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Geochemical investigation of a source rock extract from
well 206/1-2, United Kingdom

by

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Sponsor: Shell Expro London

Code: 876.106.10

investigation: 8BAS0818

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RIJSWIJK, THE NETHERLANDS

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CONTENTS

	page
1. Introduction	1
2. Conclusions	1
3. Geochemical parameters	
Summary of the analytical data	2
Bar diagram of normal alkanes & isoprenoids	3
GCMS sterane typing	4
GCMS triterpane typing	5
4. Analytical data	
GCMS data of the aromatic fraction	
Gas chromatogram of the saturated hydrocarbons	
Gross composition	
Sterane fragmentogram	
Triterpane fragmentogram	
5. Rock Eval and Maceral data	

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Geochemical investigation of a source rock extract from well 206/1-2, United Kingdom

1.0 Introduction

A geochemical investigation has been carried out on a source rock cuttings extract from 8090+8160+8190 ft (2465.83 m, Faeroe Fm, Eocene) in well 206/1-2, United Kingdom (request telex ref. ABX 015029 of 27.05.94). The geochemical parameters are shown on pages 2 to 4, analysis results are presented on the yellow pages.

2.0 Conclusions

1. Source Rock analysis

The organic carbon content (6.6 %), the Rock Eval data (HI=247) and the maceral analysis indicate a Type III/II source rock for gas and some oil. The high extract/organic carbon ratio and the high S1 (Rock Eval) both indicate an impregnated source rock. The shape of the gas chromatogram and the unusual gross composition confirm that the source rock is impregnated with a mud additive (fraction up to n-C17). Since the impregnation is most likely only a low boiling fraction, biomarkers (and probably also the carbon isotope/aromatics) can still be used for typing. The sample has therefore not been heated after extraction, since it appears that these data are only of limited value compared with the costs.

2. Maturity

The vitrinite reflectance measured on the sample is between VR=0.38 (desmocollinite) and 0.55 (telinite). The immature character is confirmed by the incomplete sterane isomerisation.

3. Environment of deposition / Type of organic matter

The sample is a shaly/coaly source rock, that contained a high amount of landplant matter (maceral analysis). The high amount of C27-steranes and the low amounts of triterpanes is generally unusual for landplant-derived organic matter; the high C27-sterane content suggests an strong algal input in the extract. The relatively high amounts of biphenyls in the light aromatic fraction is indicative for landplant matter. The extract contains minor amounts of Oleananes (from landplant resins) confirming the Eocene age.

4. Correlation

A comparison with previously analysed crudes from the West Shetland basin shows that this source rock extract does not correlate or has not contributed in a significant amount to these oils because of the following arguments:

- the extract shows no waxy character;
 - the carbon isotopes differ strongly from the oils;
 - the biomarkers differ strongly from the oils.
-

Summary of the Geochemical Data of the extract from well 206/01-02 (2465.83 m.), United Kingdom

Gravity and Gross Composition

% Extract :	2.2
% TOC after extract :	7.6
Extract/TOC :	0.29

Gross Composition (W%)

Saturates :	25
Aromatics :	6
Heterocompounds :	68
Rest (High molecular) :	1

Sulphur (%) :	1.9
---------------	-----

Vanadium (ppm) :	0.0
------------------	-----

Nickel (ppm) :	1.0
----------------	-----

Saturates Distributions

(Gaschromatography)

Pristane / Phytane :	1.8
Pristane / n-C17 :	0.4
Phytane / n-C18 :	0.4
ACI :	84
Corr. Coeff. :	-0.9982

C-7 Distributions

(Gaschromatography)

C-7 Alkanes (%)	
Normal C-7 :	no data
Mono Branched :	
Poly Branched :	
C-7 Alkanes / Cyclo Alkanes (%)	
Normal C-7 :	no data
Cyclo Alkanes :	
Branched Alkanes :	
C-7 Alk. / Cyclo Alk. / Aromatics (%)	
Alkanes :	no data
Cyclo Alkanes :	
Aromatics :	

Carbon Isotope Ratios

(Mass Spectrometry)

Total Sample (topped) :	-27.1
Saturates :	-27.3
Aromatics :	-26.8

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 :	29
Rearranged Steranes :	64
Triterpanes :	7

Steranes (%)

Iso Steranes :	24
Rearranged Steranes :	35
Normal Steranes :	41

Triterpanes (%)

C-30 Hopanes :	100
Oleanane ($\alpha + \beta$) :	0
W + T :	0

Steranes Carbon No. Dist. (%)

