

U-542

3

April 1988

RKER.88.072

GEOCHEMICAL INVESTIGATION OF THREE SOURCE ROCK  
EXTRACTS FROM WELL 6508/5-1, NORWAY

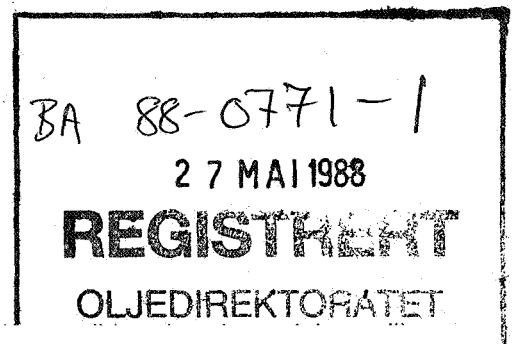
by

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Sponsor: Shell Risavika EP

Code: 774.106.10

Investigation: 812204531



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KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM

RIJSWIJK, THE NETHERLANDS

(Shell Research B.V.)

TABLE 1 - GEOCHEMICAL DATA OF EXTRACTS

Sample:	Norway, 6508/5-1 1614-1647 m		
	original	heated	
% ethyl acetate extract	0.37	1.69	
% organic carbon after ethyl acetate extraction	8.37	6.86	
% extract/original carbon (after extraction)	0.04	0.20	$\frac{\text{Ekst.}}{(\text{ToC} - \text{Ekst.})} \cdot 100$
% sulphur	-	4.2	
ppm V as metals	-	104	
ppm Ni as metals	-	50	
pristane/phytane	0.6	1.6	
pristane/nC17	0.9	0.7	
phytane/nC18	1.5	0.5	
C <sub>15</sub> distribution			
1-ring	21	70	
2-ring	47	19	
3-ring	32	12	
C <sub>30</sub> distribution			
3-ring	7	23	
4-ring	27	44	
5-ring	66	34	
C <sub>29</sub> VR/E	0.62	-	
% saturates *	14	6	
% aromatics	13	47	
% heterocompounds	63	44	
% rest (high molecular)	9.6	2.9	
$\delta^{13}\text{C}^{\text{o}}$ /‰ (whole extract)	-28.1	-27.0	
" (saturates)	NEM	-29.2	
" (aromatics)	-28.3	-27.9	

\*) Determined by thin-layer chromatography  
 ND = not detectable

TABLE 2 - GEOCHEMICAL DATA OF EXTRACTS

Sample:	Norway, 6508/5-1 1695-1710 m	
	original	heated
% ethyl acetate extract	0.12	0.42
% organic carbon after ethyl acetate extraction	3.0	2.52
% extract/original carbon (after extraction)	0.04	0.14
% sulphur	-	-
ppm V as metals	-	-
ppm Ni as metals	-	-
pristane/phytane	0.9	1.7
pristane/nC17	0.7	0.5
phytane/nC18	0.7	0.3
C <sub>15</sub> distribution		
1-ring	69	70
2-ring	24	18
3-ring	7	12
C <sub>30</sub> distribution		
3-ring	25	24
4-ring	28	53
5-ring	47	23
C <sub>29</sub> VR/E	0.78	-
% saturates *	20	10
% aromatics	18	37
% heterocompounds	55	49
% rest (high molecular)	6.8	3.9
$\delta^{13}\text{C}^{\text{O}}$ /‰ (whole extract)	-28.2	-27.5
" (saturates)	NEM	-29.0
" (aromatics)	-28.6	-28.3

\*) Determined by thin-layer chromatography

ND = not detectable

TABLE 3 - GEOCHEMICAL DATA OF EXTRACTS

Sample:	Norway, 6508/5-1 2217-2226 m	
	original	heated
% ethyl acetate extract	0.11	1.7
% organic carbon after ethyl acetate extraction	29.73	33.4
% extract/original carbon (after extraction)	0.004	0.06
% sulphur	0.3	-
ppm V as metals	4	-
ppm Ni as metals	7	-
pristane/phytane	2.3	3.2
pristane/nC17	1.7	1.1
phytane/nC18	0.7	0.3
C <sub>15</sub> distribution		
1-ring	ND	39
2-ring		37
3-ring		24
C <sub>30</sub> distribution		
3-ring	8	17
4-ring	20	31
5-ring	72	52
C <sub>29</sub> VR/E	0.63	-
% saturates*	9	9
% aromatics	20	31
% heterocompounds	61	56
% rest (high molecular)	9.1	3.6
$\delta^{13}\text{C}^{\text{O}}/\text{oo}$ (whole extract)	-29.3	-27.9
" (saturates)	NEM	-31.0 ( $\pm$ 0.3)
" (aromatics)	-29.8	-28.7

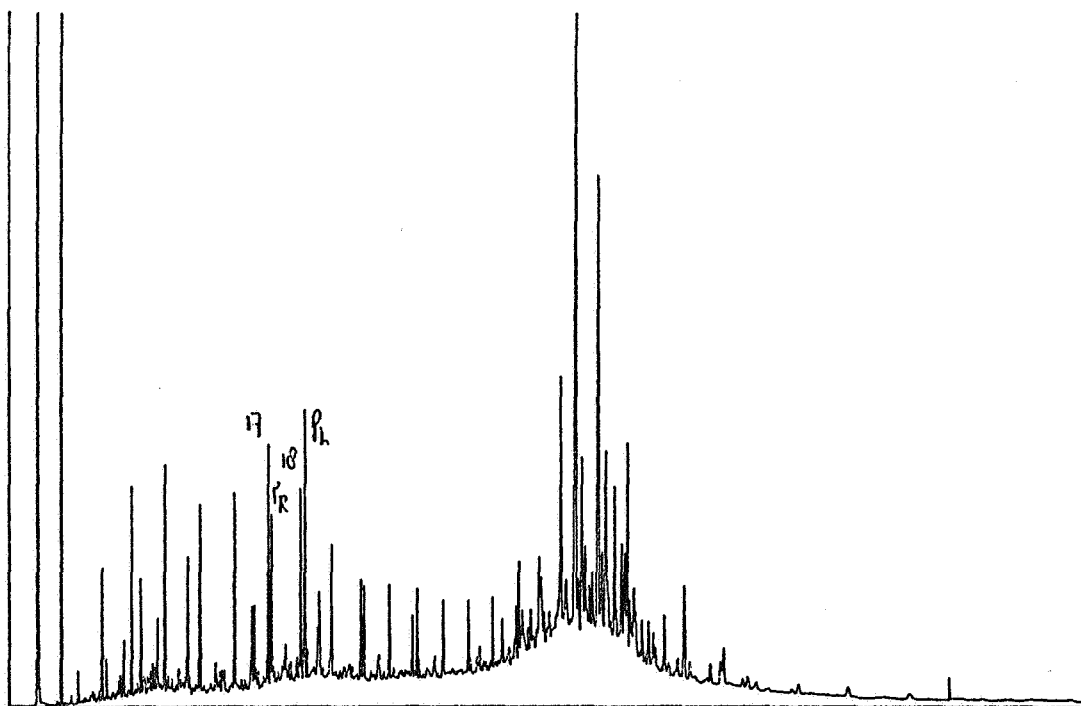
\*) Determined by thin-layer chromatography

ND = not detectable

TABLE 4 STERANE AND TRITERPANE DATA

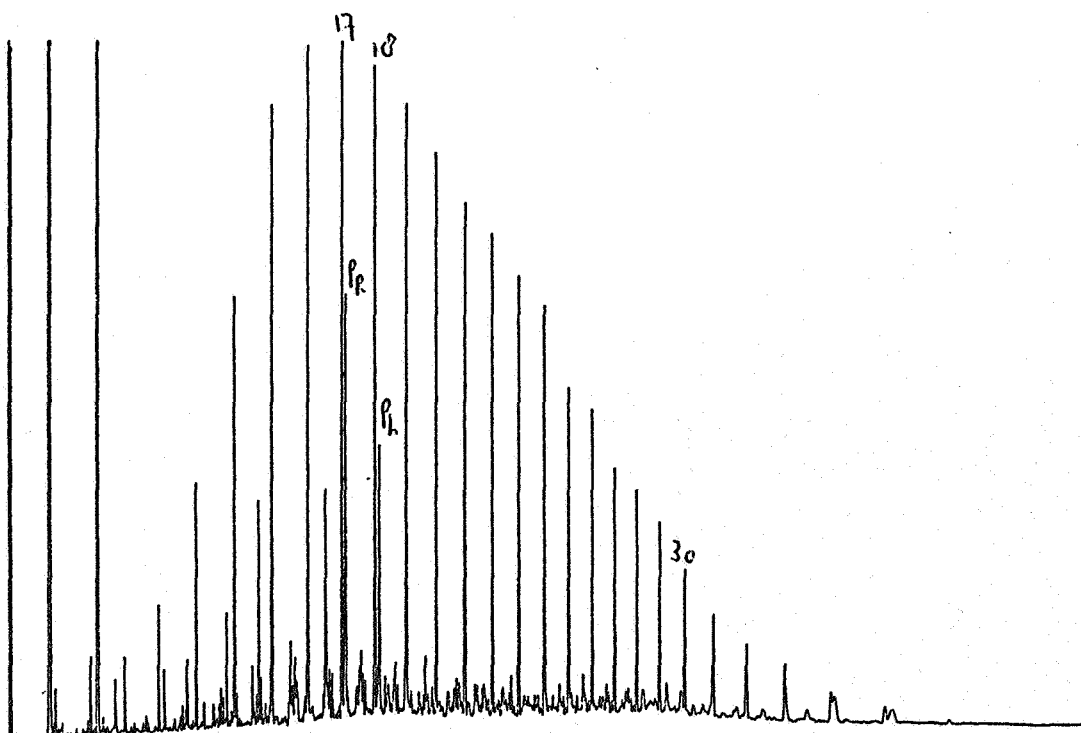
	6508/5-1 1614-1647 m		6508/5-1 1695-1710 m		6805/5-1 2217-2226 m	
	original	heated	original	heated	original	heated
Sterane/triterpane diagram						
% iso-steranes*	ND	ND	35	26	ND	31
% rearranged-steranes*			39	44		24
% triterpanes			25	30		46
Sterane diagram						
% iso-steranes	ND	ND	34 ( 94 ppm)	32 ( 5 ppm)	ND	44 ( 10 ppm)
% rearranged-steranes			26 ( 71 ppm)	36 ( 6 ppm)		23 ( 5 ppm)
% normal-steranes			40 ( 112 ppm)	32 ( 5 ppm)		34 ( 8 ppm)
Sterane carbon number diagram						
% C-27	ND	ND	35 ( 98 ppm)	52 ( 9 ppm)	ND	20 ( 4 ppm)
% C-28			33 ( 91 ppm)	33 ( 6 ppm)		27 ( 6 ppm)
% C-29			32 ( 87 ppm)	15 ( 2 ppm)		54 ( 12 ppm)
C-29 Sterane ratios						
20S/20S + 20R	ND	ND	0.21	0.56	ND	0.68
iso/iso + normal	ND	ND	0.36	0.50	ND	0.43
Tricyclics/tricyclics + pentacyclics	ND	ND	0.23	0.47	ND	0.13

\* Recalculated



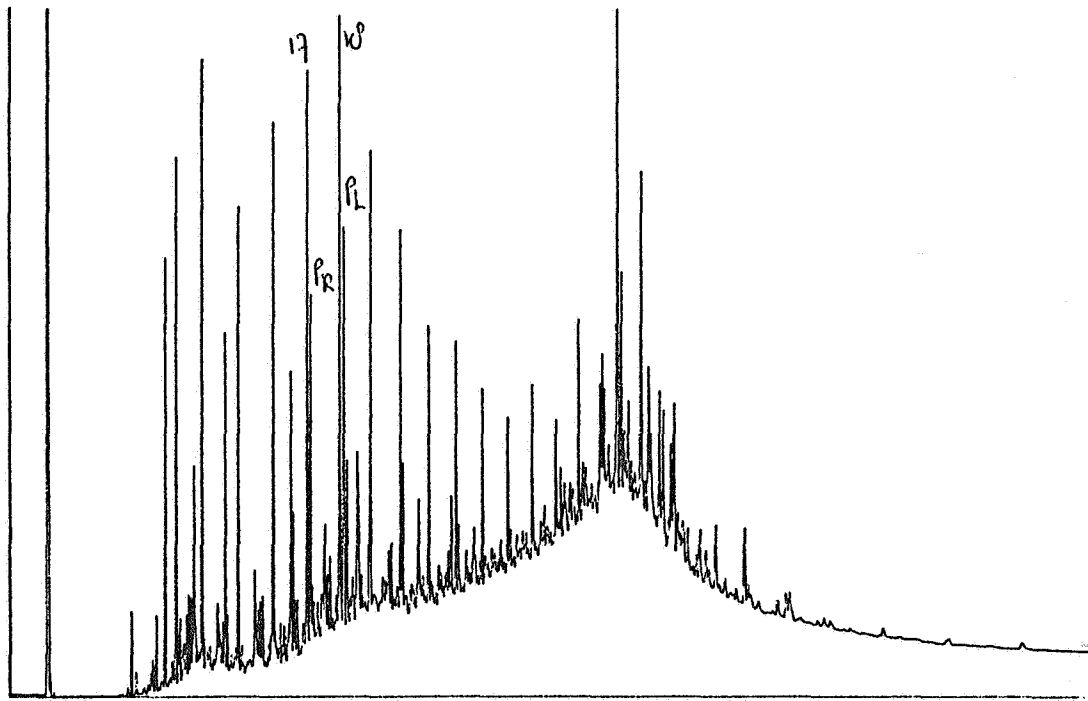
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 1, NORWAY 6508/5-1 , 1614-1647 m



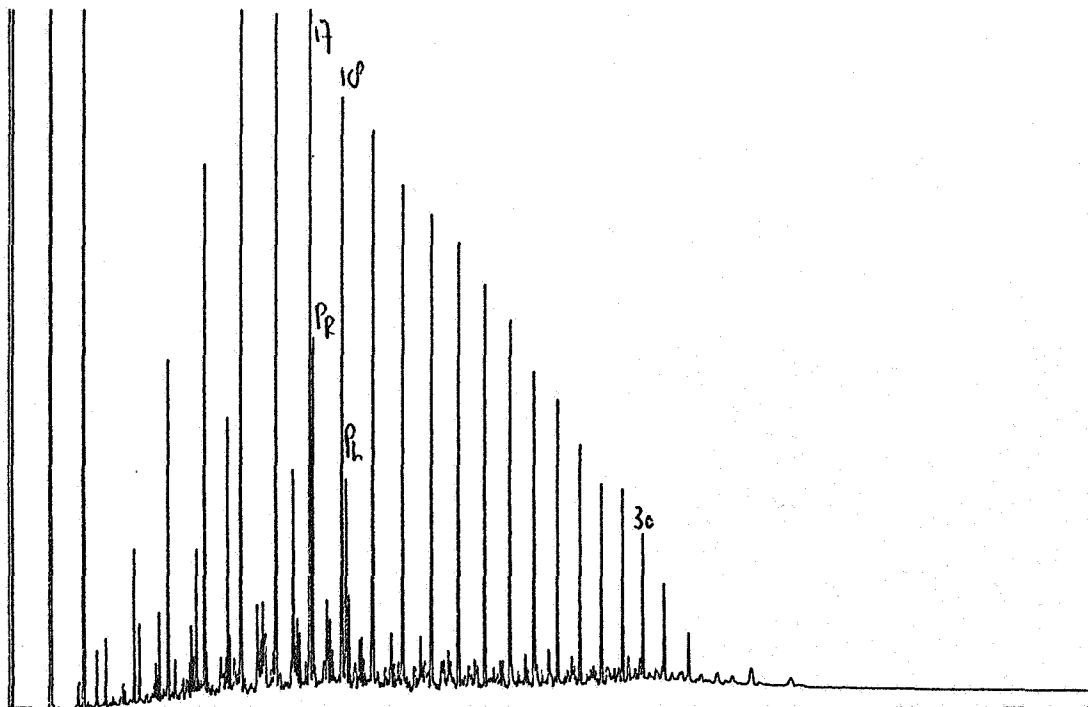
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 2, NORWAY 6508/5-1 , 1614-1647 m, heated sample.



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

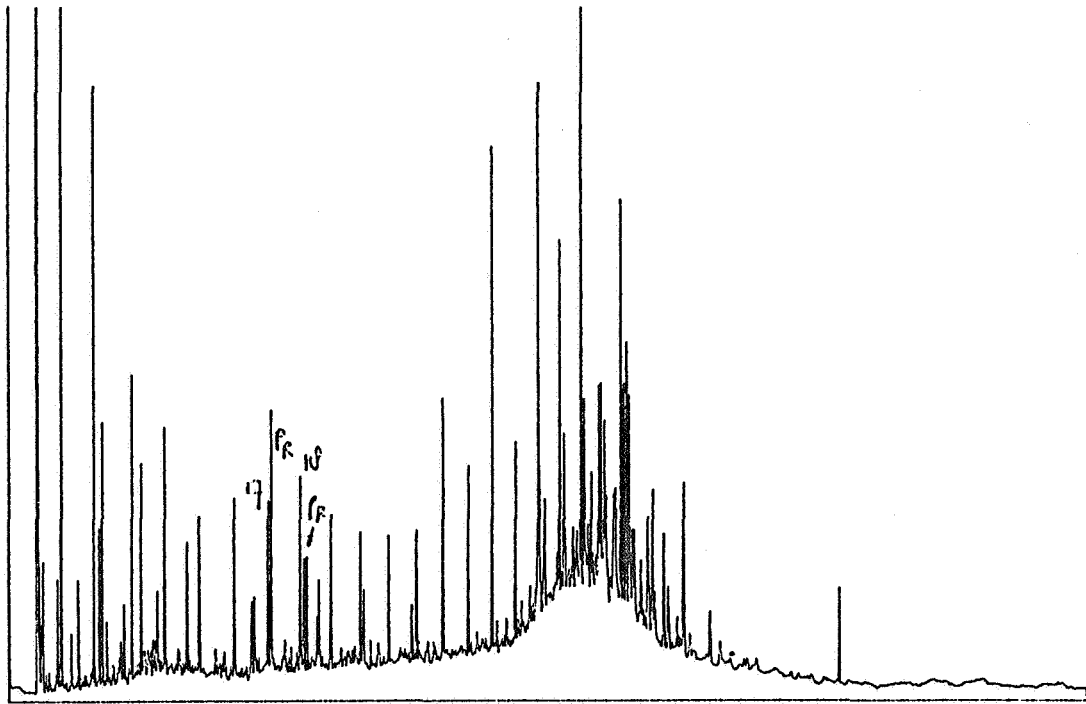
FIG. 3, NORWAY 6508/5-1, 1695-1710 m.



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

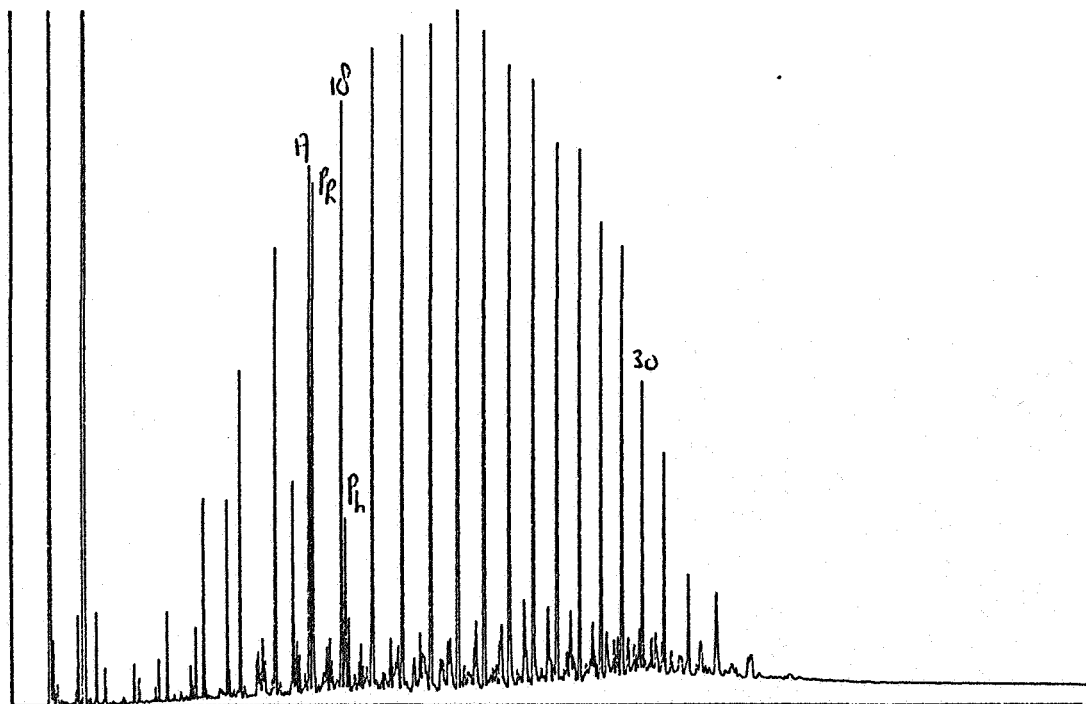
FIG. 4, NORWAY 6508/5-1, 1695-1710 m, heated sample,

RKER 88.072



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 5, NORWAY 6508/5-1 , 2217-2226 m.



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 6, NORWAY 6508/5-1, 2217-2226 m, heated sample.



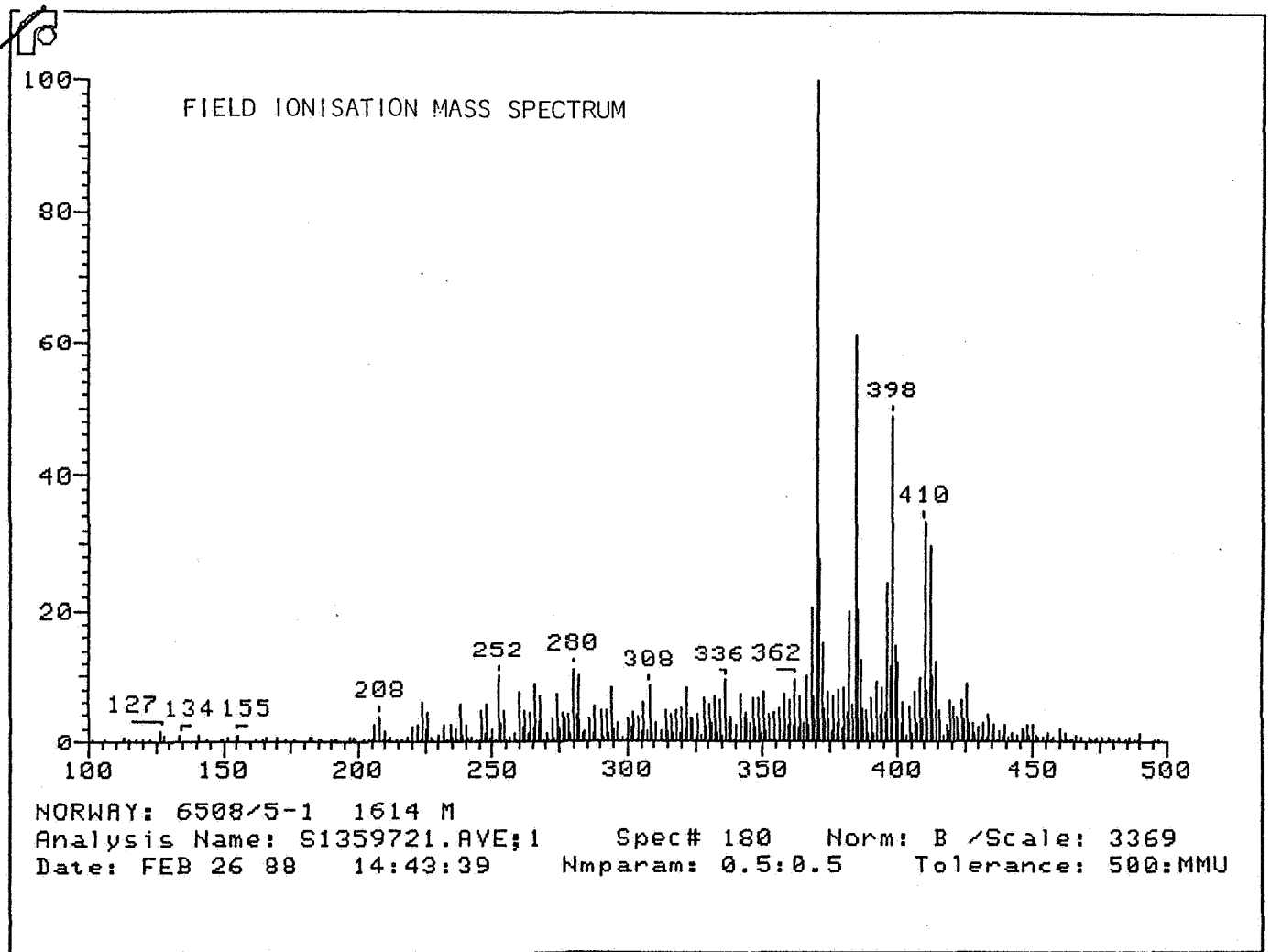


FIG. 7.

