December 1992

RKER 92.200

Geochemical investigation of two crude oils from Douglas and Hamilton, United Kingdom

by

J.M.A. Buiskool Toxopeus and F.A.M. de Gier

Sponsor: SIPM-EP Code: 774.106.10

investigation: 8BAS0480

KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM
RIJSWIJK, THE NETHERLANDS

(Shell research B.V.)

CONTENTS

Initial distribution:

SIPM-EP - 3 copies
SIPM-EPA/2 - 3 copies

Geochemical investigation of two crude oils from Douglas and Hamilton, United Kingdom

1.0 Introduction

A geochemical investigation has been carried out on the following two (blended) oil samples the United Kingdom (request telex ref. Memo UETB/2 30-10-92):
- Douglas, 110/13-02 (OMC 5664);
- Hamilton, 110/15 (OMC 5665).

The geochemical parameters are shown on pages 3 to 14, analysis results are presented on the yellow pages.

2.0 Conclusions

1. Transformation processes
   Both oils show peculiar whole oil gas chromatograms in that they are depleted in the n-C9 to n-C12 fraction, while a (bacterially not degraded, but water washed) light fraction up to n-C9 is present again. This depletion can be explained by three different mechanisms:
   1. gas washing removing part of the oil fraction. In this case unlikely since the oils do not show an increased content of aromatics resulting from this process.
   2. biodegradation of the oils up to about n-C10 (removing the light fraction) and a subsequent second charge in the reservoir of a (more mature) wet gas/ condensate. Although less unlikely compared to gas washing, this process cannot explain the absence of aromatics in the light fraction (pointing to water washing) and the similar maturity level of the light fraction versus the heavy fraction (C7-, C29- and Sterane-VRE values are all similar). However, the geological feasibility of such a process should be checked.
   3. An initial biodegration phase of the oils removing only the n-alkanes in the range C9 to C12. The accompanying absence of aromatics indicating water washing supports this possibility. The 110/15 oil seems slightly less degraded compared to the 110/13-2 oil.

2. Maturity
   Both oils have a similar well-mature character (API, gross composition, C29-VRE, strong sterane isomerisation, low sulphur contents).

3. Environment of deposition / Type of organic matter
   Both oils type very similar (similarities in biomarkers and carbon isotopes). The oils have been derived from a shaly source rock (n-alkane distribution, C7-distribution), that contained algal SOM (biomarkers). The waxy character of the oils is probably due to the algal matter.

4. Sulphur analysis
Since the oils have relatively low sulphur contents but a strong characteristic sulphuric smell some attention was paid to the distribution of the sulphur. The sulphur contents were measured before and after topping with the following results:

	%S Topped	%S untopped	% weight lost on topping
110/13-02 (OMC 5664)	0.37	0.28	37
110/15 (OMC 5665)	0.28	0.22	48

These values show that there are - as usual - slightly higher amounts of sulphur in the heavy fraction compared to the light fraction. An overview of the distribution of the various sulphur components in the whole oil shows occurrence in the light fraction (sulphides, mercaptanes) as well as in the heavy fraction (dibenzothiophenes). A detailed distribution of the benzothiophenes in the heavy fraction is presented and confirms the well-mature character of the oils.

Summary of the Geochemical Data of the oil sample from well 110/13-02, United Kingdom

Gravity and Gross Composition

API gravity (degrees) :	43.8
Specific Gravity (g/ml) :	0.807
Viscosity (centipoise) :	no data
Gross Composition (W%)	
Weight lost on topping :	no data
Saturates :	66
Aromatics :	30
Heterocompounds :	2
Rest (High molecular) :	1
Gasoline fraction (%) :	13.0
Sulphur (%) :	0.3
Vanadium (ppm) :	0.0
Nickel (ppm) :	1.0

Saturates Distributions

(Gaschromatography)

Pristane / Phytane :	1.4
Pristane / n-C17 :	0.7
Phytane / n-C18 :	0.5
ACI :	14
Corr. Coeff. :	-0.9589

C-7 Distributions

(Gaschromatography)

C-7 Alkanes (%)	
Normal C-7 :	49
Mono Branched :	40
Poly Branched :	11
C-7 Alkanes / Cyclo Alkanes (%)	
Normal C-7 :	30
Cyclo Alkanes :	37
Branched Alkanes :	33
C-7 Alk. / Cyclo Alk. / Aromatics (%)	
Alkanes :	63
Cyclo Alkanes :	37
Aromatics :	0

Carbon Isotope Ratios

(Mass Spectrometry)

Total Oil (topped) :	-30.9
Saturates :	-30.6
Aromatics :	-30.3

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 :	34
4 ring :	34
5 ring :	32
C-29 VR/E :	1.0

Sterane and Triterpane Distributions

(Gaschromatography / Mass Spectrometry)

Steranes/Triterpanes (%)	
Iso Steranes :	22
Rearranged Steranes :	48
Triterpanes :	30
Steranes (%)	
Iso Steranes :	35
Rearranged Steranes :	52
Normal Steranes :	13
Triterpanes (%)	
C-30 Hopanes :	100
Oleanane (α+ β) :	0
W + T :	0
Steranes Carbon No. Dist. (%)	
C-27 :	41
C-28 :	24
C-29 :	35
C-29 Sterane Ratios	
20S / 20R + 20S :	0.57
Iso / Iso + Normal :	0.69
Triterpane Ratios	
TS / TM :	0.94
3R / 3R + 5R :	0.42

S16151901

Summary of the Geochemical Data of the oil sample from well 110/15, United Kingdom

Gravity and Gross Composition

API gravity (degrees) :	46.5
Specific Gravity (g/ml) :	0.795
Viscosity (centipoise) :	no data
Gross Composition (W%)	
Weight lost on topping :	48.4
Saturates :	66
Aromatics :	32
Heterocompounds :	2
Rest (High molecular) :	0
Gasoline fraction (%) :	22.3
Sulphur (%) :	0.2
Vanadium (ppm) :	0.0
Nickel (ppm) :	0.0

Saturates Distributions

(Gaschromatography)

Pristane / Phytane :	1.5
Pristane / n-C17 :	0.5
Phytane / n-C18 :	0.3
ACI :	13
Corr. Coeff. :	-0.9814

C-7 Distributions

(Gaschromatography)

C-7 Alkanes (%)	
Normal C-7 :	49
Mono Branched :	41
Poly Branched :	10
C-7 Alkanes / Cyclo Alkanes (%)	
Normal C-7 :	21
Cyclo Alkanes :	56
Branched Alkanes :	23
C-7 Alk. / Cyclo Alk. / Aromatics (%)	
Alkanes :	43
Cyclo Alkanes :	55
Aromatics :	2

Carbon Isotope Ratios

(Mass Spectrometry)

Total Oil (topped) :	-31.1
Saturates :	-31.2
Aromatics :	-30.6

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 :	22
4 ring :	49
5 ring :	29
C-29 VR/E :	1.03

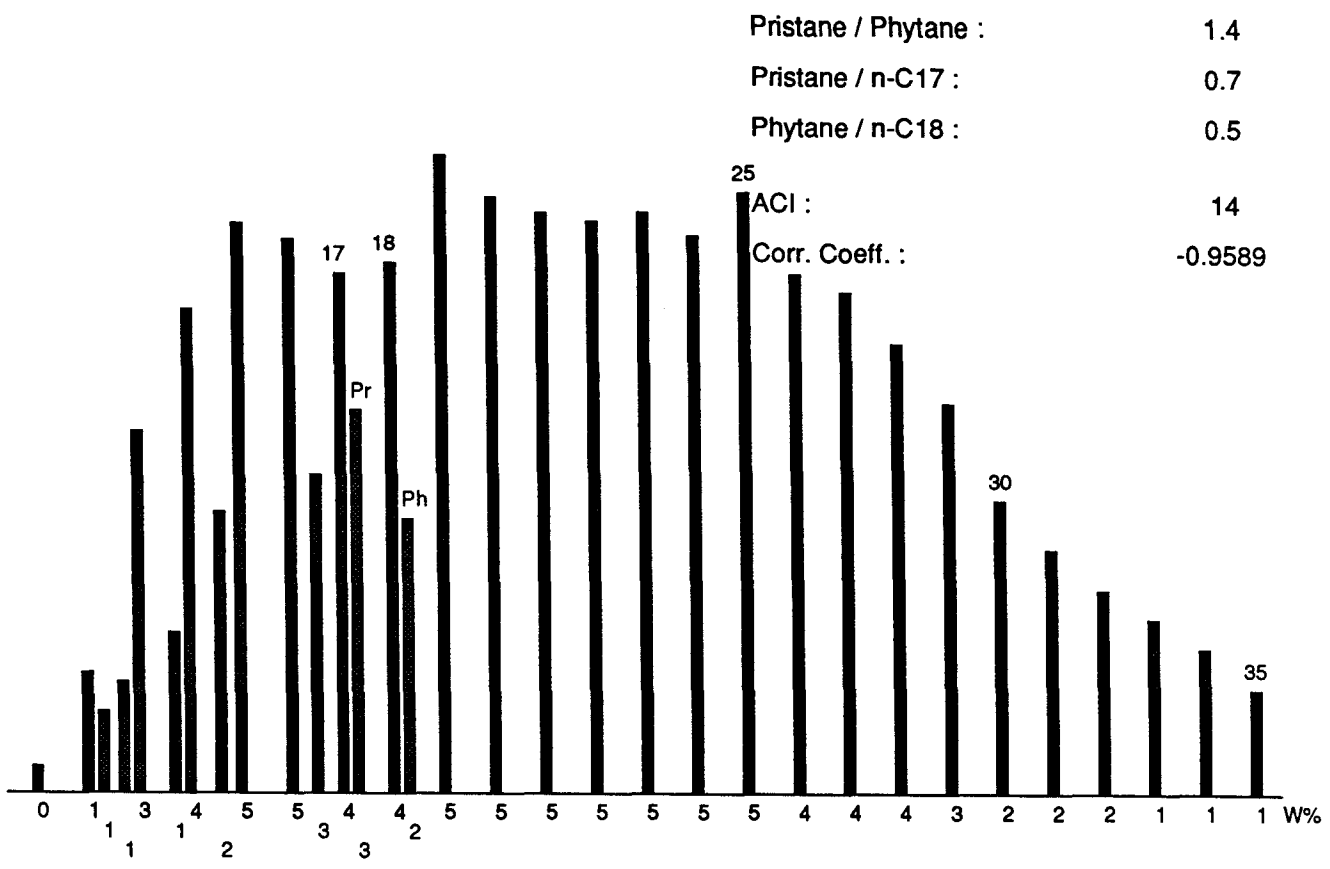
Sterane and Triterpane Distributions

(Gaschromatography / Mass Spectrometry)

Steranes/Triterpanes (%)	
Iso Steranes :	26
Rearranged Steranes :	53
Triterpanes :	21
Steranes (%)	
Iso Steranes :	37
Rearranged Steranes :	52
Normal Steranes :	11
Triterpanes (%)	
C-30 Hopanes :	100
Oleanane ($\alpha + \beta$) :	0
W + T :	0
Steranes Carbon No. Dist. (%)	
C-27 :	39
C-28 :	26
C-29 :	35
C-29 Sterane Ratios	
20S / 20R + 20S :	0.64
Iso / Iso + Normal :	0.72
Triterpane Ratios	
TS / TM :	1.07
3R / 3R + 5R :	0.46

S16152001

Bar diagram of Normal-alkanes & Isoprenoids of the oil sample from well 110/13-02, United Kingdom



Conclusions based on saturated hydrocarbon fraction :

1 : the saturates show no indication of bacterial degradation

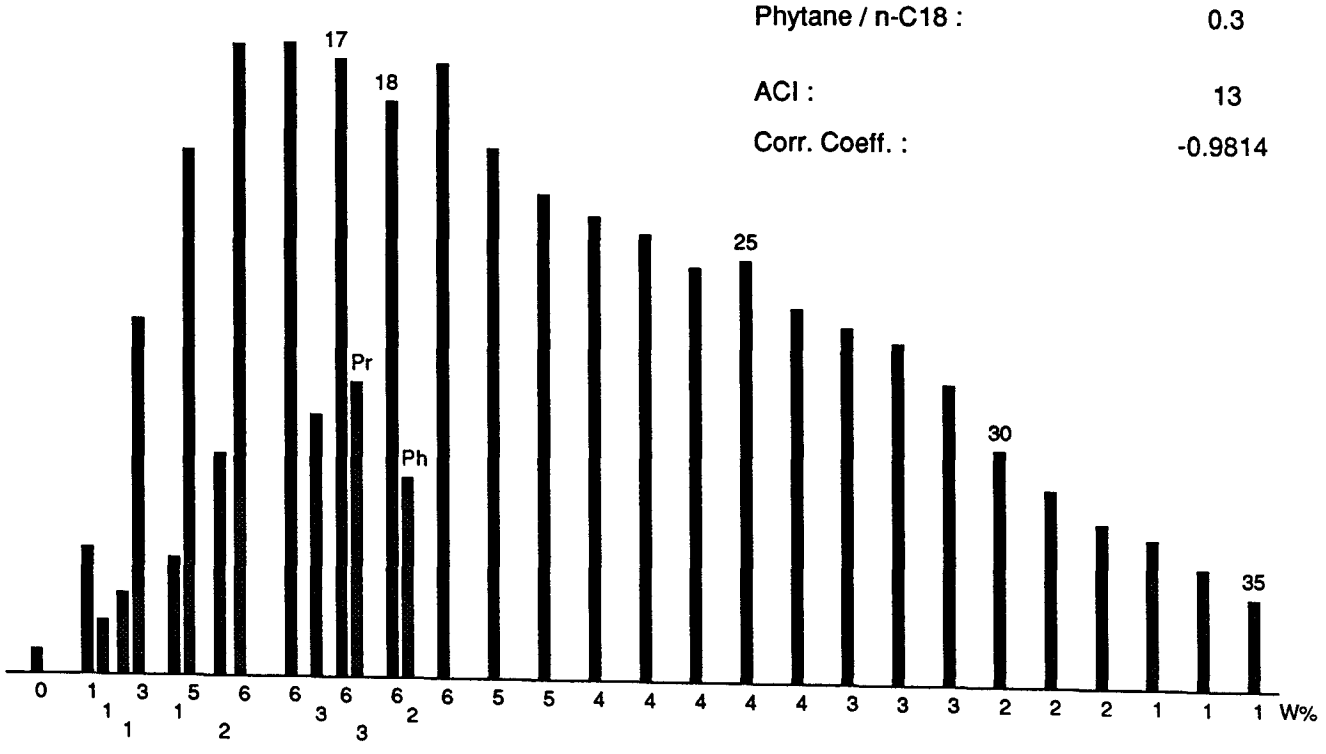
2 : the n-alkane distribution has a mature character

3 : the saturates indicate that the oil has been expelled from a source rock containing structureless organic matter with a substantial contribution of landplant and/or algal matter

S16151901

Bar diagram of Normal-alkanes & Isoprenoids of the oil sample from well 110/15, United Kingdom

Pristane / Phytane :	1.5
Pristane / n-C17 :	0.5
Phytane / n-C18 :	0.3
ACI :	13
Corr. Coeff. :	-0.9814



Conclusions based on saturated hydrocarbon fraction :

1 : the saturates show no indication of bacterial degradation

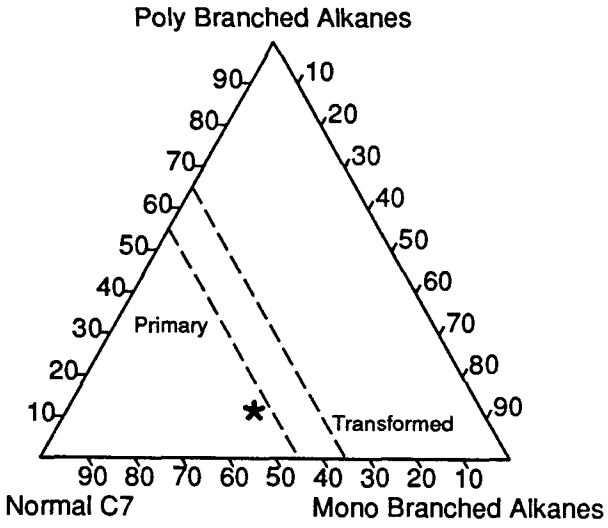
2 : the n-alkane distribution has a mature character

