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GEOCHEMICAL INVESTIGATION OF TWO CUTTING SAMPLES FROM WELL 12/27-1, U.K.

by

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KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM

RIJSWIJK, THE NETHERLANDS

(Shell Research B.V.)

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GEOCHEMICAL INVESTIGATION OF TWO CUTTING SAMPLES FROM WELL 12/27-1, U.K.

1.0 INTRODUCTION

A geochemical investigation has been carried out on the following cutting samples in well 12/27-1:

- 8120 + 8130 + 8140 ft, Devonian
- 8810 + 8820 + 8830 ft, Devonian.

The results are shown in Tables 1-2 and in Figures 1-10.

2.0 RESULTS

The extract/carbon ratios, organic carbon contents and maceral analysis (Fig. 10) indicate that both samples are slightly impregnated source rocks. Earlier reported source rock analysis is listed below:

Sample	SRI (after extraction)	Hydrogen index (Rock Eval)
8120-8140 ft	1800	601
8810-8830 ft	765	584

The extracts of both samples have an immature to nearly mature character (gaschromatograms, Figs. 1 and 3; C_{29} VRE of 0.62-0.65; incomplete (8120 ft) and complete (8810 ft) sterane isomerisation, Figs. 8-9). The absence of rearranged steranes in sample 8120 ft suggests a carbonate source rock, while the presence of rearranged steranes in sample 8810 ft points to a (additional) clay component (Figs. 8-9). The presence of clay minerals in sample 8810 ft could (partly) have caused the higher degree of isomerisation.

Both samples contain SOM of algal origin (sterane/triterpane fragmentograms, Figs. 8-9; maceral descriptions, Fig. 10) but type different (differences in: sterane /triterpane distributions, carbon isotopes, lithology). Heating of sample 8120 ft shows an excellent oil generation capacity.

3.0 CONCLUSIONS

Two Devonian cutting samples at 8120-8140 and 8810-8830 ft are slightly impregnated, algal SOM-source rocks with an excellent oil generation potential. Both extracts type different in that sample 8120-8140 ft is most probably derived from a carbonate and sample 8810-8830 ft from a more shaly source rock.

Table 1 - Geochemical data of extracts

Sample	UK 12/27-1 8120-8140 ft, cuttings original	heated
% ethyl acetate extract	0.5	1.3
% organic carbon after ethyl acetate extraction	1.6	0.7
extract/original carbon (after extraction)	0.32	0.80
% sulphur		
ppm V as metals		
ppm Ni as metals		
pristane/phytane	0.9	1.6
pristane/nC17	0.6	0.6
phytane/nC18	1.0	0.4
C_{15}-distribution		
1-ring	59	75
2-ring	31	21
3-ring	11	4
C_{30}-distribution		
3-ring	19	21
4-ring	58	52
5-ring	23	27
C_{29} VR/E	0.62	-
% saturates*	53	28
% aromatics	12	25
% heterocompounds	35	24
% asphaltenes	0	22.3
$\delta^{13}C$ °/oo (whole extract)	-34.4	-33.8
" (saturates)		-34.5
" (aromatics)	-33.4	-34.1

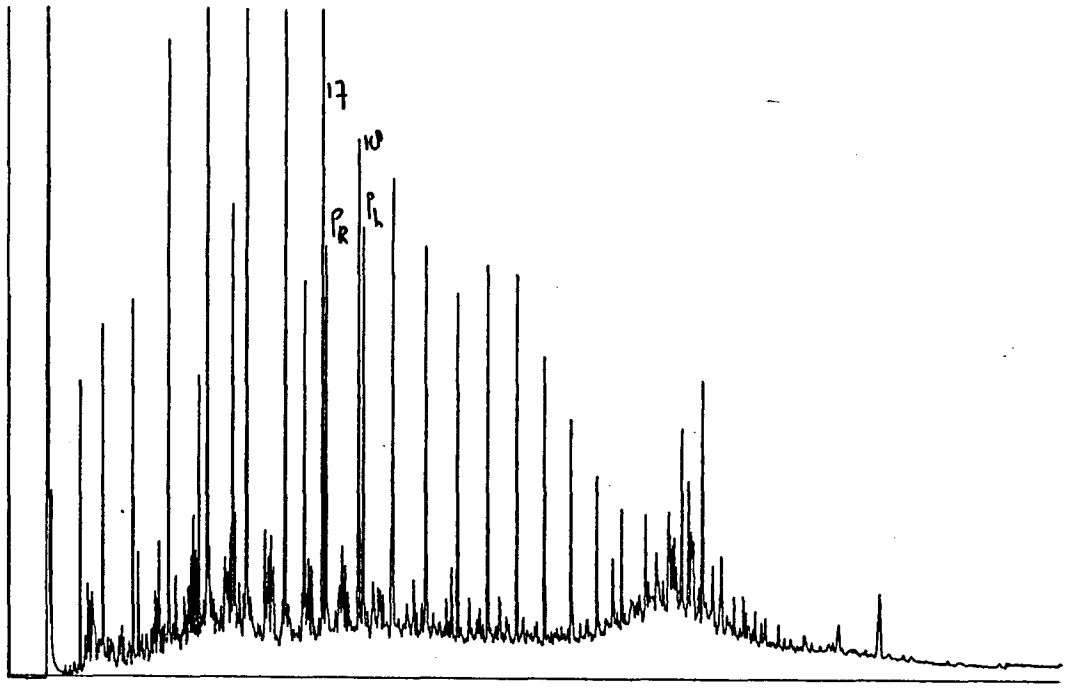
*) Determined by thin-layer-chromatography

Table 2 - Geochemical data of extracts

Sample	UK 12/27-1 8810-8830 ft, cuttings original	heated[1)]
% ethyl acetate extract	0.3	
% organic carbon after ethyl acetate extraction	1.1	
extract/original carbon (after extraction)	0.30	
% sulphur		
ppm V as metals		
ppm Ni as metals		
pristane/phytane	1.0	
pristane/nC17	0.6	
phytane/nC18	1.0	
C_{15}-distribution		
1-ring	58	
2-ring	26	
3-ring	16	
C_{30}-distribution		
3-ring	22	
4-ring	55	
5-ring	22	
C_{29} VR/E	0.65	
% saturates*	53	
% aromatics	15	
% heterocompounds	32	
% asphaltenes	0.1	
$\delta^{13}C$ °/oo (whole extract)	-32.3	
" (saturates)	-32.8	
" (aromatics)	-31.6	

