



## 8.1 SUMMARY

Prior to testing several runs were made with the RFT: the reservoir pressure measured was hydrostatic, 2392 psia at a datum of 1630 m ss. The OWC could not be accurately determined using the RFT pressures. No downhole sample was recovered due to repeated plugging of the sampling probe.

The waterzone was perforated from 1645 to 1650.5 m ss. Formation water samples recovered contained an equivalent of some 64,000 ppm NaCl. Laboratory analysis has shown that the sample may not be representative of formation water. An eight hours water injection test at rates up to 8000 b/d did not reveal any immediate problems related to injection of unfiltered clean seawater. The (semi-steady state) water injectivity index (clean cold seawater), assuming a skin of 20, is 19 b/d/psi.

After abandonment of the waterzone test the oilzone was perforated from 1626 to 1632 m ss. The well was gravelpacked and rates up to 7400 stb/d of 40<sup>0</sup> API oil were achieved. The evaluation showed a permeability of 2.6 Darcy. Observed productivity indices after gravel packing varied from 10.7 to 15.2 stb/d/psi. Skins calculated ranged from 117 to 174. The reservoir pressure from build-up surveys was 2390 psia at datum. Due to weather related problems no downhole samples were recovered.

Table 8.1

WELL : 6407/9-2  
 WATER TEST SUMMARY  
 INTERVAL 1645 - 1650.5 m ss

Test	DST-1	Water Inj. Test		
	26.12.84	28.12.84		
Flow Period, mins	8.5	60	450	60
Average Rate, b/d	4270	-8000	-7000	0
Cumulative, bbls	25.2	- 330	-2490	0
THP, psig	0-160	800	722	-
Final FBHP, psig	2300	2674	2758	-
Final CIBHP, psig	2353	-	2405	2405
kh, mD.ft	22700	-	-	92400
k, mD	1260	-	-	1080
Skin <sup>2)</sup>	- 2.2	-	61	-

Comments

1. DST-1; prior to opening the downhole valve, the tubing was filled with diesel. Gauge depth 1638.5 m bdf
2. Water Injection Test; gauge depth 1664.0 m bdf. The total skin of 61 is composed of a partial completion skin of 15, a Darcy skin of 5 and a skin due to injection of cold water of 41
3. DFE is 25 m above MSL
4. Formation water salinity is 36400 ppm Cl<sup>-</sup>
5. Cold seawater injectivity is 19 b/d/psi (assuming a skin of 20)

WELL : 6407/9-2  
WATER ZONE TEST : SEQUENCE OF EVENTS

FLOW PER.	TIME OF START	THP psig	BHP (1638.5 m) psig	CUM. PROD. bbls	PROD. RATE b/d (est.)	COMMENTS
DST-1	26.12.84					
	15:50		1994.7 (133°F)			Displace tbg to diesel
	15:51		1992.1			Perforate
	15:54	336				1670-1675.5 m bdf
	15:55		2349.0			Close PCT valve
	17:35		2349.3 (133°F)			
	17:37:15	-	2279.0			Open PCT valve
	17:38	160	2275.9			and flow on
	17:39	135	2280.0			40/64 inch choke
	17:40	120	2286.2	10.0	5236	
	17:41	98	2290.3			
	17:42	90	2293.0			
	17:43	80	2294.9	17.6	3650	
	17:44	71	2296.4			
	17:45	63	2300.1	22.8	3745	
	17:45:45	-	2302.5	25.2	4608	Close PCT
	18:21	-	2352.8			P.B.U. survey
						Open PCT
						no flow, due
						to sand bridge
	18:28		2351.8			Close PCT
	19:10					Open MORV
	19:40					Reverse out

Whilst reversing out recovered samples

Sandbailer indicated hold up depth = 1595 m bdf which is some 38 m above the packer. Pulled test string to circulate out sand

