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September 1994

RKER.94.100

Geochemical investigation of a Cretaceous source rock sample from  
well 208/26-01, United Kingdom

by

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Sponsor: Shell Expro London

Code: 774.106.10

investigation: 8BAS0795

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RIJSWIJK, THE NETHERLANDS

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## *Geochemical investigation of a Cretaceous source rock sample from well 208/26-01, United Kingdom*

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### 1.0 Introduction

A geochemical investigation has been carried out on a source rock extract from 11630-11820 ft (Turonian-Mid Albian) in well 208/26-01, United Kingdom (request telex ref. ABX 0140064 of 29.04.94). The geochemical parameters are shown on pages 2 to 5, analysis results are presented on the yellow pages.

### 2.0 Conclusions

#### 1. Source Rock analysis

The selected sample contains very marginal (1.3 % TOC) Type II(III) source rock particles for predominantly gas (HI=126). The sample is partly contaminated with immature coal particles from the drilling mud. After removal of the contamination (as good as possible) the sample has been used for extract analysis. The extract/organic carbon ratio of 0.2 shows that the sample has been only slightly impregnated, most probably by its own generated products.

#### 2. Maturity

The extract has a well-mature character (n-alkane distribution, gross composition, Sterane distribution). This is in agreement with the microscopic observations indicating a VRE of 0.99.

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

The extract has been derived from a shaly source rock (high amounts of rearranged steranes, pristane/phytane >1.0), that contained predominantly structureless organic matter (biomarker distribution). Although some landplant matter has been described by microscopy (maceral analysis), a clear landplant input cannot be distinguished in the geochemical parameters.

#### 4. Correlation

The Cretaceous source rock extract can be distinguished from the Upper Jurassic Kimmeridge Clay Fm by differences in the biomarker distribution (high C27 and C29 iso-steranes, relatively low amounts of rearranged steranes, relatively high 3R compared to 5R terpanes, low bisnorhopane, presence of gammacerane) and in the carbon isotopes.

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## Summary of the Geochemical Data of the extract from well 208/26-01 (3544.82 m.), United Kingdom

### Gravity and Gross Composition

% Extract :	0.3
% TOC after extract :	1.3
Extract/TOC :	0.23
Gross Composition (W%)	
Saturates :	44
Aromatics :	22
Heterocompounds :	33
Rest (High molecular) :	0
Sulphur (%) :	no data
Vanadium (ppm) :	no data
Nickel (ppm) :	no data

### Saturates Distributions (Gaschromatography)

Pristane / Phytane :	2.4
Pristane / n-C17 :	0.6
Phytane / n-C18 :	0.4
ACI :	14
Corr. Coeff. :	-0.8040

### 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) :	no data
Saturates :	-27.9
Aromatics :	-27.5

### 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
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### Sterane and Triterpane Distributions

(Gaschromatography / Mass Spectrometry)

#### Steranes/Triterpanes (%)

Iso Steranes :	37
Rearranged Steranes :	36
Triterpanes :	27

#### Steranes (%)

Iso Steranes :	44
Rearranged Steranes :	29
Normal Steranes :	27

#### Triterpanes (%)

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

#### Steranes Carbon No. Dist. (%)

C-27 :	33
C-28 :	24
C-29 :	43

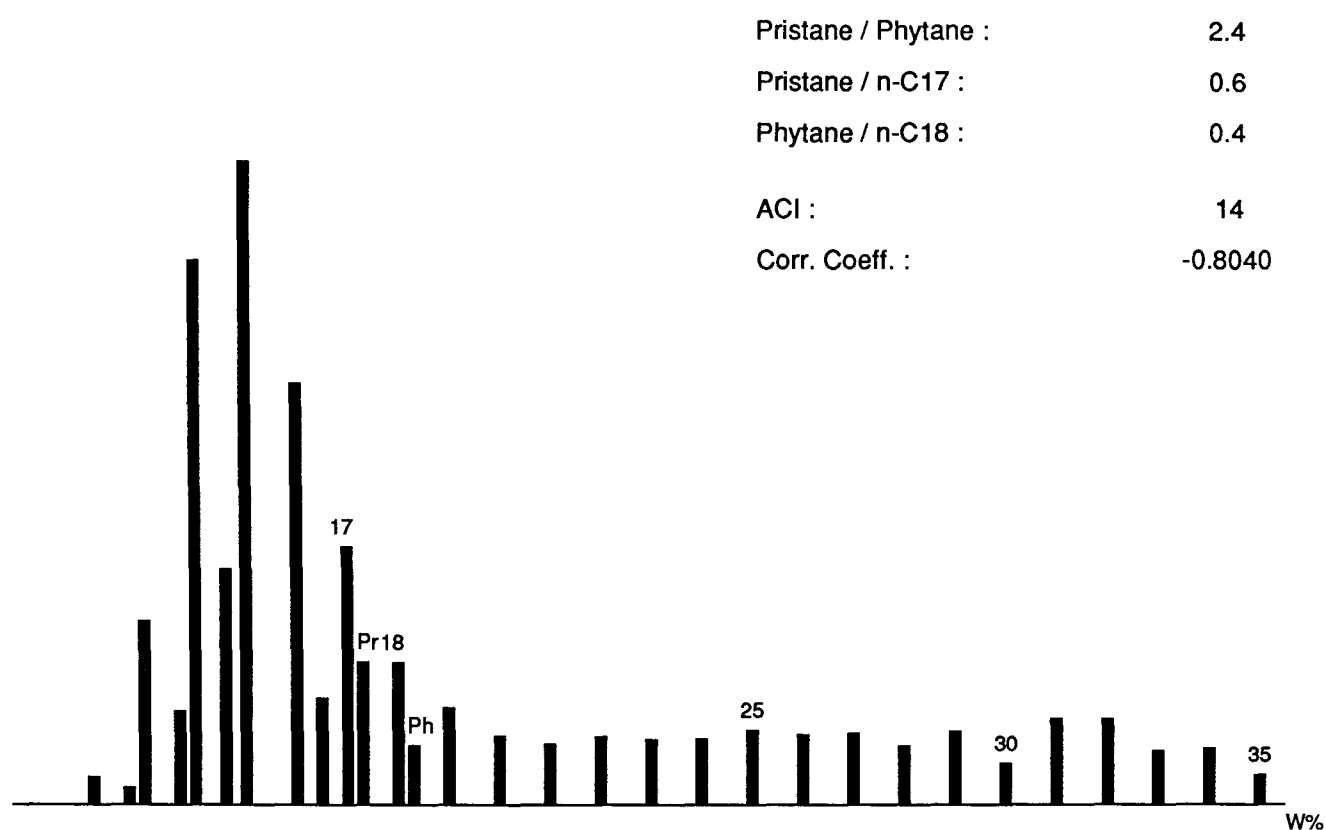
#### C-29 Sterane Ratios

20S / 20R + 20S :	0.59
Iso / Iso + Normal :	0.50

#### Triterpane Ratios

TS / TM :	0.87
3R / 3R + 5R :	0.16

*Bar diagram of Normal-alkanes & Isoprenoids of the extract from well 208/26-01 (3544.82 m.), United Kingdom*

