ANALYSIS OF BITUMEN

FROM THREE WATER BORES IN THE EROMANGA BASIN

P.J. Stanmore
January, 1983

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Three water bores have been sampled and analysed for evidence of near surface bitumen occurrences. A total of nine (9) samples were collected from cuttings stored at the South Australian Mines Department Core Store, Glenside. The bores and the intervals sampled were:

Cannuwaukaninna Bore 80', 100', 109', 118'

Patchawarra Bore 470'-590', 590'-600', 630'-640', 670'-690',

Oodnadatta Bore 250'-263'

These three bores are among twenty that were logged by J.M. Harrison of Delhi Petroleum in 1960, and were described as containing evidence of residual oil and bitumen in sandstone samples of the above intervals. The sandstones are within the Winton Formation (Cannuwaukaninna, Patchawarra) and Rolling Downs Group (Oodnadatta).

The samples were sent to Amdel for geochemical analysis and these results appear in Table I and Appendix I. The analysis performed on each sample consisted of a measure of total organic carbon (TOC) and extractable organic matter (EOM). The EOM was subdivided into saturates, aromatics, resins (ONS) and asphaltenes by liquid chromatography, and gas chromatograms were recorded on the saturate fraction (C15+). The sulphur content in most samples was also determined.

Conclusions

The presence of bitumen in near surface sandstones has been confirmed by analysis. It is concluded that the precurser (oil) migrated into these sediments and was subsequently degraded to a bitumen residue which occurred as a black powder substance coating grains of sand. The presence of bitumen in such widely spaced locations within the Eromanga Basin would suggest widespread generation and migration, although the mode of emplacement of these hydrocarbons is conjectural.

In the Cannuwaukaninna bore (109') a maximum TOC of 3.74% (by weight) was measured indicating the organic nature of pore fillings in an otherwise clean, friable quartzose sandstone. The EOM yield indicated that 91.3% of the total extract consisted of aspheltenes with small proportions of saturates and aromatics (2.8% total). This suggests the loss of the more volatile,lighter fractions.

High aspheltenes and low saturates - aromatics content is common to all analyses confirming the bituminous nature of the samples. Physical, chemical and biological degradation is inferred to have occurred after trapping of liquid hydrocarbons near the surface.

Hydrocarbons heavier than methane are generated mainly in the temperature interval 60-150°C thus implying migration from a deeper source bed.

Chromatograms of the saturate fraction show a predominance in the C17 to C19 range with a steady decrease to about C25. This is confirmed on the plots of carbon number and weight percent n alkanes. Similar profiles were recorded in the 9.1 m and 10.7 m samples taken at Coward Mound Spring (Bowering, 1982), located at the edge of the Eromanga Basin. The chromatograms recorded at these shallow depths were considered to reflect the presence of a marine (algal and bacterial) source or a mature oil (C14 to C20 range). However in the water bores sampled the carbon preference index (CPI) for the C23 - C33 range is suggestive of immaturity (range of 1.26-2.59). Immaturity is also reflected in the low hydrocarbon yield (range 1.6-41.1 mg/g TOC) although the lack of saturates and aromatics which comprise the yield may be attributed to their removal by near-surface processes of degradation. Alternatively the CPI may indicate a terrestrial, land plant derived component in the source matter.

Reports of shallow oil shows are not uncommon in the Eromanga Basin. In the Santos Oodnadatta No. 1 petroleum exploration well (Santos Ltd., 1957) "core from 190' yielded an extract of pale brown oil wax, with a greenish brown fluorescence and a pour point of approximately 80 Degrees C" (in Moore, 1982, pp. 241). An analysis carried out on core material from this well (Moore, 1982) from a depth of 379' (121m) is similar to that obtained from the Oodnadatta water bore reported here in (see Table I). The presence of oil in this well was inferred to be the result of limited shallow generation from source rocks generally considered to be immature.

The origin of the bitumen samples is considered to be a degraded reservoired oil. However bitumens can be characterised into pyrobitumens, petroleum asphaltenes and reservoir bitumens. These can be differentiated on the basis of their elemental composition. (Hunt, 1979, pp. 401). Reservoir bitumens from the Western Canada Basin are, for instance, typified by a relatively low H/C and high (N + S/O) ratios. Elemental analysis could be used to confirm the nature of the bitumens in the Cannuwaukaninna, Patchawarra and Oodnadatta bores.

References

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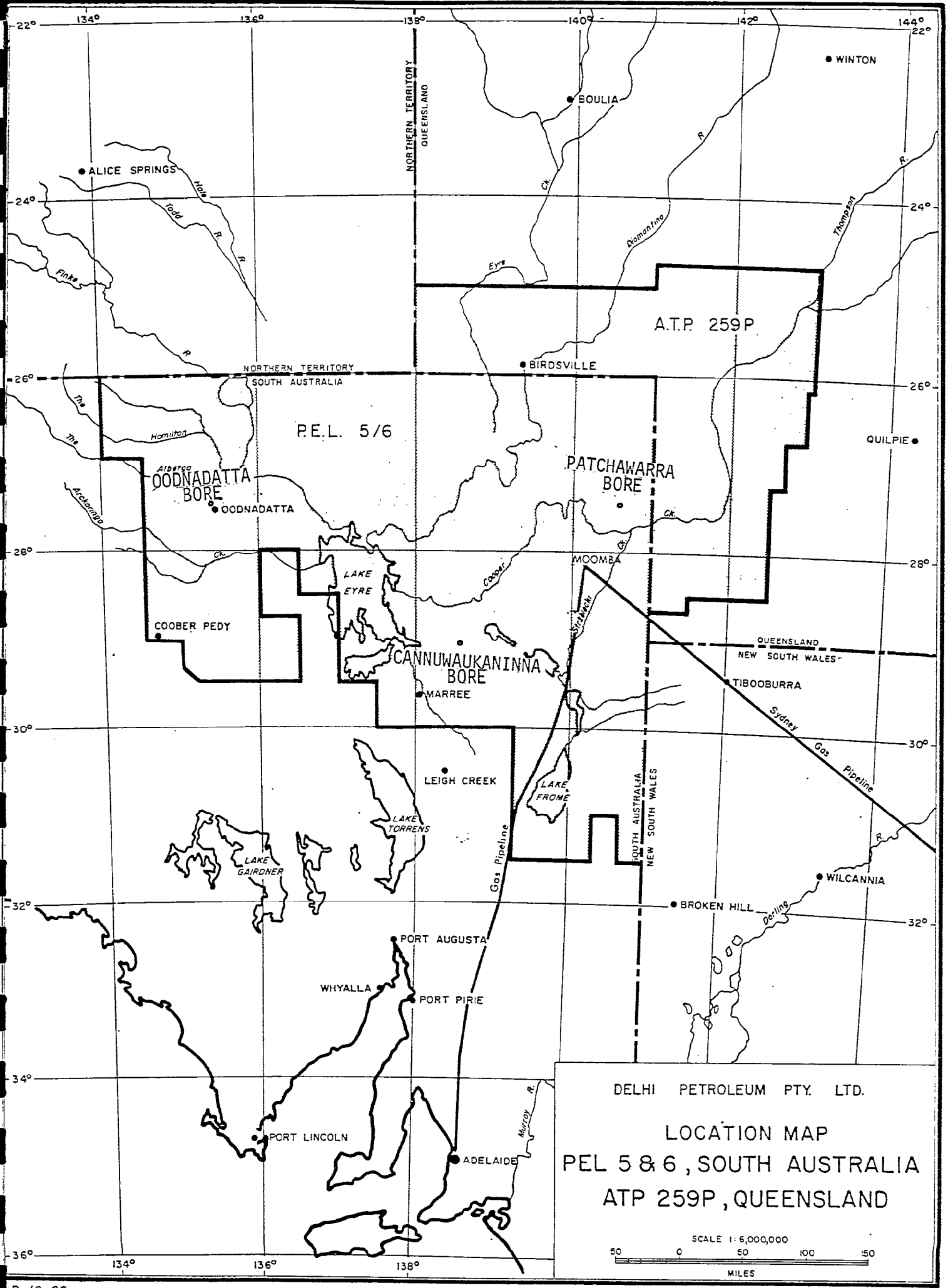

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FIGURE 1

TABLE 1. SUMMARY OF SOURCE ROCK ANALYSIS

BORE	CANNUWAUKANINNA				PATCHAWARRA				OONADATTA	SANTOS OONADATTA No.1+
Location	$28^{o}47'S$		$138^{o}38'E$		$27^{o}21'S$		$140^{o}40'E$		$27^{o}34'S$ $135^{o}27'E$	
Depth	80′	100′	109′	118′	570-590′	590-600′	630-640′	670-690′	250-263′	397′
TOC (wt%)	0.4	2.08	3.74	0.22	1.04	0.68	1.16	0.24	2.82	1.50
EOM Yield (ppm)	645	12013	2203	497	3355	1785	10506	1096	692	938
Total H'Cs* (ppm)	54	36	62	90	27	41	84	24	46	
H'C Yield* (mg/gTOC)	13.4	1.7	1.6	41.1	2.6	6.0	7.2	10.0	1.6	
Saturates (%)	5.7	0.2	2.1	17.3	0.3	2.0	0.7	1.5	5.9	3.4
Aromatics (%)	2.6	0.1	0.7	0.9	0.5	0.3	0.1	0.7	0.8	2.0
ONS (%)	10.6	1.6	5.5	41.8	4.5	12.7	2.5	5.3	18.0	22.6
Aspheltenes (%)	61.2	38.6	91.5	37.3	81.5	77.9	76.7	79.6	55.9	72.0
Loss on Column (%)	19.8	9.5	0.3	2.7	13.1	7.0	20.0	12.9	19.5	
$Pr/_{n\text{-}C_{17}}$	0.71	0.5	0.76	0.8	0.6	0.48	0.53	0.41	0.48	0.5
$Ph/_{n\text{-}C_{18}}$	0.42	0.36	0.5	0.45	0.41	0.42	0.38	0.33	0.38	0.52
Pr/Ph	1.81	0.94	1.83	1.92	1.33	1.02	1.38	0.83	1.45	1.56
Sulphur (mg)	3.0	19.5	-	-	4.8	-	15.3	25.8	0.3	
CPI (C_{23}-C_{33})	1.75	1.66	2.59	1.94	2.12	2.54	2.22	1.26	2.38	2.3
Fluorescence	ABSENT				ABSENT				ABSENT	
Cut	ABSENT				FAINT				FAINT ORANGE	
Sample Type	CT				CT				CT	CR

* Saturates plus aromatic hydrocarbons (C_{15+})

+ Data from Moore (1982, pp. 242)

CT - Cuttings CR - Core

DELHI PETROLEUM PTY. LTD.

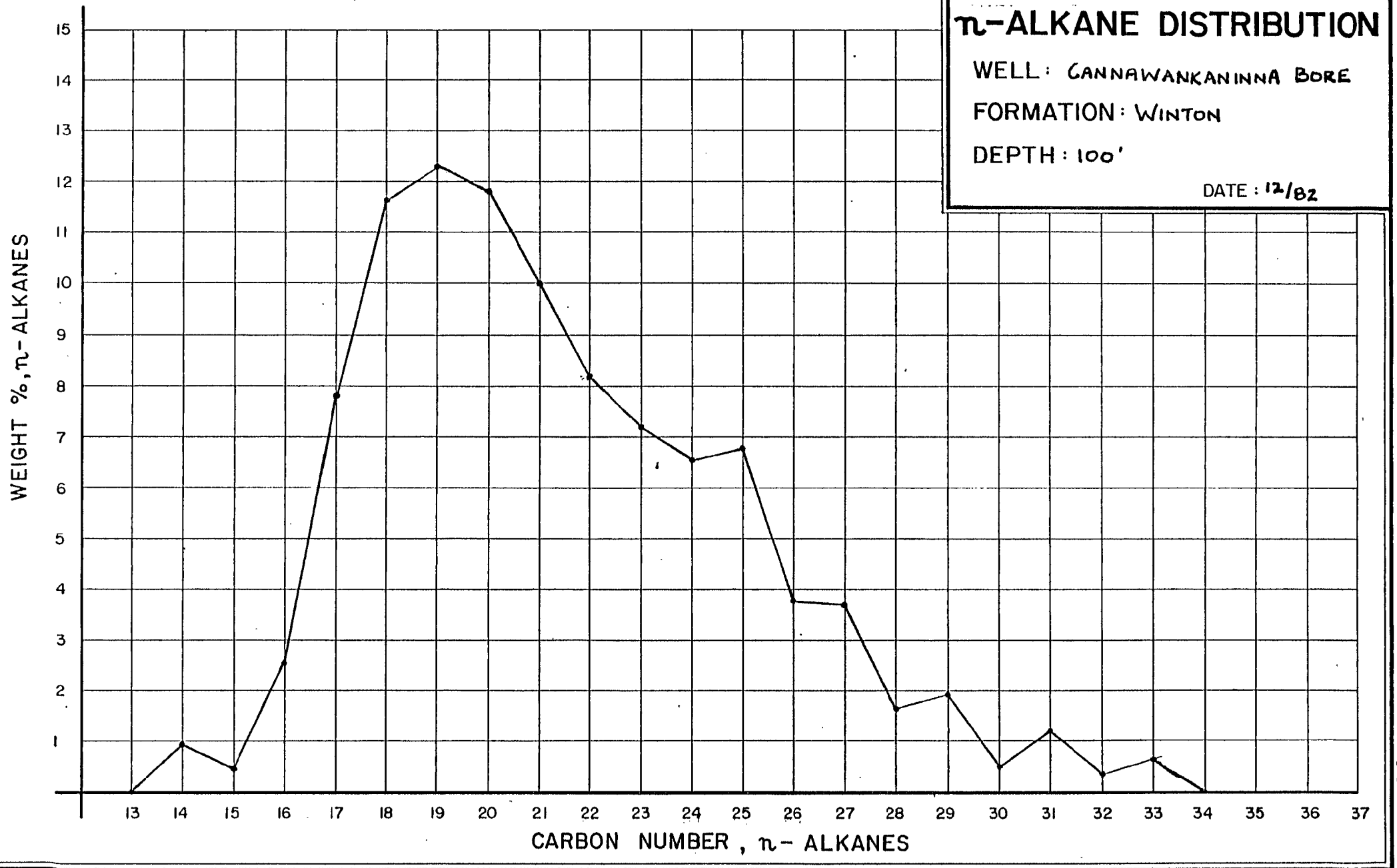
n-ALKANE DISTRIBUTION

WELL: CANNAWANKANINNA BORE

FORMATION: WINTON

DEPTH: 100'

DATE: 12/82



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00054

DELHI PETROLEUM PTY. LTD.

