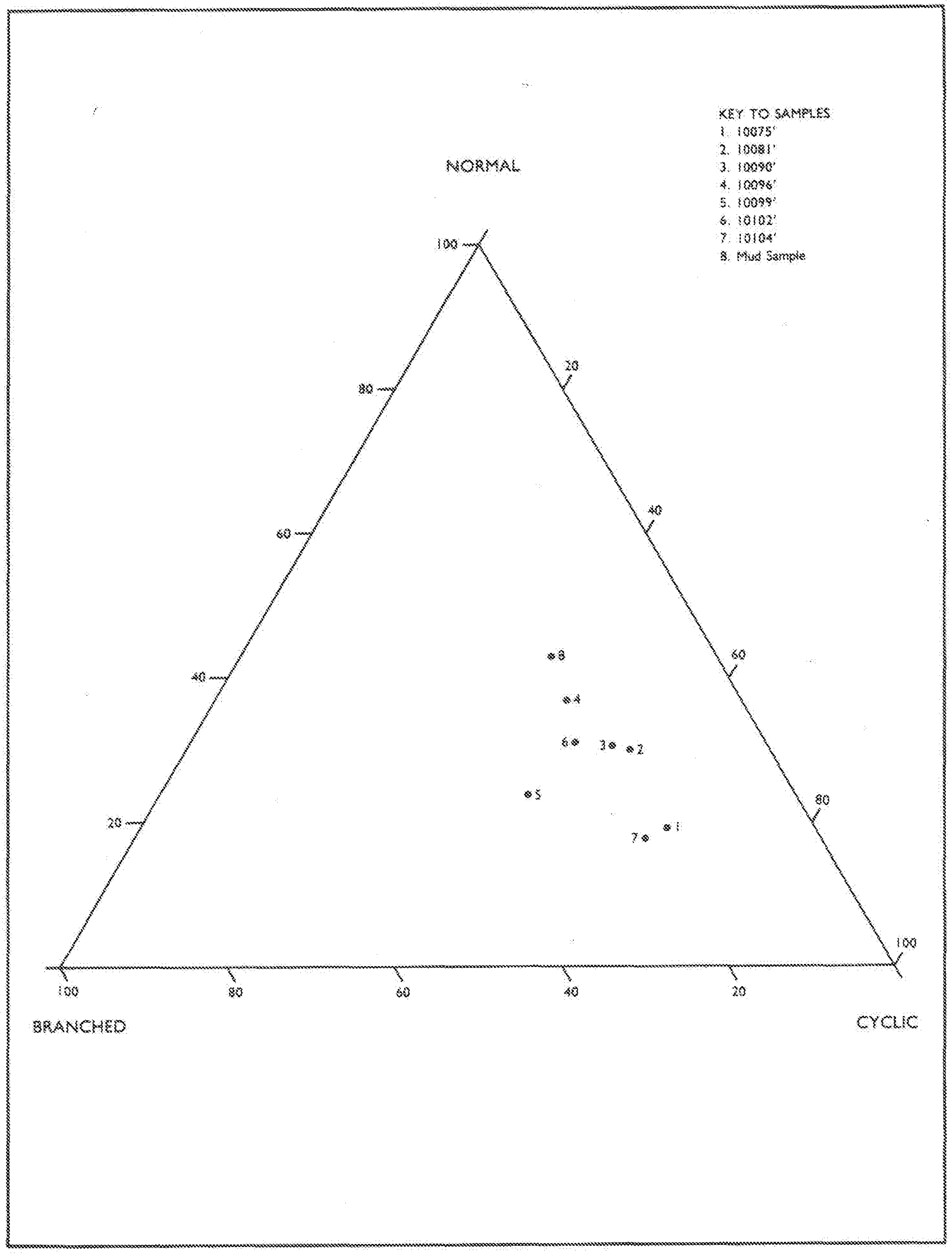


FIGURE 4 Composition of C_7 hydrocarbons in terms of straight chain, branched chain and cyclic components.

Trilab 2000 Analysis 4.88
SAMPLE 8564 PHILLIPS 2/7-20 88A 459 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area)

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
166.2		2.945	7.539	3.491	2.225	IC4
171.9		1.802	2.923	1.354	.863	NC4
208.2		2.653	7.207	3.133	1.997	IC5
226.5		4.729	11.963	5.532	3.527	NC5
267.6		.985	3.367	1.480	.944	22DMB
290.4		1.418	3.517	1.739	1.109	CP
293.4		.305	.626	.288	.184	23DMB
299.1		2.193	5.660	2.411	1.537	2MP
318.6		1.534	4.141	1.921	1.225	3MP
345.6		5.286	13.330	6.713	4.280	N-HEX
390.0		4.688	12.631	6.353	4.050	MCP/22DMP
399.3		.140	.532	.272	.173	24DMP
434.7		13.786	35.985	18.086	11.531	BEN
446.4		.054	.156	.076	.049	33DMP
453.3		7.179	19.056	8.652	5.516	C-HEX
475.8		1.031	4.012	1.901	1.212	2MH
483.0		.435	1.315	.653	.416	11DMCP
494.4		1.201	3.124	1.505	.959	3MH
506.7		.715	1.930	.907	.578	C13DMCP
512.7		.663	1.779	.836	.533	T13DMCP
519.0		1.196	3.423	1.586	1.011	T12DMCP3EP
550.5		3.618	9.800	4.648	2.963	N-HEP
594.6		8.792	25.012	11.942	7.613	MCH/C12DMC
623.7		.450	1.208	.578	.369	ECP
679.5		43.381	121.072	70.799	45.136	TOL

13130 ppb

Trilab 2000 Analysis 4.88
SAMPLE 8564 PHILLIPS 2/7-20 88A 459 (.30R)
Plotting factors 20706.812 63.679

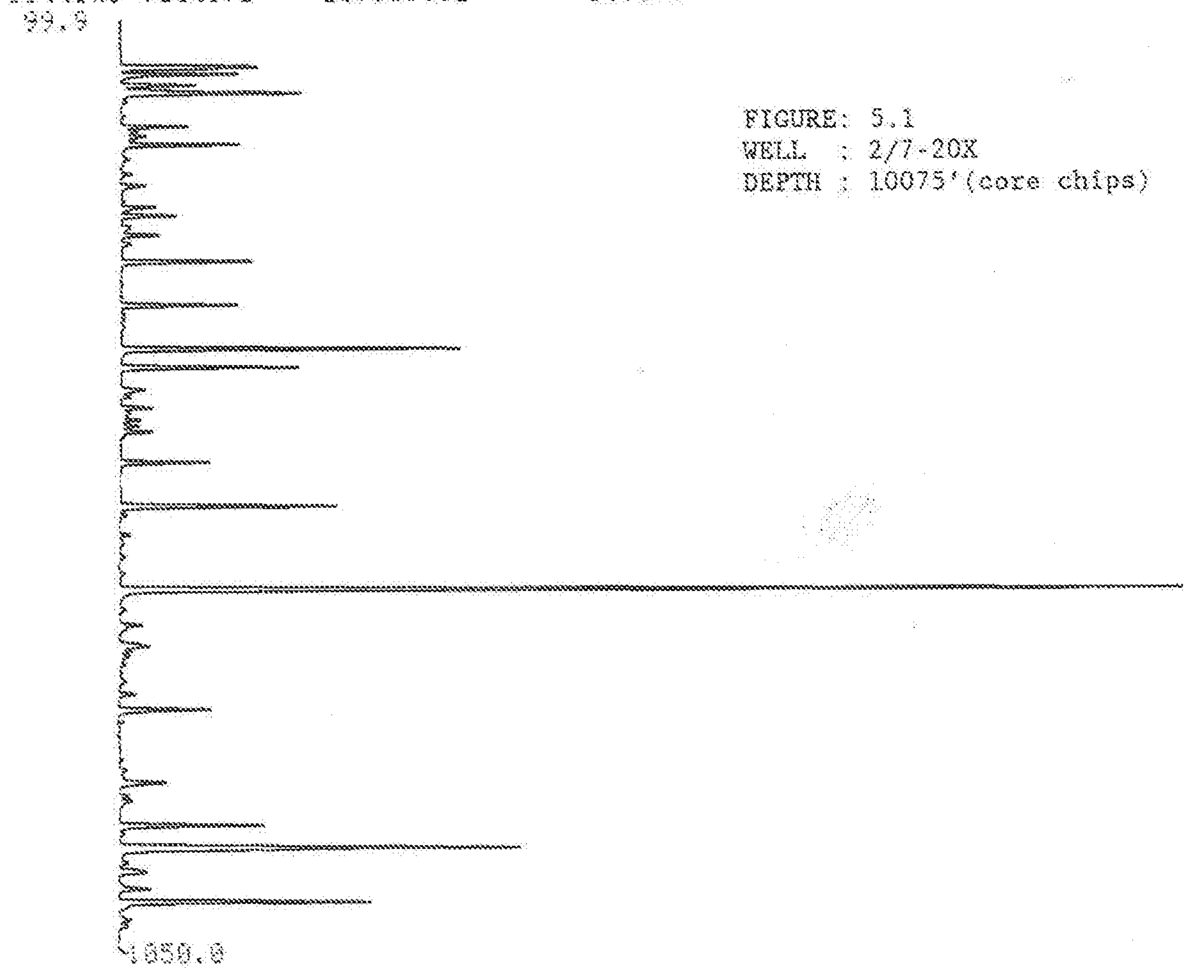


FIGURE: 5.1
WELL : 2/7-20X
DEPTH : 10075'(core chips)

Trilab 2000 Analysis 4.00
SAMPLE 8565 PHILLIPS 2/7-20 00A 460 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area)

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
166.8		2.664	5.134	2.377	.317	IC4
175.9		3.283	5.741	2.659	.355	NC4
209.1		5.845	12.414	5.396	.720	IC5
227.1		10.539	20.907	9.668	1.290	NC5
259.2		.159	.796	.350	.047	22DMB
290.1		2.020	4.248	2.101	.280	CP
293.1		1.172	2.567	1.185	.158	23DMB
298.8		12.396	27.716	11.805	1.575	2MP
317.7		6.220	10.934	8.786	1.172	3MP
344.1		35.478	81.926	41.250	5.503	N-HEX
387.3		21.287	51.523	25.916	3.457	MCP/22DMP
396.0		1.798	4.405	2.250	.300	24DMP
431.1		3.557	8.804	4.425	.590	BEN
443.4		.349	.930	.454	.061	33DMP
449.1		36.494	93.124	42.278	5.640	C-HEX
470.7		19.613	65.147	30.873	4.118	2MH
477.9		4.296	11.887	5.865	.782	11DMCP
489.0		23.914	62.160	29.942	3.994	3MH
501.3		8.836	23.001	10.811	1.442	C13DMCP
507.3		3.583	22.546	10.597	1.413	T13DMCP
513.3		15.504	46.358	21.480	2.865	T12DMCP3EP
543.6		104.099	265.408	125.878	16.791	N-HEP
586.8		130.798	367.755	175.583	23.421	MCH/C12DMC
615.0		3.323	22.123	10.584	1.412	ECP
669.5		104.664	285.867	167.165	22.298	TOL

12275 ppb

Trilab 2000 Analysis 4.00
SAMPLE 8565 PHILLIPS 2/7-20 00A 460 (.30R)
Plotting factors 2591.673 -87.546
99.9

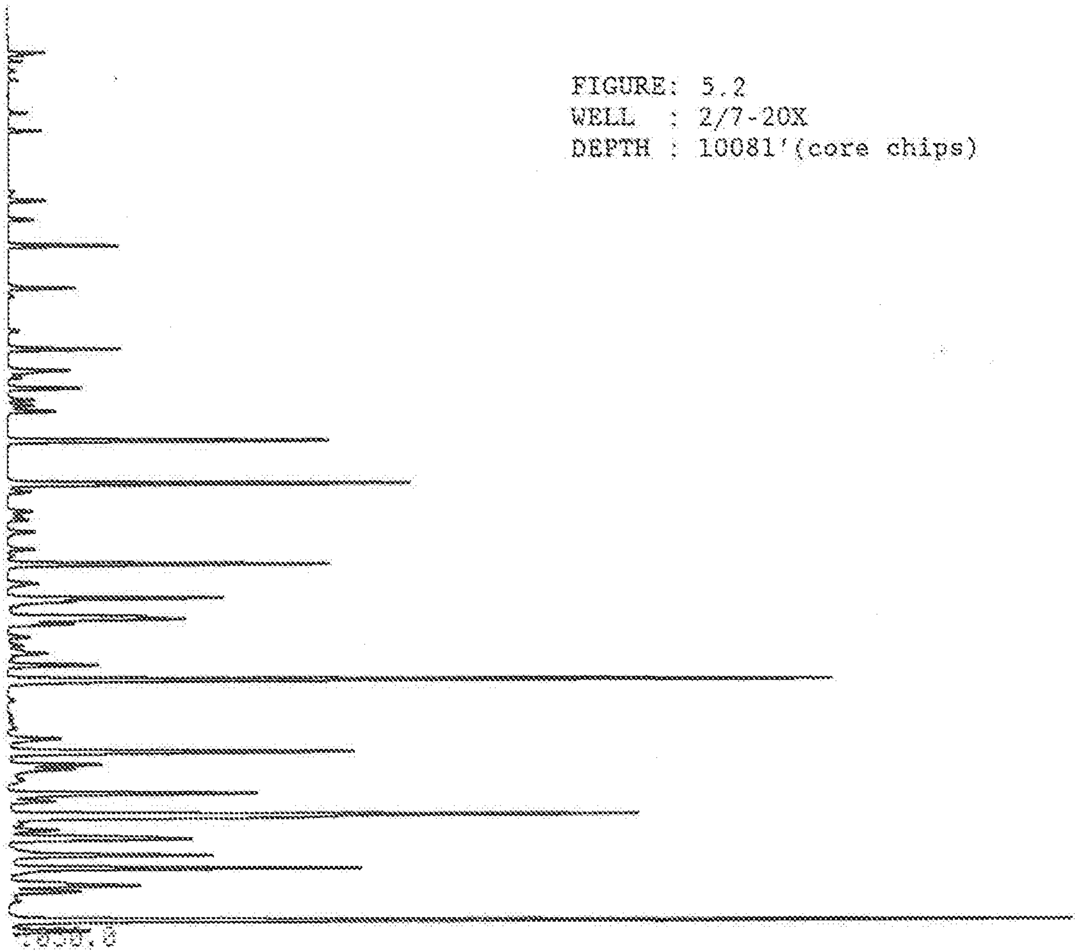


FIGURE: 5.2
WELL : 2/7-20X
DEPTH : 10081'(core chips)

Trilab 2000 Analysis 4.8G
SAMPLE 8566 PHILLIPS 2/7-20 88A 461 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area)

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
166.2		2.284	5.278	2.444	.611	IC4
174.9		2.097	4.921	2.233	.558	NC4
207.3		3.053	8.727	3.793	.948	IC5
224.7		4.899	10.866	5.024	1.255	NC5
263.1		.464	1.244	.547	.137	22DMB
285.9		.733	1.688	.835	.208	CP
288.3		.631	1.360	.626	.156	23DMB
294.3		6.776	16.172	6.888	1.721	2MP
312.9		4.476	10.830	5.025	1.256	3MP
338.1		20.604	49.177	24.766	6.187	N-HEX
380.4		9.394	24.140	12.143	3.034	MCP/22DMP
388.8		1.071	2.821	1.441	.360	24DMP
423.3		1.877	4.734	2.379	.594	BEN
435.0		.232	.615	.300	.075	33DMP
441.0		14.659	38.537	17.496	4.371	C-HEX
462.3		12.323	41.836	19.326	4.953	2MH
469.5		2.331	6.572	3.264	.816	11DMCP
480.3		14.875	39.844	19.190	4.794	3MH
492.3		5.022	13.342	6.271	1.567	C13DMCP
498.3		4.962	13.199	6.203	1.550	T13DMCP
504.3		8.784	27.009	12.515	3.127	T12DMCP3EP
534.3		64.695	169.031	80.169	20.029	N-HEP
577.5		73.987	209.584	100.065	25.000	MCH/C12DMC
605.4		4.770	12.777	6.113	1.527	ECP
659.7		36.764	103.802	60.700	15.165	TOL

				9750 ppb		

Trilab 2000 Analysis 4.8G
SAMPLE 8566 PHILLIPS 2/7-20 88A 461 (.30R)
Plotting factors 4278.378 -74.961

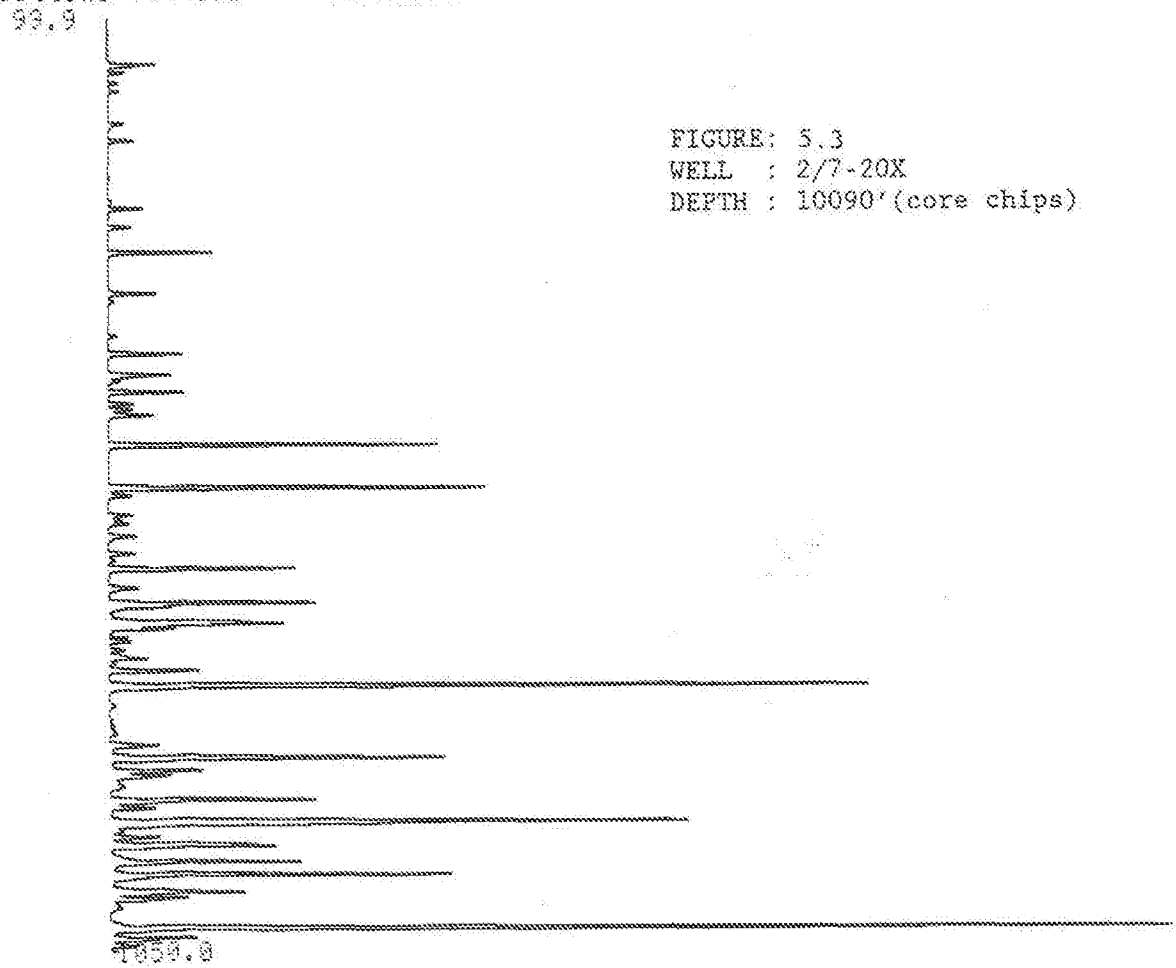


FIGURE: 5.3
WELL : 2/7-20X
DEPTH : 10090'(core chips)

Trilab 2000 Analysis 4.0G
SAMPLE 8567 PHILLIPS 2/7-20 88A 462 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area)

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
167.4		4.321	7.864	3.641	4.905	IC4
176.4		4.585	7.029	3.256	4.386	NC4
209.4		4.045	5.661	3.765	5.071	IC5
226.8		3.196	5.641	2.608	3.514	NC5
266.4		.914	2.656	1.168	1.573	22DMB
288.9		.499	1.010	.503	.678	CP
291.6		.298	.623	.287	.387	23DMB
297.3		1.854	3.820	1.627	2.192	2MP
315.9		1.162	2.384	1.106	1.490	3MP
341.4		3.660	8.072	4.065	5.476	N-HEX
384.0		1.679	4.031	2.027	2.731	MCP/22DMP
392.1		.206	.636	.325	.437	24DMP
426.6		2.636	6.263	3.148	4.241	BEN
434.7		.031	.098	.048	.065	33DMP
444.6		2.031	5.113	2.321	3.127	C-HEX
465.3		1.722	5.574	2.642	3.559	2MH
472.8		.262	.711	.353	.476	11DMCP
483.0		1.925	4.684	2.256	3.039	3MH
495.3		.558	1.453	.683	.920	C13DMCP
501.0		.467	1.092	.513	.692	T13DMCP
507.3		.887	2.309	1.070	1.442	T12DMCP3EP
537.0		8.383	21.161	10.036	13.520	N-HEP
580.5		6.694	18.396	8.783	11.832	MCH/C12DMC
608.4		.430	.989	.473	.638	ECP
663.0		10.852	29.969	17.525	23.608	TOL

				1440 ppb		

Trilab 2000 Analysis 4.0G
SAMPLE 8567 PHILLIPS 2/7-20 88A 462 (.30R)
Plotting factors 26002.937 82.872

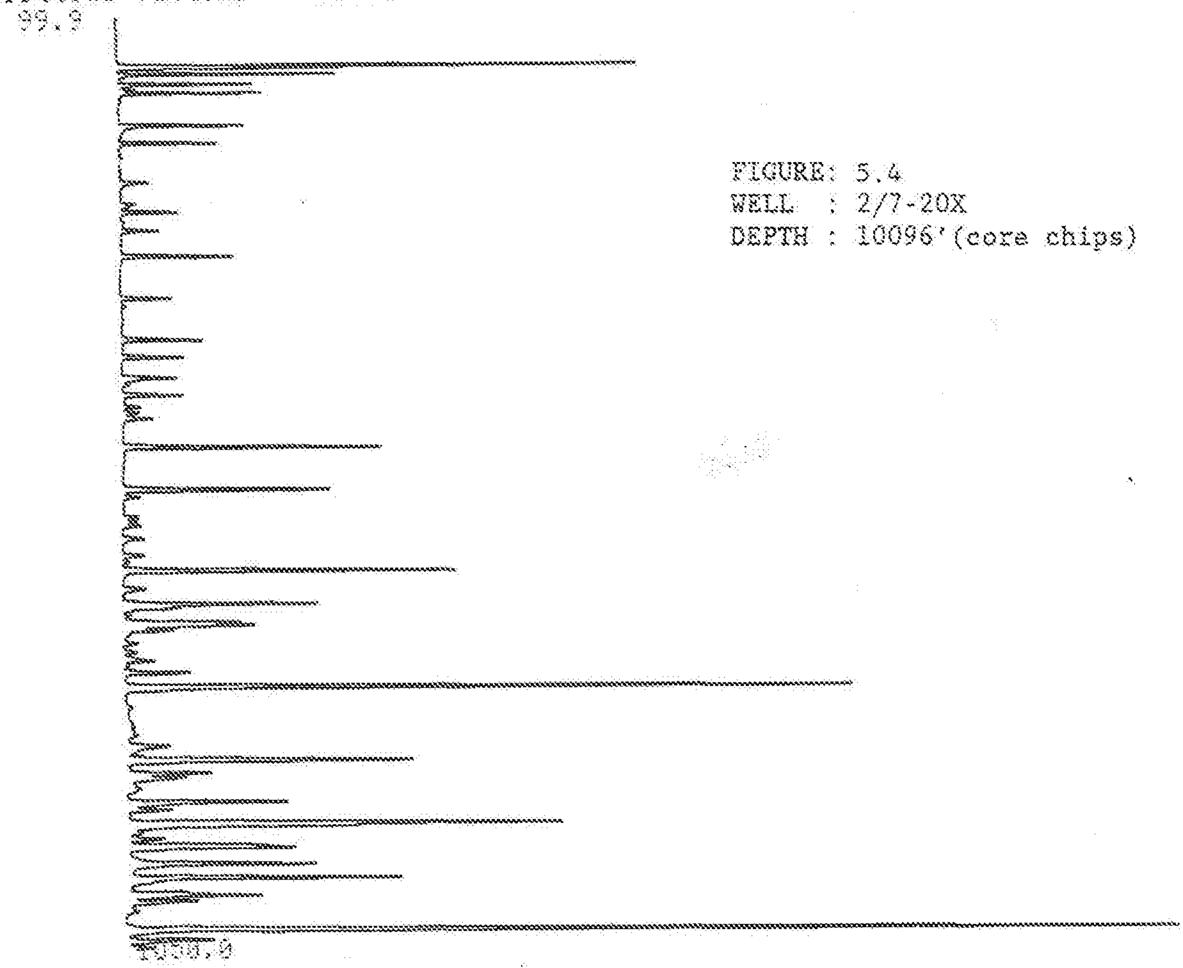


FIGURE: 5.4
WELL : 2/7-20X
DEPTH : 10096'(core chips)

Trilab 2000 Analysis 4.0G
SAMPLE B572 PHILLIPS 2/7-20 88A 463 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area)

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
163.2		1.747	5.163	2.390	5.565	IC4
168.9		3.839	16.533	7.658	17.830	NC4
204.0		.979	4.593	1.996	4.648	IC5
221.1		1.171	5.499	2.543	5.921	NC5
260.4		.242	1.080	.439	1.023	22DMB
282.6		.178	.455	.225	.524	CP
285.6		.129	.411	.189	.441	23DMB
290.7		.608	1.958	.834	1.942	2MP
317.7		.651	2.025	.940	2.188	3MP
334.8		1.743	4.811	2.423	5.641	N-HEX
376.8		.644	1.682	.846	1.970	MCP/22DMP
390.6		.441	1.685	.860	2.003	24DMP
419.7		1.644	5.476	2.752	6.407	BEN
430.2		.056	.127	.062	.144	33DMP
437.4		.803	2.507	1.138	2.649	C-HEX
458.7		.320	1.319	.625	1.455	2MH
464.7		.084	.376	.187	.434	11DMCP
476.4		.372	1.149	.554	1.289	3MH
489.0		.171	.557	.262	.609	C13DMCP
495.0		.144	.484	.227	.529	T13DMCP
500.4		.305	1.109	.514	1.196	T12DMCP3EP
530.7		1.272	3.652	1.732	4.032	N-HEP
573.6		1.568	4.612	2.202	5.126	MCH/C12DMC
602.4		.090	.294	.140	.327	ECP
655.8		6.611	19.175	11.213	26.106	TOL

4655 ppb

Trilab 2000 Analysis 4.0G
SAMPLE B572 PHILLIPS 2/7-20 88A 463 (.30R)
Plotting factors 94832.609 471.040
99.9

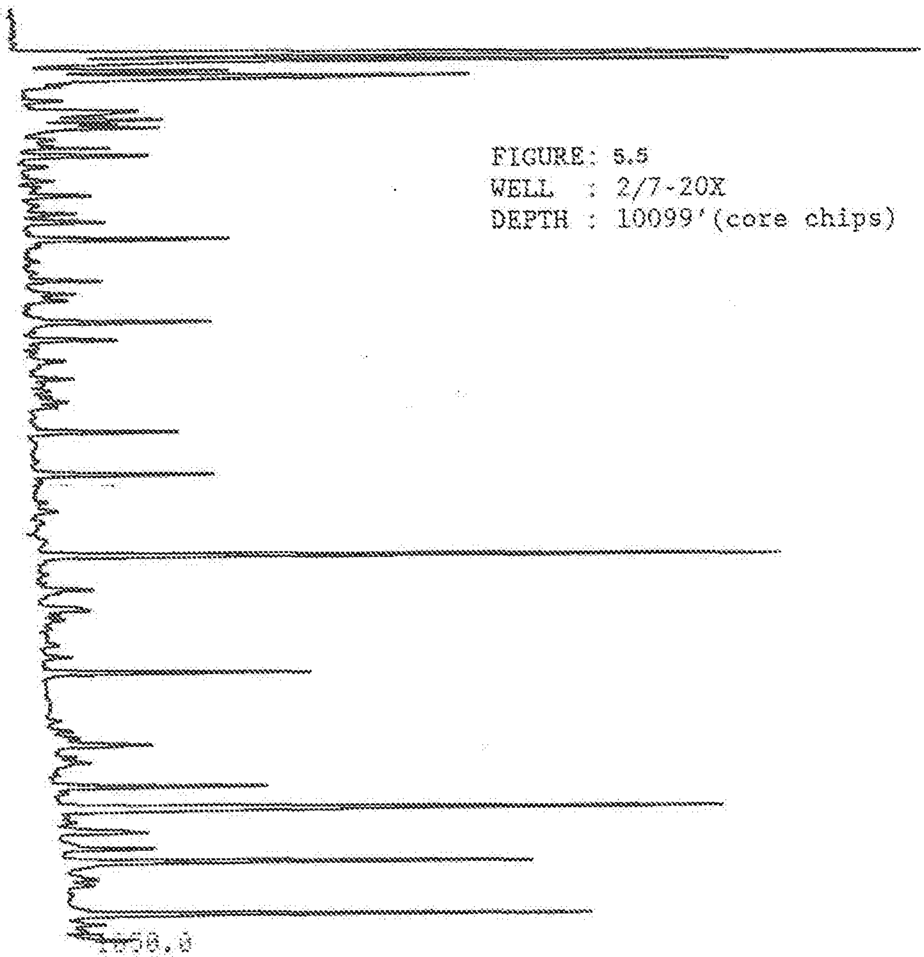


FIGURE: 5.5
WELL : 2/7-20X
DEPTH : 10099'(core chips)

Trilab 2000 Analysis 4.80
SAMPLE 8569 PHILLIPS 2/7-20 08A 464 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area) -

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
164.7		2.832	7.389	3.421	7.606	IC4
173.1		4.039	10.506	4.867	10.820	NC4
204.6		2.758	8.706	3.784	8.413	IC5
221.4		2.124	5.509	2.548	5.664	NC5
258.9		.147	.512	.225	.501	22DMB
280.5		.263	.603	.298	.663	CP
282.9		.212	.496	.229	.508	23DMB
288.6		1.104	2.651	1.214	2.700	2MP
306.9		.709	2.139	.993	2.207	3MP
330.9		2.221	6.223	3.134	6.968	N-HEX
371.7		.938	2.399	1.207	2.683	MCP/22DMP
379.5		.112	.394	.201	.447	24DMP
413.1		.457	1.149	.579	1.284	BEN
423.6		.056	.127	.062	.138	33DMP
438.5		1.122	3.219	1.461	3.249	C-HEX
450.6		.934	3.364	1.594	3.545	2MH
457.5		.164	.488	.242	.539	11DMCP
468.0		1.056	2.860	1.377	3.062	3MH
479.7		.346	.925	.435	.967	C13DMCP
486.0		.304	.848	.398	.886	T13DMCP
491.1		.621	1.994	.924	2.054	T12DMCP3EP
520.2		3.929	10.774	5.110	11.361	N-HEP
562.5		4.116	11.828	5.647	12.556	MCH/C12DMC
590.4		.255	.846	.405	.900	ECP
642.9		2.750	7.907	4.624	10.280	TOL

----
675 ppb

Trilab 2000 Analysis 4.80
SAMPLE 8569 PHILLIPS 2/7-20 08A 464 (.30R)
Plotting factors 67466.820 432.297

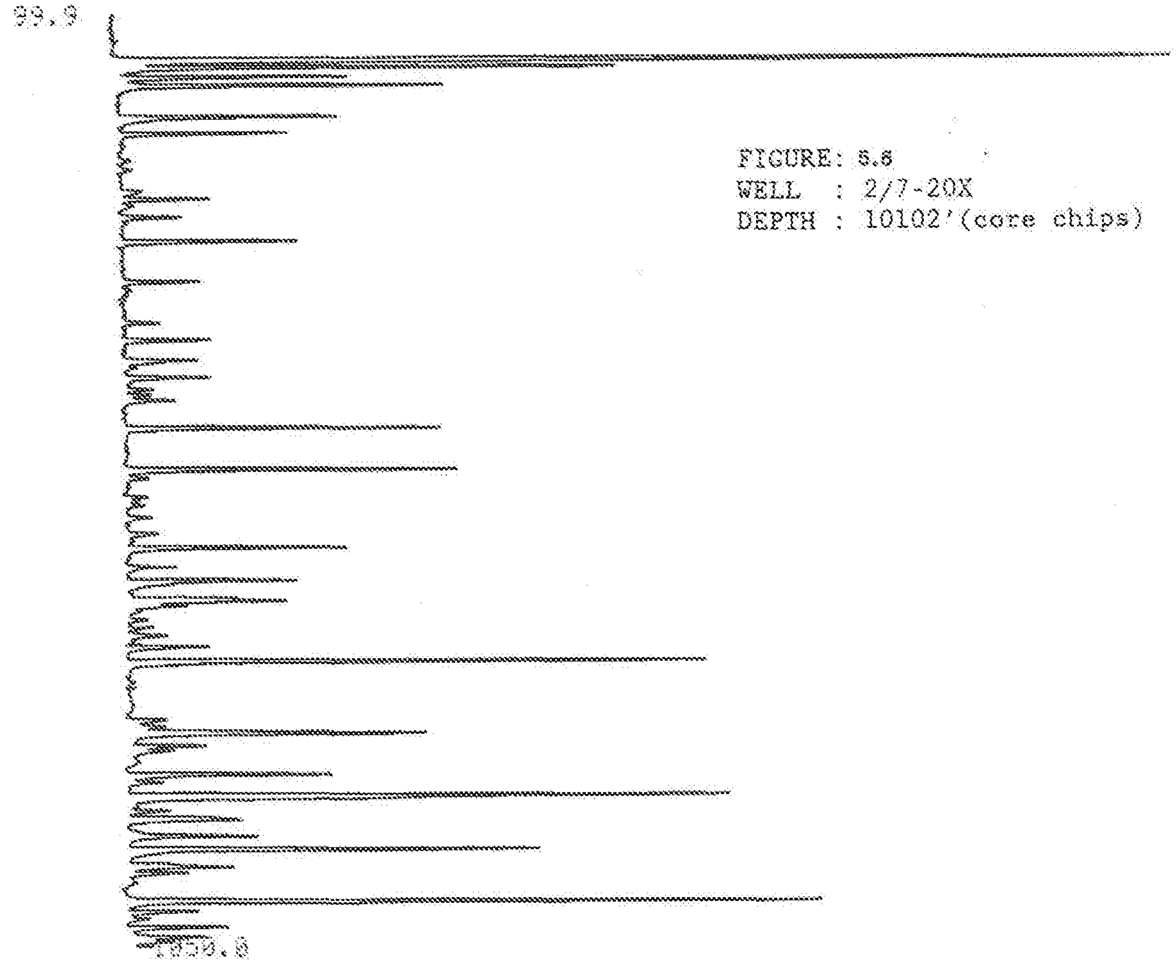


FIGURE: 5.6
WELL : 2/7-20X
DEPTH : 10102'(core chips)

Trilab 2000 Analysis 4.80
SAMPLE 8571 PHILLIPS 2/7-20 83A 465 (.30R)
Method : GASOLINE

Table No.10 GASOLINE (Area)

RETN TIME	REL RET	PEAK HT	PEAK AREA	PEAK CONC	%CONC	PEAK NAME
165.3		10.744	31.834	14.739	11.228	IC4
171.0		8.958	34.409	15.939	12.142	NC4
206.7		8.708	38.046	16.536	12.597	IC5
223.5		5.667	15.998	7.398	5.636	NC5
262.2		2.880	9.350	4.111	3.131	22DMB
285.3		.901	2.381	1.177	.897	CP
288.3		.387	.946	.436	.332	23DMB
293.4		1.877	5.206	2.217	1.689	2MP
312.0		1.425	4.574	2.123	1.617	3MP
336.3		3.265	8.394	4.227	3.220	N-HEX
378.3		2.863	7.647	3.846	2.930	MCP/22DMP
386.7		.097	.268	.137	.104	24DMP
420.0		4.390	12.671	6.369	4.852	BEN
430.3		.054	.125	.061	.047	33DMP
437.4		3.379	9.994	4.537	3.456	C-HEX
458.1		.559	2.032	.963	.733	2MH
465.3		.136	.315	.156	.119	11DMCP
475.0		.685	1.965	.946	.721	3MH
487.5		.425	1.174	.552	.420	C13DMCP
493.2		.298	.803	.377	.287	T13DMCP
499.2		.704	2.319	1.074	.819	T12DMCP3EP
528.9		1.677	4.649	2.205	1.680	N-HEP
571.8		3.981	11.690	5.581	4.252	MCH/C12DMC
599.4		.282	.763	.365	.278	ECP
653.7		20.552	60.191	35.198	26.813	TOL
				2135 ppb		

Trilab 2000 Analysis 4.80
SAMPLE 8571 PHILLIPS 2/7-20 83A 465 (.30R)
Plotting factors 25740.195 102.077

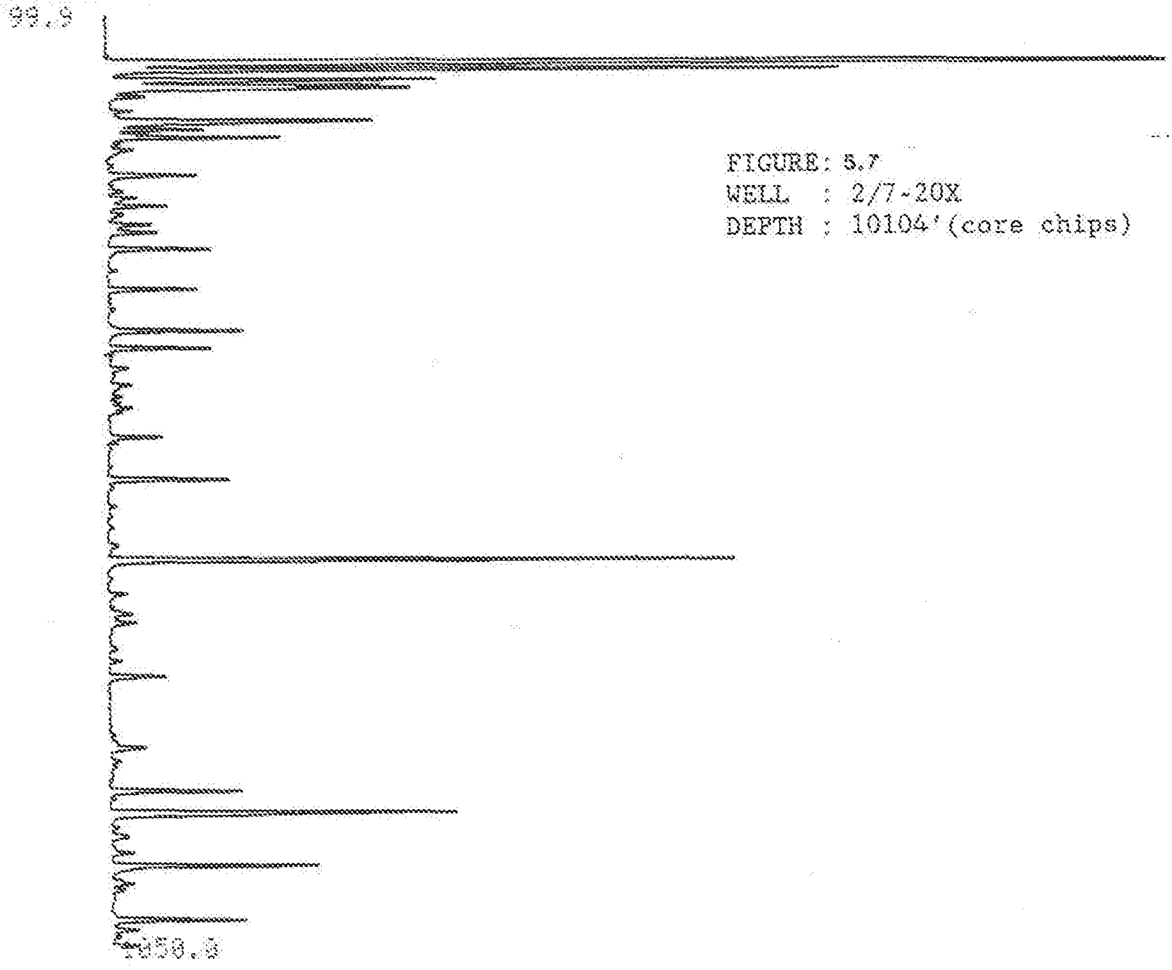
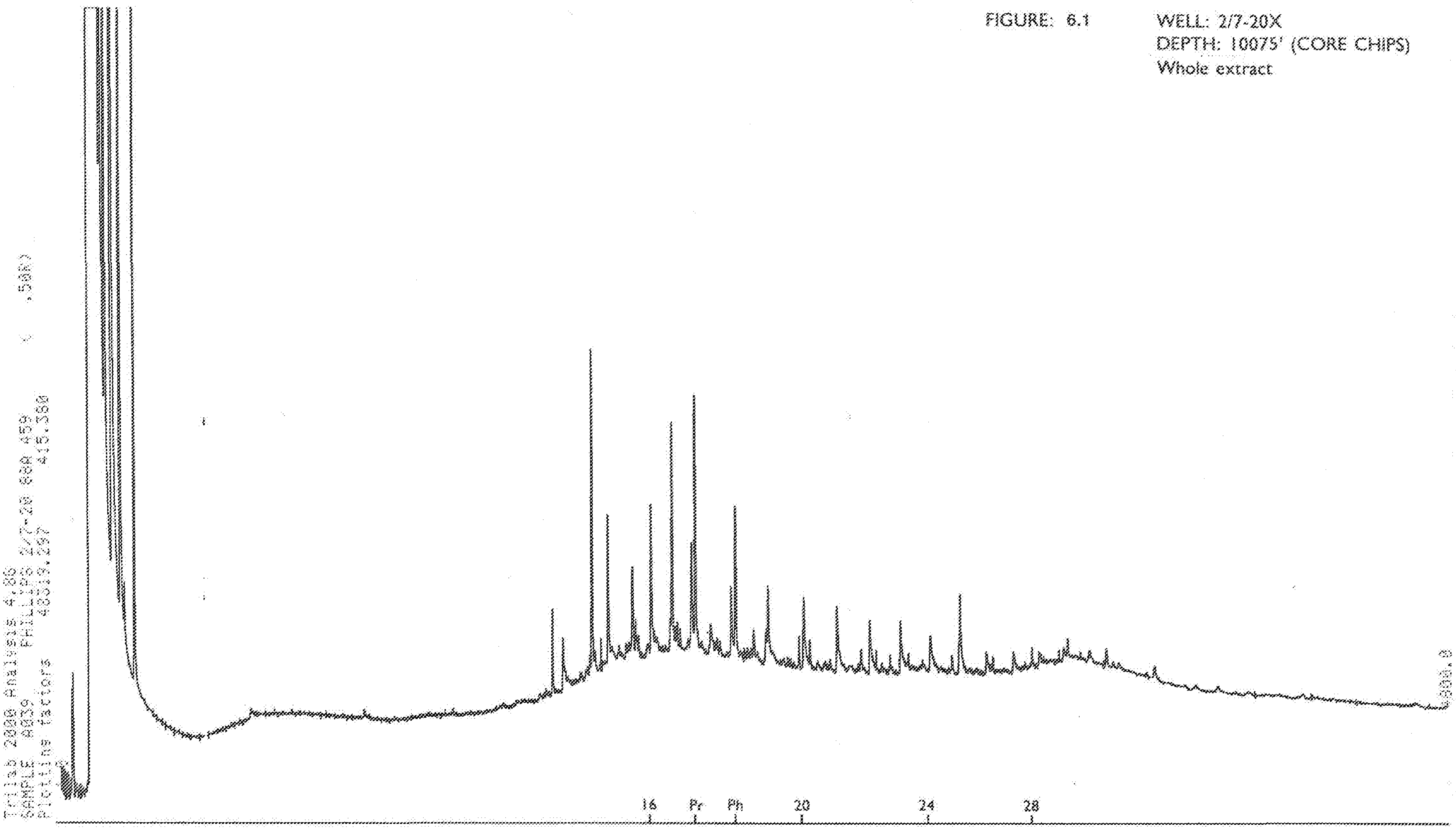


FIGURE: 5.7
WELL : 2/7-20X
DEPTH : 10104'(core chips)

