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Geochemical investigation of a crude oil sample from
well 09/02-03, Norway

by

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Code: 876.106.10

investigation: 811005087

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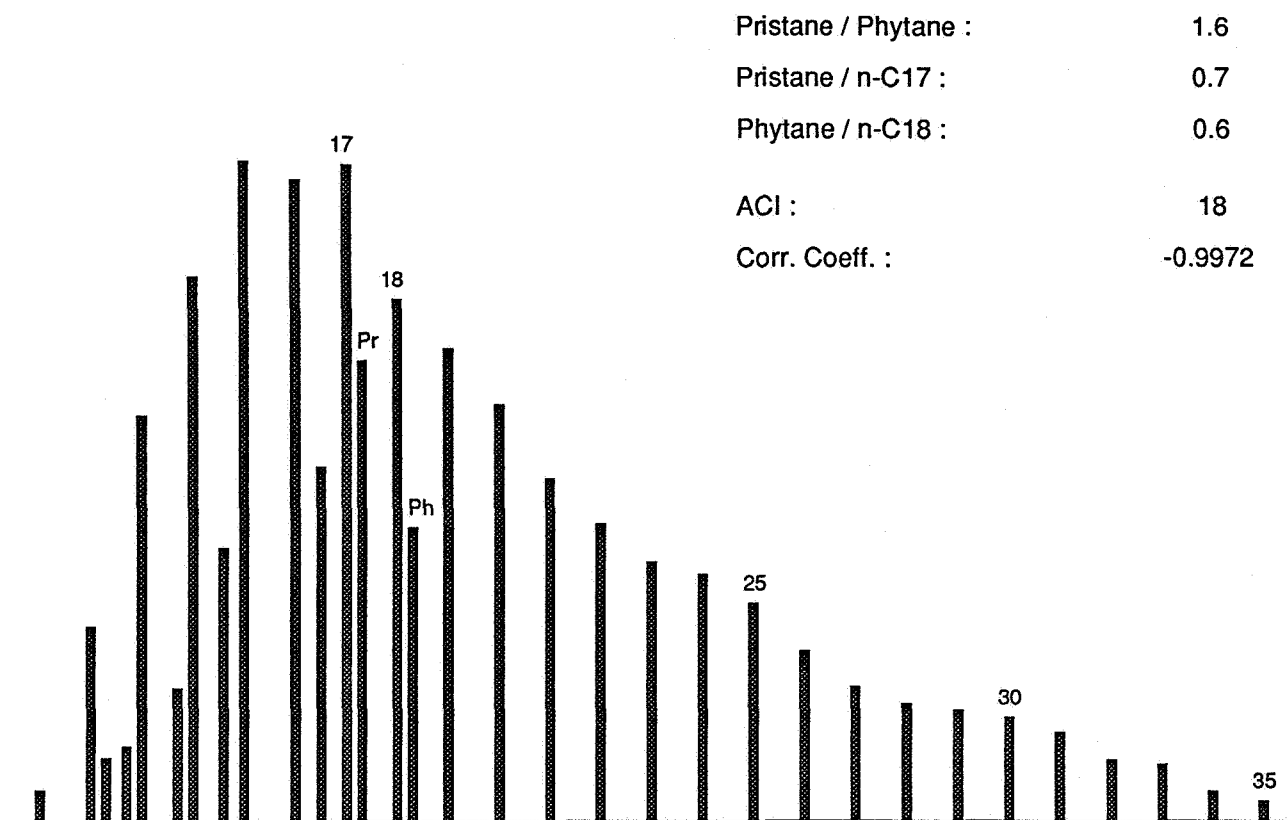
KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM
RIJSWIJK, THE NETHERLANDS

(Shell research B.V.)

**Summary of the Geochemical Data of the oil sample from
well 09/02-03 (3258 m.), Norway**

<p>Gravity and Gross Composition</p> <p>API gravity (degrees) : 34.9 Specific Gravity (g/ml) : 0.8502</p> <p>Gross Composition (wt%) Weight lost on topping : 32 Saturates : 46 Aromatics : 41 Heterocompounds : 7 Rest (High molecular) : 6</p> <p>Gasoline fraction (%) : 10.6 Sulphur (%) : 0.2 Vanadium (ppm) : 4 Nickel (ppm) : 6</p>	<p>Distribution of Ring Compounds (Field Ionisation Mass Spectrometry)</p> <p>C-15 Ring Compounds (%) 1 ring : 75 2 ring : 20 3 ring : 5</p> <p>C-30 Ring Compounds (%) 3 ring : 25 4 ring : 54 5 ring : 21</p> <p>C-29 VR/E : 0.9</p>
<p>Saturates Distributions (Gaschromatography)</p> <p>Pristane / Phytane : 1.6 Pristane / n-C17 : 0.7 Phytane / n-C18 : 0.6</p> <p>ACI : 18 Corr. Coeff. : -0.9972</p>	<p>Sterane and Triterpane Distributions (Gaschromatography / Mass Spectrometry)</p> <p>Steranes/Triterpanes (%) Iso Steranes : 26 Rearranged Steranes : 50 Triterpanes : 24</p> <p>Steranes (%) Iso Steranes : 33 Rearranged Steranes : 44 Normal Steranes : 23</p> <p>Triterpanes (%) C-30 Hopanes : 100 Oleanane + Lupane : 0 W + T : 0</p> <p>Steranes Carbon No. Dist. (%) C-27 : 38 C-28 : 34 C-29 : 28</p> <p>C-29 Sterane Ratios 20S / 20R + 20S : 0.51 Iso / Iso + Normal : 0.57</p> <p>Triterpane Ratios TS / TM : 1.38 3R / 3R + 5R : 0.09</p>
<p>C-7 Distributions (Gaschromatography)</p> <p>C-7 Alkanes (%) Normal C-7 : 49 Mono Branched : 42 Poly Branched : 9</p> <p>C-7 Alkanes / Cyclo Alkanes (%) Normal C-7 : 22 Cyclo Alkanes : 54 Branched Alkanes : 24</p> <p>C-7 Alk. / Cyclo Alk. / Aromatics (%) Alkanes : 41 Cyclo Alkanes : 49 Aromatics : 10</p>	<p>Carbon Isotope Ratios (Mass Spectrometry)</p> <p>Total Oil (topped) : -29.2 Saturates : -29.9 Aromatics : -28.7</p>

