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# PHILLIPS PETROLEUM COMPANY NORWAY

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12th April, 1988

Norsk Hydro A/S  
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Elf Aquitaine  
P.O. Box 168

1321 STABEKK

4001 STAVANGER

Attn.: A. Lycke

Attn.: O. Minsaas

Total Marine Norsk A/S  
P.O. Box 4317

Fina Exploration Norway  
P.O. Box 4055, Tasta

5013 NYGAARDSTANGEN

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Attn.: J. Vallet

Attn.: C.J. Campbell

Norsk Agip A/S  
P.O. Box 220

Norwegian Petroleum Directorate  
P.O. Box 600

4300 SANDNES

4001 STAVANGER

Attn.: A. Ianniello

Attn.: S. Eidnes/S. Lysholm

Statoil A/S  
Postboks 300, Forus

4001 STAVANGER

Attn.: E.B. Nilsen/A. Erevik

BA 88-0698-1
10 MAI 1988
<b>REGISTRERT</b>
OLJEDIREKTORATET

Please find enclosed the latest received Sedimentological and Geochemical description from Robertson Research from well 2/7-20.

Regards,

*W.E. van Goijtsnoven*  
W.E. van Goijtsnoven

STF INTA0429024 88/04/29 12:11 ( 5547) INTA 88/04/29 12:11

STF B2

TLX07:61216 ROBRES G

PRI DKTLX0429025 -

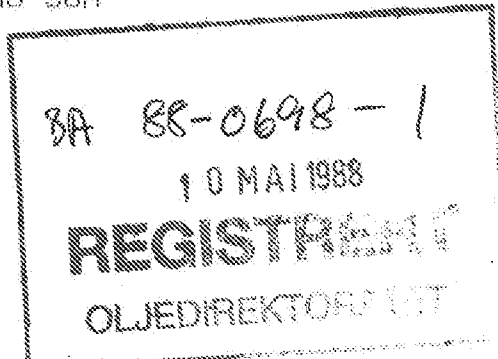
88/04/29 11:35 ( 5545) 88/04/29 11:35 .,NO SOM

4966 88-04-29 10:09

TLX REF: 2614/DG

ATTN. RUDI KLEIBER, PHILLIPS, NORWAY.  
FROM. C.WYNN, THE ROBERTSON GROUP PLC., U.K.

RE: ADDITIONAL PETROGRAPHY AND XRD WELL 2/7-20



SIX ADDITIONAL THIN SECTIONS HAVE BEEN INSPECTED. THREE OF THESE ARE OF SANDSTONES AND THREE OF MUDSTONES.

SANDSTONE : 13430', 13518' AND 13657'

MUDSTONES : 13370', 13417' AND 13655'

XRDA HAS BEEN CARRIED OUT ON THE THREE MUDSTONE SAMPLES.

THE RESULTS ARE SUMMARISED BELOW.

SANDSTONES

13430' : A VERY FINE GRAINED, MICACEOUS SUBLITHIC ARENITE WITH 42 PERCENT MONOCRYSTALLINE QUARTZ, 13 PERCENT LITHIC FRAGMENTS (12 PERCENT POLYCRYSTALLINE QUARTZ, 1 PERCENT METAMORPHIC) AND 11 PERCENT MICA (MUSCOVITE). DETRITAL CLAY COMMON (20 PERCENT). AUTHIGENIC MINERALS INCLUDE HAEMATITE (3 PERCENT), PYRITE (2 PERCENT), DOLOMITE (TR PERCENT), QUARTZ OVERGROWTHS (1 PERCENT) AND KAOLINITE (6 PERCENT). NO VISIBLE POROSITY, SOME ARTIFICIAL FRACTURE POROSITY (3 PERCENT).

13518' : A FINE GRAINED, SLIGHTLY MICACEOUS SUBLITHICARENITE WITH 42 PERCENT MONOCRYSTALLINE QUARTZ, 19 PERCENT LITHIC FRAGMENTS (15 PERCENT POLYCRYSTALLINE QUARTZ, 4 PERCENT ROCK FRAGMENTS), 3 PERCENT MUDSTONE INTRACLASTS, 2 PERCENT MICA, AND 1 PERCENT DETRITAL CLAY. QUARTZ OVERGROWTHS (6 PERCENT), HAEMATITE (1 PERCENT), PYRITE (2 PERCENT) AND KAOLINITE (11 PERCENT) ARE PRINCIPLE DIAGENETIC MINERALS. VISIBLE POROSITY IS 12 PERCENT, MAINLY COMPRISING INTERGRANULAR MICROPOROSITY AND MACROPOROSITY, SLIGHTLY ENHANCED BY (?ARTIFICIAL) GRAIN SHATTERING AND FRACTURING.

13657' : A VERY FINE GRAINED, MICACEOUS LITHICARENITE, LOCALLY GRADING TO SILTSTONE WITH 47 PERCENT MONOCRYSTALLINE QUARTZ, 10 PERCENT MICA (MUSCOVITE), 23 PERCENT LITHIC FRAGMENTS (POLYCRYSTALLINE QUARTZ = 16 PERCENT, ROCK FRAGMENTS = 7 PERCENT), 3 PERCENT MUDSTONE INTRACLASTS AND 2 PERCENT DETRITAL CLAY. MICA IS BOTH SCATTERED THROUGHOUT AND LOCALLY CONCENTRATED INTO LAMINAE.

AUTHIGENIC MINERALS INCLUDE 4 PERCENT SIDERITE (?POSSIBLY A FRACTURE - FILLING PHASE), 1 PERCENT DOLOMITE, 3 PERCENT QUARTZ OVERGROWTHS, TRACES OF PYRITE AND HAEMATITE AND 7 PERCENT KAOLINITE. VISIBLE  
END OF PAGE 001

POROSITY IS 3 PERCENT, MAINLY CONSISTING OF INTERGRANULAR MICROPOROSITY AND GRAIN SHATTER POROSITY.

## MUDSTONES

13370' : A SILTY MUDSTONE WITH SCATTERED SAND GRADE CLASTS OF UPTO COARSE GRAIN SIZE. SILT GRADE CLASTS COMPRISE 10 PERCENT, SAND GRADE CLASTS 10 PERCENT. THESE CLASTS ARE MAINLY MONO- AND POLYCRYSTALLINE QUARTZ. MICA (MAINLY CHLORITE) IS ALSO PRESENT (VISIBLE = 10 PERCENT). CLAY MATRIX COMPRISES 64 PERCENT. DIAGENETIC MINERALS INCLUDE HAEMATITE (2 PERCENT), PYRITE (4 PERCENT) AND DOLOMITE (TR PERCENT).