C-27 :	37
C-28 :	29
C-29 :	34

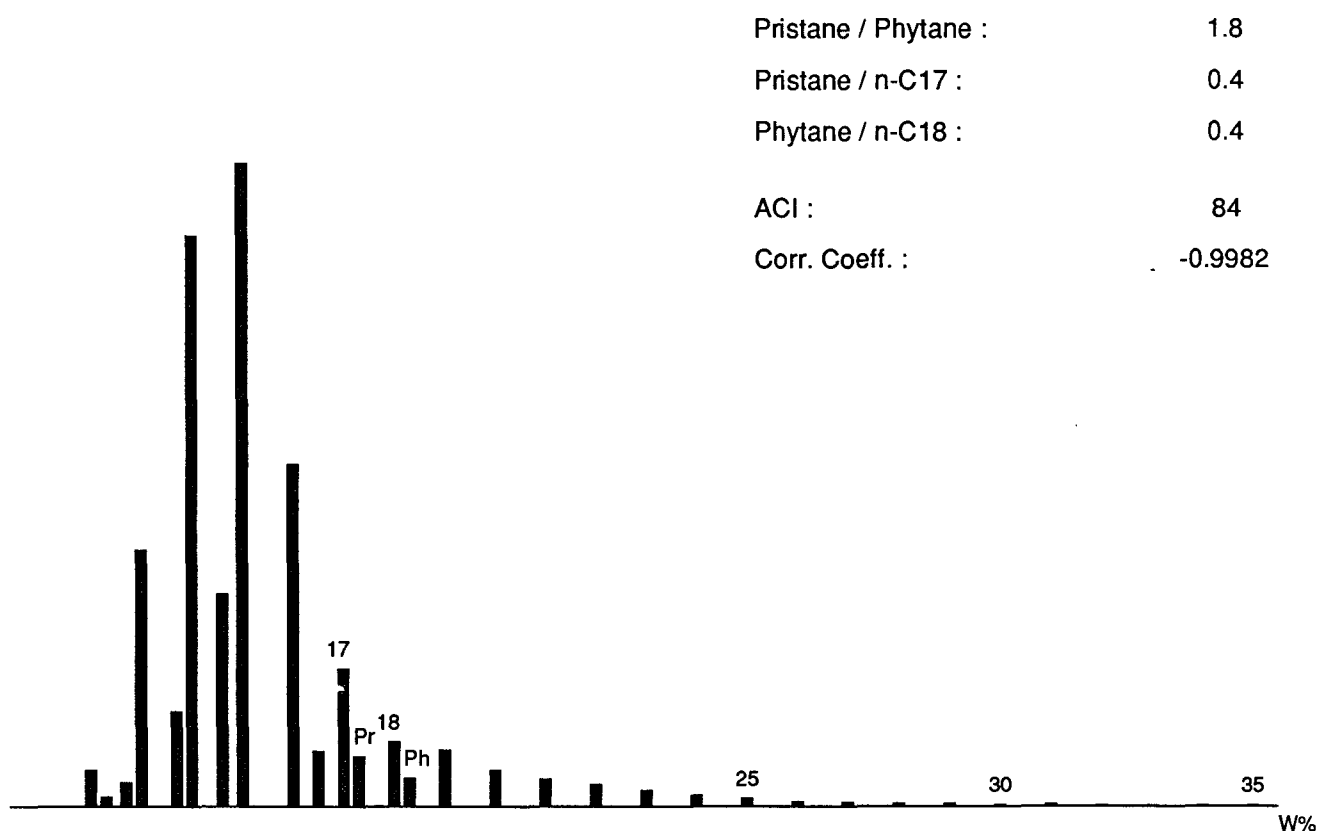
C-29 Sterane Ratios

20S / 20R + 20S :	0.13
Iso / Iso + Normal :	0.48

Triterpane Ratios

TS / TM :	0.60
3R / 3R + 5R :	0.14

Bar diagram of Normal-alkanes & Isoprenoids of the extract from well 206/01-02 (2465.83 m.), United Kingdom

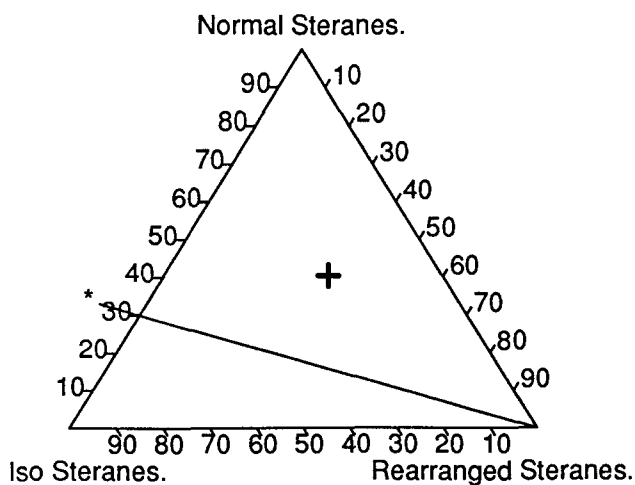


Conclusions based on saturated hydrocarbon fraction :

- 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 predominantly structureless organic matter
- 4 : the extract has most probably been contaminated

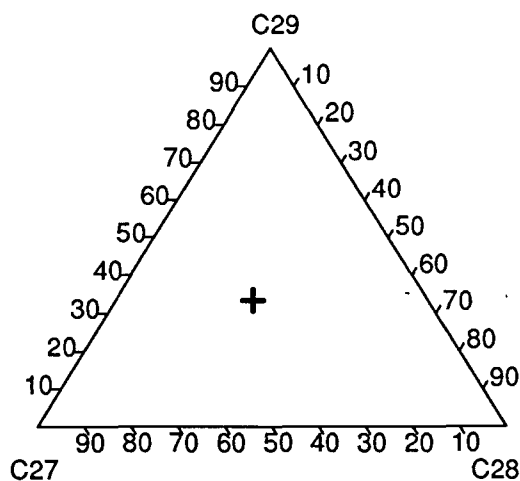
GCMS Sterane typing of the extract from well 206/01-02 (2465.83 m.), United Kingdom

Sterane Conversion Diagram



* The line of complete sterane isomerisation indicating a mature character

Sterane Typing Diagram

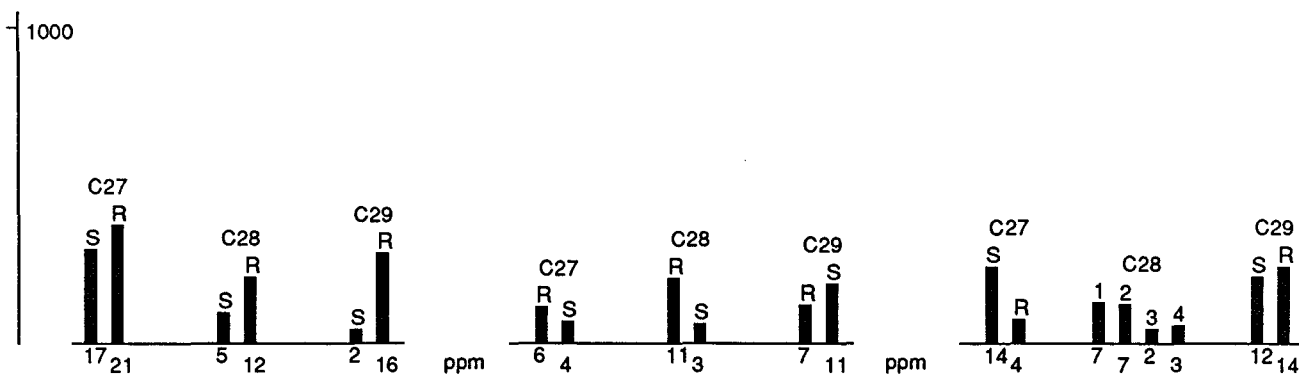


Sterane Distribution

normal steranes

iso steranes

rearranged steranes



STERANE DISTRIBUTION	(ppm)	(%)
Iso Steranes :	42	24
Rearranged Steranes :	63	35
Normal Steranes :	73	41

CARBON NUMBER DISTRIBUTION

C-27 :	66	37
C-28 :	52	29
C-29 :	61	34

C-29 STERANE CONVERSION RATIOS

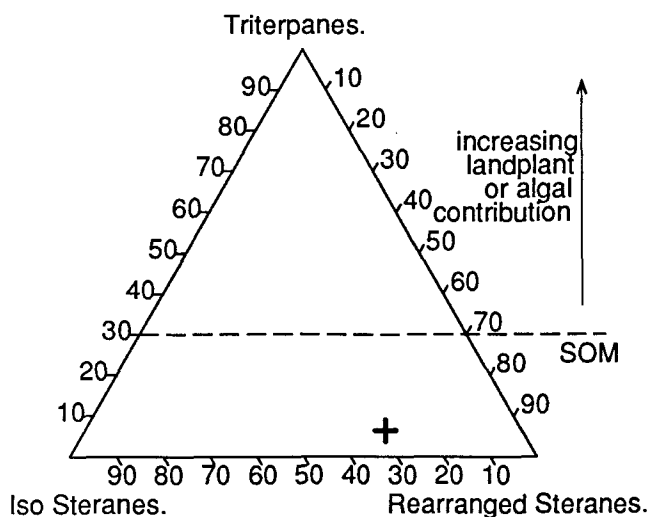
20S / 20R + 20S :	0.13
Iso / Iso + Normal :	0.48

Conclusions based on steranes :

1 : the incomplete sterane isomerisation indicates that the source rock of this oil is low mature and/or of Tertiary age

GCMS Triterpane typing of the extract from well 206/01-02 (2465.83 m.), United Kingdom

