DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2002/114

Petroleum geochemistry: selected wells from the eastern Canada offshore area

Data report: Gjoa G-37, Hekja 0-71, Ogmund E-72 Ralegh N-18 and Skolp E-09 wells

J. A. Bojesen-Koefoed

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MINISTRY OF THE ENVIRONMENT

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Contents

Introduction

This report presents Rock-Eval/TOC screening data on the following five exploration wells from the eastern Canadian offshore:

- Gjoa G-37
- Hekja O-71
- Ogmund E-72
- Ralegh N-18
- Skolp E-09

In addition, biological marker data obtained from analysis of solvent extracts of a limited number of samples are included. Biological marker data are available from samples collected in the following wells.

- Hekja O-71, 4 samples
- Ralegh N-18, 4 samples
- Skolp E-09, 6 samples

The data were produced by the Geological Survey of Denmark and Greenland (GEUS) as part of a research project on the distribution of petroleum source rocks in the Davis Strait region and in the Arctic in general. A short commentary text is included for each well.

A CD-ROM containing data tables (MS Excel spreadsheets) and figures (MS Windows *.emf format) is enclosed.

Samples were kindly provided by the Canada Nova Scotia Offshore Petroleum Board (CNSOPB) in Halifax (Gjoa G-37, Hekja O-71 and Ralegh N-18 wells) and the Canada Newfoundland Offshore Petroleum Board (CNOPB) in St. Johns (Ogmund E-72 and Skolp E-09 wells).

Methods

All samples were ditch cuttings, rinsed on a brass sieve under lukewarm water. Obvious non-indigenous objects were removed manually, bit-chips were removed using a magnet. Only the 1-4 mm size fraction, ground to attain a grainsize < 250µm, was used for analysis.

Rock-Eval/TOC screening pyrolysis of powdered (<250 µm) samples was carried out by means of a Rock-Eval 6 Turbo instrument using standard procedures. The instrument was calibrated using the GEUS inhouse Rock-Eval standard MS.15.05.1999, which in turn was calibrated against the commercially available IFP 55000 standard. The MS.15.05.1999 standard shows the following average parameter-values and acceptance limits:

TOC (%):	3.23 ± 0.55
Tmax (°C):	417 ± 5
S2 (mg/g):	13.74 ± 0.92
S3 (mg/g):	0.94 ± 0.13

Sets of standard+blank were run for every 10 samples. In case such control-standards did not comply with the values and acceptance levels stated, 5 samples on both sides of the spurious standard+blank set were reanalysed.

Solvent extraction was carried out by means of a Soxtec™ instrument, using dichloromethane+methanol (93 + 7 vol. + vol.) as solvent. Asphaltenes were precipitated by addition of 40-fold excess of n-pentane. Maltenes were separated into saturated, aromatic and heteroatomic (NSO) fractions using MPLC, following procedures adapted from Radke et al. (1980).

Gas chromatographic analysis of saturated extract fractions was carried out by means of a Hewlett-Packard 5890 gas chromatograph, using splitless injection, a 25m HP-1 WCOT column and FID

Coupled gas chromatography – mass spectrometry of saturated biological markers was carried out by means of a Hewlett-Packard 5890 gas chromatograph, using splitless injection and a 30m ZB-5 WCOT column, connected to a Hewlett-Packard 5971 MSD. Analysis was carried out using selected ion monitoring (SIM).

Gjoa- G-37 well

Rock-Eval/TOC screening

A total of 78 samples were analysed, covering the interval 1510m to 3998m (Table 1, Figure 1).
TOC contents are generally low, 0.1% – 2.5%, averaging 1.1%. S2 pyrolysis yields are low, averaging 0.4 mg/g, never exceeding 2.1 mg/g. Consequently Hydrogen Indices (HI) are invariably <100 (Figs. 2 and 3). No petroleum source potential has been recorded.
The Production Index (PI) is generally low, although a few excursions towards values >0.1 are recorded. These, however, coincide with low S1 and S2 yields and probably represent technical artefacts. No signs of staining or contamination are observed.
Tmax is very variable, probably due to poorly defined S2 peaks, but a depth-trend may be tentatively identified, showing an increse from values slightly below 430 °C at the top of the section, to values close to 440 °C at the base of the section.

Solvent extract analysis

No samples were analysed.

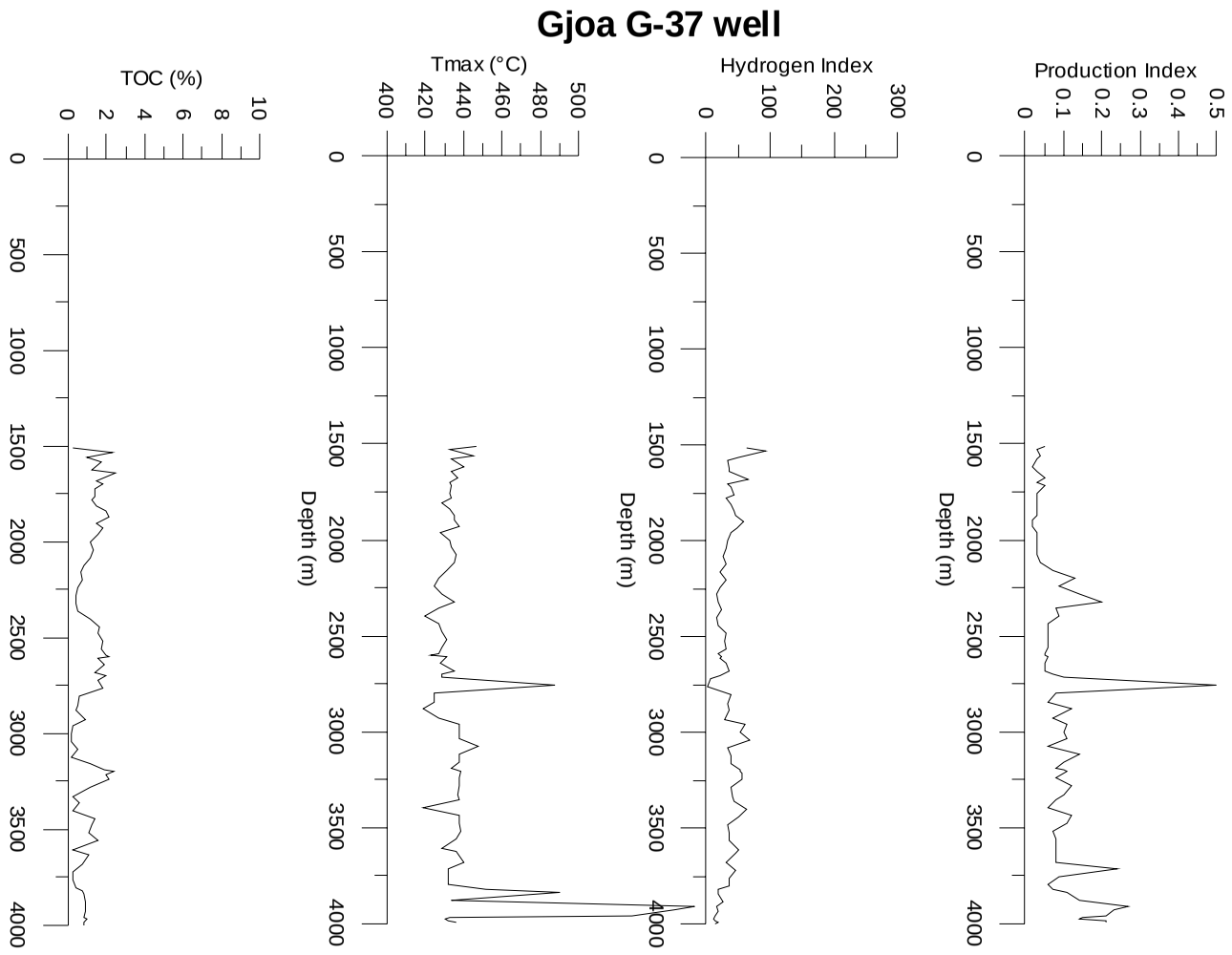


Fig. 1. Simple geochemical log, Gjoa G-37 well

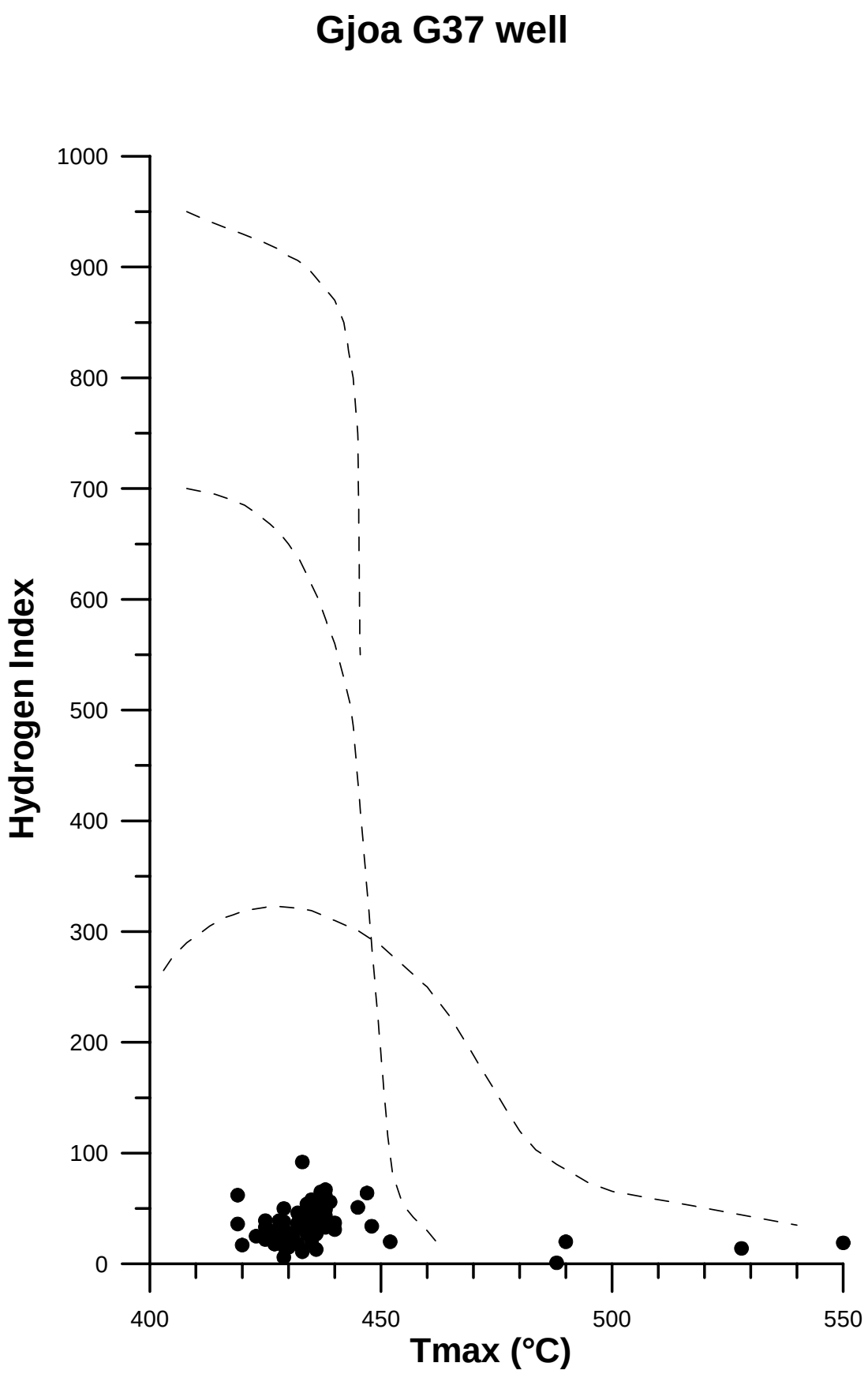


Fig. 2. Gjoa -37 well, all data

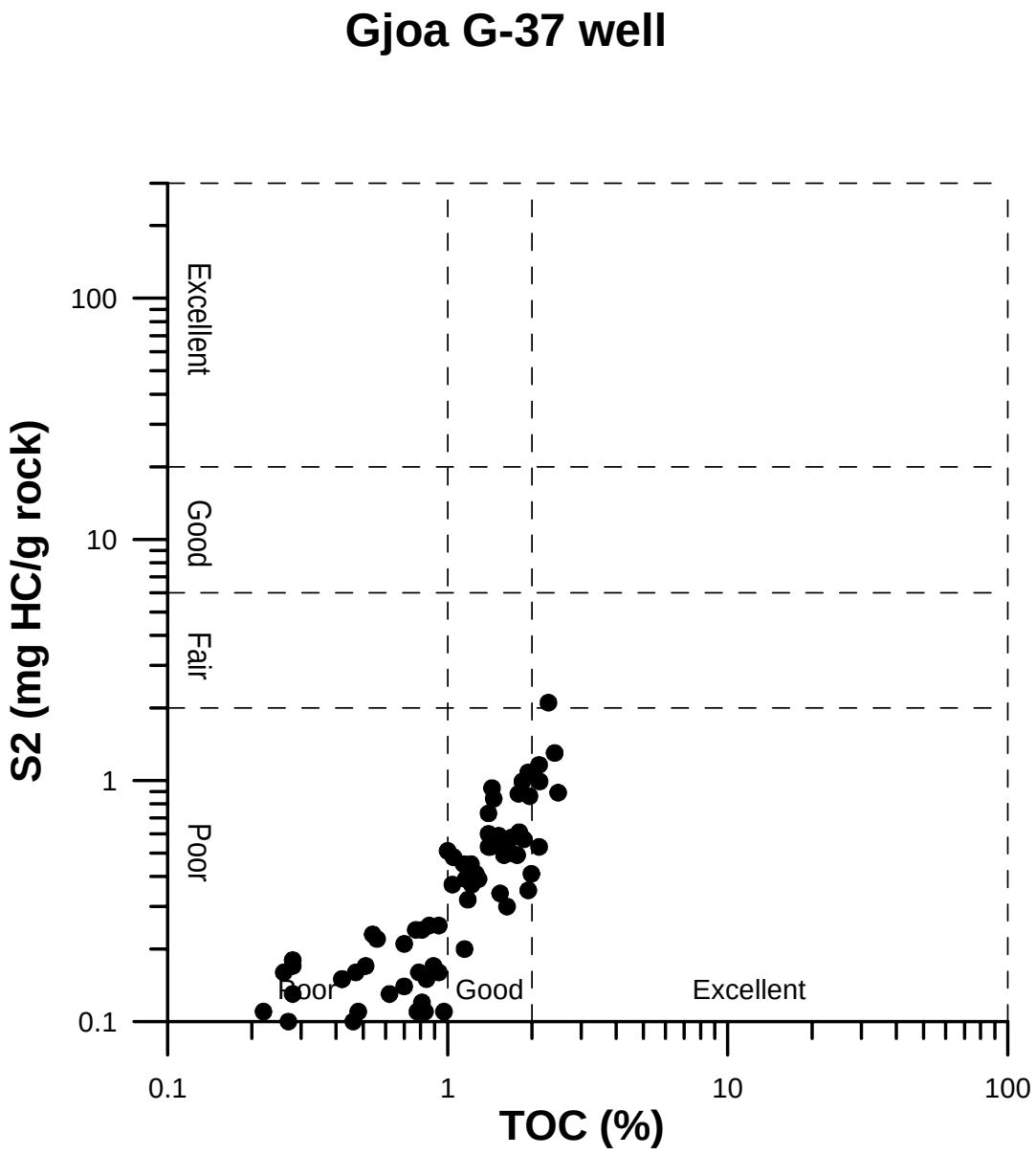


Fig. 3. Gjoa G-37 well, all data

Table 1. Gjoa G37 well. Rock-Eval /TOC screening data

Lab (#)	meter (Base)	TOC (wt-%)	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HI	OI	PI	PC
6951	1510	0,28	447	0,01	0,18	3,30	64	1179	0,05	0,02
6952	1530	2,29	433	0,07	2,10	6,47	92	283	0,03	0,18
6953	1560	1,00	445	0,02	0,51	10,37	51	1037	0,04	0,04
6954	1580	1,69	434	0,02	0,58	3,07	34	182	0,03	0,05
6955	1620	1,21	440	0,01	0,45	3,81	37	315	0,02	0,04
6956	1640	2,48	434	0,03	0,89	4,27	36	172	0,03	0,08
6957	1680	1,44	437	0,05	0,93	4,66	65	324	0,05	0,08
6958	1700	1,80	433	0,02	0,61	5,21	34	289	0,03	0,05
6959	1720	1,40	434	0,03	0,53	4,63	38	331	0,05	0,05
6960	1760	1,40	433	0,02	0,60	4,68	43	334	0,03	0,05
6961	1780	1,22	434	0,01	0,37	3,84	30	315	0,03	0,03
6962	1810	1,51	429	0,02	0,57	3,59	38	238	0,03	0,05
6963	1840	1,96	433	0,03	0,86	3,84	44	196	0,03	0,07
6964	1870	2,13	435	0,03	0,99	3,60	46	169	0,03	0,08
6965	1900	1,46	435	0,02	0,84	5,72	58	392	0,02	0,07
6966	1930	1,79	438	0,02	0,88	4,12	49	230	0,02	0,07
6967	1960	1,52	428	0,02	0,59	2,98	39	196	0,03	0,05
6968	2000	1,16	433	0,01	0,39	3,34	34	288	0,03	0,03
6969	2040	1,29	434	0,01	0,39	2,23	30	173	0,03	0,03
6970	2080	1,18	436	0,01	0,32	2,47	27	209	0,03	0,03
7045	2120	0,81	435	0,01	0,24	1,73	30	214	0,04	0,02
7046	2160	0,62	431	0,01	0,13	1,23	21	198	0,07	0,01
7047	2200	0,70	427	0,03	0,21	1,29	30	184	0,13	0,02
7048	2240	0,46	425	0,01	0,10	1,29	22	280	0,09	0,01
7049	2280	0,38	429	0,01	0,06	1,04	16	274	0,14	0,01
7050	2320	0,42	435	0,02	0,08	0,80	19	190	0,20	0,01
7051	2360	0,48	427	0,01	0,11	1,01	23	210	0,08	0,01
7052	2400	1,15	420	0,02	0,20	1,48	17	129	0,09	0,02
7053	2440	1,63	427	0,02	0,30	2,77	18	170	0,06	0,03
7054	2480	1,59	429	0,03	0,49	2,14	31	135	0,06	0,04
7055	2520	1,77	431	0,03	0,49	2,23	28	126	0,06	0,04
7056	2560	1,69	429	0,03	0,50	1,95	30	115	0,06	0,04
7057	2590	1,94	427	0,02	0,35	1,86	18	96	0,05	0,03
7058	2600	2,12	423	0,03	0,53	2,22	25	105	0,05	0,05
7059	2610	1,54	431	0,02	0,34	1,85	22	120	0,06	0,03
7060	2640	1,87	428	0,03	0,57	2,57	30	137	0,05	0,05
7061	2680	1,42	435	0,03	0,53	1,25	37	88	0,05	0,05
7062	2700	1,99	429	0,03	0,41	1,57	21	79	0,07	0,04
7063	2720	1,52	429	0,01	0,09	0,73	6	48	0,10	0,01
7064	2760	1,80	488	0,01	0,01	0,38	1	21	0,50	0,00
7065	2800	0,56	425	0,02	0,22	0,85	39	152	0,08	0,02
7066	2850	0,51	425	0,01	0,17	0,48	33	94	0,06	0,01
7067	2880	0,42	419	0,02	0,15	0,48	36	114	0,12	0,01
7068	2930	0,86	427	0,02	0,25	0,75	29	87	0,07	0,02
7069	2960	0,28	438	0,02	0,17	0,32	61	114	0,11	0,02
7070	3000	0,17	438	0,01	0,09	0,30	53	176	0,10	0,01
7071	3040	0,12	438	0,01	0,08	0,20	67	167	0,11	0,01
7072	3080	0,47	448	0,01	0,16	0,71	34	151	0,06	0,01
7073	3120	0,16	438	0,01	0,06	0,54	38	338	0,14	0,01
7074	3160	1,17	438	0,05	0,44	0,94	38	80	0,10	0,04
7075	3190	1,85	434	0,09	0,99	1,02	54	55	0,08	0,09
7076	3200	2,41	436	0,14	1,30	0,78	54	32	0,10	0,12
7077	3210	1,94	439	0,13	1,08	0,77	56	40	0,11	0,10
7078	3240	2,12	438	0,10	1,16	0,90	55	42	0,08	0,10

7079	3280	1,14	438	0,06	0,45	0,42	39	37	0,12	0,04
7080	3330	0,22	437	0,01	0,09	0,07	41	32	0,10	0,01
7081	3360	0,54	438	0,02	0,23	0,34	43	63	0,08	0,02
7082	3400	0,26	419	0,01	0,16	0,35	62	135	0,06	0,01
7083	3440	1,40	438	0,10	0,73	0,20	52	14	0,12	0,07
7084	3480	1,26	438	0,05	0,41	0,39	33	31	0,11	0,04
7085	3520	1,04	439	0,03	0,37	0,28	36	27	0,07	0,03
7086	3560	1,56	436	0,05	0,56	0,69	36	44	0,08	0,05
7087	3610	0,22	429	0,01	0,11	0,21	50	95	0,08	0,01
7088	3630	1,05	436	0,04	0,48	0,44	46	42	0,08	0,04
7089	3680	0,77	440	0,02	0,24	0,33	31	43	0,08	0,02
7090	3720	0,28	432	0,04	0,13	0,22	46	79	0,24	0,01
7091	3760	0,27	432	0,01	0,10	0,09	37	33	0,09	0,01
7092	3800	0,42	432	0,01	0,15	0,06	36	14	0,06	0,01
7093	3820	0,70	452	0,01	0,14	0,05	20	7	0,07	0,01
7094	3840	0,79	490	0,02	0,16	0,11	20	14	0,11	0,01
7095	3880	0,93	434	0,04	0,25	0,29	27	31	0,14	0,02
7096	3910	0,93	561	0,06	0,16	0,24	17	26	0,27	0,02
7097	3930	0,89	550	0,05	0,17	0,32	19	36	0,23	0,02
7098	3960	0,78	528	0,03	0,11	0,10	14	13	0,21	0,01
7099	3970	0,97	433	0,02	0,11	0,04	11	4	0,15	0,01
7100	3980	0,81	430	0,02	0,12	0,07	15	9	0,14	0,01
7101	3990	0,84	432	0,04	0,15	0,24	18	29	0,21	0,02
7102	3998	0,83	436	0,03	0,11	0,06	13	7	0,21	0,01

Hekja O-71 well

Rock-Eval/TOC screening

A total of 69 samples were analysed, covering the interval 1465m to 4566m (Table 2, Figure 4).
TOC contents are very variable, 0.0% – 25.7%, averaging 5.8. S2 pyrolysis yields show wide variation, from 0.0 mg/g to 49.4 mg/g, with an average of 8.6 mg/g. Consequently Hydrogen Indices (HI) are also very variable, ranging from zero to 425 (Figs. 2 and 3). The maximum value is obviously a technical artefact, but several samples yield values close to 200 or above, while maintaining high values of both TOC and S2. Hence, several intervals within the 2100m – 3300m portion of the succession may possess petroleum source potential.
The Production Index (PI) is generally low, although a few excursions towards values >0.1 are recorded. These, however, coincide with low S1 and S2 yields and obviously represent technical artefacts. No signs of staining or contamination are observed.
Tmax shows a rather irregular increase from values close to 415 °C at the top of the section, to values close to 440 °C at the base of the section.

Solvent extract analysis

All samples contain very high proportions of diterpanes (pimarane/isopimarane, kaurane, phyllocladane etc.), disturbing n-alkane distributions in the C_{19-21} region. The 2550m sample further contains very high proportions of triterpanes, disturbing longer chain length n-alkane distributions.
Biomarker data show that all samples are thermally immature. Triterpane distributions are dominated by unsaturated compounds such as 13(18)-hopenes, and hopanes of the $\beta\beta$-configuration. In addition, several isomers of oleanene are abundant, causing notable distortion of the hopane distributions due to coelution, and rendering sterane data largely useless.

