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GEOCHEMICAL INVESTIGATION OF THREE CORE SAMPLES AT 1577.7, 1585.0 AND 1590.0 M FROM WELL 31/2-10, NORWAY

by
J.M.A. Buiskool Toxopeus and J. Posthuma

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Investigation 9.5.4099

With cooperation from P. Lohbeck

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RIJSWIJK, THE NETHERLANDS

(Shell Research B.V.)

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GEOCHEMICAL INVESTIGATION OF THREE CORE SAMPLES AT 1577.7, 1585.0 AND 1590.0 M FROM WELL 31/2-10, NORWAY

1. RESULTS AND DISCUSSION

Geochemical analysis of the following three core samples from the Upper Jurassic Kimmeridge Clay Fm. of well 31/2-10, Norway, has been carried out:

1577.7 m
1585.0 m
1590.0 m

The results are shown in Tables 1-3 and in Figures 1-9. The results indicate the following:

1.1.

All three selected samples are fairly good to good source rocks for oil and gas (organic carbon contents; extract/carbon ratios; pyrolysis sniff values between 150 and 440 units; maceral analysis, Fig. 9; 'kerogenous' to 'mainly kerogenous' type of organic matter.

1.2.

The extracts of the samples are immature (gaschromatograms, Figs 1,3,4; sterane/triterpane fragmentograms, Figs. 7-8; grosscompositions).

All three samples were heated for further typing. However, the heating experiment for sample 1585.0 m failed and, since no material was left, no results are available.

1.3.

The shape of the gaschromatograms of the heated samples 1577.7 and 1590.0 m indicate the presence of structureless organic matter - SOM - (Figs. 2,5). The SOM is of bacterially reworked phytoplanktonic origin (C_{27}-C_{29} distribution of the sterane fragmentograms, Figs. 7-8). No indication for a

significant amount of landplant derived organic matter could be detected. There is a large variation in sulphur contents in the original samples (9.0-18.9%). The significance of this variation is not known.

1.4.

Geochemically, the three extracts are very similar to each other and also very similar to three core extracts from well 31/2-2 (gaschromatograms; sterane/triterpane fragmentograms; gross compostions; carbon isotope values).
The difference in sterane distribution between the samples in wells 31/2-2 and 31/2-10 and the samples from wells 15/3-1, 24/9-1 and 2/11-1 is explained by maturity differences.

The extracts are similar to an average North sea crude oil with respect to their gaschromatograms and sterane distributions. The carbon isotope value of -29.8 to -30.0 °/oo (heated samples), however, are somewhat lighter compared to the mean for crude oils from blocks 30,31,34 and 35 (-29.0 °/oo).

2. CONCLUSIONS

Three core samples from the Upper Jurassic Kimmeridge Clay Fm. of well 31/2-10, Norway, at 1577.7, 1585.0 and 1590.0 m are fairly good to good source rocks for oil and gas. The extracts of the samples are derived from predominantly structureless organic matter (bacterially reworked phytoplankton). No significant landplant contribution could be detected in the extracts.

Geochemically the three extracts are very similar to each other and also very similar to three core extracts from well 31/2-2. The extracts are of the same broad type of organic matter as that of an average North Sea crude oil. The carbon isotope values (-29.8 to -30.0 °/oo), however, are slightly more negative compared to those of crude oils from blocks 30,31,34 and 35.

Table 1 - GEOCHEMICAL DATA OF EXTRACTS

	Norway 31/2-10 1577.7 m Core 1 Original	Norway 31/2-10 1577.7 m heated
% ethyl acetate extract	0.35	2.56
% organic carbon after ethyl acetate extraction	5.3	2.7
% sulphur	9.0	3.2
ppm V as metals	-	26
ppm Ni as metals	-	74
pristane/phytane	0.8	1.7
pristane/nC17	2.1	0.6
phytane/nC18	3.4	0.4
C_{15} distribution		
1-ring		
2-ring		
C_{30} distribution		
3-ring		
4-ring		
5-ring		
C_{29} DOM		
% saturates*	10	16
% aromatics	31	38
% heterocompounds	59	46
$\delta^{13}C^{o}/oo$	n.e.	-29.8
extract/carbon	0.07	0.95
extract/original carbon	-	0.48
% saturates per original organic carbon	0.66	7.73