WELL : 6407/9-2  
WATER ZONE TEST : SEQUENCE OF EVENTS

DATE TIME	DESCRIPTION
27.12.84	Pulled DST-1 assembly Lost 80 bbls brine whilst circulating out sand Ran DST-2 assembly
28.12.84	Circulated 10 bbls 15% HCl (+ additives), set packer, closed PCT valve, opened MORV, circulated tubing to diesel
19:00	<u>DST-2a</u> : Opened PCT, flowed well, cum. prod. 44.6 bbls
29.12.84	
00:30	Closed PCT, reversed out, took samples. Circulated tubing to diesel
02:00	<u>DST-2b</u> : Opened PCT, flowed well, cum. prod. 96.5 bbls
13:00	Closed PCT, reversed out, took samples Circulated tubing to diesel
15:30	<u>DST-2c</u> : Opened PCT, flowed well, cum. prod. 142.4 bbls
22:00	Closed PCT, reversed out, took samples Circulated tubing to diesel
30.12.84	
00:30	<u>DST-2d</u> : Opened PCT, flowed well, cum. prod. 193.7 bbls
08:30	Closed PCT, reversed out, took samples Circulated tubing to diesel
11:00	<u>DST-2e</u> : Opened PCT, flowed well, cum. prod. 258.1 bbls
19:00	Closed PCT, reversed out, took samples Circulated to diesel
21:00	<u>DST-2f</u> : Opened PCT, flowed well, cum. prod. 323.4 bbls
31.12.84	
04:30	Ran 3 BHS + gauge, took 3 samples simultaneous
09:00	Closed PCT, reversed out, took samples Circulated to seawater for water injection test Opened PCT. Ran 2 SDP-gauges and hung off in RN-nipple
15:00	Closed PCT
18:30	Opened PCT. <u>Performed seawater injection test</u> at 8000 b/d and 7000 b/d
01.01.85	
03:00	Closed PCT and recorded fall off test
04:00	Ran in with wireline and retrieved gauges Closed PCT, reversed out seawater, spotted viscous brine, circulated to brine, pulled DST-2 assembly with packer, abandoned water test zone

WELL : 6407/9-2  
SUMMARY OF SEPARATOR DATA

DATE TIME	THP/THT psig/°F	OIL-RATE stb/d	GOR scf/stb	Psep/Tsep psig/°F	BHP psia	COMMENTS
07.01.85						PT-1A 2D BHP 1622.5 m bdf
20.30	470/44	239	354	60/100	2328.9	Oil Grav. =
21.00	478/44	450	192	60/103	2329.0	0.8227
21.45	490/44	260	160	60/89	2333.4	
22.30	487/42	98	505	57/90	2334.3	Gas Grav. =
23.00	487/42	90	509	60/87	2334.3	0.99 (air = 1)
23.30	487/42	100	459	60/89	2334.0	
13.01.85						PT-1B 12Dd
17.00	142/48	743	307	77/104	--	
17.30	137/48	855	312	69/110	--	1% CO <sub>2</sub>
18.00	135/48	884	291	69/116	--	0 ppm H <sub>2</sub> S
18.30	131/48	909	280	69/117	--	
19.00	129/48	893	280	66/118	--	
19.30	128/48	862	288	67/118	--	Oil Grav. =
20.00	125/48	897	277	66/118	--	0.834
20.30	93/48	1730	233	49/118	--	
21.00	87/48	1182	347	37/117	--	Gas Grav. =
21.30	84/48	1151	348	37/117	--	1.16 (air = 1)
22.00	82/48	1095	351	38/118	--	
22.30	79/48	1044	360	37/118	--	
23.00	77/48	909	398	36/118	--	
23.30	75/48	991	353	37/116	--	
14.01.85						PT-1C 6Dd
13.00	286/50	1665	257	86/120	--	32/64" bean
13.30	289/50	1679	263	89/121	--	Oil Grav. = 0.8317
14.00	295/50	1681	275	92/122	--	Gas Grav. =
14.30	299/50	1772	267	89/122	--	1.005 (air = 1)
15.00	301/50	1795	262	90/122	--	
15.30	304/50	1847	255	91/122	--	0 ppm H <sub>2</sub> S
16.00	307/52	1887	252	91/122	--	1% CO <sub>2</sub>
16.30	309/52	1861	256	92/122	--	
17.00	263/54	2487	248	97/122	--	44/64" bean
14.01.85						PT-1C 7Dd
18.00	236/57	2957	244	104/125	--	48/64" bean
18.30	239/58	3005	241	105/124	--	
19.00	242/60	3059	236	104/124	--	
19.30	243/60	2969	245	104/124	--	
20.00	244/60	3053	240	106/126	--	
20.30	246/61	3071	245	106/124	--	

