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ANNUAL REPORT, YEAR 3, T20P

OTWAY BASIN

TASMANIA

FOR

VAN DIEMENS LAND RESOURCES N.L. CONSORTIUM.

OCTOBER, 1984.

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Australian Mineral Development Laboratories,  
August, 1984.

## INTRODUCTION

This report relates to exploration undertaken by Van Diemens Land Resources N.L., Operator of the group which holds title to T20P, for the period September 11, 1983 to September 10, 1984.

## GEOLOGICAL

During the last quarter AMDEL were analysing cuttings and core samples from Flaxmans -1, Mussel -1, Nautilus -1, Pecten -1 and Prawn -1A. The results are available and copies of the two reports are enclosed as Appendicies 1 and 2.

- (1) The Upper Cretaceous in the Eastern Otway Basin is immature for hydrocarbon generation.
- (2) The dominantly non-marine organic matter is a poor hydrocarbon source, notable exceptions being two samples at Prawn -1A at 9860' and 10210-10220' from the Lower Cretaceous, Otway Group. Both cutting samples are in sandy sections and were thought to be biodegraded reservoir bitumen or be contaminated by pipe-dope.

In the case of the 9860-70' sample, Core 14, two samples, from 9850' to 9873' were submitted for examination. The August report from AMDEL indicates that the C<sub>15+</sub> encountered in the cuttings analyses were not noted in the core. A reasonable explanation is that pipe-dope caused the cuttings anomalies, although the core and cuttings samples may not have been coincident.

## GEOPHYSICAL

The major review of seismic data in the permit area was not complete at the end of the report period. This work, in conjunction with the geochemical work will be used to determine the exploration course following the failure of the Granada Group to generate data by drilling of the Abalone Prospect on Vic P16. This prospect straddles the boundary between Vic P16 and T20P.

THIRD YEAR EXPENDITURE

QUARTER	LEASE FEES (RENT)	OFFICE OVERHEADS	GEOLOGICAL GEOPHYSICAL
11/9-10/12/83	-	600	700
11/12/83-10/3/84	1125	300	1534
11/3-10/6/84	259	300	1714
11/6-10/9/84	-	600	6633
	\$1184	\$1800	\$10581

A summary of expenditure on the permit to date is :-

YEAR	EXPENDITURE		WORK PROGRAMME
	Required	Actual	
First	\$100,000	\$18,809	Data Review
Second	\$200,000	\$ 4,760	Seismic Survey
Third	\$2,400,000	\$13,565	Well No. 1
		<u>\$37,134</u>	

WORK PROGRAMME YEAR 4

Exploration on the permit suffered a set-back when a farmout to drill a well was not consumated on Vic P16. If the present seismic interpretation does not reveal major structural targets and demonstrate that Prawn - 1A was well downdip, it is likely that the permit will be recommended for relinquishment by the Operator. In the event there is considerable encouragement, a detailed work programme will be submitted before the end of the First Quarter, Year 4.

HYDROCARBON SOURCE POTENTIAL OF SELECTED  
ROCK SAMPLES FROM FIVE EXPLORATION WELLS,  
EASTERN OTWAY BASIN

Bass Strait Oil & Gas (Holdings) N.L.

F3/0/0-6901/84

July, 1984

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8. Cutting Saturates – Prawn No.A1 9860ft
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**The Australian  
Mineral Development  
Laboratories**

# amdel

18 July 1984

F3/0/0  
6901/84

Bass Strait Oil & Gas (Holdings) NL,  
67-69 Palmerston Crescent,  
SOUTH MELBOURNE Vic. 3205

Attention: Mr Richard Ingram

REPORT F6901/84

CLIENT REFERENCE: Letter dated 28 May 1984

TITLE: Hydrocarbon source potential of  
selected rock samples from five  
exploration wells, eastern Otway Basin.

MATERIAL: Cuttings, core

LOCALITIES: FLAXMANS-1, MUSSEL-1, NAUTILUS-1,  
PECTEN-1, PRAWN-A1

SAMPLE IDENTIFICATION: As specified in report

DATE RECEIVED: 28 May 1984

WORK REQUIRED: Total organic carbon. Rock-Eval pyrolysis.  
Liquid chromatography of extract. Gas  
chromatography of saturates. Kerogen  
isolation and analysis by pyrolysis-  
gas chromatography. Interpretation.

Investigation and Report by: Dr David M. McKirdy

Chief - Fuels Section: Dr Brian G. Steveson

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## 1. INTRODUCTION

Nineteen cuttings and one core sample from five petroleum exploration wells in the eastern Otway Basin were received for source rock analysis (Table 1). The resulting analytical data are used to assess the hydrocarbon generating potential (maturity, source richness, kerogen type) of the rocks sampled.

## 2. ANALYTICAL PROCEDURES

### 2.1 Sample Preparation

The rock samples (as received) were ground in a Siebtechnik mill for 20-3 secs.

### 2.2 Total Organic Carbon (TOC)

Total organic carbon was determined by digestion of a known weight (0.2-0.5 g) of powdered rock in 50% HCl to remove carbonates, followed by combustion in oxygen in the induction furnace of a Leco IR-12 Carbon Determinator and measurement of the resultant CO<sub>2</sub> by infra-red detection.

### 2.3 Rock-Eval Analysis

A 100 mg portion of powdered rock was analysed by the Rock-Eval pyrolysis technique (Girdel IFP-Fina Mark 2 instrument; operating mode, Cycle 1).

### 2.4 Extractable Organic Matter (EOM)

Powdered rock (10-60 g) was extracted with methylene chloride/methanol (85:15) in a Soxhlet apparatus for 24 hrs. Removal of solvent by careful rotary evaporation gave the crude extract (nominally C<sub>15+</sub> EOM).

### 2.5 Liquid Chromatography

Asphaltenes were precipitated from the extract with petroleum ether (IP method 143/57), and the asphaltene-free fraction separated into saturated hydrocarbons, aromatic hydrocarbons and polar compounds (resins) by liquid chromatography on 20 parts activated alumina under 80 parts activated silica gel. The saturates were eluted with petroleum ether, the aromatics with petroleum ether/methylene chloride (91:9), and the resins with methanol/methylene chloride (65:35) followed by methanol.

### 2.6 Gas Chromatography

The saturated hydrocarbons (alkanes) were examined by gas chromatography using the following instrumental parameters:

Gas chromatograph:	Perkin Elmer Sigma 2 fitted with Grob injector.
Column:	25 m x 0.33 mm fused silica, SGE QC3/BP1
Detector:	FID
Injector and detector temperature:	280°C
Carrier gas:	H <sub>2</sub> at 9 psi
Column temperature:	80°C for 4 mins, then 5° per minute to 295°C and held at 295° until all peaks eluted.
Quantitation:	Relative concentrations of individual normal and isoprenoid alkanes obtained by measurement of peak areas with a Spectra-Physics SP4270 integrator.

## 2.

2.7 Kerogen Isolation

Solvent-extracted rock powder was digested in 5N HCl on a steam bath, with occasional agitation, for 1-2 hours. The carbonate-free residue was then washed thoroughly with distilled water, before acid digestion in conc. HF/HCl (5:1) for 2-3 hours. The spent acid was carefully decanted and the residue washed in distilled water until neutral. The kerogen concentrate was then dried in air at 50°C.

2.8 Pyrolysis-Gas Chromatography (PGC)

The kerogen concentrate was analysed by pyrolysis-gas chromatography (PGC), as follows:

Instrument:	Chemical Data Systems Pyroprobe 120 solids pyrolyser (incorporating 382 extended temperature programming option), in tandem with Perkin Elmer Sigma 3 gas chromatograph.
Column:	25 m x 0.33 mm fused silica SGE QC3/BP1
Carrier gas:	He at 36 cm/sec
Detector:	FID
Injector and detector temperature:	280°C
Sample size:	5 mg
Pyrolysis temperature:	700°C for 30 sec.
Column temperature:	-40°C while trapping pyrolysate on front end of column; then 10°C for 3 min, 10-280°C at 5°/min, and held at 280°C.

## 3. RESULTS

TOC and Rock-Eval data on Flaxmans-1, Mussel-1, Nautilus-1, Pecten-1 and Prawn-A1 are listed in Tables 2-6, respectively. Figures 1-5 are cross plots of hydrogen index versus Tmax which demonstrate kerogen type and maturity for the sample suite from each of these wells.

EOM data on five samples from Flaxmans-1, Pecten-1 and Prawn-A1 high-graded by Rock-Eval analysis are presented in Tables 7-11, Figures 6-10 (saturates chromatograms) and Figures 11-15 (n-alkane and isoprenoid distributions).

Kerogen PGC data are summarised in Table 12 and plotted in Figure 16. Figures 17-20 are PGC traces of the four kerogens analysed.

## 3.

## 4. DISCUSSION

## 4.1 Maturity

Rock-Eval pyrolysis data (Figs. 1-5) provide the following estimates of thermal maturity, expressed as vitrinite reflectance (VR):

Well	Interval ft	Tmax °C	Equiv. VR %
Flaxmans-1	8950-10360	440-451	0.6-0.9
Mussel-1	4680-8030	421-435	<0.5
Nautilus-1	5950-6950	429	<0.5
Pecten-1	8010-9330	443-444	~0.7
Prawn-A1	9860-10290	425-437	0.4-0.6

These results are in reasonable to good agreement with published VR data for Pecten-1, Mussel-1 and Nautilus-1 (Middleton & Falvey, 1983).

The principal rank thresholds for hydrocarbon generation from terrigenous organic matter (after Snowdon & Powell, 1982; Powell & Snowdon, 1983; and Monnier *et al.*, 1983) are as follows:

Threshold	VR %
top oil window (resinite-rich)	0.45
top gas window	0.6
top oil window (resinite-poor)	0.7

Oil generation from algal and/or bacterial organic matter commences at VR = 0.5%.

Thus, only one of the samples analysed herein (viz. Flaxmans-1, 10350-10400 ft) comes from within the main zone of oil generation for terrigenous organic matter.

The low proportion of hydrocarbons (<30% of EOM) in the five rock extracts (Tables 7-11) also, in part, reflects this lack of maturity.

## 4.2 Source Richness

Three quarters of the samples examined have total organic carbon contents (Table 2) which exceed the minimum value (TOC = 0.5%) commonly considered necessary for the generation and expulsion of producible quantities of hydrocarbons from a fine-grained siliciclastic rock (shale, siltstone). TOC values greater than 2% probably indicate the presence of coal in the cuttings.

## 4.

Source richness is in most cases poor, as indicated by potential hydrocarbon yields ( $S_1 + S_2$ ) of less than 2 kg/tonne. However, the following samples have  $S_1 + S_2$  values characteristic of fair to good oil-source rocks:

Well	Depth ft	$S_1 + S_2$ kg h'c/tonne	Richness
Flaxmans-1	9650-9680	11.0	good
Pecten-1	8010-8050	2.1	fair
Prawn-A1	9860	4.7	fair
	10210-10220	2.7	fair
	10280-10290	4.6	fair

#### 4.3 Source Quality and Kerogen Type

Hydrogen indices in the range  $HI = 0-190$  (Table 2) suggest that these rocks contain organic matter of humic Type III, tending to inertinitic Type IV, composition (Figs. 1-5).

Low hydrogen index values ( $HI < 100$ ) generally correlate with the presence of dry gas-prone, inertinite-rich dispersed organic matter (DOM).

Four samples appear to contain Type III kerogen which has significant liquids-generating potential. They are as follows:

Well	Depth ft	Hydrogen Index mg $S_2$ /g TOC
Flaxmans-1	9650-9680	186
Prawn-A1	9860	176
	10210-10220	189
	10280-10290	179

The oil and gas-prone character of these kerogens is demonstrated by their PGC traces (Figs. 17-20). The pyrolysate of all four kerogens contains a high proportion of  $C_{15+}$  n-alkenes/n-alkanes (Table 12). The somewhat more oil-prone nature of the Flaxmans-1 (9650-9680 feet) and Prawn-A1 (10280-10290 feet) kerogens (Fig. 16) is reflected in the higher abundance of n-alkyl moieties relative to aromatic products (labelled A).

The terrigenous (land-plant) source affinity of these kerogens, and of kerogen in the Pecten-1 (8010-8050 feet) sample, is confirmed by the high pristane/phytane ratios of their associated EOM ( $pr/ph = 3-8$ ; Tables 7-11). The lower pristane/phytane ratios ( $pr/ph \sim 2$ ) of the Prawn-A1 (9860-9870 and 10210-10220 feet) extracts correlate with anomalously high  $C_{15+}$  hydrocarbon yields (83-100 mg/g TOC) and the occurrence of prominent naphthene humps in the saturates chromatograms (Tables 9 and 10, Figs. 8 and 9). Both these samples are from sandy intervals and may contain partially biodegraded reservoir bitumen. Alternatively, they may be contaminated (e.g. by pipe dope).

## 5. CONCLUSIONS AND RECOMMENDATIONS

1. Preliminary source-rock analysis of Cretaceous sediments from five wells in the eastern Otway Basin indicates that the well sections sampled, viz.

Flaxmans-1	5510-10050 feet
Mussel-1	4680-8030 feet
Nautilus-1	5950-6950 feet
Pecten-1	6930-9330 feet
Prawn-A1	9860-10290 feet

all lie above the top of the oil-generation window for resinite-poor terrigenous organic matter. One Otway Group sample from below 10300 feet depth in Flaxmans-1 is oil-mature.

2. Siliciclastics represented by the cuttings and core examined generally contain poor quality, gas-prone terrigenous organic matter.
3. Notable exceptions are carbonaceous shale and siltstone from Flaxmans-1 (9650-9680 feet) and Prawn-A1 (9860 and 10210-10290 feet) in which oil and gas-prone, woody-herbaceous, Type III kerogen (HI ~180 mg hydrocarbons/g TOC) is present. This particular organic facies, where it has attained somewhat higher levels of thermal maturity than exist at these two well localities, is a potential source of waxy paraffinic oil of the type found in Port Campbell-4.
4. The foregoing conclusions are based on only twenty spot samples from five exploration wells. Such sampling is totally inadequate and cannot be regarded as a valid assessment of the hydrocarbon source potential of the Cretaceous section in this part of the Otway Basin.
5. It is recommended that a more comprehensive program of source-rock screening by Rock-Eval pyrolysis be undertaken on cuttings from Flaxmans-1, Mussel-1, Pecten-1 and Prawn-A1, paying particular attention to the Otway Group (Eumeralla Formation). Samples high-graded by Rock-Eval analysis should also be subjected to organic petrological examination in order to establish the abundance and identity of the oil-prone liptinite (exinite) macerals.