*) determined by thin layer chromatography

n.e. = not enough sample material

Table 2 - GEOCHEMICAL DATA OF EXTRACTS

	Norway 31/2-10 1585.0 m Core 2 Original
% ethyl acetate extract	0.27
% organic carbon after ethyl acetate extraction	3.5
% sulphur	18.9
ppm V as metals	-
ppm Ni as metals	-
pristane/phytane	0.6
pristane/nC17	1.9
phytane/nC18	4.4
C_{15} distribution	
1-ring	
2-ring	
C_{30} distribution	
3-ring	
4-ring	
5-ring	
C_{29} DOM	
% saturates*	12
% aromatics	23
% heterocompounds	65
$\delta^{13}C^{o}/oo$	n.e.
extract/carbon	0.08
extract/original carbon	-
% saturates per original organic carbon	0.93

*) determined by thin layer chromatography

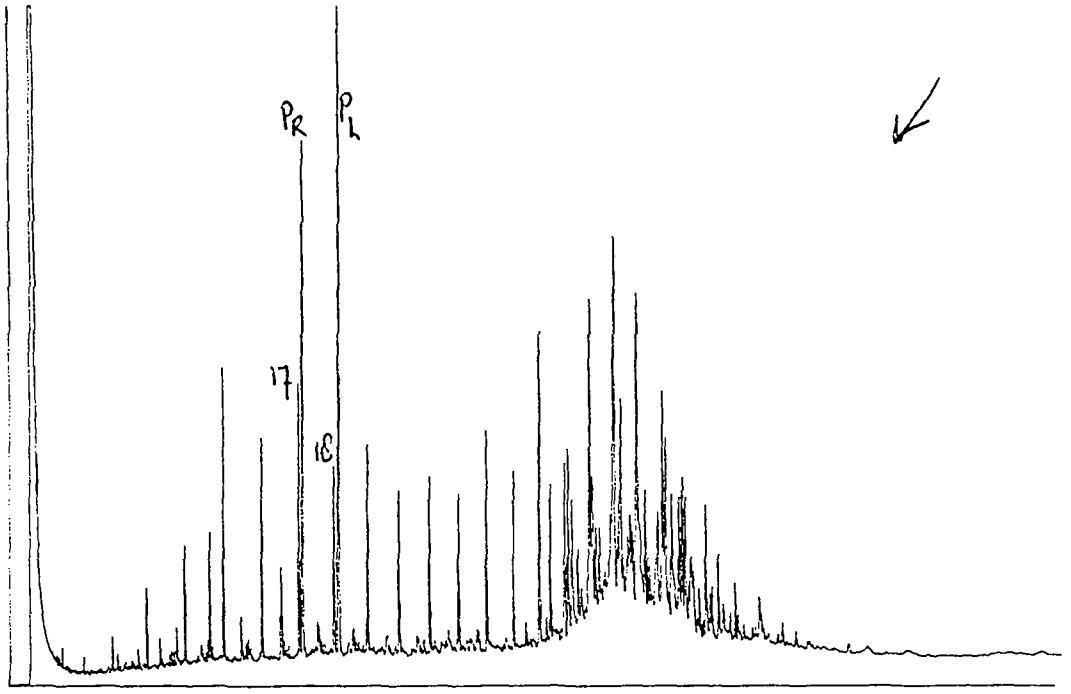
n.e. = not enough sample material

Table 3 - GEOCHEMICAL DATA OF EXTRACTS

	Norway 31/2-10 1590.0 m Core 2 Original	Norway 31/2-10 1590.0 m heated
% ethyl acetate extract	0.26	1.46
% organic carbon after ethyl acetate extraction	3.0	1.6
% sulphur	17.1	2.6
ppm V as metals	-	10
ppm Ni as metals	-	62
pristane/phytane	0.6	1.5
pristane/nC17	1.9	0.6
phytane/nC18	3.9	0.4
C_{15} distribution		
1-ring		
2-ring		
C_{30} distribution		
3-ring		
4-ring		
5-ring		
C_{29} DOM		
% saturates*	10	12
% aromatics	22	38
% heterocompounds	68	50
$\delta^{13}C^{o}/oo$	n.e.	-30.0
extract/carbon	0.09	0.91
extract/original carbon	-	0.49
% saturates per original organic carbon	0.87	5.84