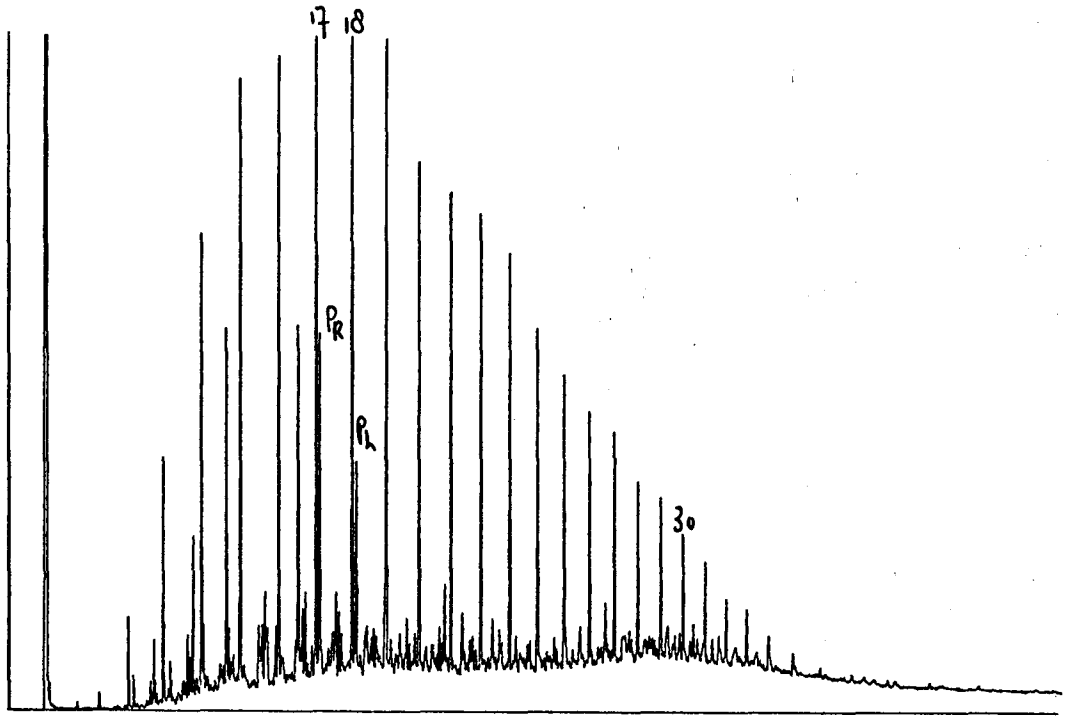
*) Determined by thin-layer-chromatography

1) heating experiment failed, no sample material left



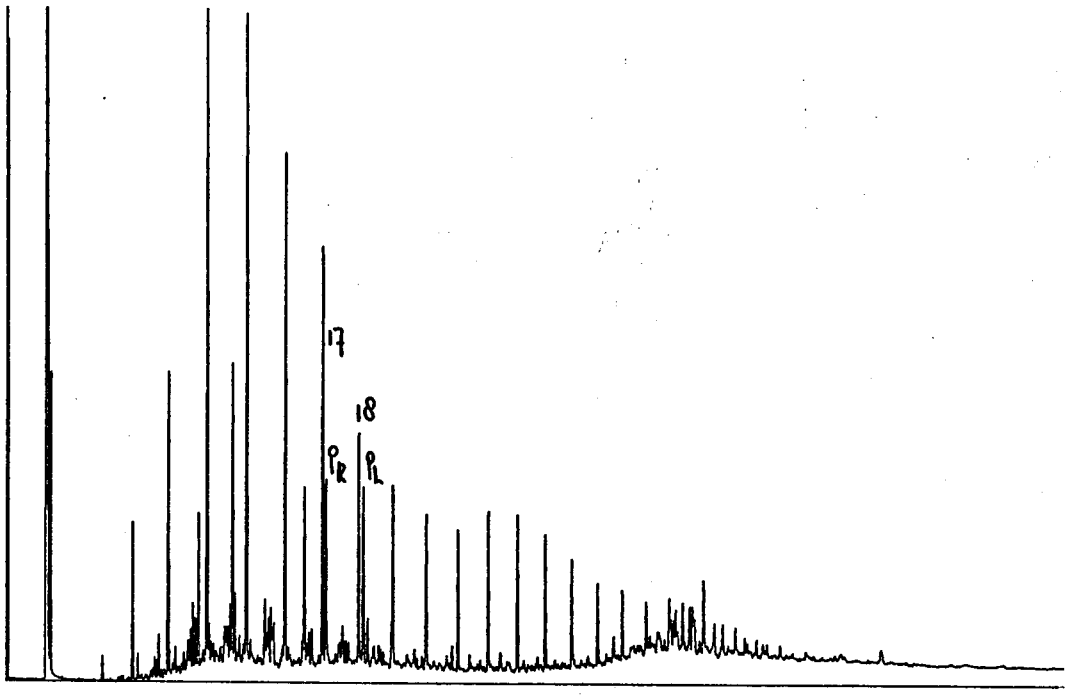
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 1. UNITED KINGDOM 12/27-1 8120-8130-8140 FT



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 2. U.K. 12/27-1 8120-8130-8140 FT heated.



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 3. UNITED KINGDOM 12/27-1 8810+8820+8830M