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

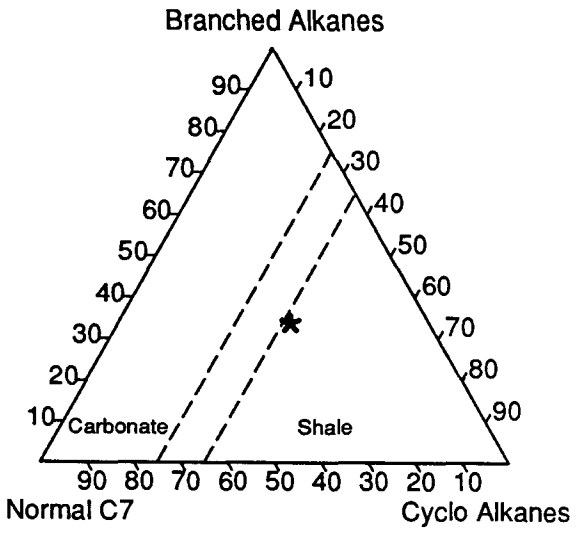
S16152001

The Light Fraction (< 120 C.) of the oil sample from well 110/13-02, United Kingdom

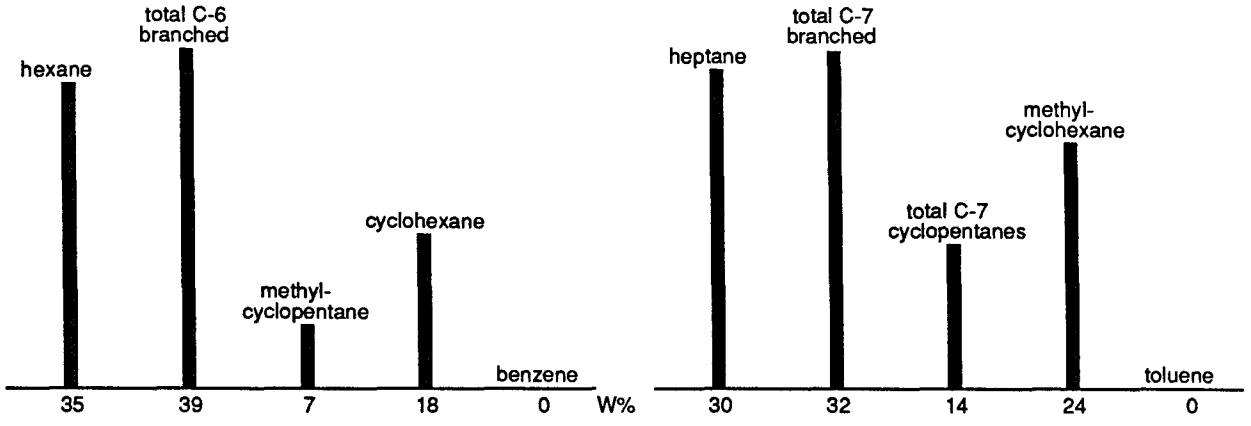
Alkane Distribution



Alkane/Cyclo-alkane Distribution



C-6 and C-7 Distributions



C-7 ALKANES (%)

Normal C-7 :	49
Mono Branched :	40
Poly Branched :	11

C-7 ALKANES / CYCLO ALKANES (%)

Normal C-7 :	30
Cyclo Alkanes :	37
Branched Alkanes :	33

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

Alkanes :	63
Cyclo Alkanes :	37
Aromatics :	0

Conclusions based on light fraction :

1 : the light fraction shows no indication of bacterial degradation

2 : the aromatics indicate that this oil has possibly been water washed

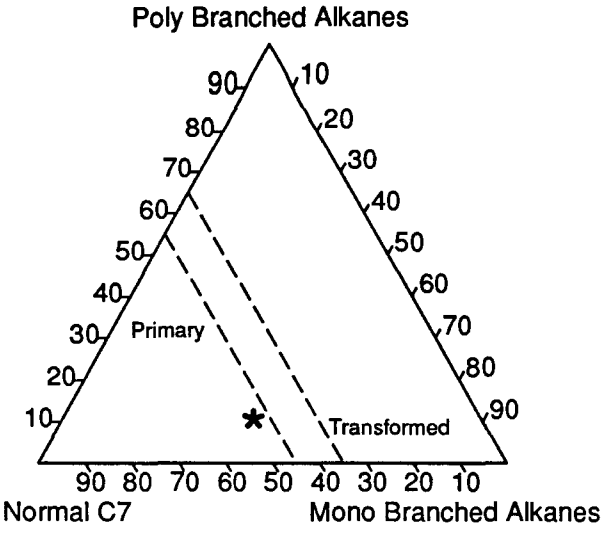
3 : the light fraction has a highly mature character

4 : the light fraction indicates a shaly source rock

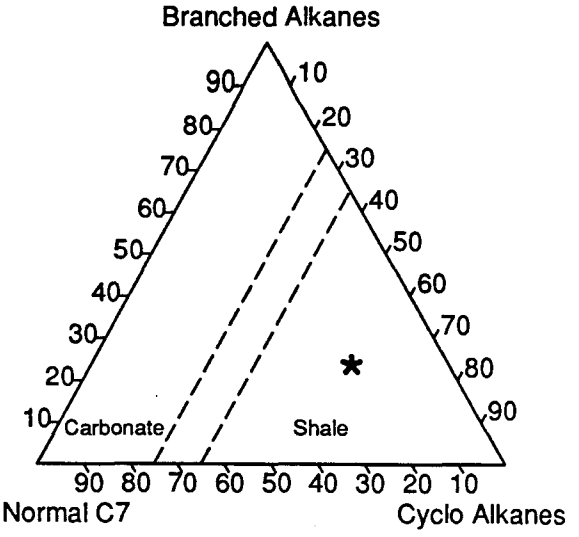
S16151901

The Light Fraction (< 120 C.) of the oil sample from well 110/15, United Kingdom

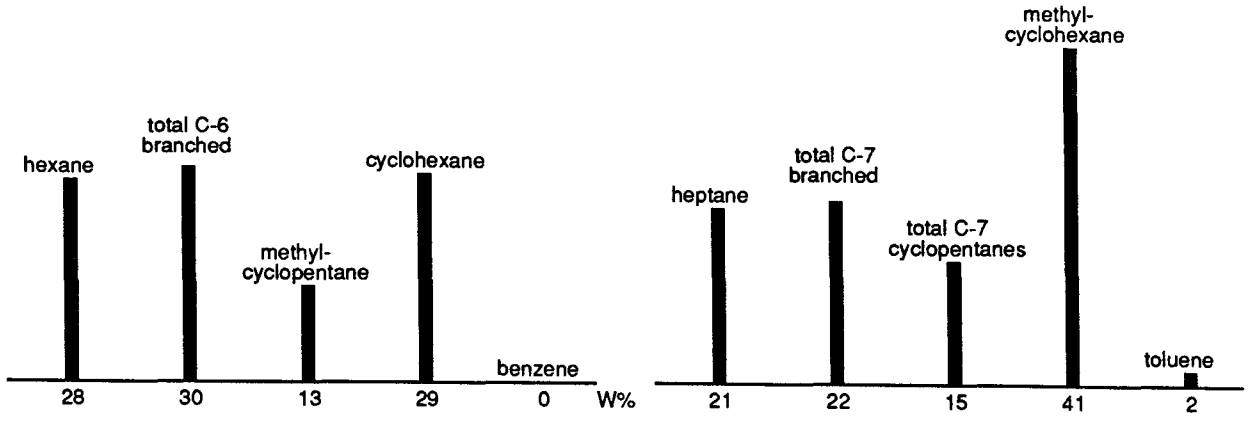
Alkane Distribution



Alkane/Cyclo-alkane Distribution



C-6 and C-7 Distributions



C-7 ALKANES (%)

Normal C-7 :	49
Mono Branched :	41
Poly Branched :	10

C-7 ALKANES / CYCLO ALKANES (%)

Normal C-7 :	21
Cyclo Alkanes :	56
Branched Alkanes :	23

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

Alkanes :	43
Cyclo Alkanes :	55
Aromatics :	2

Conclusions based on light fraction :

1 : the light fraction shows no indication of bacterial degradation

2 : the aromatics indicate that this oil has possibly been water washed

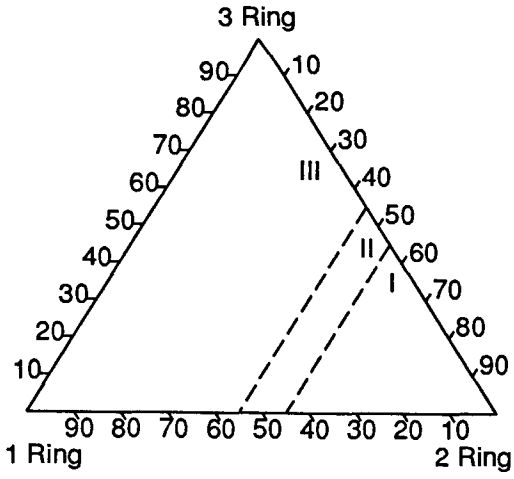
3 : it is likely that the light fraction has a highly mature character

4 : the light fraction indicates a shaly source rock

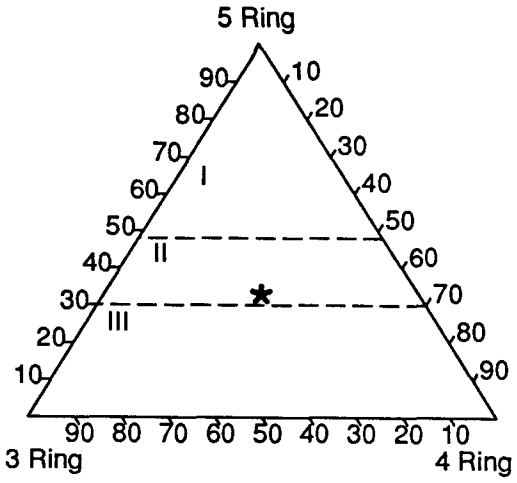
S16152001

FIMS typing of the oil sample from well 110/13-02, United Kingdom

C-15 Ring Distribution

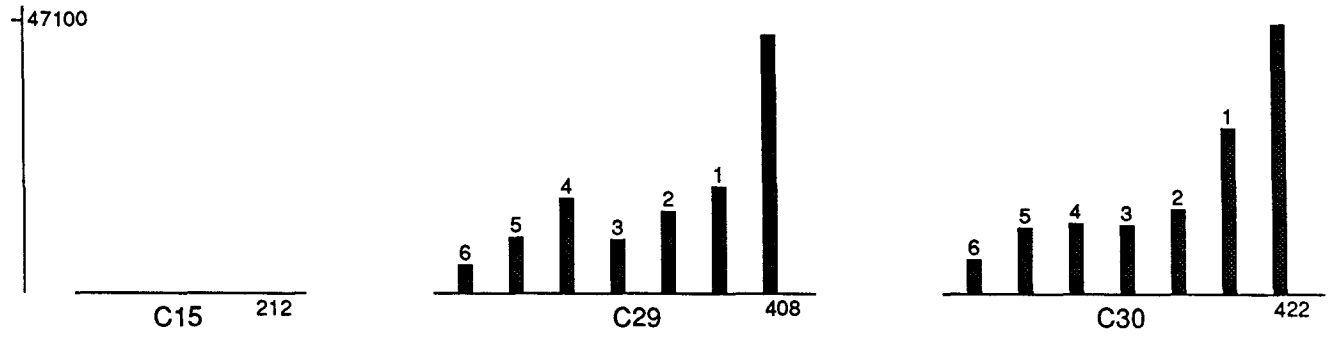


C-30 Ring Distribution



I Landplant derived crudes with substantial resin contibution to source matter
II Crudes of mixed origin
III Crudes derived from structureless organic and/or algal matter

FIMS Distributions



C-15 RING COMPOUNDS (%)

1 ring :	no data
2 ring :	
3 ring :	

C-30 RING COMPOUNDS (%)

3 ring :	34
4 ring :	34
5 ring :	32
C-29 VR/E :	0.99

Conclusions based on FIMS data :

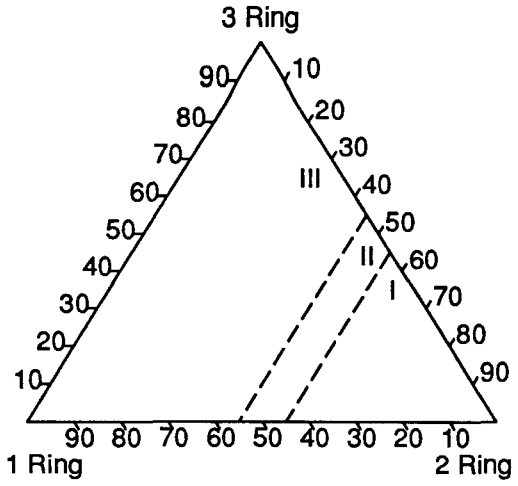
1 : the C29 VRE indicates a well mature character

2 : the C30 ring distribution indicates a mixed origin

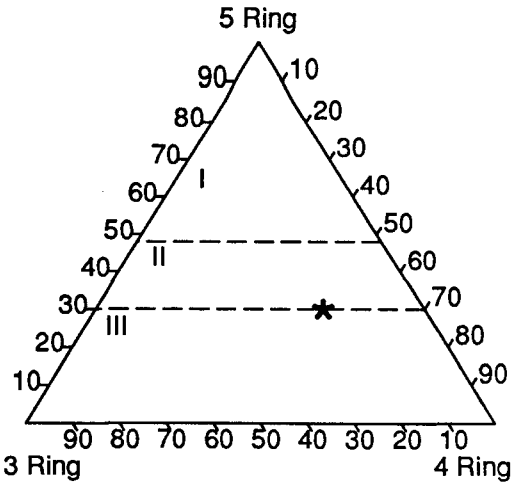
S16151901

FIMS typing of the oil sample from well 110/15, United Kingdom

C-15 Ring Distribution

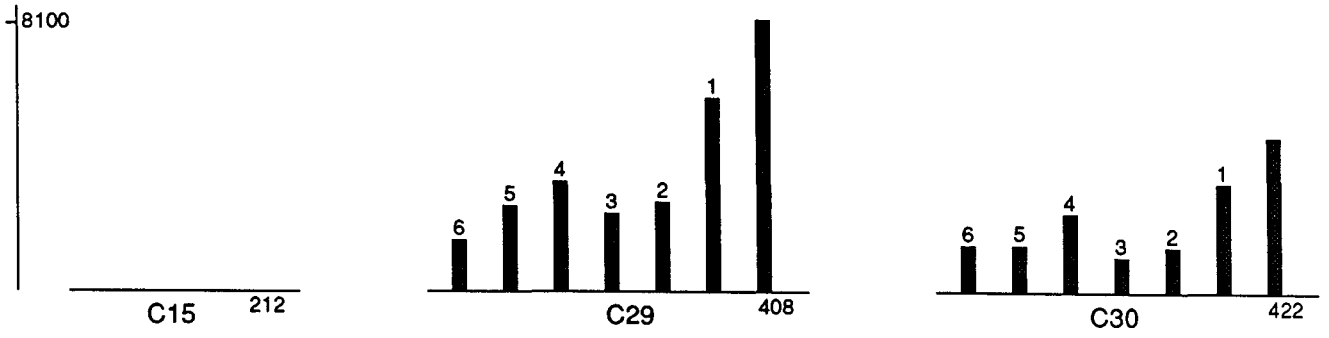


C-30 Ring Distribution



I Landplant derived crudes with substantial resin contibution to source matter
II Crudes of mixed origin
III Crudes derived from structureless organic and/or algal matter

FIMS Distributions



C-15 RING COMPOUNDS (%)

1 ring :	no data
2 ring :	
3 ring :	

C-30 RING COMPOUNDS (%)

3 ring :	22
4 ring :	49
5 ring :	29
C-29 VR/E :	1.03

Conclusions based on FIMS data :

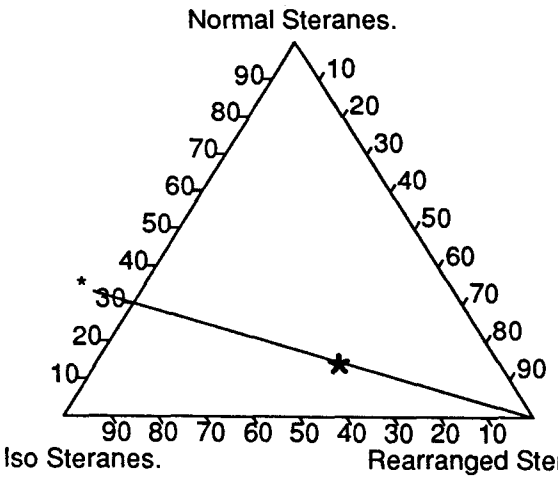
1 : the C29 VRE indicates a wel mature character