Sterane/Triterpane Diagram



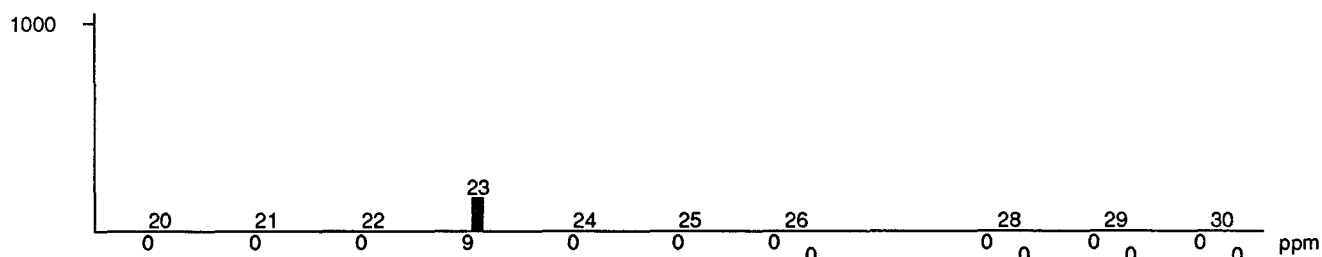
STERANES/TRITERPANES (calculated %)

Iso Steranes :	29
Rearranged Steranes :	64
Triterpanes :	7

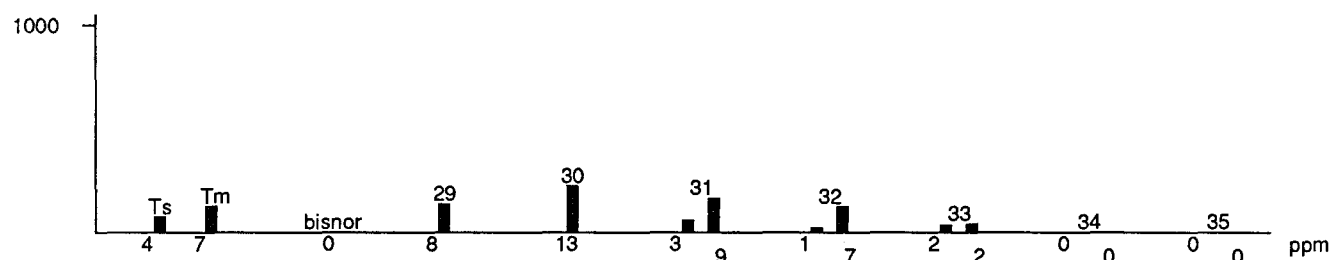
TRITERPANE CONVERSION RATIOS

TS / TM :	0.60
3R / 3R + 5R :	0.14
C30 Hopane (ppm) :	13

Tricyclic Terpanes



Pentacyclic Terpanes



Conclusions based on triterpanes :

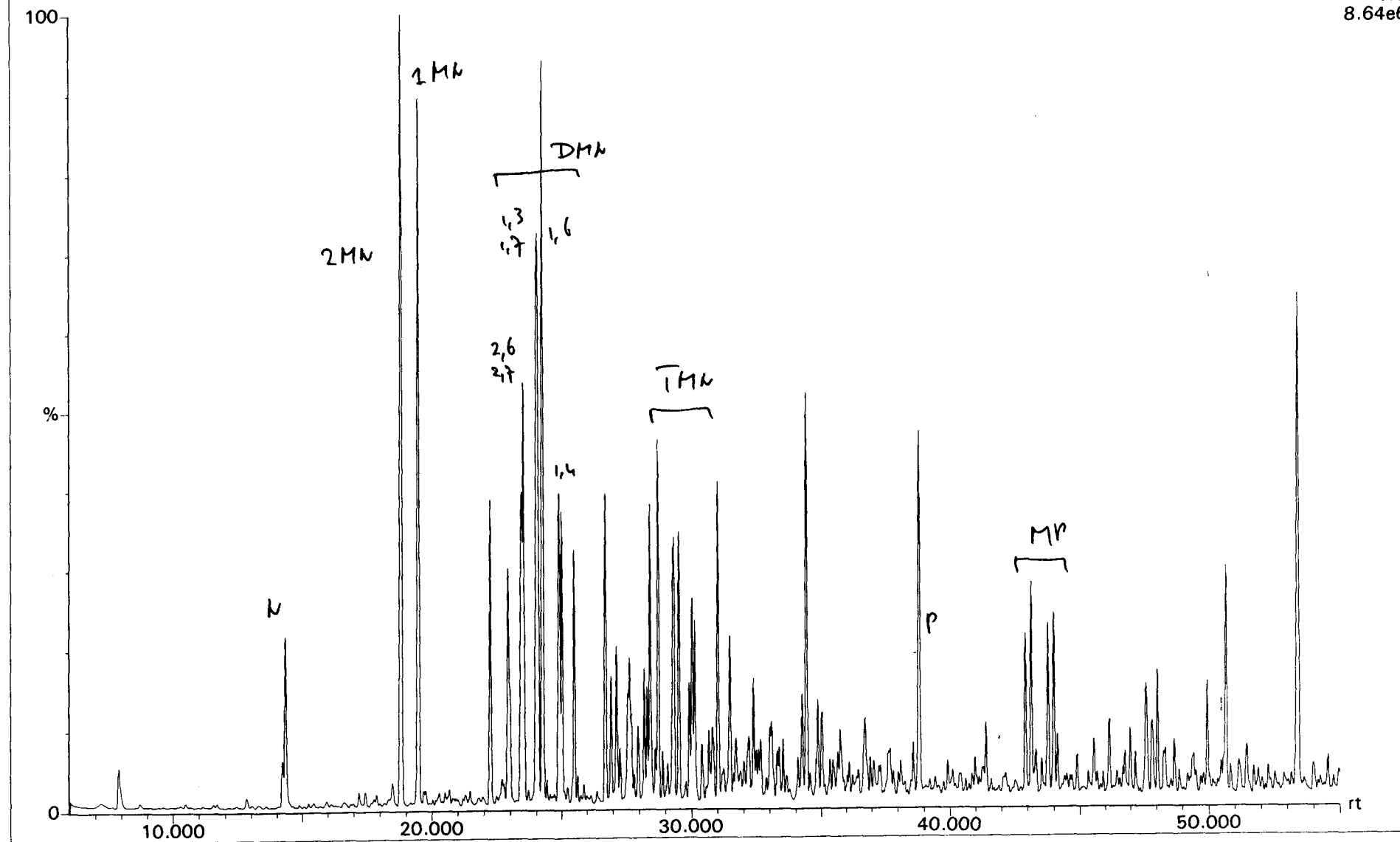
- 1 : the triterpane distribution indicates a source rock containing predominantly structureless organic matter

ANALYTICAL DATA
well 206/01-02 (2465.83 m.), United Kingdom

K.S.E.P.L.
02-Nov-1994 11:11:29
1670795

U.K. 206/01-02 8090-8190 ft cutting

MD-800
RON
Scan El+
TIC
8.64e6



GCMS data of the aromatic fraction well 206/01-02 (2465.83 m.), United Kingdom

Report of sample: U.K. 206/01-02 8090-8190 ft cutting
Acquired at : 02-Nov-1994

Standard used for calculations: PDP
Discrimination factor : 1.94

I) NAPHTHALENES

a) Concentrations (ppm)

2-MN
1-MN
2,6+2,7-DMN
1,6-DMN
1,5-DMN
1,3,5+1,4,6-TMN
2,3,6-TMN
1,2,5-TMN
C4-NAPH
THN
CAD
Total Naphthalenes