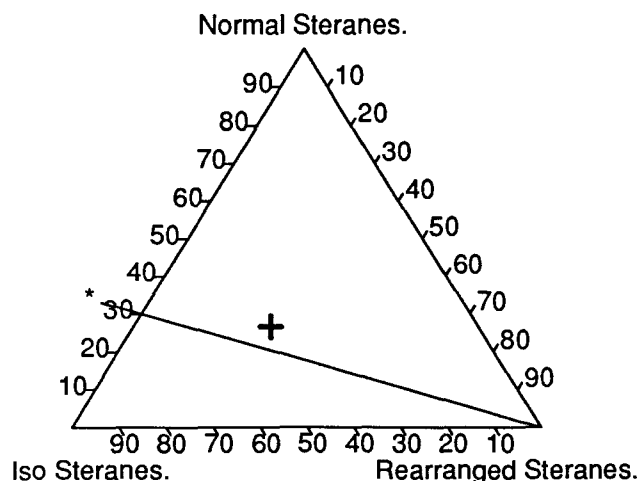


**Conclusions based on saturated hydrocarbon fraction :**

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

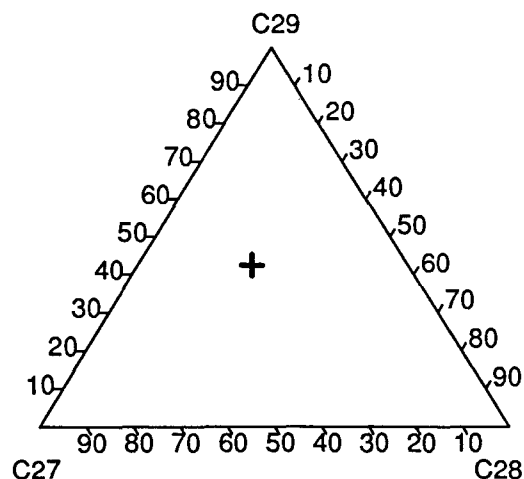
## GCMS Sterane typing of the extract from well 208/26-01 (3544.82 m.), United Kingdom

### Sterane Conversion Diagram

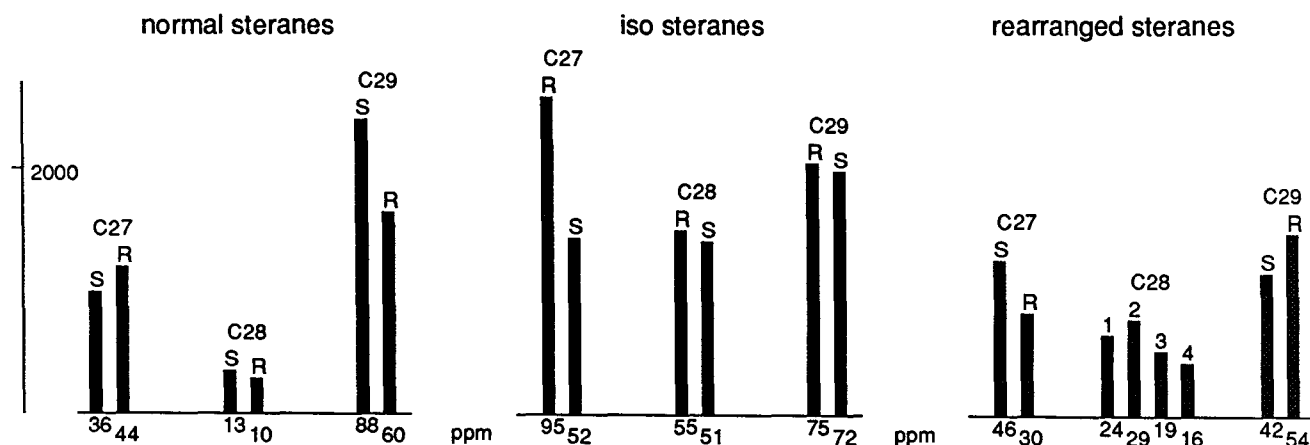


\* The line of complete sterane isomerisation indicating a mature character

### Sterane Typing Diagram



### Sterane Distribution



STERANE DISTRIBUTION (ppm)	(%)
Iso Steranes :	401 44
Rearranged Steranes :	260 29
Normal Steranes :	251 27

#### CARBON NUMBER DISTRIBUTION

C-27 :	303 33
C-28 :	217 24
C-29 :	391 43

#### C-29 STERANE CONVERSION RATIOS

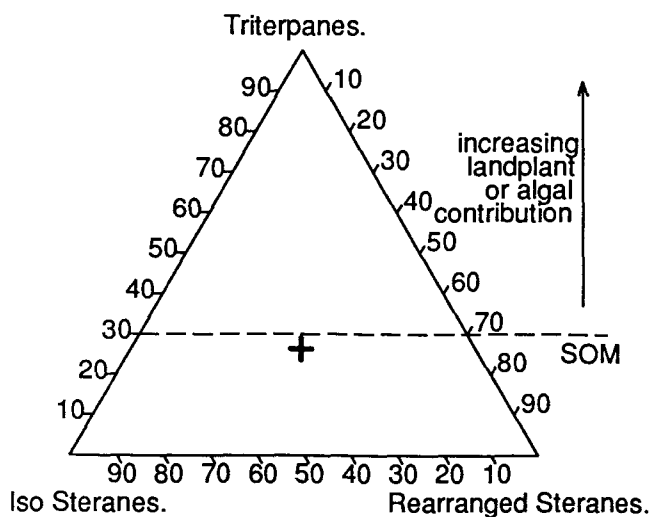
20S / 20R + 20S :	0.59
Iso / Iso + Normal :	0.50

#### Conclusions based on steranes :

1 : the complete sterane isomerisation indicates that this oil has been expelled from a mature source rock

## GCMS Triterpane typing of the extract from well 208/26-01 (3544.82 m.), United Kingdom

### Sterane/Triterpane Diagram



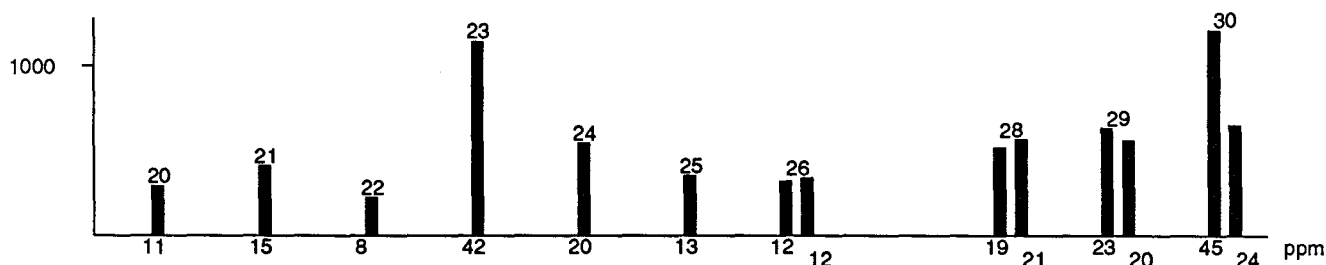
### STERANES/TRITERPANES (calculated %)