## 6. REFERENCES

- MIDDLETON, M.F., and FALVEY, D.A., 1983. Maturation modeling in Otway Basin, Australia. *Bull. Am. Assoc. Petrol. Geol.*, 67, 271-279.
- MONNIER, F., POWELL, T.G., and SNOWDON, L.R., 1983. Qualitative and quantitative aspects of gas generation during maturation of sedimentary organic matter. Examples from Canadian frontier basins. In: BJOROY, M. *et al.* (eds), *Advances in Organic Geochemistry 1981*, Wiley, Chichester, pp.487-495.
- POWELL, T.G., and SNOWDON, L.R., 1983. A composite hydrocarbon generation model - implications for evaluation of basins for oil and gas. *Erdöl und Kohle*, 36 (4), 163-170.

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SNOWDON, L.R., and POWELL, T.G., 1982. Immature oil and condensate - modification of hydrocarbon generation model for terrestrial organic matter. *Bull. Am. Assoc. Petrol. Geol.*, 66, 775-788.

TABLE 1: WELLS AND INTERVALS SAMPLED FOR SOURCE ROCK ANALYSIS

Well	Interval Sampled ft
Flaxmans-1	5510-5530
	8090-8150
	8950-9350
	9650-9680
	9950-10050
	10350-10400
Mussel-1	4680-4910
	7150-7210
	7730-7910
	7980-8030
Nautilus-1	5950-6950
Pecten-1	6930-6960
	8010-8050
	9230-9330
Prawn-A1	*9860
	9900-9910
	9940-9950
	10120-10130
	10210-10220
	10280-10290

\*Core; all other samples cuttings

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TABLE 2

AMDEL

Page 1

ROCK-EVAL PYROLYSIS

29/05/84

Client BASS STRAIT OIL AND GAS

Well FLAXMANS #1

DEPTH	T MAX	S1	S2	S3	S1+S2	PI	S2/S3	PC	TOC	HI	OI
5510.00	428	0.38	1.28	1.10	1.66	0.23	1.16	0.13	1.83	70	60
8090.00	361	0.03	0.05	0.23	0.08	0.37	0.21	0.00	0.25	20	92
8950.00	443	0.01	0.03	0.21	0.04	0.25	0.14	0.00	0.37	8	57
9650.00	440	0.88	10.15	0.35	11.03	0.08	29.00	0.91	5.45	186	6
9950.00	330	0.01	0.03	0.21	0.04	0.25	0.14	0.00	0.31	10	68
10350.00	451	0.04	0.16	0.19	0.20	0.20	0.84	0.01	0.35	46	54

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TABLE 3

AMDEL

Page 1

ROCK-EVAL PYROLYSIS

29/05/84

Client BASS STRAIT OIL AND GAS

Well MUSSEL #1

DEPTH	T MAX	S1	S2	S3	S1+S2	PI	S2/S3	PC	TOC	HI	OI
4680.00	435	0.08	0.35	0.75	0.43	0.19	0.46	0.03	1.00	35	75
7150.00	421	0.11	0.44	1.16	0.55	0.20	0.37	0.04	1.03	43	113
7730.00	429	0.09	0.45	0.89	0.54	0.17	0.50	0.04	1.35	33	66
7980.00	428	0.54	1.22	0.96	1.76	0.31	1.27	0.14	1.70	72	56

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TABLE 4

AMDEL

Page 1

ROCK-EVAL PYROLYSIS

29/05/84

Client BASS STRAIT OIL AND GAS

Well NAUTILUS #1

DEPTH	T MAX	S1	S2	S3	S1+S2	PI	S2/S3	PC	TOC	HI	OI
5950.00	429	0.07	0.44	0.90	0.51	0.14	0.48	0.04	1.16	38	78

AMDEL

## ROCK-EVAL PYROLYSIS

16/07/84

Client BASS STRAIT OIL AND GAS

Well PECTEN #1

DEPTH	T MAX	S1	S2	S3	S1+S2	PI	S2/S3	PC	TOC	HI	OI
6930.00	455	0.03	0.00	0.27	0.03	1.00	0.00	0.00	0.25	0	108
8010.00	443	0.10	1.97	0.31	2.07	0.05	6.35	0.17	1.76	112	18
9230.00	444	0.03	0.34	0.26	0.37	0.08	1.30	0.03	0.63	54	41

AMDEL

## ROCK-EVAL PYROLYSIS

29/05/84

Client	BASS STRAIT OIL AND GAS										
Well	PRAWN #A1										
DEPTH	T MAX	S1	S2	S3	S1+S2	PI	S2/S3	PC	TOC	HI	OI
9860.00	425	1.09	3.60	0.66	4.69	0.23	5.45	0.39	2.04	176	32
9900.00	427	0.20	0.84	0.58	1.04	0.19	1.44	0.08	0.71	118	82
9940.00	433	0.06	0.52	0.55	0.58	0.10	0.94	0.04	0.70	74	79
10120.00	437	0.11	0.78	0.58	0.89	0.12	1.34	0.07	1.07	73	54
10210.00	429	0.42	2.23	0.48	2.65	0.16	4.64	0.22	1.18	189	41
10280.00	437	0.17	4.44	0.51	4.61	0.04	8.70	0.38	2.48	179	21

KEY TO ROCK-EVAL PYROLYSIS DATA SHEET

<u>PARAMETER</u>	<u>SPECIFICITY</u>
T max      position of S <sub>2</sub> peak in temperature program (°C)	Maturity/Kerogen type
S <sub>1</sub> kg hydrocarbons (extractable)/tonne rock	Kerogen type/Maturity/Migrated oil
S <sub>2</sub> kg hydrocarbons (kerogen pyrolysate)/tonne rock	Kerogen type/Maturity
S <sub>3</sub> kg CO <sub>2</sub> (organic)/tonne rock	Kerogen type/Maturity *
S <sub>1</sub> + S <sub>2</sub> Potential Yield	Organic richness/Kerogen type
PI         Production Index (S <sub>1</sub> /S <sub>1</sub> + S <sub>2</sub> )	Maturity/Migrated Oil
PC         Pyrolysable Carbon (wt. percent)	Organic richness/Kerogen type/Maturity
TOC        Total Organic Carbon (wt. percent)	Organic richness
HI         Hydrogen Index (mg h'c (S <sub>2</sub> )/g TOC)	Kerogen type/Maturity
OI         Oxygen Index (mg CO <sub>2</sub> (S <sub>3</sub> )/g TOC)	Kerogen type/Maturity *

\*Also subject to interference by CO<sub>2</sub> from decomposition of carbonate minerals.

TABLE 7

**AMDEL  
SOURCE ROCK ANALYSIS**

WELL: FLAXMANS NO.1

SAMPLE: 9650 FT

TYPE OF SAMPLE: CUTTINGS

total organic carbon	5.45 %
weight of sample extracted	33.93 g
weight of eom	229.8 mg
extracted organic matter	6773 ppm
eom as fraction of toc	124.3 mg/g

## ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

SATURATES	13.8
AROMATICS	4.4
RESINS	17.8
ASPHALTENES	63.9

## N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	1.6	17	10.0	22	6.1	27	1.7	32	.0
13	4.0	18	9.4	23	5.3	28	.8	33	.0
14	7.0	19	9.1	24	3.9	29	.5	34	.0
15	9.6	20	7.9	25	3.4	30	.3	35	.0
16	10.1	21	7.0	26	2.1	31	.2	36	.0

## ISOPRENOID RATIOS

TMTD/pristane ratio	.52
norpristane/pristane ratio	.27
pristane/phytane ratio	7.74
pristane/C-17 ratio	.67
phytane/C-18 ratio	.09

TABLE 8

**AMDEL**  
**SOURCE ROCK ANALYSIS**

WELL: PECTEN NO.1

SAMPLE: 8010 FT  
TYPE OF SAMPLE: CUTTINGS

total organic carbon	1.76 %
weight of sample extracted	56.82 g
weight of eom	126.8 mg
extracted organic matter	2232 ppm
eom as fraction of toc	126.8 mg/g

## ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

SATURATES	5.1
AROMATICS	3.5
RESINS	16.6
ASPHALTENES	74.8

## N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	3.7	17	12.1	22	2.7	27	1.4	32	.0
13	8.6	18	8.1	23	2.7	28	.5	33	.0
14	12.9	19	5.7	24	2.0	29	.5	34	.0
15	14.5	20	3.9	25	2.2	30	.2	35	.0
16	14.0	21	3.1	26	1.2	31	.1	36	.0

## ISOPRENOID RATIOS

TMTD/pristane ratio	.59
norpristane/pristane ratio	.26
pristane/phytane ratio	6.38
pristane/C-17 ratio	.99
phytane/C-18 ratio	.23

TABLE 9

**AMDEL**  
**SOURCE ROCK ANALYSIS**

WELL: PRAWN NO. A1

SAMPLE: 9860 FT

TYPE OF SAMPLE: CUTTINGS

total organic carbon	2.04 %
weight of sample extracted	15.97 g
weight of eom	147.7 mg
extracted organic matter	9249 ppm
eom as fraction of toc	453.4 mg/g

## ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

SATURATES	13.3
AROMATICS	5.0
RESINS	23.1
ASPHALTENES	58.6

## N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	.1	17	5.0	22	8.8	27	6.4	32	.7
13	.4	18	6.0	23	6.7	28	4.1	33	1.0
14	1.0	19	7.6	24	6.0	29	4.2	34	.4
15	1.9	20	9.7	25	6.2	30	2.5	35	.2
16	3.2	21	10.4	26	5.9	31	1.6	36	.0

## ISOPRENOID RATIOS

TMTD/pristane ratio	.22
norpristane/pristane ratio	.34
pristane/phytane ratio	2.17
pristane/C-17 ratio	1.02
phytane/C-18 ratio	.39

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

C.P.I. = 1.23

TABLE 10

**AMDEL**  
**SOURCE ROCK ANALYSIS**

WELL: PRAWN NO.A1

SAMPLE: 10210 FT

TYPE OF SAMPLE: CUTTINGS

total organic carbon	1.18 %
weight of sample extracted	9.83 g
weight of eom	44.6 mg
extracted organic matter	4537 ppm
eom as fraction of toc	384.5 mg/g

## ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

SATURATES	17.7
AROMATICS	8.3
RESINS	39.9
ASPHALTENES	34.1

## N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	.2	17	9.4	22	6.8	27	4.1	32	.5
13	.7	18	8.9	23	5.8	28	3.0	33	.9
14	2.1	19	8.8	24	4.7	29	2.5	34	.4
15	4.1	20	10.9	25	4.3	30	1.2	35	.3
16	7.3	21	7.6	26	4.3	31	1.0	36	.2

## ISOPRENOID RATIOS

TMTD/pristane ratio	.15
norpristane/pristane ratio	.40
pristane/phytane ratio	1.86
pristane/C-17 ratio	.84
phytane/C-18 ratio	.48

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

C.P.I. = 1.15

TABLE 11

**AMDEL**  
**SOURCE ROCK ANALYSIS**

WELL: FRAWN NO. A1

SAMPLE: 10280 FT  
TYPE OF SAMPLE: CUTTINGS

total organic carbon	2.48 %
weight of sample extracted	10.91 g
weight of eom	24.2 mg
extracted organic matter	2218 ppm
eom as fraction of toc	89.4 mg/g

## ANALYSIS OF EXTRACTED ORGANIC MATTER, (%)

SATURATES	14.3
AROMATICS	8.2
RESINS	4.4
ASPHALTENES	73.1

## N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	.1	17	10.6	22	6.7	27	3.3	32	.2
13	.6	18	9.9	23	6.4	28	1.7	33	.5
14	2.8	19	7.7	24	5.4	29	1.8	34	.0
15	6.7	20	8.1	25	5.3	30	.6	35	.0
16	10.3	21	7.1	26	3.6	31	.6	36	.0

## ISOPRENOID RATIOS

TMTD/pristane ratio	.19
nonpristane/pristane ratio	.29
pristane/phytane ratio	3.07
pristane/C-17 ratio	.93
phytane/C-18 ratio	.32