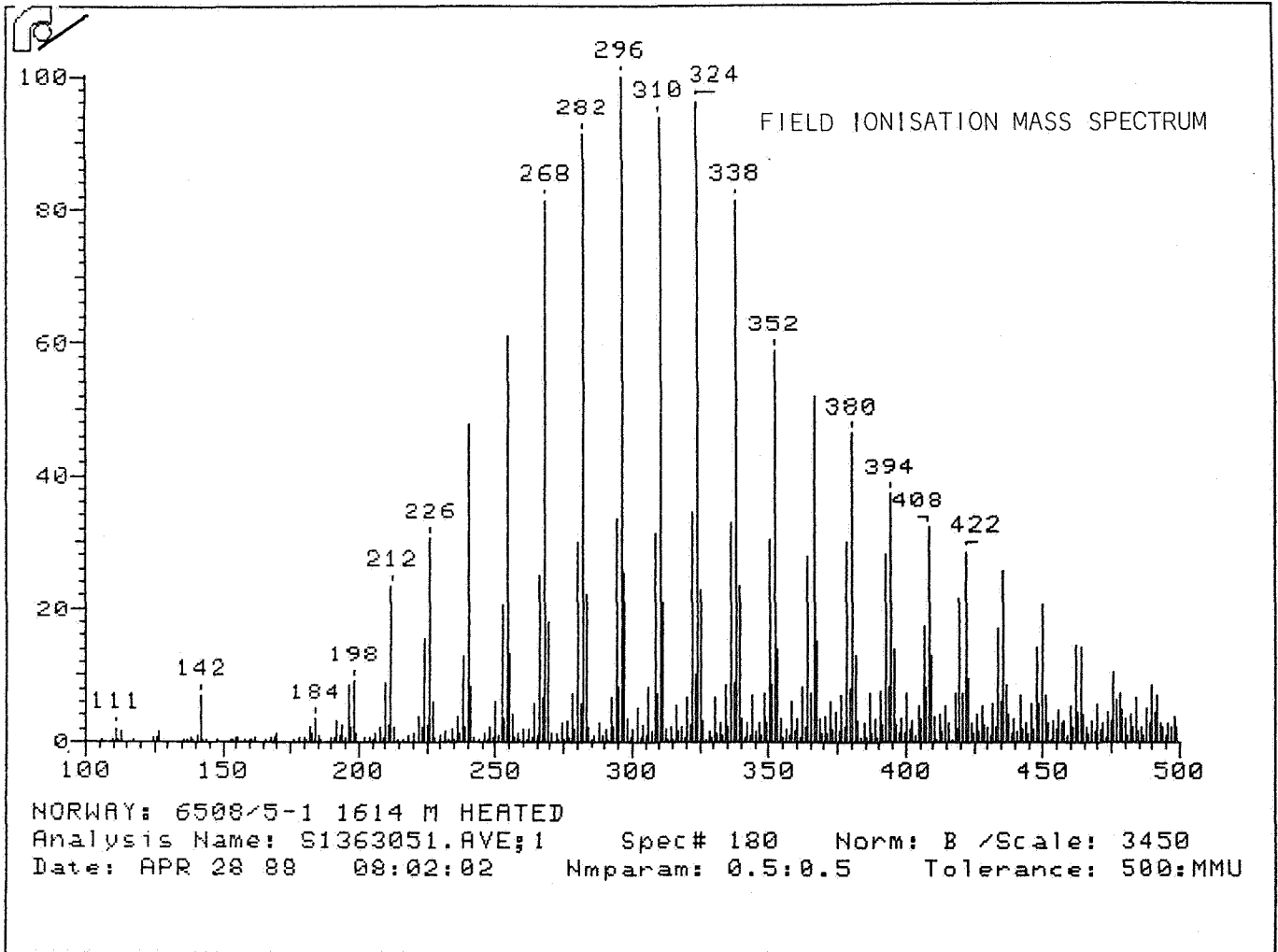


FIG. 8

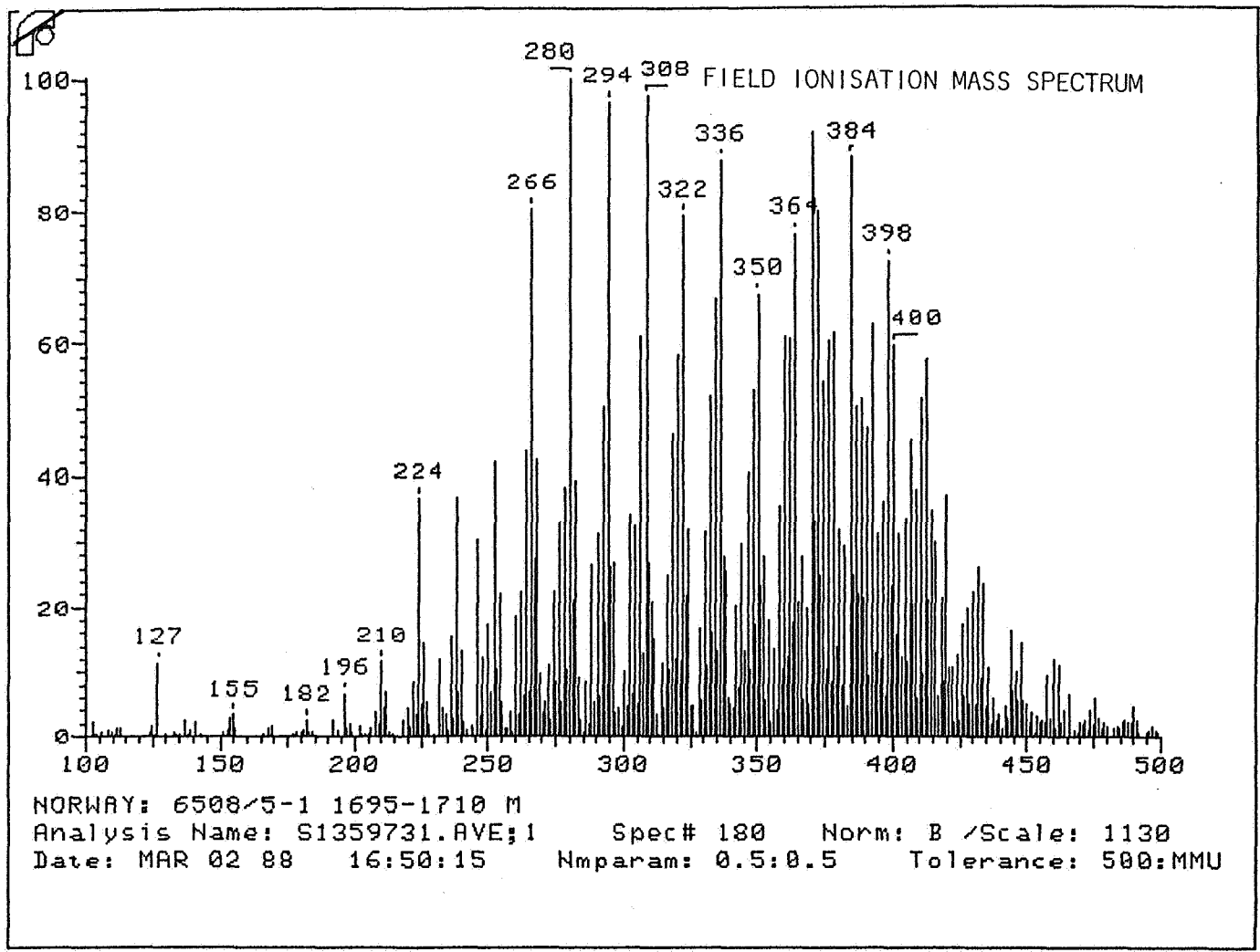


FIG. 9.

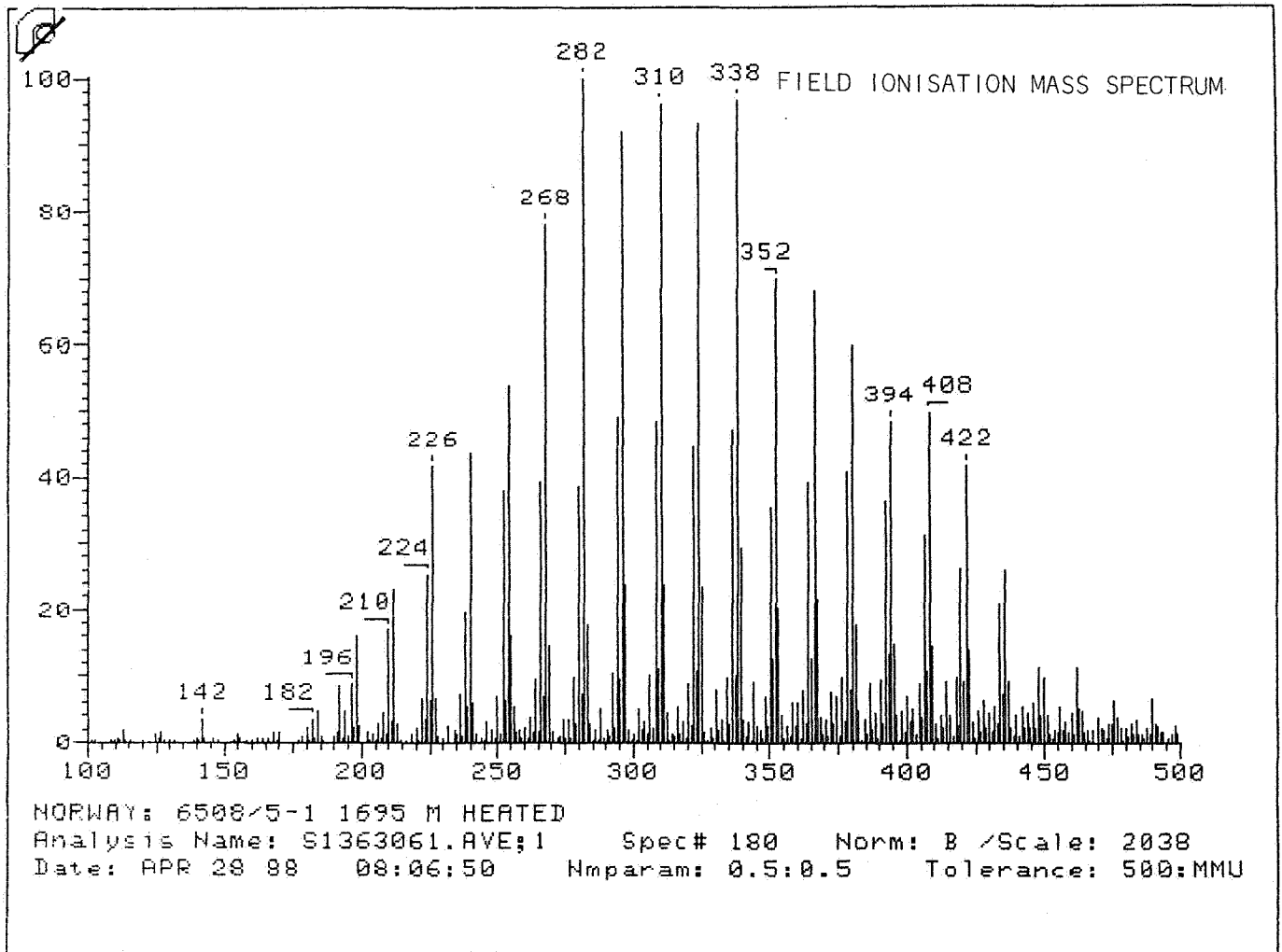


FIG. 10.

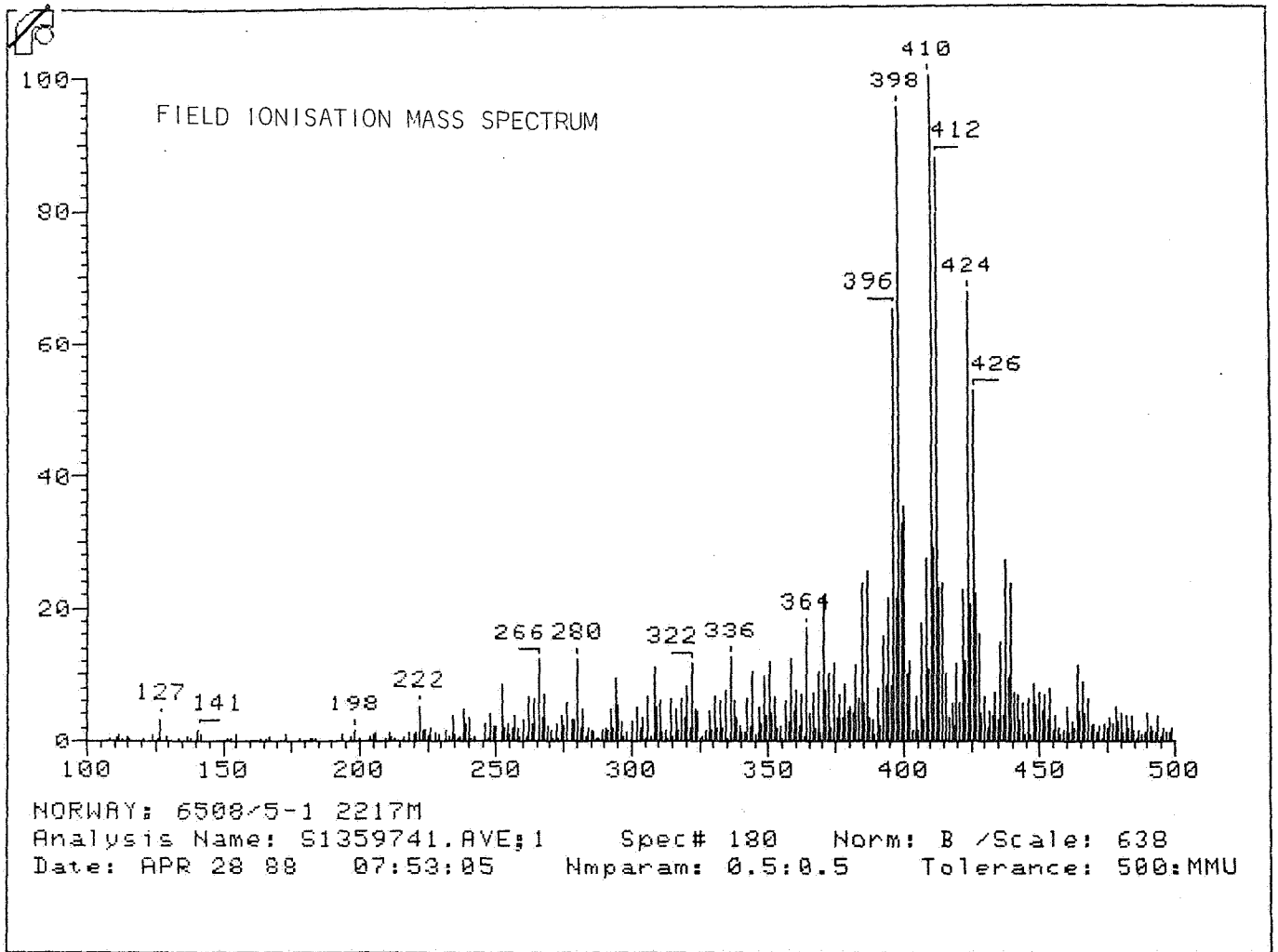


FIG. 11.

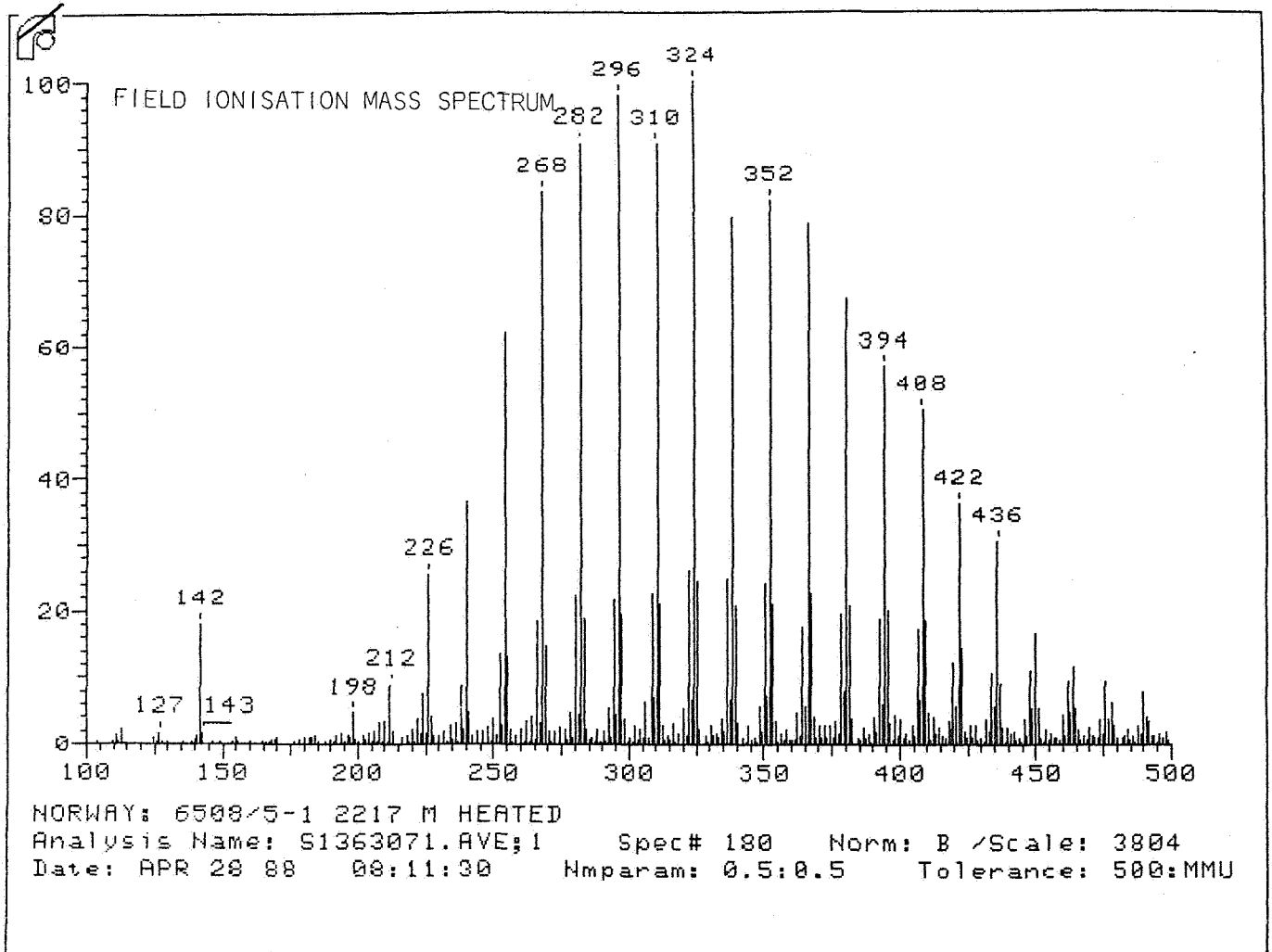


FIG. 12.

