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Geochemical investigation of a crude oil sample from  
well 204/19-02, United Kingdom

by

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## *Geochemical investigation of a crude oil sample from well 204/19-02, United Kingdom*

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### 1.0 Introduction

A geochemical investigation has been carried out on a crude oil sample from well 204/19-02, United Kingdom,

OMC 5491, 210/19-2, 2923m, Faeroe Fm. (Montrose Group)

The geochemical parameters are shown on pages 2 to 6, analysis results are presented on the yellow pages. In addition to the routine analytical program the aromatic hydrocarbons are also measured. FIMS has not been carried out.

### 2.0 Conclusions

#### 1. Transformation processes

The oil shows no sign of bacterial degradation (n-Alkane distribution, C-7 distribution)

#### 2. Maturity

It is almost certain that the oil has been expelled from a highly mature source rock (Sterane distribution, N-alkane distribution, API, C-7 distribution)

#### 3. Environment of deposition / Type of organic matter

It is almost certain that the oil has been derived from a shaly source rock (GCMS Steranes, C-7 distribution, % Sulphur) containing structureless organic matter with a small contribution of algal or landplant matter (n-Alkane distribution, high biphenyls, C7 distribution)

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## Summary of the Geochemical Data of the oil sample from well 204/19-02 (2923 m.), United Kingdom

### Gravity and Gross Composition

API gravity (degrees) :	40.7
Specific Gravity (g/ml) :	0.822
Viscosity (centipoise) :	no data
Gross Composition (W%)	
Weight lost on topping :	24.1
Saturates :	83
Aromatics :	16
Heterocompounds :	1
Rest (High molecular) :	0
Gasoline fraction (%) :	7.8
Sulphur (%) :	0.1
Vanadium (ppm) :	0.0
Nickel (ppm) :	1.0

### Saturates Distributions (Gaschromatography)

Pristane / Phytane :	1.6
Pristane / n-C17 :	0.3
Phytane / n-C18 :	0.2
ACI :	16
Corr. Coeff. :	-0.9555

### C-7 Distributions (Gaschromatography)

C-7 Alkanes (%)	
Normal C-7 :	54
Mono Branched :	36
Poly Branched :	10
C-7 Alkanes / Cyclo Alkanes (%)	
Normal C-7 :	26
Cyclo Alkanes :	51
Branched Alkanes :	23
C-7 Alk. / Cyclo Alk. / Aromatics (%)	
Alkanes :	43
Cyclo Alkanes :	44
Aromatics :	13

### Carbon Isotope Ratios (Mass Spectrometry)

Total Oil (topped) :	-29.9
Saturates :	-30.2
Aromatics :	-29.0

### Distribution of Ring Compounds

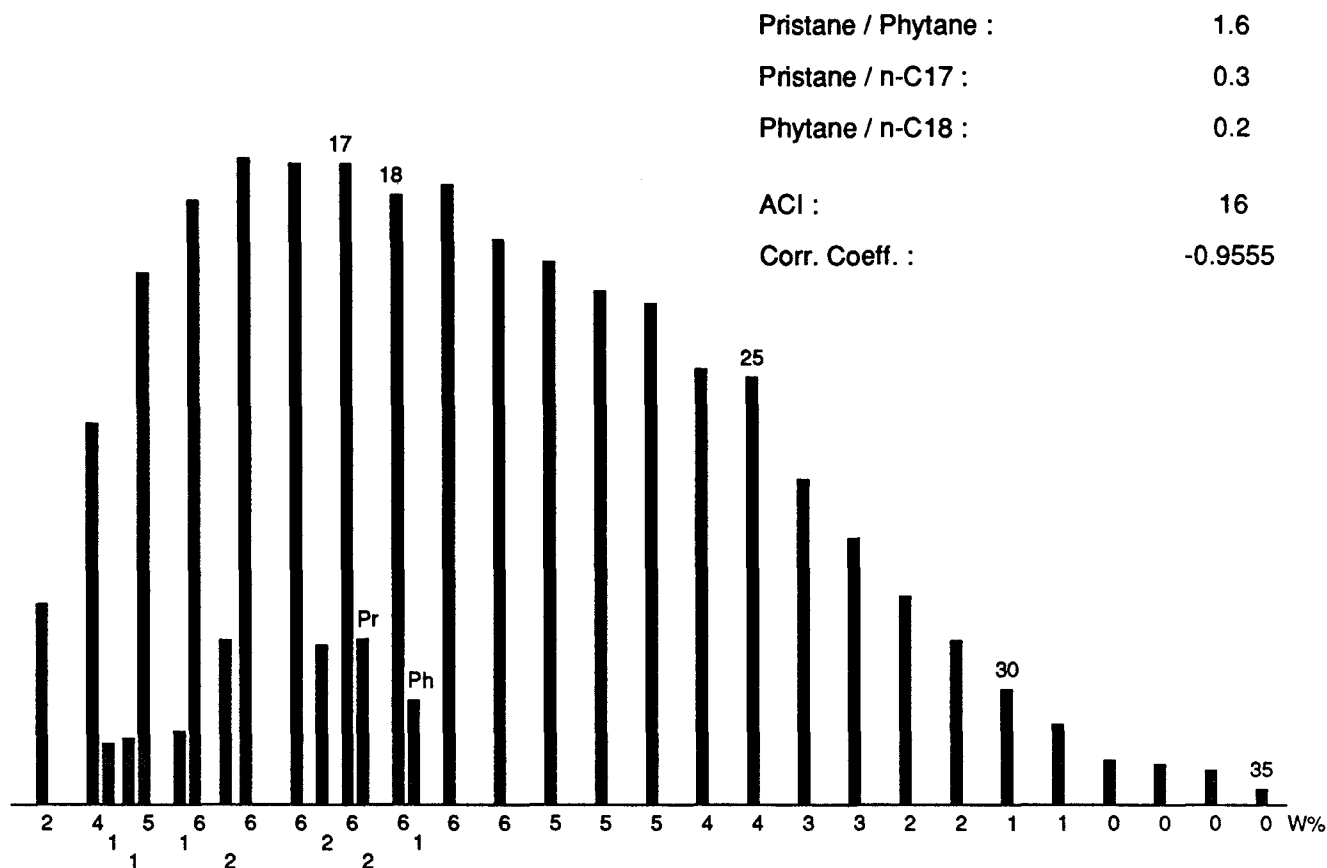
(Field Ionisation Mass Spectrometry)

C-15 Ring Compounds (%)	
1 ring :	no data
2 ring :	
3 ring :	
C-30 Ring Compounds (%)	
3 ring :	no data
4 ring :	
5 ring :	
C-29 VR/E :	no data

### Sterane and Triterpane Distributions (Gaschromatography / Mass Spectrometry)

Steranes/Triterpanes (%)	
Iso Steranes :	24
Rearranged Steranes :	48
Triterpanes :	28
Steranes (%)	
Iso Steranes :	33
Rearranged Steranes :	45
Normal Steranes :	22
Triterpanes (%)	
C-30 Hopanes :	100
Oleanane ( $\alpha + \beta$ ) :	0
W + T :	0
Steranes Carbon No. Dist. (%)	
C-27 :	37
C-28 :	33
C-29 :	30
C-29 Sterane Ratios	
20S / 20R + 20S :	0.41
Iso / Iso + Normal :	0.56
Triterpane Ratios	
TS / TM :	1.19
3R / 3R + 5R :	0.17