2 : the C30 ringdistribution indicates a mixed origin

S16152001

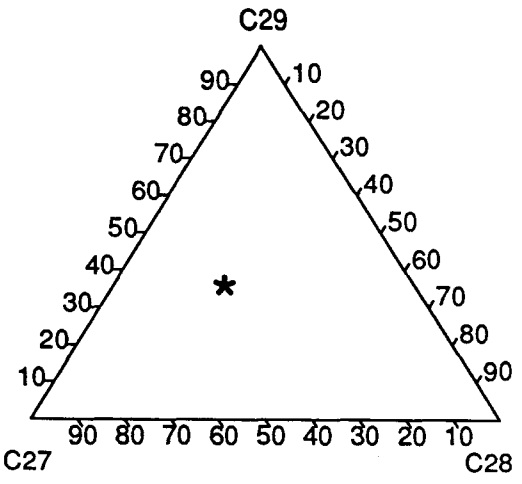
GCMS Sterane typing of the oil sample from well 110/13-02, United Kingdom

Sterane Conversion Diagram

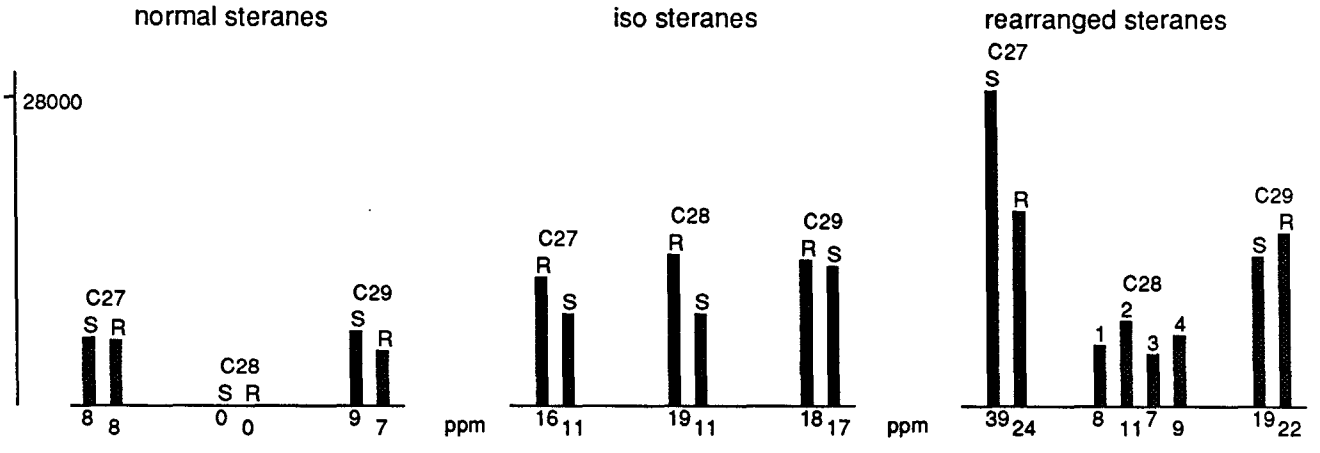


* The line of complete sterane isomerisation indicating a mature character

Sterane Typing Diagram



Sterane Distribution



STERANE DISTRIBUTION	*(ppm)*	*(%)*
Iso Steranes :	93	35
Rearranged Steranes :	138	52
Normal Steranes :	32	13
CARBON NUMBER DISTRIBUTION		
C-27 :	108	41
C-28 :	64	24
C-29 :	92	35
C-29 STERANE CONVERSION RATIOS		
20S / 20R + 20S :		0.57
Iso / Iso + Normal :		0.69

Conclusions based on steranes :

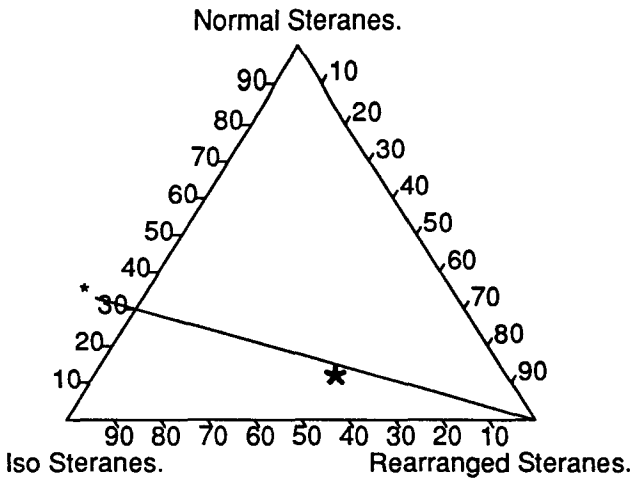
1 : it is likely that the complete sterane isomerisation indicates that this oil has been expelled from a mature source rock

2 : it is likely that the steranes indicate a shaly source rock

S16151901

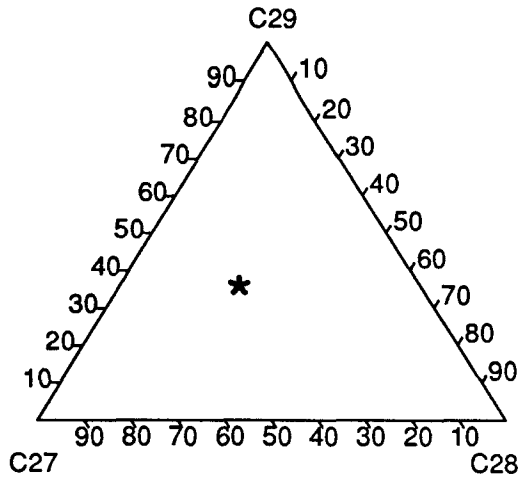
GCMS Sterane typing of the oil sample from well 110/15, United Kingdom

Sterane Conversion Diagram

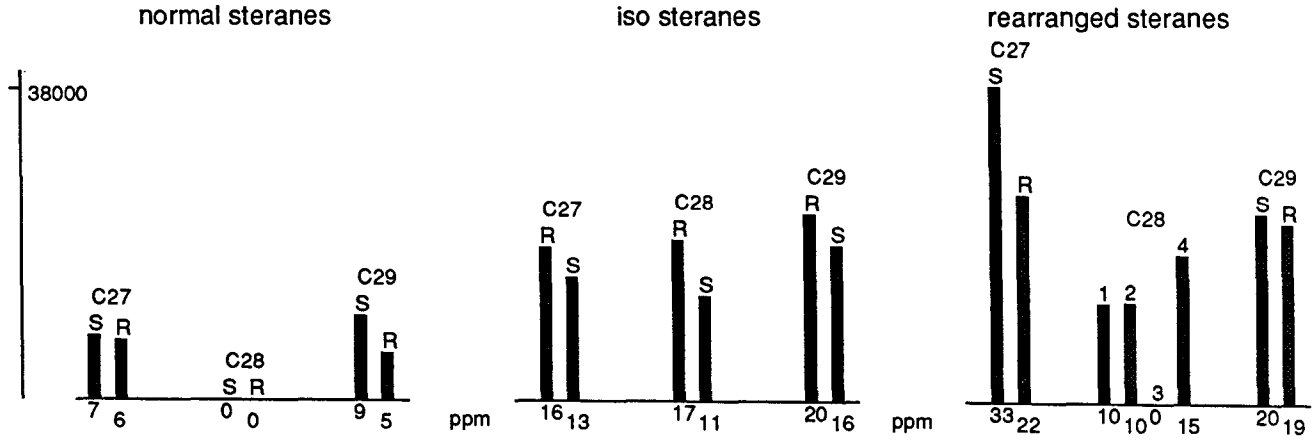


* The line of complete sterane isomerisation indicating a mature character

Sterane Typing Diagram



Sterane Distribution



STERANE DISTRIBUTION	*(ppm)*	*(%)*
Iso Steranes :	92	37
Rearranged Steranes :	129	52
Normal Steranes :	27	11
CARBON NUMBER DISTRIBUTION		
C-27 :	96	39
C-28 :	64	26
C-29 :	88	35
C-29 STERANE CONVERSION RATIOS		
20S / 20R + 20S :		0.64
Iso / Iso + Normal :		0.72

Conclusions based on steranes :

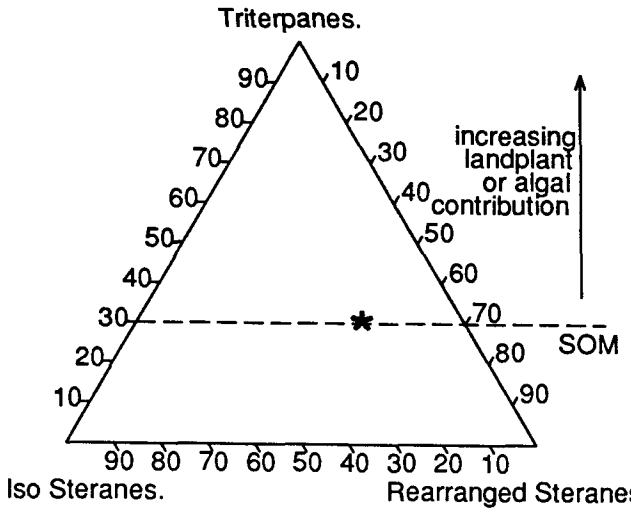
1 : it is likely that the complete sterane isomerisation indicates that this oil has been expelled from a mature source rock

2 : it is likely that the steranes indicate a shaly source rock

S16152001

GCMS Triterpane typing of the oil sample from well 110/13-02, United Kingdom

Sterane/Triterpane Diagram



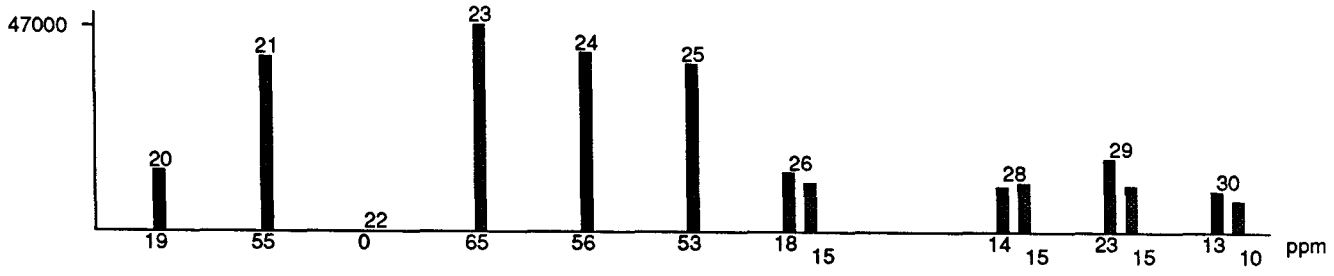
STERANES/TRITERPANES (calculated %)

Iso Steranes :	22
Rearranged Steranes :	48
Triterpanes :	30

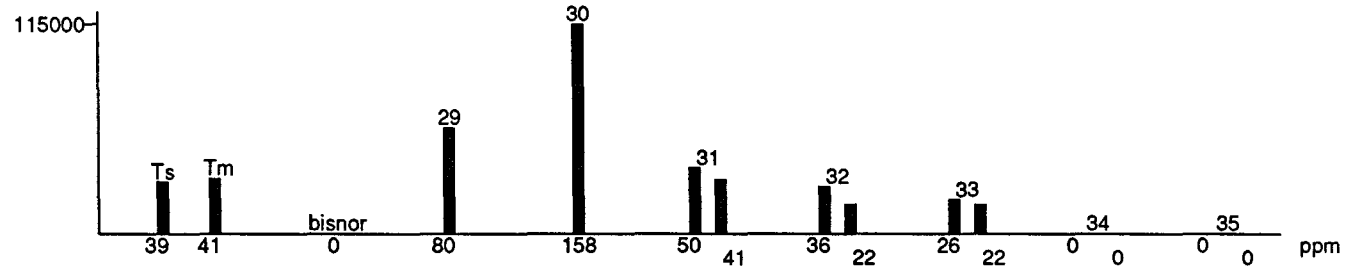
TRITERPANE CONVERSION RATIOS

TS / TM :	0.94
3R / 3R + 5R :	0.42
C30 Hopane (ppm) :	158

Tricyclic Terpanes



Pentacyclic Terpanes



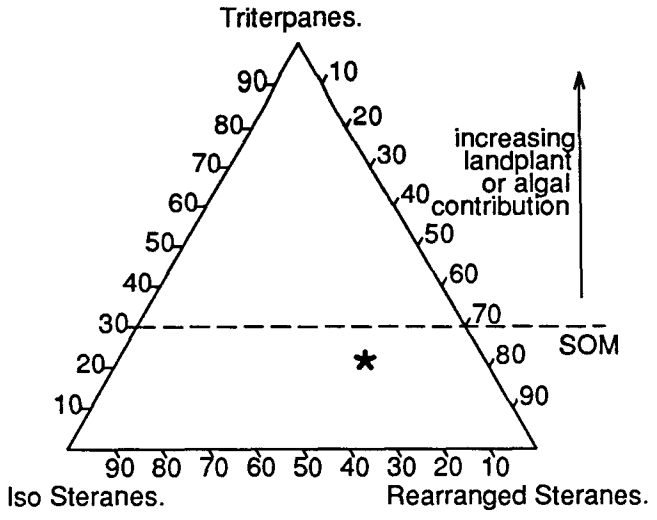
Conclusions based on triterpanes :

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

S16151901

GCMS Triterpane typing of the oil sample from well 110/15, United Kingdom

Sterane/Triterpane Diagram



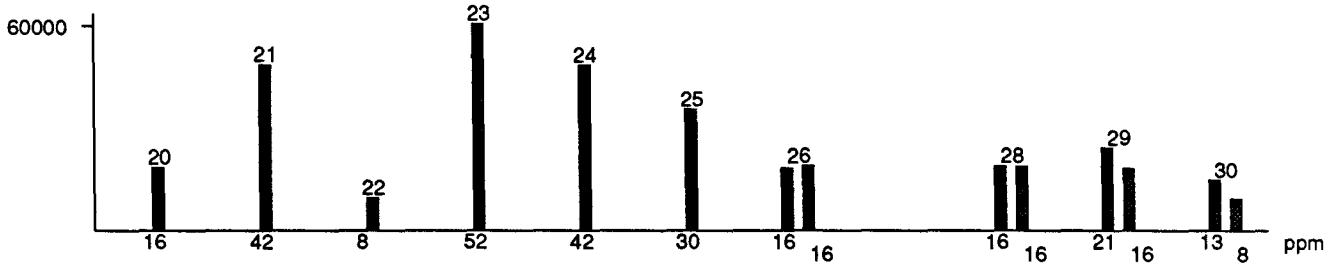
STERANES/TRITERPANES (calculated %)