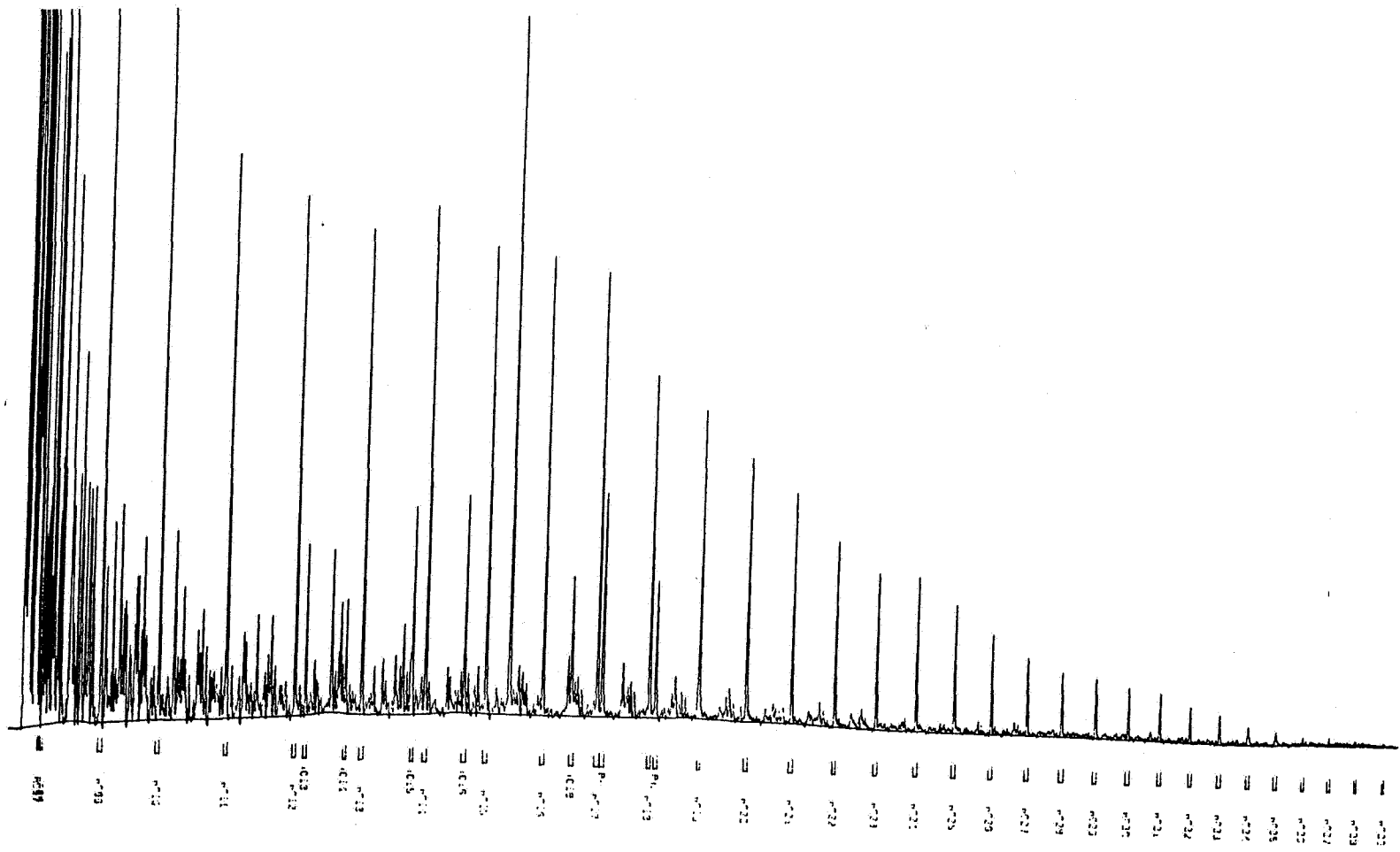
Bar diagram of Normal-alkanes & Isoprenoids of the oil sample from well 09/02-03 (3258 m.), Norway