FIGURE: 6.1

WELL: 2/7-20X
DEPTH: 10075' (CORE CHIPS)
Whole extract



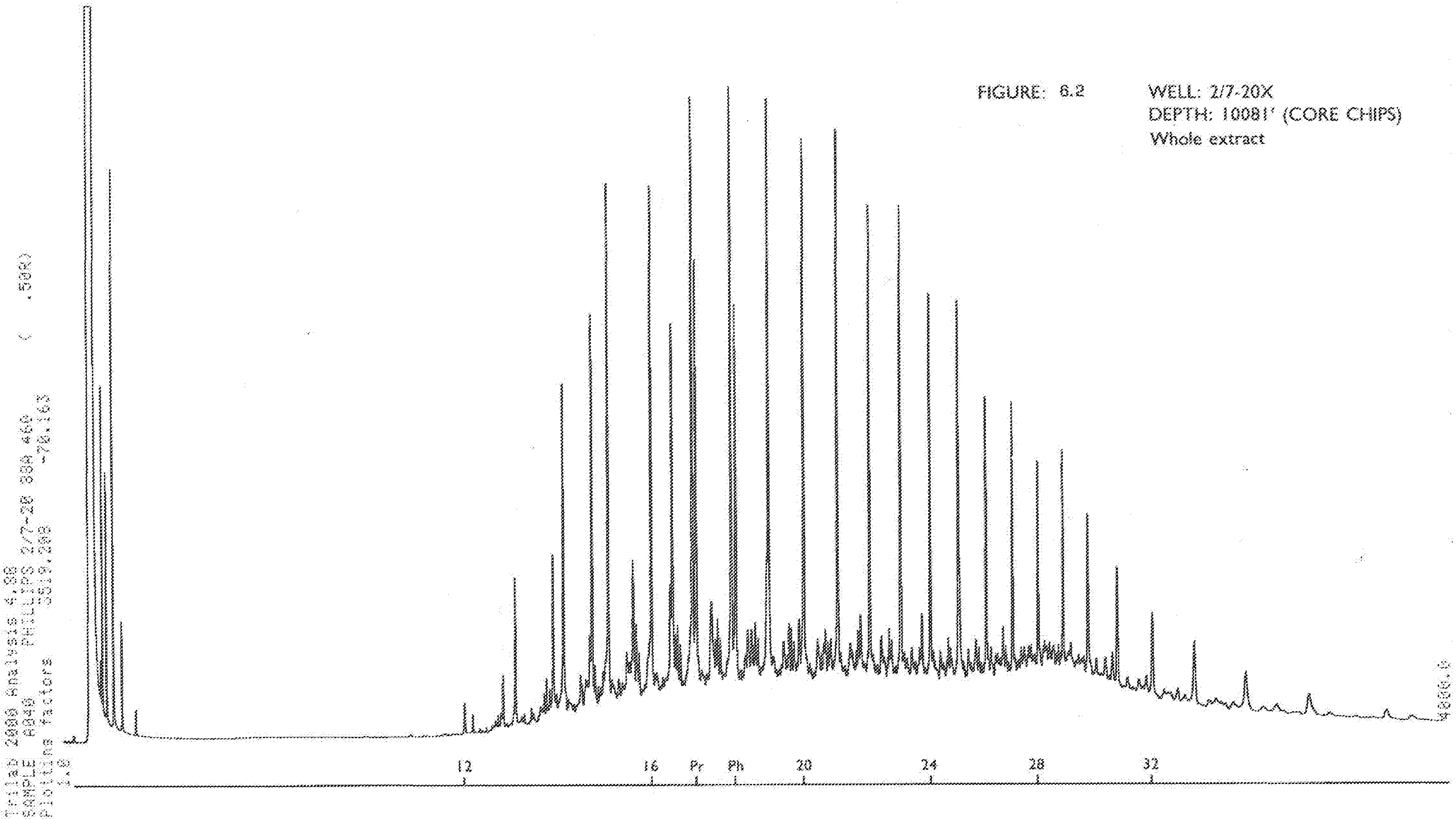


FIGURE: 6.2 WELL: 2/7-20X
DEPTH: 10081' (CORE CHIPS)
Whole extract

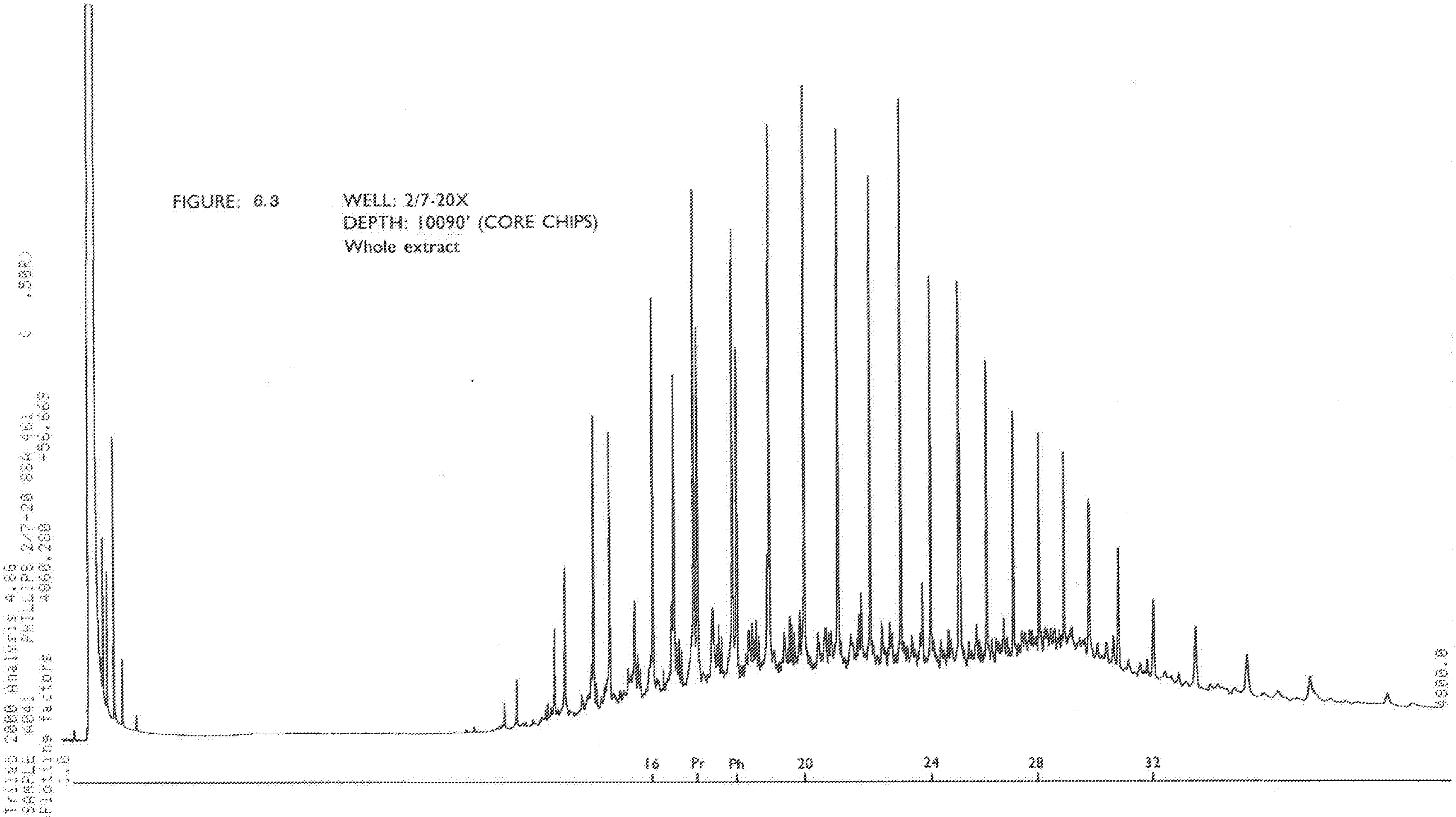


FIGURE: 6.3 WELL: 2/7-20X
DEPTH: 10090' (CORE CHIPS)
Whole extract

FIGURE: 6.4

WELL: 2/7-20X
DEPTH: 10096' (CORE CHIPS)
Whole extract

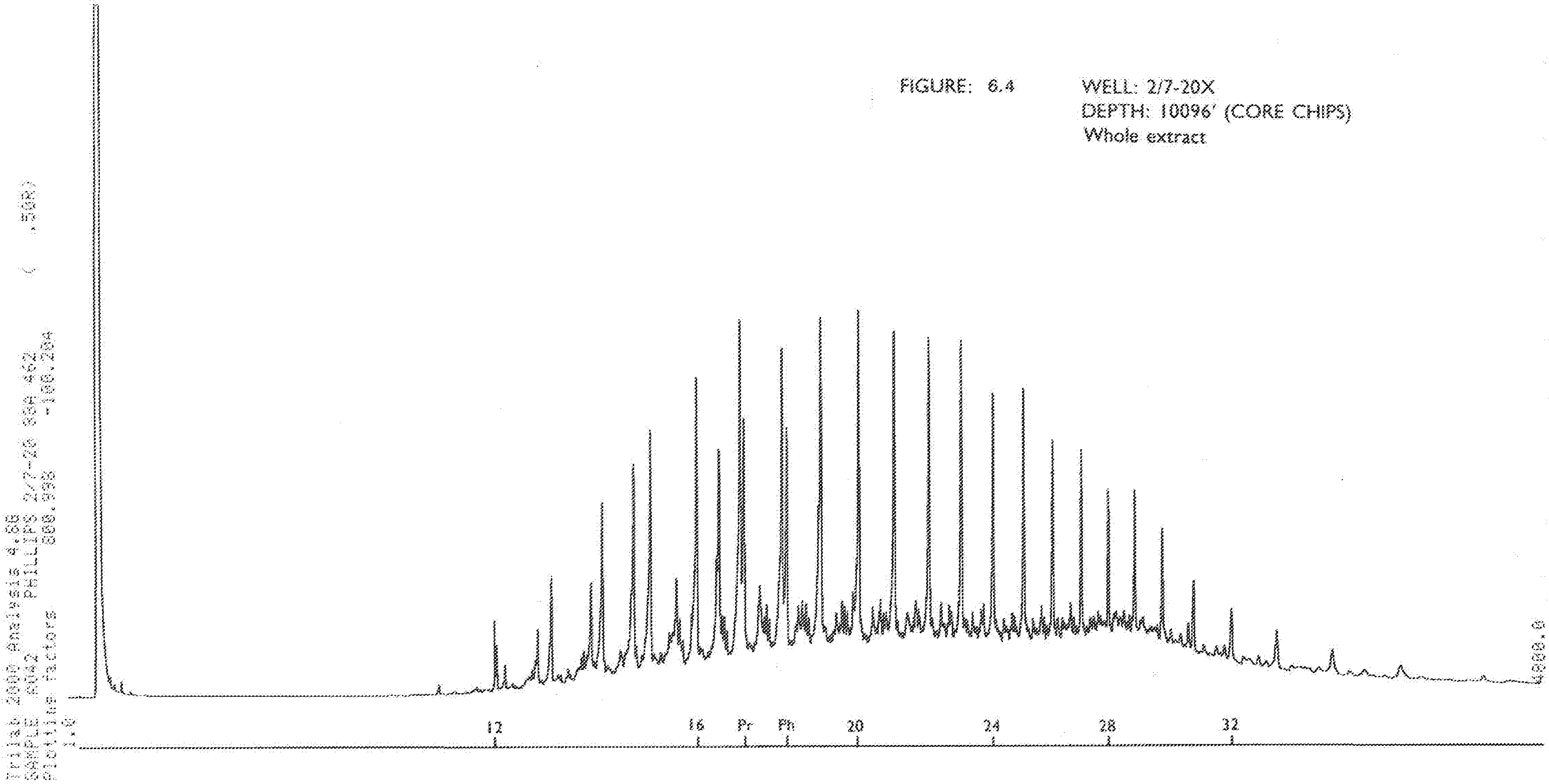


FIGURE: 6.5 WELL: 2/7-20X
DEPTH: 10099' (CORE CHIPS)
Whole extract

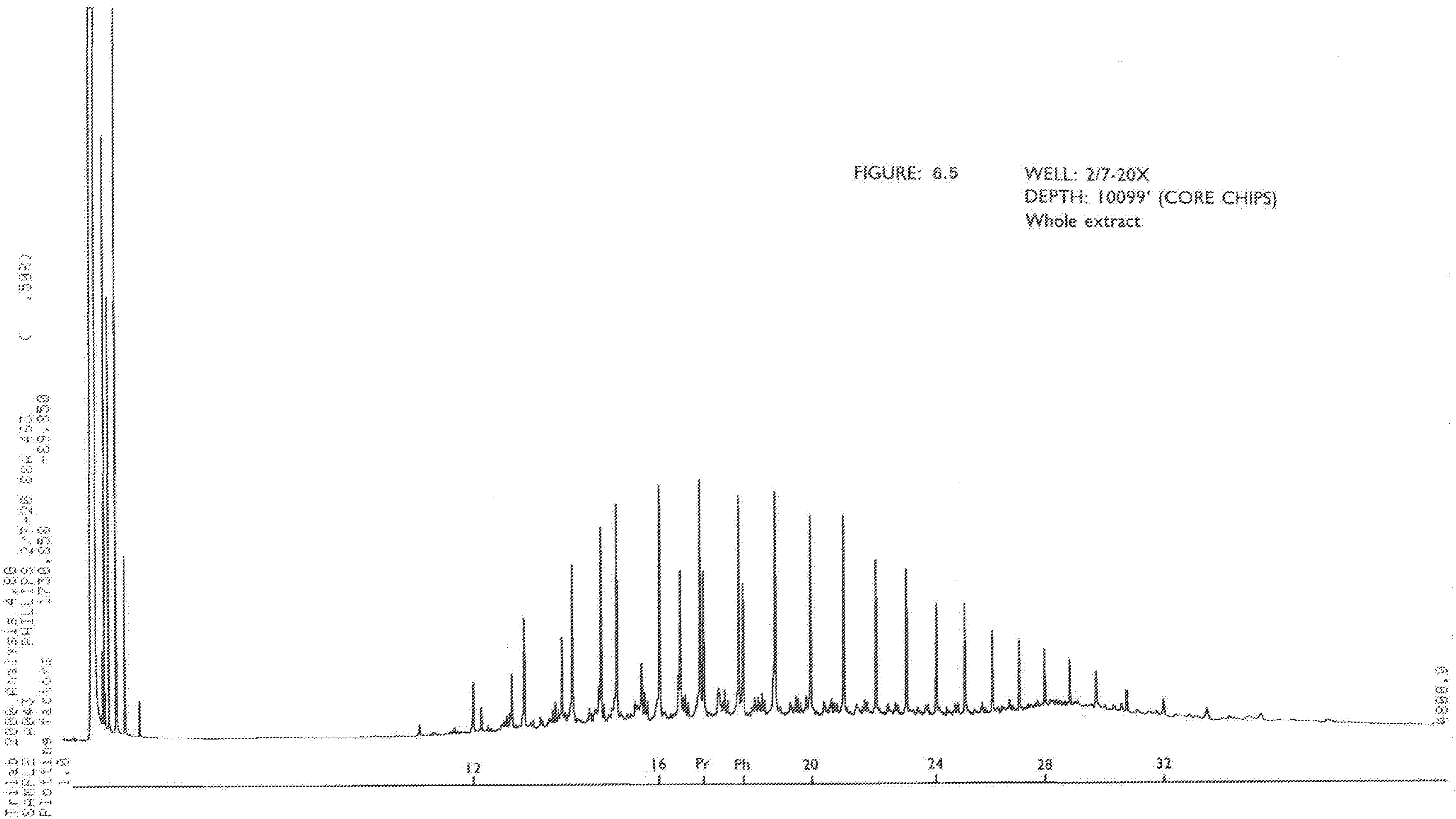
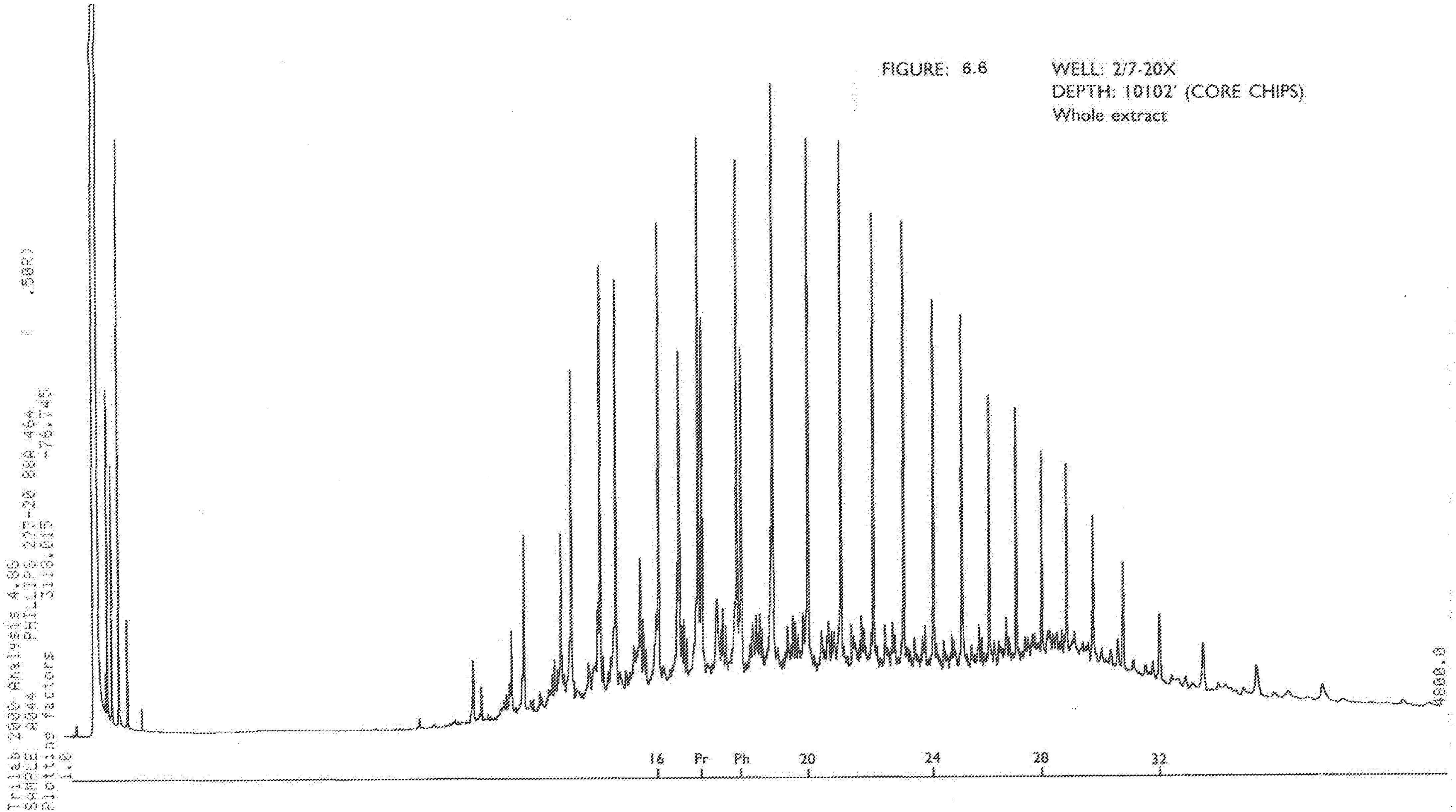


FIGURE: 6.6

WELL: 2/7-20X
DEPTH: 10102' (CORE CHIPS)
Whole extract



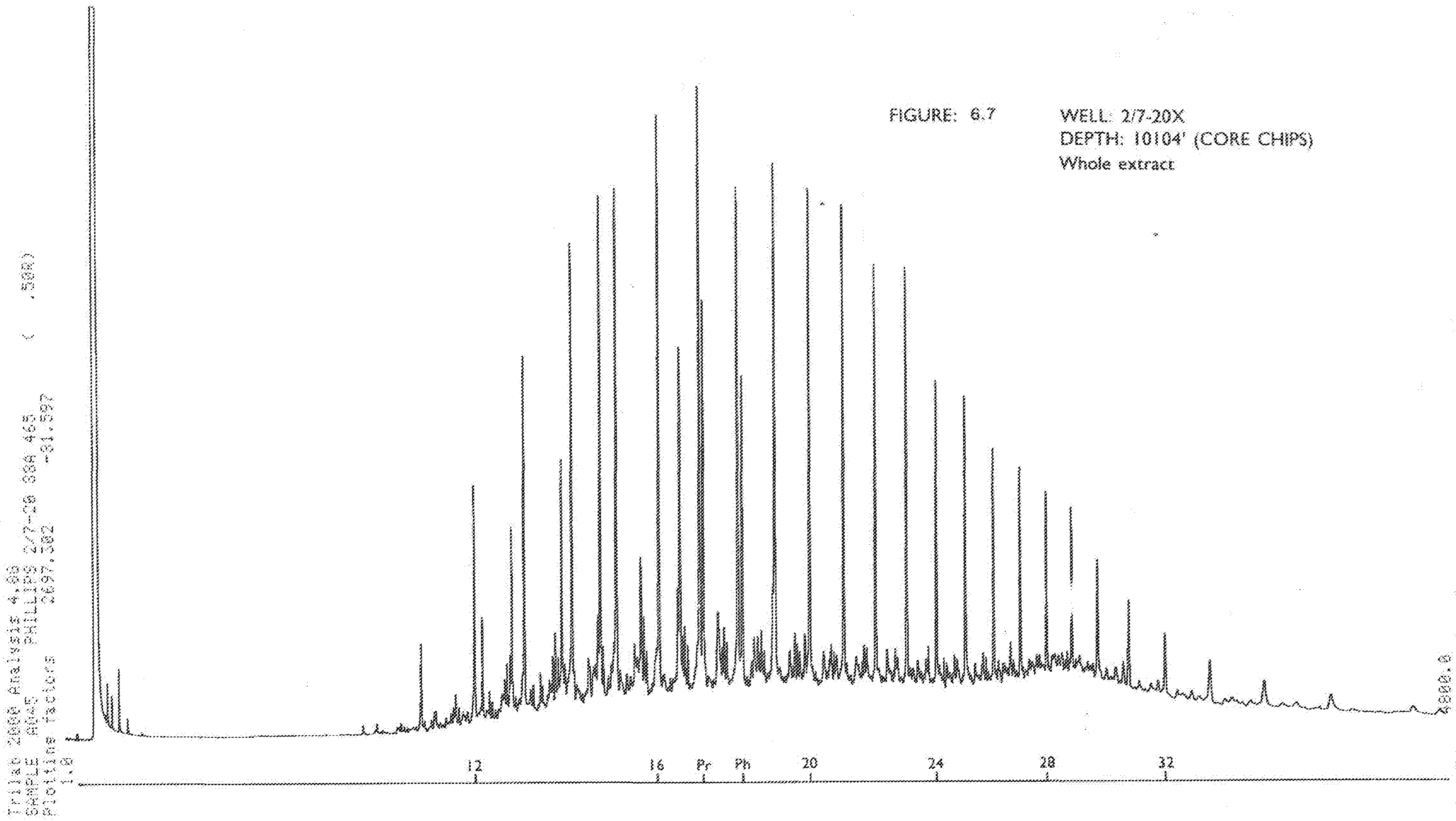


FIGURE: 6.7

WELL: 2/7-20X
DEPTH: 10104' (CORE CHIPS)
Whole extract

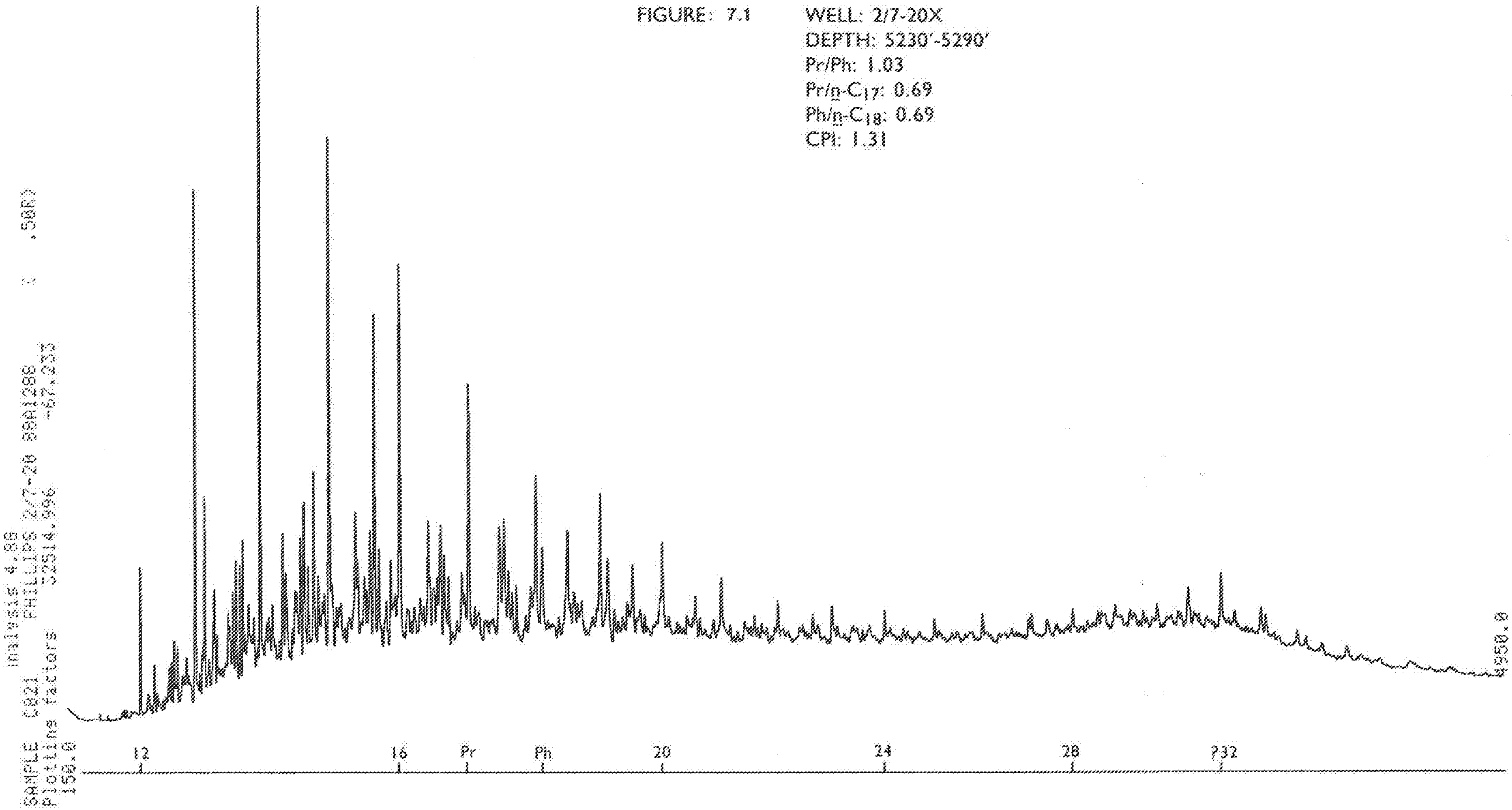


FIGURE: 7.1
WELL: 2/7-20X
DEPTH: 5230'-5290'
Pr/Ph: 1.03
Pr/$\underline{n}$-C_{17}: 0.69
Ph/$\underline{n}$-C_{18}: 0.69
CPI: 1.31
SAMPLE C821 Analysis 4.88
Plotting factors PHILLIPS 2/7-20 88A1288
150.0 32514.996 -67.233
12
16
Pr
Ph
20
24
28
32
4950.0

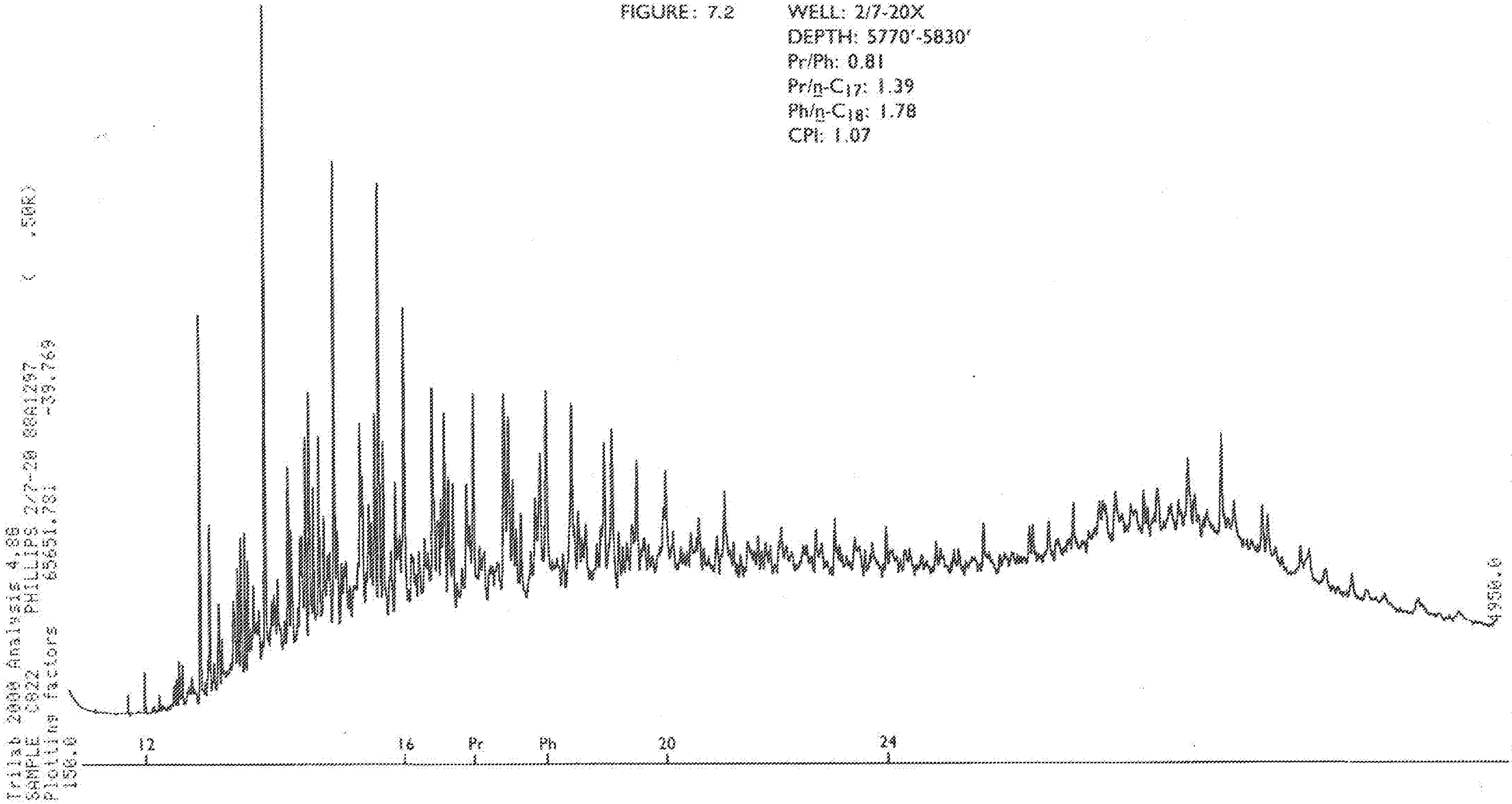


FIGURE: 7.2
WELL: 2/7-20X
DEPTH: 5770'-5830'
Pr/Ph: 0.81
Pr/n-C17: 1.39
Ph/n-C18: 1.78
CPI: 1.07
Trilab 2000 Analysis 4.00
SAMPLE C022 PHILLIPS 2/7-20 88A1297 (.50R)
Plotting factors 85651.781 -39.769
150.0
4950.0
12
16
Pr
Ph
20
24

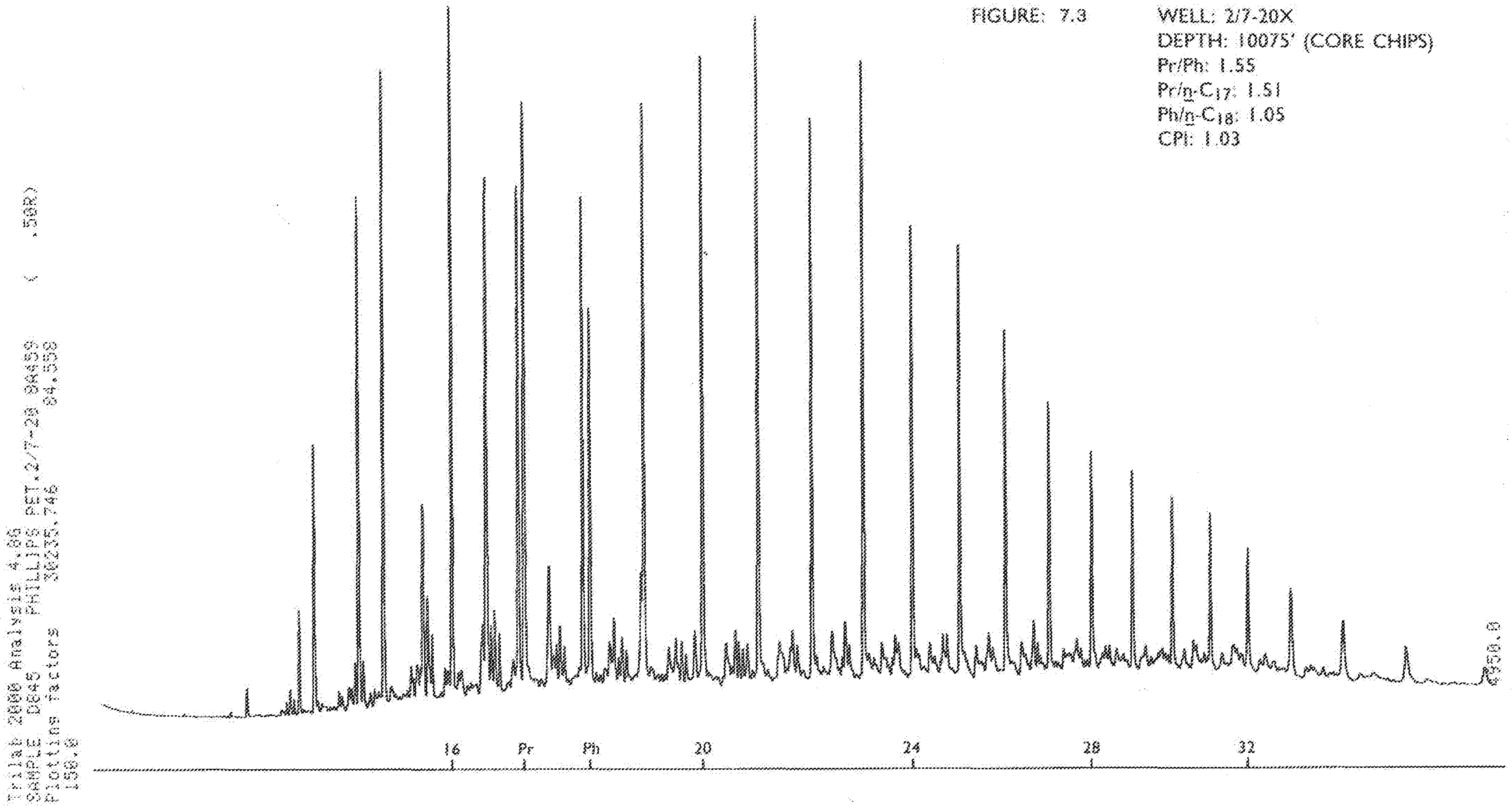

Trilab 2000 Analysis 4.06
SAMPLE D845 PHILLIPS PET.2/7-20 9A459 (.50R)
Plotting factors 30235.746 94.558
150.0
16
Pr
Ph
20
24
28
32
4350.0
WELL: 2/7-20X
DEPTH: 10075' (CORE CHIPS)
Pr/Ph: 1.55
Pr/n-C17: 1.51
Ph/n-C18: 1.05
CPI: 1.03

FIGURE: 7.3

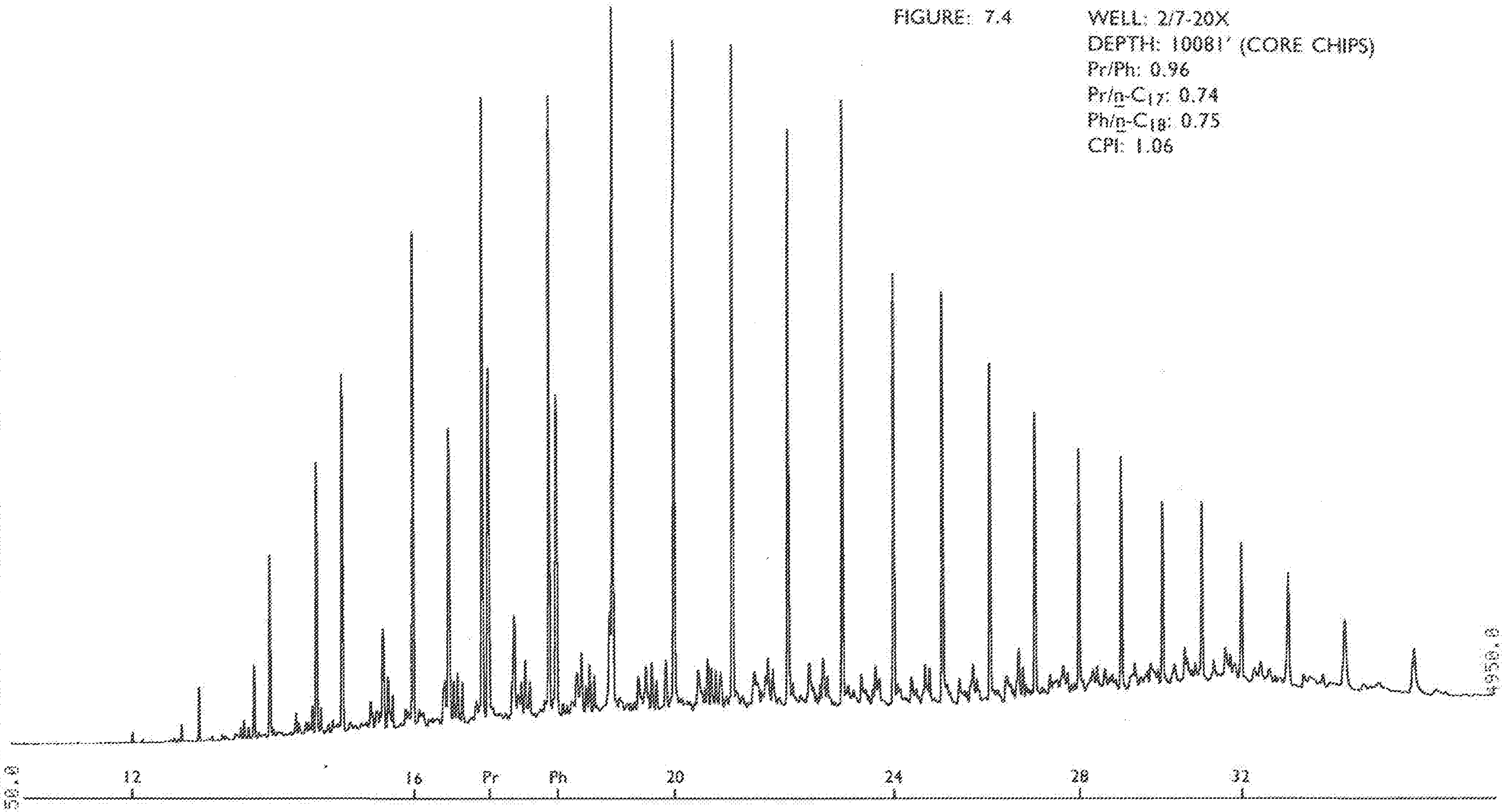


FIGURE: 7.4

WELL: 2/7-20X
DEPTH: 10081' (CORE CHIPS)
Pr/Ph: 0.96
Pr/$\underline{n}$-C_{17}: 0.74
Ph/$\underline{n}$-C_{18}: 0.75
CPI: 1.06

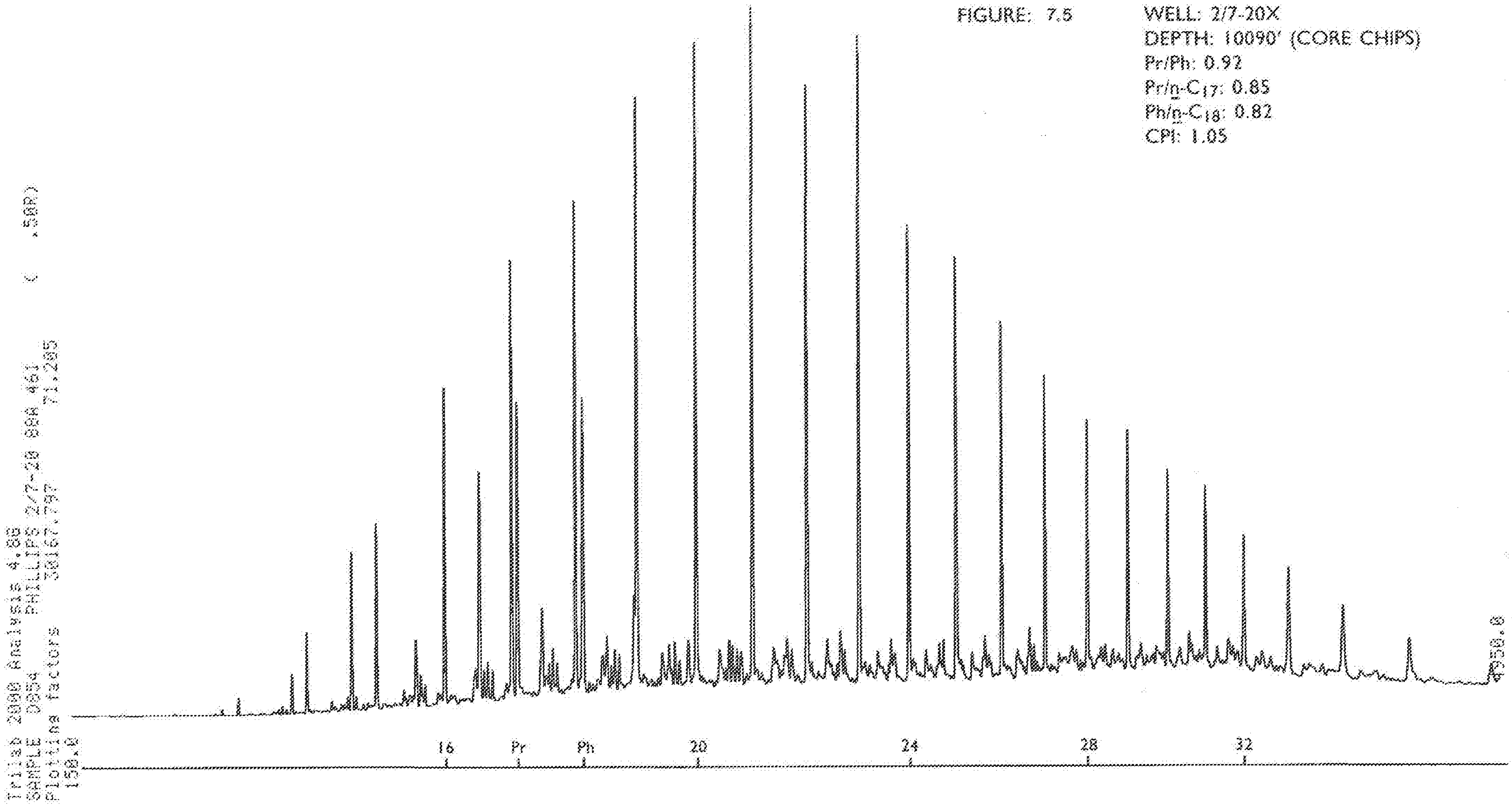
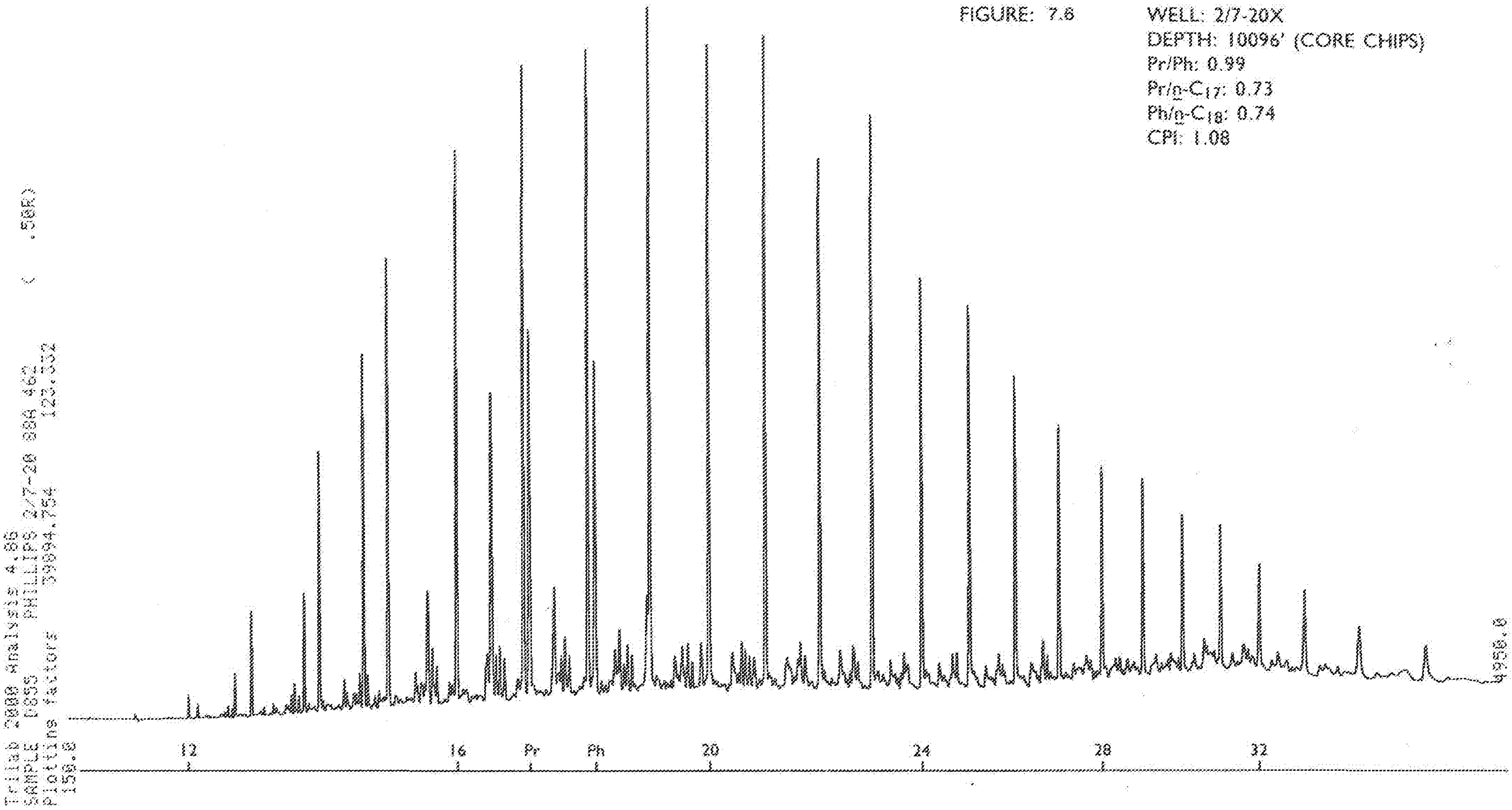


FIGURE: 7.5
WELL: 2/7-20X
DEPTH: 10090' (CORE CHIPS)
Pr/Ph: 0.92
Pr/n-C17: 0.85
Ph/n-C18: 0.82
CPI: 1.05
16
Pr
Ph
20
24
28
32
Trilab 2000 Analysis 4.80
SAMPLE 0054 PHILLIPS 2/7-20 80A 461
Plotting factors 30167.797 71.205 (.50R)
150.0
4950.0

FIGURE: 7.6

WELL: 2/7-20X
DEPTH: 10096' (CORE CHIPS)
Pr/Ph: 0.99
Pr/$\underline{n}$-C_{17}: 0.73
Ph/$\underline{n}$-C_{18}: 0.74
CPI: 1.08



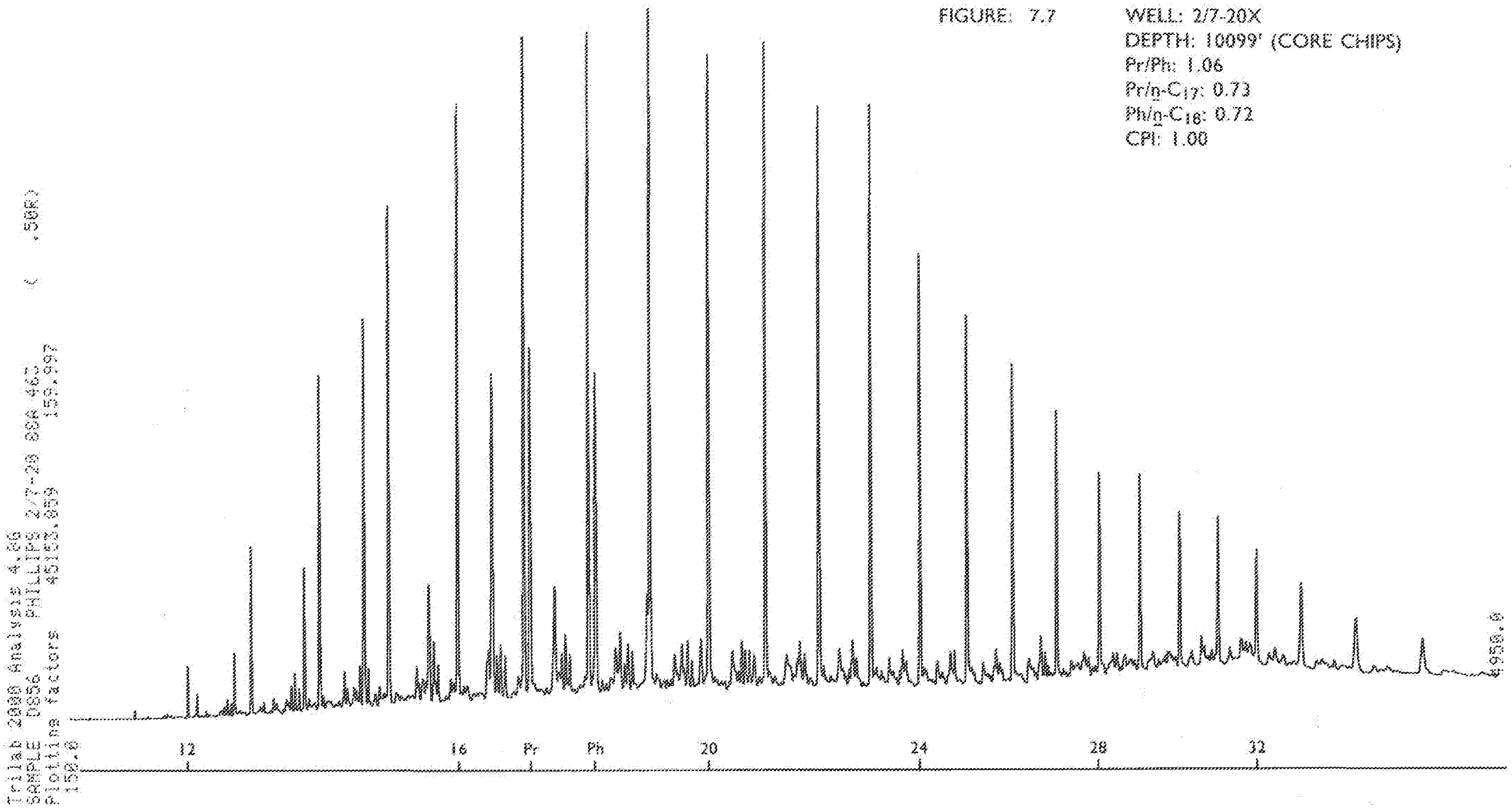


FIGURE: 7.7
WELL: 2/7-20X
DEPTH: 10099' (CORE CHIPS)
Pr/Ph: 1.06
Pr/n-C17: 0.73
Ph/n-C18: 0.72
CPI: 1.00
12
16
Pr
Ph
20
24
28
32