Iso Steranes :	37
Rearranged Steranes :	36
Triterpanes :	27

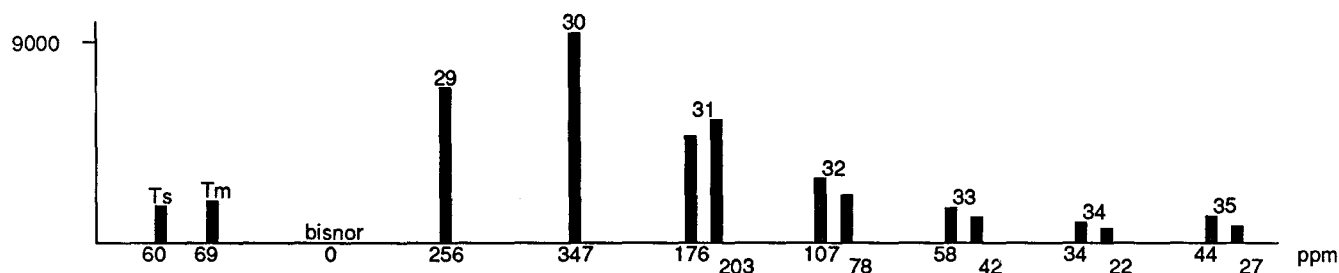
### TRITERPANE CONVERSION RATIOS

TS / TM :	0.87
3R / 3R + 5R :	0.16
C30 Hopane (ppm) :	347

### Tricyclic Terpanes



### Pentacyclic Terpanes



### Conclusions based on triterpanes :

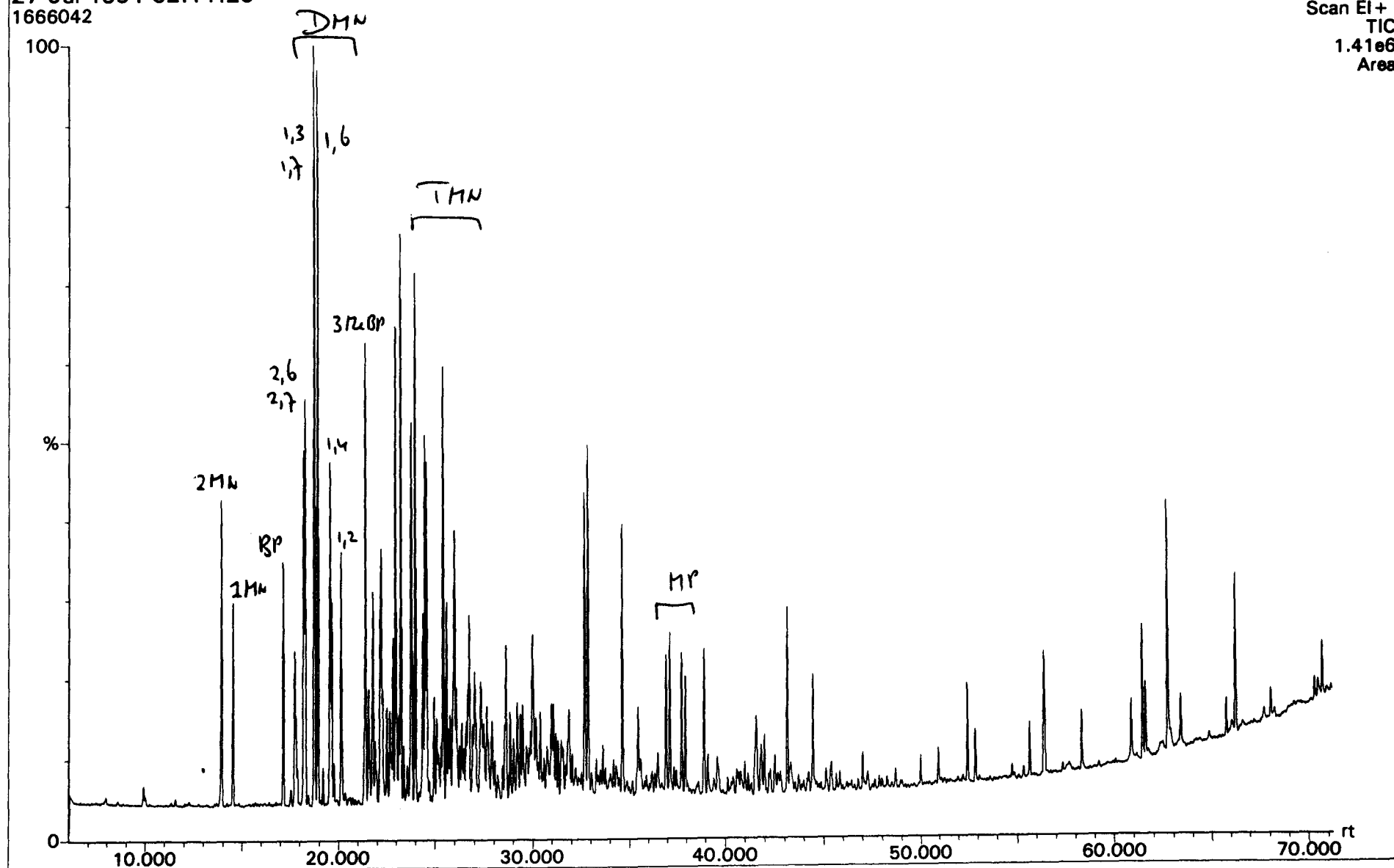
- 1 : the triterpane distribution indicates a source rock containing predominantly structureless organic matter

**ANALYTICAL DATA**  
**well 208/26-01 (3544.82 m.), United Kingdom**

K.S.E.P.L.  
27-Jul-1994 02:11:20  
1666042

U.K. 208/26-01 11630-11820 ft cutting

MD-800  
RON  
Scan EI+  
TIC  
1.41e6  
Area



# GCMS data of the aromatic fraction well 208/26-01 (3544.82 m.), United Kingdom

Report of sample:  
Acquired at : 27-Jul-1994

Standard used for calculations: PDP  
Discrimination factor : 0.11

## 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

### b) Parameters

296 4-MDBT/2+3-MDBT 1.85  
191 4-MDBT/1-MDBT 4.69  
566 2+3-MDBT/1-MDBT 2.54  
499 4-MDBT/DBT 1.03  
285 2+3-MDBT/DBT 0.55  
361 1-MDBT/DBT 0.22

## IV) BIPHENYLS

### a) Concentrations (ppm)

3 BP 254  
15 2-MBP 18  
2839 3-MBP 359  
4-MBP 151  
Total Biphenyls 782

### b) Parameters

2-MN/1-MN (MNR) 1.55  
2,6+2,7-DMN/1,5-DMN (DNR-1) 1.99  
2,3,6-TMN/1,3,5+1,4,6-TMN (TNR-1) 1.01  
2,3,6-TMN/1,2,5-TMN (TNR-2) 1.85  
2,3,6-TMN/THN 142.63  
2,3,6-TMN/Cadelene 24.69  
3-MBP/4-MBP 2.38  
3-MBP/2-MBP 19.42

## V) DIBENZOFURANS

### a) Concentrations (ppm)

DBF 121  
420 4-MDBF 140  
119 2+3-MDBF 200  
142 1-MDBF 74  
134 Total Dibenzofurans 535  
110

### b) Parameters

4-MDBF/2+3-MDBF 0.70  
4-MDBF/1-MDBF 1.90  
1.29 2+3-MDBF/1-MDBF 2.72  
0.59 4-MDBF/DBF 1.16  
0.64 2+3-MDBF/DBF 1.65  
1.07 1-MDBF/DBF 0.61  
0.52

## VI) OVERALL RATIOS

Biphenyls/NAPH\* 0.50  
Dibenzothiophenes/NAP 0.11  
61 Dibenzofurans/NAPH\* 0.34

## III) DIBENZOTHIOPHENES

### a) Concentrations (ppm)

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

61  
63  
34  
13  
171

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 208/26-01 (3544.82 m.), United Kingdom**

