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GEOCHEMICAL INVESTIGATION OF A SOURCE ROCK SAMPLE
FROM WELL 6407/9-1 (2224 M), NORWAY

by

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Sponsor: Shell Risavika

Code:774.103.00

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Investigation: 812203929

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RIJSWIJK, THE NETHERLANDS

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GEOCHEMICAL INVESTIGATION OF A SOURCE ROCK SAMPLE FROM WELL
6407/9-1, NORWAY

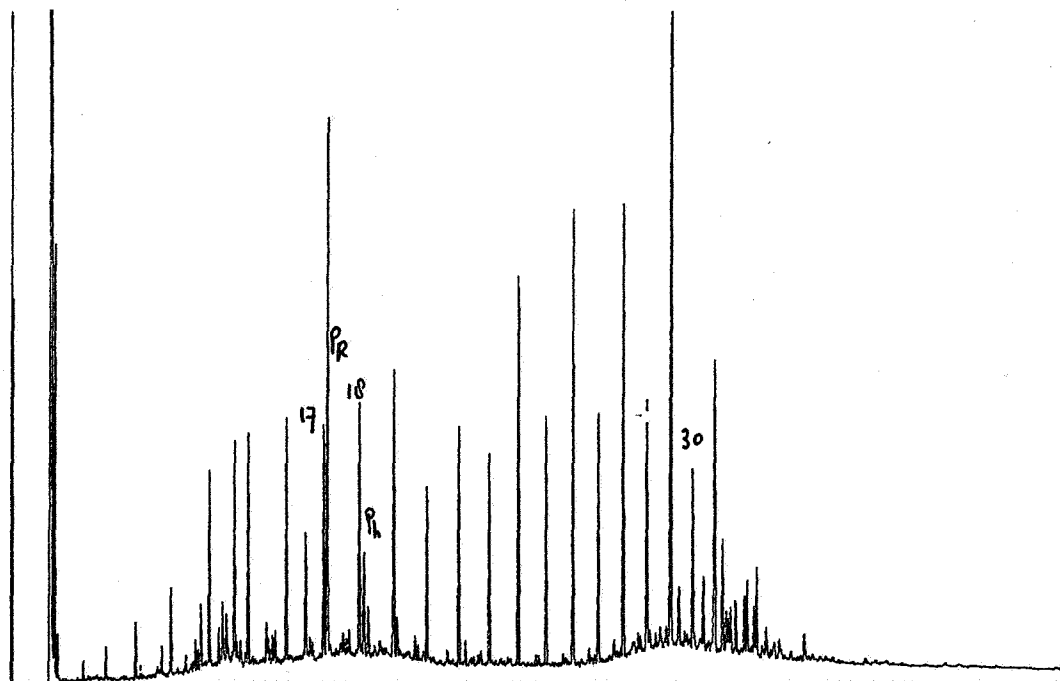
1. INTRODUCTION

A geochemical investigation has been carried out on sample 6407/9-1, 2224 m, cuttings, Lower Jurassic.