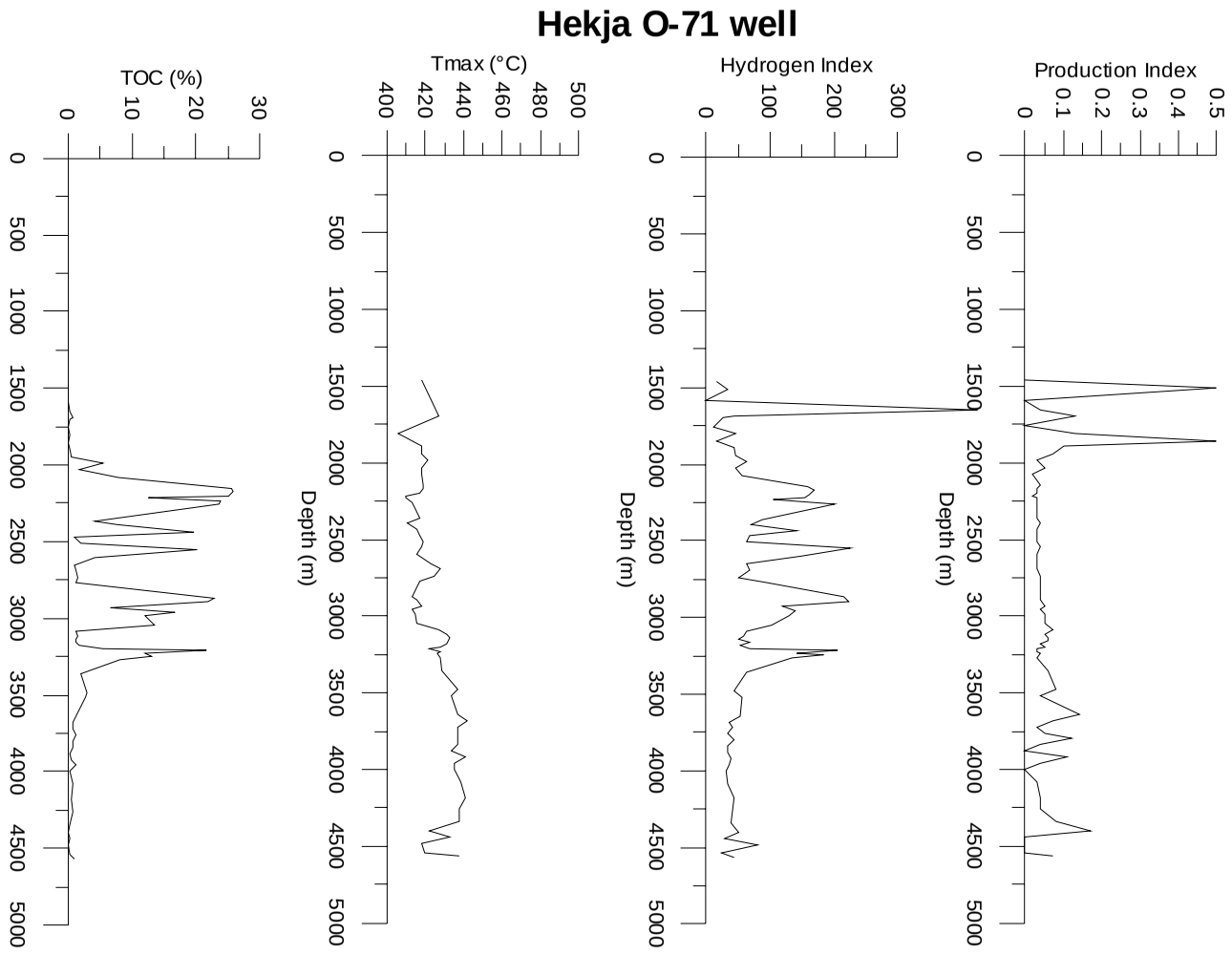


Fig. 4. Simple geochemical log, Hekja O-71 well

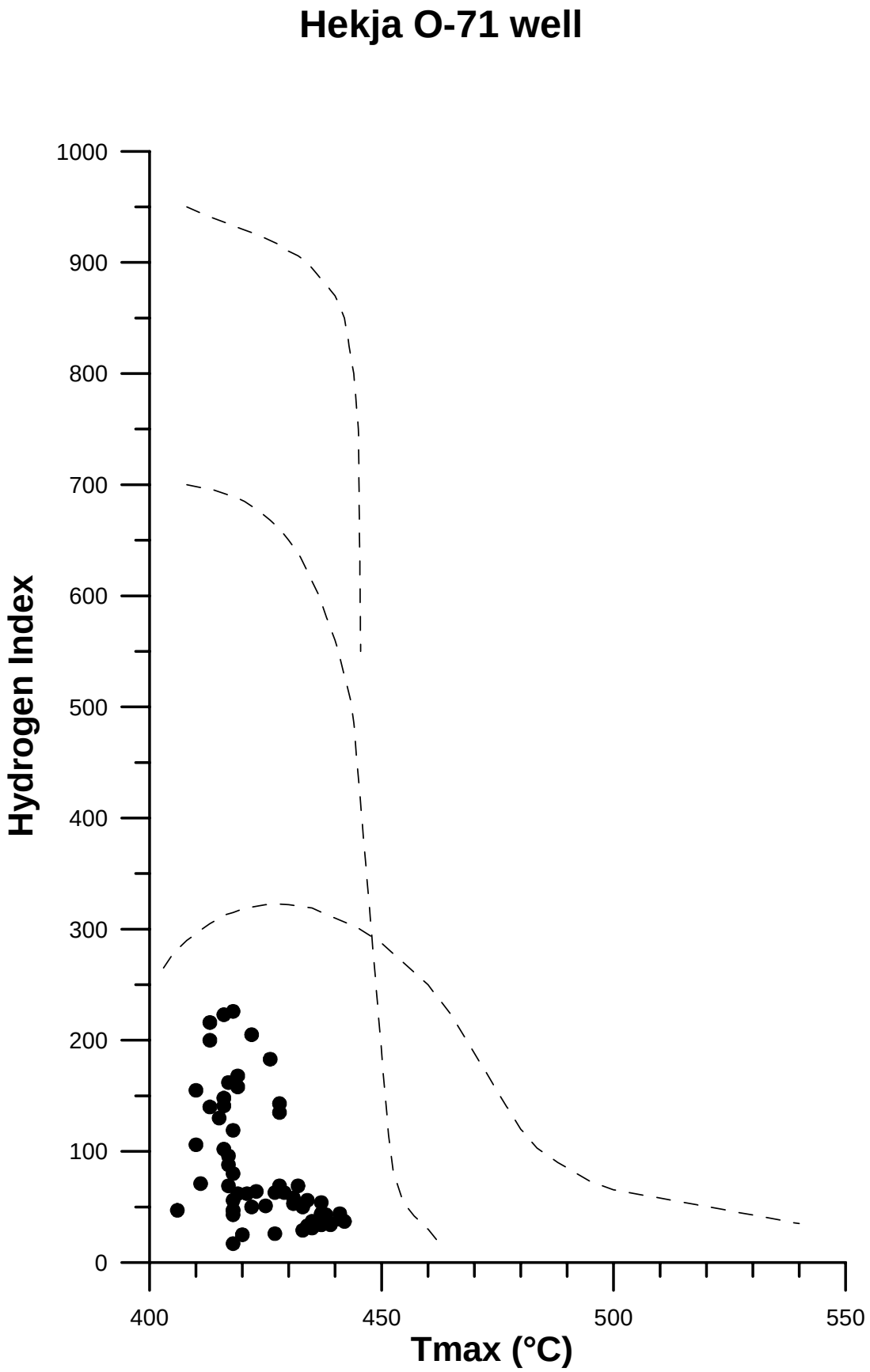


Fig. 5. Hekja O-71 well, all data

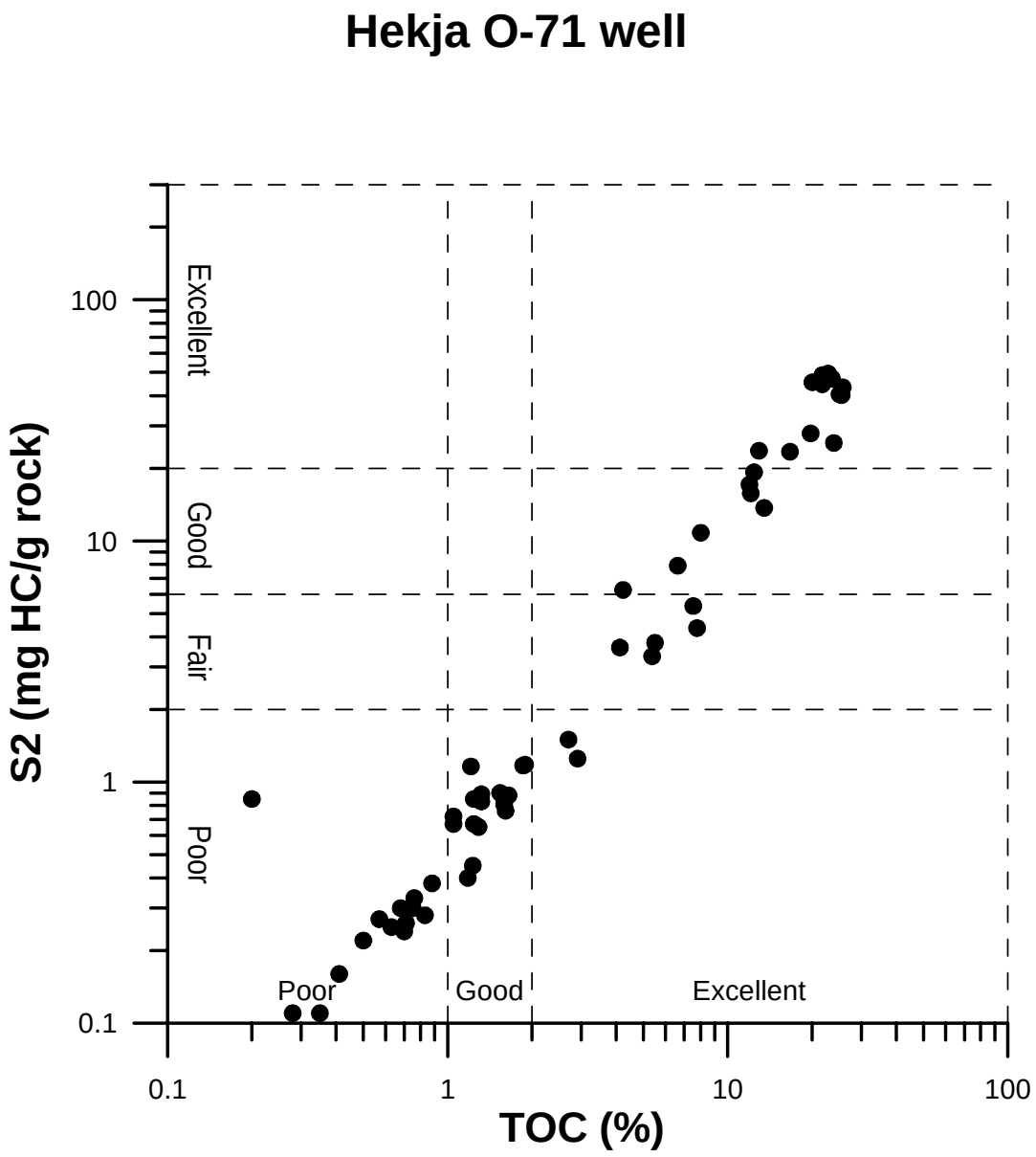
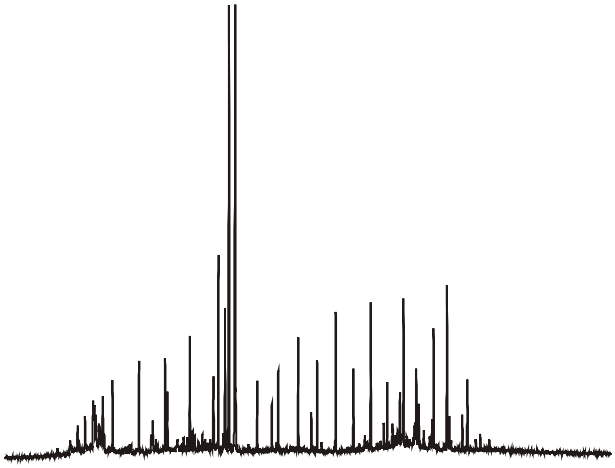


Fig. 6. Hekja O-71 well, all data

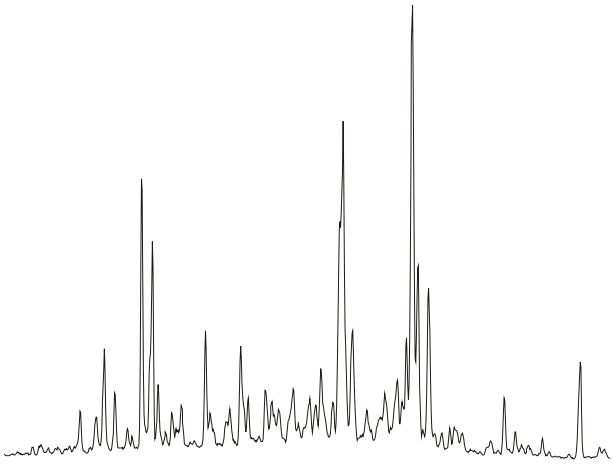
Table 2. Hekja O-71 well. Rock-Eval /TOC screening data

Lab (#)	meter (Base)	TOC (wt-%)	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HI	OI	PI	PC
6871	1465	0,06	418	0,00	0,01	0,36	17	600	0,00	0,00
6872	1510	0,03	263	0,01	0,01	0,15	33	500	0,50	0,00
6873	1590	0,02	288	0,00	0,00	0,19	0	950	0,00	
6874	1650	0,20	383	0,04	0,85	0,26	425	130	0,04	0,07
6875	1690	0,76	334	0,04	0,33	8,44	43	1111	0,11	0,03
6876	1700	0,27	427	0,01	0,07	1,43	26	530	0,13	0,01
6877	1755	0,09	388	0,00	0,01	0,50	11	556	0,00	0,00
6878	1805	0,15	406	0,01	0,07	0,33	47	220	0,13	0,01
6879	1855	0,06	397	0,01	0,01	0,04	17	67	0,50	0,00
6880	1895	0,21	418	0,01	0,09	0,60	43	286	0,10	0,01
6881	1945	0,57	418	0,02	0,27	0,92	47	161	0,07	0,02
6882	1985	5,37	421	0,09	3,32	6,73	62	125	0,03	0,28
6883	2030	1,61	418	0,04	0,76	1,78	47	111	0,05	0,07
6884	2080	7,77	418	0,11	4,35	10,65	56	137	0,02	0,37
6885	2150	25,54	419	1,54	40,24	25,81	158	101	0,04	3,47
6886	2170	25,73	419	1,32	43,35	30,56	168	119	0,03	3,71
6887	2200	25,05	417	1,18	40,54	20,72	162	83	0,03	3,46
6888	2215	12,42	410	0,49	19,25	12,22	155	98	0,02	1,64
6889	2230	23,94	410	0,87	25,49	29,36	106	123	0,03	2,19
6890	2260	23,57	413	1,39	47,05	27,95	200	119	0,03	4,02
6891	2365	4,12	417	0,12	3,61	4,92	88	119	0,03	0,31
6892	2390	7,53	411	0,24	5,37	10,00	71	133	0,04	0,47
6893	2435	19,77	416	0,80	27,88	18,68	141	94	0,03	2,38
6894	2470	1,05	417	0,02	0,72	1,36	69	130	0,03	0,06
6895	2510	1,89	419	0,04	1,18	4,11	62	217	0,03	0,10
6896	2550	20,07	418	1,75	45,44	11,15	226	56	0,04	3,92
6897	2600	4,23	416	0,17	6,26	3,69	148	87	0,03	0,53
6898	2655	1,05	423	0,02	0,67	1,35	64	129	0,03	0,06
6899	2690	1,32	428	0,03	0,89	1,58	67	120	0,03	0,08
6900	2740	1,59	425	0,03	0,81	2,20	51	138	0,04	0,07
6901	2770	1,21	417	0,05	1,16	1,49	96	123	0,04	0,10
6902	2870	22,84	413	2,30	49,40	16,98	216	74	0,04	4,29
6903	2895	21,80	416	2,21	48,72	14,27	223	65	0,04	4,23
6904	2930	6,63	418	0,43	7,88	3,79	119	57	0,05	0,69
6905	2960	16,70	413	1,08	23,41	9,16	140	55	0,04	2,03
6906	2985	12,09	415	0,76	15,73	6,18	130	51	0,05	1,37
6907	3045	13,49	416	0,71	13,70	7,19	102	53	0,05	1,20
6908	3090	1,32	427	0,06	0,83	1,02	63	77	0,07	0,07
6909	3120	1,54	431	0,05	0,90	1,05	58	68	0,05	0,08
6910	3140	1,29	433	0,04	0,65	0,64	50	50	0,06	0,06
6911	3160	1,24	432	0,05	0,85	0,87	69	70	0,06	0,07
6912	3180	1,65	431	0,04	0,88	0,90	53	55	0,04	0,08
6913	3200	5,50	428	0,18	3,78	3,31	69	60	0,05	0,33
6914	3210	21,75	422	1,50	44,63	6,90	205	32	0,03	3,83
6915	3230	11,96	428	0,58	17,12	3,05	143	26	0,03	1,47
6916	3245	12,92	426	0,96	23,64	2,81	183	22	0,04	2,04
6917	3270	8,02	428	0,36	10,81	2,11	135	26	0,03	0,93
6918	3360	1,86	429	0,08	1,17	1,28	63	69	0,06	0,10
6919	3480	2,91	437	0,11	1,25	1,36	43	47	0,08	0,11
6920	3520	2,70	434	0,06	1,50	1,65	56	61	0,04	0,13
6921	3640	1,24	437	0,11	0,67	0,96	54	77	0,14	0,06
6922	3680	0,71	442	0,02	0,26	0,64	37	90	0,07	0,02
6923	3720	0,75	437	0,01	0,30	0,52	40	69	0,03	0,03

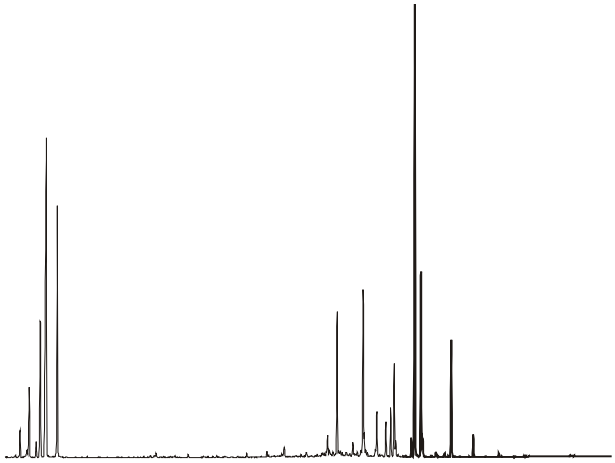
6924	3760	1,18	437	0,02	0,40	0,37	34	31	0,05	0,03
6925	3800	0,68	437	0,04	0,30	0,94	44	138	0,12	0,03
6926	3840	0,70	437	0,01	0,24	0,49	34	70	0,04	0,02
6927	3880	0,18	434	0,00	0,06	0,12	33	67	0,00	0,00
6928	3920	0,41	441	0,02	0,16	0,13	39	32	0,11	0,01
6929	3960	1,23	435	0,02	0,45	0,64	37	52	0,04	0,04
6930	4000	0,35	435	0,00	0,11	0,14	31	40	0,00	0,01
6932	4080	0,83	439	0,01	0,28	0,53	34	64	0,03	0,02
6934	4180	0,50	441	0,01	0,22	0,29	44	58	0,04	0,02
6936	4260	0,63	438	0,01	0,25	0,49	40	78	0,04	0,02
6938	4340	0,28	438	0,01	0,11	0,21	39	75	0,08	0,01
6940	4400	0,10	422	0,01	0,05	0,20	50	200	0,17	0,00
6942	4440	0,21	433	0,00	0,06	0,20	29	95	0,00	0,00
6944	4480	0,05	418	0,00	0,04	0,06	80	120	0,00	0,00
6946	4540	0,32	420	0,00	0,08	0,51	25	159	0,00	0,01
6948	4566	0,88	438	0,03	0,38	0,54	43	61	0,07	0,03



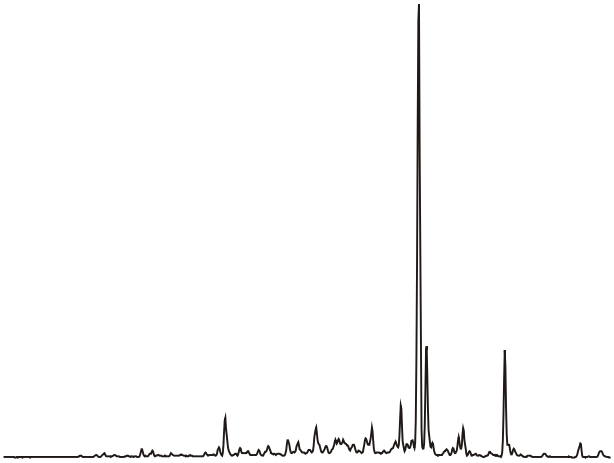
Gas Chromatogram



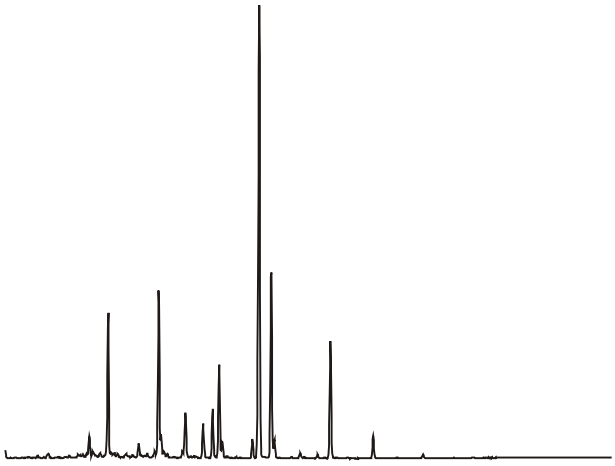
m/z 217



m/z 191 (full)



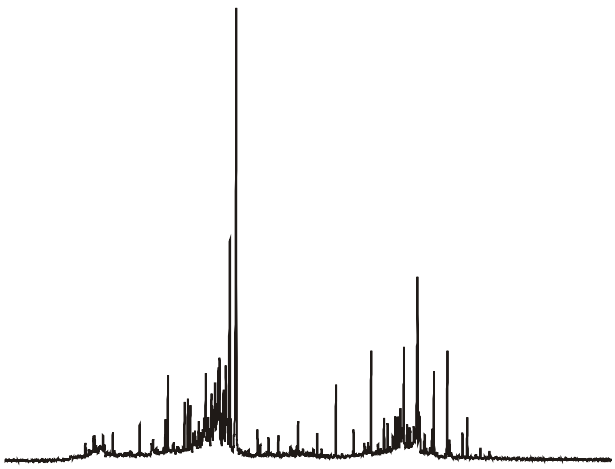
m/z 218



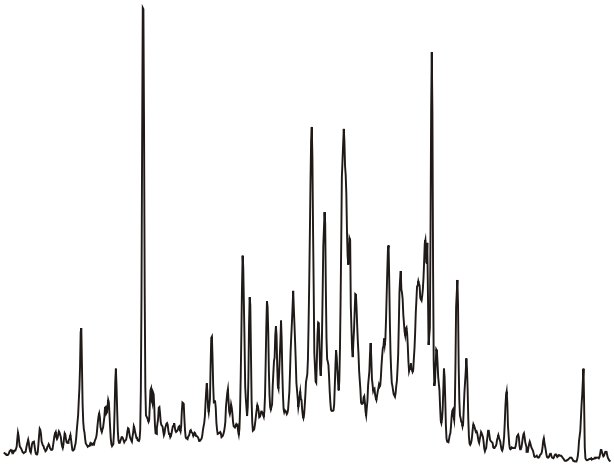
m/z 191 (partial)