Iso Steranes :	26
Rearranged Steranes :	53
Triterpanes :	21

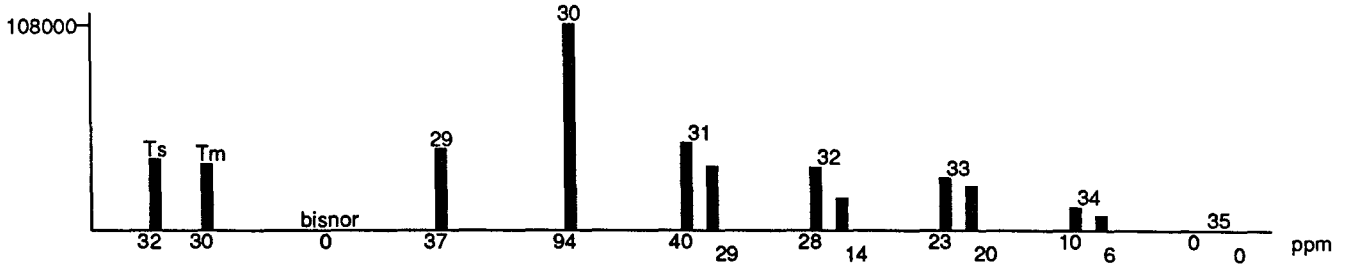
TRITERPANE CONVERSION RATIOS

TS / TM :	1.07
3R / 3R + 5R :	0.46
C30 Hopane (ppm) :	94

Tricyclic Terpanes



Pentacyclic Terpanes



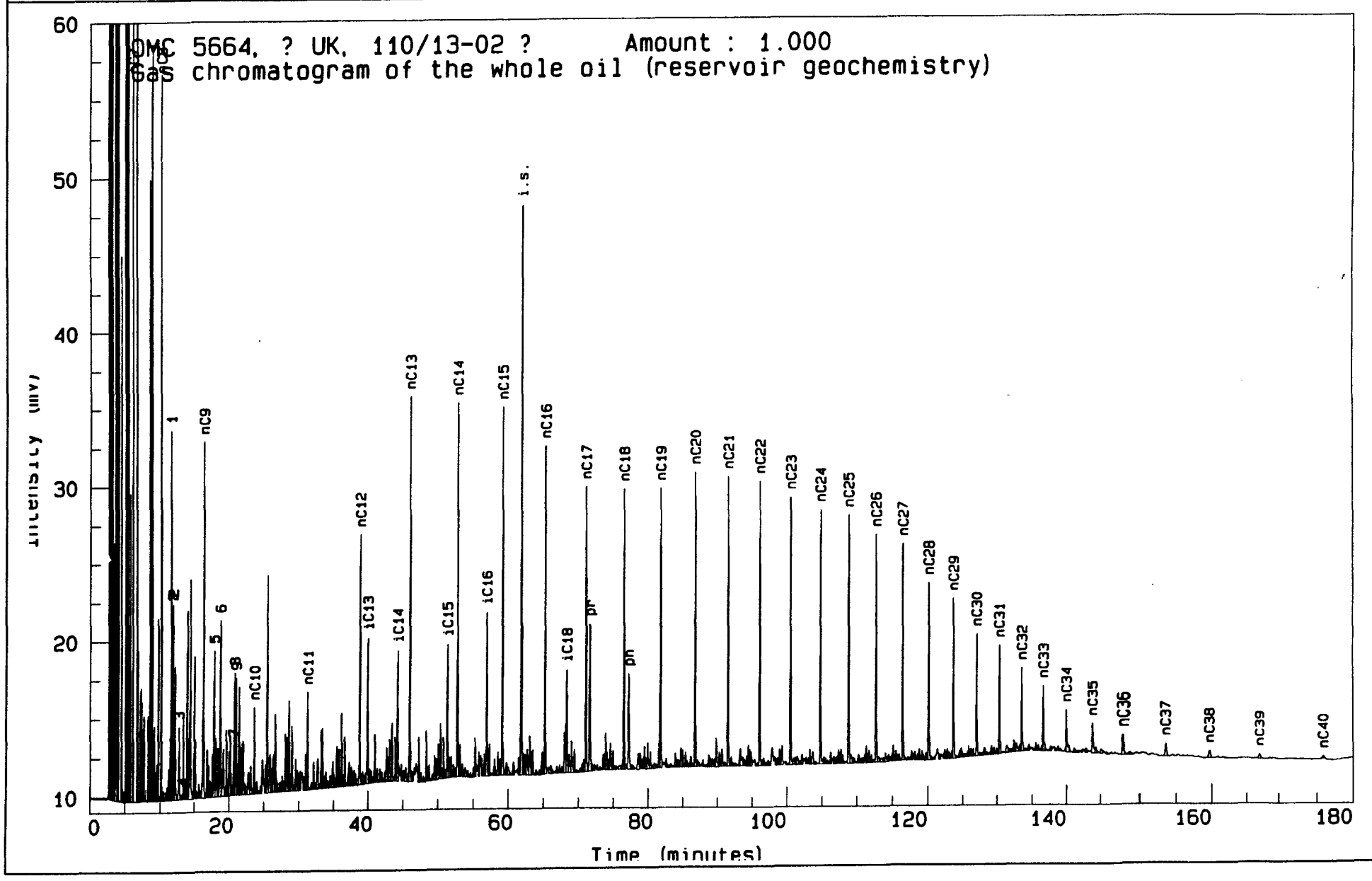
Conclusions based on triterpanes :

1 : it is very likely that the triterpane distribution indicates a source rock containing predominantly structureless organic matter

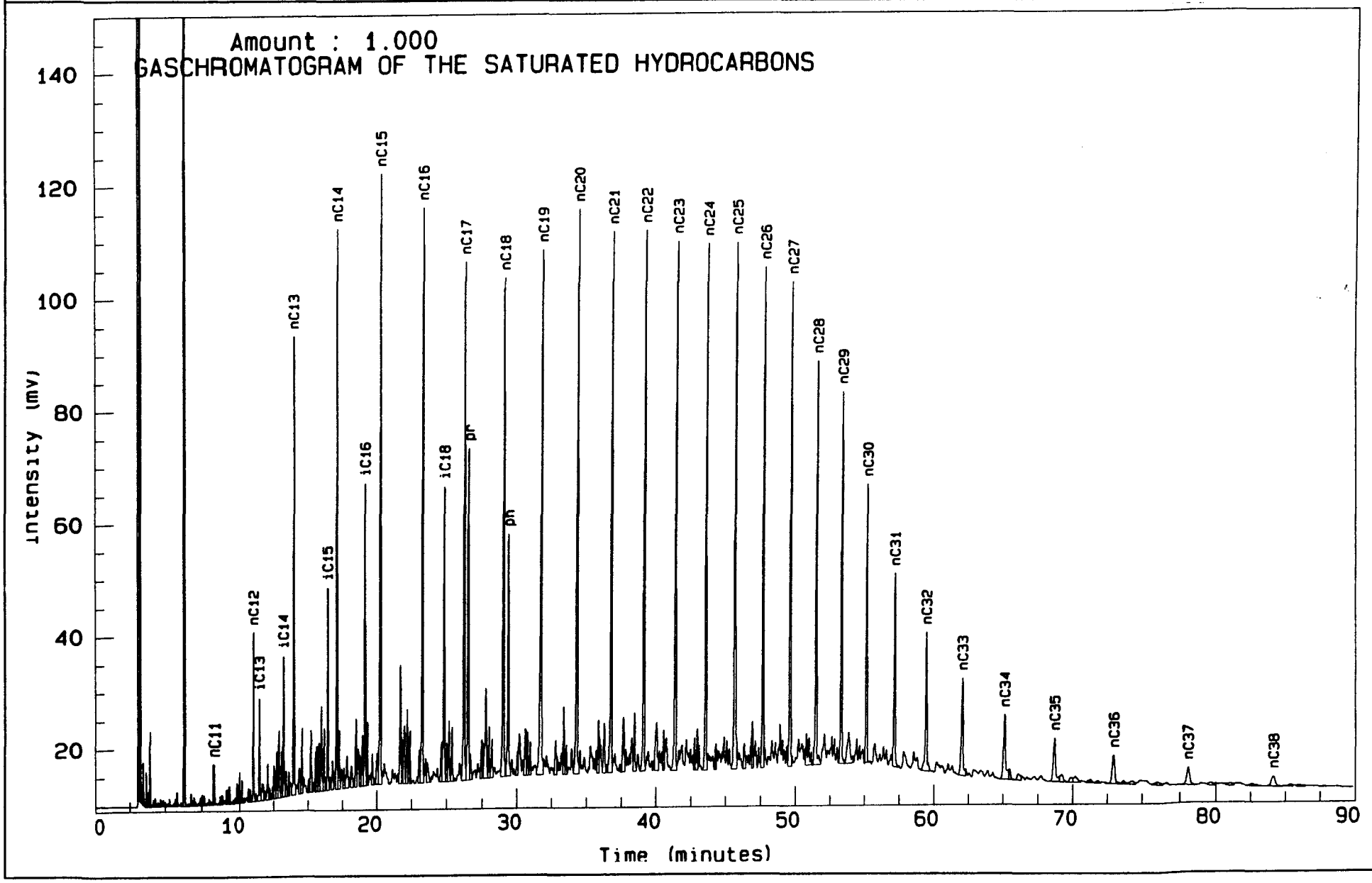
S16152001

ANALYTICAL DATA
well 110/13-02, United Kingdom

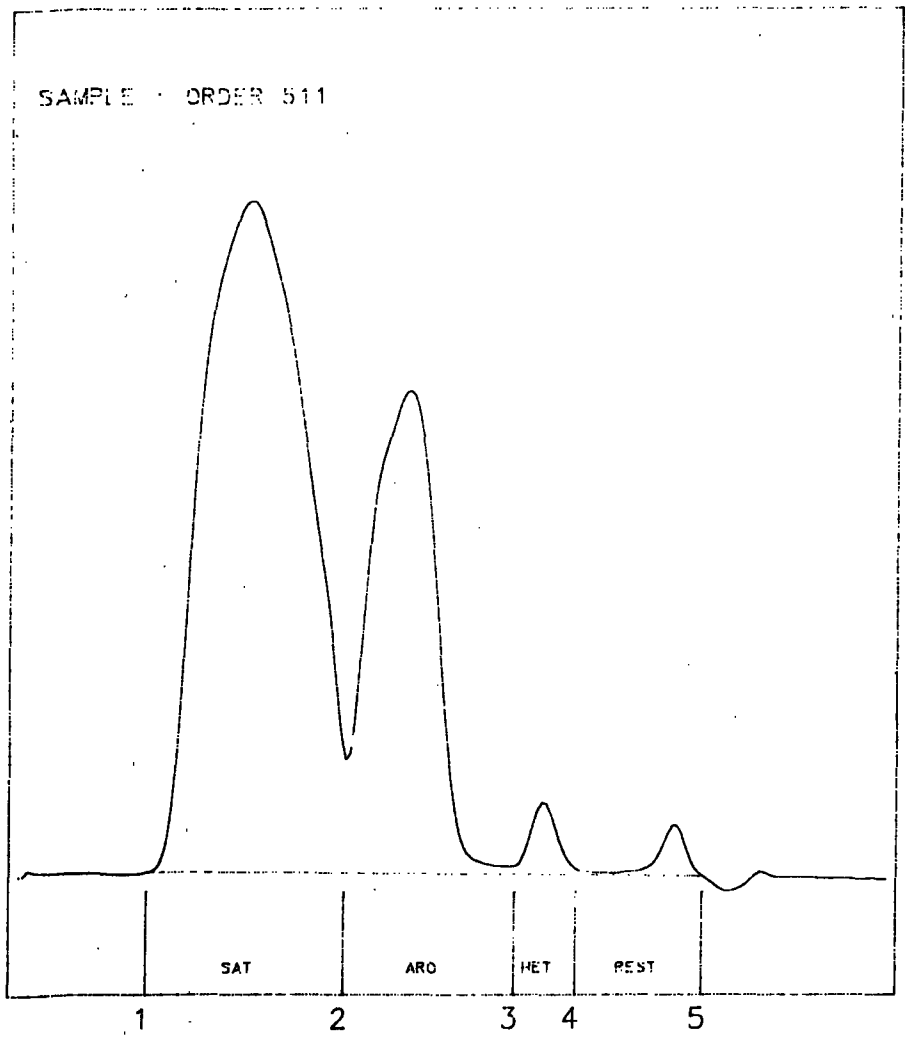
Gas chromatogram of the whole oil sample from well 110/13-02, United Kingdom



Gas chromatogram of the saturated hydrocarbons of the oil sample from well 110/13-02, United Kingdom



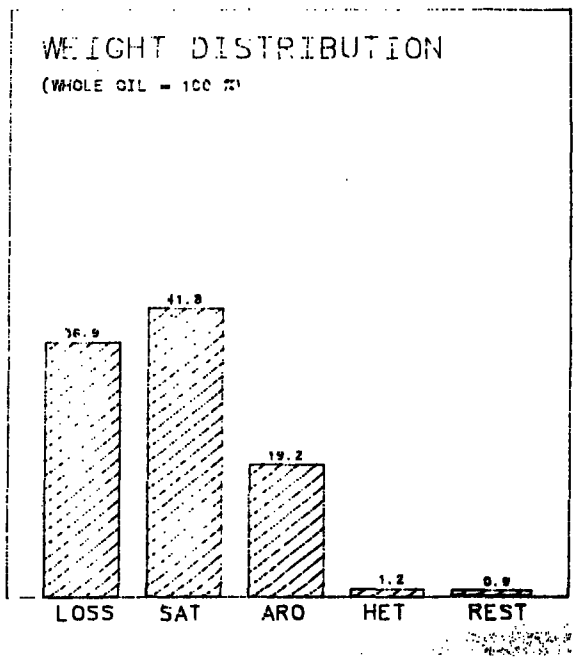
Gross Composition of the oil sample from well 110/13-02, United Kingdom



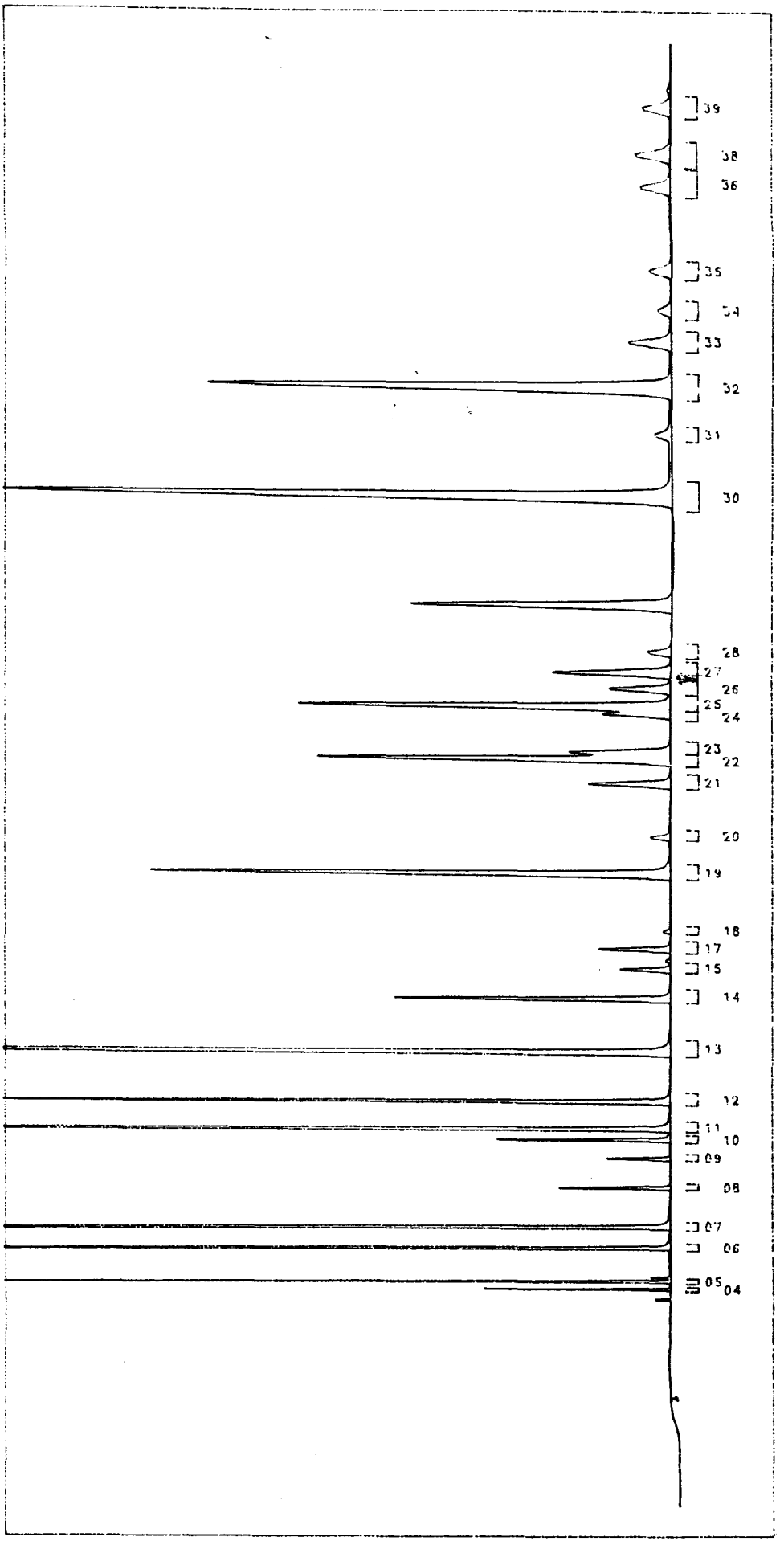
SAMPLE : S161519-1

WEIGHT LOST ON TOPPING	36.9 %
- SATURATES	66.2 %
- AROMATICS	30.4 %
- HETEROCOMPOUNDS	1.9 %
- REST (HIGH MOL.)	1.4 %

* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE



Gas chromatogram of the light fraction (< 120 C.) of the oil sample from well 110/13-02, United Kingdom



816151901

Gas chromatographic hydrocarbons analysis (< 120 C.) well 110/13-02, United Kingdom