Table 1 - Geochemical data of extracts

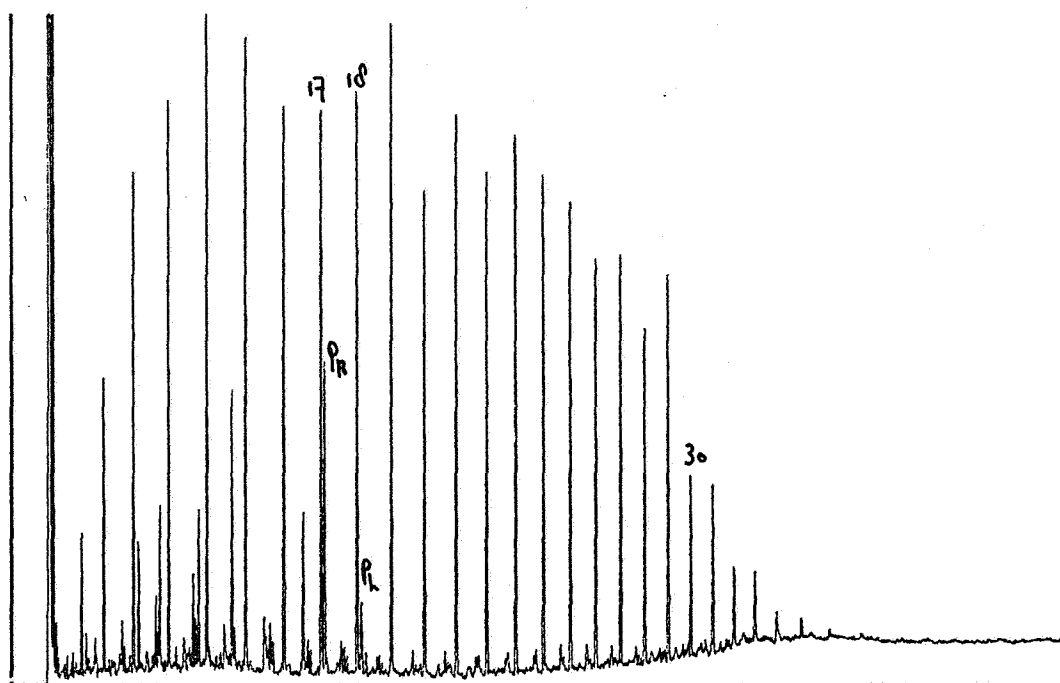
Sample	Norway 6407/9-1 2224 m, cuttings	
	original	heated
% ethyl acetate extract	1.6	4.6
% organic carbon after ethyl acetate extraction	24.3	21.7
extract/original carbon (after extraction)	0.07	0.19
% sulphur	4.5	0.9
ppm V as metals	4	0
ppm Ni as metals	12	2
pristane/phytane	5.8	3.8
pristane/nC17	3.3	0.7
phytane/nC18	0.5	0.2
C ₁₅ -distribution		
1-ring	32	70
2-ring	43	22
3-ring	25	8
C ₃₀ -distribution		
3-ring	8	9
4-ring	33	63
5-ring	59	28
C ₂₉ VR/E	0.77	-
% saturates*	5	9
% aromatics	18	34
% heterocompounds	65	53
% asphaltenes	12	5
$\delta^{13}\text{C}^{\circ}/\text{oo}$ (whole extract)	-27.3	-26.4
" (saturates)	-29.6	-28.4
" (aromatics)	-27.8	-26.5

*) Determined by thin-layer-chromatography



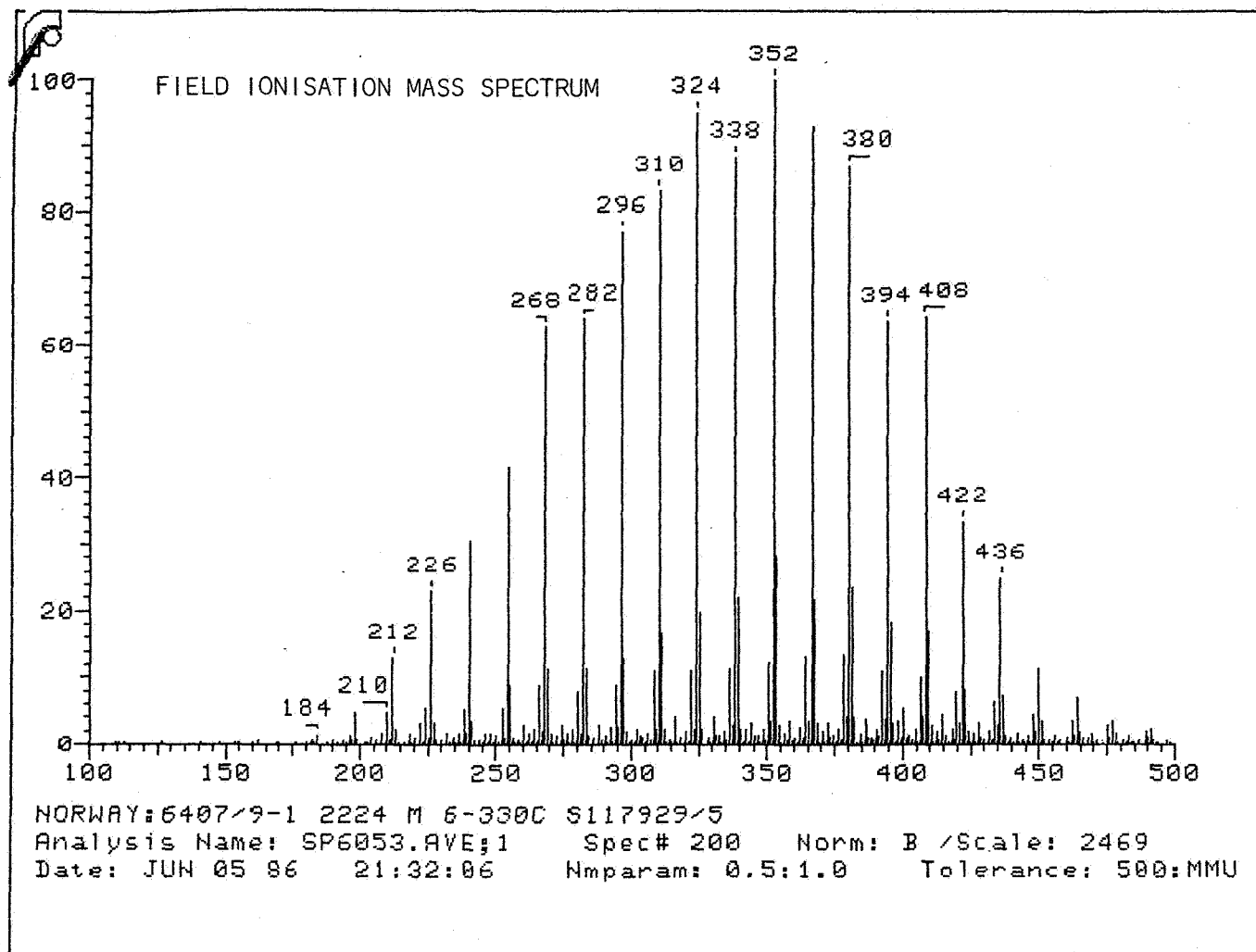
GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 1 NORWAY 6407/9-1 2224 M



GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 2 NORWAY 6407/9-1 2224 M 6 DGN 330 GR C VE heated



176540.

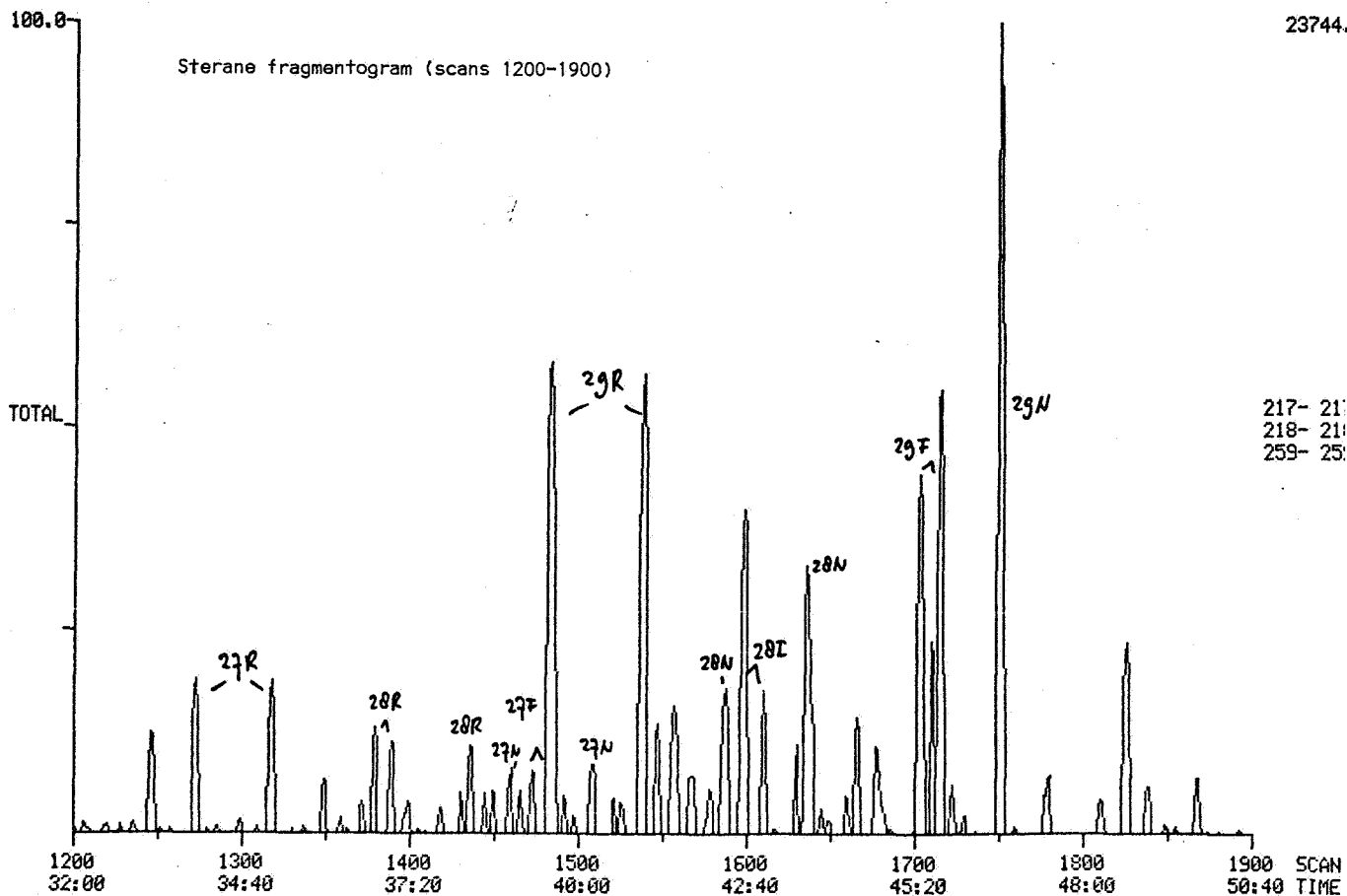
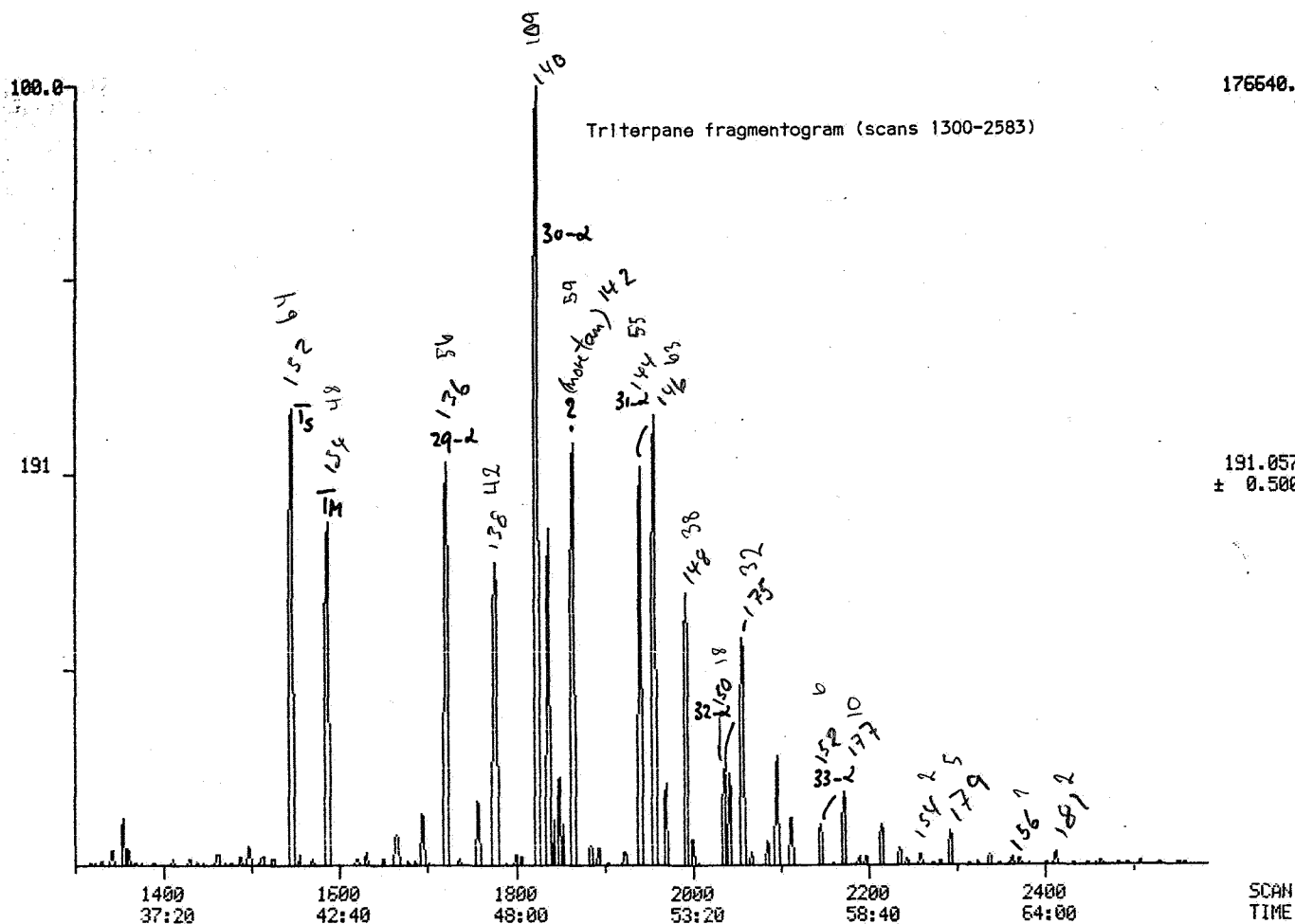


FIG.5A GC-MS analysis 6407/9-1, 2224 m, cuttings.