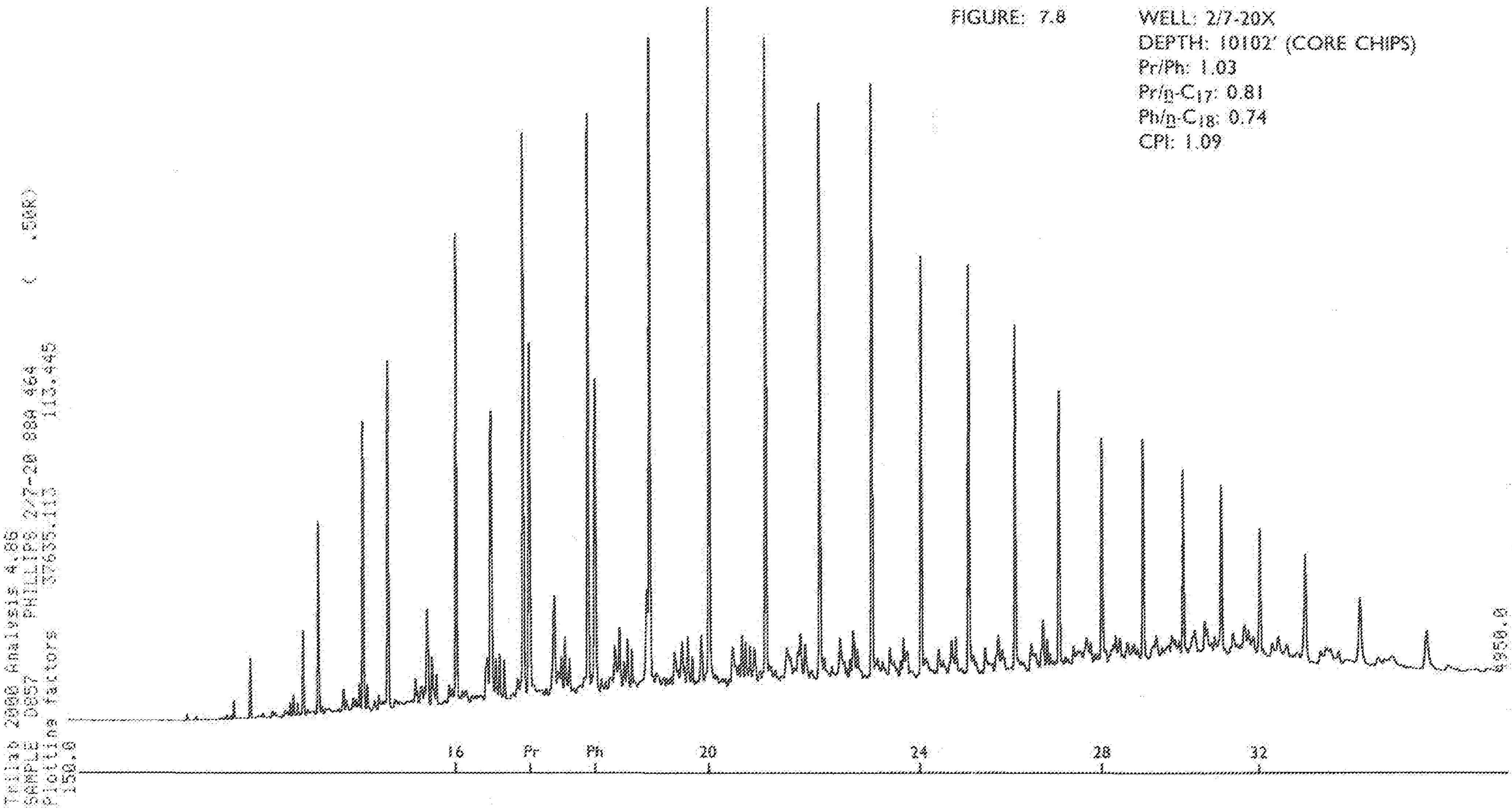


FIGURE: 7.8

WELL: 2/7-20X
DEPTH: 10102' (CORE CHIPS)
Pr/Ph: 1.03
Pr/$\underline{n}$-C_{17}: 0.81
Ph/$\underline{n}$-C_{18}: 0.74
CPI: 1.09

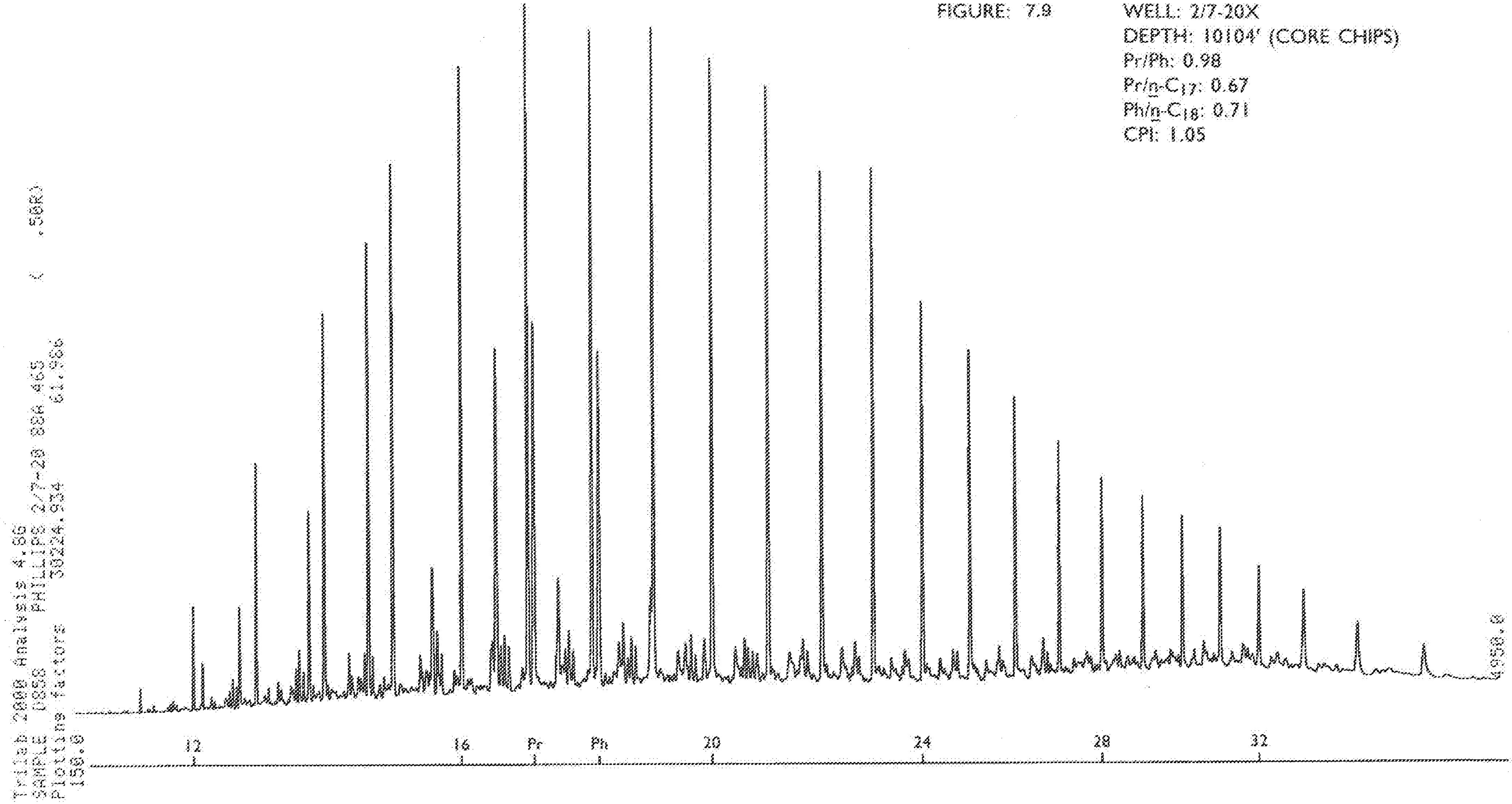


FIGURE: 7.9

WELL: 2/7-20X
DEPTH: 10104' (CORE CHIPS)
Pr/Ph: 0.98
Pr/n-C_{17}: 0.67
Ph/n-C_{18}: 0.71
CPI: 1.05

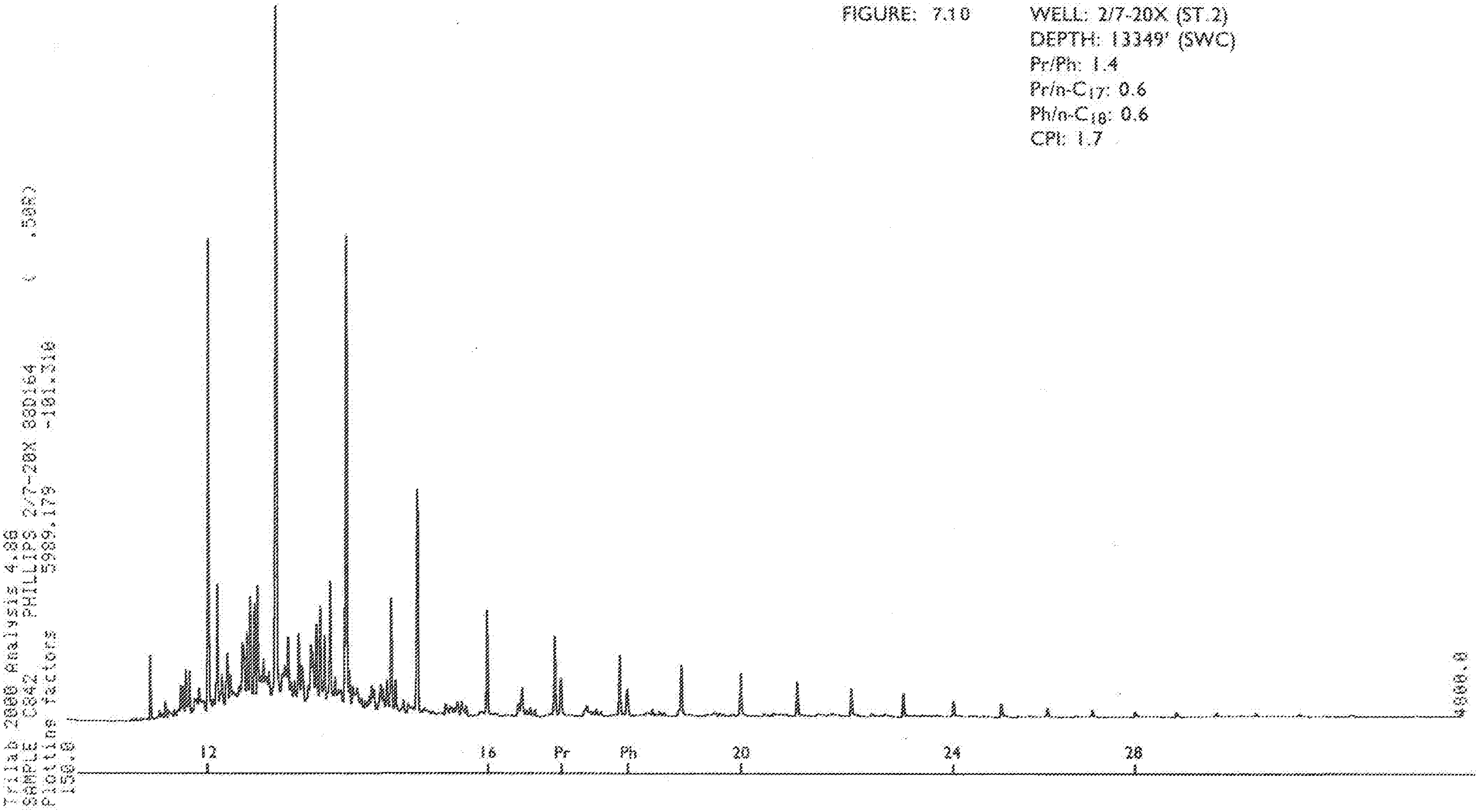


FIGURE: 7.10
WELL: 2/7-20X (ST.2)
DEPTH: 13349' (SWC)
Pr/Ph: 1.4
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.7
12
16
Pr
Ph
20
24
28
4000.0

FIGURE: 7.11

WELL: 2/7-20X (ST.2)
DEPTH: 13349' (SWC)
Pr/Ph: 1.4
Pr/$\underline{n}$-C_{17}: 0.6
Ph/$\underline{n}$-C_{18}: 0.6
CPI: 1.7
(enhanced)

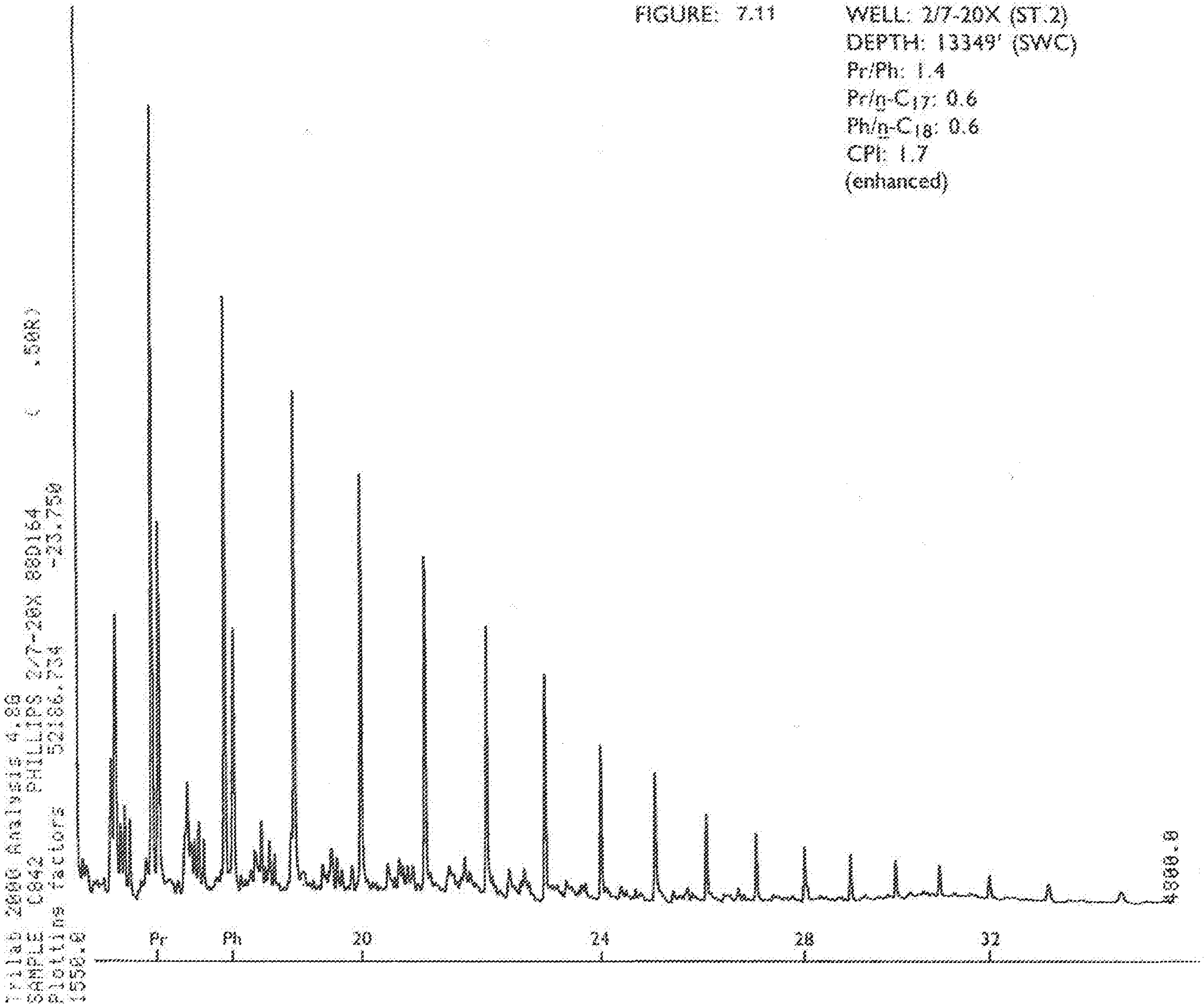


FIGURE: 7.12

WELL: 2/7-20X (ST.2)
DEPTH: 13395' (SWC)
Pr/Ph: 1.3
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.0

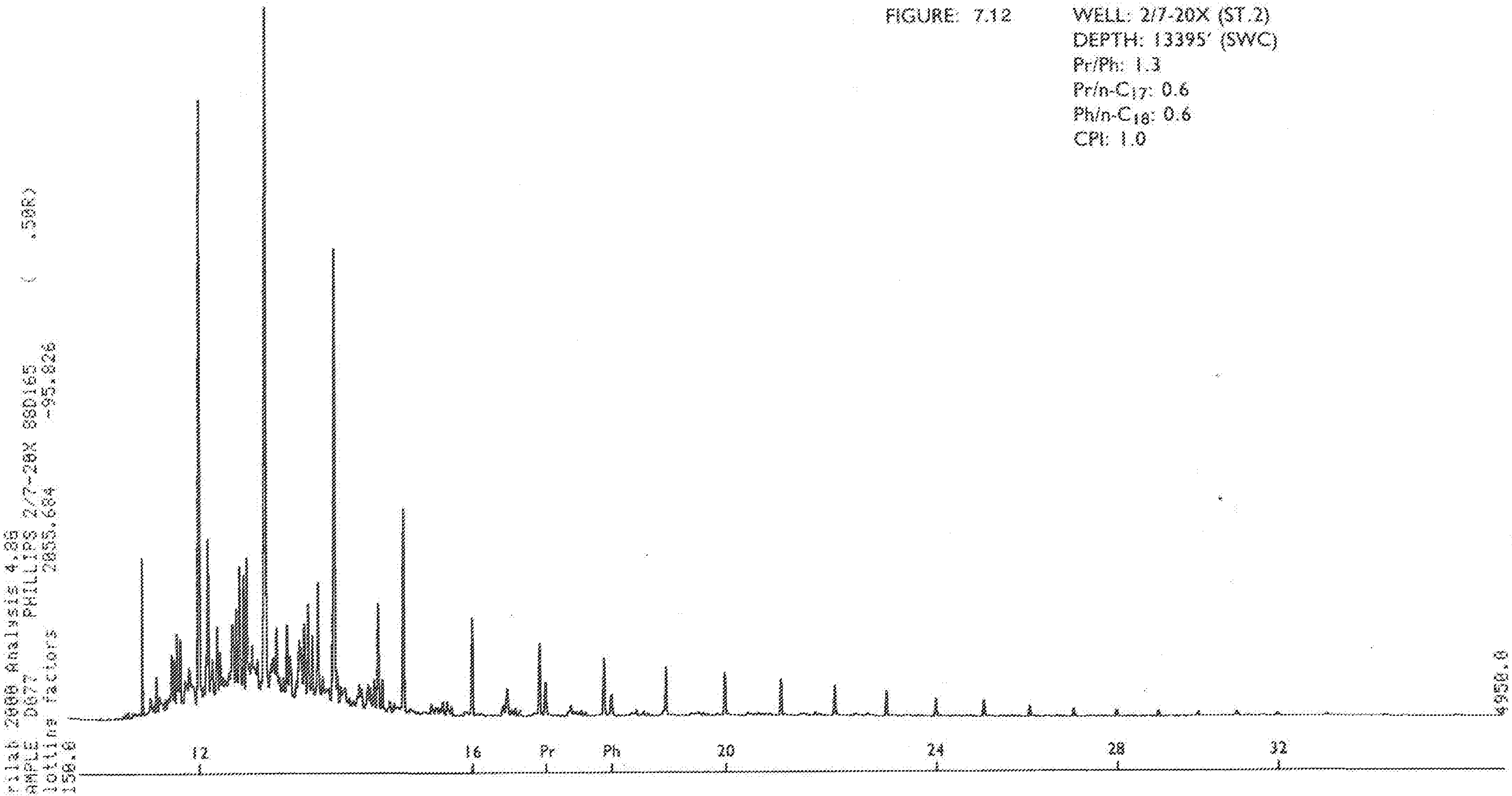


FIGURE: 7.13

WELL: 2/7-20X (ST.2)
DEPTH: 13395' (SWC)
Pr/Ph: 1.3
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.0
(enhanced)

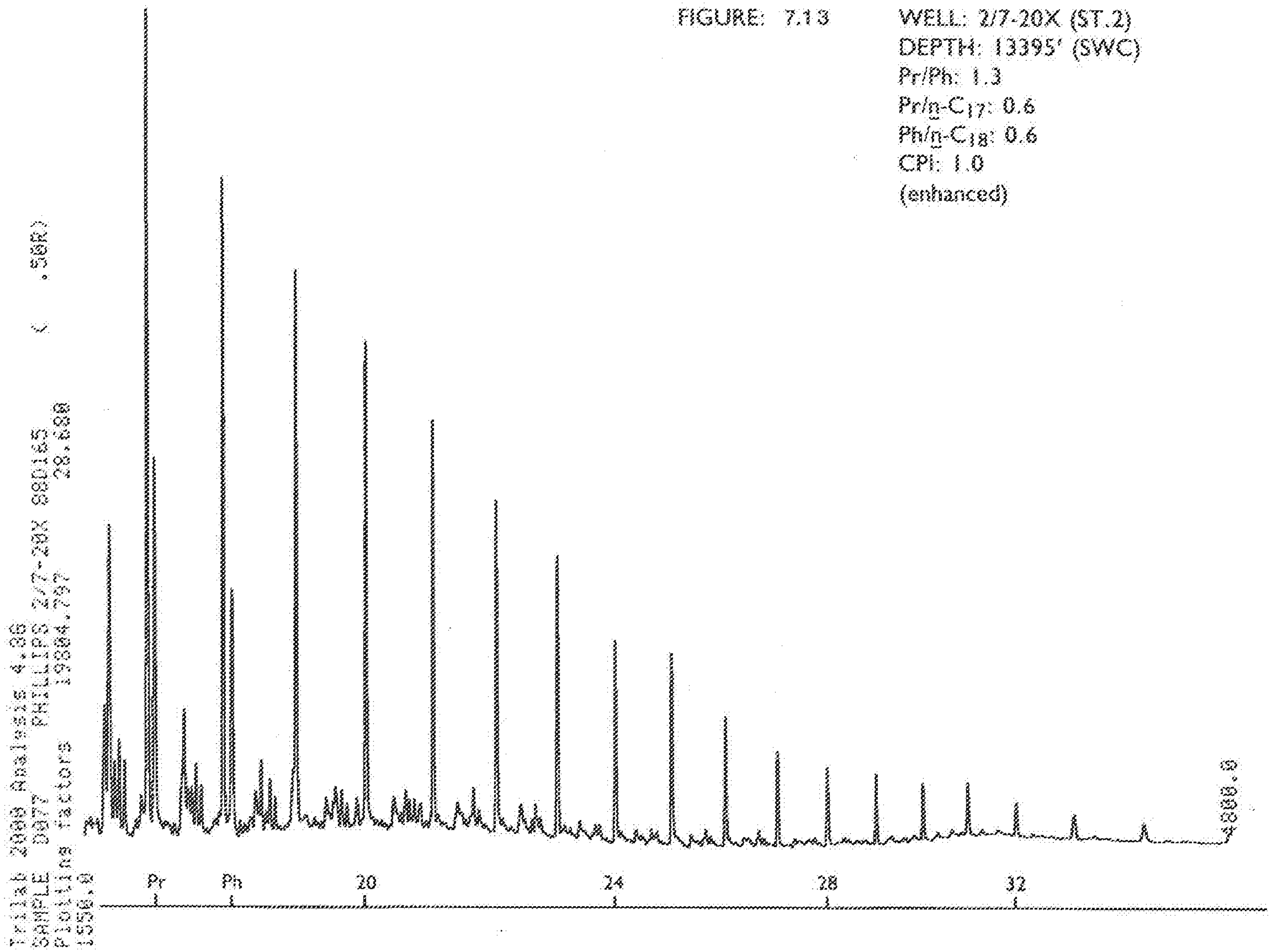


FIGURE: 7.14

WELL: 2/7-20X (ST.2)
DEPTH: 13480' (SWC)
Pr/Ph: 1.4
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.5
CPI: 1.5

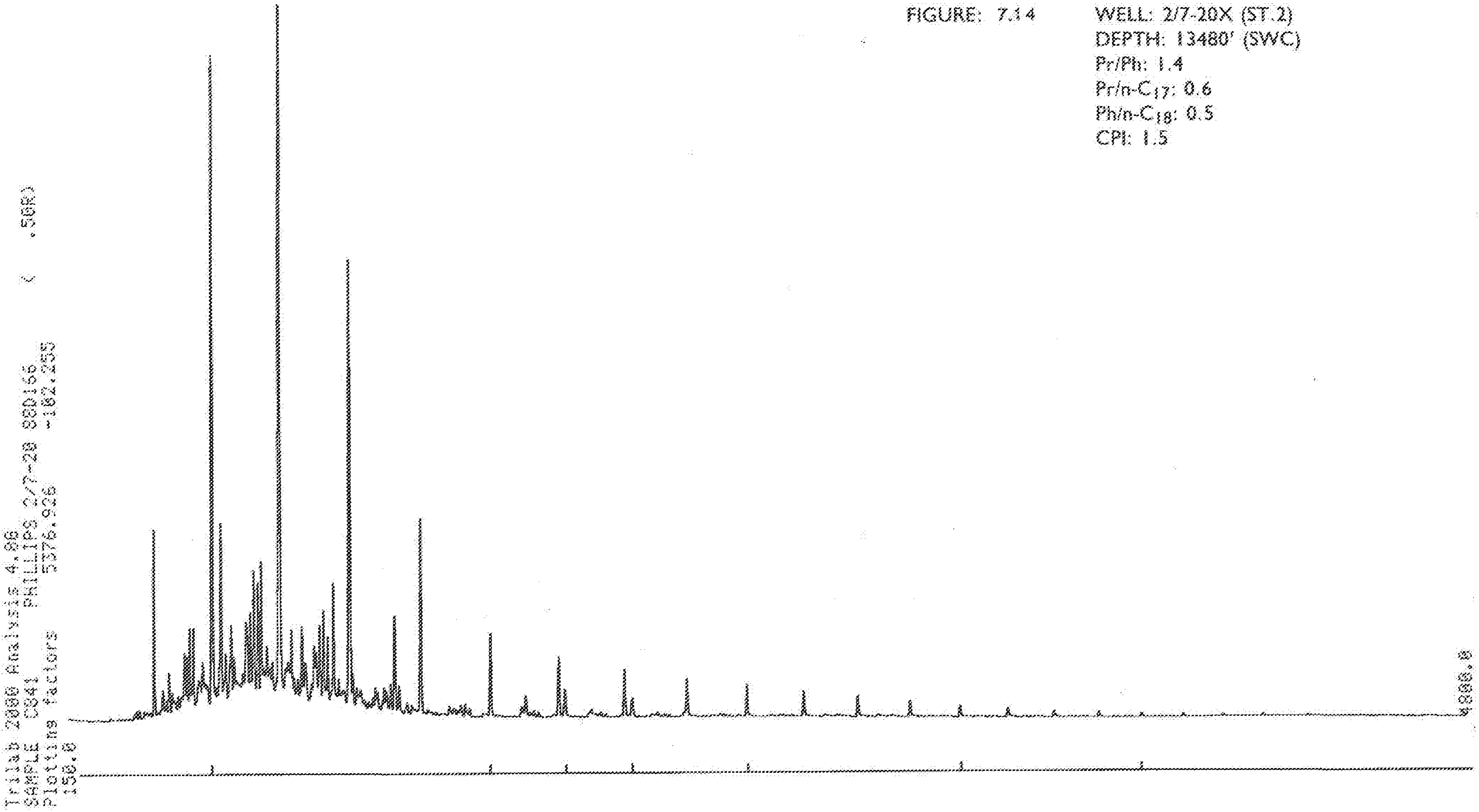


FIGURE: 7.15

WELL: 2/7-20X (ST.2)
DEPTH: 13480' (SWC)
Pr/Ph: 1.4
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.5
CPI: 1.5
(enhanced)

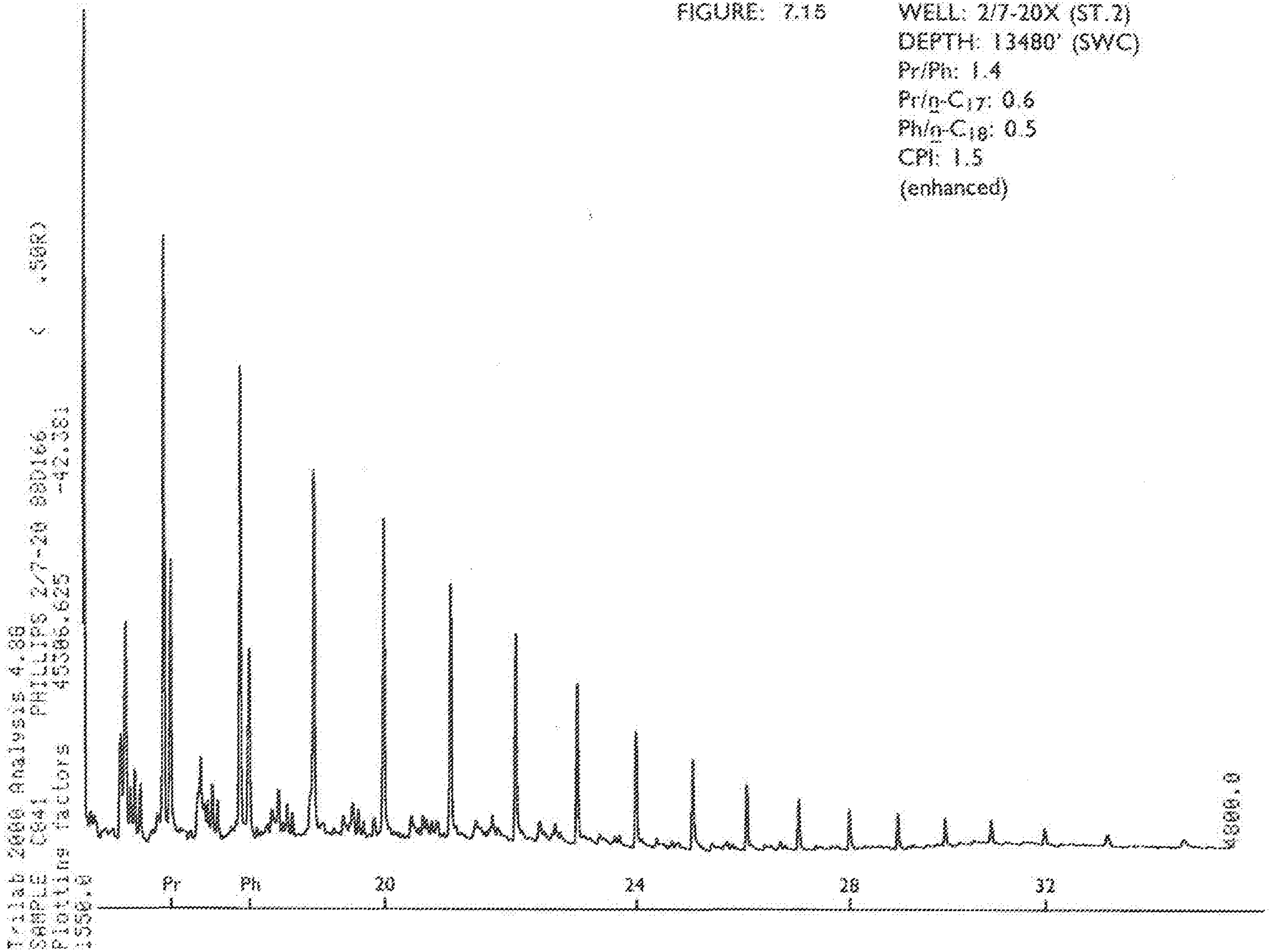


FIGURE: 7.16

WELL: 2/7-20X (ST.2)
DEPTH: 13545' (SWC)
Pr/Ph: 1.4
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.1

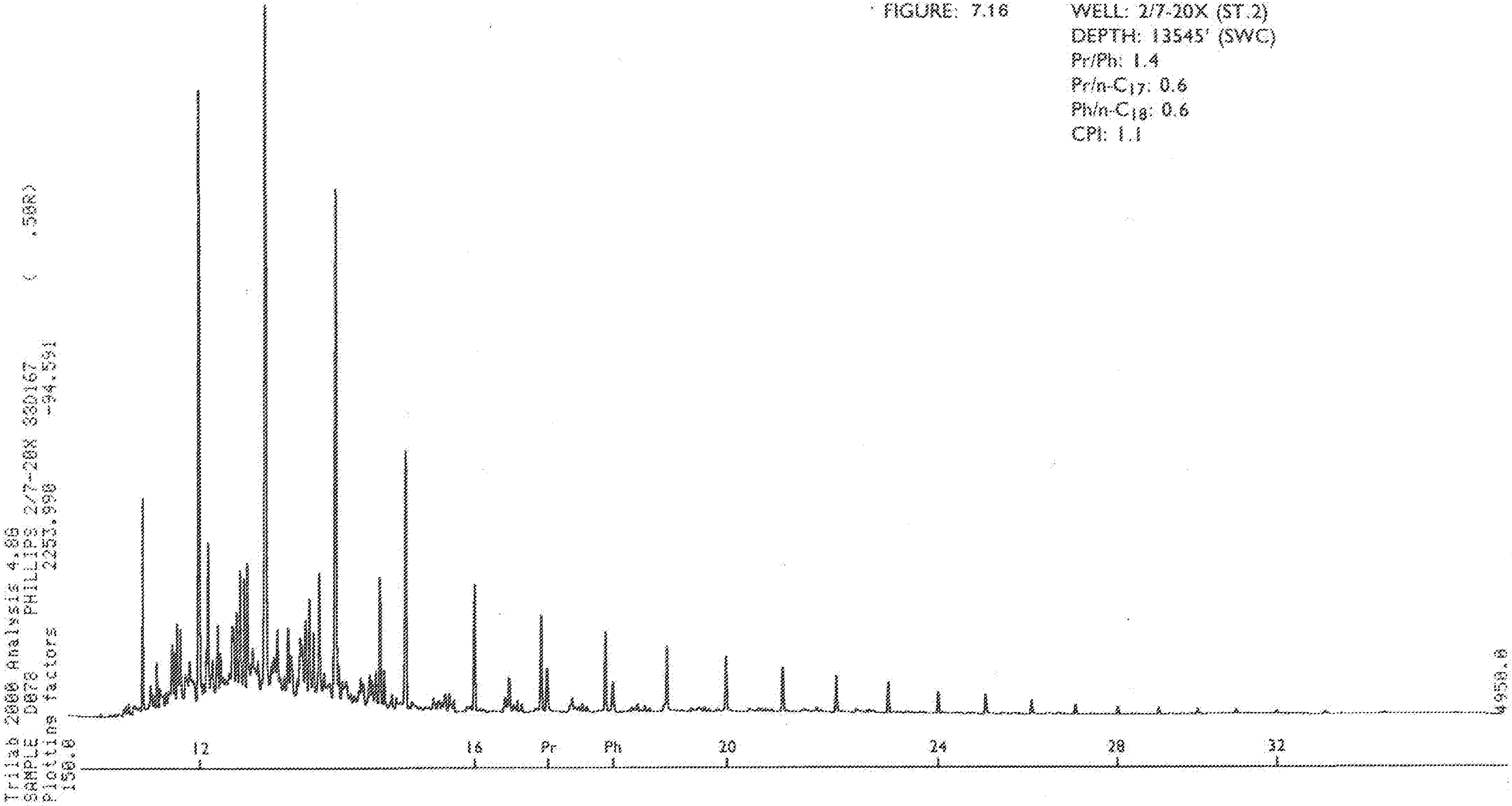


FIGURE: 7.17

WELL: 2/7-20X (ST.2)
DEPTH: 13545' (SWC)
Pr/Ph: 1.4
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.1
(enhanced)

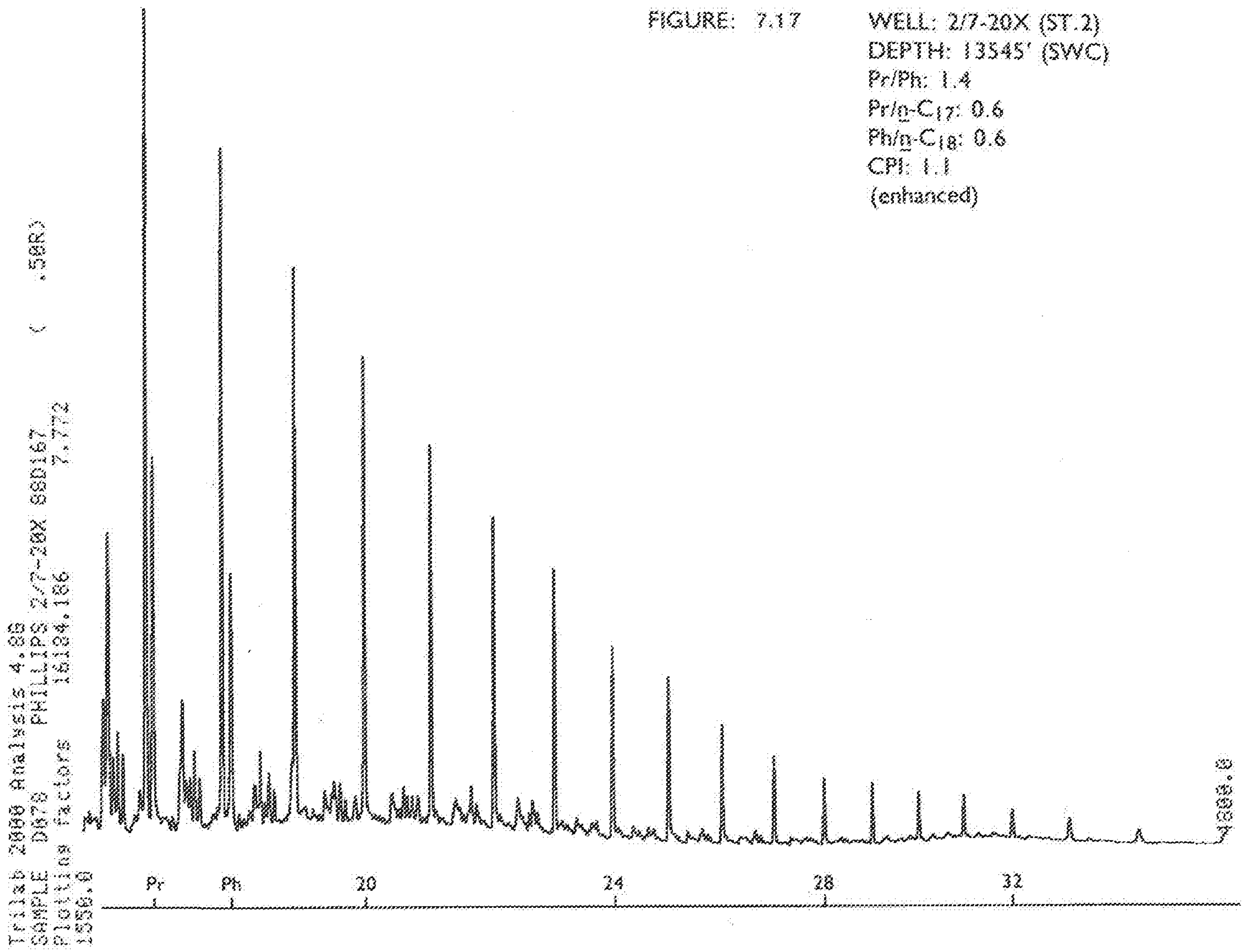


FIGURE: 7.18

WELL: 2/7-20X (ST.2)
DEPTH: 13634' (SWC)
Pr/Ph: 1.3
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.1

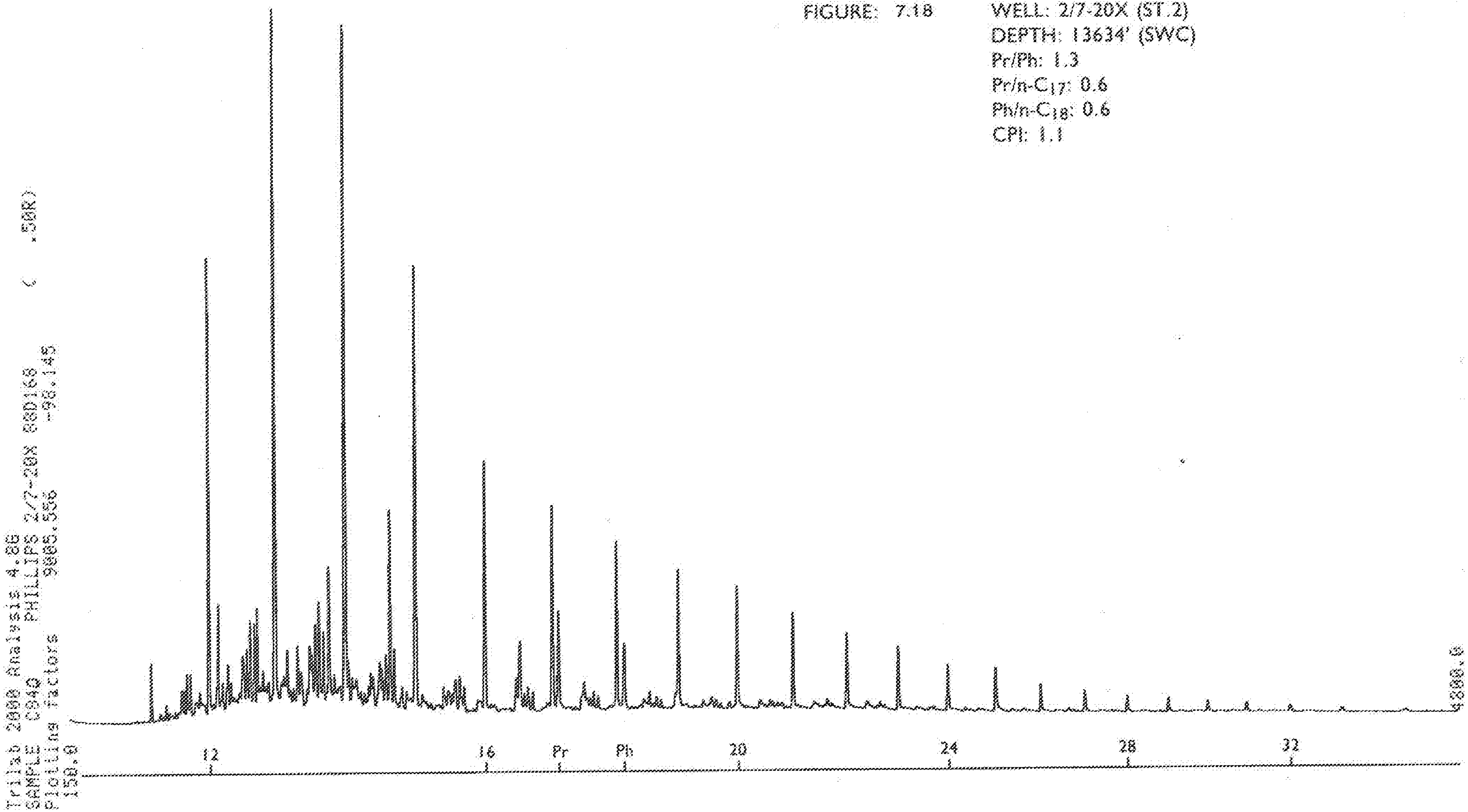
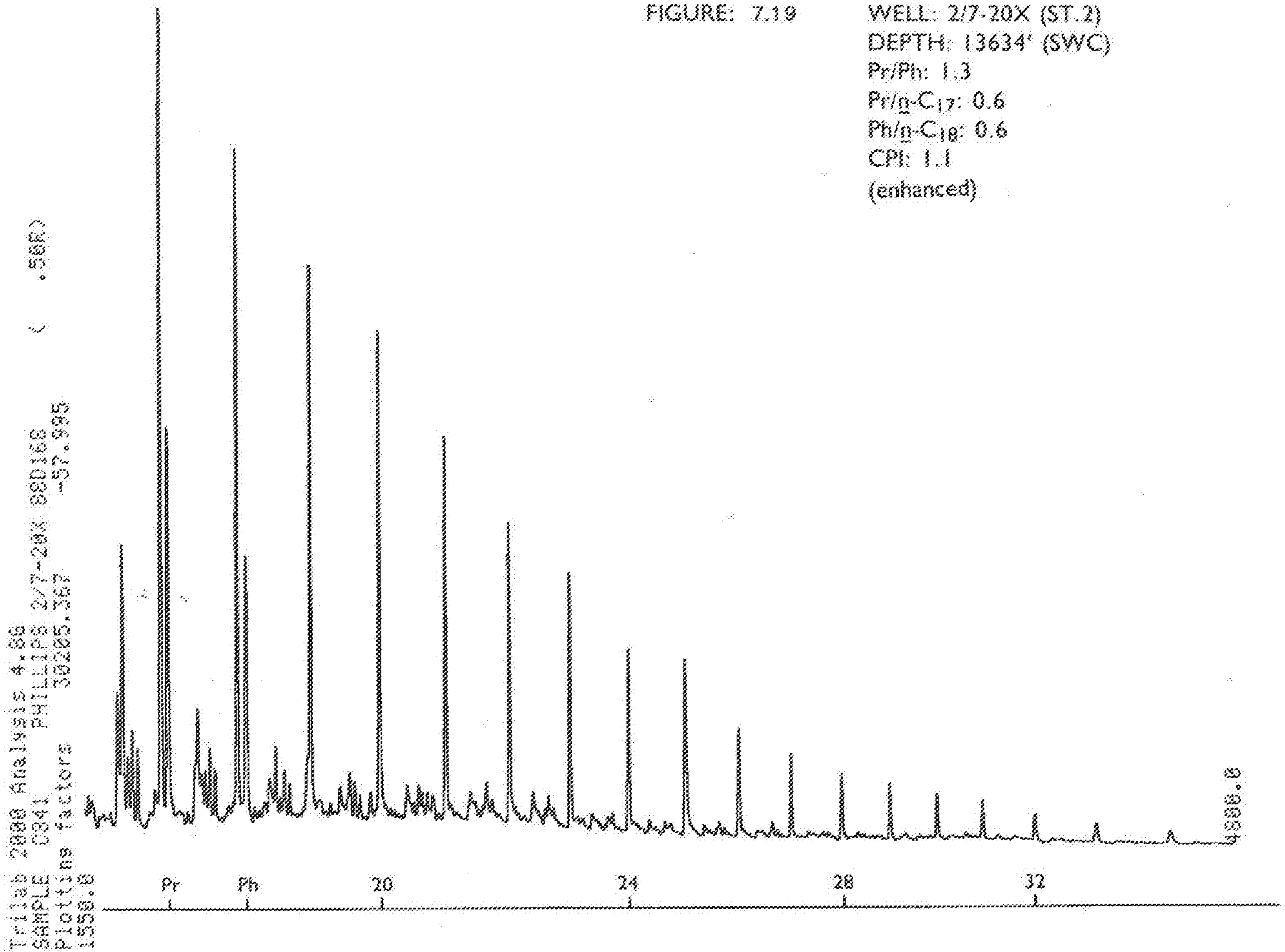


FIGURE: 7.19

WELL: 2/7-20X (ST.2)
DEPTH: 13634' (SWC)
Pr/Ph: 1.3
Pr/$\underline{n}$-C_{17}: 0.6
Ph/$\underline{n}$-C_{18}: 0.6
CPI: 1.1
(enhanced)



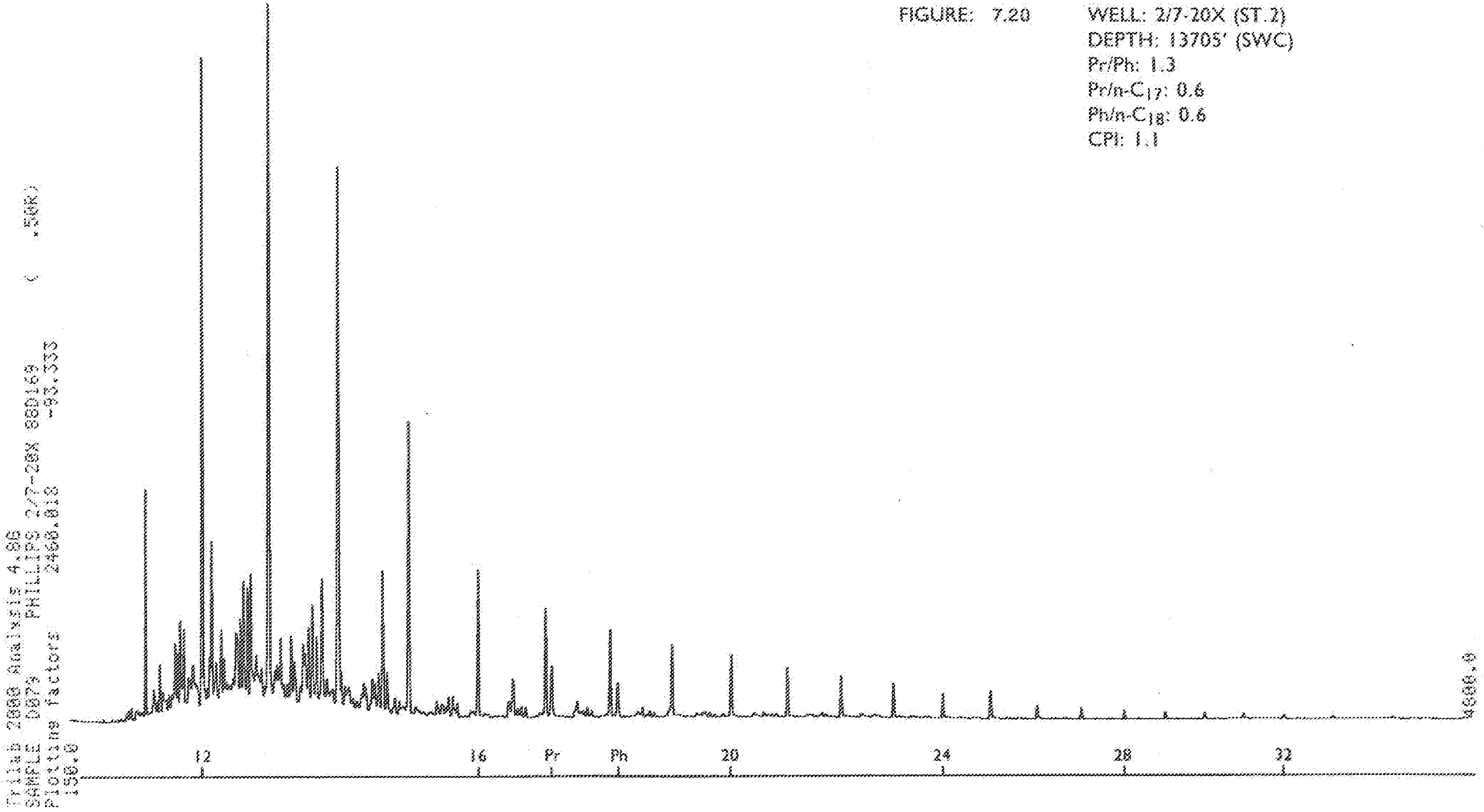
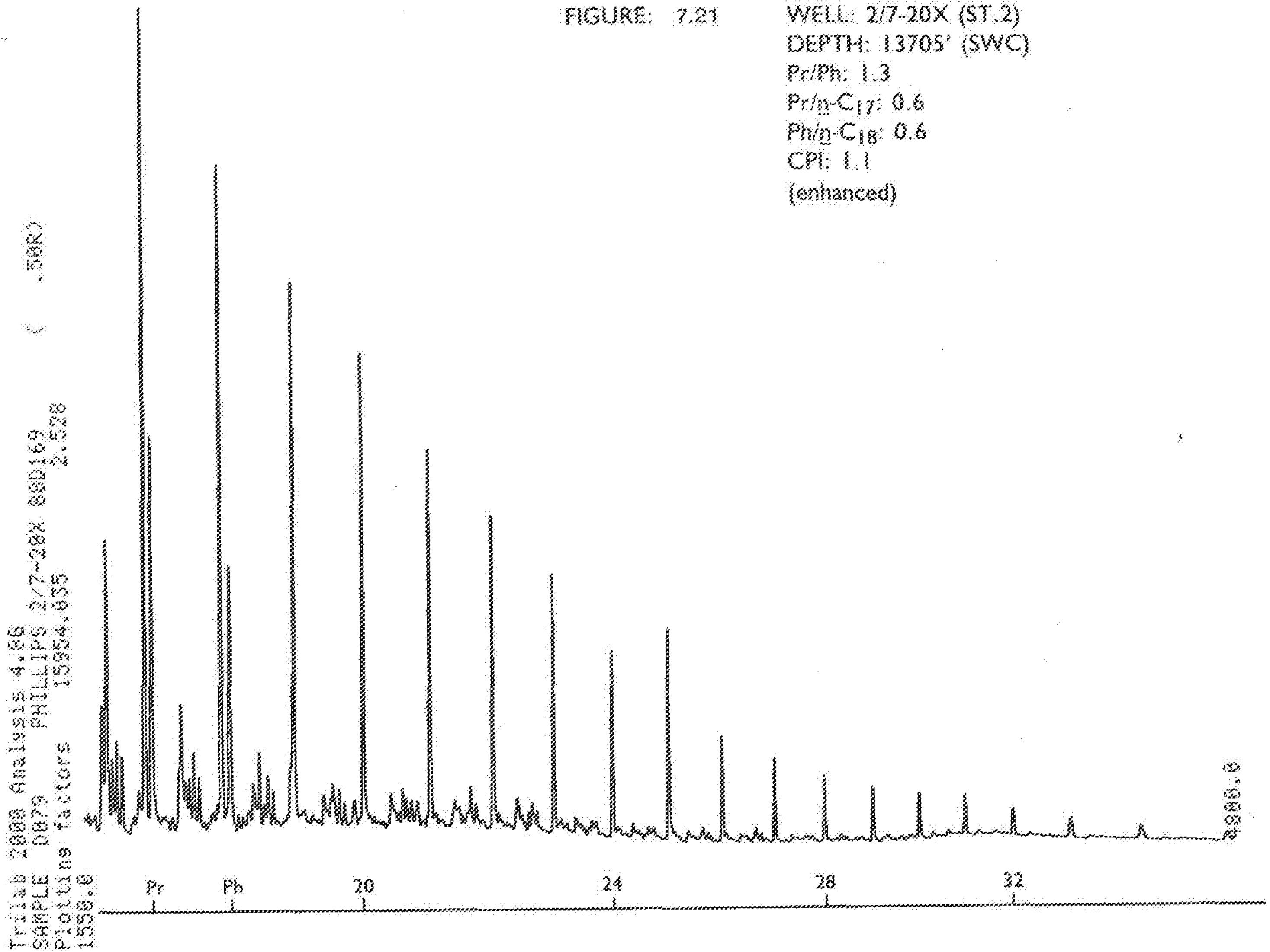


