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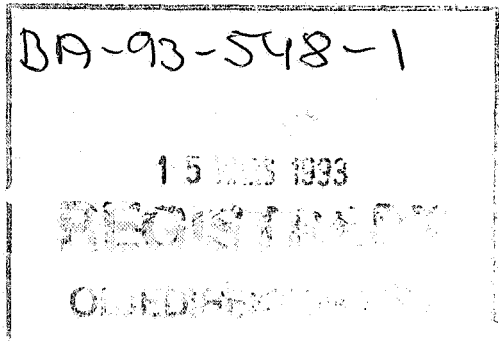
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Title
GEOCHEMICAL ANALYSIS
OIL FROM WELL 25/8-4

Summary/Conclusion/Recommendation



Keywords
GEOCHEMISTRY, OIL
BIOMARKERS

Pages-appendix 6	Amendment no.	Revision no.	Revision date
Quadrant/Block-well 25	Project no. 32345	Licens no. PL 169	Date 18.01.93
Department	GEOSECTION		
Section	BAS.MOD./PETR.GEOCHEM.		
Authors	NILS TELNÆS		
Controlled	<i>Sigill Njorster</i>		
Accepted	<i>Arve G. Borchert</i>		
Approved			

INTRODUCTION

The oil sample from well 25/8-4 has been analysed by The Geochemical and Environmental Research Group (GERG) Texas A&M University, Texas.

This report is compiled by Norsk Hydro Research Center, Bergen, Norway.

APPENDIX 1

QUANTITATIVE BIOMARKER DATA

FLUID ANALYSIS SUMMARY SHEET

NORSK HYDRO RESEARCH CENTER BERGEN

SAMPLE INFORMATION

WELL:	25/8-4	COUNTRY:	NORWAY
SAMPLE TYPE:	RFT	FIELD:	
DEPTH:	1750.7 M	OPERATOR:	NORSK HYDRO

BULK PARAMETRS

% Topping loss	21	o API	
% Aliphatics	34.5	% Sulphur	0.43
% Aromatics	28.1	Nickel (ppm)	4.62
% NSO	11.4	Vanadium (ppm)	13.67
% Asphaltenes	4.1		

ISOTOPIC COMPOSITION

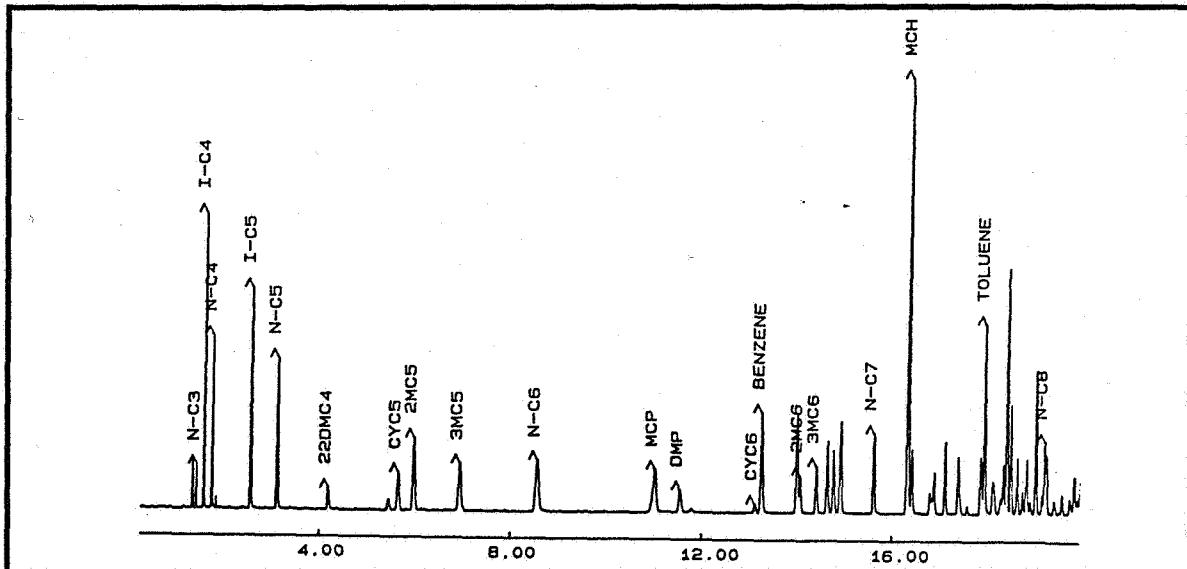
Whole oil (o/oo)	-28.4	NSOs (o/oo)	
Aliphatics (o/oo)	-28.4	Asphalt. (o/oo)	
Aromatics (o/oo)	-28.2		

