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GEOCHEMICAL INVESTIGATION OF TWO ROCK EXTRACTS IN WELL NORTH STAFFORD-1, UNITED KINGDOM

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 ROCK EXTRACTS IN WELL NORTH STAFFORD-1, UNITED KINGDOM

1.0. INTRODUCTION

A geochemical investigation has been carried out on two source rock samples (cuttings) from the Millstone Gritt in well North Stafford-1:

- 4190 ft, Namurian - C/Westphalian-A;
- 4760 ft, Namurian - B.

The objective of this investigation was to correlate the samples with crudes from the Midlands (see report RKER.85.110[1]).

The results are shown in Table 1 and in Figures 1-5.

2.0. RESULTS

Both extracts were generated from mature source (gaschromatograms, Figs. 1-2; mature sterane/triterpane distributions, Figs. 3-4).

Geochemically both extracts are different. Sample 4190 ft has a waxy character (gaschromatogram, Fig. 1) and contains a mixture of landplant matter and SOM (sterane fragmentogram with C_{29}- rearranged predominance, Fig. 3). The high pristane/phytane and pristane/nC_{17} ratios indicate a swampy environment of deposition for this sample.

Sample 4760 ft has a less waxy character (Fig. 2) and contains SOM probably with a less predominant landplant input (sterane fragmentogram with no C_{29}-rearranged predominance, Fig. 4). The relatively low pristane/phytane and low pristane/nC_{17} ratios indicate a more marine, reducing environment of deposition.

A comparison with the Midlands crudes and impregnations[1] shows the following. The high pristane/phytane ratio and the sterane fragmentograms (predominance of C_{29} rearranged) of sample 4190 ft correlate with similar features in the crudes Parsonage Colliery, Florence Colliery and Cronton Colliery. The low pristane/phytane ratio and the sterane fragmentogram (no C_{29} rearranged predominance) of sample 4760 ft correlate with similar features in crudes Dukeswood-181 and Eakring-177.

The carbon isotopes of samples 4190 ft (-23.8^{o}/oo) and 4790 ft ($-24.4.^{o}$/oo) do not correlate with the cabon isotopes of the Midlands crudes

(range -28.0 to 29.3°/oo). The values -23.8 and -24.4°/oo, however, were determined on topped whole samples containing only 6-9 % saturates. The topped oils on which the carbon isotopes have been determined, contain 58-66 % saturates. Therefore, we determined the carbon isotopes on the topped saturated fraction only on a combined sample 4220 + 4730 ft (no more original sample material was left; the sample material was combined since the isotopes values of the two groups of oils do not show large differences). The isotope value of the saturated fraction of sample 4220 + 4730 ft (-27.6°/oo) is comparable to the oils.

3.0. CONCLUSIONS

Two source rock extracts (4190 ft and 4760 ft) from well North Stafford-1 show a mature character. Both extracts are geochemically different. Sample 4190 ft (Westphalian A/Namurian C) has a waxy character and contains a mixture of SOM and landplant-derived material. This sample was deposited is a swampy environment and correlates with crude oils from Parsonage Colliery, Florence Colliery and Cronton Colliery. Sample 4760 ft (Namurian B) has a less waxy character and contains SOM with a less predominant landplant input. The sample was deposited in a more marine, reducing environment and correlates with the crude oils from Dukeswood and Eakring.