XRD INDICATES THAT THE SAMPLE COMPRISES: QUARTZ 16 PERCENT, ILLITE/SMECTITE 5 PERCENT, CHLORITE 54 PERCENT AND KAOLINITE 25 PERCENT.

THE ILLITE/SMECTITE AND KAOLINITE ARE POORLY CRYSTALLISED AND PROBABLY DETRITAL IN ORIGIN. THE LARGE AMOUNT OF CHLORITE, WITH A MODERATELY WELL CRYSTALLISED FORM PROBABLY REFLECTS A MIXTURE OF CHLORITIC MICA AND DETRITAL CHLORITE.

13417' : SILTY MUDSTONE WITH SCATTERED SAND GRADE CLASTS OF UPTO MEDIUM GRAIN SIZE. SILT GRADE CLASTS COMPRISE 15 PERCENT, SAND GRADE CLASTS 10 PERCENT. THESE ARE MAINLY MONO- AND POLYCRYSTALLINE QUARTZ. MICA (MAINLY CHLORITE) IS ALSO PRESENT (9 PERCENT). CLAY MATRIX COMPRISES 50 PERCENT. DIAGENETIC MINERALS INCLUDE HAEMATITE (4 PERCENT), PYRITE (2 PERCENT), DOLOMITE (1 PERCENT) AND KAOLINITE (10 PERCENT)

XRD INDICATES:  
ILLITE/SMECTITE TR PERCENT, ILLITE 7 PERCENT, CHLORITE 36 PERCENT, KAOLINITE 37 PERCENT, QUARTZ 20 PERCENT.

THE ILLITE IS POORLY CRYSTALLISED AND PRESUMED TO BE DETRITAL. BOTH THE CHLORITE AND KAOLINITE ARE INDICATED TO BE MODERATELY WELL CRYSTALLISED AND THIS PROBABLY REFLECTS THE ADMIXING OF DETRITAL AND AUTHIGENIC PHASES. QUARTZ MAY BE SLIGHTLY MASKED BY THE CLAYS.

13655' : SILTY MUDSTONE WITH SCATTERED SAND GRADE CLASTS OF UPTO COARSE GRAIN SIZE. SILT GRADE CLASTS COMPRISE 10 PERCENT, SAND GRADE CLASTS 7 PERCENT. THESE ARE MAINLY MONO- AND POLYCRYSTALLINE QUARTZ. MUSCOVITE (10 PERCENT) AND CHLORITE MICAS (5 PERCENT) ARE PRESENT. CLAY MATRIX COMPRISES 60 PERCENT. DIAGENETIC MINERALS INCLUDE SIDERITE (1 PERCENT), PYRITE AND HAEMATITE (TR PERCENT) AND KAOLINITE (7 PERCENT).

XRD INDICATES:  
ILLITE/SMECTITE 2 PERCENT, ILLITE 38 PERCENT, CHLORITE 2 PERCENT, KAOLINITE 20 PERCENT, QUARTZ 10 PERCENT, SIDERITE 1 PERCENT.

THE ILLITE/SMECTITE IS POORLY CRYSTALLISED DETRITAL CLAY. ALL THE OTHER CLAYS (CHLORITE, ILLITE, KAOLINITE) ARE MODERATELY WELL CRYSTALLISED AND PROBABLY REPRESENT ADMIXTURES OF DETRITAL MICA, DETRITAL CLAY AND AUTHIGENIC CLAY. QUARTZ MAY BE SLIGHTLY MASKED BY CLAYS.

THE SEMI-QUANTITATIVE XRD ON THE BULK MUDSTONE SAMPLES IS SUMMARISED BELOW.

SEMI-QUANTITATIVE XRD

PHILLIPS 2/7-20 BULK

DEPTH	ILLITE/ SMECTITE	ILLITE	ILLITE/ CHLORITE	CHLORITE	KAOLINITE	QUARTZ
13370'	5			54	25	16
13417'	TR	7		36	37	20
13655'	2	38	5	24	20	10

DEPTH	DOLOMITE	SIDERITE	BARITE
13370'	TR	TR	TR
13417'		TR	TR
13655'		1	

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FRI DKTLX0425066 -

88/04/25 16:58 ( 1556) 88/04/26 07:14 ..NO SOM

4919 88-04-25 15:49

TLX REF:2517/MT

ATTN: R KLEIBER, PHILLIPS PETROLEUM COMPANY, NORWAY  
FROM: P C BARNARD/J MILNER, THE ROBERTSON GROUP PLC., U.K.

RE: 2/7-20X (ST.2) 'HOTS'

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WITH REFERENCE TO THE DATA SENT TO YOU VIA 'DATAPOST' ON FRIDAY 22ND  
APRIL, 1988:-

SAMPLES EXAMINED OVER THE DEPTH INTERVAL 13349' (SWC) TO 13985' (SWC)  
FOR EXTRACTION, FRACTIONATION AND ALKANE GAS CHROMATOGRAPHY, WERE  
DOMINANTLY OIL-STAINED, SAND-RICH LITHOLOGIES, AND REVEALED HIGH  
TOTAL EXTRACT VALUES RANGING FROM 28605 PPM TO 55490 PPM.  
HYDROCARBONS COMPRISED 68 PERCENT TO 84 PERCENT OF THE EXTRACT,  
GENERALLY GREATER THAN 80 PERCENT OF THESE HYDROCARBONS CONSISTED OF  
ALKANES (EXCEPT ONLY 44 PERCENT AT 13705').

ALKANE GAS CHROMATOGRAPHY OF THE 8 SWC SAMPLES REVEALED THE PRESENCE  
OF A MEDIUM TO HIGH GRAVITY, WAXY OIL CONTAINING A BIODEGRADED  
COMPONENT, CONTAMINATION, PROBABLY DERIVED FROM OIL-BASED MUD, IS  
ADDITIONALLY PRESENT IN ALL OF THE SAMPLES EXCEPT THOSE AT 13753' AND  
13985'. UREA CLATHRATION WAS UNDERTAKEN ON ONE REPRESENTATIVE SAMPLE  
(13480') IN ORDER TO REMOVE THE NORMAL ALKANES PRIOR TO GC-MS  
ANALYSIS.

GC-MS ANALYSIS DATA (BRANCHED CYCLICS AT 13480') INDICATED DERIVATION  
FROM A MIDDLE MATURE, MARINE-DERIVED, KIMMERIDGE CLAY FORMATION  
SOURCE, AND THE PRESENCE OF A BIODEGRADED COMPONENT.

WE ARE PRESENTLY EVALUATING THE COMPOSITIONS OF THE BIOMARKERS IN THE  
2 SAMPLES AT 13753' AND 13985'. RESULTS WILL FOLLOW SOON.