GASOLINE RANGE HYDROCARBONS

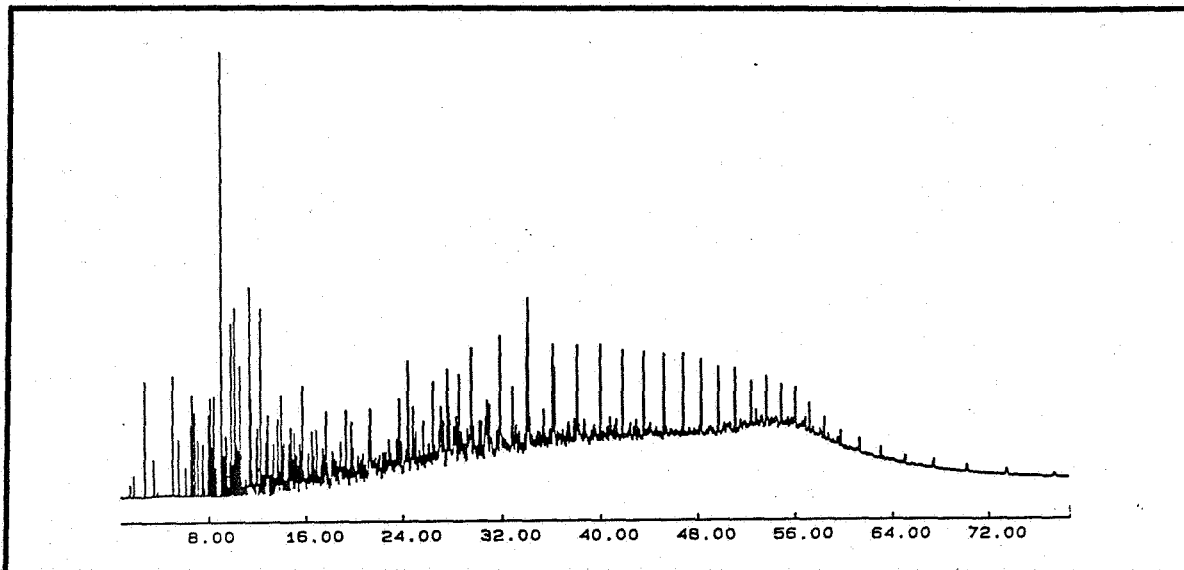
Heptane ratio	8.13		
Iso-hept. ratio	0.37		
Parafinicity (1)	0.19		
Aromaticity (1)	3.07		

1)Thompson (1987)