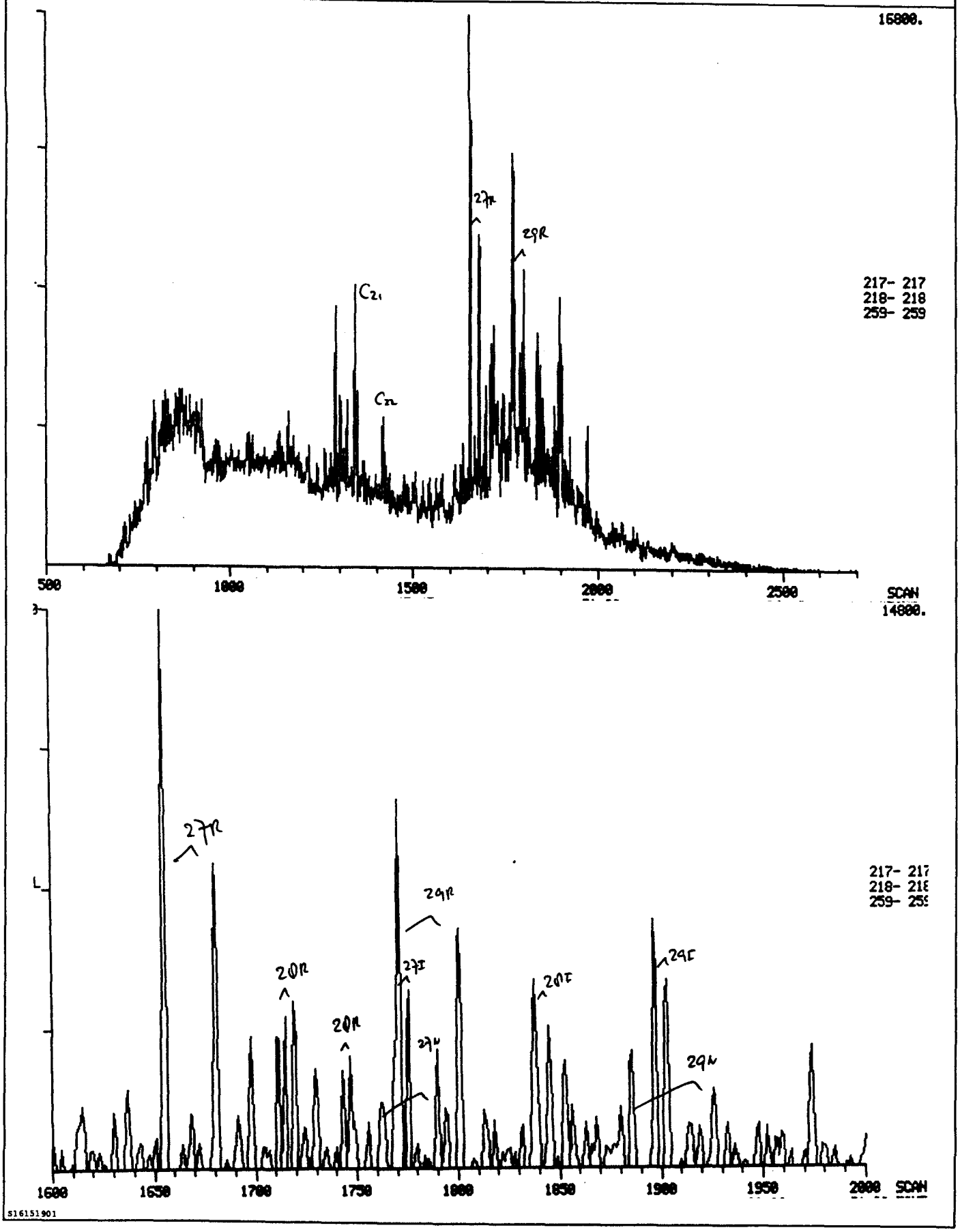
GAS CHROMATOGRAPHIC ANALYSIS OF THE FRACTION BOILING BELOW 114 DEGREES CENTIGRADE

Sample: S16151901 d.d. 21-nov-92 09:35:

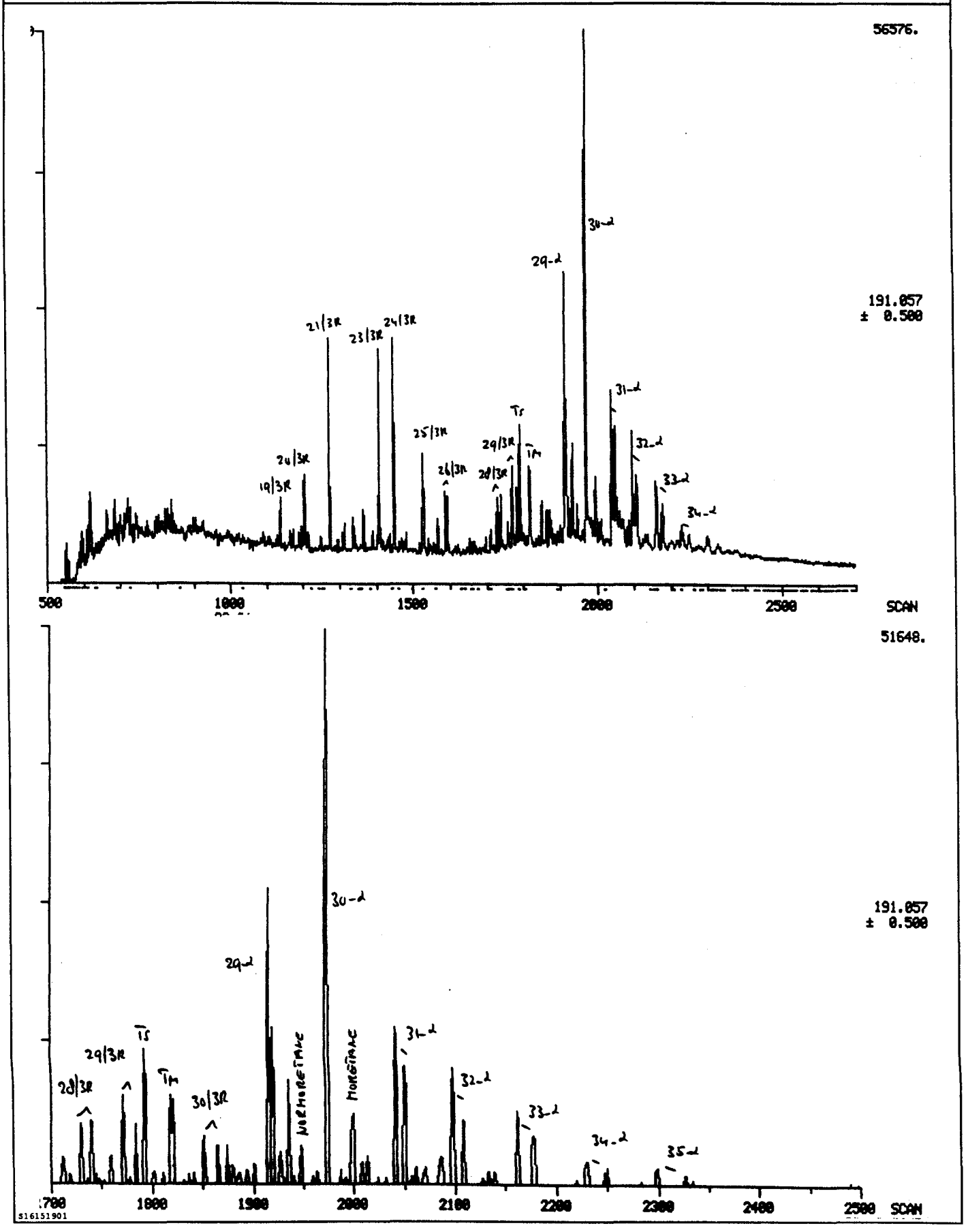
COMPONENT No.	Name	RET.TIM (min)	MAXIMUM (mV)	AREA * (cnts)	WEIGHT PERC.
4	I-BUTANE	017:56	590.7	4713	0.52
5	N-BUTANE	018:32	2584.2	21843	2.39
6	I-PENTANE	021:02	5148.8	55508	6.08
7	N-PENTANE	022:34	6888.5	82568	9.04
8	2.2-DIMETHYLBUTANE	025:28	353.6	5242	0.57
9	CYCLOPENTANE	027:37	201.6	3360	0.37
10	2.3-DIMETHYLBUTANE	029:01	548.4	9920	1.09
11	2-METHYLPENTANE	029:49	3677.3	67077	7.34
12	3-METHYLPENTANE	031:49	2175.2	43616	4.78
13	N-HEXANE	035:24	4993.2	112877	12.36
14	METHYLCYCLOPENTANE	039:19	871.4	23460	2.57
15	2.2-DIMETHYLPENTANE	041:30	162.5	4544	0.50
16	BENZENE	* * * Not detected * * *			
17	2.4-DIMETHYLPENTANE	042:59	227.1	6589	0.72
18	2.2.3-TRIMETHYLBUTANE	044:16	28.4	824	0.09
19	CYCLOHEXANE	048:24	1638.5	57319	6.28
20	3.3-DIMETHYLPENTANE	051:09	67.5	2497	0.27
21	1.1-DIMETHYLCYCLOPENTANE	054:59	262.1	10557	1.16
22	2-METHYLHEXANE	056:45	1114.1	44624	4.89
23	2.3-DIMETHYLPENTANE	057:15	322.9	12585	1.38
24	1-C-3-DIMETHYLCYCLOPENTANE	060:03	218.0	8340	0.91
25	3-METHYLHEXANE	060:36	1175.6	50244	5.50
26	1-TR-3-DIMETHYLCYCLOPENTANE	061:56	197.2	8830	0.97
27	1-TR-2-DIMETHYLCYCLOPENTANE	063:04	374.8	17416	1.91
28	3-ETHYLPENTANE	064:35	79.2	3687	0.40
30	N-HEPTANE	075:50	2131.6	118795	13.01
31	1-C-2-DIMETHYLCYCLOPENTANE	080:21	53.1	3676	0.40
32	METHYLCYCLOHEXANE	083:46	1459.4	92091	10.08
33	1.1.3-TRIMETHYLCYCLOPENTANE	087:05	135.8	9286	1.02
34	2.2-DIMETHYLHEXANE	089:25	42.8	2946	0.32
35	ETHYLCYCLOPENTANE	092:19	73.6	5165	0.57
36	2.5-DIMETHYLHEXANE	098:08	95.8	7342	0.80
38	2.2.3-TRIMETHYLPENTANE	100:27	112.5	8850	0.97
39	1-TR-2-C-4-TRIMETHYLCYCLOPENTANE	103:50	90.2	7010	0.77
40	TOLUENE	* * * Not detected * * *			
	REFERENCE PEAK (29)	067:55	827.3	42151	
	Total peak area			913403	

*) Corrected for difference in response

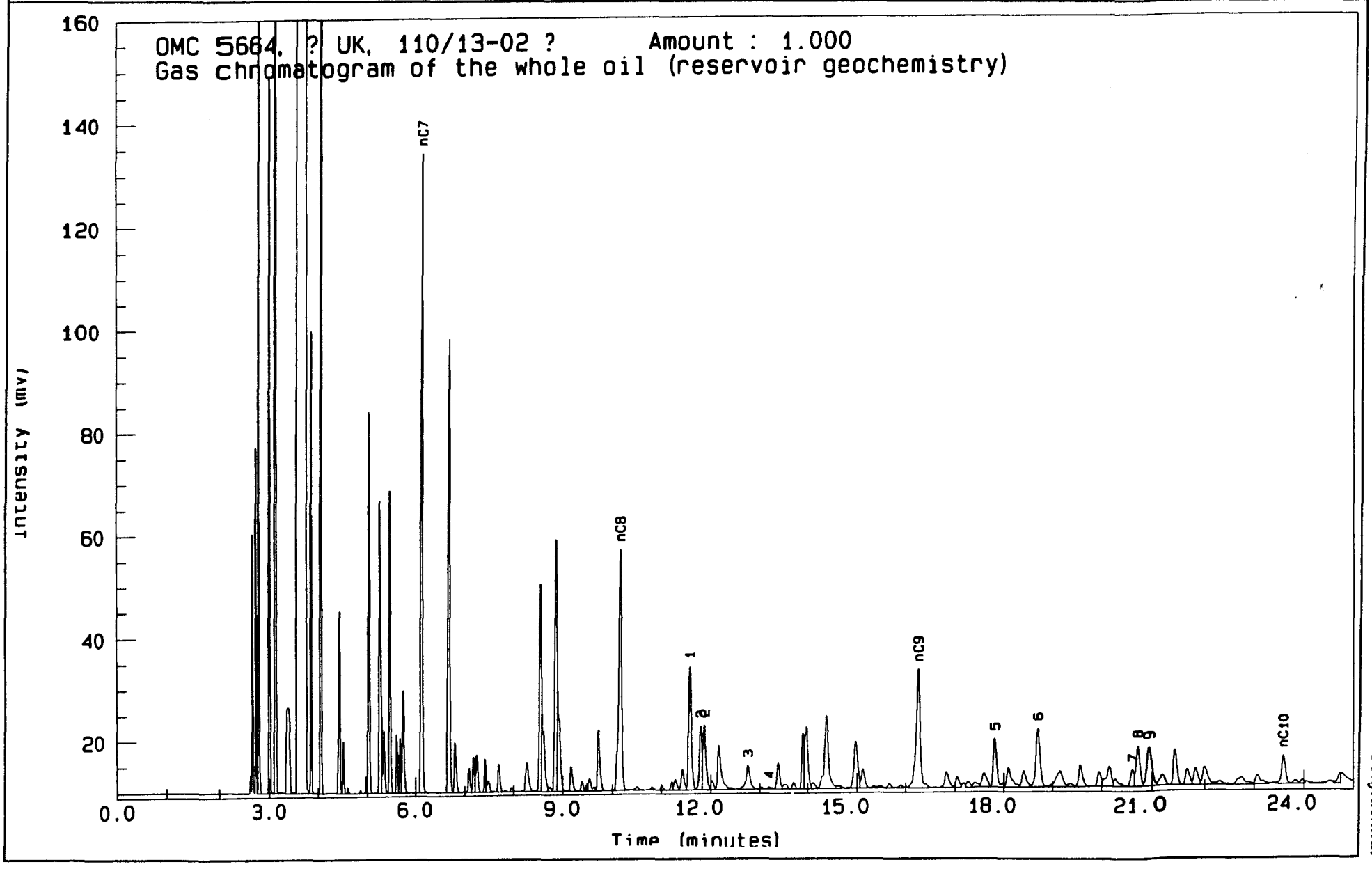
Sterane Fragmentograms of the oil sample from well 110/13-02, United Kingdom



Triterpane Fragmentograms of the oil sample from well 110/13-02, United Kingdom



Enlarged part of the whole oil gas chromatogram from well 110/13-02, United Kingdom



Data for the enlarged part of the whole oil gas chromatogram from well 110/15, United Kingdom

[DEFPROJECT] 11 RESGEO_201192,1,1
Reported on 23-NOV-1992 at 10:41

Injection Report

Acquired on 20-NOV-1992 at 09:50

Sample Name : OMC 5664, ? UK, 110/13-02 ?
Sample Id : S161519/1
Sample Type : Sample Amount=1.00000
Bottle No : 1

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
1	2.768	161623	212475	
2	2.997	139370	220077	
3	3.125	179854	341150	
4	3.227	273	1171	
5	3.387	16626	78315	
6	3.723	987941	10976877	
7	3.856	89886	112843	
8	4.048	197727	274251	
9	4.432	35273	68006	
10	4.512	10050	16142	
11	4.608	1168	2025	
12	4.869	719	1251	
13	5.029	74146	139850	
14	5.253	56786	125677	
15	5.301	12376	37441	
16	5.456	58773	118142	
17	5.611	11437	22997	
18	5.680	10627	21520	
19	5.744	19945	51715	
20	6.112	124294	273761	nC7
21	6.667	88226	220828	
22	6.805	9703	27515	
23	7.093	4661	11742	
24	7.179	6847	16733	
25	7.243	7265	21464	
26	7.413	6372	13707	
27	7.435	3901	11139	
28	7.685	5470	15329	
29	7.824	223	820	
30	7.957	832	2717	
31	8.267	5479	25012	
32	8.533	40166	106147	
33	8.565	18204	61276	
34	8.699	862	3720	
35	8.848	48885	153715	
36	8.885	22935	71497	
37	9.173	4782	16217	
38	9.392	1863	6015	
39	9.499	1393	3174	
40	9.547	2365	10909	
41	9.717	11722	41106	
42	10.144	46874	182183	nC8
43	10.501	652	3019	
44	10.560	127	332	
45	10.811	539	2007	
46	11.013	865	3295	