**Bar diagram of Normal-alkanes & Isoprenoids of the oil sample from well 204/19-02 (2923 m.), United Kingdom**

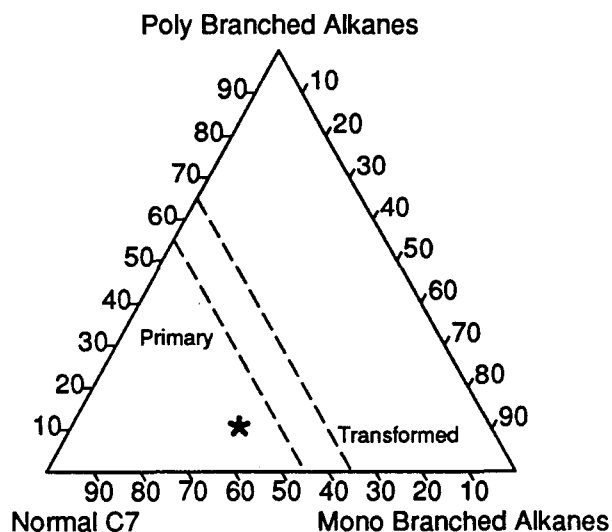


**Conclusions based on saturated hydrocarbon fraction :**

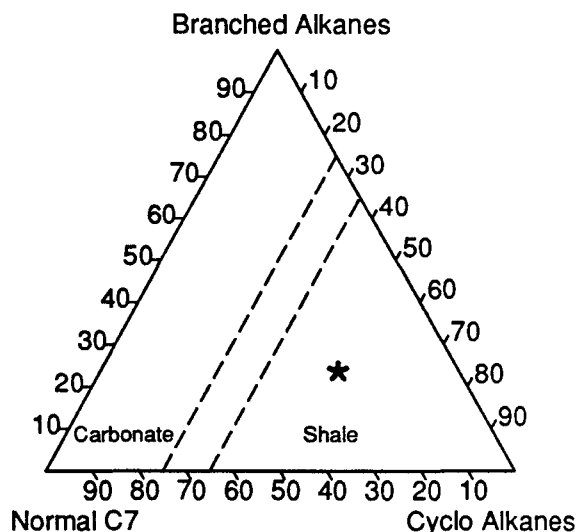
- 1 : the saturates show no indication of bacterial degradation
- 2 : the n-alkane distribution has a mature character
- 3 : the saturates indicate that the oil has been expelled from a source rock containing structureless organic matter with a small contribution of algal matter

**The Light Fraction (< 120 C.) of the oil sample from  
well 204/19-02 (2923 m.), United Kingdom**

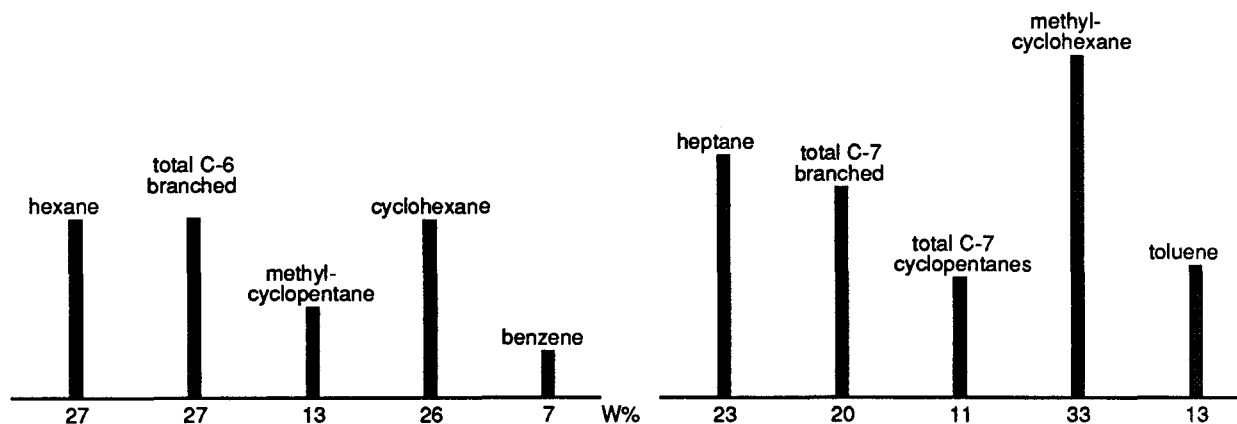
**Alkane Distribution**



**Alkane/Cyclo-alkane Distribution**



**C-6 and C-7 Distributions**



**C-7 ALKANES (%)**

Normal C-7 :	54
Mono Branched :	36
Poly Branched :	10

**C-7 ALKANES / CYCLO ALKANES (%)**

Normal C-7 :	26
Cyclo Alkanes :	51
Branched Alkanes :	23

**C-7 ALK. / CYCLO ALK. / AROMATICS (%)**

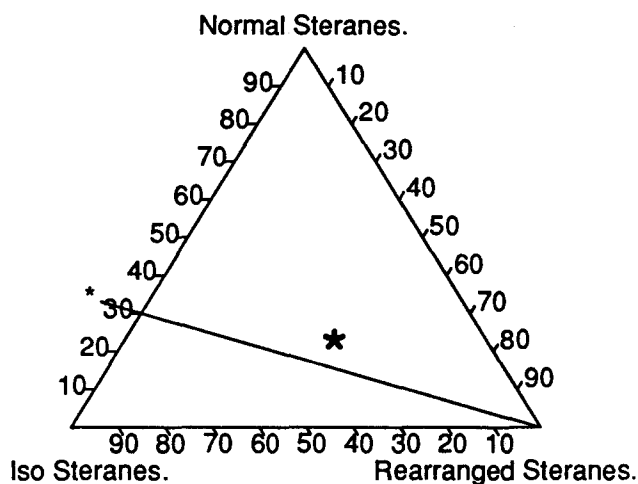
Alkanes :	43
Cyclo Alkanes :	44
Aromatics :	13

**Conclusions based on light fraction :**

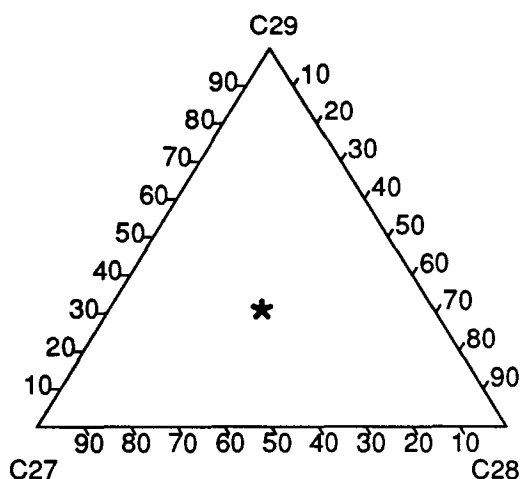
- 1 : the light fraction shows no indication of bacterial degradation
- 2 : it is likely that the light fraction has a highly mature character
- 3 : the light fraction indicates a shaly source rock