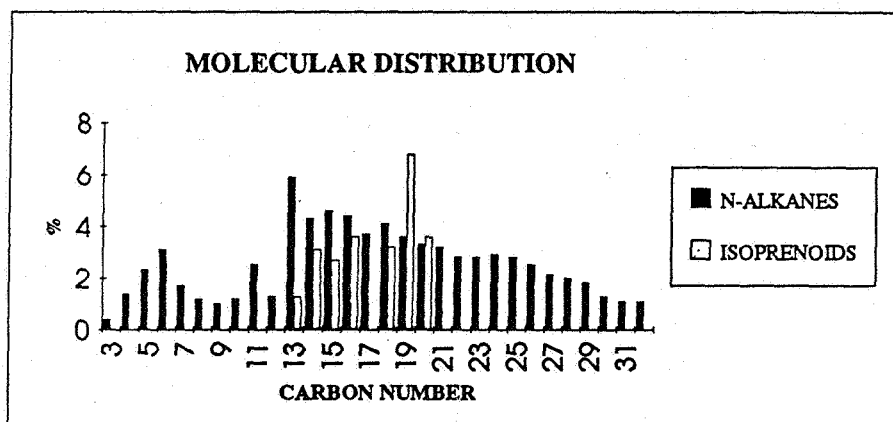
GC-FID GASOLINE RANGE HYDROCARBONS



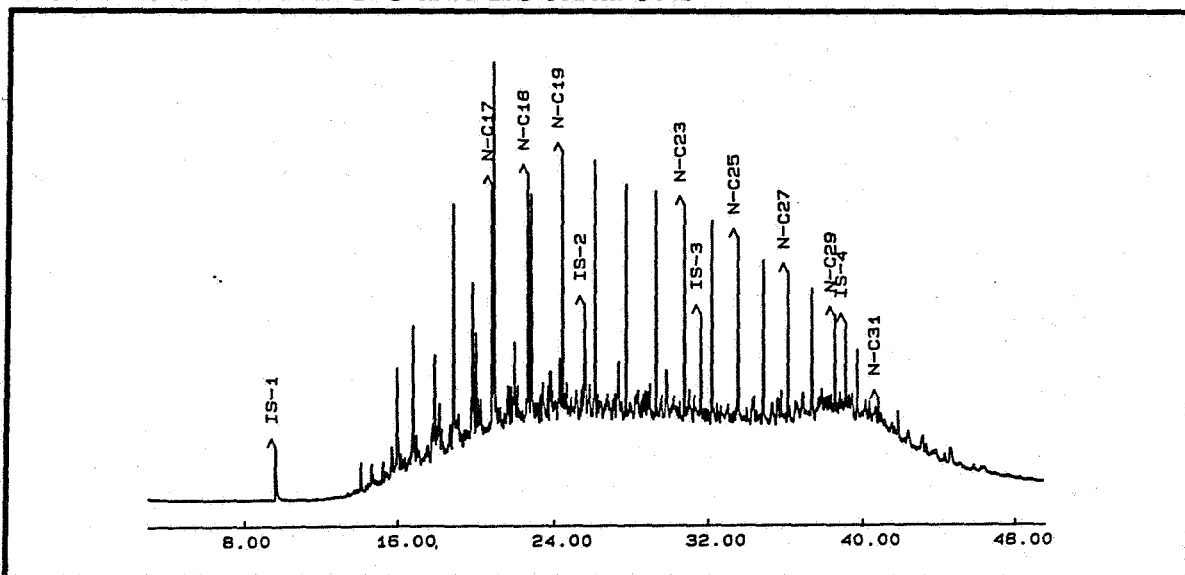
GC-FID WHOLE OIL



MOLECULAR DISTRIBUTION



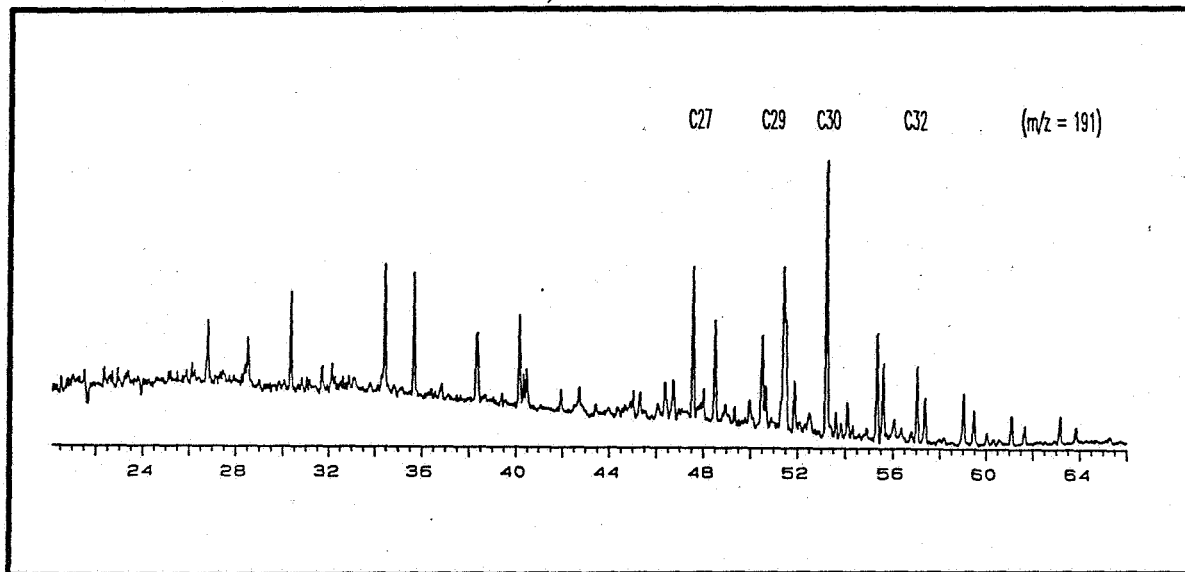
GC-FID C15+ ALIPHATIC HYDROCARBONS



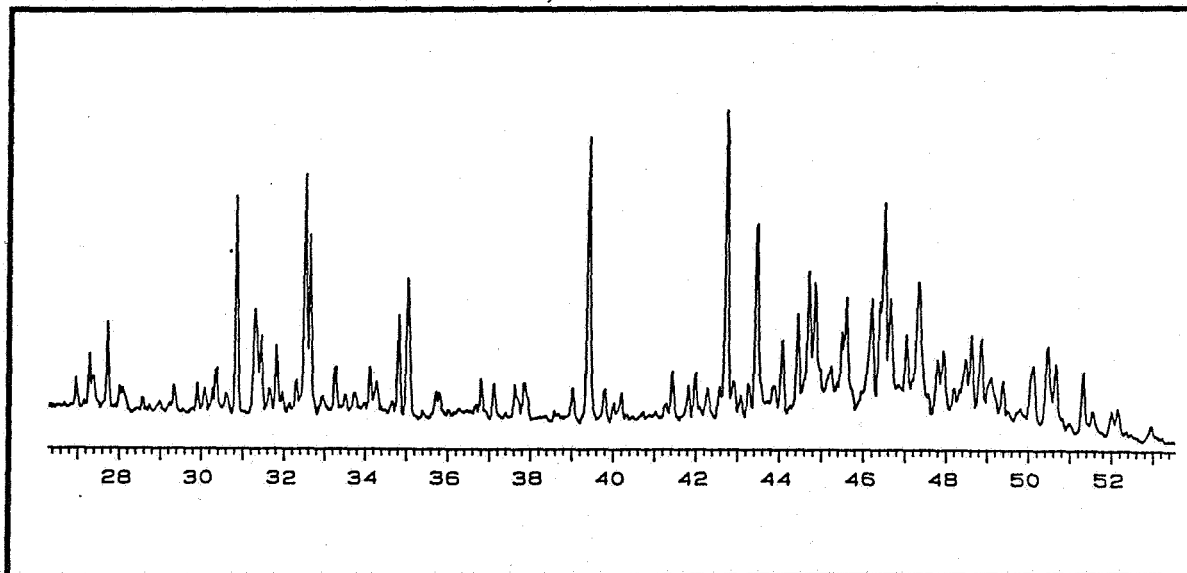
MOLECULAR RATIOS

Pristane/n-C17	1.84	Hopane/Sterane	0.31	% 20S	55
Pristane/Phytane	1.89	Ts/Tm	1.36	% abb	56
Phytane/n-C18	0.88	% Tricyclics	14	% 27/28/29	49:18:33
CPI	1.08	Moretane Index	13	% Diasteranes	63
C15/C25	1.65	Gammac. Index	7	% Triaromatic	52.8

M/Z 191 MASS CHROMATOGRAM, TERPANES



M/Z 217 MASS CHROMATOGRAM, STERANES



APPENDIX 1

QUANTITATIVE BIOMARKER DATA

Identifications of Terpanes (m/z = 191)