FIGURE: 7.20

WELL: 2/7-20X (ST.2)
DEPTH: 13705' (SWC)
Pr/Ph: 1.3
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.1

FIGURE: 7.21

WELL: 2/7-20X (ST.2)
DEPTH: 13705' (SWC)
Pr/Ph: 1.3
Pr/$\underline{n}$-C_{17}: 0.6
Ph/$\underline{n}$-C_{18}: 0.6
CPI: 1.1
(enhanced)



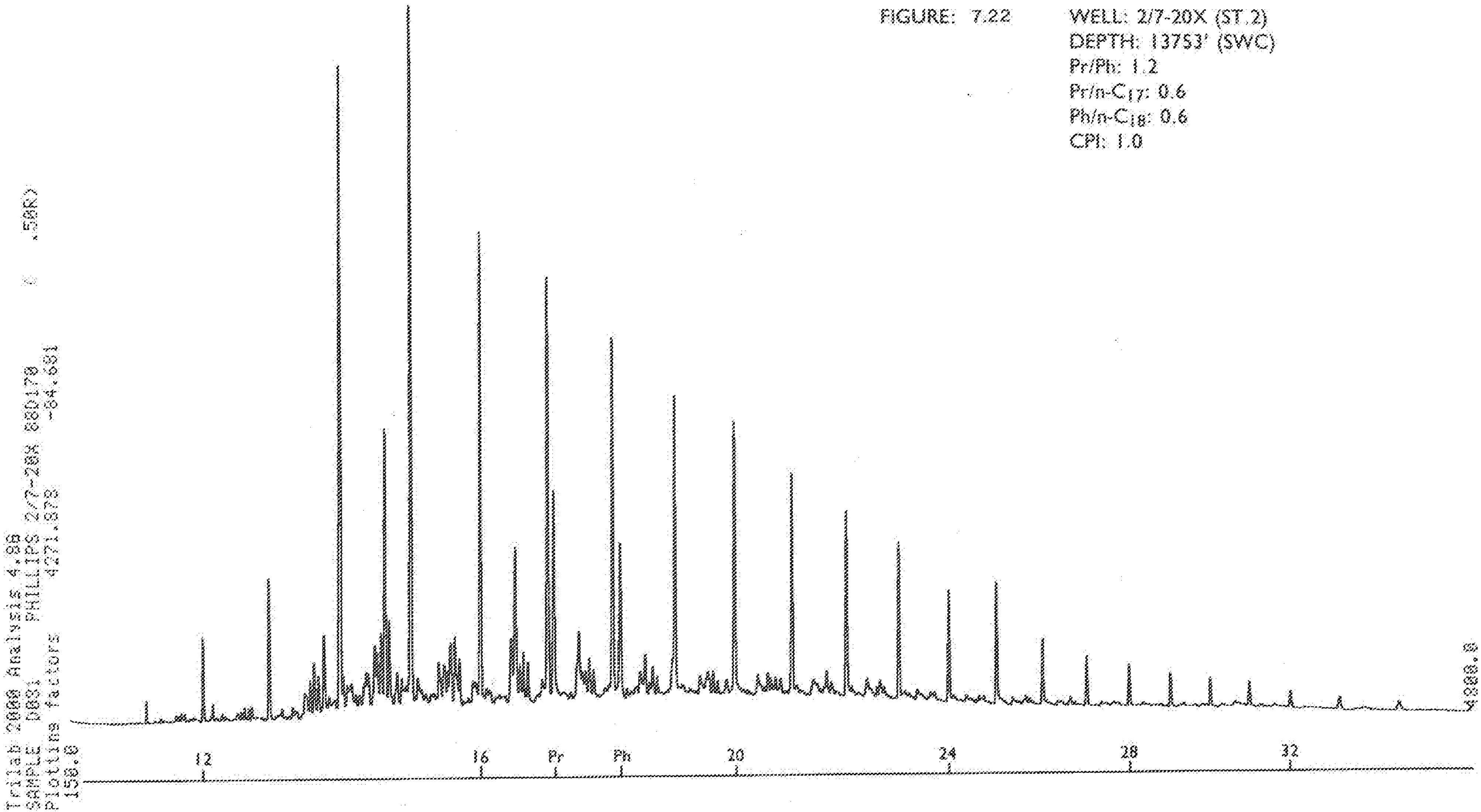
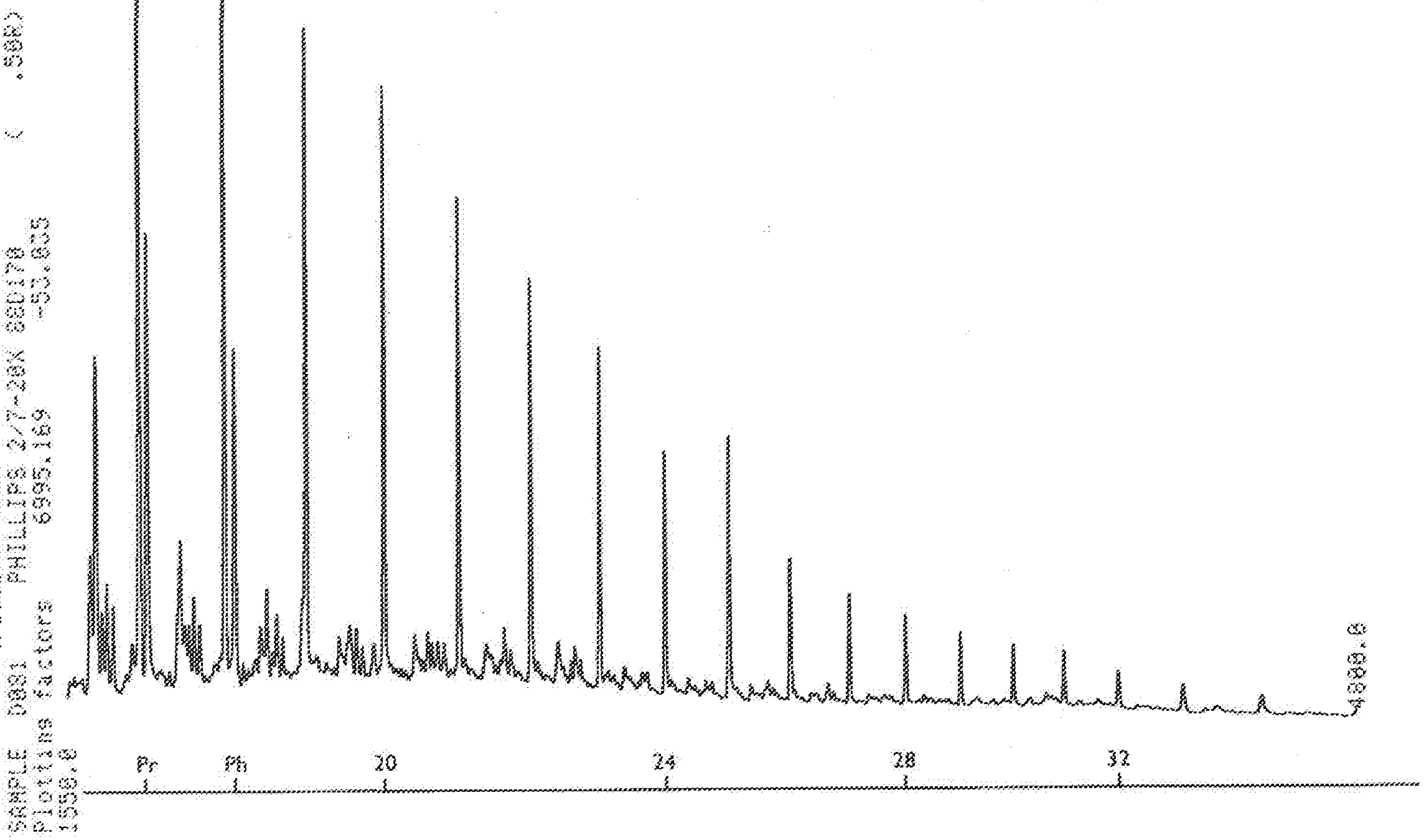


FIGURE: 7.22

WELL: 2/7-20X (ST.2)
DEPTH: 13753' (SWC)
Pr/Ph: 1.2
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.0

FIGURE: 7.23

WELL: 2/7-20X (ST.2)
DEPTH: 13753' (SWC)
Pr/Ph: 1.2
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.0
(enhanced)



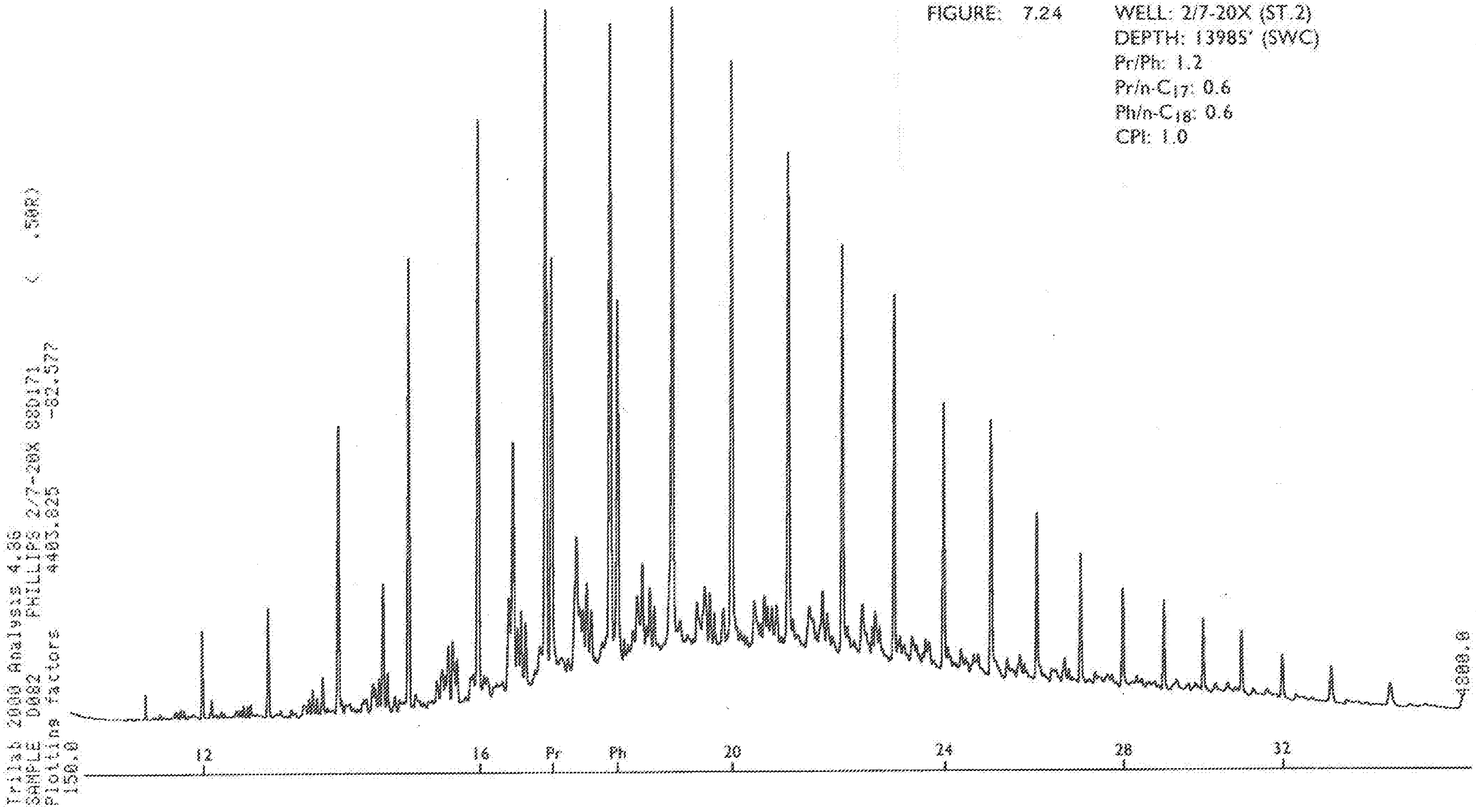


FIGURE: 7.24

WELL: 2/7-20X (ST.2)
DEPTH: 13985' (SWC)
Pr/Ph: 1.2
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.0

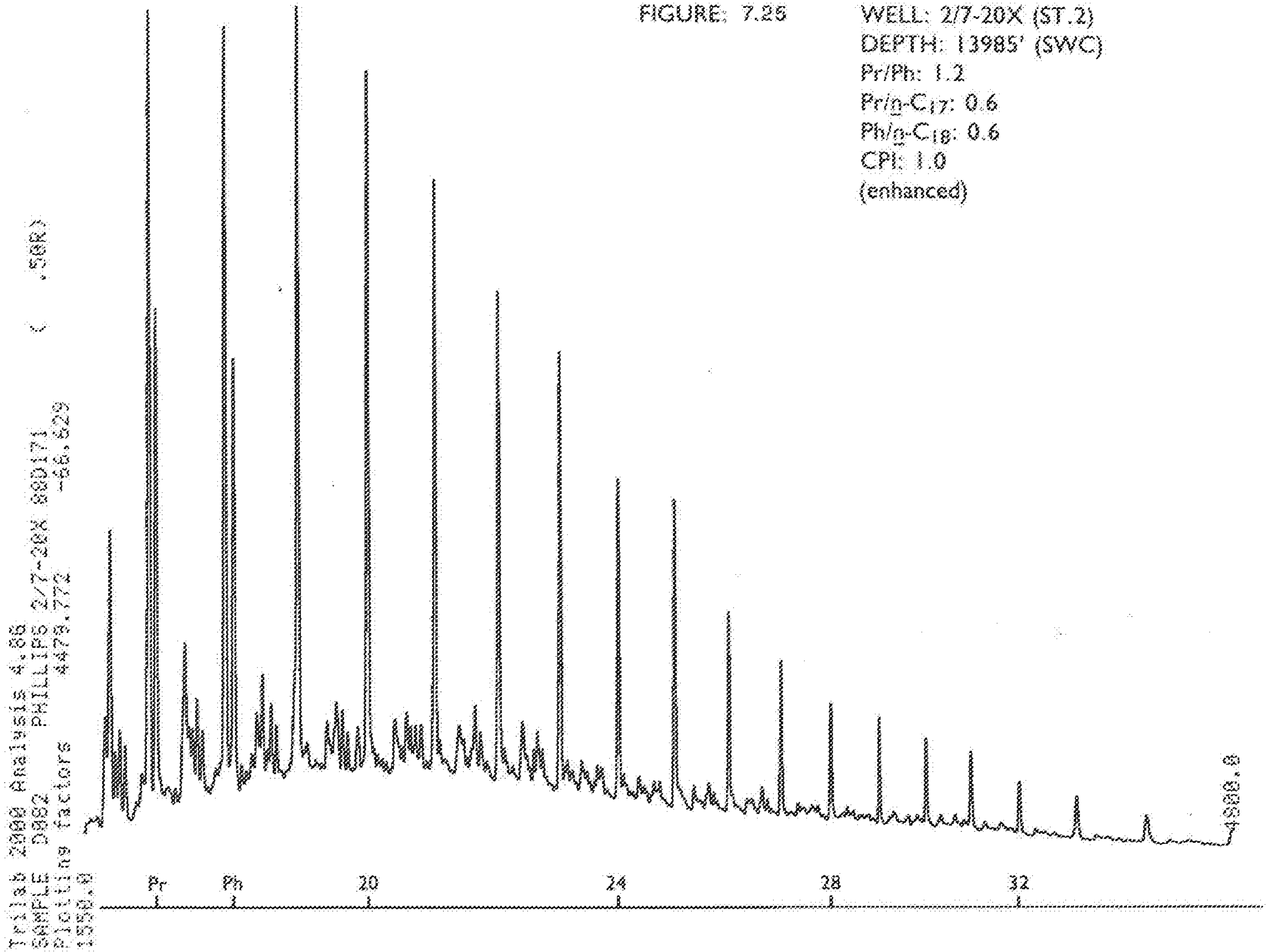


FIGURE: 7.25

WELL: 2/7-20X (ST.2)
DEPTH: 13985' (SWC)
Pr/Ph: 1.2
Pr/n-C_{17}: 0.6
Ph/n-C_{18}: 0.6
CPI: 1.0
(enhanced)

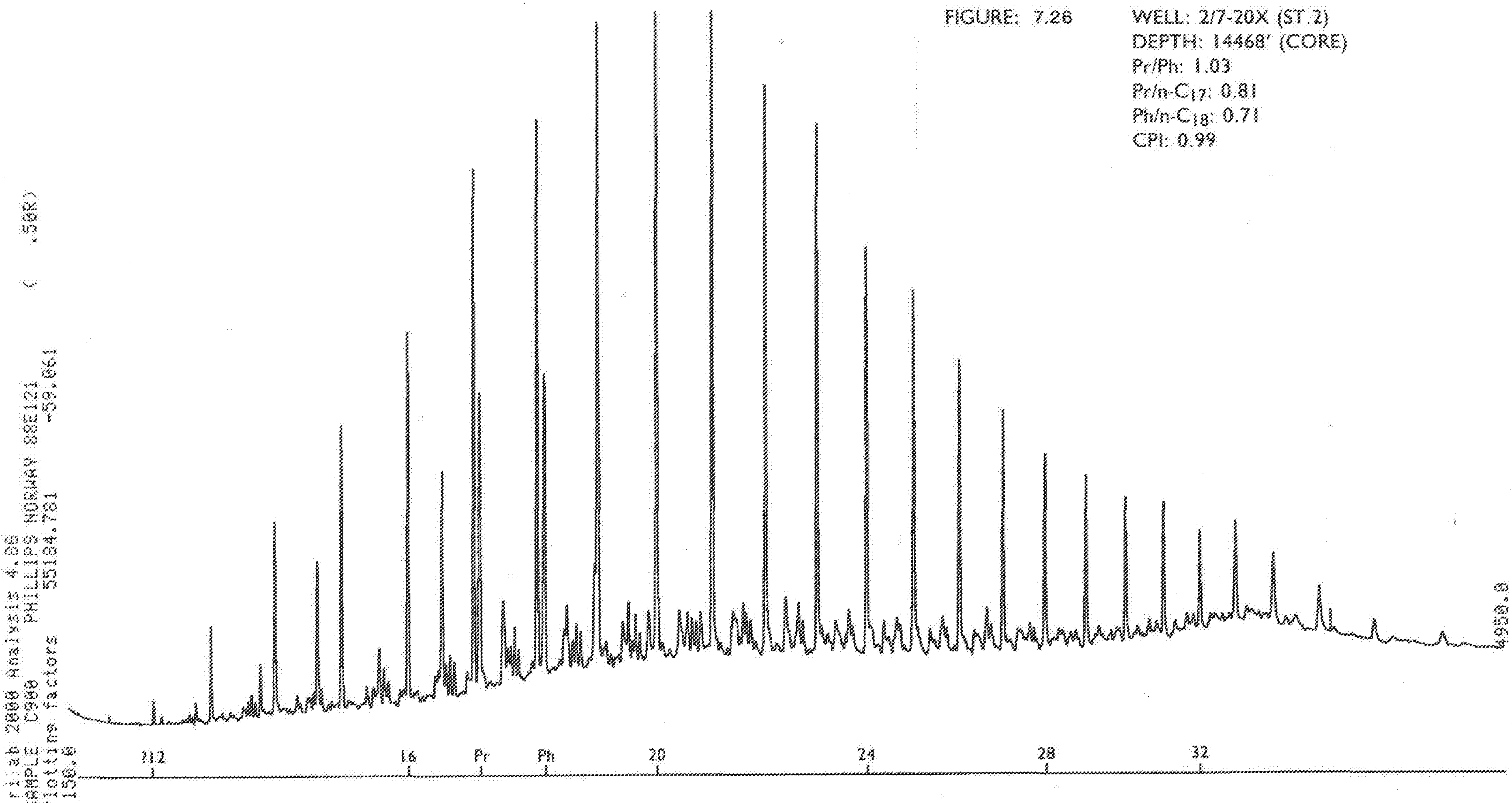


FIGURE: 7.26
WELL: 2/7-20X (ST.2)
DEPTH: 14468' (CORE)
Pr/Ph: 1.03
Pr/n-C_{17}: 0.81
Ph/n-C_{18}: 0.71
CPI: 0.99
12
16
Pr
Ph
20
24
28
32
4950.0
Filab 2000 Analysis 4.06 (.50R)
SAMPLE C900 PHILLIPS NORWAY 88E121
Plotting factors 55184.781 -59.061
150.0

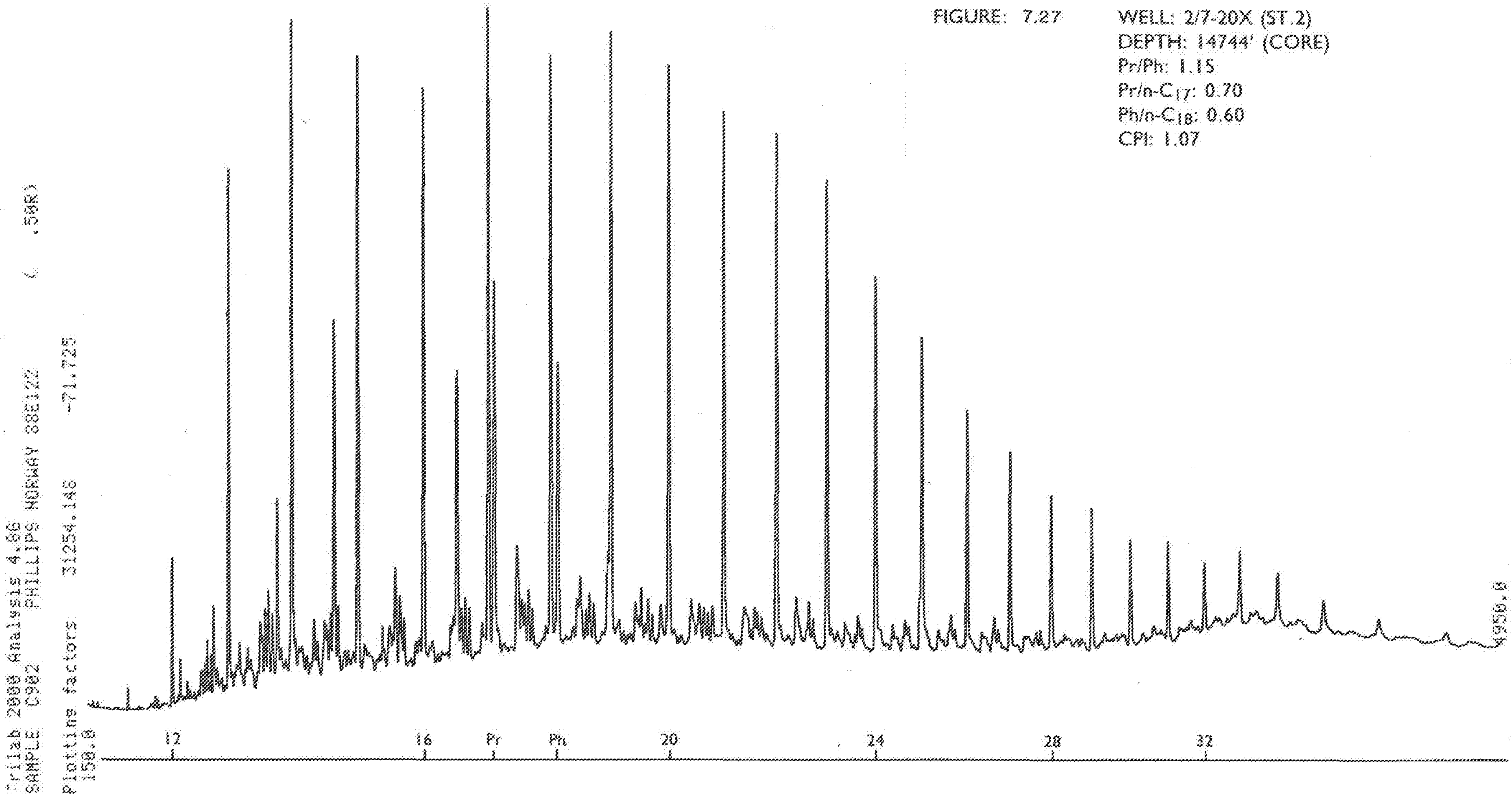
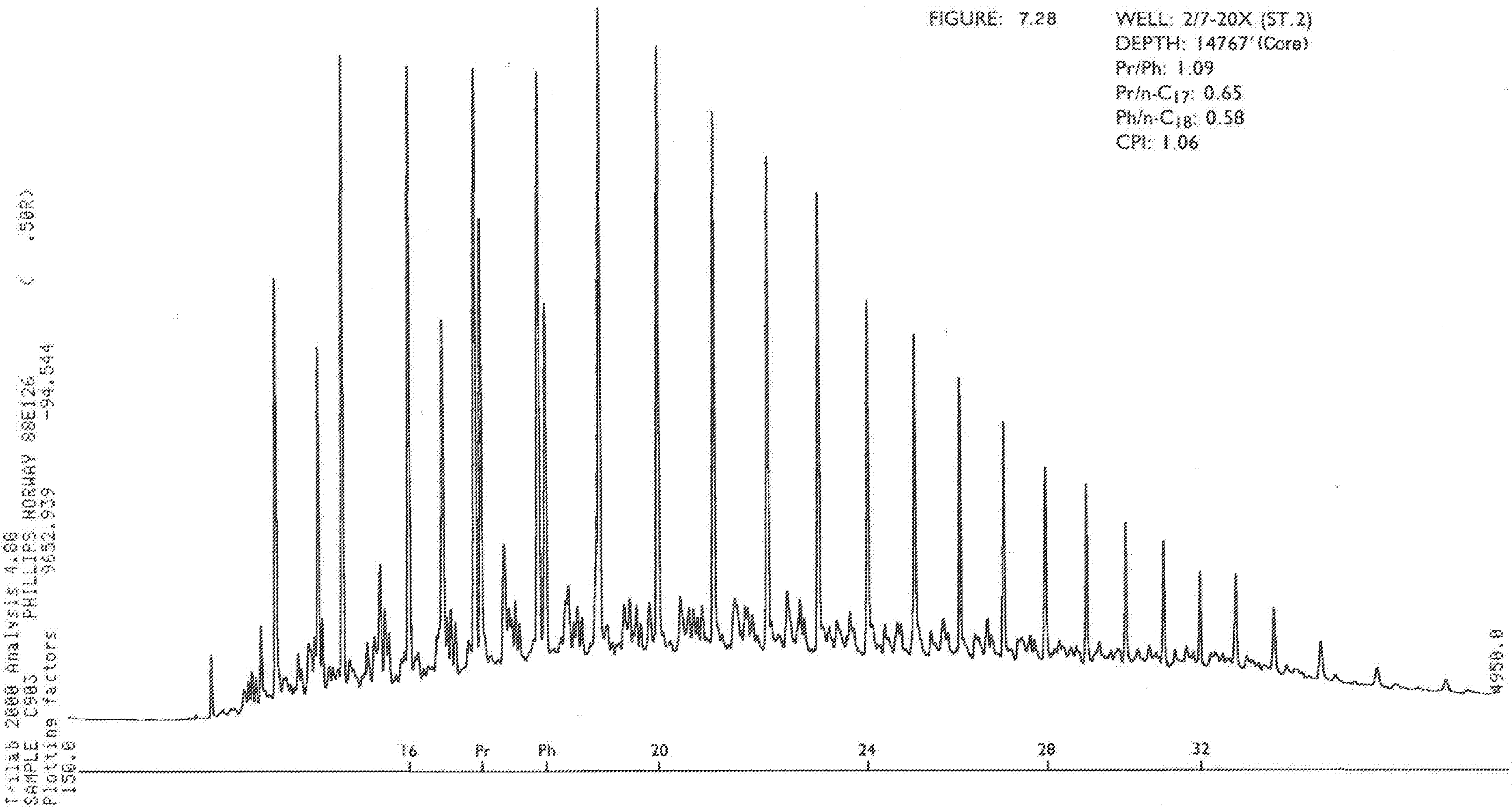


FIGURE: 7.27

WELL: 2/7-20X (ST.2)
DEPTH: 14744' (CORE)
Pr/Ph: 1.15
Pr/n-C_{17}: 0.70
Ph/n-C_{18}: 0.60
CPI: 1.07

FIGURE: 7.28

WELL: 2/7-20X (ST.2)
DEPTH: 14767' (Core)
Pr/Ph: 1.09
$Pr/n\text{-}C_{17}$: 0.65
$Ph/n\text{-}C_{18}$: 0.58
CPI: 1.06



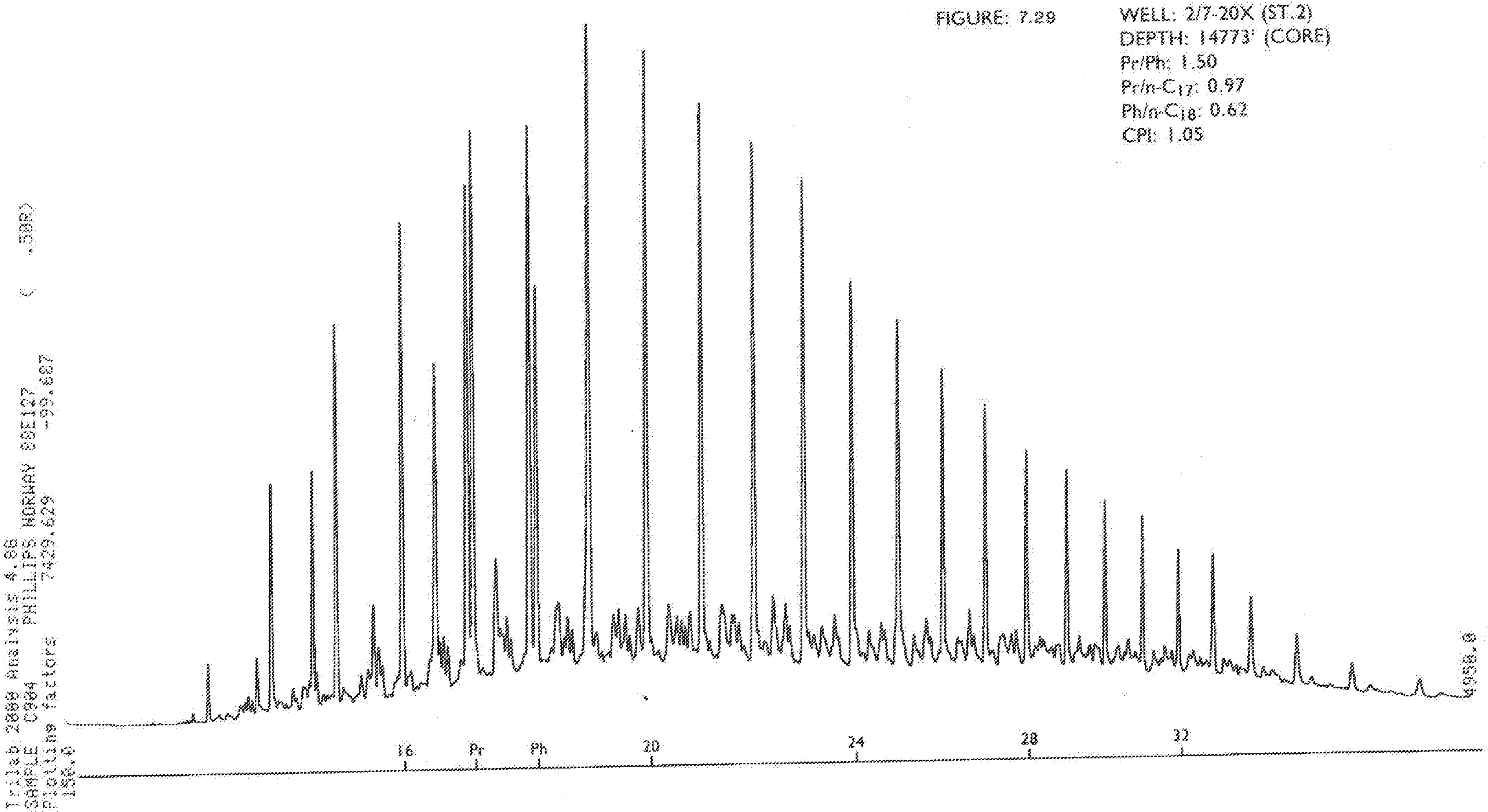

WELL: 2/7-20X (ST.2)
DEPTH: 14773' (CORE)
Pr/Ph: 1.50
Pr/n-C17: 0.97
Ph/n-C18: 0.62
CPI: 1.05
16
Pr
Ph
20
24
28
32
4950.0
Trilab 2000 Analysis 4.86
SAMPLE C984 PHILLIPS NORWAY 88E127 (.50R)
Plotting factors 7429.629 -99.687
150.0

FIGURE: 7.29

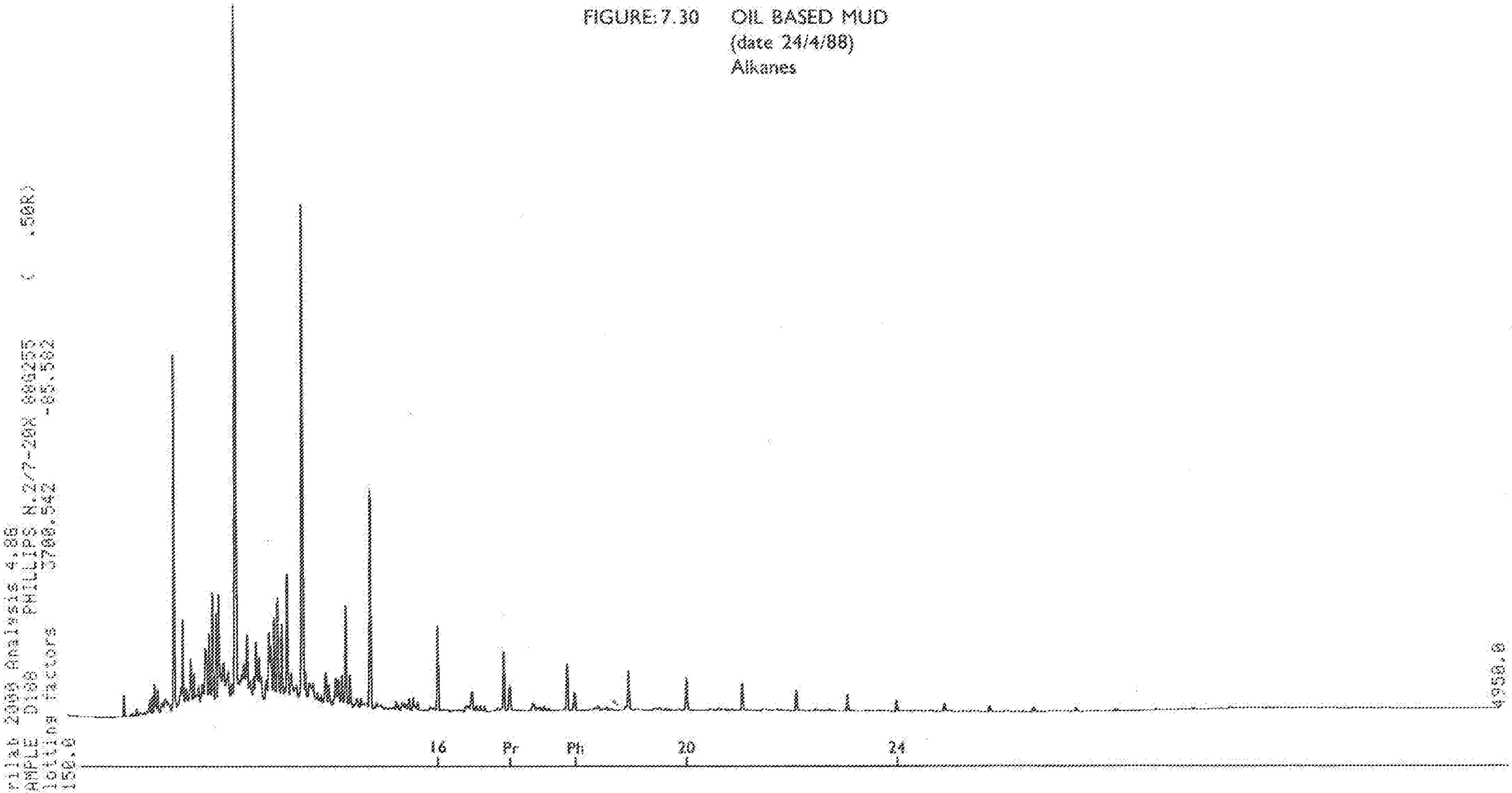
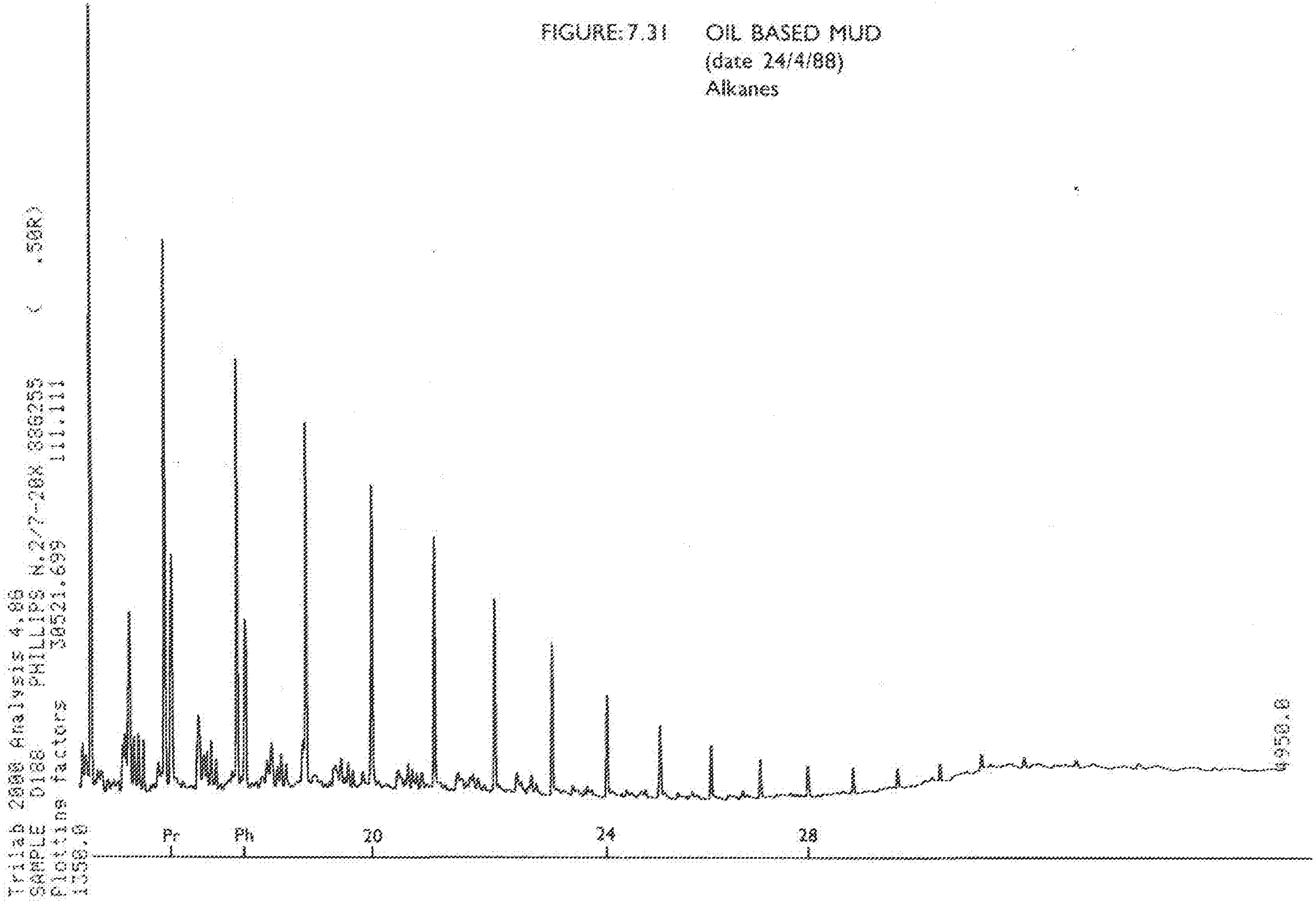


FIGURE: 7.30 OIL BASED MUD
(date 24/4/88)
Alkanes

FIGURE: 7.31 OIL BASED MUD
(date 24/4/88)
Alkanes



Steranes m/e 217, 218

Peak No.	Assignment
1	C_{27} 5β(H)14α(H)17α(H) 20R cholestane
2	C_{27} 5α(H)14α(H)17α(H) 20S cholestane
3	C_{27} 5α(H)14β(H)17β(H) 20R isocholestane and coeluting
	C_{29} 24-ethyl-13β(H)17α(H) 20S diacholestane
4	C_{27} 5α(H)14β(H)17β(H) 20S isocholestane
5	C_{27} 5α(H)14α(H)17α(H) 20R cholestane
6	C_{28} 24-methyl-5β(H)14α(H)17α(H) 20R cholestane
7	C_{28} 24-methyl-5α(H)14a(H)17α(H) 20R cholestane
8	C_{28} 24-methyl-5α(H)14β(H)17β(H) 20R isocholestane and coeluting
	C_{29} 24-methyl-13α(H)17β(H) 20R diacholestane
9	C_{28} 24-methyl-5α(H)14β(H)17β 20S isocholestane
10	C_{28} 24-methyl-5α(H)14α(H)17α 20R cholestane
11	C_{29} 24-ethyl-5β(H)14a(H)17α 20R cholestane
12	C_{29} 24-ethyl-5α(H)14a(H)17a 20S cholestane
13	C_{29} 24-ethyl-5α(H)14β(H)17β 20R isocholestane
14	C_{29} 24-ethyl-5α(H)14β(H)17β 20R isocholestane
15	C_{29} 24-ethyl-5α(H)14β(H)17β 20R cholestane

All steranes listed are likely to be 24R and 24S epimers which cannot be separated with the chromatography conditions used.

Rearranged Steranes (Diasteranes) m/e 259

Peak No.	Assignment
16	C_{27} 13β(H)17α(H) 20S diacholestane
17	C_{27} 13β(H)17α(H) 20R diacholestane
18	C_{27} 13α(H)17β(H) 20S diacholestane
19	C_{27} 13α(H)17β(H) 20R diacholestane
20	C_{28} 24-methyl-13β(H)17α(H) 20S diacholestane (24R and 24S)
21	C_{28} 24-methyl-13β(H)17α(H) 20R diacholestane (24R and 24S)
22	C_{28} 24-methyl-13α(H)17β(H) 20S diacholestane
3	C_{28} 24-ethyl-13β(H)17a(H) 20R diacholestane and coeluting C_{27} 5α(H)14β(H)17β(H) 20R isocholestane
23	C_{29} 24-ethyl-13β(H)17a(H) 20R diacholestane
24	C_{29} 24-ethyl-13β(H)17a(H) 20S diacholestane
8	C_{29} 24-ethyl-13α(H)17β(H) 20R diacholestane and coeluting C_{28} 24-ethyl-5α(H)14β(H)17β(H) 20R isocholestane

All rearranged steranes listed are likely to be 24R and 24S epimers which, with the exception of C_{28} 24-methyl-13β(H)18α(H) diacholestanes, cannot be separated with the chromatography conditions used.