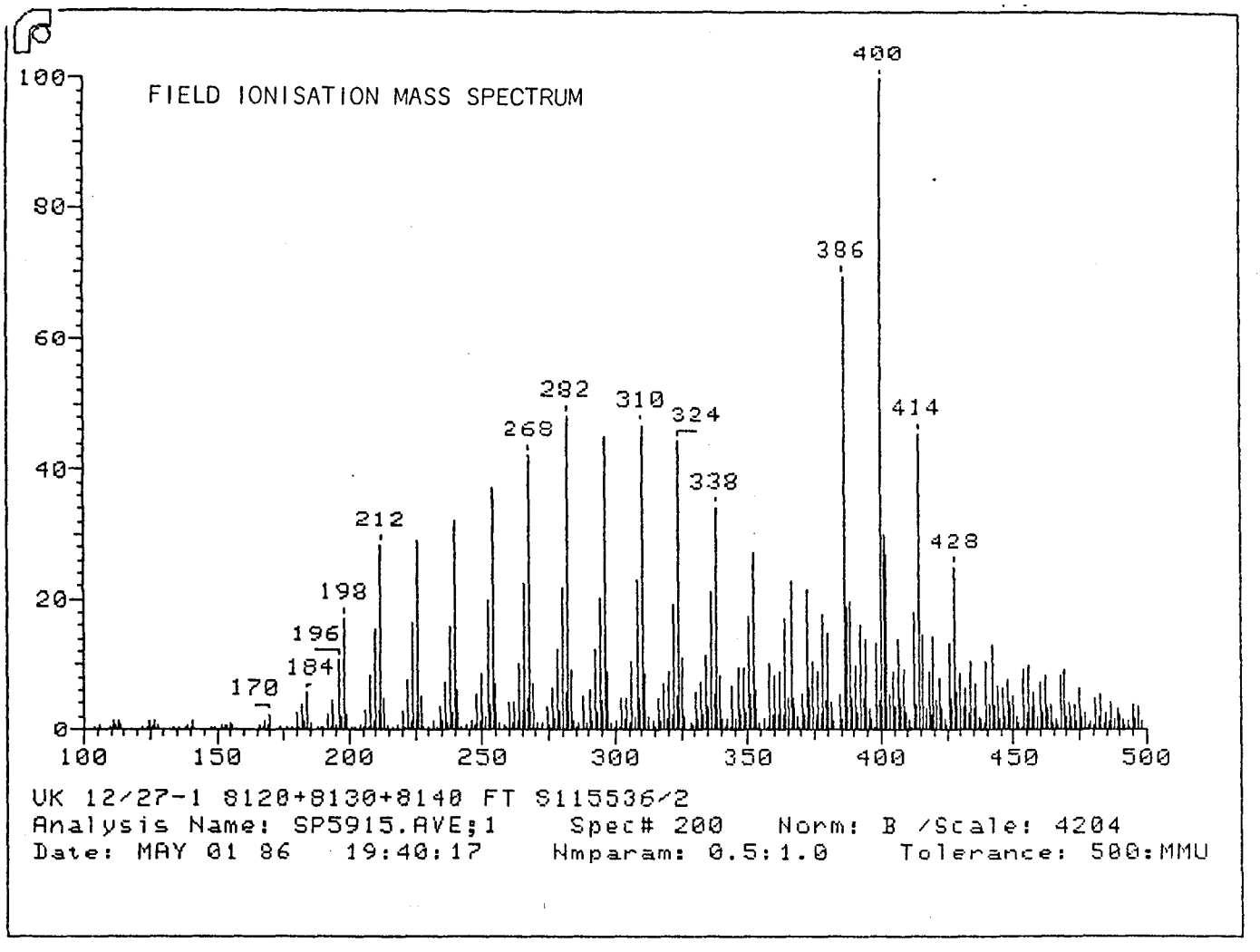

FIELD IONISATION MASS SPECTRUM
100
80
60
40
20
0
100
150
200
250
300
350
400
450
500
400
386
282
310
268
324
414
338
212
428
198
196
184
170
UK 12/27-1 8120+8130+8140 FT S115536/2
Analysis Name: SP5915.AVE;1 Spec# 200 Norm: B /Scale: 4204
Date: MAY 01 86 19:40:17 Nmparam: 0.5:1.0 Tolerance: 500:MMU

FIG. 4.

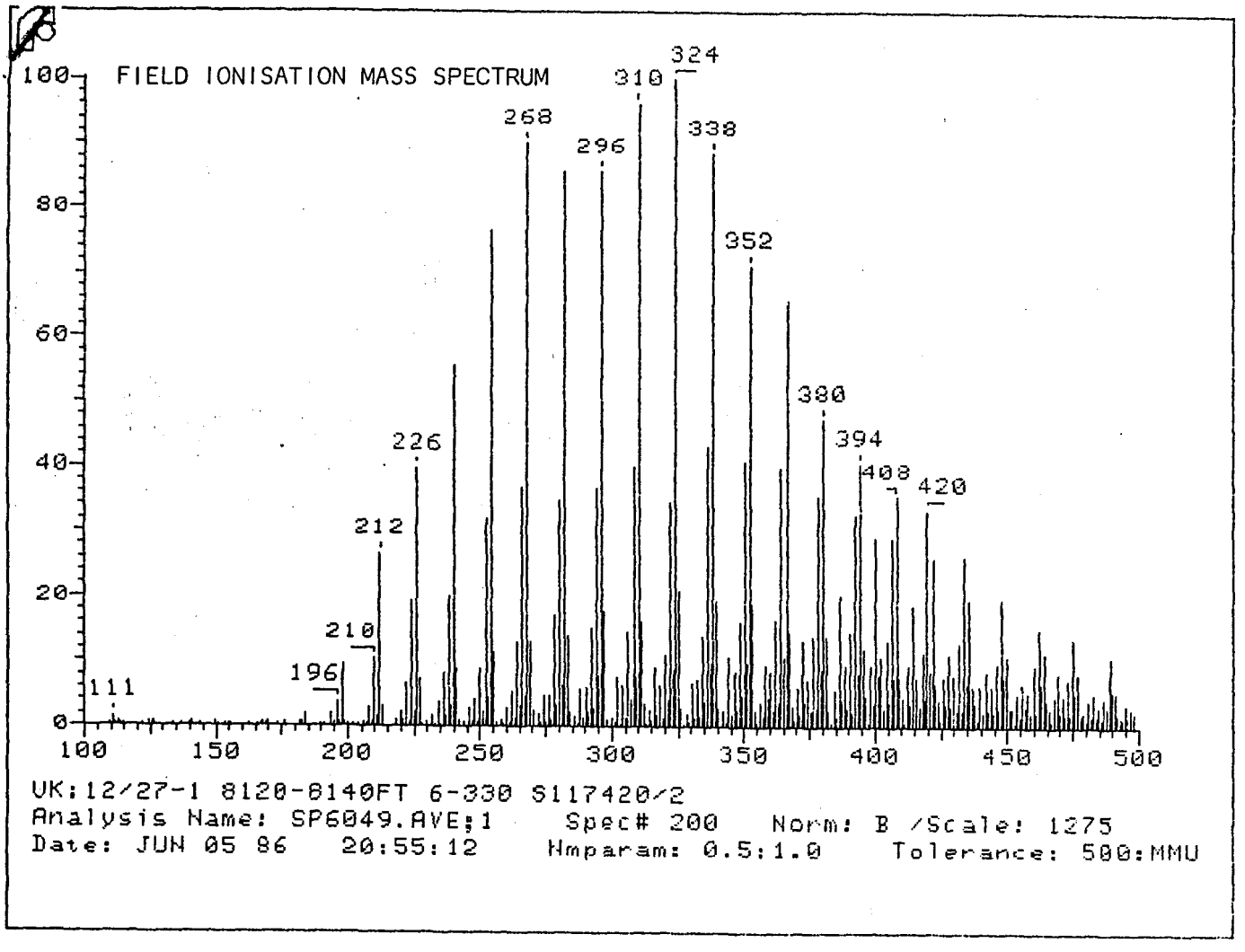

FIELD IONISATION MASS SPECTRUM
100
80
60
40
20
0
111
196
210
212
226
268
296
310
324
338
352
380
394
408
420
100
150
200
250
300
350
400
450
500
UK:12/27-1 8120-8140FT 6-330 S117420/2
Analysis Name: SP6049.AVE;1 Spec# 200 Norm: B /Scale: 1275
Date: JUN 05 86 20:55:12 Hmparam: 0.5:1.0 Tolerance: 500:MMU

FIG. 5.