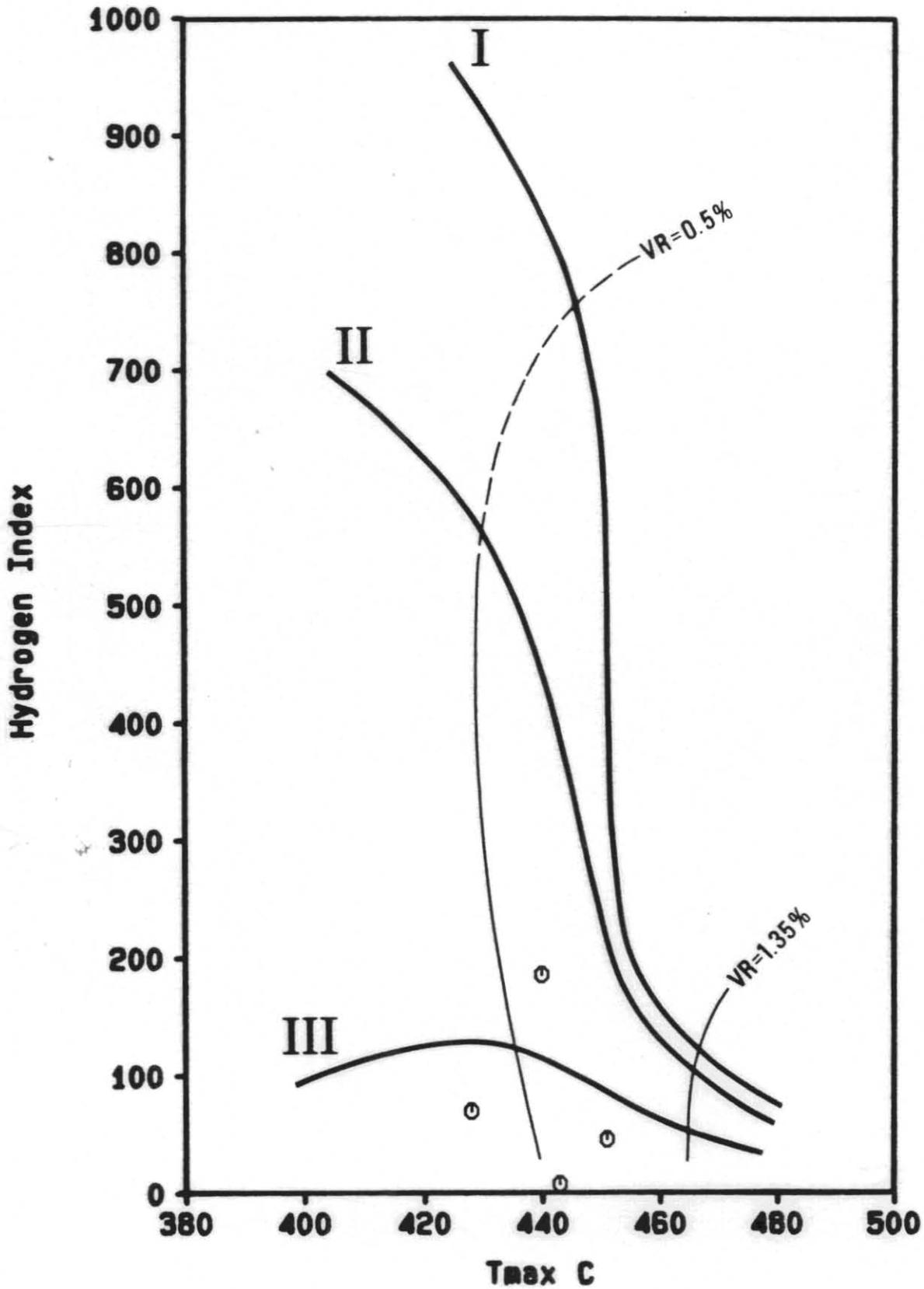
## CARBON PREFERENCE INDEX (C-23 TO C-33):

C.P.I. = 1.43

TABLE 12: PYROLYSIS-GC DATA ON KEROGEN CONCENTRATES FROM TWO EXPLORATION WELLS, EASTERN OTWAY BASIN

Well	Depth ft	TOC %	Kerogen concentrate %	Wt. loss after pyrolysis %	n-Alkenes + n-Alkanes			Toluene n-Heptene	m+p-Xylene n-Octene
					C <sub>5</sub> -C <sub>9</sub> %	C <sub>10</sub> -C <sub>14</sub> %	C <sub>15</sub> + %		
Flaxmans-1	9650-9680	5.45	3.2	27.2	31	23	46	1.15	0.33
Prawn-A1	9860	2.04	2.9	9.0	27	25	48	1.45	0.91
	10210-10220	1.18	0.96	11.6	31	27	42	1.36	0.61
	10280-10290	2.48	1.6	19.6	25	20	55	0.74	0.46