Hekja O-71 well
Lab. # 2001059-6886
D = 2170 m

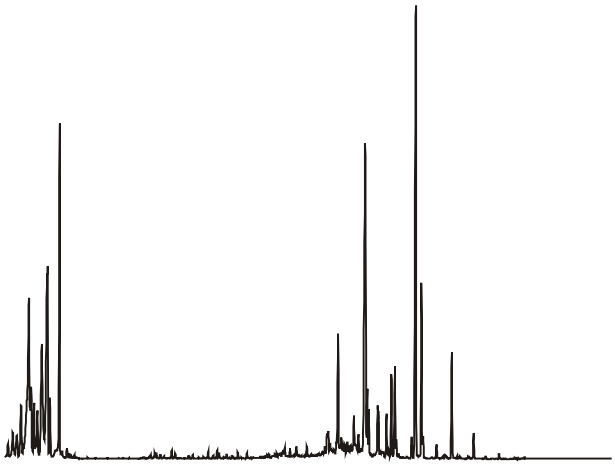
Fig. 7. GC and GC-MS data, peak identification key is shown in Appendix 1



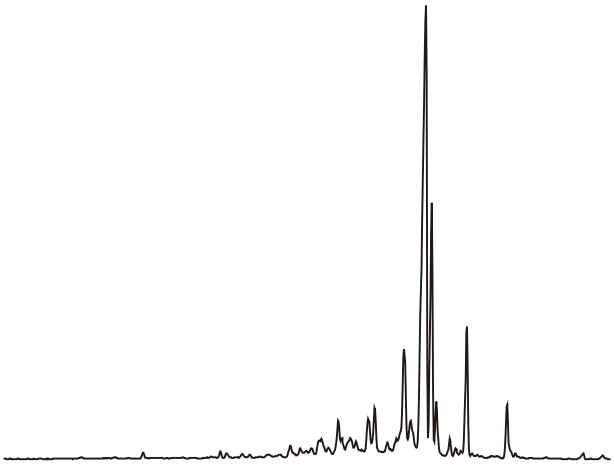
Gas Chromatogram



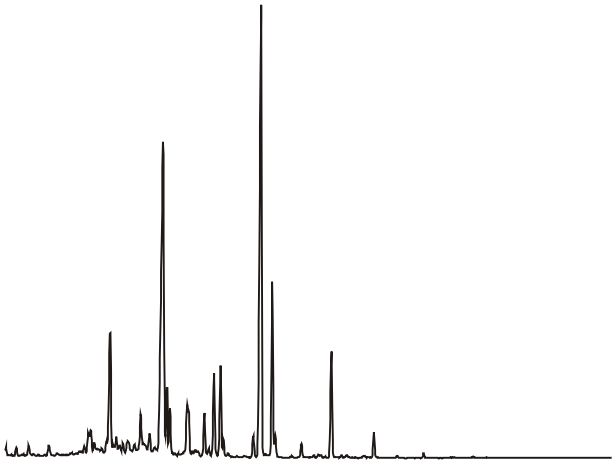
m/z 217



m/z 191 (full)



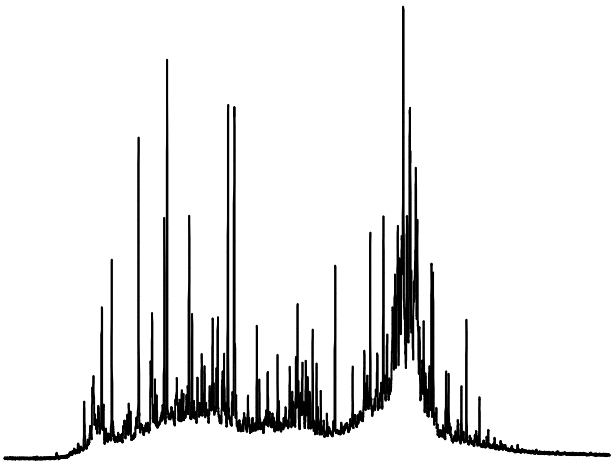
m/z 218



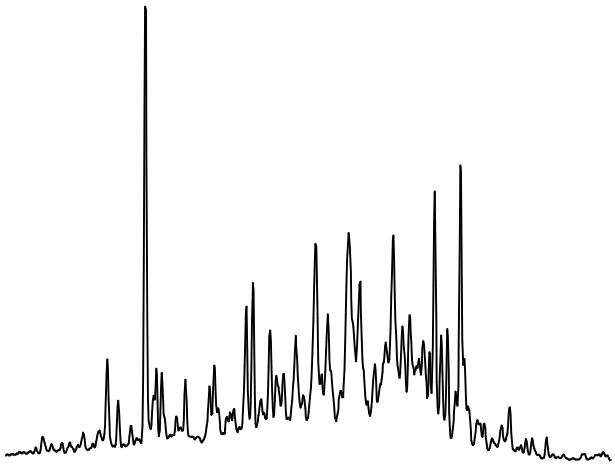
m/z 191 (partial)

Hekja O-71 well
Lab. # 2001059-6890
D = 2260 m

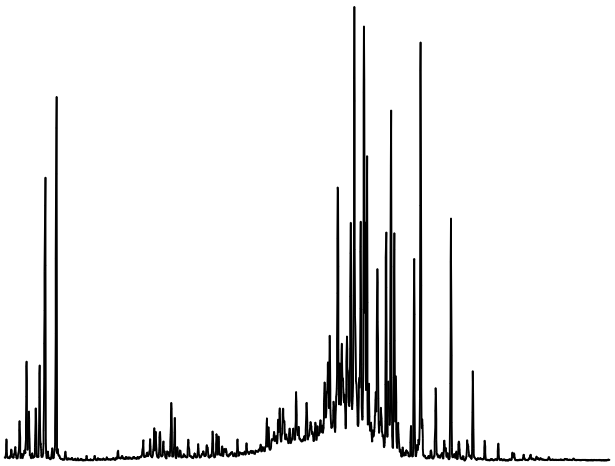
Fig 8. GC and GC-MS data, peak identification key is shown in Appendix 1



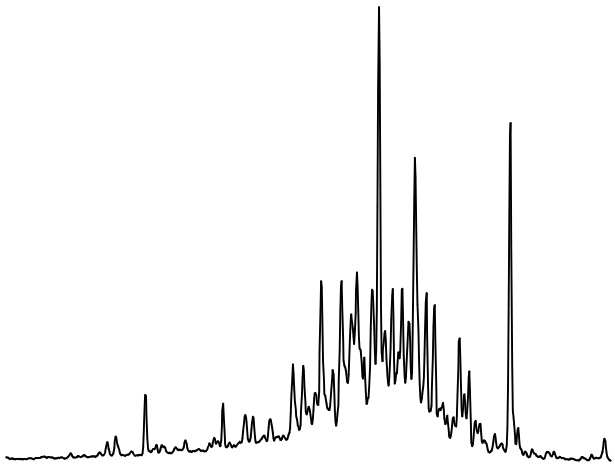
Gas Chromatogram



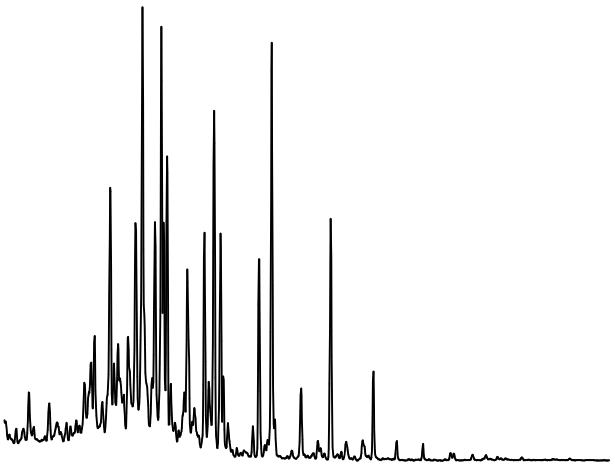
m/z 217



m/z 191 (full)



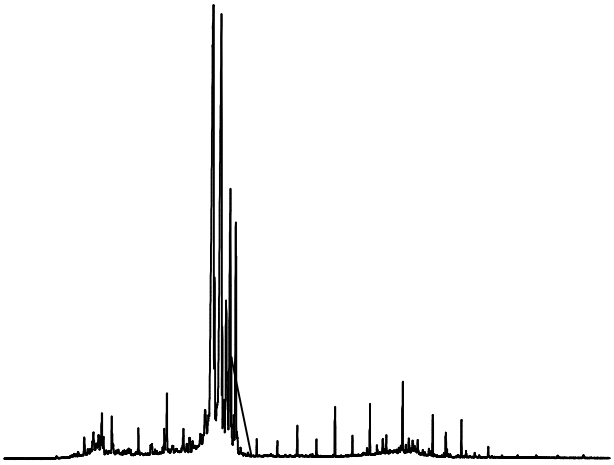
m/z 218



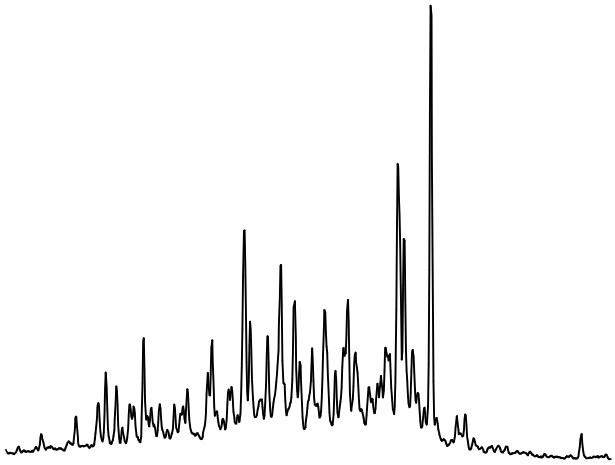
m/z 191 (partial)

Hekja O-71 well
Lab. # 2001059-6896
D = 2550 m

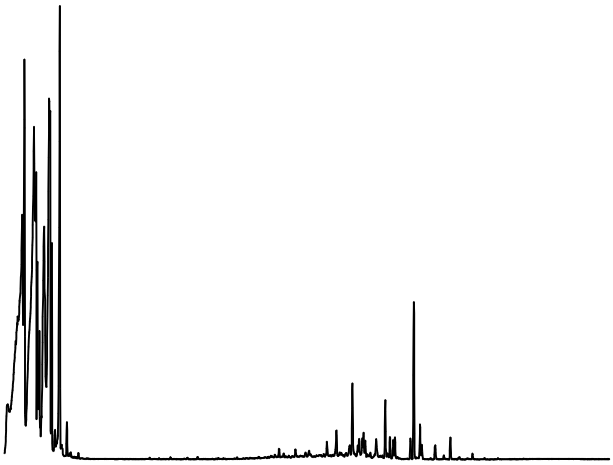
Fig 9. GC and GC-MS data, peak identification key is shown in Appendix 1



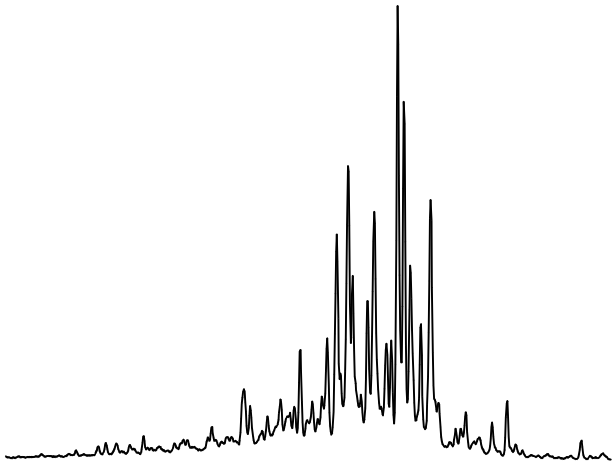
Gas Chromatogram



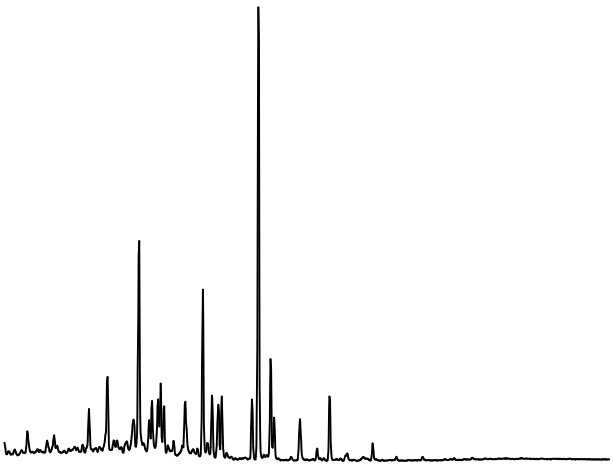
m/z 217



m/z 191 (full)



m/z 218



m/z 191 (partial)

Hekja O-71 well
Lab. # 2001059-6903
D = 2895 m

Fig 10. GC and GC-MS data, peak identification key is shown in Appendix 1

Ogmund E-72 well

Rock-Eval/TOC screening

A total of 134 samples were analysed, covering the interval 724m to 3090m (Table 3, Figure 11).
TOC contents are very variable, 0.1% – 37.5%, averaging 3.1%. S2 pyrolysis yields show wide variation, from 0.0 mg/g to 22.9 mg/g, with an average of 1.7 mg/g. However, Hydrogen Indices (HI) are consistently low, with a recorded maximum of 113 and an average of 46 (Figs. 12 and 13). Although coaly intervals in the deeper portion of the succession may show fairly high values of S2, in general, no potential petroleum source rocks are observed.
The Production Index (PI) is generally low, although a few excursions towards values >0.1 are recorded. These, however, coincide with low S1 and S2 yields and obviously represent technical artefacts. No signs of staining or contamination are observed.
Tmax shows a rather irregular increase from values close to 420 °C at the top of the section, to values close to 430 °C at the base of the section. Hence, the entire succession is thermally immature