## GCMS Sterane typing of the oil sample from well 204/19-02 (2923 m.), United Kingdom

### Sterane Conversion Diagram

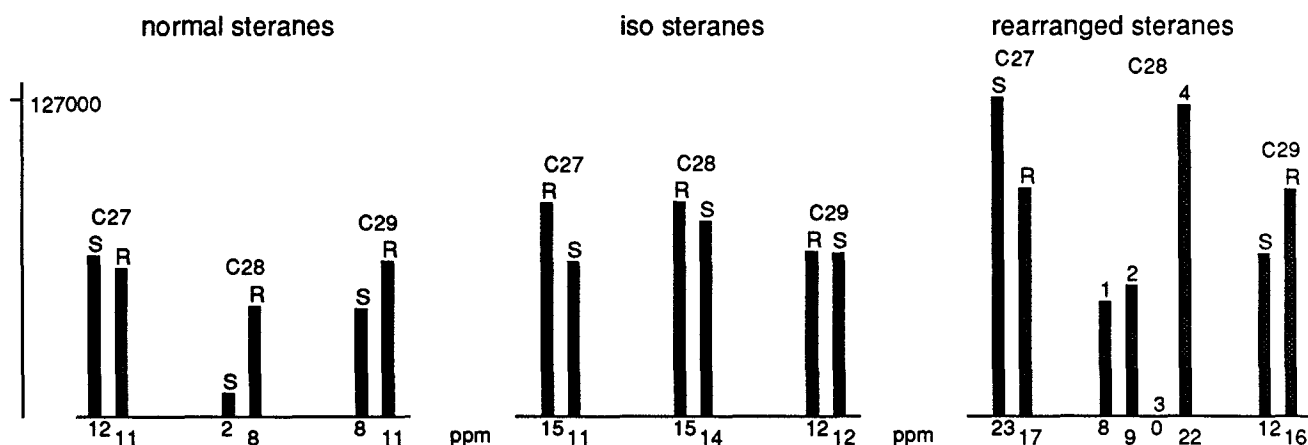


### Sterane Typing Diagram



\* The line of complete sterane isomerisation indicating a mature character

### Sterane Distribution



STERANE DISTRIBUTION	(ppm)	(%)
Iso Steranes :	80	33
Rearranged Steranes :	108	45
Normal Steranes :	51	22

#### CARBON NUMBER DISTRIBUTION

C-27 :	88	37
C-28 :	79	33
C-29 :	71	30

#### C-29 STERANE CONVERSION RATIOS

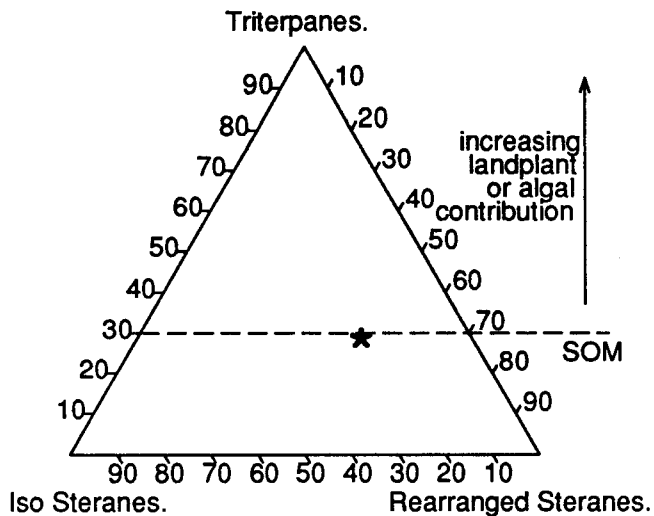
20S / 20R + 20S :	0.41
Iso / Iso + Normal :	0.56

#### Conclusions based on steranes :

- 1 : it is likely that the complete sterane isomerisation indicates that this oil has been expelled from a mature source rock
- 2 : it is likely that the steranes indicate a shaly source rock

## GCMS Triterpane typing of the oil sample from well 204/19-02 (2923 m.), United Kingdom

### Sterane/Triterpane Diagram



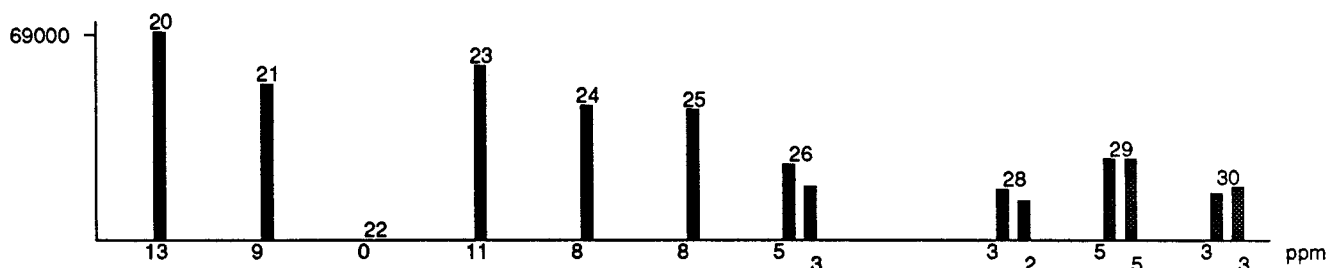
#### STERANES/TRITERPANES (calculated %)