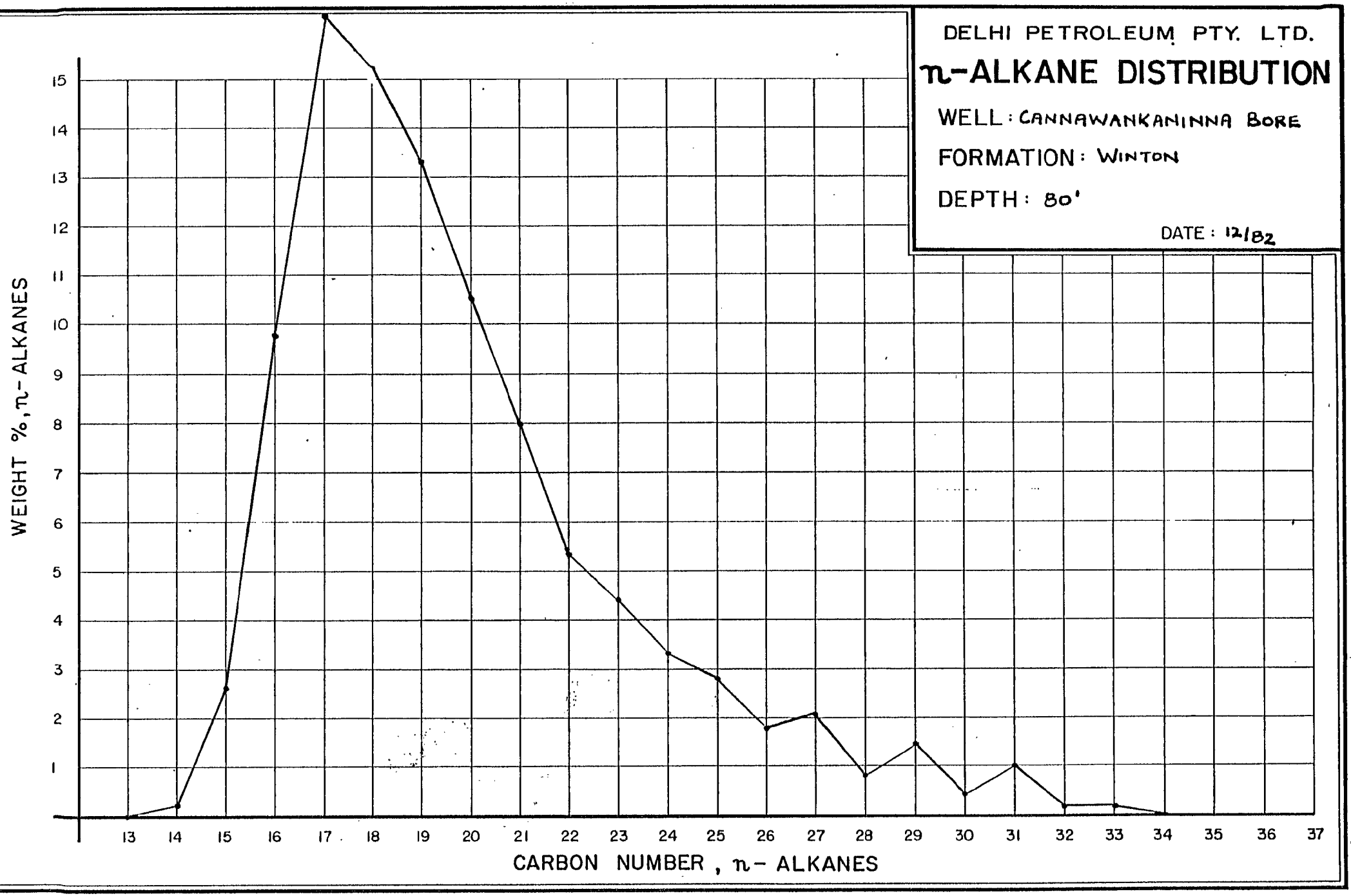
n-ALKANE DISTRIBUTION

WELL : CANNAWANKANINNA BORE

FORMATION : WINTON

DEPTH : 80'

DATE : 12/82



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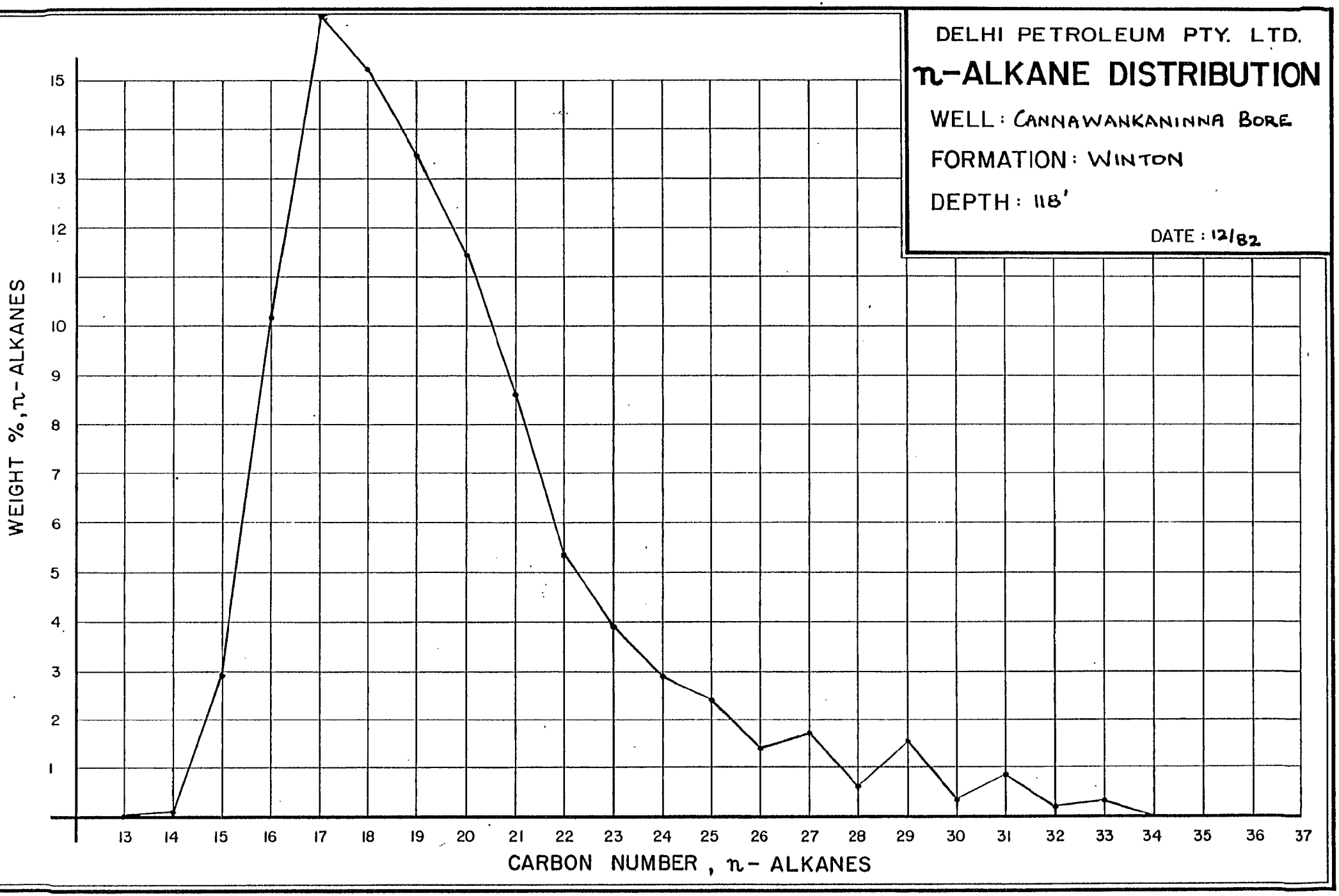
n-ALKANE DISTRIBUTION

WELL : CANNAWANKANINNA BORE

FORMATION : WINTON

DEPTH : 118'

DATE : 12/82



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DELHI PETROLEUM PTY. LTD.

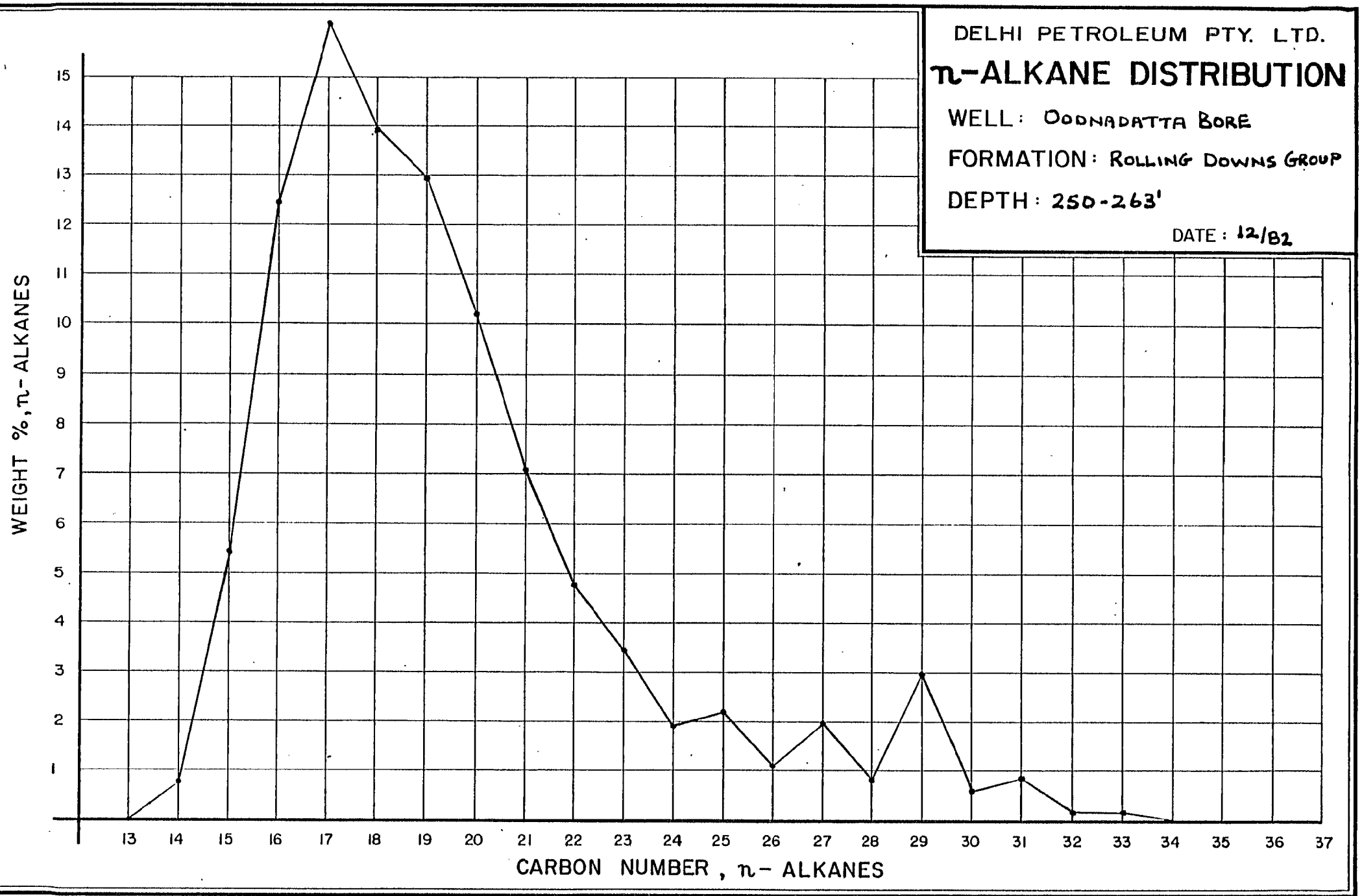
n-ALKANE DISTRIBUTION

WELL: Oodnadatta Bore

FORMATION: Rolling Downs Group

DEPTH: 250-263'

DATE: 12/82



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DELHI PETROLEUM PTY. LTD.

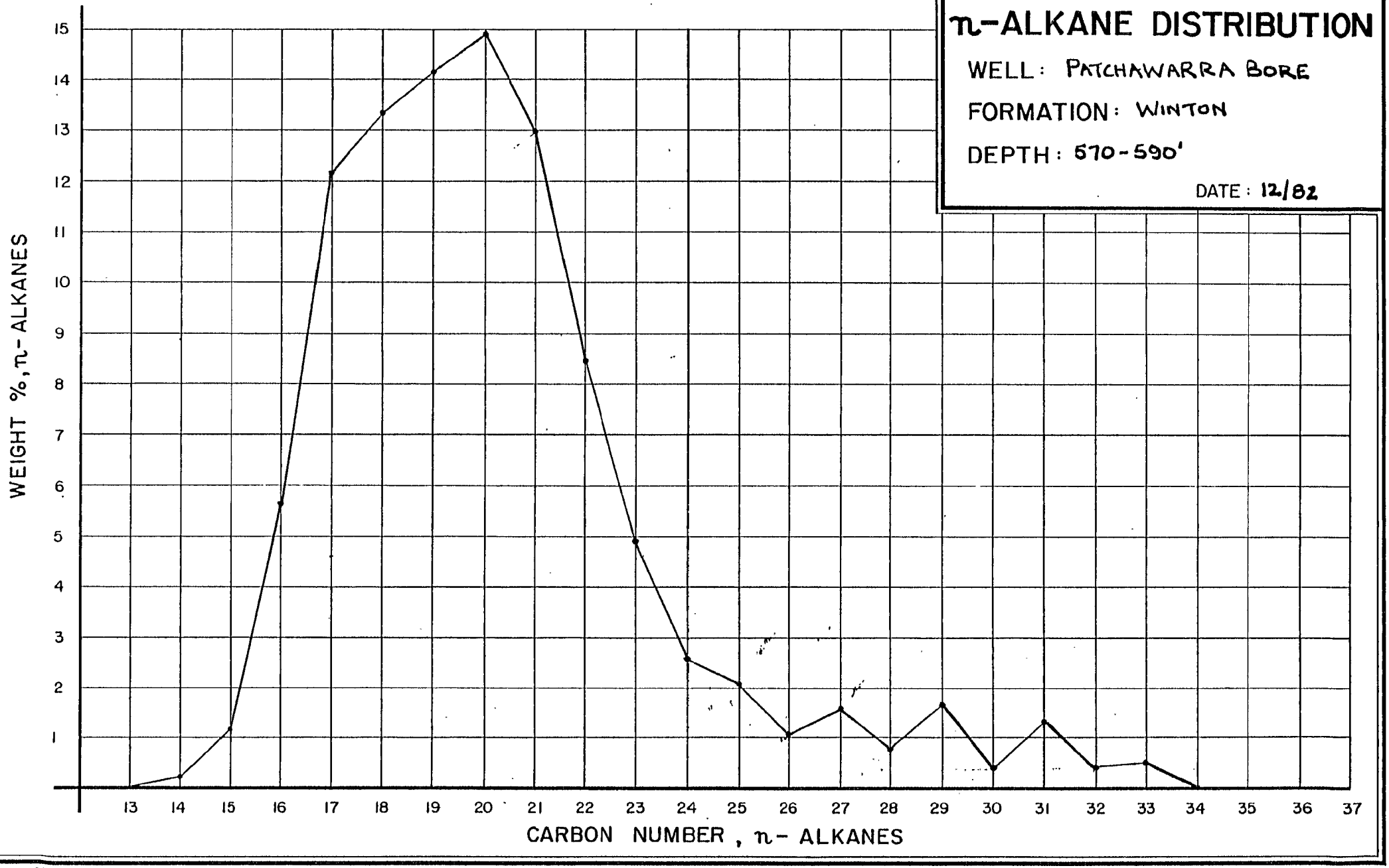
n-ALKANE DISTRIBUTION

WELL: PATCHAWARRA BORE

FORMATION: WINTON

DEPTH: 570-590'

DATE: 12/82



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00023

DELHI PETROLEUM PTY. LTD.

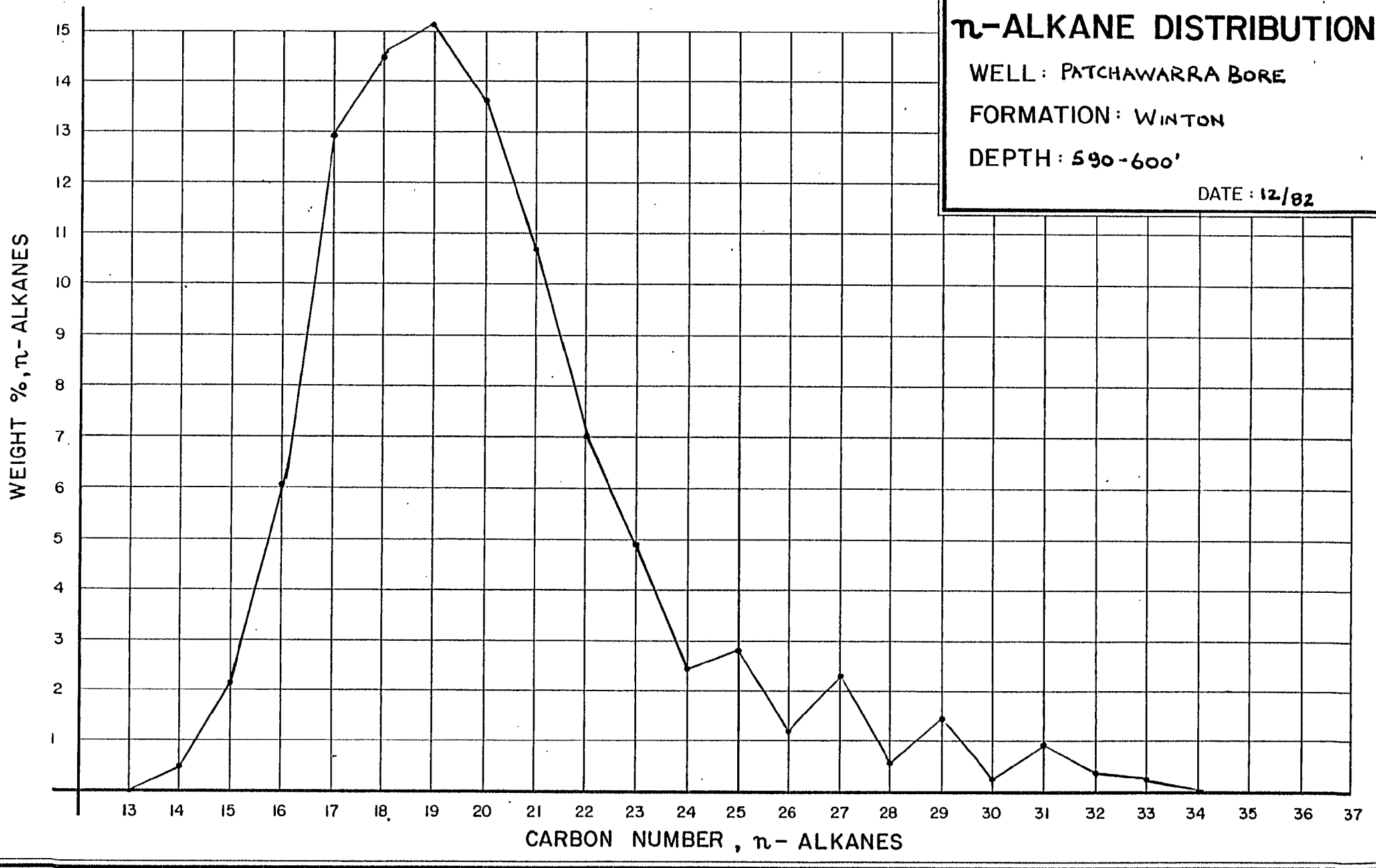
n-ALKANE DISTRIBUTION

WELL: PATCHAWARRA BORE

FORMATION: WINTON

DEPTH: 590-600'

DATE: 12/82



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DELHI PETROLEUM PTY. LTD.