Solvent extract analysis

No samples were analysed

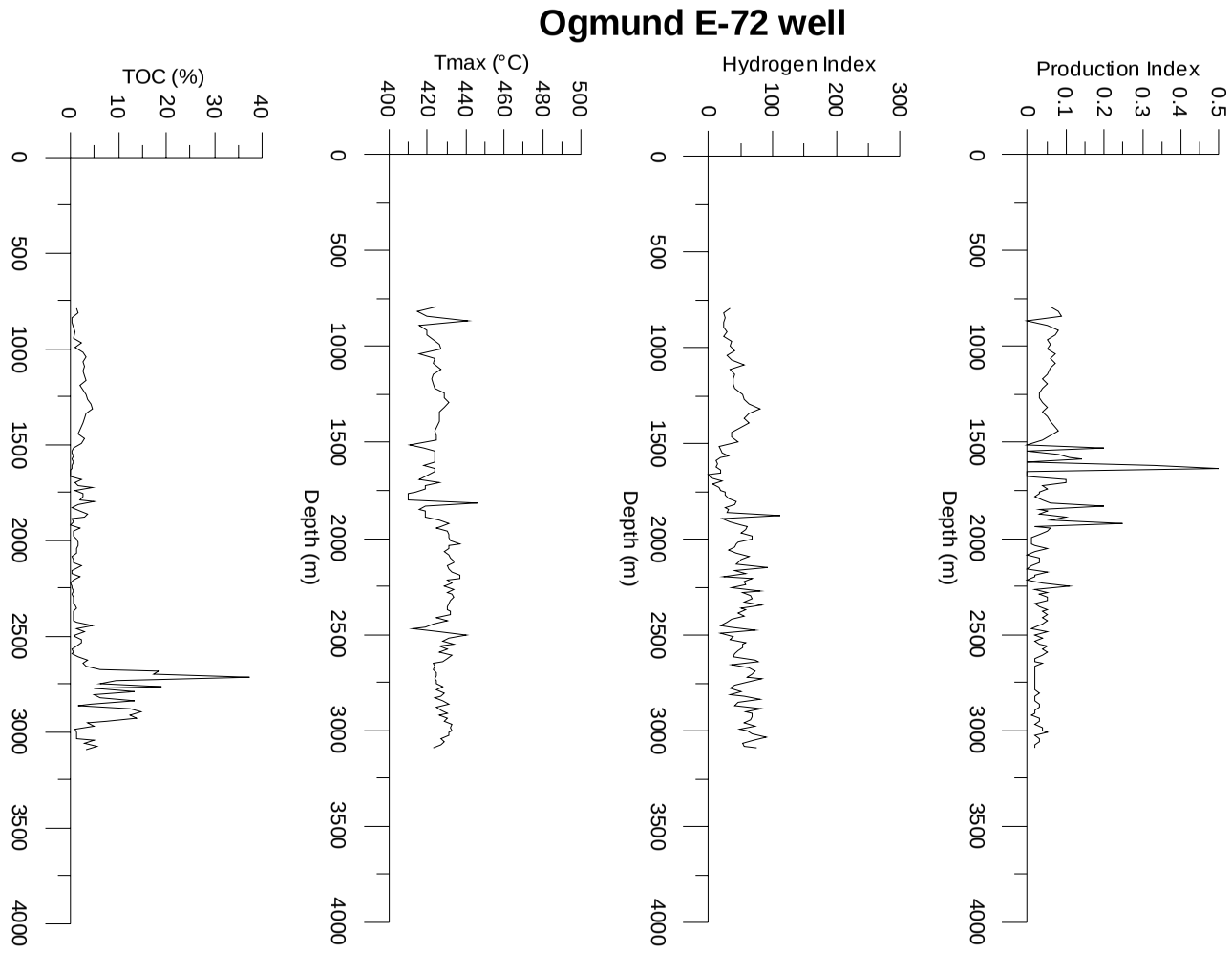


Fig. 11. Simple geochemical log, Ogmund E-72 well

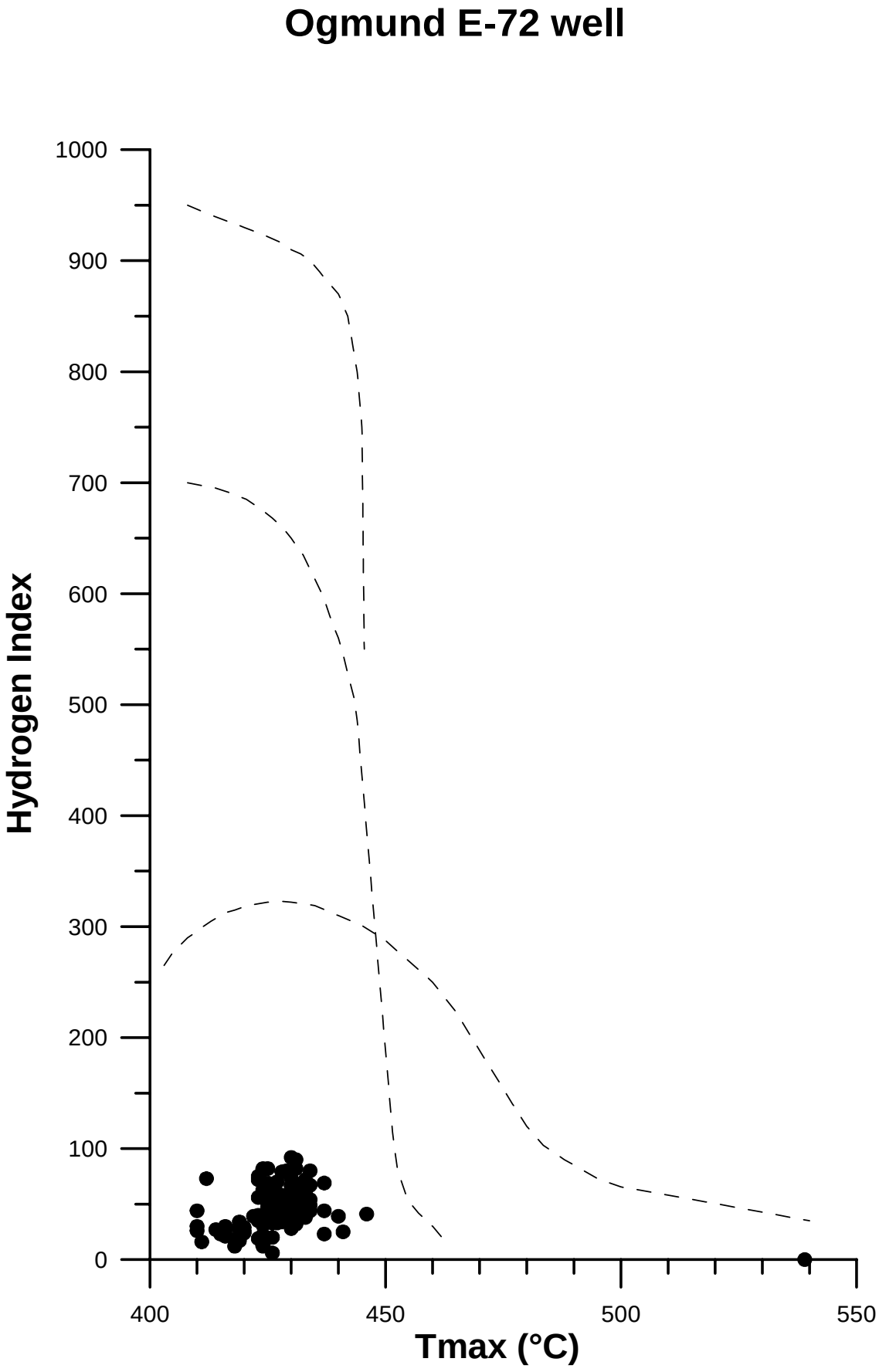


Fig. 12. Ogmund E-72 well, all data

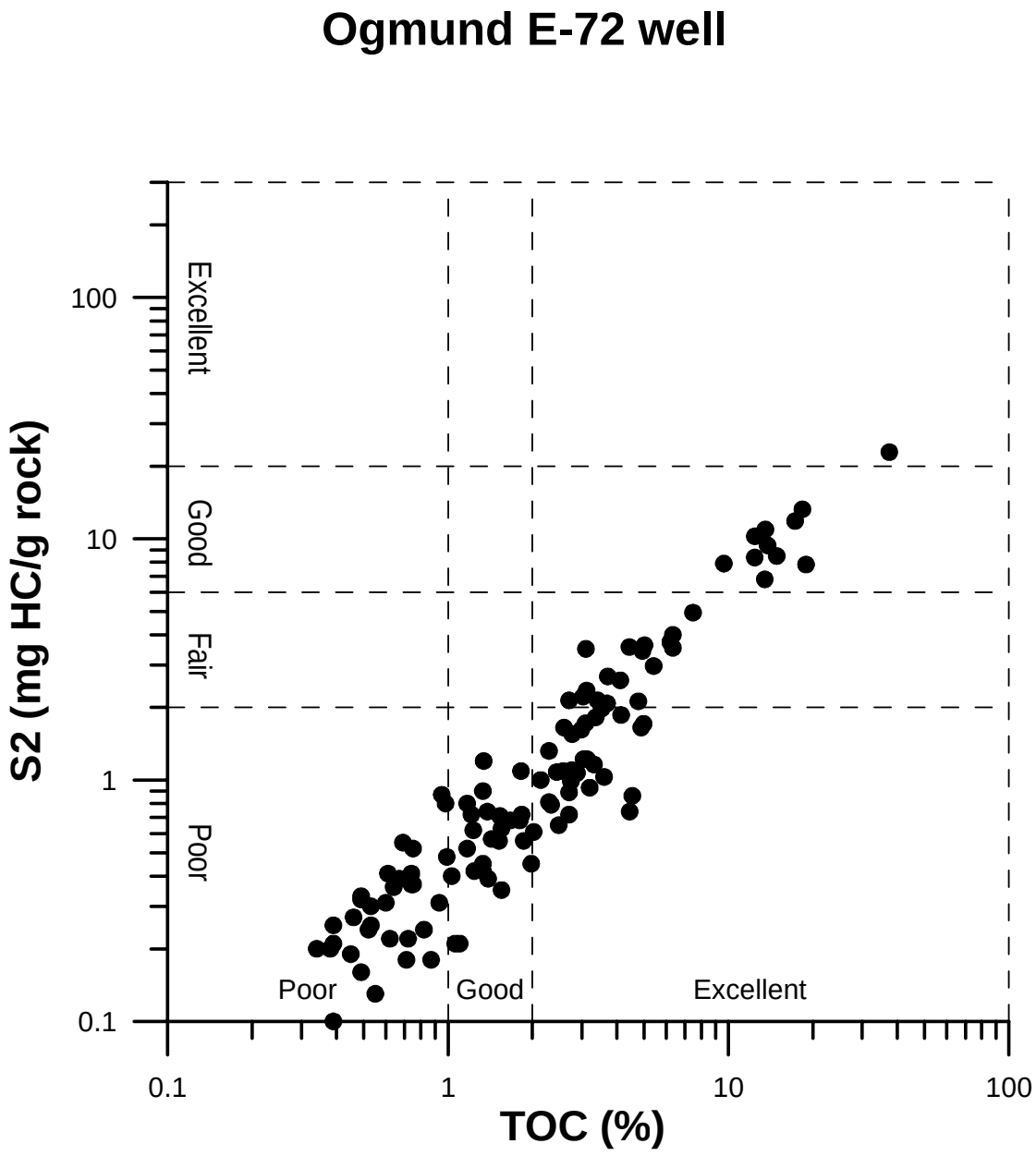


Fig. 13. Ogmund E-72 well, all data

Table 3. Ogmund E-72 well. Rock-Eval /TOC screening data

Lab (#)	meter (Base)	TOC (wt-%)	Tmax (°C)	S1 (mg/ g)	S2 (mg/ g)	S3 (mg/ g)	HI	OI	PI	PC
6724	790	1,33	425	0,03	0,45	2,60	34	195	0,06	0,04
6725	815	1,55	415	0,03	0,35	2,74	23	177	0,08	0,03
6726	840	0,39	420	0,01	0,10	0,60	26	154	0,09	0,01
6727	865	0,20	441	0,00	0,05	0,30	25	150	0,00	0,00
6728	890	0,71	416	0,01	0,18	1,27	25	179	0,05	0,02
6729	915	0,82	420	0,02	0,24	1,53	29	187	0,08	0,02
6730	940	0,55	420	0,01	0,13	1,04	24	189	0,07	0,01
6731	965	2,29	390	0,04	0,81	2,70	35	118	0,05	0,07
6732	990	0,93	426	0,02	0,31	3,03	33	326	0,06	0,03
6733	1015	2,57	427	0,06	1,09	4,21	42	164	0,05	0,10
6734	1040	3,20	416	0,07	0,93	5,45	29	170	0,07	0,08
6735	1065	2,74	424	0,06	0,99	4,09	36	149	0,06	0,09
6736	1090	2,77	423	0,12	1,55	3,46	56	125	0,07	0,14
6737	1115	2,70	427	0,06	0,89	3,55	33	131	0,06	0,08
6738	1140	3,04	423	0,07	1,22	3,97	40	131	0,05	0,11
6739	1165	3,13	422	0,05	1,22	4,31	39	138	0,04	0,11
6740	1190	1,83	423	0,04	0,72	2,76	39	151	0,05	0,06
6741	1215	2,76	424	0,05	1,10	3,97	40	144	0,04	0,10
6742	1240	3,36	429	0,06	1,82	4,26	54	127	0,03	0,16
6743	1265	3,53	429	0,07	1,98	4,59	56	130	0,03	0,17
6744	1290	4,11	431	0,10	2,59	4,84	63	118	0,04	0,22
6745	1315	4,43	429	0,18	3,56	5,60	80	126	0,05	0,31
6746	1340	3,41	426	0,10	2,14	5,36	63	157	0,04	0,19
6747	1365	3,09	426	0,09	1,72	4,36	56	141	0,05	0,15
6748	1390	2,59	426	0,11	1,65	4,32	64	167	0,06	0,15
6749	1440	1,52	424	0,05	0,56	2,25	37	148	0,08	0,05
6750	1465	2,88	425	0,07	1,07	4,90	37	170	0,06	0,09
6751	1490	2,14	425	0,04	1,00	2,75	47	129	0,04	0,09
6752	1515	0,49	411	0,00	0,08	0,64	16	131	0,00	0,01
6753	1530	0,22	418	0,01	0,04	0,13	18	59	0,20	0,00
6754	1545	0,18	424	0,00	0,04	0,07	22	39	0,00	0,00
6755	1560	0,72	424	0,02	0,22	0,61	31	85	0,08	0,02
6756	1575	0,43	424	0,01	0,08	0,23	19	53	0,11	0,01
6757	1590	0,50	424	0,01	0,06	0,34	12	68	0,14	0,01
6758	1605	0,16	424	0,00	0,02	0,02	13	13	0,00	0,00
6759	1620	0,17	418	0,01	0,02	0,03	12	18	0,33	0,00
6760	1635	0,05	424	0,01	0,01	0,00	20	0	0,50	0,00
6761	1650	0,11	424	0,00	0,02	0,00	18	0	0,00	0,00
6762	1665	0,05	539	0,00	0,00	0,00	0	0	0,00	
6763	1680	2,27	584	0,00	0,06	0,84	3	37	0,00	0,00
6857	1695	0,87	416	0,02	0,18	0,71	21	82	0,10	0,02
6764	1710	1,51	426	0,01	0,09	0,69	6	46	0,10	0,01
6765	1725	4,44	419	0,03	0,74	6,28	17	141	0,04	0,06
6766	1740	1,10	419	0,01	0,21	1,07	19	97	0,05	0,02
6767	1755	2,70	414	0,02	0,72	2,84	27	105	0,03	0,06
6768	1770	2,48	410	0,02	0,65	3,18	26	128	0,03	0,06
6769	1785	1,86	410	0,01	0,56	2,23	30	120	0,02	0,05
6770	1800	4,77	410	0,09	2,12	5,86	44	123	0,04	0,18
6771	1815	1,67	446	0,04	0,68	2,27	41	136	0,06	0,06
6772	1830	0,15	419	0,01	0,04	0,18	27	120	0,20	0,00
6773	1845	2,02	416	0,02	0,61	2,54	30	126	0,03	0,05
6774	1860	3,60	419	0,05	1,03	3,90	29	108	0,05	0,09
6775	1875	3,10	388	0,10	3,50	3,43	113	111	0,03	0,30
6776	1890	0,43	419	0,01	0,09	0,36	21	84	0,10	0,01

6777	1905	0,49	426	0,01	0,16	0,53	33	108	0,06	0,01
6778	1920	0,06	431	0,01	0,03	0,03	50	50	0,25	0,00
6779	1935	1,82	427	0,02	1,09	1,31	60	72	0,02	0,09
6780	1950	0,53	425	0,02	0,30	0,34	57	64	0,06	0,03
6781	1965	0,74	430	0,02	0,37	0,56	50	76	0,05	0,03
6782	1980	0,49	431	0,01	0,33	0,26	67	53	0,03	0,03
6783	1995	1,33	431	0,01	0,90	1,07	68	80	0,01	0,08
6784	2010	1,53	432	0,01	0,71	1,29	46	84	0,01	0,06
6785	2025	1,56	437	0,01	0,69	0,75	44	48	0,01	0,06
6786	2040	1,43	431	0,01	0,57	1,40	40	98	0,02	0,05
6787	2055	1,33	431	0,02	0,42	1,12	32	84	0,05	0,04
6788	2070	1,17	429	0,01	0,52	1,05	44	90	0,02	0,04
6789	2085	0,39	431	0,00	0,25	0,25	64	64	0,00	0,02
6790	2100	0,60	432	0,01	0,31	0,53	52	88	0,03	0,03
6791	2115	0,75	434	0,01	0,37	0,52	49	69	0,03	0,03
6792	2130	2,44	434	0,03	1,08	2,05	44	84	0,03	0,09
6793	2145	0,95	430	0,01	0,87	0,35	92	37	0,01	0,07
6794	2160	0,15	431	0,00	0,06	0,06	40	40	0,00	0,00
6795	2175	0,34	433	0,01	0,20	0,25	59	74	0,05	0,02
6796	2190	1,98	437	0,01	0,45	1,33	23	67	0,02	0,04
6797	2205	0,75	437	0,01	0,52	0,42	69	56	0,02	0,04
6798	2220	0,09	430	0,00	0,05	0,03	56	33	0,00	0,00
6799	2235	0,46	433	0,01	0,27	0,17	59	37	0,04	0,02
6800	2250	0,23	429	0,01	0,08	0,15	35	65	0,11	0,01
6801	2265	0,69	434	0,01	0,55	0,28	80	41	0,02	0,05
6802	2280	0,38	430	0,01	0,20	0,19	53	50	0,05	0,02
6803	2295	0,49	433	0,01	0,32	0,12	65	24	0,03	0,03
6804	2310	0,61	434	0,02	0,41	0,43	67	70	0,05	0,04
6805	2325	0,64	432	0,02	0,36	0,41	56	64	0,05	0,03
6806	2340	0,98	431	0,02	0,80	0,47	82	48	0,02	0,07
6807	2355	1,23	430	0,02	0,62	0,65	50	53	0,03	0,05
6808	2370	0,67	430	0,02	0,39	0,43	58	64	0,05	0,03
6809	2385	0,52	432	0,01	0,24	0,40	46	77	0,04	0,02
6810	2400	0,74	432	0,02	0,41	0,47	55	64	0,05	0,04
6811	2415	0,62	425	0,01	0,22	0,62	35	100	0,04	0,02
6812	2430	1,39	430	0,02	0,39	0,83	28	60	0,05	0,03
6813	2445	4,54	423	0,04	0,86	4,54	19	100	0,04	0,07
6814	2460	1,24	419	0,01	0,42	1,17	34	94	0,02	0,04
6815	2475	3,03	412	0,03	2,22	2,46	73	81	0,01	0,19
6816	2490	1,06	426	0,01	0,21	0,59	20	56	0,05	0,02
6817	2505	1,03	440	0,01	0,40	0,77	39	75	0,02	0,03
6818	2520	2,33	431	0,03	0,79	2,14	34	92	0,04	0,07
6819	2535	2,29	428	0,03	1,32	1,59	58	69	0,02	0,11
6820	2550	1,38	434	0,02	0,74	1,02	54	74	0,03	0,06
6821	2565	0,39	426	0,01	0,21	0,21	54	54	0,05	0,02
6822	2580	0,53	430	0,01	0,25	0,36	47	68	0,04	0,02
6823	2595	0,45	426	0,01	0,19	0,26	42	58	0,05	0,02
6824	2610	1,80	433	0,03	0,68	0,96	38	53	0,04	0,06
6825	2625	3,71	430	0,06	2,69	2,33	73	63	0,02	0,23
6826	2640	2,70	428	0,05	2,14	1,73	79	64	0,02	0,18
6827	2655	3,31	423	0,05	1,16	2,60	35	79	0,04	0,10
6828	2670	6,33	424	0,10	4,00	4,76	63	75	0,02	0,34
6829	2685	18,34	423	0,22	13,25	10,36	72	56	0,02	1,12
6830	2700	17,28	425	0,23	11,85	11,42	69	66	0,02	1,00
6831	2715	37,47	425	0,45	22,86	23,52	61	63	0,02	1,93
6832	2730	9,63	424	0,18	7,89	5,08	82	53	0,02	0,67
6833	2745	6,20	425	0,08	3,73	3,92	60	63	0,02	0,32
6834	2760	18,91	425	0,15	7,82	12,64	41	67	0,02	0,66
6835	2775	4,88	428	0,04	1,65	3,48	34	71	0,02	0,14
6836	2790	13,47	425	0,17	6,79	8,52	50	63	0,02	0,58

6837	2805	4,98	429	0,05	1,71	3,40	34	68	0,03	0,15
6838	2820	6,33	427	0,07	3,53	2,80	56	44	0,02	0,30
6839	2835	13,54	424	0,19	10,93	7,41	81	55	0,02	0,92
6840	2850	4,14	428	0,04	1,86	2,28	45	55	0,02	0,16
6841	2865	1,55	431	0,02	0,63	1,02	41	66	0,03	0,05
6842	2880	12,42	425	0,34	10,24	7,46	82	60	0,03	0,88
6843	2895	14,86	427	0,21	8,49	9,37	57	63	0,02	0,72
6844	2910	12,40	430	0,13	8,36	7,29	67	59	0,02	0,70
6845	2925	13,79	426	0,12	9,39	8,27	68	60	0,01	0,79
6846	2940	7,47	430	0,14	4,94	4,83	66	65	0,03	0,42
6847	2955	3,69	429	0,06	2,08	2,53	56	69	0,03	0,18
6848	2970	5,02	433	0,09	3,62	2,63	72	52	0,02	0,31
6849	2985	0,99	432	0,02	0,48	0,43	48	43	0,04	0,04
6850	3000	1,21	433	0,03	0,72	0,64	60	53	0,04	0,06
6851	3015	1,17	431	0,04	0,80	0,42	68	36	0,05	0,07
6852	3030	1,34	431	0,03	1,20	0,38	90	28	0,02	0,10
6853	3045	4,93	427	0,09	3,43	3,22	70	65	0,03	0,29
6854	3060	2,99	429	0,05	1,62	1,49	54	50	0,03	0,14
6855	3075	5,41	427	0,07	2,97	3,19	55	59	0,02	0,25
6856	3090	3,12	423	0,06	2,35	1,79	75	57	0,02	0,20

Ralegh N-18 well

Rock-Eval/TOC screening

A total of 76 samples were analysed, covering the interval 1365m to 3840m (Table 4, Figure 14).
TOC contents are very variable, 0.1% – 25.0 %, averaging 2.5%. S2 pyrolysis yields show wide variation, from 0.0 mg/g to 107.0 mg/g, with an average of 3.7 mg/g. Consequently, Hydrogen Indices (HI) are also very variable, ranging from zero to 427 (Figs. 15 and 16). Although Hydrogen Indices are generally rather low, several intervals of the drilled succession may possess some petroleum source potential.
The Production Index (PI) is generally low, but in the upper portion of the succession (shallower than app. 2200 m) values >>0.1 are frequent. Some of these obviously represent technical artefacts, whereas others may represent staining or contamination, see below.
Tmax shows a rather irregular increase from values close to 420 °C at the top of the section, to values close to 435 °C at the base of the section.

Solvent extract analysis

Four samples were analysed: 1795m, 2605m, 2745m, and 3385m.

Gas chromatographic data on the 1795m sample (fig. 17), shows high proportions of UCM, with minor n-alkanes superimposed onto the prominent ”humpane” envelope. The m/z 191 ion fragmentogram shows high proportions of tricyclic triterpanes with homologues extending to at least C_{31}. Notable features of the hopane distribution comprises 30-norhopanes, 25-norhopanes, and high proportions of homohopanes, with enhancement of the C_{35} homologue. Homohopane isomerisation is at equilibrium. The sterane distribution (m/z 217 and 218) show low to moderate proportions of diasteranes, and notable enhancement of $\alpha\beta\beta$-epimers. Sterane 20S/(20S+20R) isomerization is below equilibrium, app. 0.40, showing early oil window maturity. In summary, the geochemical characteristics point to an origin form an early mature, biodegraded oil, generated from a Cretaceous-Tertiary marl or carbonate source rock, possibly containing a minor terrestrial component. In addition, there might be contributions from other sources. The 1795m sample was collected from i high-PI interval and the extract probably represent contamination by pipe-dope or similar, since in the characteristics of the extract conform very well to those of pipe dope used in many wells.

Gas chromatographic data on the 2605m sample show a unimodal. heavy-end skewed, high-CPI n-alkane distribution, a prominent ”biomarker envelope” and abundant diterpanes eluting in the nC_{19-21} region (fig. 18). The m/z 191 ion fragmentogram shows a near-absence of tricyclic triterpanes, and abundant $\beta\beta$-hopanes plus hopenes of the 13(18)-configuration. Hopanes of the $\alpha\beta$ configuration are very sparse, and only $\beta\beta$-epimers of homohopanes can be recognised. Sterane (m/z 217 and 218) data are useless due to interference from oleanenes. In summary, the 2605m extract composition indicate very immature terrestrial organic matter

The 2745m and 3385m samples differ principally with respect to thermal maturity. Gas chromatographic data show bimodal n-alkane distrubutions, comprising a fairly smooth

and symmetrical distrubution maximum centred around nC_{17-19}, plus a high-CPI distribution maxuímum centred around nC_{29}. In addition, prominent biomarker envelopes and abundant diterpanes, eluting in the C_{19-21} region, are noted. The m/z 191 ion fragmentogram shows a near-absence of tricyclic triterpanes, and abundant ββ-hopanes. In addition, hopenes of the 13(18)- configuration are present in the 2745m sample. Homohopane 22S/(22S+22R) epimerisation ratio is very low, 0.15, in the 2745m sample, whereas the 3385m sample shows a ratio of 0.41. Both values are, however, far from equilibrium distribution, indicating a level of thermal maturity far below the oil generation treshold. Sterane (m/z 217 and 218) data from the 2745m sample are useless due to interference from oleanenes, whereas the 3385m sample shows a strong predominance of C_{29} steranes, and a 20S/(20S+20R) epimerisation ratio <0.1, testifying to the low level of thermal maturity. In summary, geochemical data indicate a mixed origin of the extracts analysed. The symmetrical low molecular weight n-alkane distribution may point to slight diesel contamination, of the samples which are otherwise dominated by immature terrigenous organic matter. The suspected diesel contamination is however, but slight, since no notable increse in PI is observed. The low level of thermal maturity at relavely great depths is remarkable, and indicates a low geothermal gradient as noted in other parts of the Davis Strait region.