Methylsteranes m/e 231

Peak No.	Assignment
25	C_{28} 4α(H)-methyl-5β(H)14α(H)17α(H) 20R cholestane
26	C_{28} 4α(H)-methyl-5α(H)14α(H)17α(H) 20R cholestane
27	C_{28} 4β(H)-methyl-5α(H)14α(H)17α(H) 20R cholestane
28	C_{29} 4α(H)-methyl-24-methyl-5β(H)14α(H)17α(H) 20R cholestane
29	C_{29} 4α(H)-methyl-24-methyl-5α(H)14α(H)17α(H) 20R cholestane
30	C_{29} 4β(H)-methyl-24-methyl-5α(H)14α(H)17α(H) 20R cholestane
31	C_{30} 4α(H)-methyl-24-methyl-5β(H)14α(H)17α(H) 20R cholestane
32	C_{30} 4α(H)-methyl-24-methyl-5α(H)14α(H)17α(H) 20R cholestane
33	C_{30} 4β(H)-methyl-24-methyl-5a(H)14a(H)17α(H) 20R cholestane

Tricyclic and Tetracyclic terpanes m/e 191

Peak No.	Assignment
34	C_{19} tricyclic terpane
35	C_{20} tricyclic terpane
36	C_{21} tricyclic terpane
37	C_{22} tricyclic terpane
38	C_{23} tricyclic terpane
39	C_{24} tricyclic terpane
40	C_{25} tricyclic terpane
41	C_{26} tricyclic terpane
42	C_{28} tricyclic terpane
43	C_{29} tricyclic terpane
44	C_{30} tricyclic terpane
45	C_{24} tricyclic terpane

Regular Pentacyclic Triterpanes (Hopanes) m/e 191

Peak No.	Assignment
46	C_{27} 18α(H)-22,29,30-trisnorneohopane
47	C_{27} 17α(H)-trisnorhopane
48	C_{28} 17α(H)21β(H)-28,30-bisnorhopane
49	C_{29} 17α(H)21β(H)-30-norhopane
50	C_{29} 17β(H)21α(H)-30-normoretane
51	C_{30} 17α(H)21β(H)-30-hopane
52	C_{30} 17β(H)21α(H)-30-moretane
53	C_{31} 17α(H)21β(H)-30,31-homohopane (22S and 22R)
54	C_{32} 17α(H)21β(H)-30,31-bishomohopane (22S and 22R)
55	C_{33} 17α(H)21β(H)-30,31-trishomohopane (22S and 22R)
56	C_{34} 17α(H)21β(H)-30,31-tetrakishomohopane (22S and 22R)
57	C_{35} 17α(H)21β(H)-30,31-pentakishomohopane (22S and 22R)

Other Pentacyclic Triterpenoids

Peak No.	Assignment
58	C_{27} 17β(H) trisnorhopane
59	unidentified compound X (Philp and Gilbert, 1986)
60	unidentified compound Y (Philp and Gilbert, 1986)
62	unidentified
63	unidentified
64	C_{30} neohop-17(18)-ene
65	C_{29} 17β(H) norhopane
66	C_{31} hop-17(21)-enes (22R and 22R)
67	C_{30} gammacerane
68	C_{30} 18α(H) oleanane
69	C_{30} 17β(H)21α(H) hopane
70	C_{32} 17β(H)21α(H) moretanes
71	C_{31} 17β(H)21α(H) homohopane

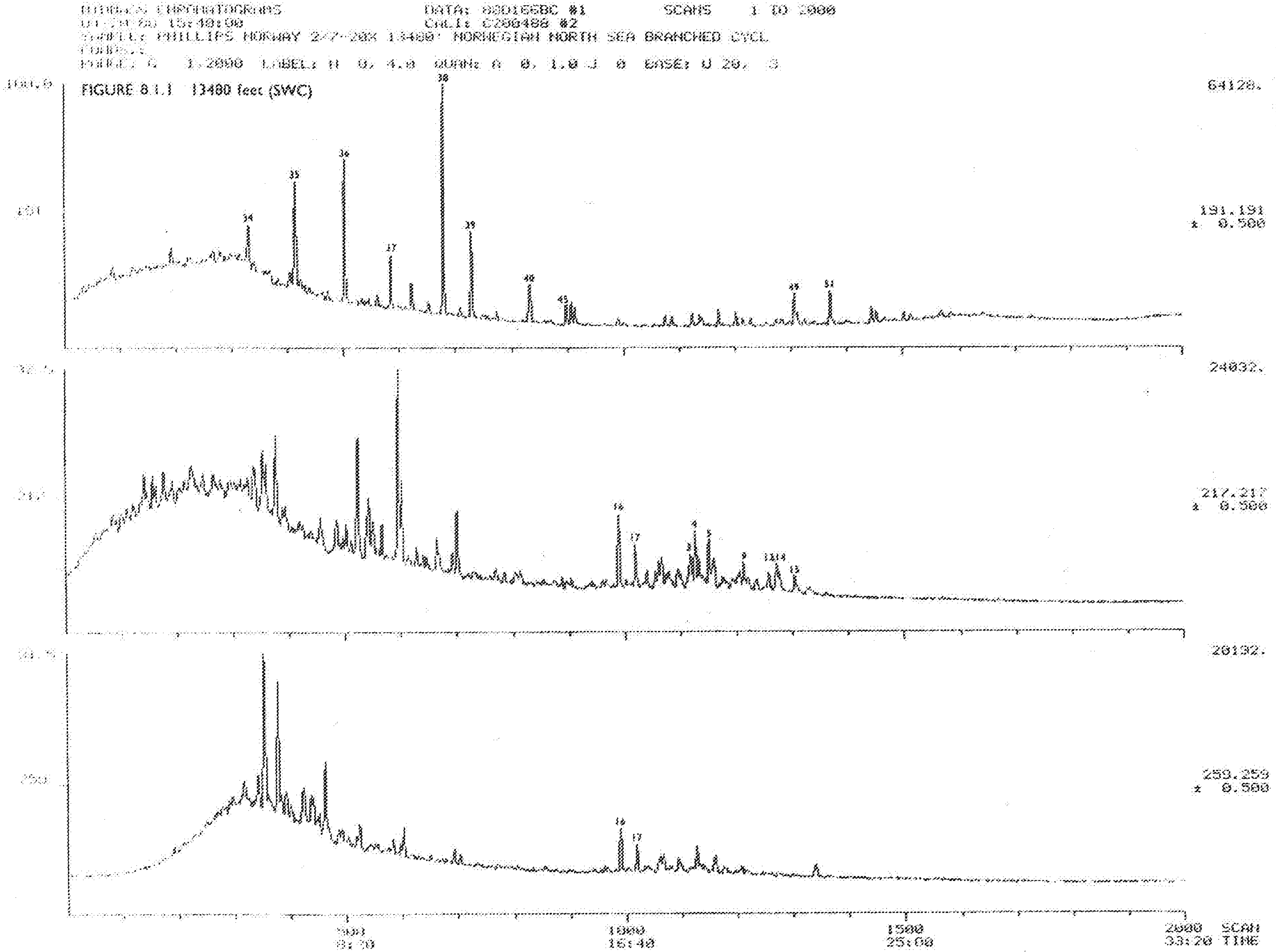
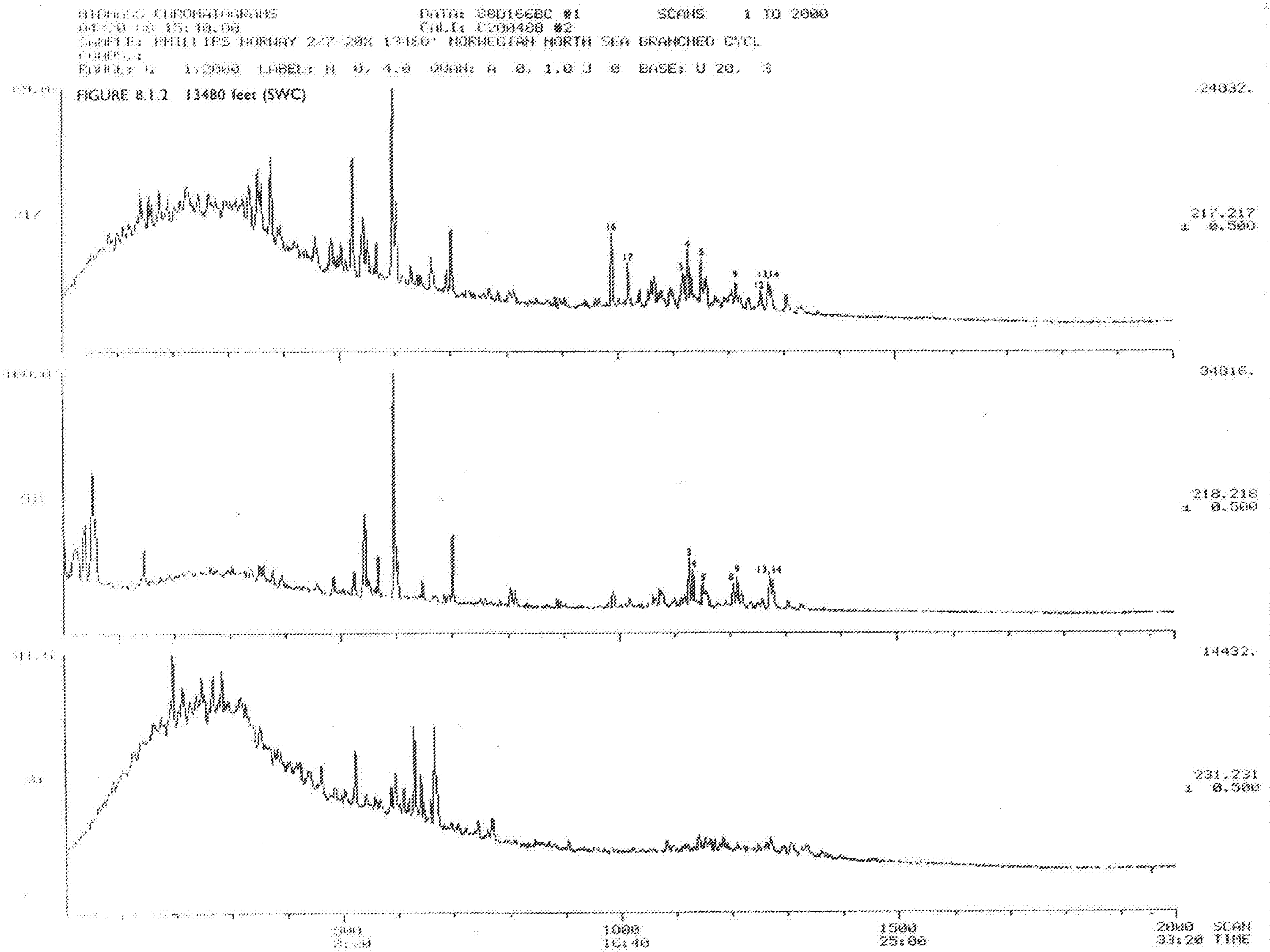


FIGURE 8.1.1 13480 feet (SWC)


DATA: S0D166BC #1
SCANS 1 TO 2000
CALI: C200408 #2
NORWEGIAN NORTH SEA BRANCHED CYCL
FIGURE 8.1.2 13480 feet (SWC)
24032.
217.217
± 0.500
34016.
218.218
± 0.500
14432.
231.231
± 0.500
1000
16:40
1500
25:00
2000 SCAN
33:20 TIME

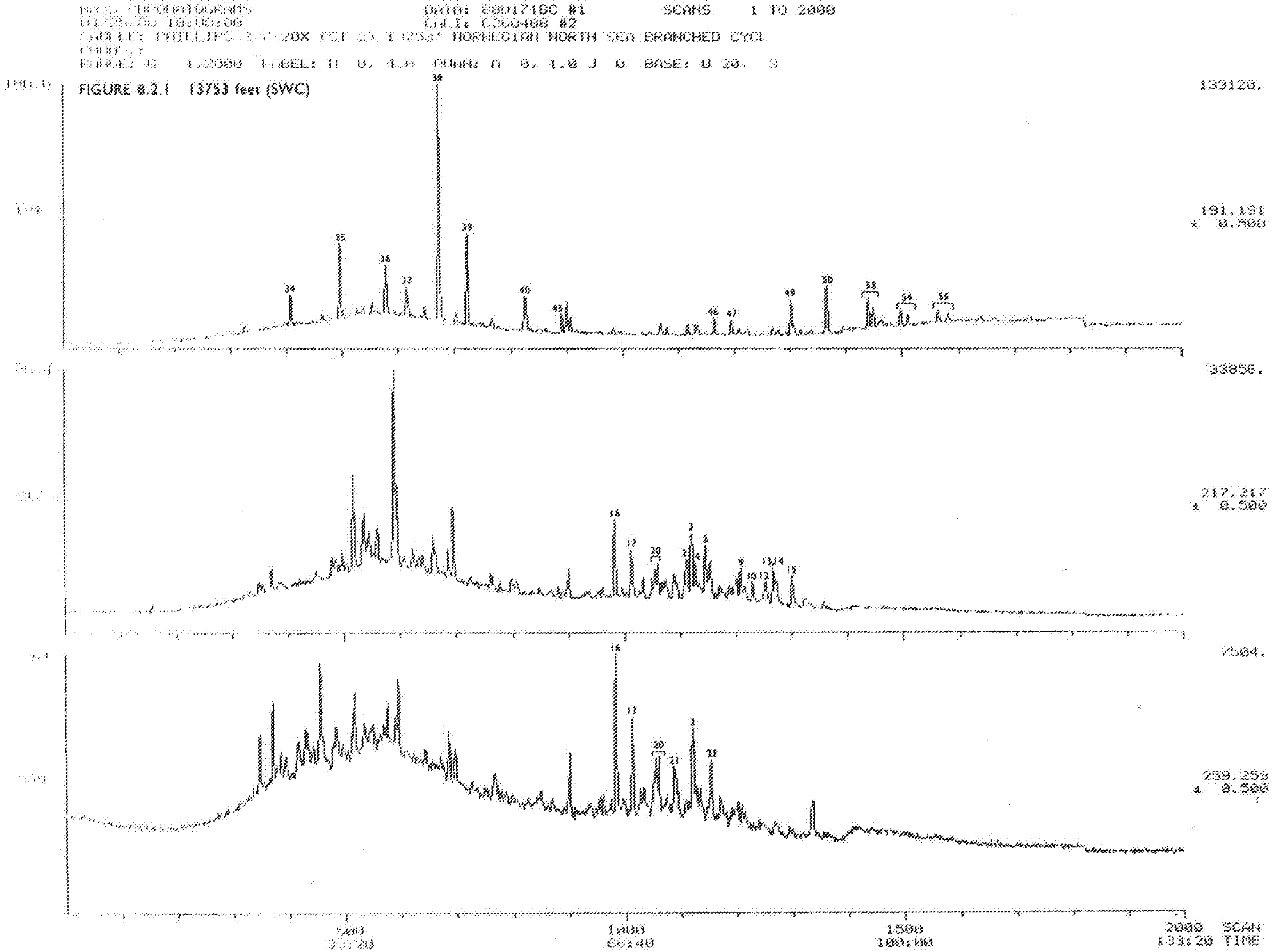
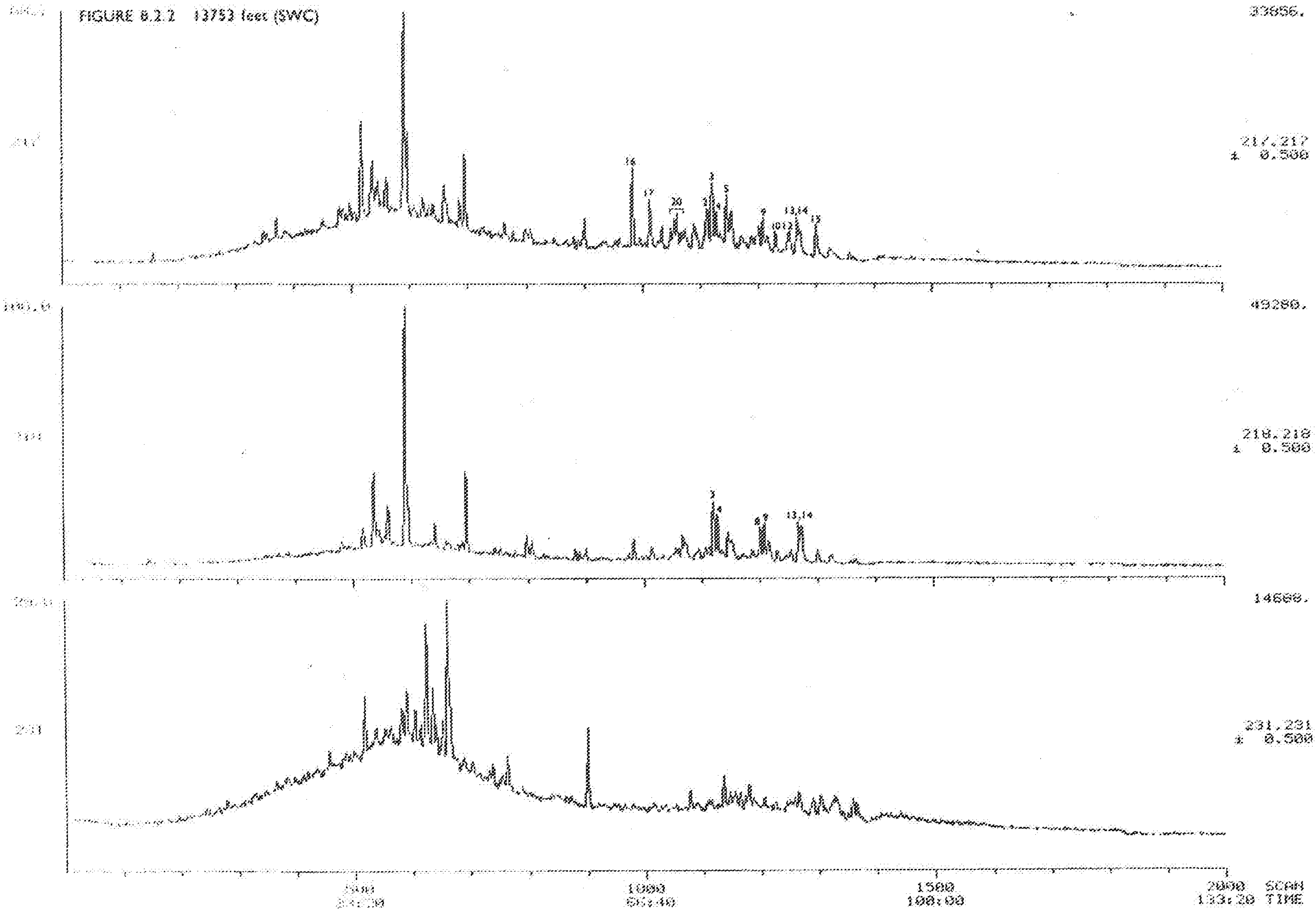


FIGURE 8.2.1 13753 feet (SWC)

DATA: 880171BC #1 SCANS 1 TO 2000
CALI: C260488 #2
SAMPLE: PHILLIPS 2/7-20X (ST-2) 13753' NORWEGIAN NORTH SEA BRANCHED CYCL
RANGE: G 1,2000 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3

FIGURE 8.2.2 13753 feet (SWC)



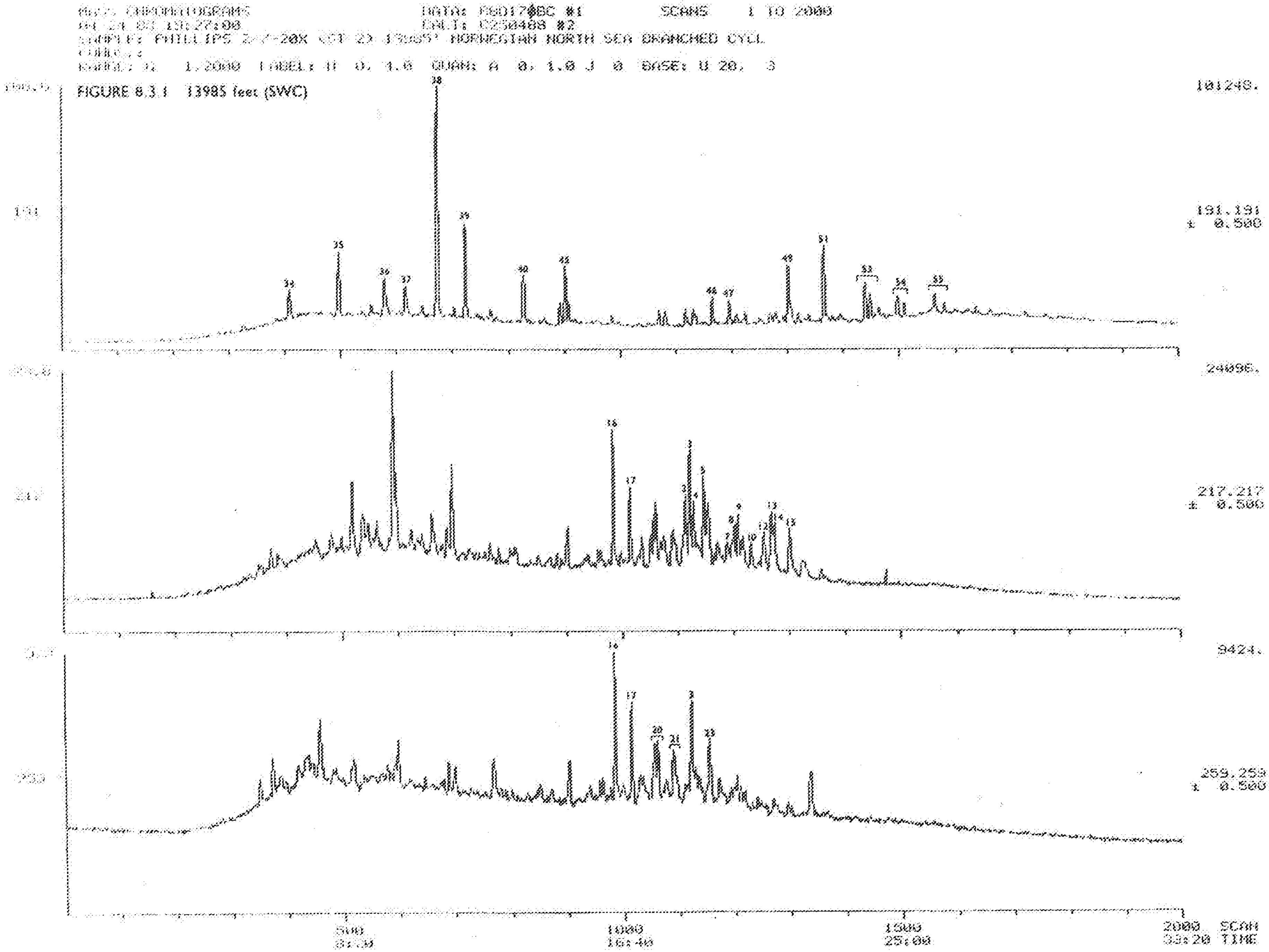


FIGURE 8.3.1 13985 feet (SWC)

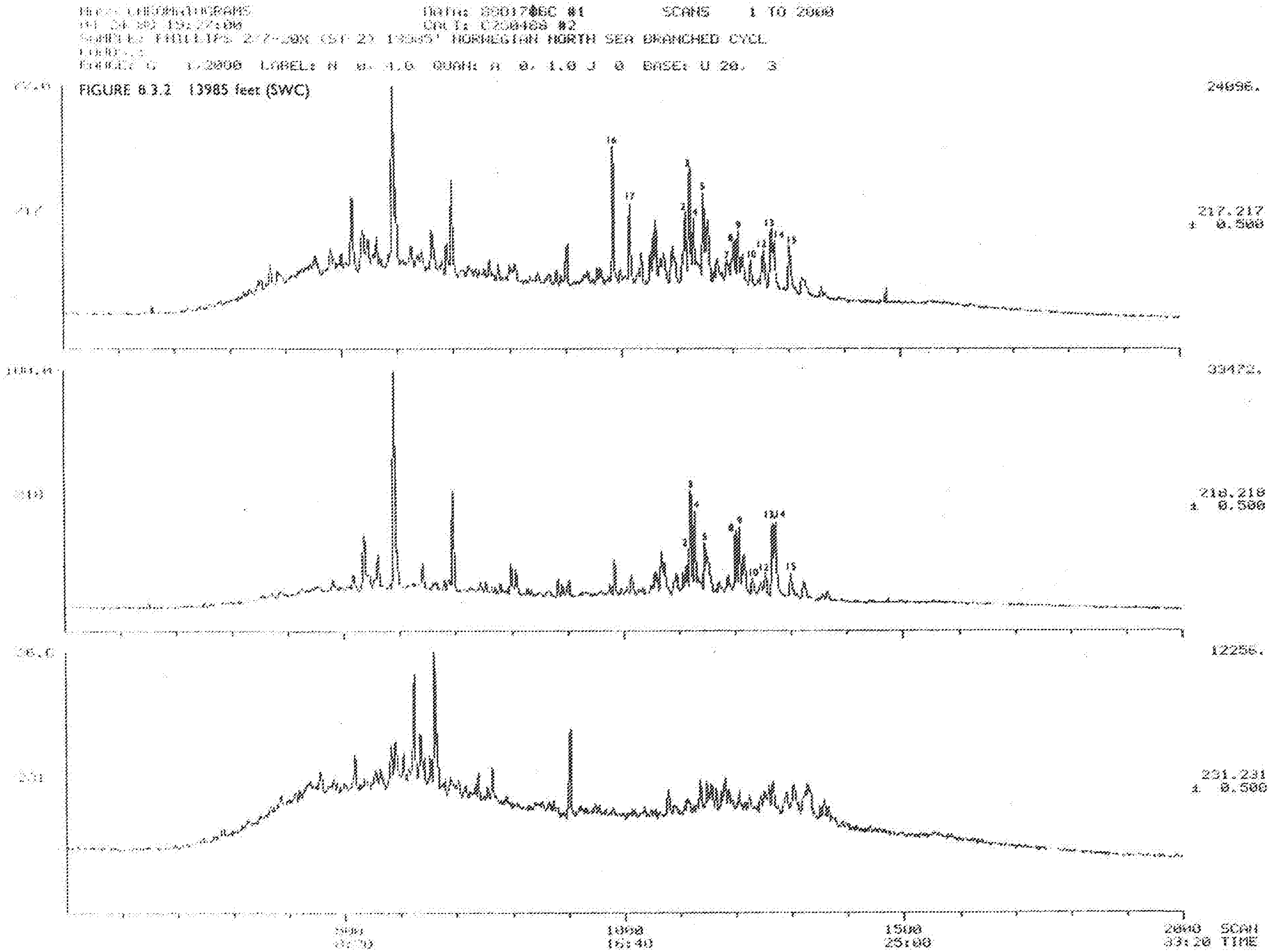


FIGURE 8.3.2 13985 feet (SWC)

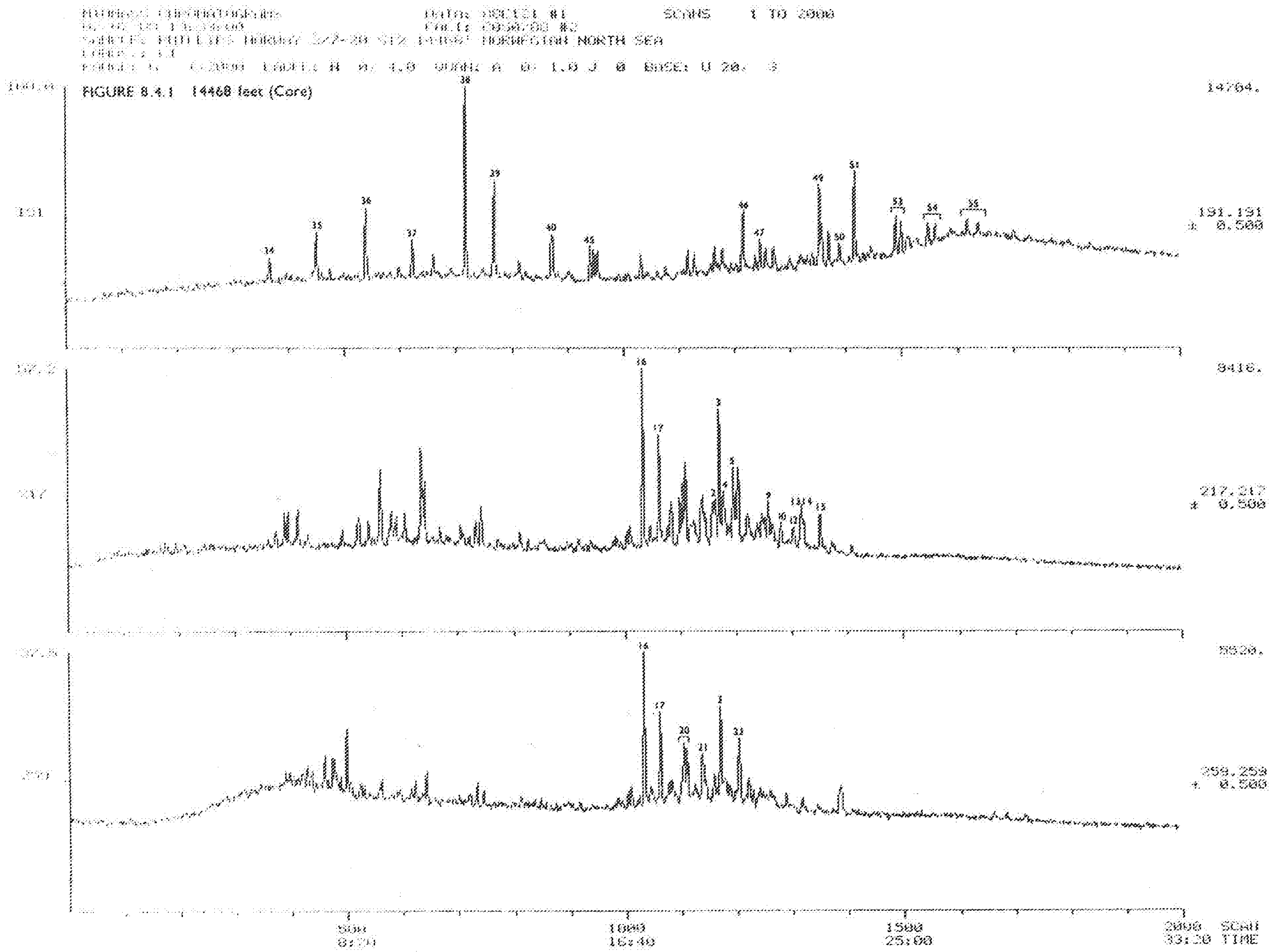


FIGURE 8.4.1 14468 feet (Core)

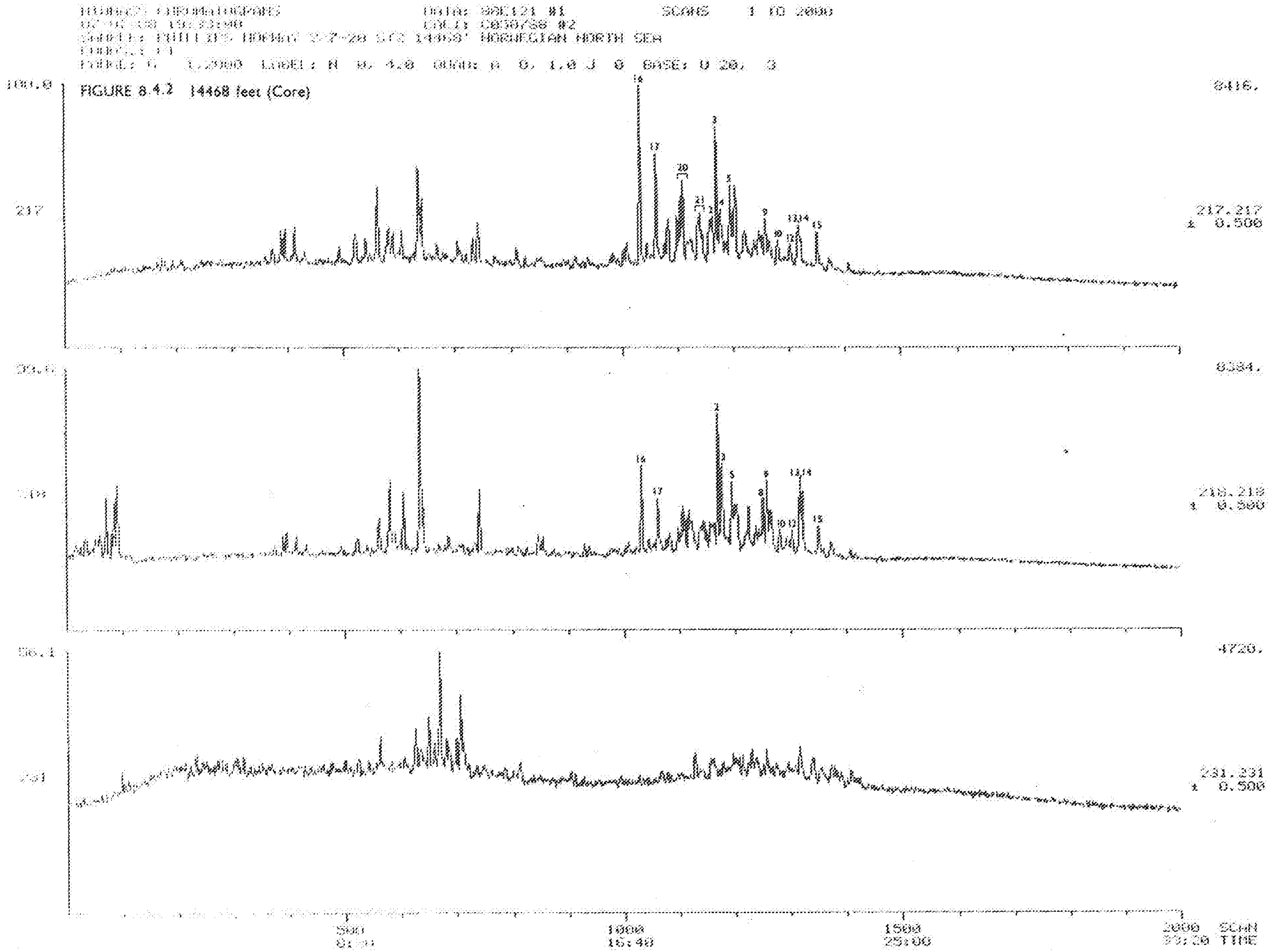


FIGURE 8.4.2 14468 feet (Core)

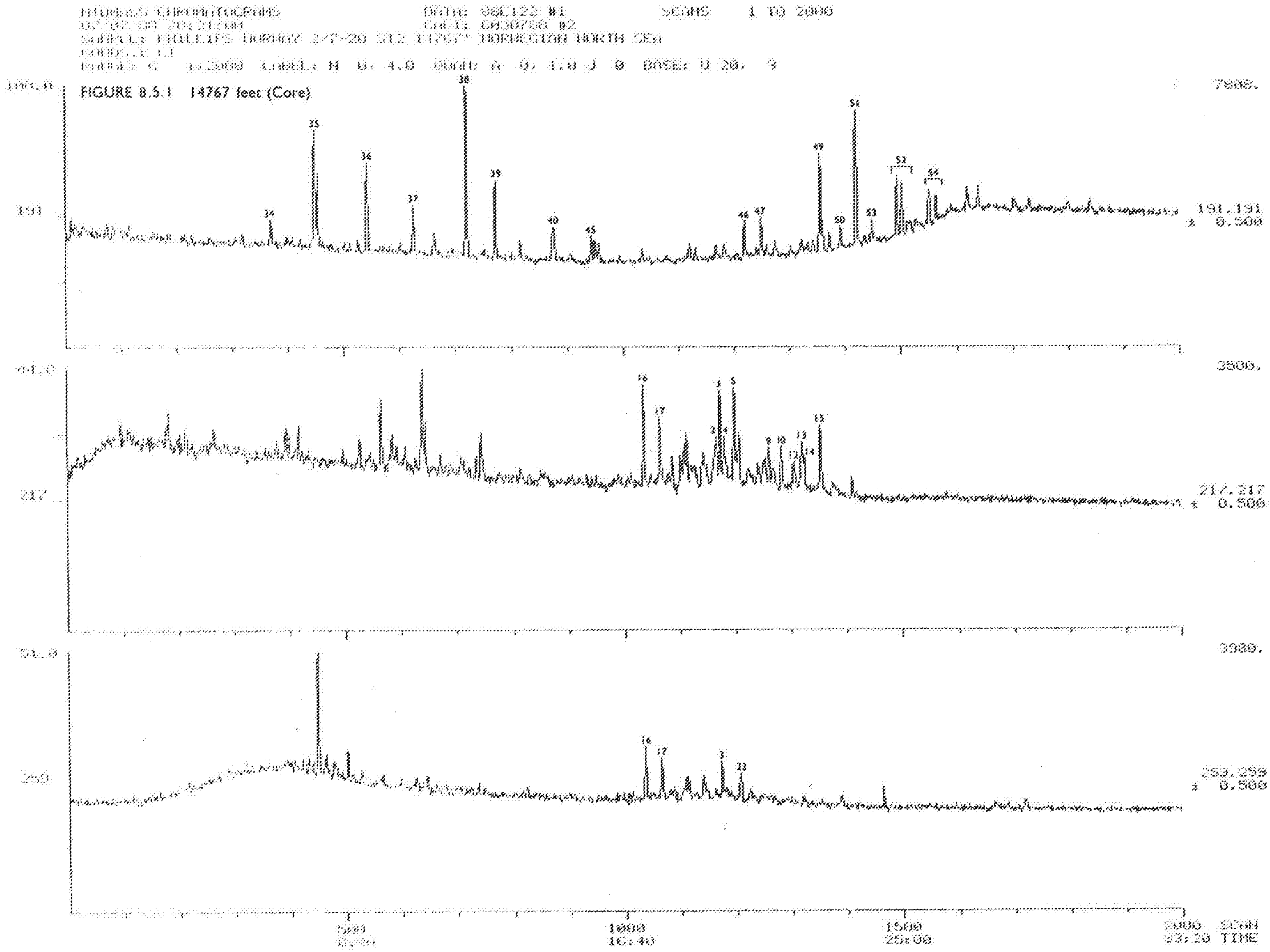


FIGURE 8.5.1 14767 feet (Core)

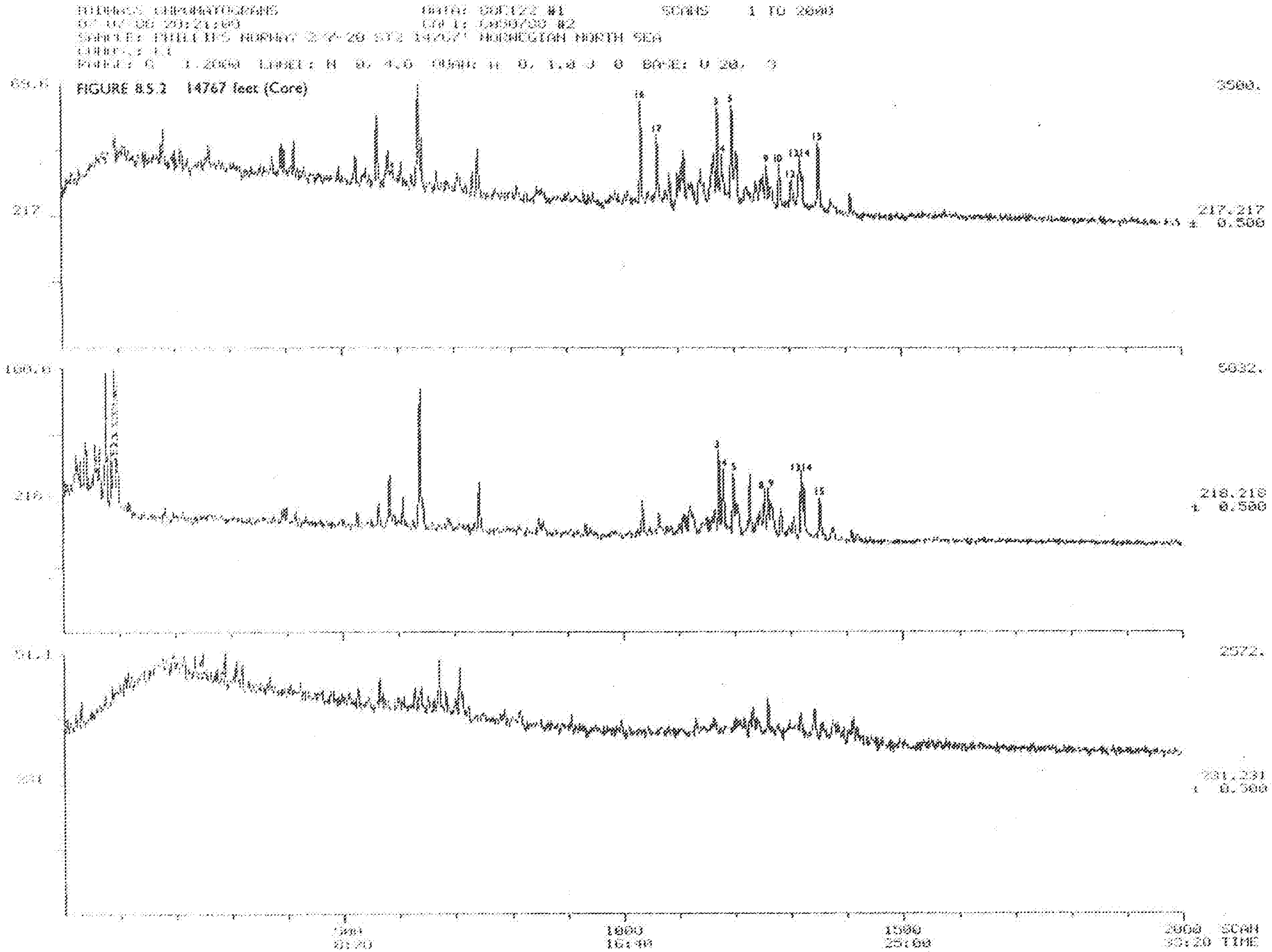


FIGURE 8.5.2 14767 feet (Core)

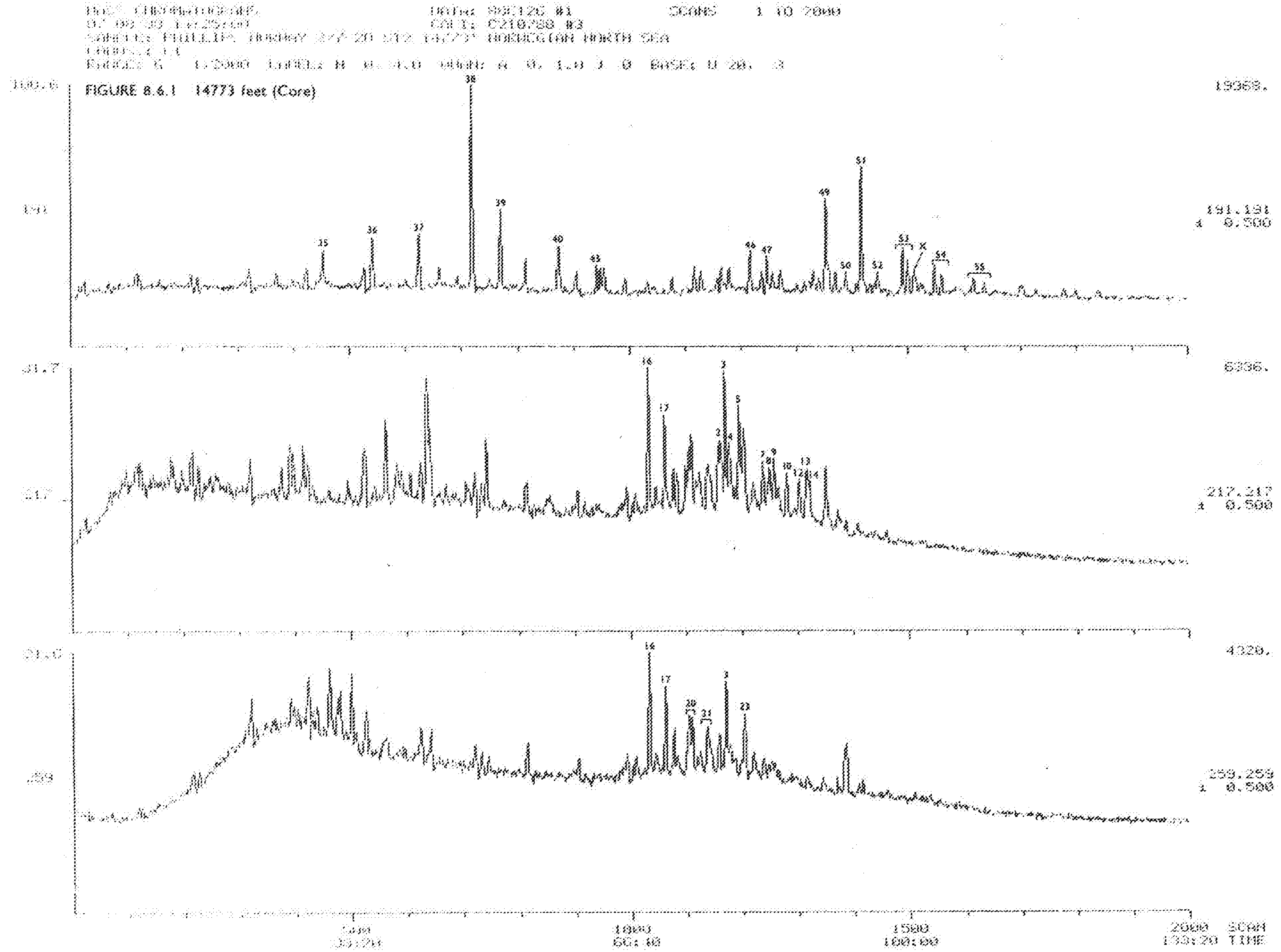


FIGURE 8.6.1 14773 feet (Core)

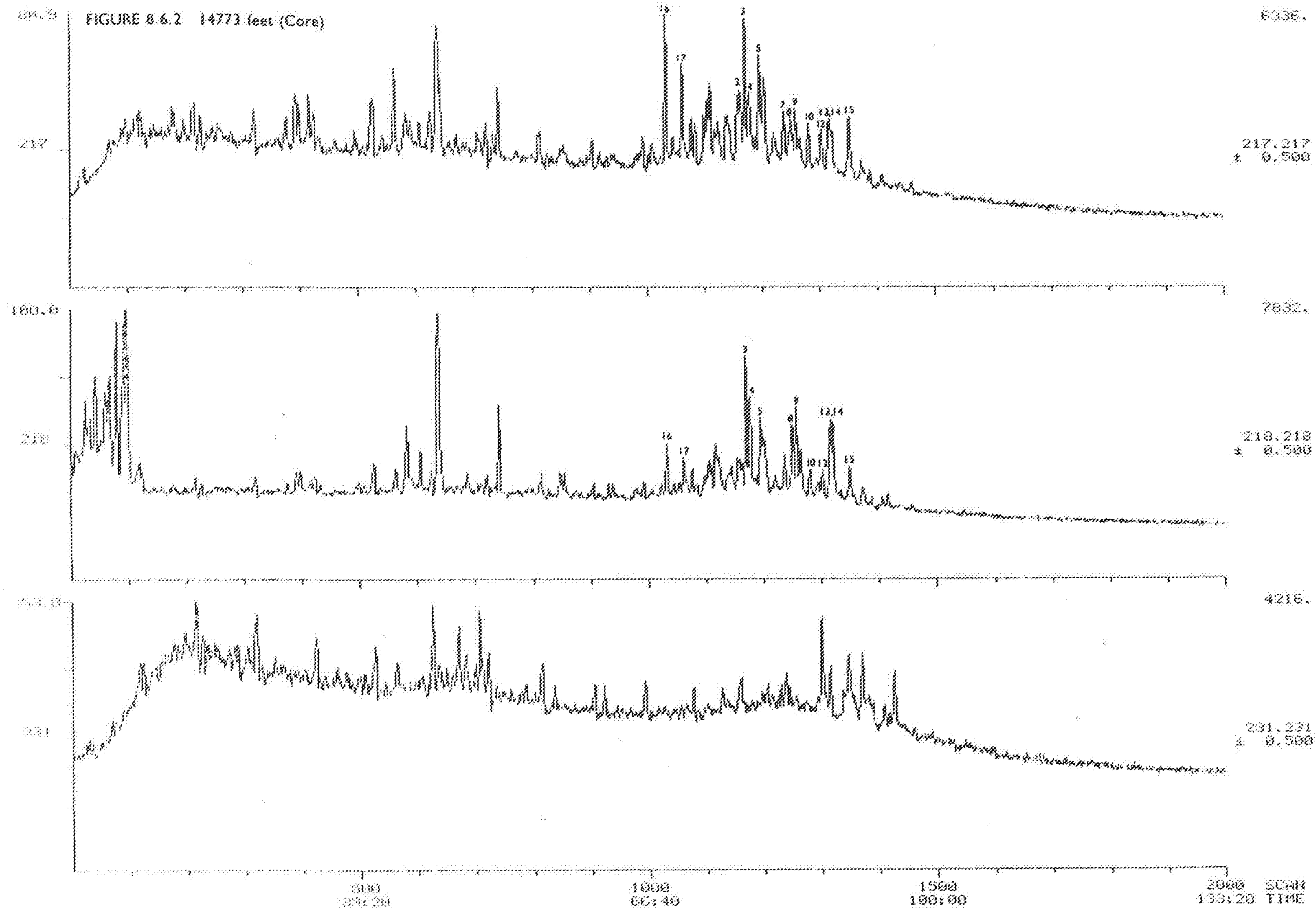
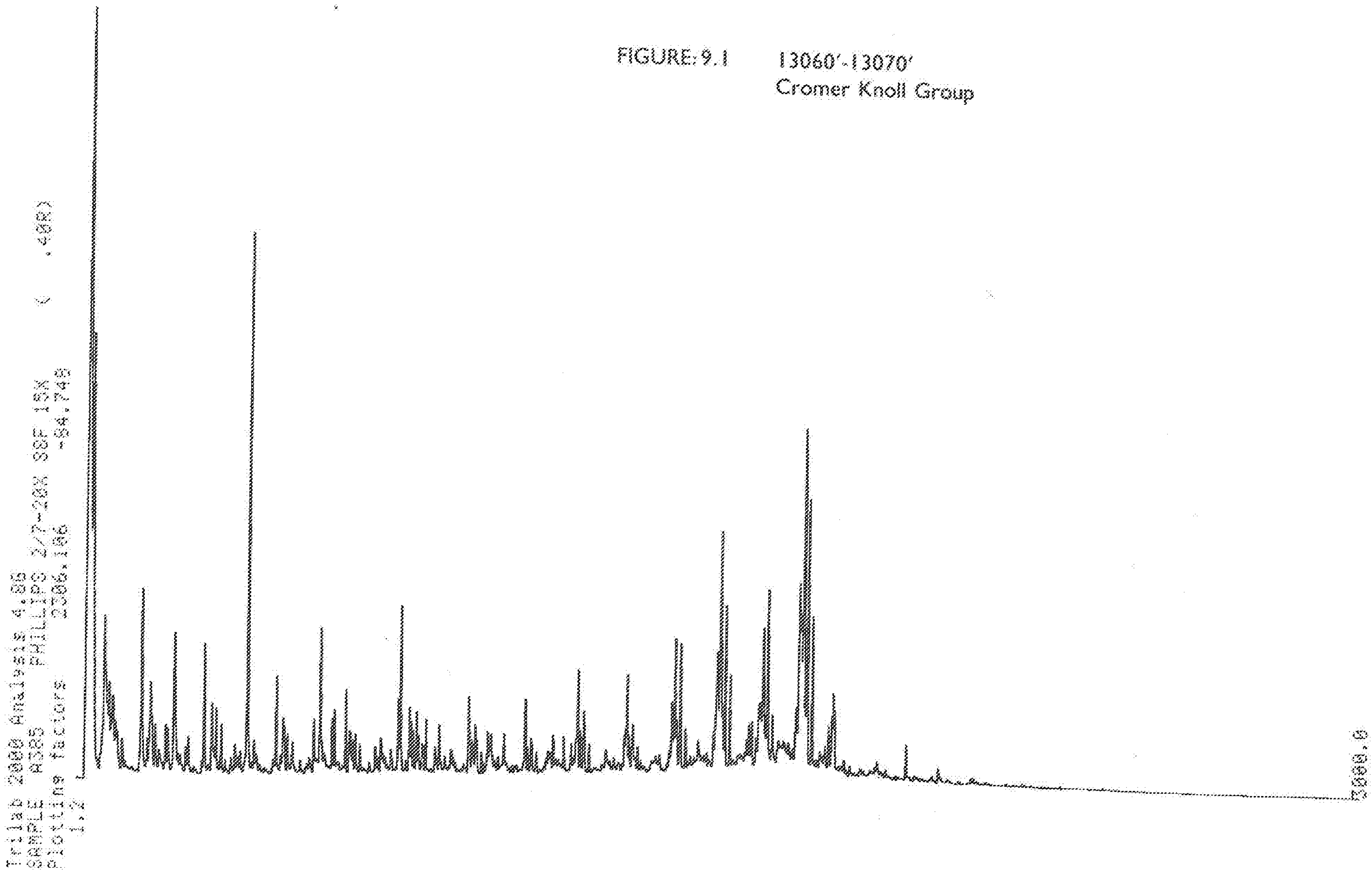