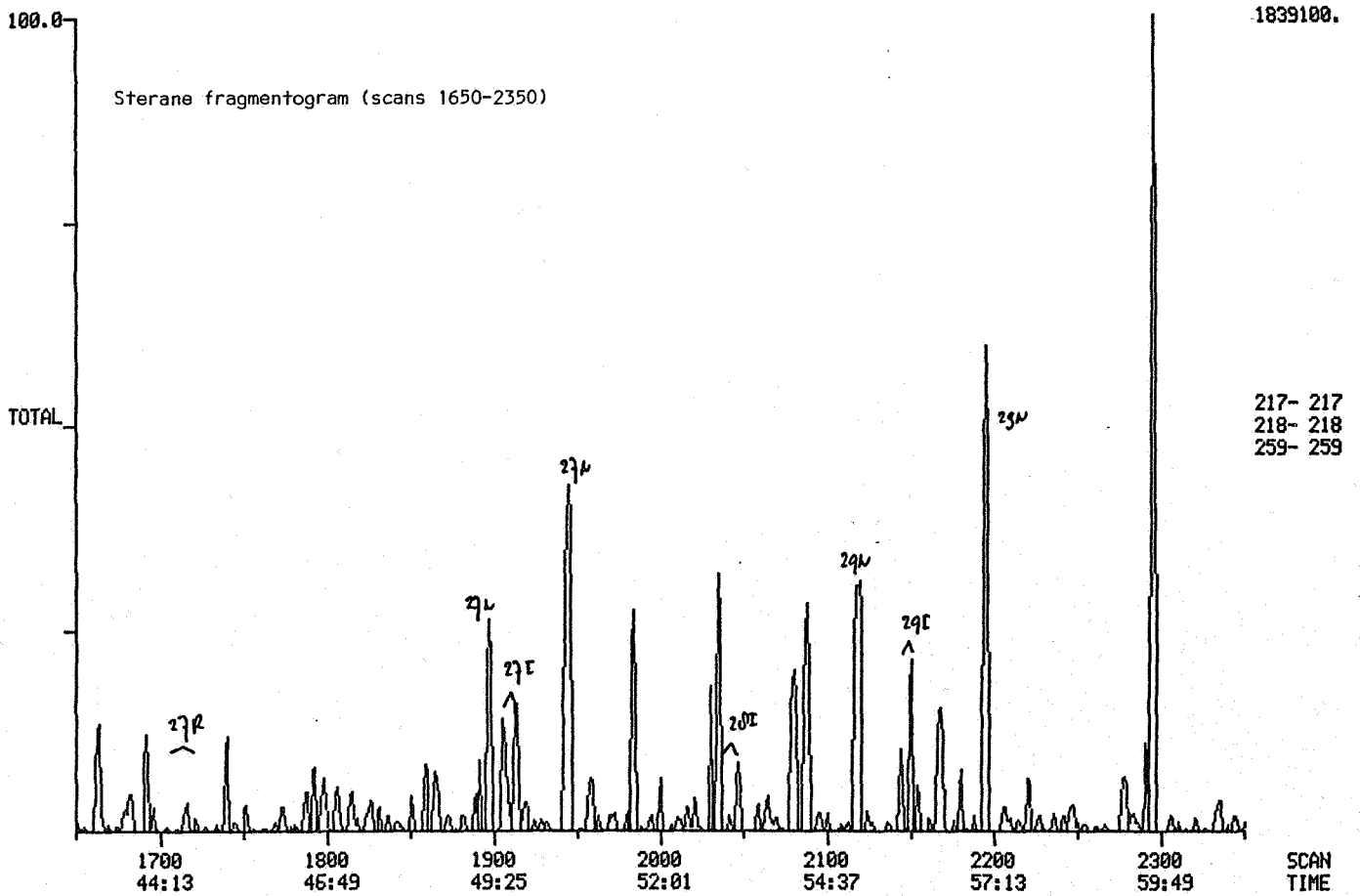
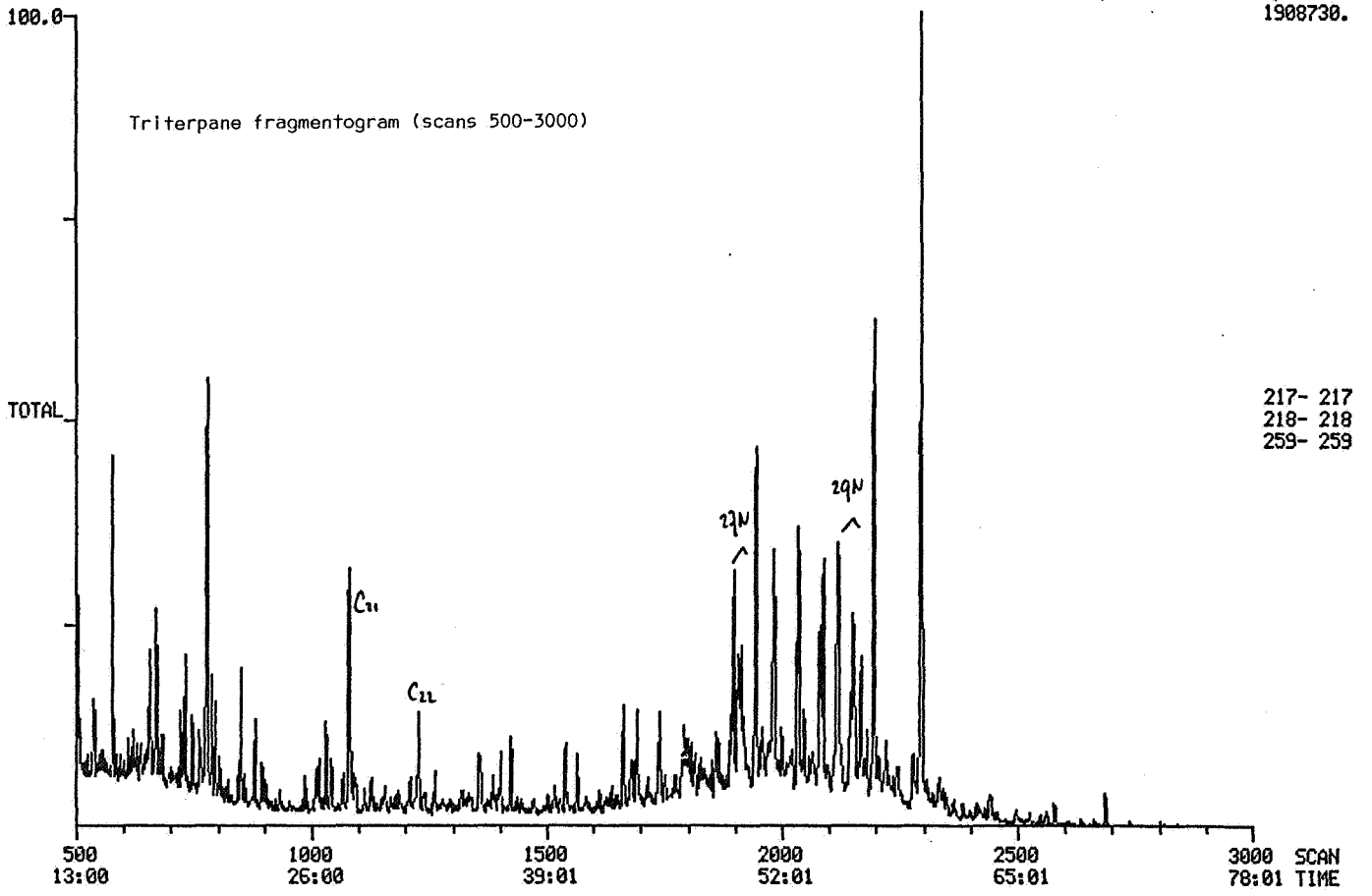


FIG. 14A. GC-MS analysis 6805/5-1, 1614-1647 m, source rock.

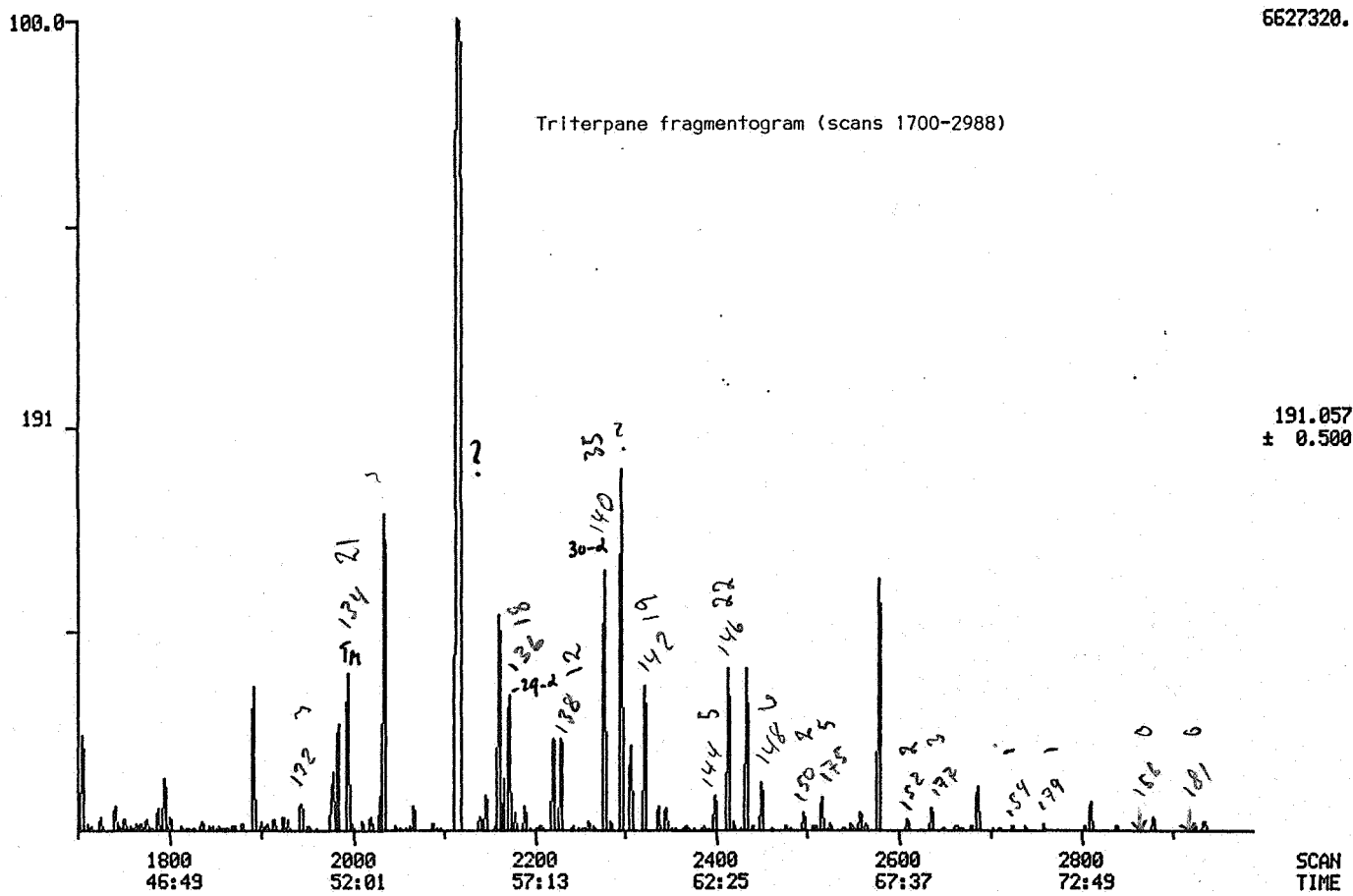
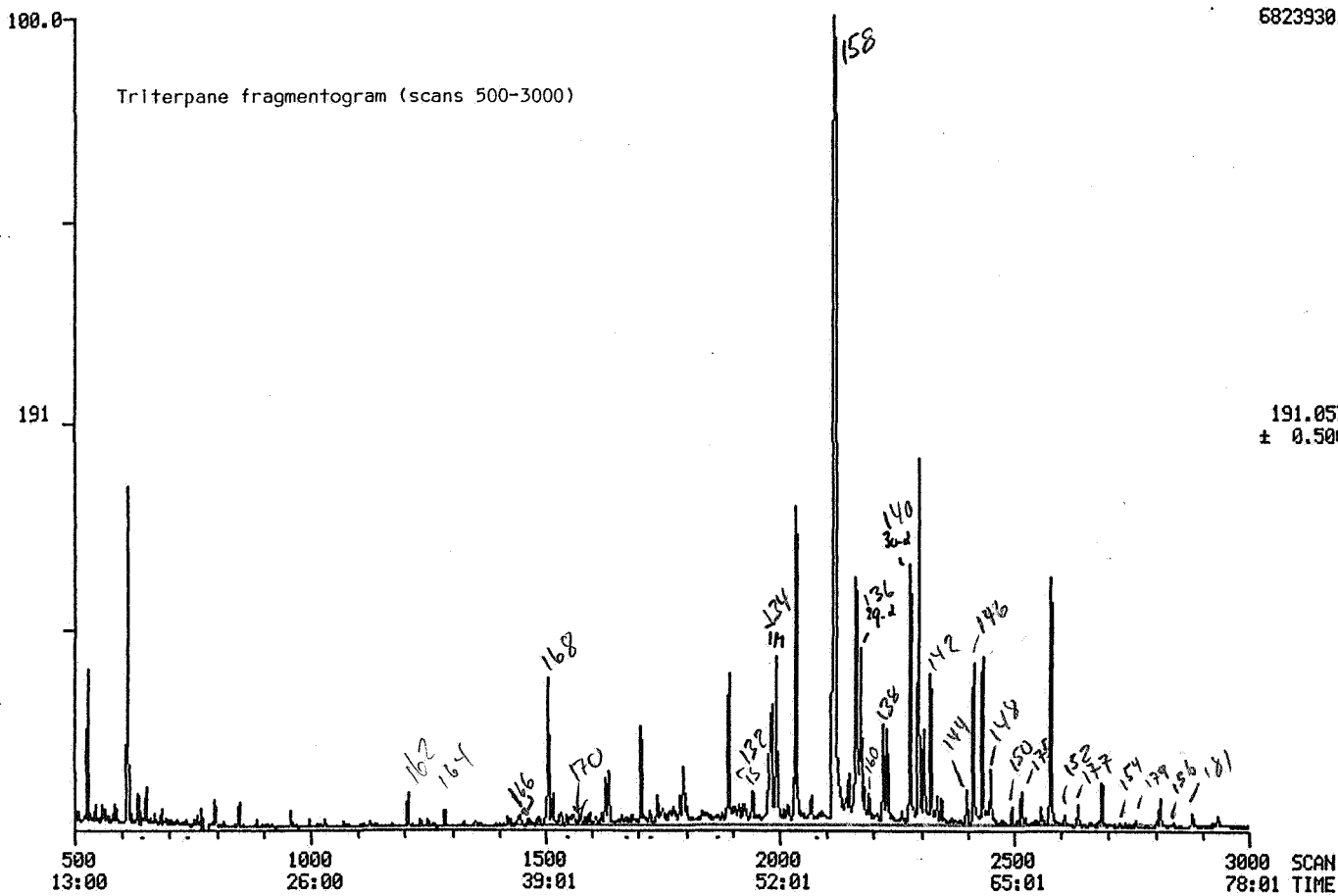


FIG. 14B. GC-MS analysis 6805/5-1, 1614-1647 m, source rock.



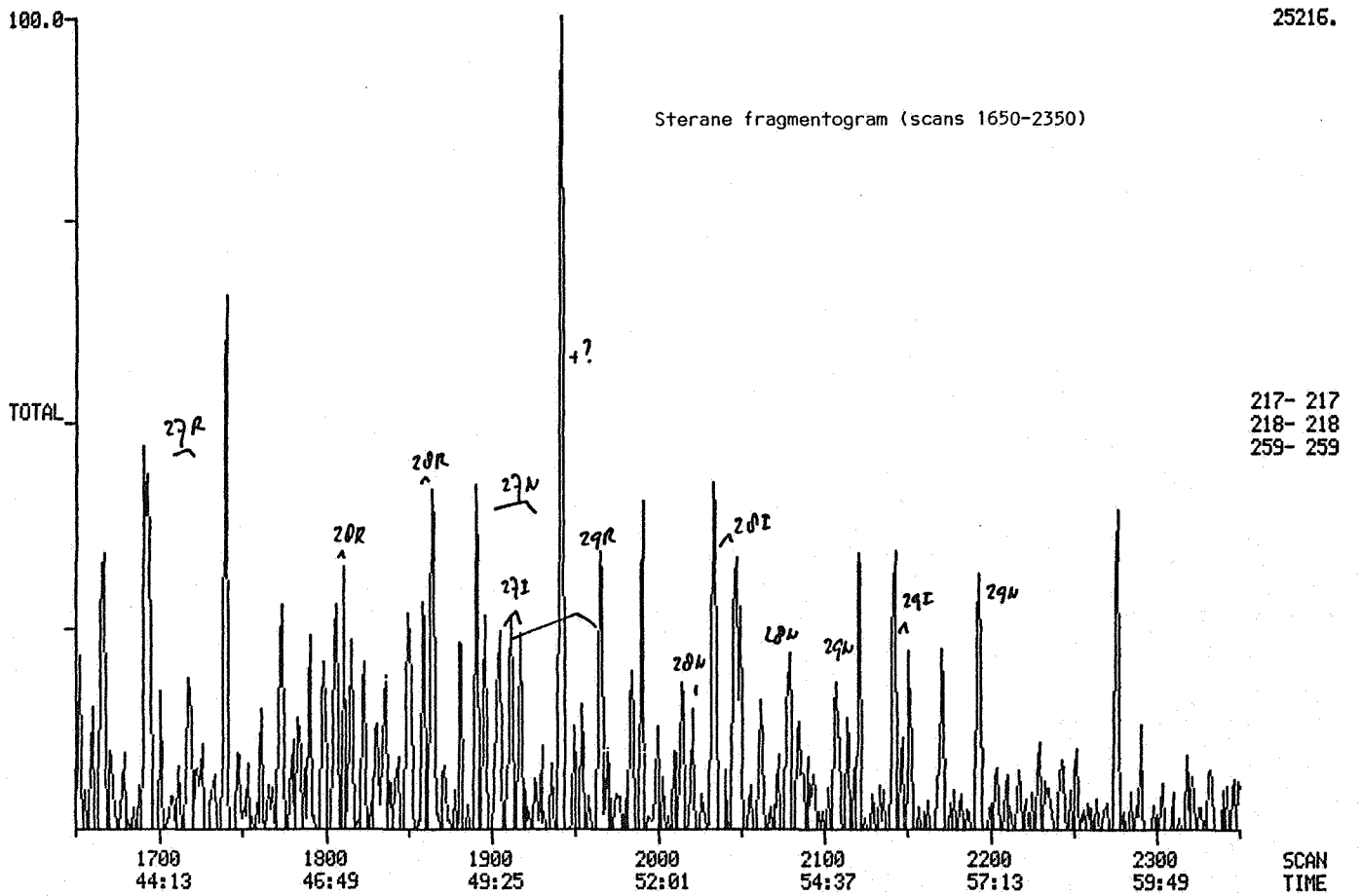
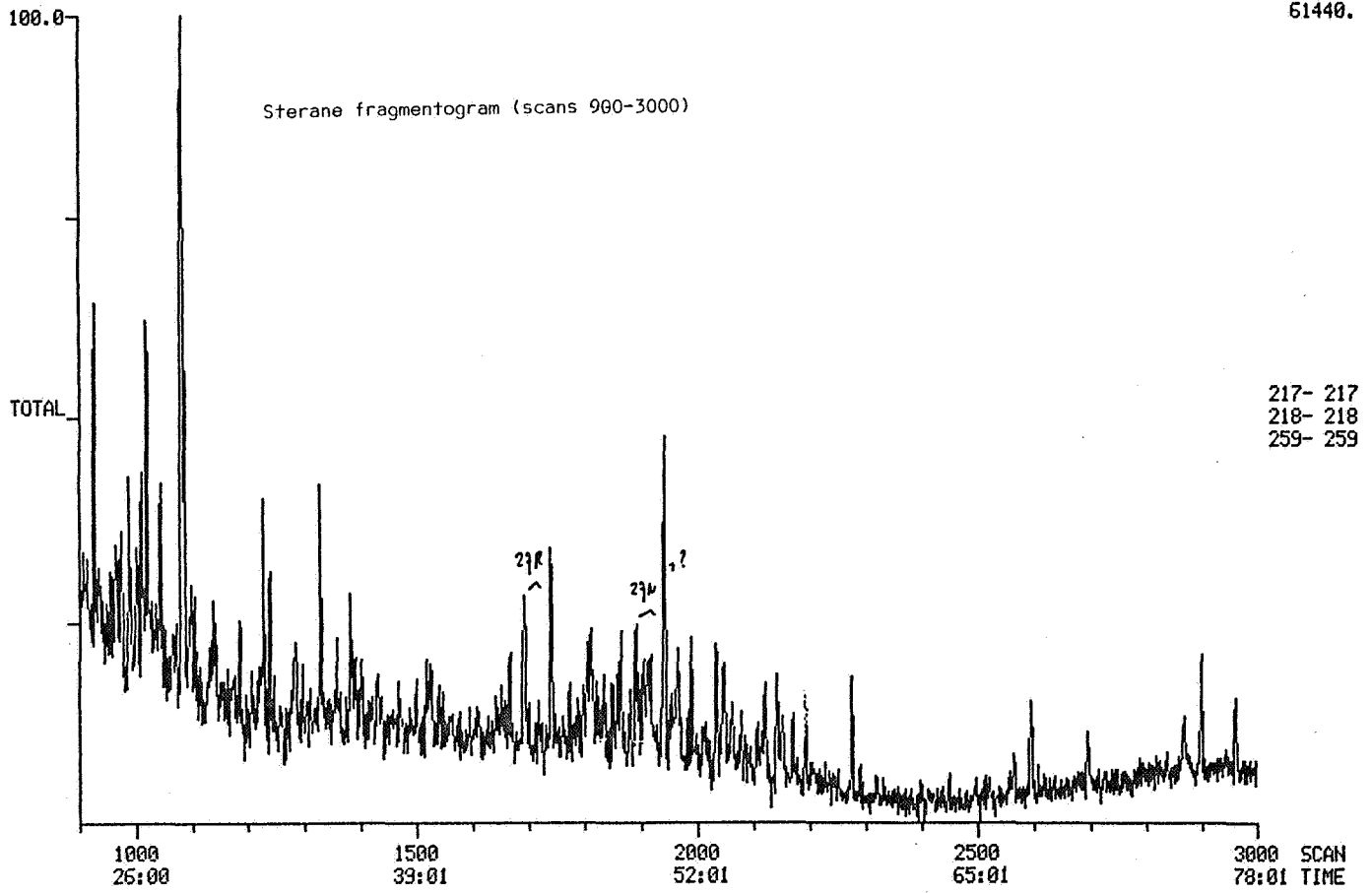


FIG. 14C. GC-MS analysis 6805/5-1, 1614-1647 m, heated source rock sample.