Iso Steranes :	24
Rearranged Steranes :	48
Triterpanes :	28

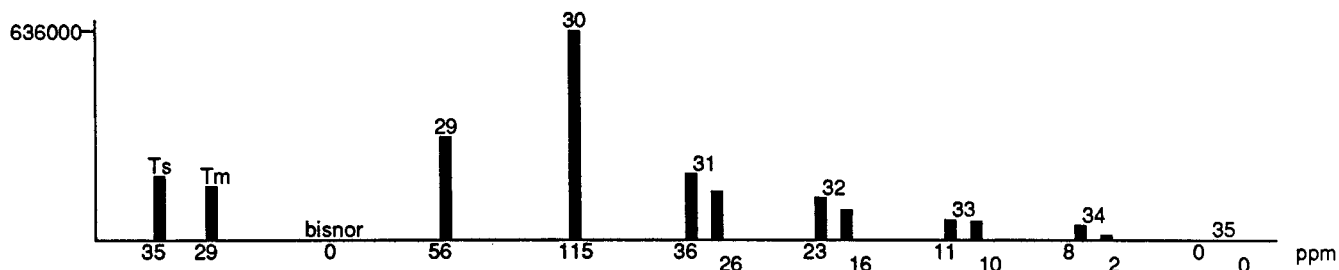
#### TRITERPANE CONVERSION RATIOS

TS / TM :	1.19
3R / 3R + 5R :	0.17
C30 Hopane (ppm) :	115

### Tricyclic Terpanes



### Pentacyclic Terpanes

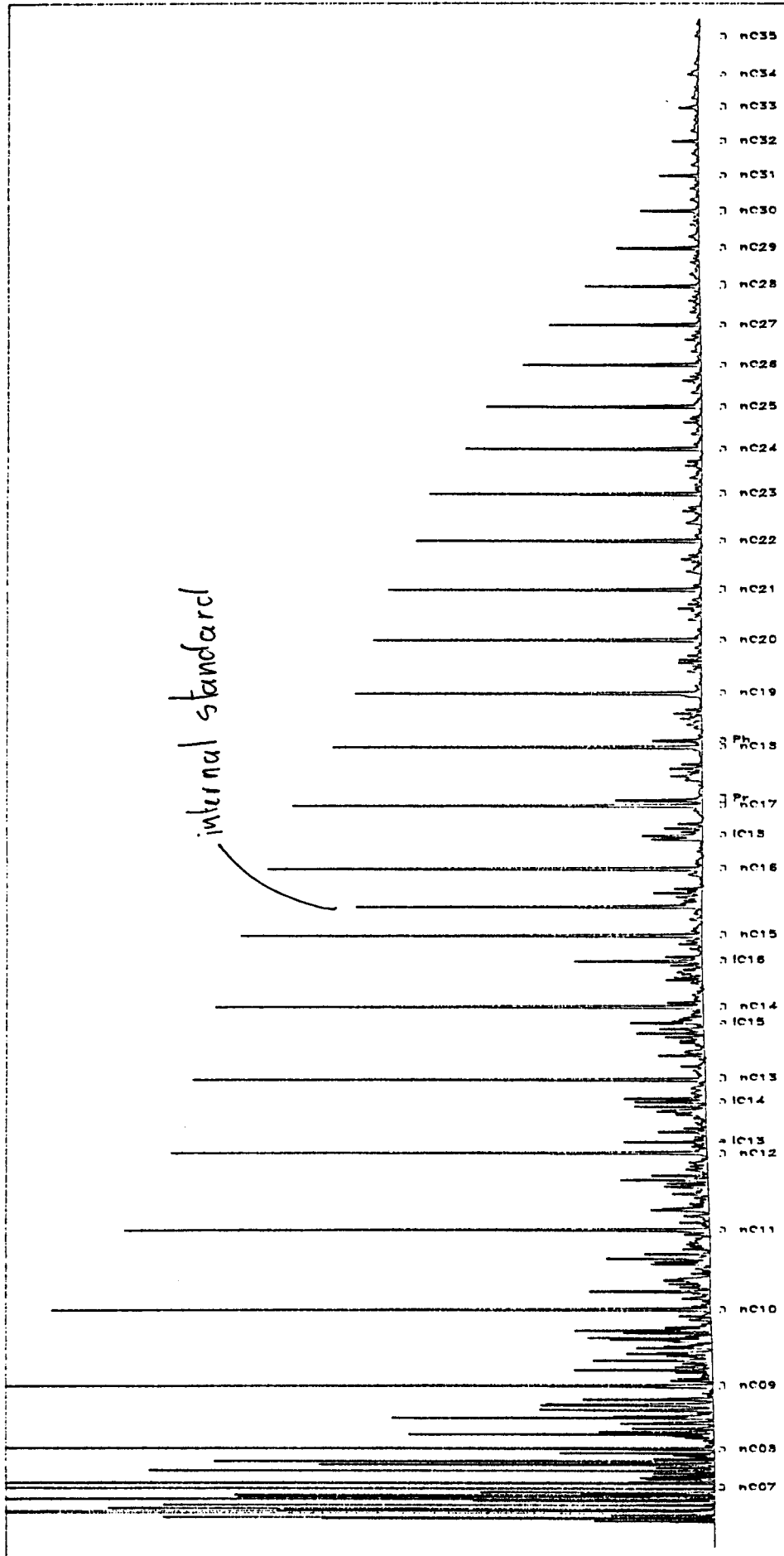


### Conclusions based on triterpanes :

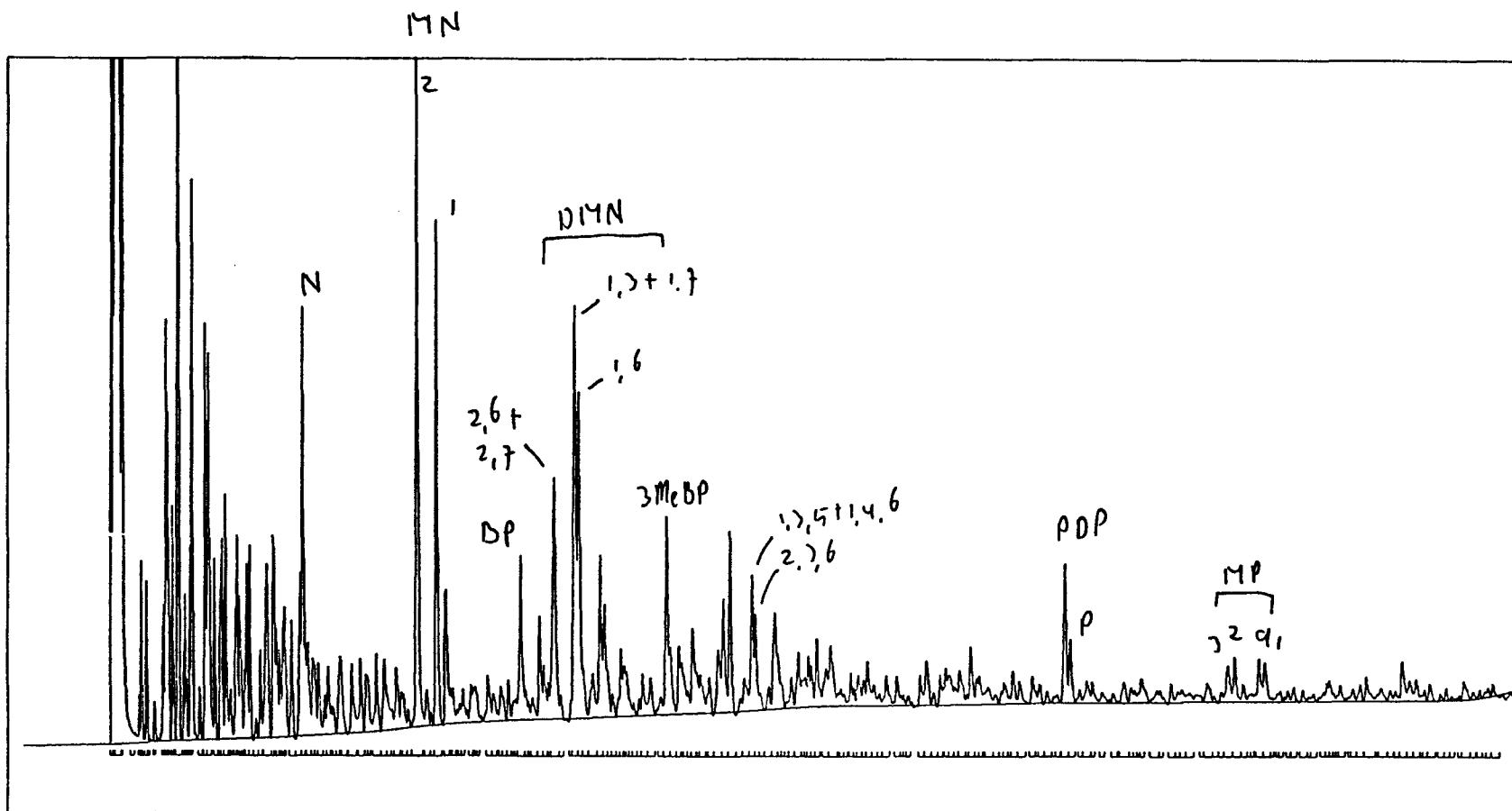
1 : the triterpane distribution indicates a source rock containing predominantly structureless organic matter