REGARDS

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TL000:61216 RUBENS 6

REF: DPTL20428081 -

88/04/28 16:23 : 2591 88-04-28 07:03 : AND 80M

13:23 88-04-28 17:19

TOP REP:2505/TT

ATTN: R. KLEIBER, PHILLIPS PETROLEUM COMPANY, SORONG  
FROM: P. C. BARNARD, NIGER, OIL ROBERTSON GROUP PLC., U.K.

REF: 377-204 (81.2) GC-MS ANALYSIS AT 13789 (88) FOR 10785 (SMD)

GC-MS ANALYSIS OF THE BRANCHED CYCLIC COMPONENTS (FOLLOWING UBER  
CLATRATION) OF THE 2 SIDEWALL CORE SAMPLES #1 13789 AND 10785,  
REVEALED THE PRESENCE OF AN OIL WHICH WAS ENRICHED WITH A MIXED  
NATURE KINETICALLY CLAY FORMATION CONTAINING MAINLY MARINE ALKAL  
HYDROCARBONS. IN ADDITION, THE OIL CONTAINS A SMALL, SEVERELY  
SUBSTITUTED COMPONENT - SUGGESTED BY THE PRESENCE OF METHYLATED NUPONES.

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PHILLIPS 2/7-20X 880164 (.50R)  
SAMPLE C842  
Plotting factors 5989.179 -101.310  
150.0

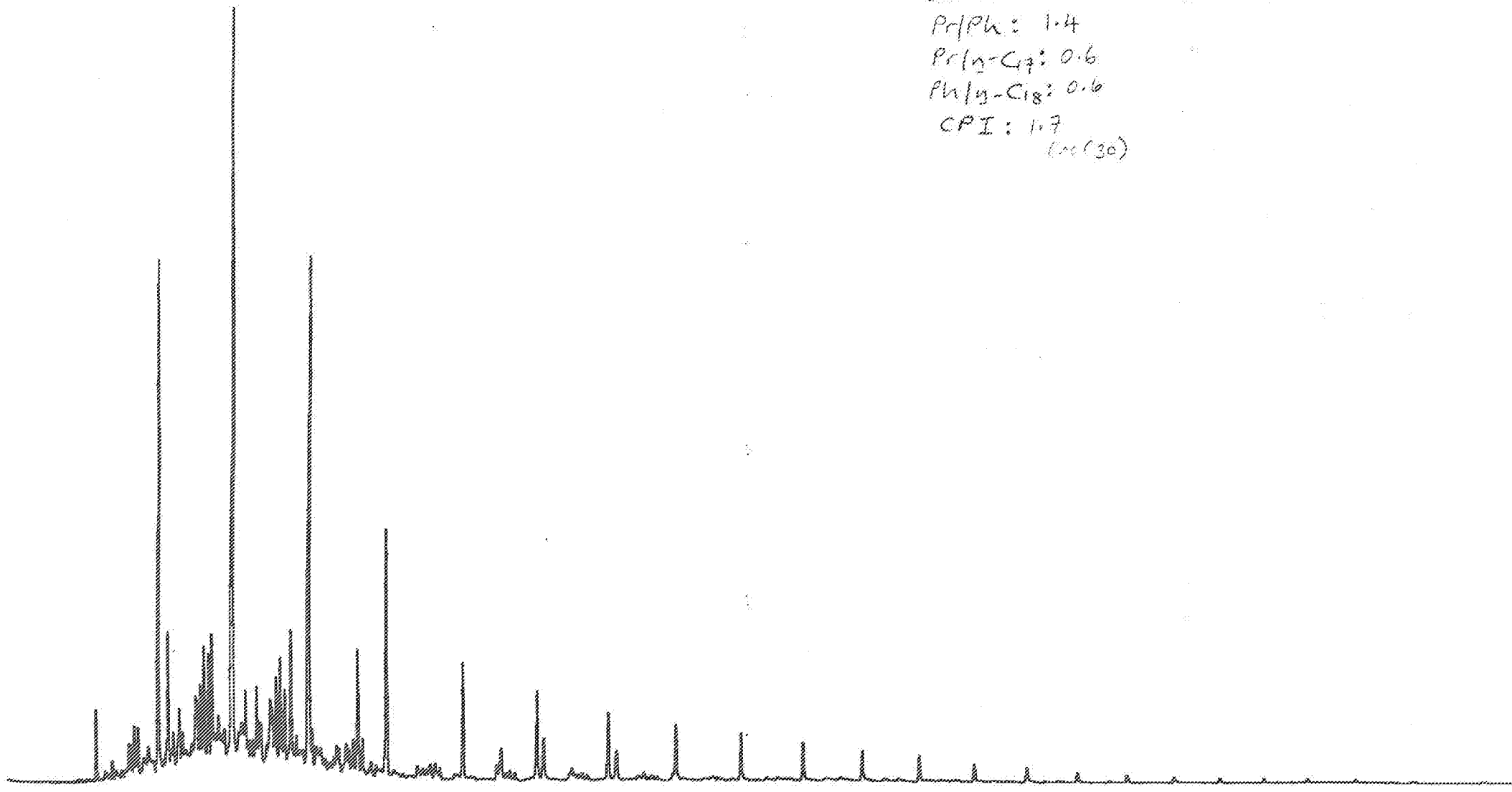
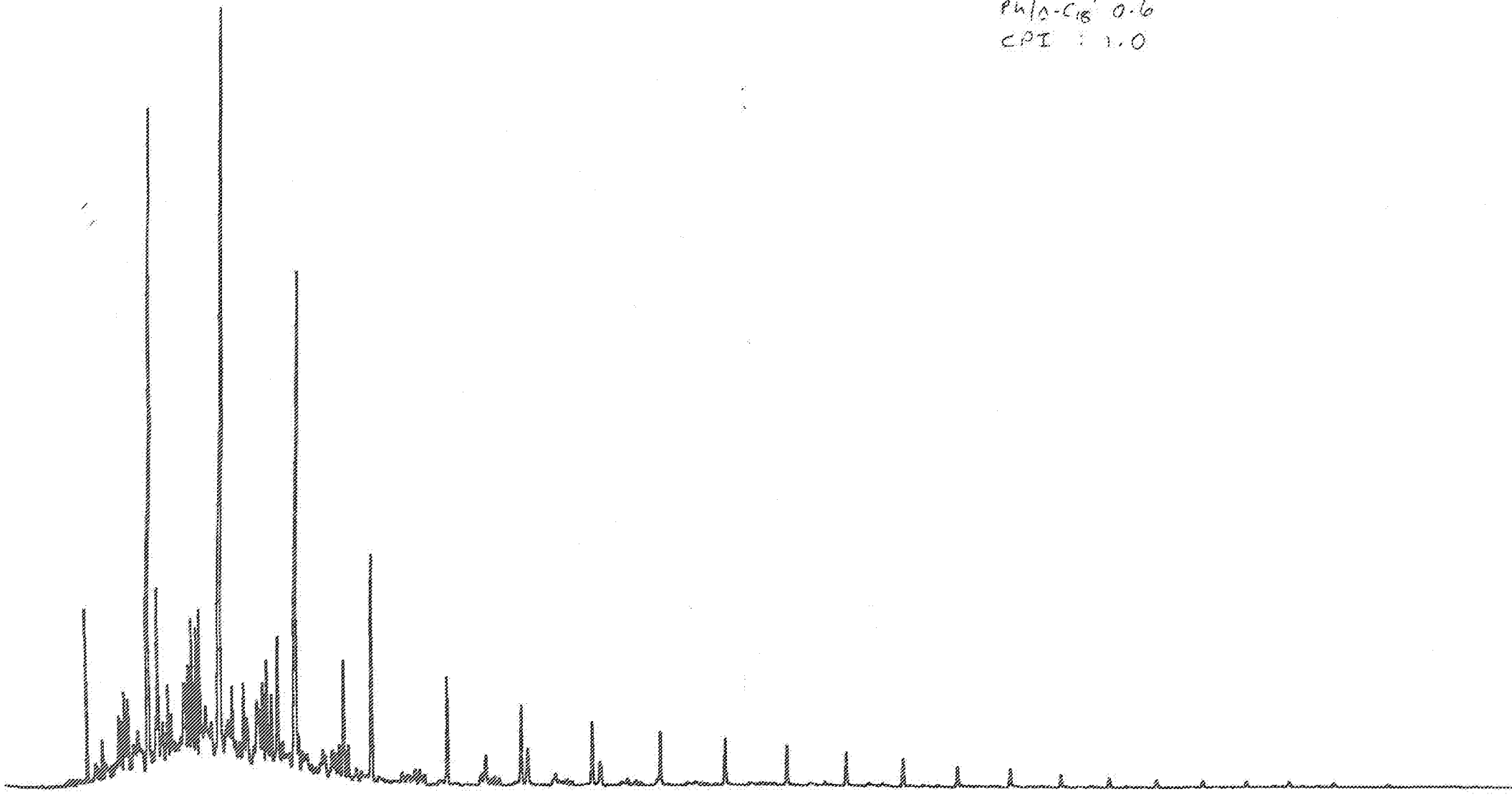