FIGURE 8.6.2 14773 feet (Core)

FIGURE: 9.1 13060'-13070'
Cromer Knoll Group



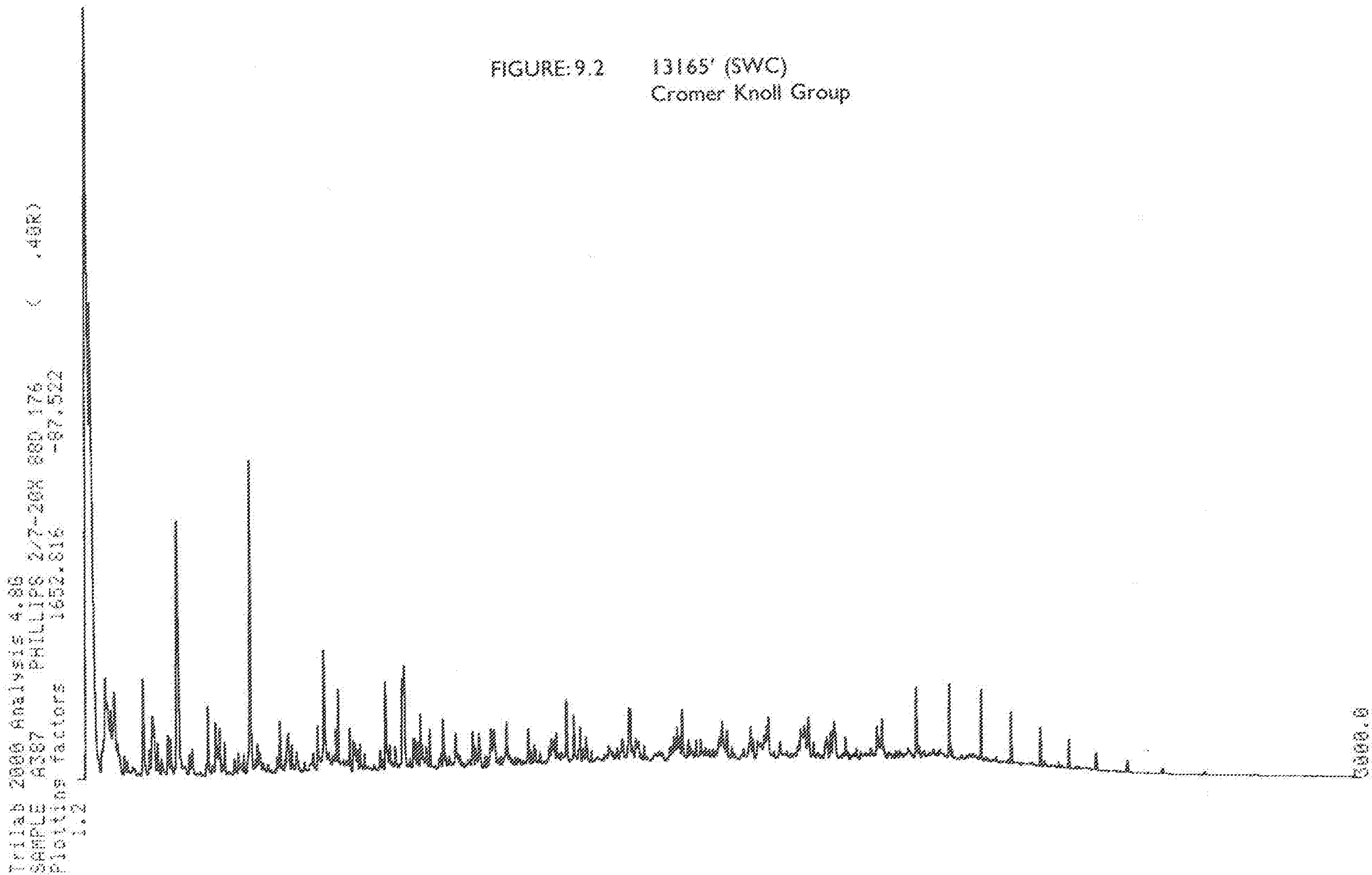
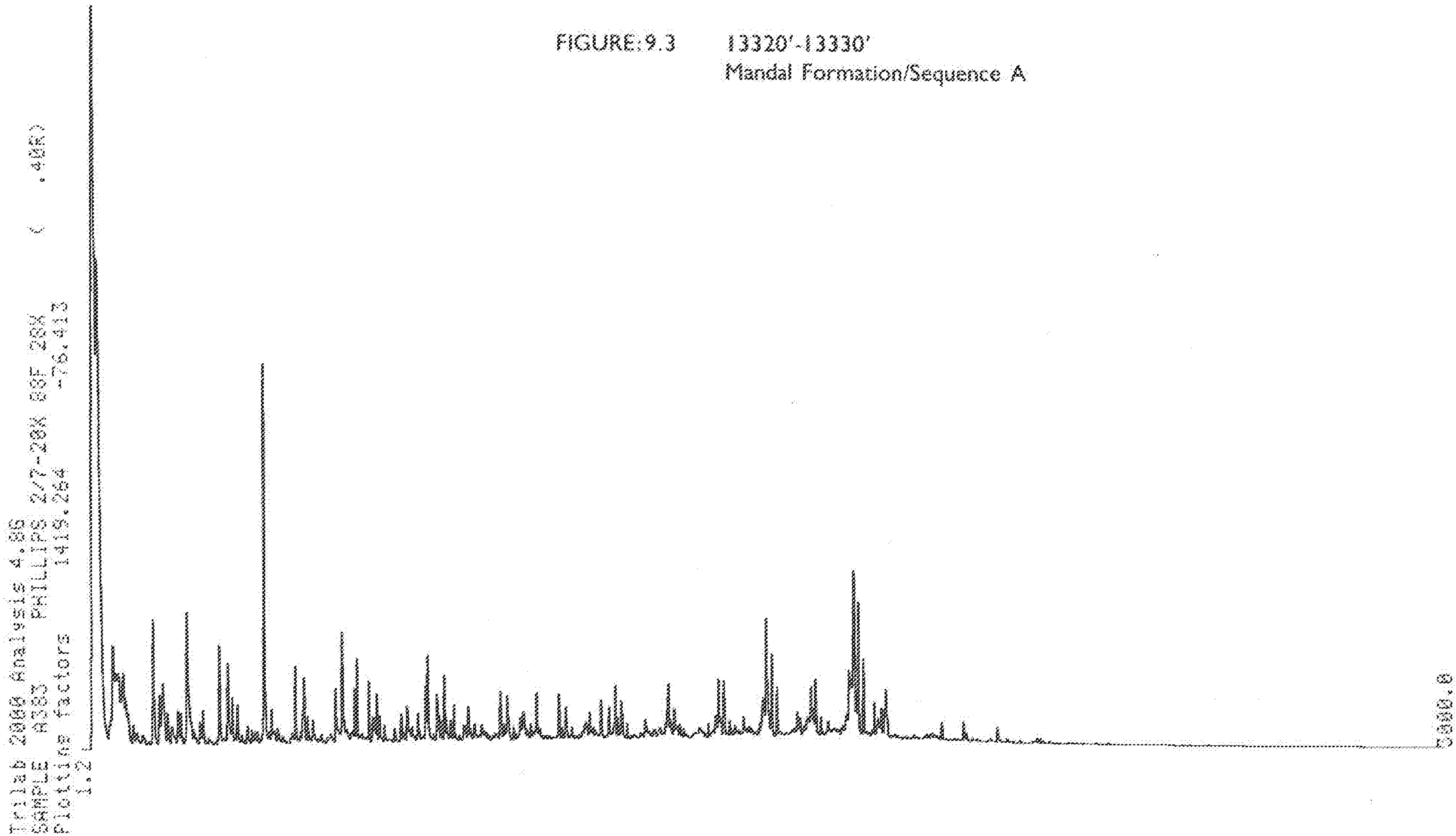


FIGURE: 9.2 13165' (SWC)
Cromer Knoll Group

FIGURE:9.3 13320'-13330'
Mandal Formation/Sequence A



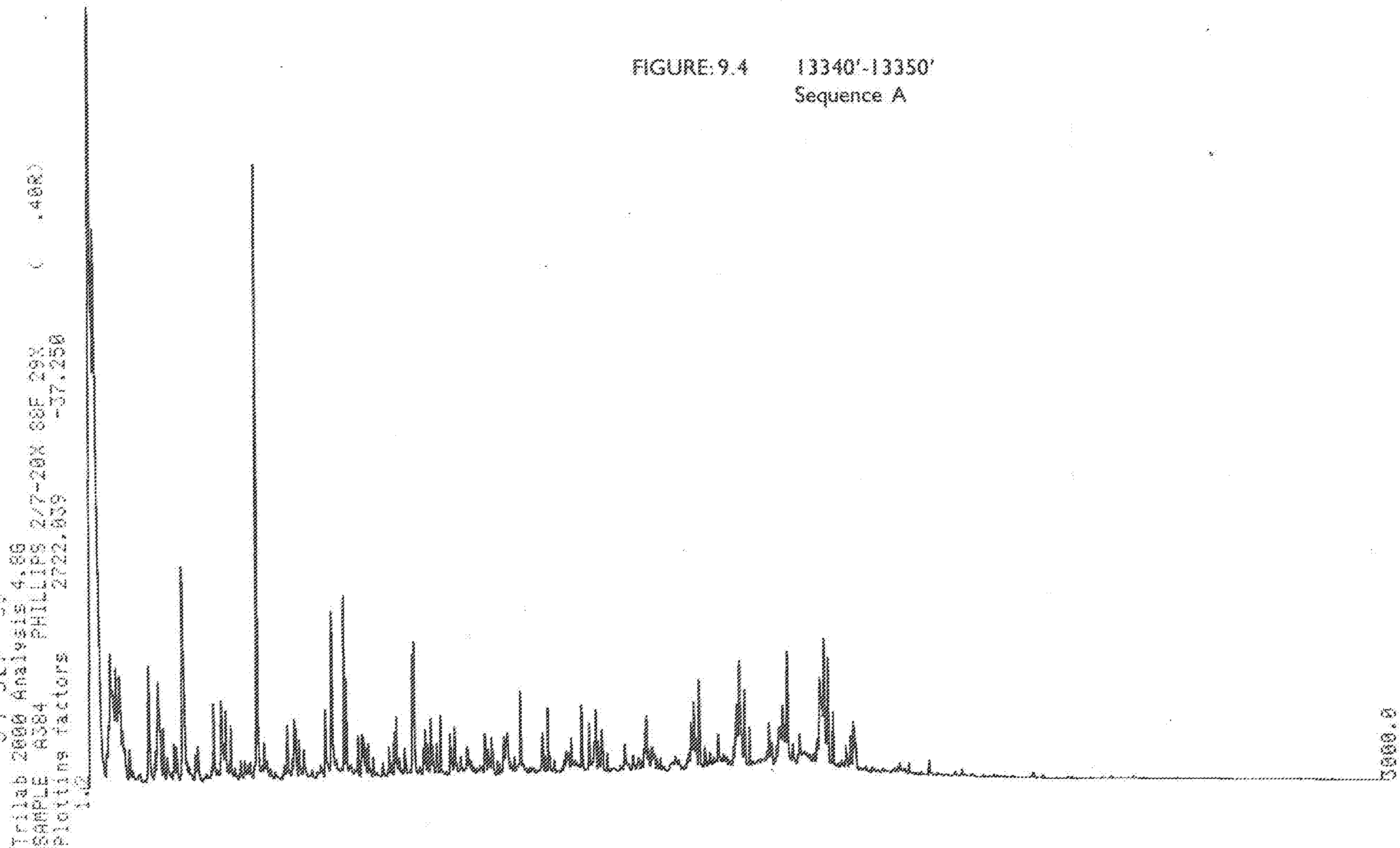


FIGURE: 9.4 13340'-13350'
Sequence A

FIGURE: 9.5 13349' (SWC)
Sequence A

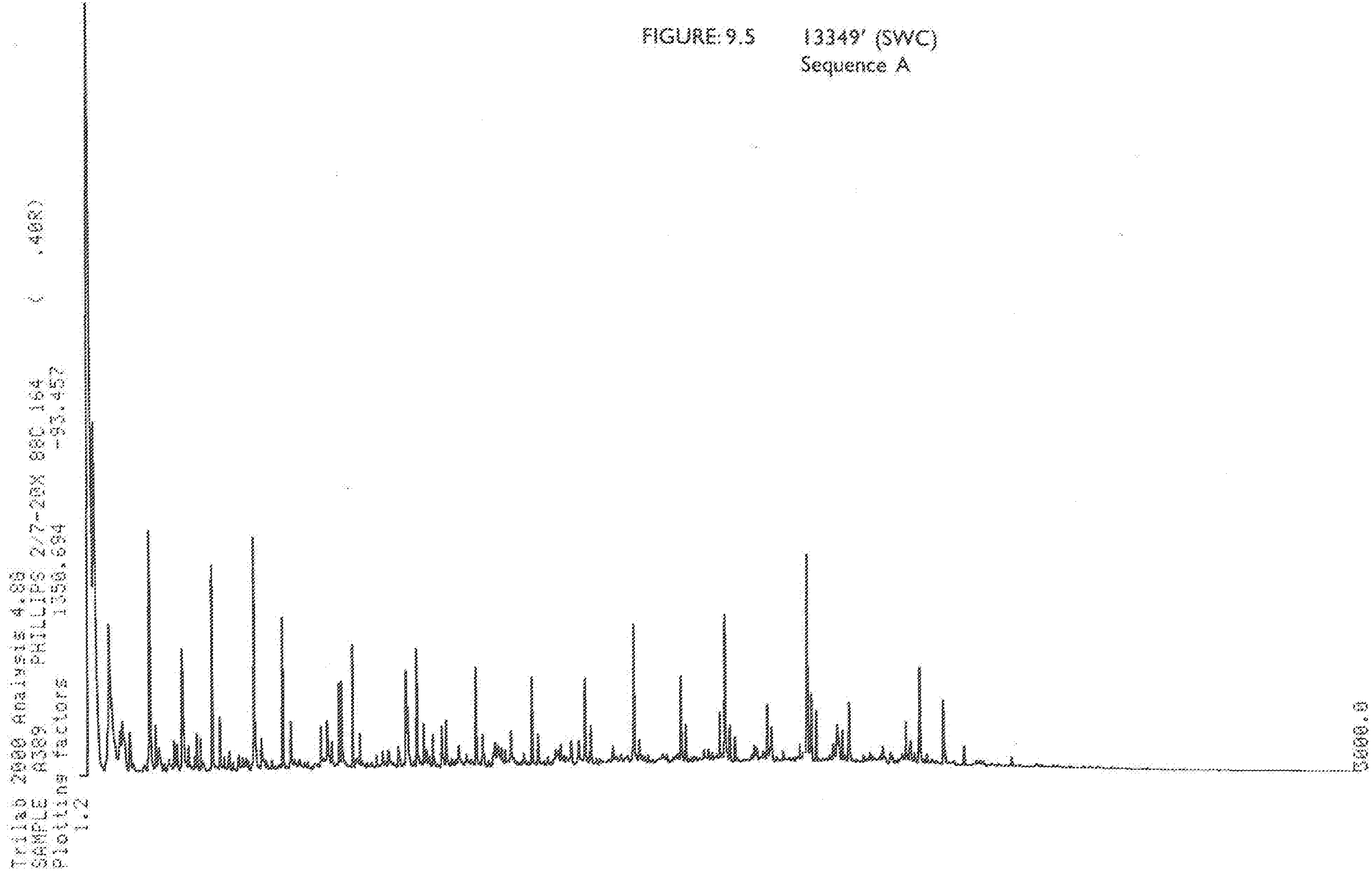


FIGURE: 9.6 14000'-14010'
Sequence B

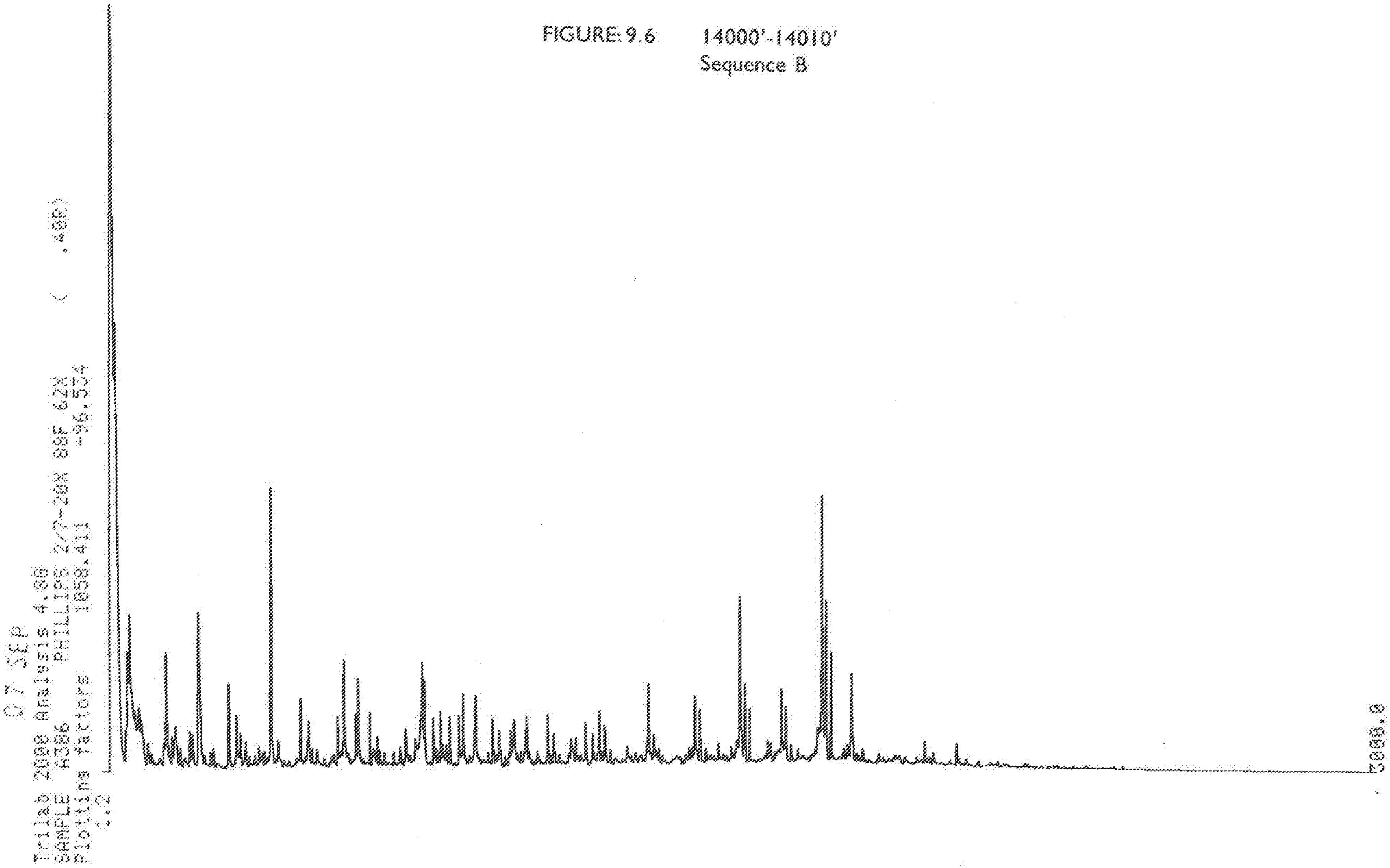
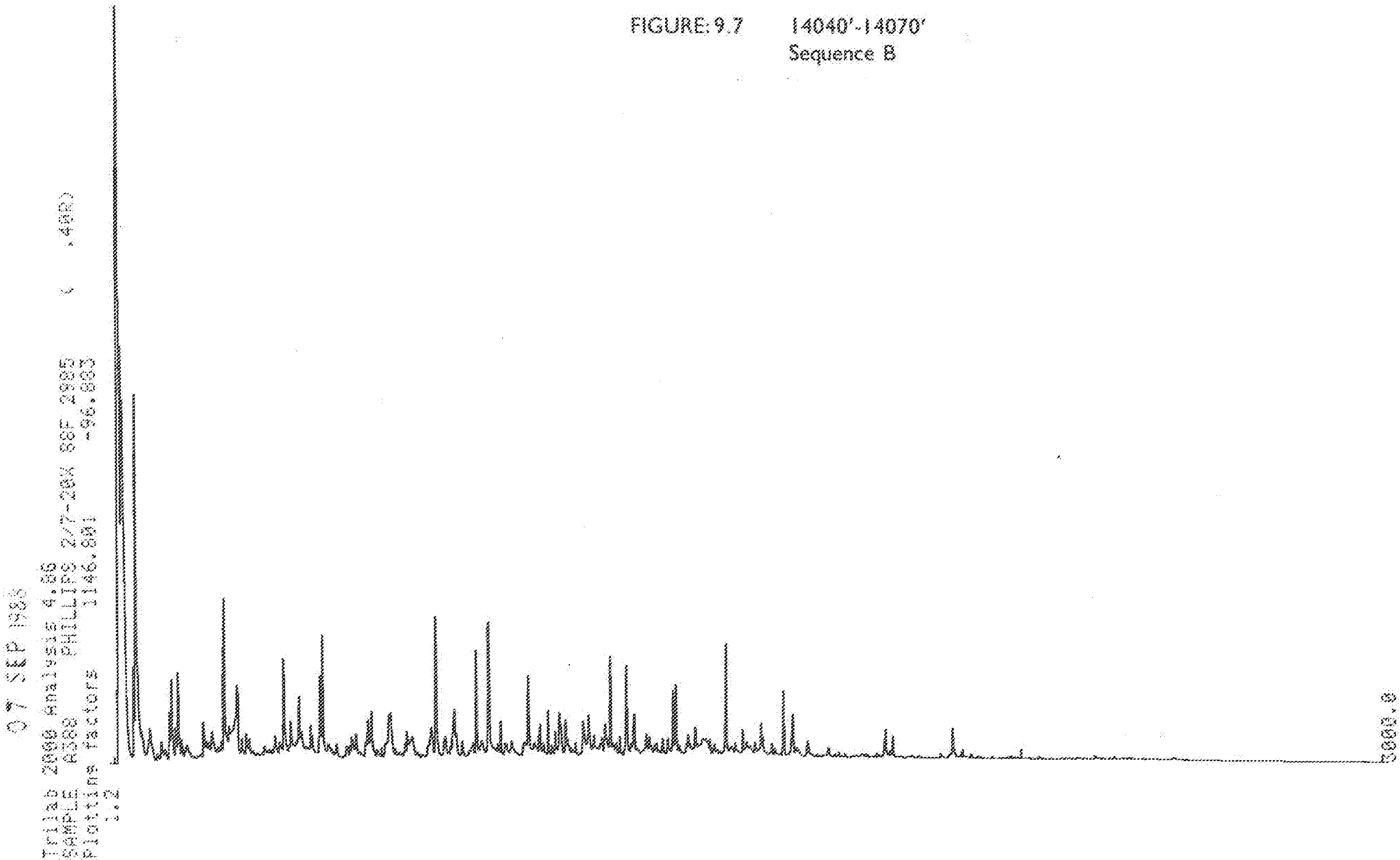


FIGURE: 9.7 14040'-14070'
Sequence B



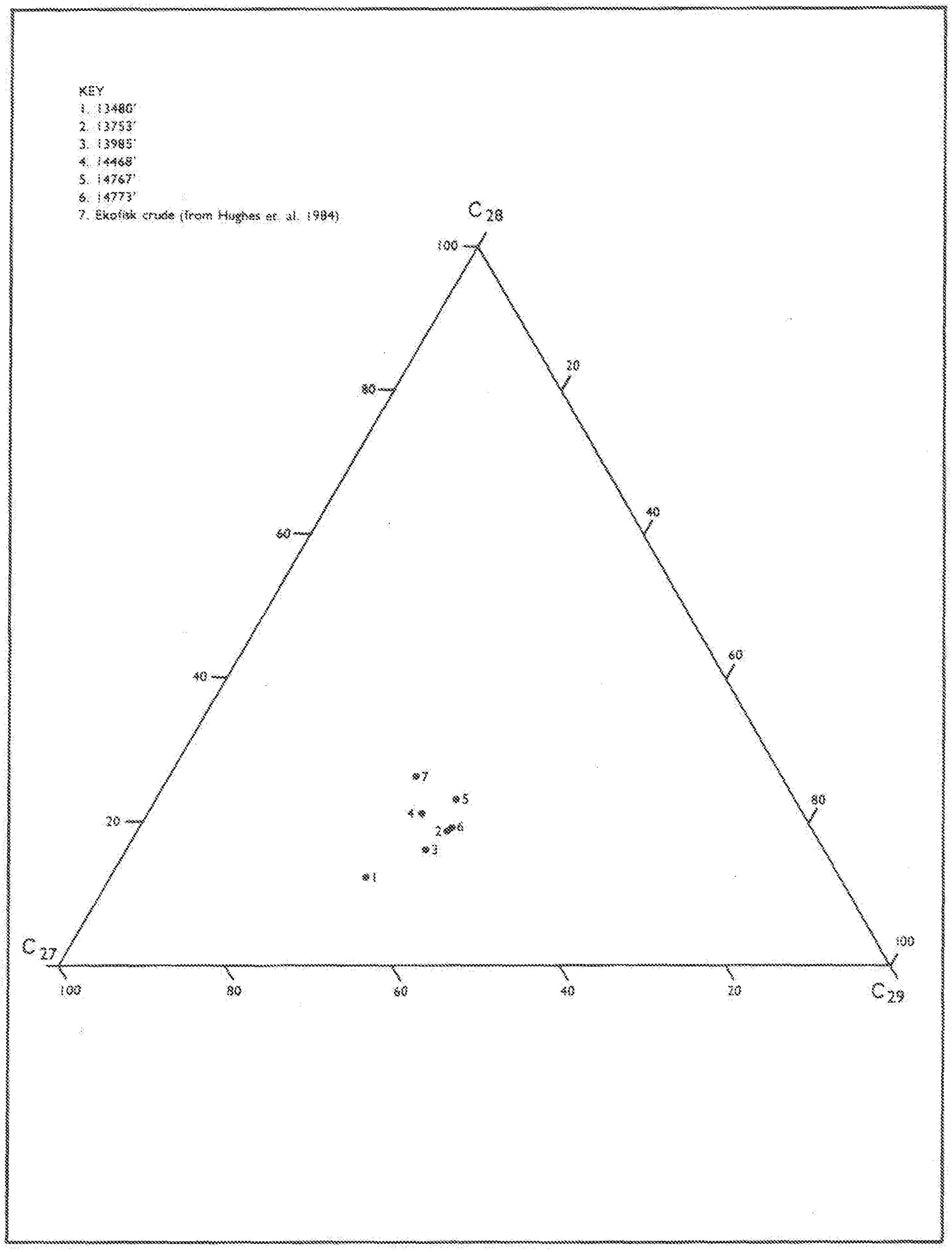


FIGURE 10 Percentage composition of 5αH, 14αH, 17αH, 20R C_{27}, C_{28} and C_{29} steranes

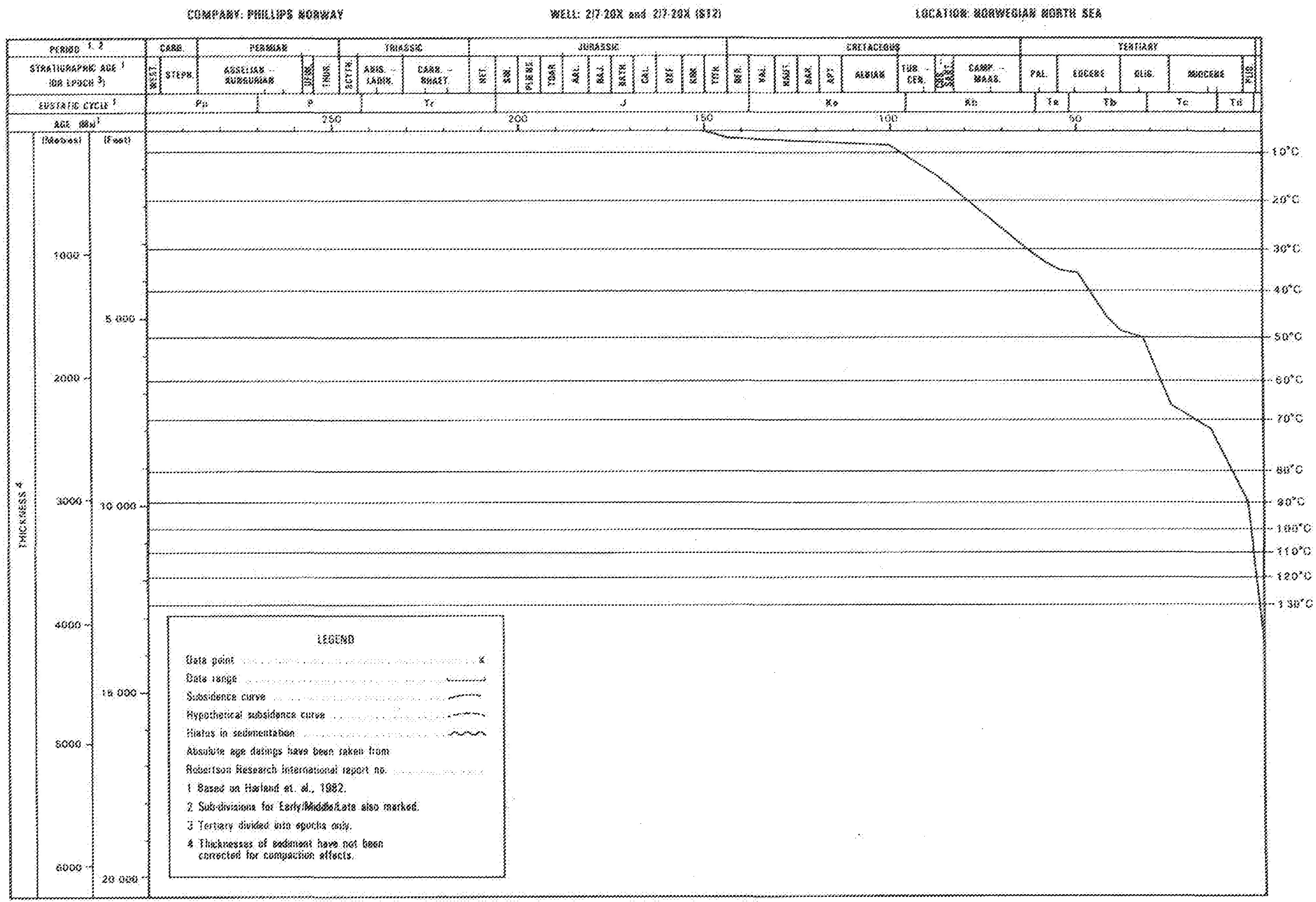


FIGURE 11 Burial History Curve. Base Cromer Knoll Group/Top Mandal Formation

APPENDIX 1

ABBREVIATIONS USED IN ANALYTICAL DATA SHEETS

a/a	-	as above
Ac	-	acritarchs
ADD	-	mud additive
Al	-	algae
Am	-	amorphous
ang	-	angular
ANH	-	anhydrite
aren	-	arenaceous
arg	-	argillaceous
BAS	-	basalt
bd	-	bedded/bedding
B(IT)	-	bitumen/bituminous
bl	-	blue
bld	-	bleached
blk	-	black
bri	-	brilliant
brn	-	brown
calc	-	calcareous
CALT	-	calcite
carb	-	carbonaceous
CGL	-	conglomerate
CHK	-	chalk
CHT	-	chert
CLYST	-	claystone
CMT	-	cement
Comp	-	composite
crs	-	coarse
CSG	-	casing point/shoe
Ctgs	-	ditch cuttings
Cu	-	cuticle
C(vd)	-	caved
decarb	-	decarbonated
Di	-	dinocysts
dk	-	dark
DLT	-	dolerite
DOL/dol	-	dolomite/dolomitic
dsk	-	dusky
Ex	-	exinite
Exs	-	exsudatinite
extr	-	extracted
f	-	fine
fel	-	feldspathic
fer	-	ferruginous
flu	-	fluorescence
fm	-	formation
foss	-	fossils/fossiliferous
fr	-	friable
frac	-	fracture
frags	-	fragments
Fu	-	fusinite
GLC/glc	-	glauconite/glauconitic
gn	-	green
grd	-	graded/grading to
grns	-	grains
gy	-	grey
GYP	-	gypsum
HAL	-	halite
hd	-	hard
hor	-	horizontal
H(RV)	-	high reflecting vitrinite
i-	-	iso-
i/b	-	inter-bedded
IGN	-	igneous rocks
inc	-	including
Inert	-	inertinite
lam	-	laminae/laminated
LCM	-	lost circulation material
LIG/Lig	-	lignite/lignitic
lns	-	lens(es)
L(RV)	-	low reflecting vitrinite
LST	-	limestone
lt	-	light
mass	-	massive
MDST	-	mudstone
med	-	medium
MET	-	metamorphic rocks
mic	-	mica/micaceous
micr	-	micritic
min	-	mineral
mnr	-	minor
mod	-	moderate
mtl	-	mottled
n-	-	normal
NA	-	not available
nod	-	nodule/nodular
NS	-	no sample
occ	-	occasional
ol	-	olive
ool	-	oolitic
orng	-	orange
OS	-	oil stain
P	-	picked lithology
pal	-	pale
Ph	-	phytane
pnk	-	pink
por	-	porous/porosity
pp	-	purple
Pr	-	pristane
pred	-	predominantly
Prt	-	present
PYR/pyr	-	pyrite/pyritic
QTZ(T)	-	quartz(ite)
Re	-	resin
R(ew)	-	reworked
rnd	-	round(ed)
Sap	-	sapropel
sbng	-	subangular
sbrd	-	subrounded
SCI	-	spore colour index
Sf	-	semifusinite
sft	-	soft
SH	-	shale
shly	-	shaly
sil	-	siliceous
sks	-	slickenside surface
SLA	-	slate
SLT(ST)	-	silt(stone)
slty	-	silty
SND	-	sand
sndy	-	sandy
Sp	-	spores
SST	-	sandstone
st	-	stained
stks	-	streaks
suc	-	sucrosic
surf	-	surface
SWC	-	side wall core
TD	-	total depth
TOC	-	total organic carbon
tr	-	trace(s)
trns	-	transparent
v	-	very
vgt	-	variegated
Vit	-	vitrinite
vn	-	vein
VOLC	-	volcanic rocks
VR	-	vitrinite reflectivity
wht	-	white
xln	-	crystalline
yel	-	yellow
-	-	no analysis carried out
*	-	analysed but no data obtained
gy-gn	-	greyish green
gy/gn	-	grey-green (gradation)
gn-gy	-	greenish grey

Note: (Maturity data tables only). Number in brackets refers to number of reflectivity values averaged to give quoted result. Preferred values for indigenous phytoclasts are listed first.

Robertson Group

APPENDIX 2

ANALYTICAL PROCEDURES AND TECHNIQUES

This appendix summarises the main steps in the analyses carried out in the Robertson Research International Ltd. petroleum geochemistry laboratories. Analytical pathways are shown on the flow chart (Appendix Figure 1) and details of laboratory procedures and techniques are given in the text. These may in certain circumstances be adapted to suit particular samples or conditions. Interpretation guidelines are also defined.

1. Sample Preparation

General

Samples are received into the laboratories in the forms of well-site canned ditch cuttings, bagged ditch cuttings in various stages of preparation from wet, unwashed to dried, washed; sidewall cores, conventional cores, outcrop samples, crude oil samples and gas samples. Each sample is assigned a number which is entered into a computer system to monitor sample selection and progress. Preparation techniques are directed towards obtaining clean samples, free of drilling mud and mud additives, obvious caving contamination and indeterminate fine material. Washing with cold water is standard but further washing with solvent (dichloromethane, DCM) is carried out if oil-based mud is present, after which samples are dried, described and individual lithologies hand-picked where practicable. Samples are rough crushed to approximately pea-sized fragments for kerogen preparation or finely milled for chemical analysis.

Kerogen Preparation

Kerogen concentrates for microscopic examination and elemental analysis are prepared using standard palynological procedures but omitting oxidation or acetolysis. Acid maceration involves the use of hot hydrochloric acid (HCl) to remove carbonates and hot 60% hydrofluoric acid (HF) to remove or break down silicates. Mineral residues are separated from the kerogen by a combination of ultrasonic vibration and zinc bromide flotation. Kerogen samples for spore colour and kerogen typing are mounted on glass slides in glycerin jelly, those for vitrinite reflectivity are dried and mounted in epoxy resin. Kerogen residues are stored in methanol.

2. Maturity Evaluation

The techniques employed for interpreting maturity and thermal history in these laboratories are based mainly on spore colouration and vitrinite reflectivity measurement, supplemented by data obtained from airspace gas and gasoline analysis, pyrolysis Tmax, and hydrocarbon analysis including gas chromatography and gas chromatography-mass spectrometry.

Spore Colouration

Sporomorph colour is assessed using a >20μ sieved kerogen fraction viewed in transmitted light on a standard palynological microscope. Unusual hues are checked using incident blue/UV light fluorescence. Measurement is made by eye against reference sets of single grain spore mounts and trained operators achieve a high degree of accuracy and reproducibility. The 1 to 10 Spore Colour Index (SCI) scale was designed for linearity with increasing depth and temperature and correlates approximately with the following zones of oil generation: 1.0 to 3.5, immature; 3.5 to 5.0, early mature, generation of low gravity oils (28 to 35 °API); 5.0 to 7.0, middle mature, generation of medium gravity oils (35 to 42°API); 7.0 to 8.5, late mature, generation of light oils (>42°API) and condensates; 8.5 to 10, post mature, generation of condensate, wet gas and, ultimately, dry gas. Linearity of scale is of great value in prediction, by extrapolation, of the depth to any part of the oil generation sequence. The value of SCI measurement lies in the objective selection of measured grains, so minimising problems of caving and reworking, and in its more direct correlation against oil generation than vitrinite reflectivity measurement. Limitations in its use concern the difficulty of correlation against other colour scales and the insensitivity of the scale in the late to post mature region. Anomalous colours may result from bleaching or staining during deposition and diagenesis. The correlation of SCI against Thermal Alteration Index (TAI) given on the SCI versus depth plot in the reports was made by direct comparison of Staplin's standard slides with SCI standard slides.

Vitrinite Reflectivity

The majority of preparations examined under reflected light in these laboratories are made using >20μ sieved kerogen, mounted in resin blocks and polished with carborundum and alumina although total kerogen may be used when sample size is limited. Picked coals, organic-rich shales or limestones containing solid bitumen are mounted directly in resin blocks and polished in the usual way. Measurement is made on a Leitz Orthoplan microscope fitted with an MPV Compact photometer which feeds values direct to a desk top computer for data processing from each sample. The system is calibrated against glass standards and reflectance values are expressed as arithmetic means of measurements taken in oil immersion (R_o or $R_{m\ oil}$). R_{max} and R_{min} may be measured and quoted in certain circumstances but the difference is insignificant below about R_o 1.0%. Some operator selection of particles during measurement is essential and obvious contaminants or non-vitrinitic material are noted but not necessarily quoted. The value quoted on data tables is that which is interpreted as most appropriate, but other possibilities may also be given. Plotted figures assume a logarithmic increase of reflectance with depth. R_o 0.5% is a widely accepted threshold value for the onset of oil generation, although as the kinetics of oil generation may not be identical to those of vitrinite reflectivity development this must be seen only as a general guide. The floor for oil generation is characterised by a reflectance value of about 1.3%. Wet gas generation peaks at a value of about 1% and ceases at the 2% level. Dry gas generation peaks at a reflectance of about 1.5% and ceases at the 3% to 4% level. Correlation of reflectance values with other maturity parameters may not be universal because of time-temperature factors and is best made on a local basis.

Reflectivity measurement is a widely used and versatile tool which may be readily calibrated against easily obtained standards. It is applicable over a wide range of maturity stages from immature to post mature (0.2% to 5% R_o). High surface intercepts on plotted figures and discordances at faults and unconformities can give realistic estimates of the amount of section missing. It is of limited value in Early Palaeozoic sections where land plant material is absent, although a general guide to maturity may be obtained from chitinous organic matter. Even a skilled operator may have difficulty in distinguishing indigenous vitrinite from some forms of inertinite, anomalously reflecting "pseudovitrinite", cavings and reworked fragments.

Airspace Gas Analysis

Wet cuttings are collected at the well site and sealed in partly full cans containing bactericide. In the laboratory, the airspace (headspace) gas is extracted using a can piercer fitted with a septum and analysed by gas chromatography. The proportions of methane, ethane, propane, iso- and n-butane are calculated from integrated peak areas by comparison with a standard mixture of these gases. Methane is the dominant gas in immature and post mature sediments, comprising 90-100% of total gas, falling to 30-70% in mature sediments. The onset of maturity for oil generation (SCI 3.5) is characteristically marked by an increase in wet gas (C_2-C_4) to between 10 and 20% with further increases in maturity indicated by a decrease in the ratio of iso- to n-butane. Ratios of >1.0 are typical for immature sediments and <0.5 are usual in mature sediments. Departures from composition versus depth trends may be useful in indicating migrant gas at faults, unconformities or reservoir rocks but limit the method as a reliable maturity indicator. Airspace gas analysis is an inexpensive and rapidly executed method of screening samples for further maturity and hydrocarbon content determinations.

Gasoline Analysis and Cuttings Gas Analysis

Cuttings samples received wet, preferably in sealed containers, are suitable for gasoline and cuttings gas analysis. A portion of the washed cuttings sample is retained wet, pulverised in a sealed shaker and warmed to expel the C_1 to C_7 hydrocarbon components into the shaker airspace. A sample of this airspace gas is then removed and analysed by gas chromatography either for cuttings gas (C_1 to C_4) or gasolines (C_4 to C_7). Up to 28 hydrocarbon components are identified in the C_4 to C_7 range and their relative proportions calculated from integrated peak areas with reference to standard mixtures. Immature source rocks yield low total abundances and limited numbers of components whereas mature source rocks usually contain a full complement of identified hydrocarbons with the onset of maturity indicated by a rapid rise in total gasoline abundances with depth. Anomalous amounts of gasolines may mark the presence of oil stain. Gasolines may be used in oil to oil or oil to source rock correlations but the concentration of some of the measured components is not only a function of source but also depends on maturity, migration and alteration in the reservoir. Using the most stable compounds, pairs with similar chemical structure and boiling points are reduced to pair ratios and compared with the same pair ratios in other oils or possible source rocks. Gasoline analysis is a valuable tool in that it measures directly the hydrocarbons being generated from a sediment but its sensitivity in detecting traces of oil places constraints on its use as a maturity indicator.

Rock-Eval Pyrolysis, Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC-MS) in Maturity Analysis

These three analytical processes measure parameters which are functions of both maturity and kerogen type. Data from them may give a general guide to maturity but if the kerogen types are known, more specific conclusions may be drawn. From Rock-Eval data, the temperature of maximum rate of pyrolysis, Tmax, is the most useful datum; gas chromatograms of alkanes, separated from source rock extracts or oils, yield carbon preference indices (CPI) and isoprenoid ratios; GC-MS quantitative fragmentograms provide abundance ratios for specific compounds which are particularly useful in assessing the level of maturity at which source rock hydrocarbons or oils have been generated. All these supplementary data may be used to confirm results from visual analysis or supplant them if poor or unavailable.

3. Source Rock Evaluation

Total Organic Carbon Content (TOC)

Organic carbon values are obtained by treating 0.1g of crushed rock sample with hot, concentrated HCl to remove carbonates. The washed residue is filtered on to a glass fibre pad and ignited in a Leco carbon analyser. For screening purposes, samples are analysed singly but where further analyses, such as pyrolysis or solvent extraction are anticipated, a duplicate sample is run. Blanks and standards are run as routine and where values from duplicated samples do not concur within strict accuracy limits, they are rerun. Where samples are heavily stained with oil, either from natural deposits or drilling mud, TOC is repeated on the dried, solvent extracted sample.

TOC measurement is fundamental in assessing source rock quality since when combined with kerogen type and maturity, a full description of the potential to generate oil may be given. It is found in practice that sediments containing less than 0.3% TOC are unlikely to have any source potential, those containing between 0.3% and 1% may be marginal sources but the better quality sources contain in excess of 1% TOC. Screening by TOC is therefore an inexpensive and rapid method of selection of samples for further analysis in source potential evaluation.

Rock-Eval Pyrolysis

Pyrolysis data are obtained using the IFP-Fina Rock-Eval apparatus. 100 mg of crushed, whole rock either from bulk sample or picked lithology is weighed accurately into a crucible and introduced into a furnace at 250°C. Free hydrocarbons (roughly equivalent to solvent extractable hydrocarbons) are volatilised and quantified by flame ionisation detector (FID) to give Peak 1 (S_1, ppm). The furnace temperature is increased to 550°C at 25°C/minute and within this range, kerogens crack to give hydrocarbons, measured by FID to give Peak 2 (S_2, ppm) and carbon dioxide, measured by thermal conductivity detector (TCD) to give Peak 3 (S_3, ppm). The temperature at the maximum rate of evolution of cracked volatiles (Tmax) is measured automatically but can also be monitored visually. The instrument is calibrated daily using standards both at the beginning of the work period and at regular intervals thereafter and crucible blanks are run as routine. The tabulated data in reports comprise the following parameters:

Tmax °C - temperature of maximum rate of Peak 2 hydrocarbon evolution.

Hydrogen Index (HI) - S_2/TOC (mg/g) or ratio of released hydrocarbon to organic carbon content. This is a measure of the hydrocarbon generating potential remaining in the kerogen as opposed to that of the whole rock.

Oxygen Index (OI) - S_3/TOC (mg/g) or ratio of released carbon dioxide to organic carbon content.

Production Index (PI) - S_1/S_1+S_2, or ratio of the amount of hydrocarbons released in the first stage of heating to the total amount of hydrocarbons released and cracked during pyrolysis.

Potential Yield (PY) - S_2 (ppm) or total of hydrocarbons released during cracking of kerogen compared to original weight of rock.

Tmax, hydrogen index and oxygen index are each functions of both maturity and kerogen type. Using published and empirical data, it has been possible to assemble a model to show the relationships of these factors to maturity as measured by spore colouration and vitrinite reflectivity for a selection of pure kerogen types. The kerogen types used are algal sapropel (type I), waxy sapropel (type II), vitrinite (type IIIA) and inertinite (type IIIB) and a computer program has been devised by which the amounts of these components may be calculated from the HI, OI, Tmax and maturity data for any sample. These are the values expressed in the "kerogen composition by calculation" columns tabulated in the reports.

The hydrogen index is a measure of the hydrocarbon generating potential of the kerogen and is analogous to the atomic H/C ratio. Immature, organically rich source rocks and oil shales give values above 500, mature oil source rocks give values between 200 and 550. For a given kerogen type, these values progressively diminish with increasing maturity.

The temperature of maximum rate of pyrolysis depends partly on the kerogen type but the transition from immature to mature organic matter is marked by temperatures between 415° and 435°C. The maturity transition from oil and wet gas generation to dry gas generation is marked by temperatures between 455° and 460°C. In practice, greater variation than these ideal temperature ranges may be seen, but they are nevertheless useful as general guides to the level of maturity attained by the sediment.

The production index increases with maturity from values near zero for immature organic matter to maximum values of 0.15 during the late stages of oil generation. Anomalously high values indicate the presence of oil or contaminants. The potential yield is an indication of the predicted yield of hydrocarbons from the source rock at optimum maturity and is a measure of the quality of the source rock. For immature sediments, values of 0 to 2000 ppm of hydrocarbon characterise a poor source rock, 2000 to 6000 ppm fair, 6000 to 20 000 ppm good and above 20 000 ppm very good.

Pyrolysis techniques have in recent years provided a major advance in the assessment of source rock quality and generating potential. Hydrocarbon yields from immature source beds examined on-structure may be translated into actual oil productivity from the same beds in mature basinal, off-structure situations. Models relating maturity and kerogen type may be used to define original source rock quality grades which are of great value in mapping organic facies. Amorphous kerogen types, indistinguishable in microscopic preparations over a wide range of chemical properties, may be readily differentiated by pyrolysis. The problem of analysing bulk samples containing mixed kerogens has been largely overcome by the kerogen type/maturity model and anomalous results arising from the presence of caving contamination and drilling mud additives can usually be explained by inspection. High oxygen indices sometimes occur as a result of the presence of metastable carbonates and in such cases the sample is acid decarbonated and re-run.