Client : BASS STRAIT OIL AND GAS  
Well name : FLAXMANS #1



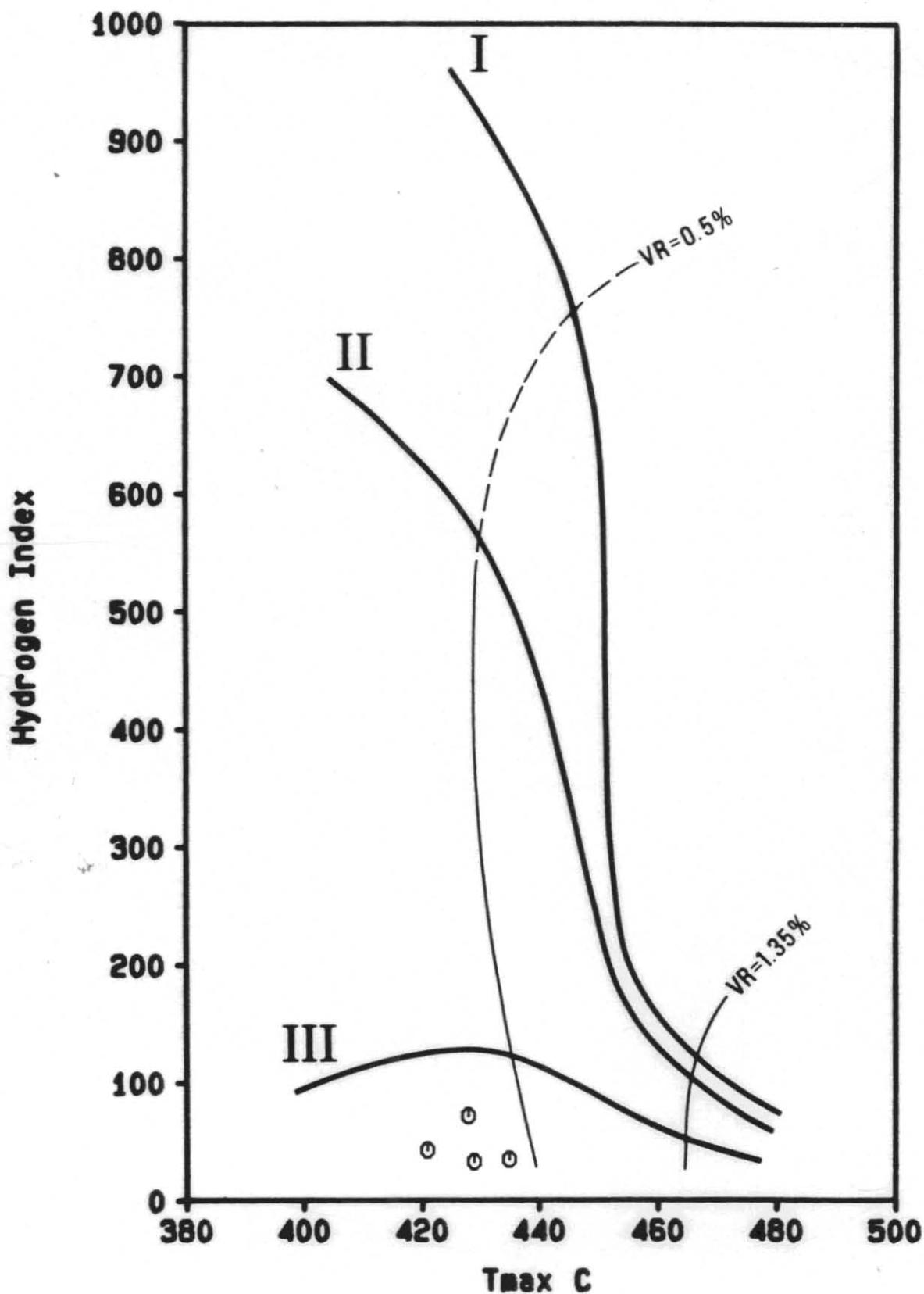
5 cm



FIGURE 2

120028

Client : BASS STRAIT OIL AND GAS  
Well name : MUSSEL #1



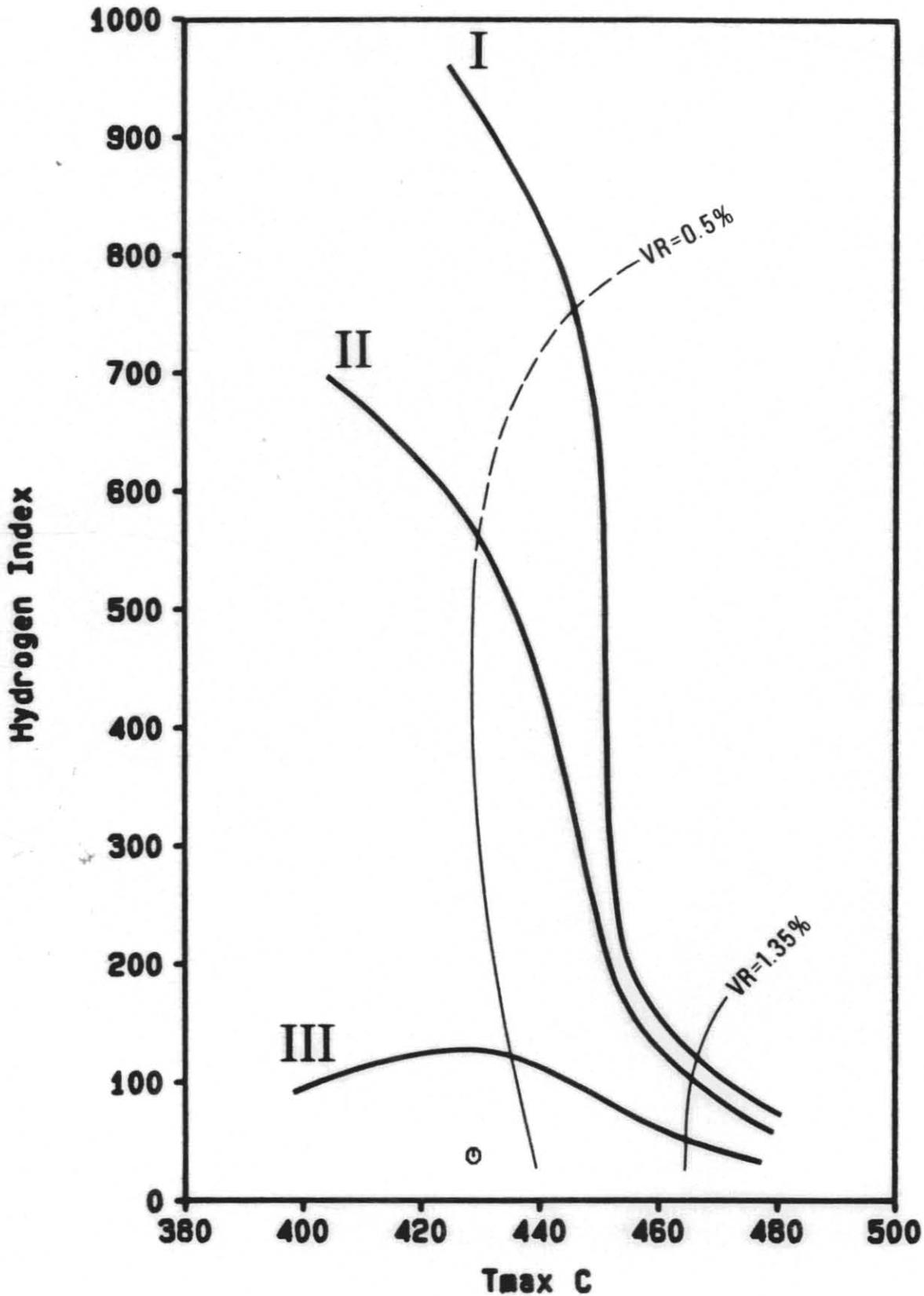
5 cm



FIGURE 3

120029

Client : BASS STRAIT OIL AND GAS  
Well name : NAUTILUS #1



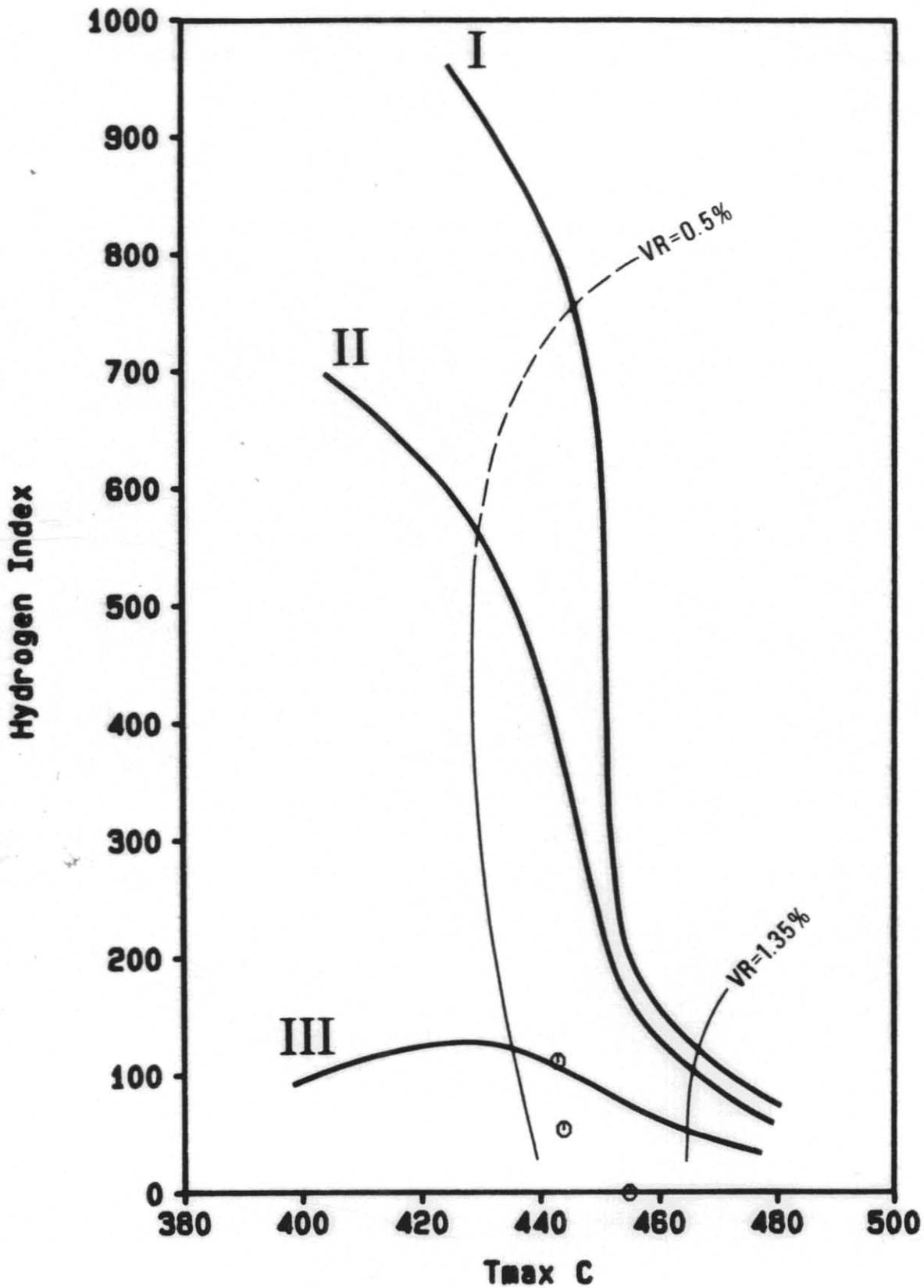
5 cm



FIGURE 4

120030

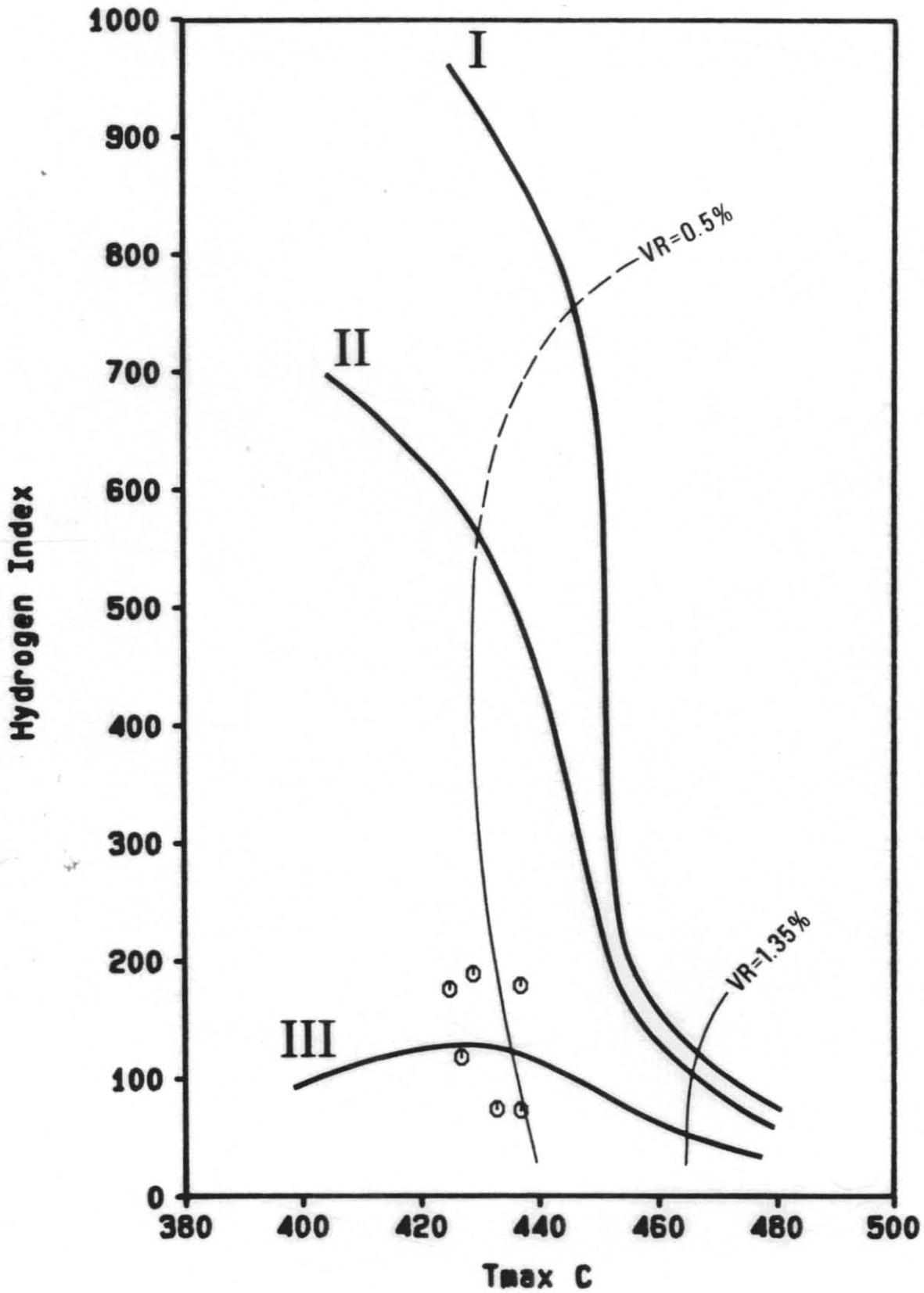
Client : BASS STRAIT OIL AND GAS  
Well name : PECTEN #1



5 cm



Client : BASS STRAIT OIL AND GAS  
Well name : PRAWN #1



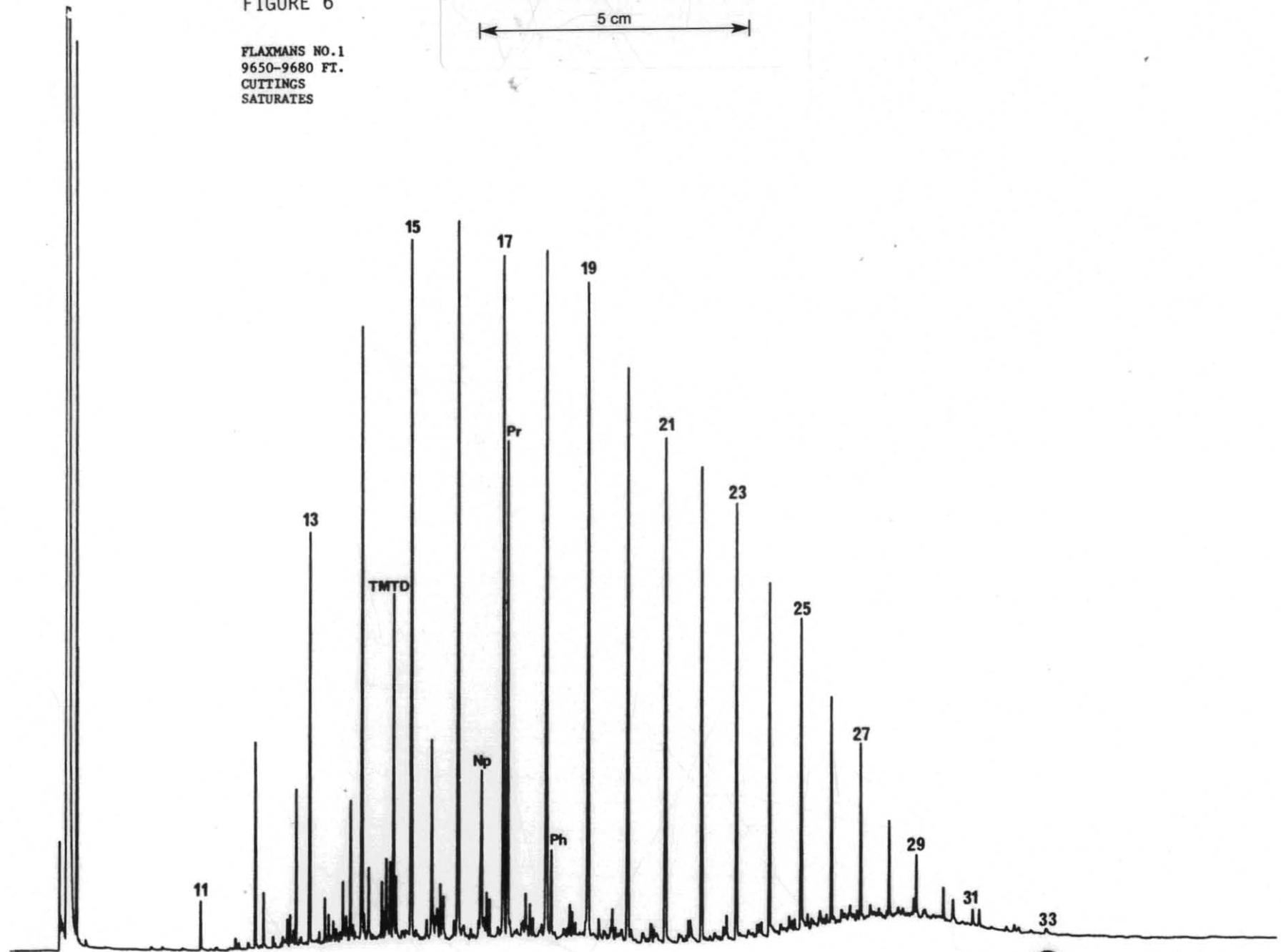
5 cm



FIGURE 6

FLAXMANS NO.1  
9650-9680 FT.  
CUTTINGS  
SATURATES

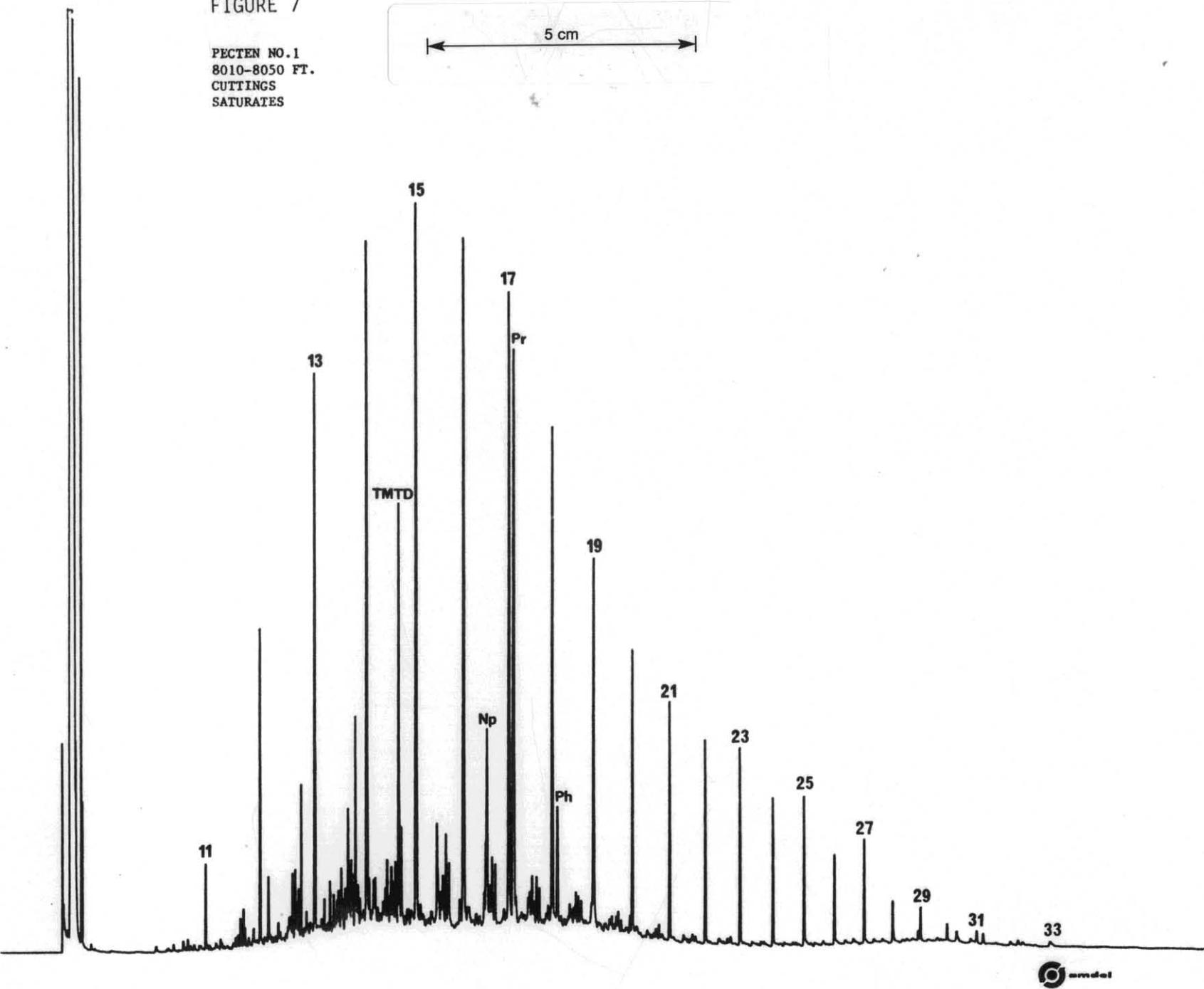
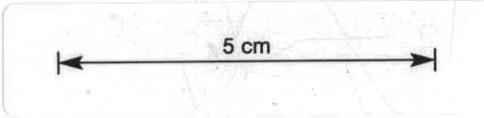
5 cm



