
May 1994

RKER.94.050

Geochemical investigation of a crude oil sample from
well 204/23-1, United Kingdom

by

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Sponsor: Shell Expro London

Code: 876.106.10

investigation: 8BAS0731

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Geochemical investigation of a crude oil sample from well 204/23-1, United Kingdom

1.0 Introduction

A geochemical investigation has been carried out on a crude oil sample from 3840.2-3869.9 m (OMC 6091, DST-1A, Pre Cambrian Basement Group) in well 204/23-1, United Kingdom (request telex ref. ABX 010775 of 01.02.94). The geochemical parameters are shown on pages 2 to 6, analysis results are presented on the yellow pages.

2.0 Conclusions

1. Transformation processes

The oil shows no sign of bacterial degradation (whole oil gas chromatogram, C7-distribution nor any other signs of transformation processes.

2. Maturity

The oil has a highly mature character (API, gross composition, complete sterane isomerisation).

3. Environment of deposition / Type of organic matter

The oil has been derived from a shaly source rock (C7-distribution, low sulphur, high rearranged steranes, pristane/phytane >1.0), that contained predominantly structureless organic matter (biomarkers). The low pristane/phytane ratio, and the relatively low amounts of aromatics (benzene, toluene, biphenyls) for the highly mature character, suggest that there is no significant landplant input.

4. Correlation

The biomarkers of this oil indicate a marine environment and contain a low amount of bisnorhopane. Moreover, also a low amount of 25-nor-hopanes are detected. These features are not found in typical Kimmeridge-derived crudes from the North Sea. It is therefore speculated that this crude has been derived from a completely different source rock or a different, more algal, facies within the Kimmeridge Fm.

Summary of the Geochemical Data of the oil sample from well 204/23-01 (3840.2 m.), United Kingdom

Gravity and Gross Composition

API gravity (degrees) :	48.5
Specific Gravity (g/ml) :	0.786
Viscosity (centipoise) :	no data
Gross Composition (W%)	
Weight lost on topping :	59.0
Saturates :	63
Aromatics :	34
Heterocompounds :	3
Rest (High molecular) :	0
Gasoline fraction (%) :	21.0
Sulphur (%) :	0.1
Vanadium (ppm) :	0.0
Nickel (ppm) :	0.0

Saturates Distributions

(Gaschromatography)

Pristane / Phytane :	1.5
Pristane / n-C17 :	0.4
Phytane / n-C18 :	0.3
ACI :	21
Corr. Coeff. :	-0.9967

C-7 Distributions

(Gaschromatography)

C-7 Alkanes (%)	
Normal C-7 :	57
Mono Branched :	34
Poly Branched :	9
C-7 Alkanes / Cyclo Alkanes (%)	
Normal C-7 :	36
Cyclo Alkanes :	36
Branched Alkanes :	28
C-7 Alk. / Cyclo Alk. / Aromatics (%)	
Alkanes :	51
Cyclo Alkanes :	30
Aromatics :	19

Carbon Isotope Ratios

(Mass Spectrometry)

Total Oil (topped) :	-30.3
Saturates :	-30.5
Aromatics :	-29.6

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 :	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 :	62
Triterpanes :	9

Steranes (%)

Iso Steranes :	33
Rearranged Steranes :	48
Normal Steranes :	19

Triterpanes (%)

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

Steranes Carbon No. Dist. (%)

C-27 :	38
C-28 :	34
C-29 :	28

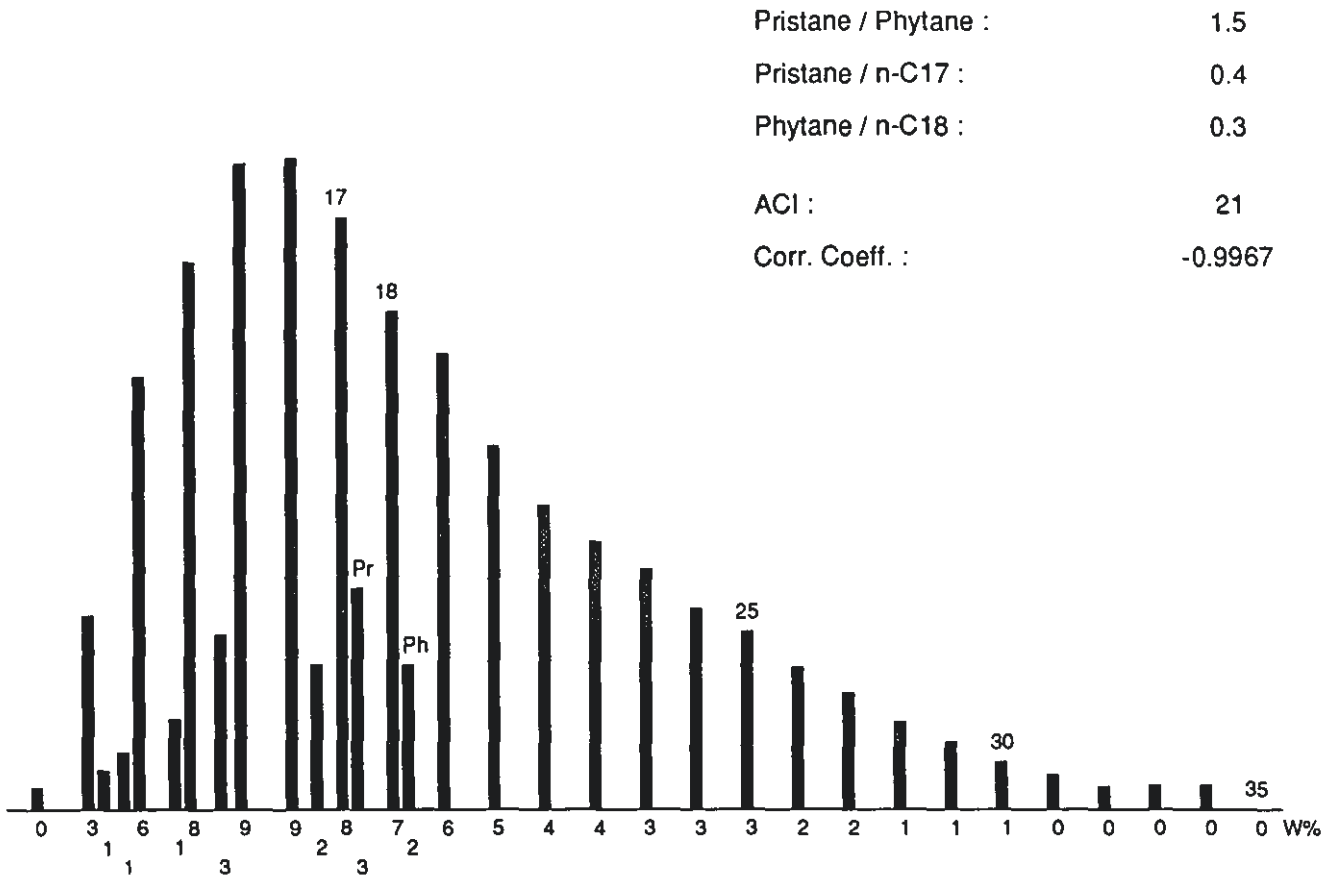
C-29 Sterane Ratios

20S / 20R + 20S :	0.60
Iso / Iso + Normal :	0.70

Triterpane Ratios

TS / TM :	1.51
3R / 3R + 5R :	0.45

Bar diagram of Normal-alkanes & Isoprenoids of the oil sample from well 204/23-01 (3840.2 m.), United Kingdom

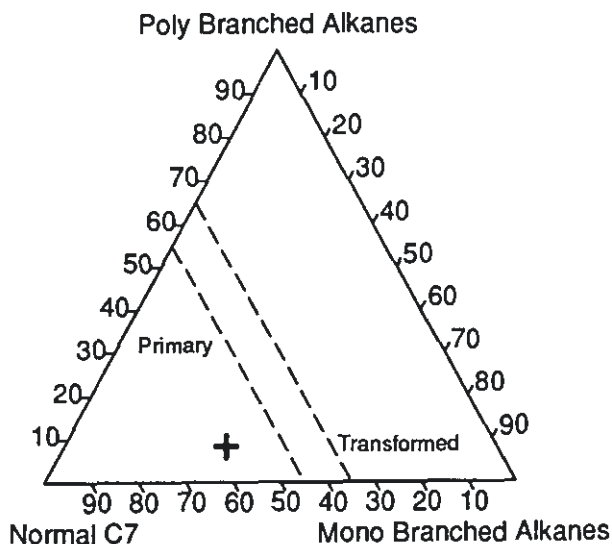


Conclusions based on saturated hydrocarbon fraction :

