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Geochemical investigation of a cutting sample from well Biddenden-1, United Kingdom

by

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Sponsor: Shell Expro London Code: 876.106.10

investigation: 8BAS0116

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RIJSWIJK, THE NETHERLANDS

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CONTENTS

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Geochemical investigation of a cutting sample from well Biddenden-1, United Kingdom

1.0 Introduction

A geochemical investigation has been carried out on a cutting sample at 2020-2030 ft (Corallian) from well Biddenden-1, United Kingdom. The geochemical parameters are shown on pages 2 to 7, analysis results are presented on the yellow pages. In addition to the routine analytical program, the aromatic fraction has been analysed by GC and GCMS. No FIMS has been carried out.

2.0 Conclusions

1. Extract analysis
   The low amount of organic carbon (0.6 %) and the low amount of extract (0.04 %) indicate that the sample is most probably a very marginal, non-impregnated source rock for predominantly gas. However, the gross-composition of the extract (with 46 % saturates) resembles an impregnation rather than a source rock extract. The extremely low amount of extract has influenced the quality of some analytical results.

2. Maturity
   It is almost certain that the extract has a nearly- to just-mature character (Sterane distribution, N-alkane distribution).

3. Environment of deposition/Type of organic matter
   It is very likely that the extract has been derived from a shaly source rock (high amounts of rearranged steranes), that contained predominantly structureless organic matter (Biomarker distribution). There is no evidence in the analytical data for a landplant contribution.

Summary of the Geochemical Data of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom

Gravity and Gross Composition

% Extract :	0.04
% TOC after extract :	0.6
Extract/TOC :	0.07
Gross Composition (wt%)	
Saturates :	46
Aromatics :	16
Heterocompounds :	35
Rest (High molecular) :	3
Sulphur (%) :	no data
Vanadium (ppm) :	no data
Nickel (ppm) :	no data

Saturates Distributions

(Gaschromatography)

Pristane / Phytane :	1.2
Pristane / n-C17 :	0.7
Phytane / n-C18 :	0.5
ACI :	13
Corr. Coeff. :	-0.9678

C-7 Distributions

(Gaschromatography)

C-7 Alkanes (%)	
Normal C-7 :	90
Mono Branched :	2
Poly Branched :	8
C-7 Alkanes / Cyclo Alkanes (%)	
Normal C-7 :	68
Cyclo Alkanes :	24
Branched Alkanes :	8
C-7 Alk. / Cyclo Alk. / Aromatics (%)	
Alkanes :	76
Cyclo Alkanes :	24
Aromatics :	0

Carbon Isotope Ratios

(Mass Spectrometry)

Total Sample (topped) :	no data
Saturates :	-27.7
Aromatics :	no data

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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

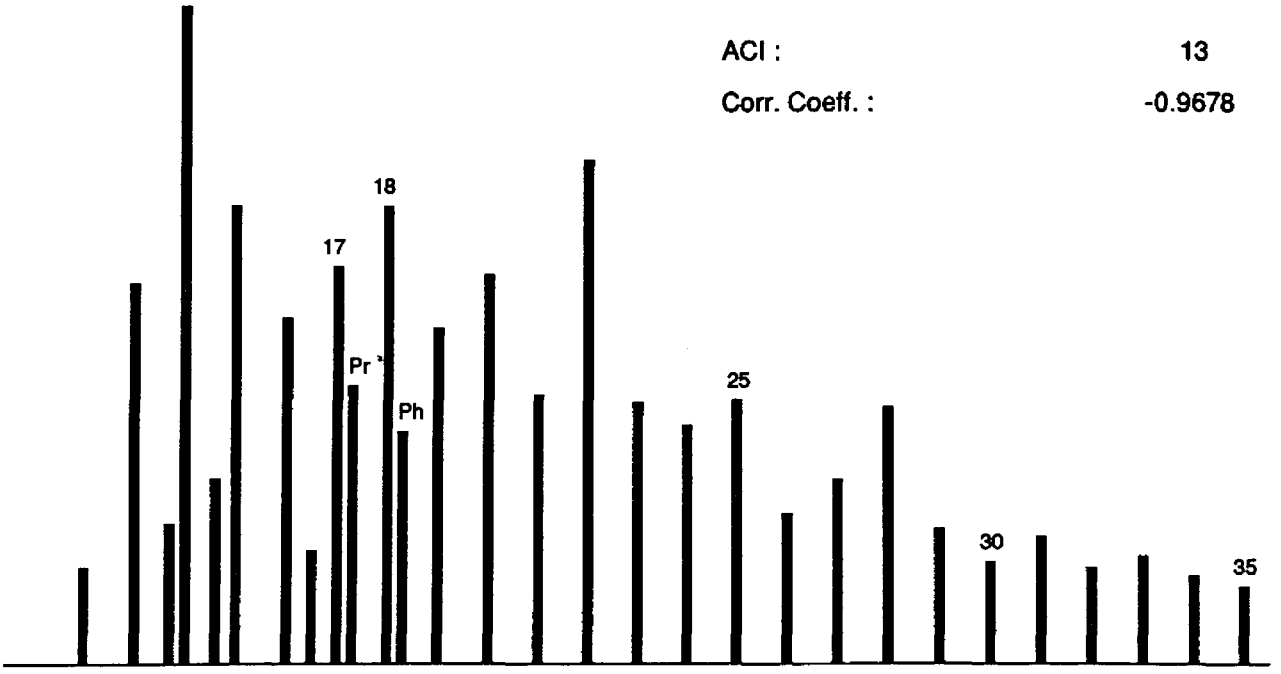
Sterane and Triterpane Distributions

(Gaschromatography / Mass Spectrometry)

