MOBIL EXPLORATION NORWAY INC.

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17 CASTLE STREET
CHESTER CH1 2DS
ENGLAND

tel CHESTER 316160
cable GEOCHEM CHESTER

SOURCE ROCK EVALUATION

OIL TO ROCK CORRELATION | OIL CHARACTERISATION

Our ref NJLB/PJP/1785
Your ref BMS/11

20th September, 1976

Mr C W Brown
Exploration Manager
Mobil Norway Exploration Inc.
Borehaugen 1
PO Box 501
4001 Stavanger
Norway

Dear Mr Brown

Re: Water sample, 33/12-6 FIT No. 1, 3070 metres

The analytical results pertaining to the water (emulsion) sample recovered from 3070 metres in 33/12-6 are reported below.

a) SAMPLE HANDLING The sample was divided into two parts. A 200ml portion was evaporated to dryness and the mud solids then extracted to recover the hydrocarbons whilst the other part was submitted for the water analysis.

b) HYDROCARBON ANALYSIS Nine (9) grammes of mud solid were left after the evaporation of 200 mls of the water-mud emulsion. On extraction, 36122 ppm of $C_{15+}$ hydrocarbons were recovered. These hydrocarbons constituted 55.6% of the total extract and have a reasonably high paraffin-naphthene to aromatic ratio of 3.05.

The paraffin-naphthene chromatogram shows a marked bias towards the lighter ends and, indeed, the normal paraffin peaks die at approximately $nC_{25}$.

Clearly, these hydrocarbons are a refinery product and the chromatogram is essentially identical to those derived from the drilling mud samples included in our earlier study on 33/12-6.

c) WATER ANALYSIS These results are quoted below, standard methods having been employed throughout.

Contd.

| CATIONS (mg/l) | | ANIONS (mg/l) | |
|---|---|---|---|
| Mg | 1213 | OH | 0 |
| Ca | 2780 | $CO_3$ | 70 |
| $NH_4$ | 7.8 | $H(CO_3)_2$ | 2510 |
| Na | 940 | Cl | 171 |
| K | 340 | $SO_4$ | 1217 |
| $Fe^{++}$ | 920 | $NO_2$ | 1.0 |
| Mn | 410 | $NO_3$ | 8.2 |
| Ba | 160 | $SiO_2$ | 4590 |
| | | F | 0.83 |

pH = 8.43
Resistivity = 17700 $\mu$mhos/cm$^2$
SG at 60°F = 1.0018

dried residue (110°C, 24 hours) =51.76g/l
dried residue (500°C, 2 hours) =43.96g/l

It is probable that the value for nitrite should be slightly less than 1mg/litres.

Total dissolved solids amount to 15339 mg/l.

Please let me know if you have a specific problem which I have not answered. I look forward to being of further service. The invoice for this work is enclosed.

Yours sincerely,

N J L Bailey
MANAGING DIRECTOR

TABLE 1A

WEIGHT (GRAMMES) OF $C_{15+}$ EXTRACTS AND CHROMATOGRAPHIC FRACTIONS

| GEOCHEM SAMPLE NUMBER | INTERVAL | ROCK EXTRACTED | TOTAL EXTRACT OBTAINED | TOTAL EXTRACT | | $nC_5$ SOLUBLE FRACTION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Precipitd. Asphaltenes | $nC_5$ soluble | Paraffin – Naphthenes | Aromatics | Eluted NSO's | Non-eluted NSO's | Sulphur |
| 91-101 | FIT NO.1 3070m | 9.0102 | 0.5854 | 0.2319 | 0.3535 | 0.2451 | 0.0803 | 0.0268 | 0.0012 | - |