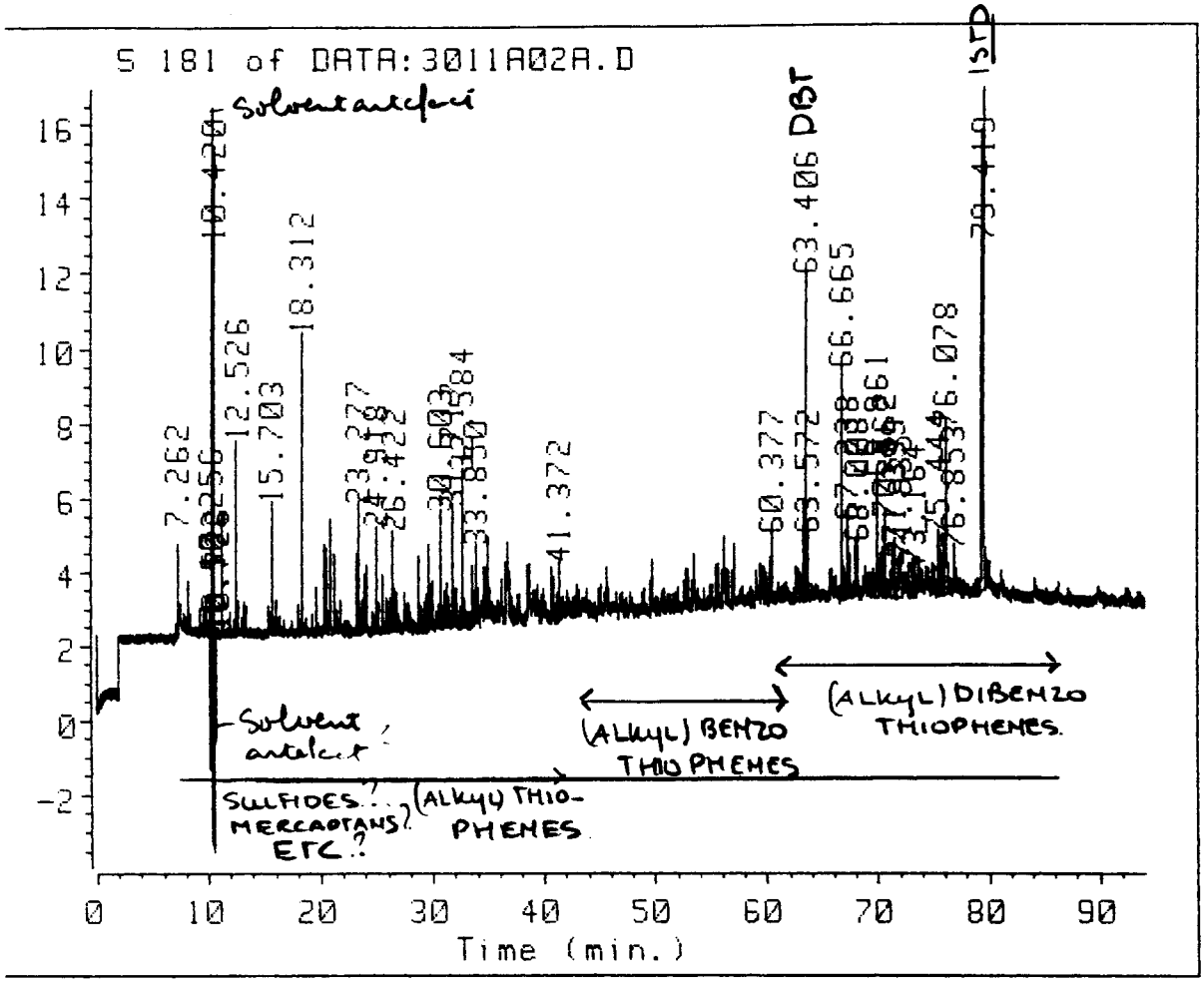
S16152001

Data for the enlarged part of the whole oil gas chromatogram from well 110/13-02, United Kingdom

Peak	RT mins	Hght uV	Area uVs	Peak name
47	11.211	1556	5075	
48	11.285	1992	8558	
49	11.429	3986	16374	
50	11.563	23816	94309	1
C1		24906	96975	2
51	11.787	12308	42160	- C1
52	11.856	12598	54815	- C1
53	12.027	1806	7706	
54	12.155	8582	44533	
55	12.416	378	1453	
C2		4657	28075	3
56	12.757	4657	28075	- C2
57	13.029	311	1331	
58	13.195	354	2409	4
59	13.381	5145	22500	
60	13.536	986	6427	
61	13.707	1291	5669	
62	13.899	10799	37558	
63	13.963	12082	57441	
64	14.112	1211	6091	
65	14.368	14131	84281	
66	14.805	223	785	
67	14.971	9149	50747	
68	15.120	3779	18680	
69	15.349	465	1915	
70	15.472	444	2539	
71	15.664	929	4279	
72	15.899	477	2444	
73	16.245	23028	131444	nC9
74	16.827	3063	18729	
75	17.040	2076	10405	
76	17.275	1132	6403	
77	17.403	888	6672	
78	17.589	2747	19710	
79	17.808	9384	50279	5
80	18.091	3704	26288	
81	18.405	3110	20561	
82	18.693	11337	66956	6
83	19.147	3046	30224	
84	19.355	614	3953	
85	19.557	4219	24100	
86	19.947	2802	15522	
87	20.155	3803	28319	
88	20.283	1493	10563	
89	20.640	3264	16784	7
90	20.741	7860	44444	8
91	20.949	7545	43652	9
92	21.173	2060	14097	
93	21.408	6950	36021	
94	21.653	3068	17905	
95	21.824	3267	18828	
96	22.000	3426	25908	
97	22.304	665	4819	
98	22.453	241	1043	
99	22.747	1456	16024	
100	23.061	1845	14660	
101	23.589	5566	32033	nC10 ;
102	23.829	674	4191	
103	23.973	755	4130	

DETAILED SULPHUR ANALYSIS
well 110/13-02, United Kingdom

OVERVIEW SULPHUR COMPONENTS WHOLE OIL



DETAILED SULPHUR ANALYSIS
well 110/13-02, United Kingdom

Operator: GERRIT
Method File Name : THIVER4.M 19 Nov 92 9:5
Sample Info : OMC 5664B . 540MG & 1ML ISTD SOL. 11.71MG/100ML
Misc Info:
Integration File Name : DATA:1911A04A.I
consisting of channels : 1. S 181 of 1911A04A.D
Bottle Number : 4 Repetition Number: 1

(DI) BENZOTHIOPHENES LOWER SULPHUR EXCL.

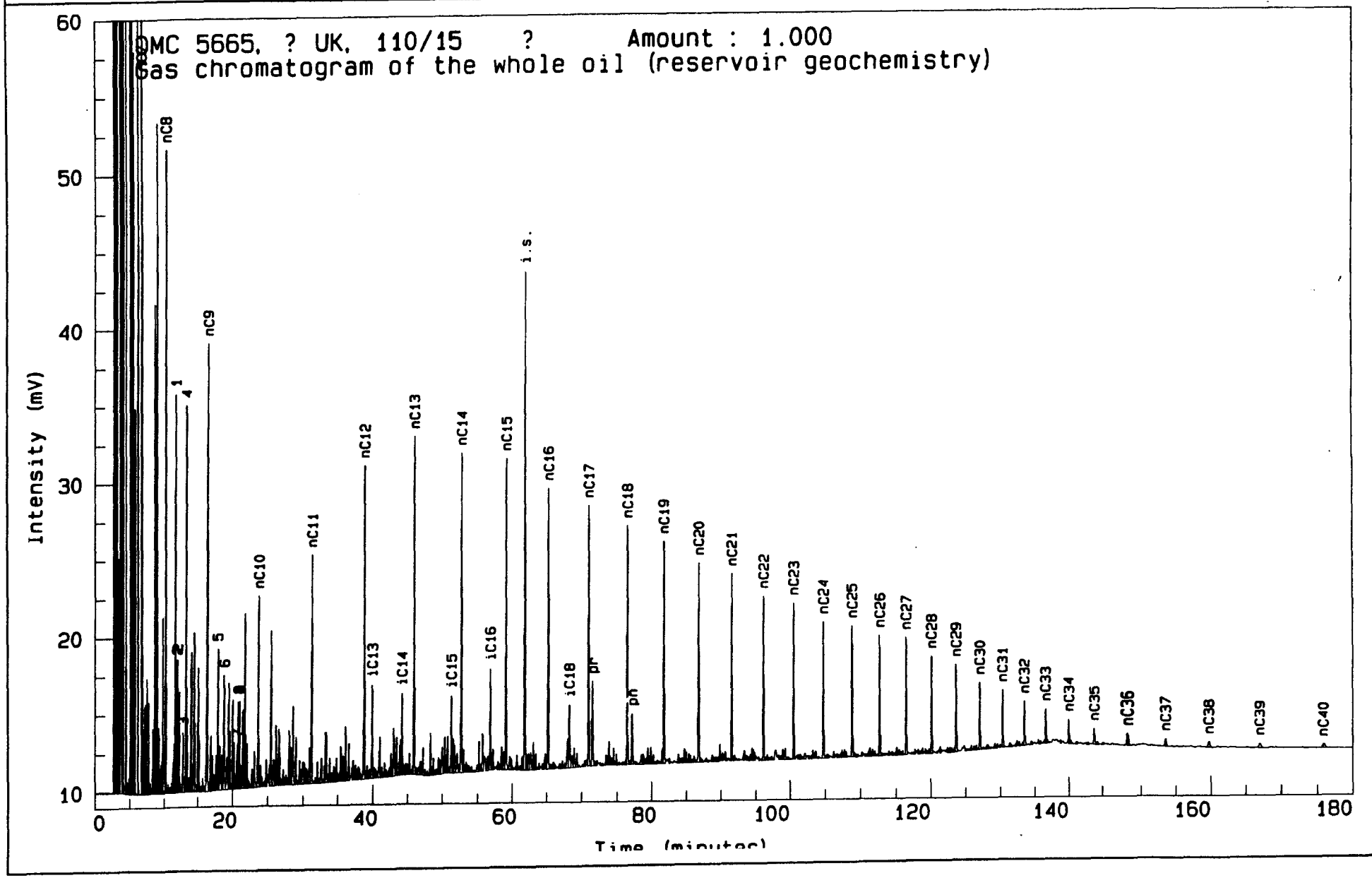
Calibration file: DATA:THIOSM2.Q Last Update: 18 Nov 92 4:46 pm
Reference Peak Window: 6.00 % of Retention Time
Non-Reference Peak Window: 2.00 % of Retention Time
Sample Amount: 540000 Uncalibrated Peak RF: 0.000 Multiplier: 10000

Peak Num	Type	Int Type	Ret Time	Signal Description	Compound Name	Area	Amount PPM
1	+	1BV	33.837	S 181	DBT	1341.86	90.672
2		1VV	38.260	S 181	1M.DBT	331.82	22.421
3		1VV	38.595	S 181	4M.DBT	1037.04	70.075
4		1VV	38.958	S 181	2M.DBT	373.59	25.244
5		1	-------		2ET.DBT	*** Not Found ***	
6		1BV	40.378	S 181	4ET.DBT	133.07	8.9917
7		1PV	40.976	S 181	4.6 DMDBT	509.93	34.457
8		1VV	41.613	S 181	2.4 DMDBT	471.77	31.879
9		1VV	42.561	S 181	1.8 & 1.4 DM	170.00	11.487
10		1VV	44.209	S 181	3M.DBT 3 MET	282.15	19.066
11		1VV	43.940	S 181	1.6 DMDBT	195.14	13.186
12		1VV	45.724	S 181	2.6? DMDBT	333.78	22.554
13		1VV	45.386	S 181	2.6?? DMDBT	216.75	14.646
14		1VV	46.109	S 181	1.3? DMDBT	233.05	15.748
15		1VV	48.196	S 181	1.7&1.2&1.9	200.88	13.574
16		1VV	49.205	S 181	3.6 & 2.7DIM	445.92	30.132
17		1VV	50.682	S 181	3.4? DMDBT	219.93	14.861
18		1VV	53.315	S 181	3.7? DMDBT	174.93	11.820
19	+ISTD	1PV	73.136	S 181	2 NITRO DBT	1680.21	216.85
20		1	-------		TRIMDBT1	*** Not Found ***	

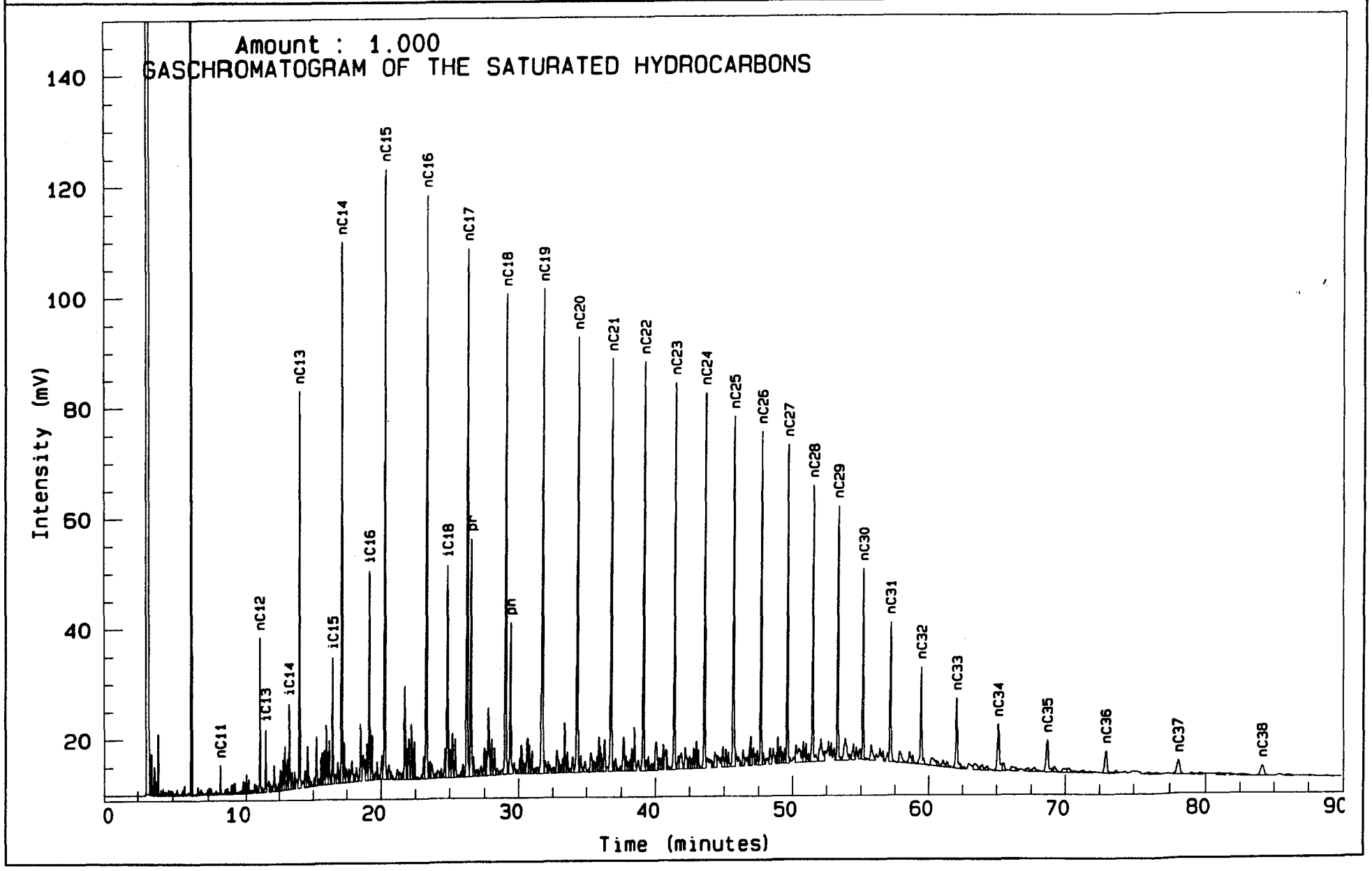
*** Not all calibrated peaks found ***

ANALYTICAL DATA
well 110/15, United Kingdom

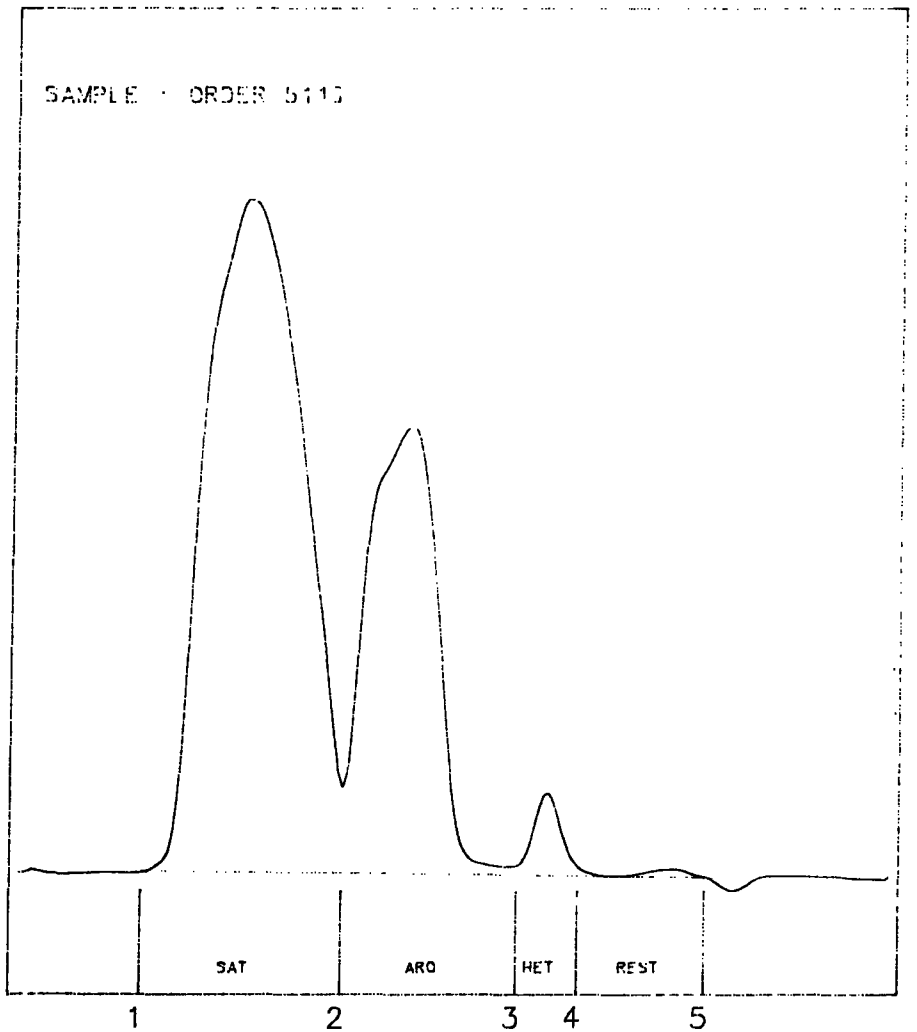
Gas chromatogram of the whole oil sample from well 110/15, United Kingdom