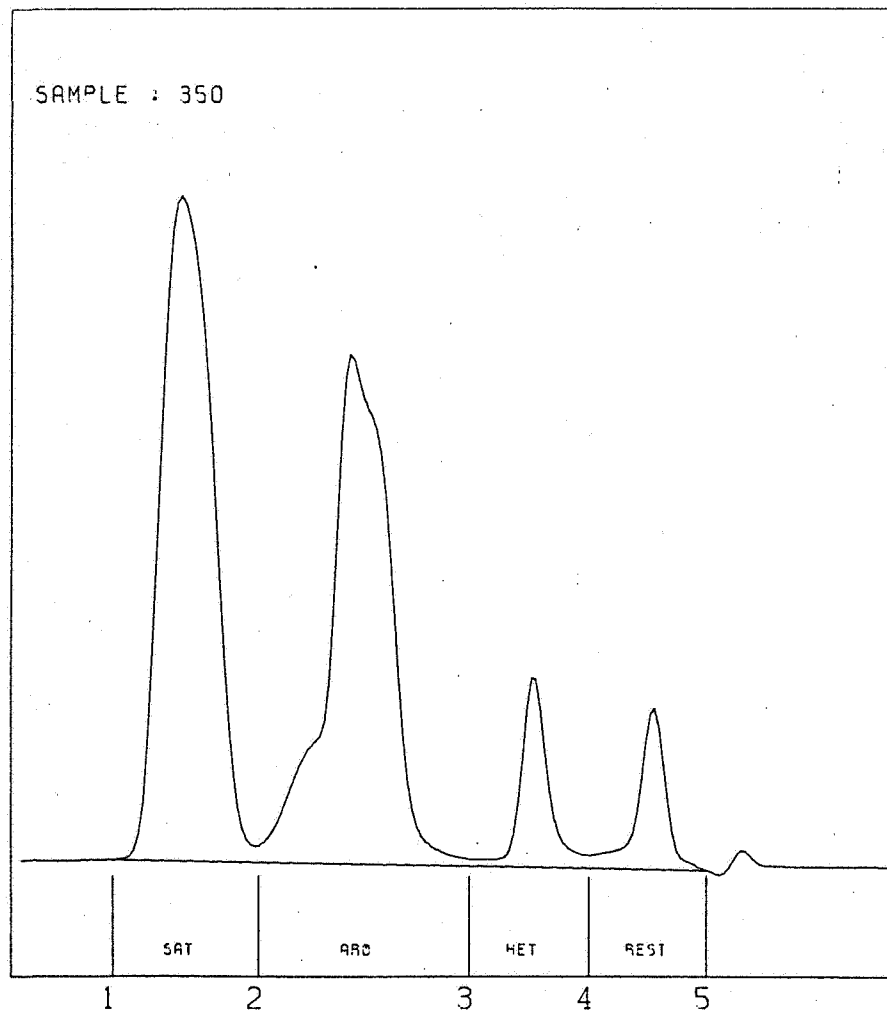
Gas chromatogram of the whole oil sample from well 09/02-03 (3258 m.), Norway

51643601

* = internal standard



Gross Composition of the oil sample from well 09/02-03 (3258 m.), Norway