8034	4-MDBT/2+3-MDBT	2.47
6330	4-MDBT/1-MDBT	3.98
4998	2+3-MDBT/1-MDBT	1.61
4692	4-MDBT/DBT	1.11
2356	2+3-MDBT/DBT	0.45
1987	1-MDBT/DBT	0.28
1471		
1054	IV) BIPHENYLS	
336	a) Concentrations (ppm)	
42	BP	2805
1039	2-MBP	266
32338	3-MBP	1909
	4-MBP	750
	Total Biphenyls	5730

b) Parameters

2-MN/1-MN (MNR) 1.27
2,6+2,7-DMN/1,5-DMN (DNR-1) 2.12
2,3,6-TMN/1,3,5+1,4,6-TMN (TNR-1) 0.74
2,3,6-TMN/1,2,5-TMN (TNR-2) 1.40
2,3,6-TMN/THN 34.79
2,3,6-TMN/Cadelene 1.42

b) Parameters
3-MBP/BP 0.68
3-MBP/4-MBP 2.55
3-MBP/2-MBP 7.17

II) PHENANTHRENES

a) Concentrations (ppm)

P
3-MP
2-MP
9-MP
1-MP
Total Phenantrenes

V) DIBENZOFURANS
a) Concentrations (ppm)
DBF 938
4-MDBF 734
2+3-MDBF 568
1-MDBF 314
Total Dibenzofurans 2554

b) Parameters

2-MP/1-MP 1.21
1.5*(2+3-MP/(P+1+9-MP)) (MPI-1) 0.58
3*(2-MP/(P+1+9-MP)) (MPI-2) 0.67
2+3-MP/1+9-MP 1.01
2+3-MP/1+9+2+3-MP 0.50

b) Parameters
4-MDBF/2+3-MDBF 1.29
4-MDBF/1-MDBF 2.34
2+3-MDBF/1-MDBF 1.81
4-MDBF/DBF 0.78
2+3-MDBF/DBF 0.61
1-MDBF/DBF 0.33

III) DIBENZOTHIOPHENES

a) Concentrations (ppm)

DBT
4-MDBT
2+3-MDBT
1-MDBT
Total Dibenzothiophenes

VI) OVERALL RATIOS
Biphenyls/NAPH* 0.53
Dibenzothiophenes/NAP 0.09
Dibenzofurans/NAPH* 0.24

MN = methylnaphthalene
DMN = dimethylnaphthalene
TMN = trimethylnaphthalene
THN = tetrahyronaphthalene
DBF = methyldibenzofuran
MDBF = methyldibenzofuran
NAPH* = 2,6+2,7-DMN + 1,5-DMN + 1,4,6+1,3,5-TMN + 2,3,6-TMN

P = phenantrene
MP = methylphenanthrene
DBT = dibenzothiophene
MDBT = methyldibenzothiophene
BP = biphenyl
MBP = methylbiphenyl

GCMS data of the aromatic fraction
well 206/01-02 (2465.83 m.), United Kingdom

VII) Misc. NAPHTHALENES

a) Concentrations (ppm)

2,6-DMN	2579	4,5-DMP	76
2,7-DMN	2419	2,6+3,6-DMP	204
1,3+1,7-DMN	5857	3,5-DMP	353
1,6-DMN	4692	2,7-DMP	245
1,4-DMN	n.d.	3,9-DMP	949
2,3-DMN	1308	1,6+2,5+2,9-DMP	499
1,5-DMN	2356	1,7-DMP	732
1,2-DMN	1126	1,9+4,9-DMP	208
1,4+2,3-DMN	1308	1,5-DMP	n.d.
		1,8-DMP	116
		1,2-DMP	118
		9,10-DMP	n.d.
1,3,7-TMN	1567	1,2,6-TMP	34
1,3,6-TMN	2174	1,2,5-TMP	56
1,3,5+1,4,6-TMN	1987	1,2,9-TMP	87
2,3,6-TMN	1471	1,2,7-TMP	n.d.
1,2,7-TMN	562	1,2,8-TMP	93
1,6,7-TMN	1148		
1,2,6-TMN	759		
1,2,4-TMN	183		
1,2,5-TMN	1054		
1,3,5,7-TeMN	174		
1,3,6,7-TeMN	515		
1,2,4,7-TeMN	426		
1,2,5,7-TeMN	256		
2,3,6,7-TeMN	158		
1,2,6,7-TeMN	120		
1,2,5,6-TeMN (C4-NAPH)	336		