**(VII) Misc. NAPHTHALENES****a) Concentrations (ppm)**

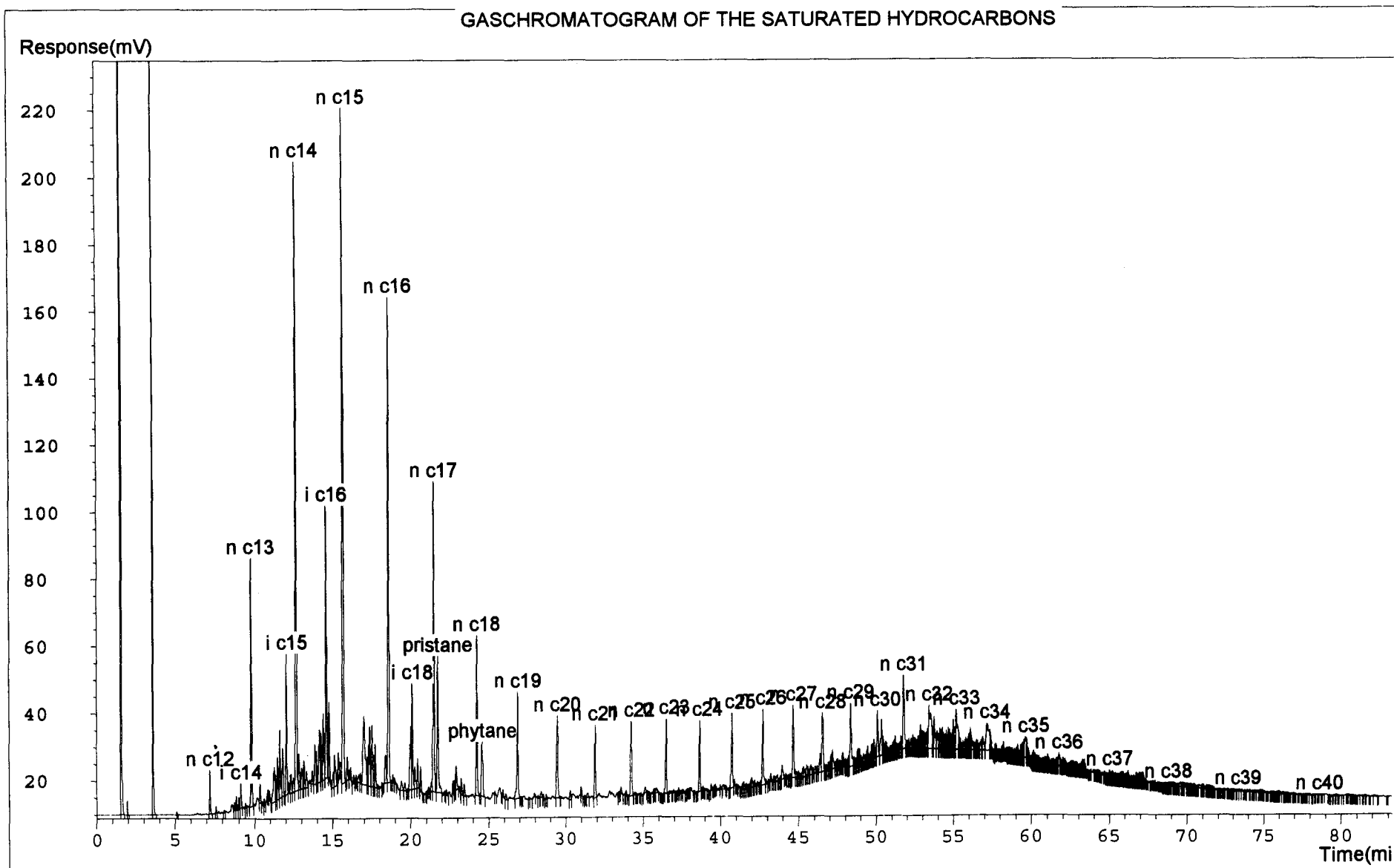
2,6-DMN	279	4,5-DMP	9
2,7-DMN	287	2,6+3,6-DMP	15
1,3+1,7-DMN	625	3,5-DMP	27
1,6-DMN	499	2,7-DMP	17
1,4-DMN	n.d.	3,9-DMP	92
2,3-DMN	120	1,6+2,5+2,9-DMP	47
1,5-DMN	285	1,7-DMP	50
1,2-DMN	152	1,9+4,9-DMP	32
1,4+2,3-DMN	120	1,5-DMP	n.d.
		1,8-DMP	11
		1,2-DMP	7
		9,10-DMP	n.d.
1,3,7-TMN	303	1,2,6-TMP	7
1,3,6-TMN	410	1,2,5-TMP	4
1,3,5+1,4,6-TMN	361	1,2,9-TMP	n.d.
2,3,6-TMN	366	1,2,7-TMP	n.d.
1,2,7-TMN	121	1,2,8-TMP	7
1,6,7-TMN	251		
1,2,6-TMN	195		
1,2,4-TMN	43		
1,2,5-TMN	198		
1,3,5,7-TeMN	44		
1,3,6,7-TeMN	111		
1,2,4,7-TeMN	64		
1,2,5,7-TeMN	50		
2,3,6,7-TeMN	41		
1,2,6,7-TeMN	24		
1,2,5,6-TeMN (C4-NAPH)	60		

**b) Parameters**

1,2,5-TMN/1,3,6-TMN	0.48
1,2,7-TMN/1,3,7-TMN	0.40

The assignment of some of these peaks is tentative

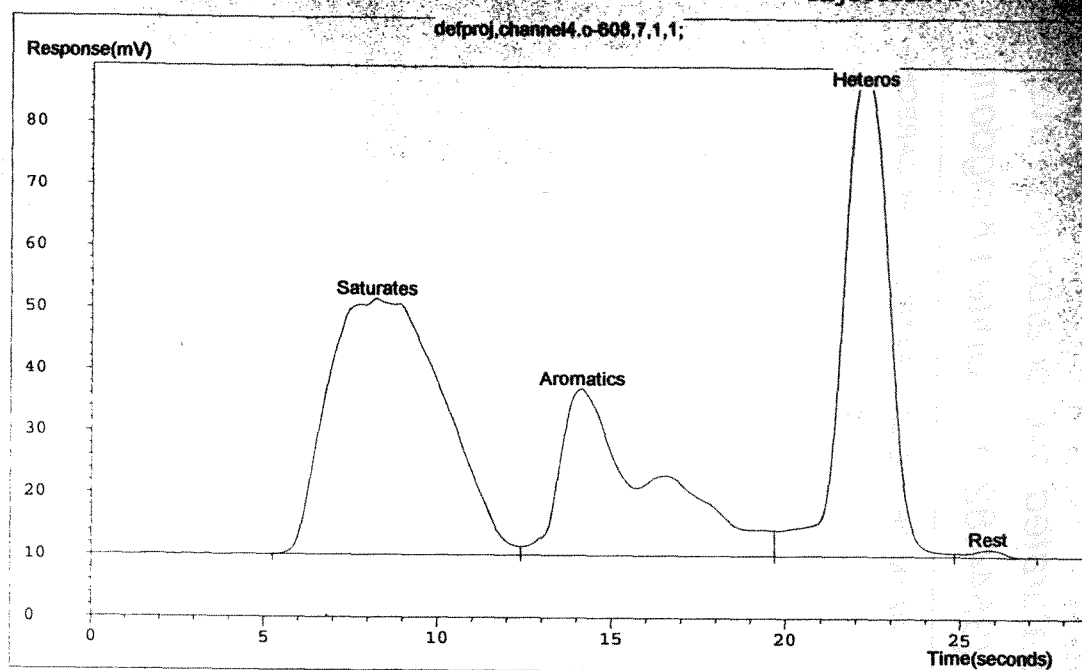
*Gas chromatogram of the saturated hydrocarbons of the extract from  
well 208/26-01 (3544.82 m.), United Kingdom*