187904.

Triterpane fragmentogram (scans 500-2600)

191.057
± 0.500

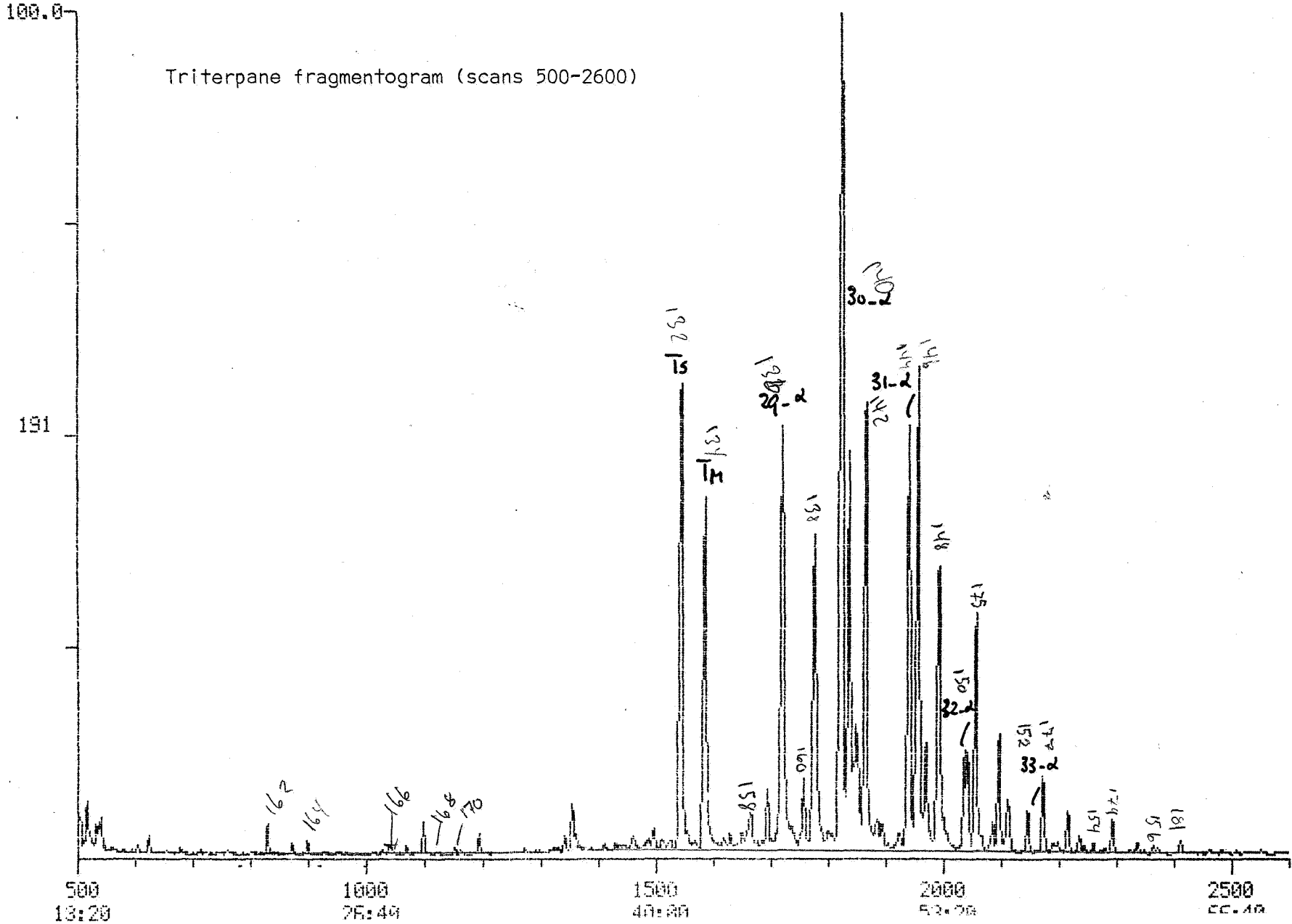


FIG. 5B GC-MS analysis 6407/9-1, 2224 m, cuttings.