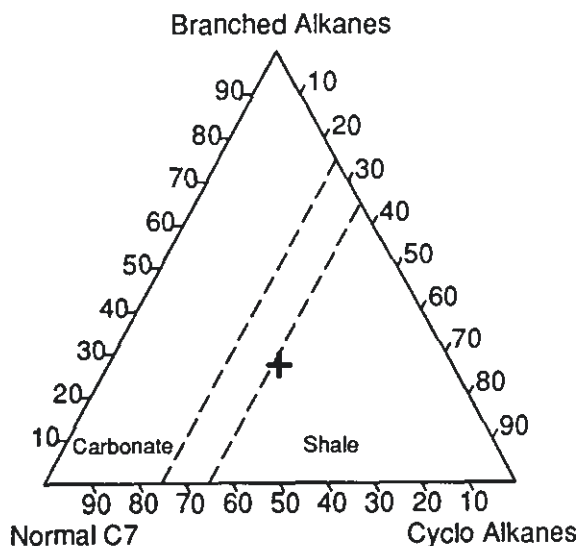
- 1 : the saturates show no indication of bacterial degradation
- 2 : it is likely that the n-alkane distribution has a highly mature character
- 3 : the saturates indicate that the oil has been expelled from a source rock containing predominantly structureless organic matter

The Light Fraction (< 120 C.) of the oil sample from well 204/23-01 (3840.2 m.), United Kingdom

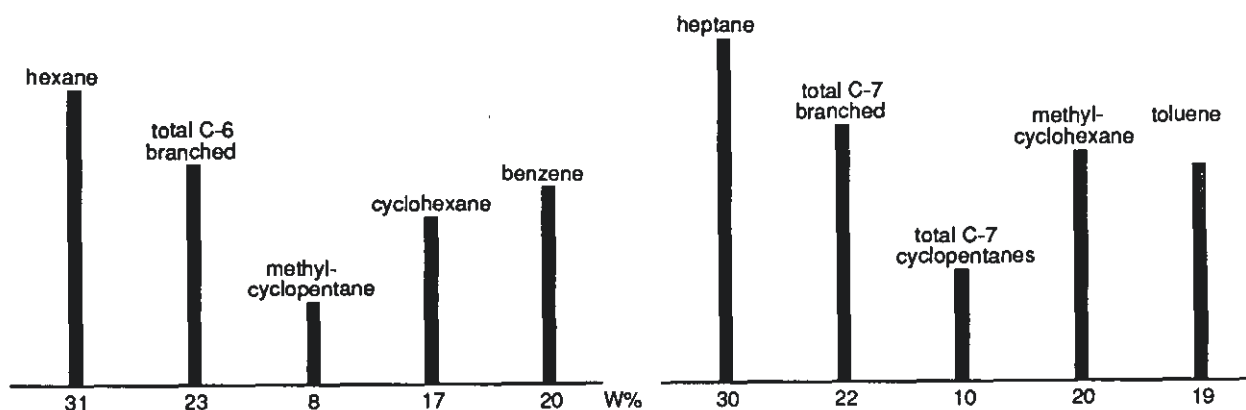
Alkane Distribution



Alkane/Cyclo-alkane Distribution



C-6 and C-7 Distributions



C-7 ALKANES (%)

Normal C-7 :	57
Mono Branched :	34
Poly Branched :	9

C-7 ALKANES / CYCLO ALKANES (%)

Normal C-7 :	36
Cyclo Alkanes :	36
Branched Alkanes :	28

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

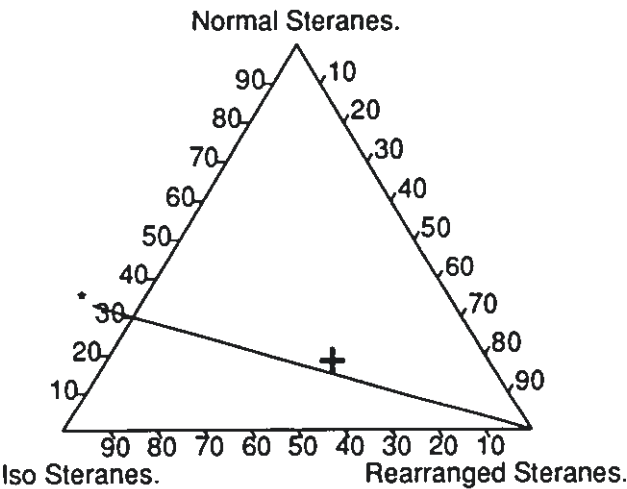
Alkanes :	51
Cyclo Alkanes :	30
Aromatics :	19

Conclusions based on light fraction :

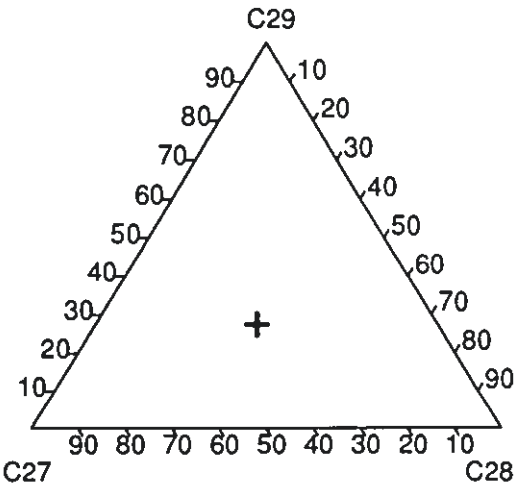
- 1 : the light fraction shows no indication of bacterial degradation
- 2 : the light fraction has a mature character
- 3 : the light fraction indicates a shaly source rock

GCMS Sterane typing of the oil sample from
well 204/23-01 (3840.2 m.), United Kingdom

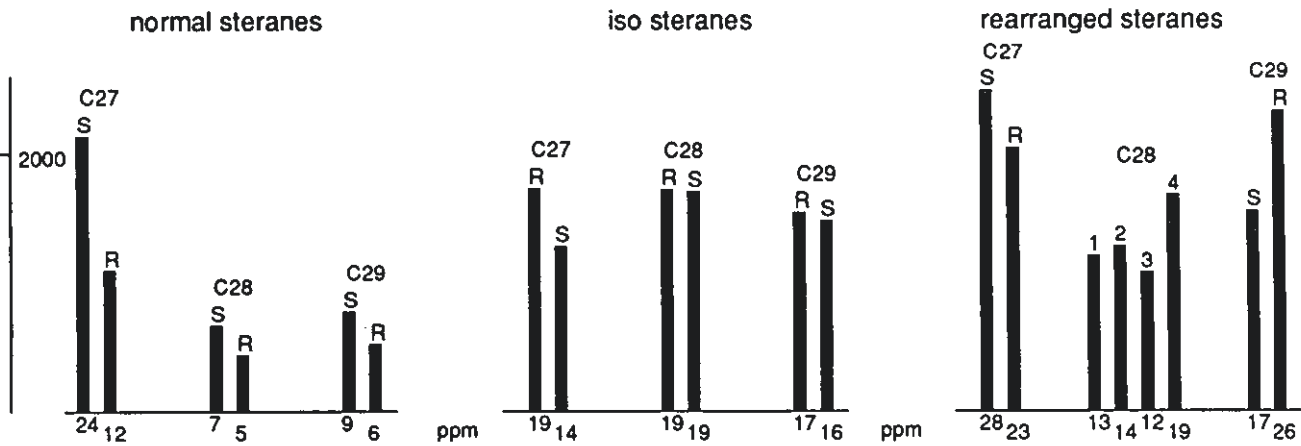
Sterane Conversion Diagram



Sterane Typing Diagram



Sterane Distribution



STERANE DISTRIBUTION	(ppm)	(%)
Iso Steranes :	105	33
Rearranged Steranes :	151	48
Normal Steranes :	62	19