120022

FIGURE 7

PECTEN NO.1  
8010-8050 FT.  
CUTTINGS  
SATURATES

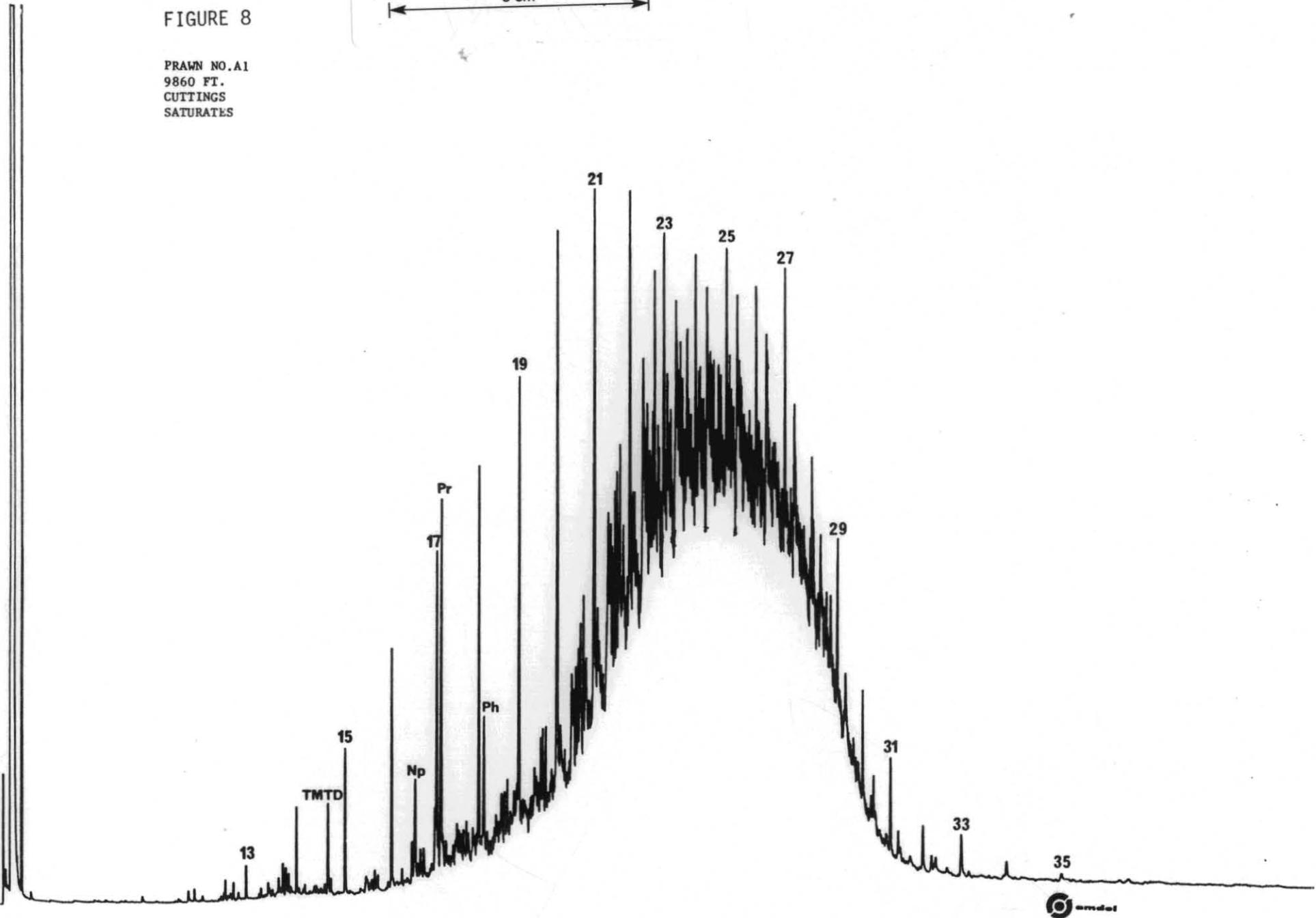


120033

FIGURE 8

PRAWN NO.A1  
9860 FT.  
CUTTINGS  
SATURATES

5 cm

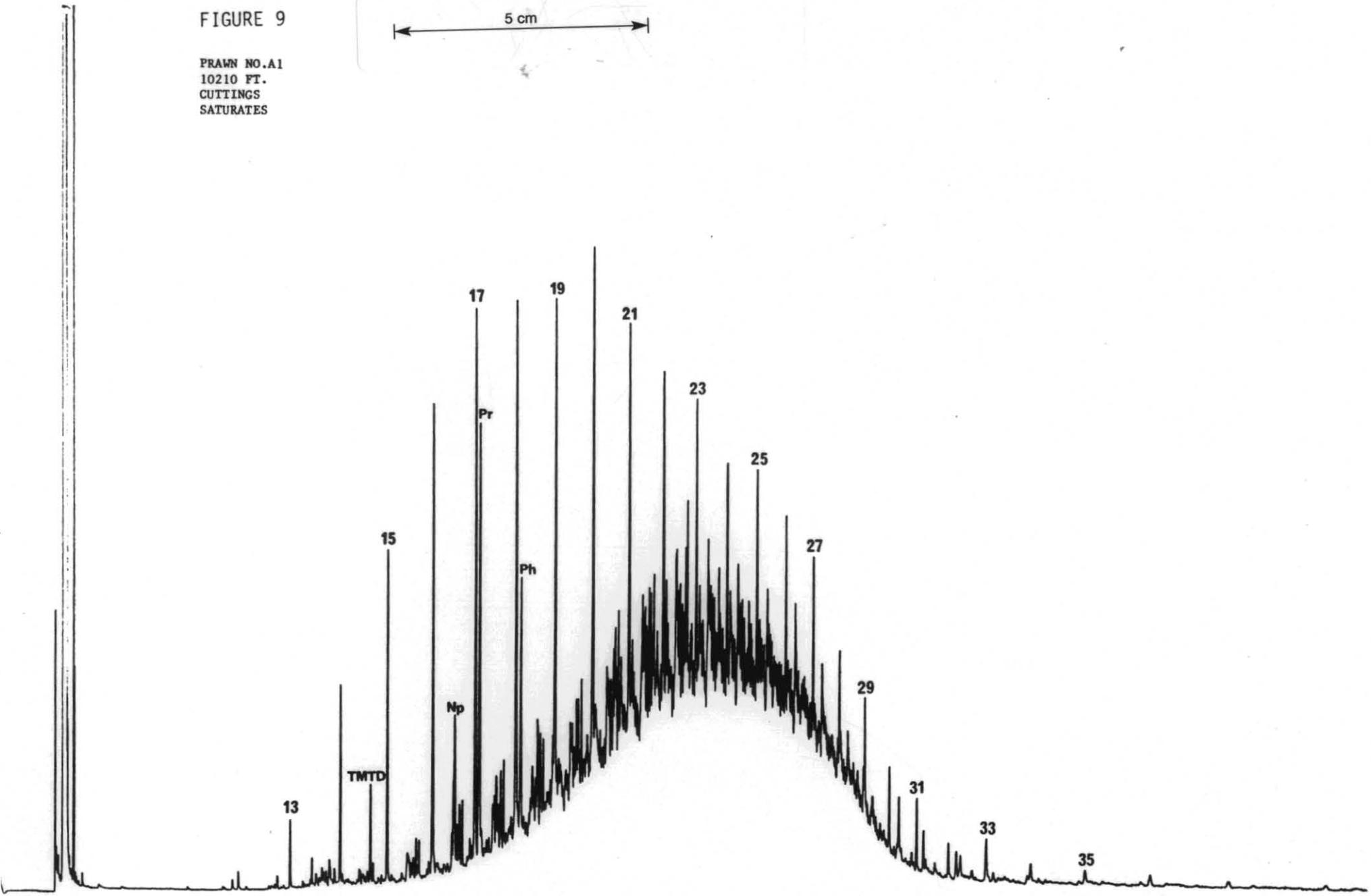


120034

FIGURE 9

PRAWN NO.A1  
10210 FT.  
CUTTINGS  
SATURATES

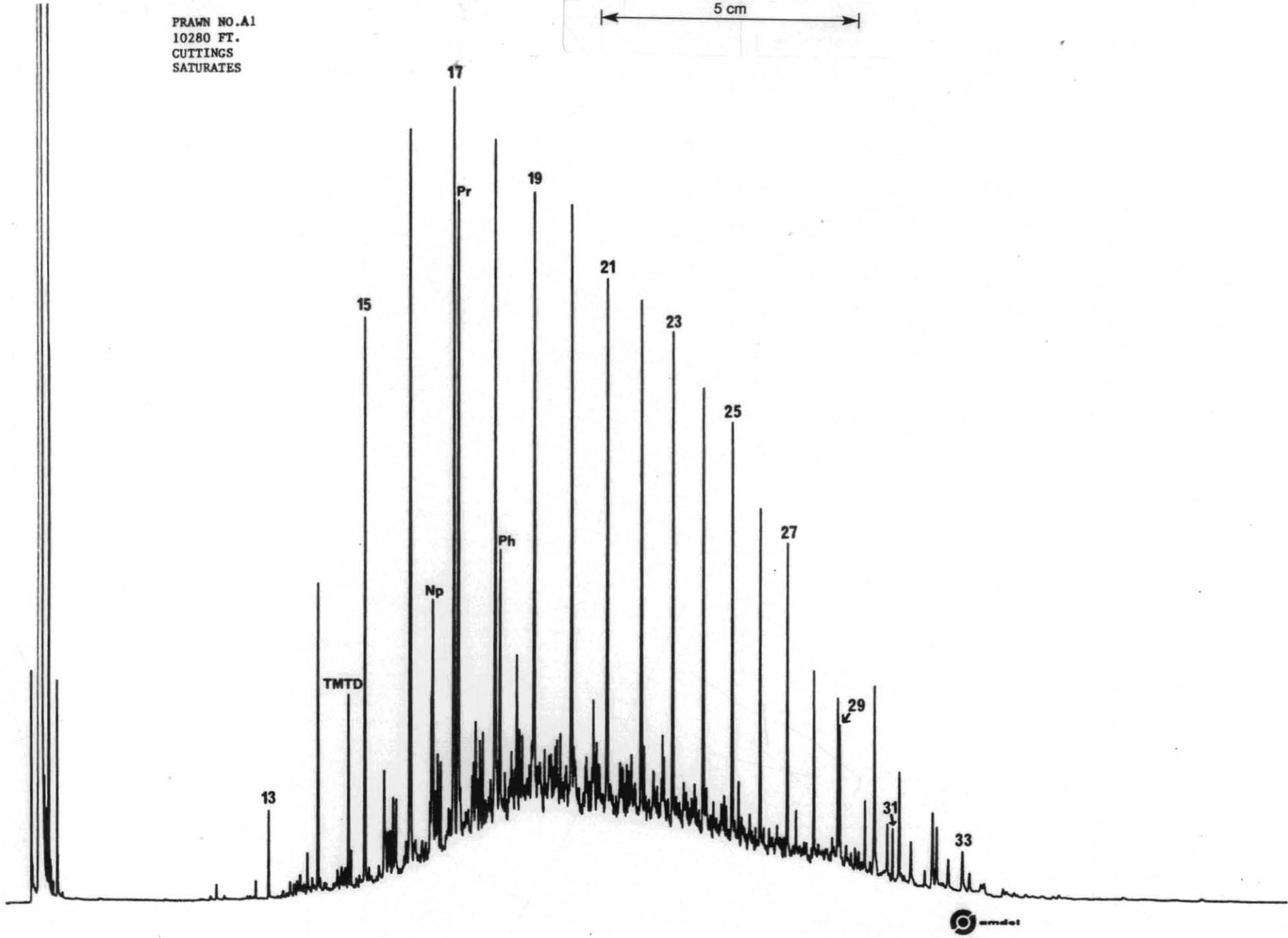
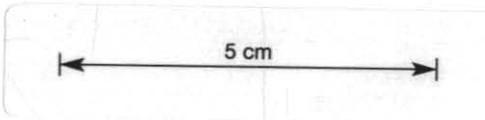
5 cm