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SCAN
TIME

COMMENT LINES FROM WELL/OUTCROP : 6407/9-1

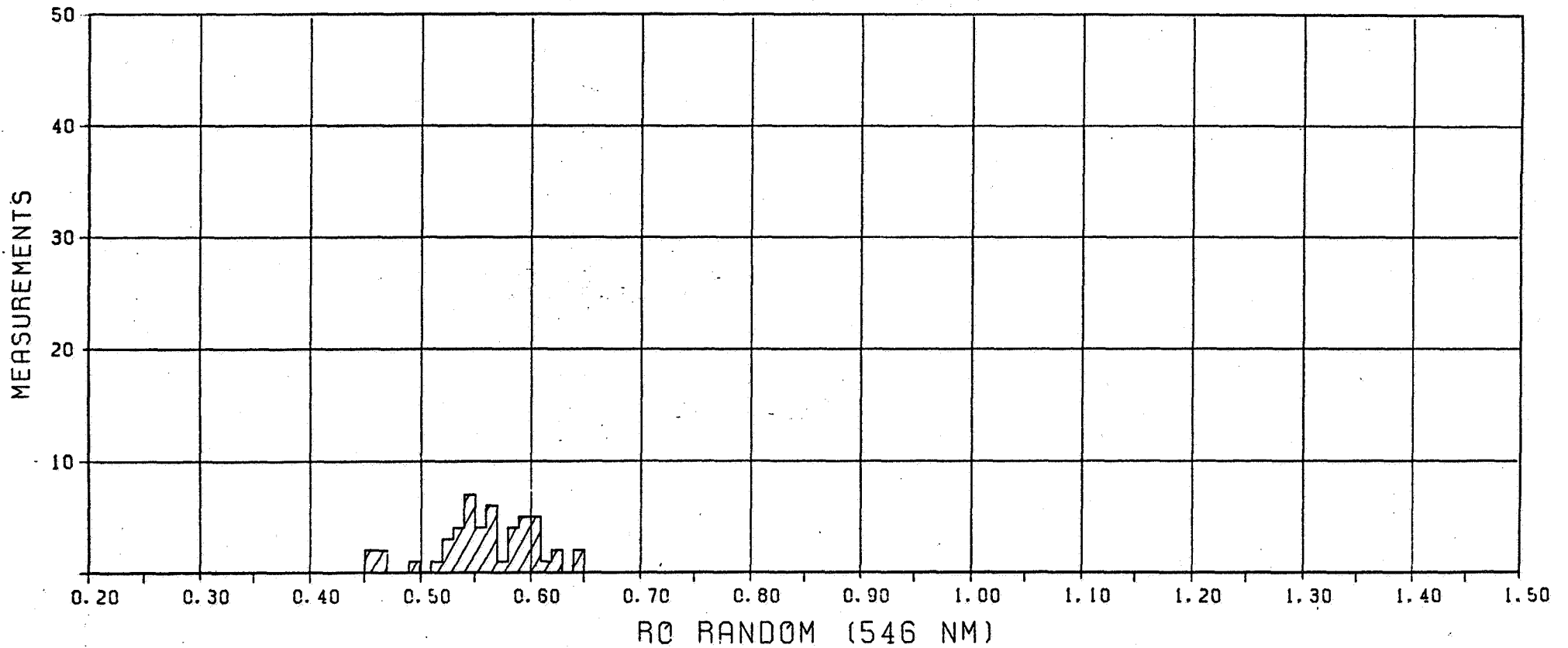
- 2134.0 M : S.O.M. MICRINISED
MICRINITE = OXY-MICRINITE ?
SAMPLE SEVERELY OXIDISED
VITRINITE GRADES INTO (SEMI-)FUSINITE
- 2224.0 M : SAMPLE PARTLY OXIDISED
INITIAL MICRINISATION S.O.M.
VITRINITE-2 GRADES INTO S.O.M.
- 2233.0 M : INITIAL MICRINISATION S.O.M.
SAMPLE PARTLY OXIDISED
VITRINITE-2 GRADES INTO S.O.M.
- 2264.0 M : SAMPLE PARTLY OXIDISED
SAMPLE SEVERELY OXIDISED
PYRITE SHOWS OXIDATION FEATURES
S.O.M. PARTLY MICRINISED
MICRINITE = OXY-MICRINITE ?
VITRINITE-2 GRADES INTO (SEMI-)FUSINITE
- 2290.0 M : INITIAL MICRINISATION S.O.M.
VITRINITE-2 GRADES INTO S.O.M.
VITRINITE-2 GRADES INTO S.O.M. ASSOCIATED WITH FRAM PYR.
- 2320.0 M : S.O.M. PARTLY MICRINISED
SAMPLE PARTLY OXIDISED
SAMPLE SEVERELY OXIDISED
VITRINITE-2 GRADES INTO S.O.M.
- 3473.0 M : S.O.M. PARTLY MICRINISED
SAMPLE SLIGHTLY OXIDISED
RESIN SHOWS MIGRATION FEATURES
- 3563.0 M : S.O.M. PARTLY MICRINISED
SAMPLE SLIGHTLY OXIDISED
- 4390.0 M : S.O.M. MICRINISED
VITRINITE-2 GRADES INTO S.O.M.
RARE SOLID HYDROCARBONS
PARTLY BAKED CTGS (BIT-METAMORPHISM)
- 4487.5 M : S.O.M. MICRINISED
VITRINITE-2 GRADES INTO S.O.M.
PARTLY BAKED CTGS (BIT-METAMORPHISM)
ORANGE FLUORESCENCE