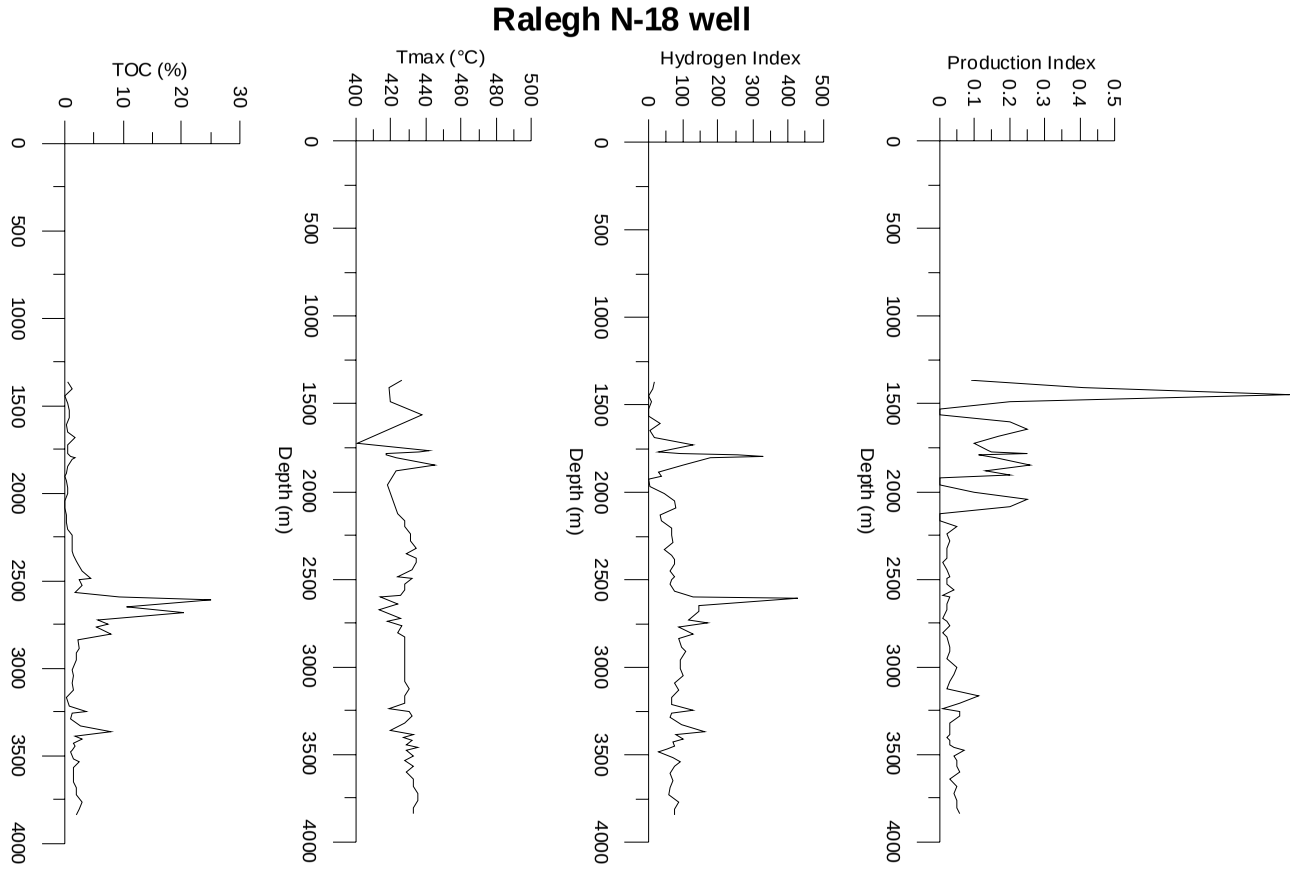


Fig. 14. Simple geochemical log, Ralegh N-18 well

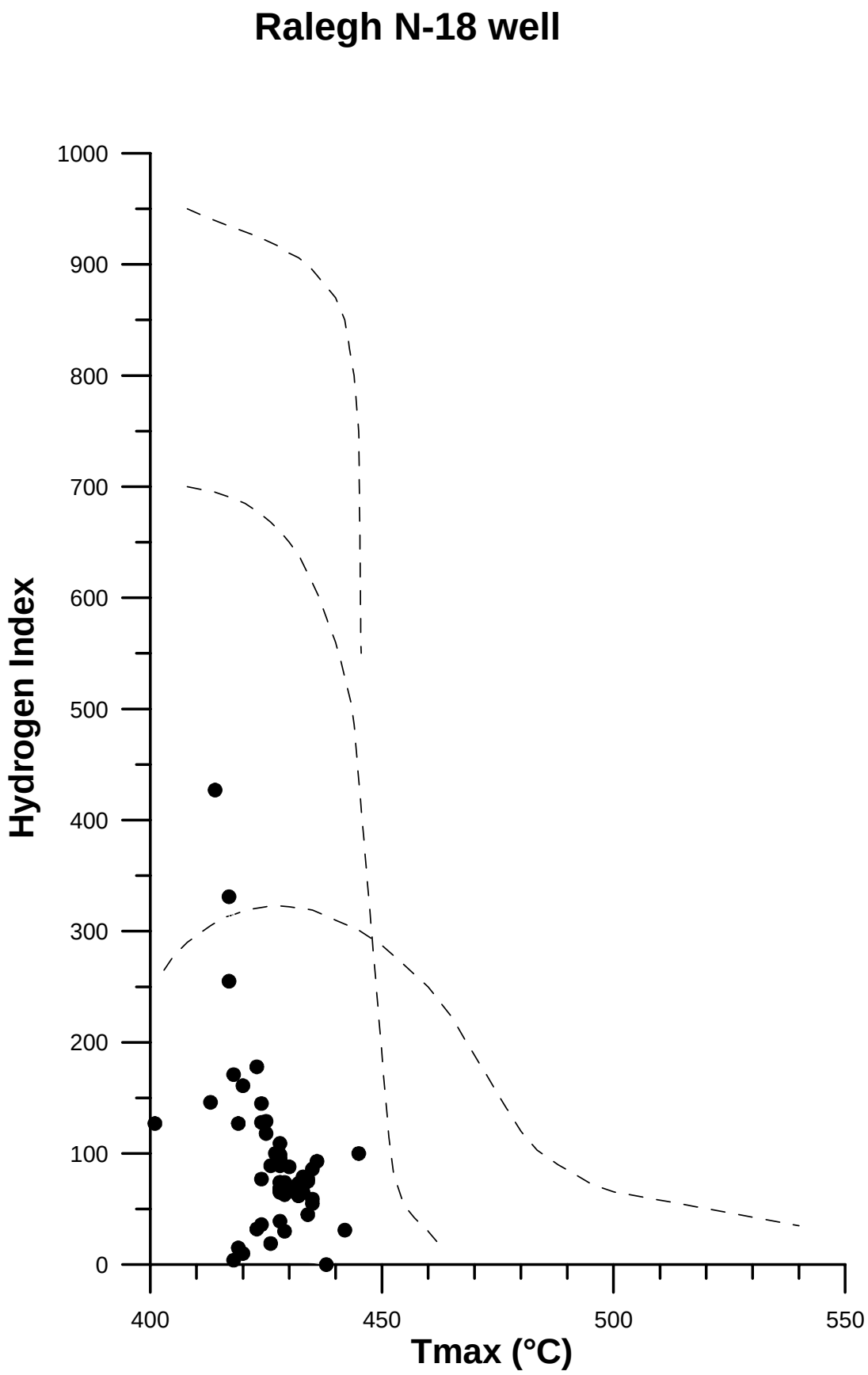


Fig. 15. Ralegh N-18 well, all data

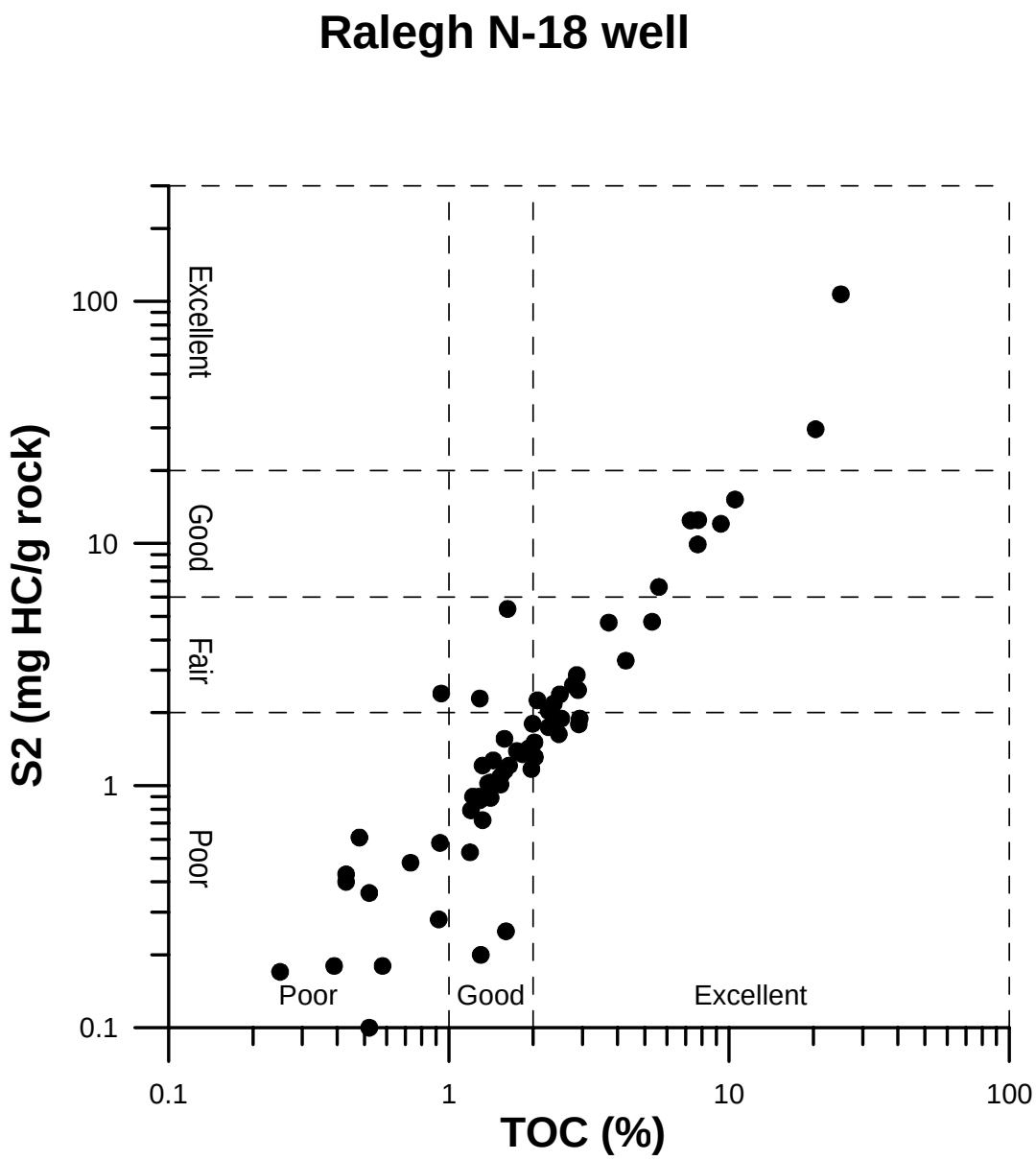
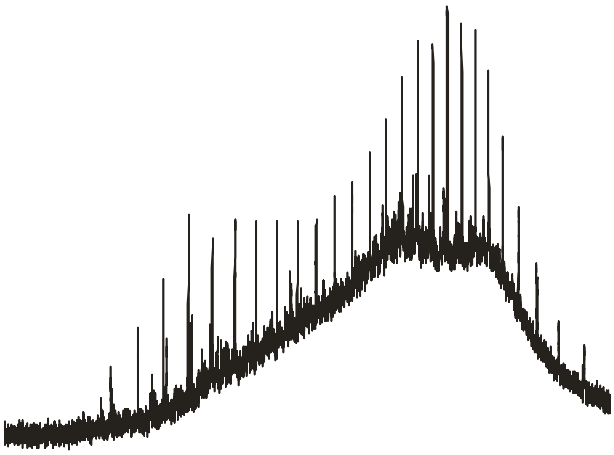


Fig. 16. Ralegh N-18 well, all data

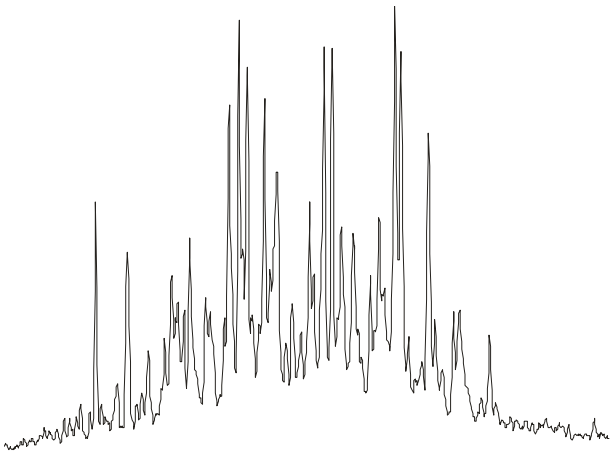
Table 4. Ralegh N-18 well. Rock-Eval /TOC screening data

Lab (#)	meter (Base)	TOC (wt-%)	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HI	OI	PI	PC
6491	1365	0,52	426	0,01	0,10	1,07	19	206	0,09	0,01
6949	1405	1,30	419	0,14	0,20	0,18	15	14	0,41	0,03
6971	1445	0,05	347	0,01	0,00	0,06	0	120	1,00	0,00
6972	1485	0,41	420	0,01	0,04	0,19	10	46	0,20	0,00
6973	1525	0,62	258	0,00	0,00	0,04	0	6	0,00	
6974	1565	0,61	438	0,00	0,00	0,01	0	2	0,00	
6975	1605	0,12	326	0,01	0,04	0,04	33	33	0,20	0,00
6976	1645	0,46	326	0,01	0,03	0,01	7	2	0,25	0,00
6977	1685	1,60	372	0,05	0,25	2,37	16	148	0,17	0,02
6978	1725	0,48	401	0,07	0,61	0,19	127	40	0,10	0,06
6979	1765	0,58	442	0,03	0,18	0,71	31	122	0,14	0,02
6980	1775	0,43	436	0,07	0,40	2,44	93	567	0,15	0,04
6981	1785	0,94	417	0,82	2,40	3,33	255	354	0,25	0,27
6982	1795	1,62	417	0,68	5,36	5,38	331	332	0,11	0,50
6983	1805	1,29	423	0,44	2,29	6,98	178	541	0,16	0,23
6984	1845	0,43	445	0,15	0,43	1,15	100	267	0,26	0,05
6985	1885	0,22	423	0,01	0,07	0,73	32	332	0,13	0,01
6986	1905	0,10	384	0,01	0,04	0,16	40	160	0,20	0,00
6987	1925	0,31	258	0,00	0,00	0,03	0	10	0,00	
6988	1965	0,56	418	0,00	0,02	0,17	4	30	0,00	0,00
6989	2005	0,39	347	0,02	0,18	0,62	46	159	0,10	0,02
6990	2045	0,08	325	0,02	0,06	0,30	75	375	0,25	0,01
6991	2085	0,05	392	0,01	0,04	0,11	80	220	0,20	0,00
6992	2125	0,14	424	0,00	0,05	0,15	36	107	0,00	0,00
6993	2165	0,23	428	0,00	0,09	0,67	39	291	0,00	0,01
6994	2205	0,52	428	0,02	0,36	0,96	69	185	0,05	0,03
6995	2240	1,20	431	0,02	0,79	1,88	66	157	0,02	0,07
6996	2285	1,29	431	0,03	0,90	2,71	70	210	0,03	0,08
6997	2325	1,19	434	0,01	0,53	2,11	45	177	0,02	0,04
6998	2355	1,53	429	0,02	1,01	4,03	66	263	0,02	0,09
6999	2385	2,02	434	0,03	1,51	3,68	75	182	0,02	0,13
7000	2405	2,27	434	0,02	1,74	3,71	77	163	0,01	0,15
7001	2445	2,91	432	0,03	1,79	3,94	62	135	0,02	0,15
7002	2485	4,28	424	0,11	3,28	4,20	77	98	0,03	0,28
7003	2495	2,47	432	0,03	1,63	3,57	66	145	0,02	0,14
7004	2525	2,93	428	0,04	1,89	3,34	65	114	0,02	0,16
7005	2565	1,83	428	0,05	1,35	4,29	74	234	0,04	0,12
7006	2595	9,34	425	0,18	12,05	7,76	129	83	0,01	1,02
7007	2605	25,02	414	3,24	106,96	35,68	427	143	0,03	9,15
7008	2645	10,50	424	0,30	15,18	7,27	145	69	0,02	1,28
7009	2680	20,35	413	0,55	29,61	14,04	146	69	0,02	2,50
7010	2725	5,62	425	0,09	6,61	4,69	118	83	0,01	0,56
7011	2745	7,29	418	0,21	12,44	5,00	171	69	0,02	1,05
7012	2765	5,31	426	0,16	4,75	5,66	89	107	0,03	0,41
7013	2805	7,73	424	0,15	9,90	5,83	128	75	0,01	0,83
7014	2835	2,27	428	0,04	2,03	1,99	89	88	0,02	0,17
7015	2885	2,49	428	0,07	2,38	2,96	96	119	0,03	0,20
7016	2910	2,07	428	0,07	2,25	2,13	109	103	0,03	0,19
7017	2955	1,99	428	0,03	1,80	1,52	90	76	0,02	0,15
7018	3005	1,32	428	0,07	1,21	1,59	92	120	0,05	0,11
7019	3045	1,58	428	0,06	1,56	1,93	99	122	0,04	0,13
7020	3085	1,22	428	0,03	0,90	1,65	74	135	0,03	0,08
7021	3125	1,44	430	0,03	1,27	1,33	88	92	0,02	0,11

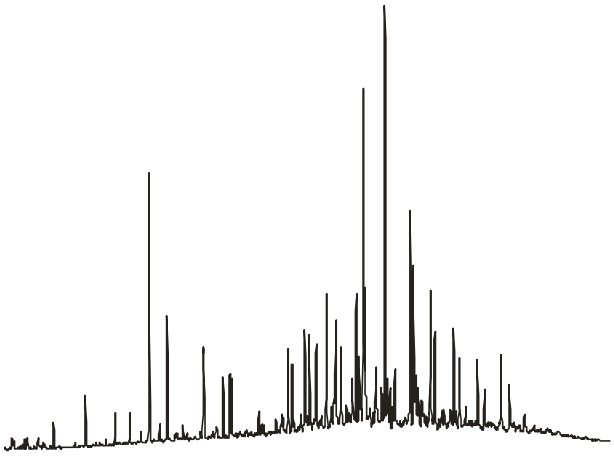
7022	3165	0,25	428	0,02	0,17	0,33	68	132	0,11	0,02
7023	3210	0,73	428	0,03	0,48	0,57	66	78	0,06	0,04
7024	3245	3,72	419	0,07	4,71	2,24	127	60	0,01	0,40
7025	3255	1,29	430	0,06	0,87	0,77	67	60	0,06	0,08
7026	3285	0,93	432	0,04	0,58	0,68	62	73	0,06	0,05
7027	3325	2,77	428	0,08	2,60	2,52	94	91	0,03	0,22
7028	3365	7,76	420	0,33	12,49	2,56	161	33	0,03	1,06
7029	3385	1,75	433	0,04	1,39	0,93	79	53	0,03	0,12
7030	3405	2,86	427	0,06	2,86	1,74	100	61	0,02	0,24
7031	3425	1,58	432	0,04	1,15	1,00	73	63	0,03	0,10
7032	3445	1,64	429	0,04	1,21	1,18	74	72	0,03	0,10
7033	3465	1,32	435	0,03	0,72	1,35	55	102	0,04	0,06
7034	3480	0,92	429	0,02	0,28	0,61	30	66	0,07	0,02
7035	3515	1,53	433	0,05	1,09	0,91	71	59	0,04	0,09
7036	3535	2,37	428	0,12	2,18	0,20	92	8	0,05	0,19
7037	3565	1,38	433	0,05	1,02	0,02	74	1	0,05	0,09
7038	3605	1,41	429	0,06	0,89	0,03	63	2	0,06	0,08
7039	3645	1,41	433	0,03	1,03	0,02	73	1	0,03	0,09
7040	3685	2,03	433	0,07	1,31	0,50	65	25	0,05	0,11
7041	3725	1,97	435	0,05	1,17	0,45	59	23	0,04	0,10
7042	3765	2,89	435	0,12	2,48	1,35	86	47	0,05	0,22
7043	3805	2,52	433	0,11	1,89	1,47	75	58	0,05	0,17
7044	3840	1,92	433	0,09	1,42	1,44	74	75	0,06	0,13



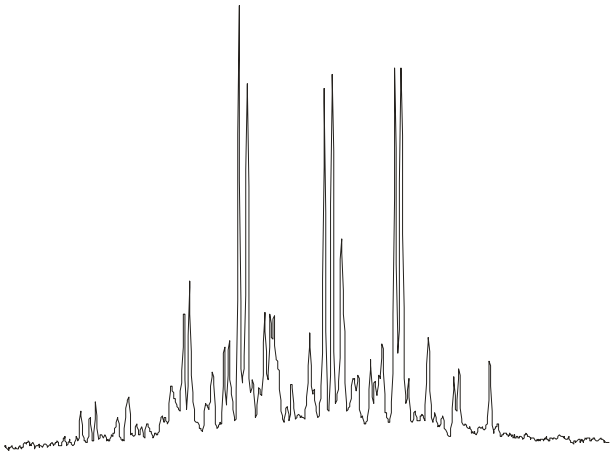
Gas Chromatogram



m/z 217



m/z 191 (full)



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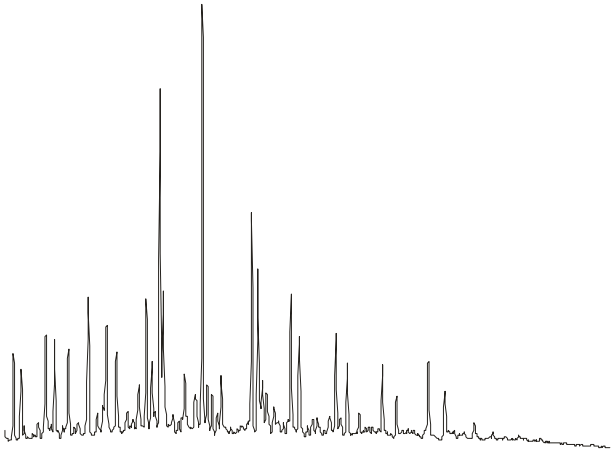


m/z 191 (partial)

Ralegh N-18 well
Lab. # 2001062-6982
D = 1795 m

Fig 17. GC and GC-MS data, peak identification key is shown in Appendix 1

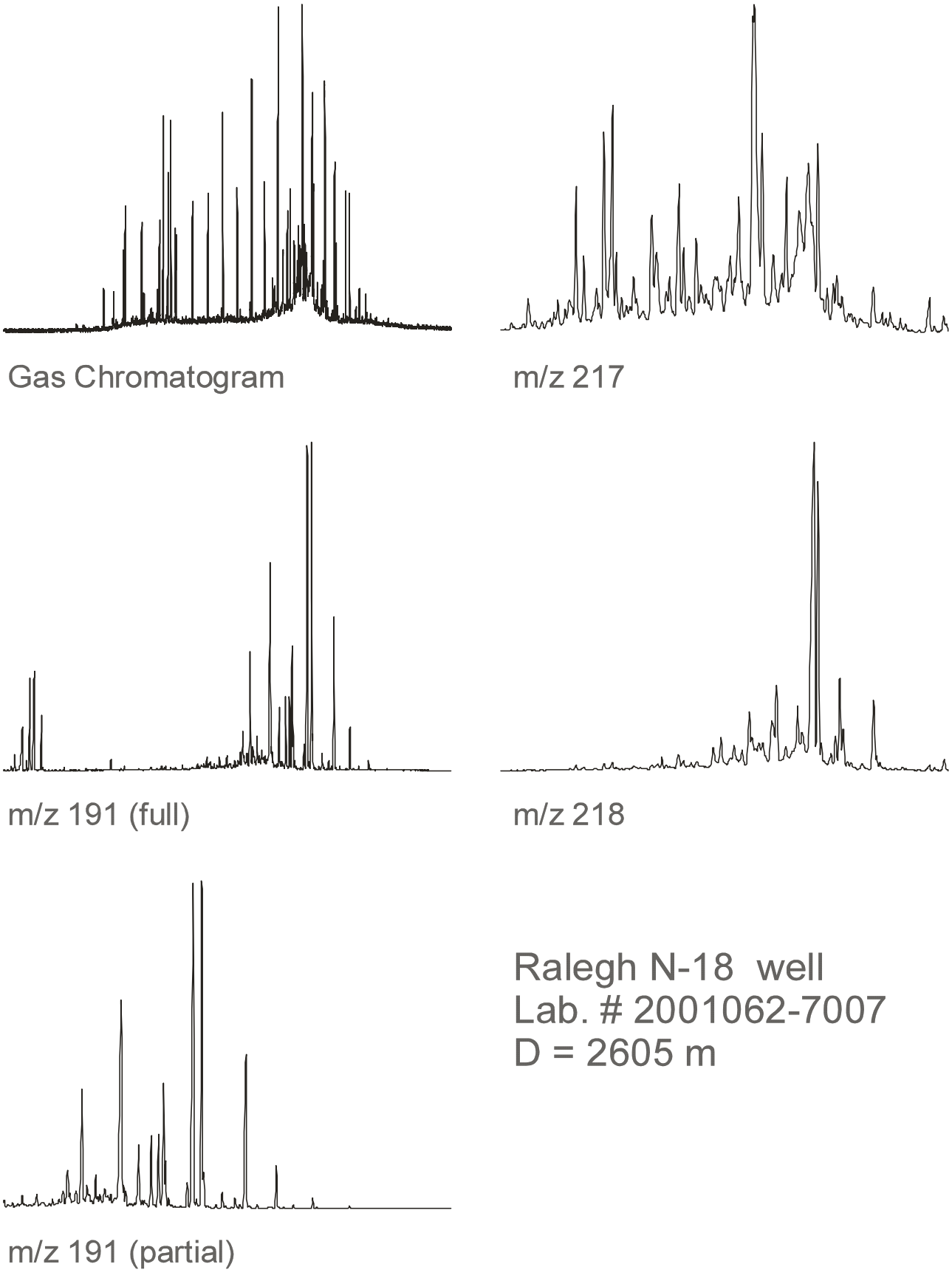
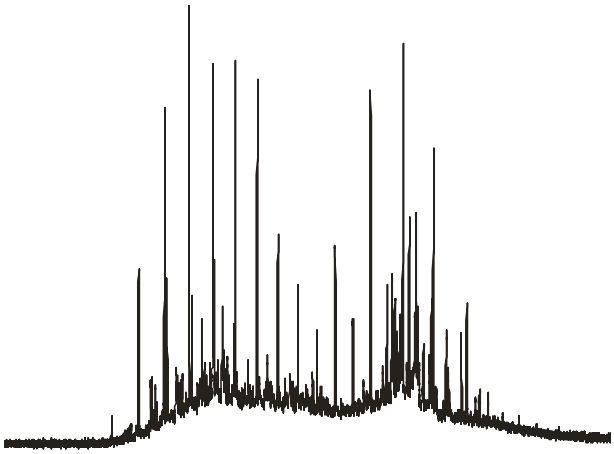
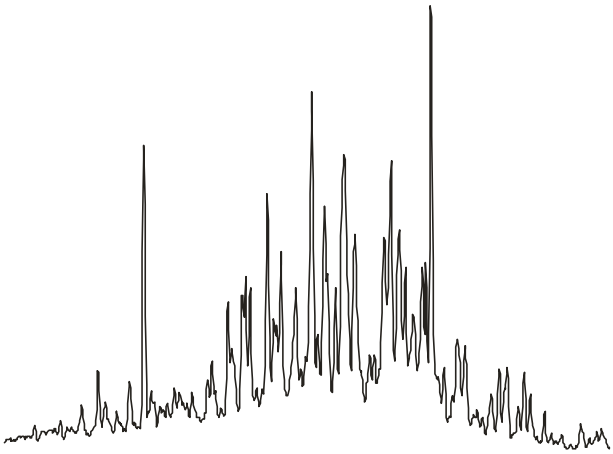


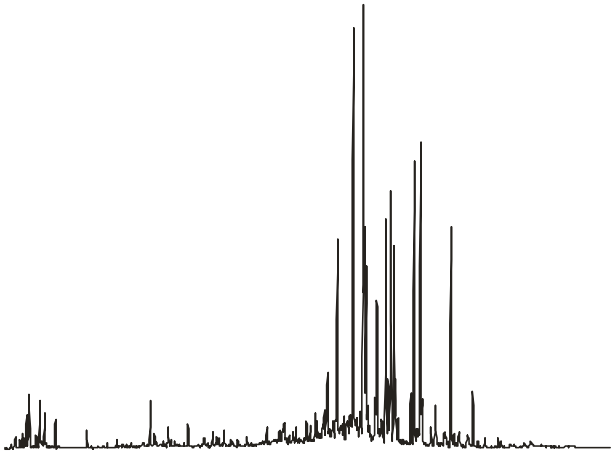
Fig 18. GC and GC-MS data, peak identification key is shown in Appendix 1



Gas Chromatogram



m/z 217



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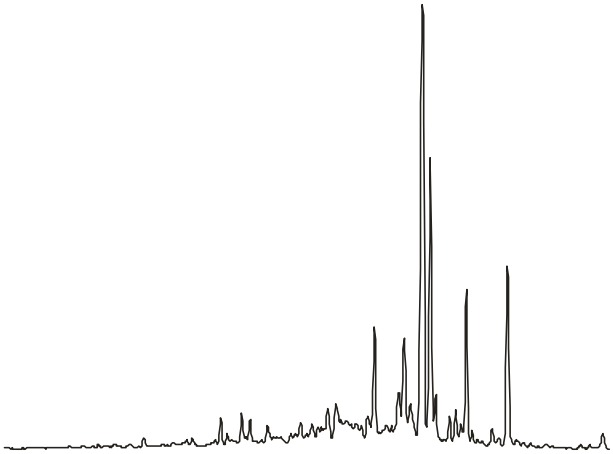
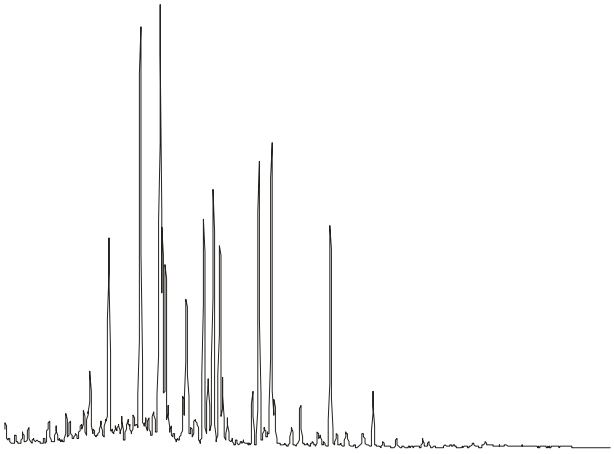