Visual Examination of Kerogen Concentrates

All palynological preparations on which SCI determinations are made are also examined for kerogen type. Visual estimations of the relative abundance of the broad groups vitrinite, inertinite and sapropel are made on the total kerogen slide mount but reference is also made to the >20μ sieved fraction to assist in identification. The scheme of identification is shown in Appendix Table 1. Full use is made of incident blue or UV light in distinguishing immature or early mature oil-prone kerogen from gas-prone kerogen.

Extract Analysis

The soluble organic materials present in rocks can be extracted with organic solvents, fractionated and analysed. The type and amount of material extracted depends largely upon the nature of the contained kerogen and its maturity, although the presence of migrant oil or drilling contamination may be the determining factors.

A maximum of 40g of crushed sample is extracted for a minimum of 12 hours in a Soxhlet apparatus using laboratory redistilled DCM. The solvent and the more volatile components (approximately up to n-C_{15}) are lost by evaporation in an air flow and the resulting total extract is weighed, dissolved in hexane and separated into alkane (saturate) hydrocarbon, aromatic hydrocarbon, resene and asphaltene (polar) fractions by silica adsorption chromatography in the Iatroscan process.

Larger fractions, suitable for further analysis, are obtained by column chromatography. The extract is run through a short glass column packed with silica and alumina and eluted with hexane (to give the saturate fraction), (3:1 hexane: toluene mixture (to give the aromatic fraction) and methanol (to give the polar, or resene and asphaltene, fraction). A small proportion of non-eluted polar compounds usually remains on the column.

The data tabulated in reports comprise the following parameters:

Total extract - soluble organic matter, heavier than about n-C_{15+}, expressed as ppm of weight of rock.

Hydrocarbons - sum of alkane and aromatic hydrocarbons, expressed as ppm of weight of rock.

Extract % of organic carbon (EPOC) - $\frac{\text{total extract ppm}}{\text{TOC} \times 100}$; the extractability.

Hydrocarbons mg/g of organic carbon - total hydrocarbons normalised to 1g of organic carbon.

Hydrocarbons % extract - total hydrocarbons as a proportion of total extract.

Alkanes % hydrocarbons - the proportion of alkanes (saturates) in the total hydrocarbons. The proportion of aromatics is (100 minus this value) expressed as a percentage.

The extractability of oil-prone sapropelic organic matter increases rapidly in the oil generation zone and diminishes to very low values in post mature sediments. Overall the extractability of sapropelic organic matter is greater than that of gas-prone humic organic matter for similar levels of maturity. Samples with extractabilities of greater than 20% generally contain migrant oil or are contaminated with mud additives.

As maturation proceeds in the oil generation zone the proportion of hydrocarbons in the total extract increases from less than 20% to a maximum in the most productive horizons of around 60%. This trend is reversed as the oil-condensate zone is entered. The relative proportions of alkanes to aromatics can be used as a check for low levels of contamination. Fractions of the extract, separated by column chromatography are retained for further analysis by gas chromatography or for stable carbon isotope determination.

Capillary Gas Chromatography of C_{15+} Alkanes

A portion of the Soxhlet extract is eluted with hexane through a short silica column to yield the saturate hydrocarbon fraction. This fraction is evaporated in a stream of dry nitrogen at room temperature. A small portion of the fraction is then taken up in hexane and introduced into a 25 metre, wall-coated, open tubular glass capillary column coated with OV-1, or equivalent, mounted in a Carlo Erba gas chromatograph which is temperature programmed from 70°C to 270°C at 3°C/minute.

C_{15+} chromatograms are inspected for the distributions of n-alkanes, and the presence and abundance of isoprenoids (particularly pristane and phytane), steranes and triterpanes and unresolved envelopes of naphthenic compounds. The ratios pristane:phytane and pristane:n-C_{17} are calculated. Carbon Preference Index (CPI) values quoted are those as defined by Philippi as the ratio $2C_{29}$ to $(C_{28}+C_{30})$ unless otherwise stated. Chromatography may reveal information about the kerogen type of the source rock, its maturity and condition of deposition and, if migrant oil is present, whether this has been water-flushed or biodegraded. Contaminant drilling mud additives may be identified.

Capillary Gas Chromatography of Aromatic and Branched/Cyclic Alkanes

The aromatic portion of the Soxhlet extract is eluted from a short silica/alumina column by a hexane/toluene mixture. The dried fraction is taken up in DCM and introduced into a 25 metre, wall-coated, open tubular glass capillary column coated with OV-1, or equivalent, mounted in a Carlo Erba gas chromatograph which is temperature programmed from 70°C to 270°C at 3°C/ minute.

Branched chain alkanes are separated from normal alkanes by urea adduction and treated as for total alkanes.

Gas Chromatography-Mass Spectrometry

Mass spectrometry is a technique in which molecules are bombarded with high energy electrons causing ionisation and fragmentation of the molecules into ions of varying mass(m) and charge(z). The way in which a molecule fragments into ions of various m/z value is known as its fragmentation pattern, or mass spectrum and is unique. When linked to a gas chromatograph the mass spectrometer can be used in two different modes:

1. Full Scan Mode: A mass spectrum is obtained of each peak eluting from the gas chromatograph and a structural identification of the compound producing that peak can be made.

2. Multiple or Single Ion Monitoring Mode: The mass spectrometer is tuned to certain m/z values to detect whether a compound, eluting from the gas chromatograph, fragments to give an ion at that value. Certain fragmentations are indicative of specific compound types and the most commonly monitored fragment ions used in petroleum geochemistry are those with m/z values of 191, 217 and 259 which are the principal fragment ions obtained from groups of alkanes known as triterpanes, regular steranes and rearranged steranes respectively. These are compounds containing 27 to 35 carbon atoms arranged in a polycyclic, normally 4 or 5 ring, structure, occurring in the n-C_{26} to n-C_{35} region of a gas chromatogram. The basic molecular skeletons of these compounds are very similar to those of the original organic matter deposited in the sediment and so these 191, 217 and 259 distribution plots, known as mass fragmentograms or mass chromatograms, form a pattern characteristic of the source material. This technique of "fingerprinting" is also one of the more exact methods of correlating an oil to its source, or to another oil.

Carbon Isotope ($^{13}C/^{12}C$) Ratio Analysis

Carbon has two stable isotopes, the more abundant ^{12}C isotope and the heavier ^{13}C isotope, which in nature forms about 1% of carbon. Deviations from the $^{13}C/^{12}C$ ratio are extremely small and carbon isotope ratios, as measured by mass spectrometry, are expressed as deviations from a standard, the Pee Dee Belemnite carbonate (PDB standard) in parts per thousand (parts per mil; $^{o}/oo$). Positive deviations indicate ^{13}C enrichment and conversely, negative deviations indicate ^{13}C impoverishment.

While the carbon isotope ratios of oils and rock extracts can range from -20 to -32 $^{o}/oo$ depending on the source organic matter type, the difference between a specific oil and its source is small. Measurements are usually made on the C_{15+} alkane and aromatic hydrocarbon fractions separately and there should be no more than 1 $^{o}/oo$ difference between the oil and its source for either fraction. If there is any doubt that the source rock extracts are not indigenous to the source rock kerogen, the carbon isotope ratio of the extracted source rock kerogen can be measured.

Pyrolysis-Gas Chromatography

The hydrocarbon pyrolysate derived from thermal, anhydrous cracking of kerogen is analysed by capillary gas chromatography. A few mg of rock, kerogen or asphaltene is heated to 600°C for 20 seconds in the injector of a gas chromatograph. The chromatograph oven is kept at -30°C during pyrolysis and then raised to 300°C at a programmed rate of 7.5°C/minute. Chromatograms produced this way are often very different from those of source rock extracts or oils in that branched and cyclic isomers are generated freely giving numerous, closely spaced peaks, along with unsaturated, alkene (olefin) hydrocarbons. The "doublet" peaks often observed in these chromatograms comprise alkene-alkane pairs, the first eluting, and usually smaller peak, being the alkene. The chromatograms range from C_1 to C_{30} or above and although variable, are broadly characteristic of source rock type. Gas-prone kerogen cracks to give a more limited molecular weight range of products, concentrated towards the light ends, whereas oil-prone kerogen gives more prominent alkene-alkane doublets in the C_{12} to C_{30} region. The largest peak from both types is usually methane.

Elemental Analysis

Total (unsieved) kerogen is prepared as described in Section 1. The dried material is combusted in oxygen in an elemental analyser and the oxides of carbon, hydrogen, nitrogen and sulphur are measured. The unburnt residue is the ash content. Oxygen is usually calculated by difference but can be determined separately if required. Results are quoted as percentage weights of C, H, O, N, S and Ash with the atomic ratio H/C and O/C calculated and plotted on the standard van Krevelen diagram. The relative amounts of C, H and O present in organic matter are dependent on both source and maturity. At known maturity levels, some measure of source quality may be determined. Limitations of the method in source rock assessment involve the difficulty of obtaining pure kerogen (in particular, free from pyrite) and the lack of a simple, direct determination of oxygen content.

4. Oil Analysis

RRI laboratories offer a wide range of oil analyses both for geochemical purposes and industrial use. Physical property determinations are based mainly on IP methods and are available for lubricating oils, fuels and greases as well as crudes. Frequently measured properties of crude oils presented in geochemistry reports include: API gravity, pour point, viscosity and contents of water, sulphur, wax, asphaltene, nickel, vanadium and other metals. Chemical analysis of oils involves the following:

Whole oil gas chromatography	- using split syringe injection and a temperature programme from -20°C or -30°C up to 270°C at 4°C/minute.
Associated gas	- if oil has high gas/oil ratio.
Gasoline analysis	- as for gasolines in rock samples but a weighed quantity of oil is used.
Topping of the oil	- this is equivalent to the removal of the fraction boiling below about 210°C and gives a more standardised product for comparison of gas chromatograms of the C_{15+} fraction.
Column chromatography and gas chromatography	- as for solvent extracts. Analysis is carried out on topped oil.

5. Gas Analysis

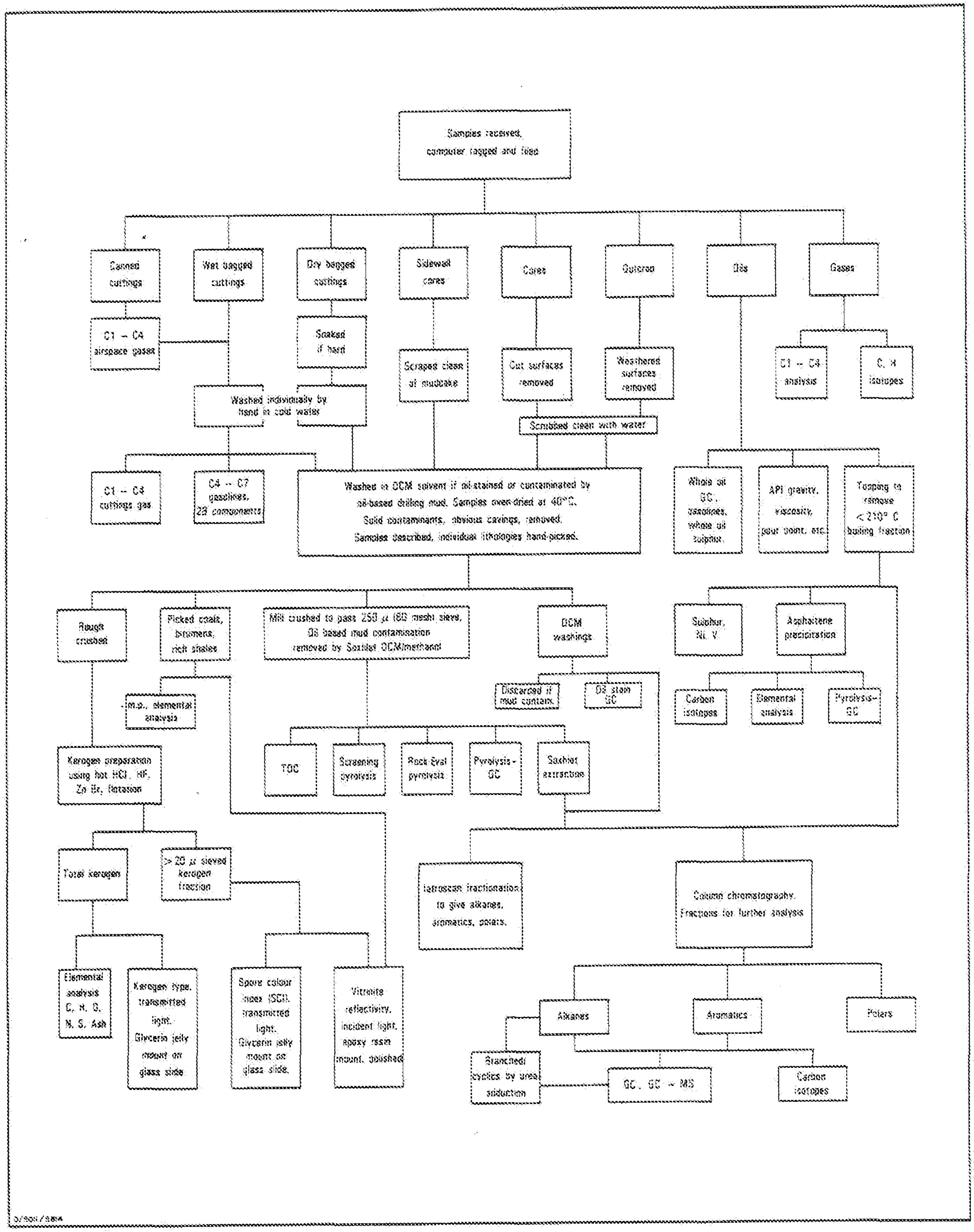
The hydrocarbon gases, C_1 to C_4, may be collected from the airspace of sealed canned samples or may be received from well-site tests in a special sealed gas cylinder (gas mouse). Chromatographic separation of the C_1 to C_4 gases is effected as described under airspace gas analysis. In addition, the separated gas components may be analysed for stable carbon and hydrogen isotope composition which may provide valuable clues to the origin of the gas.

6. Solid Bitumen Analysis

In some oil fields, problems are encountered where bitumen developments form continuous or patchy layers within reservoirs, dividing the pay zones and acting as barriers to natural fluid movement or inhibiting enhanced oil recovery techniques. Integrated geochemical and sedimentological studies aim to produce geological models capable of predicting the occurrence of bitumen layers and their likely thickness and ability to act as permeability barriers. Of further concern are the past or present relationships between the bitumen and reservoired oil, their source rocks and the timing of bitumen formation.

Analysis schemes involve screening of samples by assessing the amount of bitumen in polished core pieces using reflected light microscopy, followed by solvent extraction of control samples to estimate the proportion of solvent soluble bitumen. Different phases of bitumen formation are differentiated by reflectance measurement as described for vitrinite reflectance measurement. Soluble extracts are fractionated to give alkane, aromatics, asphaltene and resene components. Separated bitumens may be subjected to elemental analysis.

FLOW CHART FOR GEOCHEMICAL ANALYSIS



APPENDIX FIGURE 1

Robertson Group

Kerogen Typing Scheme for Transmitted White and Incident Blue/U.V. Light

General Properties	RRI Report Data Tables	Type *
Sapropelic (Oil-prone gas-prone at high maturity)	Algal Sapropel	Type I
	Waxy Sapropel	Type II
Humic (Gas-prone)	Vitrinite	Type IIIA
	Inertinite	Type IIIB

<table>
<tr><th colspan="2">Amorphous</th><th colspan="2">Structured</th></tr>
<tr><th>Non-Fluorescent</th><th>Fluorescent</th><th>Non-fluorescent</th><th>Fluorescent</th></tr>
<tr><td>Type I/II
at high
maturity
(SCI >7.5)</td><td rowspan="2">Type I
Sapropel
Type II
(degraded
spores)
Soft bitumens</td><td>Vitrinite (Type IIIA)
brown/black, woody
tissue</td><td rowspan="2">Cuticle
Spores
Pollen
Dinocysts
(Type II)</td></tr>
<tr><td>Type IIIA/B</td><td rowspan="2">Inertinite (Type IIIB)
very dark brown/black,
woody tissue</td></tr>
<tr><td colspan="2" rowspan="5">Oil residues (bitumens)
Mineral (undigested)
Grease contamination
Mud additives</td><td rowspan="4">Resinite
Algae
(Tasmanites,
Botryococcus
etc.)

(Type I)</td></tr>
<tr><td>Solid bitumen - brown/
black (oil residue)
often with crystal
imprints</td></tr>
<tr><td>Microforaminifera,
chitinozoa etc.
(Not usually important)</td></tr>
<tr><td>Spores, cuticle etc.
at high maturity
levels</td></tr>
<tr><td colspan="2">Mud Additives - walnut etc.</td></tr>
</table>

* Types I, II, III approximately *sensu* Tissot et al but Type III subdivided into IIIA (vitrinite) and IIIB (inertinite)

APPENDIX TABLE 1

APPENDIX 3

Histograms, data and statistics for vitrinite reflectivity

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

APPENDIX 3.1

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

DEPTH: 3550.0-610.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BA1260
BLOCK: 107P KEROGEN

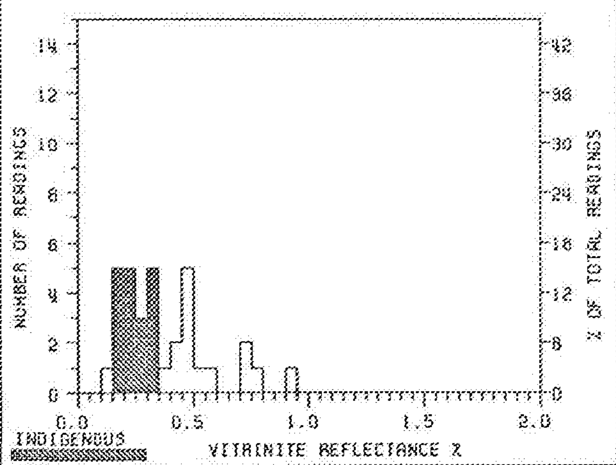
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .24 %
STD DEVIATION : .06 %
NO. OF VALUES : 18
RANGE : .15 TO .32 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .14 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .14 TO .14 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .47 %
STD DEVIATION : .06 %
NO. OF VALUES : 10
RANGE : .37 TO .58 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : .78 %
STD DEVIATION : .09 %
NO. OF VALUES : 4
RANGE : .71 TO .91 %



.14	.20	.30	.41	.58
.15	.22	.30	.46	.71
.16	.22	.31	.47	.71
.17	.24	.31	.47	.79
.18	.25	.32	.48	.91
.19	.28	.37	.48	
.20	.29	.41	.52	

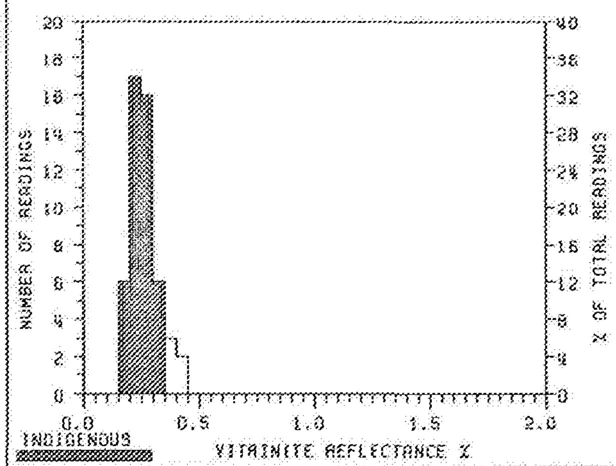
SAMPLE DATA

DEPTH: 4150.0-210.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BA1270
BLOCK: 109P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .24 %
STD DEVIATION : .05 %
NO. OF VALUES : 45
RANGE : .15 TO .33 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .40 %
STD DEVIATION : .02 %
NO. OF VALUES : 5
RANGE : .38 TO .43 %



.15	.20	.22	.24	.26	.28	.33	.43
.15	.20	.22	.24	.26	.28	.33	
.16	.20	.23	.25	.27	.29	.33	
.16	.21	.23	.25	.27	.29	.38	
.19	.22	.23	.25	.27	.31	.38	
.19	.22	.24	.25	.28	.31	.38	
.20	.22	.24	.26	.28	.32	.42	

SAMPLE DATA

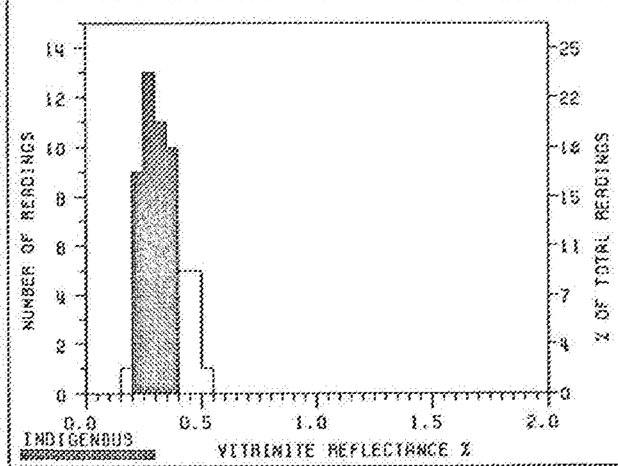
DEPTH: 3850.0-910.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BA1265
BLOCK: 108P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .29 %
STD DEVIATION : .05 %
NO. OF VALUES : 43
RANGE : .21 TO .39 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .19 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .19 TO .19 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .45 %
STD DEVIATION : .03 %
NO. OF VALUES : 11
RANGE : .40 TO .52 %



.19	.23	.26	.28	.32	.35	.38	.45
.21	.24	.26	.29	.32	.35	.39	.46
.21	.24	.26	.30	.32	.35	.40	.46
.22	.25	.27	.30	.34	.36	.42	.47
.22	.26	.28	.30	.34	.36	.42	.48
.22	.26	.28	.31	.34	.36	.42	.52
.23	.26	.28	.31	.35	.38	.43	

SAMPLE DATA

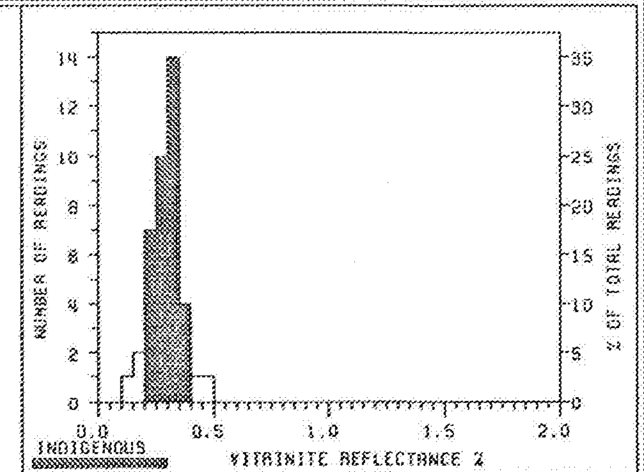
DEPTH: 4450.0-510.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BA1275
BLOCK: 110P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .29 %
STD DEVIATION : .05 %
NO. OF VALUES : 35
RANGE : .20 TO .37 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .16 %
STD DEVIATION : .02 %
NO. OF VALUES : 3
RANGE : .14 TO .18 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .44 %
STD DEVIATION : .04 %
NO. OF VALUES : 2
RANGE : .41 TO .46 %



.14	.24	.26	.30	.32	.36
.15	.24	.27	.31	.32	.37
.18	.24	.27	.31	.33	.37
.20	.25	.27	.31	.33	.41
.20	.25	.28	.31	.33	.46
.22	.26	.28	.31	.34	
.23	.26	.30	.32	.36	

APPENDIX 3.2

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

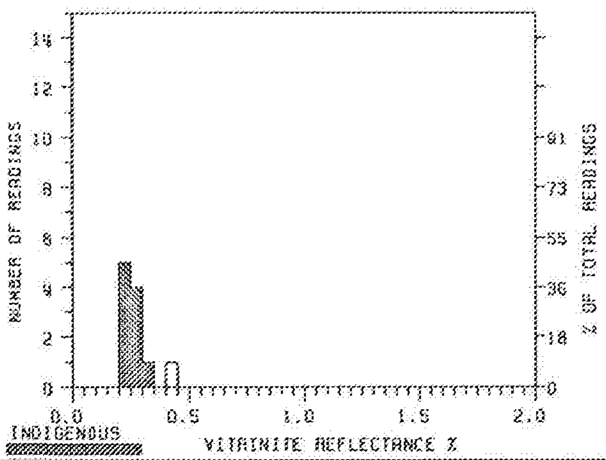
SAMPLE DATA

DEPTH: 4750.0-810.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1280
BLOCK: 111P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .25 %
STD DEVIATION : .03 %
NO. OF VALUES : 10
RANGE : .20 TO .30 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .43 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .43 TO .43 %



.20	.27
.21	.27
.22	.30
.24	.43
.24	
.26	
.27	

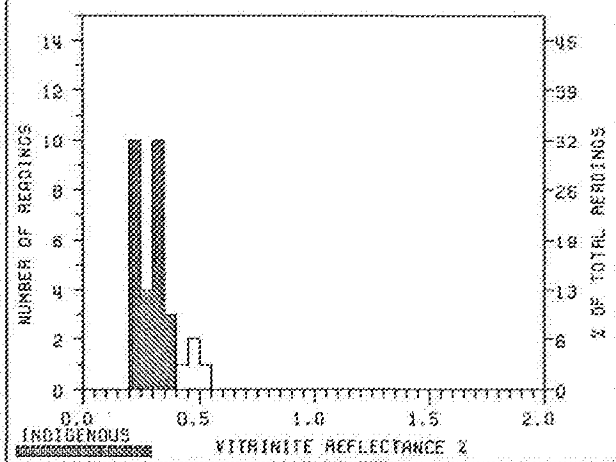
SAMPLE DATA

DEPTH: 5350.0-410.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1290
BLOCK: 113P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .28 %
STD DEVIATION : .05 %
NO. OF VALUES : 27
RANGE : .21 TO .37 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .48 %
STD DEVIATION : .05 %
NO. OF VALUES : 4
RANGE : .42 TO .54 %



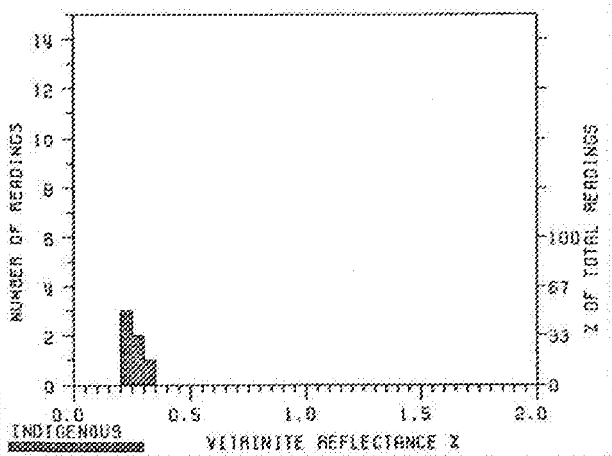
.21	.24	.30	.34	.46
.21	.24	.30	.34	.49
.21	.24	.31	.34	.54
.22	.26	.31	.35	
.22	.26	.32	.36	
.22	.27	.32	.37	
.23	.29	.33	.42	

SAMPLE DATA

DEPTH: 5050.0-110.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1285
BLOCK: 112P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .25 %
STD DEVIATION : .04 %
NO. OF VALUES : 6
RANGE : .22 TO .33 %



.22
.22
.23
.25
.28
.33

SAMPLE DATA

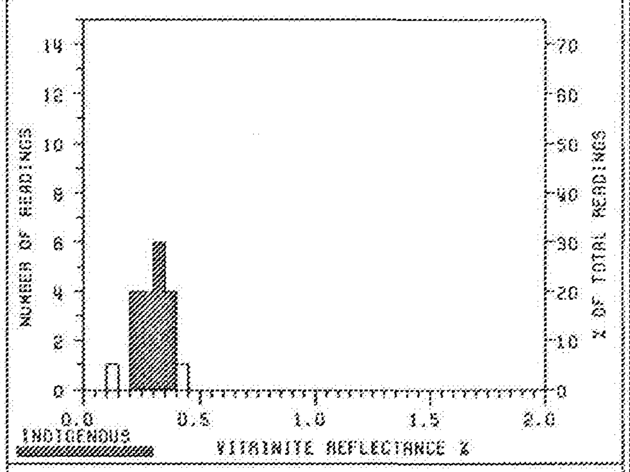
DEPTH: 5650.0-710.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1295
BLOCK: 114P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .30 %
STD DEVIATION : .05 %
NO. OF VALUES : 18
RANGE : .22 TO .39 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .14 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .14 TO .14 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .42 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .42 TO .42 %



.14	.27	.33
.22	.29	.36
.23	.30	.36
.23	.30	.37
.24	.32	.39
.26	.33	.42
.27	.33	

APPENDIX 3.3

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

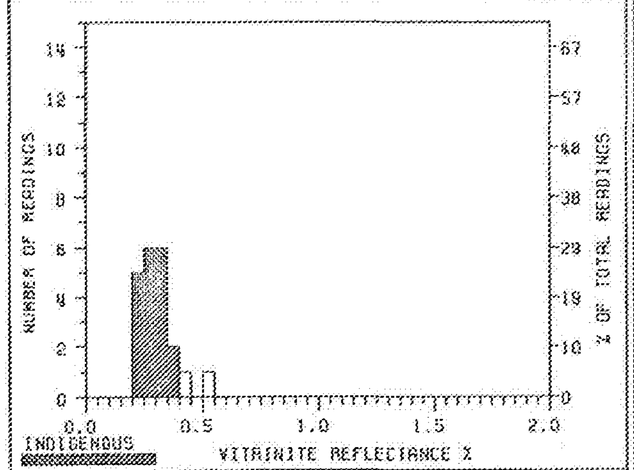
SAMPLE DATA

DEPTH: 5950.0-010.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1300
BLOCK: 115P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .29 %
STD DEVIATION : .05 %
NO. OF VALUES : 19
RANGE : .21 TO .38 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .48 %
STD DEVIATION : .09 %
NO. OF VALUES : 2
RANGE : .41 TO .54 %



.21	.28	.32
.22	.28	.33
.23	.28	.34
.24	.29	.36
.24	.30	.38
.27	.30	.41
.28	.31	.54

SAMPLE DATA

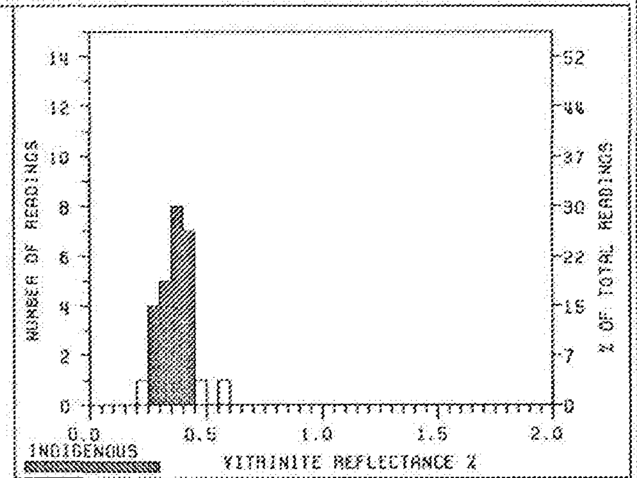
DEPTH: 6550.0-610.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1310
BLOCK: 117P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .36 %
STD DEVIATION : .05 %
NO. OF VALUES : 24
RANGE : .28 TO .44 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .23 %
STD DEVIATION : -----
NO. OF VALUES : 1
RANGE : .23 TO .23 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .51 %
STD DEVIATION : .08 %
NO. OF VALUES : 2
RANGE : .45 TO .57 %



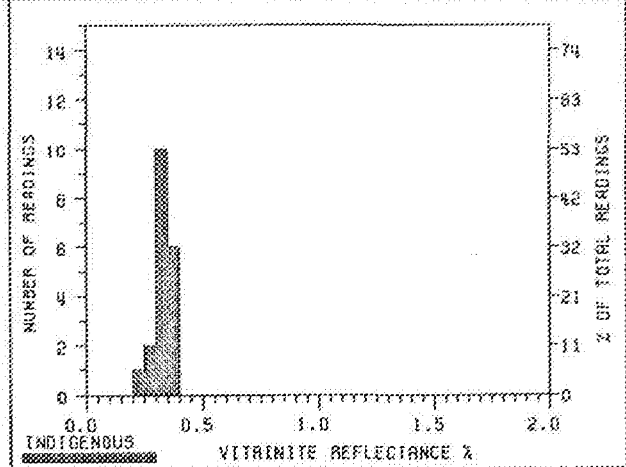
.23	.33	.37	.40
.28	.33	.37	.41
.28	.34	.38	.43
.29	.35	.39	.44
.29	.36	.40	.45
.31	.36	.40	.57
.32	.37	.40	

SAMPLE DATA

DEPTH: 6250.0-310.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1305
BLOCK: 116P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .33 %
STD DEVIATION : .04 %
NO. OF VALUES : 19
RANGE : .24 TO .38 %



.24	.31	.36
.25	.31	.37
.29	.33	.38
.30	.33	.38
.31	.34	.38
.31	.34	
.31	.36	

SAMPLE DATA

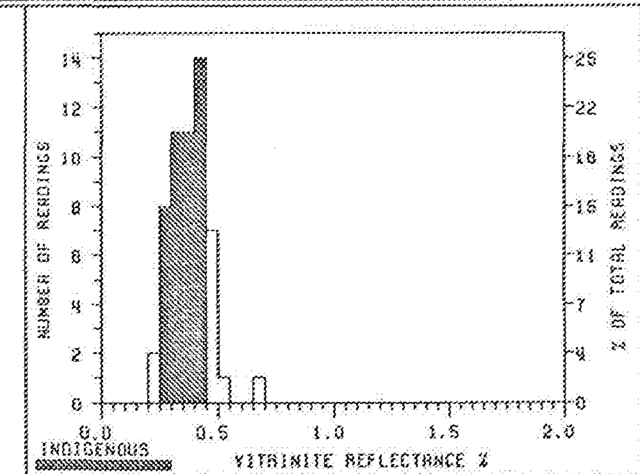
DEPTH: 6850.0-910.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1315
BLOCK: 118P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .36 %
STD DEVIATION : .05 %
NO. OF VALUES : 44
RANGE : .28 TO .43 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .23 %
STD DEVIATION : 0.00 %
NO. OF VALUES : 2
RANGE : .23 TO .23 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .50 %
STD DEVIATION : .07 %
NO. OF VALUES : 9
RANGE : .45 TO .69 %



.23	.29	.33	.35	.37	.40	.42	.47
.23	.29	.33	.36	.37	.40	.43	.47
.28	.29	.33	.36	.38	.41	.43	.48
.28	.30	.33	.37	.39	.41	.43	.49
.29	.31	.34	.37	.40	.42	.45	.52
.29	.32	.34	.37	.40	.42	.47	.69
.29	.32	.34	.37	.40	.42	.47	

APPENDIX 3.4

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

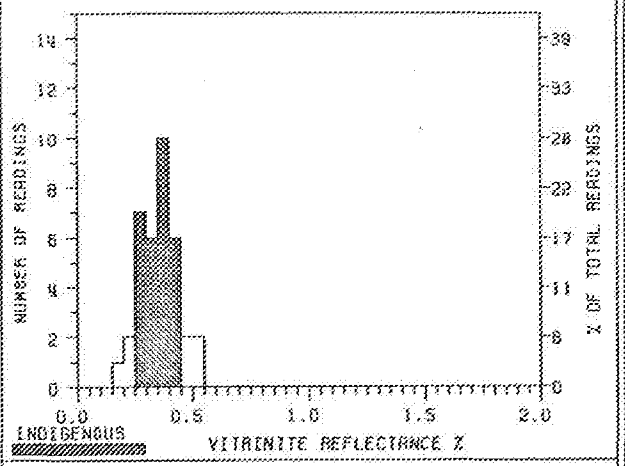
DEPTH: 7150.0-210.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1320
BLOCK: 119P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .35 %
STD DEVIATION : .05 %
NO. OF VALUES : 29
RANGE : .25 TO .44 %

POPN 2 - CAVED
MEAN VALUE : .21 %
STD DEVIATION : .03 %
NO. OF VALUES : 3
RANGE : .18 TO .24 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .50 %
STD DEVIATION : .03 %
NO. OF VALUES : 4
RANGE : .47 TO .53 %



.18	.28	.34	.37	.41	.53
.20	.28	.34	.38	.41	
.24	.29	.35	.38	.43	
.25	.33	.36	.39	.44	
.26	.33	.36	.39	.47	
.27	.33	.37	.40	.49	
.27	.33	.37	.40	.51	

SAMPLE DATA

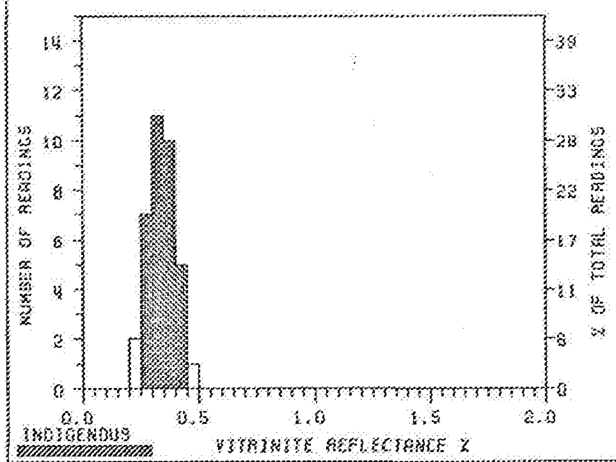
DEPTH: 7750.0-810.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1330
BLOCK: 121P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .34 %
STD DEVIATION : .05 %
NO. OF VALUES : 33
RANGE : .25 TO .44 %

POPN 2 - CAVED
MEAN VALUE : .24 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .23 TO .24 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .46 %
STD DEVIATION : -----
NO. OF VALUES : 1
RANGE : .46 TO .46 %



.23	.29	.32	.35	.38	.46
.24	.29	.32	.36	.39	
.25	.30	.33	.36	.40	
.26	.30	.33	.37	.40	
.27	.30	.33	.38	.43	
.28	.31	.34	.38	.44	
.28	.31	.35	.38	.44	

SAMPLE DATA

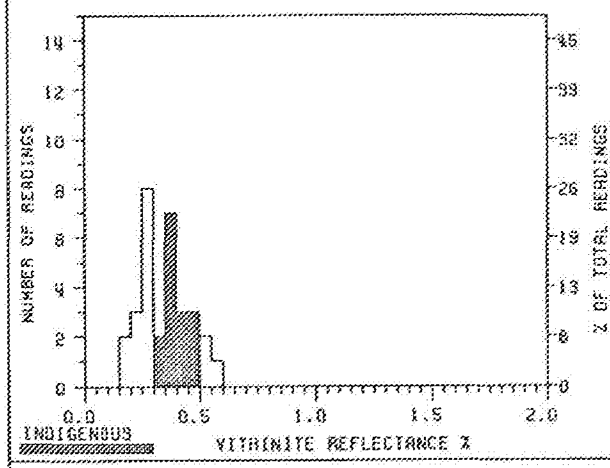
DEPTH: 7450.0-510.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1325
BLOCK: 120P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .39 %
STD DEVIATION : .05 %
NO. OF VALUES : 15
RANGE : .33 TO .47 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .25 %
STD DEVIATION : .02 %
NO. OF VALUES : 11
RANGE : .22 TO .29 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .54 %
STD DEVIATION : .01 %
NO. OF VALUES : 3
RANGE : .54 TO .55 %



.18	.25	.34	.39	.54
.19	.26	.35	.40	.54
.22	.26	.36	.43	.55
.23	.27	.36	.44	
.24	.27	.38	.45	
.25	.29	.38	.46	
.25	.33	.39	.47	

SAMPLE DATA

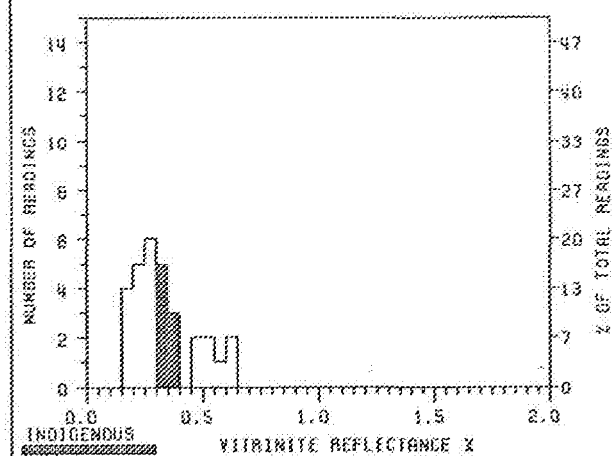
DEPTH: 8050.0-110.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8A1335
BLOCK: 122P KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .33 %
STD DEVIATION : .02 %
NO. OF VALUES : 8
RANGE : .30 TO .36 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .23 %
STD DEVIATION : .04 %
NO. OF VALUES : 15
RANGE : .17 TO .29 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .54 %
STD DEVIATION : .06 %
NO. OF VALUES : 7
RANGE : .48 TO .62 %



.17	.23	.29	.35	.60
.19	.24	.30	.36	.62
.19	.25	.30	.48	
.19	.27	.31	.48	
.20	.28	.32	.51	
.21	.29	.33	.53	
.21	.29	.35	.57	

APPENDIX 3.5

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

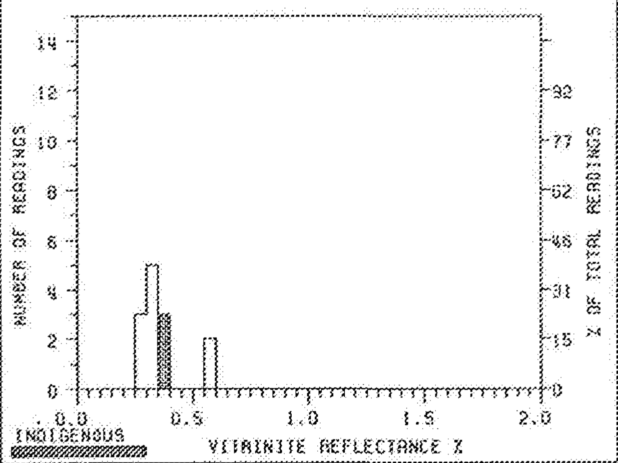
SAMPLE DATA
DEPTH: 8350.0-380.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800018
BLOCK: 1160 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .37 %
STD DEVIATION : .01 %
NO. OF VALUES : 3
RANGE : .36 TO .38 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .30 %
STD DEVIATION : .02 %
NO. OF VALUES : 8
RANGE : .26 TO .33 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .59 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .58 TO .59 %



.26	.33
.28	.36
.29	.36
.30	.38
.30	.58
.31	.59
.32	

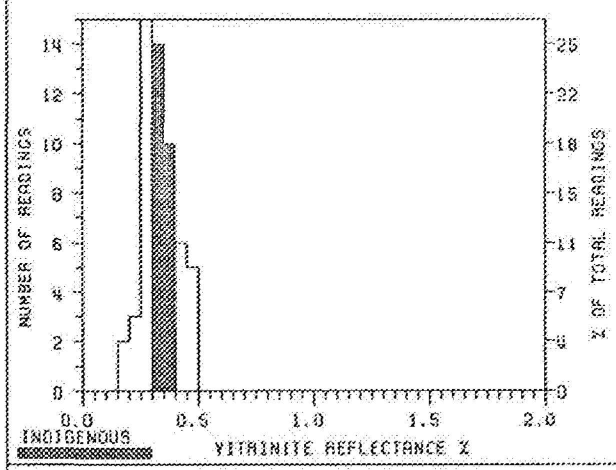
SAMPLE DATA
DEPTH: 8950.0-980.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800028
BLOCK: 1180 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .34 %
STD DEVIATION : .03 %
NO. OF VALUES : 24
RANGE : .30 TO .39 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .25 %
STD DEVIATION : .03 %
NO. OF VALUES : 20
RANGE : .16 TO .29 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .44 %
STD DEVIATION : .03 %
NO. OF VALUES : 11
RANGE : .41 TO .48 %



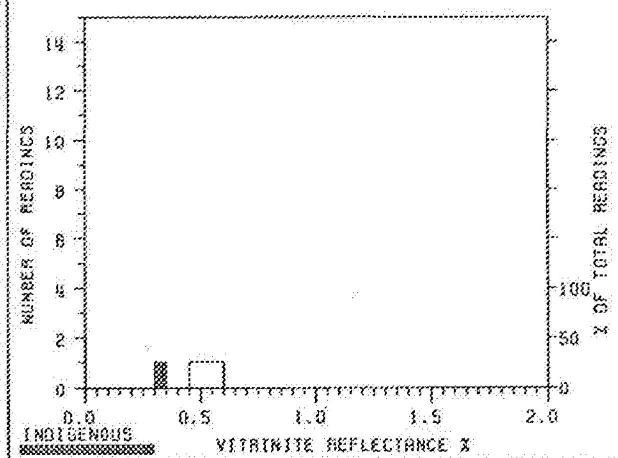
.16	.26	.27	.30	.32	.35	.38	.44
.17	.26	.28	.30	.32	.35	.39	.46
.22	.26	.28	.30	.33	.35	.41	.46
.24	.26	.28	.30	.33	.36	.41	.47
.24	.27	.28	.31	.33	.36	.41	.47
.25	.27	.29	.31	.34	.37	.41	.48
.25	.27	.30	.31	.35	.38	.42	

SAMPLE DATA
DEPTH: 8650.0-680.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800021
BLOCK: 1170 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .31 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .31 TO .31 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .52 %
STD DEVIATION : .04 %
NO. OF VALUES : 3
RANGE : .49 TO .57 %



.31
.49
.50
.57

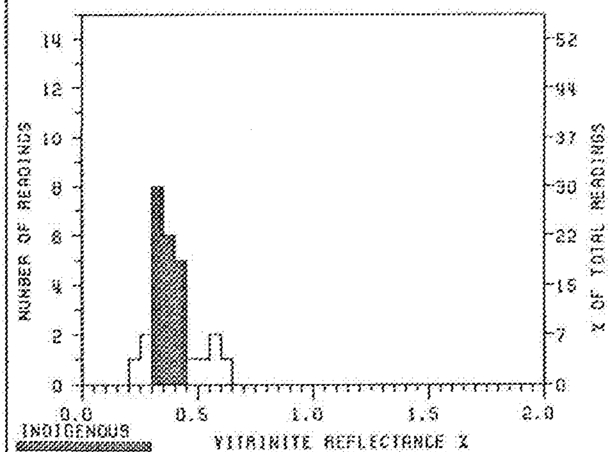
SAMPLE DATA
DEPTH: 9250.0-280.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800031
BLOCK: 1190 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .36 %
STD DEVIATION : .04 %
NO. OF VALUES : 19
RANGE : .30 TO .44 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .25 %
STD DEVIATION : .01 %
NO. OF VALUES : 3
RANGE : .24 TO .25 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .55 %
STD DEVIATION : .06 %
NO. OF VALUES : 5
RANGE : .46 TO .61 %



.24	.33	.36	.44
.25	.33	.37	.46
.25	.34	.37	.52
.30	.34	.40	.56
.31	.35	.41	.59
.31	.35	.41	.61
.32	.35	.44	

APPENDIX 3.6

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

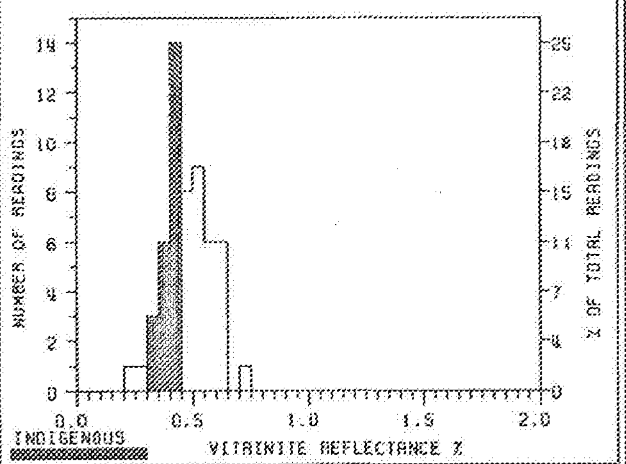
DEPTH: 9550.0-580.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800038
BLOCK: 1200 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .40 %
STD DEVIATION : .04 %
NO. OF VALUES : 23
RANGE : .30 TO .44 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .28 %
STD DEVIATION : .04 %
NO. OF VALUES : 2
RANGE : .23 TO .28 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .53 %
STD DEVIATION : .05 %
NO. OF VALUES : 29
RANGE : .45 TO .63 %



.23	.37	.42	.43	.47	.51	.55	.60
.28	.37	.42	.44	.48	.52	.55	.60
.30	.37	.42	.44	.48	.52	.55	.61
.32	.39	.42	.44	.48	.52	.58	.63
.32	.41	.43	.45	.49	.53	.58	.63
.35	.41	.43	.46	.51	.53	.57	.73
.38	.41	.43	.46	.51	.54	.60	