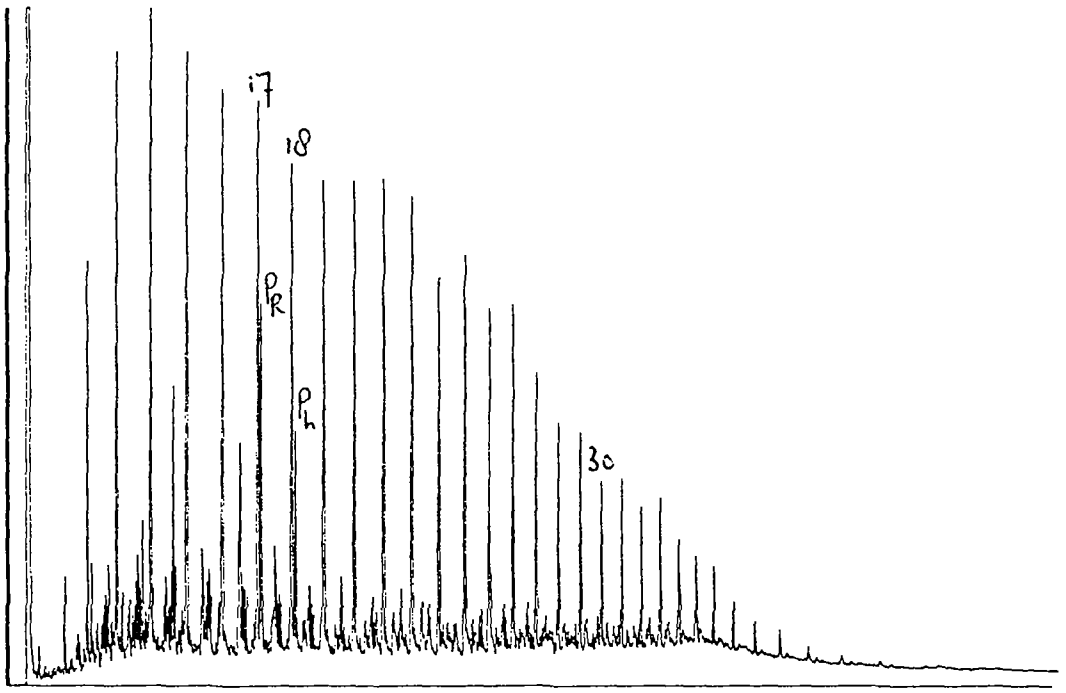
*) determined by thin layer chromatography

n.e. = not enough sample material



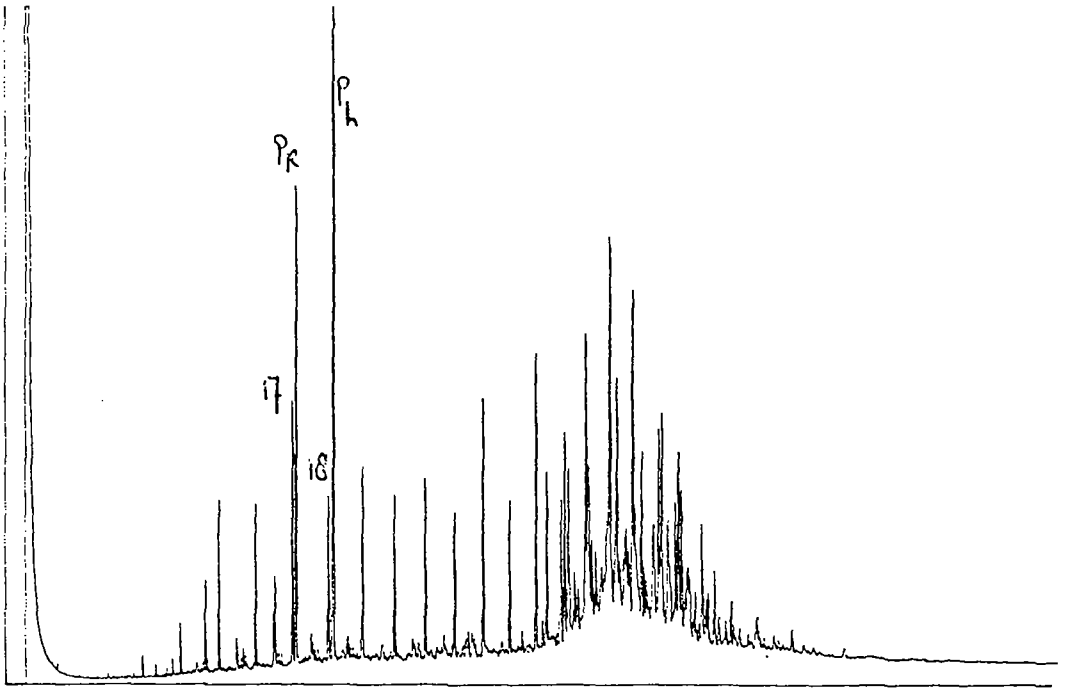
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 1. NORWAY. 31/2-10 1577.7 M. CORE#1