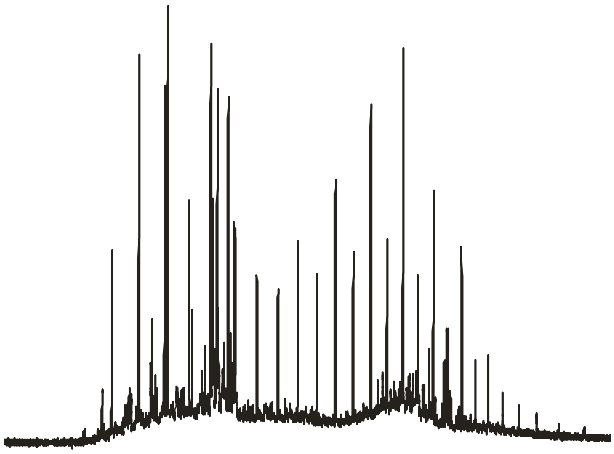
m/z 218



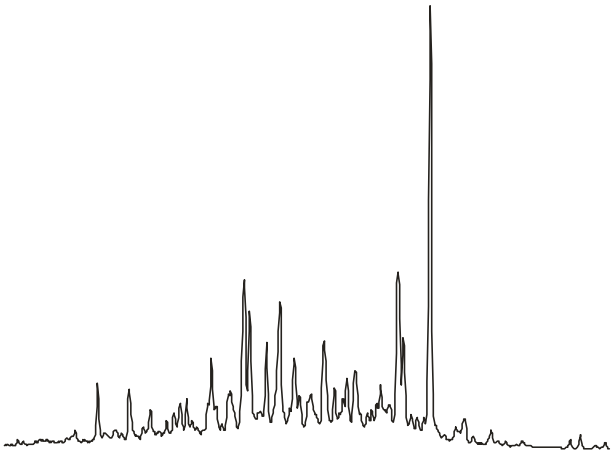
m/z 191 (partial)

Ralegh N-18 well
Lab. # 2001062-7011
D = 2745 m

Fig 19. GC and GC-MS data, peak identification key is shown in Appendix 1



Gas Chromatogram



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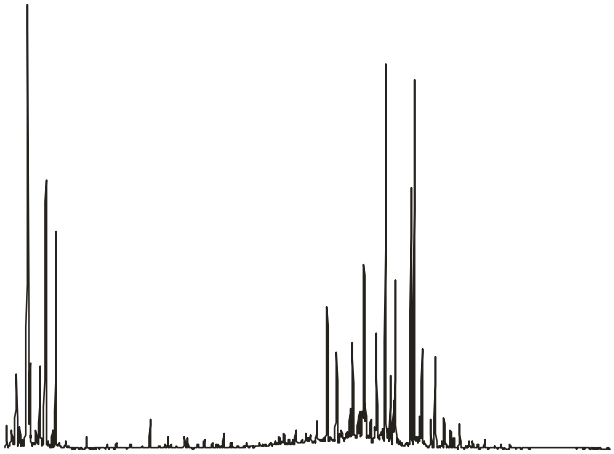

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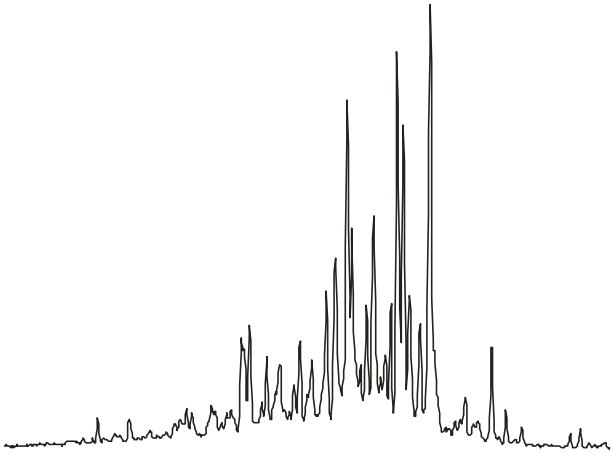
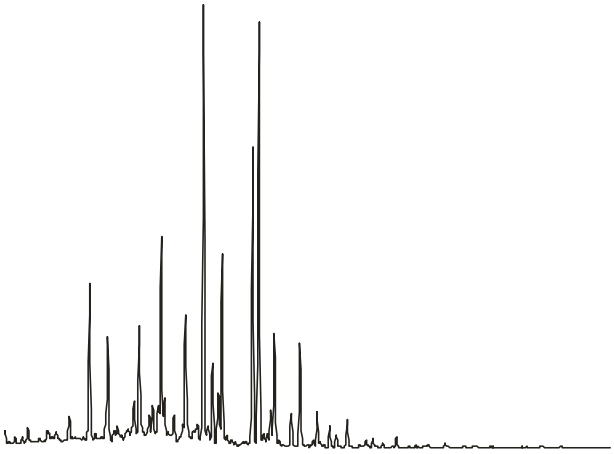


m/z 218



m/z 191 (partial)

Ralegh N-18 well
Lab. # 2001062-7028
D = 3385 m

Fig 20. GC and GC-MS data, peak identification key is shown in Appendix 1

Skolp E-09 well

Rock-Eval/TOC screening

A total of 136 samples were analysed, covering the interval 925m to 2985m (Table 4, Figure 21).
TOC contents are variable, 0.5% – 36.7%, averaging 5.3%. S2 pyrolysis yields show wide variation, from 0.2 mg/g to 101.2 mg/g, with an average of 7.5 mg/g. Consequently, Hydrogen Indices (HI) range from 14 to 277 (Figs. 22 and 23).
Although Hydrogen Indices are generally rather low, several intervals in the deeper portion of the drilled succession may possess some petroleum source potential.
The Production Index (PI) is generally low, but over the 1500 – 1800m interval, PI is >>0.1, indicating either snatural staining or contamination.
In the upper portion of the succession, i.e. until a depth of approximately 1800m, Tmax shows rather random variation, whereas the deeper portion sees a fairly regular increase from approximately 420 °C near 1800m to values close to 435 °C at the base of the section.

Solvent extract analysis

Six samples were analysed: 1370m, 1460m, 2570m, 2600m, 2735m and 2840m.

The 1370m and 1460m samples were both collected within an interval showing very high PI. Both samples show very high extract yields, and an extract composition characterised by high proportions of hydrocarbons compared to non-hydrocarbons. In particular the 1370m sample shows very high proportions of hydrocarbons, approximately 81%. Gas chromatographic data on the 1370m sample (fig. 24), show a minor UCM-hump, with a superimposed, nC_{17}-centred, near-symmetrical n-alkane distribution. The biomarker concentration is very low, and the distributions of both hopanes and steranes are distorted and light-end skewed These features are characteristic of distillation cuts, and the data suggest contamination by a combination of diesel and pipedope. The 1460m sample shows very similar characteristics, however with higher proportions of UCM, and higher concentrations of biomarkers, that show marl/carbonate signature. These differences are probably caused by adulteration by higher proportions of pipe-dope relative to diesel. Based on the solvent extract analyses, it must be concluded that the high values of PI recorded over the 1500–1800m depth interval are most likely caused by contamination rather than by natural oil staining.

The 2570m and 2600m samples both represent the 2450–2650 depth interval, which is characteristic by showing stable HI's >100. The samples show very similar features, comprising light-end skewed n-alkane distributions with minor odd-number predominance in the nC_{25+} region, Pr/Ph 1.5–2.0, notable proportions of tricyclic triterpanes, abundant moretanes, moderate proportions of extended hopanes, relatively high proportions of diasteranes, and predominance of C_{27} regular steranes. Based on the abundance of moretanes and on sterane 20S/(20S+20R) epimerisation ratios, the level of thermal maturity is not sufficient for significant petroleum generation to occur. In summary, the geochemical characteristics are typical of immature/early mature marine mudrocks/shales. Based on Rock-Eval data, the deposits will not qualify as potential petroleum source rocks.

The 2735m and 2840m samples both represent the 2650–TD depth interval, which is characteristic by showing very variable TOC, and HI's close to 200. Both samples show bimodal n-alkane distributions with minor odd-number predominance in the nC_{25+} region, and Pr/Ph 4–6. the 2735m sample shows low proportions of tricyclic triterpanes, abundant moretanes and Tm, minor 17β(H)-trisnorhopane, moderate proportions of extended hopanes, low proportions of diasteranes, and strong predominance of C_{29} regular steranes. The hopane to sterane ratio is high. Based on the abundance of moretanes and on sterane 20S/(20S+20R) epimerisation ratio, the level of thermal maturity is not sufficient for significant petroleum generation to occur. In summary, the geochemical characteristics are typical of immature/early mature terrestrial mudrocks/shales. By comparison, the 2840m sample shows somewhat higher proportions of tricyclic triterpanes and enhancement of ββ-steranes, while maintaining a high hopane to sterane ratio. These features seem to overprint characteristics that are otherwisevery similar to those noted for the 2735m sample, and are probably caused byminor pipe-dope contamination, disturbing primarily the biomarker distribution.
Based on Rock-Eval data, the deposits will not qualify as potential petroleum source rocks.

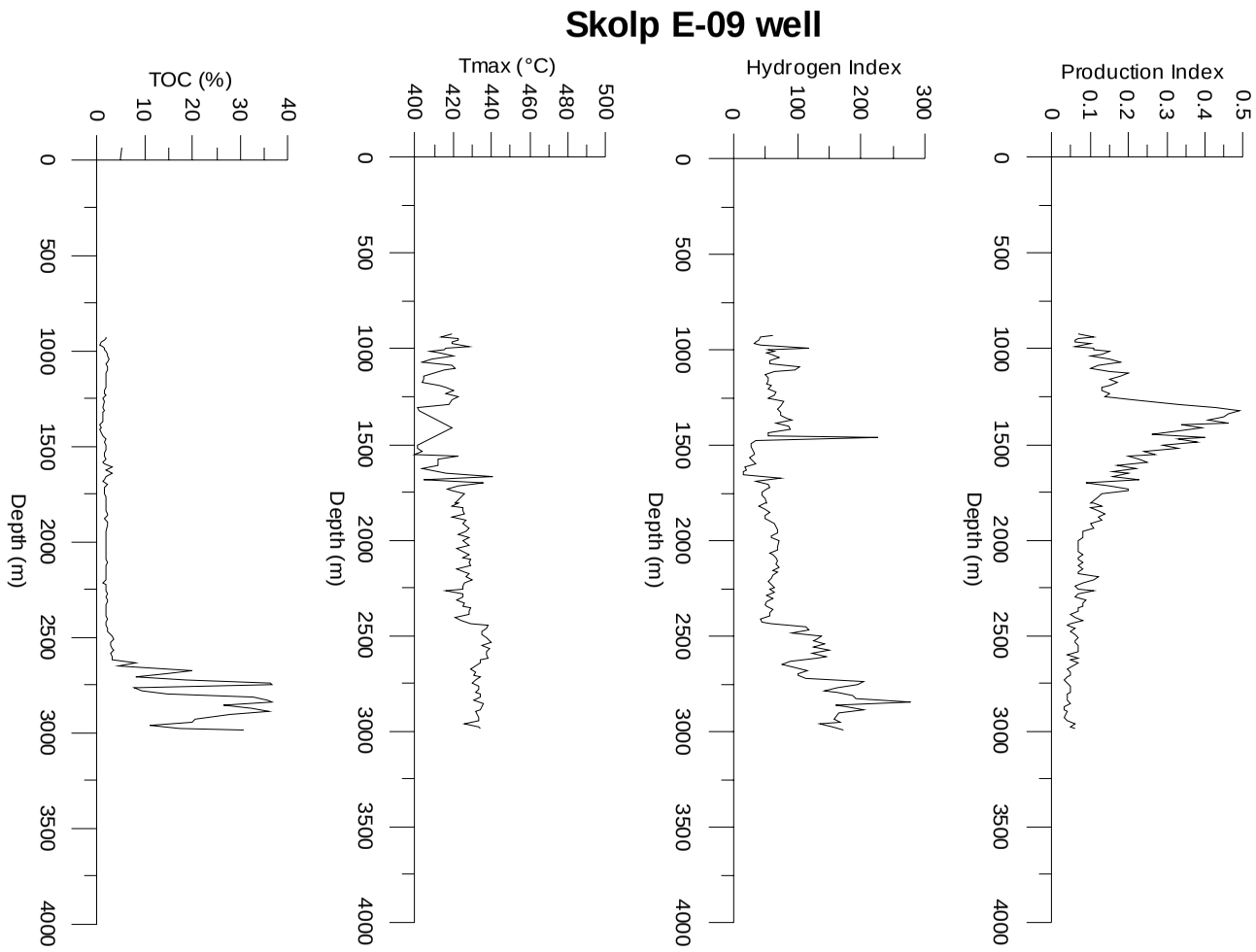


Fig. 21. Simple geochemical log, Skolp E-09 well

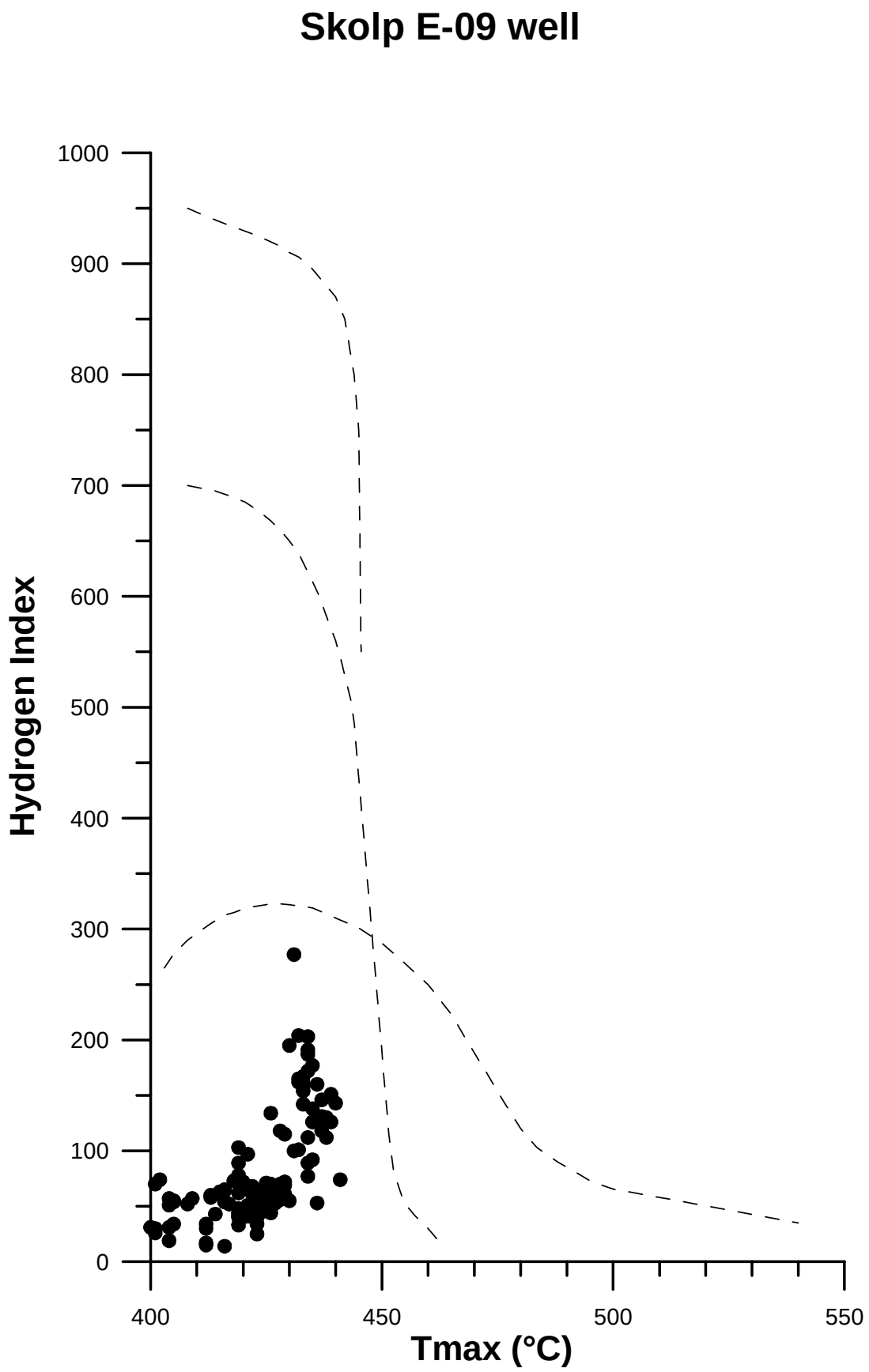


Fig. 22. Skolp E-09 well, all data

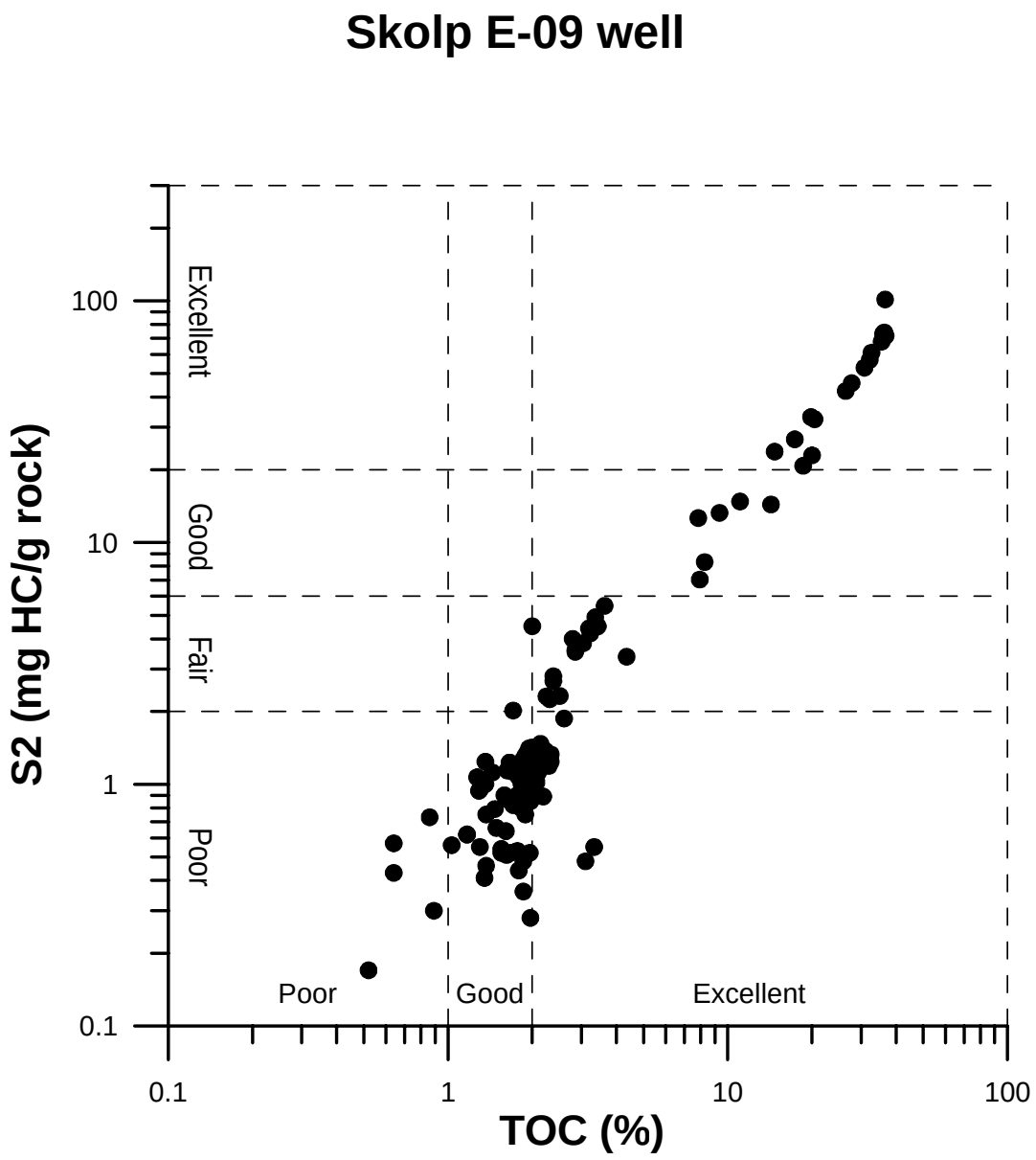


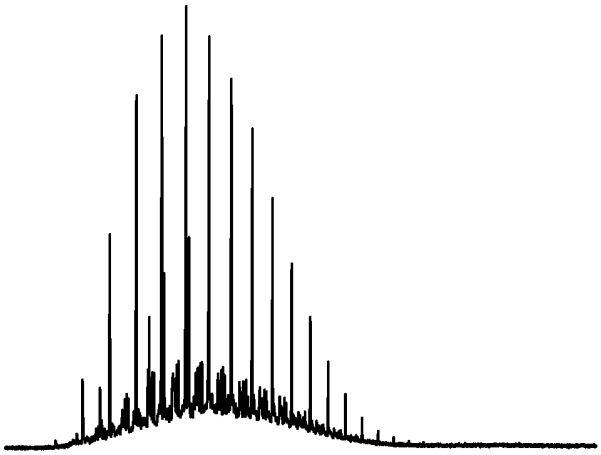
Fig. 23. Skolp E-09 well, all data

Table 5. Skolp E-09 well. Rock-Eval /TOC screening data

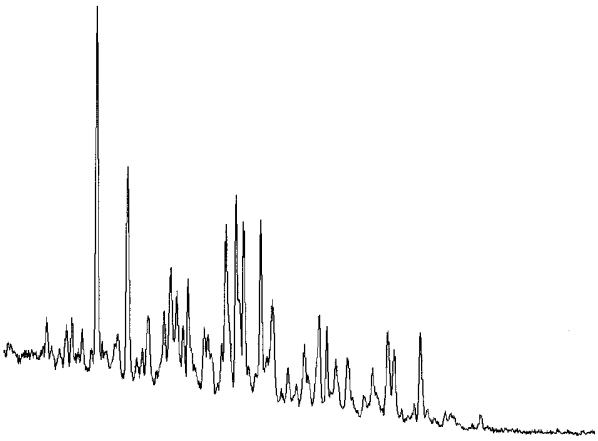
Lab (#)	meter (Base)	TOC (wt-%)	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HI	OI	PI	PC
6579	925	2,00	419	0,10	1,24	3,28	62	164	0,07	0,11
6580	935	1,97	414	0,10	0,85	4,15	43	211	0,11	0,08
6581	945	1,61	423	0,05	0,64	2,71	40	168	0,07	0,06
6582	955	0,89	423	0,02	0,30	1,55	34	174	0,06	0,03
6583	965	0,52	419	0,01	0,17	0,98	33	188	0,06	0,01
6584	975	1,30	419	0,06	0,55	2,42	42	186	0,10	0,05
6585	985	1,71	428	0,13	2,02	2,15	118	126	0,06	0,18
6586	995	1,62	416	0,11	0,87	2,97	54	183	0,11	0,08
6587	1005	1,88	415	0,15	1,19	3,07	63	163	0,11	0,11
6588	1015	2,29	408	0,21	1,19	5,14	52	224	0,15	0,12
6589	1025	2,26	413	0,19	1,30	4,35	58	192	0,13	0,12
6590	1040	2,60	420	0,21	1,87	4,82	72	185	0,10	0,17
6591	1055	2,33	409	0,23	1,33	5,30	57	227	0,15	0,13
6592	1070	1,99	404	0,25	1,14	4,58	57	230	0,18	0,12
6593	1085	2,25	419	0,31	2,31	3,56	103	158	0,12	0,22
6594	1100	2,31	421	0,26	2,25	3,30	97	143	0,10	0,21
6595	1115	1,92	415	0,21	1,20	3,62	63	189	0,15	0,12
6596	1130	1,77	399	0,22	0,86	3,65	49	206	0,20	0,09
6597	1145	1,83	405	0,22	1,00	3,86	55	211	0,18	0,10
6598	1160	1,86	405	0,18	1,01	3,77	54	203	0,15	0,10
6599	1175	1,77	404	0,18	0,90	3,90	51	220	0,17	0,09
6600	1190	1,92	413	0,20	1,16	3,87	60	202	0,15	0,11
6601	1205	1,47	416	0,12	0,79	2,51	54	171	0,13	0,08
6602	1220	1,69	420	0,17	1,13	2,99	67	177	0,13	0,11
6603	1235	1,83	416	0,21	1,18	3,44	64	188	0,15	0,12
6604	1250	1,17	423	0,10	0,62	3,12	53	267	0,14	0,06
6605	1265	1,44	419	0,29	1,12	1,16	78	81	0,21	0,12
6606	1295	1,29	418	0,47	0,94	1,03	73	80	0,33	0,12
6607	1310	1,63	401	0,87	1,14	1,15	70	71	0,43	0,17
6608	1325	1,36	402	0,95	1,00	1,12	74	82	0,49	0,16
6609	1340	1,30	302	0,81	0,95	0,97	73	75	0,46	0,15
6610	1355	1,27	298	0,88	1,07	0,65	84	51	0,45	0,16
6611	1370	1,36	300	0,85	1,24	0,96	91	71	0,41	0,17
6612	1385	0,64	306	0,37	0,43	0,29	67	45	0,46	0,07
6613	1400	0,86	305	0,37	0,73	2,03	85	236	0,34	0,09
6614	1415	0,64	419	0,37	0,57	1,01	89	158	0,39	0,08
6615	1430	1,03	310	0,27	0,56	1,53	54	149	0,33	0,07
6616	1445	1,17	311	0,22	0,62	1,75	53	150	0,26	0,07
6617	1460	2,00	298	3,00	4,51	1,42	226	71	0,40	0,62
6618	1475	1,55	372	0,27	0,54	2,00	35	129	0,33	0,07
6619	1490	1,96	397	0,32	0,52	2,21	27	113	0,38	0,07
6620	1505	1,86	401	0,20	0,48	1,44	26	77	0,29	0,06
6621	1520	1,77	401	0,26	0,53	1,53	30	86	0,33	0,07
6622	1535	1,67	404	0,16	0,52	1,62	31	97	0,24	0,06
6623	1550	1,62	400	0,19	0,51	1,37	31	85	0,27	0,06
6624	1565	1,79	423	0,11	0,44	1,62	25	91	0,20	0,05
6625	1580	1,35	412	0,12	0,41	1,07	30	79	0,23	0,04
6626	1595	1,55	412	0,17	0,52	1,38	34	89	0,25	0,06
6627	1610	3,33	412	0,11	0,55	1,57	17	47	0,17	0,05
6628	1625	1,86	404	0,10	0,36	1,26	19	68	0,22	0,04
6629	1640	3,10	412	0,09	0,48	2,46	15	79	0,16	0,05
6630	1655	1,97	416	0,07	0,28	0,74	14	38	0,20	0,03
6631	1670	1,66	441	0,23	1,23	0,78	74	47	0,16	0,12
6632	1685	1,37	405	0,14	0,46	1,02	34	74	0,23	0,05