CARBON NUMBER DISTRIBUTION		
C-27 :	119	38
C-28 :	108	34
C-29 :	91	28

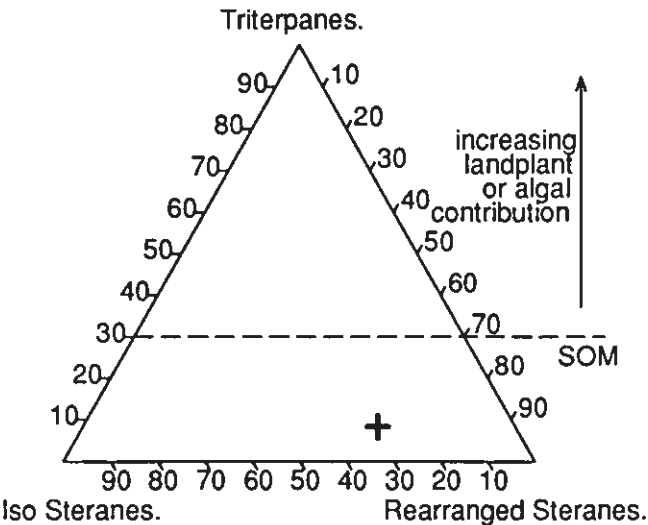
C-29 STERANE CONVERSION RATIOS	
20S / 20R + 20S :	0.60
Iso / Iso + Normal :	0.70

Conclusions based on steranes :

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

GCMS Triterpane typing of the oil sample from
well 204/23-01 (3840.2 m.), United Kingdom

Sterane/Triterpane Diagram



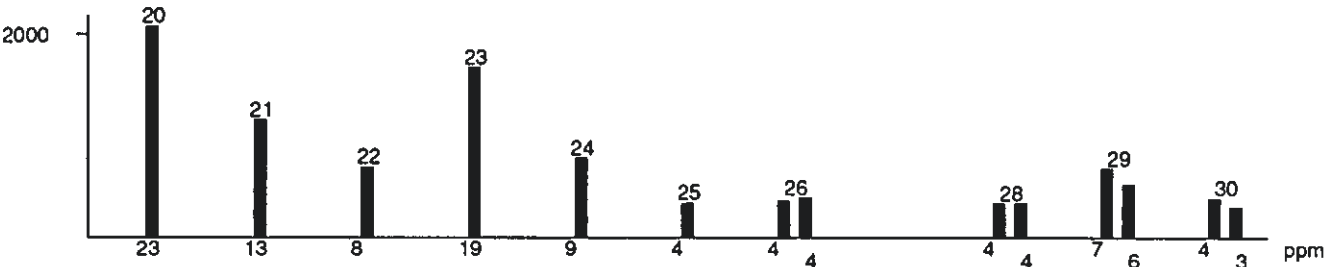
STERANES/TRITERPANES (calculated %)

Iso Steranes :	29
Rearranged Steranes :	62
Triterpanes :	9

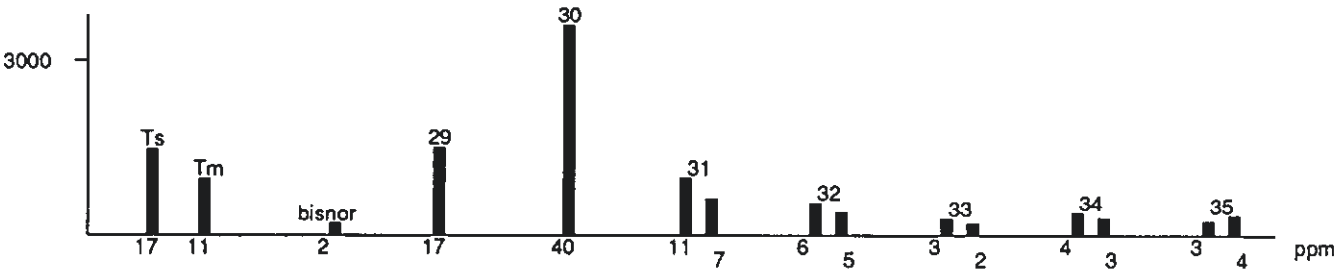
TRITERPANE CONVERSION RATIOS

TS / TM ;	1.51
3R / 3R + 5R :	0.45
C30 Hopane (ppm) :	40

Tricyclic Terpanes



Pentacyclic Terpanes



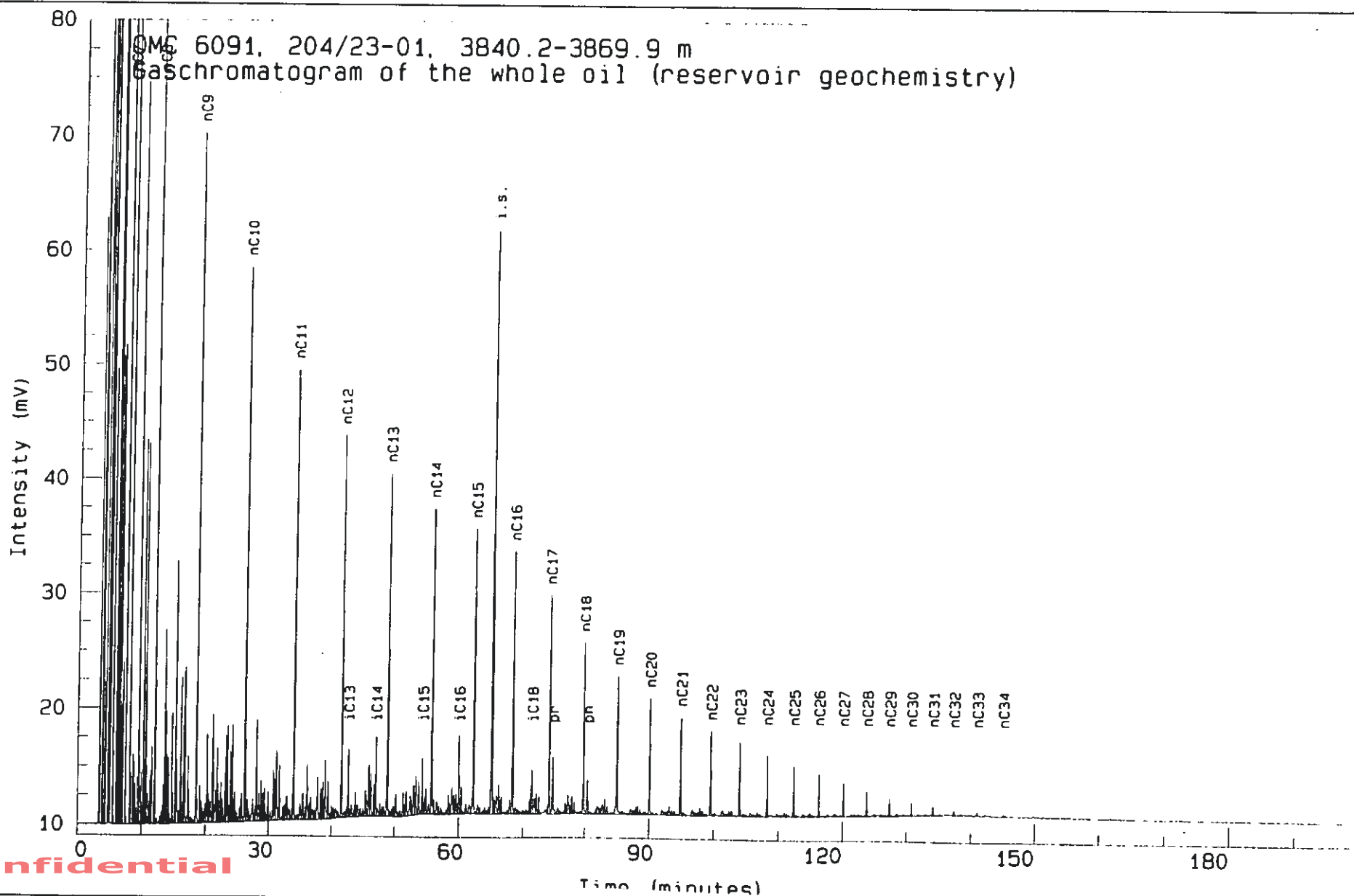
Conclusions based on triterpanes :

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

ANALYTICAL DATA
well 204/23-01 (3840.2 m.), United Kingdom

Gas chromatogram of the whole oil sample from
well 204/23-01 (3840.2 m.), United Kingdom