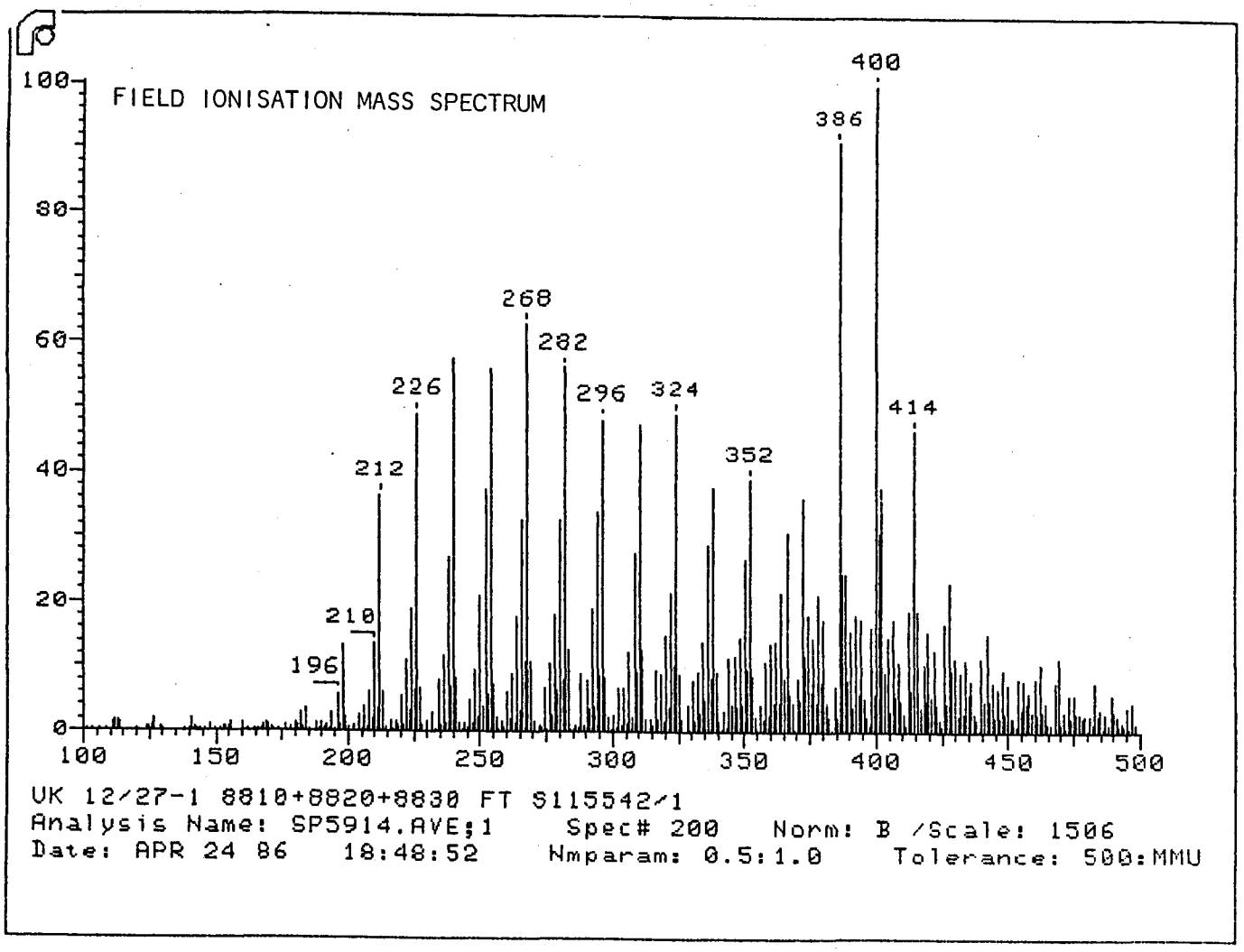


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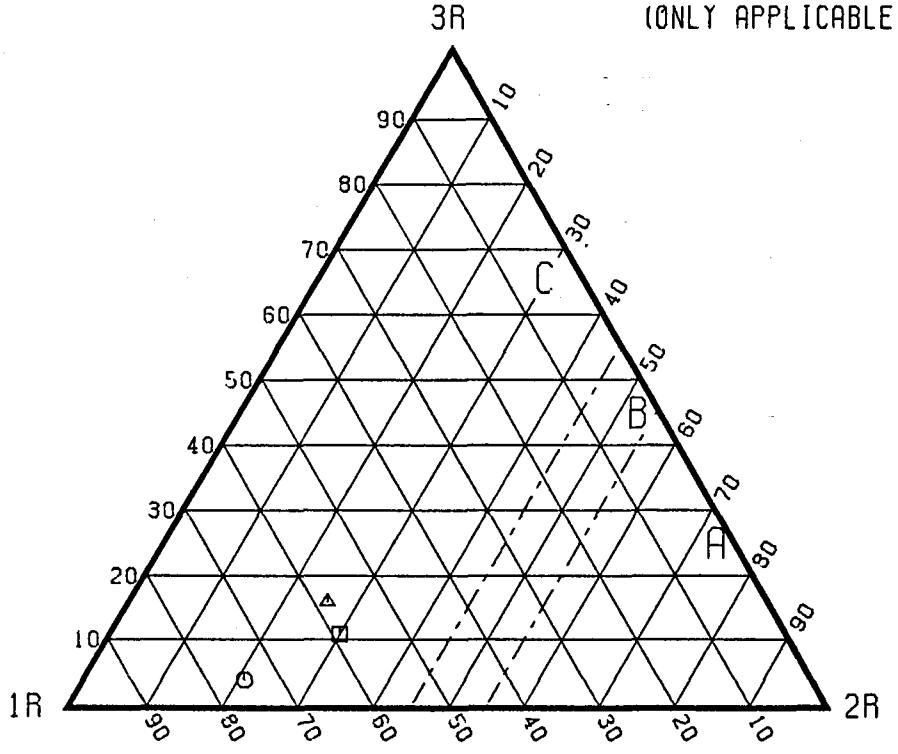
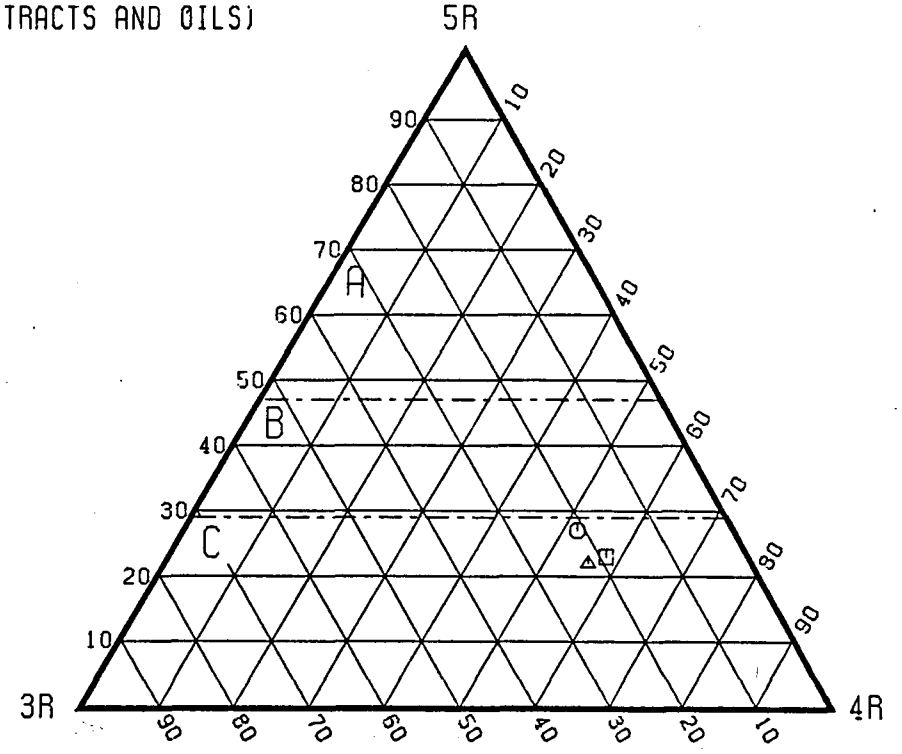
FIG. 6.