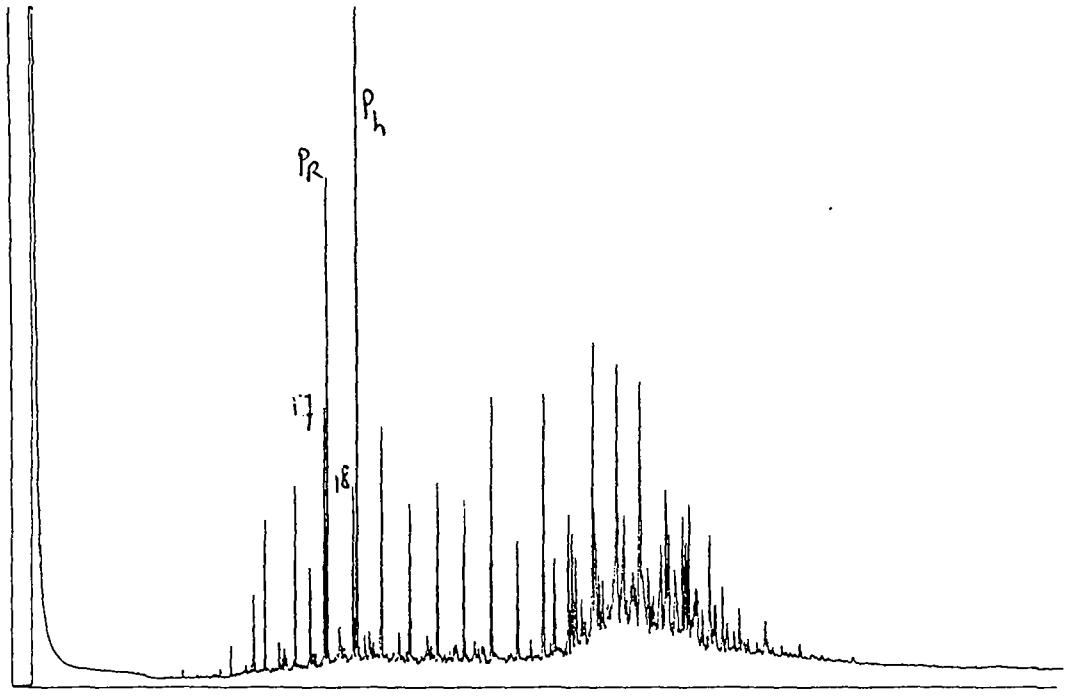
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 2. NORWAY. 31/2-10. 1577.7 M CORE-1 **heated**