FIG 1  
WELL: 2/7-20X (ST2)  
DEPTH: 13349' (SWC)  
Pr/Ph: 1.4  
Pr/n-C7: 0.6  
Ph/n-C18: 0.6  
CPI: 1.7  
(30)

PHILLIPS 2/7-20X (ST.2)  
SAMPLE D877 PHILLIPS 2/7-20X 880165  
Plotting factors 2655.684  
158.8

FIG 2  
LOELL 2/7-20X (ST.2)  
DEPTH 13395' (SWC)  
Pr/PH : 1.3  
Pr/PC17 : 0.6  
PH/O-C18 : 0.6  
CPI : 1.0





PHILLIPS 2/7-20 98D166 ( .56R)  
SAMPLE C841  
Plotting factors 5376.926 -182.255  
158.0

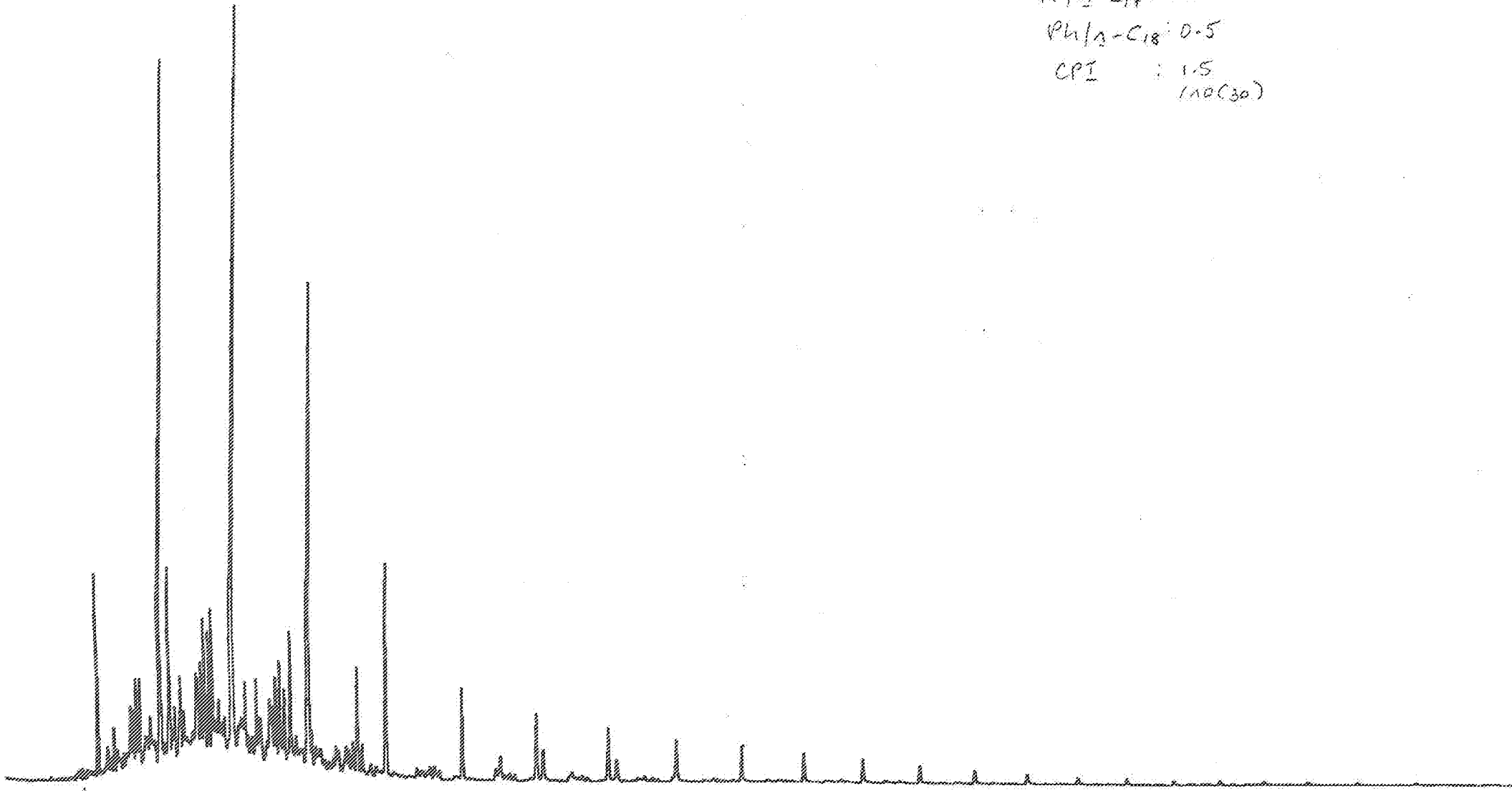


FIG 3  
WELL: 2/7-20X (ST 2)  
DEPTH: 13480' (SWC)  
Pr/Ph: 1.4  
Pr/2-C17: 0.6  
Ph/3-C18: 0.5  
CPI : 1.5  
(100(30))