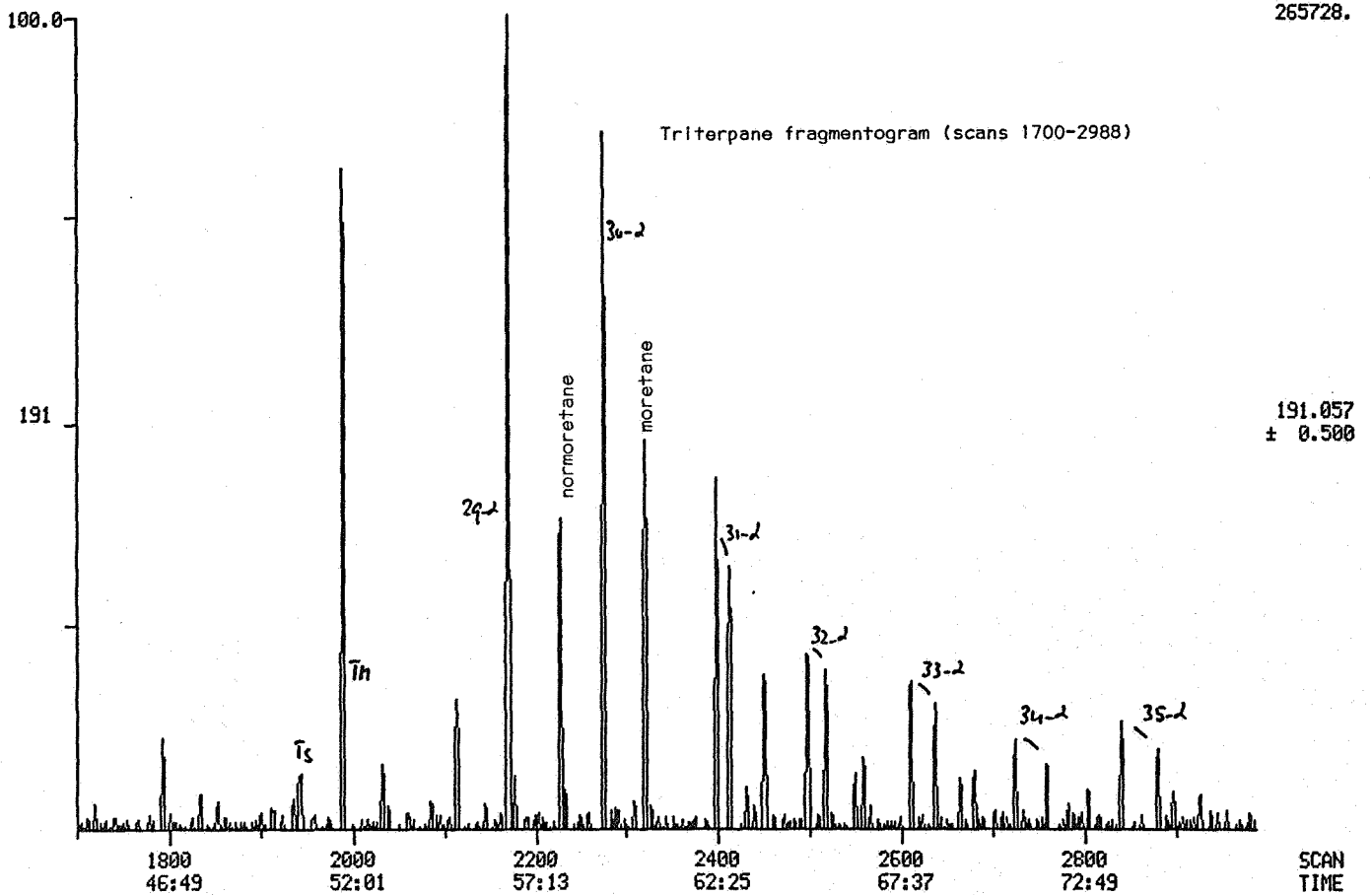
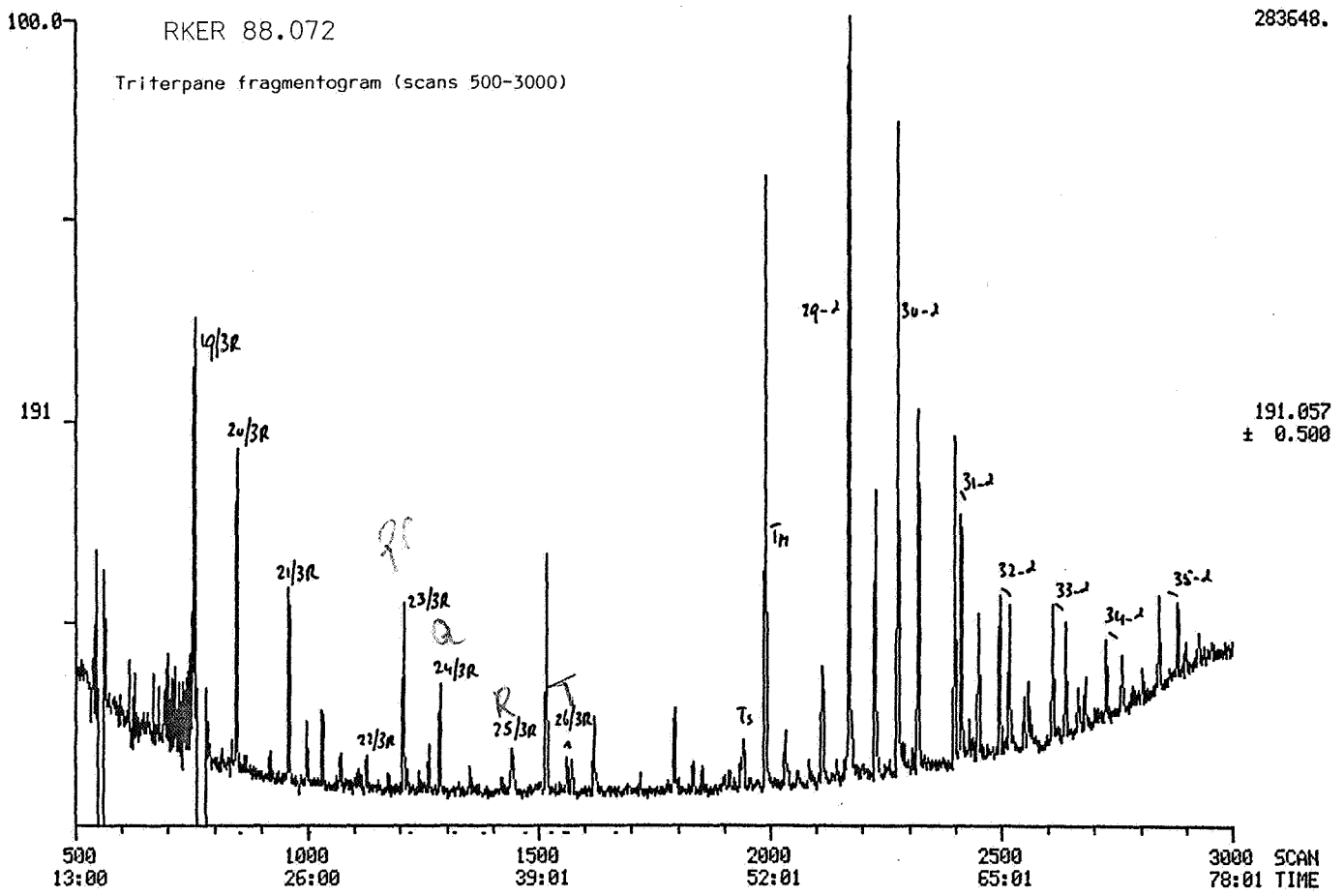


FIG. 14D. GC-MS analysis 6805/5-1, 1614-1647 m, heated source rock sample.

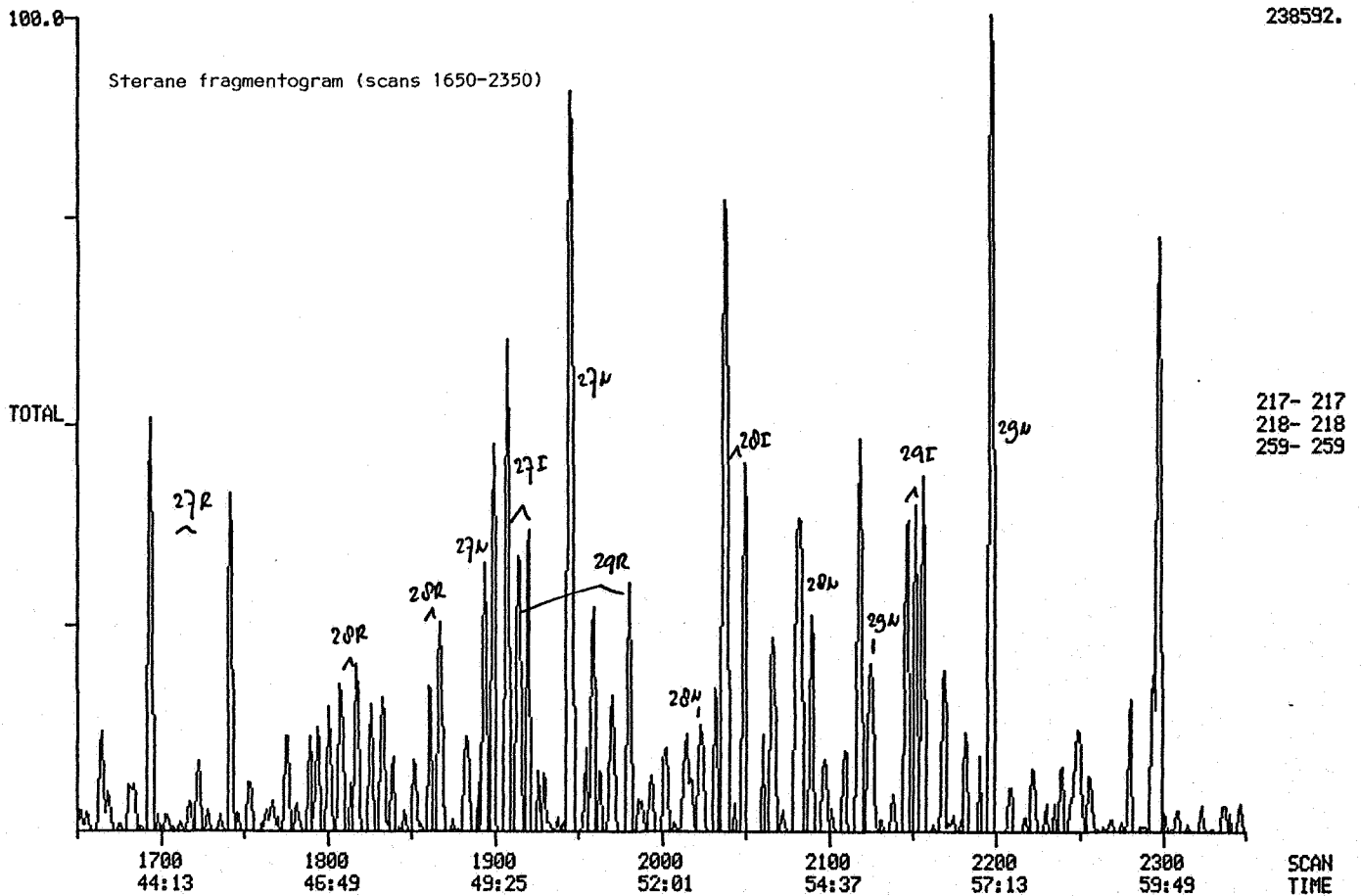
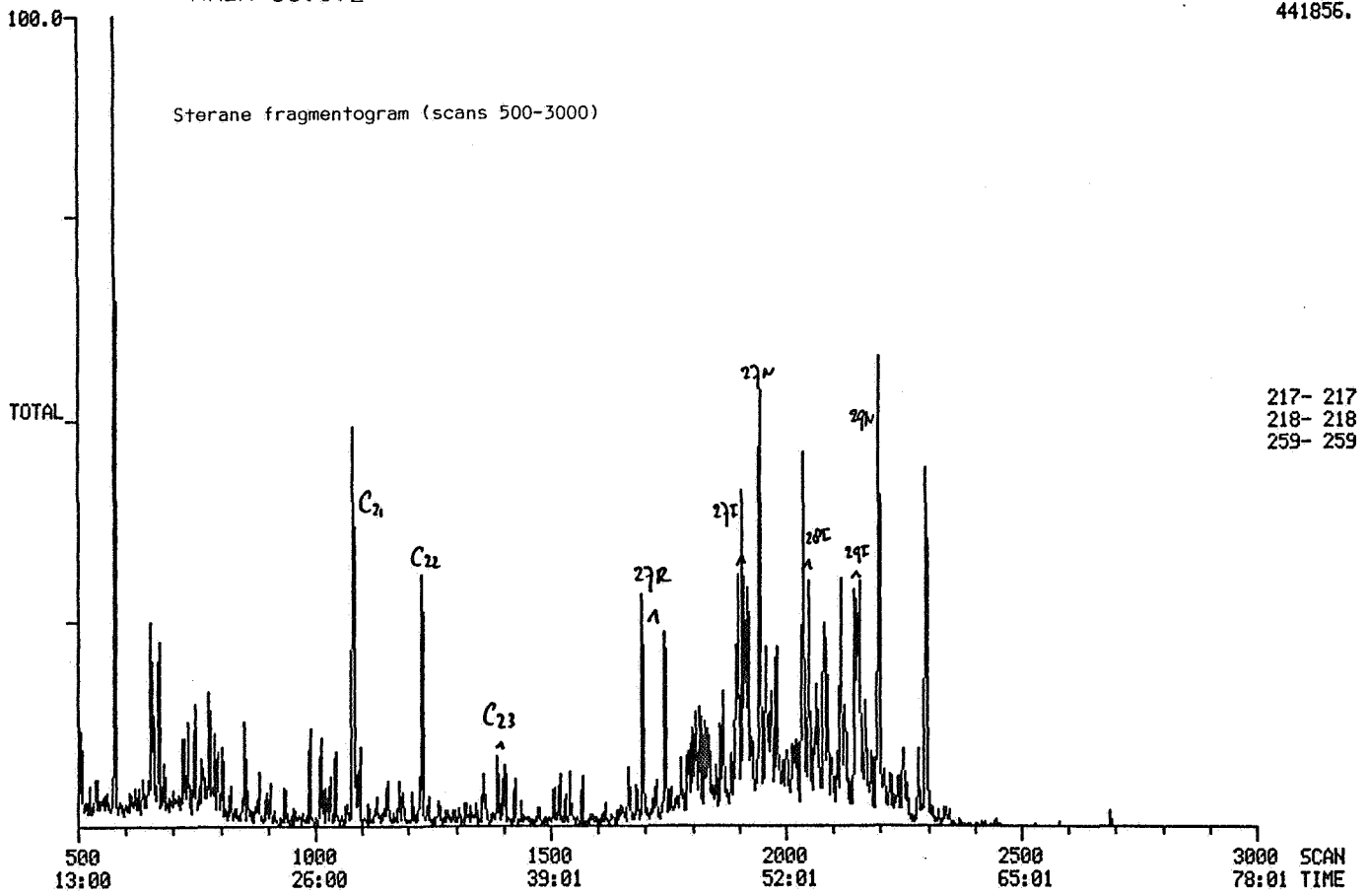
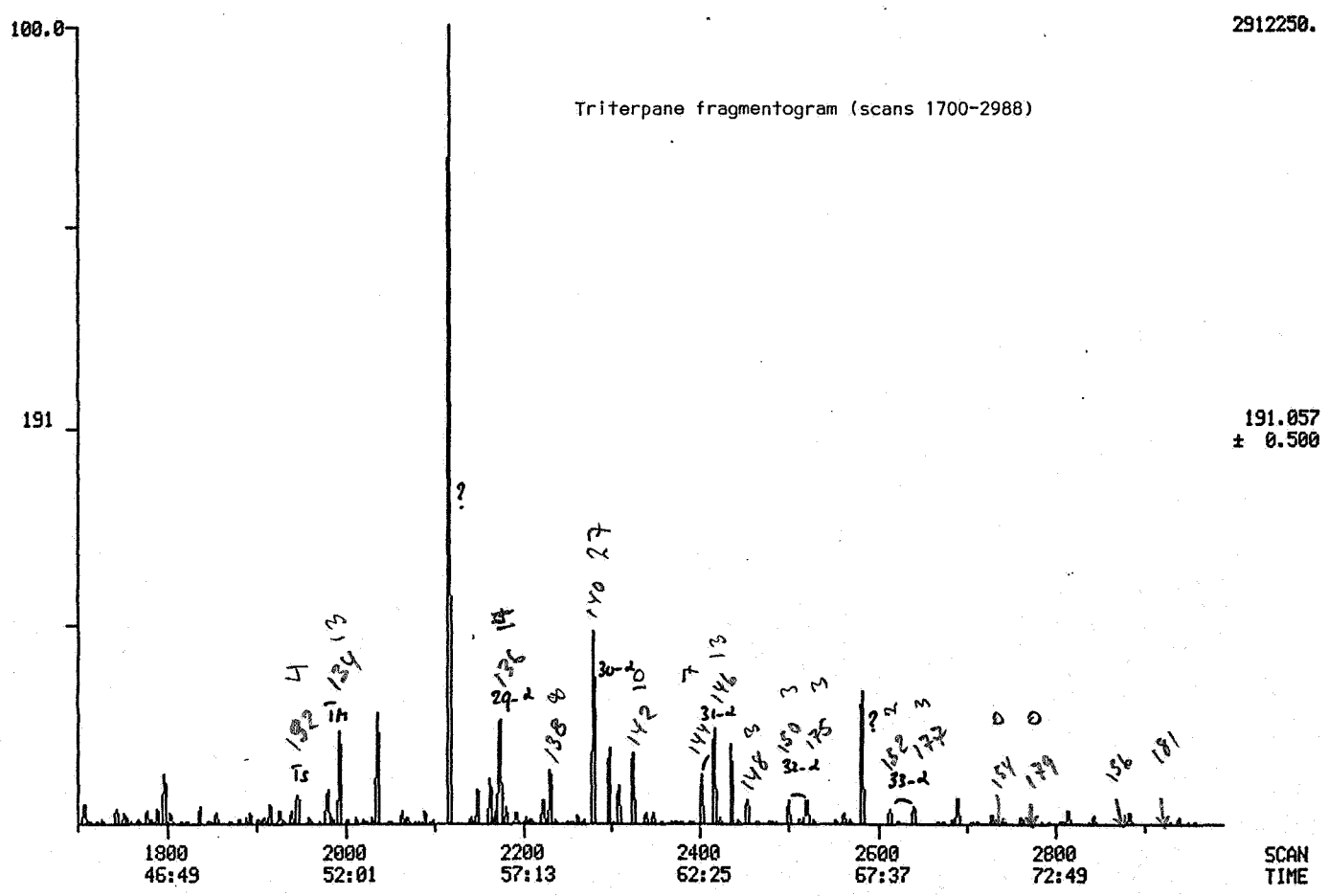
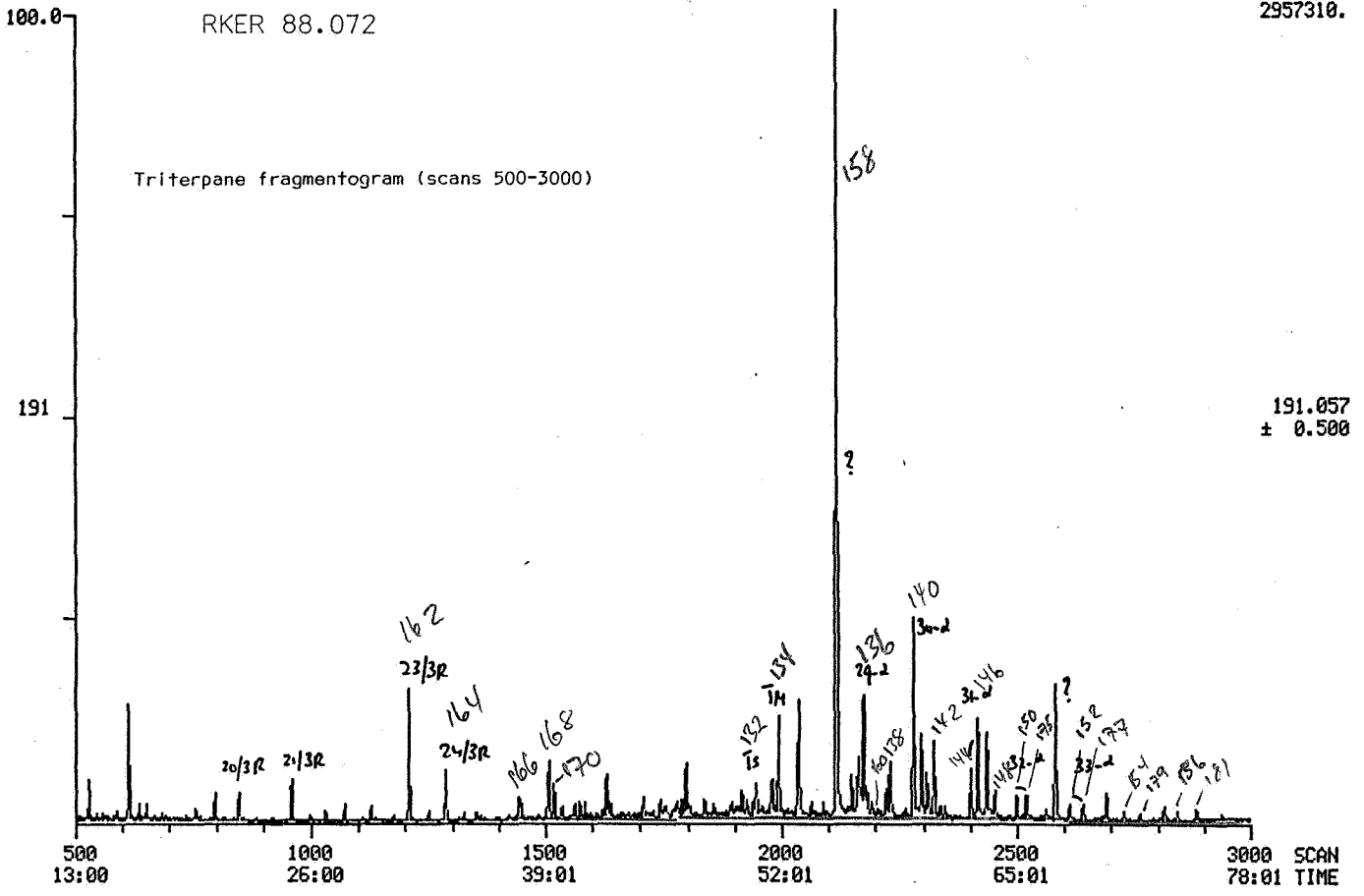


FIG. 15A. GC-MS analysis 6805/5-1, 1695-1710 m, source rock.