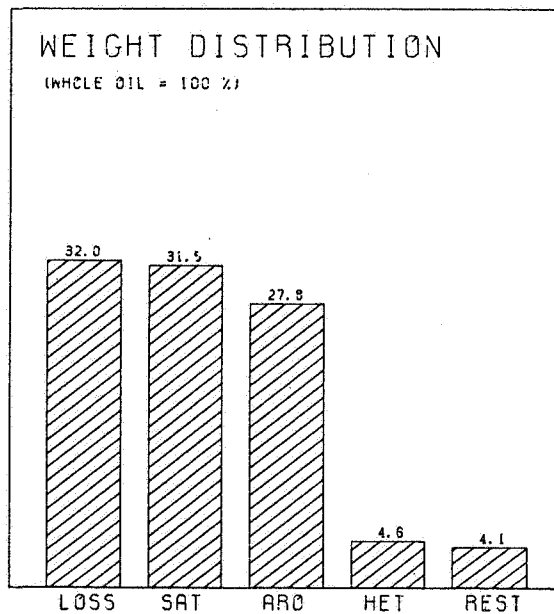


SAMPLE : S146436

WEIGHT LOST ON TOPPING : 32.0 %

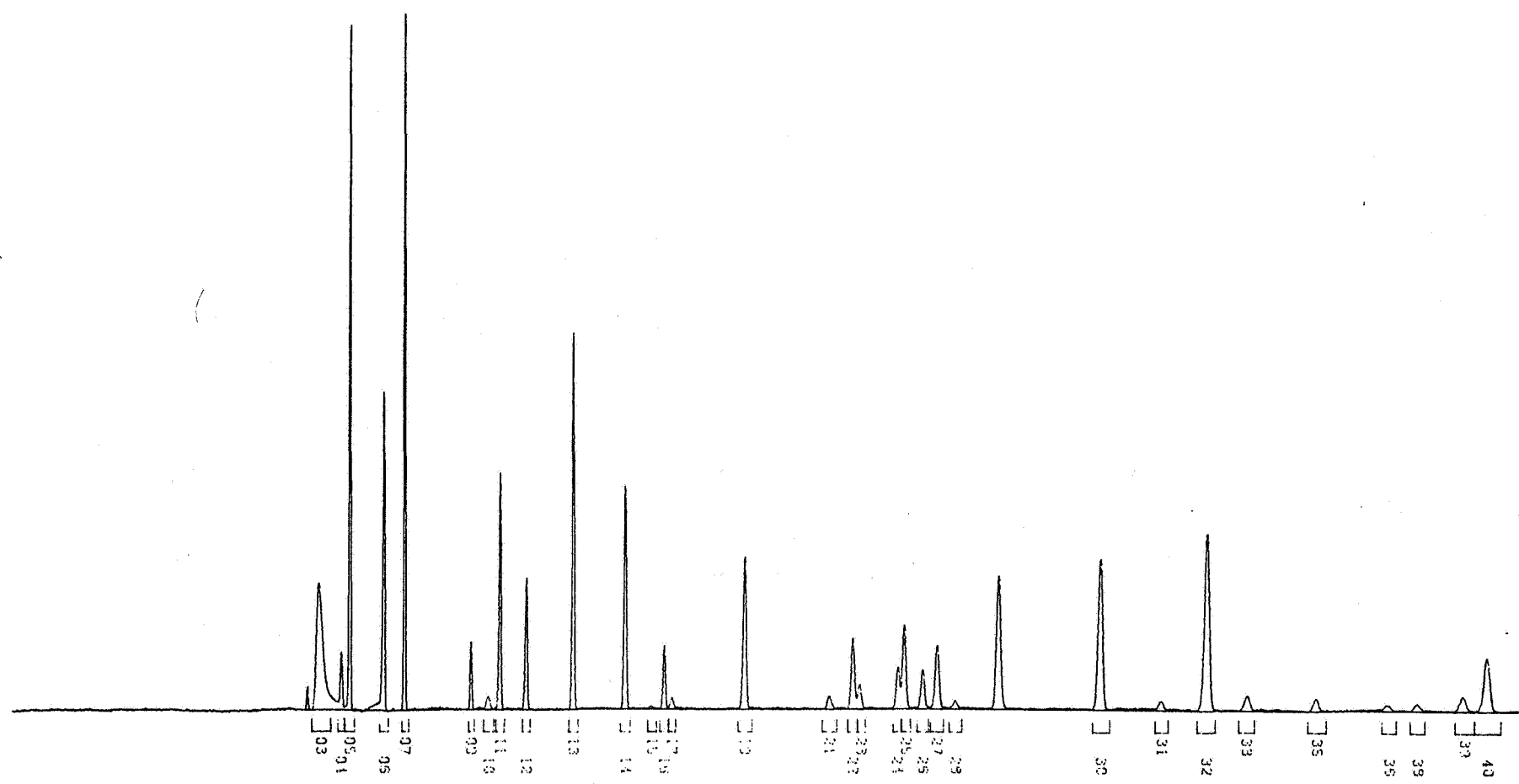
- SATURATES	: 46.3 %
- AROMATICS	: 40.8 %
- HETEROCOMPOUNDS	: 6.8 %
- REST (HIGH MOL.)	: 6.0 %