FIG 4

WELL : 2/7-70X (ST. 2)  
DEPTH : 13545' (SWC)  
Pr/Pw : 1.4  
Ph/A-C17 : 0.6  
Ph/A-C18 : 0.6  
CPI : 1.1

PHILLIPS 2/7-20X 89D167 ( .50R)  
SAMPLE 0878 2253.990 -94.591  
Plotting factors  
150.0

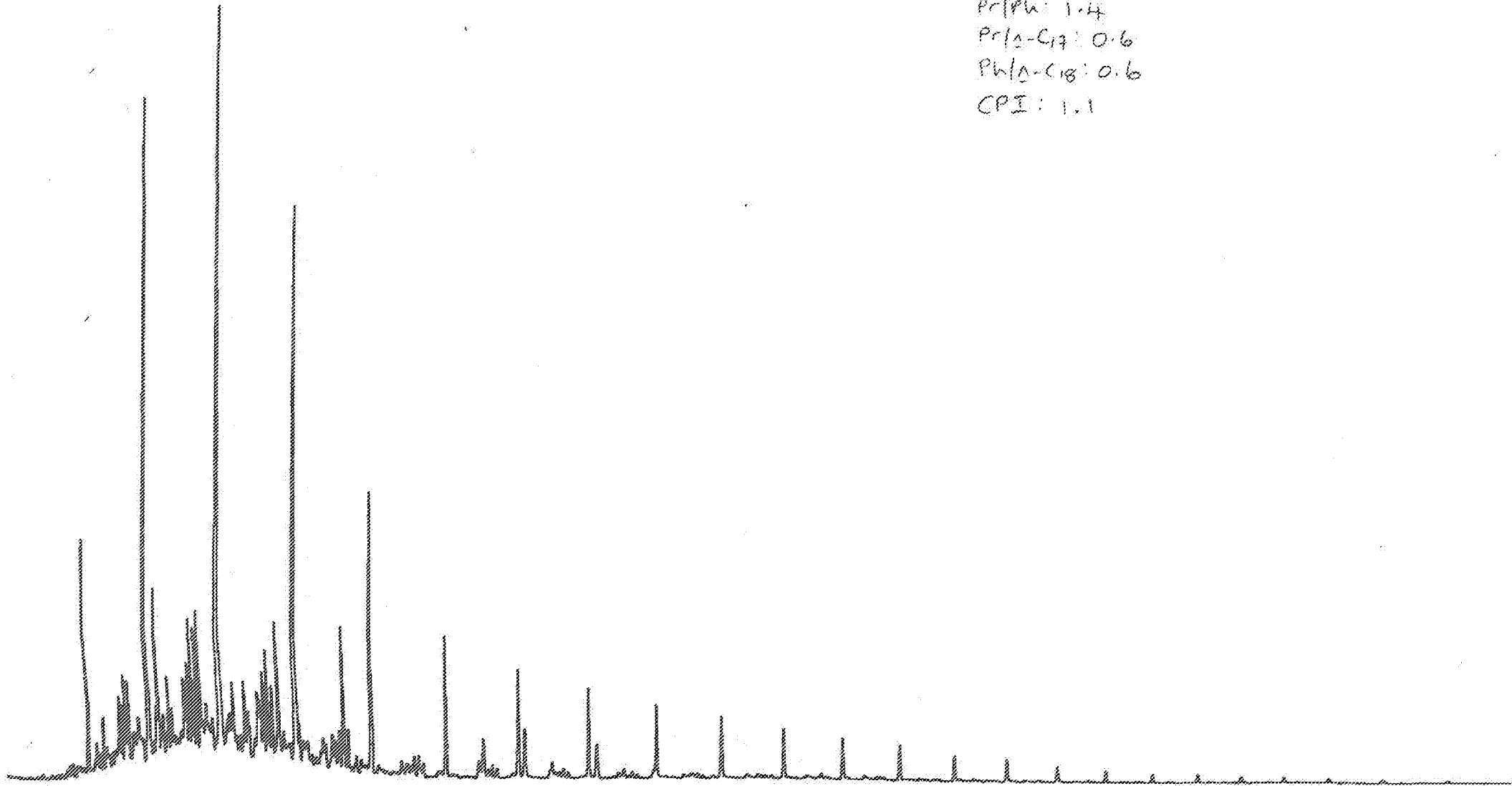


FIG 5

WELL: 2/7-20X (ST. 2)  
DEPTH: 13634' (SWC)  
P-Ph: 1.3  
Pr/A-C17: 0.6  
Ph/A-C18: 0.6  
CPI: 1.1

101140 2000 PHILIPS 2/7-20X 88D168 ( .588 )  
SAMPLE C840 PHILIPS 2/7-20X 88D168  
Plotting factors 9885.556 -98.145  
150.0