WELL : 6407/9-2  
SUMMARY OF SEPARATOR DATA

DATE TIME	THP/THT psig/°F	OIL-RATE stb/d	GOR scf/stb	Psep/Tsep psig/°F	BHP psia	COMMENTS
14.01.85						PT-1C 8Dd
21.00	198/64	3898	239	105/126	--	60/64" bean
21.30	189/64	3974	255	96/124	--	72/64" bean
22.00	188/66	3945	264	92/124	--	
23.00	192/68	4109	254	92/124	--	
24.00	193/68	4214	250	-/-	--	
15.01.85						PT-1C 9Dd
01.00	132/72	4933	277	62/105	--	2" bean
02.00	132/72	5015	273	62/104	--	Oil Grav. =
03.00	133/72	5042	267	62/104	--	0.8260
04.00	134/72	5107	263	62/104	--	Gas Grav. =
05.00	134/72	5099	265	63/104	--	1.005 (air = 1)
06.00	136/72	5135	264	63/105	--	0 ppm H <sub>2</sub> S
07.00	136/72	5178	261	63/105	--	0.5% CO <sub>2</sub>
15.01.85						PT-1D 1Dd
13.00	486/52	1209	221	97/123	2292.23	20/64" bean
13.30	487/52	1164	230	97/121	2290.17	
14.00	486/52	1212	223	96/121	2290.65	BHP data from
14.30	485/52	1185	228	96/121	2291.93	CG 83780
15.00	485/52	1167	230	96/121	2290.80	1644 m bdf
15.30	474/52	1167	231	95/121	2289.45	
15.01.85						PT-1D 2Dd
16.00	351/58	2773	203	136/120	2163.02	36/64" bean
16.30	350/58	2522	231	131/122	2161.22	Oil Grav. =
17.00	350/58	2557	228	130/122	2160.06	0.8264
17.30	350/58	2603	223	131/123	2160.01	Gas Grav. =
18.00	350/58	2575	225	130/123	2159.56	0.943
18.30	350/59	2593	222	130/122	2158.87	0 ppm H <sub>2</sub> S
19.00	350/59	2620	221	131/122	2158.57	1% CO <sub>2</sub>
15.01.85						PT-1D 3Dd
20.30	187/68	4362	262	90/124	1972.75	80/64" bean
21.00	187/70	4353	263	90/125	1970.33	
22.00	187/70	4424	260	91/124	1966.89	
23.00	188/71	4406	262	91/122	1965.35	PVT sampleset 1
24.00	188/71	4433	262	92/122	1964.30	PVT sampleset 2
01.00	189/71	4469	256	95/121	1964.37	PVT sampleset 3
02.00	189/72	4406	255	95/123	1963.25	
03.00	189/72	4433	257	95/122	1962.94	PVT sampleset 4
04.00	189/72	4460	255	95/121	1962.68	
05.00	189/72	4460	255	95/121	1962.35	BSW = 0%

WELL : 6407/9-2  
SUMMARY OF SEPARATOR DATA

DATE TIME	THP/THT psig/°F	OIL-RATE stb/d	GOR scf/stb	Psep/Tsep psig/°F	BHP psia	COMMENTS
06.00	190/72	4469	255	95/122	1961.96	
19.01.85						PT-1E 2Dd
13.30	284/43	2232	222	115/116	--	36/64" bean
14.00	287/43	2080	244	110/119	--	
15.30	180/51	3589	279	88/119	--	64/64" bean
16.00	180/51	3625	275	88/120	--	
16.30	163/53	3868	295	78/120	--	80/64" bean
17.30	122/56	4495	290	60/101	--	128/64" bean
18.00	124/56	4495	291	60/106	--	
18.30	125/57	4558	287	60/106	--	
19.00	125/60	4602	287	60/106	--	
20.01.85						PT-1F 5Dd
13.00	428/40	--	--	123/160	--	24/64" bean
13.30	430/40	1396	312	124/158	--	
14.00	435/40	1428	314	125/158	--	
14.30	363/47	2653	351	97/168	--	36/64" bean
15.00	368/48	2635	289	90/130	--	
15.30	345/51	3104	276	97/126	--	44/64" bean
16.00	348/52	3166	270	95/126	--	
16.30	249/59	4838	265	106/128	--	64/64" bean
17.00	250/60	4838	267	109/127	--	
17.30	224/64	5342	284	103/128	--	80/64" bean
18.00	225/64	5342	284	103/128	--	
19.00	181/66	6336	234	105/112	--	2" bean
20.00	183/66	6398	233	105/110	--	Oil Grav. =
21.00	182/66	6398	236	103/110	--	0.825
22.00	182/68	6362	241	104/110	--	Gas Grav. =
23.00	183/68	6443	238	104/110	--	0.935 (air = 1)
21.01.85						PT-1G 8Dd
10.00	380/38	1053	333	65/109	--	24/64" bean
11.00	390/38	1177	285	59/94	--	
14.00	313/53	2755	270	110/133	--	44/64" bean
21.01.85						PT-1G 9Dd
16.00	152/64	6526	229	60/90	--	2" bean
17.00	152/64	6766	229	63/96	--	
18.00	152/66	6908	226	63/98	--	Oil Grav. =
19.00	154/68	6842	224	66/100	--	0.8248
20.00	155/68	6864	232	69/104	--	Gas Grav. =
21.00	155/68	7017	221	66/102	--	0.965