*ANALYTICAL DATA*  
*well 204/19-02 (2923 m.), United Kingdom*

Gas chromatogram of the whole oil sample from  
well 204/19-02 (2923 m.), United Kingdom



Gas chromatogram of the aromatic hydrocarbons of the oil sample from  
well 204/19-02 (2923 m.), United Kingdom



# GCMS data of the aromatic fraction well 204/19-02 (2923 m.), United Kingdom

## I) NAPHTHALENES

## a) Concentrations (ppm):

2-MN	1531
1-MN	1181
2,6+2,7-DMN	654
1,6-DMN	542
1,5-DMN	157
1,4,6+1,3,5-TMN	224
2,3,6-TMN	160
1,2,5-TMN	95
C4-Naphthalene	42
THN	80
Cadalene	32
Total Naphthalenes	4698

## b) Parameters:

2-MN/1-MN (MNR)	1.30
2,6+2,7-DMN/1,5-DMN (DNR-1)	4.18
2,3,6-TMN/1,4,6+2,3,5-TMN (TNR-1)	0.72
2,3,6-TMN/1,2,5-TMN (TNR-2)	1.68
2,3,6-TMN/THN	2.01
2,3,6-TMN/Cadalene	4.96

## II) PHENANTHRENES

## a) Concentrations (ppm):

P	163
3-MP	55
2-MP	54
9-MP	87
1-MP	63
Total Phenanthrenes	422

## b) Parameters:

2-MP/1-MP	0.87
$1.5(2\text{-MP}+3\text{-MP})/(P+1\text{-MP}+9\text{-MP})$ (MPI1)	0.53
$3(2\text{-MP})/(P+1\text{-MP}+9\text{-MP})$	0.52
$(2\text{-MP}+3\text{-MP})/(1\text{-MP}+9\text{-MP})$	0.73
$(2\text{-MP}+3\text{-MP})/(1\text{-MP}+9\text{-MP}+2\text{-MP}+3\text{-MP})$	0.42