Steranes/Triterpanes (%)	
Iso Steranes :	37
Rearranged Steranes :	51
Triterpanes :	12
Steranes (%)	
Iso Steranes :	39
Rearranged Steranes :	36
Normal Steranes :	25
Triterpanes (%)	
C-30 Hopanes :	100
Oleanane + Lupane :	0
W + T :	0
Steranes Carbon No. Dist. (%)	
C-27 :	37
C-28 :	28
C-29 :	35
C-29 Sterane Ratios	
20S / 20R + 20S :	0.33
Iso / Iso + Normal :	0.59
Triterpane Ratios	
TS / TM :	0.73
3R / 3R + 5R :	0.32

Bar diagram of Normal-alkanes & Isoprenoids of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom

Pristane / Phytane :	1.2
Pristane / n-C17 :	0.7
Phytane / n-C18 :	0.5
ACI :	13
Corr. Coeff. :	-0.9678



Conclusions based on saturated hydrocarbon fraction :

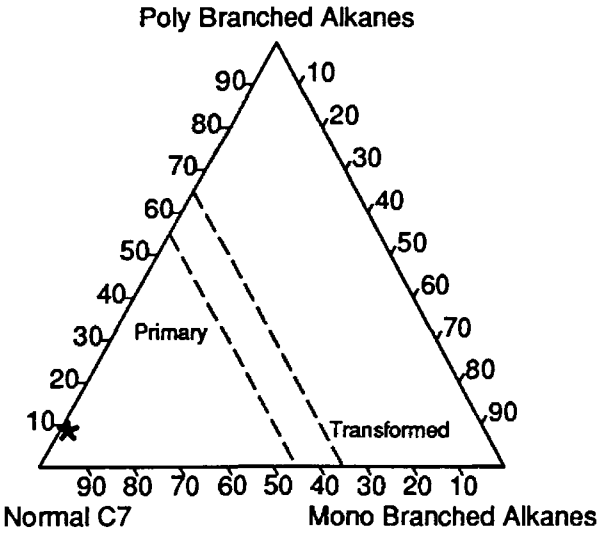
1 : the saturates show no indication of bacterial degradation

2 : the n-alkane distribution has a nearly- to just-mature character

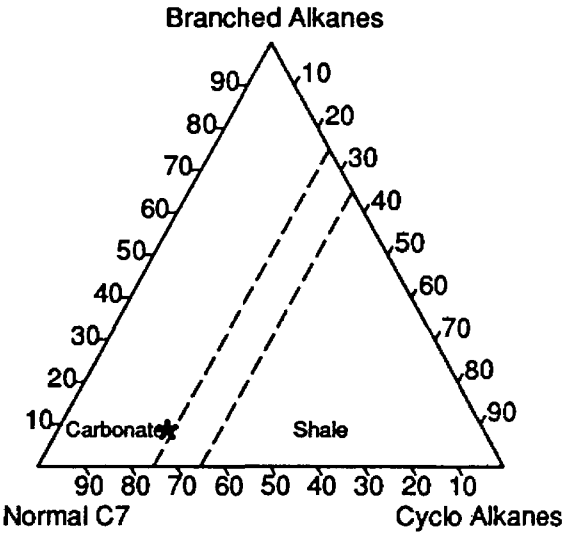
3 : the n-alkane distribution should be interpreted with care since the amount of saturated hydrocarbons and the amount of extract are very low

The Light Fraction (< 120 C.) of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom

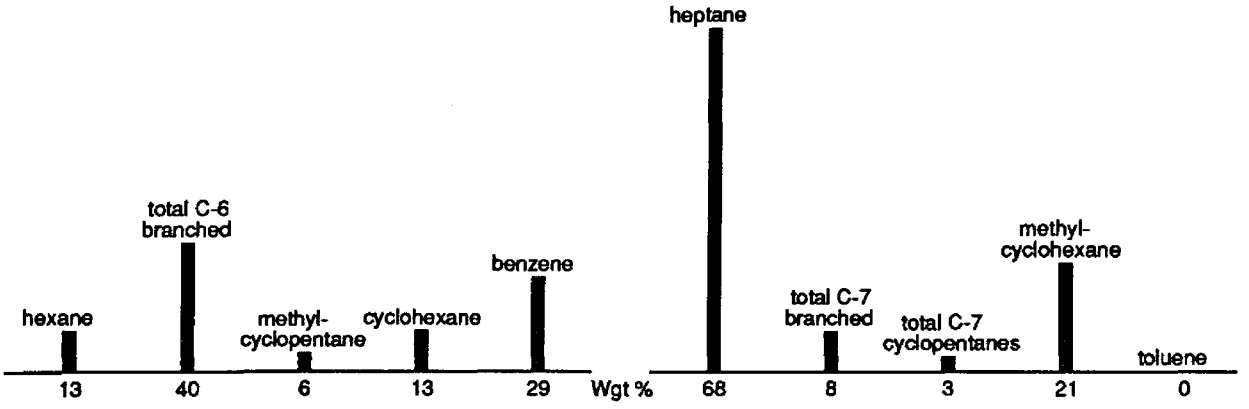
Alkane Distribution



Alkane/Cyclo-alkane Distribution



C-6 and C-7 Distributions



C-7 ALKANES (%)

Normal C-7 :	90
Mono Branched :	2
Poly Branched :	8

C-7 ALKANES / CYCLO ALKANES (%)

Normal C-7 :	68
Cyclo Alkanes :	24
Branched Alkanes :	8

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

Alkanes :	76
Cyclo Alkanes :	24
Aromatics :	0

Conclusions based on light fraction :