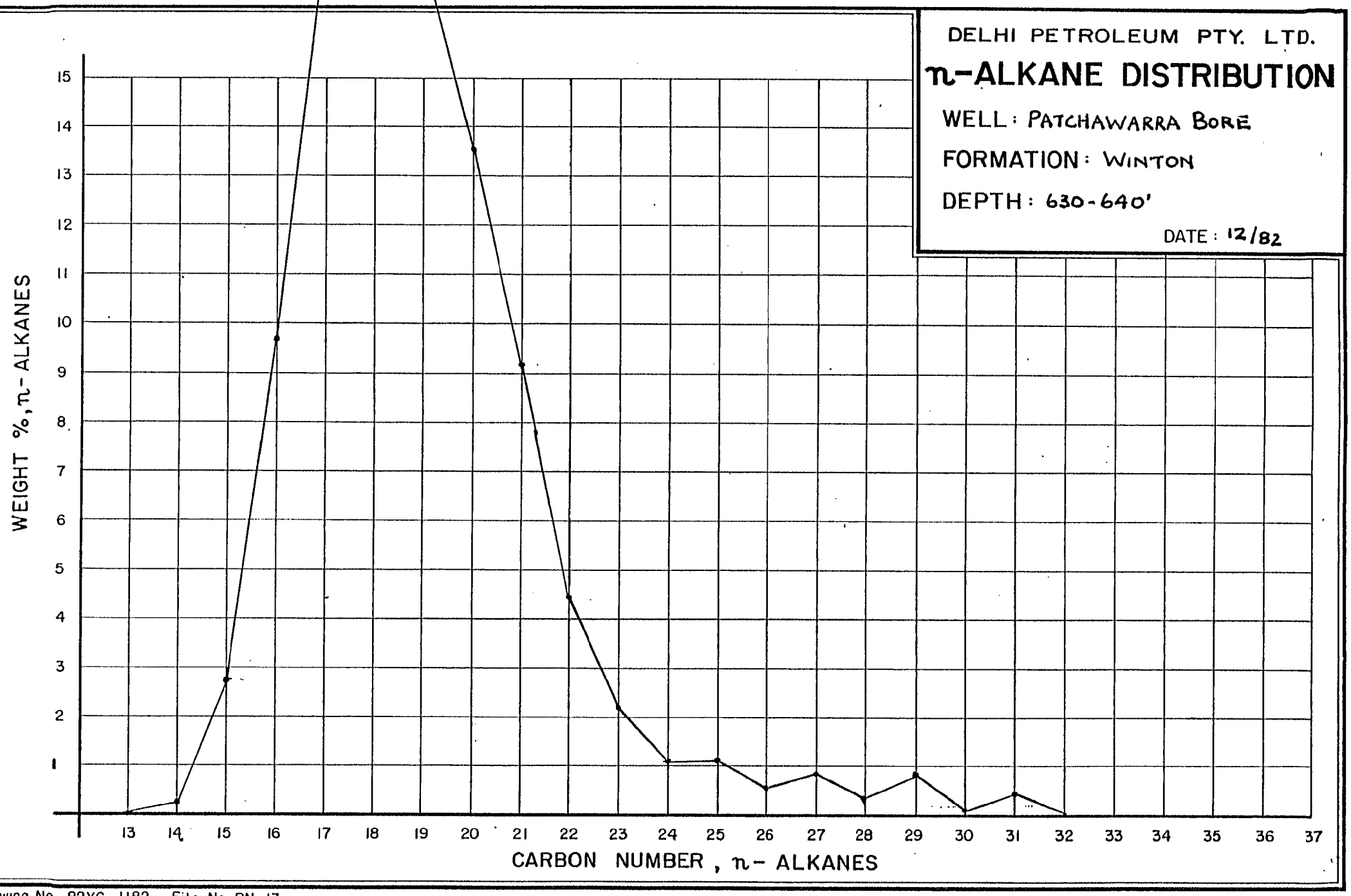
n-ALKANE DISTRIBUTION

WELL: PATCHAWARRA BORE

FORMATION: WINTON

DEPTH: 630-640'

DATE: 12/82



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DELHI PETROLEUM PTY. LTD.

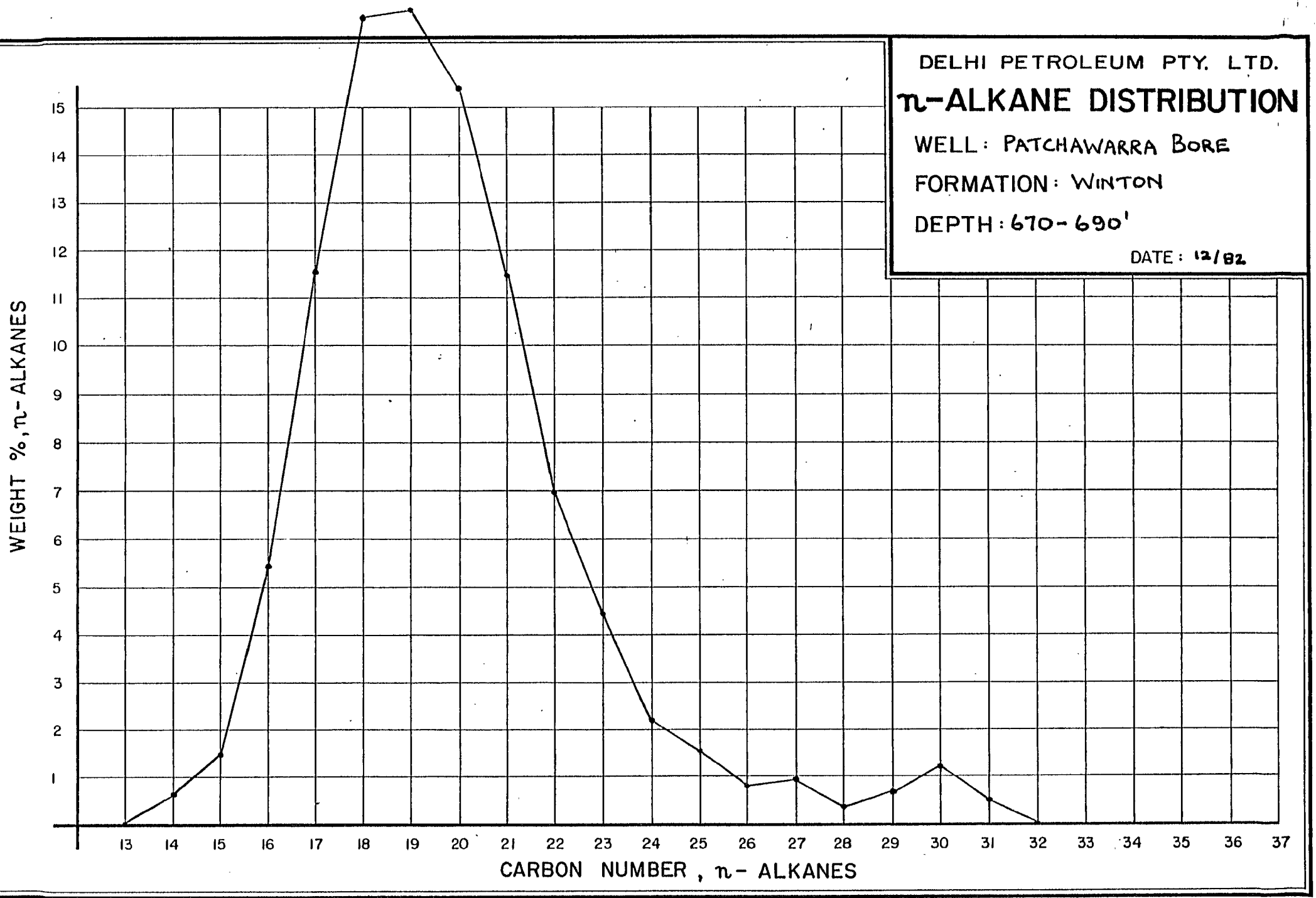
n-ALKANE DISTRIBUTION

WELL: PATCHAWARRA BORE

FORMATION: WINTON

DEPTH: 670-690'

DATE: 12/82



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The Australian
Mineral Development
Laboratories

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Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

22 December 1982

F3/51/0
2723/83

Delhi Petroleum Pty. Ltd.,
33 King William Street,
ADELAIDE. SA 5000

Attention: Mr P. Stanmore

REPORT F2723/83

YOUR REFERENCE:	EXPL:50303
MATERIAL:	Cuttings
LOCALITY:	CANNAWANKANINNA BORE; PATCHAWARRA BORE; OODNADATTA BORE
DATE RECEIVED:	3 November 1982
WORK REQUIRED:	Full source rock analysis

Investigation and Report by: Dr Brett Mooney

Chief - Fuel Section: Dr Brian G. Steveson
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

for Norton Jackson
Managing Director

cah

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Telephone (09) 325 7311
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Queensland 4814
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SOURCE ROCK ANALYSIS

WELL: CANNAWANKANINNA BORE

SAMPLE: 80 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	.4 %
weight of sample extracted	35.2 g
weight of eom	22.7 mg
extracted organic matter	645 ppm
eom as fraction of toc	161.3 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	61.2
SATURATES	5.7
AROMATICS	2.6
RESINS	10.6
LOSS ON COLUMN	19.8

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	8.0	29	1.4
14	.2	22	5.3	30	.4
15	2.7	23	4.4	31	1.0
16	9.8	24	3.3	32	.2
17	16.4	25	2.8	33	.2
18	15.2	26	1.8	34	.0
19	13.3	27	2.1	35	.0
20	10.6	28	.8	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	11.66 %
phytane	6.43 %

pristane/phytane ratio	1.81
pristane/c-17 ratio	.71
phytane/c-18 ratio	.42

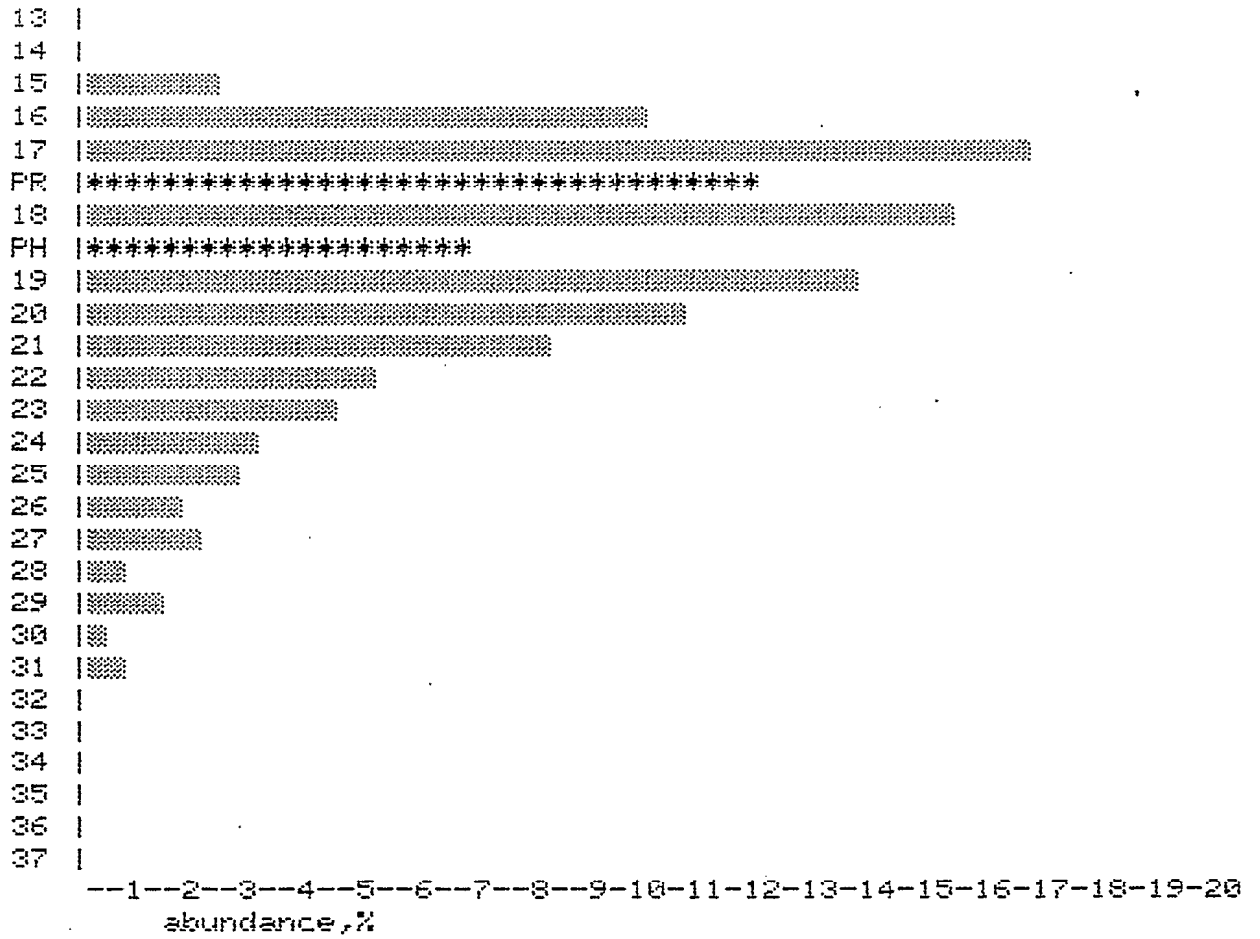
CARBON PREFERENCE INDEX (C-23 TO C-33):