## III) DIBENZOTHIOPHENES

## a) Concentrations (ppm):

DBT	34
4-MDBT	29
2+3-MDBT	13
1-MDBT	8
Total Dibenzothiophenes	84

MN = methylnaphthalene

DMN = dimethylnaphthalene

TMN = trimethylnaphthalene

THN = tetrahydronaphthalene

DBF = dibenzofuran

MDBF = methyldibenzofuran

NAPH\* = 2,6+2,7-DMN + 1,5-DMN + 1,4,6+1,3,5-TMN + 2,3,6-TMN

## b) Parameters

4-MDBT/2+3-MDBT	2.28
4-MDBT/1-MDBT	3.72
2+3-MDBT/1-MDBT	1.63
4-MDBT/DBT	0.87
2+3-MDBT/DBT	0.38
1-MDBT/DBT	0.23

## IV) BIPHENYLS

## a) Concentrations (ppm):

BP	449
2-MBP	39
3-MBP	385
4-MBP	133
Total Biphenyls	1006

## b) Parameters:

3-MBP/BP	0.86
3-MBP/4-MBP	2.90
3-MBP/2-MBP	9.77

## V) DIBENZOFURANS

## a) Concentrations (ppm):

DBF	44
4-MDBF	42
2+3-MDBF	70
1-MDBF	23
Total Dibenzofurans	179

## b) Parameters:

4-MDBF/2+3-MDBF	0.60
4-MDBF/1-MDBF	1.81
2+3-MDBF/1-MDBF	3.03
4-MDBF/DBF	0.96
2+3-MDBF/DBF	1.61
1-MDBF/DBF	0.53

## VI) OVERALL RATIOS

Biphenyls/NAPH*	0.84
Dibenzothiophenes/NAPH*	0.07
Dibenzofurans/NAPH*	0.15

P = phenanthrene

MP = methylphenanthrene

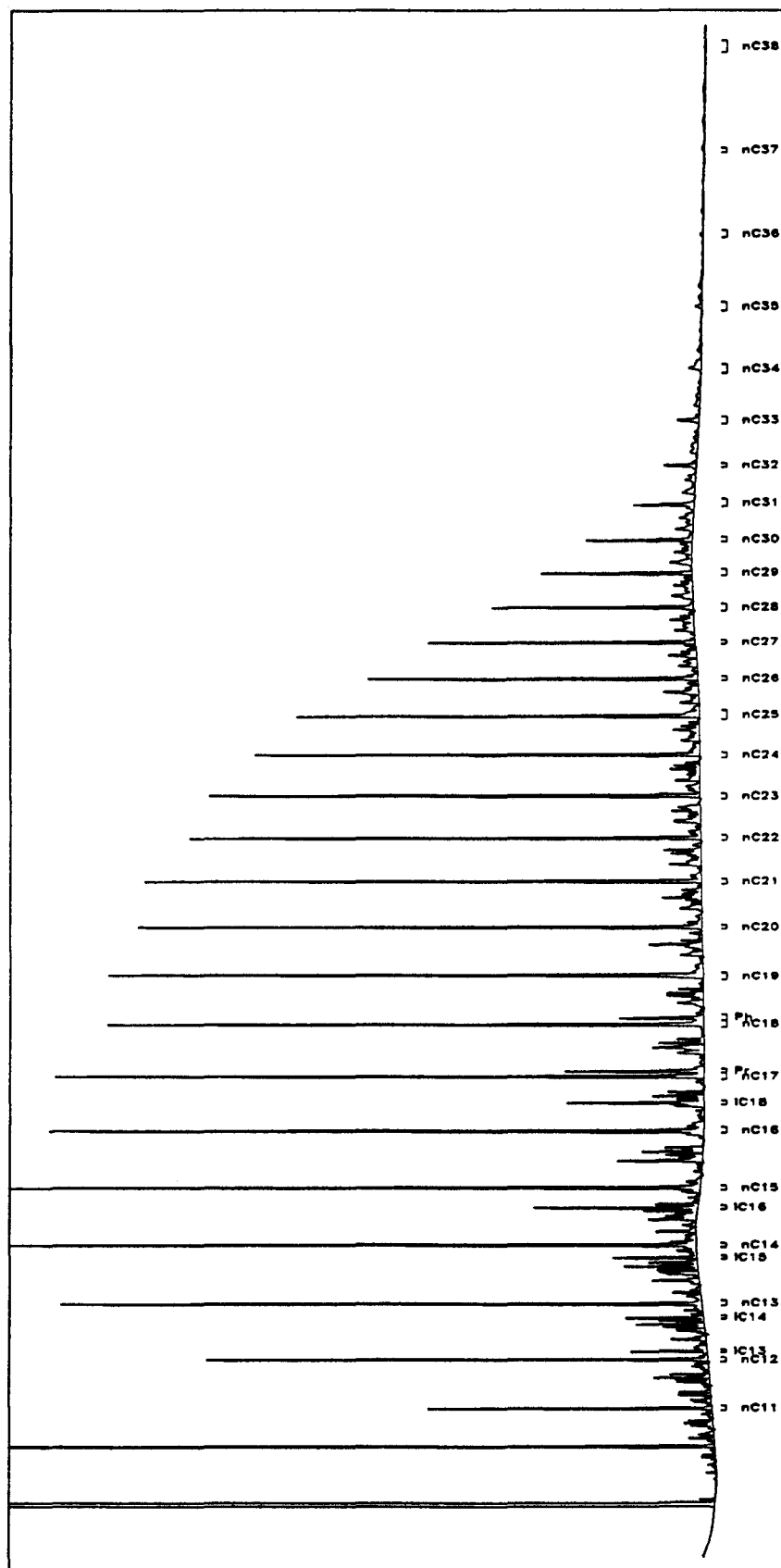
DBT = dibenzothiophene

MDBT = methyldibenzothiophene

BP = biphenyl

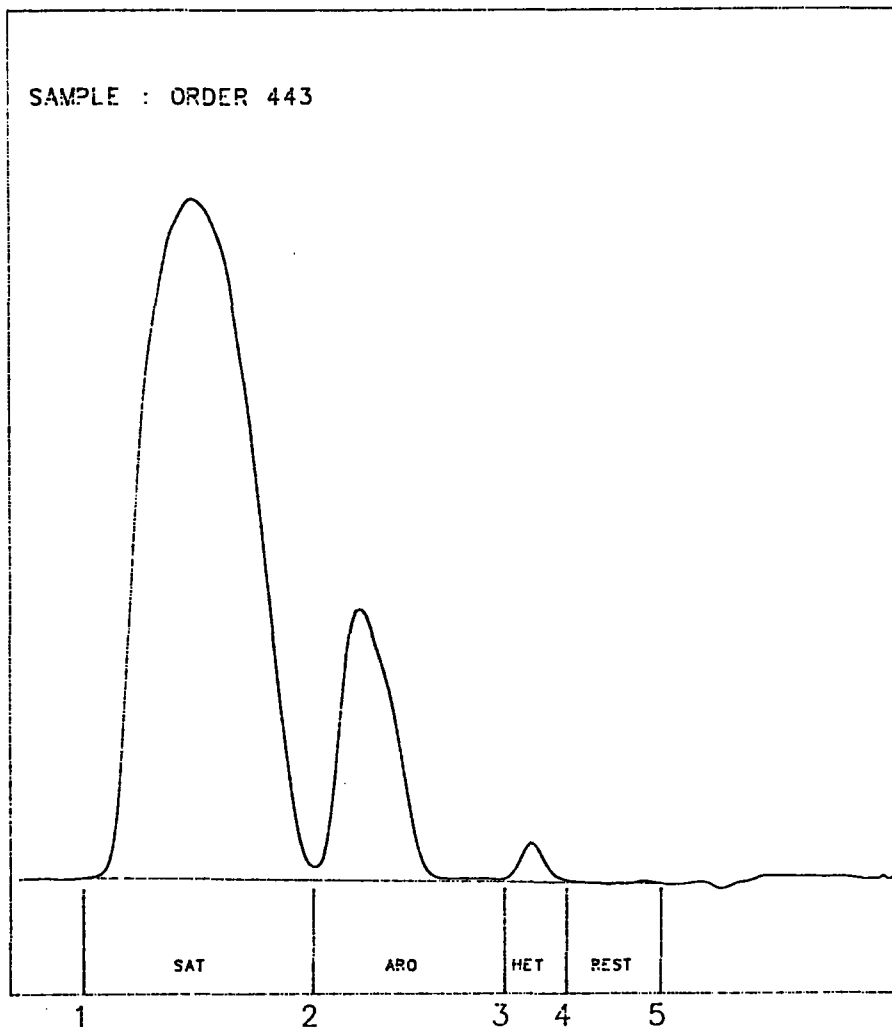
MBP = methylbiphenyl

Gas chromatogram of the saturated hydrocarbons of the oil sample from  
well 204/19-02 (2923 m.), United Kingdom



*Gross Composition of the oil sample from  
well 204/19-02 (2923 m.), United Kingdom*