TABLE 1 B

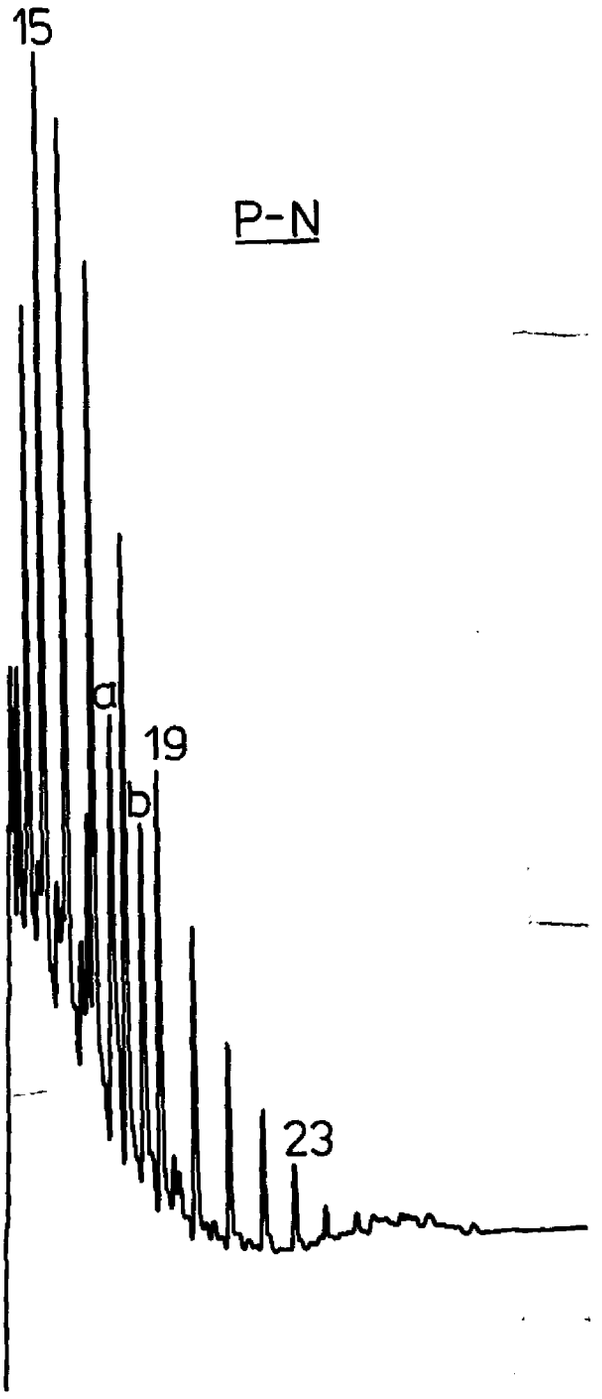
CONCENTRATION (PPM) OF EXTRACTED $C_{15+}$ MATERIAL IN ROCK

| GEOCHEM SAMPLE NUMBER | INTERVAL | TOTAL EXTRACT | HYDROCARBONS | | | NON HYDROCARBONS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Paraffin – Naphthenes | Aromatics | TOTAL | Preciptd. Asphaltenes | Eluted NSO's | Non-eluted NSO's | Sulphur | TOTAL |
| 91-101 | FIT No.1 3070m | 64971 | 27207 | 8915 | 36122 | 25738 | 2972 | 133 | - | 28843 |

TABLE 1C