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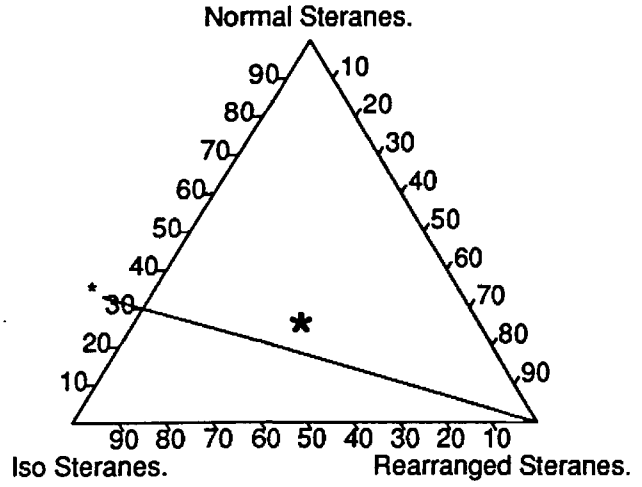
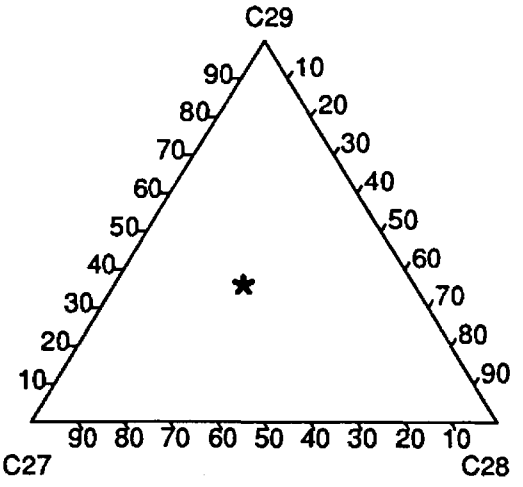
GCMS Sterane typing of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom

Sterane Conversion Diagram

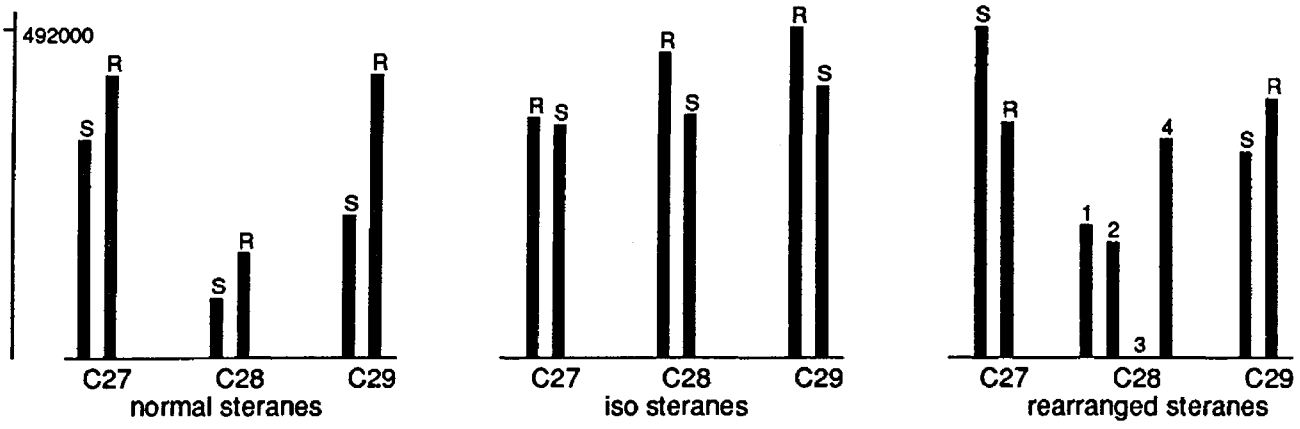


* The line of complete sterane isomerisation indicating a mature character

Sterane Typing Diagram



Sterane Distibution



STERANE DISTRIBUTION	*(ppm)*	*(%)*
Iso Steranes :	305	39
Rearranged Steranes :	281	36
Normal Steranes :	205	25
CARBON NUMBER DISTRIBUTION		
C-27 :	289	37
C-28 :	221	28
C-29 :	280	35
C-29 STERANE CONVERSION RATIOS		
20S / 20R + 20S :		0.33
Iso / Iso + Normal :		0.59

Conclusions based on steranes :

1 : the nearly complete sterane isomerisation indicates a just-mature character

2 : the steranes indicate a shaly source rock

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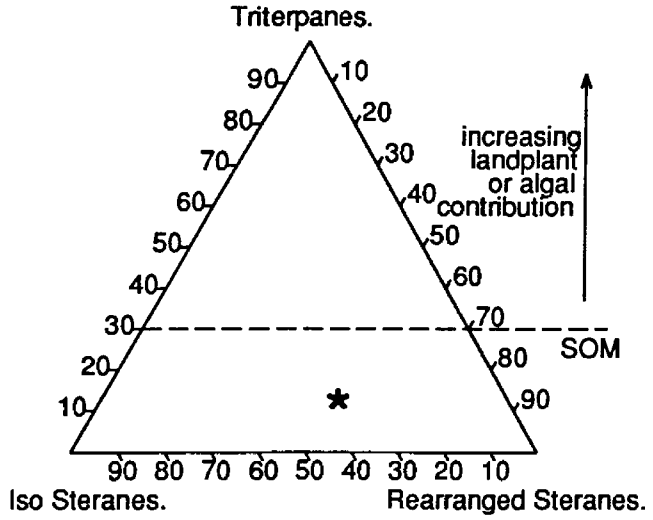
GCMS Triterpane typing of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom

Sterane/Triterpane Diagram



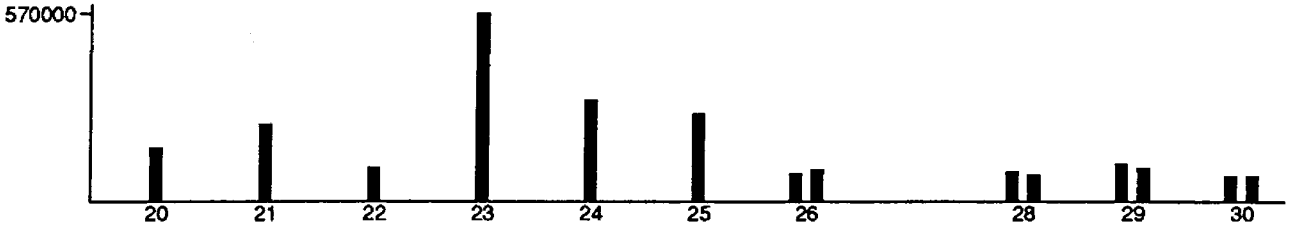
STERANES/TRITERPANES (calculated %)