* WEIGHT PERCENTAGES CALCULATED FROM FID RESPONSE



Gas chromatogram of the light fraction (< 120 C.) of the sample from well 09/02-03 (3258 m.), Norway

514643601



**Gas chromatographic hydrocarbons analysis (< 120 C.)
well 09/02-03 (3258 m.), Norway**

GAS CHROMATOGRAPHIC ANALYSIS OF THE FRACTION BOILING BELOW
114 DEGREES CENTIGRADE

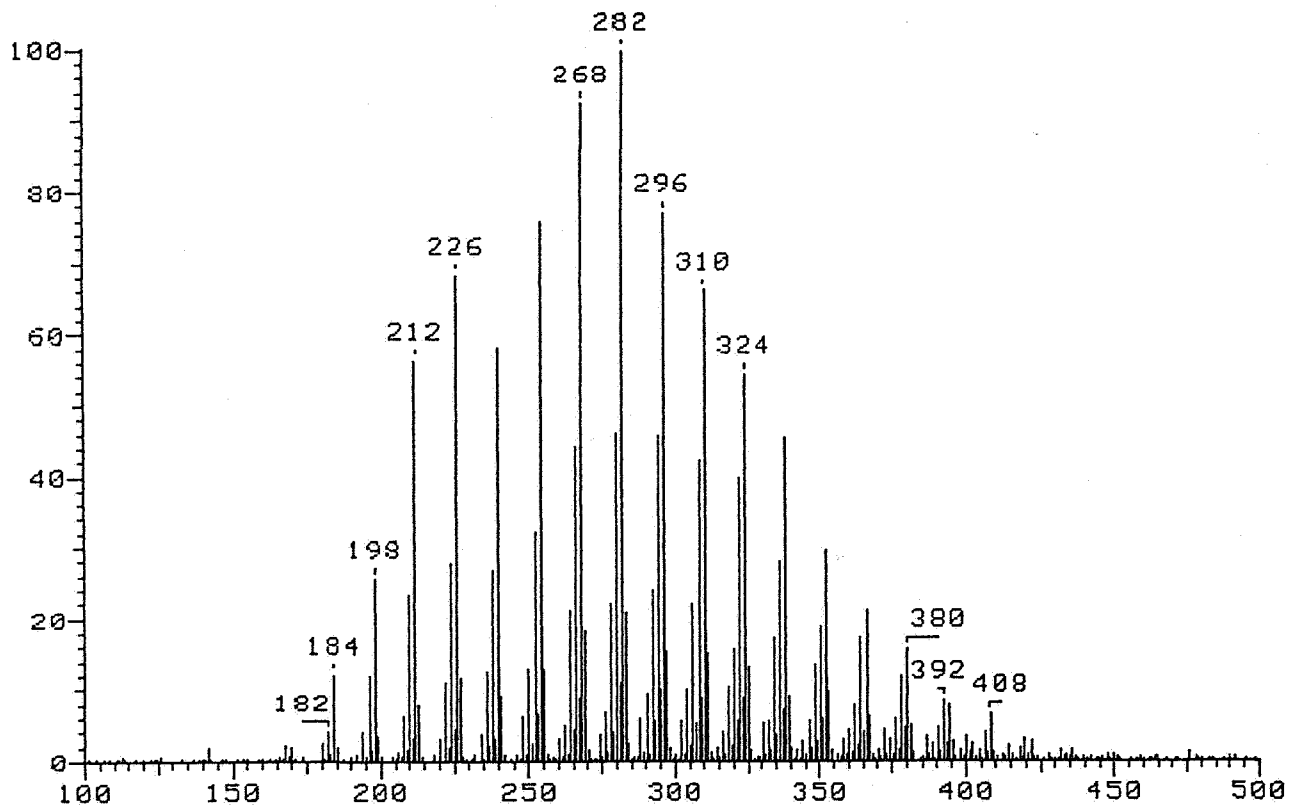
Sample: S14643601

d.d. 22-mar-90 04:57

COMPONENT No. Name	RET. TIM (min)	MAXIMUM (mV)	AREA * (cnts)	WEIGHT PERC.
4 - I-BUTANE	016:43	582.7	6788	1.41
5 - N-BUTANE	017:04	6928.1	52144	10.80
6 - I-PENTANE	018:29	3250.0	34054	7.06
7 - N-PENTANE	019:21	7179.1	49599	10.28
8 - 2.2-DIMETHYLBUTANE	* * *	Not detected	* * *	
9 - CYCLOPENTANE	022:07	683.8	5816	1.20
10 - 2.3-DIMETHYLBUTANE	022:50	130.4	2641	0.55
11 - 2-METHYLPENTANE	023:19	2414.0	24764	5.13
12 - 3-METHYLPENTANE	024:25	1341.6	15336	3.18
13 - N-HEXANE	026:22	3836.5	39142	8.11
14 - METHYLCYCLOPENTANE	028:32	2270.5	27164	5.63
15 - 2.2-DIMETHYLPENTANE	029:37	31.5	564	0.12
16 - BENZENE	030:10	641.4	7743	1.60
17 - 2.4-DIMETHYLPENTANE	030:30	112.5	1986	0.41
18 - 2.2.3-TRIMETHYLBUTANE	* * *	Not detected	* * *	
19 - CYCLOHEXANE	033:30	1552.8	24510	5.08
20 - 3.3-DIMETHYLPENTANE	* * *	Not detected	* * *	
21 - 1.1-DIMETHYLCYCLOPENTANE	037:01	131.1	3172	0.66
22 - 2-METHYLHEXANE	038:00	725.3	13035	2.70
23 - 2.3-DIMETHYLPENTANE	038:17	239.0	4531	0.94
24 - 1-C-3-DIMETHYLCYCLOPENTANE	039:53	419.1	8352	1.73
25 - 3-METHYLHEXANE	040:08	847.0	15693	3.25
26 - 1-TR-3-DIMETHYLCYCLOPENTANE	040:55	393.5	7625	1.58
27 - 1-TR-2-DIMETHYLCYCLOPENTANE	041:32	642.7	13939	2.89
28 - 3-ETHYLPENTANE	042:17	83.2	2014	0.42
30 - N-HEPTANE	048:20	1532.0	36155	7.49
31 - 1-C-2-DIMETHYLCYCLOPENTANE	050:52	91.7	2703	0.56
32 - METHYLCYCLOHEXANE	052:46	1798.1	47331	9.81
33 - 1.1.3-TRIMETHYLCYCLOPENTANE	054:27	150.2	4678	0.97
34 - 2.2-DIMETHYLHEXANE	* * *	Not detected	* * *	
35 - ETHYLCYCLOPENTANE	057:19	124.8	3684	0.76
36 - 2.5-DIMETHYLHEXANE	060:16	58.8	2094	0.43
38 - 2.2.3-TRIMETHYLPENTANE	061:33	76.4	2428	0.50
39 - 1-TR-2-C-4-TRIMETHYLCYCLOPENTANE	063:27	146.2	5213	1.08
40 - TOLUENE	064:27	539.7	17754	3.68
REFERENCE PEAK (29)	044:05	1361.2	31490	
Total peak area			482650	