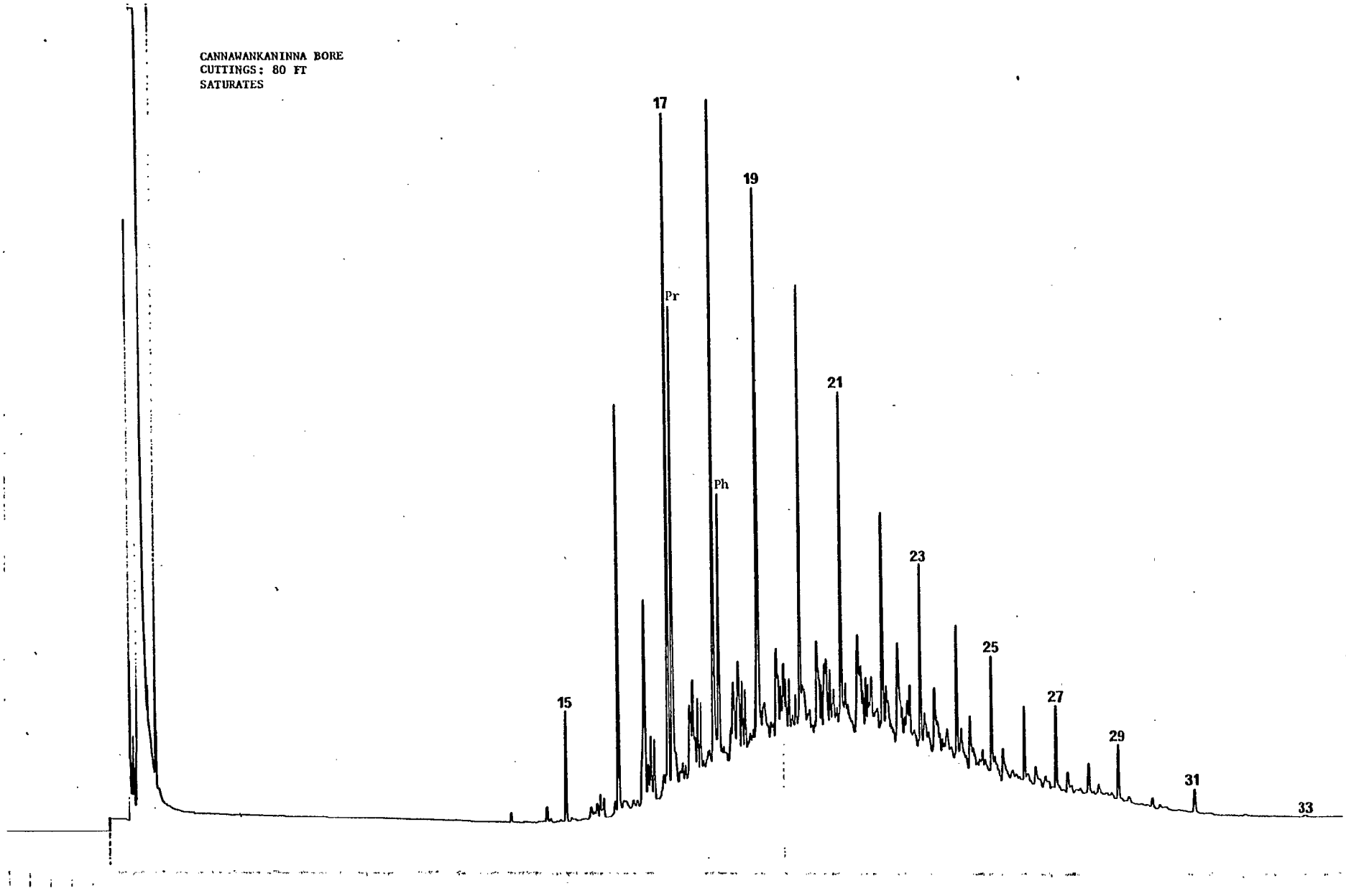
C.P.I. = 1.75

Note: 3.0 mg Sulphur extracted

CANNAWANKANINNA BORE
80 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




CANNAWANKANINNA BORE
CUTTINGS: 80 FT
SATURATES
17
19
Pr
21
Ph
23
25
15
27
29
31
33

SOURCE ROCK ANALYSIS

WELL: CANNAWANKANINNA BORE

SAMPLE: 100 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	2.08 %
weight of sample extracted	30.85 g
weight of eom	370.6 mg
extracted organic matter	12013 ppm
eom as fraction of toc	577.5 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	88.6
SATURATES	.2
AROMATICS	.1
RESINS	1.6
LOSS ON COLUMN	9.5

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	10.0	29	1.9
14	.9	22	8.2	30	.5
15	.4	23	7.2	31	1.2
16	2.6	24	6.6	32	.3
17	7.8	25	6.8	33	.6
18	11.7	26	3.8	34	.0
19	12.3	27	3.7	35	.0
20	11.8	28	1.7	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	3.92 %
phytane	4.17 %

pristane/phytane ratio	.94
pristane/c-17 ratio	.5
phytane/c-18 ratio	.36

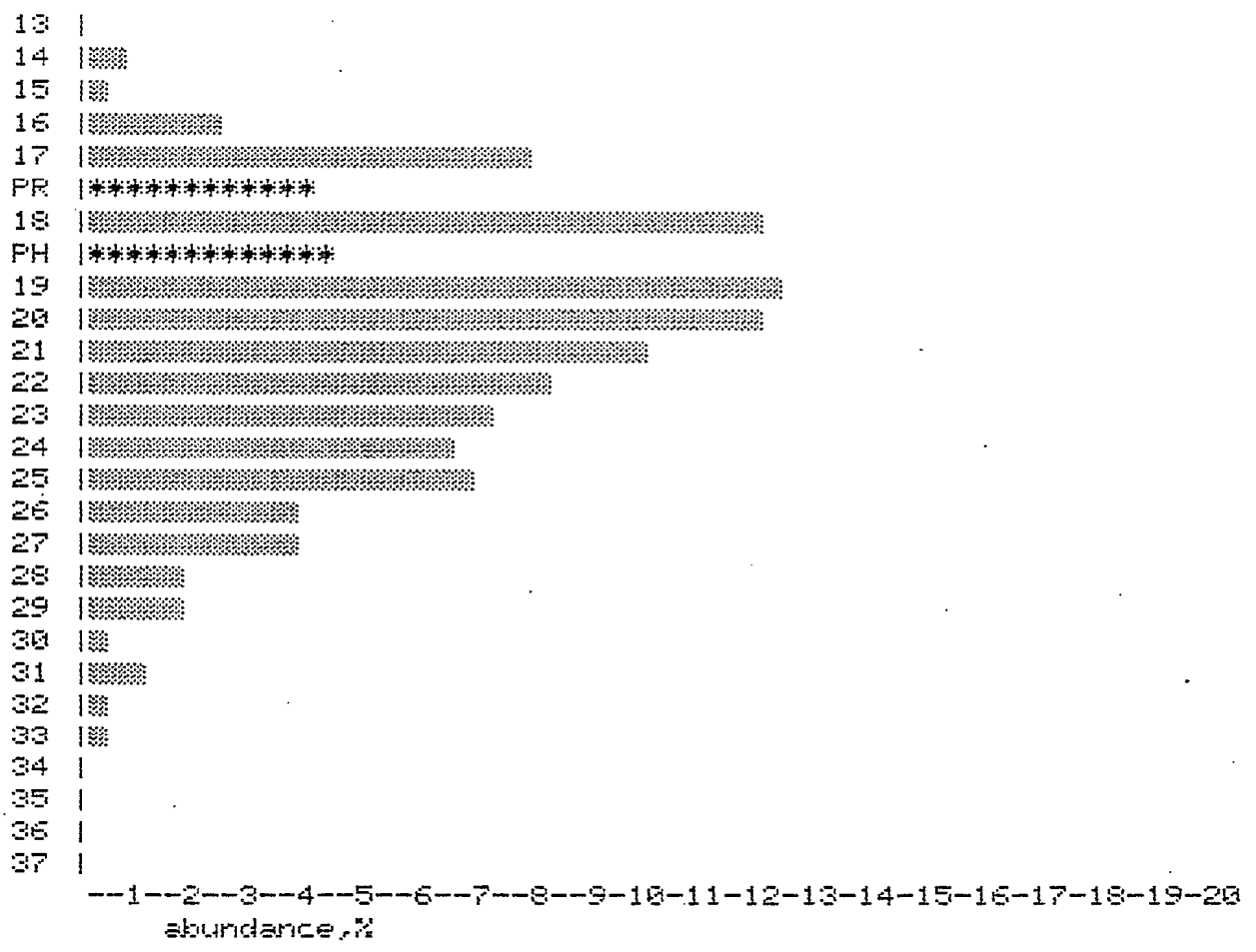
CARBON PREFERENCE INDEX (C-23 TO C-33):

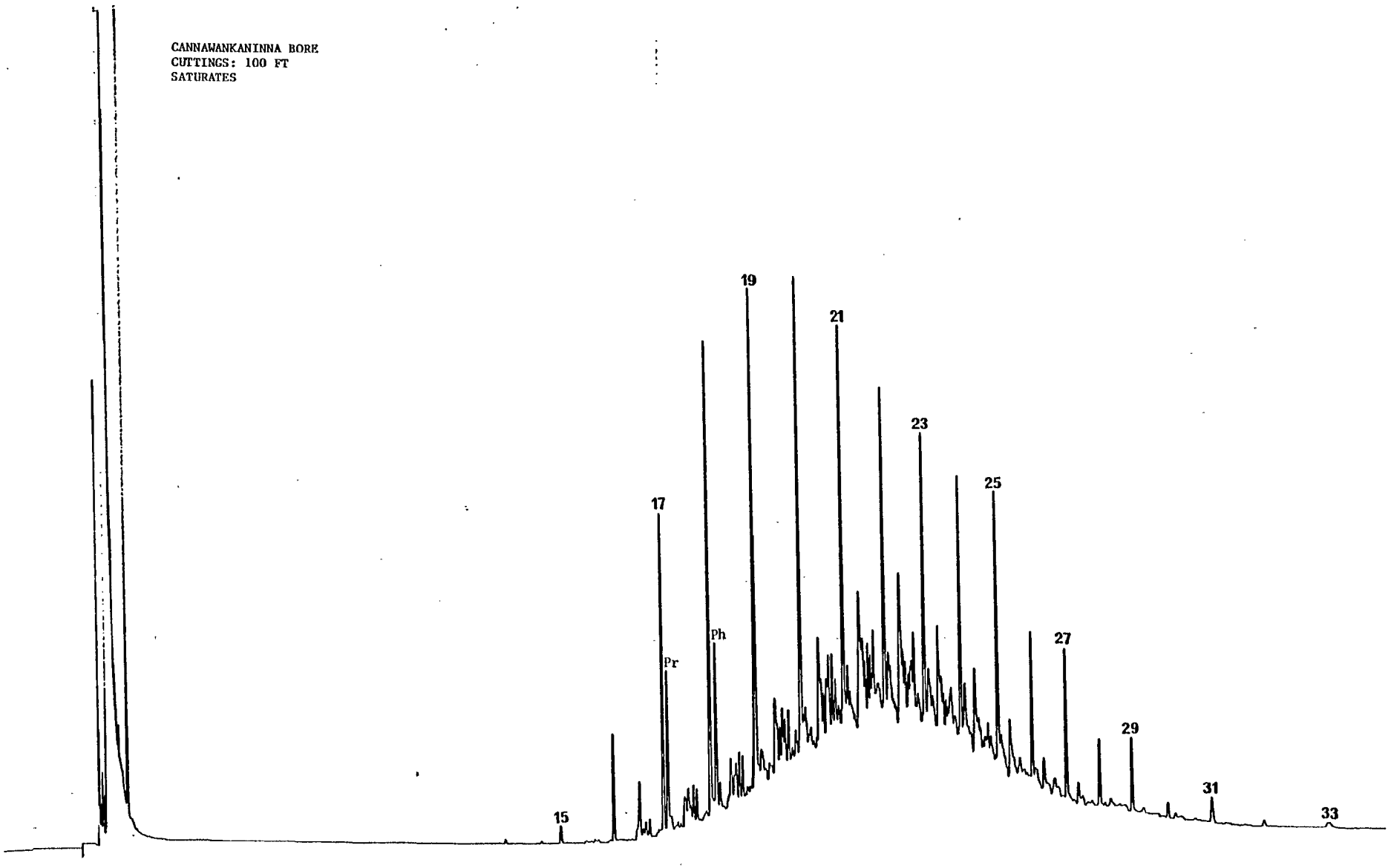
C.P.I. = 1.66

Note: 19.5 mg Sulphur extracted

CANNAWANKANINNA BORE
100 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




CANNAWANKANINNA BORE
CUTTINGS: 100 FT
SATURATES
15
17
Pr
Ph
19
21
23
25
27
29
31
33

SOURCE ROCK ANALYSIS

WELL: CANNAWANKANINNA BORE

SAMPLE: 109 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	3.74 %
weight of sample extracted	34.05 g
weight of eom	75 mg
extracted organic matter	2203 ppm
eom as fraction of toc	58.9 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	91.5
SATURATES	2.1
AROMATICS	.7
RESINS	5.5
LOSS ON COLUMN	.3

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	5.9	29	6.1
14	.5	22	4.7	30	.8
15	2.8	23	4.9	31	1.6
16	7.6	24	4.2	32	.4
17	12.5	25	7.0	33	.3
18	10.4	26	3.5	34	.0
19	9.4	27	7.3	35	.0
20	7.8	28	2.4	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	9.45 %
phytane	5.17 %

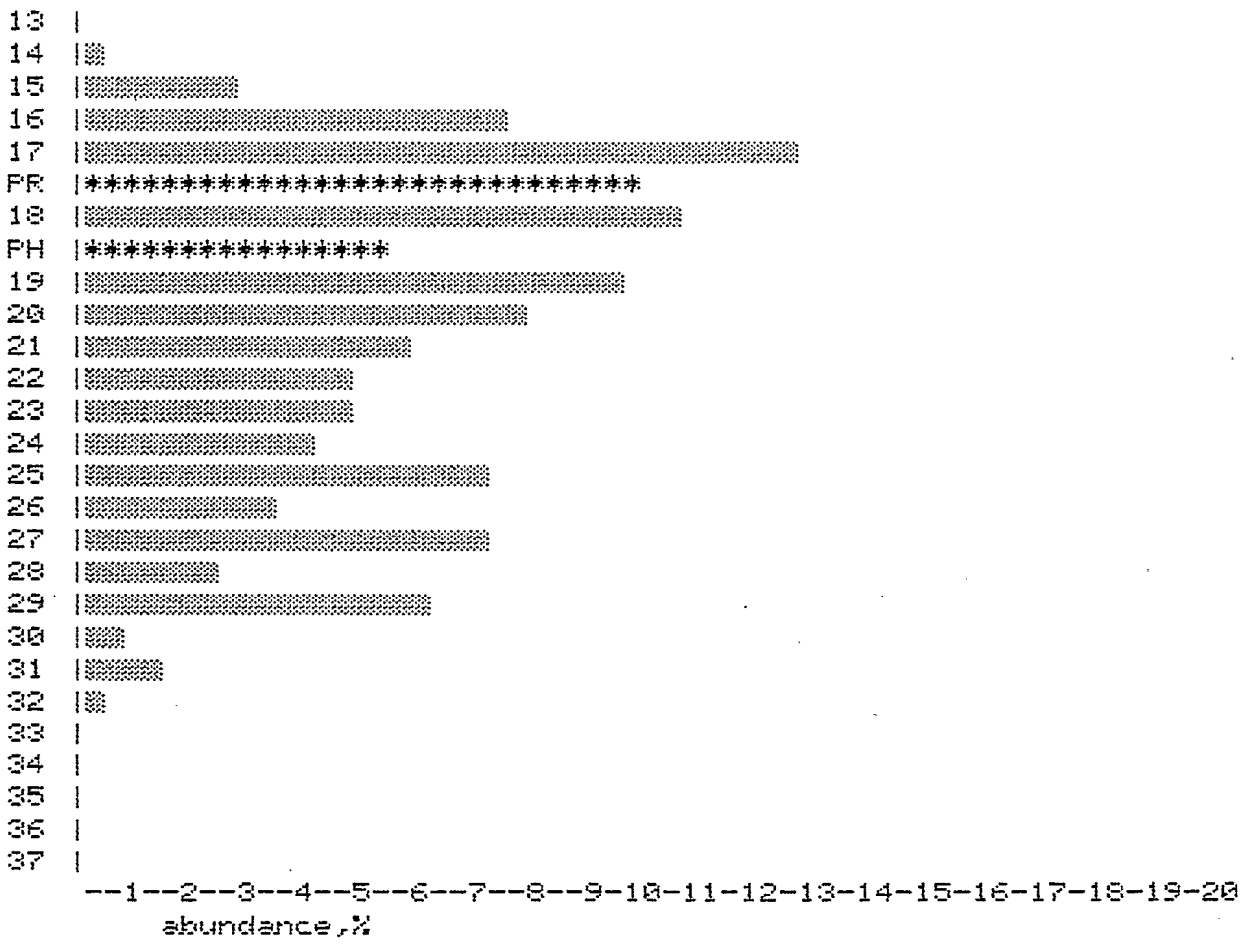
pristane/phytane ratio	1.83
pristane/c-17 ratio	.76
phytane/c-18 ratio	.5