Gross Composition of the extract from  
well 208/26-01 (3544.82 m.), United Kingdom

Printed at 01:11pm on 14 June 1994  
Project: defproj Instrument: channel4  
Sample: s 166604-1

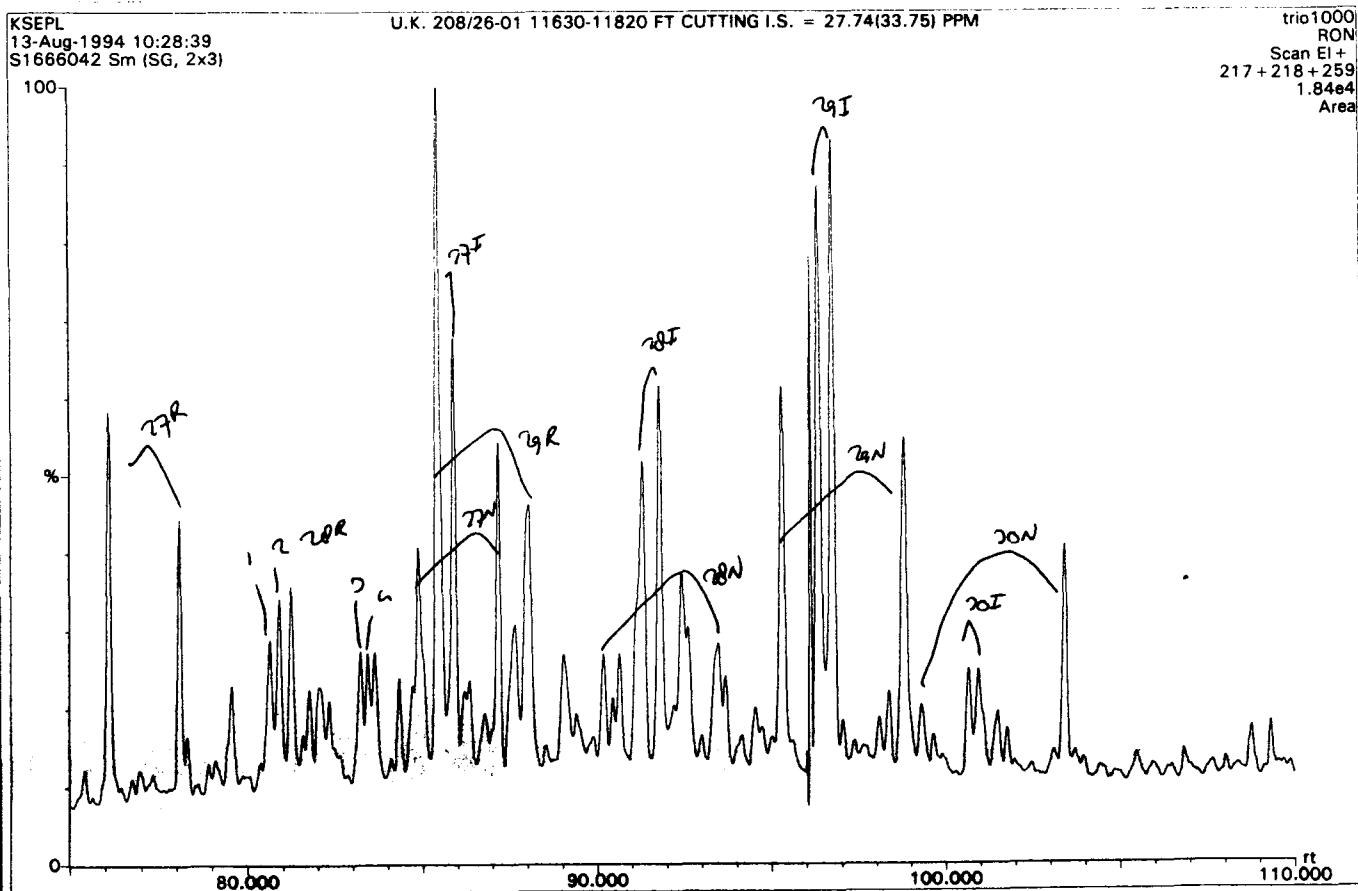
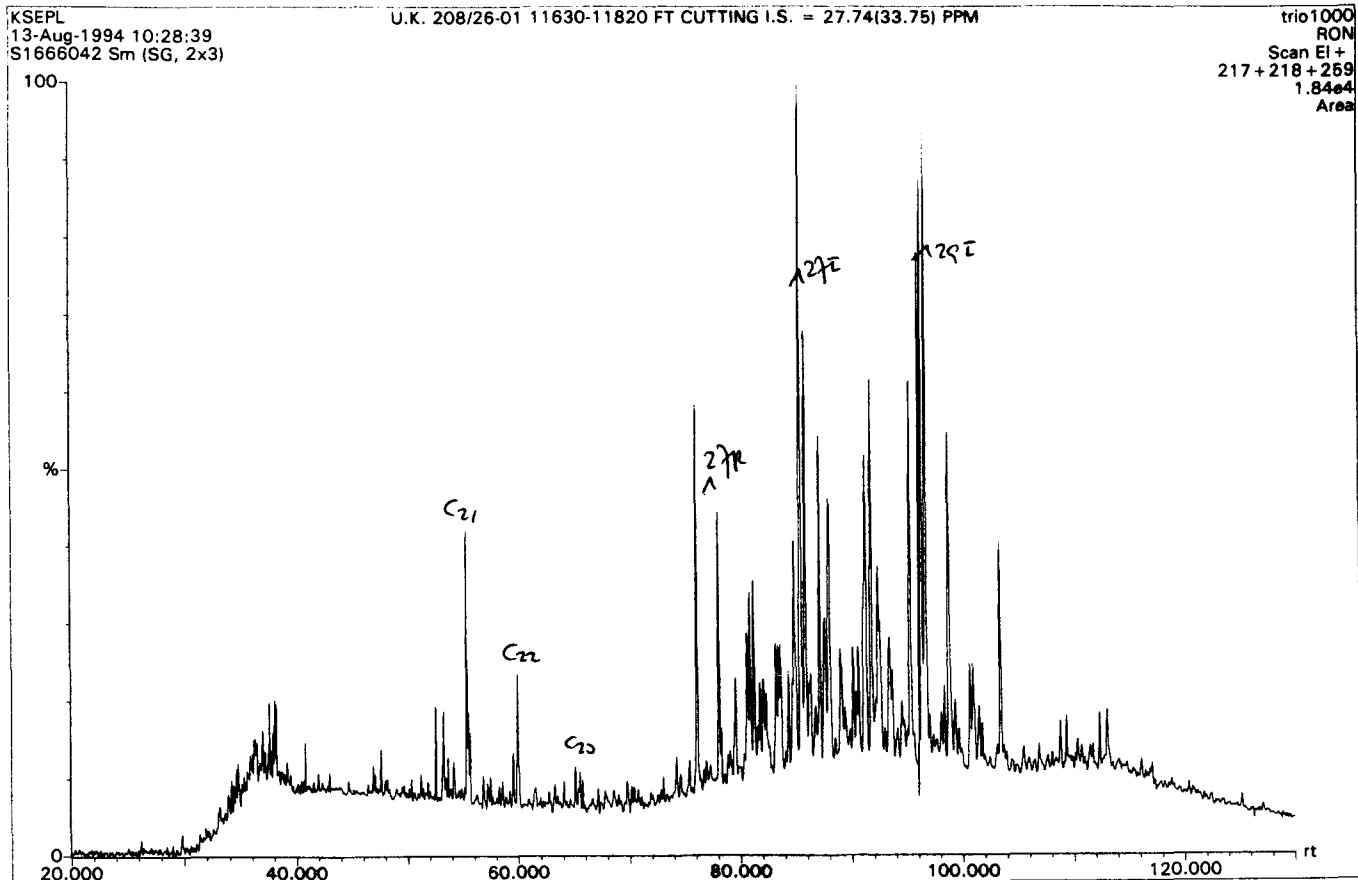
Page 1  
Analysis: o-608  
Injection: 1