C_{15}-RINGDISTRIBUTION

(ONLY APPLICABLE FOR MATURE EXTRACTS AND OILS)



C_{30}-RINGDISTRIBUTION



A. ORGANIC MATTER WITH SUBSTANTIAL LANDPLANT RESIN CONTRIBUTION

B. MIXED LANDPLANT RESIN/SOM OR MIXED ALGAL/SOM

C. STRUCTURELESS ORGANIC MATTER (SOM)

LEGEND
⊡ - 12/27-1, 8120-8140 FT
⊙ - 12/27-1, 8120-8140 FT, HEATED
△ - 12/27-1, 8810-8830 FT

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FIG. 7

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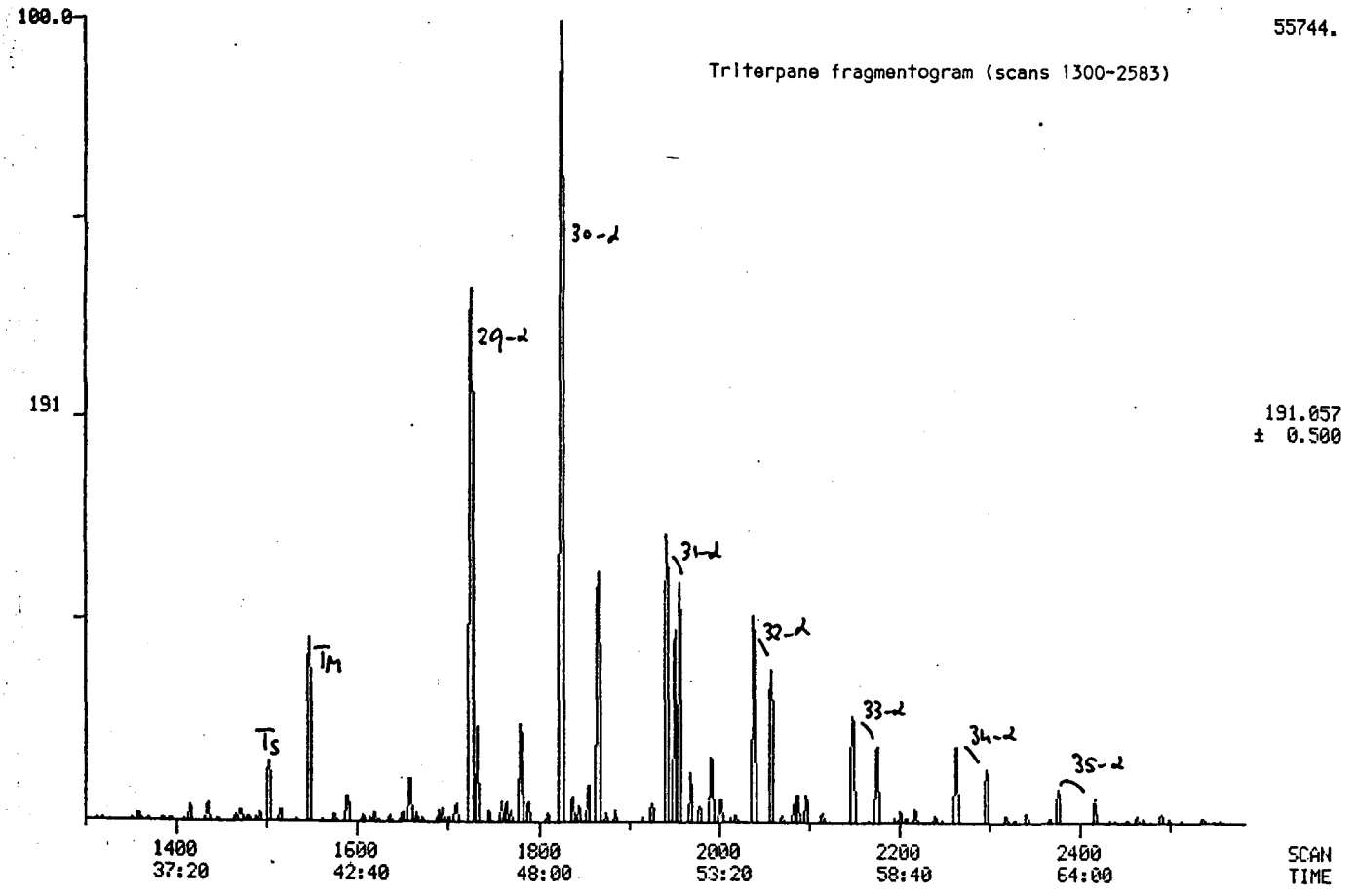