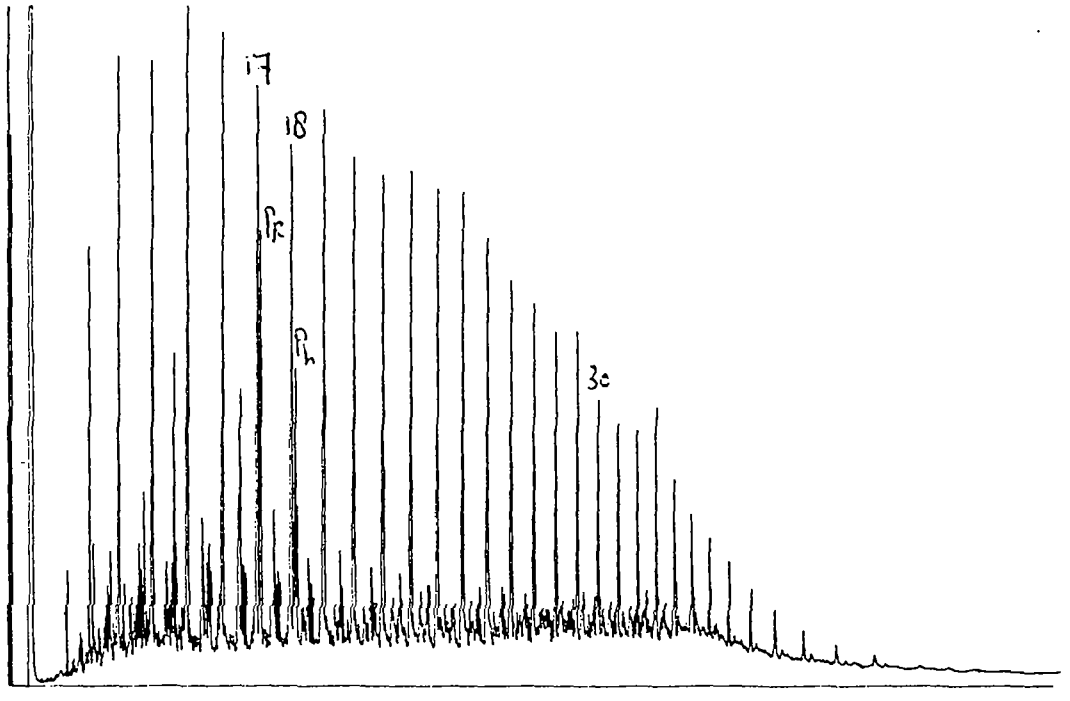
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 3. NORWAY. 31/2-10 1585.0 M. CORE#2



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

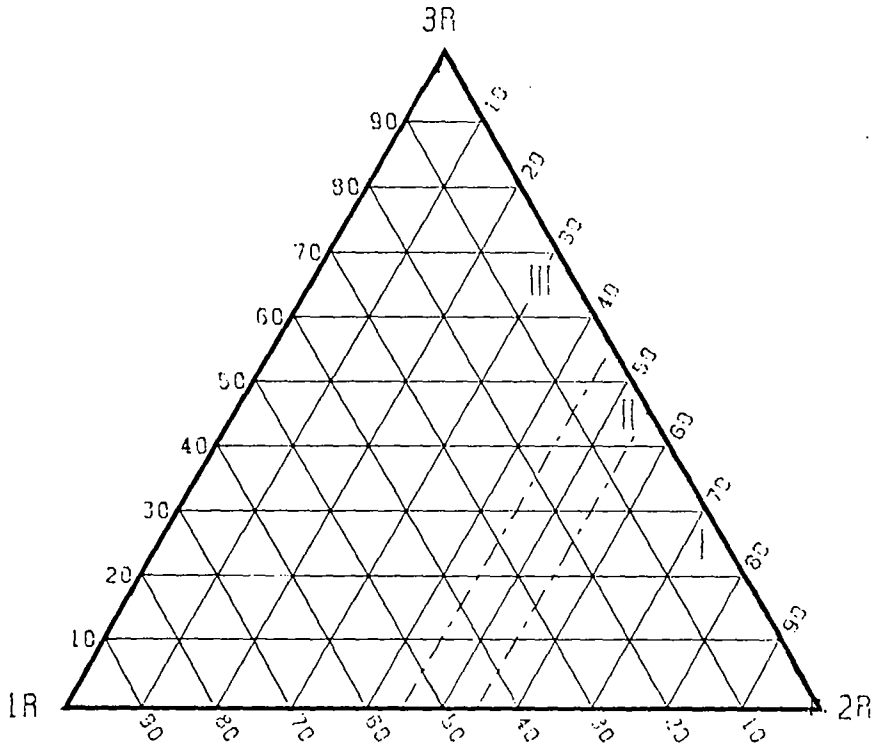
FIG. 4. NORWAY. 31/2-10 1590.0 M. CORE=2