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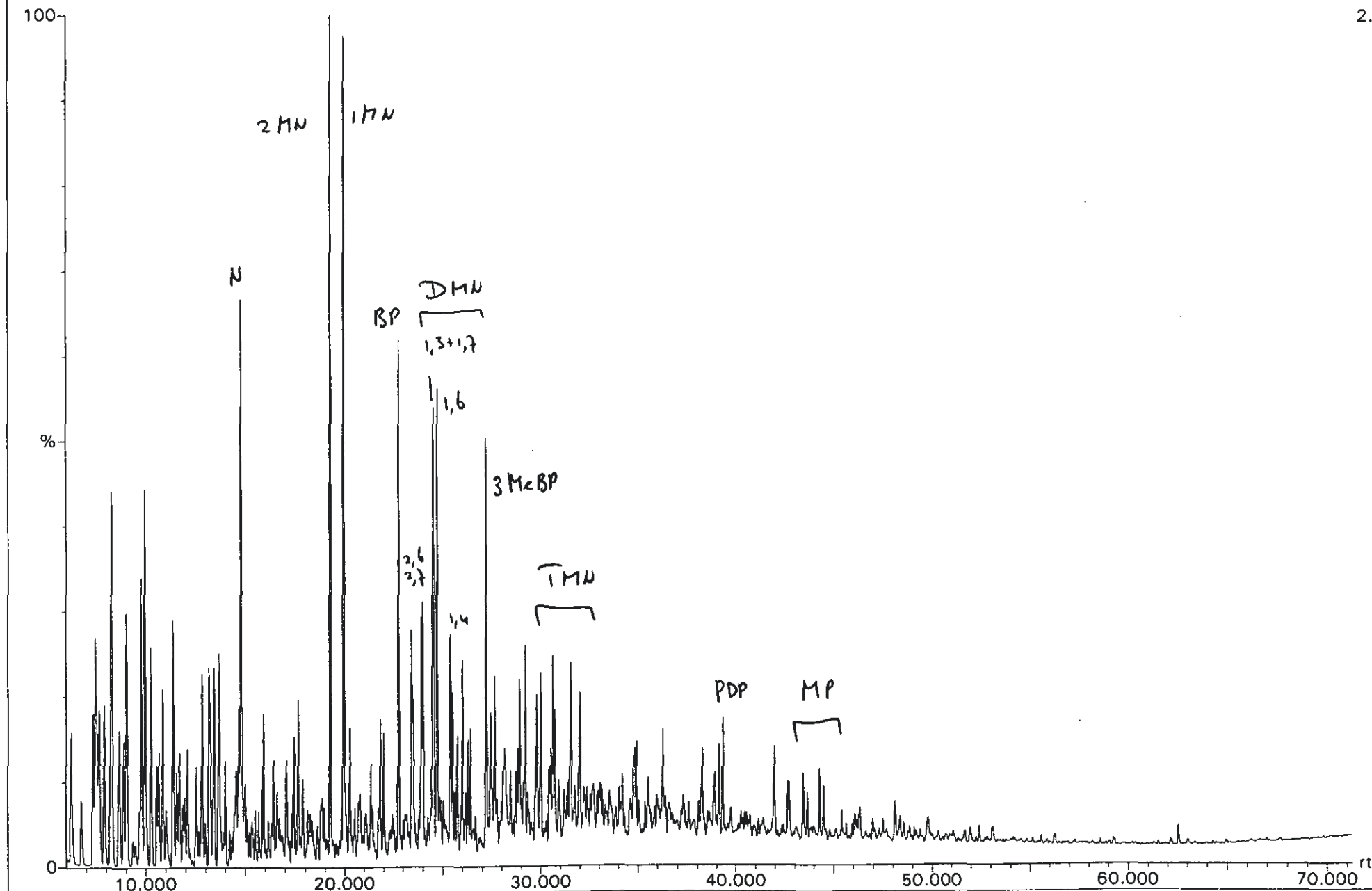
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Lab
01-Apr-1994 11:28:59
1660711

U.K. 204/23-01 3840.2-3869.9 M OMC 6091

Inst
User
Scan EI+
TIC
2.95e6
Area



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GCMS data of the aromatic fraction well 204/23-01 (3840.2 m.), United Kingdom

Report of sample: U.K. 204/23-01 3840.2-3869.9 M OMC 6091

Acquired at : 01-Apr-1994

Standard used for calculations: PDP
Discrimination factor : 1.42

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
1155 4-MDBT/2+3-MDBT 2.51
1062 4-MDBT/1-MDBT 3.61
459 2+3-MDBT/1-MDBT 1.44
470 4-MDBT/DBT 0.70
210 2+3-MDBT/DBT 0.28
191 1-MDBT/DBT 0.19
119

IV) BIPHENYLS

a) Concentrations (ppm)

5 BP 786
4 2-MBP 70
3783 3-MBP 406
4-MBP 143
Total Biphenyls 1404

b) Parameters

2-MN/1-MN (MNR) 1.09
2,6+2,7-DMN/1,5-DMN (DNR-1) 2.19
2,3,6-TMN/1,3,5+1,4,6-TMN (TNR-1) 0.62
2,3,6-TMN/1,2,5-TMN (TNR-2) 1.35
2,3,6-TMN/THN 22.73
2,3,6-TMN/Cadelene 26.56

b) Parameters
0.62 3-MBP/BP 0.52
1.35 3-MBP/4-MBP 2.84
22.73 3-MBP/2-MBP 5.83

II) PHENANTHRENES

a) Concentrations (ppm)

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

V) DIBENZOFURANS
a) Concentrations (ppm)
DBF 83
213 4-MDBF 55
50 2+3-MDBF 33
55 1-MDBF 25
92 Total Dibenzofurans 196
68

b) Parameters

478 4-MDBF/2+3-MDBF 1.68
4-MDBF/1-MDBF 2.18
0.81 2+3-MDBF/1-MDBF 1.30
0.42 4-MDBF/DBF 0.66
0.45 2+3-MDBF/DBF 0.39
0.66 1-MDBF/DBF 0.30
0.40

III) DIBENZOTHIOPHENES

a) Concentrations (ppm)

DBT 150
4-MDBT 105
2+3-MDBT 42
1-MDBT 29
Total Dibenzothiophenes 326

VI) OVERALL RATIOS
Biphenyls/NAPH* 1.43
Dibenzothiophenes/NAP 0.33
Dibenzofurans/NAPH* 0.20

MN = methylnaphthalene
DMN = dimethylnaphthalene
TMN = trimethylnaphthalene
THN = tetrahyronaphthalene
DBF = methyldibenzofuran
MDBF = methyldibenzofuran