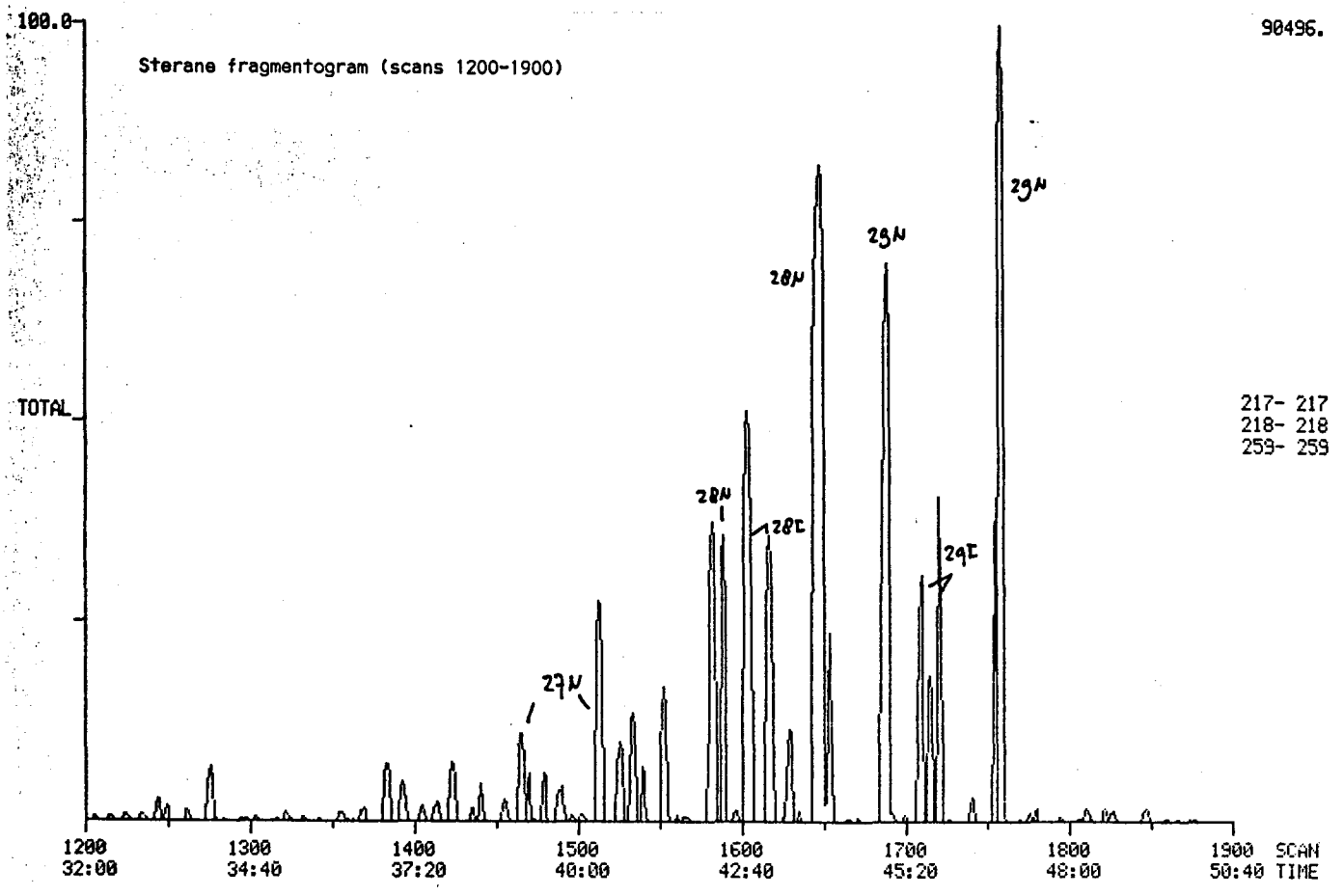

FIG. 8A. GC-MS analysis 12/27-1, 8120-8140 ft, cuttings.

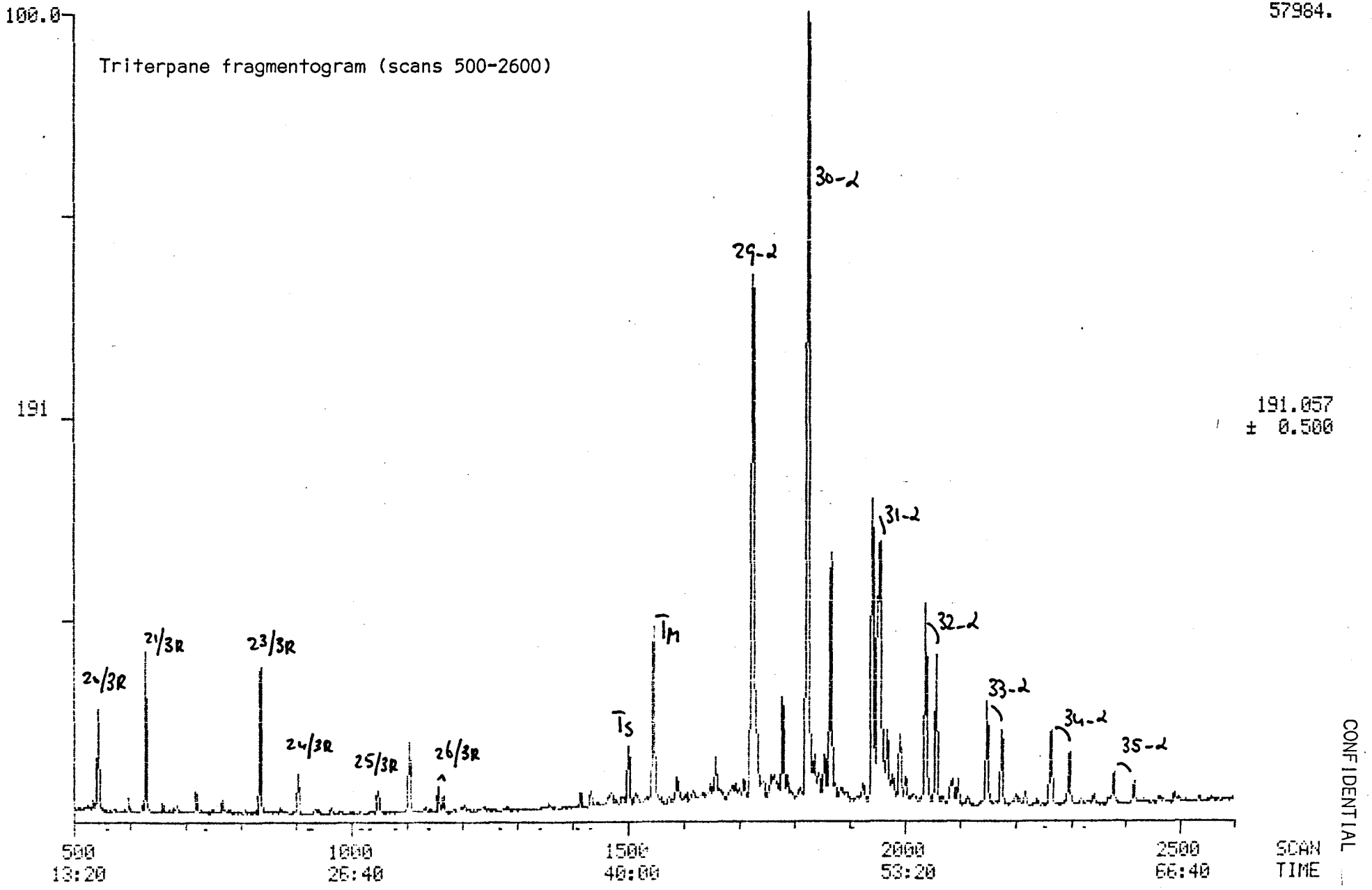

FIG. 8B. GC-MS analysis 12/27-1, 8120-8140 ft, cuttings.