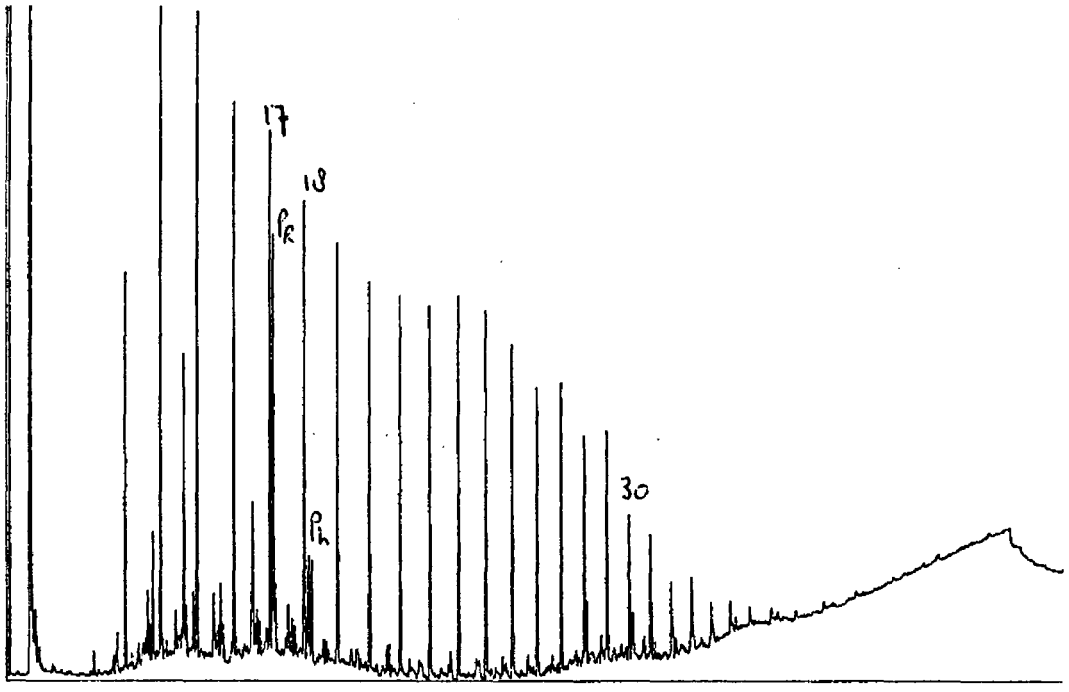
REFERENCES

1. Buiskool Toxopeus, J.M.A. and Veen, F.M. van der, Geochemical investigation of nine crude oils and two rocks extracts from the Midlands, United Kingdom.
RKER.85.110.

TABLE 1 - GEOCHEMICAL DATA OF EXTRACTS

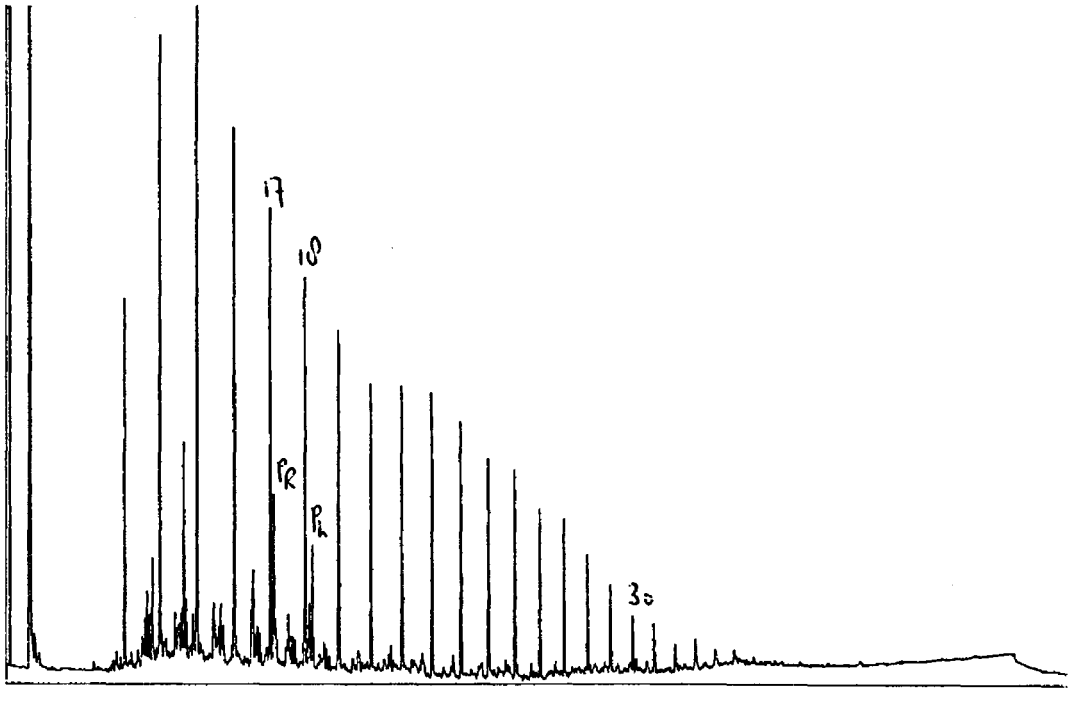
Sample	North Stafford-1 4190 ft cuttings Namurian-C/Westphalian-A Millstone gritt	North Stafford-1 4760 ft cuttings Namurian-B Millstone gritt
% ethyl acetate extract	0.38	0.22
% organic carbon after ethyl acetate extraction	8.7	3.8
extract/original carbon (after extraction)	0.04	0.06
% sulphur		
ppm V as metals	23	29
ppm Ni as metals	53	21
pristane/phytane	2.9	1.7
pristane/nC17	1.0	0.6
phytane/nC18	0.4	0.4
C_{15} distribution		
1-ring		
2-ring		
3-ring		
C_{30} distribution		
4-ring		
5-ring		
6-ring		
C_{29} DOM		
% saturates *	6	9
% aromatics	57	47
% heterocompounds	35	43
% asphaltenes	2	2
$\delta^{13}C^{o}/oo$	-23.8	-24.4
$\delta^{13}C^{o}/oo$ (saturates 4220 + 4730 ft		-27.6