WELL : 6407/9-2  
SUMMARY OF SEPARATOR DATA

DATE TIME	THP/THT psig/°F	OIL-RATE stb/d	GOR scf/stb	Psep/Tsep psig/°F	BHP psia	COMMENTS
22.00	156/68	6984	225	67/100	--	
22.01.85						PT-1H 1Dd
05.00	360/48	3237	294	97/144	2144.54	40/64" bean
06.00	355/50	3173	293	98/124	2133.95	BHP data from
07.00	358/52	3283	254	92/118	2133.07	CG 83780
08.00	359/52	3274	283	95/136	2132.49	1641.69 m bdf
22.01.85						PT-1H 2Dd
09.00	247/60	4773	272	102/132	2008.18	64/64" bean
10.00	246/60	4747	269	101/129	2004.17	
11.00	245/60	4818	251	100/114	2002.45	
12.00	240/61	4763	--	--	1997.17	
22.01.85						PT-1H 3Dd
13.00	153/64	7351	243	64/111	1915.99	2+1-1/2 beans
14.00	152/64	7452	212	62/92	1910.64	
15.00	152/65	7430	212	61/89	1905.64	0 ppm H <sub>2</sub> S
16.00	152/65	7418	210	60/90	1902.16	1% CO <sub>2</sub>
17.00	151/65	7452	209	60/90	1900.88	
18.00	150/65	7401	209	60/91	1901.02	
19.00	150/65	7379	210	60/91	1902.60	Oil Grav. =
20.00	150/65	7396	209	60/90	1904.48	0.825 - 0.829
21.00	148/65	7283	212	60/91	1905.40	
22.00	148/65	7317	211	60/91	1906.66	Gas Grav. =
23.00	148/65	7379	209	60/91	1907.63	0.96-0.97 (air=1)
24.00	147/65	7351	210	60/91	1908.33	
23.01.85						BSW 0%
01.00	145/65	7345	210	60/90	1909.02	
02.00	145/66	7323	210	60/90	1909.48	
03.00	145/66	7312	208	60/90	1909.00	
04.00	146/66	7286	207	60/91	1909.58	
05.00	147/67	7281	209	60/91	1908.23	
06.00	147/67	7292	208	61/91	1908.30	
07.00	147/67	7270	205	61/91	1909.82	
08.00	147/66	7320	205	61/91	1907.61	
09.00	147/66	7230	207	62/90	1907.38	
10.00	145/66	7292	203	62/90	1907.89	

Table 8.6

WELL : 6407/9-2  
PT-1D : OIL SAMPLES RECOVERED

(a) PVT samples: 4 x 700 ml oil and 4 x 20 litres gas.