Iso Steranes :	37
Rearranged Steranes :	51
Triterpanes :	12

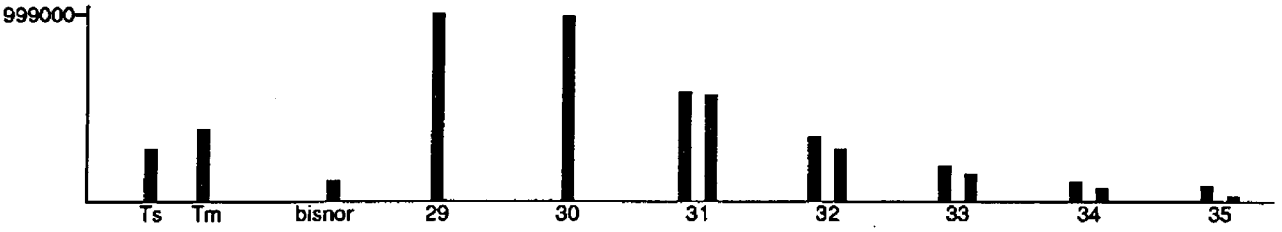
TRITERPANE CONVERSION RATIOS

TS / TM :	0.73
3R / 3R + 5R :	0.32
C30 Hopane (ppm) :	124

Tricyclic Terpanes



Pentacyclic Terpanes



Conclusions based on triterpanes :

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

GCMS data of the aromatic fraction well Biddenden-1, United Kingdom

Sample: U.K. BIDDENDEN-1 2020-2030 FT S150111/1 ARO.FRAC

I) NAPHTHALENES

a) Concentrations (ppm):

2-MN	177
1-MN	166
2,6+2,7-DMN	74
1,6-DMN	82
1,5-DMN	26
1,4,6+1,3,5-TMN	41
2,3,6-TMN	23
1,2,5-TMN	28
C4-Naphthalene	22
THN	0
Cadalene	0
Total Naphthalenes	639

b) Parameters:

2-MN/1-MN (MNR)	1.06
2,6+2,7-DMN/1,5-DMN (DNR-1)	2.84
2.3.6-TMN/1,4,6+2,3,5-TMN (TNR-1)	0.56
2,3,6-TMN/1,2,5-TMN (TNR-2)	0.83
2,3,6-TMN/THN	0.00
2,3,6-TMN/Cadalene	0.00

II) PHENANTHRENES

a) Concentrations (ppm):

P	238
3-MP	31
2-MP	38
9-MP	42
1-MP	32
Total Phenanthrenes	381

b) Parameters:

2-MP/1-MP	1.17
1.5(2-MP+3-MP)/(P+1-MP+9-MP)(MPI1)	0.33
3(2-MP)/(P+1-MP+9-MP)	0.36
(2-MP+3-MP)/(1-MP+9-MP)	0.92
(2-MP+3-MP)/(1-MP+9-MP+2-MP+3-MP)	0.48

III) DIBENZOTHIOPHENES

a) Concentrations (ppm):

DBT	18
4-MDBT	13
2+3-MDBT	5
1-MDBT	7
Total Dibenzothiophenes	43

b)Parameters

4-MDBT/2+3-MDBT	2.80
4-MDBT/1-MDBT	1.75
2+3-MDBT/1-MDBT	0.63
4-MDBT/DBT	0.72
2+3-MDBT/DBT	0.26
1-MDBT/DBT	0.41

IV)BIPHENYLS

a)Concentrations (ppm):

BP	40
2-MBP	0
3-MBP	25
4-MBP	8
Total Biphenyls	73

b) Parameters:

3-MBP/BP	0.62
3-MBP/4-MBP	3.02
3-MBP/2-MBP	0.00

V) DIBENZOFURANS

a) Concentrations (ppm):

DBF	42
4-MDBF	13
2+3-MDBF	19
1-MDBF	5
Total Dibenzofurans	79

b) Parameters:

4-MDBF/2+3-MDBF	0.65
4-MDBF/1-MDBF	2.71
2+3-MDBF/1-MDBF	4.19
4-MDBF/DBF	0.30
2+3-MDBF/DBF	0.46
1-MDBF/DBF	0.11

VI) OVERALL RATIOS

Biphenyls/NAPH*	0.45
Dibenzothiophenes/NAPH*	0.26
Dibenzofurans/NAPH*	0.48

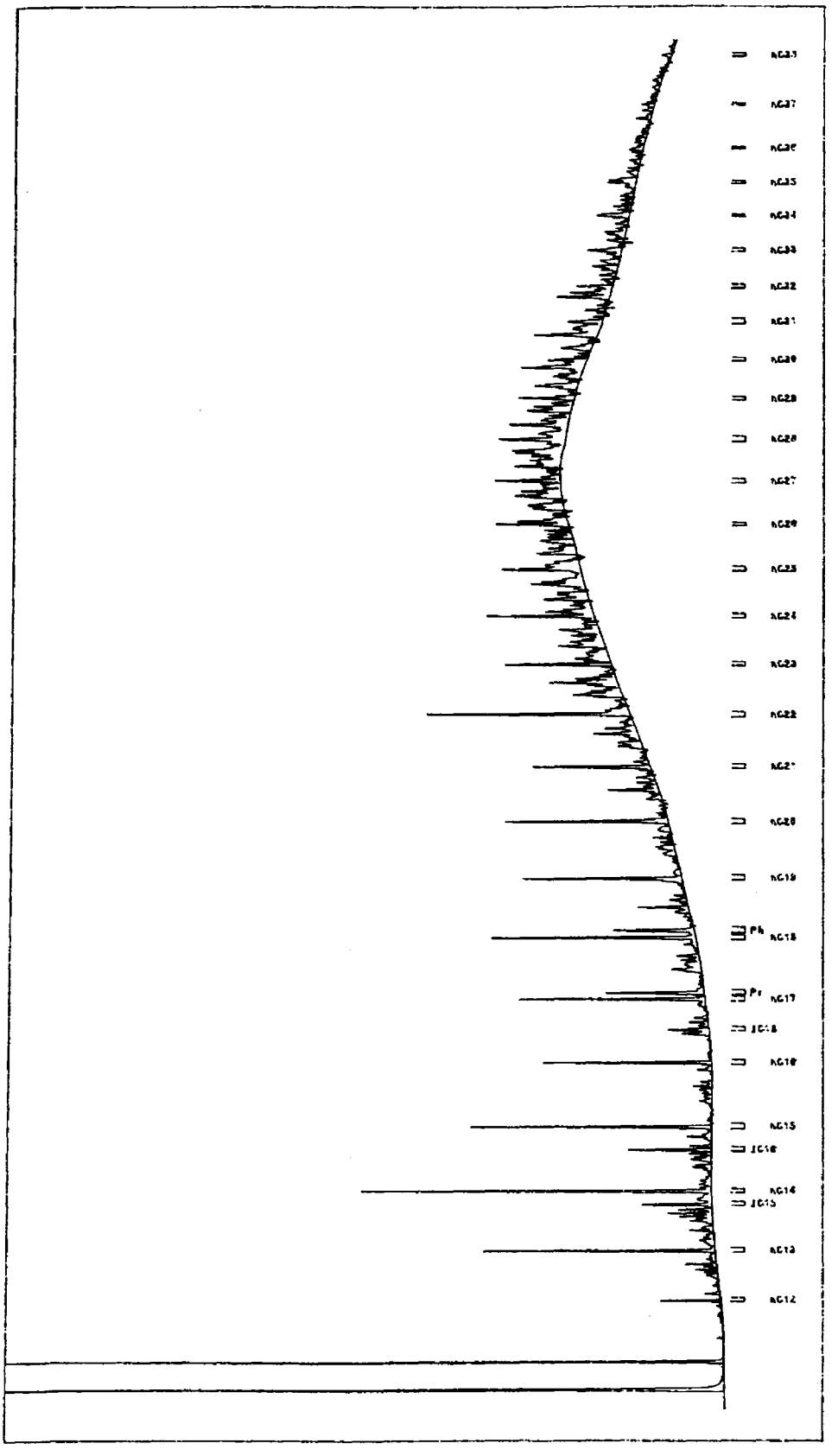
MN = methylnaphthalene
DMN = dimethylnaphthalene
TMN = trimethylnaphthalene
THN = tetrahydronaphthalene
DBF = dibenzofuran
MDBF = methyldibenzofuran
P = phenanthrene
MP = methylphenanthrene
DBT = dibenzothiophene
MDBT = methyldibenzothiophene
BP = biphenyl
MBP = methylbiphenyl

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

ANALYTICAL DATA
well BIDDENDEN-1 (615.7 m.), United Kingdom

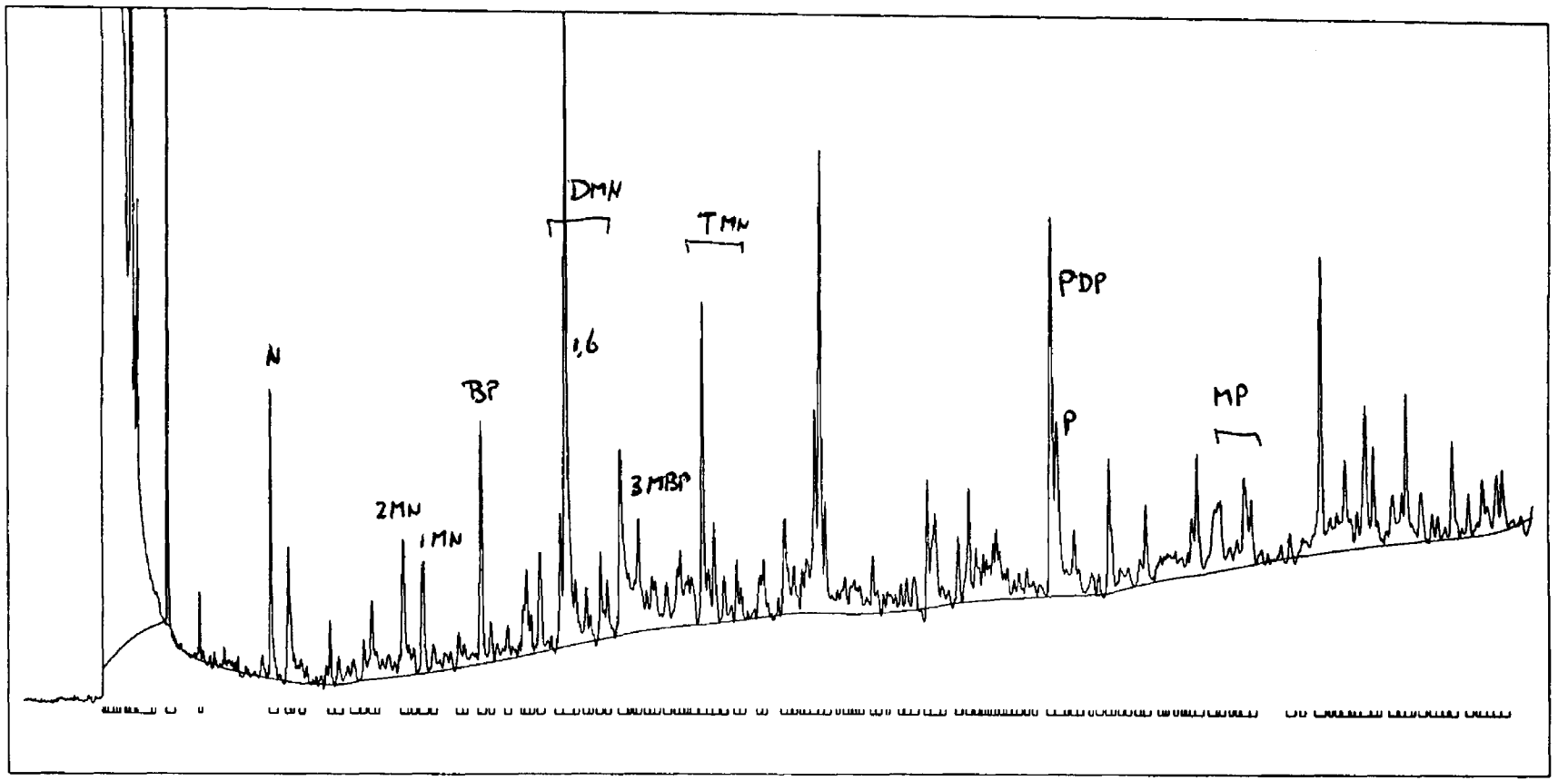
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