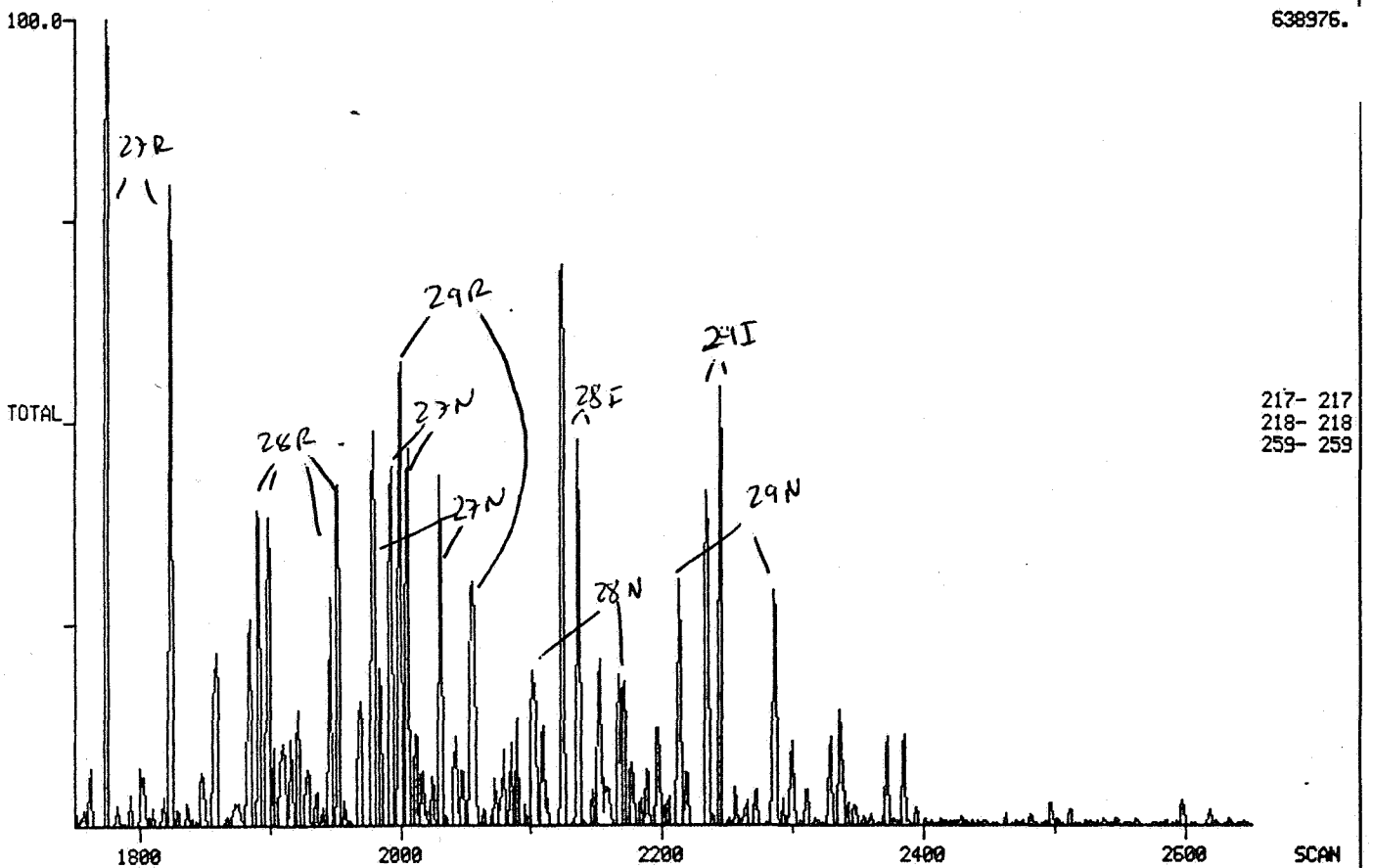
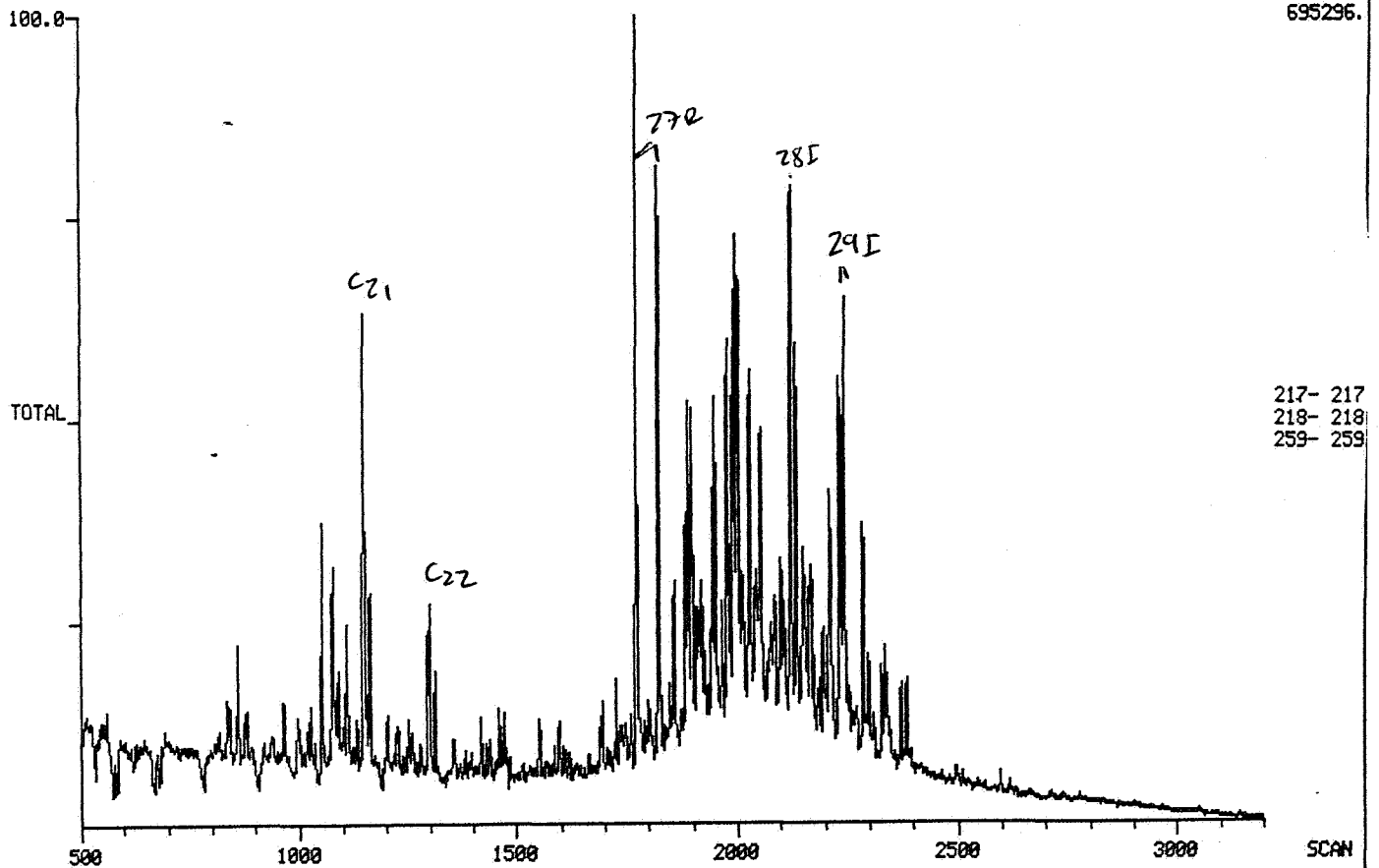
*) Corrected for difference in response