#### Peak information

Peak No.	Peak Name	Amount	Norm/Area	Rt Time	Area
1	Saturates		44.0200	8.22	159.433
2	Aromatics		22.4115	14.14	81.171
3	Heteros		33.1830	22.24	120.184
4	Rest		0.3855	25.80	1.396

# Sterane Fragmentograms of the extract from well 208/26-01 (3544.82 m.), United Kingdom

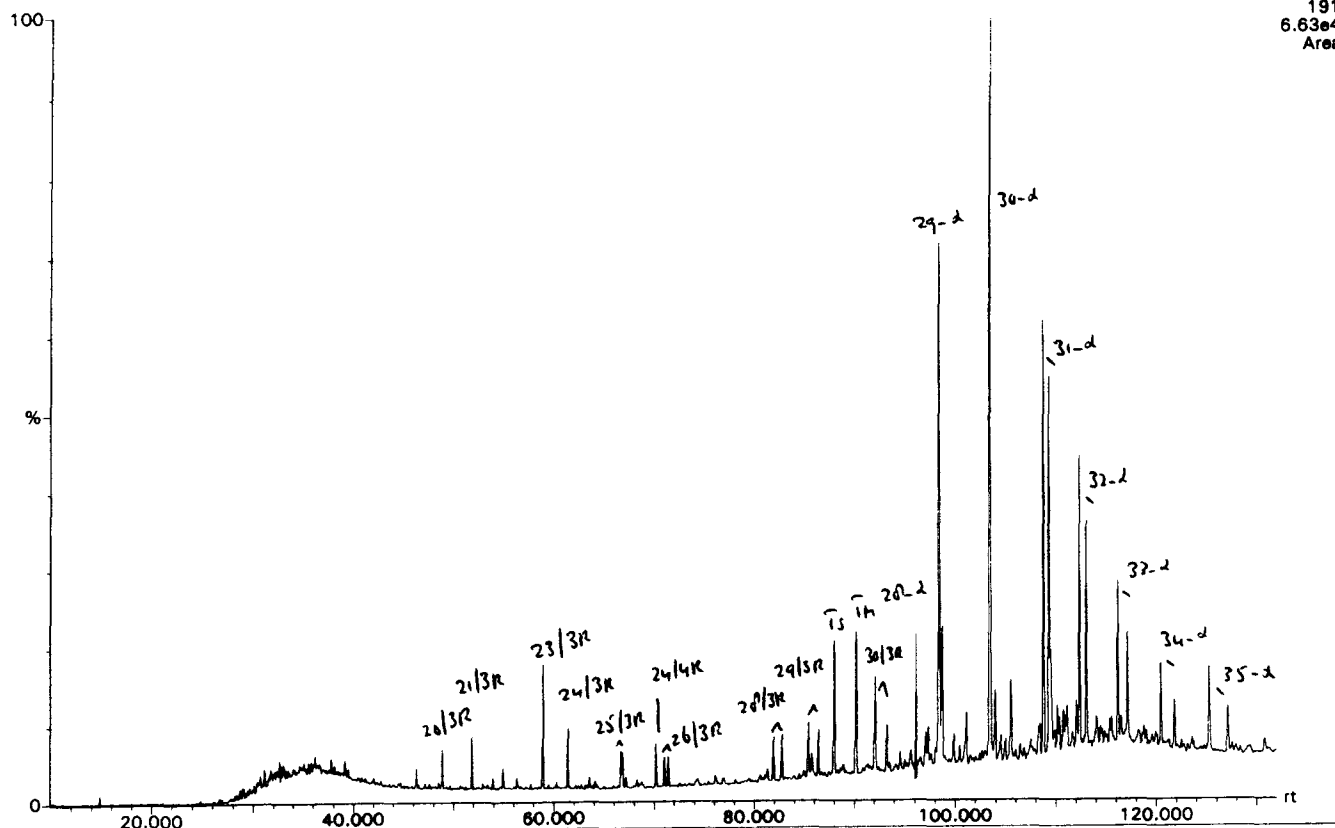


# Triterpane Fragmentograms of the extract from well 208/26-01 (3544.82 m.), United Kingdom

KSEPL  
13-Aug-1994 10:28:39  
S1666042 Sm (SG, 2x3)

U.K. 208/26-01 11630-11820 FT CUTTING I.S. = 27.74(33.75) PPM

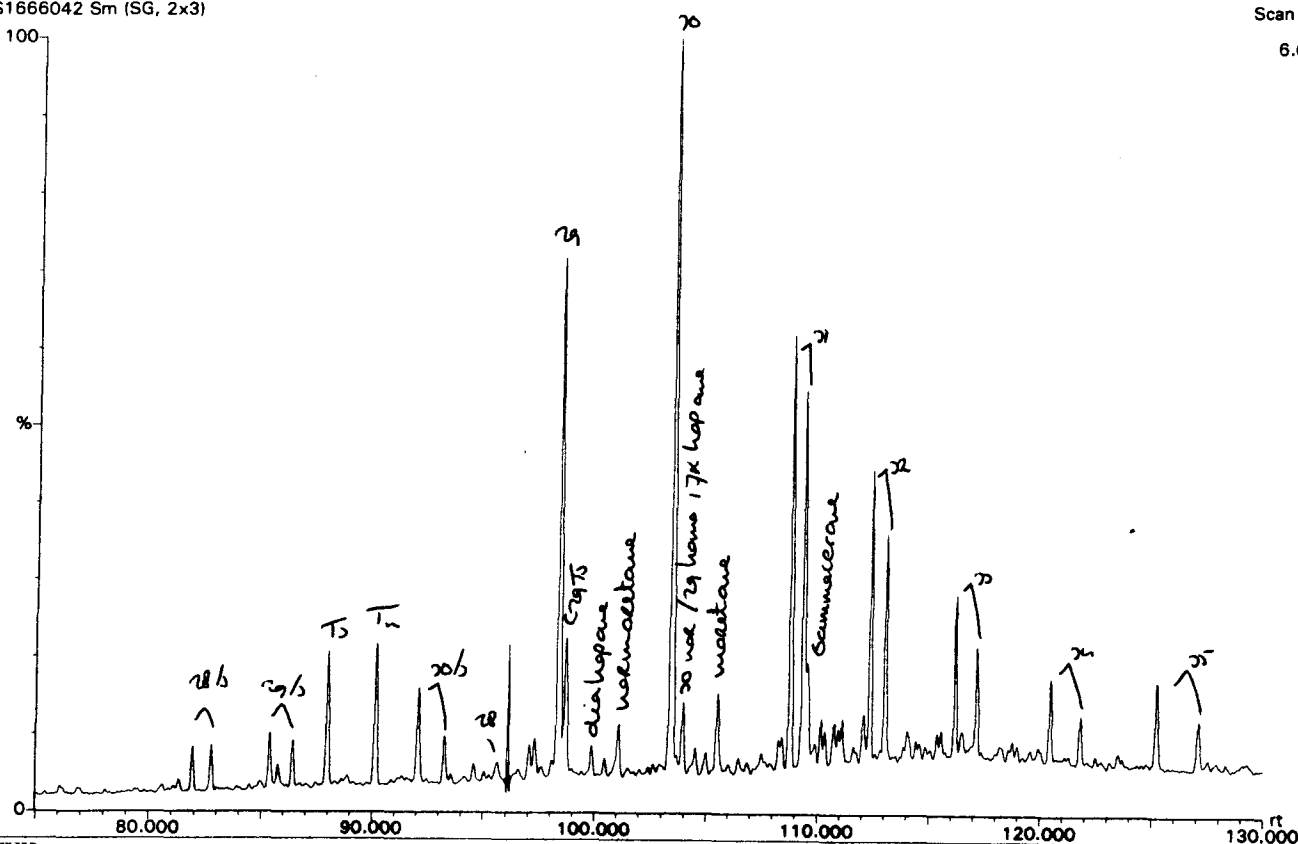
trio1000  
RON  
Scan EI+  
191  
6.63e4  
Area