SAMPLE : ORDER 443



SAMPLE : S156479-1

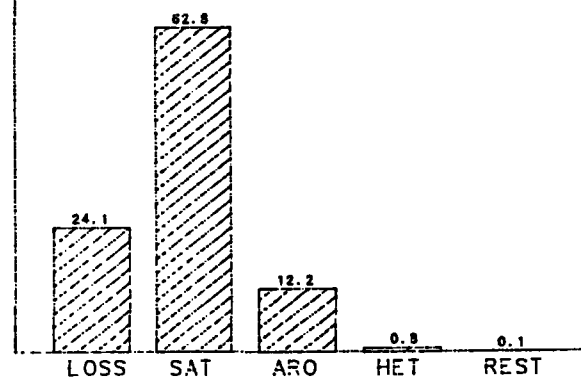
WEIGHT LOST ON TOPPING : 24.1 %

- SATURATES : 82.8 %  
- AROMATICS : 16.1 %  
- HETEROCOMPOUNDS : 1.1 %  
- REST (HIGH MOL.) : 0.1 %

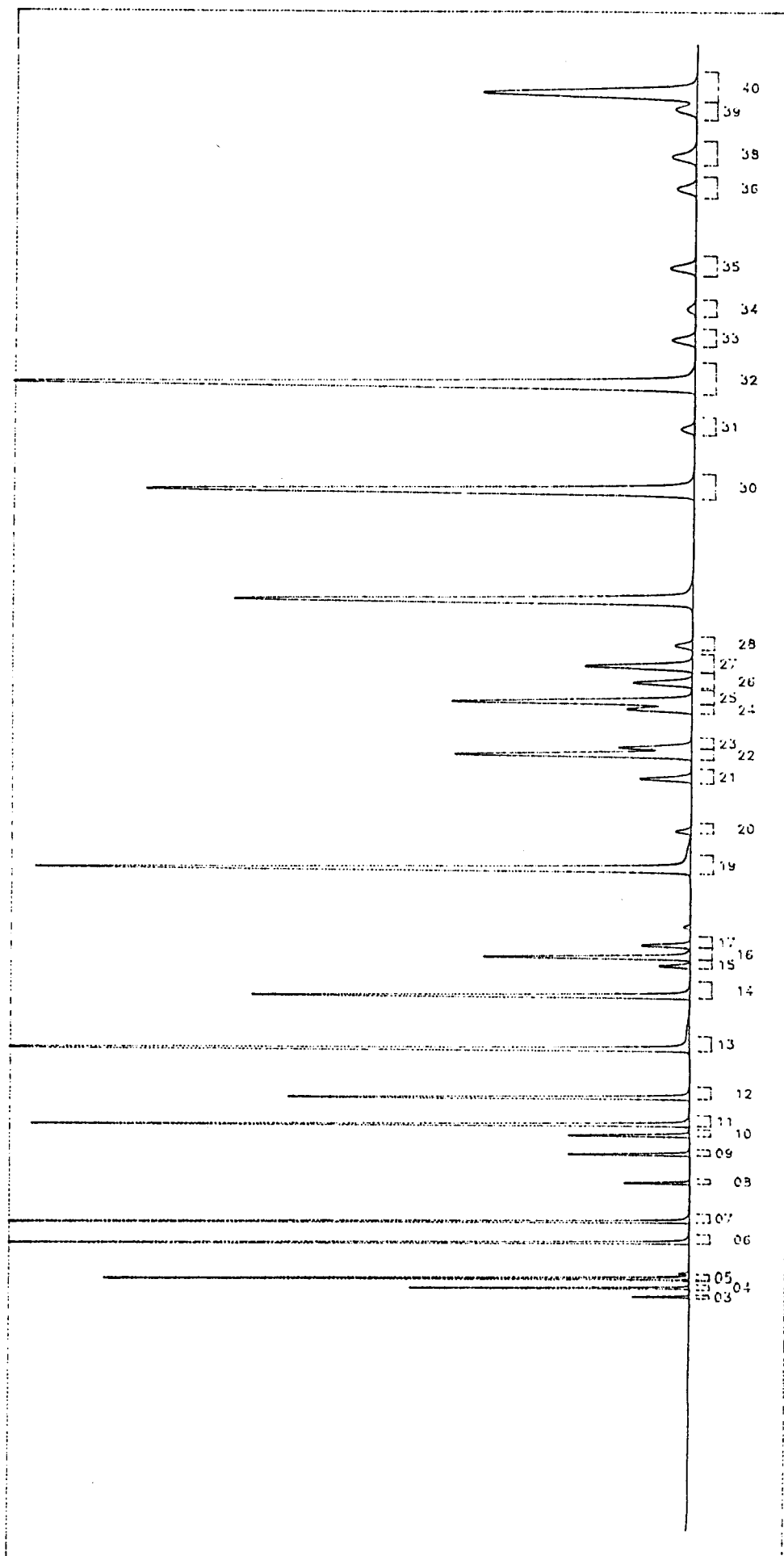
• WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE

WEIGHT DISTRIBUTION

(WHOLE OIL = 100 %)



Gas chromatogram of the light fraction (< 120 C.) of the oil sample from  
well 204/19-02 (2923 m.), United Kingdom



# Gas chromatographic hydrocarbons analysis (< 120 C.) well 204/19-02 (2923 m.), United Kingdom

## GAS CHROMATOGRAPHIC ANALYSIS OF THE FRACTION BOILING BELOW 114 DEGREES CENTIGRADE

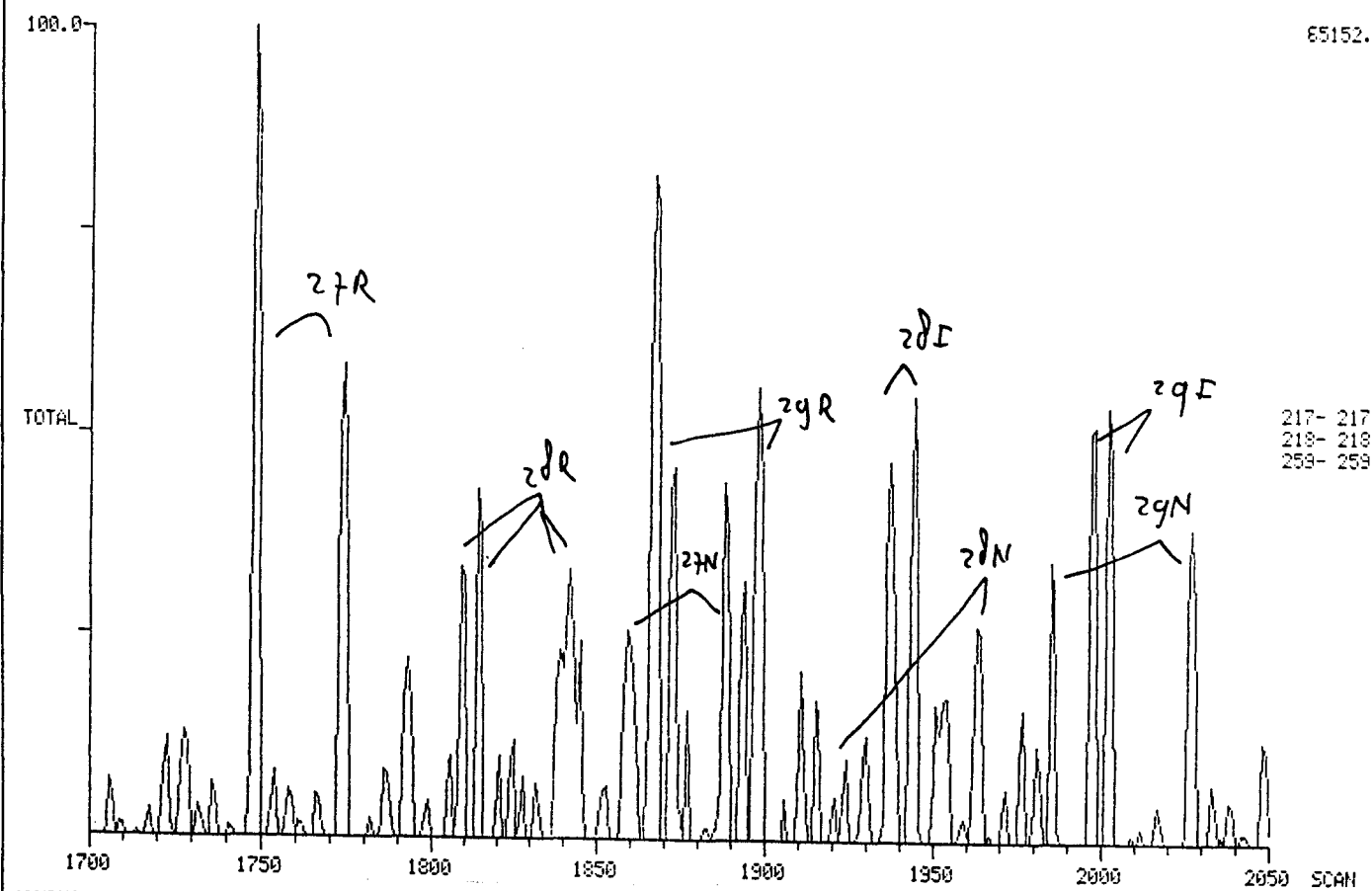
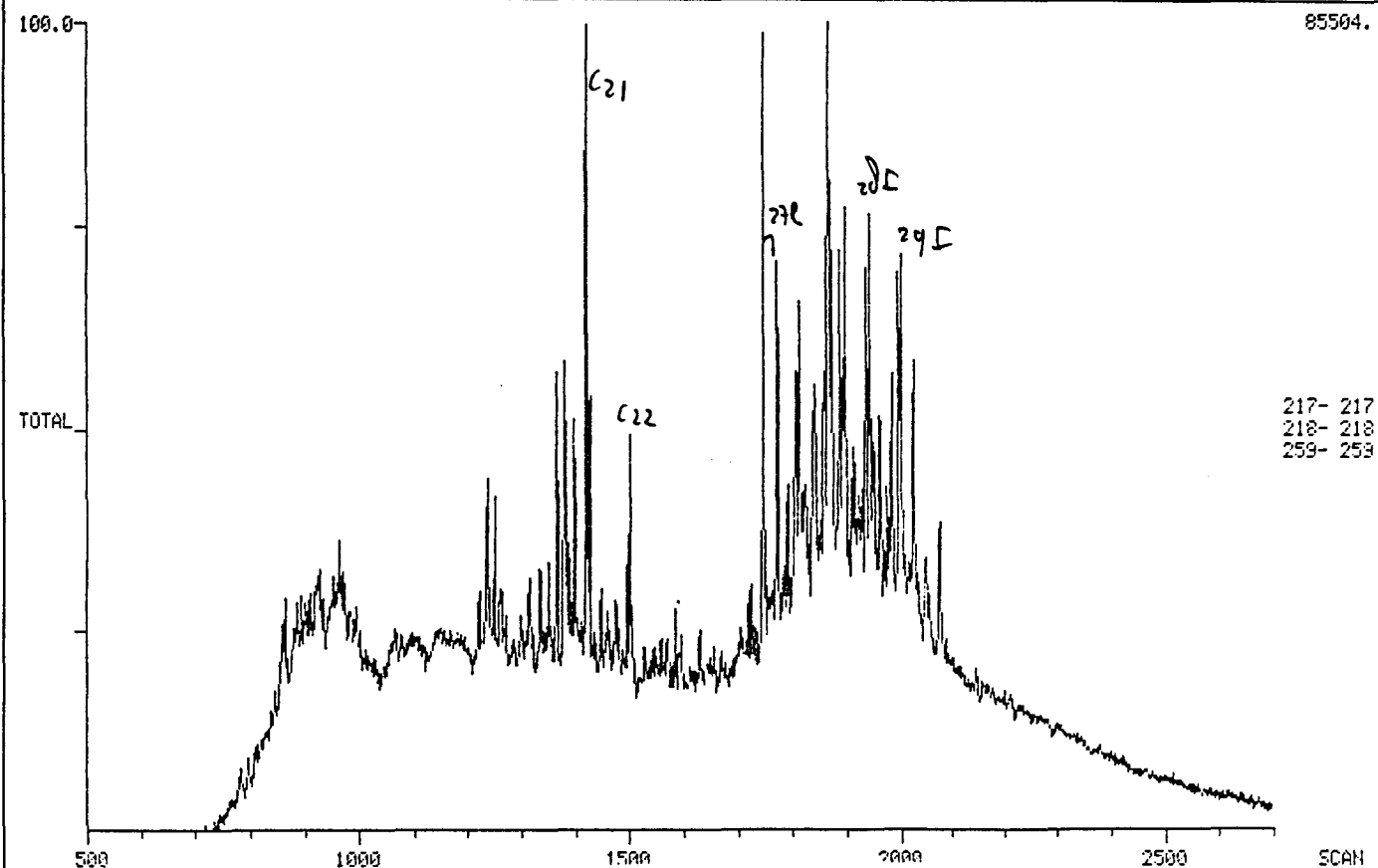
Sample: S15647901