Gas chromatogram of the saturated hydrocarbons of the oil sample from well 110/15, United Kingdom



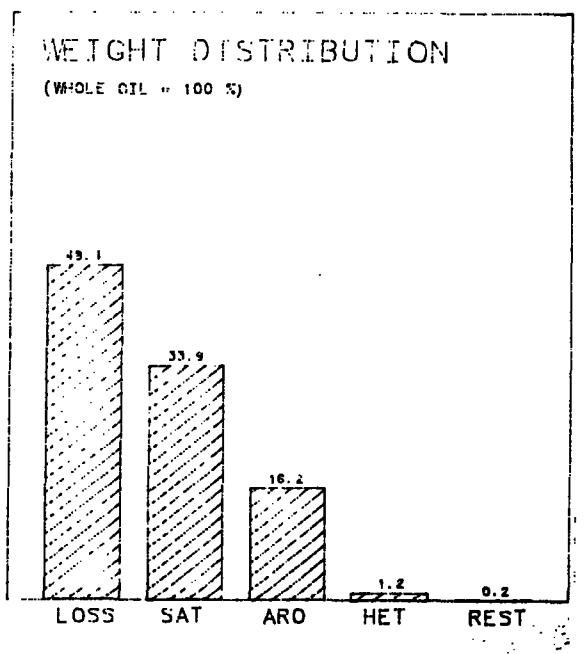
Gross Composition of the oil sample from well 110/15, United Kingdom



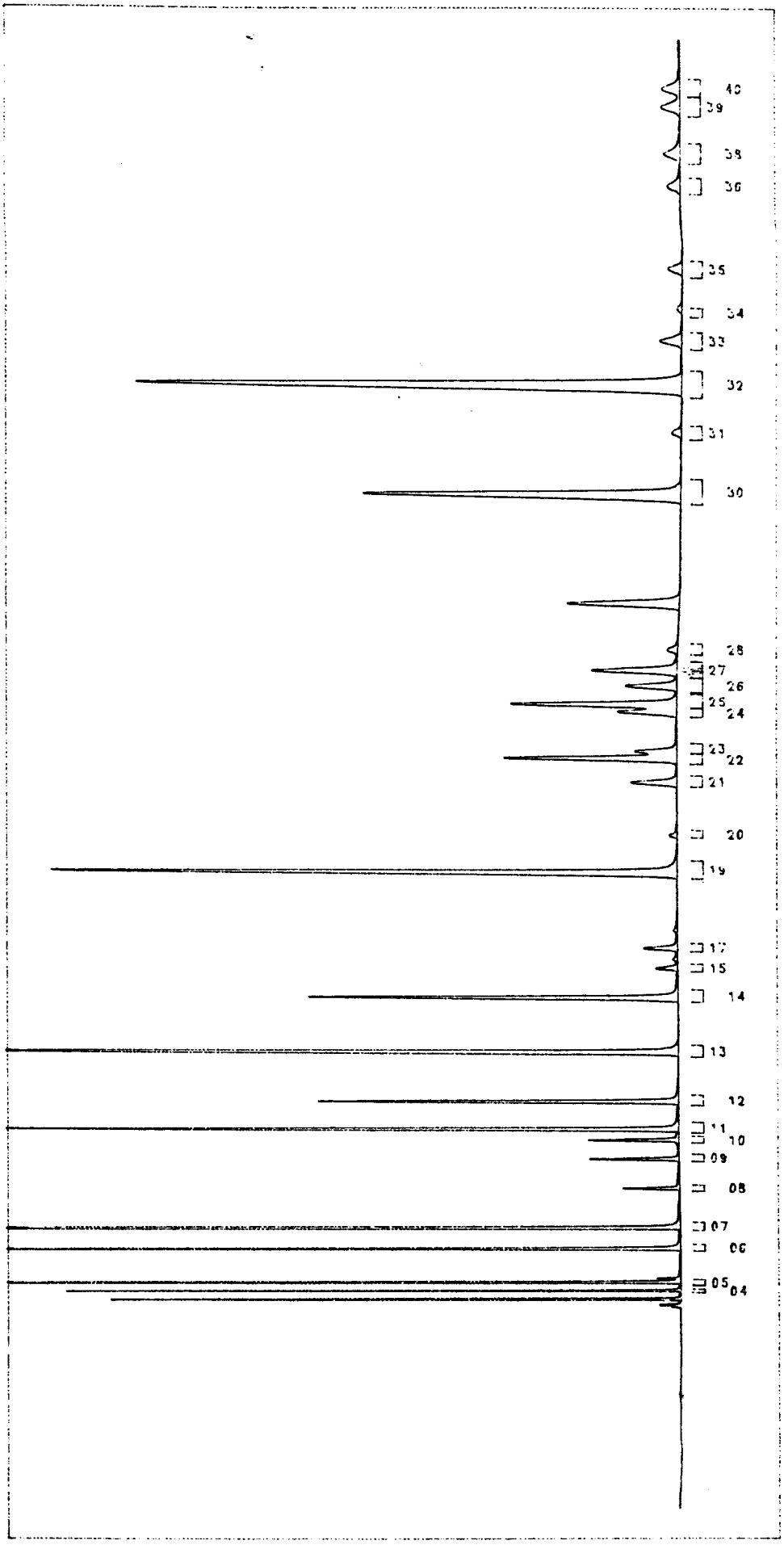
SAMPLE · S161520-1

WEIGHT LOST ON TOPPING	48.4 %
- SATURATES	: 65.7 %
- AROMATICS	: 31.5 %
- HETEROCOMPOUNDS	: 2.4 %
- REST (HIGH MOL.)	: 0.4 %

* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE



Gas chromatogram of the light fraction (< 120 C.) of the oil sample from well 110/15, United Kingdom



S16152001

Gas chromatographic hydrocarbons analysis (< 120 C.) well 110/15, United Kingdom

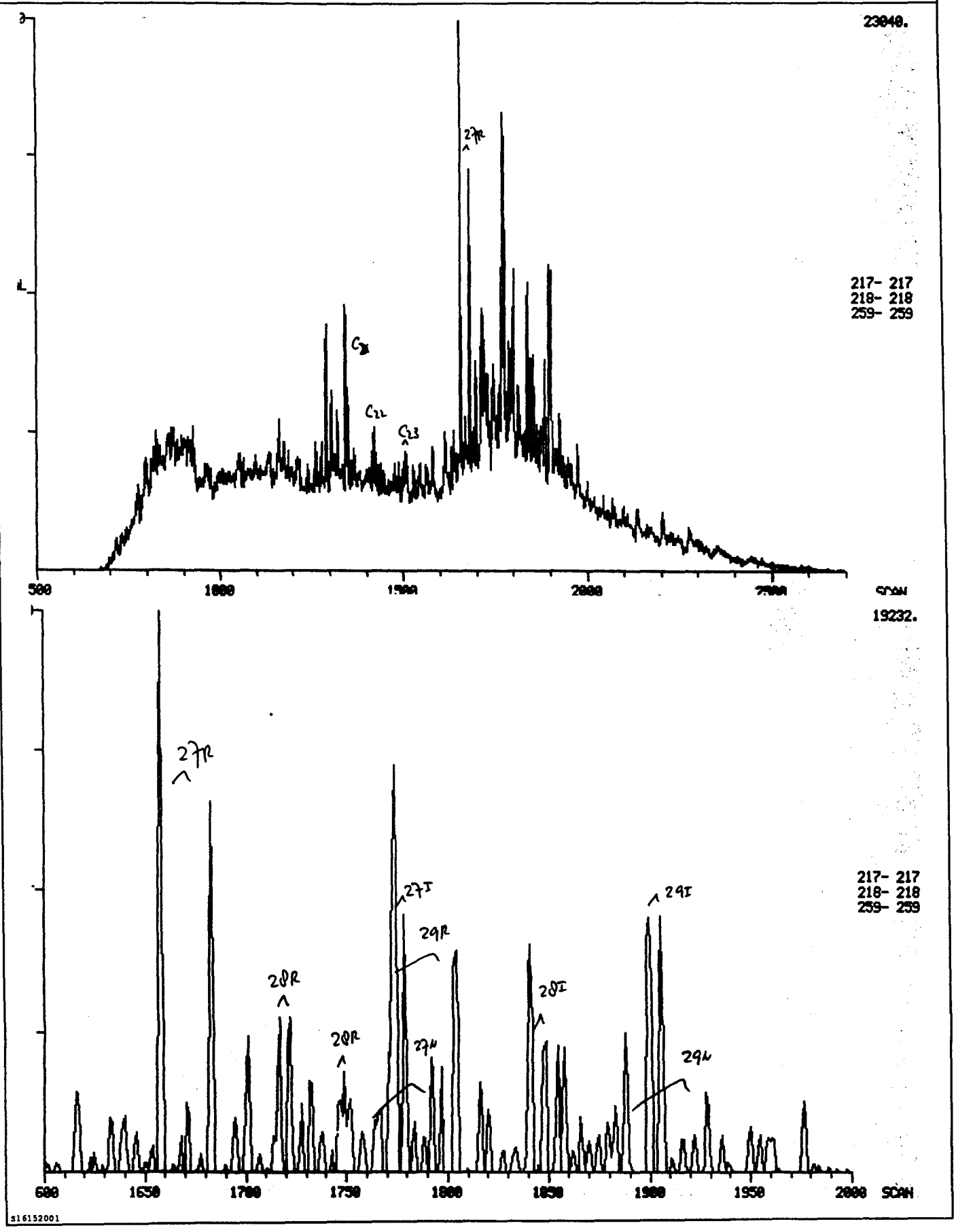
GAS CHROMATOGRAPHIC ANALYSIS OF THE FRACTION BOILING BELOW 114 DEGREES CENTIGRADE

Sample: S16152001 d.d. 27-nov-92 11:52:

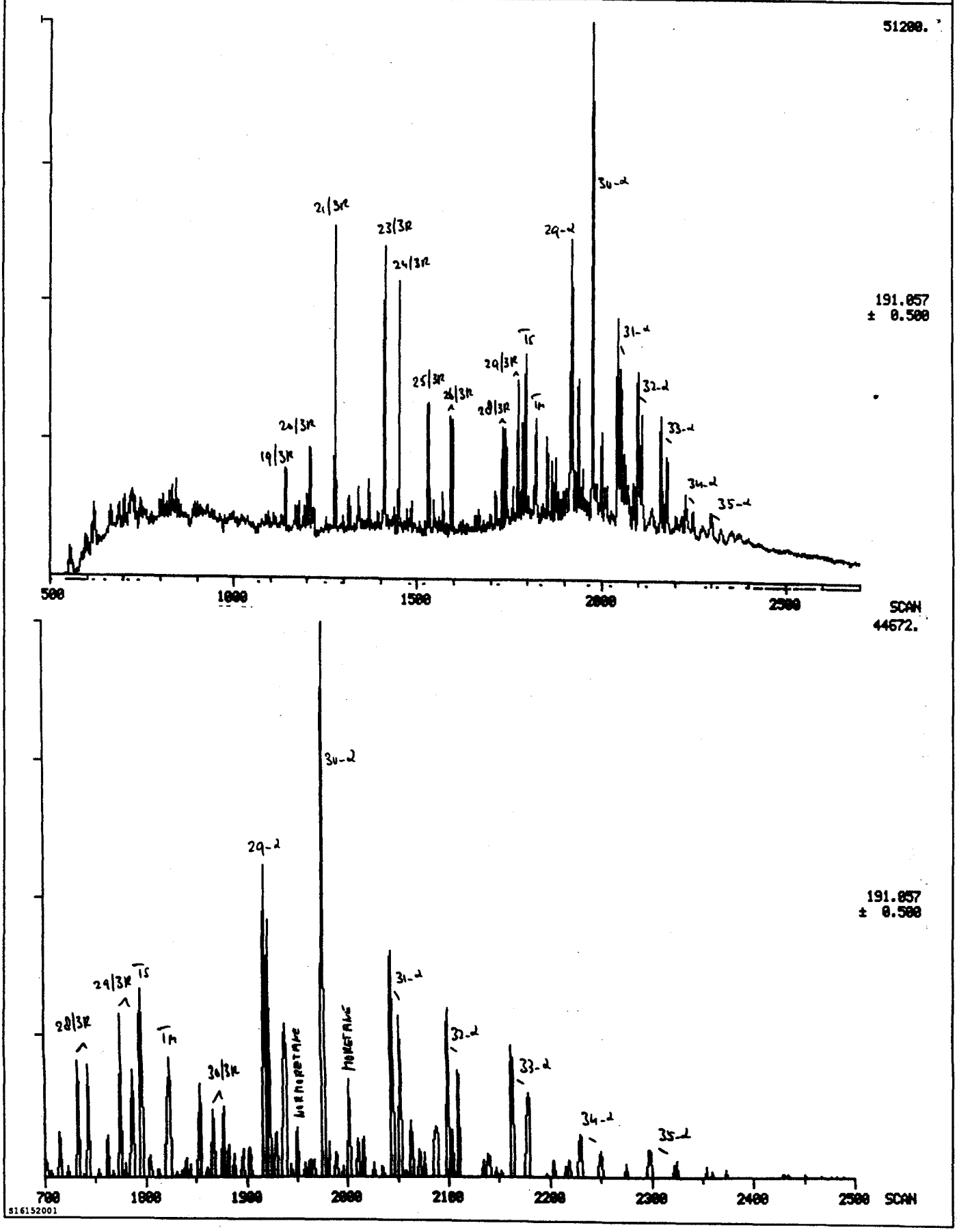
COMPONENT No.	Name	RET.TIM (min)	MAXIMUM (mV)	AREA * (cnts)	WEIGHT PERC.
4	I-BUTANE	018:01	1621.1	11993	2.18
5	N-BUTANE	018:37	5448.5	42903	7.80
6	I-PENTANE	021:05	3940.8	38742	7.04
7	N-PENTANE	022:36	4970.6	54360	9.88
8	2.2-DIMETHYLBUTANE	025:27	150.5	2100	0.38
9	CYCLOPENTANE	027:35	236.1	3620	0.66
10	2.3-DIMETHYLBUTANE	028:58	239.2	4021	0.73
11	2-METHYLPENTANE	029:45	1791.2	29531	5.37
12	3-METHYLPENTANE	031:45	952.9	17495	3.18
13	N-HEXANE	035:16	2431.7	50074	9.10
14	METHYLCYCLOPENTANE	039:09	976.3	23725	4.31
15	2.2-DIMETHYLPENTANE	041:18	58.7	1521	0.28
16	BENZENE	* * *	Not detected	* * *	
17	2.4-DIMETHYLPENTANE	042:45	90.0	2509	0.46
18	2.2.3-TRIMETHYLBUTANE	* * *	Not detected	* * *	
19	CYCLOHEXANE	048:07	1652.1	51690	9.39
20	3.3-DIMETHYLPENTANE	050:50	21.2	683	0.12
21	1.1-DIMETHYLCYCLOPENTANE	054:37	122.2	4480	0.81
22	2-METHYLHEXANE	056:21	457.8	16801	3.05
23	2.3-DIMETHYLPENTANE	056:51	112.1	4096	0.74
24	1-C-3-DIMETHYLCYCLOPENTANE	059:40	158.3	6057	1.10
25	3-METHYLHEXANE	060:13	440.5	18200	3.31
26	1-TR-3-DIMETHYLCYCLOPENTANE	061:33	138.9	5886	1.07
27	1-TR-2-DIMETHYLCYCLOPENTANE	062:40	227.9	9986	1.81
28	3-ETHYLPENTANE	064:08	30.7	1406	0.26
30	N-HEPTANE	075:12	840.8	43349	7.88
31	1-C-2-DIMETHYLCYCLOPENTANE	079:42	26.5	1541	0.28
32	METHYLCYCLOHEXANE	083:06	1444.8	83466	15.17
33	1.1.3-TRIMETHYLCYCLOPENTANE	086:22	60.7	3811	0.69
34	2.2-DIMETHYLHEXANE	088:40	15.4	621	0.11
35	ETHYLCYCLOPENTANE	091:32	39.8	2475	0.45
36	2.5-DIMETHYLHEXANE	097:19	36.0	2523	0.46
38	2.2.3-TRIMETHYLPENTANE	099:34	45.6	3398	0.62
39	1-TR-2-C-4-TRIMETHYLCYCLOPENTANE	102:53	51.0	3687	0.67
40	TOLUENE	104:14	47.8	3501	0.64
	REFERENCE PEAK (29)	067:27	297.8	13812	
	Total peak area			550252	