KSEPL  
13-Aug-1994 10:28:39  
S1666042 Sm (SG, 2x3)

U.K. 208/26-01 11630-11820 FT CUTTING I.S. = 27.74(33.75) PPM

trio1000  
RON  
Scan EI+  
191  
6.63e4  
Area



*Rock Eval and Maceral data*  
*well 208/26-01 (3544.82 m.), United Kingdom*

To : Shell Expro London, UEX/32 (attn. Mr. W. Knowles)  
From: KSEPL Rijswijk, RR/26  
Date : 6 June 1994  
Ref: Tlx ABX011613 of 24.2.1994

Subject: source rock screening of samples well 208/26-1

**RESULTS OF SOURCE ROCK SCREENING CARRIED OUT ON 1 COMBINED CUTTING SAMPLE (interval 11630-11820ft) COLLECTED FROM THE CRETACEOUS (Turonian-Mid Albian) IN WELL 208/26-1,UK**

**Organic carbon determination:**

11630-11820FT: 1.3%

**Rock-Eval analysis:**

Depth	S-1	S-2	S-3	TOC	HI	OI	Tmax
11630-11820ft	0.91	1.64	1.98	1.3%	126	152	425

**Maceral analysis:**

11630-11820ft: micrinised partly- and non-loadbearing SOM, rare detrital desmocollinite, liptodetrinite and semi-fusinite. Yellow-dark yellow fluorescing liptinites/exsudatinite (VR.E probably well mature).

Although the immature coal particles could be separated and removed from the bulk sample, according to microscopy, contamination still exists and is composed of liptinite-containing claystone particles, the removal of which is hardly impossible.

**Maturity:**

The following mean values were obtained from reflectance values carried out on desmocollinite VR=0.95%, desmocollinite/semi-fusinite VR=1.33% and solid hydrocarbons SHR=1.1%. A mean VR.E=0.99% is probably the most reliable value for this sample.

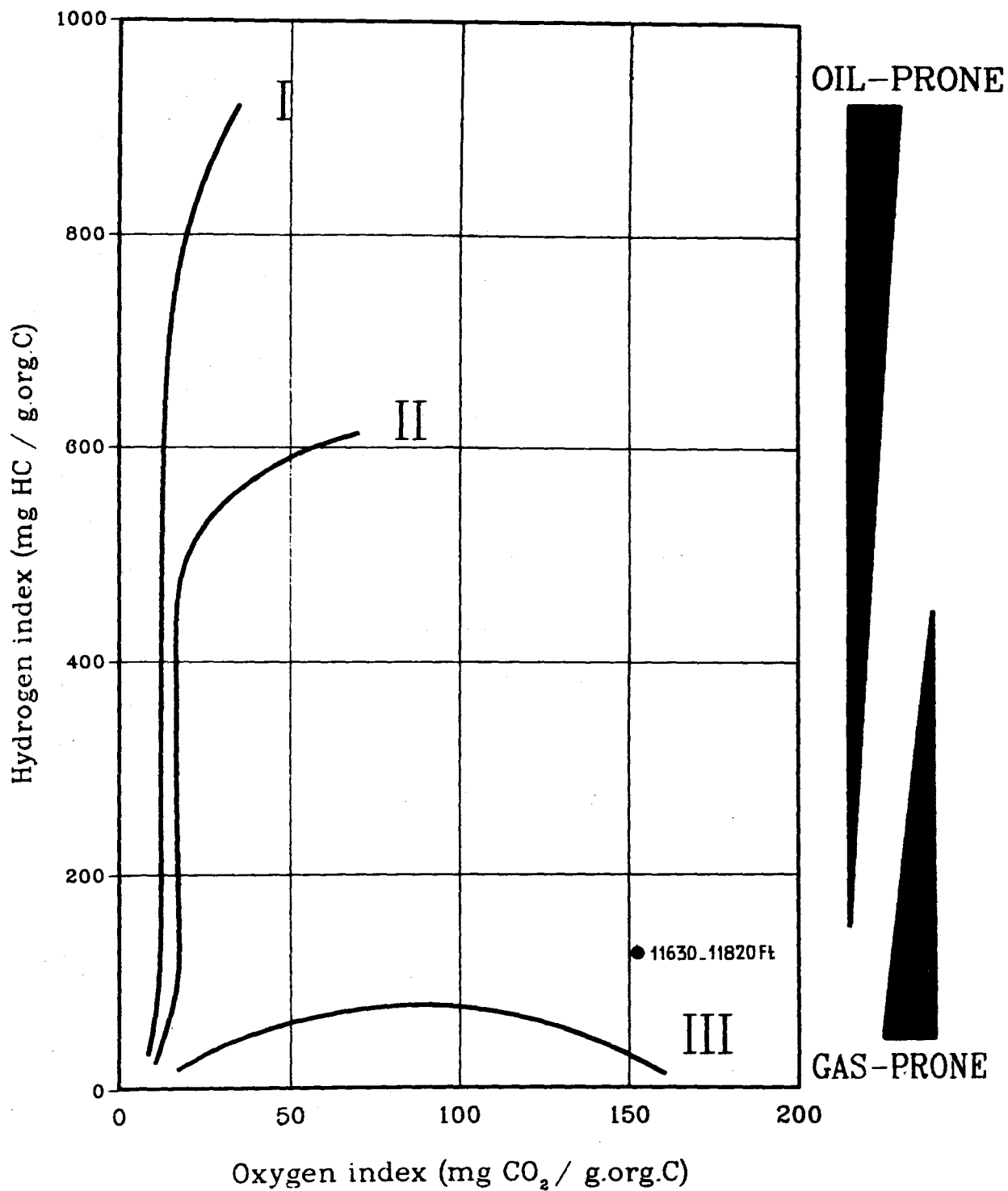
**Conclusion:**

The selected sample contains very marginal, probably immature Type II/(III) source rock particles for gas.

Selection of cuttings for extract analysis will be continued.