120035

FIGURE 10

PRAWN NO.A1  
10280 FT.  
CUTTINGS  
SATURATES



120036

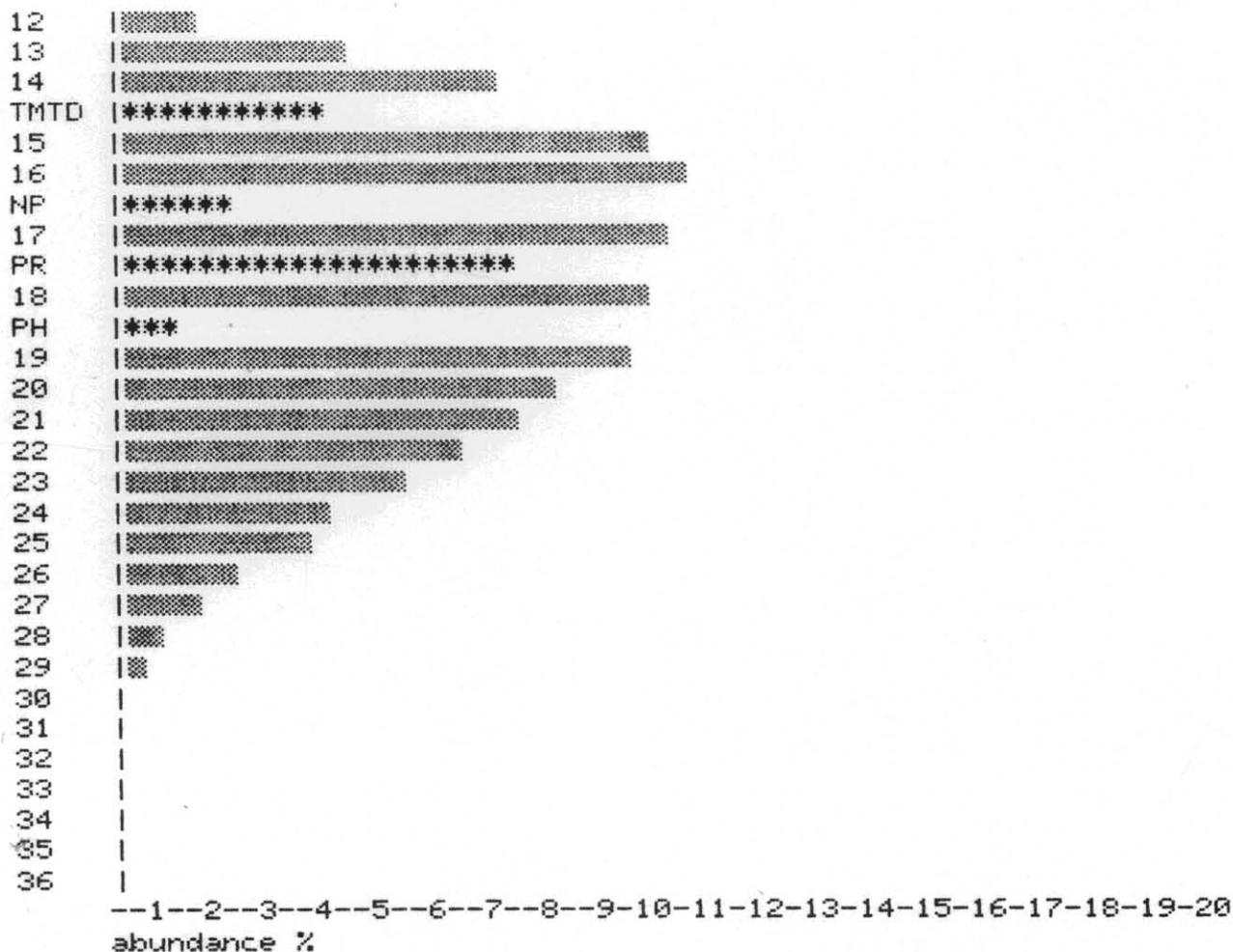
5 cm

120037

FIGURE 11

FLAXMANS NO.1  
9650 FT

N-ALKANE AND ISOPRENOID DISTRIBUTION IN SATURATES



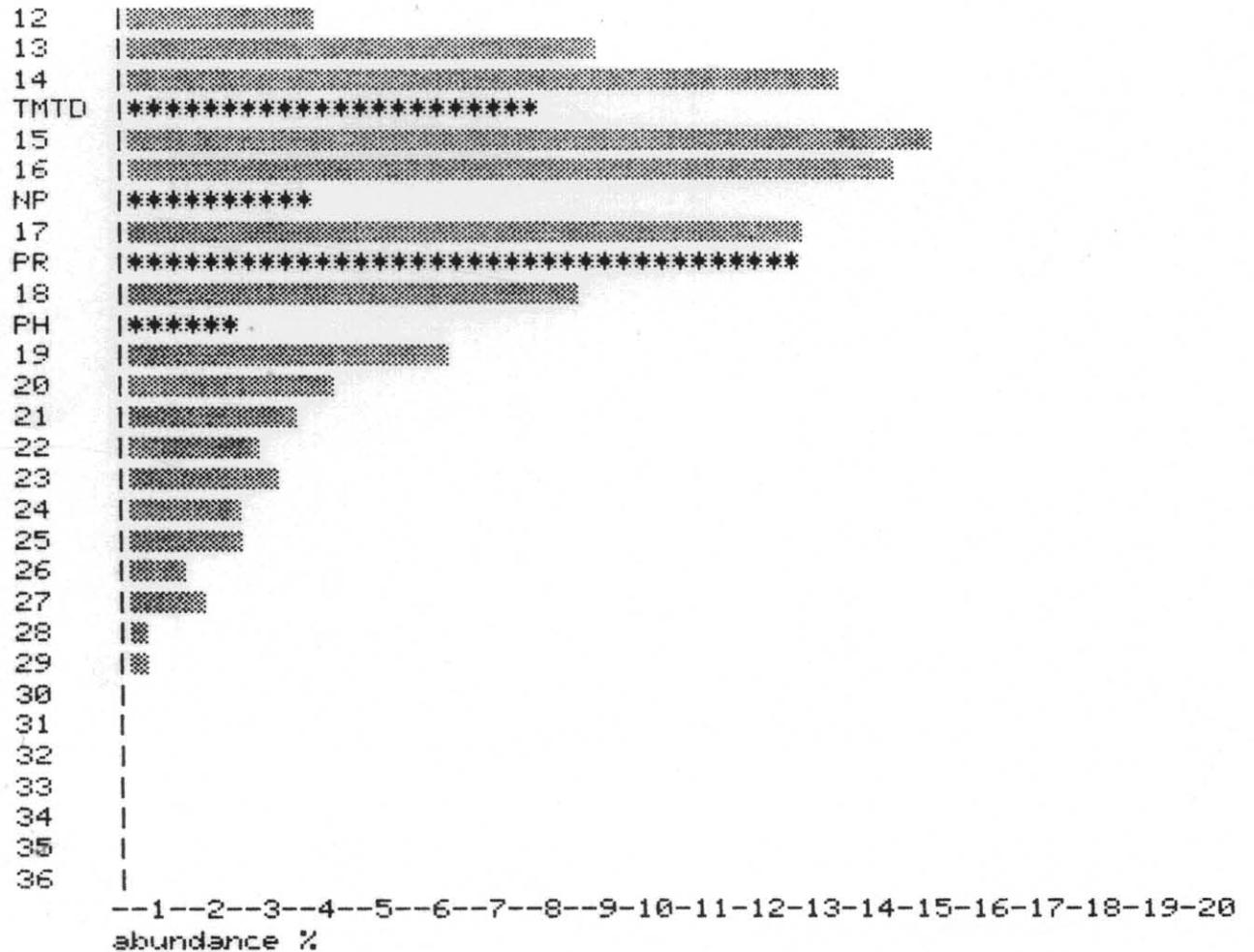
5 cm

120038

FIGURE 12

PECTEN NO. 1  
8010 FT

N-ALKANE AND ISOPRENOID DISTRIBUTION IN SATURATES



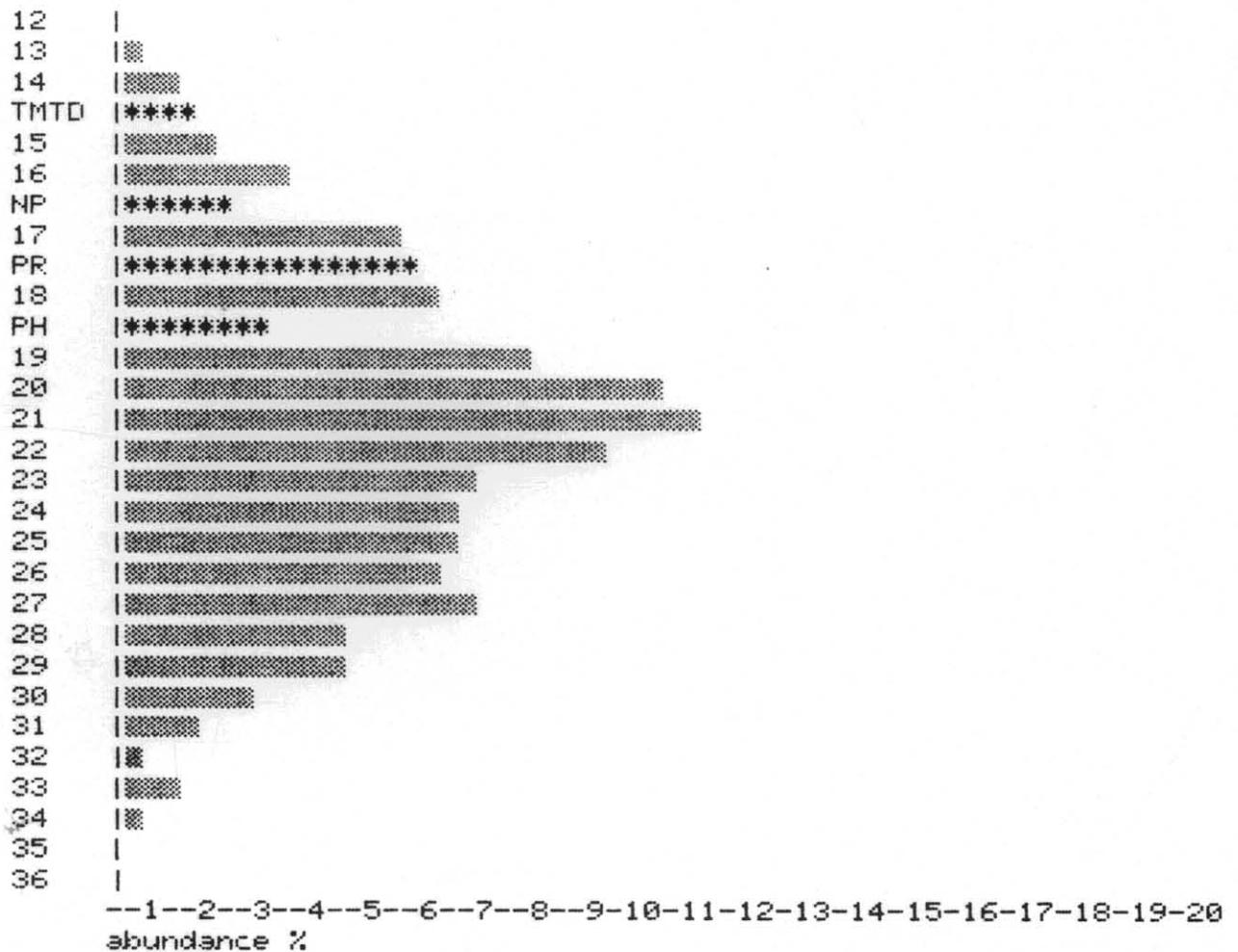
5 cm

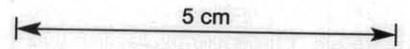
120000

FIGURE 13

PRAWN NO. A1  
9860 FT