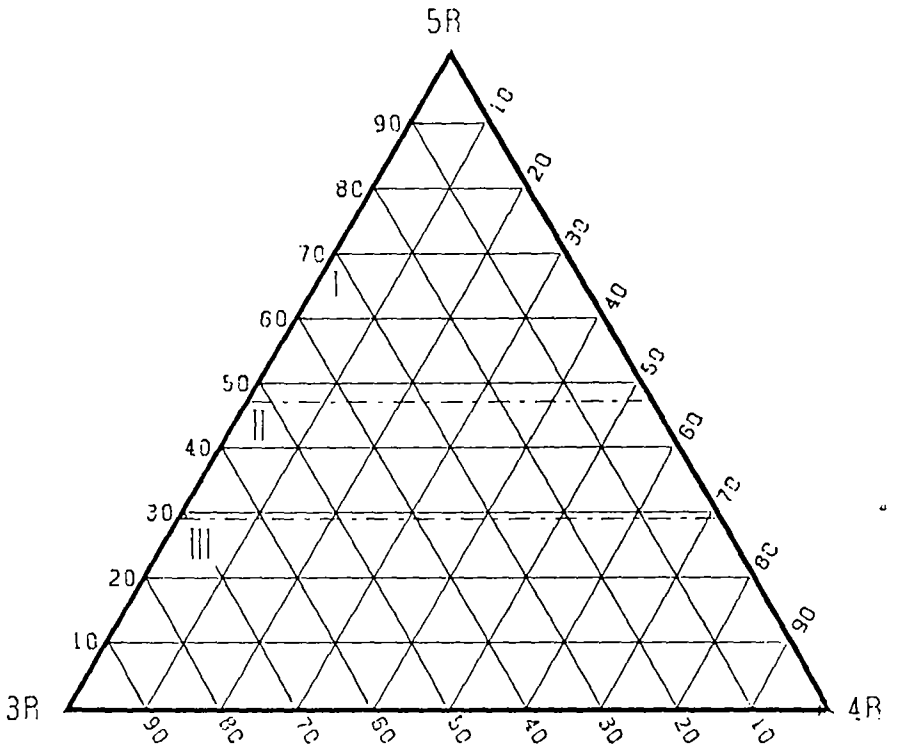
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 5. NORWAY. 31/2-10 1590 M CORE-2 **heated**