ROCK EVAL DATA AND CLASSIFICATION OF  
KEROGEN TYPES

Well/Outcrop : 208/26\_1 , UK



MACERAL DESCRIPTION OF WELL/OUTCROP  
United Kingdom, 208/26-01

Date : 3-JUN-94

Page : 1

Sample(s)

9410.0 ft/C  
10560.0 ft/C  
10750.0 ft/C  
11630.0 ft/C  
11660.0 ft/C  
11700.0 ft/C  
11710.0 ft/C  
11780.0 ft/C

ORGANIC MATTER										MINERAL MATTER
SOM		VITRINITE		LIPTINITE				INERTINITE		
DENSE	LOAD BEARING	DIFFUSE / INTERGRANULAR		NON-L. B.						
LAYERS		LAYERS / LENSES TELOCOLLINITE		VT.-1						
LENSES		DETRITAL TELOCOLLINITE								
	LAYERS / LENSES TELINITE		VT.-2							
	DETRITAL TELINITE									
	LAYERS / LENSES DESMOCOLLINITE									
	DETRITAL DESMOCOLLINITE									
		SPORINITE (MICRO-)								
		SPORINITE (MEGA-)								
		CUTINITE								
		SUBERINITE								
		RESINITE (+ FLUORINITE)								
		LIPTODETRINITE								
		BOTRYOCOCCUS				ALGAE				
		TASMANITES								
		OTHER ALGAE								
		MICROPLANKTON								
		EXSUDATINITE (FLUORESCING)								
		EXSUDATINITE (NON-FLUORESING) 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

# VISUAL VOLUME PERCENTAGE ESTIMATION

## United Kingdom, 208/26-01

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

# Listing of Comment lines




Country : United Kingdom  
Well/Outcrop : 208/26-01

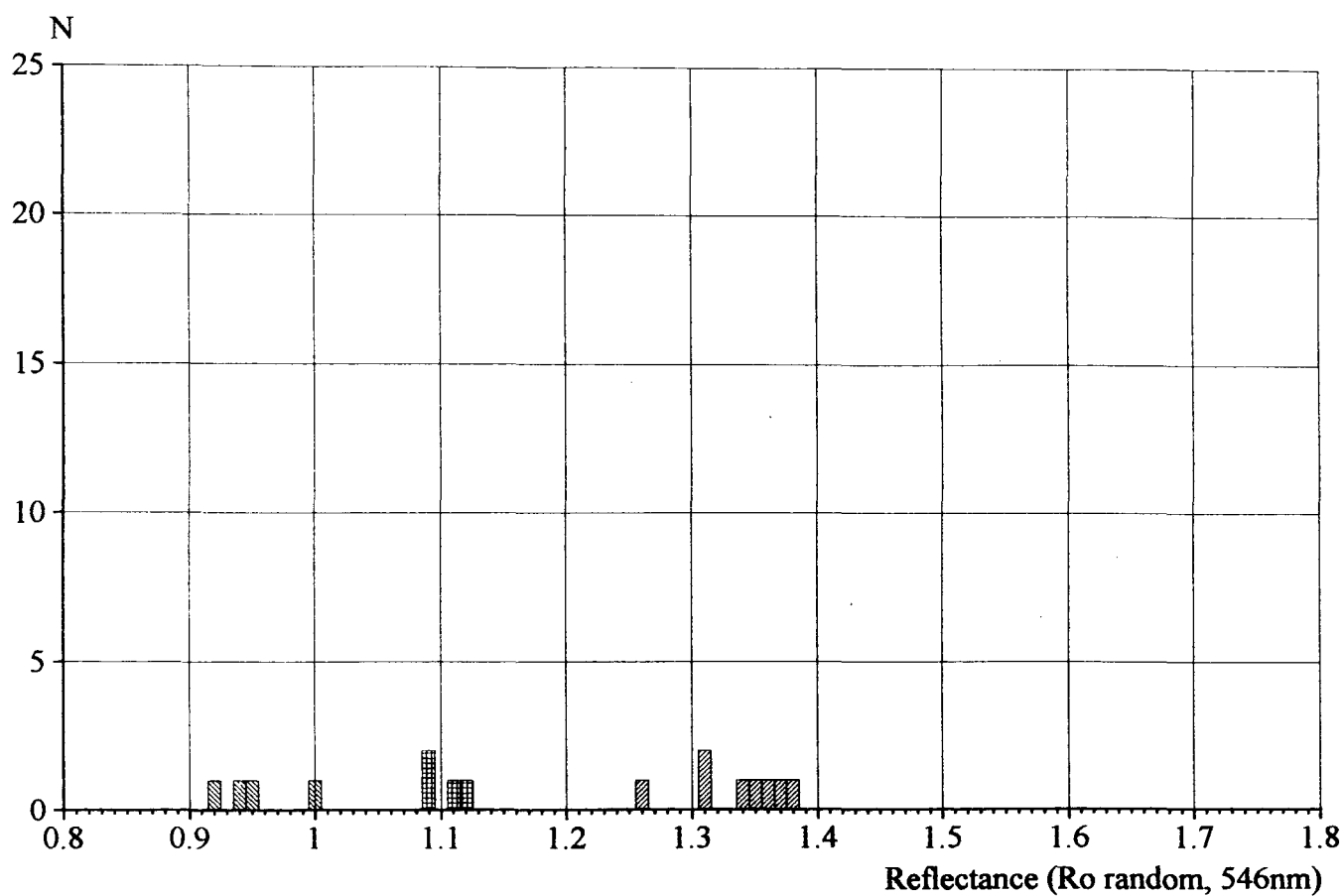
Depth (ft)	Sample Type	Comment
9410.0	C	Light yellow - dark yellow fluorescence
10560.0	C	Sample slightly oxidised Desmocollinite grades into (semi-)fusinite Light yellow - yellow fluorescing liptinites
10750.0	C	SOM micrinised Sample partly oxidised Sample severely oxidised Contaminated Few cement + paint + coal contam.; Rare Lst with plankton Yellow - dark yellow fluorescence -> probably well mature
11630.0	C	SOM micrinised Sample partly oxidised Desmocollinite grades into (semi-)fusinite Fossil remains Picked sample depth 11630-11820 ft with rare contamination Yellow-dark yellow fluorescing liptinites -> well mature
11660.0	C	SOM micrinised Sample partly oxidised Sample severely oxidised Contaminated Abundant coal (Rheolig) contam.; Rare indigenous Type II Yellow - dark yellow fluorescence -> probably well mature
11700.0	C	SOM micrinised Desmocollinite grades into (semi-)fusinite Fossil remains Contaminated Abundant coal contam.; Few indigenous marg. Type II sr. Rare Lst+plankt.forams; yel/dk yel fluo.-> ?well mature
11710.0	C	SOM micrinised Sample partly oxidised Sample severely oxidised Fossil remains Contaminated Abundant coal contam.; Few indigenous marg. Type II sr. Rare Lst+plankt.forams; Yel/dkyel fluo.-> ?well mature
11780.0	C	SOM micrinised Desmocollinite grades into (semi-)fusinite Fossil remains Contaminated Few coal+cement contam. and bit metamorphism Few marginal Type II sr part.; yel/dkyel -> ?well mature

# Reflectance histogram

Country *United Kingdom*  
 Well *208/26-01*  
 Depth *11630 ft*  
 Reference *Derrick floor*

Sample type *Cutting*  
 Sample/Order *S167069/01*  
 Analyst *KMR*  
 Date *11-06-1994*

	Mean	Std	Min	Max	Mode	Measurements
 Desmocollinite	0.95	0.03	0.92	1	0.92	4
 Desmocollinite/(semi-)Fusinite	1.33	0.04	1.26	1.38	1.31	8
 Solid Hydrocarbons obj. 50x	1.1	0.01	1.09	1.12	1.09	4



Comment:

Depth interval: 11630 - 11820 ft  
 Solid hydrocarbons ? = 1.10 -> V.R.E = 0.99 %