*) Corrected for difference in response

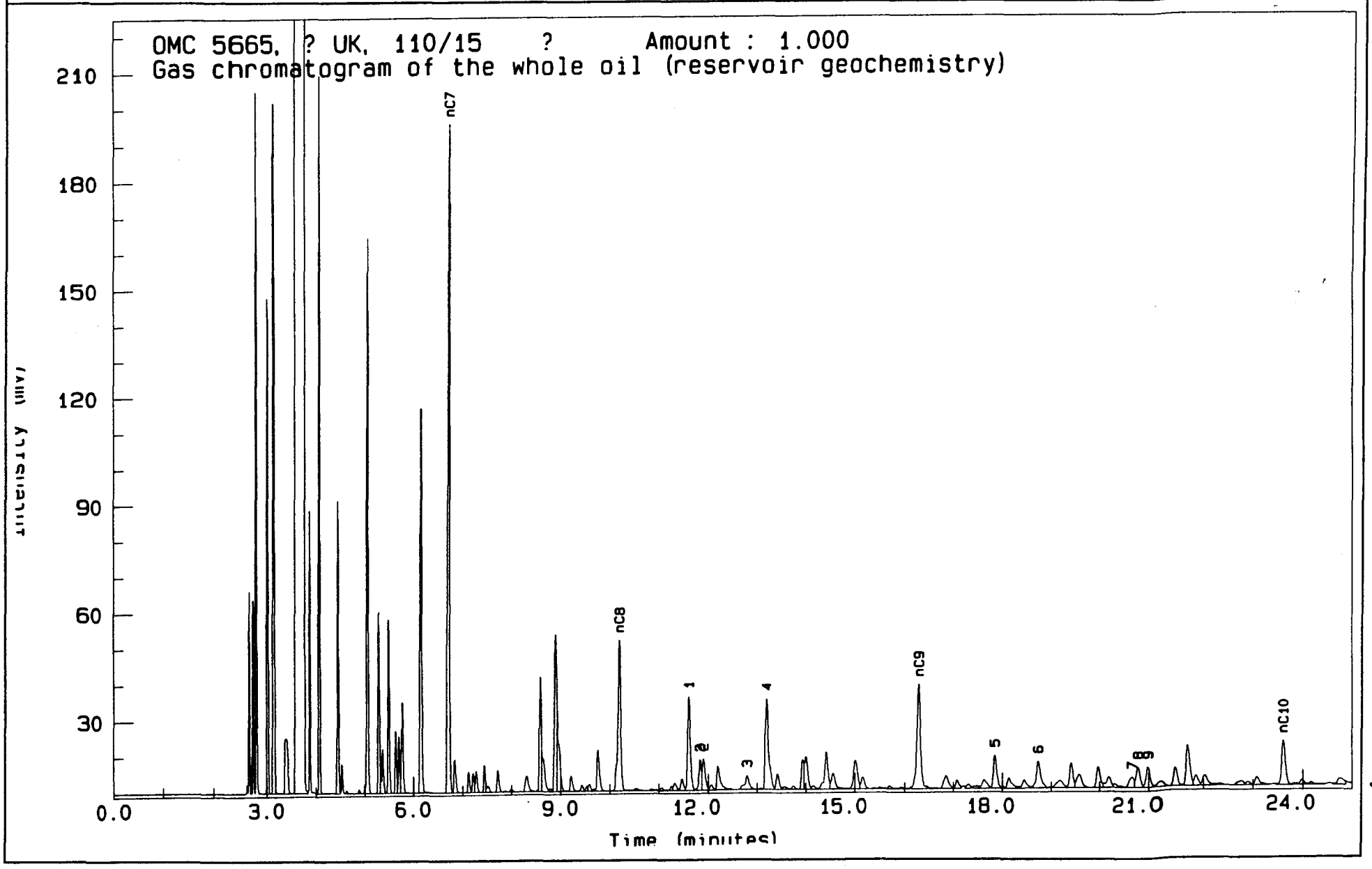
Sterane Fragmentograms of the oil sample from well 110/15, United Kingdom



Triterpane Fragmentograms of the oil sample from well 110/15, United Kingdom



Enlarged part of the whole oil gas chromatogram from well 110/15, United Kingdom



Data for the enlarged part of the whole oil gas chromatogram from well 110/13-02, United Kingdom

[DEFPROJECT] 11 RESGEO 201192,2,1
Reported on 23-NOV-1992 at 10:41

Injection Report

Acquired on 20-NOV-1992 at 13:10

Sample Name : OMC 5665, ? UK, 110/15 ?
Sample Id : S161520/1
Sample Type : Sample Amount=1.00000
Bottle No : 2

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
1	3.008	137746	212489	
2	3.136	191700	356178	
3	3.189	268	875	
4	3.403	15172	68603	
5	3.675	988122	10699674	
6	4.064	199327	274199	
7	4.133	179	598	
8	4.448	81287	136526	
9	4.629	765	1408	
10	4.891	1040	1944	
11	5.051	154425	283455	
12	5.280	50125	105003	
13	5.371	12116	36461	
14	5.483	48039	96580	
15	5.632	17069	34508	
16	5.701	15556	32353	
17	5.765	25009	60579	
18	6.139	106772	238625	
19	6.693	185746	464272	nC7
20	6.837	8976	25256	
21	7.125	5604	14179	
22	7.216	5138	13173	
23	7.275	5779	16379	
24	7.445	7398	18151	
25	7.477	2592	7418	
26	7.717	5887	16730	
27	7.867	196	697	
28	7.995	745	2428	
29	8.309	4195	19845	
30	8.571	31735	87877	
31	8.608	12609	44678	
32	8.784	835	2902	
33	8.885	43432	140490	
34	8.923	19535	66144	
35	9.211	4269	14349	
36	9.429	1613	5219	
37	9.531	1310	3167	
38	9.584	1867	8307	
39	9.755	11347	39417	
40	10.181	41692	167369	nC8
41	10.539	565	2782	
42	10.597	124	315	
43	10.848	408	1605	
44	11.045	668	2664	
45	11.253	1196	4001	
46	11.323	2008	8080	

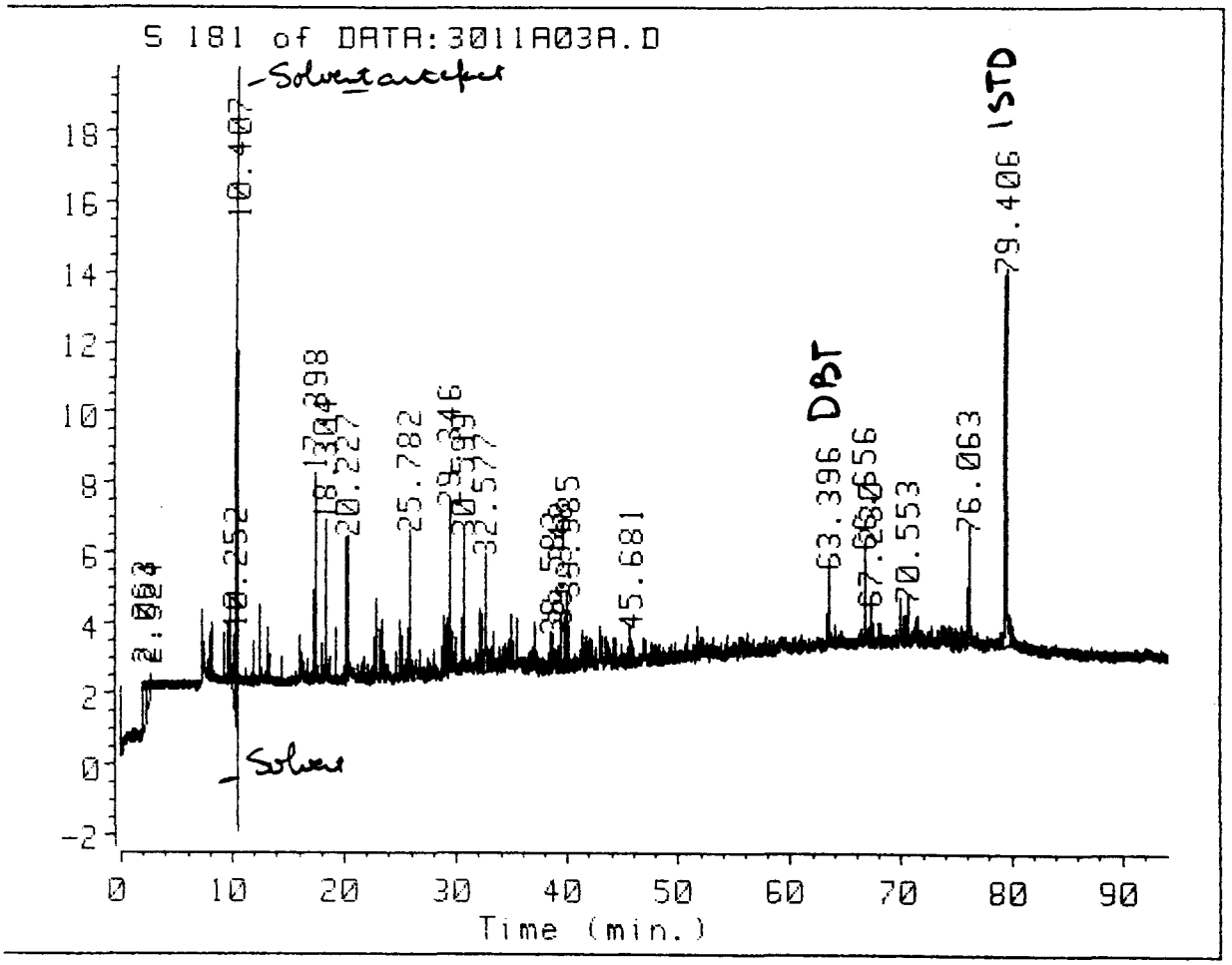
S16151901

Data for the enlarged part of the whole oil gas chromatogram from well 110/15, United Kingdom

Peak	RT mins	Hght uV	Area uVs	Peak name
47	11.467	3136	12479	
48	11.595	25798	101937	1
C1		16906	66586	2
49	11.829	8353	29361	- C1
50	11.899	8553	37225	- C1
51	12.064	1357	5973	
52	12.197	6440	33291	
53	12.453	226	1118	
C2		3855	25313	3
54	12.795	3855	25313	- C2
55	13.067	264	1069	
56	13.184	25042	122595	4
57	13.419	4276	19005	
58	13.573	754	5114	
59	13.744	937	4290	
60	13.936	8190	28154	
61	14.000	9020	43463	
62	14.149	1007	4726	
63	14.405	10308	53361	
64	14.549	4456	25755	
65	14.853	201	771	
66	15.008	8004	44271	
67	15.157	3341	16673	
68	15.387	333	1435	
69	15.509	389	2229	
70	15.701	848	4085	
71	15.925	398	2178	
72	16.053	129	688	
73	16.283	29011	152653	nC9
74	16.853	3551	25230	
75	17.072	2252	11181	
76	17.307	1102	6253	
77	17.440	686	5054	
78	17.627	2267	16106	
79	17.845	9118	45242	5
80	18.005	599	2485	
81	18.133	2834	20566	
82	18.448	2206	15213	
83	18.736	7395	48913	6
84	19.195	2102	21580	
85	19.413	6872	34137	
86	19.584	3756	28692	
87	19.968	5773	30717	
88	20.192	3003	20753	
89	20.320	981	7546	
90	20.656	2850	19434	7
91	20.779	5592	32202	8
92	20.981	5628	33089	9
93	21.205	1520	10269	
94	21.435	5071	25521	
95	21.685	11278	59735	
96	21.851	2801	16135	
97	22.027	2870	20728	
98	22.325	479	3062	
99	22.475	130	557	
100	22.768	1196	10375	
101	22.896	973	5773	
102	23.077	2316	16022	
103	23.605	12326	67604	nC10

S16152001

DETAILED SULPHUR ANALYSIS
well 110/15, United Kingdom



S16152001

DETAILED SULPHUR ANALYSIS
well 110/15, United Kingdom

OVERVIEW SULPHUR COMPONENTS WHOLE OIL

Operator: GERRIT 20 Nov 92 2:41
Method File Name : THIVER4.M
Sample Info : OMC 5665B, 500.1 MG & 1ML ISTD SOL. 11.71MG/100M
Misc Info:
Integration File Name : DATA:1911A07A.I
consisting of channels : 1. S 181 of 1911A07A.D
Bottle Number : 7 Repetition Number: 1

(DI) BENZOTHIOPHENES LOWER SULPHUR EXCL.

Calibration file: DATA:THIOSM2.Q Last Update: 18 Nov 92 4:46 pm
Reference Peak Window: 6.00 % of Retention Time
Non-Reference Peak Window: 2.00 % of Retention Time
Sample Amount: 500100 Uncalibrated Peak RF: 0.000 Multiplier: 10000

Peak Num	Type	Int Type	Ret Time	Signal Description	Compound Name	Area	Amount ppm
1	+	1BV	33.884	S 181	DBT	300.84	23.116
2		1	-------		1M.DBT	*** Not	Found ***
3		1VV	38.618	S 181	4M.DBT	453.69	34.861
4		1VB	38.973	S 181	2M.DBT	145.61	11.188
5		1	-------		2ET.DBT	*** Not	Found ***
6		1	-------		4ET.DBT	*** Not	Found ***
7		1PV	40.990	S 181	4.6 DMDBT	225.87	17.356
8		1VV	41.615	S 181	2.4 DMDBT	209.47	16.096
9		1	-------		1.8 & 1.4 DM	*** Not	Found ***
10		1VV	44.225	S 181	3M.DBT	119.55	9.1864
11		1PV	43.950	S 181	1.6 DMDBT	100.81	7.7458
12		1VV	45.732	S 181	2.6? DMDBT	150.93	11.598
13		1VV	45.396	S 181	2.6?? DMDBT	102.56	7.8807
14		1	-------		1.3? DMDBT	*** Not	Found ***
15		1BB	48.194	S 181	1.7&1.2&1.9	110.19	8.4666
16		1PV	49.210	S 181	3.6 & 2.7DIM	198.91	15.284
17		1	-------		3.4? DMDBT	*** Not	Found ***
18		1	-------		3.7? DMDBT	*** Not	Found ***
19	+ISTD	1PB	73.128	S 181	2 NITRO DBT	1595.45	234.15
20		1	-------		TRIMDBT1	*** Not	Found ***

*** Not all calibrated peaks found ***

516152001