P = phenantrene
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

GCMS data of the aromatic fraction
well 204/23-01 (3840.2 m.), United Kingdom

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

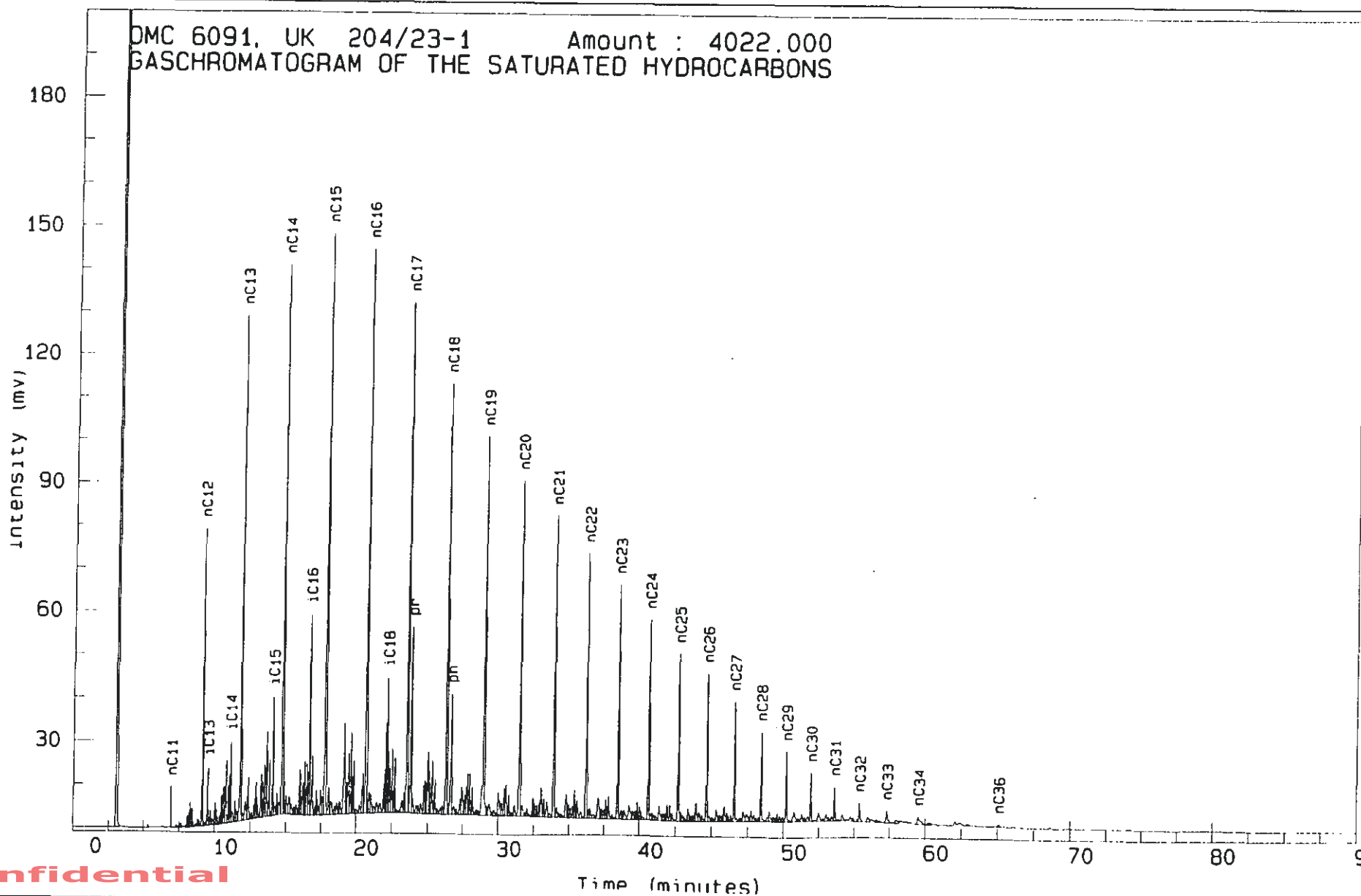
2,6-DMN	220	4,5-DMP	4
2,7-DMN	239	2,6+3,6-DMP	12
1,3+1,7-DMN	605	3,5-DMP	11
1,6-DMN	470	2,7-DMP	6
1,4-DMN	n.d.	3,9-DMP	56
2,3-DMN	149	1,6+2,5+2,9-DMP	26
1,5-DMN	210	1,7-DMP	18
1,2-DMN	123	1,9+4,9-DMP	22
1,4+2,3-DMN	149	1,5-DMP	n.d.
		1,8-DMP	7
		1,2-DMP	3
		9,10-DMP	n.d.
1,3,7-TMN	164	1,2,6-TMP	2
1,3,6-TMN	190	1,2,5-TMP	1
1,3,5+1,4,6-TMN	191	1,2,9-TMP	n.d.
2,3,6-TMN	119	1,2,7-TMP	n.d.
1,2,7-TMN	41	1,2,8-TMP	3
1,6,7-TMN	97		
1,2,6-TMN	65		
1,2,4-TMN	20		
1,2,5-TMN	88		
1,3,5,7-TeMN	18		
1,3,6,7-TeMN	44		
1,2,4,7-TeMN	31		
1,2,5,7-TeMN	19		
2,3,6,7-TeMN	13		
1,2,6,7-TeMN	8		
1,2,5,6-TeMN (C4-NAPH)	19		

b) Parameters

1,2,5-TMN/1,3,6-TMN	0.46
1,2,7-TMN/1,3,7-TMN	0.25

The assignment of some of these peaks is tentative

Gas chromatogram of the saturated hydrocarbons of the oil sample from
well 204/23-01 (3840.2 m.), United Kingdom

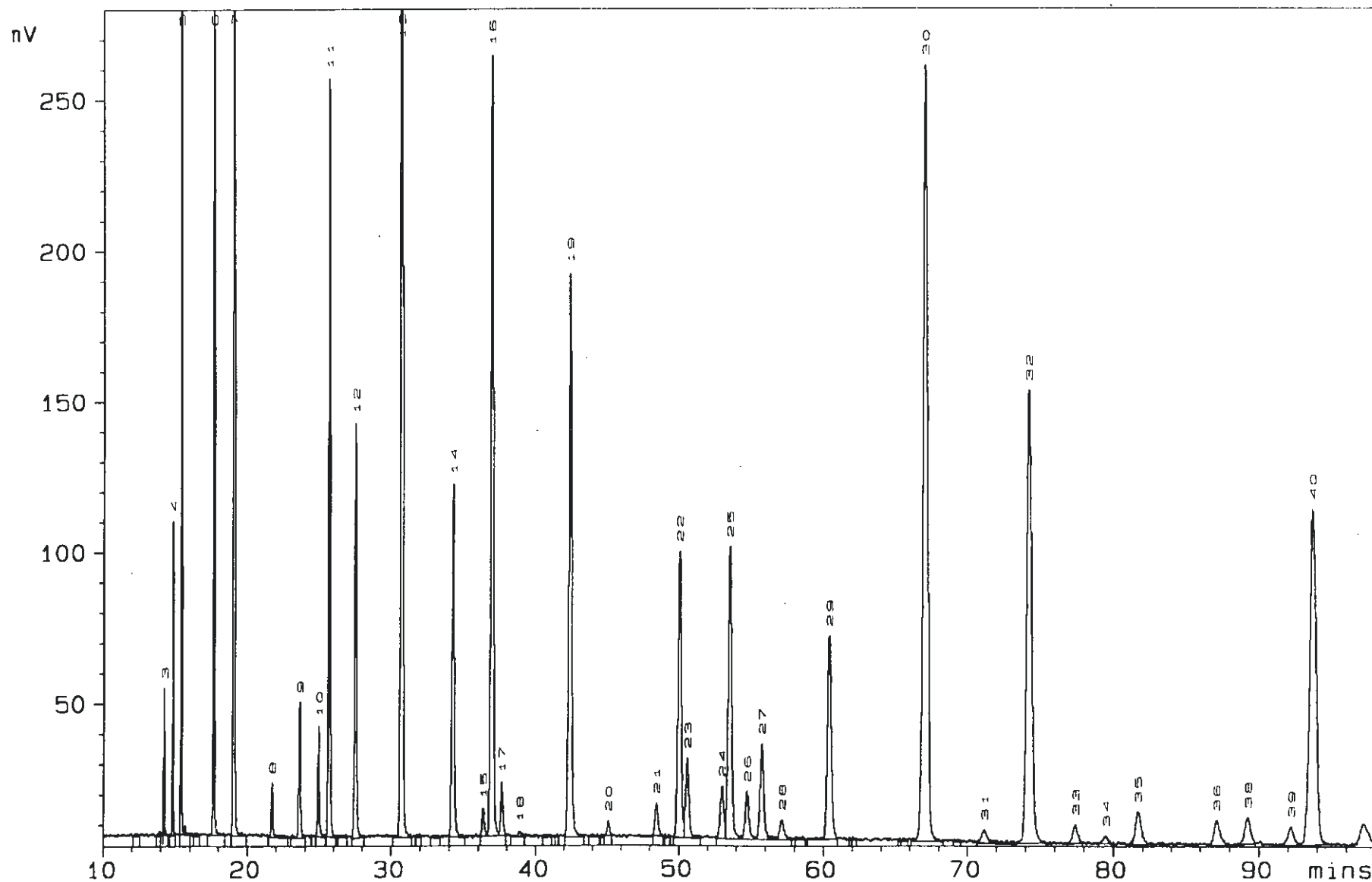


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Gas chromatogram of the light fraction (< 120 C.) of the oil sample from
well 204/23-01 (3840.2 m.), United Kingdom



Acquired on 12-Apr-94 at 23: 59: 59

Reported on 20-Apr-94 at 05: 56: 36

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Gas chromatographic hydrocarbons analysis (< 120 C.) well 204/23-01 (3840.2 m.), United Kingdom