REFLECTANCE HISTOGRAM

COUNTRY : NORWAY
WELL/OUTCROP : 6407/9-1
DEPTH/SAMPLE NR. : 2224, M
SAMPLE TYPE : CUTTING SAMPLE

MEAN : 0.56
DEVIATION : 0.04
MODE : 0.54
MEASUREMENTS : 50

ANALYST: BTX D. D. : 12-JUN-86



TELESCOPE/MICROSCOPE LENS + MINERAL MATTER

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FIG. 7

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REPORT TYPE	REPORT NO. IFE/KR/F-95/110		DATE 1995-07-05	
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	CLIENT A/S Norske Shell		REV. NO.	
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1 Introduction

This report gives the result of routine vitrinite reflectance analyses on 29 samples covering the interval from 410 to 2500 mRKB in well 6407/9-1 offshore Norway. Photometric spore colour estimation (sporecolomation) has been performed on 7 of these samples.

2 Material

2.1 Samples

The material was provided from the client as 23 washed and dried cuttings, 1 side wall core and 5 core chips. The sample positions are indicated in figure 1.

2.2 Geological information and casing points

Information on the stratigraphy and casing points was not supplied from the client.

3 Analytical techniques

3.1 Preparation

Standard palynological preparation techniques were used for sample preparation. The samples were initially treated with hydrochloric acid followed by hydrofluoric acid in order to dissolve and remove the mineral phase. The resulting organic residues were splitted in two parts. One part was dried to make briquettes for vitrinite reflectance analysis. The other part was prepared for photometric spore colour analysis and treated in a surplus of nitric acid for about 15 minutes (\pm 5 minutes). The residues resulting from

the acid treatment were then sieved through a 15 micron net and mounted as ordinary strew mounts using glyserol gelatin as embedding medium.

The sample material for vitrinite reflectance analysis was embedded in an epoxy resin to make briquettes, ground flat and polished using 0.25 micron diamond paste and magnesium oxide as the two final steps.

3.2 Analysis vitrinite reflectance

The analytical equipment being used was a Zeiss MPM 03 photometer microscope equipped with an Epiplan-Neofluar 40/0.90 oil objective. The sensitive measuring spot was kept constant for all measurements at about 2.5 micron in diameter. The measurements were made through a green band pass filter (546 nm) and in oil immersion (refractive index 1.515 at 18°C). The readings were made without a polarizer and using a stationary stage. This procedure is called measurement of random reflectance (%Rm). The photometer is calibrated daily against a standard of known reflectance (%Rm=0.588) and routinely (daily) checked against two other standards of significant different reflectances (%Rm=0.879 and 1.696). A deviation from these values of less than ± 0.01 and ± 0.02 respectively is considered as acceptable. The calibration is routinely checked during the course of measurements at least every hour, and a deviation of less than ± 0.005 is considered as acceptable.

For each sample at least 20 points were measured if possible, and quality ratings are given to various important aspects which may affect the measurements. The aspects are abundance of vitrinite, uncertainties in the identification of indigenous vitrinite, type of vitrinite, particle size, particle surface quality and abundance of pyrite.

3.3 Analysis photometric spore colour

The analytical equipment being used was a Zeiss Universal MPM 03 photometer microscope equipped for transmitted light. The measurements were made through a Neofluar 40/0.75 dry objective for transmitted light. The light source of the microscope, a 100 W tungsten lamp, was set to 7.5 V. The measurements were made with a sensitive measuring spot of about 5 micron in diameter. The measurements were made at two

wavelengths, 480 and 644 nm, using fixed Scott band pass filters mounted below the microscope stage.