6508  
FIG. 15B. GC-MS analysis ~~6805~~ 5-1, 1695-1710 m, source rock.

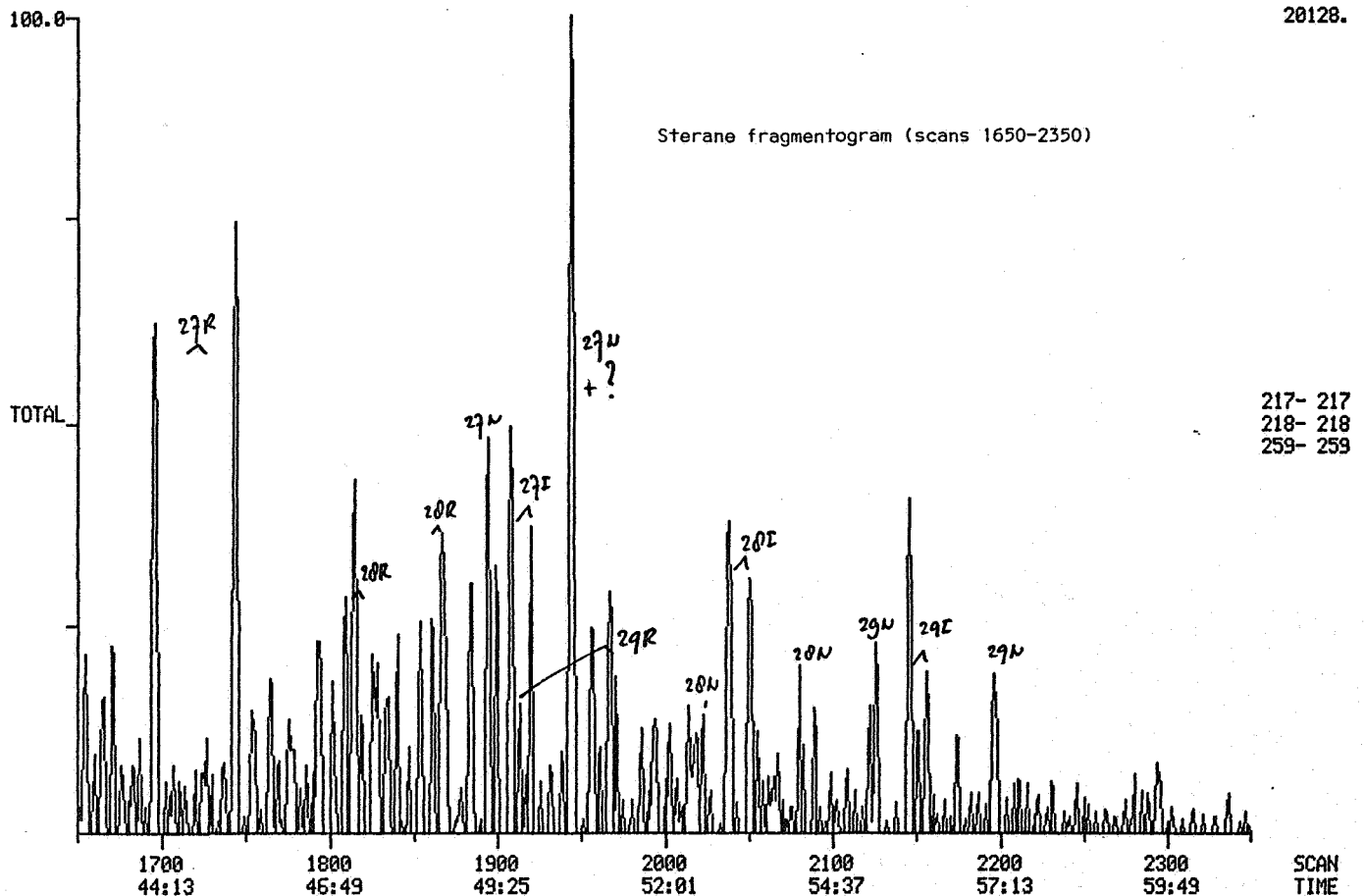
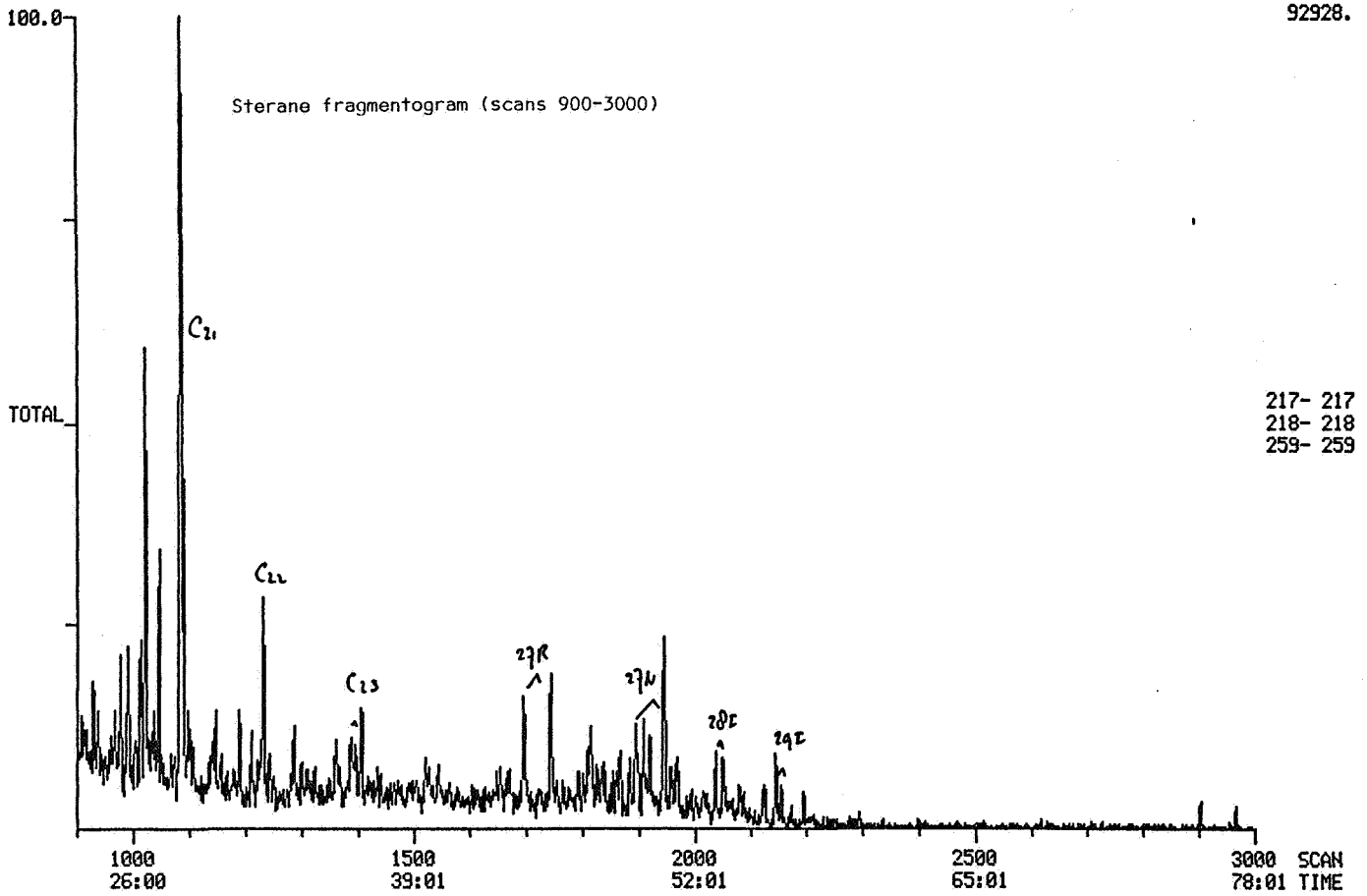


FIG. 15C. GC-MS analysis 6805/5-1, 1695-1710 m, heated source rock sample.

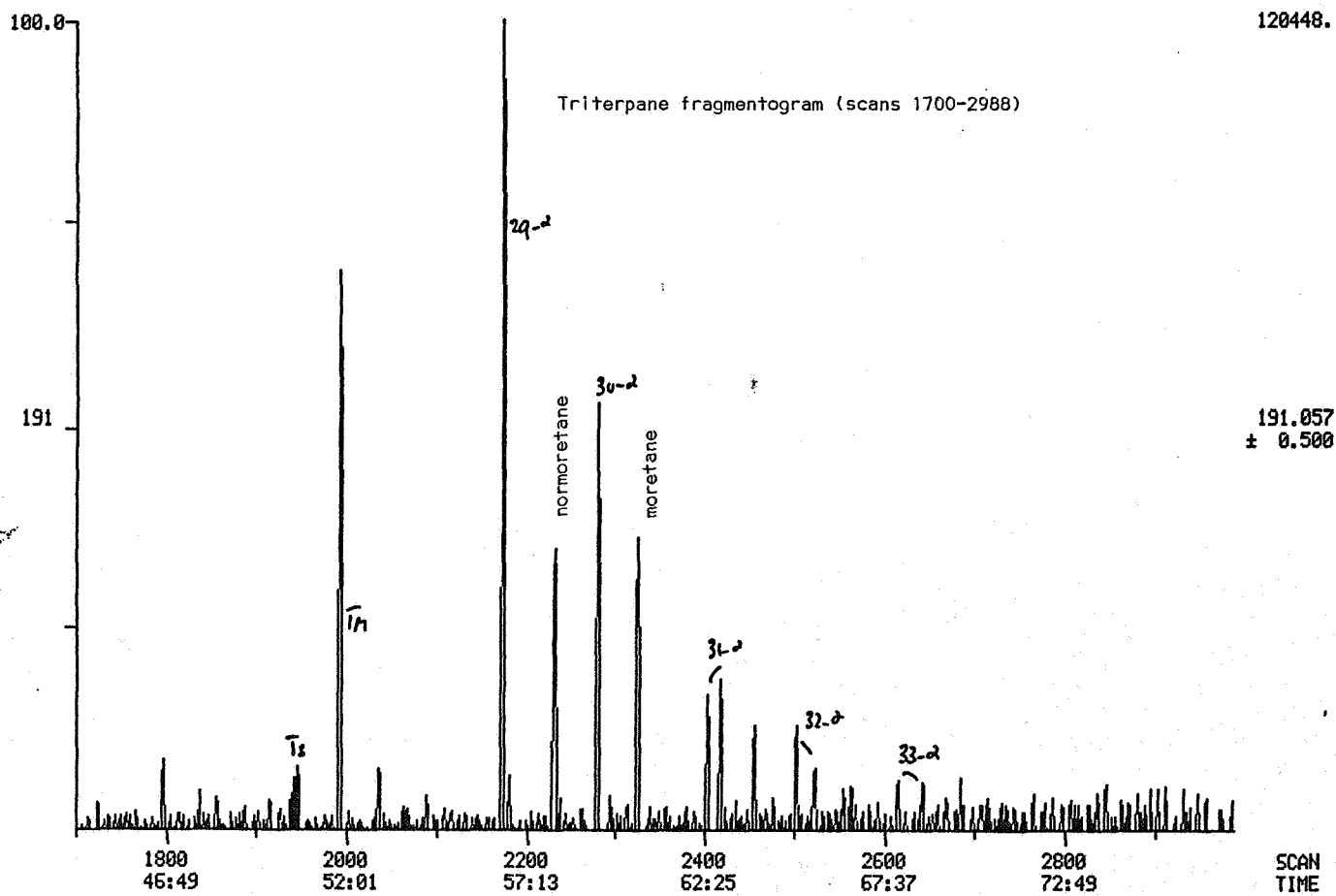
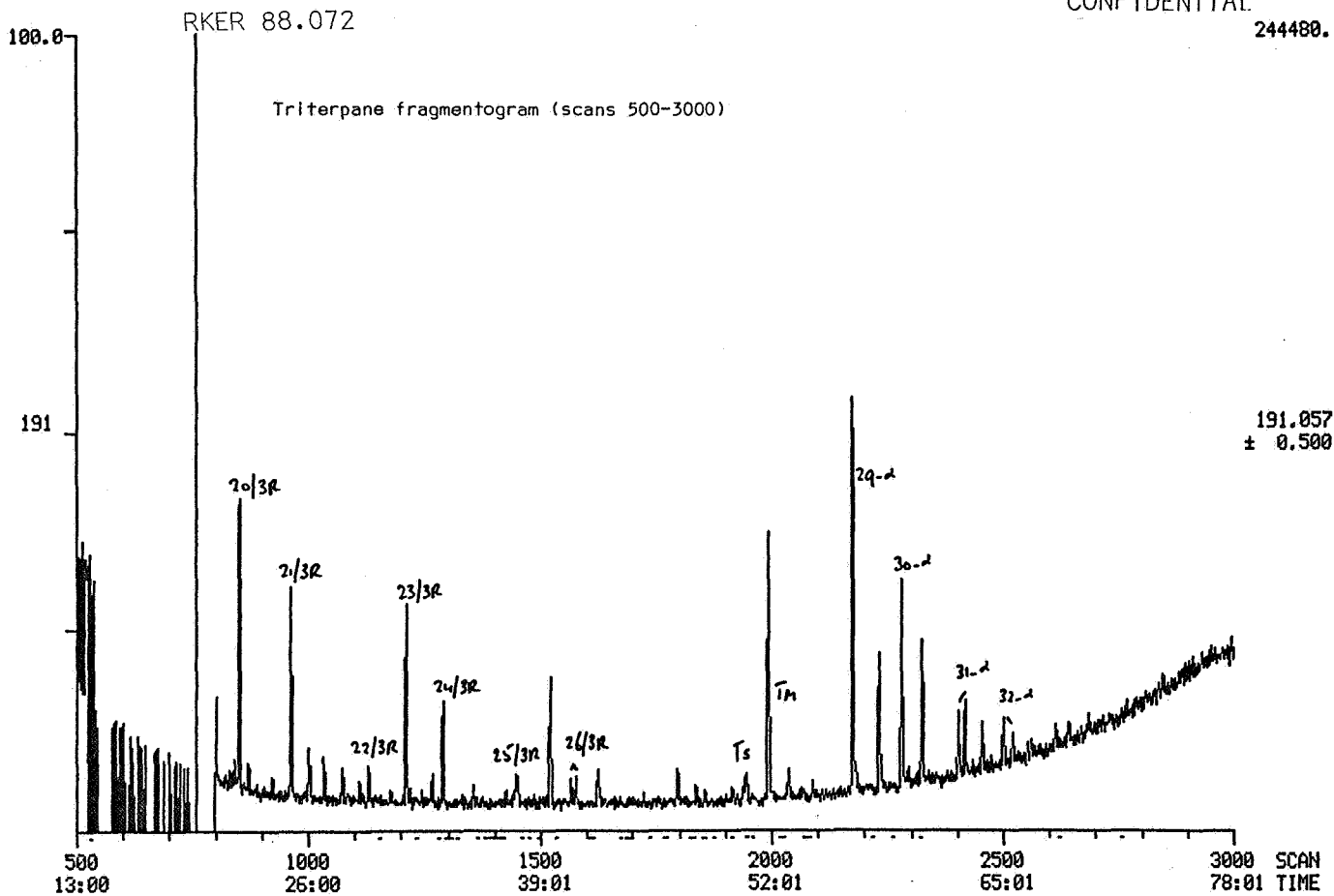


FIG. 15D. GC-MS analysis 6805/5-1, 1695-1710 m, heated source rock sample.

RKER 88.072

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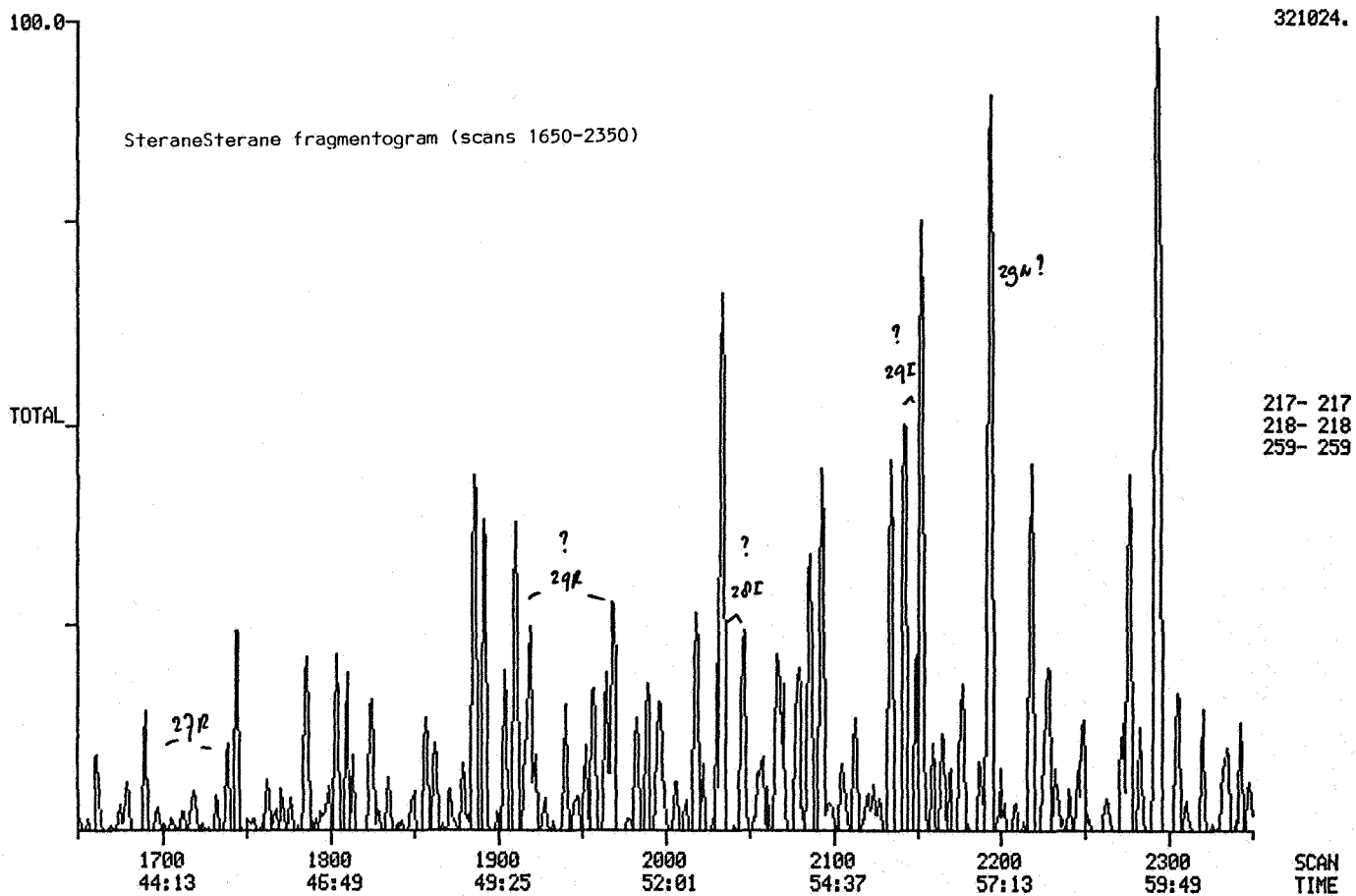
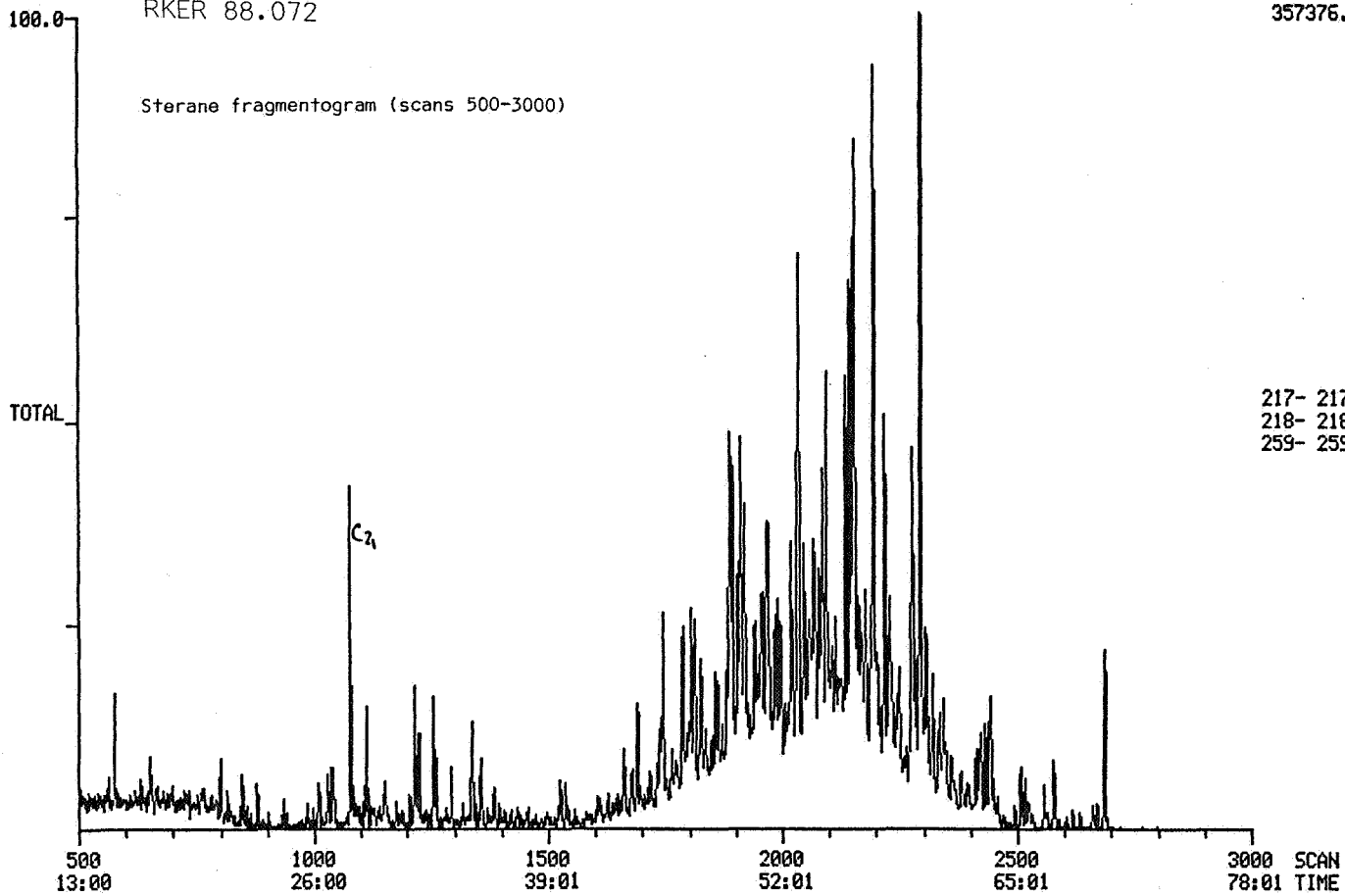


FIG. 16A. GC-MS analysis 6805/5-1, 2217-2226 m, source rock.