* determined by thin layer chromatography.



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 1. U.K. N-STAFFORD-1 4190 F1



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 2. U.K N-STAFFORD 4760 F1

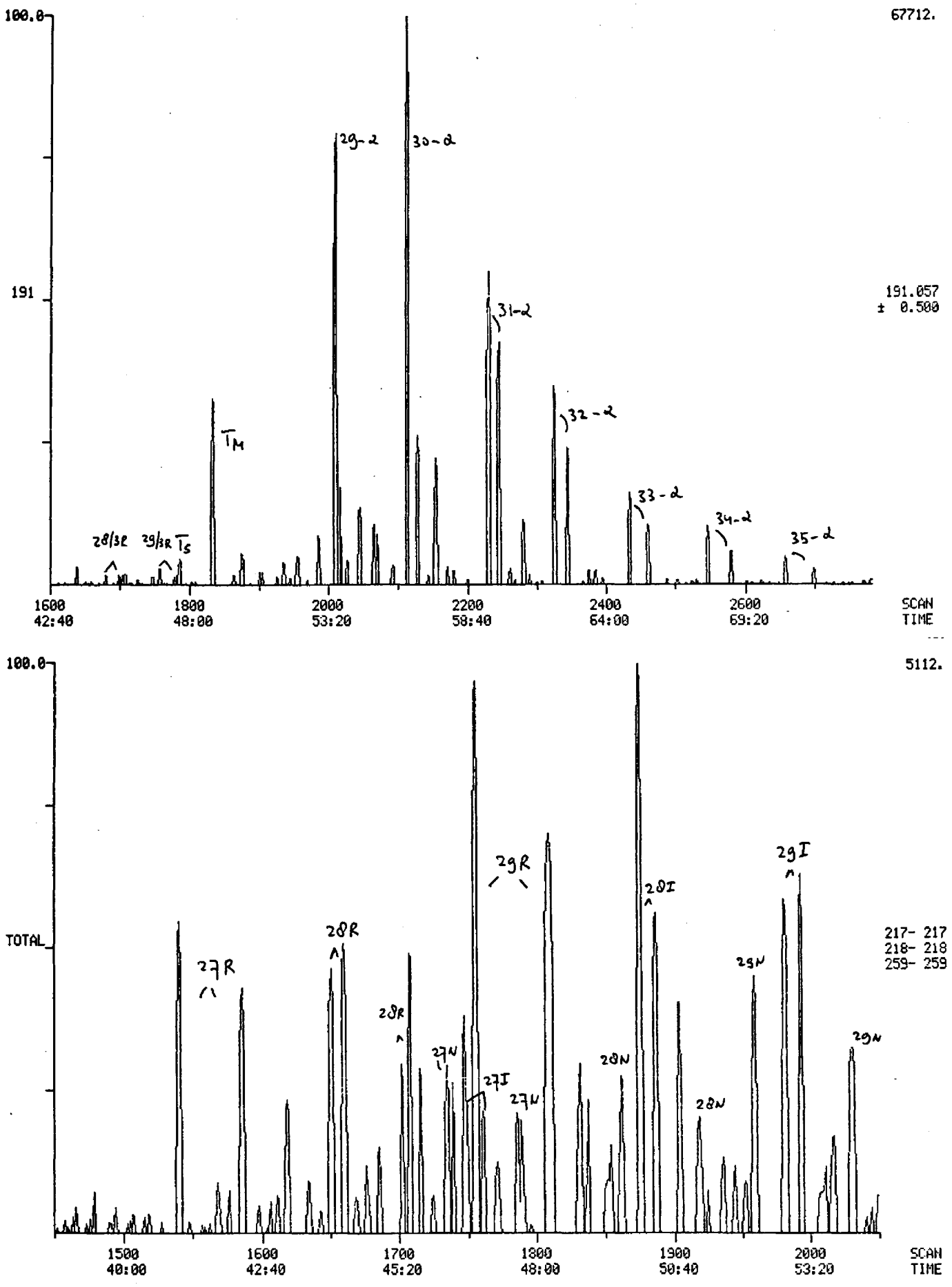


FIG. 3. GC-MS analysis North Stafford-1, 4190 ft

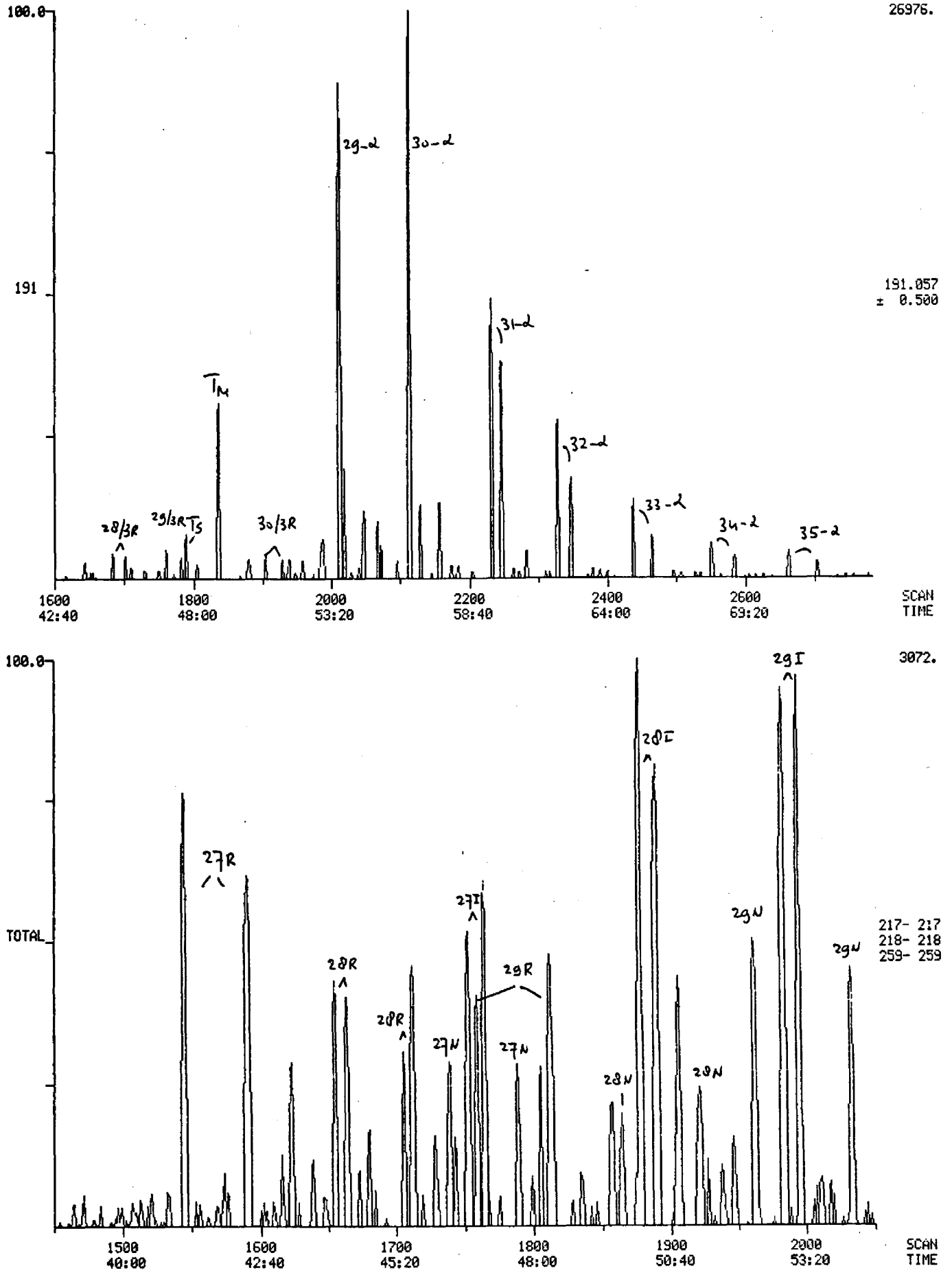


FIG. 4. GC-MS analysis North Stafford-1, 4760 ft

CONFIDENTIAL

MACERAL DESCRIPTION OF 12 SAMPLES FROM WELL NORTH STAFFORD-1

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
4070.0	CTGS	+		/	+	+								/	+	-	-			-					-		/		+	*	/	-	-
4190.0	CTGS		/	/	+	+		/	/					/	+	/	-			-					-		+		+	*	-	-	/
4220.0	CTGS	-	/	+	+	+			+					-	/	/	-			-					-		/		+	*	/	-	/