The measurements were made in terms of translucency and subsequently subverted to absorbance using equation (1). The translucency values were obtained by dividing the intensity of light measured on a sporomorph by that on an empty spot next to the sporomorph in the embedding medium. Each measurement on a sporomorph was made on a complete area away from the periphery of the particle. For each sample up to 20 sporomorphs of higher land plant origin only are measured. No distinction, however, was made between different species of sporomorphs.

$$(1) \quad A = \log (1/T)$$

where A is absorbance (numeral 0) and T is translucency.

The spore colour data are presented in terms of the ratio $A_{644\text{nm}}/A_{480\text{nm}}$. This ratio is the average of calculated ratios for each individual measurement.

Table 1 Vitrinite reflectance data

Well
6407/9-1

IFE no.	Depth, mRKB	Sample type	Lithology	%Rm	Std. dev.	N	Quality	Preparation
SH 107	410	cut	clst	0.25	0.04	25	M	HF
SH 108	500	cut	clst	0.25	0.04	23	P	HF
SH 109	600	cut	clst	0.27	0.03	19	M	HF
SH 110	700	cut	sst/clst	0.26	0.04	23	M	HF
SH 111	790	cut	clst	0.27	0.04	20	M	HF
SH 112	900	cut	clst	0.19	0.03	11	P	HF
SH 113	1000	cut	clst	0.26	0.06	29	M	HF
SH 114	1100	cut	clst	0.25	0.02	19	M	HF
SH 115	1200	cut	clst	0.27	0.04	17	M	HF
SH 116	1300	cut	clst	0.27	0.02	9	M	HF
SH 117	1399	cut	clst	0.28	0.03	22	M	HF
SH 118	1498	cut	clst	0.30	0.05	13	M	HF
SH 119	1600	cut	clst	0.27	0.04	25	M	HF
SH 135	1603	swc	clst	0.32	0.04	18	M	bulk
SH 130	1668.45	core	sst/clst	0.31	0.03	22	M	bulk
SH 131	1671.74	core	sst/clst	0.31	0.03	21	M	bulk
SH 132	1673.8	core	clst/sst	0.34	0.04	22	M	bulk
SH 133	1674.4	core	clst	0.35	0.06	23	M	bulk
SH 134	1674.95	core	clst	0.34	0.03	22	M	bulk
SH 120	1699	cut	clst	0.33	0.05	25	Mst	HF
SH 121	1702	cut	clst	0.35	0.03	25	Gst	HF
SH 122	1798	cut	clst	0.37	0.05	24	Mst	HF
SH 123	1900	cut	clst	0.36	0.04	23	Mst	HF
SH 124	1999	cut	clst	0.36	0.04	24	Mst	HF
SH 125	2101	cut	clst	0.40	0.05	24	Mst	HF
SH 126	2200	cut	coal/sst	0.39	0.03	25	Gst	HF
SH 127	2299	cut	coal	0.48	0.05	25	Gst	HF
SH 128	2401	cut	sst	0.47	0.06	22	Mst	HF
SH 129	2500	cut	clst	0.46	0.05	15	M	HF

G	Good quality	P	Poor quality	st	HC-staining	HF	HF-treated
M	Moderate quality	X	Not vitrinite	Barren	Barren of vitrinite	Bulk	Bulk rock

Table 3 Photometric spore colour data

Well 6407/9-1

IFE no.	Depth, mRKB	Sample type	Lithology	A644n	Std. dev.	N	Quality	Eq. range
SH 107	410	cut	clst	0.20	0.09	16	P	0.29-0.64
SH 108	500	cut	clst	0.15	0.08	16	M	0.24-0.47
SH 109	600	cut	clst	0.19	0.05	16	M	0.28-0.60
SH 110	700	cut	sst/clst	barren	-	-	-	-
SH 111	790	cut	clst	0.18	0.09	15	G	0.25-0.57
SH 112	900	cut	clst	0.18	0.07	16	G	0.25-0.57
SH 132	1673.8	core	clst/sst	0.18	0.04	15	M	0.25-0.57
SH 129	2500	cut	clst	0.18	0.06	16	M	0.25-0.57

G	Good quality	P	Poor quality	st	HC-staining	HF	HF-treated
M	Moderate quality	X	Not sporom.	Barren	Barren of sporom.	Bulk	Bulk rock