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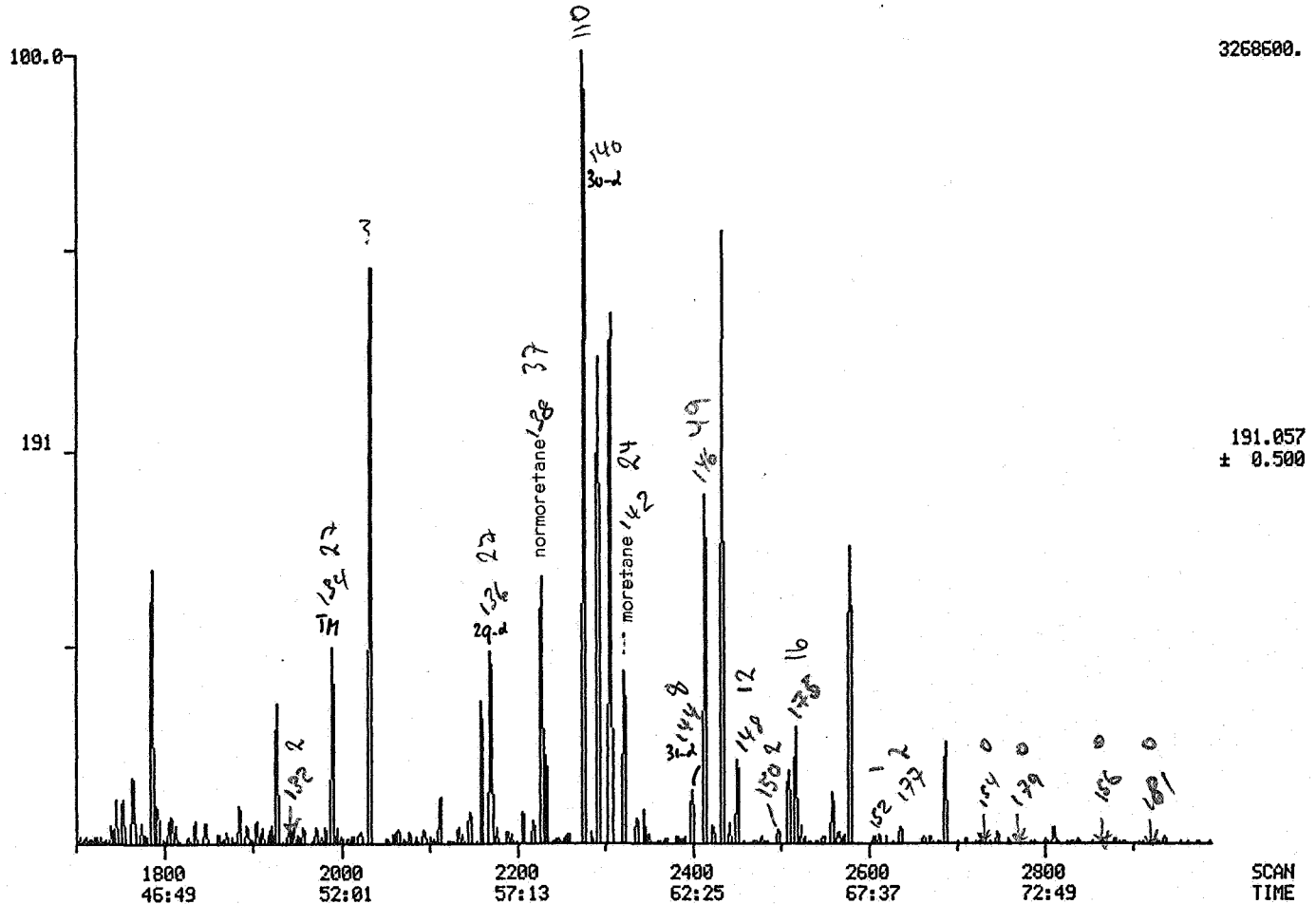
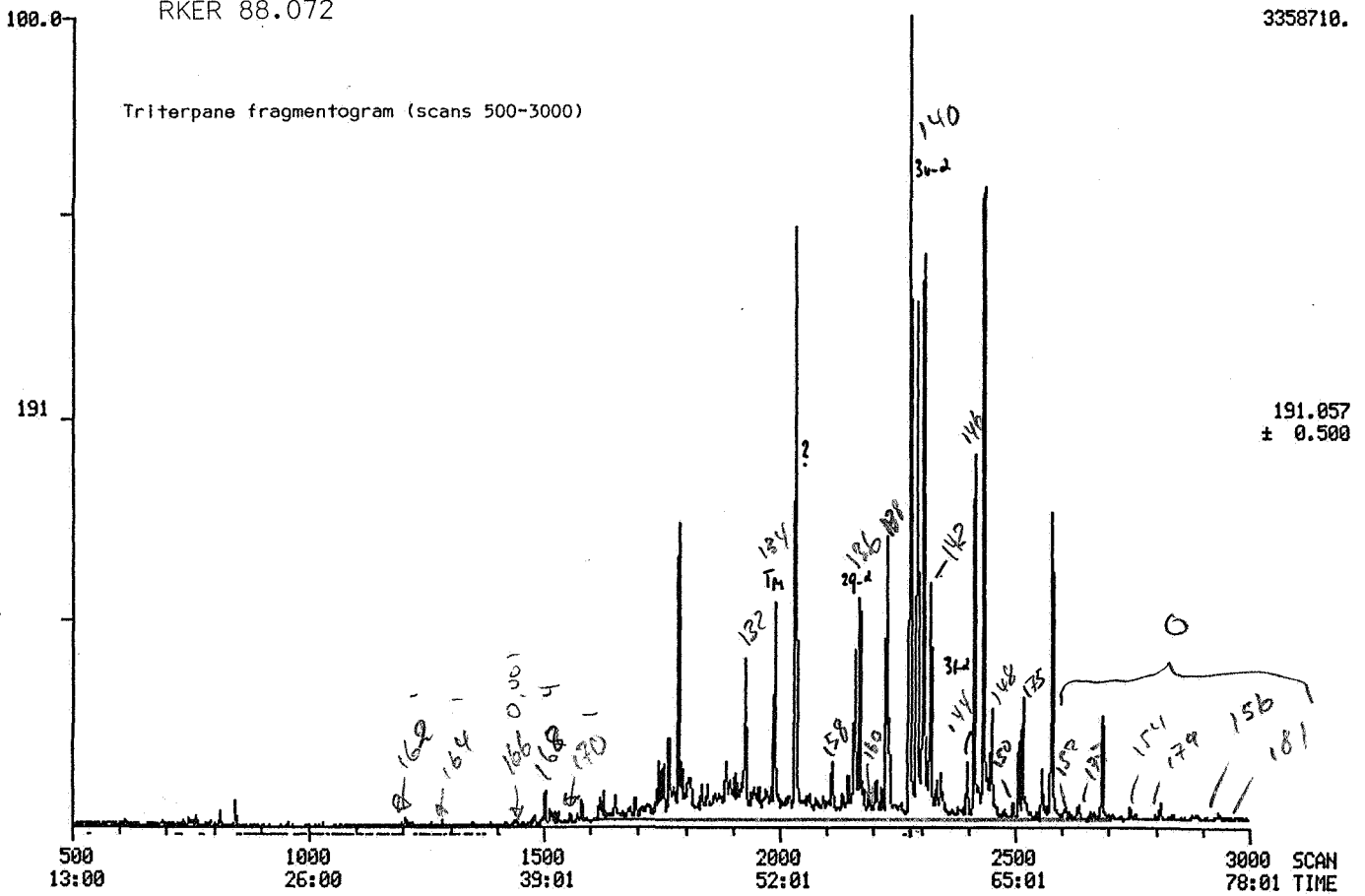


FIG. 16B. GC-MS analysis 6805/5-1, 2217-2226 m, source rock.



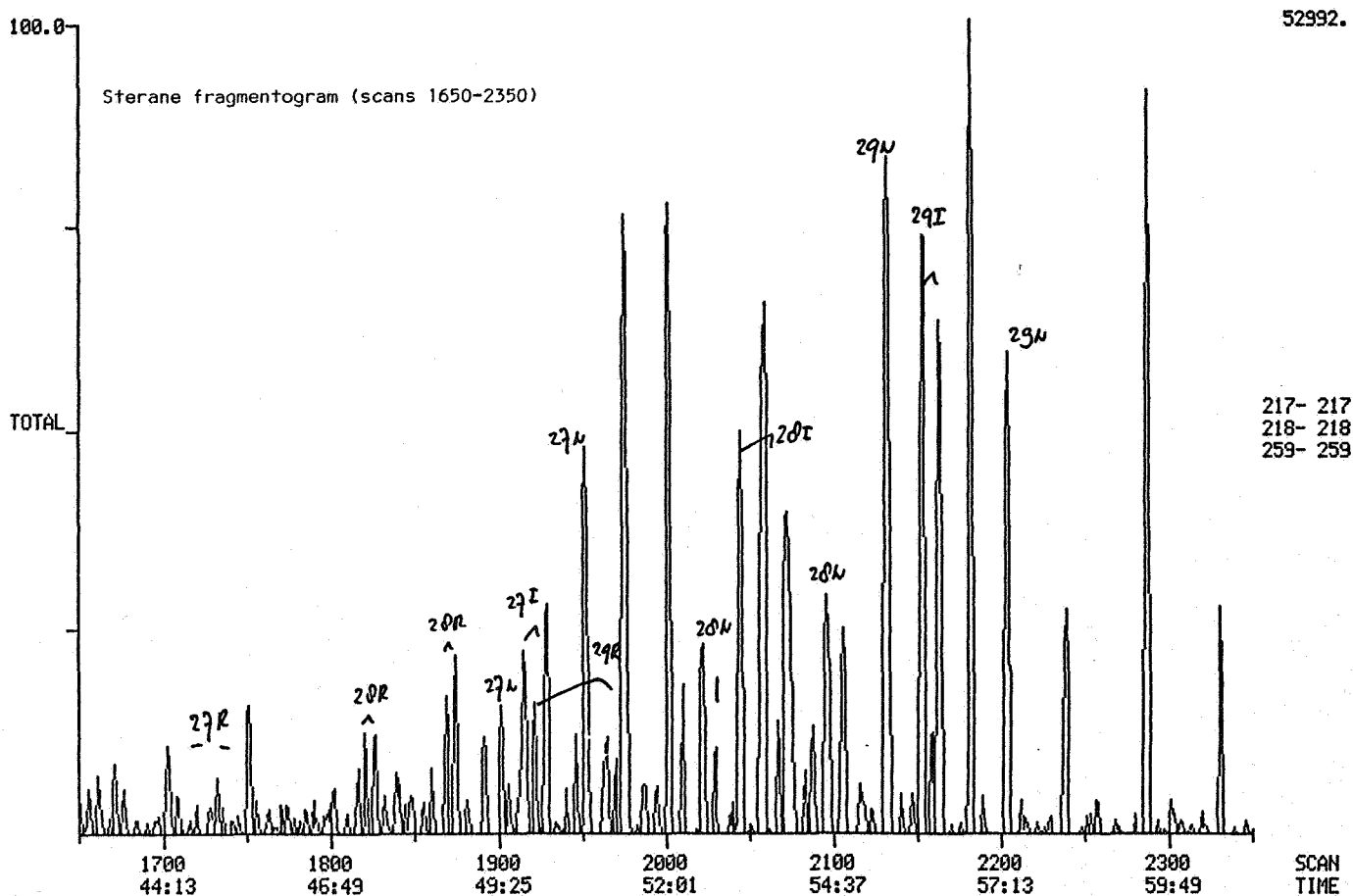
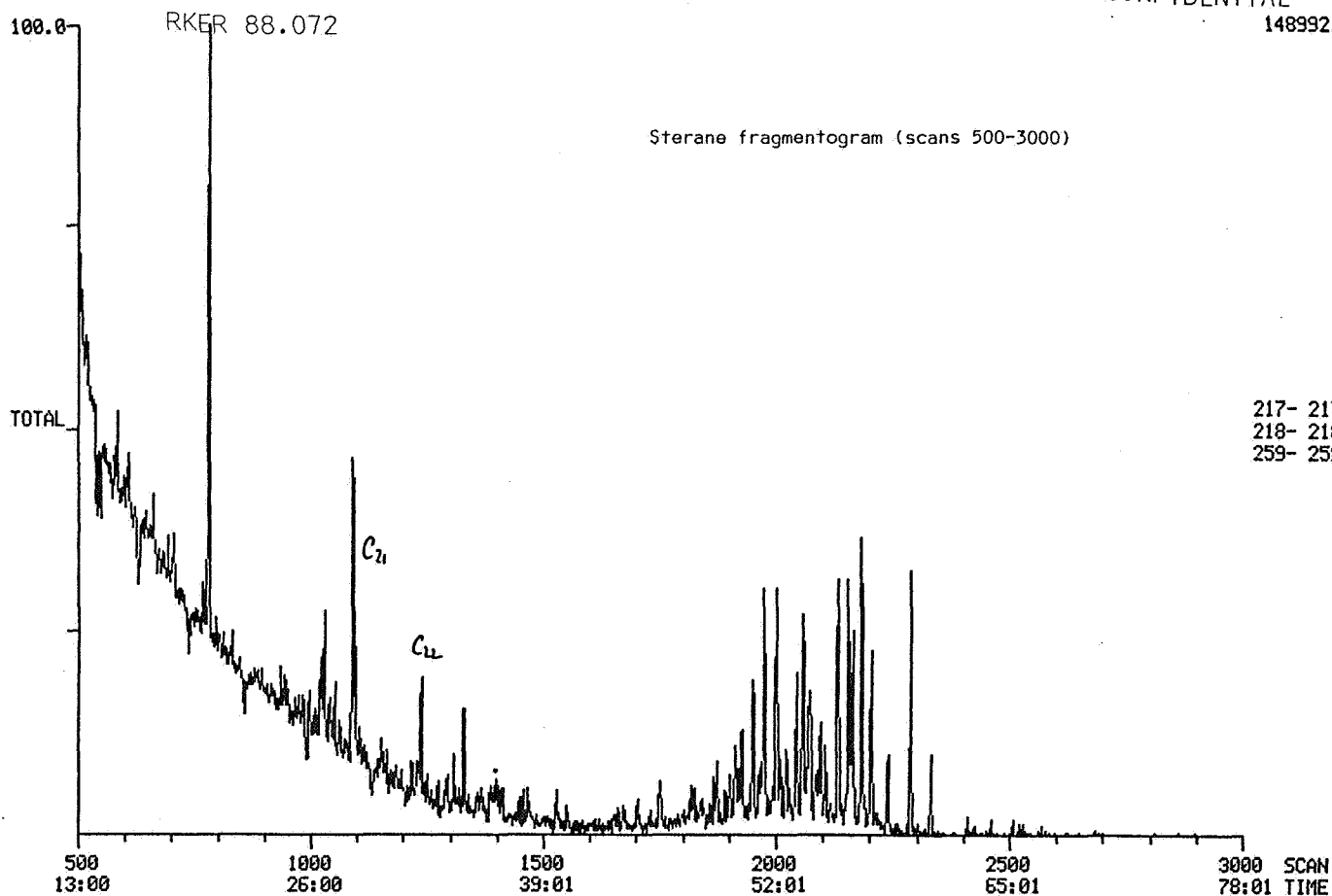


FIG. 16C. GC-MS analysis 6805/5-1, 2217-2226 m, heated source rock sample.

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2965500.

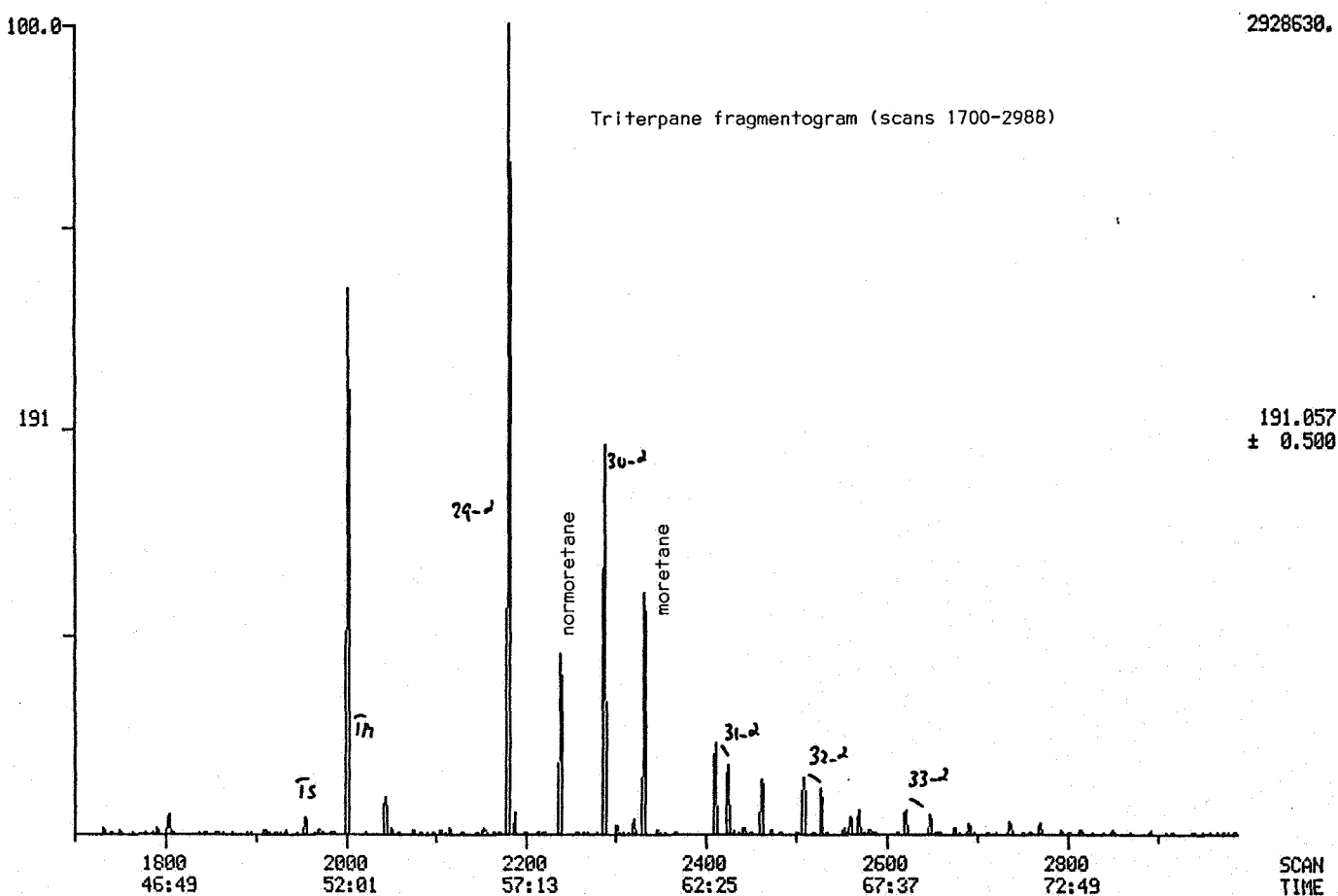
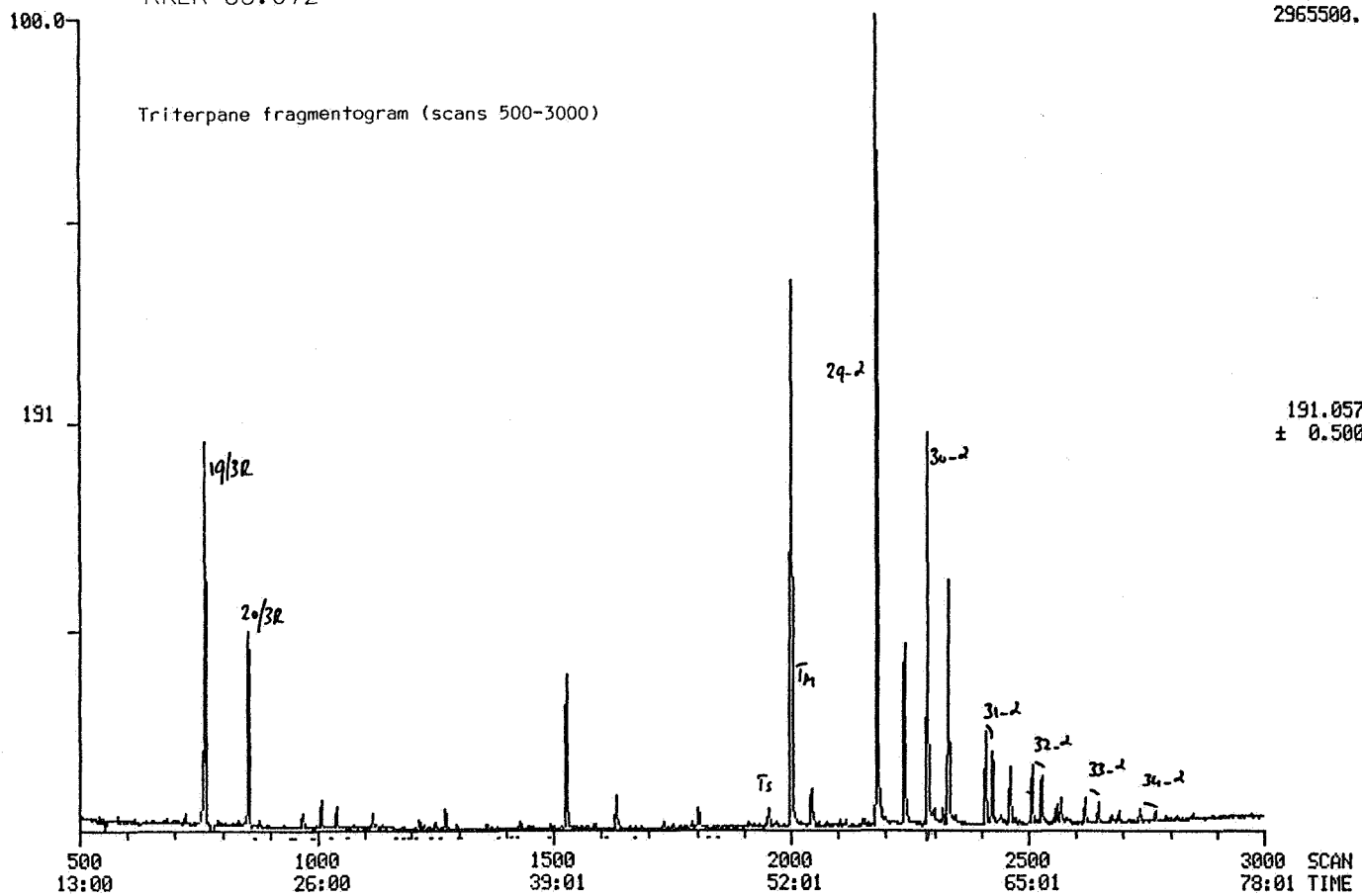
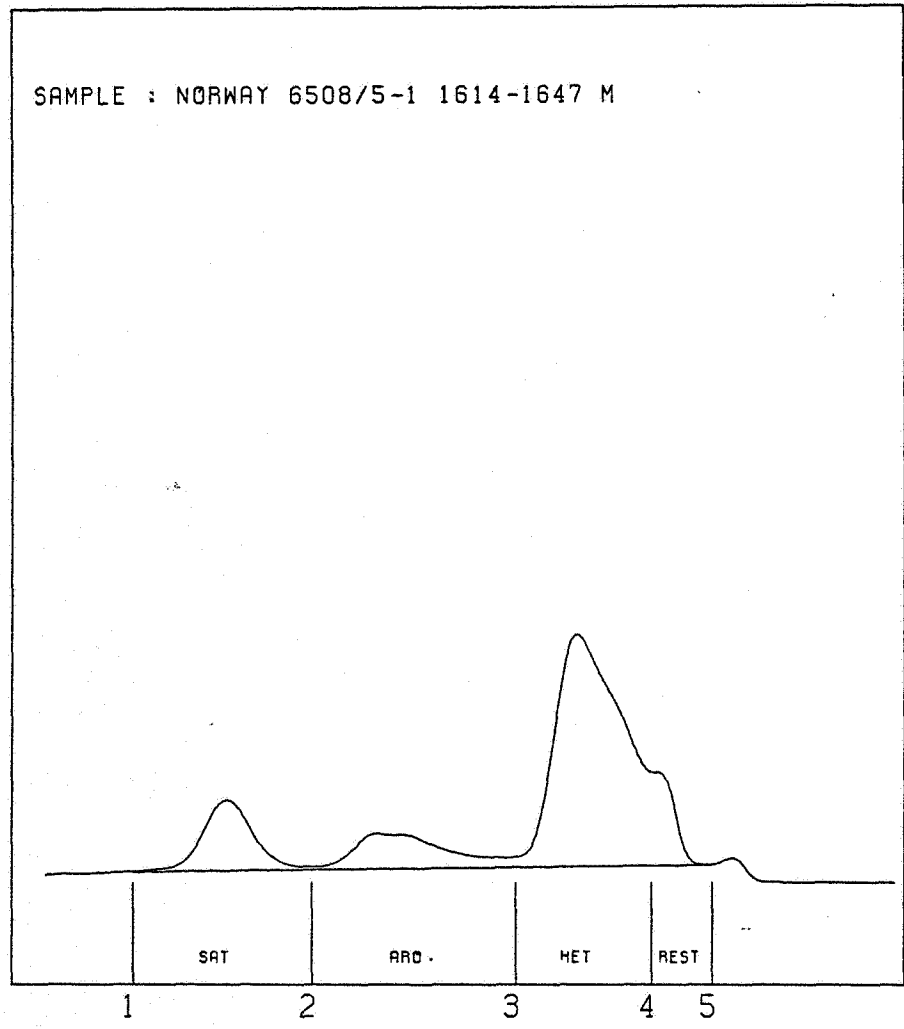


FIG. 16D. GC-MS analysis 6805/5-1, 2217-2226 m, heated source rock sample.