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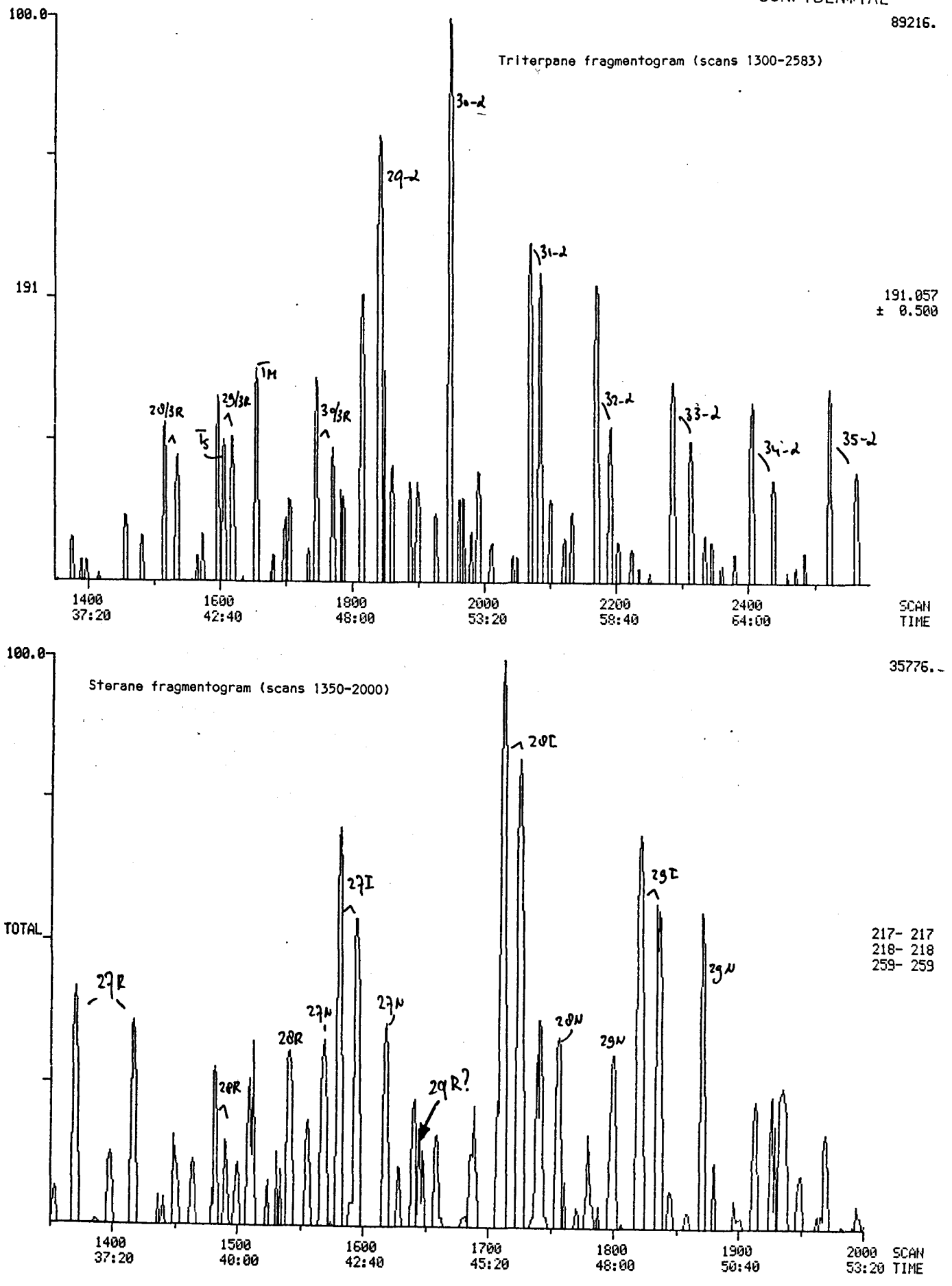

FIG. 9A. GC-MS analysis 12/27-1, 8810-8830 ft, cuttings.