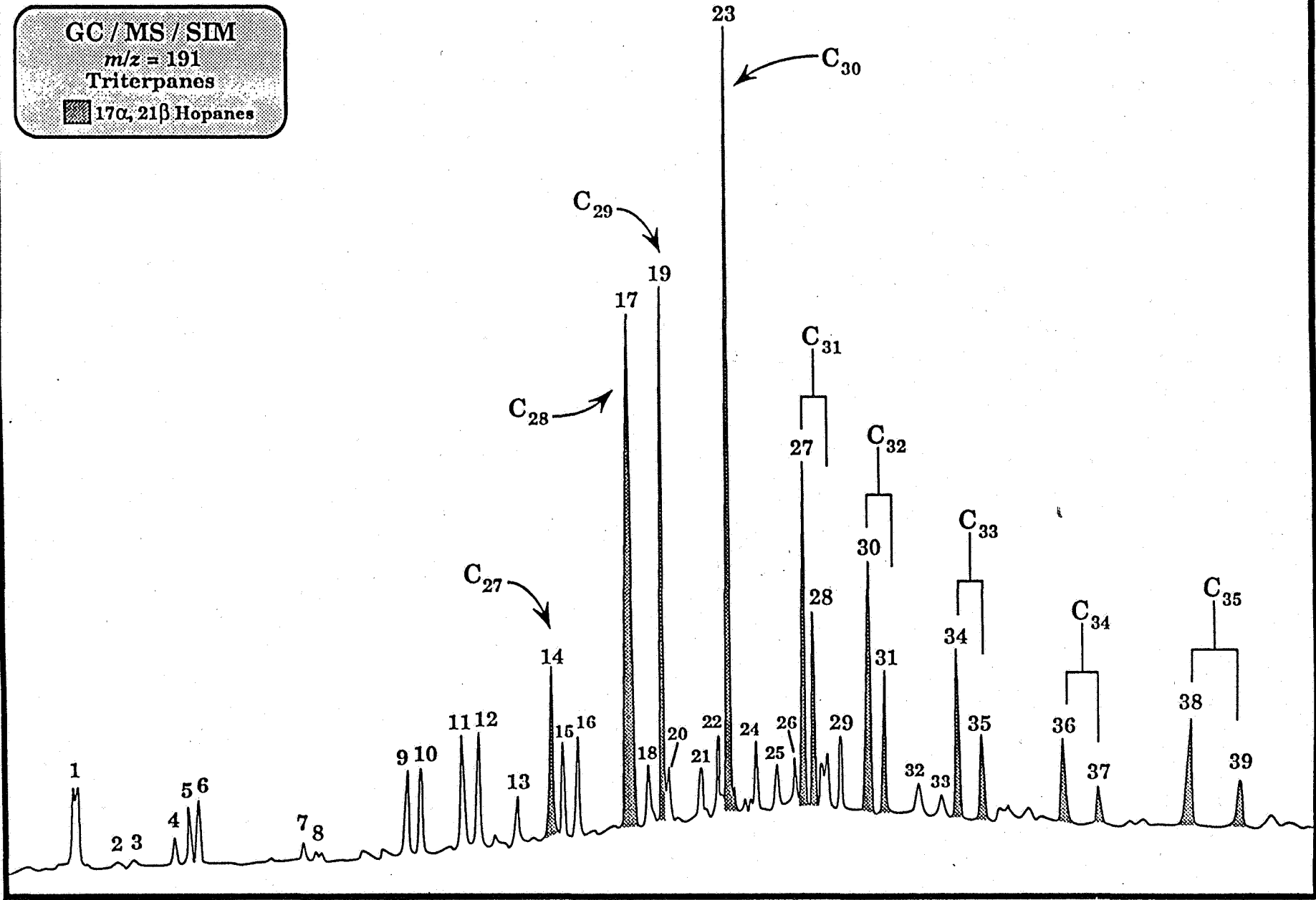
Peak Number	Formula	Molecular Weight	Compound
A	C ₂₀ H ₃₆	276	Diterpane C ₂₀
B	C ₂₁ H ₄₈	290	Diterpane C ₂₁
C	C ₂₂ H ₄₀	304	Diterpane C ₂₂
D	C ₂₃ H ₄₂	318	Diterpane C ₂₃
E	C ₂₄ H ₄₄	332	Diterpane C ₂₄
1	C ₂₅ H ₄₆	346	Diterpane C ₂₅
2	-----	----	Unknown
3	-----	----	Unknown
4	C ₂₄ H ₄₂	330	Tetracyclic terpane C ₂₄
5	C ₂₆ H ₄₈	360	Tricyclic triterpane C ₂₆
6	C ₂₆ H ₄₈	360	Tricyclic triterpane C ₂₆
7,8	-----	----	Unknown
9	C ₂₈ H ₅₂	388	Tricyclic triterpane C ₂₈
10	C ₂₈ H ₅₂	388	Tricyclic triterpane C ₂₈
11	C ₂₉ H ₅₄	402	Tricyclic triterpane C ₂₉
12	C ₂₉ H ₅₄	402	Tricyclic triterpane C ₂₉
13	C ₂₇ H ₄₆	370	18 α (H)-22,29,30-trisnorhopane (TS)
14	C ₂₇ H ₄₆	370	17 α (H)-22,29,30-trisnorhopane (TM)
15	C ₂₇ H ₄₆	370	17 β (H)-22,29,30-trisnorhopane
16	C ₂₈ H ₄₈	384	unknown
17	C ₂₈ H ₄₈	384	17 α (H), 21 β (H)-29,30-bisnorhopane
18	----	----	unknown
19	C ₂₉ H ₅₀	398	17 α (H),21 β (H)-30-norhopane
20	C ₂₉ H ₅₀	398	18 α (H) neonorhopane
21	C ₂₉ H ₅₀	398	17 β (H), 21 α (H)-normoretane
22	C ₃₀ H ₅₂	412	18 α (H)-oleanane
23	C ₃₀ H ₅₂	412	17 α (H),21 β (H)-hopane
24	C ₃₀ H ₅₂	412	17 β (H),21 α (H)-moretane
25,26	-----	----	unknown
27	C ₃₁ H ₅₄	426	17 α (H),21 β (H)-30-homohopane (22S)
28	C ₃₁ H ₅₄	426	17 α (H),21 β (H)-30-homohopane (22R)
29	C ₃₁ H ₅₄	426	17 β (H)-21 α (H)-homomoretane
30	C ₃₂ H ₅₆	440	17 α (H),21 β (H)-30,31-bishomohopane(22S)
31	C ₃₂ H ₅₆	440	17 α (H),21 β (H)-30,31-bishomohopane (22R)
32	C ₃₂ H ₅₆	440	17 β (H),21 α (H)-30-31-bishomomoretane
33	C ₃₁ H ₅₄	426	17 β (H),21 β (H)-homohopane
34	C ₃₃ H ₅₈	454	17 α (H),21 β (H)-30,31,32-trishomohopane (22S)
35	C ₃₃ H ₅₈	454	17 α (H),21 β (H)-30,31,32-trishomohopane (22R)
36	C ₃₄ H ₆₀	468	17 α (H),21 β (H)-30,31,32,33-tetrakishomohopane (22S)
37	C ₃₄ H ₆₀	468	17 α (H),21 β (H)-30,31,32,33-tetrakishomohopane (22R)
38	C ₃₅ H ₆₂	482	17 α (H),21 β (H)-30,31,32,33,34-pentakishomohopane (22S)
39	C ₃₅ H ₆₂	482	17 α (H),21 β (H)-30,31,32,33,34-pentakishomohopane (22R)