d.d. 13-feb-92 14:53

COMPONENT No. Name	RET.TIM (min)	MAXIMUM (mV)	AREA * (cnts)	WEIGHT PERC.
4 - I-BUTANE	016:13	1139.2	6941	0.96
5 - N-BUTANE	016:41	2381.1	15575	2.16
6 - I-PENTANE	018:35	4385.4	33458	4.63
7 - N-PENTANE	019:46	4446.5	37104	5.14
8 - 2.2-DIMETHYLBUTANE	021:59	268.1	2718	0.38
9 - CYCLOPENTANE	023:38	496.0	5595	0.77
10 - 2.3-DIMETHYLBUTANE	024:42	491.2	5826	0.81
11 - 2-METHYLPENTANE	025:19	2677.0	32749	4.53
12 - 3-METHYLPENTANE	026:52	1631.2	21755	3.01
13 - N-HEXANE	029:37	4164.2	62526	8.65
14 - METHYLCYCLOPENTANE	032:39	1782.7	31568	4.37
15 - 2.2-DIMETHYLPENTANE	034:19	129.0	2369	0.33
16 - BENZENE	034:48	841.6	16231	2.25
17 - 2.4-DIMETHYLPENTANE	035:27	199.9	3977	0.55
18 - 2.2.3-TRIMETHYLBUTANE	* * *	Not detected	* * *	
19 - CYCLOHEXANE	039:40	2662.1	62273	8.62
20 - 3.3-DIMETHYLPENTANE	041:46	65.2	1583	0.22
21 - 1.1-DIMETHYLCYCLOPENTANE	044:44	212.6	5684	0.79
22 - 2-METHYLHEXANE	046:05	966.3	26712	3.70
23 - 2.3-DIMETHYLPENTANE	046:29	300.2	8068	1.12
24 - 1-C-3-DIMETHYLCYCLOPENTANE	048:42	268.1	7749	1.07
25 - 3-METHYLHEXANE	049:07	978.5	28831	3.99
26 - 1-TR-3-DIMETHYLCYCLOPENTANE	050:10	242.8	7301	1.01
27 - 1-TR-2-DIMETHYLCYCLOPENTANE	051:03	438.0	13663	1.89
28 - 3-ETHYLPENTANE	052:11	72.5	2209	0.31
30 - N-HEPTANE	060:49	2230.2	85124	11.78
31 - 1-C-2-DIMETHYLCYCLOPENTANE	064:19	58.4	2442	0.34
32 - METHYLCYCLOHEXANE	066:59	2814.1	120619	16.69
33 - 1.1.3-TRIMETHYLCYCLOPENTANE	069:27	96.3	4354	0.60
34 - 2.2-DIMETHYLHEXANE	071:11	36.1	1714	0.24
35 - ETHYLCYCLOPENTANE	073:30	106.8	5061	0.70
36 - 2.5-DIMETHYLHEXANE	077:54	78.1	4058	0.56
38 - 2.2.3-TRIMETHYLPENTANE	079:40	101.7	5691	0.79
39 - 1-TR-2-C-4-TRIMETHYLCYCLOPENTANE	082:16	89.1	4754	0.66
40 - TOLUENE	083:13	872.8	46220	6.40
REFERENCE PEAK (29)	054:45	1866.2	64536	
Total peak area			722503	

\*) Corrected for difference in response

*Sterane Fragmentograms of the oil sample from  
well 204/19-02 (2923 m.), United Kingdom*



# Triterpane Fragmentograms of the oil sample from well 204/19-02 (2923 m.), United Kingdom