COMPOSITION (NORMALISED %) OF $C_{15+}$ MATERIAL EXTRACTED FROM ROCK

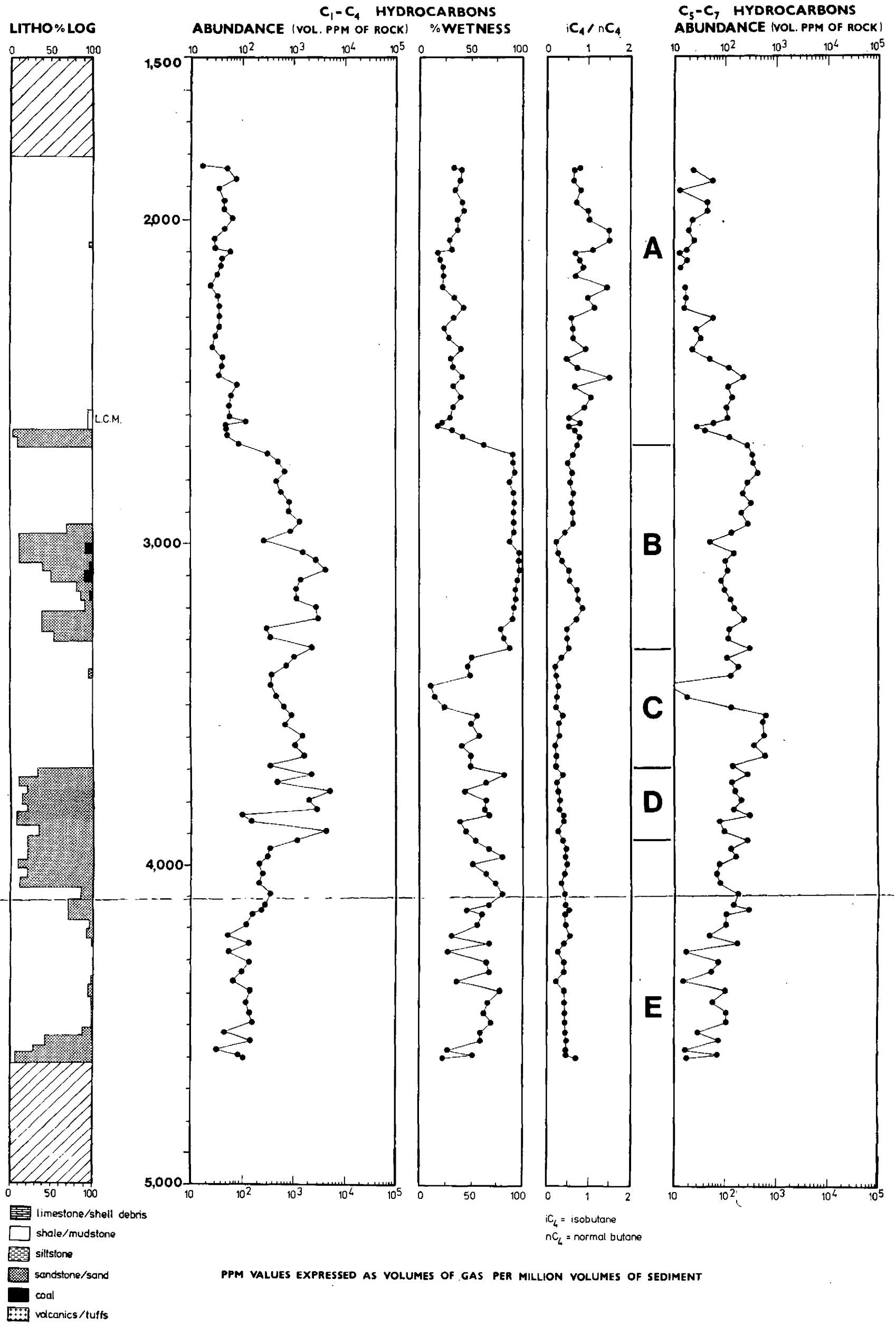
| GEOCHEM SAMPLE NUMBER | INTERVAL | HYDROCARBONS | | | NON HYDROCARBONS | | | | | HC / NON HC |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Paraffin – Naphthenes | Aromatics | P – N / AROM | Preciptd. Asphaltenes | Eluted NSO's | Non eluted NSO's | Sulphur | ASPH / NSO | |
| 91-101 | FIT NO.1 3070m | 41.88 | 13.72 | 3.05 | 39.62 | 4.57 | 0.20 | - | 8.66 | 1.25 |