GC / MS / SIM

$m/z = 191$

Triterpanes

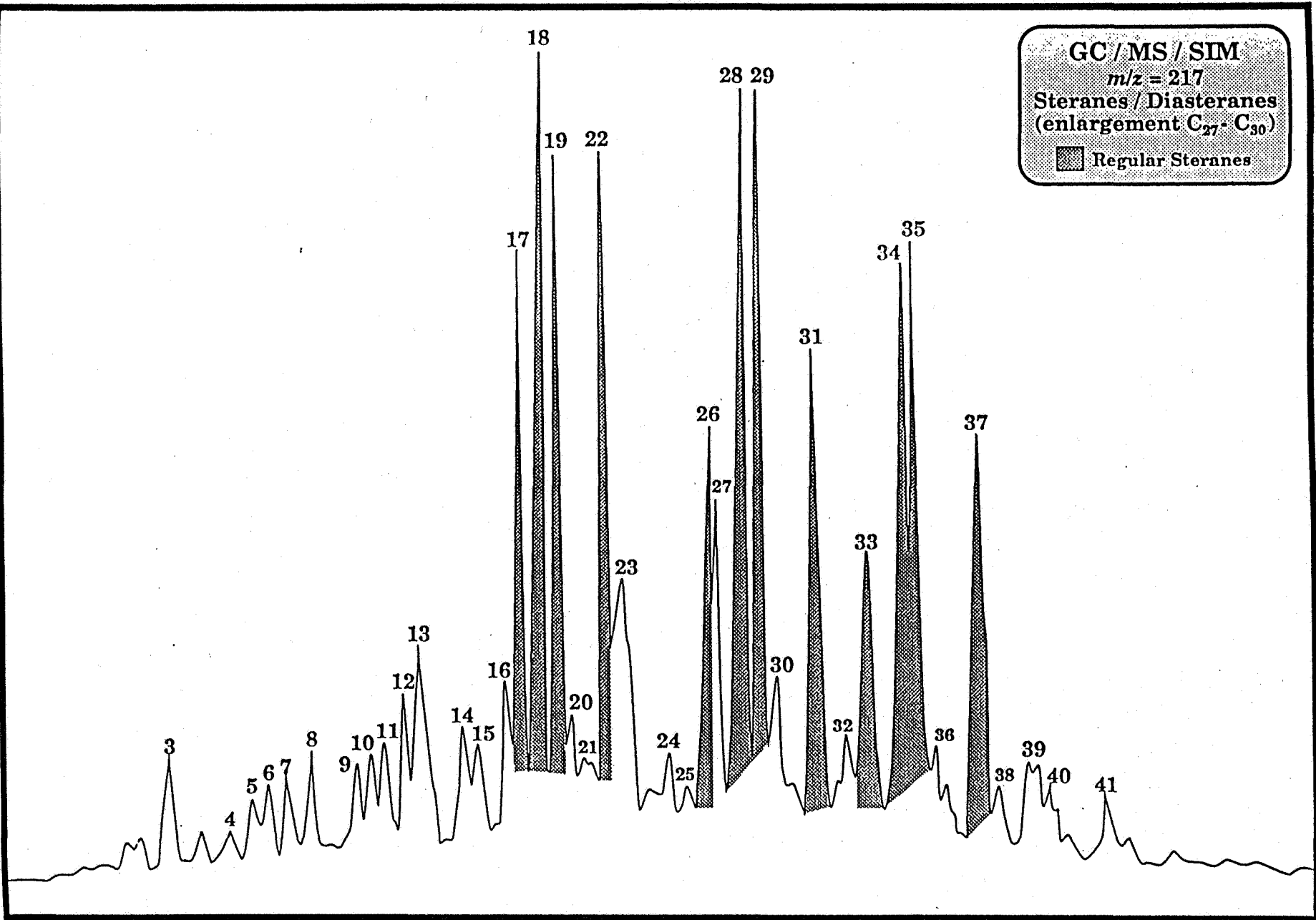
17 α , 21 β Hopanes



Identification of Steranes (m/z = 217)