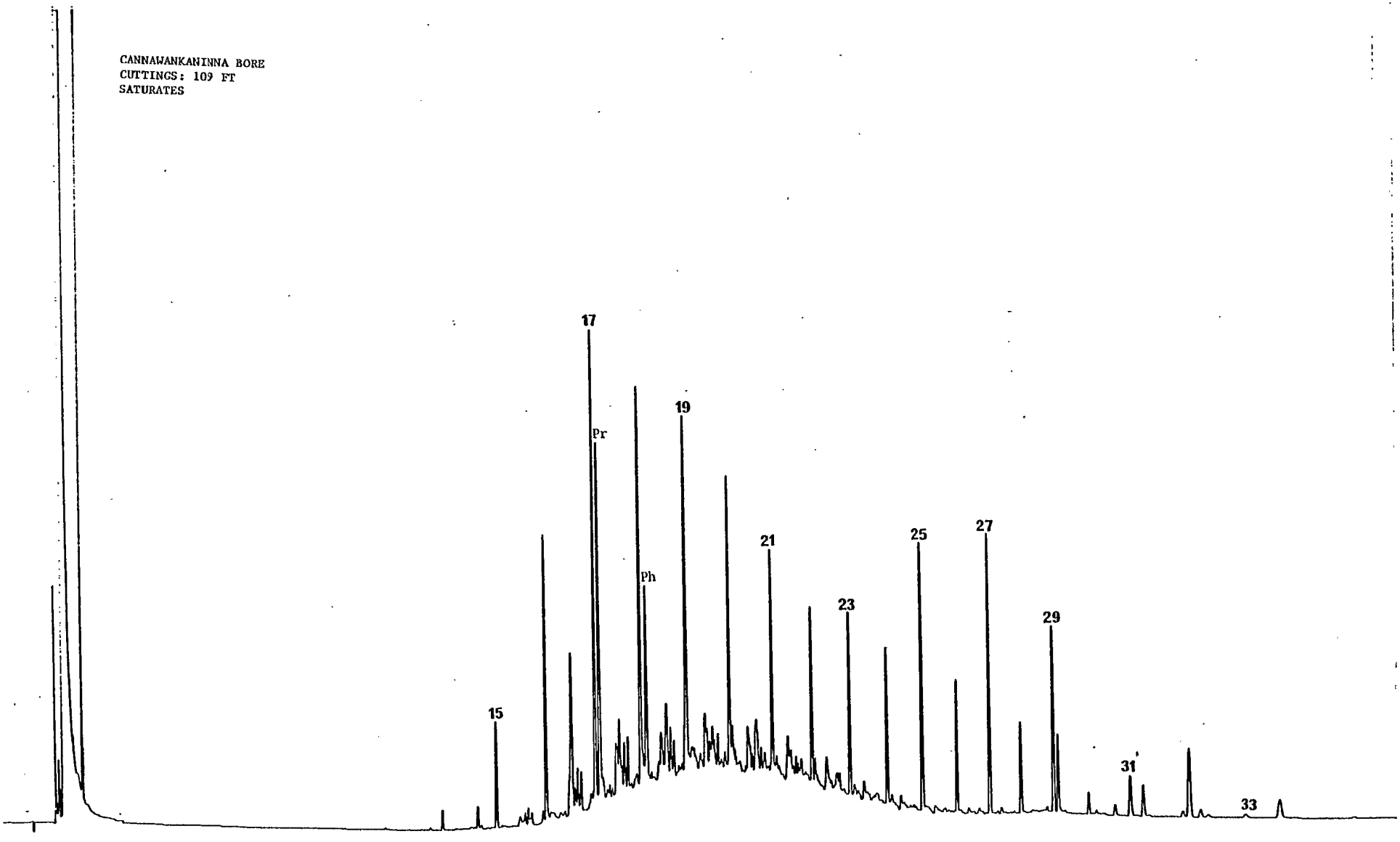
CARBON PREFERENCE INDEX (C-23 TO C-33):

C.P.I. = 2.59

CANNAWANKANINNA BORE
109 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




CANNAWANKANINNA BORE
CUTTINGS: 109 FT
SATURATES
15
17
Pr
Ph
19
21
23
25
27
29
31
33

SOURCE ROCK ANALYSIS

WELL: CANNAWANKANINNA BORE

SAMPLE: 118 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	.22 %
weight of sample extracted	22.12 g
weight of eom	11 mg
extracted organic matter	497 ppm
eom as fraction of toc	225.9 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	37.3
SATURATES	17.3
AROMATICS	.9
RESINS	41.8
LOSS ON COLUMN	2.7

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	8.7	29	1.6
14	.1	22	5.3	30	.3
15	2.9	23	3.9	31	.8
16	10.2	24	2.9	32	.2
17	16.6	25	2.4	33	.3
18	15.2	26	1.4	34	.0
19	13.5	27	1.7	35	.0
20	11.5	28	.7	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

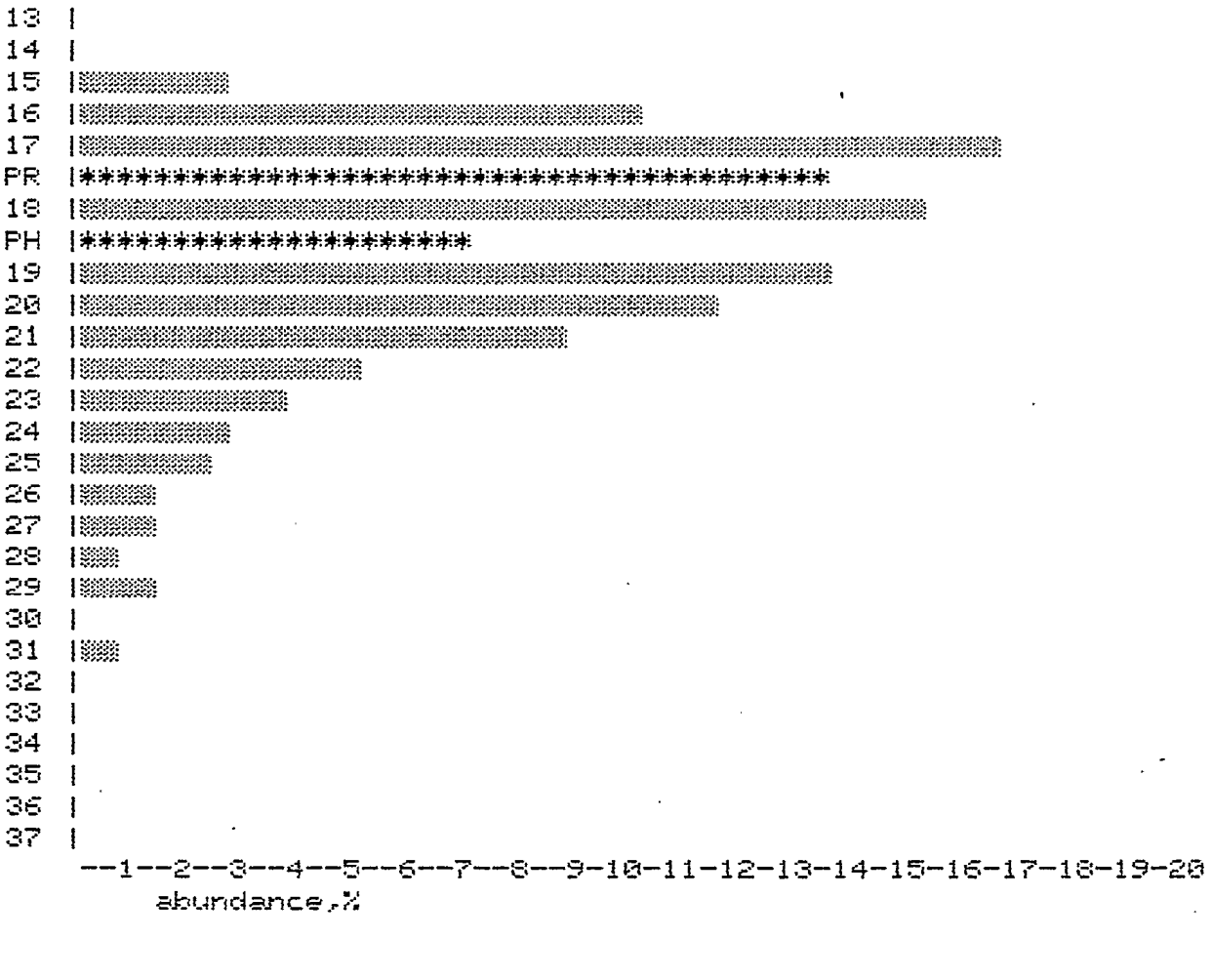
pristane	13.23 %
phytane	6.88 %
pristane/phytane ratio	1.92
pristane/c-17 ratio	.8
phytane/c-18 ratio	.45

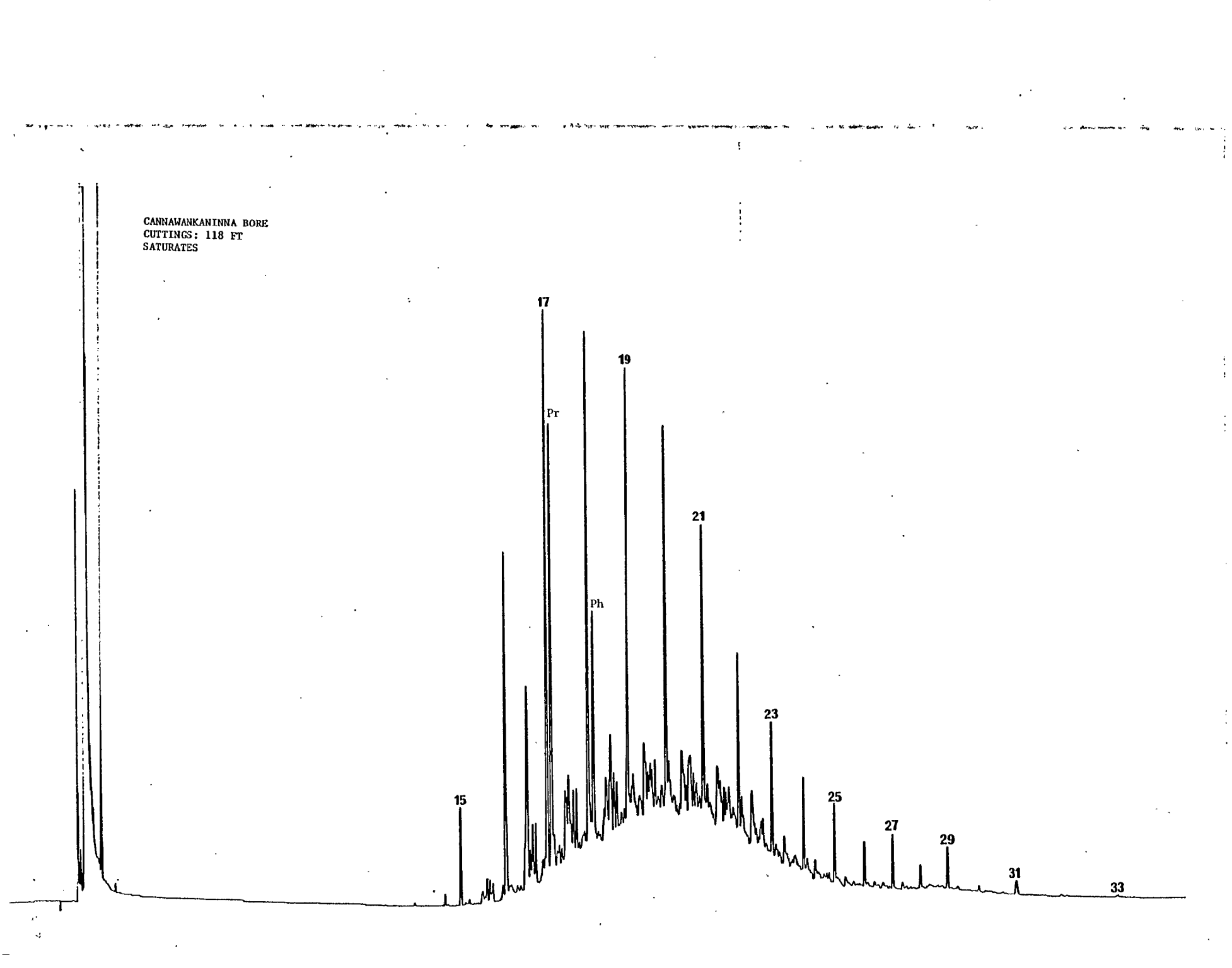
CARBON PREFERENCE INDEX (C-23 TO C-33):

C.P.I. = 1.94

CANNAWANKANINNA BORE
118 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




CANNAWANKANINNA BORE
CUTTINGS: 118 FT
SATURATES
17
Pr
19
Ph
21
23
15
25
27
29
31
33

SOURCE ROCK ANALYSIS

WELL: PATCHAWARRA BORE

SAMPLE: 570-590 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	1.04 %
weight of sample extracted	18.36 g
weight of eom	61.6 mg
extracted organic matter	3355 ppm
eom as fraction of toc	322.6 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	81.5
SATURATES	.3
AROMATICS	.5
RESINS	4.5
LOSS ON COLUMN	13.1

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	13.0	29	1.7
14	.2	22	8.4	30	.3
15	1.2	23	4.9	31	1.3
16	5.7	24	2.6	32	.3
17	12.2	25	2.1	33	.4
18	13.3	26	1.1	34	.0
19	14.2	27	1.6	35	.0
20	14.9	28	.8	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	7.26 %
phytane	5.47 %

pristane/phytane ratio	1.33
pristane/c-17 ratio	.6
phytane/c-18 ratio	.41

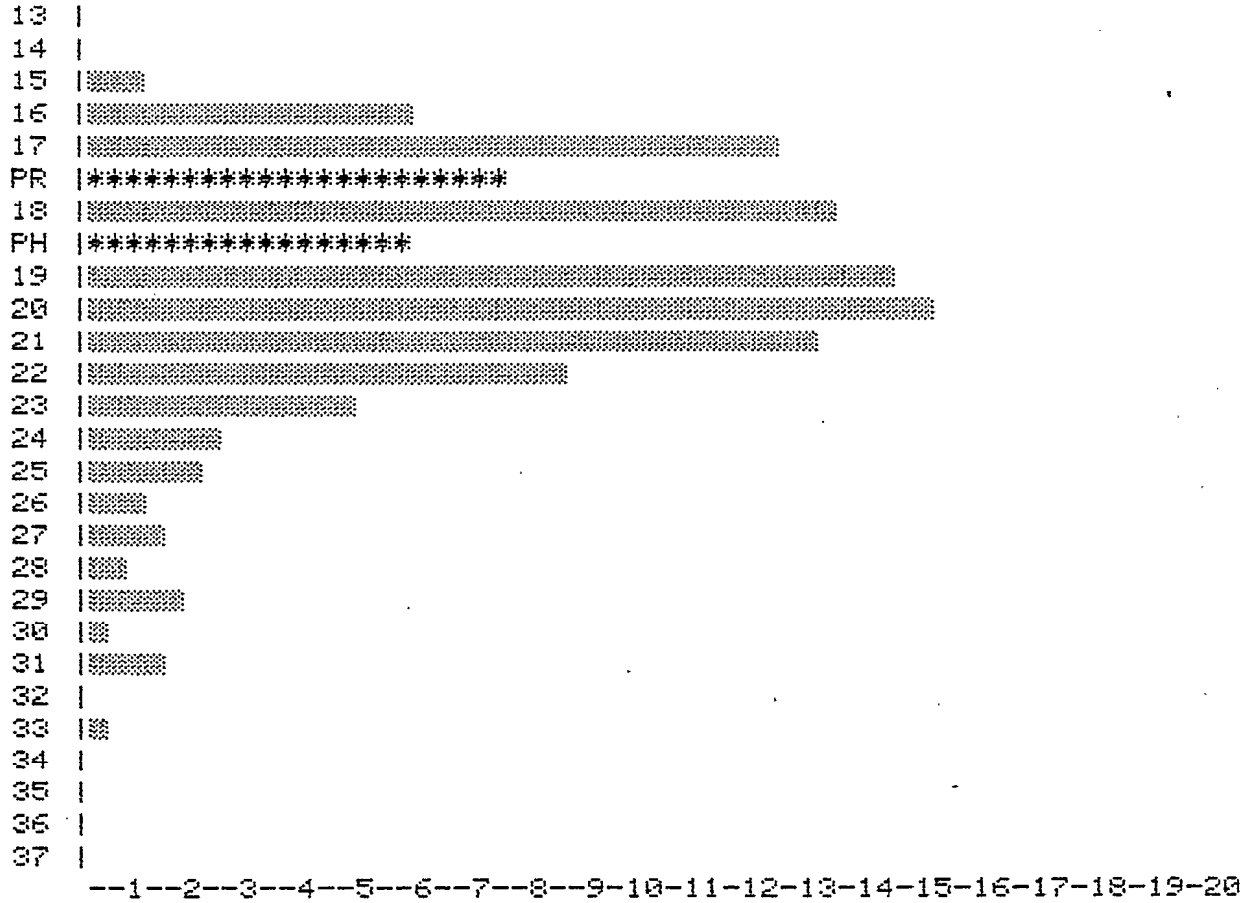
CARBON PREFERENCE INDEX (C-23 TO C-33):