GAS CHROMATOGRAPHICS ANALYSIS OF THE FRACTION BOILING BELOW 120 DEGREES CENTIGRADE

Sample: sl66071/1

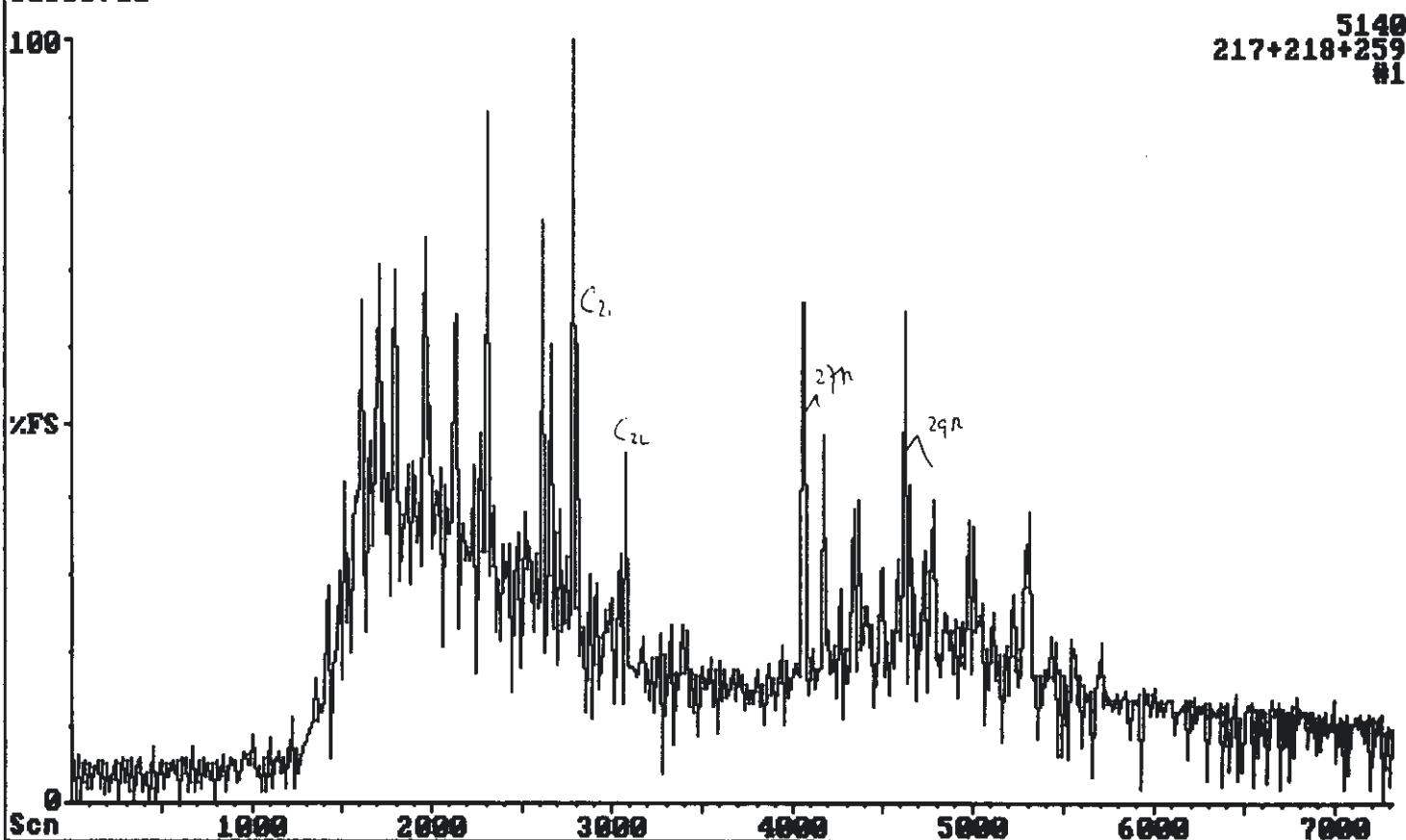
COMPONENT No.	Name	RET.TIME (min)	HEIGHT (uV)	AREA (uVs)
1	methane	0.00	0	0
2	ethane	0.00	0	0
3	propane	14.24	48367	201361
4	i-butane	14.84	103917	431280
5	n-butane	15.38	305162	1303915
6	i-pentane	17.67	343242	1693252
7	n-pentane	19.07	587390	3116889
8	2.2-dimethylbutane	21.73	18149	125710
9	cyclopentane	23.62	45022	342761
10	2.3-dimethylbutane	24.96	36461	280414
11	2-methylpentane	25.67	251045	1880904
12	3-methylpentane	27.50	137459	1168905
13	n-hexane	30.71	496846	4610737
14	methylcyclopentane	34.24	116647	1276566
15	2.2-dimethylpentane	36.34	9202	106309
16	benzene	36.94	258489	3076526
17	2.4-dimethylpentane	37.65	17557	193557
18	2.2.3-trimethylbutane	38.90	1729	22972
19	cyclohexane	42.41	186917	2601189
20	3.3-dimethylpentane	45.09	4887	57746
21	1.1-dimethylcyclopentane	48.46	10920	166512
22	2-methylhexane	50.03	94792	1455530
23	2.3-dimethylpentane	50.57	26610	429046
24	1-c-3-dimethylcyclopentane	53.02	17543	288821
25	3-methylhexane	53.56	96524	1591348
26	1-tr-3-dimethylcyclopentane	54.76	15887	291059
27	1-tr-2-dimethylcyclopentane	55.76	31633	565103
28	3-ethylpentane	57.14	6752	141420
29	reference peak	60.42	67098	1292022
30	n-heptane	67.09	256696	5338499
31	1-c-2-dimethylcyclopentane	71.18	4623	114996
32	methylcyclohexane	74.24	149828	3594127
33	1.1.3-trimethylcyclopentane	77.44	6242	146344
34	2.2-dimethylhexane	79.53	2541	60799
35	ethylcyclopentane	81.70	10811	302580
36	2.5-dimethylhexane	87.10	8358	242051
37	not present	0.00	0	0
38	2.2.3-trimethylpentane	89.25	8972	247720
39	1-tr-2-c-4-trimethylcyclopentane	92.20	6372	194385
40	toluene	93.69	110855	3374339

total area excluding i.s.: 41035672

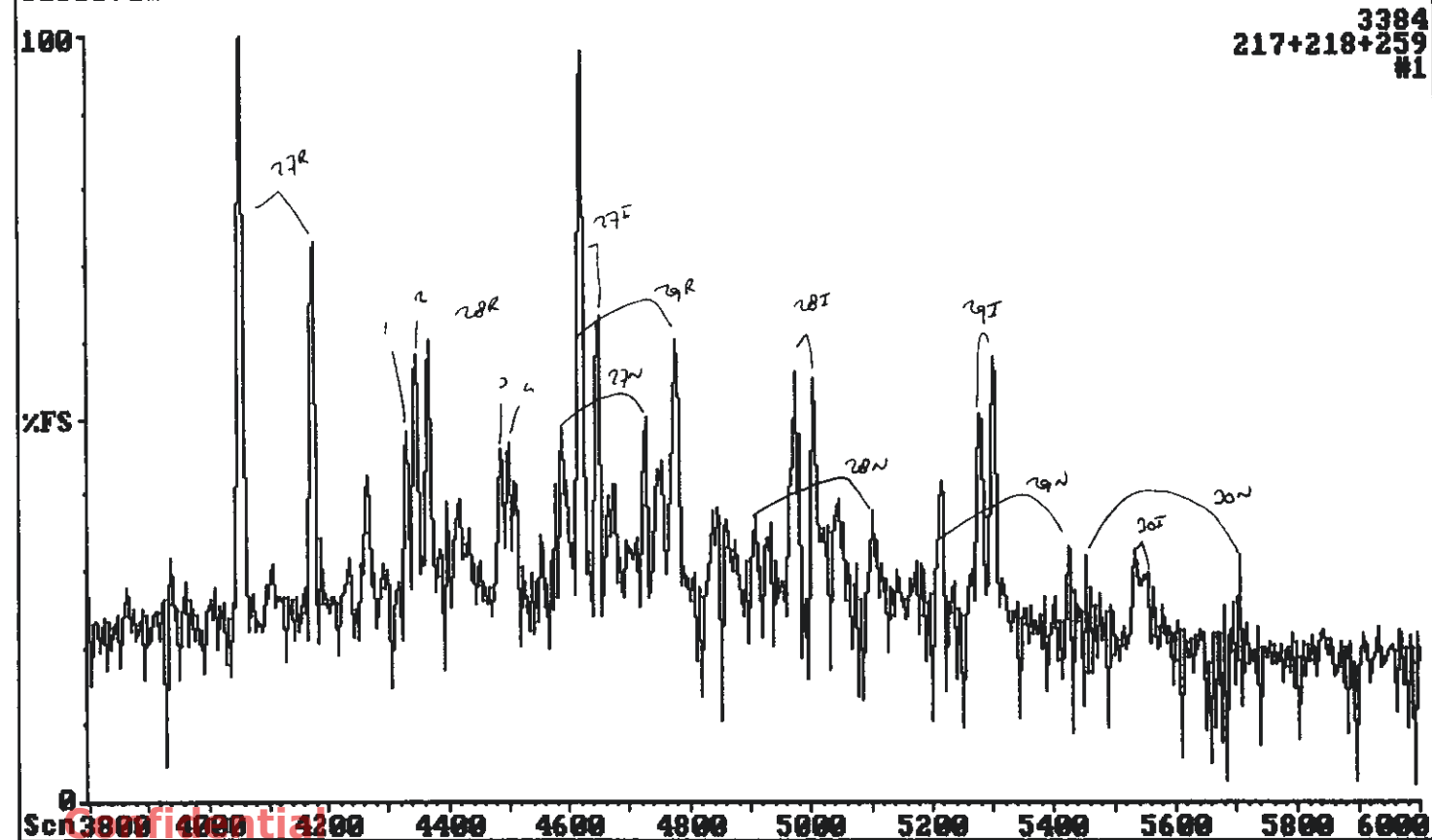
Weight percentage internal standard: 0.66
Weight percentage C7 fraction : 20.96