Peak Number	Formula	Molecular Weight.	Compound
1	C ₂₁ H ₃₆	288	5 α (H),14 β (H),17 β (H)-pregnane
2	C ₂₂ H ₃₈	302	5 α (H),14 β (H),17 β (H),20-methyl pregnane
3	C ₂₇ H ₄₈	372	13 β (H),17 α (H)-diacholestane (20S)
4	C ₂₇ H ₄₈	372	13 β (H),17 α (H)-diacholestane (20R)
5,6,7	-----	-----	unknown (diasteranes ?)
8	C ₂₇ H ₄₈	372	13 α (H),17 β (H)-diacholestane (20S)
9	C ₂₇ H ₄₈	372	13 α (H)-17 β (H)-diacholestane (20R)
10,11	C ₂₈ H ₅₀	386	13 β (H),17 α (H),24-methyldiacholestane (20S) 24 S/R isomers
12,13	C ₂₈ H ₅₀	386	C ₂₈ diasteranes
4,15	C ₂₈ H ₅₀	386	13 β (H),17 α (H),24-methyldiacholestane (20R) 24 S/R isomers
16	-----	-----	Unknown (diasterane ?)
17	C ₂₈ H ₅₀	386	13 α (H),17 β (H),24-methyldiacholestane (20S)
17	C ₂₇ H ₄₈	372	5 α (H),14 α (H),17 α (H)-cholestane (20S)
18	C ₂₉ H ₅₂	400	13 β (H),17 α (H),24-ethyl diacholestane (20S)
18	C ₂₇ H ₄₈	372	5 α (H),14 β (H),17 β (H)-cholestane (20R)
19	C ₂₇ H ₄₈	372	5 α (H),14 β (H),17 β (H)-cholestane (20S)
19	C ₂₈ H ₅₀	386	13 α (H),17 β (H), 24-methyldiacholestane (20R)
20,21	-----	-----	unknown (diasteranes ?)
22	C ₂₇ H ₄₈	372	5 α (H),14 α (H),17 α (H), cholestane (20R)
23	C ₂₉ H ₅₂	400	13 β (H),17 α (H),24-ethyl diacholestane (20R)
24,25	-----	-----	unknown (diasterane?)
26	C ₂₈ H ₅₀	386	5 α (H),14 α (H),17 α (H),24-methylcholestane (20S)
27	-----	-----	unknown (diasterane ?)
28	C ₂₈ H ₅₀	400	5 α (H),14 β (H),17 β (H),24-methylcholestane (20R)
28	C ₂₉ H ₅₀	386	13 α (H),17 β (H),24-methyldiacholestane (20R)
29	C ₂₈ H ₅₀	386	5 α (H),14 β (H),17 β (H),24-methylcholestane (20S)
30	-----	-----	unknown (diasterane ?)
31	C ₂₈ H ₅₀	386	5 α (H),14 α (H),17 α (H),24-methylcholestane (20R)
32	-----	-----	unknown (diasterane ?)
33	C ₂₉ H ₅₂	400	5 α (H),14 α (H),17 α (H),24-ethylcholestane (20S)
34	C ₂₉ H ₅₂	400	5 α (H),14 β (H),17 β (H),24-ethylcholestane (20R)
35	C ₂₉ H ₅₂	400	5 α (H),14 β (H),17 β (H),24-ethylcholestane (20S)
36	-----	-----	diasterane
37	C ₂₉ H ₅₂	400	5 α (H),14 α (H),17 α (H),24-ethylcholestane (20R)
38-41	C ₃₀ H ₅₄	414	C ₃₀ steranes

GC/MS/SIM
 $m/z = 217$
Steranes / Diasteranes
(enlargement $C_{27} - C_{30}$)
■ Regular Steranes



Norsk-Hydro Well #25 Oils
Sterane Concentrations (m/z=217)

Description	C21 Sterane	C21 Sterane	C21 Sterane	C22 Sterane	C27 Diaster	C27 Diaster	Diaster	Diaster	Diaster	C27 Diaster	C27 Diaster
	Peak A (ppm)	Peak #1 (ppm)	Peak B (ppm)	#2 (ppm)	#3 (ppm)	#4 (ppm)	#5 (ppm)	#6 (ppm)	#7 (ppm)	#8 (ppm)	9 (ppm)

Norsk-Hydro Well #25 Oils
Sterane Concentrations (m/z=217)

Description	C21 Sterane	C21 Sterane	C21 Sterane	C22 Sterane	C27 Diaster	C27 Diaster	Diaster	Diaster	Diaster	C27 Diaster	C27 Diaster
	Peak A (ppm)	Peak #1 (ppm)	Peak B (ppm)	#2 (ppm)	#3 (ppm)	#4 (ppm)	#5 (ppm)	#6 (ppm)	#7 (ppm)	#8 (ppm)	9 (ppm)
OIL 25/8-4	18.25	22.05	11.01	16.13	26.11	18.00	0.65	2.52	2.52	6.02	7.37

Norsk-Hydro Well #25
Sterane Concentrations (

Description	C28 Diaster #10 (ppm)	C28 Diaster #11 (ppm)	C28 Diaster #12 (ppm)	C28 Diaster #13 (ppm)	C28 Diaster #14 (ppm)	C28 Diaster Peak #15 (ppm)	C27 Diaster (?) + Diaster #16 (ppm)	C27 aaaS #17 (ppm)	C27 abbR #18 (ppm)	C27 abbS #19 (ppm)	Diaster (?) #20 (ppm)
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Norsk-Hydro Well #25
Sterane Concentrations (

Description	C28 Diaster #10 (ppm)	C28 Diaster #11 (ppm)	C28 Diaster #12 (ppm)	C28 Diaster #13 (ppm)	C28 Diaster #14 (ppm)	C28 Diaster Peak #15 (ppm)	C27 Diaster (?) + Diaster #16 (ppm)	C27 aaaS #17 (ppm)	C27 abbR #18 (ppm)	C27 abbS #19 (ppm)	Diaster (?) #20 (ppm)
OIL 25/8-4	10.79	10.08	0.85	2.81	3.76	10.88	1.51	9.97	18.89	6.83	0.10