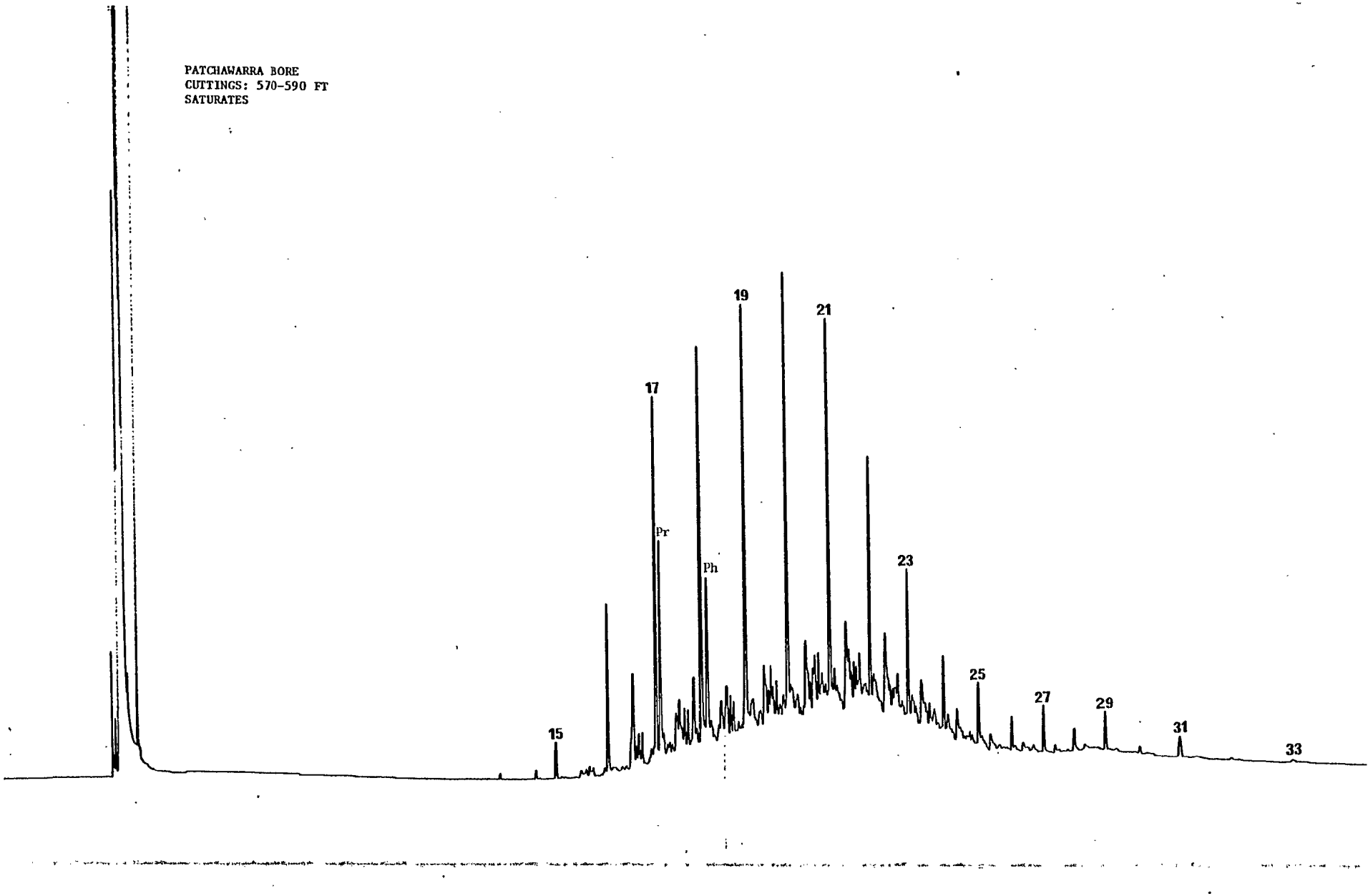
C.P.I. = 2.12

Note: 4.8 mg Sulphur extracted

PATCHAWARRA BORE
570-590 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




PATCHAWARRA BORE
CUTTINGS: 570-590 FT
SATURATES
15
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SOURCE ROCK ANALYSIS

WELL: PATCHAWARRA BORE

SAMPLE: 590-600 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	.68 %
weight of sample extracted	33.51 g
weight of eom	59.8 mg
extracted organic matter	1785 ppm
eom as fraction of toc	262.5 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	77.9
SATURATES	2.0
AROMATICS	.3
RESINS	12.7
LOSS ON COLUMN	7.0

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	10.7	29	1.4
14	.4	22	7.0	30	.2
15	2.2	23	4.9	31	.9
16	6.1	24	2.4	32	.3
17	12.9	25	2.8	33	.2
18	14.5	26	1.2	34	.0
19	15.2	27	2.3	35	.0
20	13.7	28	.6	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	6.14 %
phytane	6.01 %

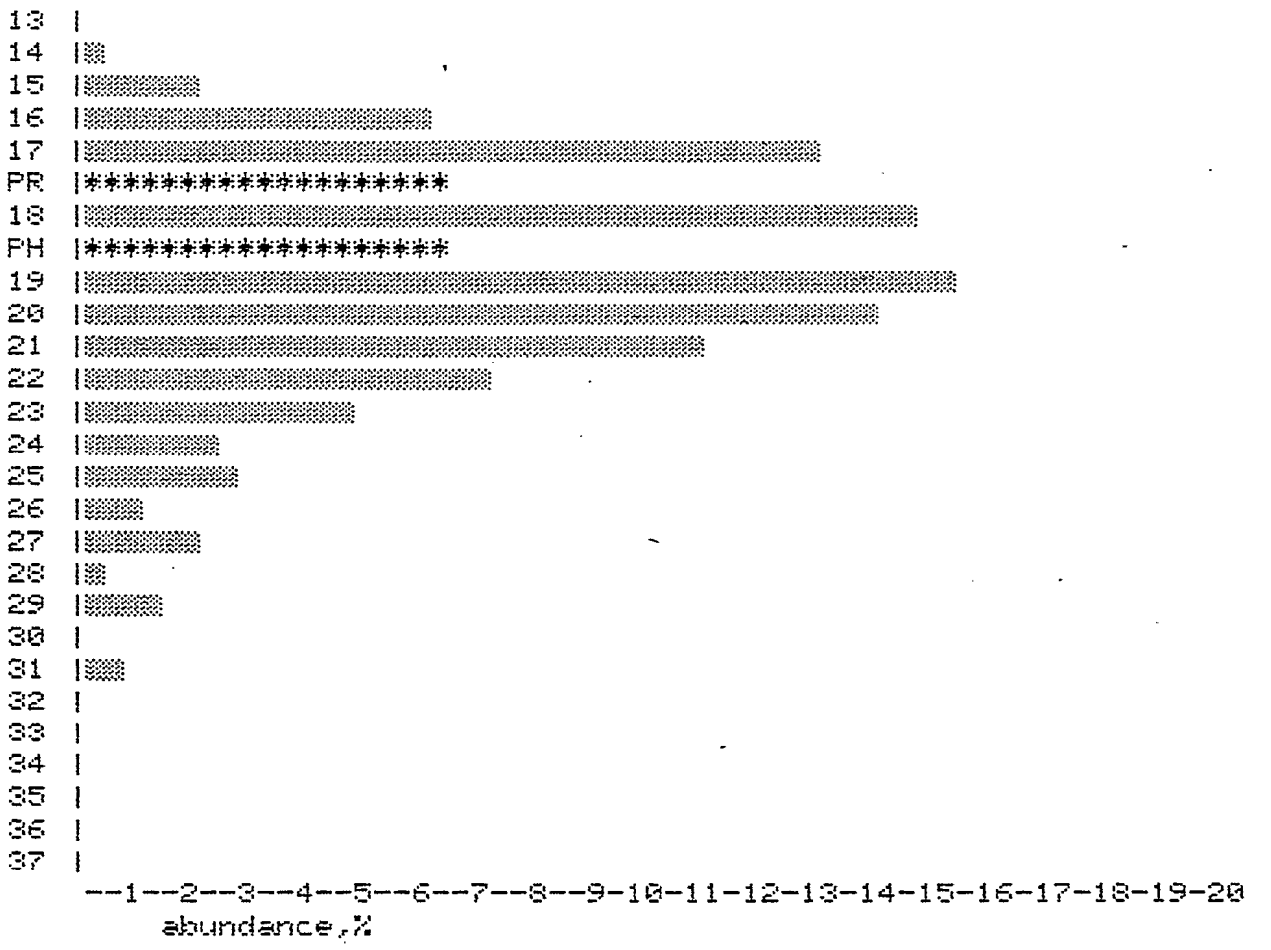
pristane/phytane ratio	1.02
pristane/c-17 ratio	.48
phytane/c-18 ratio	.42

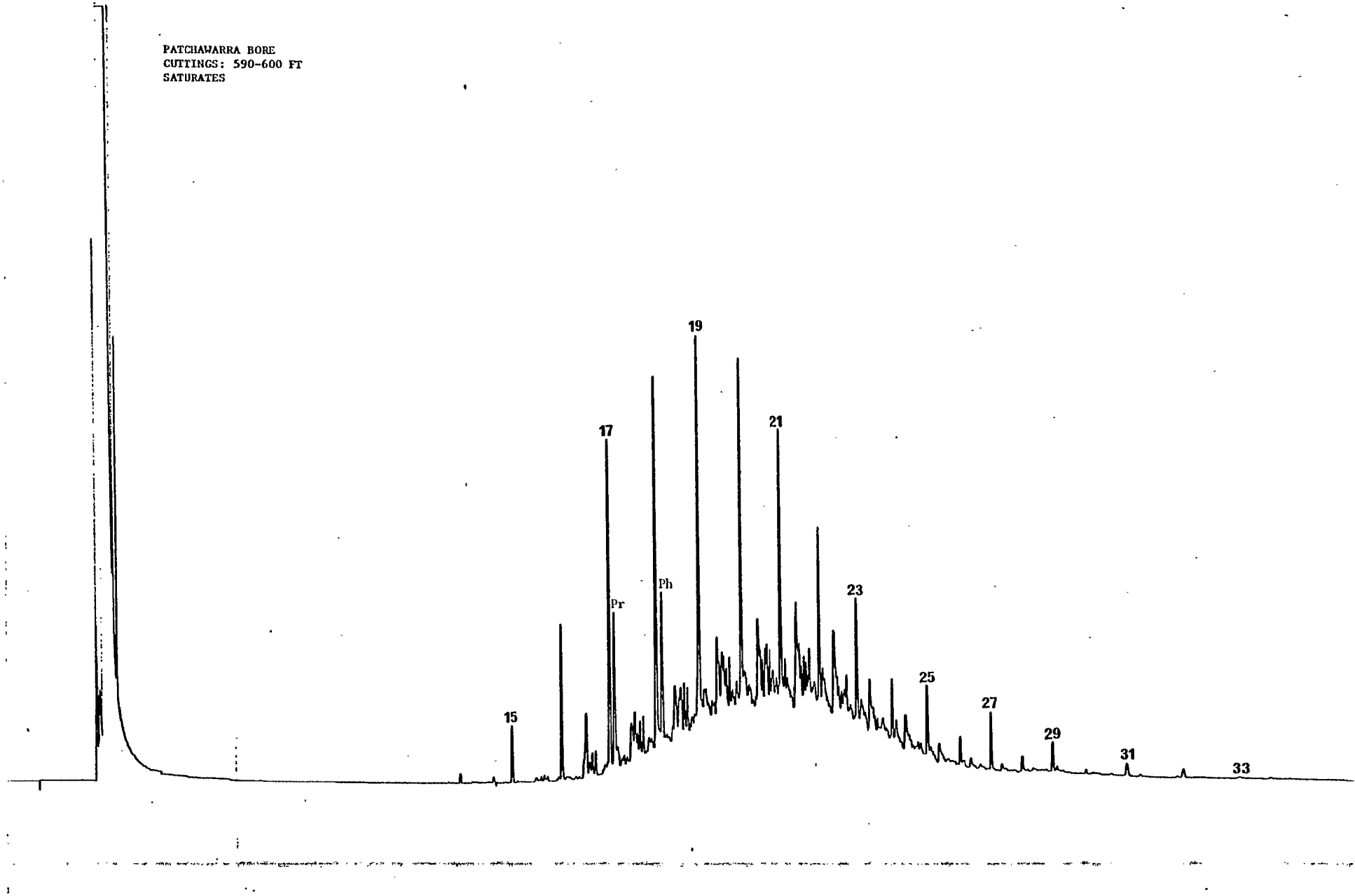
CARBON PREFERENCE INDEX (C-23 TO C-33):

C.P.I. = 2.54

PATCHAWARRA BORE
590-600 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




PATCHAWARRA BORE
CUTTINGS: 590-600 FT
SATURATES
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SOURCE ROCK ANALYSIS

WELL: PATCHAWARRA BORE

SAMPLE: 630-640 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	1.16 %
weight of sample extracted	10.48 g
weight of eom	110.1 mg
extracted organic matter	10506 ppm
eom as fraction of toc	905.7 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	76.7
SATURATES	.7
AROMATICS	.1
RESINS	2.5
LOSS ON COLUMN	20.0