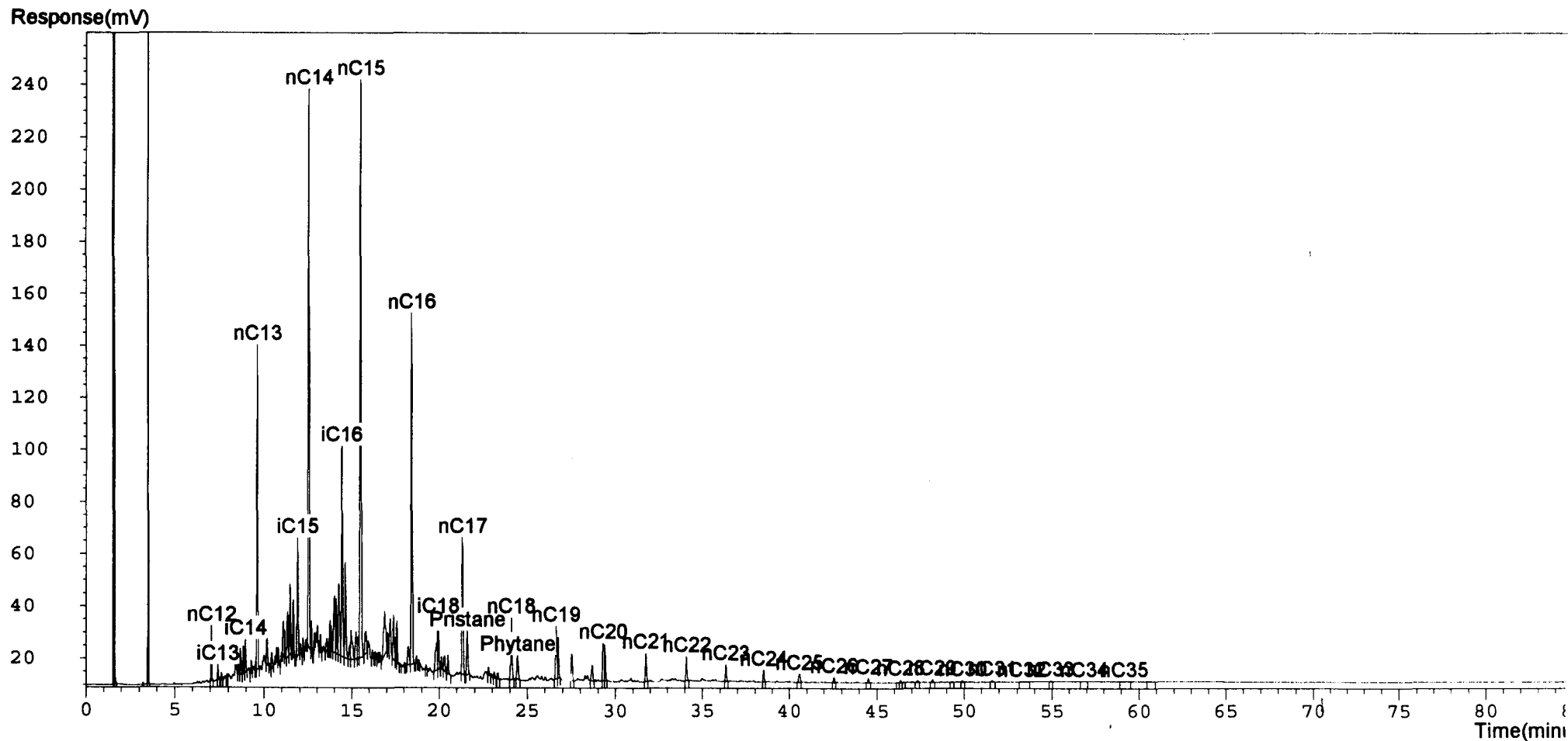
b) Parameters

1,2,5-TMN/1,3,6-TMN	0.48
1,2,7-TMN/1,3,7-TMN	0.36

The assignment of some of these peaks is tentative

Gas chromatogram of the saturated hydrocarbons of the extract from well 206/01-02 (2465.83 m.), United Kingdom

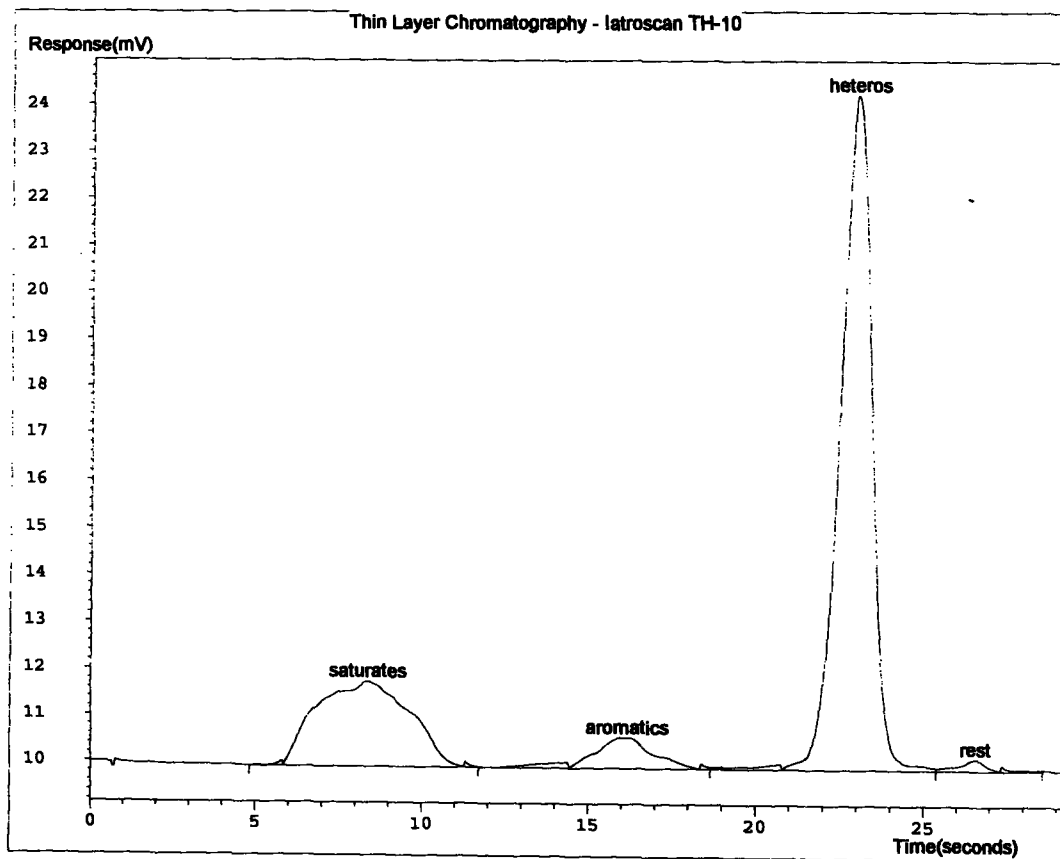
GASCHROMATOGRAM OF THE SATUTATED HYDROCARBONS



Gross Composition of the extract from
well 206/01-02 (2465.83 m.), United Kingdom

Printed at 01:33pm on 19 September 1994
Project: defproj Instrument: channel4
Sample: s 167079/5

Page 1
Analysis: 0627-d
Injection: 1



Analyst Name mb
Analysis Name SHELL
Comment Thin Layer Chromatografie / GC-Iatroscan bepaling.

Peak information:

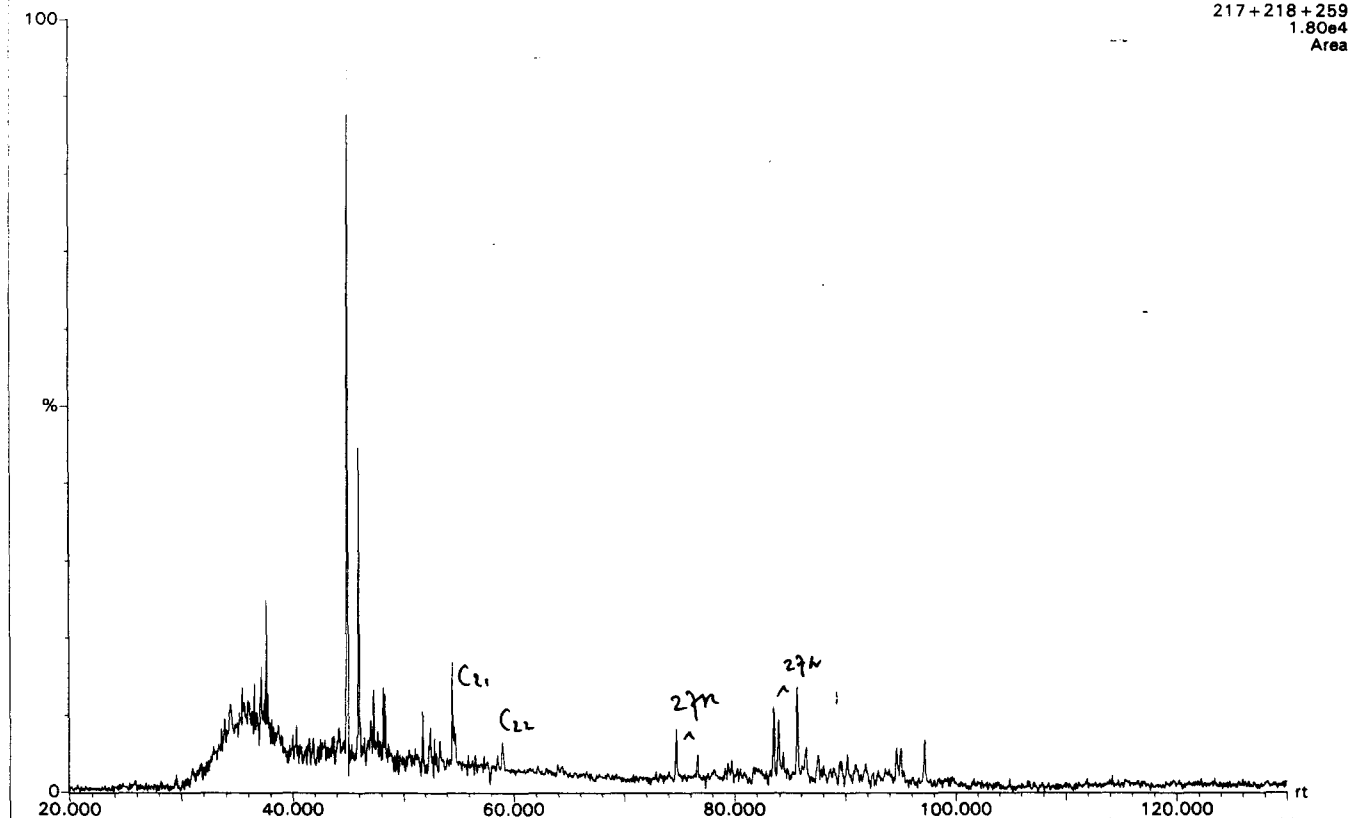
Peak No.	Peak Nam	Amount N	Area
1	saturate	25.42	5.92
2	aromatic	5.99	1.40
3	heteros	67.45	15.71
4	rest	1.14	0.27