	NO.	OIL stb/d	GAS Mscf	BOTTLE NO.	SAMPLING psig °F	SAMPLE VOLUME	GAS CAP VOLUME	HG LEFT IN BOTTLE
oil	1	4406		811503	91 122	640 ml	20 cc	15 cc
gas	1		1152	1015	91 108	20 l		
oil	2	4433		811450	92 122	650 ml	10 cc	15 cc
gas	2		1163	1012	92 104	20 l		
oil	3	4460		811501	95 123	600 ml	65 cc	10 cc
gas	3		1141	1002	95 104	20 l		
oil	4	4433		811420	95 122	600 ml	65 cc	10 cc
gas	4		1137	1003	95 103	20 l		

(b) Bulk samples: 3 x 1 bbl dead oil

NO.	TIME TAKEN	OIL PROD. (stb/d)
1	01.30	4451
2	03.15	4433
3	04.20	4460

oil gravity during sampling 0.8274 g/cm<sup>3</sup>  
 gas gravity during sampling 0.990 - 1.005 (air = 1)  
 H<sub>2</sub>S zero percent  
 CO<sub>2</sub> one percent

100



January 1986

RKER.86.035

GEOCHEMICAL INVESTIGATION OF A CRUDE OIL  
FROM WELL 6407/9-2, Norway  
by

J.M.A. Buiskool Toxopeus & F.M. van der Veen

Sponsor: Shell Risavika EP

Code: 774.10.300



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**KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM**

**RIJSWIJK, THE NETHERLANDS**

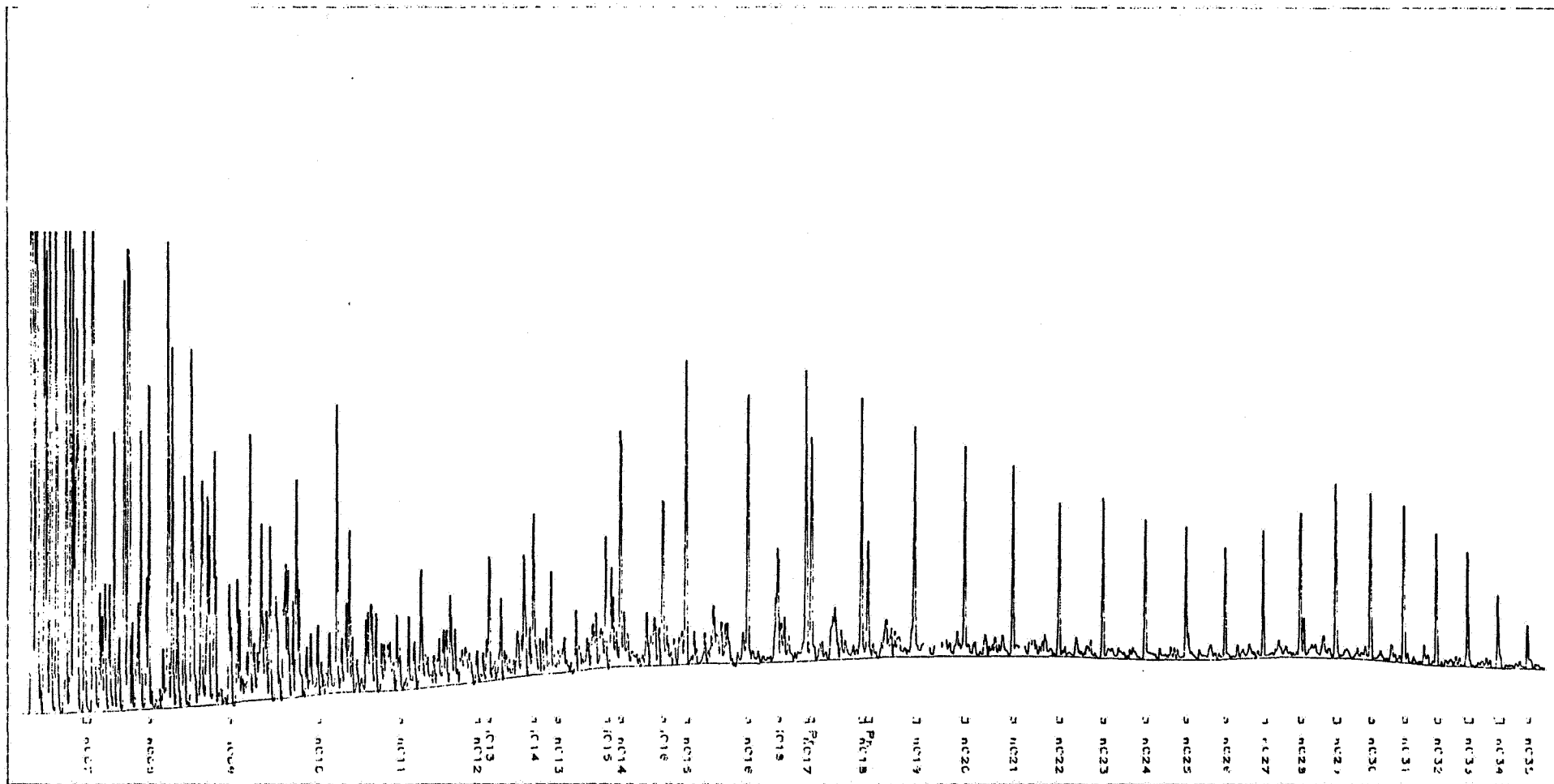
(Shell Research B.V.)