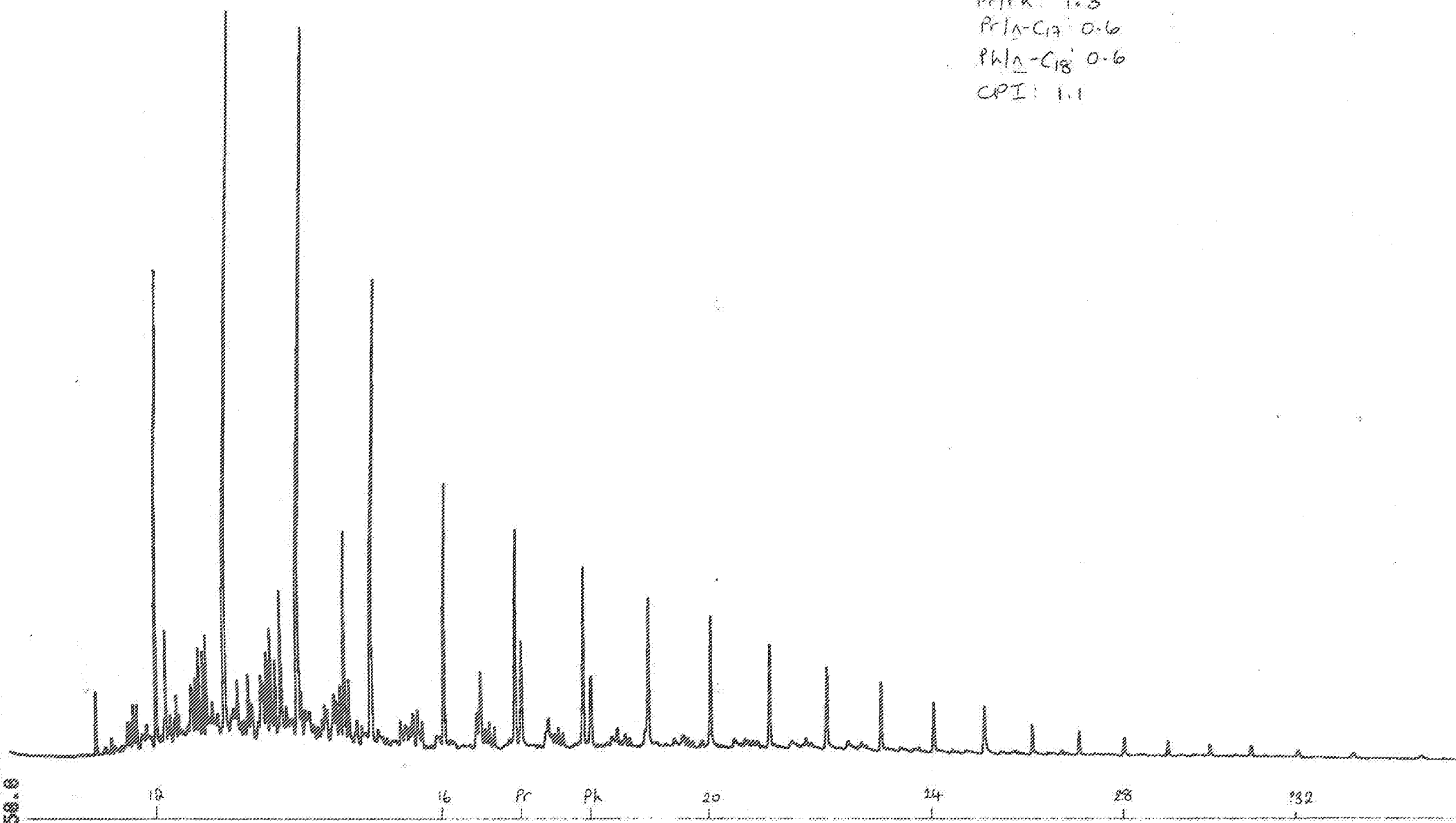
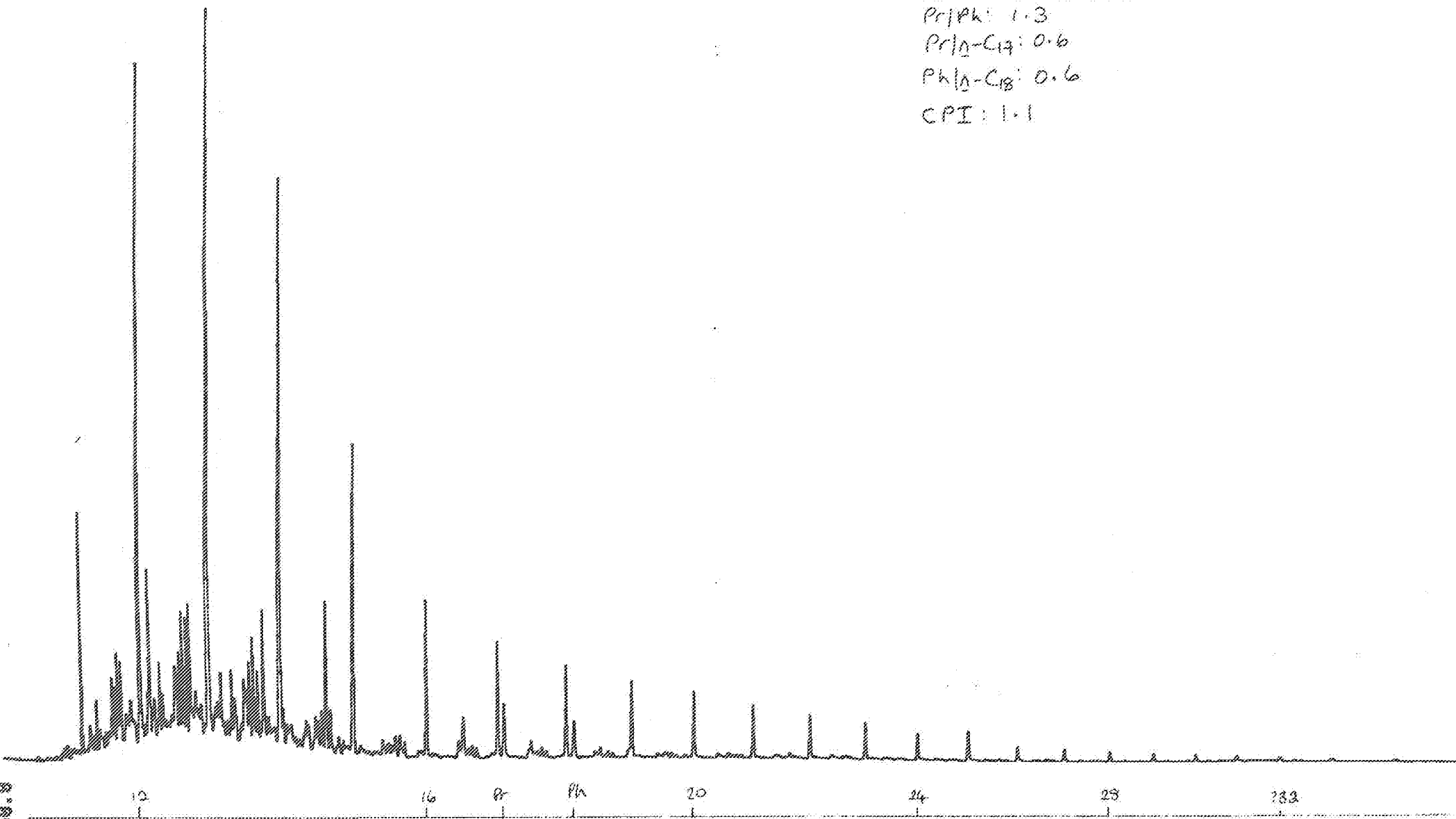