6633	1700	2,33	436	0,12	1,24	0,70	53	30	0,09	0,11
6634	1715	1,59	423	0,16	0,90	1,03	57	65	0,15	0,09
6635	1730	1,65	417	0,22	0,86	0,85	52	52	0,20	0,09
6636	1745	1,49	419	0,16	0,66	0,82	44	55	0,20	0,07
6637	1760	1,82	426	0,12	0,80	0,70	44	38	0,13	0,08
6638	1775	1,93	424	0,13	0,95	0,87	49	45	0,12	0,09
6639	1805	1,94	421	0,11	0,99	1,25	51	64	0,10	0,09
6639	1805	1,96	423	0,12	0,96	0,93	49	47	0,11	0,09
6640	1820	1,89	419	0,11	0,75	1,55	40	82	0,13	0,07
6641	1835	2,02	425	0,11	1,00	1,50	50	74	0,10	0,09
6642	1850	2,11	425	0,16	1,18	1,62	56	77	0,12	0,11
6643	1865	2,07	426	0,16	1,02	1,68	49	81	0,14	0,10
6644	1880	1,71	419	0,11	0,82	1,48	48	87	0,12	0,08
6645	1895	2,10	427	0,17	1,12	1,96	53	93	0,13	0,11
6646	1910	2,07	425	0,15	1,33	1,82	64	88	0,10	0,12
6647	1940	1,90	428	0,16	1,33	3,11	70	164	0,11	0,12
6648	1955	1,99	427	0,12	1,36	1,35	68	68	0,08	0,12
6649	1970	1,85	423	0,10	1,11	1,20	60	65	0,08	0,10
6650	1985	1,91	428	0,09	1,10	1,10	58	58	0,08	0,10
6651	2000	2,00	425	0,11	1,42	1,31	71	65	0,07	0,13
6652	2030	1,99	428	0,11	1,37	0,93	69	47	0,07	0,12
6653	2045	1,86	422	0,10	1,27	0,92	68	49	0,07	0,11
6654	2060	1,88	425	0,08	1,07	1,07	57	57	0,07	0,10
6655	2075	2,04	428	0,11	1,24	0,95	61	47	0,08	0,11
6656	2090	2,03	425	0,10	1,37	1,27	67	63	0,07	0,12
6657	2105	2,14	429	0,11	1,47	1,22	69	57	0,07	0,13
6658	2120	1,98	428	0,12	1,31	1,14	66	58	0,08	0,12
6659	2135	1,95	429	0,11	1,41	1,38	72	71	0,07	0,13
6660	2150	1,85	422	0,10	1,13	0,96	61	52	0,08	0,10
6661	2165	1,93	426	0,10	1,35	1,25	70	65	0,07	0,12
6662	2180	1,90	428	0,09	1,18	1,62	62	85	0,07	0,11
6663	2195	1,79	427	0,14	1,07	2,25	60	126	0,12	0,10
6664	2210	1,37	430	0,09	0,75	1,27	55	93	0,11	0,07
6665	2225	1,92	426	0,09	1,11	1,39	58	72	0,08	0,10
6666	2240	1,94	425	0,08	1,26	0,88	65	45	0,06	0,11
6667	2255	2,03	425	0,09	1,15	1,21	57	60	0,07	0,10
6668	2270	2,09	416	0,16	1,36	0,89	65	43	0,11	0,13
6669	2285	2,00	425	0,08	1,02	0,95	51	47	0,07	0,09
6670	2300	2,22	425	0,09	1,38	1,09	62	49	0,06	0,12
6671	2315	2,06	422	0,10	1,07	1,20	52	58	0,09	0,10
6672	2330	1,79	426	0,07	0,86	1,53	48	85	0,08	0,08
6673	2345	1,95	425	0,09	0,99	1,15	51	59	0,08	0,09
6674	2360	1,92	429	0,09	1,18	0,80	61	42	0,07	0,11
6675	2375	2,00	428	0,08	1,15	0,75	57	38	0,07	0,10
6676	2390	1,87	428	0,06	1,05	0,96	56	51	0,05	0,09
6677	2405	2,19	421	0,06	0,89	0,71	41	32	0,06	0,08
6678	2420	1,84	424	0,07	0,82	0,83	45	45	0,08	0,07
6679	2435	2,02	429	0,06	1,17	1,20	58	59	0,05	0,10
6680	2450	2,38	438	0,10	2,67	0,88	112	37	0,04	0,23
6681	2465	2,38	437	0,17	2,80	1,67	118	70	0,06	0,25
6682	2480	2,51	435	0,13	2,32	1,15	92	46	0,05	0,20
6683	2495	3,19	435	0,30	4,41	1,89	138	59	0,06	0,39
6684	2510	3,43	437	0,34	4,50	1,94	131	57	0,07	0,40
6685	2525	2,85	439	0,24	3,59	0,78	126	27	0,06	0,32
6686	2540	2,79	440	0,26	3,99	1,23	143	44	0,06	0,35
6687	2555	3,04	435	0,27	3,83	1,49	126	49	0,07	0,34
6688	2570	3,63	439	0,40	5,47	1,58	151	44	0,07	0,49
6689	2585	2,85	437	0,28	3,53	1,96	124	69	0,07	0,32
6690	2600	3,36	437	0,21	4,91	0,32	146	10	0,04	0,42
6691	2615	3,23	438	0,33	4,21	1,13	130	35	0,07	0,38

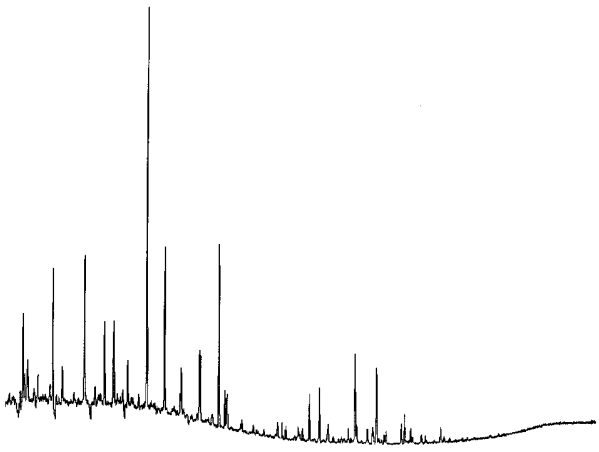
6692	2630	7,94	434	0,38	7,03	2,22	89	28	0,05	0,62
6693	2645	4,35	434	0,24	3,37	0,62	77	14	0,07	0,30
6694	2675	20,02	429	1,02	22,97	4,57	115	23	0,04	1,99
6695	2690	14,28	432	0,72	14,37	3,64	101	25	0,05	1,25
6696	2705	8,27	431	0,46	8,31	1,82	100	22	0,05	0,73
6697	2720	18,60	434	0,94	20,77	4,26	112	23	0,04	1,80
6698	2735	36,27	432	2,68	73,97	9,50	204	26	0,03	6,36
6699	2750	36,68	430	3,00	71,68	7,63	195	21	0,04	6,20
6700	2765	7,84	433	0,64	12,63	3,15	161	40	0,05	1,10
6701	2780	9,34	433	0,63	13,27	2,95	142	32	0,05	1,15
6702	2795	14,71	432	1,17	23,78	3,01	162	20	0,05	2,07
6703	2810	32,64	434	2,50	61,07	5,84	187	18	0,04	5,28
6704	2825	35,48	434	3,07	67,78	6,25	191	18	0,04	5,88
6705	2840	36,53	431	4,44	101,24	9,15	277	25	0,04	8,77
6706	2855	26,39	436	2,09	42,34	4,02	160	15	0,05	3,69
6707	2870	32,18	435	2,05	56,95	5,08	177	16	0,03	4,90
6708	2885	35,90	434	2,59	72,88	6,05	203	17	0,03	6,26
6709	2900	27,73	432	1,74	45,63	3,38	165	12	0,04	3,93
6710	2930	20,44	433	1,05	32,36	3,17	158	16	0,03	2,77
6711	2945	19,83	433	1,55	33,04	3,54	167	18	0,04	2,87
6712	2960	11,07	426	0,92	14,78	2,30	134	21	0,06	1,30
6713	2975	17,35	433	1,37	26,72	3,27	154	19	0,05	2,33
6714	2985	30,81	434	3,53	52,86	4,61	172	15	0,06	4,68



Gas Chromatogram



m/z 217



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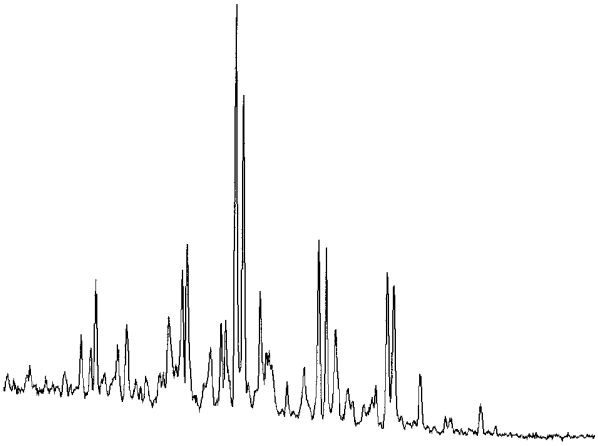

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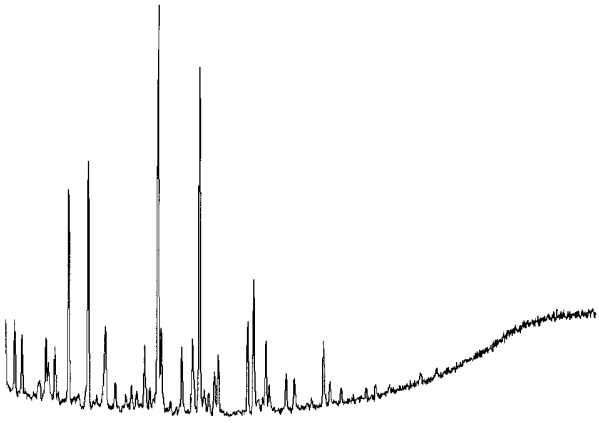
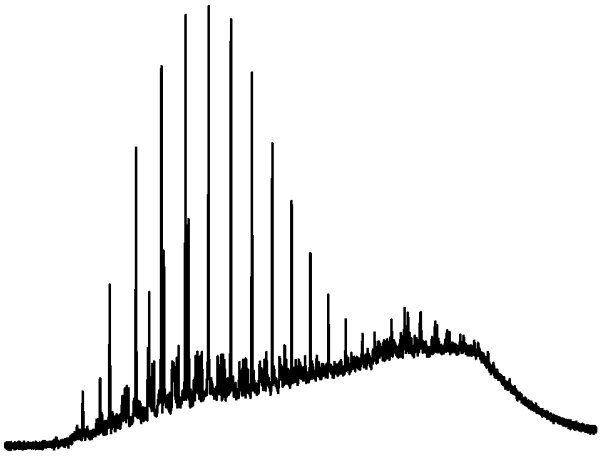


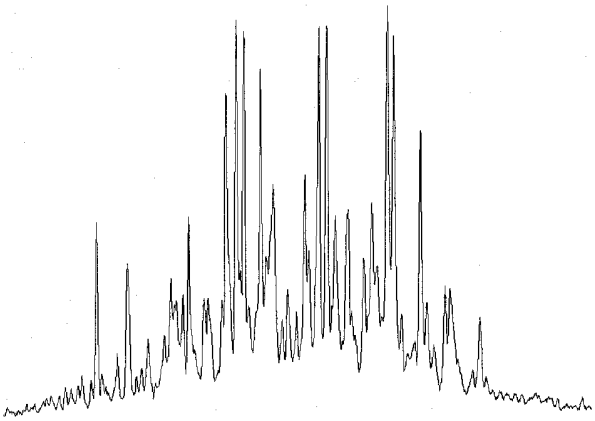
m/z 191 (partial)

Skolp E-09 well
Lab. # 2001053-6611
D = 1370 m

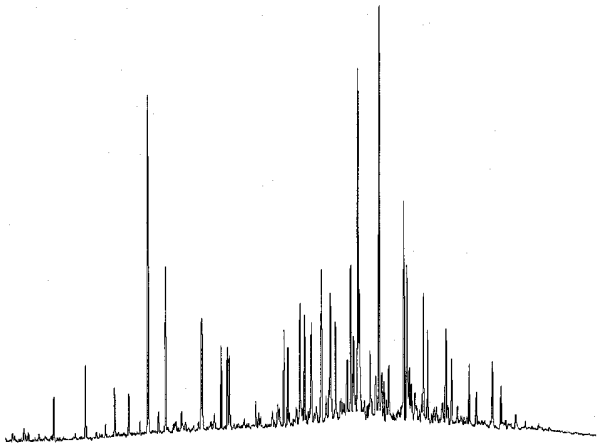
Fig 24. GC and GC-MS data, peak identification key is shown in Appendix 1



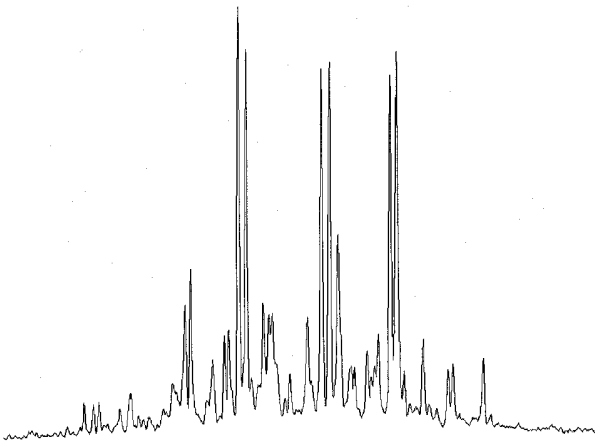
Gas Chromatogram



m/z 217



m/z 191 (full)



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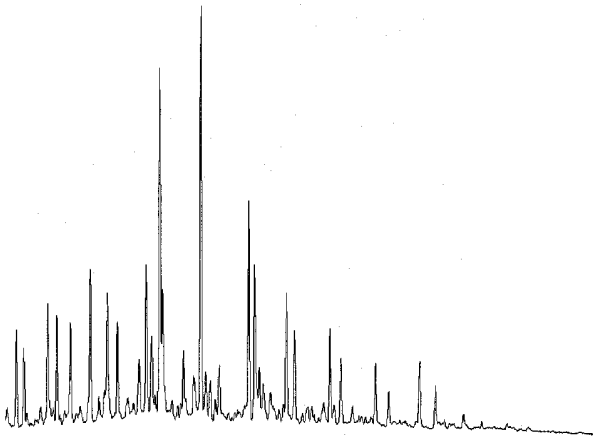
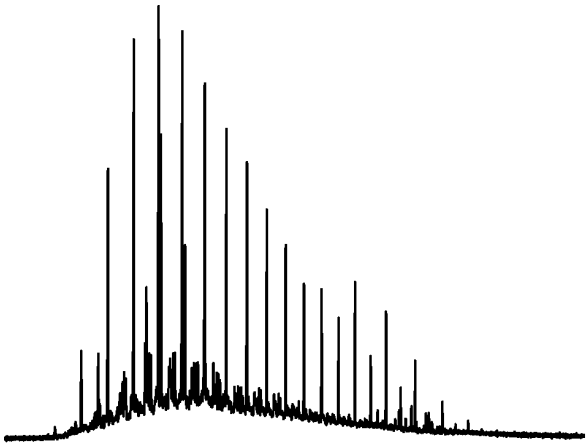


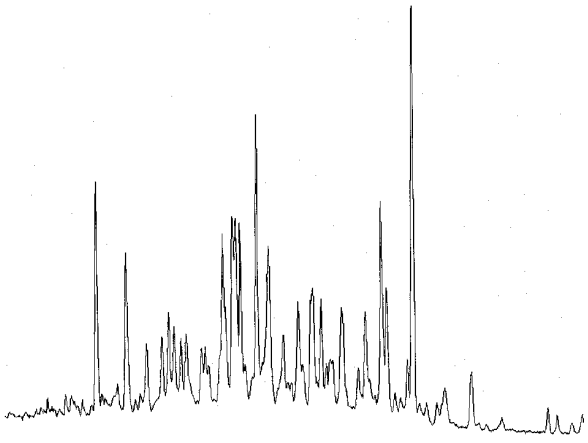
m/z 191 (partial)

Skolp E-09 well
Lab. # 2001053-6617
D = 1460 m

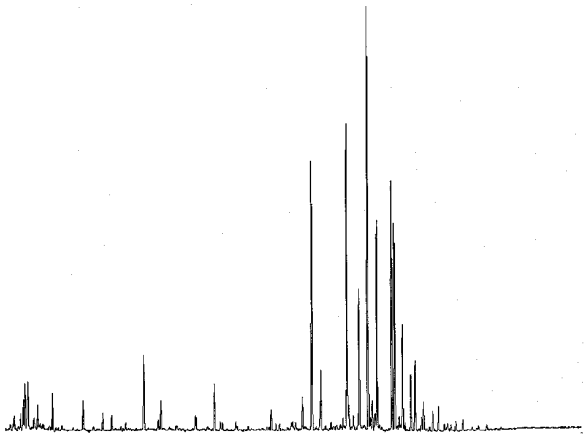
Fig 25. GC and GC-MS data, peak identification key is shown in Appendix 1



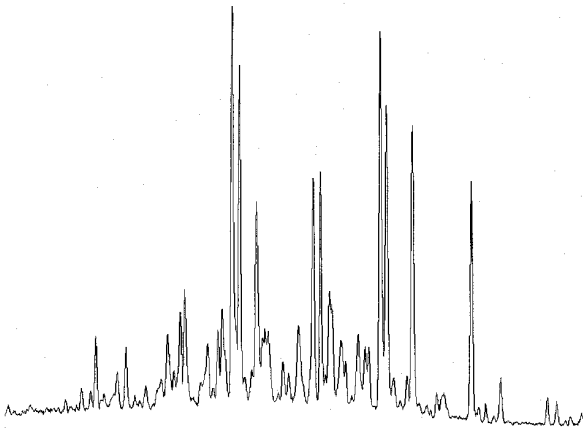
Gas Chromatogram



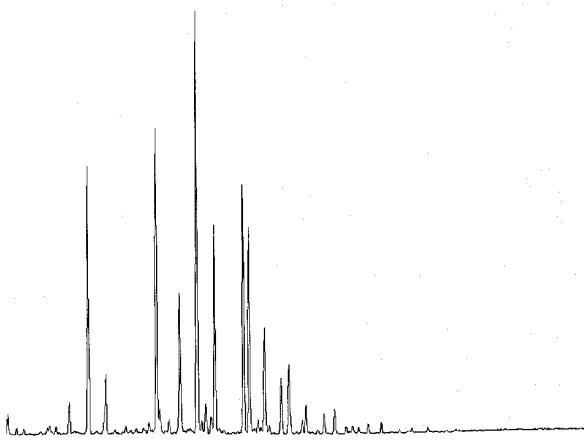
m/z 217



m/z 191 (full)



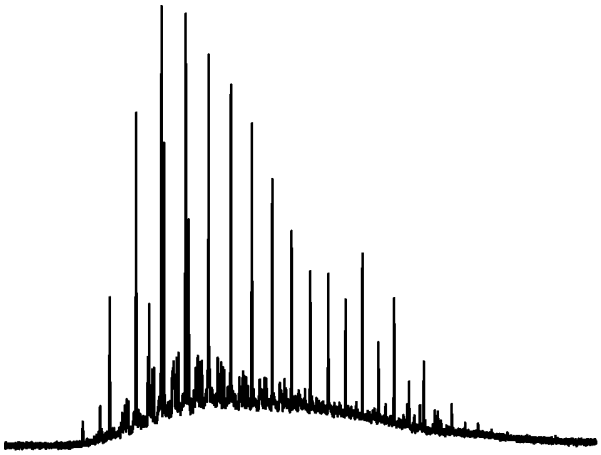
m/z 218



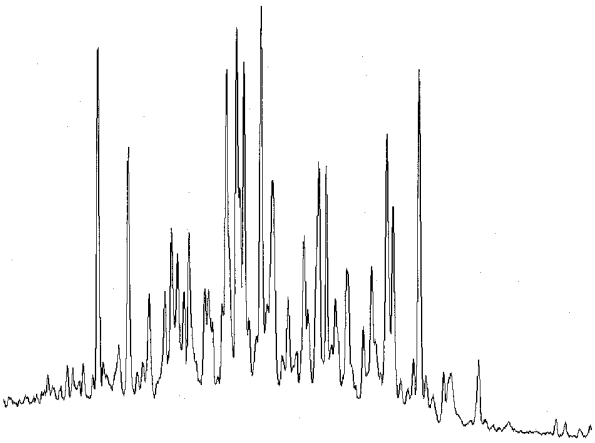
m/z 191 (partial)