FIMS spectrum of the oil sample from well 09/02-03 (3258 m.), Norway

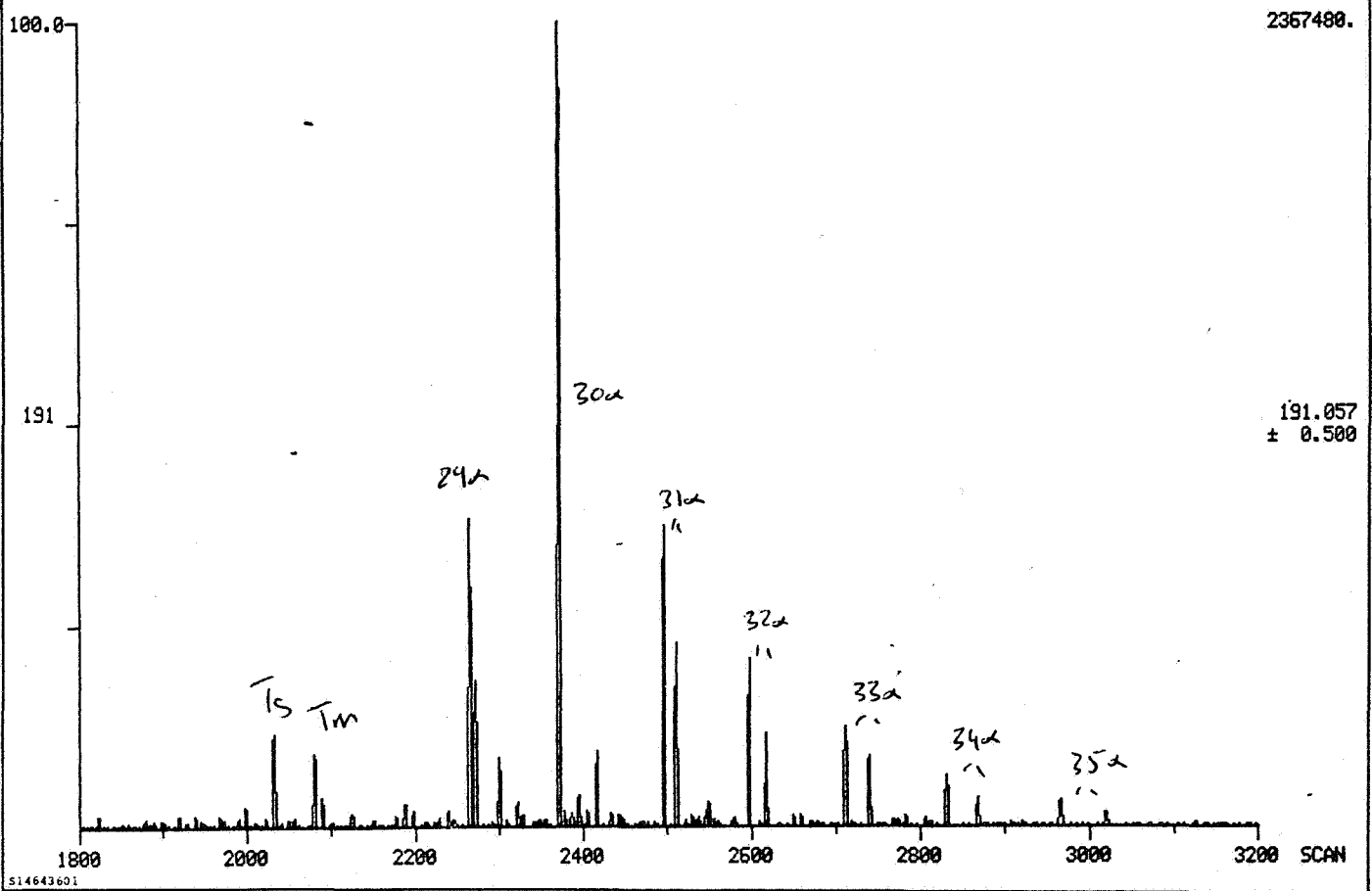
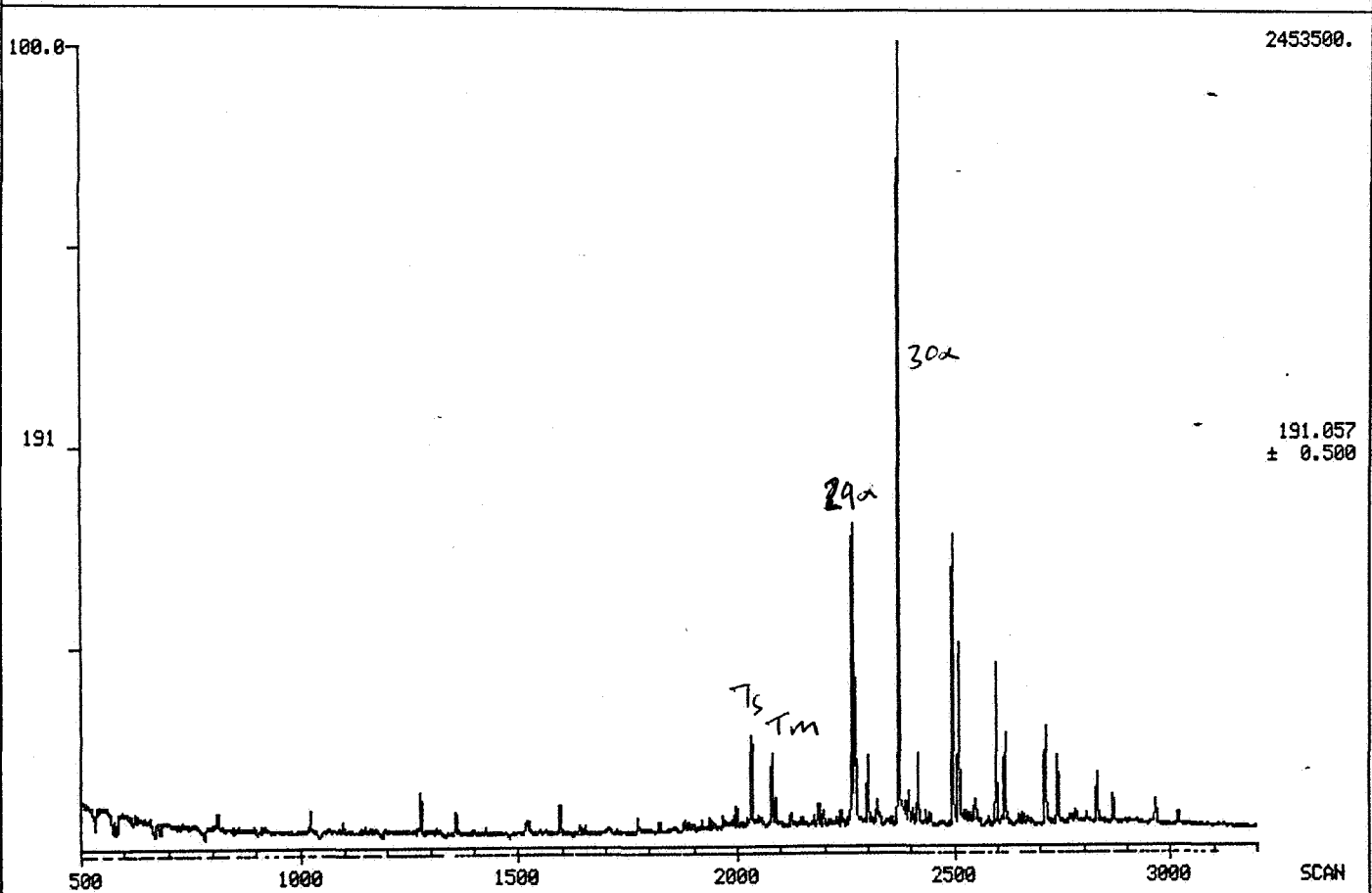