SAMPLE : S135972

WEIGHT LOST ON TOPPING : 0.0 %

- SATURATES	: 14.3 %
- AROMATICS	: 12.8 %
- HETEROCOMPOUNDS	: 63.2 %
- REST (HIGH MOL.)	: 9.6 %

\* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE

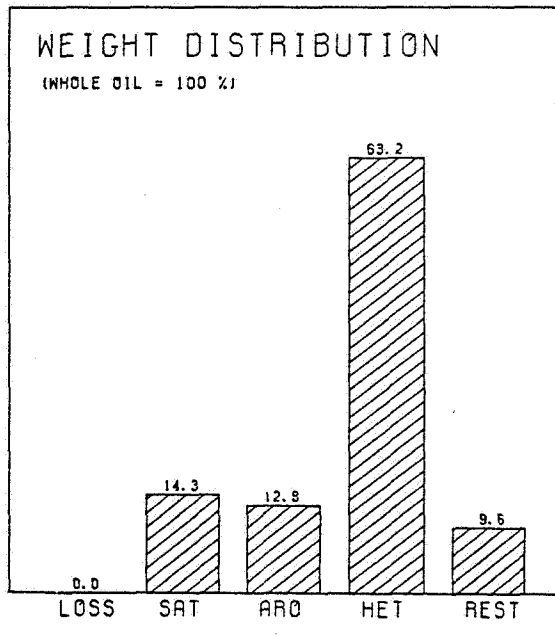
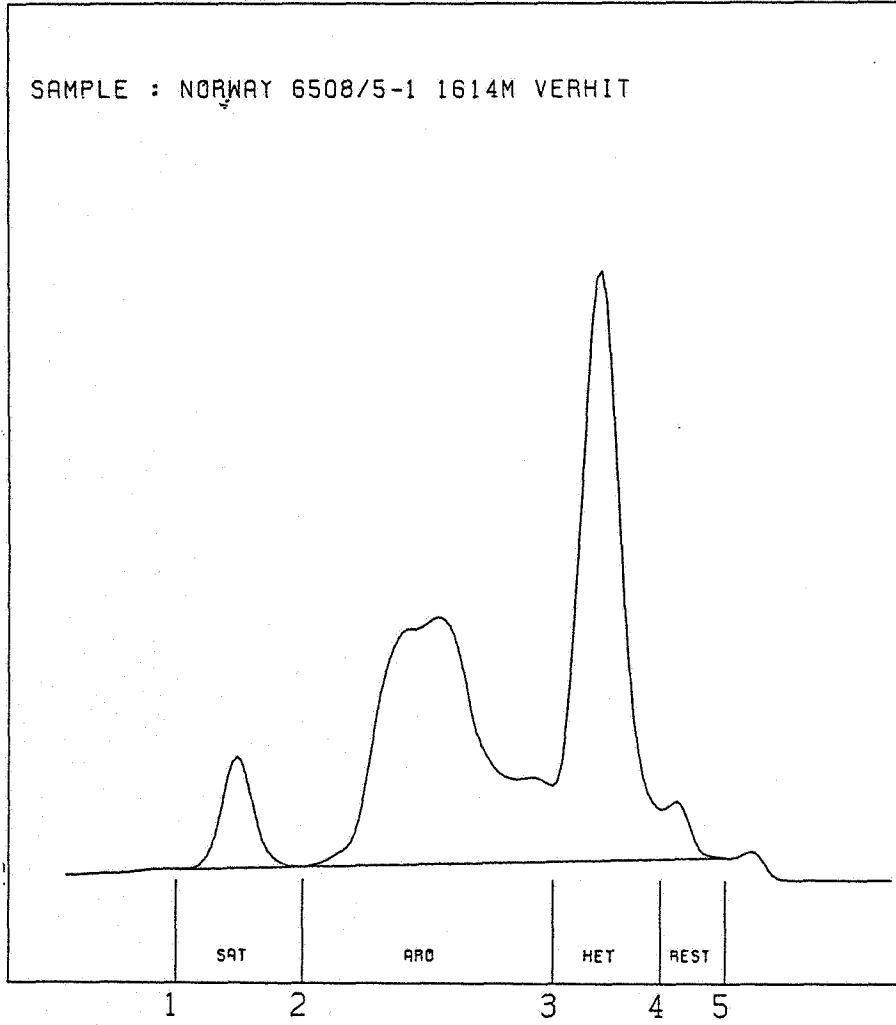


FIG. 19A.



SAMPLE : S136305

WEIGHT LOST ON TOPPING : 0.0 %

- SATURATES : 6.4 %
- AROMATICS : 47.1 %
- HETEROCOMPOUNDS : 43.6 %
- REST (HIGH MOL.) : 2.9 %

■ WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE

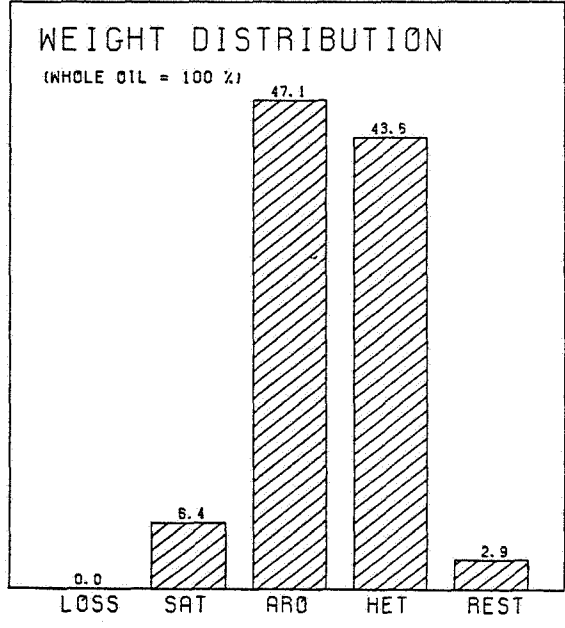
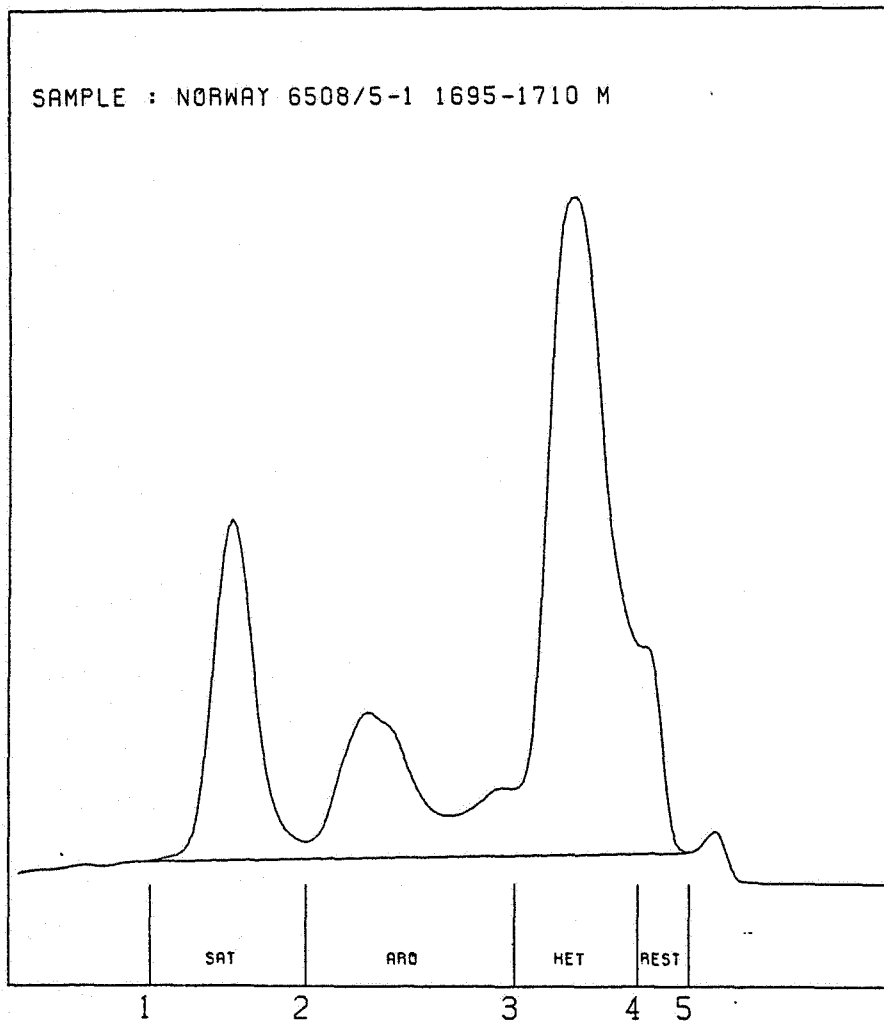


FIG. 19B.



SAMPLE : S135973

WEIGHT LOST ON TOPPING : 0.0 %

- SATURATES	: 19.9 %
- AROMATICS	: 18.2 %
- HETEROCOMPOUNDS	: 55.0 %
- REST (HIGH MOL.)	: 6.8 %

■ WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE

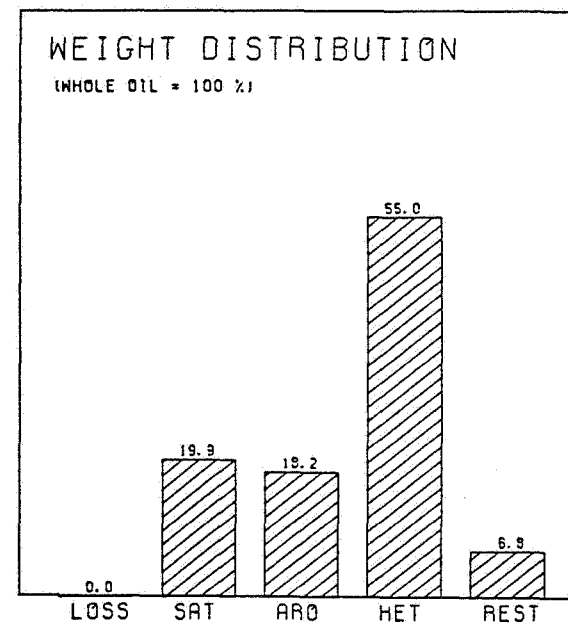


FIG. 19C.

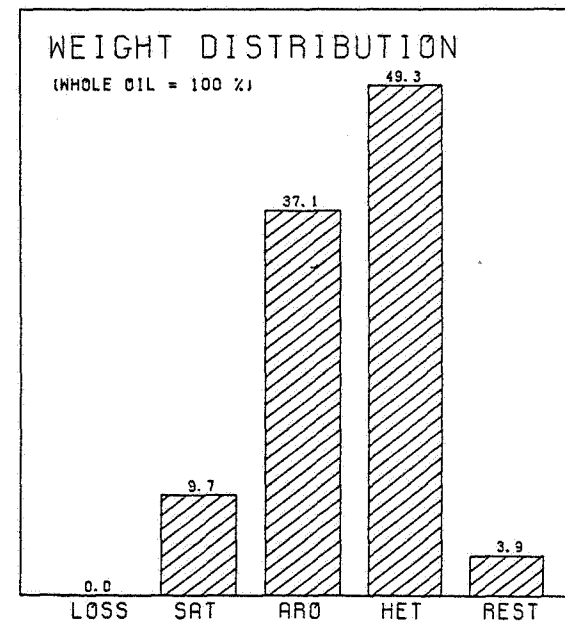
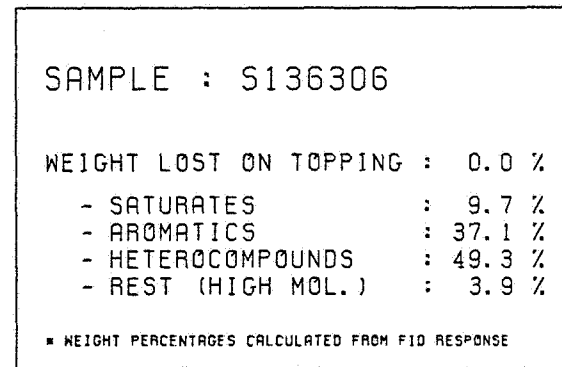
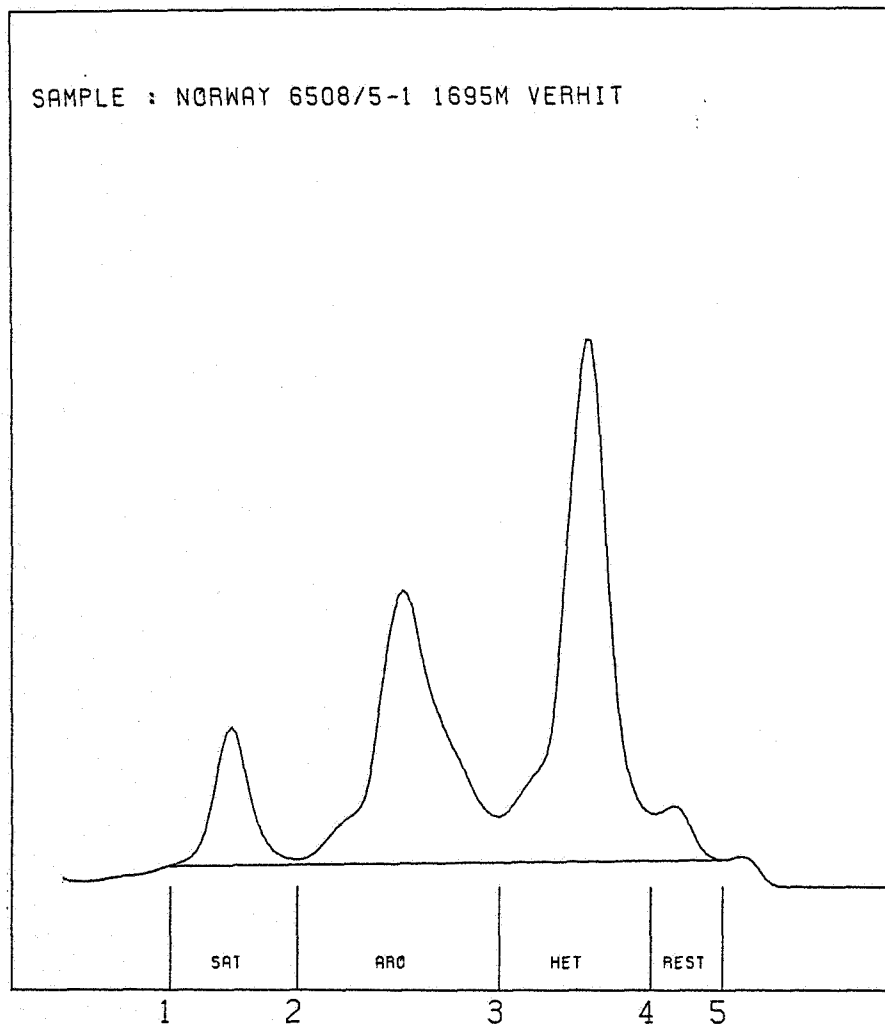
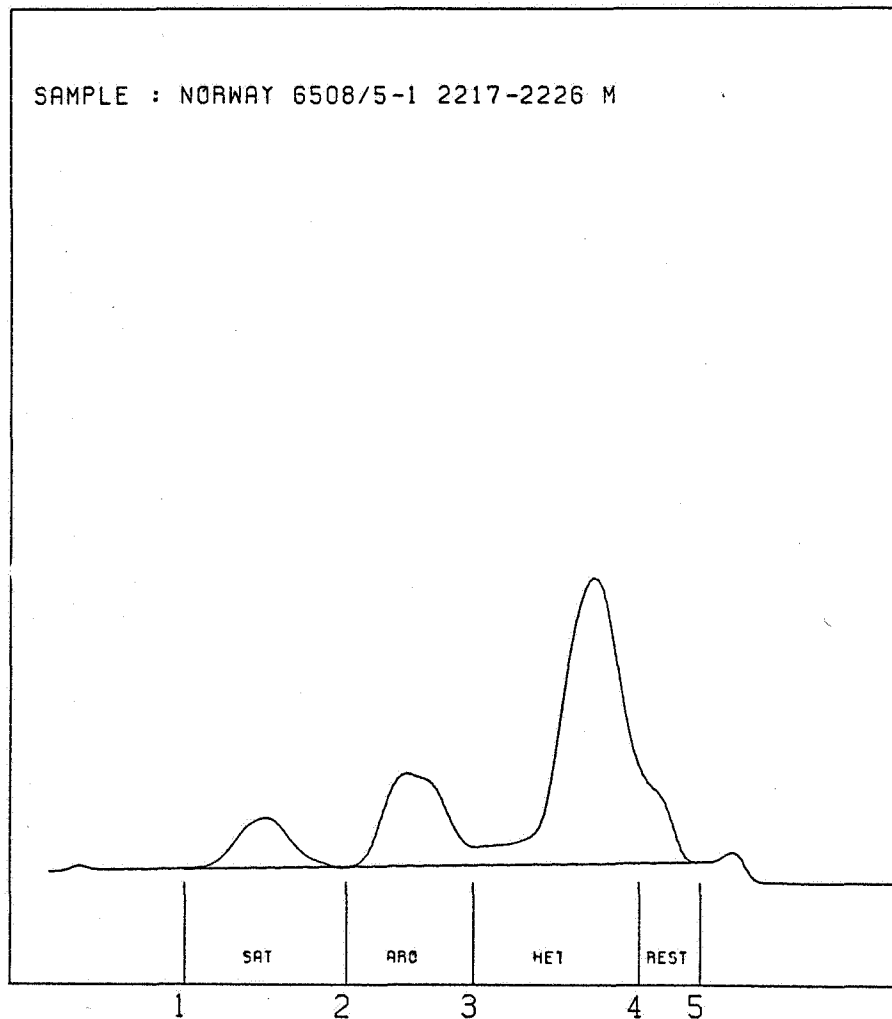


FIG. 19D.



SAMPLE : S135974

WEIGHT LOST ON TOPPING : 0.0 %

- SATURATES	: 9.5 %
- AROMATICS	: 20.0 %
- HETEROCOMPOUNDS	: 61.3 %
- REST (HIGH MOL.)	: 9.1 %

\* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE

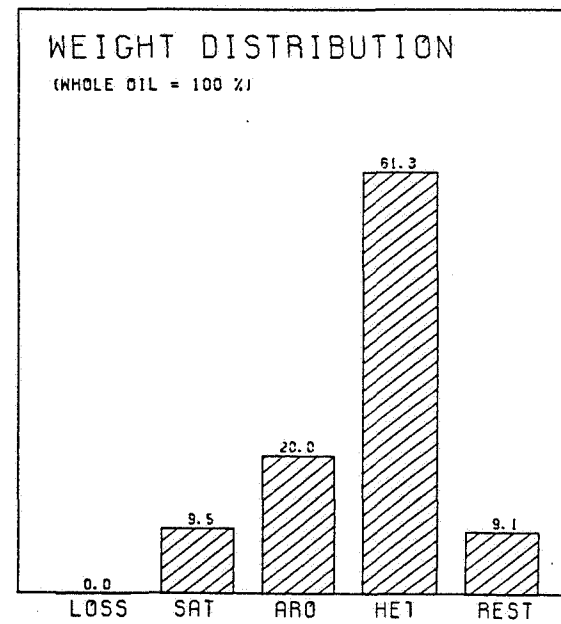
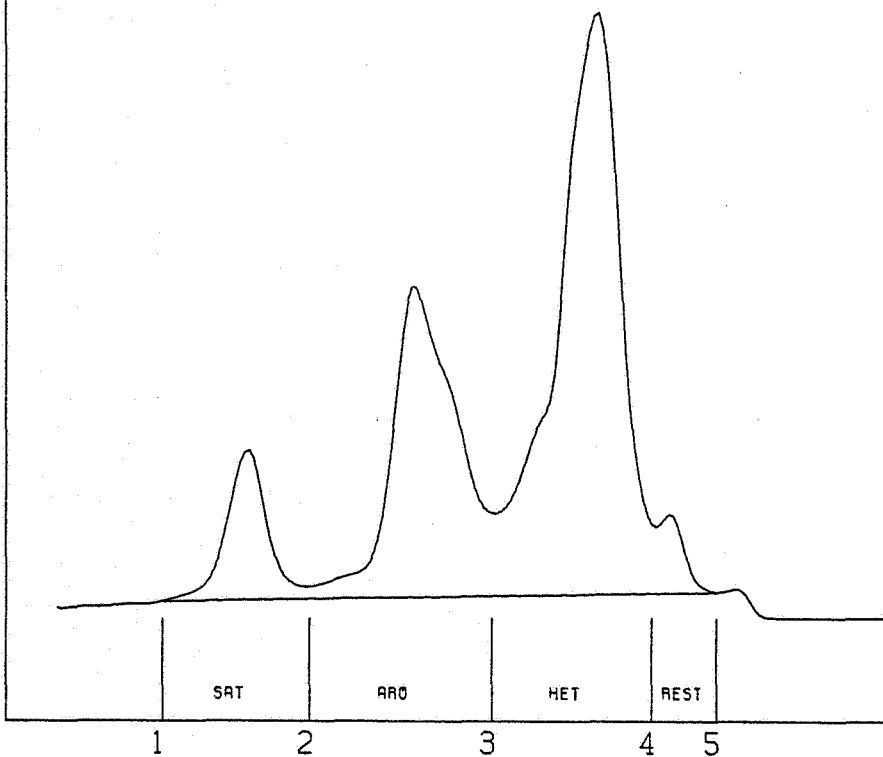


FIG. 19E.

SAMPLE : NORWAY 6508/5-1 2217M VERHIT



SAMPLE : S136307

WEIGHT LOST ON TOPPING : 0.0 %

- SATURATES : 9.4 %
- AROMATICS : 30.7 %
- HETEROCOMPOUNDS : 56.3 %
- REST (HIGH MOL.) : 3.6 %

\* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE

### WEIGHT DISTRIBUTION

(WHOLE OIL = 100 %)

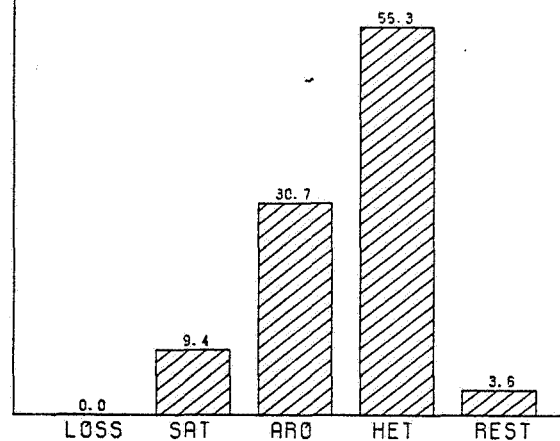


FIG. 19F.