N-ALKANE AND ISOPRENOID DISTRIBUTION IN SATURATES



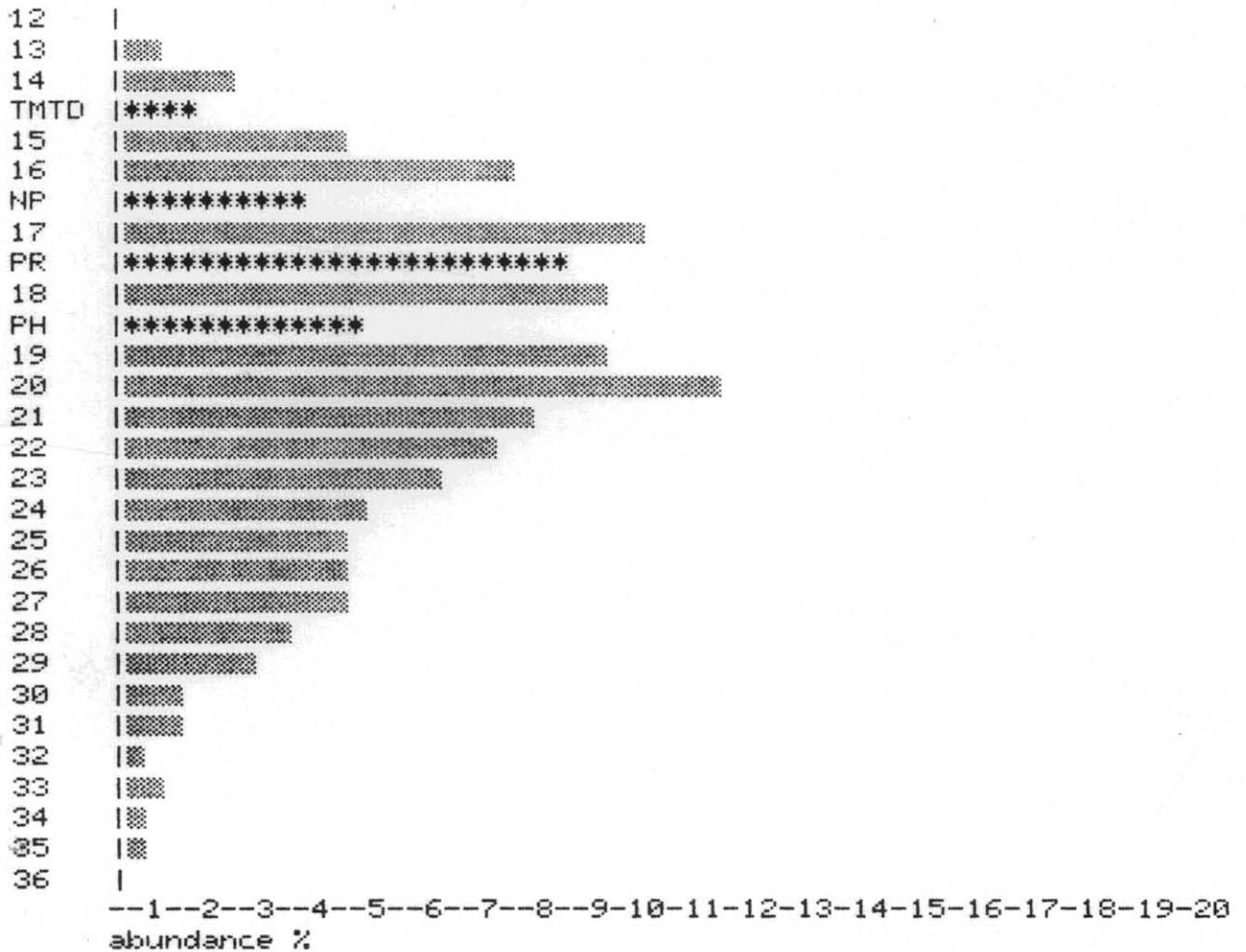


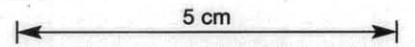
120040

FIGURE 14

PRAWN NO. A1  
10210 FT

N-ALKANE AND ISOPRENOID DISTRIBUTION IN SATURATES





120041

FIGURE 15

PRAWN NO. A1  
10280 FT

N-ALKANE AND ISOPRENOID DISTRIBUTION IN SATURATES

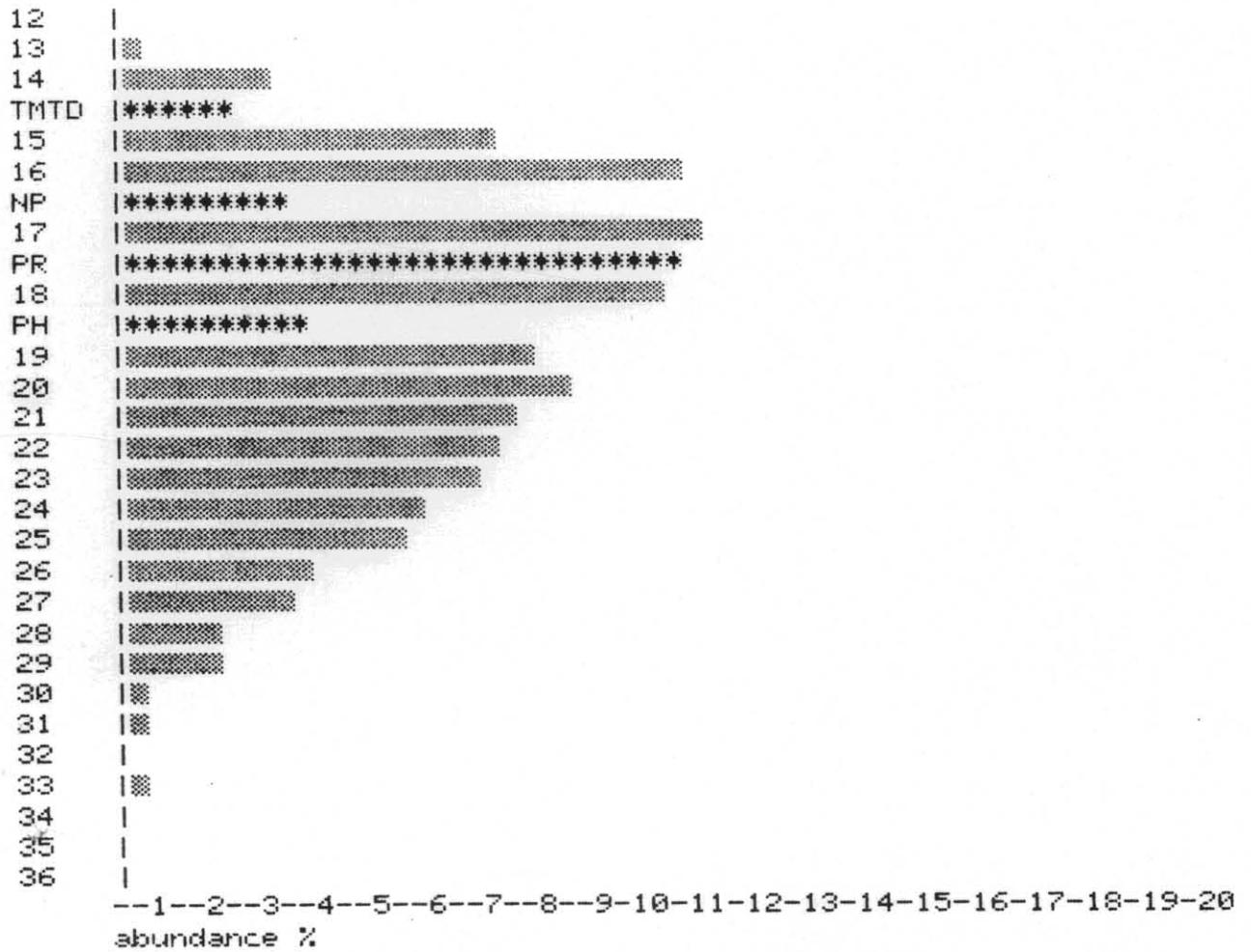
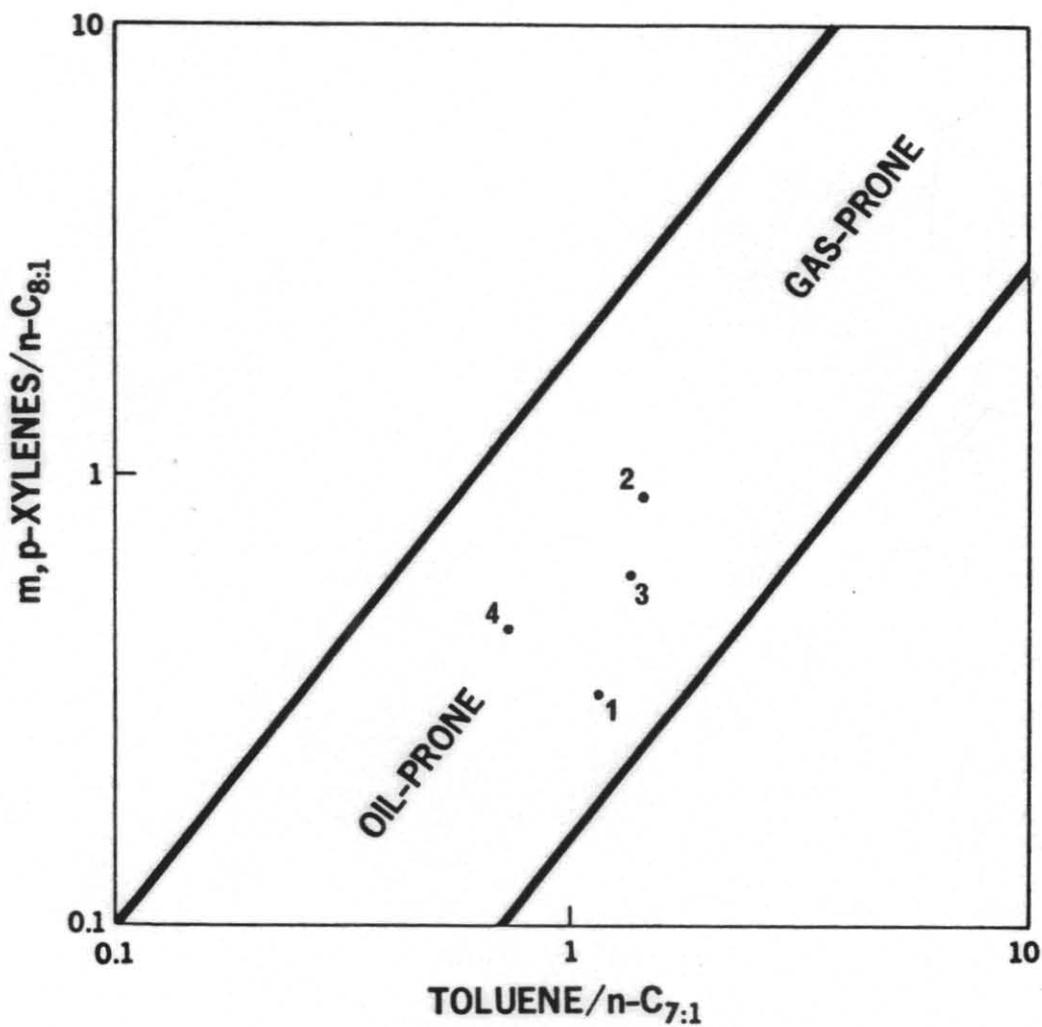


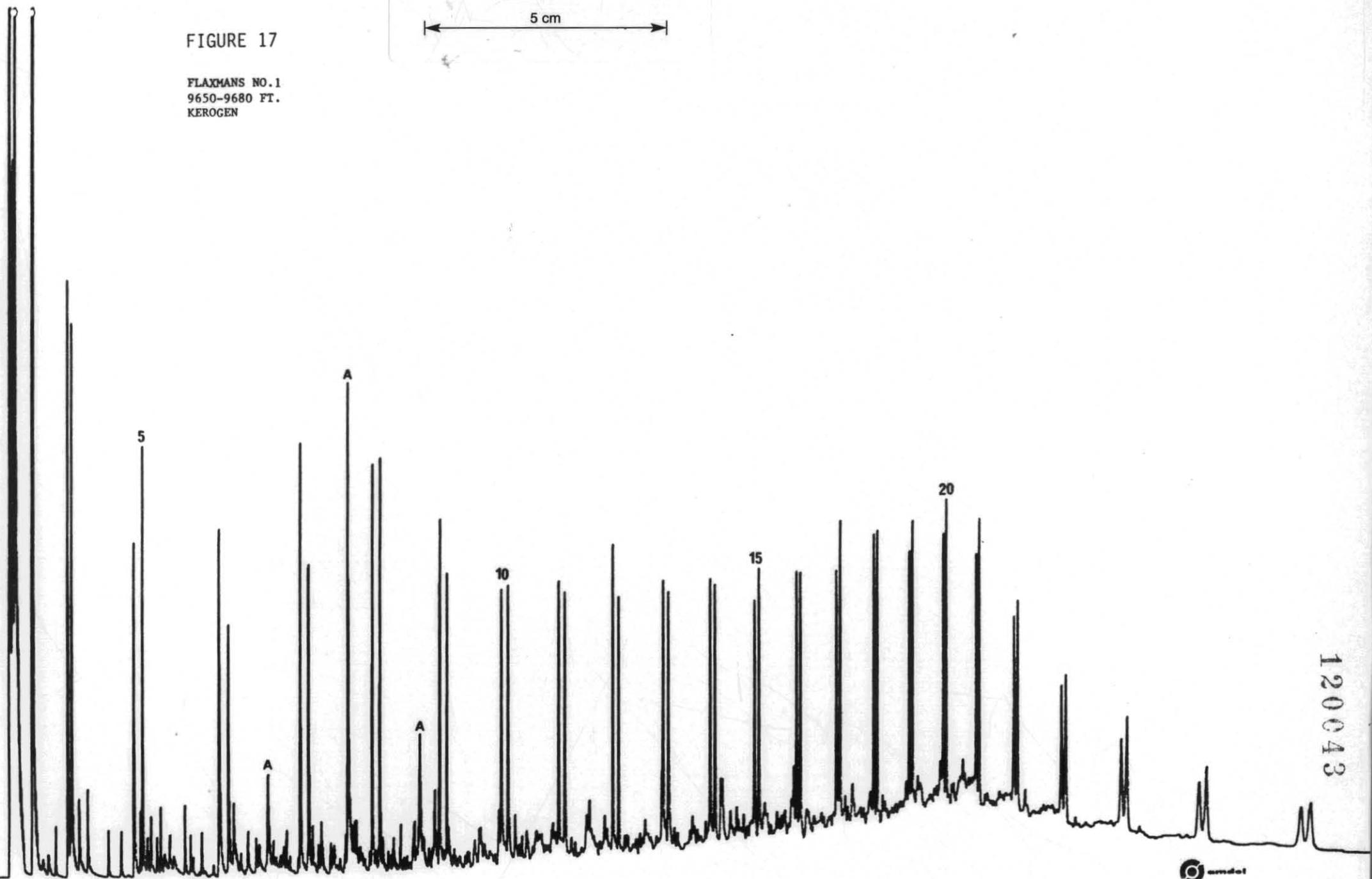
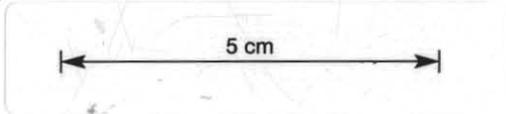
FIGURE 16