FIG 6

WELL: 2/7-20X (ST 2)  
DEPTH: 13705' (SWC)  
Pr/Ak: 1.3  
Ph/A-C19: 0.6  
Ph/A-C18: 0.6  
CPI: 1.1

11130 4000 00447510 7100  
SAMPLE D079 PHILLIPS 2/7-20X 880169  
Plotting factors 2460.018 -93.333  
150.0



SAMPLE D881 PHILLIPS 2/7-20X 880178 (.58R)  
Plotting factors 4271.878 -84.681  
150.0

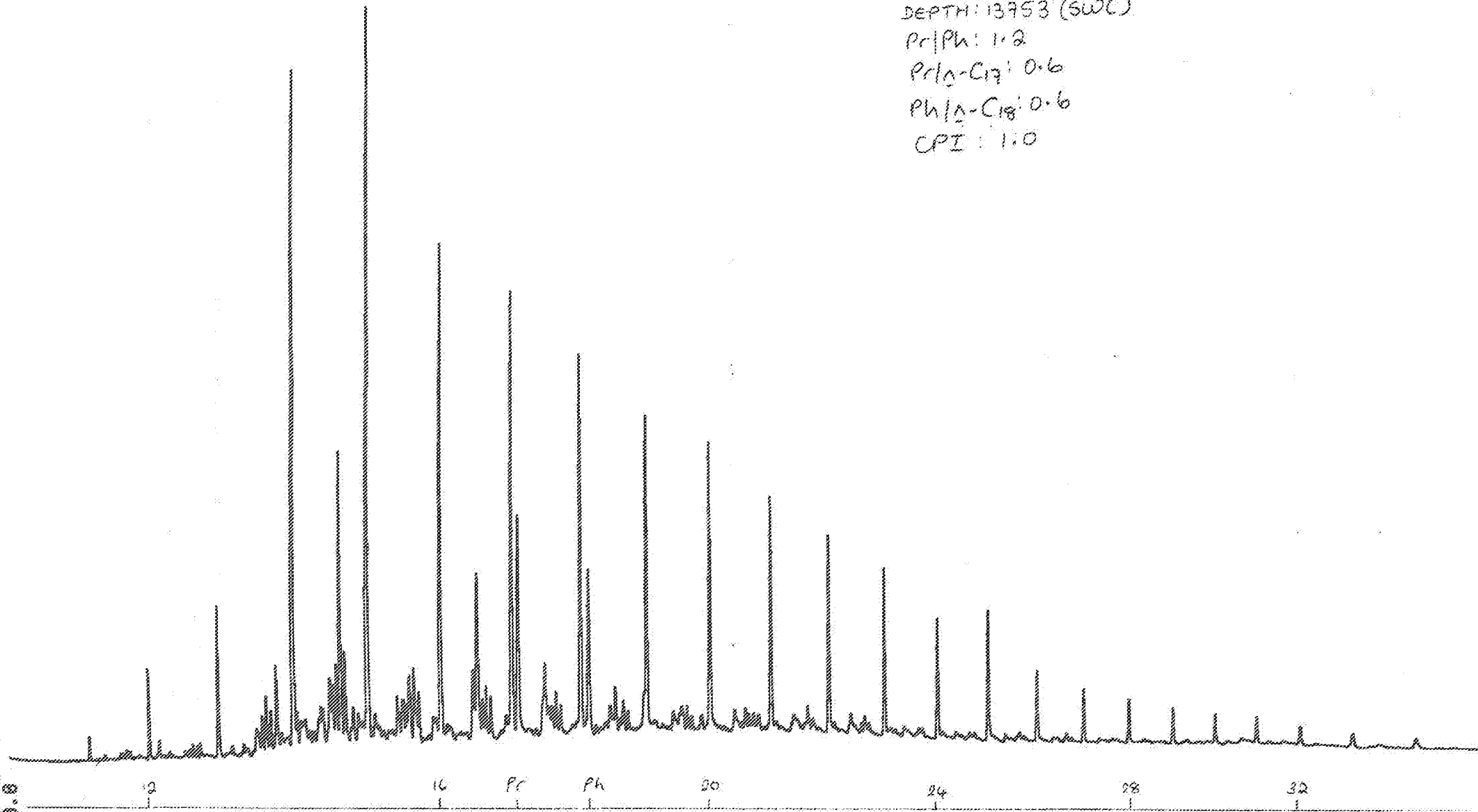


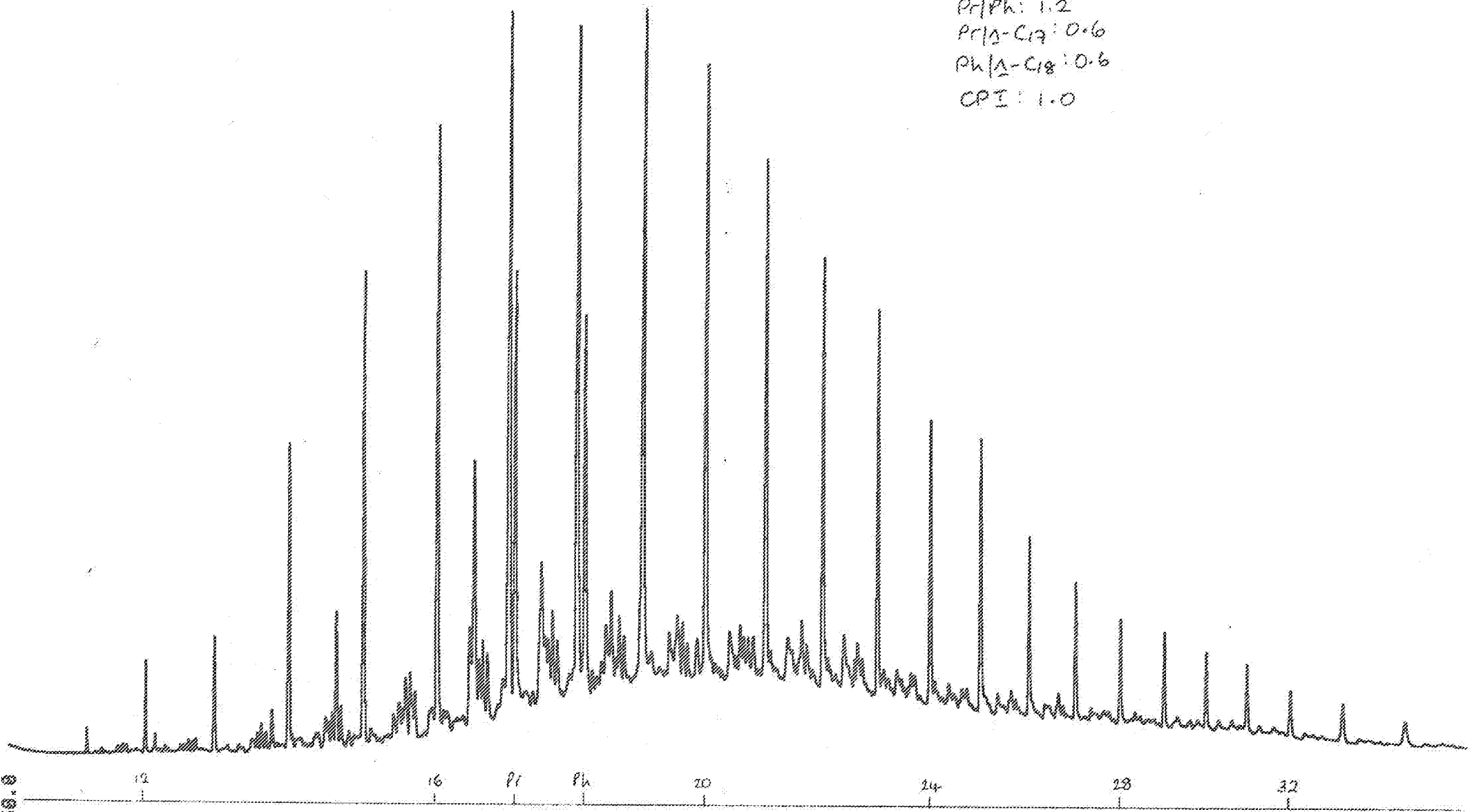
FIG 7

WELL: 2/7-20X (ST 2)  
DEPTH: 13953' (SWC)  
Pr/Ph: 1.2  
Pr/ $\Delta$ -C<sub>17</sub>: 0.6  
Ph/ $\Delta$ -C<sub>18</sub>: 0.6  
CPI: 1.0

SAMPLE D682 PHILLIPS 2/7-20X 88D171 ( .50R)  
Plotting factors 4403.825 -92.577  
150.0

FIG. 8

WELL: 2/7-20X (ST. 2)  
DEPTH: 13985' (SWC)  
Pr/Ph: 1.2  
Pr/A-C17: 0.6  
Ph/A-C18: 0.6  
CPI: 1.0



GENERAL DATA			CHEMICAL ANALYSIS DATA													
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION							
				Tmax °C	HI	DI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %OC	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+ 10X 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+ 10X LST, yel-gy+ tr BIT	1.40													
8050-110	Ctgs	MDST, ol-gy+ 20X LST, yel-gy+ tr BIT	1.51													
	P	MDST, ol-gy	1.14													
	P	LST, yel-gy	1.17													
10075.00	Core	LST, med-lt gy, arg	-						140	120			83	76		
10081.00	Core	LST, v lt gy+ tr PYR	-						2980	2590			87	74		
10090.00	Core	LST, yel-gy	-						2685	2415			90	74		
10096.00	Core	LST, yel-gy, xln	-						9040	8065			89	73		
10099.00	Core	LST, yel-gy, micr+ tr xln	-						9490	8655			91	73		
3102.00	Core	LST, yel-gy, micr	-						6610	5970			90	74		
10104.00	Core	LST, yel-gy, micr	-						10725	9405			88	72		
13349.00	Swc	CLYST, gy-blk, mtl	-						40985	30740			75	83		
13395.00	Swc	SST, med-dk gy, slty+ tr SND, arg	-						28605	21025			74	83		
13480.00	Swc	SND, gy-brn, slty	-						36255	24475			68	83		