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	9.2	29	.8
14	.2	22	4.4	30	.1
15	2.8	23	2.2	31	.4
16	9.7	24	1.1	32	.0
17	17.6	25	1.1	33	.0
18	17.8	26	.6	34	.0
19	17.5	27	.8	35	.0
20	13.6	28	.3	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	9.36 %
phytane	6.78 %

pristane/phytane ratio	1.38
pristane/c-17 ratio	.53
phytane/c-18 ratio	.38

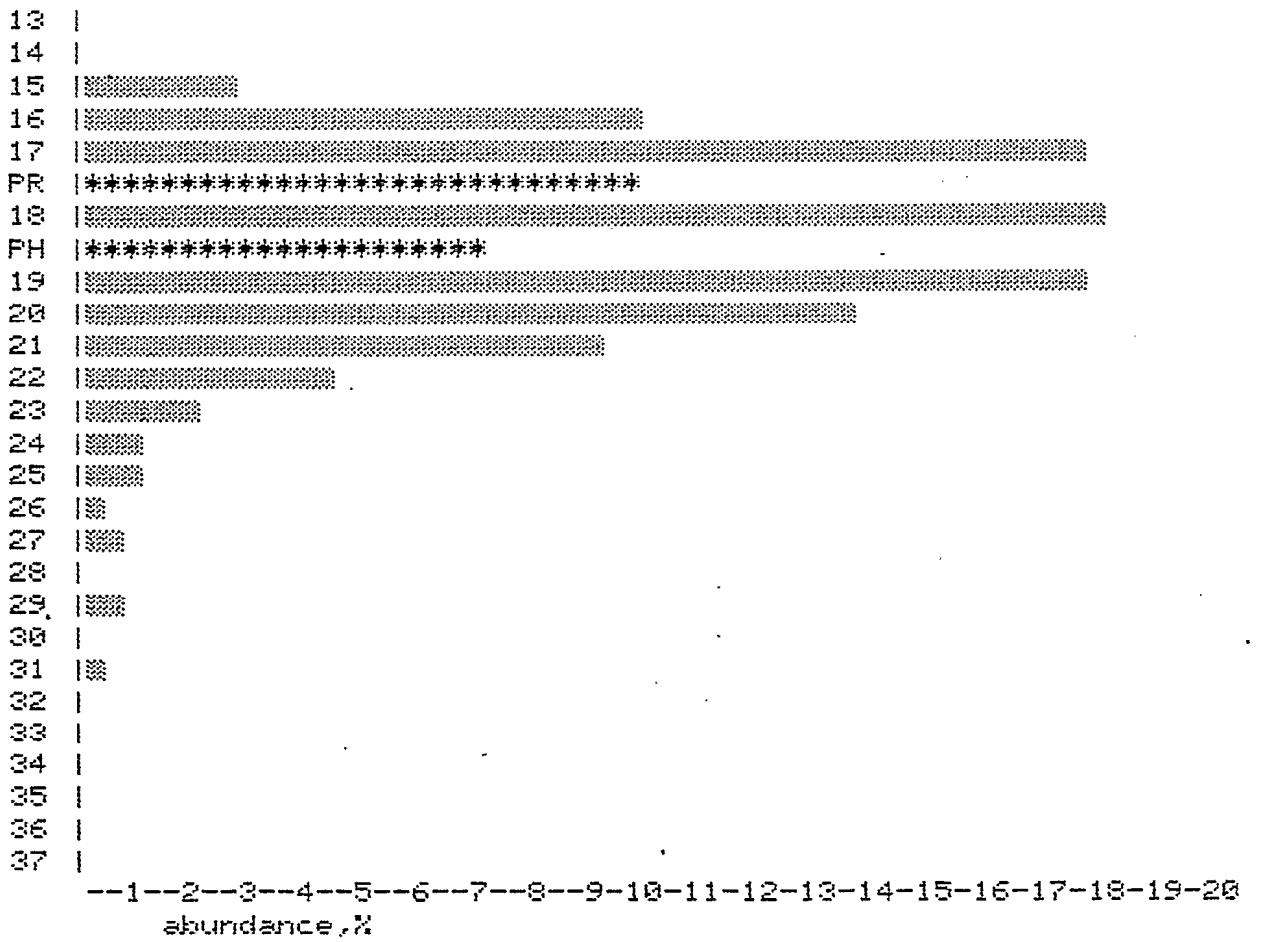
CARBON PREFERENCE INDEX (C-23 TO C-33):

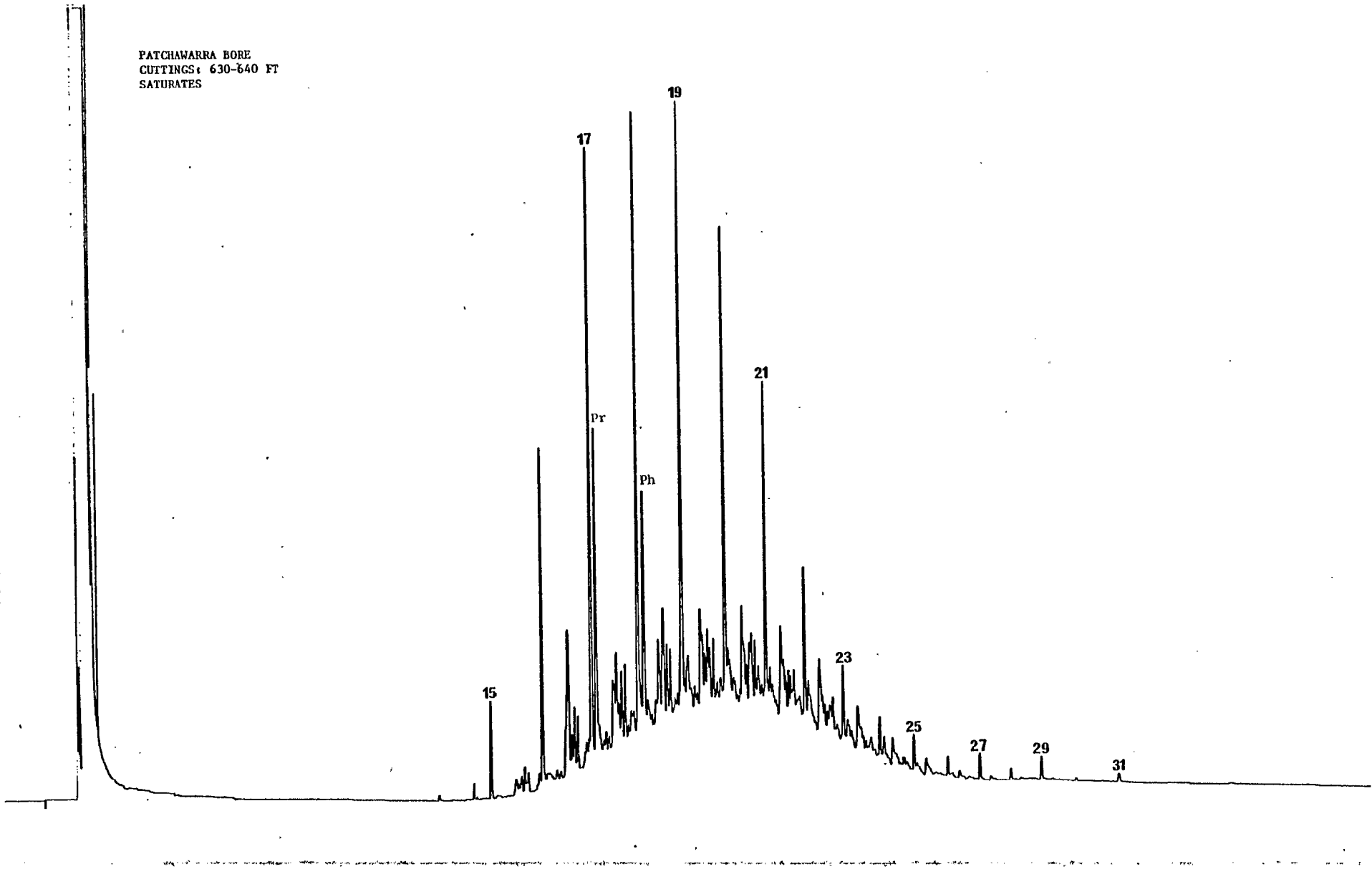
C.P.I. = 2.22

Note: 15.3 mg Sulphur extracted

PATCHAWARRA BORE
630-640 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES




PATCHAWARRA BORE
CUTTINGS: 630-640 FT
SATURATES
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Pr
Ph
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23
25
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SOURCE ROCK ANALYSIS

WELL: PATCHAWARRA BORE

SAMPLE: 670-690 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	.24 %
weight of sample extracted	49.89 g
weight of eom	54.7 mg
extracted organic matter	1096 ppm
eom as fraction of toc	456.7 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	79.6
SATURATES	1.5
AROMATICS	.7
RESINS	5.3
LOSS ON COLUMN	12.9

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	11.5	29	.7
14	.7	22	7.0	30	1.2
15	1.5	23	4.5	31	.5
16	5.4	24	2.2	32	.0
17	11.6	25	1.6	33	.0
18	17.0	26	.8	34	.0
19	17.2	27	.9	35	.0
20	15.4	28	.3	36	.0
				37	0

ISOPRENOID DISTRIBUTION IN SATURATES

pristane	4.73 %
phytane	5.68 %

pristane/phytane ratio	.83
pristane/c-17 ratio	.41
phytane/c-18 ratio	.33

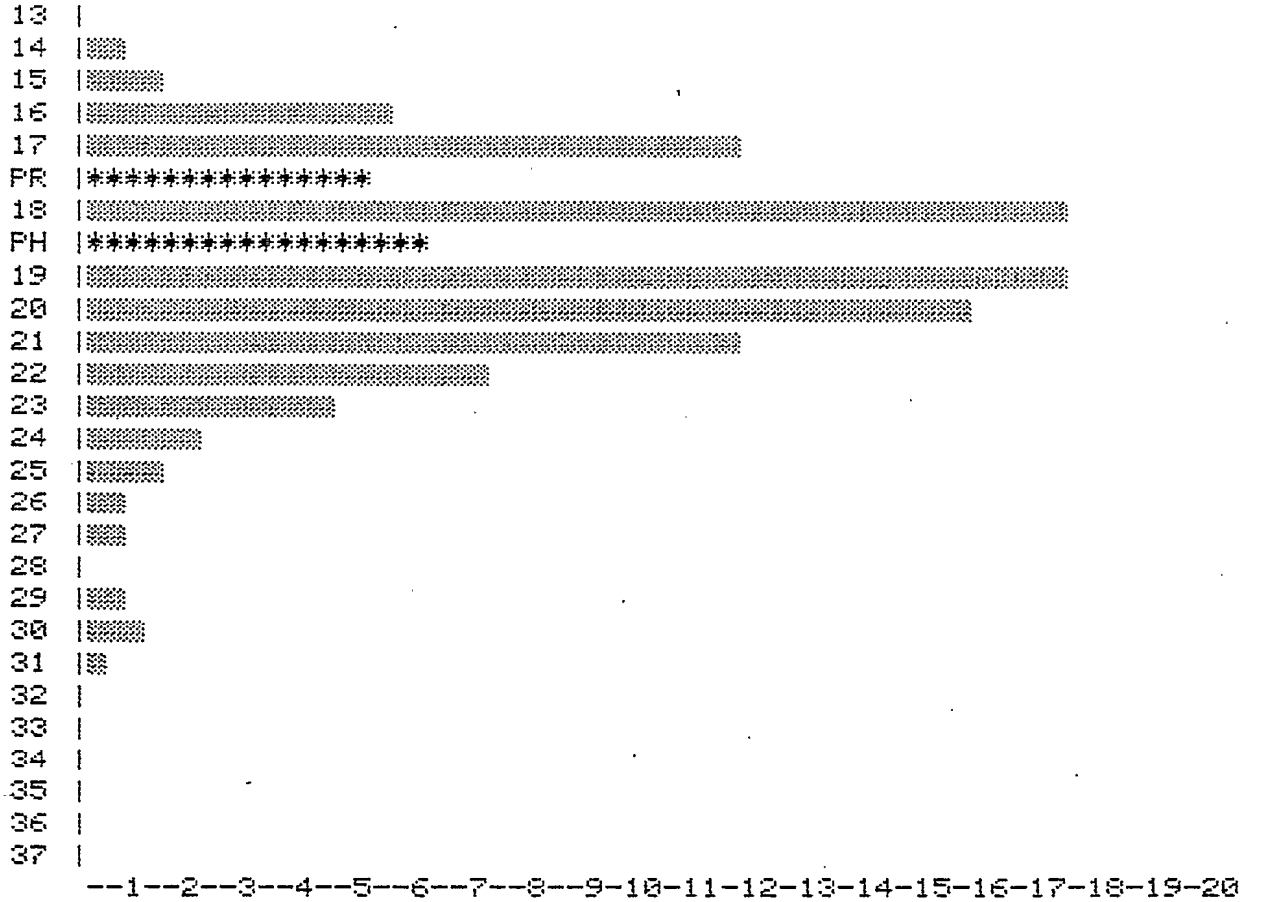
CARBON PREFERENCE INDEX (C-23 TO C-33):

C.P.I. = 1.26

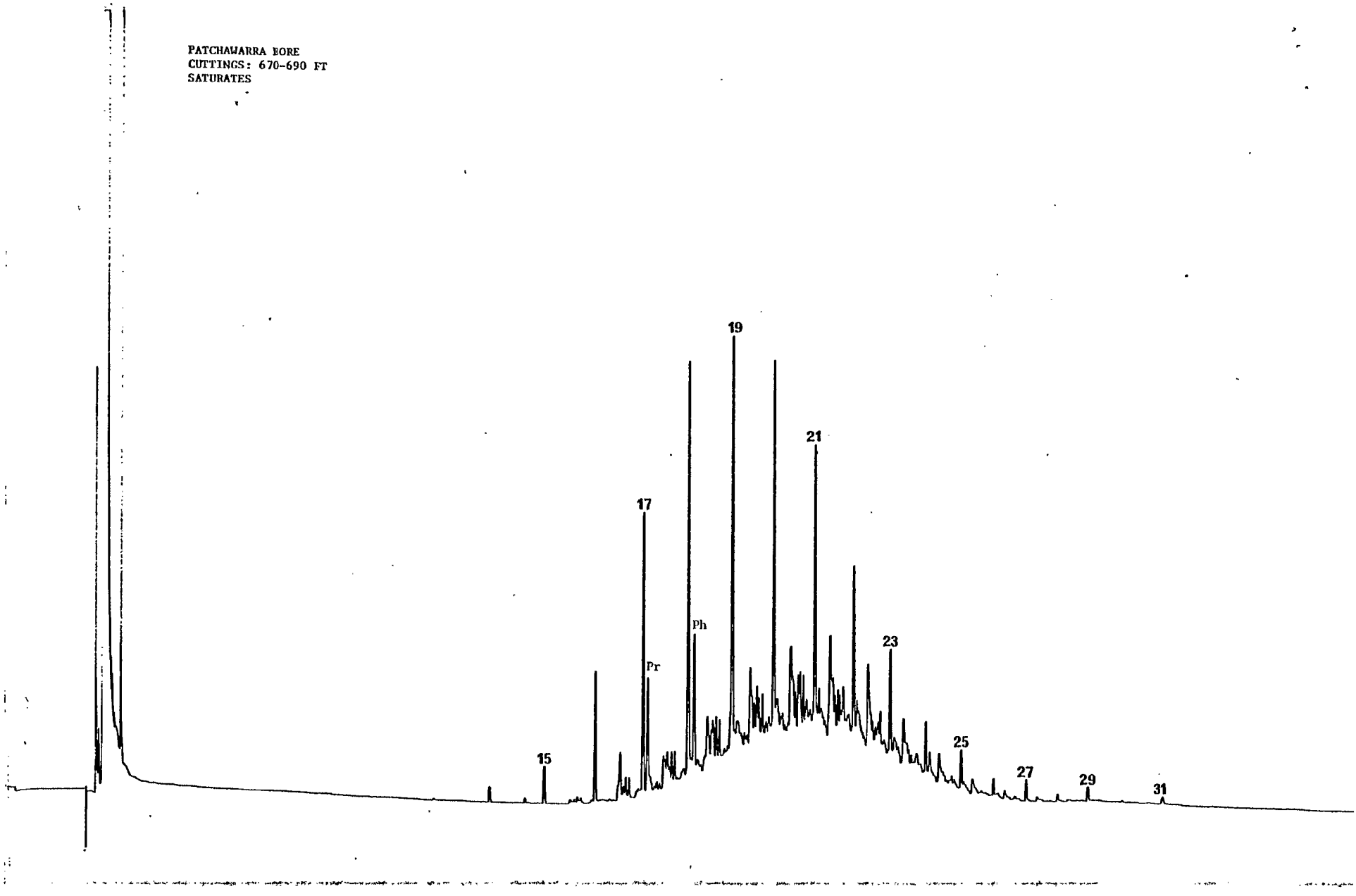
Note: 25.8 mg Sulphur extracted

PATCHAWARRA BORE
670-690 FT.