SOURCE QUALITY BASED ON  
KEROGEN PYROLYSIS-GCKEY

1. Flaxmans-1, 9650-9680 ft
2. Prawn-A1, 9860 ft
3. Prawn-A1, 10210-10220 ft
4. Prawn-A1, 10280-10290 ft

FIGURE 17

FLAXMANS NO.1  
9650-9680 FT.  
KEROGEN

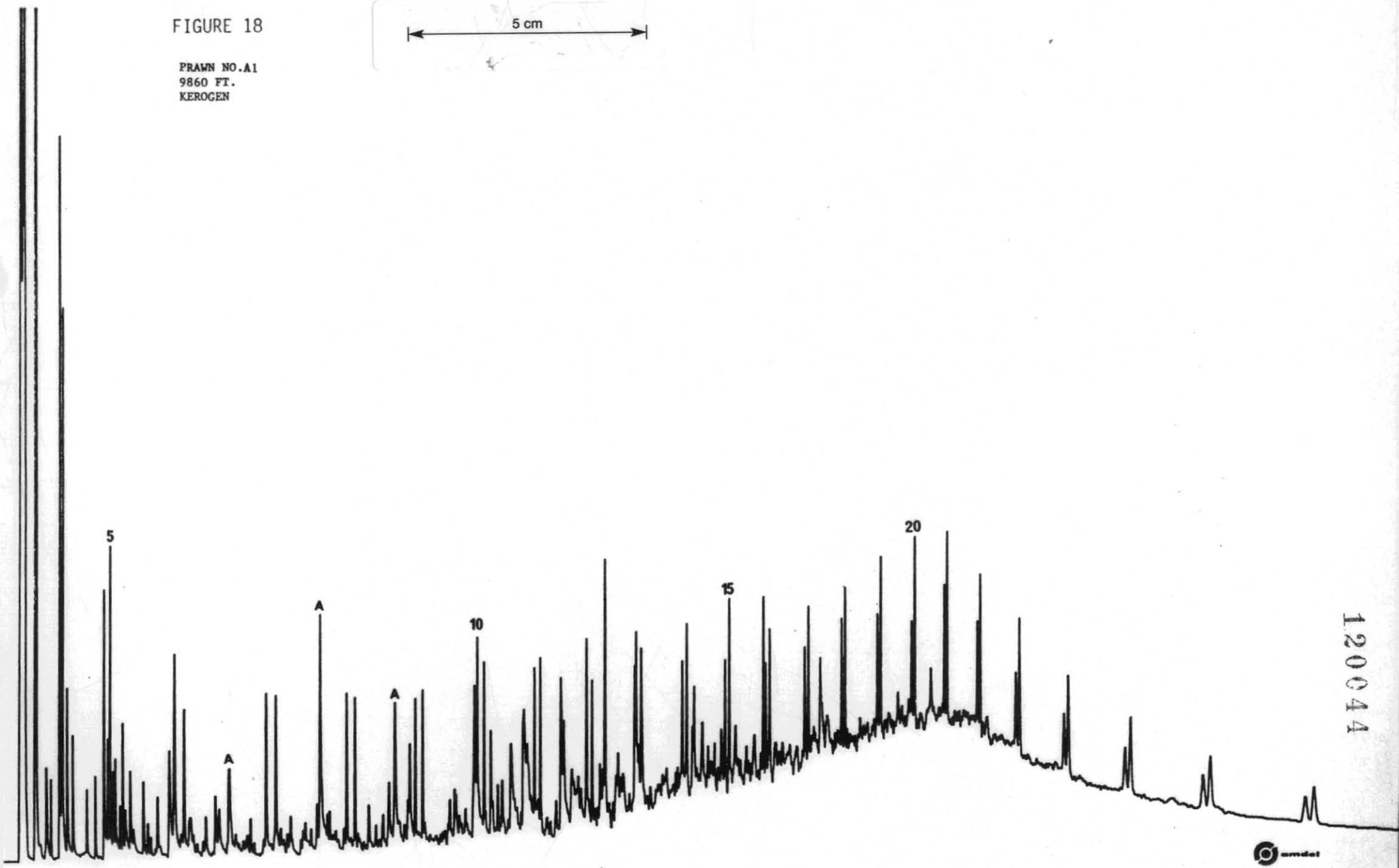


120043



FIGURE 18

PRAWN NO. A1  
9860 FT.  
KEROGEN



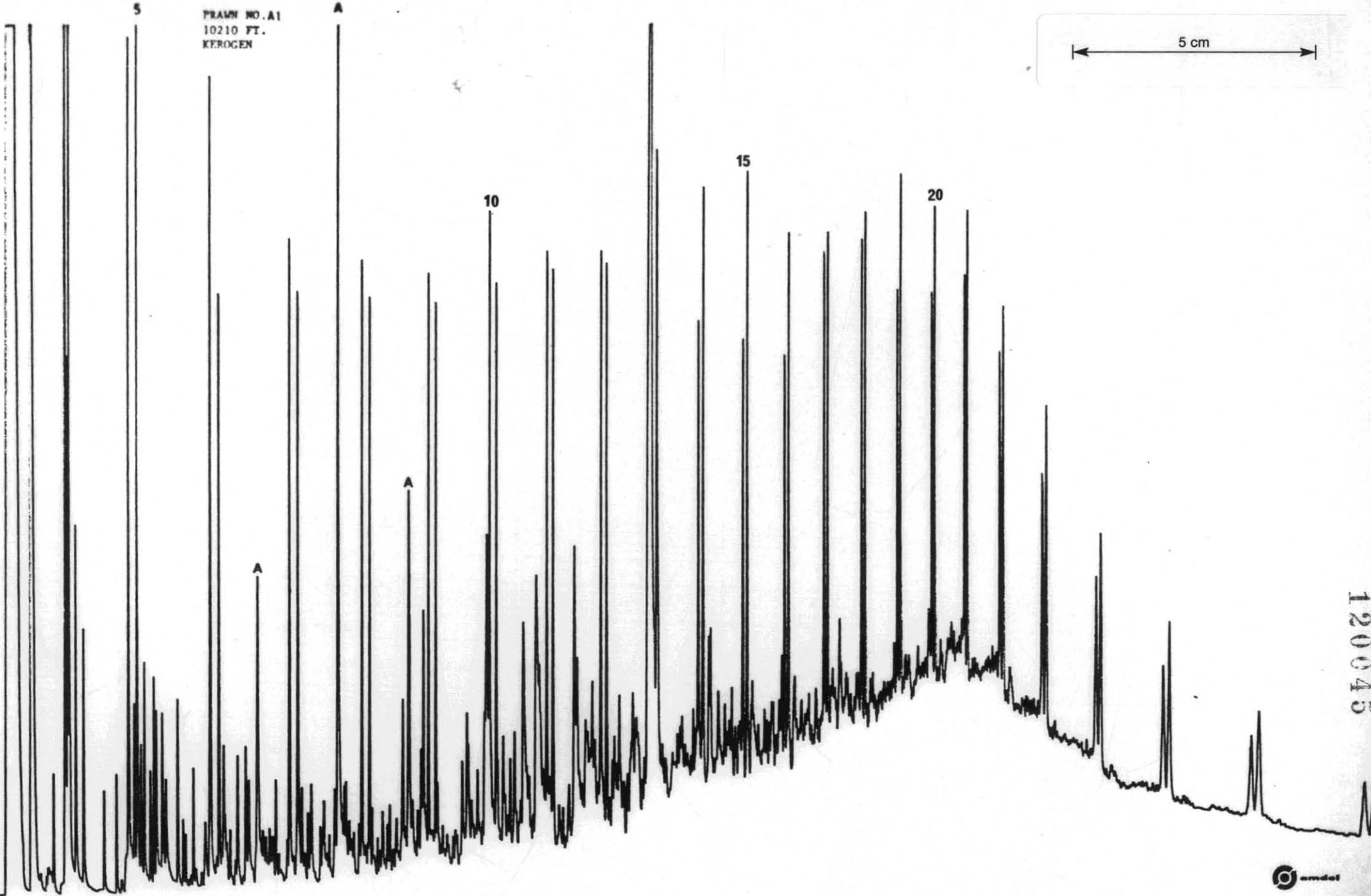
120044



FIGURE 19

PRAWN NO. A1  
10210 FT.  
KEROGEN

5 cm

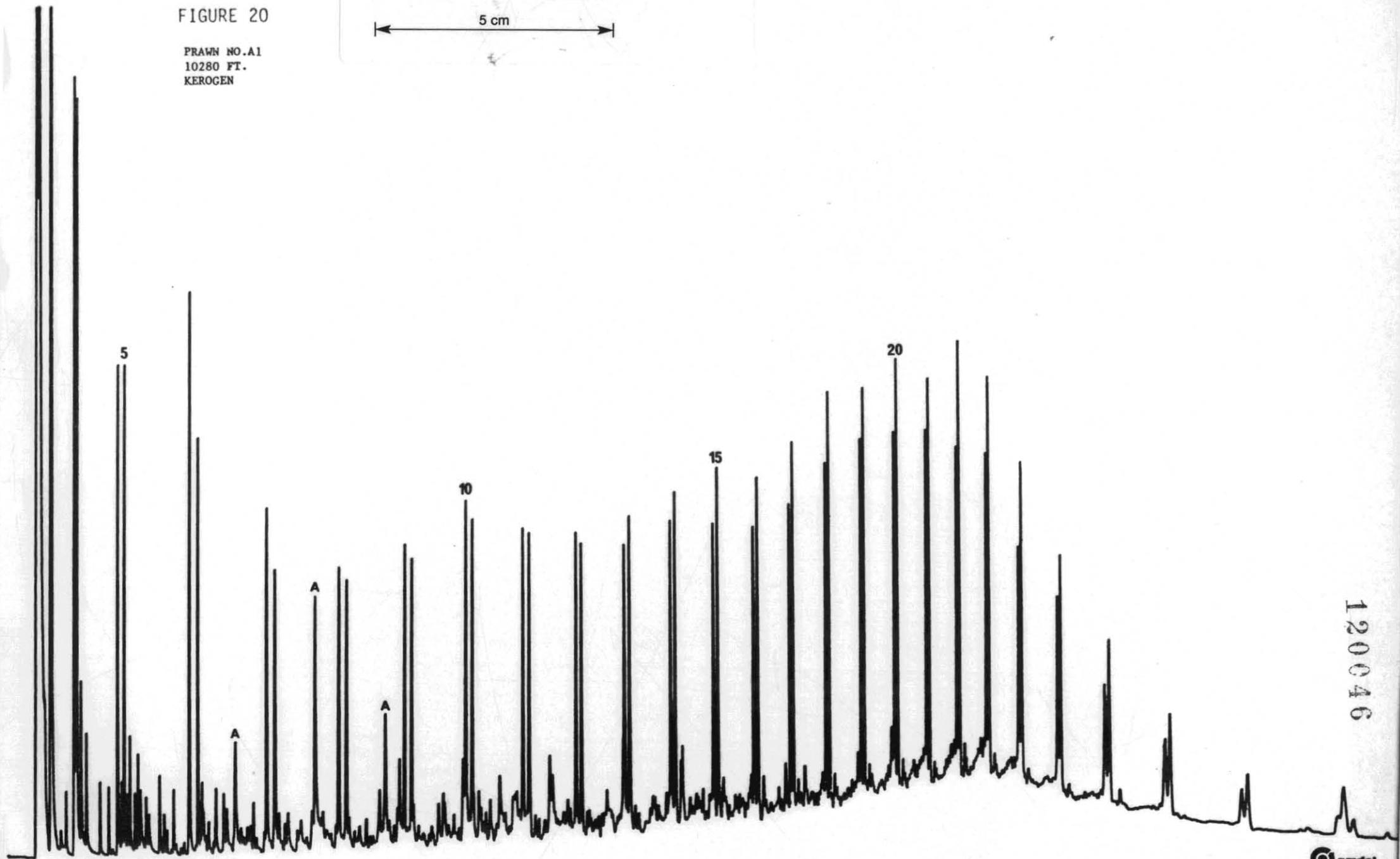
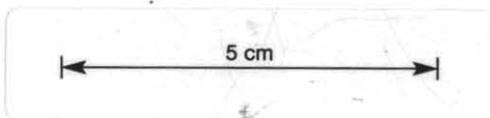


120045



FIGURE 20

PRAWN NO.A1  
10280 FT.  
KEROGEN



120046



120047

**APPENDIX 2**

ORGANIC PETROLOGY OF TWO CAORE SAMPLES FROM PRAWN - 1A,  
OTWAY BASIN  
SERVICE REPORT BY  
AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES  
AUGUST, 1984.



**The Australian  
Mineral Development  
Laboratories**

Flemington Street, Frewville  
South Australia 5063  
Phone Adelaide 79 1662  
Telex AA82520

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

# amdel

13 August 1984

F3/0/0  
F6016 (Part 1 - Final)

Bass Strait Oil and Gas,  
67-69 Palmerston Crescent,  
SOUTH MELBOURNE Vic. 3205

Attention: Mr R. Ingram

REPORT F6016 (Part 1 - Final)

CLIENT REFERENCE:	Phone advice 20/7/84 from Mr R. Ingram
TITLE:	Organic petrology of two core samples from Prawn-A1, Otway Basin
MATERIAL:	Core
LOCALITY:	PRAWN-A1
SAMPLE IDENTIFICATION:	Core #14, Samples A & B
DATE RECEIVED:	25 July 1984
WORK REQUIRED:	Organic petrology

Investigation and Report by: Brian L. Watson and Dr David M. McKirdy

Chief - Fuels Section: Dr Brian G. Steveson

for Dr William G. Spencer  
Manager,  
Mineral & Materials Sciences Division

Head Office:  
Flemington Street, Frewville  
South Australia 5063  
Telephone (08) 79 1662  
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Melbourne, Vic.  
Telephone (03) 645 3093  
Perth, W.A.  
Telephone (09) 325 7311  
Telex: Amdel AA94893  
Townsville  
Queensland 4814  
Telephone (077) 75 1377

cah

## 1. INTRODUCTION

This report formally presents the results of an organic petrological examination of two samples of Core 14 from Prawn-1A.

## 2. ANALYTICAL PROCEDURE

Representative portions of each rock (crushed to -14+35 BSS mesh) were obtained with a sample splitter and then mounted in cold setting Astic resin using a 2.5 cm diameter mould. Each block was ground flat using diamond impregnated laps and carborundum paper. The surface was then polished with aluminium oxide and finally magnesium oxide.

Fluorescence observations were made with a Leitz Ortholux microscope utilising a 3 mm BG3 excitation filter, a TK400 dichroic mirror and a K510 suppression filter.

## 3. RESULTS

The organic petrology of the two core samples is summarised in Tables 1-3.

## 4. DISCUSSION

A previous study of cuttings from 9860-9870 feet depth (part of the interval spanned by Core 14) revealed an anomalously high concentration of C<sub>15+</sub> hydrocarbons (McKirdy, 1984). It was suggested that this high hydrocarbon yield may represent migrated reservoir bitumen or free oil.

In the two samples of Core 14 submitted for organic petrological examination no such oil or bitumen was detected (Tables 2 & 3). However, the exact depths represented by these samples are unknown.

Therefore, the question of the origin of the hydrocarbons in the original cuttings sample remain unresolved.

## 5. REFERENCE

McKIRDY, D.M., 1984. Hydrocarbon source potential of selected rock samples from five exploration wells, eastern Otway Basin. *AMDEL Report F6901/84 for Bass Strait Oil and Gas (Holdings) N.L.*

TABLE 1: PERCENTAGE OF VITRINITE, INERTINITE AND EXINITE IN DISPERSED ORGANIC MATTER, PRAWN-A1

Sample	Percentage of		
	Vitrinite	Inertinite	Exinite
Core 14A	*75	20	5
Core 14B	-	95	<5

\*Vitrinite reflectance ~0.9%

TABLE 2: ORGANIC MATTER TYPE AND ABUNDANCE, PAWN-A1

Sample	Relative Maceral Group Proportions	Estimated Volume of		Exinite Macerals
		DOM	Exinites	
Core 14A	V > I > E	0.5-1	Ra	res, cut, ?exsu lipto
Core 14B	I >> E	<0.5	Vr	lipto

TABLE 3: EXINITE MACERAL ABUNDANCE AND FLUORESCENCE CHARACTERISTICS, PRAWN-A1

Sample	Exinite Macerals	Comments
Core 14A	res(Ra;d0-no fluorescence),cut(Vr;m0),?exsu(Vr;m0),lipto(Vr;d0)	Sandstone; DOM occurs as stringers of coal.
Core 14B	lipto(Vr;d0).	Sandstone; DOM is more dispersed than in the previous sample.

120051

of M	A.O.	C.G.	E.O.	D.S.M.E
				Registrar
Received Answered	15 FEB 1984			E & IL
DEPT. OF MINES				
REF. No. 1541/84				

QUARTERLY REPORT FOR PERIOD  
SEPTEMBER 11TH, 1983 TO DECEMBER 10TH, 1983

FIRST QUARTER, YEAR 3

ON

PETROLEUM EXPLORATION PERMIT T.20P  
OTWAY BASIN, TASMANIA

FOR

VAN DIEMEN'S LAND RESOURCES N.L. CONSORTIUM

TPR  
OR-125  
Vol 2.

T/20P Part

Van Diemen's Land Resources N.L.,  
Suite 4, 67 Palmerston Crescent,  
South Melbourne, Vic. 3205

13th February, 1984

INTRODUCTION

This quarterly report by Van Diemen's Land Resources N.L. is presented on behalf of the Van Diemen's Land Resources N.L. Consortium, which is title holder to the permit Tas.20P.

This report is for the period September 11th, 1983 to December 10th, 1983, and is the first quarterly report for the third permit year.

ACTIVITY

A farm-out package has been prepared for the contiguous permit Vic/P.16, and this is being presently reviewed by a number of exploration companies.

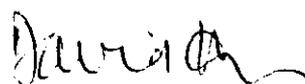
The principal exploration prospect is "Abalone", a significant four-way closed structure that straddles the three eastern offshore Otway Basin Permits, T.20P, T.17P and Vic/P.16. It is anticipated that once farm-out agreements have been reached on Vic/P.16 then similar farm-outs on T.17P and T.20P will follow. It is possible that a farm-out agreement could be reached on all the three permits, therefore the data review and promotion that is taking place principally on Vic/P.16 also applies to T.17P and T.20P.

EXPENDITURE

Van Diemen's Land Resources N.L.

Period: September 30th, 1983 to December 31st, 1983

Geological/Geophysical Consultant	\$700.00
Administration overhead	\$300.00
	<hr/>
	\$1,000.00

Signed .....   
 Company Secretary, D.B. Hill

ANTICIPATED ACTIVITY FOR THE PERIOD  
DECEMBER 11TH, 1983 TO MARCH 10TH 1984

Continue to promote farm-out package, principally in Vic/P.16 and secondarily on T.17P and T.20P.

It is anticipated that if a farm-out agreement is reached, then drilling on Vic/P.16 will take place in 1984, and this will be followed by further exploration on T.17P and T.20P.