C_{15}-RINGDISTRIBUTION



C_{30}-RINGDISTRIBUTION



I LANDPLANT-DERIVED CRUDES WITH SUBSTANTIAL RESIN CONTRIBUTION TO SOURCE MATTER

II CRUDES OF MIXED ORIGIN

III CRUDES DERIVED FROM SOM AND/OR ALGAL MATTER

LEGEND
▭ -

FIG. 9

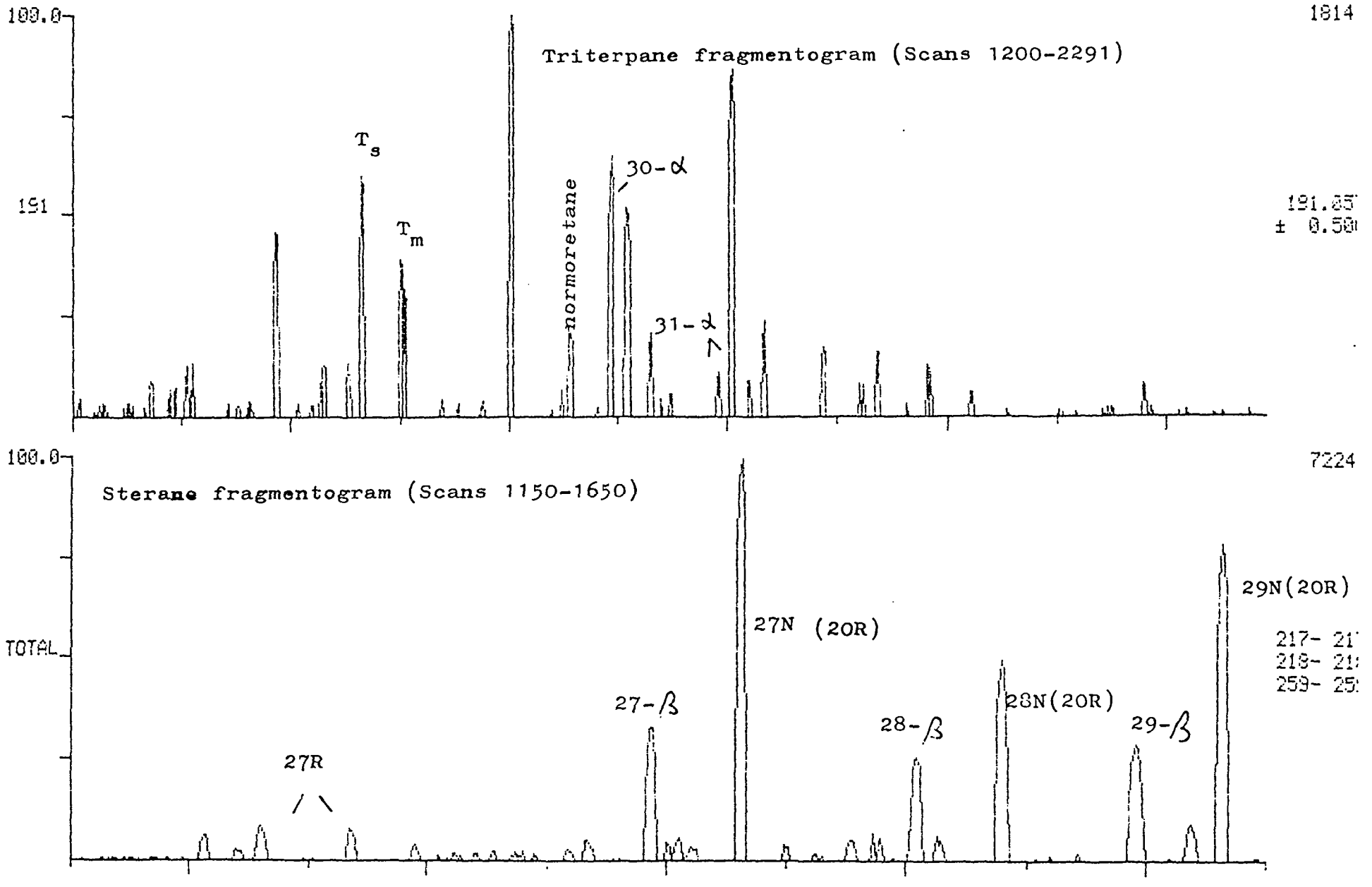


FIG. 7. GC-MS analysis 31/2-10, 1577.7 m.