*Sterane Fragmentograms of the extract from
well 206/01-02 (2465.83 m.), United Kingdom*

KSEPL
18-Nov-1994 00:15:14
S1670795 Sm (SG, 2x3)

U.K. 206/01-02 8090-8190 FT CUTTING I.S. = 30(33) PPM

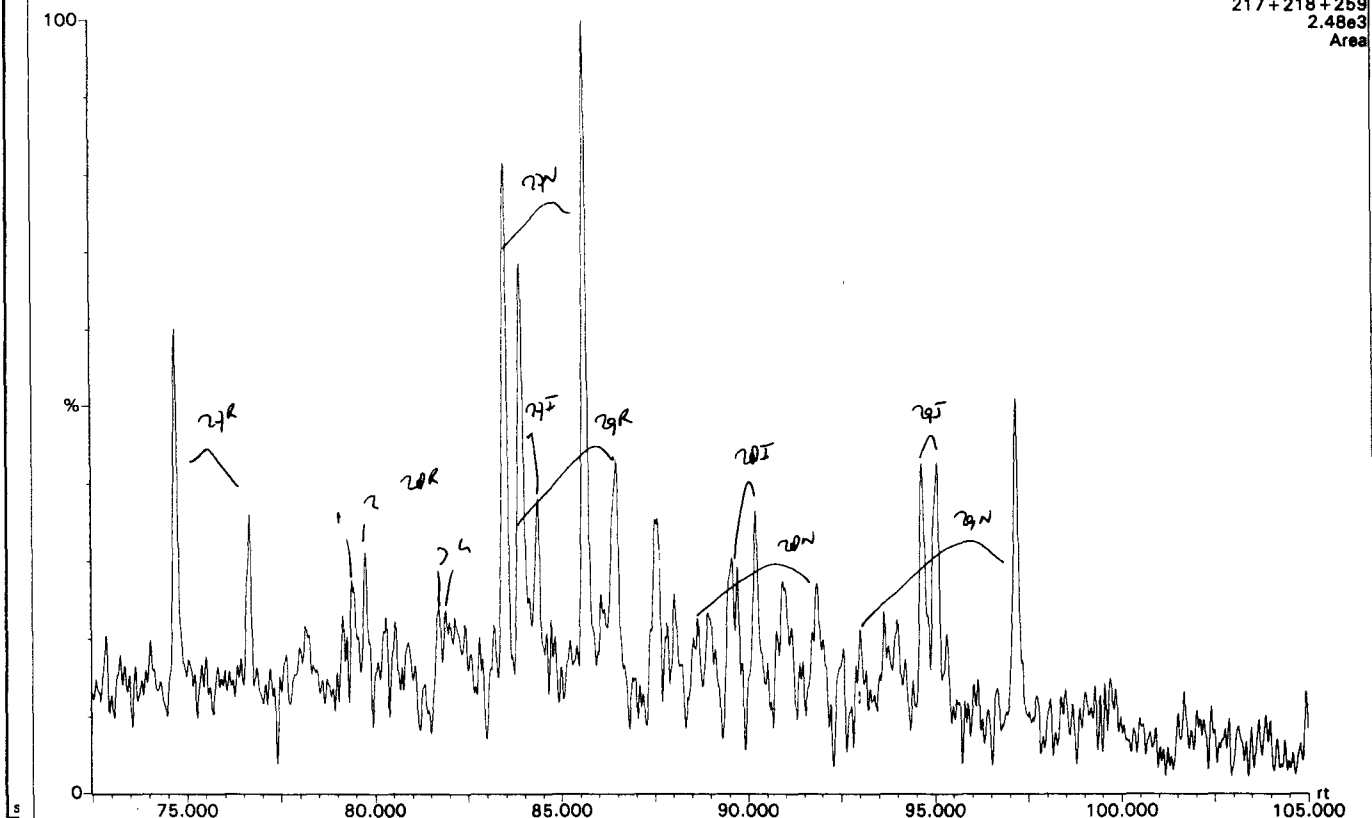
TRIO1000
RON
Scan EI +
217+218+259
1.80e4
Area



KSEPL
18-Nov-1994 00:15:14
S1670795 Sm (SG, 2x3)