*Sterane Fragmentograms of the oil sample from
well 204/23-01 (3840.2 m.), United Kingdom*

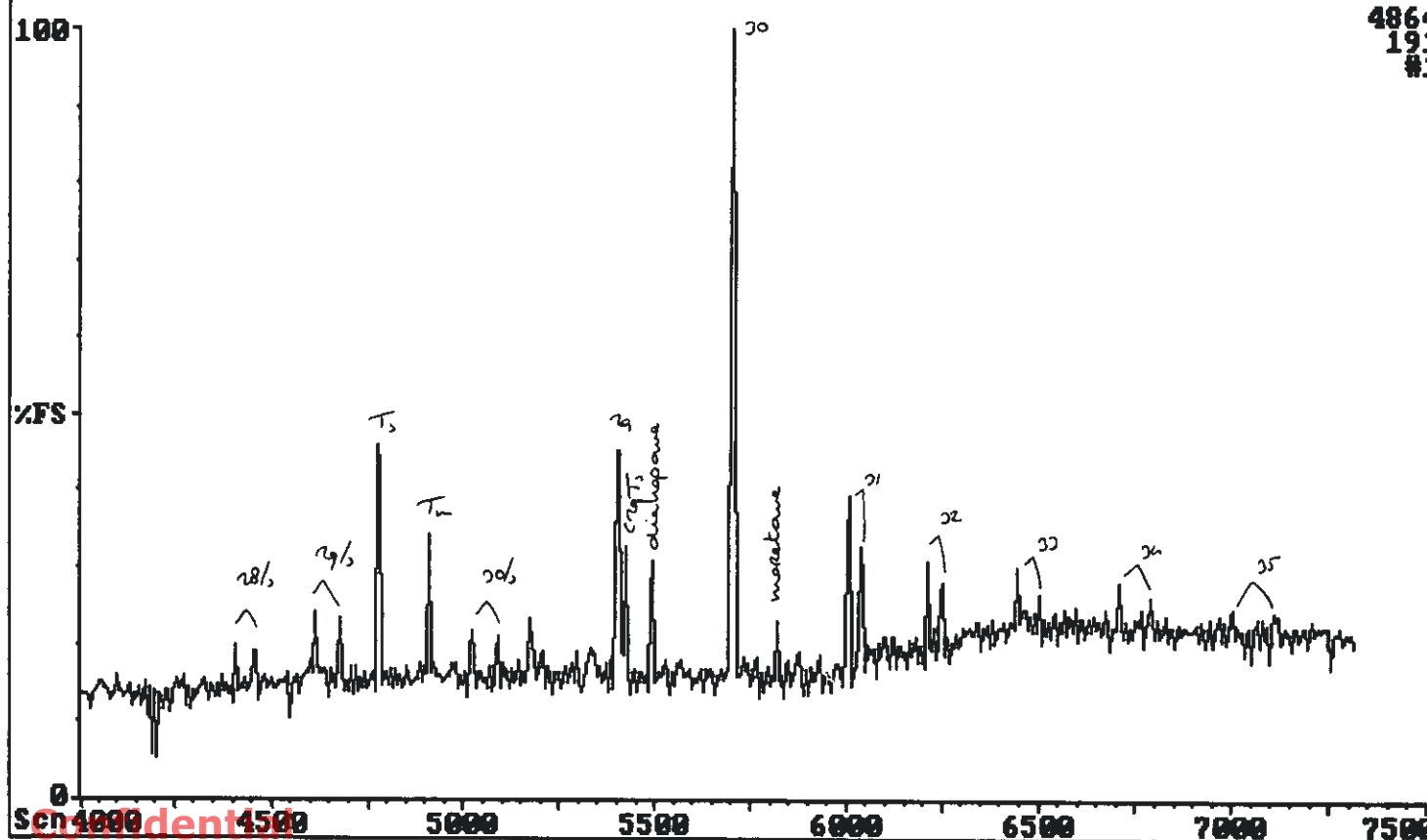
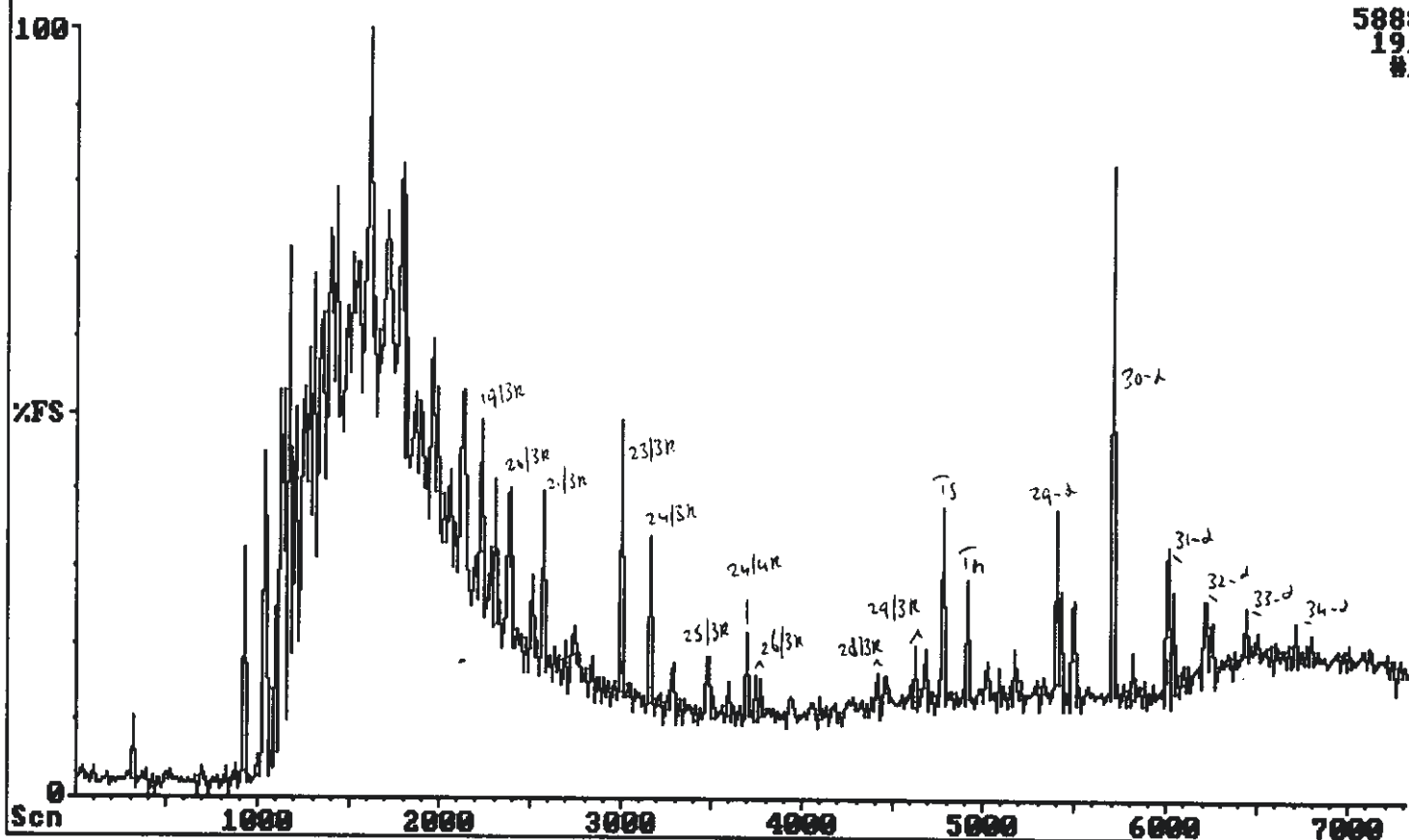
S1660711