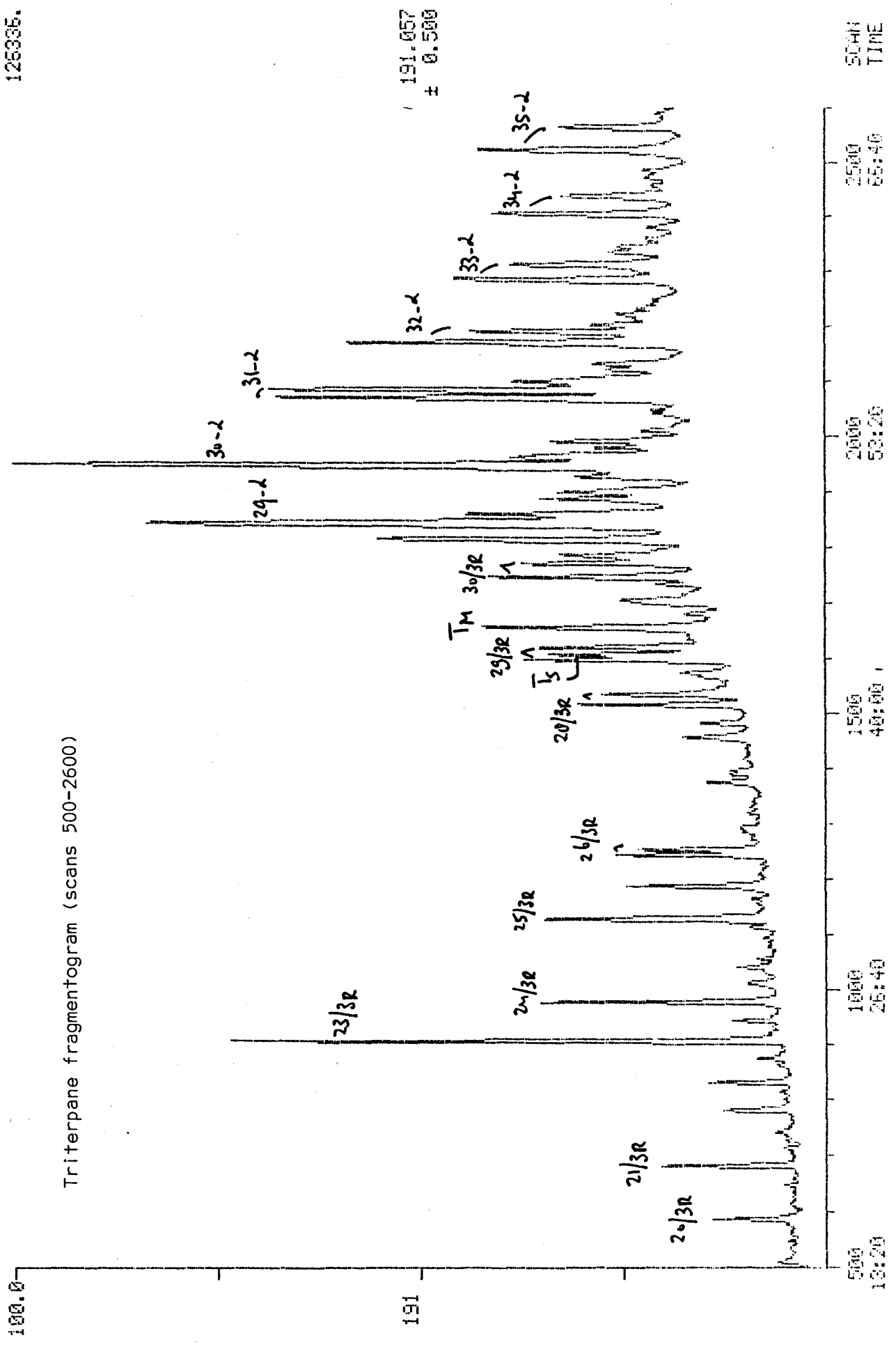

FIG. 9B. GC-MS analysis 12/27-1, 8810-8830 ft, cuttings.

MACERAL DESCRIPTION OF 7 SAMPLES FROM WELL 12/27-1, UNITED KINGDOM

DEPTH IN FT	SAMPLE TYPE	ORGANIC																												INORG.			
		S.O.M.						VITRINITE								LIPTINITE							INERT.										
								VITRINITE-1											ALGAE															
		DENSE S.O.M.	LAYERS OF S.O.M.	LENSES OF S.O.M.	DIFFUSE S.O.M.	INTERGRANULAR S.O.M.	PATCHES OF S.O.M.	LAYERS OF TELOCOLLINITE	LENSES OF TELOCOLLINITE	DETRITAL TELOCOLLINITE	LAYERS OF TELINITE	LENSES OF TELINITE	DETRITAL TELINITE	LAYERS OF VITRINITE-2	LENSES OF VITRINITE-2	DETRITAL VITRINITE-2	SPORINITE	CUTINITE	RESINITE	LIPTODETRINITE	BOTRYOCOCCUS	TASMANITES	OTHER ALGAE	MICROPLANKTON	EXSUDATINITE	SCLEROTINITE	FUSINITE	MACRINITE	MICRINITE	UNDEFINED MINERALS	FRAMBOIDAL PYRITE	AGGREGATES OF PYRITE	CRYSTALS OF PYRITE
8120.0	CTGS			/	+	+													+		+		/					*			/
8220.0	CTGS			-	/	/													+		+		/					*	-		/
8360.0	CTGS			/	+	+											-		+		+		/					*	-		+
8720.0	CTGS			-	/	/													/		+		/					*			+
8810.0	CTGS			/	/	/											-		+		+		-					*	-		+
9140.0	CTGS			/	/	/													+		+		/					*	-		+
9340.0	CTGS			/	+	+													+		+		/					*	-		+

LEGEND	
*	: ABUNDANT
+	: COMMON
/	: FEW
-	: RARE

8120.0 F : LAMINATED S.O.M. PROBABLY OF ALGAL ORIGIN
OTHER ALGAE GRADING INTO LAMINATED S.O.M.
FEW SOLID HYDROCARBONS
RARE/FEW RESERVOIR PARTICLES + (SOLID)HYDROCARBONS

8220.0 F : LAMINATED S.O.M. PROBABLY OF ALGAL ORIGIN
OTHER ALGAE GRADING INTO LAMINATED S.O.M.
RARE SOLID HYDROCARBONS

8360.0 F : LAMINATED S.O.M. PROBABLY OF ALGAL ORIGIN
OTHER ALGAE GRADING INTO LAMINATED S.O.M.
RARE SOLID HYDROCARBONS

8720.0 F : OTHER ALGAE GRADING INTO LAMINATED S.O.M.
RARE FLUID INCLUSIONS
SOME BIT-METAMORPHISM (BAKED CUTTINGS)

8810.0 F : LAMINATED S.O.M. PROBABLY OF ALGAL ORIGIN
OTHER ALGAE GRADING INTO LAMINATED S.O.M.
RARE SOLID HYDROCARBONS
SOME BIT-METAMORPHISM (BAKED CUTTINGS)

9140.0 F : LAMINATED S.O.M. PROBABLY OF ALGAL ORIGIN
OTHER ALGAE GRADING INTO LAMINATED S.O.M.
SAMPLE PARTLY OXIDISED
RARE SOLID HYDROCARBONS
SOME BIT-METAMORPHISM (BAKED CUTTINGS)

9340.0 F : LAMINATED S.O.M. PROBABLY OF ALGAL ORIGIN
OTHER ALGAE GRADING INTO LAMINATED S.O.M.
RARE SOLID HYDROCARBONS
SAMPLE PARTLY OXIDISED
SOME BIT-METAMORPHISM (BAKED CUTTINGS)

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MACERAL DESCRIPTION
VISUAL VOLUME PERCENTAGE ESTIMATION

Country UK
Well/Location 12/27-1

sample nr. depth (ft/m)	ORGANIC																													INORG.		
	S.O.M.						VITRINITE									LIPTINITE									INERT.								
							VITRINITE-1													ALGAE													
	DENSE S.O.M.	LAYERS OF S.O.M.	LENSES OF S.O.M.	DIFFUSE S.O.M.	INTERGRANULAR S.O.M.	PATCHES OF S.O.M.	LAYERS OF TELOCOLLINITE	LENSES OF TELOCOLLINITE	DETRITAL TELOCOLLINITE	LAYERS OF TELINITE	LENSES OF TELINITE	DETRITAL TELINITE	LAYERS OF VITRINITE-2	LENSES OF VITRINITE-2	DETRITAL VITRINITE-2	SPORINITE	CUTINITE	RESINITE	LIPTODETRINITE	BOTRYOCOCCUS	TASMANITES	OTHER ALGAE	MICROPLANKTON	EXSUDATINITE	SCLEROTINITE	FUSINITE	MACRINITE	MICRINITE	UNDEFINED MINERALS	FRAMBOIDAL PYRITE	AGGREGATES OF PYRITE	CRYSTALS OF PYRITE
8120.0			2	3															5			5							83	<1	2
8220.0			<1	2															5			5							86	<1	2
8360.0			1	3												<1			5			5							83	<1	3
8720.0			<1	2															2			3							90		3
8810.0			1	2												<1			5			5							84	<1	3
9140.0			1	2															5			5							83	<1	4
9340.0			2	3															3			5							84	<1	3

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FIG. 10C.

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