15
P-N
a
19
b
23

# FIGURE 1

# $C_1$-$C_7$ HYDROCARBONS

## PRESENTATION OF ANALYTICAL DATA




PPM VALUES EXPRESSED AS VOLUMES OF GAS PER MILLION VOLUMES OF SEDIMENT

# FIGURE 2

# $C_{15+}$ HYDROCARBONS — RICHNESS

## PRESENTATION OF ANALYTICAL DATA

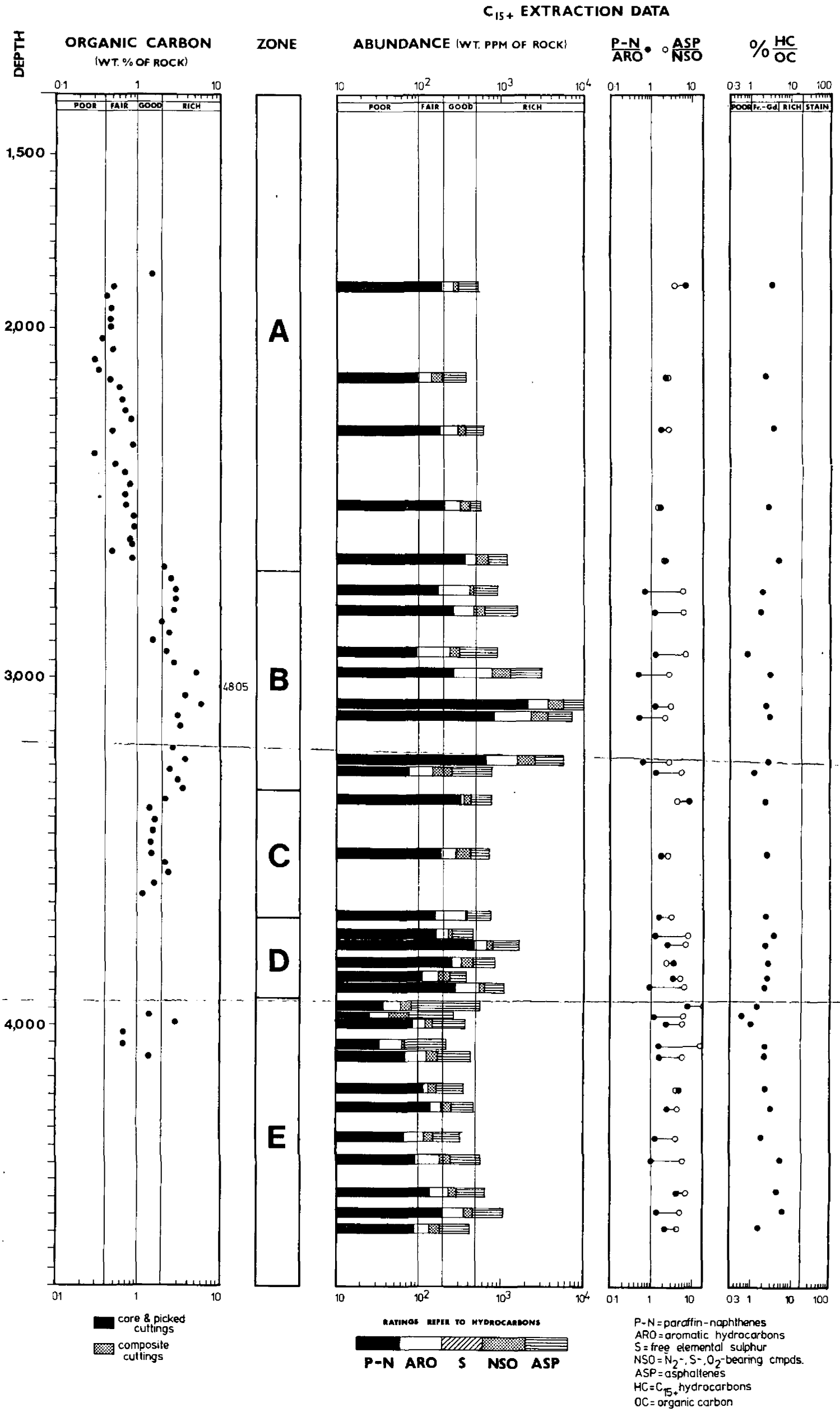


FIGURE 3a