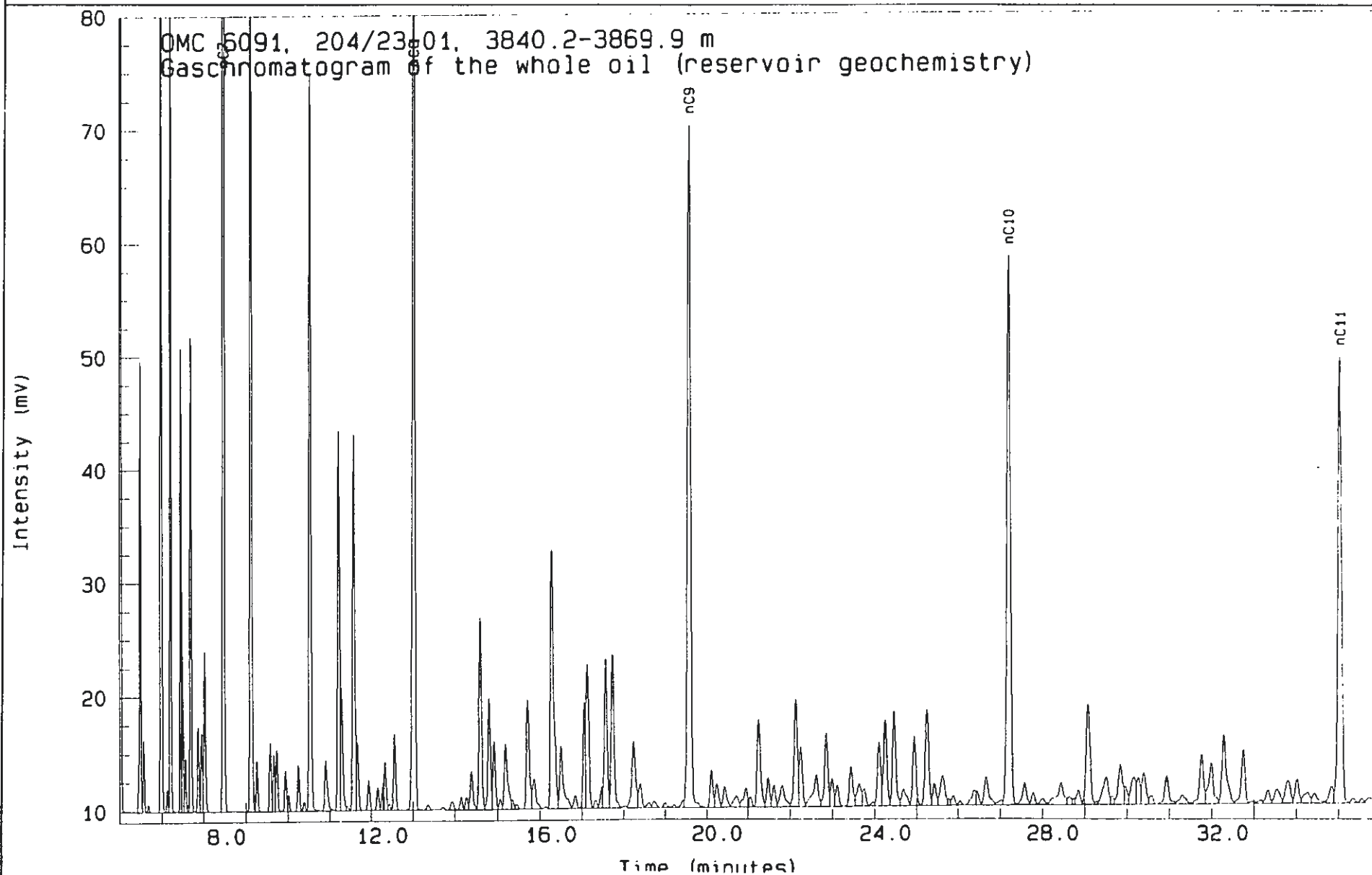
S1660711



Triterpane Fragmentograms of the oil sample from well 204/23-01 (3840.2 m.), United Kingdom



Enlarged part of the whole oil gas chromatogram from
well 204/23-01 (3840.2 m.), United Kingdom



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Data for the enlarged part of the whole oil gas chromatogram from well 204/23-01 (3840.2 m.), United Kingdom

Injection Report

Acquired on 10-FEB-1994 at 07:49

Sample Name : OMC 6091, 204/23-01, 3840.2-3869.9 m
 Sample Id : S166071/1
 Sample Type : Sample Amount=0.00000
 Bottle No : 5

Peak RT mins Hght uV Area uVs Peak

46	13.795	9705	41269
47	13.915	5921	25085
48	14.059	892	3747
49	14.189	5724	32258
50	14.349	844	3543
51	14.453	451	1865
52	14.715	9584	45946
53	14.864	2686	15375
54	15.283	22832	122366
55	15.496	5516	36151
56	15.835	1144	5586
57	16.061	9346	36779
58	16.133	12598	60071
59	16.328	679	3700
60	16.472	1829	6882
61	16.573	13076	61216
62	16.733	13502	66241
63	17.237	5843	38240
64	17.397	2102	10996
65	17.613	455	2903
66	17.747	566	3541
67	17.992	418	2222
68	18.213	268	1335
69	18.429	640	2975
70	18.595	60189	315180 nC9
71	19.112	3309	15949
72	19.240	2102	12394
73	19.437	1836	11623
74	19.736	992	8294
75	19.955	1707	12017
76	20.056	893	4209
77	20.259	7742	44442
78	20.488	2558	13630
79	20.629	1900	9806
80	20.816	1869	15664
81	21.139	9433	53658
82	21.256	5208	26935
83	21.621	2788	25789
84	21.856	6454	35831
85	21.995	2450	13098
86	22.117	1890	10075
87	22.443	3507	20440
88	22.637	1995	14776
89	22.755	1534	8813
90	22.968	350	1865
91	23.109	5625	32276
92	23.261	7557	42041
93	23.469	8352	47794
94	23.683	1448	12137
95	23.947	6137	33482
96	24.251	8406	50021
97	24.421	1960	11431
98	24.621	2649	21536
99	24.763	592	2662
100	24.888	869	5108
101	25.051	371	1801
102	25.387	1346	10246
103	25.451	1245	5859

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
1	3.909	110664	227289	
2	4.208	12367	56996	
3	4.555	988409	11999092	
4	5.488	39688	84115	
5	5.680	711	1443	
6	5.984	87392	190999	
7	6.128	2013	4157	
8	6.205	71719	158671	
9	6.459	40826	88136	
10	6.480	19400	30519	
11	6.568	4719	11318	
12	6.696	41814	96501	
13	6.869	7454	17945	
14	6.952	6947	17439	
15	7.029	14111	41694	
16	7.467	126479	328409	nC7
17	8.117	79124	227043	
18	8.253	4478	13164	
19	8.579	6023	17995	
20	8.667	4965	14600	
21	8.739	5418	16564	
22	8.944	3521	10991	
23	9.013	1397	4136	
24	9.253	4046	12714	
25	9.387	793	2587	
26	9.531	64707	212918	
27	9.904	4436	20527	
28	10.219	33423	112907	
29	10.259	11010	41276	
30	10.424	385	1492	
31	10.581	33120	122446	
32	10.640	6337	22622	
33	10.939	2673	9718	
34	11.157	1948	7373	
35	11.280	2152	4899	
36	11.328	4231	15095	
37	11.429	537	1935	
38	11.555	6689	24987	
39	12.027	82192	328165	nC8
40	12.363	442	2359	
41	12.933	725	3846	
42	13.141	1123	4451	
43	13.269	1118	4634	
44	13.384	3382	15505	
45	13.589	16801	68844	