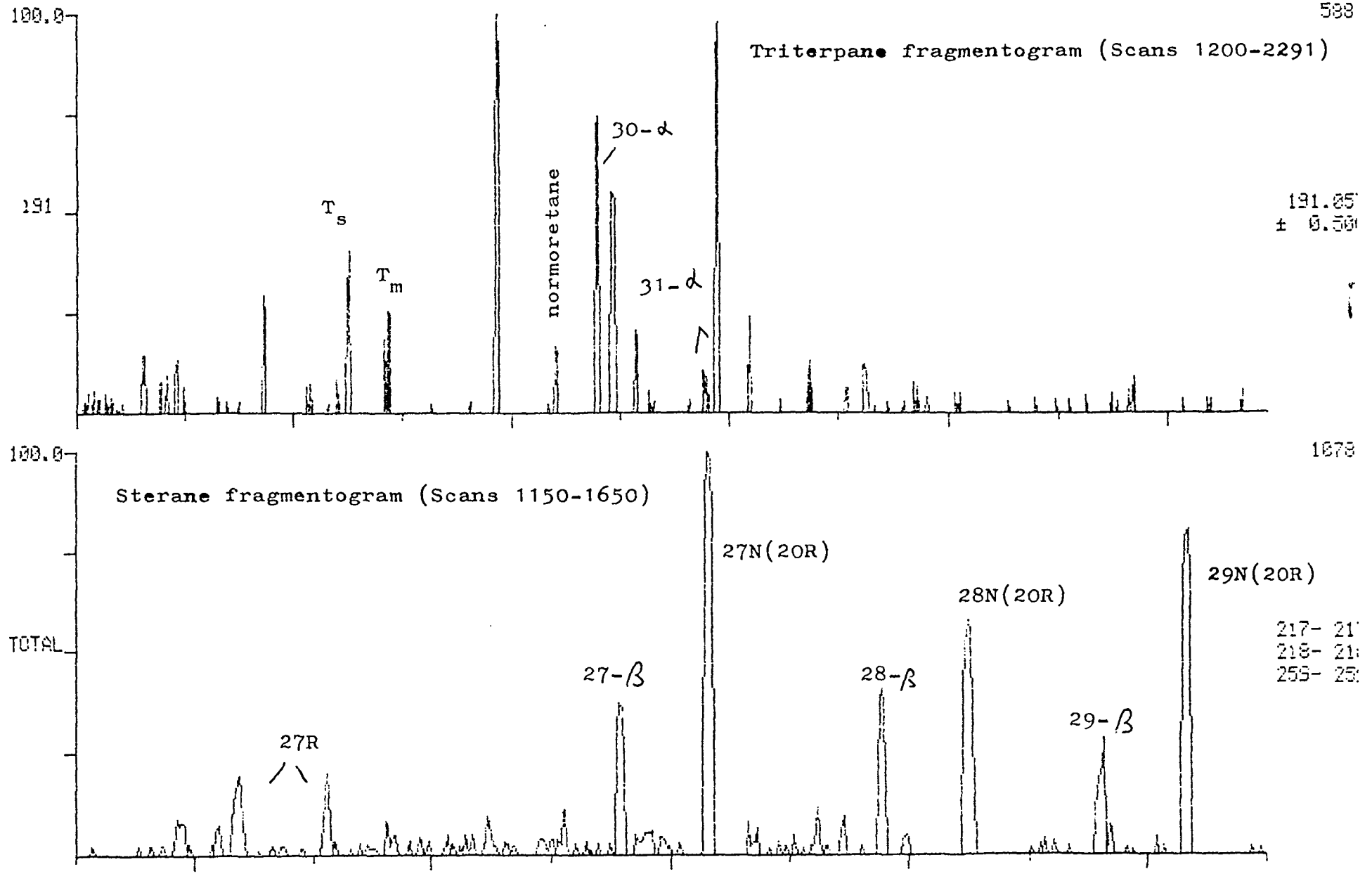


FIG. 8. GC-MS analysis 31/2-10, 1590 m.

MACERAL DESCRIPTION OF 14 SAMPLES FROM WELL 31/2-10, NORWAY

DEPTH IN M	SAMPLE TYPE	ORGANIC																		INORG.			
		VITR.			LIPTINITE					ALGAE				INERT.									
		SAPROPELIC ORG. MATTER	TELOCOLLINITE	TELINITE	DESMOCOLLINITE	SPORINITE	CUTINITE	RESINITE	LIPTODETRINITE	BOTRYOCOCCUS	TASMANITES	OTHER ALGAE	MICROPLANKTON	EXSUDATINITE	SCLEROTINITE	FUSINITE	MACRINITE	MICRINITE	UNDIFFINED MINERALS	FRAMBOIDAL PYRITE	AGGREGATES OF PYRITE	CRYSTALS OF PYRITE
1575.7	CORE	+			-	/			+		/		+			-		+	*	+	/	-
1576.7	CORE	+			-	/			+		/		+			-		+	*	+	/	-
1577.7	CORE	+			-	/			+		/		+			-		/	*	/	/	-
1578.7	CORE	+			-	-			+		-		+			-		/	*	/	-	-
1579.8	CORE	+			/	/			+		/		+			-		/	*	/	-	-
1580.7	CORE	+			-	/			+		-		+			-		+	*	/	/	-
1585.0	CORE	/			/	-			+		-		+			-		-	*	/	-	-
1586.0	CORE	-			/	-			/				/			-		-	*	/	-	-
1586.9	CORE	/			/	-			+		-		/			-		-	*	/	/	-
1588.0	CORE	/			/	-			+		-		+			-		-	*	/	-	-
1589.0	CORE	/			/	-			/		-		/			/		-	*	/	/	-
1590.0	CORE	+			/	-			+		-		/			/		+	*	+	/	/
1590.9	CORE	+			-	-			+				/			-		+	*	+	+	/
1592.0	CORE	+			/	/			+		-		+			/		+	*	/	/	-

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

FIG. 9

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