NORWAY: 9/2-3
Analysis Name: S1464361.AVE;1 Spec# 200 Norm: B /Scale: 2508
Date: APR 19 90 09:27:21 Nmparam: 0.5:1.0 Tolerance: 500:MMU

Sterane Fragmentograms of the oil sample from well 09/02-03 (3258 m.), Norway



Triterpane Fragmentograms of the oil sample from well 09/02-03 (3258 m.), Norway



ADDRESS KJELLER N-2007 Kjeller, Norway TELEPHO. +47 6 806000 TELEX 74 573 energ n TELEFAX +47 6 815553		HALDEN N-1751 Halden, Norway +47 9 183100 76 335 energ n		AVAILABILITY Private Confidential
REPORT TYPE	REPORT NO. IFE/KR/F-90/042		DATE 1990-03-08	
	REPORT TITLE REPORT ON STABLE ISOTOPES ($\delta^{13}\text{C}$, δD , $\delta^{18}\text{O}$) ON A NATURAL GAS SAMPLE FROM WELL 9/2-3.		DATE OF LAST REV. REV. NO.	
	CLIENT STATOIL		NUMBER OF PAGES 5	
	CLIENT REF. T 6269 no.143		NUMBER OF ISSUES 15	
SUMMARY The gas components $\text{C}_1\text{-C}_5$ have been separated from a natural gas sample from well 9/2-3 (gas from single flash water, bottle no. 813188, 14/2-90), and the $\delta^{13}\text{C}$ values of methane, ethane, propane, the butanes and CO_2 have been measured.			DISTRIBUTION Statoil (10) Andresen, B. Råheim, A. Thronsen, T. File (2)	
KEYWORDS				
NAME		DATE		SIGNATURE
PREPARED BY	Björg Andresen	1990-03-08		Björg Andresen
REVIEWED BY	Torbjørn Thronsen	1990-03-08		Torbjørn Thronsen
APPROVED BY	Arne Råheim	1990-03-08		Arne Råheim

1 INTRODUCTION

One gas sample from well 9/2-3 (gas from single flash water, bottle no. 813188, 14/2-90) was received and analysed February/Mars 1990.

On the sample $C_1 - C_5$ and CO_2 are quantified, and the $\delta^{13}C$ value is measured on methane, ethane, propane, the butanes and CO_2 . The δD value is also measured on methane.

2 ANALYTICAL PROCEDURE

The natural gas have been quantified and separated into the different gas components by a Carlo Erba 4200 instrument.

The hydrocarbon gas components were oxidized in separate CuO-ovens in order to prevent cross contamination. The combustion products CO_2 and H_2O were frozen into collection vessels and separated.

The water was reduced with zinc metal in a sealed tube to prepare hydrogen for isotopic analysis. The isotopic measurements were performed on a Finnigan Mat 251 and Finnigan Delta mass spectrometer. IFE's value on NBS 22 is $-29.77 \pm .06$ ‰ PDB.

3 RESULTS

The volume composition of the gas sample is given in Table 1. The results have been normalized to 100%. The stable isotope results are given in Table 2. The isotopic results are the average of the analytical results from two separate bottles.

The uncertainty on the $\delta^{13}C$ value is estimated to be ± 0.3 ‰ PDB and includes all the different analytical steps. The uncertainty on the δD value is likewise estimated to be ± 5 ‰.

Table 1 Volume composition of a gas sample from well 9/2-3.

SAMPLE	IFE no.	C ₁ %	C ₂ %	C ₃ %	iC ₄ %	nC ₄ %	iC ₅ %	nC ₅ %	CO ₂ %	Σ C ₁ - C ₅	WET- NESS	iC ₄ / nC ₄
Gass fra single flash av vann,												
flaske nr. 813188 14/2-90	8745	89.1	4.9	2.6	0.15	0.43	0.22	0.07	2.6	97.4	0.09	0.36

Table 2 Isotopic composition of a gas sample from well 9/2-3.

SAMPLE	IFE no.	C ₁ δ ¹³ C PDB	C ₁ δ D SMOW	C ₂ δ ¹³ C PDB	C ₃ δ ¹³ C PDB	iC ₄ δ ¹³ C PDB	nC ₄ δ ¹³ C PDB	CO ₂ δ ¹³ C PDB	CO ₂ δ ¹⁸ O PDB
Gass fra single flash av vann,									
flaske nr. 813188 14/2-90	8745	-56.4	-249	-34.9	-30.2	-27.1	-29.6	-24.4	-1.5