SAMPLE DATA

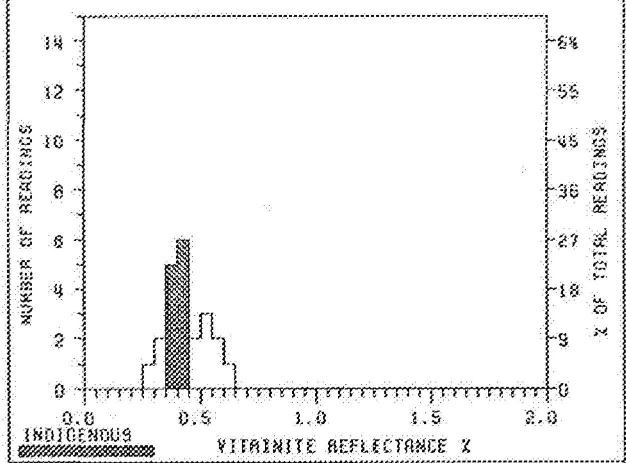
DEPTH: 10150.0-180.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800046
BLOCK: 1220 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .40 %
STD DEVIATION : .03 %
NO. OF VALUES : 11
RANGE : .36 TO .44 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .32 %
STD DEVIATION : .03 %
NO. OF VALUES : 3
RANGE : .29 TO .34 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .53 %
STD DEVIATION : .04 %
NO. OF VALUES : 8
RANGE : .47 TO .60 %



.29	.39	.47	.60
.32	.40	.49	
.34	.42	.51	
.36	.42	.51	
.37	.43	.53	
.37	.44	.56	
.38	.44	.57	

SAMPLE DATA

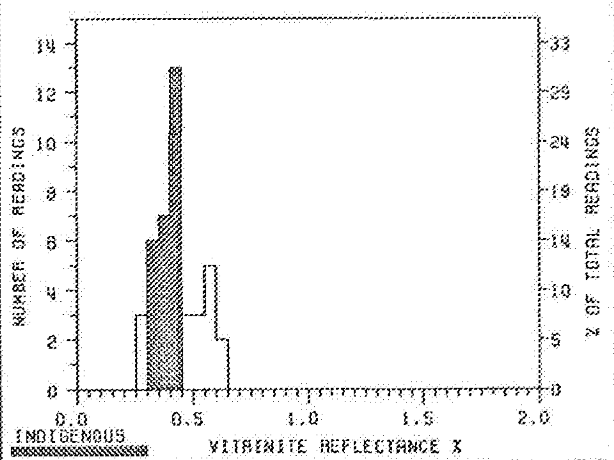
DEPTH: 9850.0-880.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800041
BLOCK: 1210 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .38 %
STD DEVIATION : .04 %
NO. OF VALUES : 26
RANGE : .30 TO .44 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .28 %
STD DEVIATION : .01 %
NO. OF VALUES : 3
RANGE : .27 TO .29 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .54 %
STD DEVIATION : .05 %
NO. OF VALUES : 13
RANGE : .46 TO .62 %



.27	.33	.38	.42	.44	.55
.27	.34	.38	.42	.46	.56
.29	.35	.40	.42	.46	.57
.30	.35	.41	.43	.47	.57
.31	.36	.42	.43	.53	.59
.31	.37	.42	.43	.54	.60
.33	.37	.42	.43	.54	.62

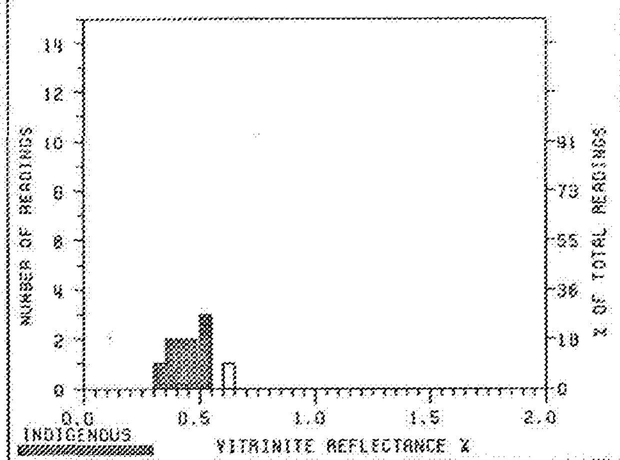
SAMPLE DATA

DEPTH: 11350.0-380.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800066
BLOCK: 1230 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .44 %
STD DEVIATION : .07 %
NO. OF VALUES : 10
RANGE : .34 TO .54 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .63 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .63 TO .63 %



.34	.52
.35	.54
.38	.54
.41	.63
.42	
.45	
.47	

APPENDIX 3.7

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

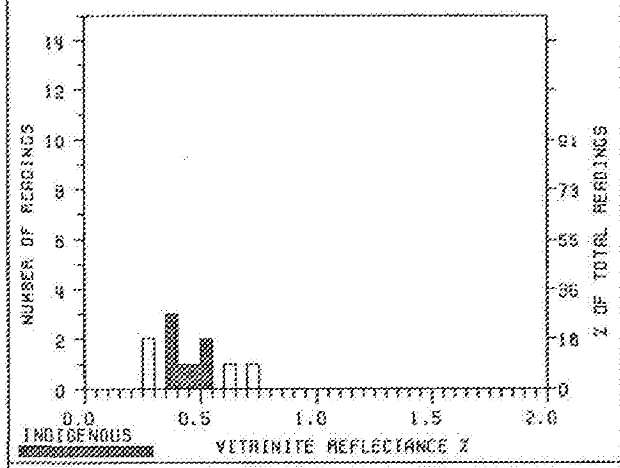
DEPTH: 11590.0-620.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800070
BLOCK: 1240 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .43 %
STD DEVIATION : .06 %
NO. OF VALUES : 7
RANGE : .36 TO .51 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .29 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .28 TO .29 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .68 %
STD DEVIATION : .08 %
NO. OF VALUES : 2
RANGE : .63 TO .72 %



.28	.50
.29	.51
.36	.63
.37	.72
.38	
.42	
.45	

SAMPLE DATA

DEPTH: 12310.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800082
BLOCK: 1270 KEROGEN

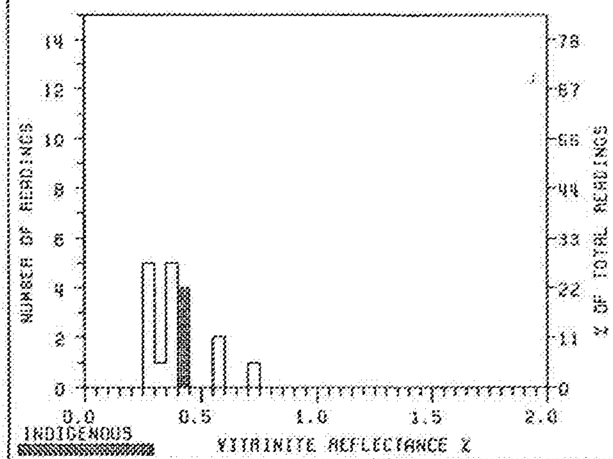
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .43 %
STD DEVIATION : .01 %
NO. OF VALUES : 4
RANGE : .42 TO .44 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .32 %
STD DEVIATION : .04 %
NO. OF VALUES : 11
RANGE : .25 TO .37 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .57 %
STD DEVIATION : .02 %
NO. OF VALUES : 2
RANGE : .55 TO .58 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : .73 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .72 TO .74 %



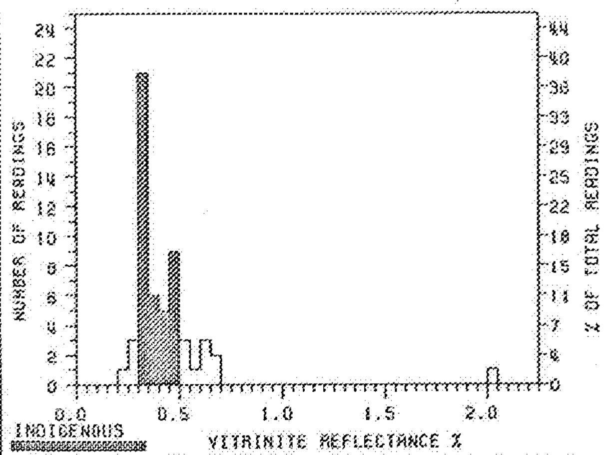
.25	.35	.44
.25	.35	.55
.28	.36	.58
.29	.37	.73
.29	.42	
.33	.43	
.35	.43	

SAMPLE DATA

DEPTH: 12070.0-100.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 800078
BLOCK: 1260 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .37 %
STD DEVIATION : .05 %
NO. OF VALUES : 41
RANGE : .30 TO .49 %



.23	.30	.32	.34	.36	.44	.48	.60
.27	.31	.33	.34	.37	.45	.48	.60
.29	.31	.33	.34	.38	.46	.49	.64
.29	.31	.33	.34	.41	.46	.50	.65
.30	.32	.33	.35	.41	.46	.51	.68
.30	.32	.33	.35	.41	.47	.52	2.00
.30	.32	.34	.35	.41	.48	.56	

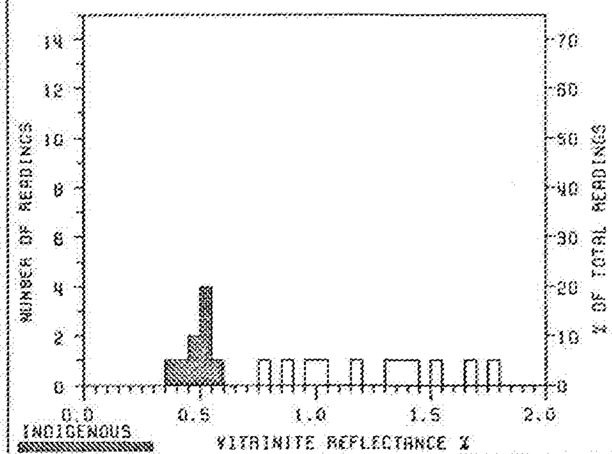
SAMPLE DATA

DEPTH: 12795.0 FT
CODE :
TYPE : SWC
PROJECT : 25616
SAMPLE : 800173
BLOCK: 8220 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .49 %
STD DEVIATION : .06 %
NO. OF VALUES : 9
RANGE : .36 TO .55 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .91 %
STD DEVIATION : .12 %
NO. OF VALUES : 4
RANGE : .75 TO 1.00 %



.36	.54	1.33
.43	.55	1.35
.47	.75	1.42
.48	.89	1.50
.51	.99	1.66
.52	1.00	1.77
.53	1.16	

APPENDIX 3.8

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

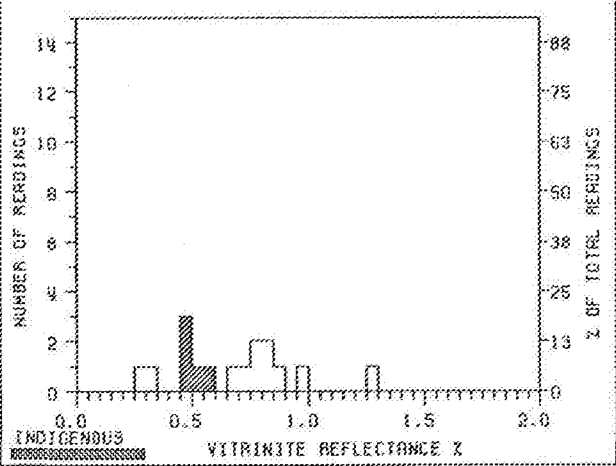
DEPTH: 12832.0 FT
CODE :
TYPE : SWC
PROJECT : 25616
SAMPLE : 800174
BLOCK: 823Q KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .50 %
STD DEVIATION : .05 %
NO. OF VALUES : 5
RANGE : .43 TO .58 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .28 %
STD DEVIATION : .04 %
NO. OF VALUES : 2
RANGE : .26 TO .31 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .80 %
STD DEVIATION : .09 %
NO. OF VALUES : 8
RANGE : .67 TO .97 %



.26	.67	.97
.31	.74	1.28
.45	.75	
.49	.76	
.49	.81	
.51	.83	
.58	.85	

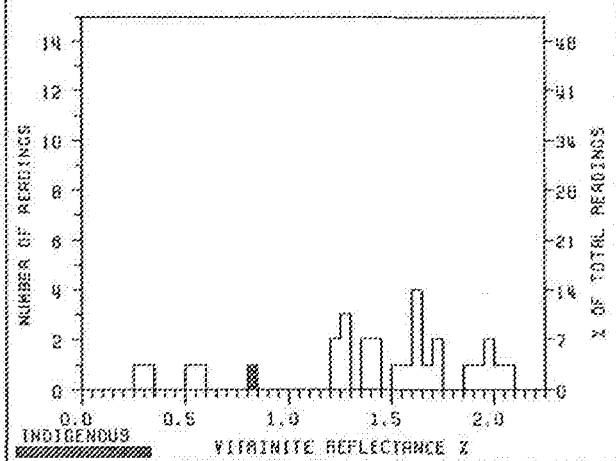
SAMPLE DATA

DEPTH: 13100.0-110.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8F0017
BLOCK: 816Q KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .83 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : .82 TO .84 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : 1.32 %
STD DEVIATION : .08 %
NO. OF VALUES : 9
RANGE : 1.23 TO 1.44 %



.26	1.27	1.51	1.71	2.08
.34	1.29	1.55	1.74	
.51	1.29	1.60	1.88	
.59	1.35	1.62	1.93	
.83	1.37	1.62	1.95	
1.23	1.43	1.63	1.98	
1.24	1.44	1.68	2.00	

SAMPLE DATA

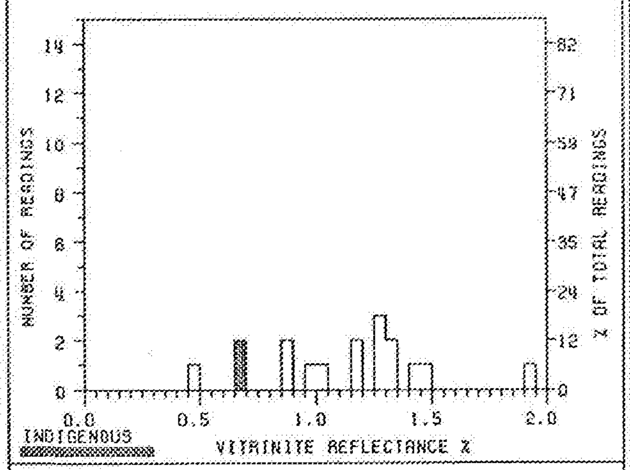
DEPTH: 12910.0-960.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8F0010
BLOCK: 815Q KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .67 %
STD DEVIATION : .03 %
NO. OF VALUES : 2
RANGE : .65 TO .69 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .93 %
STD DEVIATION : .07 %
NO. OF VALUES : 4
RANGE : .86 TO 1.01 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.30 %
STD DEVIATION : .10 %
NO. OF VALUES : 8
RANGE : 1.17 TO 1.48 %



.49	1.17	1.41
.65	1.19	1.48
.69	1.26	1.98
.86	1.27	
.88	1.29	
.97	1.31	
1.01	1.34	

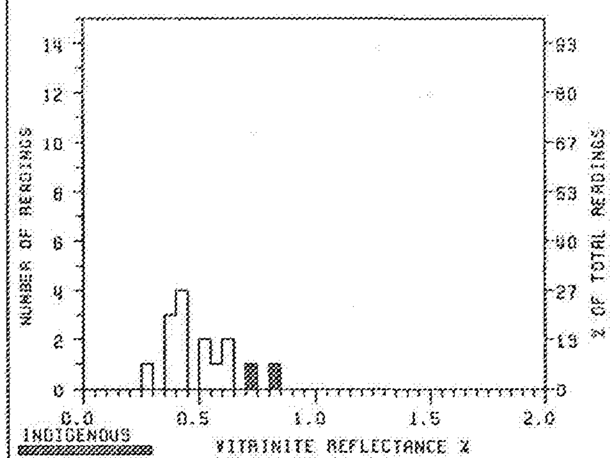
SAMPLE DATA

DEPTH: 13165.0 FT
CODE :
TYPE : SWC
PROJECT : 25616
SAMPLE : 800176
BLOCK: 825Q KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .78 %
STD DEVIATION : .08 %
NO. OF VALUES : 2
RANGE : .72 TO .84 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .46 %
STD DEVIATION : .10 %
NO. OF VALUES : 13
RANGE : .28 TO .61 %



.28	.43	.84
.38	.53	
.39	.54	
.39	.56	
.40	.61	
.42	.61	
.43	.72	

APPENDIX 3.9

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

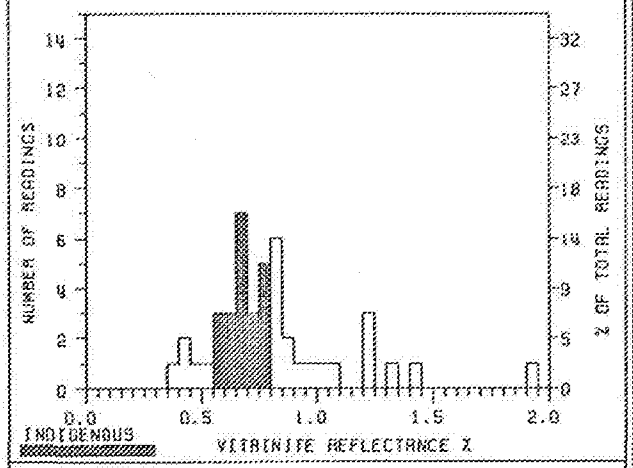
DEPTH: 13300.0-310.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BFD027
BLOCK: 8170 KEROGEN

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .68 %
STD DEVIATION : .07 %
NO. OF VALUES : 21
RANGE : .55 TO .77 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .89 %
STD DEVIATION : .09 %
NO. OF VALUES : 12
RANGE : .80 TO 1.08 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.28 %
STD DEVIATION : .09 %
NO. OF VALUES : 5
RANGE : 1.21 TO 1.41 %



.39	.59	.67	.75	.82	.89	1.41
.42	.61	.68	.76	.82	1.01	1.91
.43	.63	.69	.77	.83	1.08	
.47	.64	.69	.77	.84	1.21	
.50	.65	.70	.77	.85	1.21	
.55	.66	.70	.80	.86	1.23	
.58	.67	.74	.81	.93	1.32	

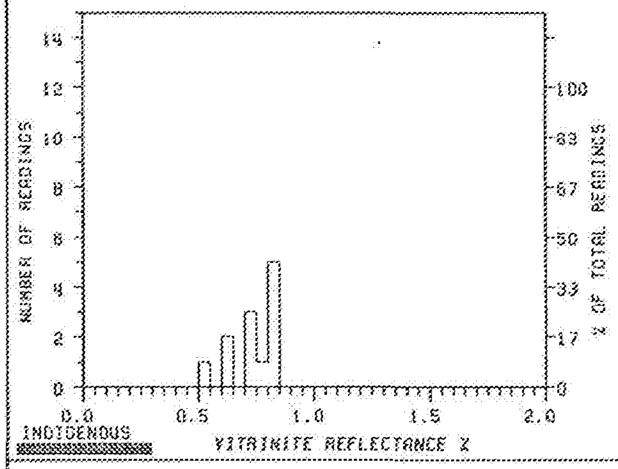
SAMPLE DATA

DEPTH: 13430.0 FT
CODE :
TYPE : SWC
PROJECT : 25616
SAMPLE : 8D0178
BLOCK: 8270 KEROGEN

STATISTICS

POPN 1 - LOW REFLECTING
MEAN VALUE : .74 %
STD DEVIATION : .10 %
NO. OF VALUES : 12
RANGE : .54 TO .84 %

POPN 3 - INDIGENOUS
MEAN VALUE : .74 %
STD DEVIATION : .10 %
NO. OF VALUES : 12
RANGE : .54 TO .84 %



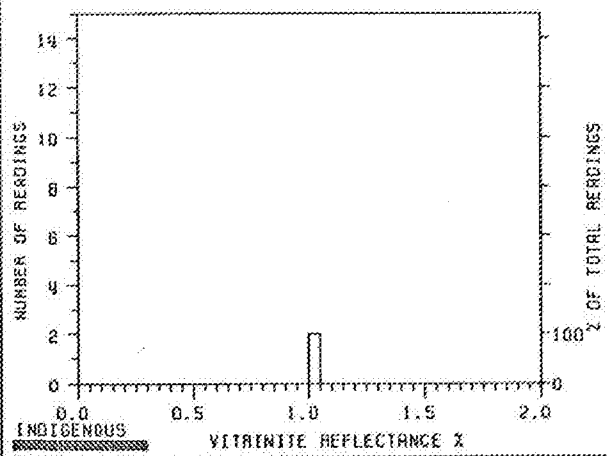
.54	.81
.60	.83
.63	.84
.70	.84
.73	.84
.74	
.77	

SAMPLE DATA

DEPTH: 13370.0 FT
CODE :
TYPE : SWC
PROJECT : 25616
SAMPLE : 8D0177
BLOCK: 8260 KEROGEN

STATISTICS

POPN 1 - SEMIFUS/REWORK
MEAN VALUE : 1.03 %
STD DEVIATION : 0.00 %
NO. OF VALUES : 2
RANGE : 1.03 TO 1.03 %



1.03
1.03

SAMPLE DATA

DEPTH: 13500.0-510.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BFD037
BLOCK: 8180 KEROGEN

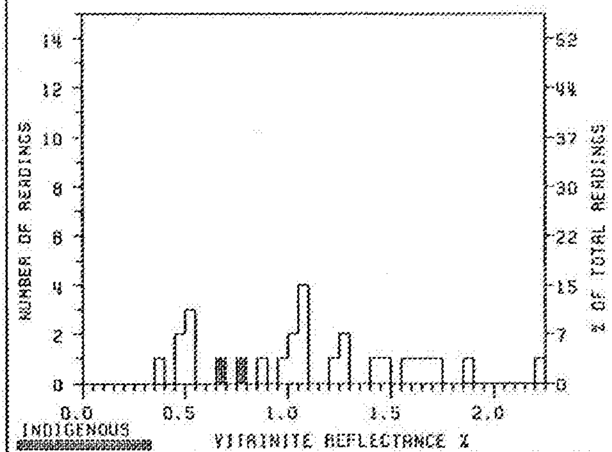
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .73 %
STD DEVIATION : .06 %
NO. OF VALUES : 2
RANGE : .68 TO .77 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .48 %
STD DEVIATION : .05 %
NO. OF VALUES : 6
RANGE : .39 TO .53 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.01 %
STD DEVIATION : .07 %
NO. OF VALUES : 8
RANGE : .87 TO 1.08 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.25 %
STD DEVIATION : .01 %
NO. OF VALUES : 3
RANGE : 1.24 TO 1.25 %



.39	.77	1.07	1.56
.46	.87	1.08	1.64
.46	.98	1.24	1.65
.52	1.00	1.25	1.73
.53	1.02	1.25	1.85
.53	1.05	1.43	2.21
.68	1.06	1.45	

APPENDIX 3.10

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

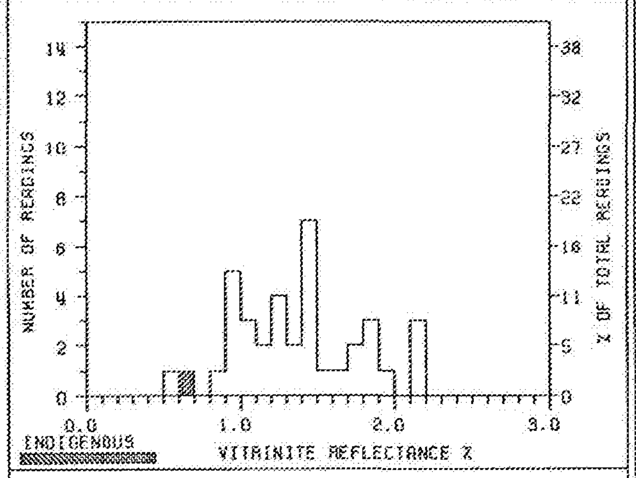
HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA
DEPTH: 13700.0-710.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8F0047
BLOCK: 8190 KEROGEN

STATISTICS
POPN 1 - INDIGENOUS
MEAN VALUE : .62 %
STD DEVIATION : -----
NO. OF VALUES : 1
RANGE : .61 TO .63 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .95 %
STD DEVIATION : .06 %
NO. OF VALUES : 8
RANGE : .86 TO 1.03 %

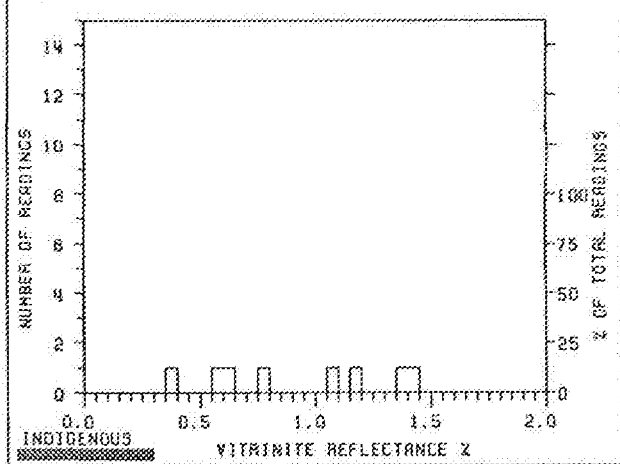
POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.76 %
STD DEVIATION : .19 %
NO. OF VALUES : 8
RANGE : 1.55 TO 1.94 %



.59	.97	1.22	1.41	1.71	2.16
.62	1.02	1.23	1.42	1.77	2.17
.86	1.03	1.24	1.45	1.80	3.00
.91	1.08	1.31	1.48	1.81	4.44
.92	1.10	1.32	1.48	1.86	
.93	1.15	1.40	1.55	1.94	
.97	1.21	1.40	1.62	2.14	

SAMPLE DATA
DEPTH: 13900.0-910.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8F0057
BLOCK: 8200 KEROGEN

STATISTICS
POPN 1 - SEMIFUS/REWORK
MEAN VALUE : 1.26 %
STD DEVIATION : .16 %
NO. OF VALUES : 4
RANGE : 1.09 TO 1.43 %



.37	1.43
.57	
.62	
.75	
1.09	
1.17	
1.35	

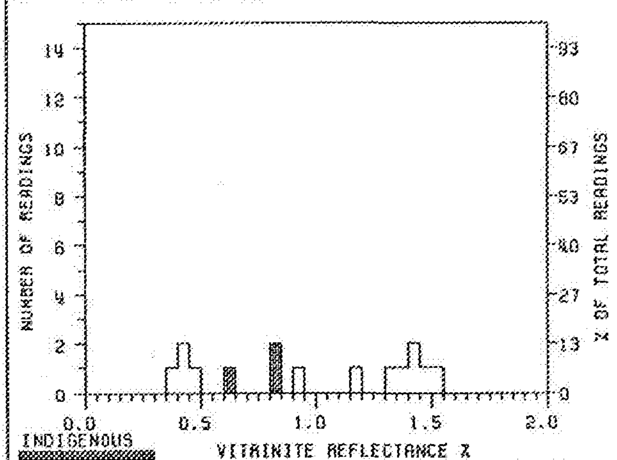
SAMPLE DATA
DEPTH: 13838.0 FT
CODE :
TYPE : SWC
PROJECT : 25616
SAMPLE : 8D0180
BLOCK: 8290 KEROGEN

STATISTICS
POPN 1 - INDIGENOUS
MEAN VALUE : .74 %
STD DEVIATION : .12 %
NO. OF VALUES : 3
RANGE : .61 TO .82 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .41 %
STD DEVIATION : .03 %
NO. OF VALUES : 4
RANGE : .38 TO .46 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : .90 %
STD DEVIATION : -----
NO. OF VALUES : 1
RANGE : .89 TO .91 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.38 %
STD DEVIATION : .11 %
NO. OF VALUES : 7
RANGE : 1.19 TO 1.50 %



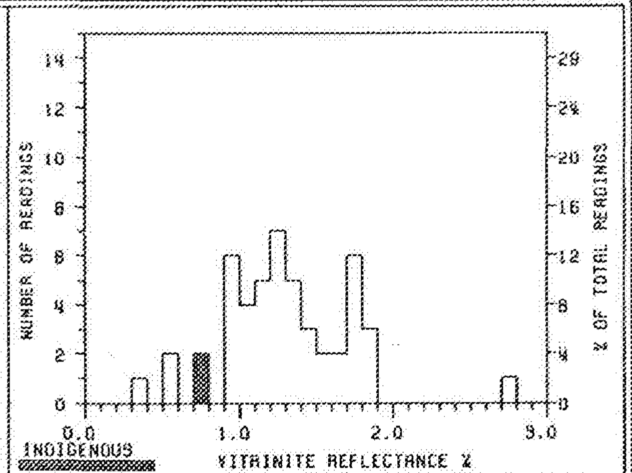
.38	.90	1.50
.40	1.19	
.41	1.33	
.46	1.36	
.61	1.40	
.80	1.41	
.82	1.49	

SAMPLE DATA
DEPTH: 14040.0-070.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8F2985
BLOCK: 8880 KEROGEN

STATISTICS
POPN 1 - INDIGENOUS
MEAN VALUE : .73 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .72 TO .73 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .95 %
STD DEVIATION : .05 %
NO. OF VALUES : 7
RANGE : .90 TO 1.02 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.26 %
STD DEVIATION : .12 %
NO. OF VALUES : 23
RANGE : 1.07 TO 1.47 %



.33	.92	1.08	1.24	1.34	1.53	1.75	4.04
.51	.94	1.15	1.24	1.35	1.55	1.77	
.53	.98	1.15	1.25	1.35	1.62	1.78	
.72	.99	1.16	1.27	1.38	1.63	1.81	
.73	1.02	1.17	1.28	1.41	1.70	1.88	
.90	1.07	1.19	1.29	1.44	1.70	1.88	
.91	1.07	1.23	1.33	1.47	1.73	2.76	

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

APPENDIX 3.11

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA
DEPTH: 14200.0-230.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BF2989
BLOCK: 8890 KEROGEN

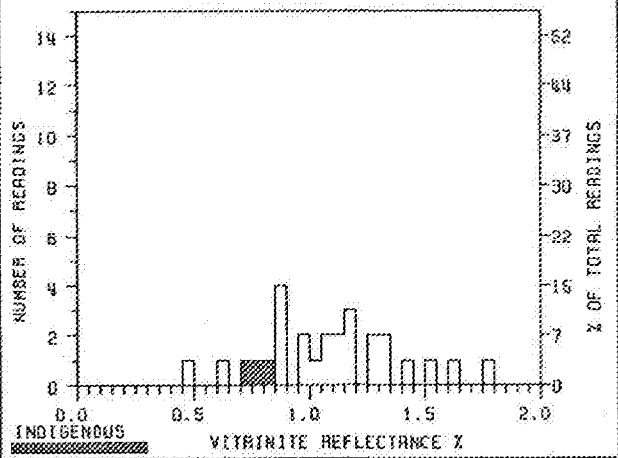
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .77 %
STD DEVIATION : .05 %
NO. OF VALUES : 3
RANGE : .73 TO .82 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .88 %
STD DEVIATION : .01 %
NO. OF VALUES : 4
RANGE : .86 TO .88 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.08 %
STD DEVIATION : .07 %
NO. OF VALUES : 10
RANGE : .99 TO 1.17 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.32 %
STD DEVIATION : .05 %
NO. OF VALUES : 5
RANGE : 1.29 TO 1.40 %



.45	.88	1.11	1.30
.69	.88	1.11	1.33
.73	.89	1.15	1.40
.77	.99	1.16	1.54
.82	1.02	1.17	1.61
.86	1.09	1.29	1.75
.88	1.09	1.29	

SAMPLE DATA
DEPTH: 14640.0-670.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BF3000
BLOCK: 8910 KEROGEN

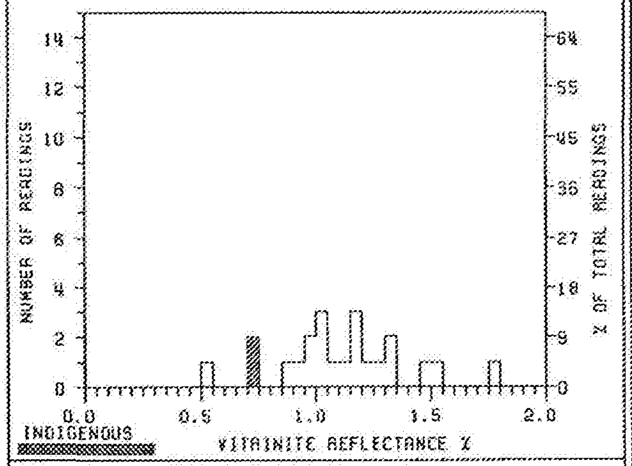
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .71 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .70 TO .71 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .99 %
STD DEVIATION : .07 %
NO. OF VALUES : 8
RANGE : .89 TO 1.08 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.23 %
STD DEVIATION : .07 %
NO. OF VALUES : 8
RANGE : 1.14 TO 1.32 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.51 %
STD DEVIATION : .03 %
NO. OF VALUES : 2
RANGE : 1.49 TO 1.53 %



.53	1.00	1.19	1.75
.70	1.02	1.29	
.71	1.04	1.28	
.89	1.08	1.30	
.90	1.14	1.32	
.97	1.16	1.49	
.99	1.19	1.53	

SAMPLE DATA
DEPTH: 14400.0-430.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : BF2994
BLOCK: 8900 KEROGEN

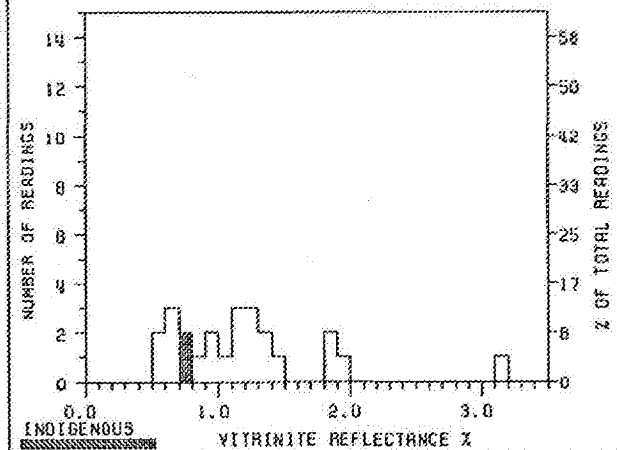
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .75 %
STD DEVIATION : .04 %
NO. OF VALUES : 2
RANGE : .72 TO .78 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .93 %
STD DEVIATION : .07 %
NO. OF VALUES : 4
RANGE : .89 TO 1.03 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.26 %
STD DEVIATION : .10 %
NO. OF VALUES : 9
RANGE : 1.13 TO 1.42 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.90 %
STD DEVIATION : .09 %
NO. OF VALUES : 3
RANGE : 1.82 TO 1.99 %



.58	.89	1.20	1.88
.59	.90	1.23	1.89
.60	.91	1.27	3.11
.62	1.03	1.33	
.64	1.13	1.39	
.72	1.17	1.42	
.78	1.18	1.82	

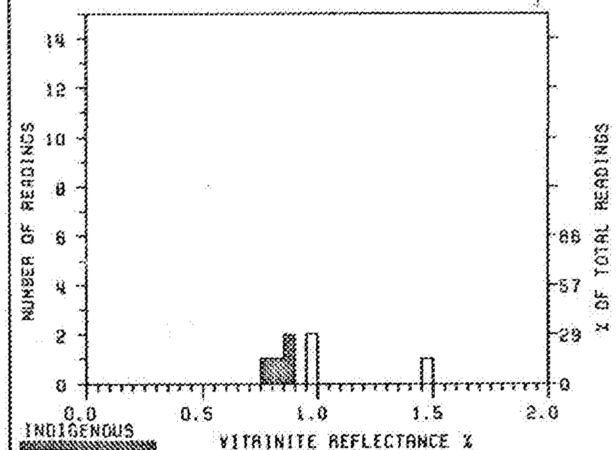
SAMPLE DATA
DEPTH: 14744.1 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0122PB
BLOCK: 3470 WHOLE ROCK

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .84 %
STD DEVIATION : .05 %
NO. OF VALUES : 4
RANGE : .77 TO .89 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .98 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .97 TO .98 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.48 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : 1.47 TO 1.49 %



.77
.84
.86
.89
.97
.98
1.48

APPENDIX 3.12

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

SAMPLE DATA

DEPTH: 14753.1 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0124PB
BLOCK: 3480 WHOLE ROCK

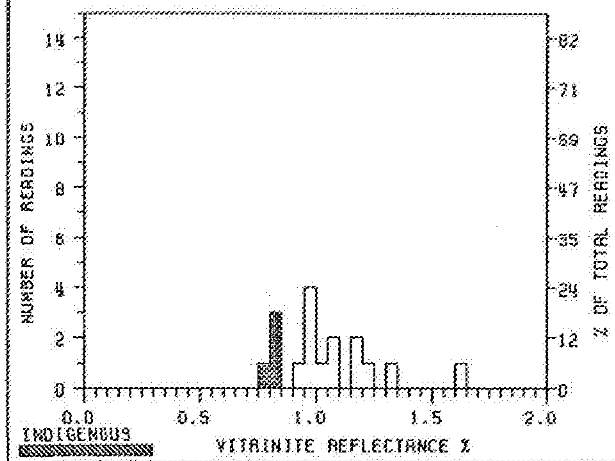
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .81 %
STD DEVIATION : .04 %
NO. OF VALUES : 4
RANGE : .75 TO .84 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .98 %
STD DEVIATION : .03 %
NO. OF VALUES : 6
RANGE : .94 TO 1.03 %

POPN 3 - BITUMEN
MEAN VALUE : 1.17 %
STD DEVIATION : .08 %
NO. OF VALUES : 6
RANGE : 1.08 TO 1.31 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.83 %
STD DEVIATION : ----
NO. OF VALUES : 1
RANGE : 1.62 TO 1.64 %



.75	.89	1.20
.81	.99	1.31
.82	1.03	1.63
.84	1.08	
.94	1.09	
.96	1.16	
.98	1.19	

SAMPLE DATA

DEPTH: 14764.0 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0125
BLOCK: 4810 KEROGEN

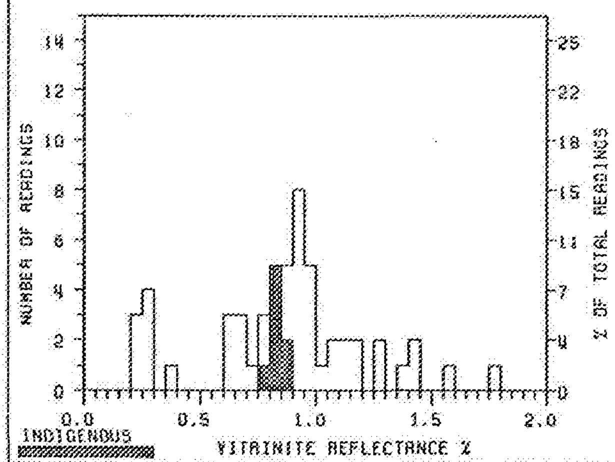
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .83 %
STD DEVIATION : .02 %
NO. OF VALUES : 8
RANGE : .78 TO .86 %

POPN 2 - LOW REFLECTING
MEAN VALUE : .65 %
STD DEVIATION : .02 %
NO. OF VALUES : 6
RANGE : .63 TO .67 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.01 %
STD DEVIATION : .09 %
NO. OF VALUES : 17
RANGE : .91 TO 1.16 %

POPN 4 - BITUMEN
MEAN VALUE : 1.28 %
STD DEVIATION : 0.00 %
NO. OF VALUES : 2
RANGE : 1.29 TO 1.28 %



.22	.35	.73	.83	.90	.94	1.08	1.28
.22	.63	.78	.84	.90	.96	1.08	1.39
.23	.64	.78	.85	.90	.96	1.13	1.43
.26	.64	.79	.86	.91	.96	1.14	1.44
.27	.66	.80	.87	.91	.97	1.15	1.56
.28	.66	.81	.89	.92	.98	1.16	1.77
.29	.67	.83	.89	.93	1.00	1.29	

SAMPLE DATA

DEPTH: 14760.0-790.0 FT
CODE :
TYPE : CTGS
PROJECT : 25616
SAMPLE : 8F3003
BLOCK: 8920 KEROGEN

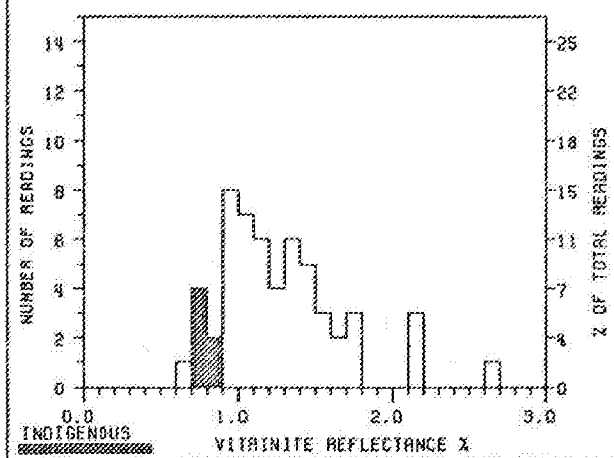
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .78 %
STD DEVIATION : .06 %
NO. OF VALUES : 6
RANGE : .73 TO .88 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .94 %
STD DEVIATION : .03 %
NO. OF VALUES : 8
RANGE : .90 TO .98 %

POPN 3 - SEMIFUS/REWORK
MEAN VALUE : 1.14 %
STD DEVIATION : .08 %
NO. OF VALUES : 18
RANGE : 1.05 TO 1.30 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.42 %
STD DEVIATION : .07 %
NO. OF VALUES : 14
RANGE : 1.30 TO 1.54 %



.65	.90	.98	1.09	1.20	1.36	1.45	1.71
.73	.90	1.05	1.10	1.23	1.38	1.51	1.77
.73	.91	1.05	1.11	1.24	1.38	1.53	2.10
.73	.93	1.08	1.12	1.26	1.41	1.54	2.12
.79	.98	1.08	1.15	1.30	1.42	1.62	2.14
.81	.96	1.08	1.17	1.34	1.43	1.63	2.60
.88	.97	1.09	1.18	1.35	1.45	1.70	

SAMPLE DATA

DEPTH: 14764.1 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0125PB
BLOCK: 3490 WHOLE ROCK

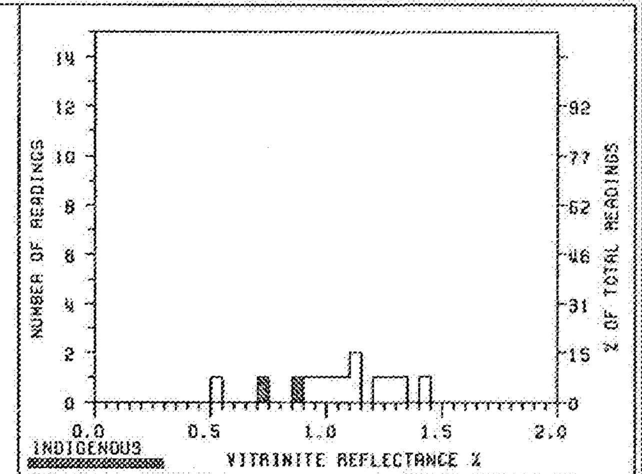
STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .81 %
STD DEVIATION : .12 %
NO. OF VALUES : 2
RANGE : .72 TO .89 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .95 %
STD DEVIATION : .01 %
NO. OF VALUES : 2
RANGE : .94 TO .95 %

POPN 3 - BITUMEN
MEAN VALUE : 1.13 %
STD DEVIATION : .09 %
NO. OF VALUES : 6
RANGE : 1.03 TO 1.27 %

POPN 4 - SEMIFUS/REWORK
MEAN VALUE : 1.36 %
STD DEVIATION : .08 %
NO. OF VALUES : 2
RANGE : 1.30 TO 1.41 %



.51	1.10
.72	1.12
.89	1.21
.94	1.27
.95	1.30
1.03	1.41
1.07	

COMPANY : PHILLIPS NORWAY
WELL : 2/7-20X ST-2
LOCATION : NORWEGIAN NORTH SEA

APPENDIX 3.13

HISTOGRAMS, DATA AND STATISTICS FOR VITRINITE REFLECTIVITY

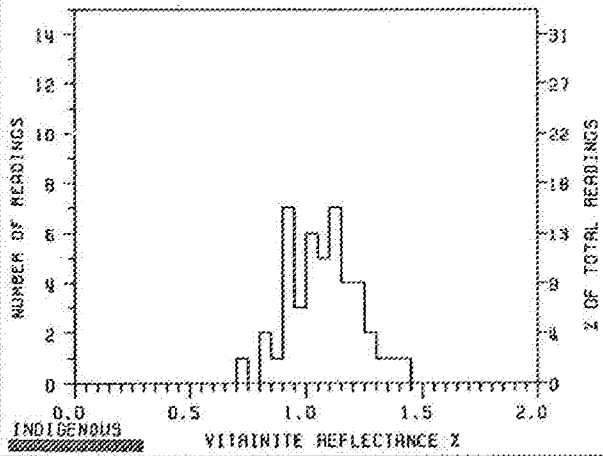
SAMPLE DATA

DEPTH: 14767.1 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0126PB
BLOCK: 3500 WHOLE ROCK

STATISTICS

POPN 1 - SEMIFUS/REWORK
MEAN VALUE : .80 %
STD DEVIATION : .07 %
NO. OF VALUES : 14
RANGE : .74 TO .88 %

POPN 2 - BITUMEN
MEAN VALUE : 1.14 %
STD DEVIATION : .10 %
NO. OF VALUES : 31
RANGE : 1.00 TO 1.41 %



.74	.91	1.00	1.08	1.10	1.18	1.30
.80	.91	1.02	1.08	1.10	1.21	1.38
.82	.92	1.03	1.09	1.13	1.21	1.41
.87	.94	1.03	1.09	1.14	1.21	
.90	.96	1.04	1.10	1.15	1.22	
.91	.97	1.04	1.10	1.16	1.25	
.91	.99	1.05	1.10	1.19	1.26	

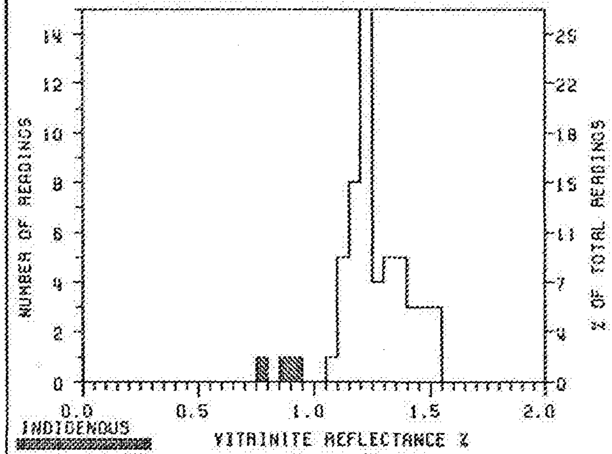
SAMPLE DATA

DEPTH: 14788.1 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0128PB
BLOCK: 3520 WHOLE ROCK

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .87 %
STD DEVIATION : .07 %
NO. OF VALUES : 3
RANGE : .79 TO .93 %

POPN 2 - BITUMEN
MEAN VALUE : 1.27 %
STD DEVIATION : .12 %
NO. OF VALUES : 52
RANGE : 1.09 TO 1.53 %



.79	1.13	1.18	1.21	1.23	1.29	1.36	1.45
.88	1.14	1.19	1.21	1.29	1.31	1.39	1.45
.93	1.16	1.19	1.21	1.24	1.32	1.39	1.48
1.09	1.17	1.20	1.21	1.24	1.32	1.39	1.51
1.11	1.18	1.20	1.22	1.25	1.33	1.40	1.52
1.11	1.18	1.21	1.22	1.25	1.33	1.42	1.53
1.13	1.18	1.21	1.22	1.28	1.35	1.43	

SAMPLE DATA

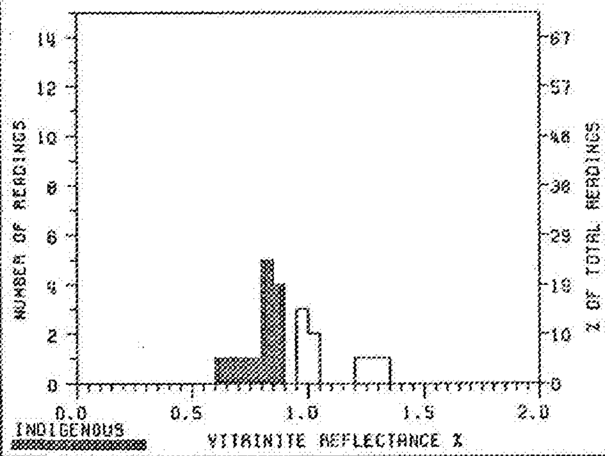
DEPTH: 14773.1 FT
CODE :
TYPE : CORE
PROJECT : 25616
SAMPLE : 8E0127PB
BLOCK: 3510 WHOLE ROCK

STATISTICS

POPN 1 - INDIGENOUS
MEAN VALUE : .80 %
STD DEVIATION : .08 %
NO. OF VALUES : 13
RANGE : .63 TO .88 %

POPN 2 - SEMIFUS/REWORK
MEAN VALUE : .99 %
STD DEVIATION : .04 %
NO. OF VALUES : 5
RANGE : .95 TO 1.03 %

POPN 3 - BITUMEN
MEAN VALUE : 1.28 %
STD DEVIATION : .05 %
NO. OF VALUES : 3
RANGE : 1.24 TO 1.34 %



.63	.83	.97
.66	.84	.97
.71	.85	1.03
.78	.87	1.03
.80	.88	1.24
.80	.88	1.26
.82	.95	1.34