Oils m/z=217)											No Ster:
Description	Diaster (?) #21 (ppm)	C27 aaaR Sterane #22 (ppm)	C29 Diaster #23 (ppm)	Diaster (?) #24 (ppm)	Diaster (?) #25 (ppm)	C28 aaaS Sterane #26 (ppm)	Diaster (?) #27 (ppm)	C28 abbR Sterane #28 (ppm)	C28 abbS Sterane Peak #29 (ppm)	Diaster (?) #30 (ppm)	C28 aaaR Sterane #31 (ppm)
OIL 25/8-4	0.10	4.30	13.09	4.61	4.86	1.45	5.02	4.86	5.51	5.65	2.31

Oils m/z=217)											No Ster:
Description	Diaster (?) #21 (ppm)	C27 aaaR Sterane #22 (ppm)	C29 Diaster #23 (ppm)	Diaster (?) #24 (ppm)	Diaster (?) #25 (ppm)	C28 aaaS Sterane #26 (ppm)	Diaster (?) #27 (ppm)	C28 abbR Sterane #28 (ppm)	C28 abbS Sterane Peak #29 (ppm)	Diaster (?) #30 (ppm)	C28 aaaR Sterane #31 (ppm)
OIL 25/8-4	0.10	4.30	13.09	4.61	4.86	1.45	5.02	4.86	5.51	5.65	2.31

orsk-Hydro Well #25 Oils
ane Concentrations (m/z=217)

Description	Diaster (?) #32 (ppm)	C29 aaaS Sterane #33 (ppm)	C29 abbR Sterane #34 (ppm)	C29 abbS Sterane #35 (ppm)	Diaster (?) #36 (ppm)	C29 aaaR Sterane #37 (ppm)	C30 Sterane (?) #38 (ppm)	C30 Sterane (?) #39 (ppm)	C30 Sterane (?) #40 (ppm)	C30 Sterane (?) #41 (ppm)
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orsk-Hydro Well #25 Oils
ane Concentrations (m/z=217)

Description	Diaster (?) #32 (ppm)	C29 aaaS Sterane #33 (ppm)	C29 abbR Sterane #34 (ppm)	C29 abbS Sterane #35 (ppm)	Diaster (?) #36 (ppm)	C29 aaaR Sterane #37 (ppm)	C30 Sterane (?) #38 (ppm)	C30 Sterane (?) #39 (ppm)	C30 Sterane (?) #40 (ppm)	C30 Sterane (?) #41 (ppm)
OIL 25/8-4	1.17	6.49	8.74	6.47	0.93	5.33	2.60	2.32	2.53	1.74

Terpane Concentrations (m/z=191)

Description	C20	C21	C22	C23	C24	C25	Unknown	Unknown
	Diterp	Diterp	Diterp	Diterp	Diterp	Diterp		
	Peak A (ppm)	B (ppm)	C (ppm)	D (ppm)	E (ppm)	#1 (ppm)	#2 (ppm)	#3 (ppm)
OIL 25/8-4	3.35	5.16	2.33	7.63	7.04	6.42	0.27	0.98

Terpane Concentrations (m/z=191)

C24 Tetra- Cyclic #4 (ppm)	C26 Tricyc #5 (ppm)	C26 Tricyc #6 (ppm)	Unknown Peak #7 (ppm)	Unknown #8 (ppm)	C28 Tricyc 9 (ppm)	C28 Tricyc #10 (ppm)	C29 Tricyc #11 (ppm)	C29 Tricyc #12 (ppm)	C27 Hopane TS #13 (ppm)
6.03	2.35	3.29	1.46	3.50	1.66	2.47	3.74	4.07	9.06

Terpane Concentrations (m/z=191)

C27 Hopane TM #14 (ppm)	C27 Hopane #15 (ppm)	Unknown #16 (ppm)	C28 Hopane #17 (ppm)	Unknown Peak #18 (ppm)	C29 Hopane #19 (ppm)	C29 Norhop #20 (ppm)	Diahopane Peak F (ppm)	C29 Moretane #21 (ppm)	C30 Oleanane #22 (ppm)
6.68	1.88	1.40	6.22	0.96	15.34	3.46	3.91	2.60	0.12

Terpane Concentrations

C30 Hopane #23 (ppm)	C30 Moretane #24 (ppm)	Unknown #25 (ppm)	Unknown #26 (ppm)	C31 Hopane 22S #27 (ppm)	C31 Hopane 22R #28 (ppm)	C31 Moretane Peak #29 (ppm)	Gammacerene Peak G (ppm)	C32 Hopane 22S #30 (ppm)	C32 Hopane 22R #31 (ppm)
21.44	3.04	0.55	0.00	8.02	6.13	1.07	1.61	4.93	3.97

1s (m/z=191)

C32 Moretane #32 (ppm)	C31 bb Homohop #33 (ppm)	C33 Hopane 22S #34 (ppm)	C33 Hopane 22R #35 (ppm)	C34 Hopane 22S #36 (ppm)	C34 Hopane 22R #37 (ppm)	C35 Hopane 22S #38 (ppm)	C35 Hopane 22R #39 (ppm)
0.23	0.49	3.89	2.83	2.28	1.39	2.09	1.52