U.K. 206/01-02 8090-8190 FT CUTTING I.S. = 30(33) PPM

TRIO1000
RON
Scan EI +
217+218+259
2.48e3
Area

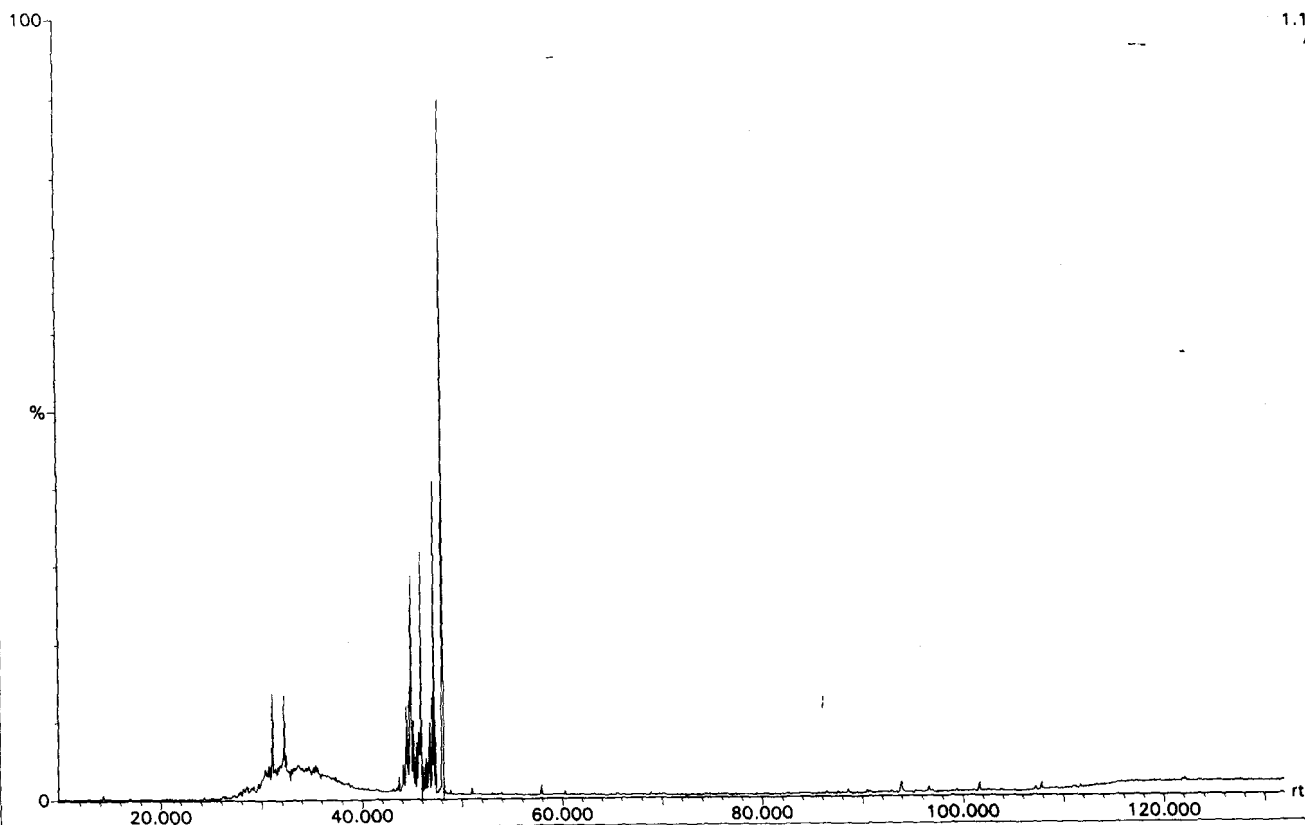


Triterpane Fragmentograms of the extract from well 206/01-02 (2465.83 m.), United Kingdom

KSEPL
18-Nov-1994 00:15:14
S1670795 Sm (SG, 2x3)

U.K. 206/01-02 8090-8190 FT CUTTING I.S. = 30(33) PPM

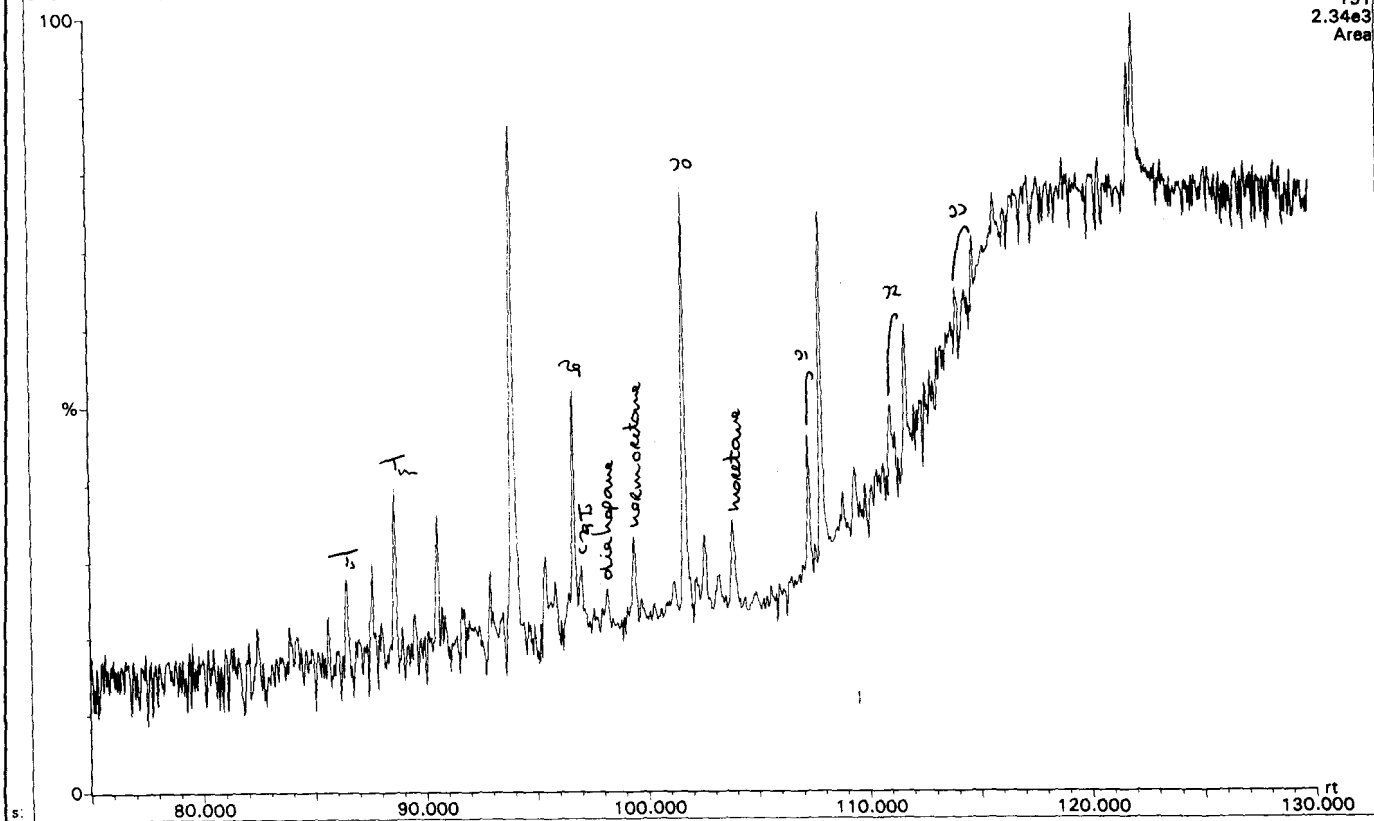
TRIO1000
RON
Scan EI+
191
1.11e5
Area



KSEPL
18-Nov-1994 00:15:14
S1670795 Sm (SG, 2x3)

U.K. 206/01-02 8090-8190 FT CUTTING I.S. = 30(33) PPM

TRIO1000
RON
Scan EI+
191
2.34e3
Area



ROCK EVAL and MACERAL data
well 206/01-02 (2465.83 m.), United Kingdom

K. S. E. P. L. , L R E / 4
G F S - Geochemical Filing System

L i s t i n g o f s a m p l e s w i t h R o c k E v a l . d a t a

Country : United Kingdom
Well/Outcrop : 206/01-02

Order seq.nr. : 004

Depth (ft)	Sample Type	Formation name	TOC (w%)	S-1 peak	S-2 peak	S-3 peak	Hydr. index	Oxyg. index	Tmax deg C	Prod. index
8090.0	C		6.6	9.96	16.32	4.75	247	72	431	0.38

MACERAL DESCRIPTION OF WELL/OUTCROP

United Kingdom, 206/01-02

Date : 3-AUG-94

Sample(s)