13545.00	Swc	SND, dsk brn, fr+ tr SLTST	-						39090	29550			76	83		
13634.00	Swc	SND, brn-gy, fr+ tr SLTST	-						55490	32765			70	85		
13705.00	Swc	SND, gy-blk, fr+ tr SLTST, arg	-						55335	32765			84	44		
13753.00	Swc	SND, dsk brn, fr+ tr SLTST, arg	-						43140	29120			68	85		

SUMMARY OF CHEMICAL ANALYSIS DATA

TABLE : 2E

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (Feet)	SAMPLE TYPE	ANALYSED LITHOLOGY	TOC % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION/FRACTIONATION					
				TimeX °C	HI	OI	PI	POT.YLD. (ppm)	EXTR. (ppm)	HC (ppm)	EXTR. % OC	HC %OC	ALK. %HC	
13985.00	Swc	SND, dsk brn, arg+ tr SLTST	-						41735	29090			70	83
13985.00	Swc	SND, dsk brn, arg+ tr SLTST	-											

SUMMARY OF CHEMICAL ANALYSIS DATA



SAMPLE DEPTH & TYPE (in feet)	Age (from provisional breakdowns)	GC Ratios				GC-MS Ratios (*see Appendix 3)											
		Pr/Ph	Pr/n-C17	Ph/n-C18	CPI	1	2	3	4	5	6	7	8	9	10		
13349 SWC		1.4	0.6	0.6	1.7												
13395 SWC		1.3	0.6	0.6	1.0												
13480 SWC		1.4	0.6	0.5	1.5	1.34	0.14	1.27	50.9	57.75	12.17	30.08	0.57	0.35	0.28		
13545 SWC		1.4	0.6	0.6	1.1												
13634 SWC		1.3	0.6	0.6	1.1												
13705 SWC		1.3	0.6	0.6	1.1												
13753 SWC		1.2	0.6	0.6	1.0												
13985 SWC		1.2	0.6	0.6	1.0												

Note: Ratios 1-8 outlined in Appendix 3

Ratio 9 = %  $\alpha/\beta/\gamma$  C<sub>29</sub> steranes / total C<sub>29</sub> steranes

Ratio 10 = C<sub>28</sub> bisnorhopane / C<sub>30</sub> triterpane

Ratio 11 = C<sub>29</sub> demethylated hopane / C<sub>30</sub> triterpane

MIDMASS CHROMATOGRAMS

DATA: 89D1658C #1

SCANS 700 TO 1900

04/28/88 15:48:00

CALI: C200488 #2

SAMPLE: PHILLIPS NORWAY 2/7-20X 13480' NORWEGIAN NORTH SEA

BRANCHED CYCL

COND: 1

RANGE: G 1.2000 LABEL: N 0. 4.0 QUAN: A 0. 1.0 J 0 BASE: U 20. 3

DEPTH: 13480'