well Biddenden-1, United Kingdom



GAS CHROMATOGRAM OF AROMATIC HYDROCARBONS

well Biddenden-1, United Kingdom

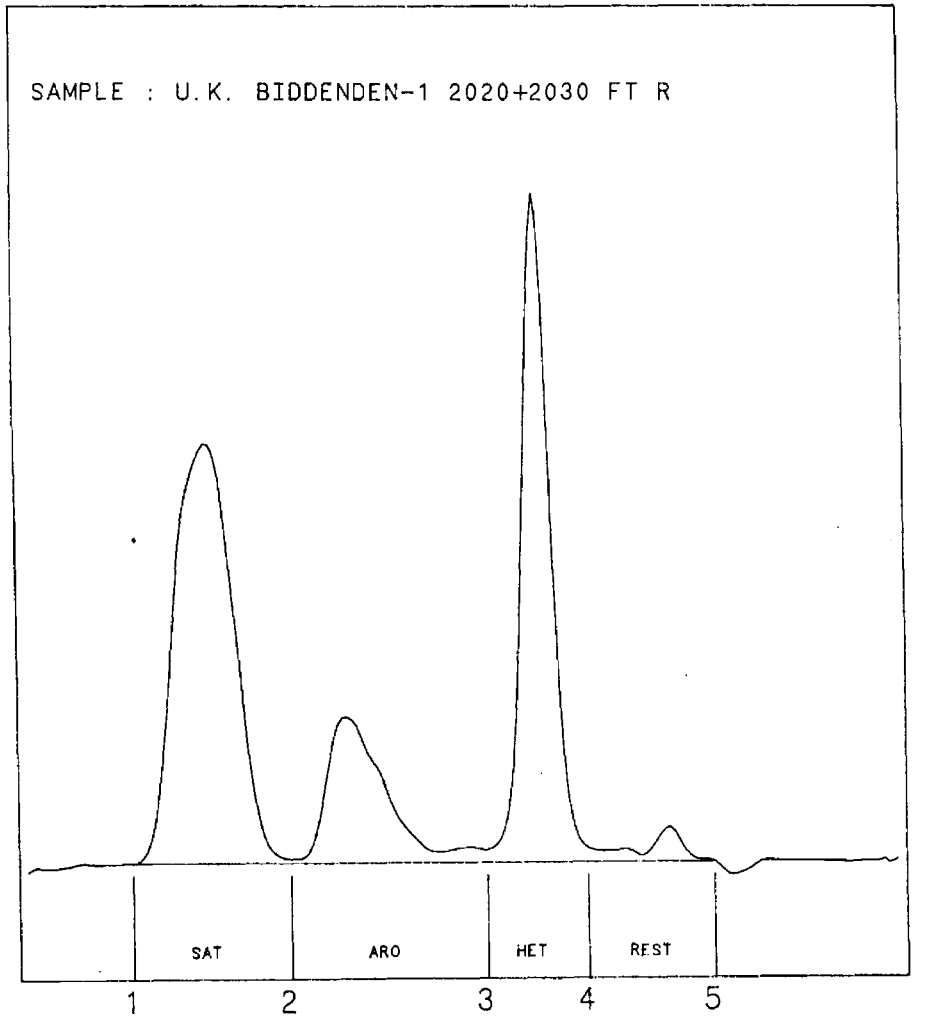


U.K. BIDDENDEN–1

2020+2030 FT

S150111/1

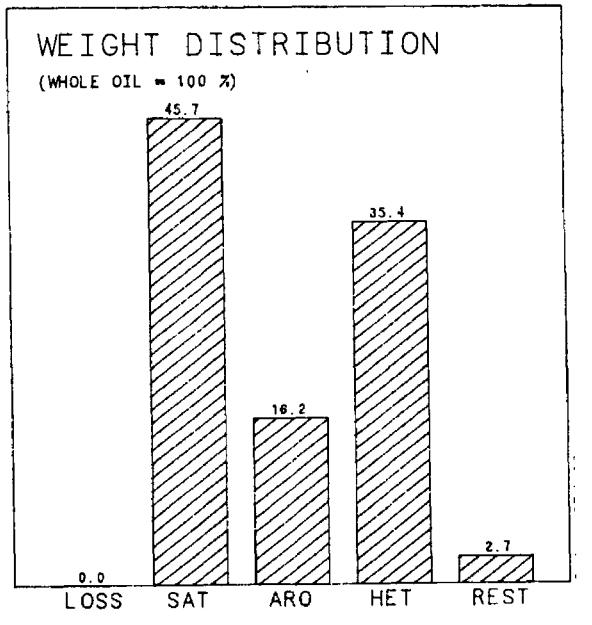
Gross Composition of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom



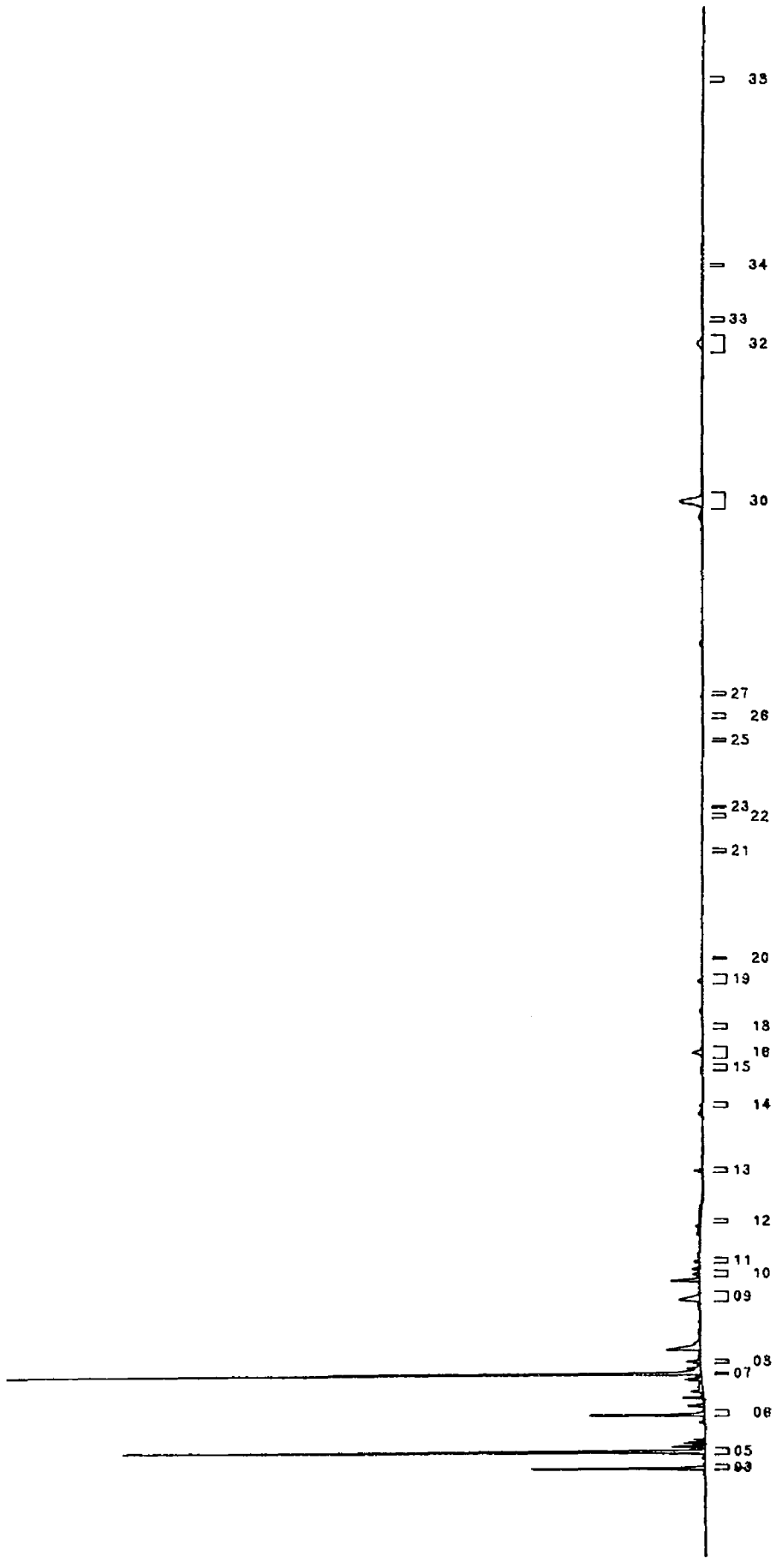
SAMPLE : S150111-1

WEIGHT LOST ON TOPPING	:	0.0 %
– SATURATES	:	45.7 %
– AROMATICS	:	16.2 %
– HETEROCOMPOUNDS	:	35.4 %
– REST (HIGH MOL.)	:	2.7 %

* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE



Gas chromatogram of the light fraction (< 120 C.) of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom



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Gas chromatographic hydrocarbons analysis (< 120 C.) well BIDDENDEN-1 (615.7 m.), United Kingdom