Table 1 - GEOCHEMICAL DATA OF OILS

Sample	Norway 6407/9-2 1651-1657 m DST-1
API	39.6
specific gravity	0.8269
%w. boil. <120°C	13.3
% sulphur	0.3
ppm V as metals	0.8
ppm Ni as metals	0.9
pristane/phytane	2.1
pristane/nC17	1.0
phytane/nC18	0.5
C <sub>7</sub> -distribution	
C <sub>7</sub> -alkane	
nC7	49
monobranched	41
polybranched	11
C <sub>7</sub> -alk/naphthene	
nC7	20
naphthenes	59
branched alkanes	21
C <sub>7</sub> -alk/naphth/arom	
nC7	39
naphthenes	56
aromatics	5
C <sub>15</sub> distribution	
1-ring	
2-ring	
3-ring	
C <sub>30</sub> distribution	
3-ring	
4-ring	
5-ring	
C <sub>29</sub> VR/E	
% asphaltenes	0.6
% saturates*	60
% aromatics	37
% heterocompounds	3
δ <sup>13</sup> C <sup>o</sup> /oo (whole oil)	-28.7
" (saturates)	
" (aromatics)	

\*) Determined by thin-layer chromatography.  
ND = not detectable.

# GAS CHROMATOGRAM OF WHOLE CRUDE

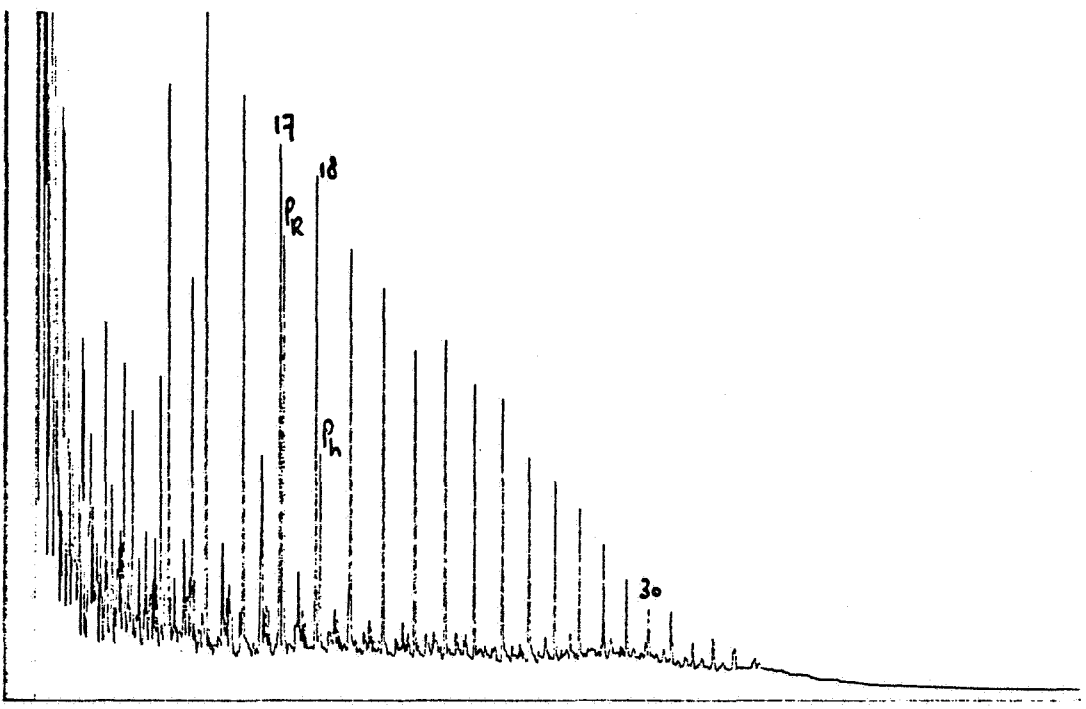


PKEP 86.035

HALTENBANKEN,6407/9-2

FIG. 1.