8090.0 ft/C

ORGANIC MATTER																							MINERAL MATTER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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DENSE LAYERS LENSES		LOAD BEARING		DIFFUSE / INTERGRANULAR		NON-L. B. LAYERS / LENSES TELOCOLLINITE		VIT. - 1		VIT. - 2		ALGAE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
						LAYERS / LENSES TELOCOLLINITE		DETITAL TELOCOLLINITE		LAYERS / LENSES TELINITE		DETITAL TELINITE		LAYERS / LENSES DESMOCOLLINITE		DETITAL DESMOCOLLINITE		SPORINITE (MICRO--)		SPORINITE (MEGA--)		CUTINITE		SUBERINITE		RESINITE (+ FLUORINITE)		LIPTODETRINITE		BOTRYOCOCCUS		TASMANITES		OTHER ALGAE		MICROPLANKTON		EXSUDATINITE (FLUORESCING)		EXSUDATINITE (NON-FLUORESCING) S. HYDR.		SCLEROTINITE		(SEMI-) FUSINITE (+ INERTODETRINITE)		MICRINITE (+ OXY-MICRINITE)		UNDEFINED MINERALS		FRAMBOIDAL PYRITE		AGGREGATES / CRYSTALS PYRITE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

L E G E N D	
*	ABUNDANT
+	COMMON
/	FEW
-	RARE

Depth (ft)	Sample Type	Comment
8090.0	C	Initial micrinisation SOM Sample slightly oxidised Sample partly oxidised Desmocollinite grades into SOM Common liptinite-rich particles White-light yellow fluorescence -> probably immature

VISUAL VOLUME PERCENTAGE ESTIMATION

United Kingdom, 206/01-02

Date : 3-AUG-94

Page : 1

Sample(s)



8090.0 ft/C

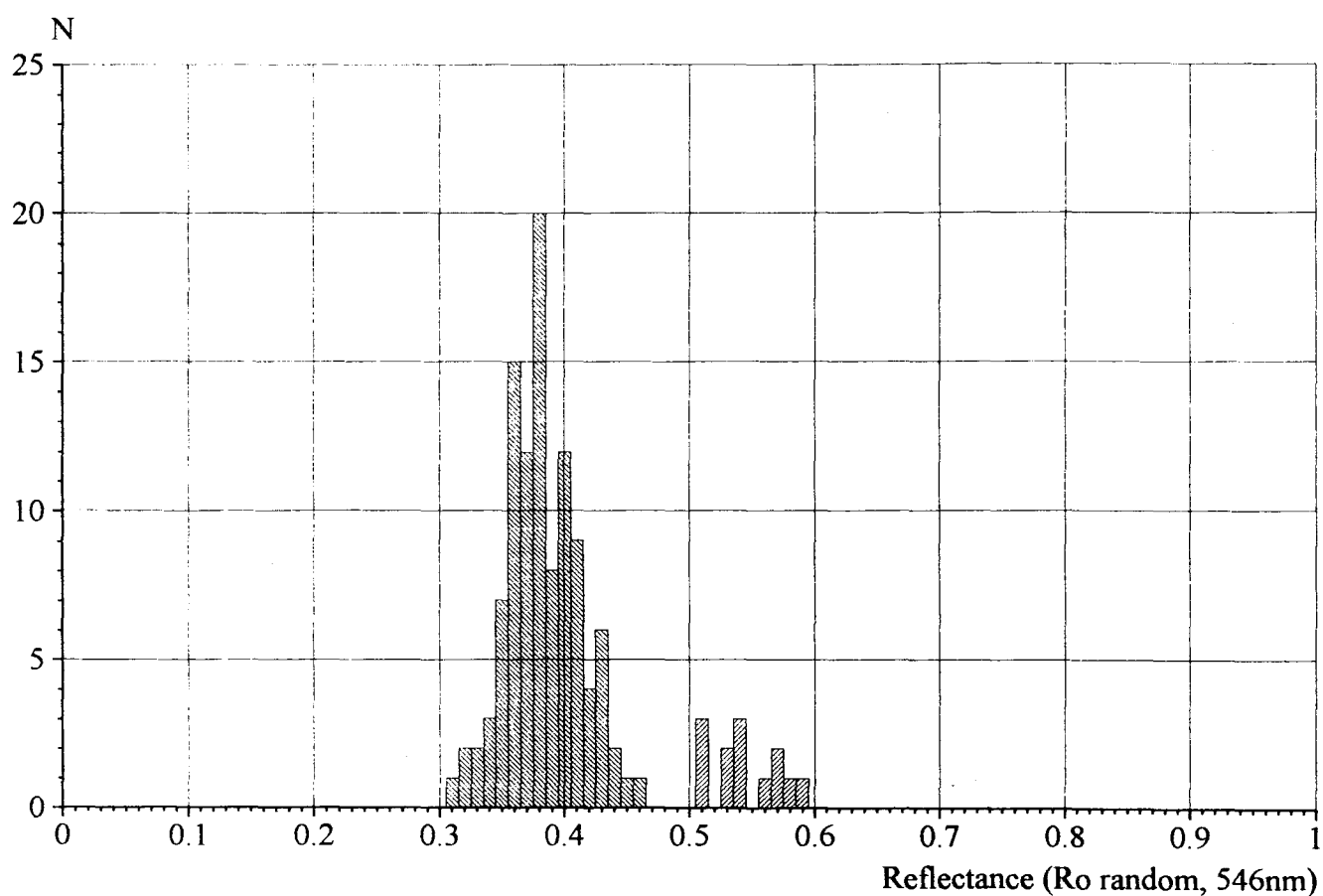
ORGANIC MATTER										MINERAL MATTER
SOM			VITRINITE			LIPTINITE				
		DENSE	LOAD BEARING			NON-L. B.			VIT.-1	VIT.-2
1		LAYERS								
1		LENSES								
		DIFFUSE / INTERGRANULAR								
		LAYERS / LENSES TELOCOLLINITE								
		DETRITAL TELOCOLLINITE								
2		LAYERS / LENSES TELINITE								
		DETRITAL TELINITE								
5		LAYERS / LENSES DESMOCOLLINITE								
1		DETRITAL DESMOCOLLINITE								
2		SPORINITE (MICRO-)								
		SPORINITE (MEGA-)								
<1		CUTINITE								
		SUBERINITE								
1		RESINITE (+ FLUORINITE)								
3		LIPTODETRINITE								
<1		BOTRYOCOCCUS						ALGAE		
		TASMANITES								
		OTHER ALGAE								
		MICROPLANKTON								
R		EXSUDATINITE (FLUORESCING)								
		EXSUDATINITE (NON-FLUORESING) S.HYDR.								
		SCLEROTINITE								
1		(SEMI-) FUSINITE (+ INERTODETRINITE)								
F		MICRINITE (+ OXY-MICRINITE)								
71		UNDEFINED MINERALS								
12		FRAMBOIDAL PYRITE								
<1		AGGREGATES / CRYSTALS PYRITE								

Reflectance histogram

Country *United Kingdom*
 Well *206.01-02*
 Depth *8090 ft*
 Reference *Derrick floor*

Sample type *Cutting*
 Sample/Order *S167075/04*
 Analyst *KMR*
 Date *02-08-1994*

	Mean	Std	Min	Max	Mode	Measurements
 Desmocollinite	0.38	0.03	0.31	0.46	0.38	105
 Telinite	0.55	0.03	0.51	0.59	0.51	13



Comment:

Depth interval: 8090 - 8190ft