GAS CHROMATOGRAPHIC ANALYSIS OF THE FRACTION BOILING BELOW
114 DEGREES CENTIGRADE

Sample: S15011101 d.d. 09-apr-91 07:57
Recorded: L1-301 GLC-1

Country: United Kingdom Well/Outcrop: BIDDENDEN-1

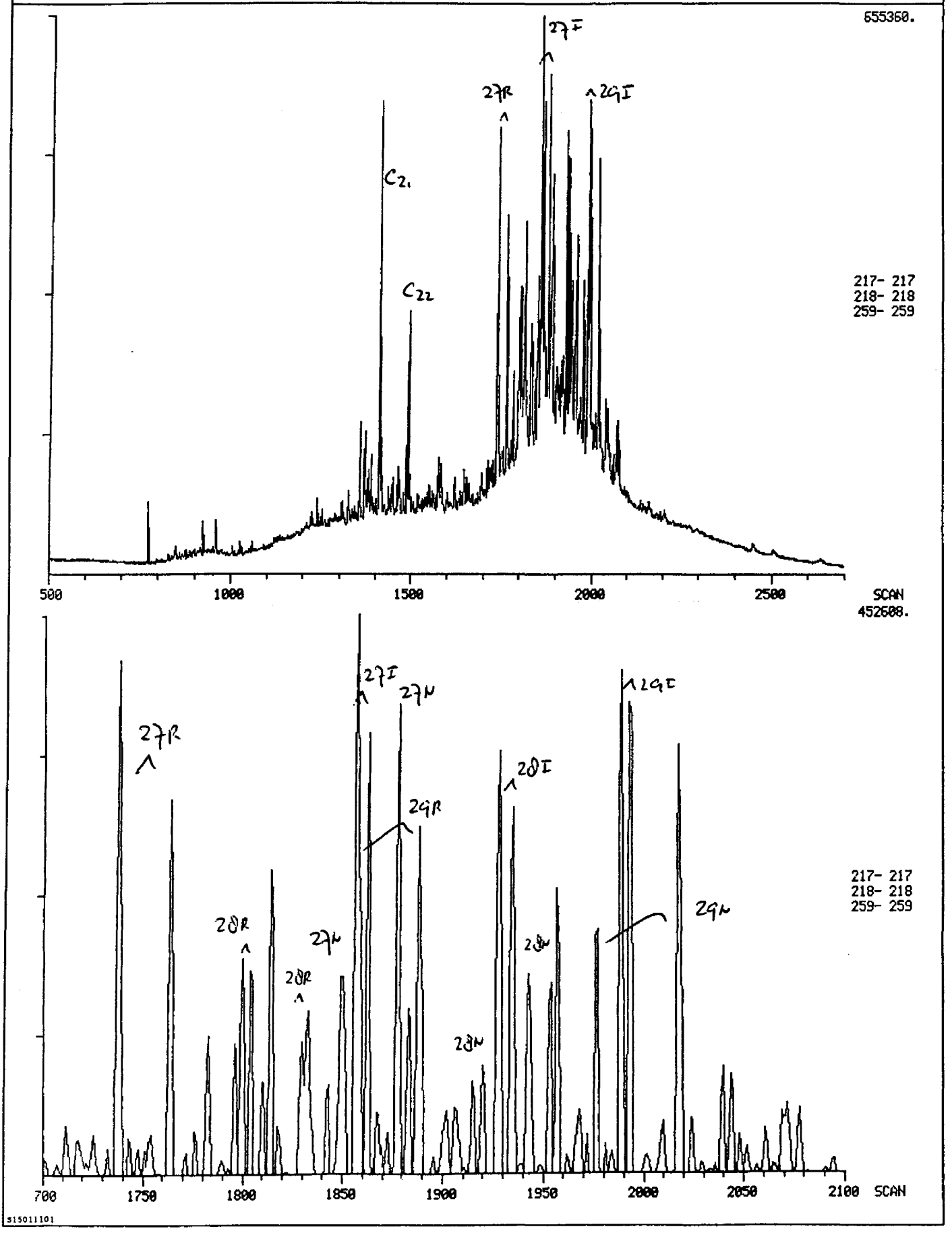
Depth/Collector: 2020.0 ft

Comment: Real depth = 2020' + 2030'.

COMPONENT No.	Name	RET.TIM (min)	MAXIMUM (mV)	AREA * (cnts)	WEIGHT PERC.
3	PROPANE	068:09	2121.3	20149	9.27
4	ISOBUTANE	* * *	Not detected	* * *	
5	N-BUTANE	069:44	7112.4	76243	35.08
6	ISOPENTANE	073:07	1403.3	14424	6.64
7	N-PENTANE	076:53	8623.8	64128	29.51
8	2.2-DIMETHYLBUTANE	078:03	177.6	2244	1.03
9	CYCLOPENTANE	083:49	255.4	7418	3.41
10	2.3-DIMETHYLBUTANE	086:11	78.5	1540	0.71
11	2-METHYLPENTANE	087:20	63.8	996	0.46
12	3-METHYLPENTANE	091:03	20.4	533	0.25
13	N-HEXANE	095:50	105.6	1692	0.78
14	METHYLCYCLOPENTANE	101:56	38.2	736	0.34
15	2.2-DIMETHYLPENTANE	105:25	25.0	835	0.38
16	BENZENE	106:51	123.6	3913	1.80
17	2.4-DIMETHYLPENTANE	* * *	Not detected	* * *	
18	2.2.3-TRIMETHYLBUTANE	109:14	11.6	229	0.11
19	CYCLOHEXANE	113:31	58.8	1671	0.77
20	3.3-DIMETHYLPENTANE	115:42	13.6	155	0.07
21	1.1-DIMETHYLCYCLOPENTANE	125:42	8.8	128	0.06
22	2-METHYLHEXANE	129:00	11.4	205	0.09
23	2.3-DIMETHYLPENTANE	129:51	11.2	109	0.05
24	1-C-3-DIMETHYLCYCLOPENTANE	* * *	Not detected	* * *	
25	3-METHYLHEXANE	136:04	8.4	120	0.06
26	1-T-3-DIMETHYLCYCLOPENTANE	138:07	11.9	217	0.10
27	1-T-2-DIMETHYLCYCLOPENTANE	140:13	16.2	261	0.12
28	3-ETHYLPENTANE	* * *	Not detected	* * *	
30	N-HEPTANE	158:21	288.1	14212	6.54
31	1-C-2-DIMETHYLCYCLOPENTANE	* * *	Not detected	* * *	
32	METHYLCYCLOHEXANE	173:06	74.2	4501	2.07
33	1.1.3-TRIMETHYLCYCLOPENTANE	175:26	13.4	219	0.10
34	2.2-DIMETHYLHEXANE	180:25	15.4	276	0.13
35	ETHYLCYCLOPENTANE	* * *	Not detected	* * *	
36	2.5-DIMETHYLHEXANE	* * *	Not detected	* * *	
38	2.2.3-TRIMETHYLPENTANE	197:46	7.1	173	0.08
39	1-T-2-C-4-TRIMETHYLCYCLOPENTANE	* * *	Not detected	* * *	
40	TOLUENE	* * *	Not detected	* * *	
	30	158:21	288.1	14212	
	Total peak area			217327	

*) Corrected for difference in response

Sterane Fragmentograms of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom



Triterpane Fragmentograms of the sample from well BIDDENDEN-1 (615.7 m.), United Kingdom