# VISUAL VOLUME PERCENTAGE ESTIMATION

## Norway, 6508/05-01

Date : 8-JAN-88

Sample(s)

1614.00 m/C  
 1695.00 m/C  
 2076.00 m/C  
 2178.00 m/S  
 2217.00 m/C  
 2276.00 m/S  
 2376.00 m/C

		ORGANIC MATTER														MINERAL MATTER													
		SOM		VITRINITE				LIPTINITE						INERTINITE		MINERAL MATTER													
		LOAD BEARING		NON-L. B.		VIT.-1		VIT.-2				ALGAE																	
DENSE	LAYERS	LENSES	DIFFUSE / INTERGRANULAR	LENSES	TELOCOLLINITE	DETTRITAL	LENSES	DETTRITAL	LENSES	DESMOCOLLINITE	SPORINITE (MICRO-)	SPORINITE (MEGA-)	CUTINITE	SUBERINITE	RESINITE (+ FLUORINITE)	LIPTODETRINITE	BOTRYOCOCCUS	TASMANITES	OTHER ALGAE	MICROPLANKTON	EXSUDATINITE (FLUORESCING)	EXSUDATINITE (NON-FLUORESCING) S.HYDR.	SCLERONITE	(SEMI-) FUSINITE (+ INERTODETRINITE)	MICRINITE (+ OXY-MICRINITE)	UNDEFINED MINERALS	FRAMBOIDAL PYRITE	AGGREGATES / CRYSTALS	PYRITE
	5	10	3					<1	1	1						1								3	F	71	5	<1	
	3	5	3					1	1							1								2	F	81	1	2	
	5	10	5	10			20	5	5		<1				<1	1	<1							1	C	33	5	<1	
		3	5	20			25	10	3		<1				1	1								5	F	26	1	<1	
		2	2	15			55		2		<1				<1	1								1	F	21	1	<1	
	5	3	5				30	15	10		<1				2	3								5	C	22	<1	<1	
		3	5	2			5	3	4		1				2	2								8	C	65	<1	<1	

Page : 1

Fig. 20 b

# REFLECTANCE HISTOGRAM

COUNTRY : NORWAY  
WELL/OUTCROP : 6508/5-1  
DEPTH/SAMPLE NR. : 2076 M  
SAMPLE TYPE : CUTTING SAMPLE

MEAN : 0.44  
DEVIATION : 0.03  
MODE : 0.42  
MEASUREMENTS : 100

ANALYST : KMR D. D. : 6-JAN-88

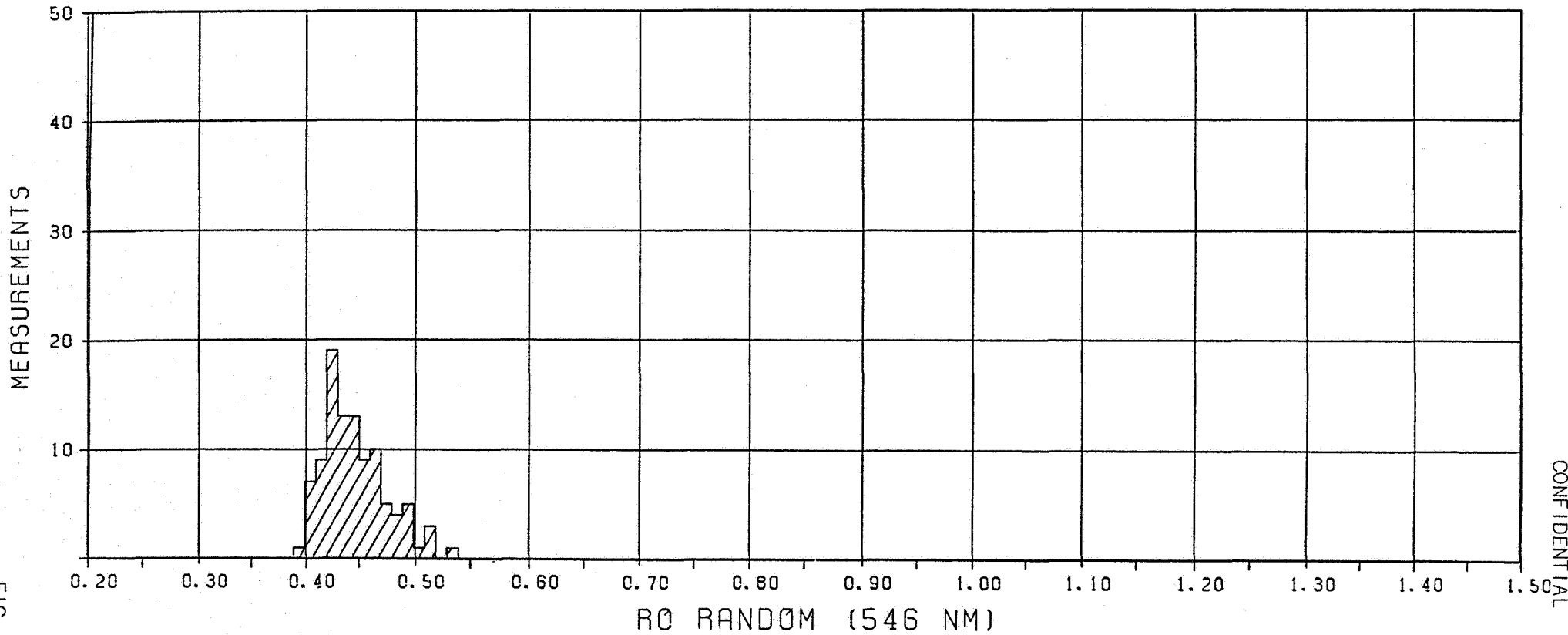


FIG. 21A.

TELOCOLLINITE

# REFLECTANCE HISTOGRAM

COUNTRY : NORWAY  
WELL/OUTCROP : 6508/5-1  
DEPTH/SAMPLE NR. : 2178 M  
SAMPLE TYPE : SIDEWALL SAMPLE

MEAN : 0.43  
DEVIATION : 0.03  
MODE : 0.40  
MEASUREMENTS : 100

ANALYST : KMR D. D. : 6-JAN-88

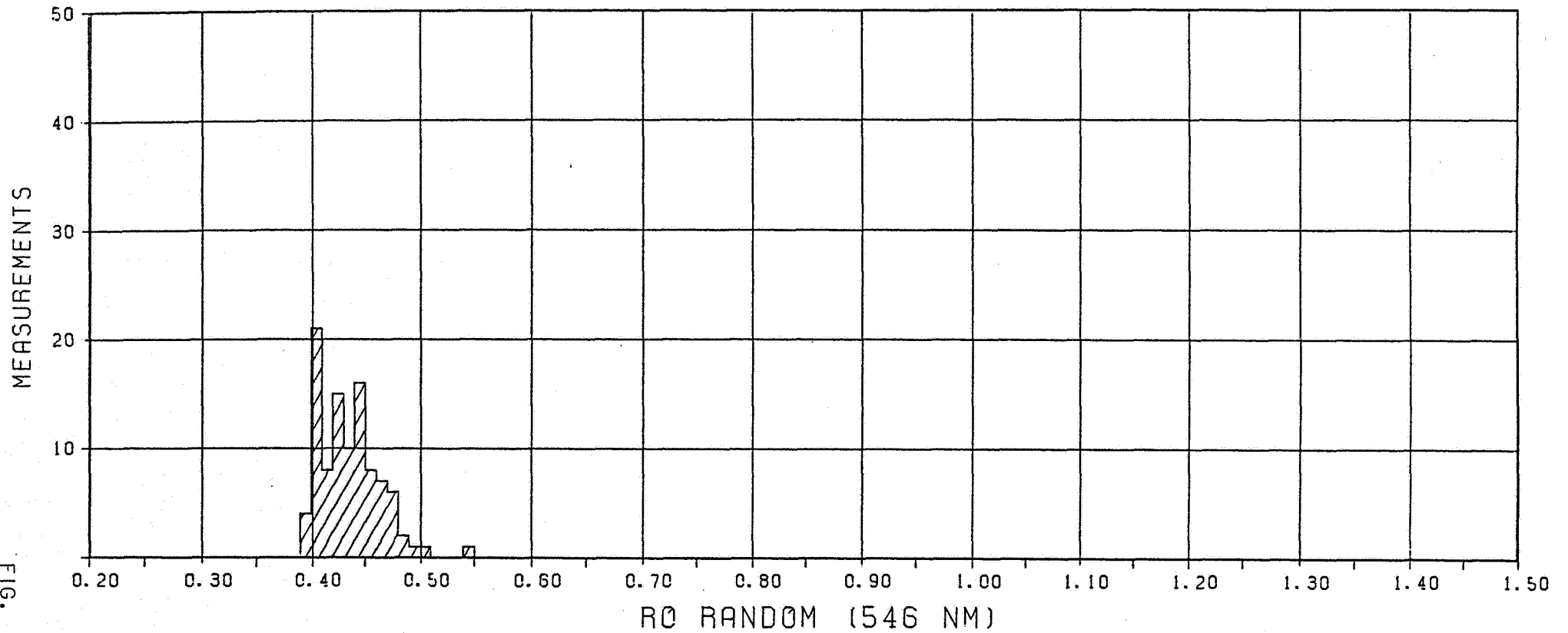


FIG. 21B.

TELOCOLLINITE

# REFLECTANCE HISTOGRAM

COUNTRY : NORWAY  
WELL/OUTCROP : 6508/5-1  
DEPTH/SAMPLE NR. : 2217 M  
SAMPLE TYPE : CUTTING SAMPLE

MEAN : 0.53  
DEVIATION : 0.03  
MODE : 0.55  
MEASUREMENTS : 100

ANALYST : KMR D. D. : 8-JAN-88

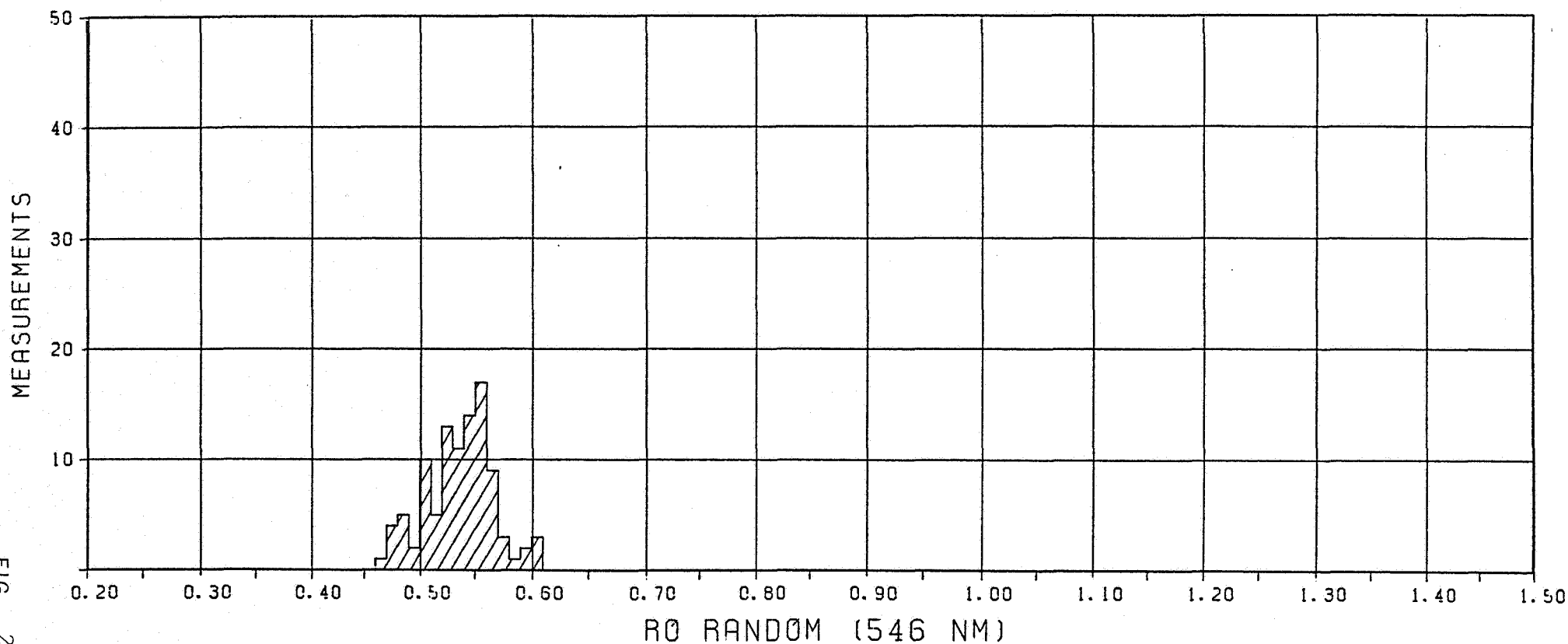


FIG. 210.

DEPTH: 2217 - 2226 M; TELLOQUINITF

# REFLECTANCE HISTOGRAM

COUNTRY : NORWAY  
WELL/OUTCROP : 6508/5-1  
DEPTH/SAMPLE NR. : 2276 M  
SAMPLE TYPE : SIDEWALL SAMPLE

MEAN : 0.41  
DEVIATION : 0.04  
MODE : 0.40  
MEASUREMENTS: 100

ANALYST: KMR D. D. : 6-JAN-88

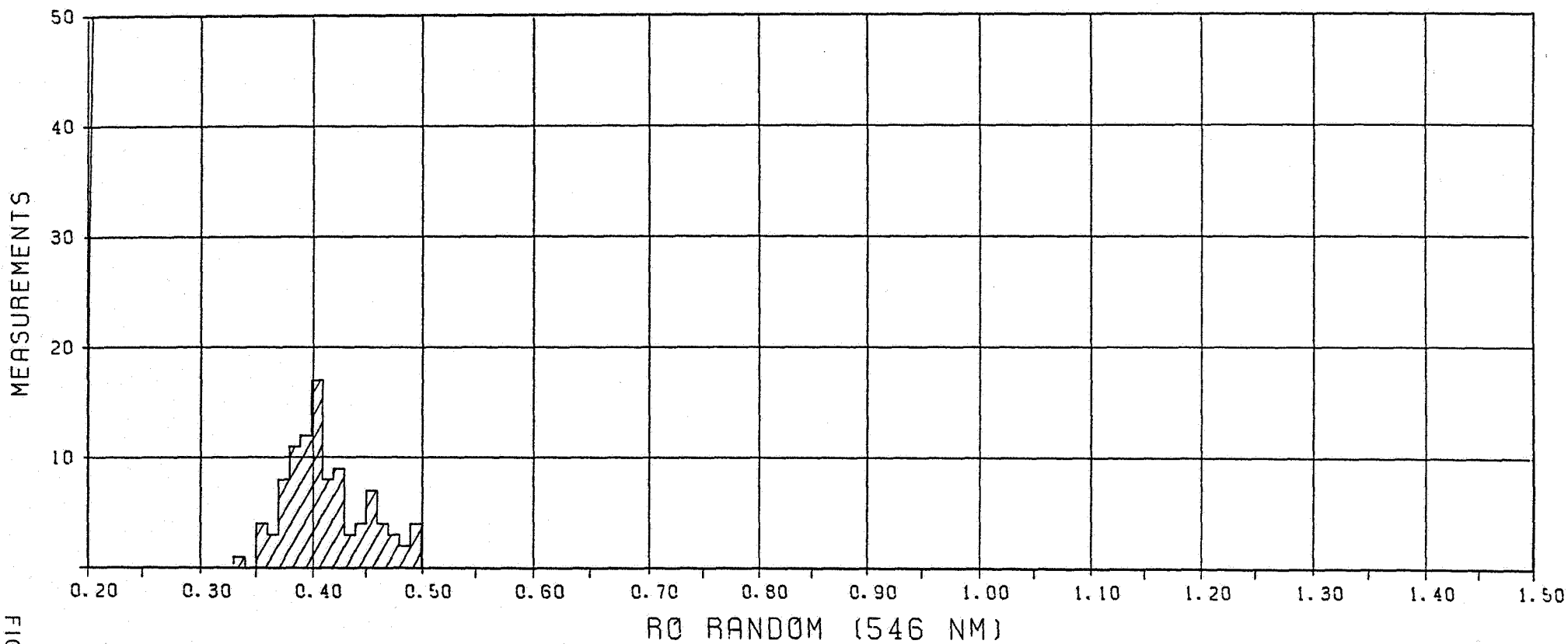


FIG. 21D.

DESMOCOLLINITE

# REFLECTANCE HISTOGRAM

COUNTRY : NORWAY  
WELL/OUTCROP : 6508/5-1  
DEPTH/SAMPLE NR. : 2376 M  
SAMPLE TYPE : CUTTING SAMPLE

MEAN : 0.46  
DEVIATION : 0.04  
MODE : 0.47  
MEASUREMENTS: 100

ANALYST : KMR D. D. : 6-JAN-88

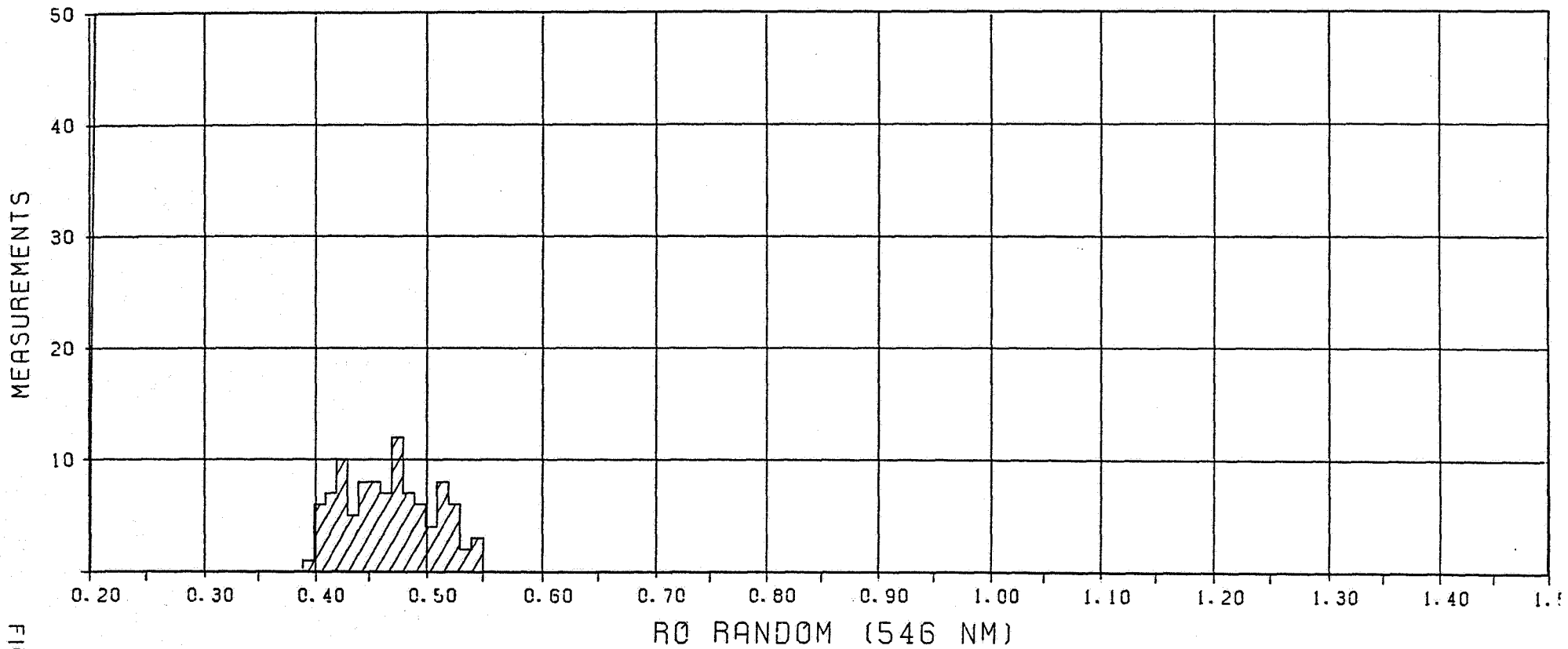


FIG. 21E.

DESMO / TELOCOLLINITE

Rock-Eval table for well 6508/5-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1614.00	cut	Sh/Clst: brn blk	0.67	27.42	2.48	11.06	9.43	291	26	28.1	0.02	403	059-1L
1617.00	cut	Sh/Clst: brn blk	0.80	29.66	2.44	12.16	10.32	287	24	30.5	0.03	401	060-1L
1620.00	cut	Sh/Clst: brn blk to blk	0.68	25.60	2.43	10.53	9.00	284	27	26.3	0.03	403	061-1L
1623.00	cut	Sh/Clst: brn blk to blk	1.27	21.63	1.89	11.44	8.36	259	23	22.9	0.06	406	050-6L
1623.00	swc	Sh/Clst: blk	0.77	11.28	1.63	6.92	6.53	173	25	12.1	0.06	404	156-1L
1626.00	cut	Sh/Clst: blk to brn blk	1.13	19.23	2.37	8.11	8.84	218	27	20.4	0.06	407	051-8L
1629.00	cut	Sh/Clst: blk to brn blk	1.01	18.39	2.47	7.45	8.71	211	28	19.4	0.05	406	052-5L
1630.00	swc	Sh/Clst: drk gy	1.03	18.73	1.78	10.52	10.18	184	17	19.8	0.05	411	157-1L
1632.00	cut	Sh/Clst: brn blk	0.62	21.98	2.29	9.60	9.36	235	24	22.6	0.03	405	053-1L
1635.00	cut	Sh/Clst: brn blk to blk	0.96	17.97	2.35	7.65	9.12	197	26	18.9	0.05	405	054-5L
1635.50	swc	Sh/Clst: gy blk	0.61	12.72	1.62	7.85	8.12	157	20	13.3	0.05	406	158-1L
1638.00	cut	Sh/Clst: brn blk to blk	1.20	18.28	2.55	7.17	9.63	190	26	19.5	0.06	402	055-5L
1641.00	cut	Sh/Clst: brn blk to blk	0.86	18.44	2.36	7.81	9.64	191	24	19.3	0.04	409	062-1L
1642.00	swc	Sh/Clst: gy blk	0.40	6.60	1.76	3.75	9.90	67	18	7.0	0.06	412	159-1L
1644.00	cut	Sh/Clst: brn blk to blk	0.56	21.11	2.28	9.26	9.29	227	25	21.7	0.03	406	063-1L
1647.00	cut	Sh/Clst: brn blk to blk	0.36	17.66	2.55	6.93	10.55	167	24	18.0	0.02	404	064-1L

TABLE 5A.

RKER 88+072

CONFIDENTIAL



Rock-Eval table for well 6508/5-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1695.00	cut	Sh/Clst: gn gy to y gy to m gy	-	-	1.20	-	0.33	-	364	-	-	447	079-1L
1695.00	cut	Sh/Clst: drk gy	0.61	30.13	2.24	13.45	9.85	306	23	30.7	0.02	407	079-3L
1698.00	cut	Sh/Clst: drk gy	0.91	22.15	3.04	7.29	10.31	215	29	23.1	0.04	409	080-2L
1699.80	swc	Sltst : brn gy	0.01	1.23	1.90	0.65	2.22	55	86	1.2	0.01	432	164-1L
1701.00	cut	Sh/Clst: drk gy	0.90	21.30	3.19	6.68	10.23	208	31	22.2	0.04	407	081-2L
1701.00	cut	Ca : m gy to y gy to m gy	0.01	0.10	0.88	0.11	0.38	26	232	0.1	0.09	428	081-3L
1704.00	cut	Sh/Clst: drk gy	1.09	20.17	3.52	5.73	9.74	207	36	21.3	0.05	405	082-2L
1704.00	cut	Sh/Clst: gn gy to y gy to m gy	0.01	0.21	3.04	0.07	0.66	32	461	0.2	0.05	470	082-4L
1707.00	cut	Sh/Clst: drk gy	0.61	25.91	2.43	10.66	10.32	251	24	26.5	0.02	404	083-2L
1707.00	cut	Sh/Clst: gn gy to y gy to m gy	0.01	0.15	2.45	0.06	0.74	20	331	0.2	0.06	419	083-4L
1710.00	cut	Sh/Clst: drk gy	0.40	24.24	2.02	12.00	9.12	266	22	24.6	0.02	404	084-1L
1710.00	swc	S/Sst : ol gy	0.01	1.18	1.60	0.74	2.06	57	78	1.2	0.01	467	165-1L

RKER 88-072

TABLE 5B.

CONFIDENTIAL

Rock-Eval table for well 6508/5-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2217.00	cut	Sltst : brn gy	0.11	9.03	2.04	4.43	6.41	141	32	9.1	0.01	420	257-1L
2223.00	cut	Coal : blk	0.89	69.28	10.35	6.69	62.80	110	16	70.2	0.01	430	259-2L
2229.00	swc	Coal : blk	0.17	51.55	5.17	9.97	40.10	129	13	51.7	-	426	179-1L