HISTOGRAM OF N-ALKANE DISTRIBUTION OF SATURATES



PATCHAWARRA BORE
CUTTINGS: 670-690 FT
SATURATES



SOURCE ROCK ANALYSIS

WELL: OODNADATTA BORE

SAMPLE: 250-263 FT.
TYPE OF SAMPLE: CUTTINGS

total organic carbon	2.82 %
weight of sample extracted	37 g
weight of eom	25.6 mg
extracted organic matter	692 ppm
eom as fraction of toc	24.5 mg/g

ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

ASPHALTENES	55.9
SATURATES	5.9
AROMATICS	.8
RESINS	18.0
LOSS ON COLUMN	19.5

N-ALKANE DISTRIBUTION OF SATURATES

C-NO.	%	C-NO.	%	C-NO.	%
13	.0	21	7.1	29	3.0
14	.8	22	4.8	30	.6
15	5.4	23	3.5	31	.8
16	12.5	24	1.9	32	.2
17	16.1	25	2.2	33	.2
18	13.9	26	1.1	34	.0
19	12.9	27	2.0	35	.0
20	10.2	28	.8	36	.0
				37	0

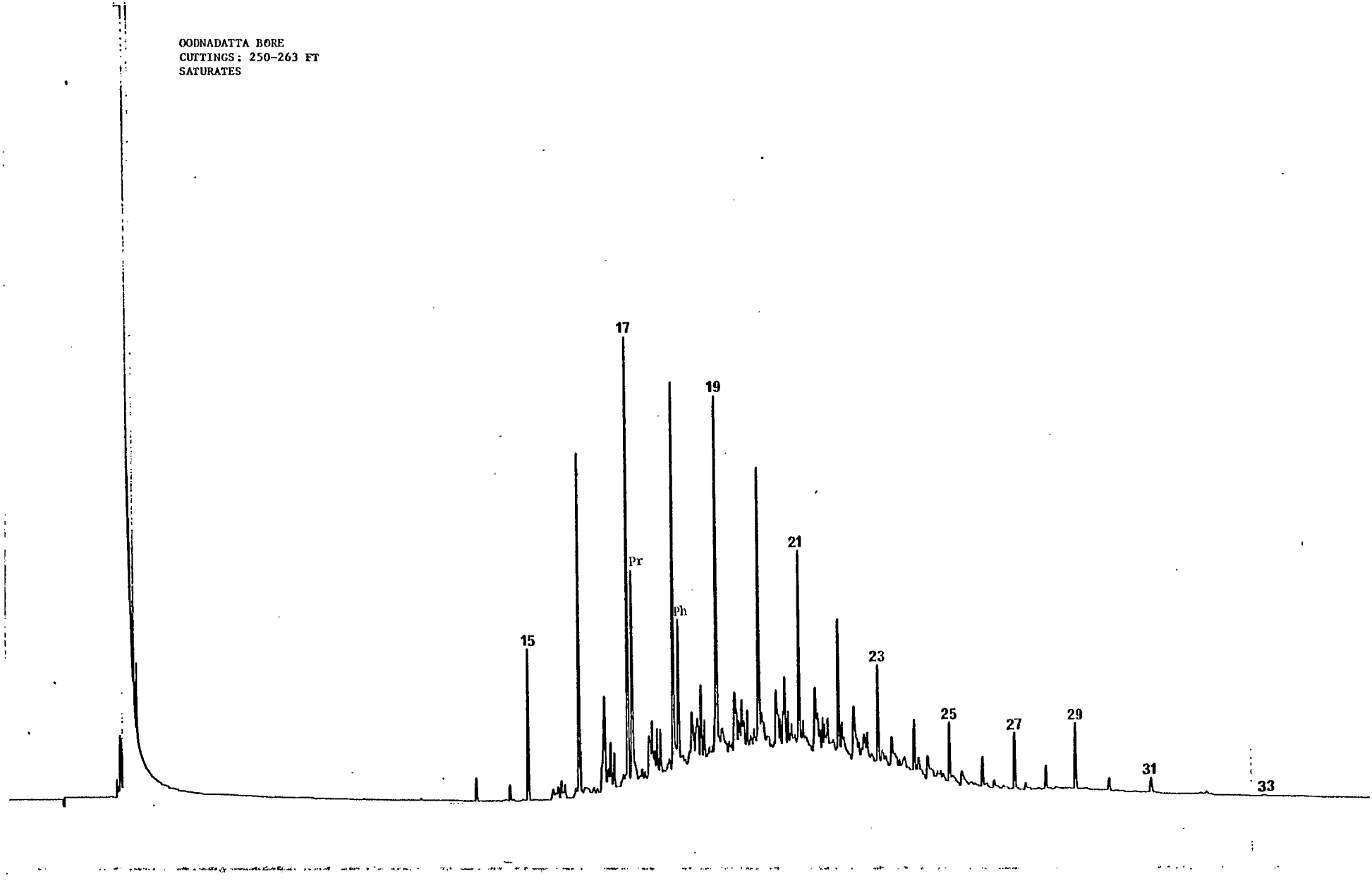
ISOPRENOID DISTRIBUTION IN SATURATES

pristane	7.67 %
phytane	5.27 %
pristane/phytane ratio	1.45
pristane/c-17 ratio	.48
phytane/c-18 ratio	.38

CARBON PREFERENCE INDEX (C-23 TO C-33):

C.P.I. = 2.38

Note: 0.3 mg Sulphur extracted


OODNADATTA BORE
CUTTINGS: 250-263 FT
SATURATES
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DELHI PETROLEUM PTY. LTD.
(INCORPORATED IN THE STATE OF SOUTH AUSTRALIA)
33 KING WILLIAM STREET, ADELAIDE
SOUTH AUSTRALIA 5000

REF: EXPL: 503/03

1st September, 1983

The Director General,
Department of Mines & Energy,
191 Greenhill Road,
PARKSIDE SA 5063

Attention: Mr. T.R. Watts

Dear Sir,

Please find enclosed a report by AMDEL on the analysis of the asphaltene fraction of extracted organic matter from three water bores, Cannuwaukinna, Patchawarra and Oodnadatta. This report is an appendix to the report entitled "Analysis of bitumen from three water bores in the Eromanga Basin" by P.J. Stanmore.

Bearing in mind the limited applications of the pyrolysis technique to the determination of maturation levels using the asphaltene fraction of the extracted organic matter (E.O.M.), the following generalized conclusions can be made.

1. A relationship exists between the level of maturation and the temperature of thermal cracking (Tmax). On this basis the Oodnadatta bitumen is too mature to be indigenous and accords with an origin at a level within the 'oil window'. This is confirmed by the comparison of the Tmax determined for Oodnadatta (432°) and Merrimelia oils (427-433°). Bitumen from the Cannuwaukinna and Patchawarra bores, on the other hand, are interpreted as early expulsion products from apparently immature near surface sediments.

2. In view of the reported oil occurence at a shallow level in the Santos Oodnadatta No. 1 well this analysis of a bitumen derived from a migrated oil in the Oodnadatta water bore supports the concept of a shallow oil play. The existence of any such accumulation and its size is at this stage conjectural.

3. Migration of oil from a mature source area to the Oodnadatta area is inferred from this study. A potential source is in the nearby Boorthana Trough, which is down-faulted along a major lineament to the southwest of Oodnadatta. This fault may have provided a conduit for migrating fluids which are now reservoired at shallow levels. Alternatively, long distance migration from the Poolowanna Trough area must be invoked to explain the presence of oil in this area.

Yours faithfully,
DELHI PETROLEUM PTY. LTD.

for O.W. NUGENT
Chief Geologist

PJS:OWN:bs

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DEPT. OF MINES AND ENERGY SECURITY

The Australian
Mineral Development
Laboratories

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

00090

amdel

15 June 1983

F3/51/0 - 6079/83

Delhi Petroleum Pty Ltd
GPO Box 2364
ADELAIDE SA 5001

Attention: Mr. Peter Stanmore

REPORT F 6079/83

YOUR REFERENCE:	Letter of 18/5/83.
MATERIAL:	Asphaltenes.
LOCALITY:	Cannuwaukaninna, Patchawarra and Oodnadatta.
IDENTIFICATION:	As tabulated in report.
DATE RECEIVED:	27/5/83.
WORK REQUIRED:	Rock-Eval Pyrolysis, Elemental Analysis.
Investigation and Report by:	Dr. R.E. Cox

Chief - Fuel Section: Dr. Brian Steveson
Manager, Mineral and Materials Sciences Division: Dr. William G. Spencer

Brian Steveson

for Norton Jackson
Managing Director

ch

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SECURITY

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ANALYSES OF ASPHALTENES IN ROCKS FROM CANNUWAUKANINNA, PATCHAWARRA AND OODNADATTA WATER BORES

1. METHODS

Asphaltenes from these rocks were subjected to Rock-Eval pyrolysis and elemental (C/H) analyses. For comparison, asphaltenes (arbitrarily selected) from EOM of Kuncherinna #1 rocks and from two oils Merrimelia #8 DST2 and Merrimelia #8 DST3 were also analysed.

2. RESULTS

Sample	T_{max}	S_1	S_2	S_3	%C	%H	HI
Pat. 570'	384	33.9	30.3	118.5	38.7	4.78	0.78
Pat. 590'	399	87.4	65.1	116.4	47.1	5.54	1.4
Pat. 630'	409	1.9	7.1	78.9	*	*	*
Pat. 670	386	5.4	1.2	55.9	*	*	*
Can. 80'	370	135.8	59.7	0.00	*	*	*
Can. 100'	+233	4.7	0.00	105.5	*	*	*
Can. 109'	393	82.8	124.0	94.0	52.8	5.51	2.4
Ood. 250'	432	146.6	199.6	108.1	57.1	7.25	3.5
Kun.2520'	409	108.1	241.2	43.7	54.5	5.84	4.4
Kun.4920'	412	119.8	239.2	50.5	70.1	6.24	3.4
Kun.8410'	444	105.2	214.0	36.2	67.0	5.30	3.2
Mer.#1DST2	433	269.7	172.1	63.4	81.8	8.74	2.1
Mer.#8DST3	427	75.6	227.5	91.6	78.9	6.76	2.9

\+ S_2 too low to obtain accurate T_{max}.

* Insufficient material for elemental analyses.

3. CONCLUSIONS

Figure 1. shows a plot of hydrogen index against T_{max} for the asphaltenes analogous to that used for source rock evaluation. We emphasize that we know of no literature data on the use of the Rock-Eval to study asphaltenes and of necessity we have little data to assist in interpretation. Nevertheless it is probably significant that the two

oil asphaltenes and the two deeper Kuncherinna asphaltenes (VR of Kerogen = 0.55% and 0.75% respectively) show high T_{max} values (>410°). It may be that ca 410° is the T_{max} value corresponding to the 'oil window' for asphaltenes. On this basis the only asphaltene from the 3 water bore rocks that shows maturity is that from Oodnadatta 250'. The other asphaltenes show low T_{max} values and low hydrogen indices probably indicating immature, mainly inertinite-derived asphaltenes.

This suggests that the asphaltenes from Patchawarra and Cannuwaukaninna rocks are truly indigenous to their rocks while that from Oodnadatta is too mature to be indigenous. The latter asphaltene could well arise from oil seeping through or into this interval. Note that the saturates of the EOM of this rock show a large n-alkane carbon preference index but this could be due to indigenous immature material present along with the mature asphaltene.

This limited amount of data raises two other questions:
(a) do oils migrating through kerogen-lean intervals at mature depths leave behind asphaltenes detectable by Rock-Eval pyrolysis,
(b) is there a direct correlation between the HI and T_{max} values of oil asphaltenes and the asphaltenes of their source rocks?

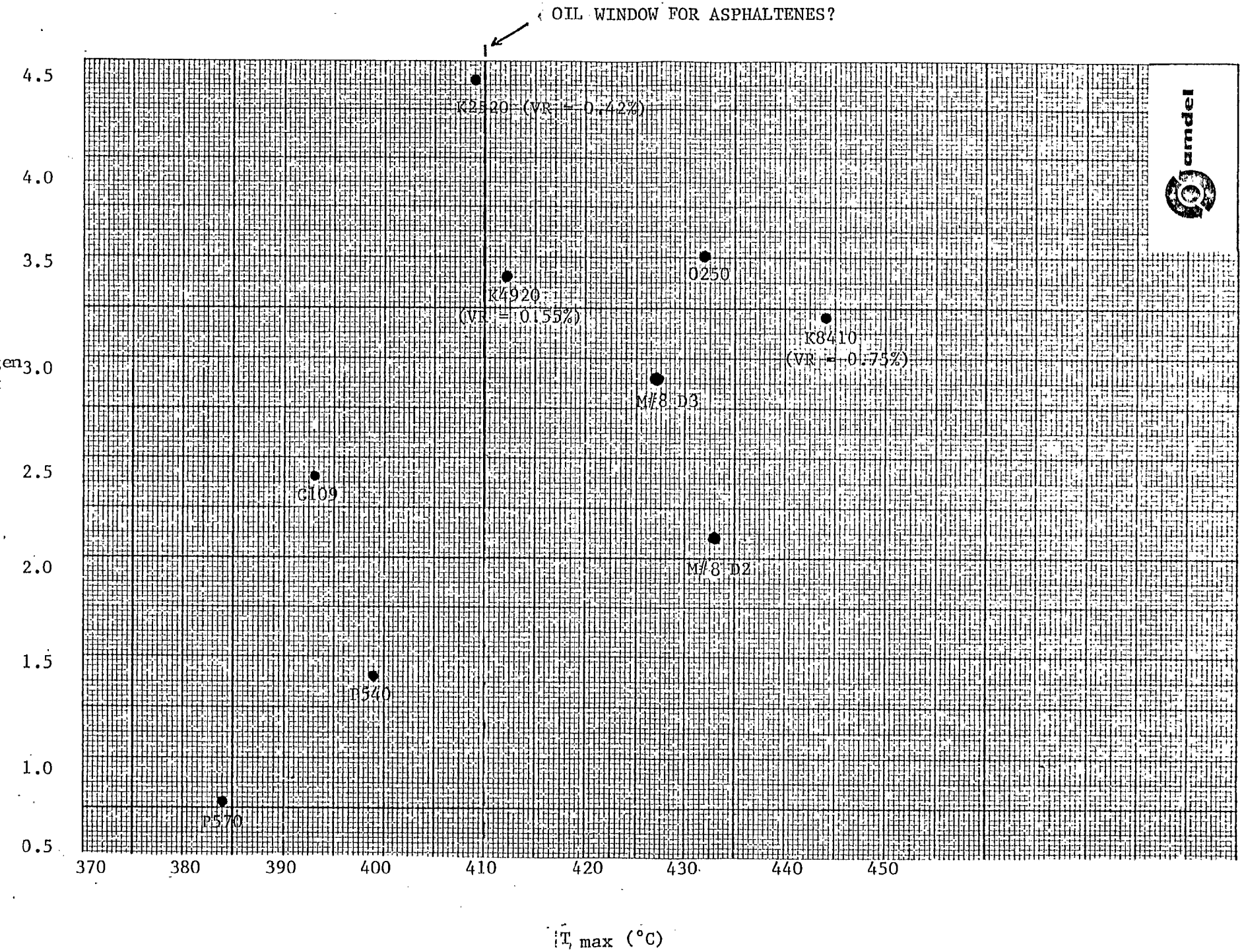

FIGURE 1.

00094

→ D. Graves book ✓

→ Lidl File
Hydrocarbon analyses
Water bores/mound springs
Eromanga Basin.

DELHI PETROLEUM PTY. LTD.
(INCORPORATED IN THE STATE OF SOUTH AUSTRALIA)
33 KING WILLIAM STREET, ADELAIDE
SOUTH AUSTRALIA 5000

April 15, 1983

REF: 503/03

The Director General
Department of Mines & Energy
191 Greenhill Road
PARKSIDE S.A. 5063

Attn: Mr. T.R. Watts

The General Manager,
South Australian Oil & Gas
Corporation Pty. Ltd.
226 Melbourne Street
NORTH ADELAIDE S.A. 5006

Attn: Miss B.C. Youngs

The Managing Director,
SANTOS Limited,
39 Grenfell Street,
ADELAIDE, S.A. 5000

Attn: Mr. A.J. Wright

The Exploration Manager,
Western Mining Corporation
Exploration Division - Petroleum,
168-9 Greenhill Road,
PARKSIDE S.A. 5063

Attn: Mr. C.R. Porter

The General Manager,
Vamgas Ltd.
459 Collins Street
MELBOURNE VIC 3000

Attn: Mr. L.G. Pearce

Madam and Gentlemen,

Please find enclosed a report entitled "Analysis of bitumen from three water bores in the Eromanga Basin" by P.J. Stanmore. The report deals with the geochemistry of nine cuttings samples collected from the Cannuwaukaninna, Patchawarra and Oodnadatta bores, the results of which confirmed the presence of a bituminous residue at shallow depths.

A study of the results has indicated that additional data is required to define the exact nature of these bitumens. It is proposed therefore that further analyses be performed by AMDEL on the asphaltene fraction of the extracted organic matter (EOM) retained from the analyses reported herein. The hydrogen and oxygen to carbon ratios and the temperature of hydrocarbon cracking (Tmax) of pyrolysed samples would be determined.

.../2

From these data it is possible to estimate the maturity and type of oil from which these bitumens were derived. Using this technique, it is possible to determine the likely level of generation of the original oil. Five to six samples would be analysed and the results interpreted by AMDEL for an approximate total cost of only $500.

Yours very truly,
DELHI PETROLEUM PTY. LTD.

for O.W. Nugent,
Chief Geologist

PJS/OJWB/OWN:bds

(encl.)