# $C_{15+}$ PARAFFIN — NAPHTHENE HYDROCARBONS

## PRESENTATION OF ANALYTICAL DATA

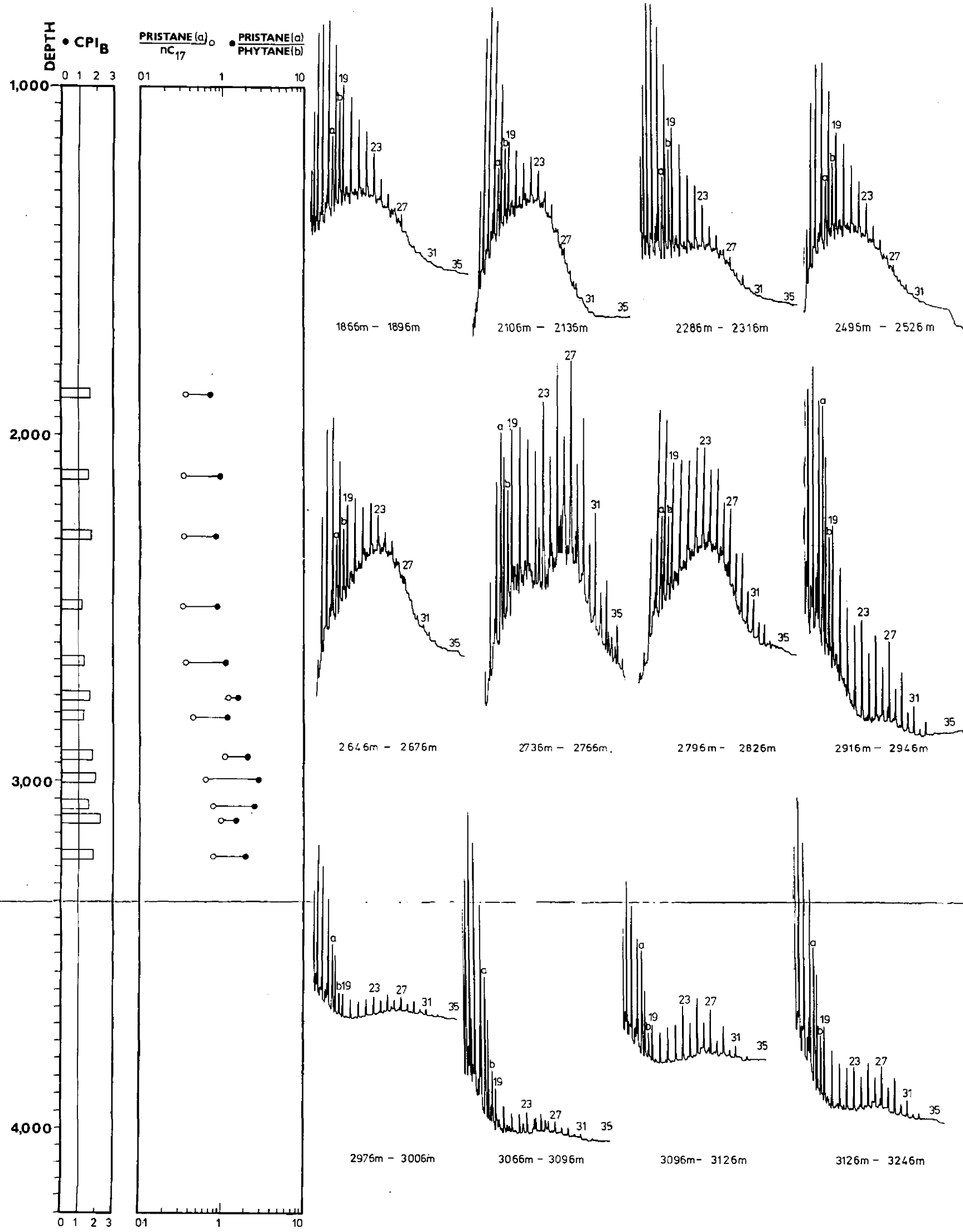
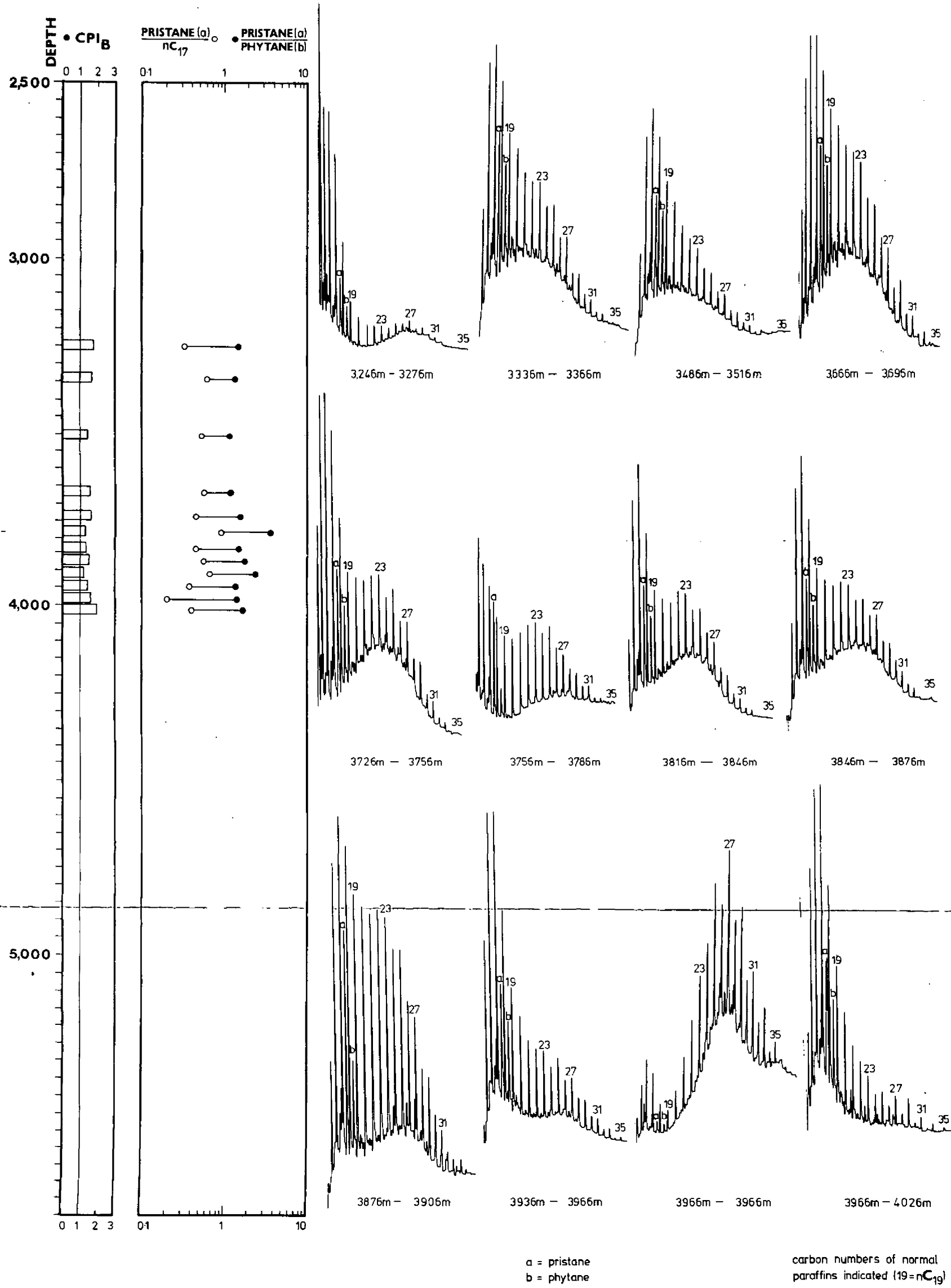


FIGURE 3 b

# $C_{15+}$ PARAFFIN — NAPHTHENE HYDROCARBONS

## PRESENTATION OF ANALYTICAL DATA




a = pristane
b = phytane

carbon numbers of normal paraffins indicated (19 = $nC_{19}$)