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GAS CHROMATOGRAM OF SATURATED HYDROCARBONS

FIG. 2, NORWAY HALTENBANKEN 6407/9-2

18560.

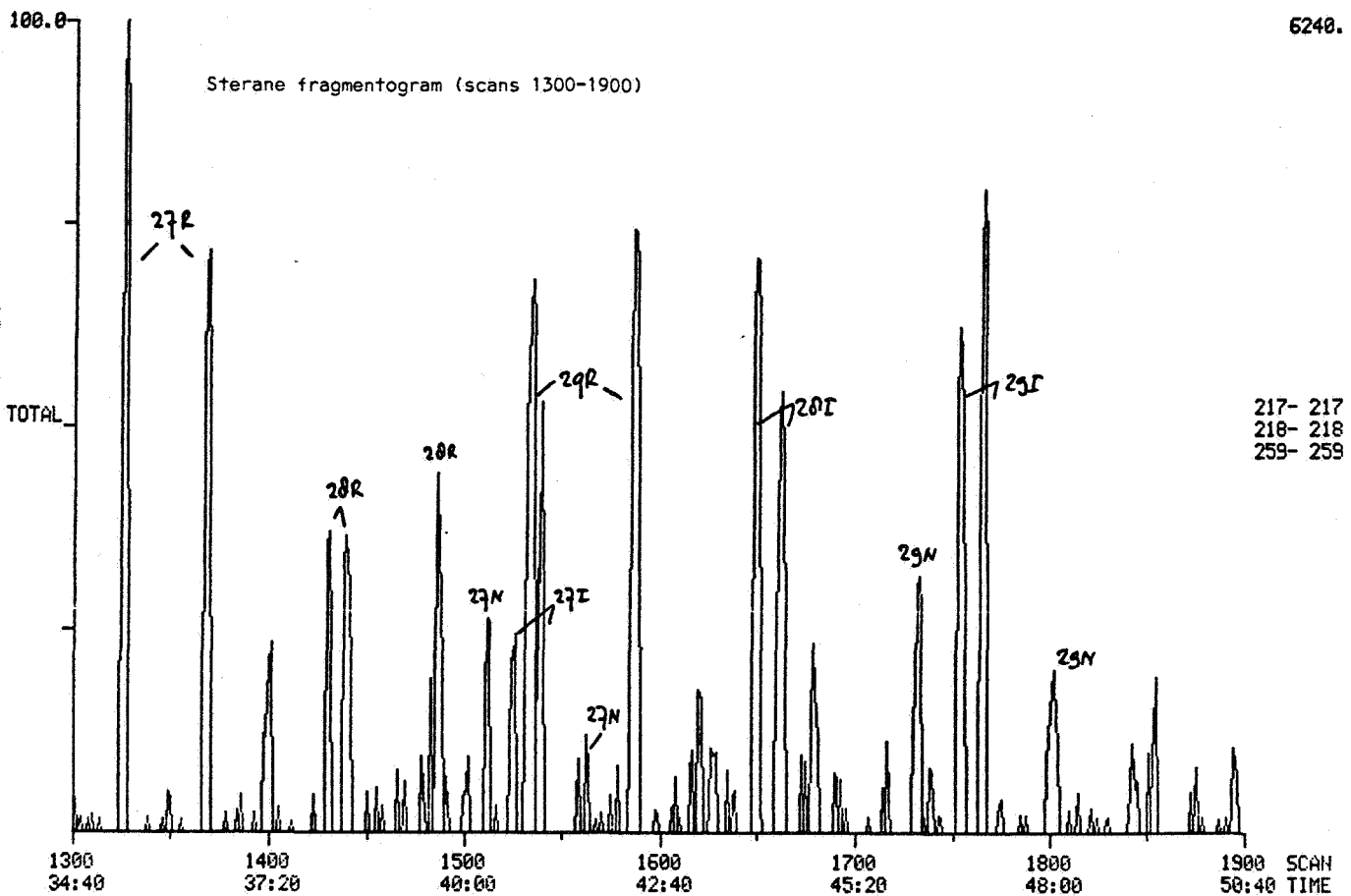