4460.0	CTGS	/		+	+	+		/	/					/	/	/	-			-					-		/		+	*	/		-
4760.0	CTGS	/		+	+	+		-	-					/	+	/	-			-					-		/		+	*	+	-	/
5010.0	CTGS		-	/	+	+		+	+					+	+	/	/		-	-					-		/		+	*	-		-
5150.0	CTGS	-		/	+	+		-	-					/	/	/	-			-					-		/		+	*	-		-
5450.0	CTGS	-		/	+	+		/	/					/	/	/	-			-					-		/		+	*	-		/
5750.0	CTGS	/		+	+	+										/				-					-		-		+	*	/		/
6050.0	CTGS			+	+	+			-							/	-			-					-		-		+	*	/		/
6350.0	CTGS		/	/	+	+										-									-		-		+	*	/		-
6620.0	CTGS		/	-	/	/										-									-		-		+	*	/		-

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

COMMENT LINES FROM WELL/OUTCROP : NORTH STAFFORD-1

4070.0 F : S.O.M. MICRINISED
AGE: NM/WP

4190.0 F : RARE MEGASPORES
S.O.M. MICRINISED
VITRINITE-2 GRADES INTO S.O.M.
AGE: NM/WP

4220.0 F : VITRINITE-2 GRADES INTO S.O.M. ASSOCIATED WITH FRAM PYRITE
S.O.M. MICRINISED
AGE: NM/WP

4460.0 F : S.O.M. MICRINISED
AGE: NM/WP

4760.0 F : VITRINITE-2 GRADES INTO S.O.M. ASSOCIATED WITH FRAM PYRITE
S.O.M. MICRINISED

5010.0 F : S.O.M. MICRINISED

5150.0 F : S.O.M. MICRINISED

5450.0 F : S.O.M. MICRINISED

5750.0 F : S.O.M. MICRINISED

6050.0 F : S.O.M. MICRINISED
ORANGE FLUORESCENCE (DOM > 70?)

6350.0 F : S.O.M. MICRINISED
INHOMOGENEOUS SAMPLE
FEW/COMMON GOOD SR PARTICLES; POSTMATURE ?

6620.0 F : S.O.M. MICRINISED
INHOMOGENEOUS SAMPLE
RARE/FEW GOOD SR PARTICLES

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