FIGURE 3c

# $C_{15+}$ PARAFFIN – NAPHTHENE HYDROCARBONS

## PRESENTATION OF ANALYTICAL DATA

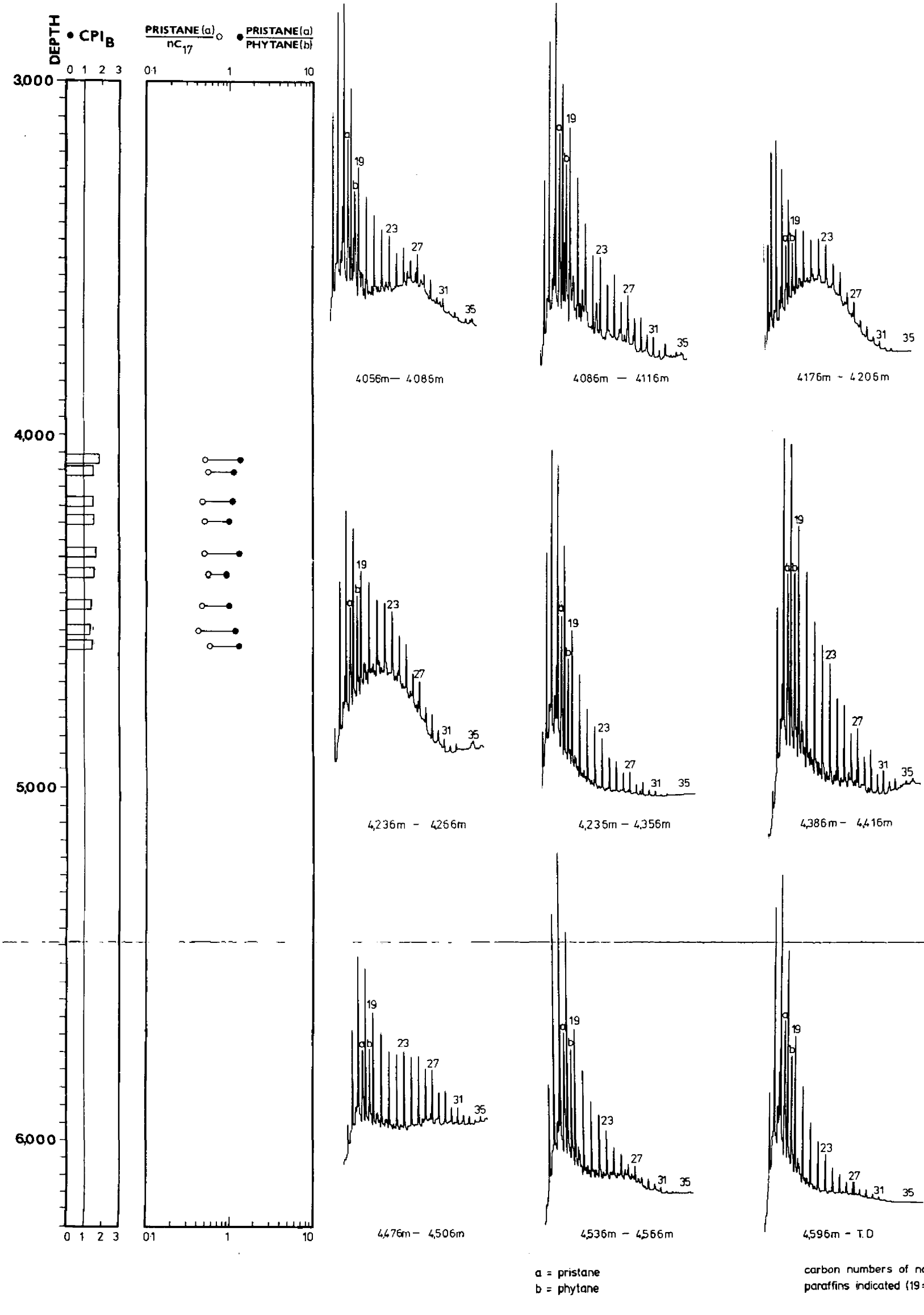
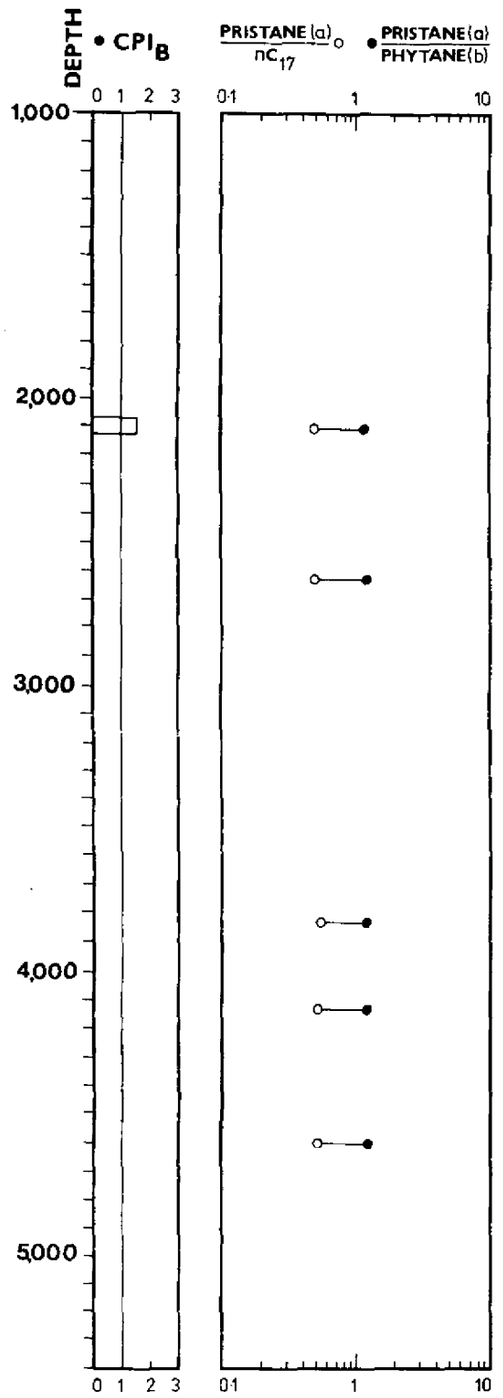