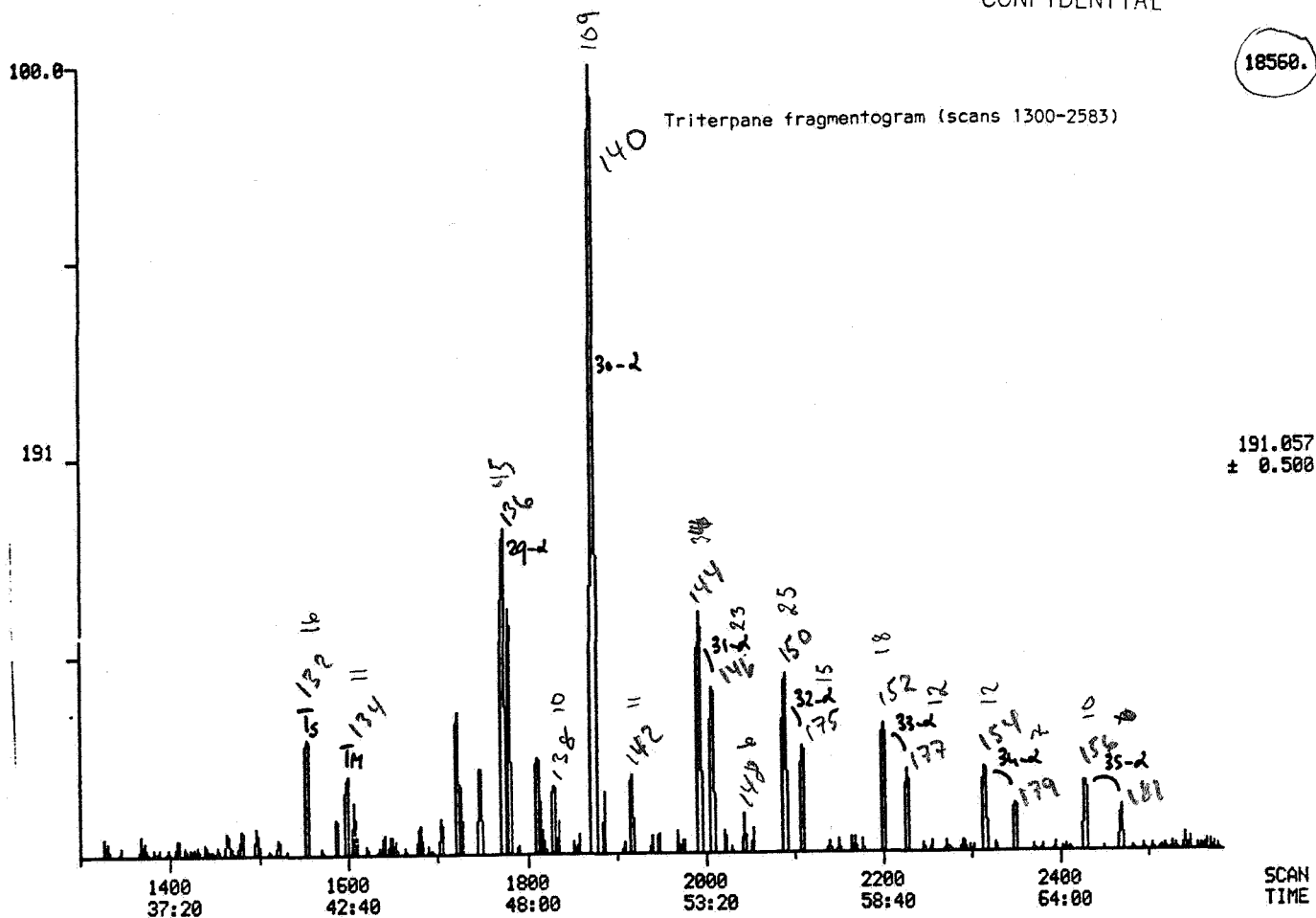


FIG. 5A. GC-MS analysis 6407/9-2, 1651-1657 m, crude oil.

FIG. 5R. GC-MS analysis 6407/9-2, 1651-1657 m, crude oil.