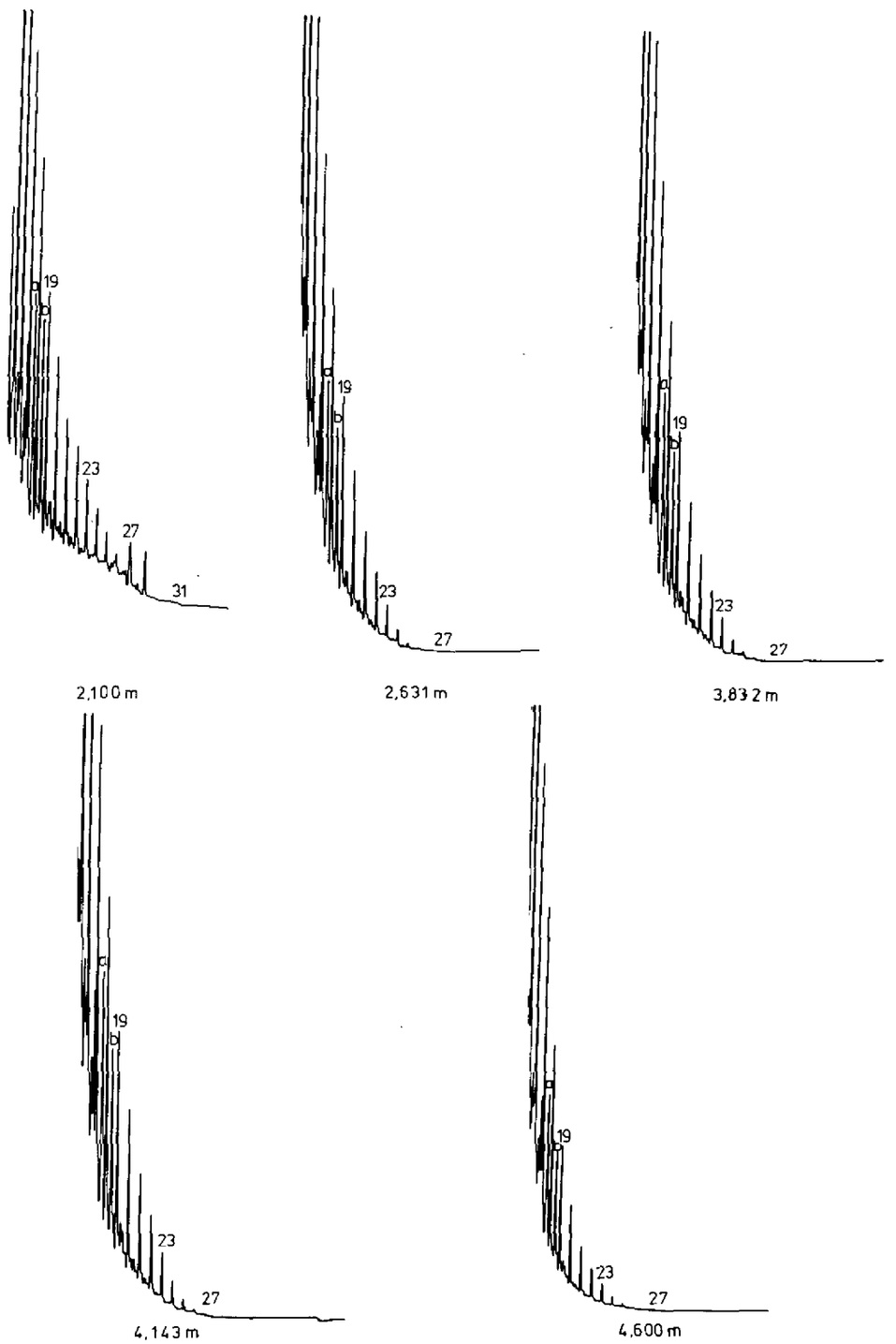
FIGURE 3 d

# $C_{15+}$ PARAFFIN – NAPHTHENE HYDROCARBONS

## PRESENTATION OF ANALYTICAL DATA




DRILLING MUD SAMPLES



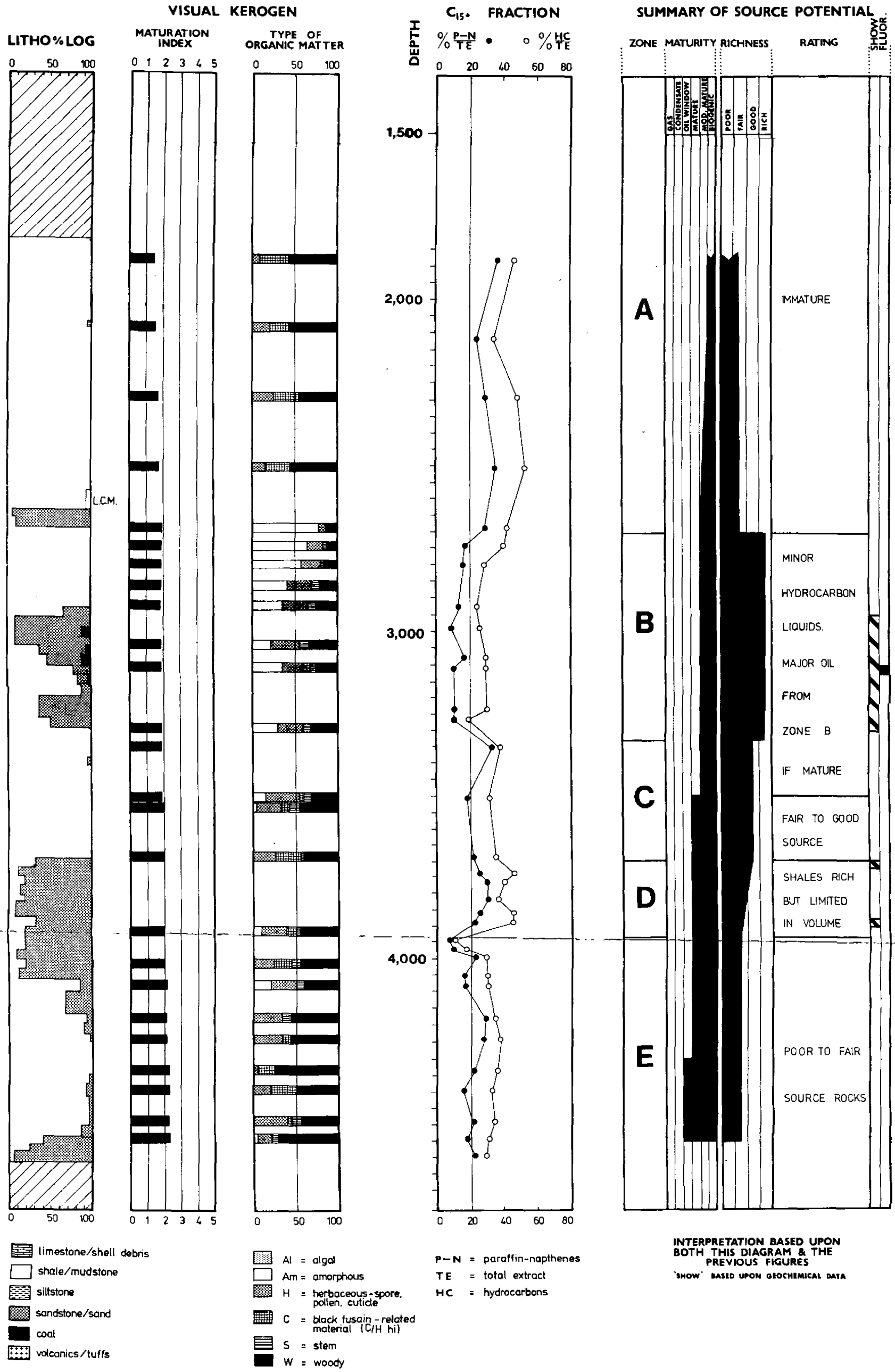

a = pristane
b = phytane

carbon numbers of normal paraffins indicated (19 = $nC_{19}$)

# FIGURE 4

# INTERPRETATION DIAGRAM

## SOURCE TYPE — MATURATION — RATING




**INTERPRETATION BASED UPON BOTH THIS DIAGRAM & THE PREVIOUS FIGURES**

'SHOW' BASED UPON GEOCHEMICAL DATA