Skolp E-09 well
Lab. # 2001053-6688
D = 2570 m

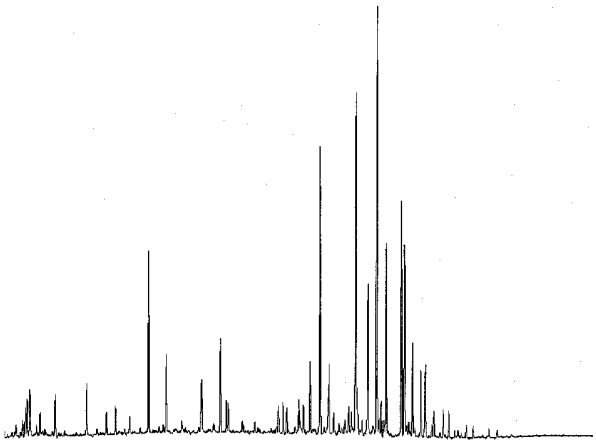
Fig 26. GC and GC-MS data, peak identification key is shown in Appendix 1



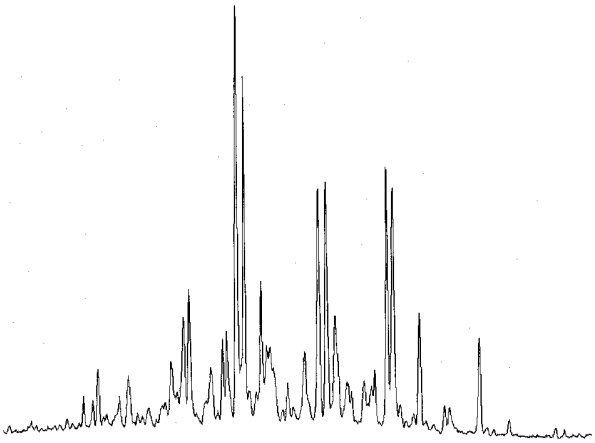
Gas Chromatogram



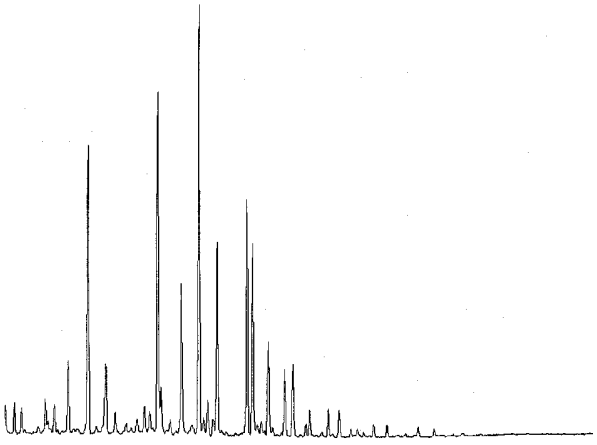
m/z 217



m/z 191 (full)



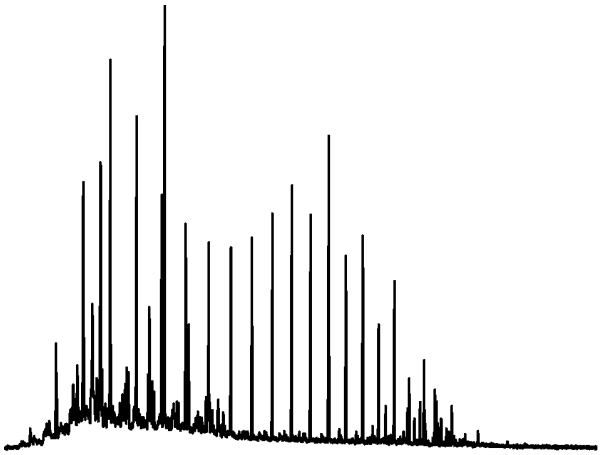
m/z 218



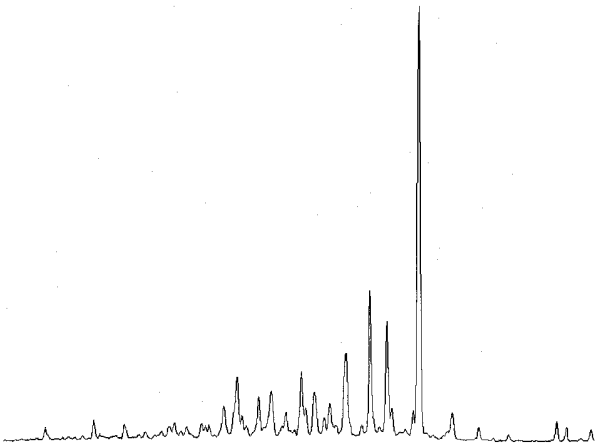
m/z 191 (partial)

Skolp E-09 well
Lab. # 2001053-6690
D = 2600 m

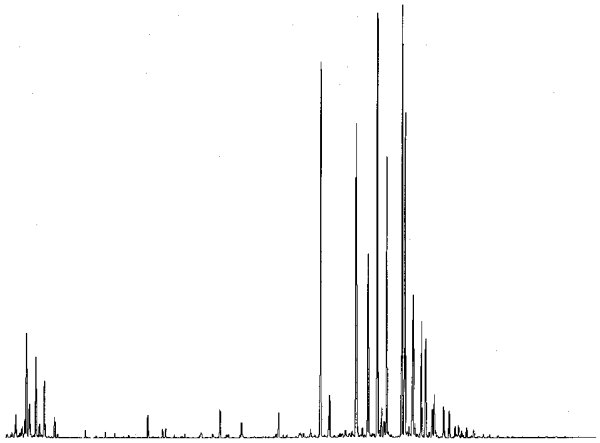
Fig 27. GC and GC-MS data, peak identification key is shown in Appendix 1



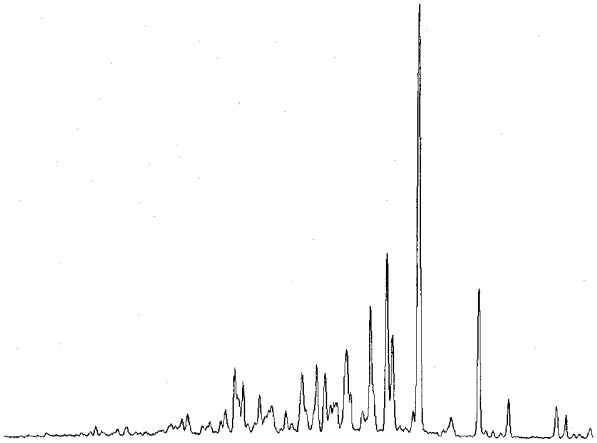
Gas Chromatogram



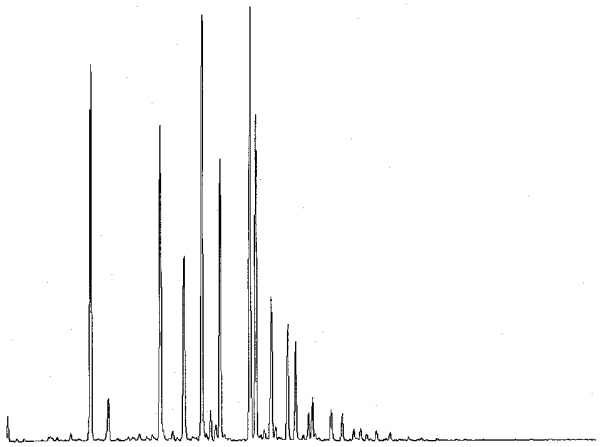
m/z 217



m/z 191 (full)



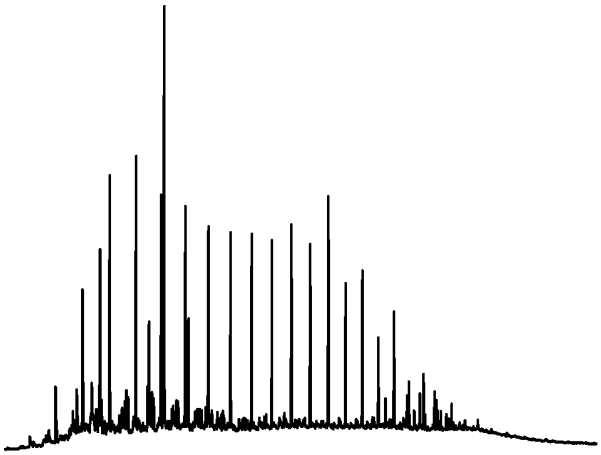
m/z 218



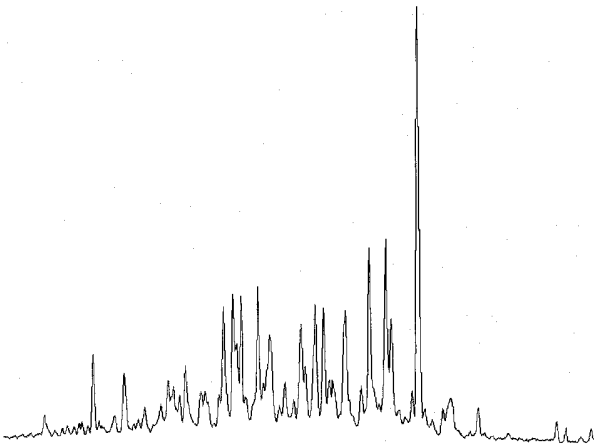
m/z 191 (partial)

Skolp E-09 well
Lab. # 2001053-6698
D = 2735 m

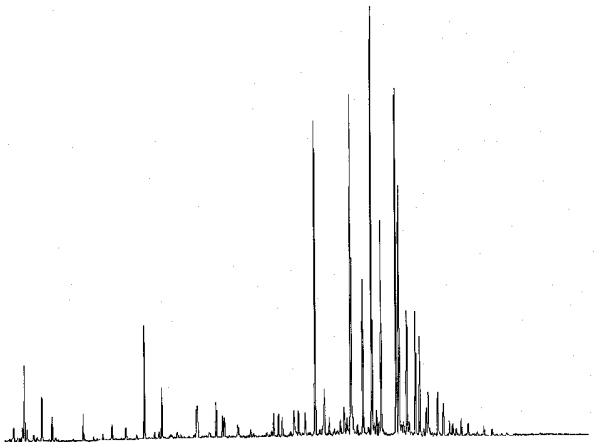
Fig 28. GC and GC-MS data, peak identification key is shown in Appendix 1



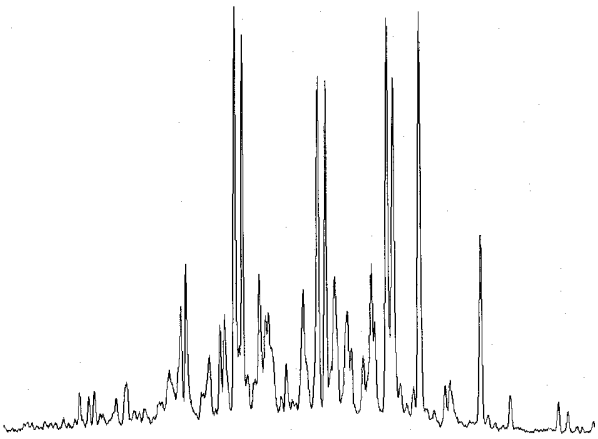
Gas Chromatogram



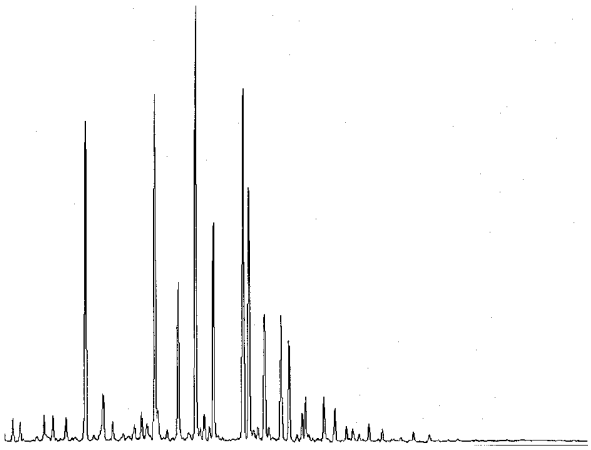
m/z 217



m/z 191 (full)



m/z 218



m/z 191 (partial)

Skolp E-09 well
Lab. # 2001053-6705
D = 2840 m

Fig 29. GC and GC-MS data, peak identification key is shown in Appendix 1

References

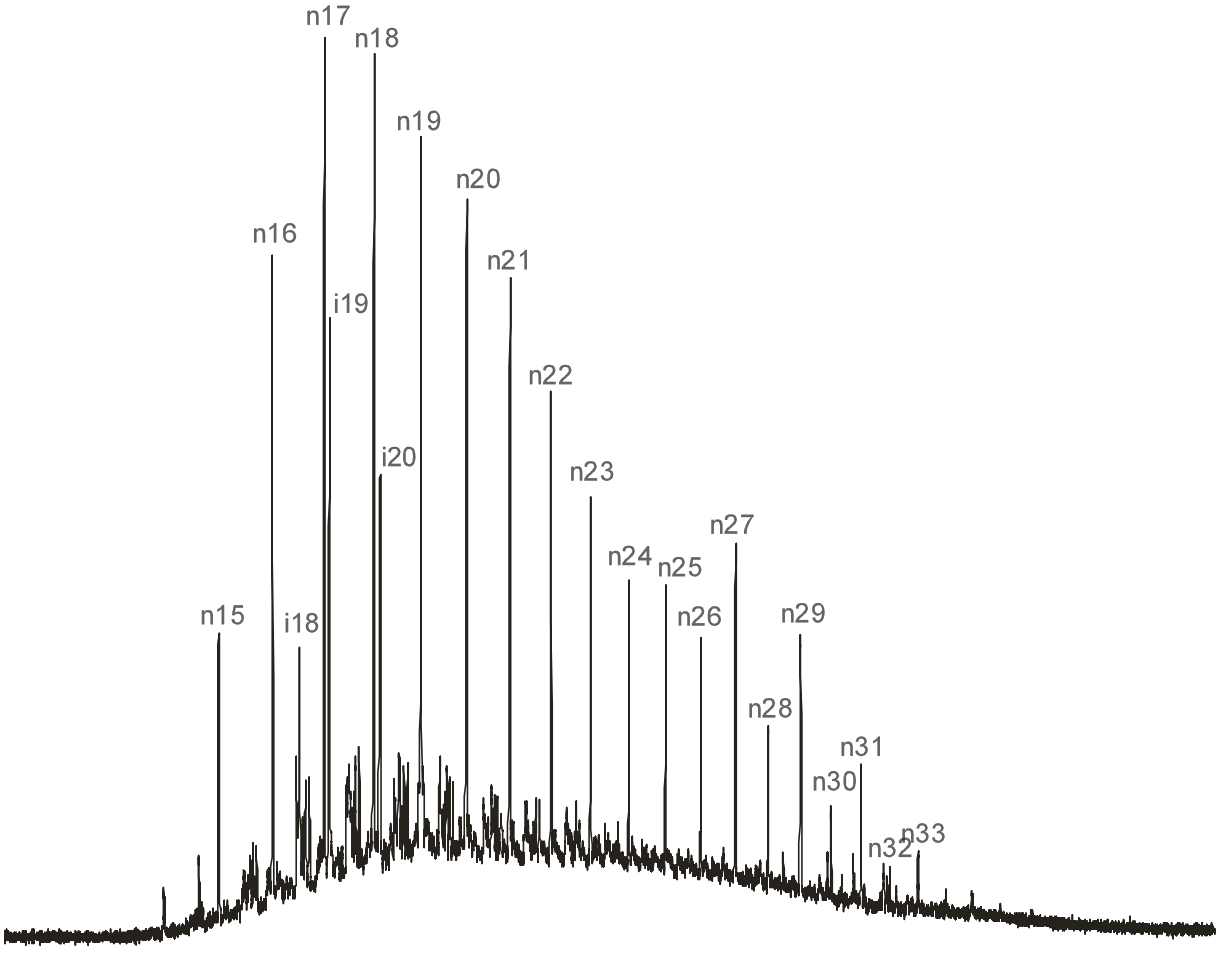
Radke, M., Willsch, H. & Welte, D. H. 1980. Preparative hydrocarbon group type determination by automated medium pressure liquid chromatography. Analytical Chemistry 52, 406-411

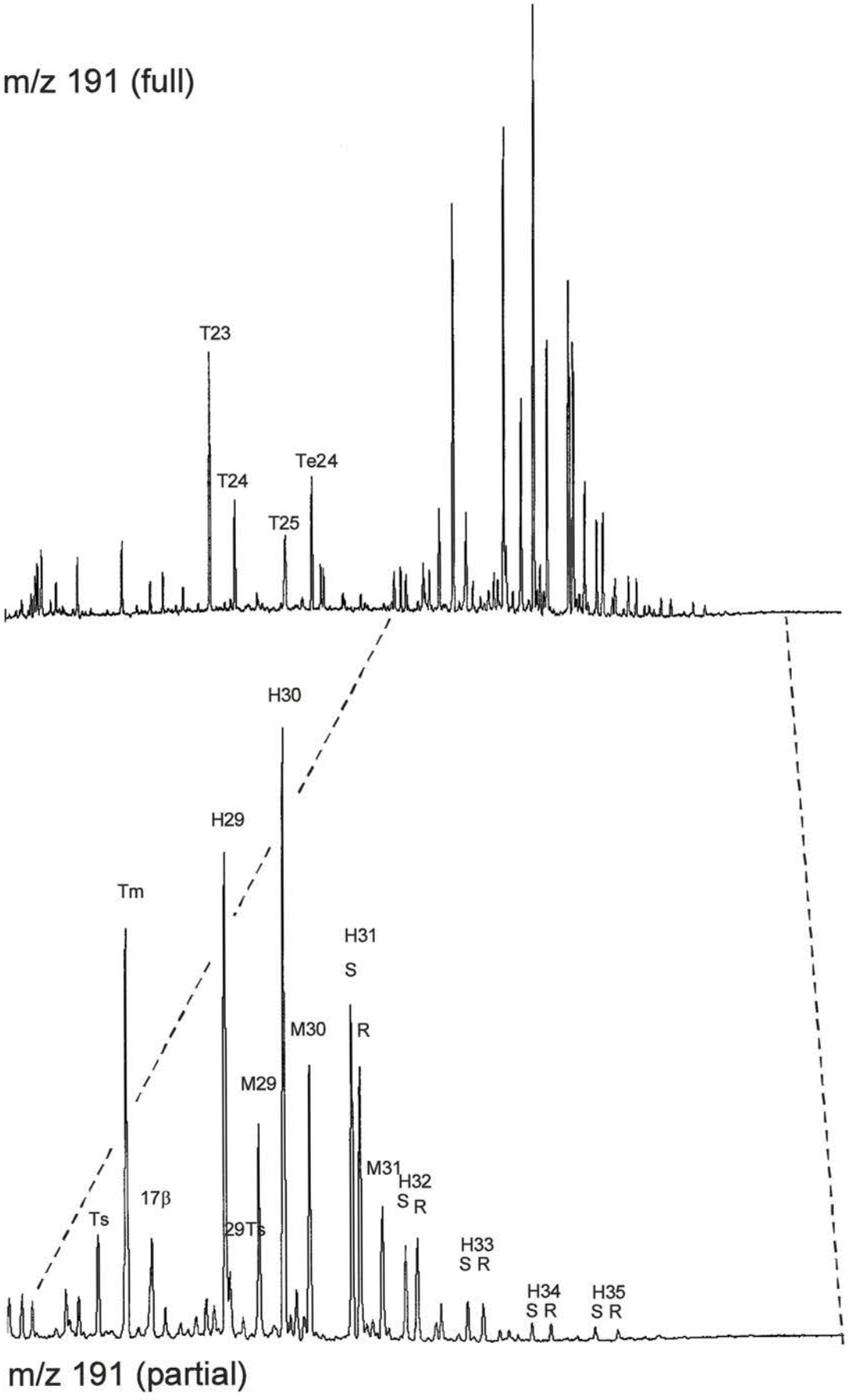
Appendix 1

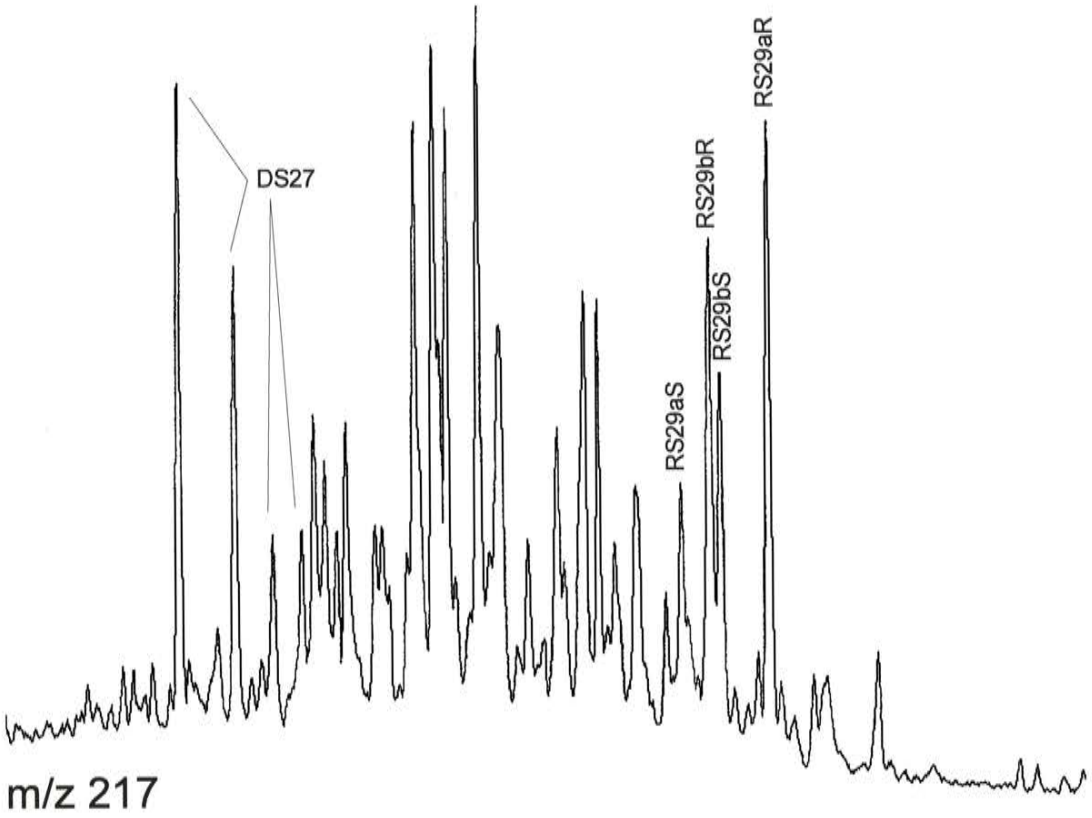
Compound identification key

n15	C_{15} normal alkane
n16	C_{16} normal alkane
i18	C_{18} acyclic isoprene
n17	C_{17} normal alkane
i19	C_{19} (=pristane) acyclic isoprene
n18	C_{18} normal alkane
i20	C_{20} (=phytane) acyclic isoprene
n19	C_{19} normal alkane
n20	C_{20} normal alkane
n21	C_{21} normal alkane
n22	C_{22} normal alkane
n23	C_{23} normal alkane
n24	C_{24} normal alkane
n25	C_{25} normal alkane
n26	C_{26} normal alkane
n27	C_{27} normal alkane
n28	C_{28} normal alkane
n29	C_{29} normal alkane
n30	C_{30} normal alkane
n31	C_{31} normal alkane
n32	C_{32} normal alkane
n33	C_{33} normal alkane
T23	C_{23} tricyclic triterpane
T24	C_{24} tricyclic triterpane
T25	C_{25} tricyclic triterpane 22R+22S coeluting
Te24	C_{24} tetracyclic terpane
Ts	C_{27} 18α(H)trisnorneohopane
Tm	C_{27} 17α(H)trisnorneohopane
17b	C_{27} 17β(H)trisnorneohopane
H29	C_{29} 30-norhopane
29Ts	C_{29} 18α(H)norneohopane
M29	C_{29} normoretane
H30	C_{30} hopane
M30	C_{30} moretane
H31S	C_{31} homohopane 22S
H31R	C_{31} homohopane 22R
M31	C_{31} homomoretane, 22S+22R coeluting
H32S	C_{32} bishomohopane 22S
H32R	C_{32} bishomohopane 22R
H33S	C_{33} trishomohopane
H33R	C_{33} trishomohopane 22R
H34S	C_{34} tetrakishomohopane 22S
H34R	C_{34} tetrakishomohopane 22R

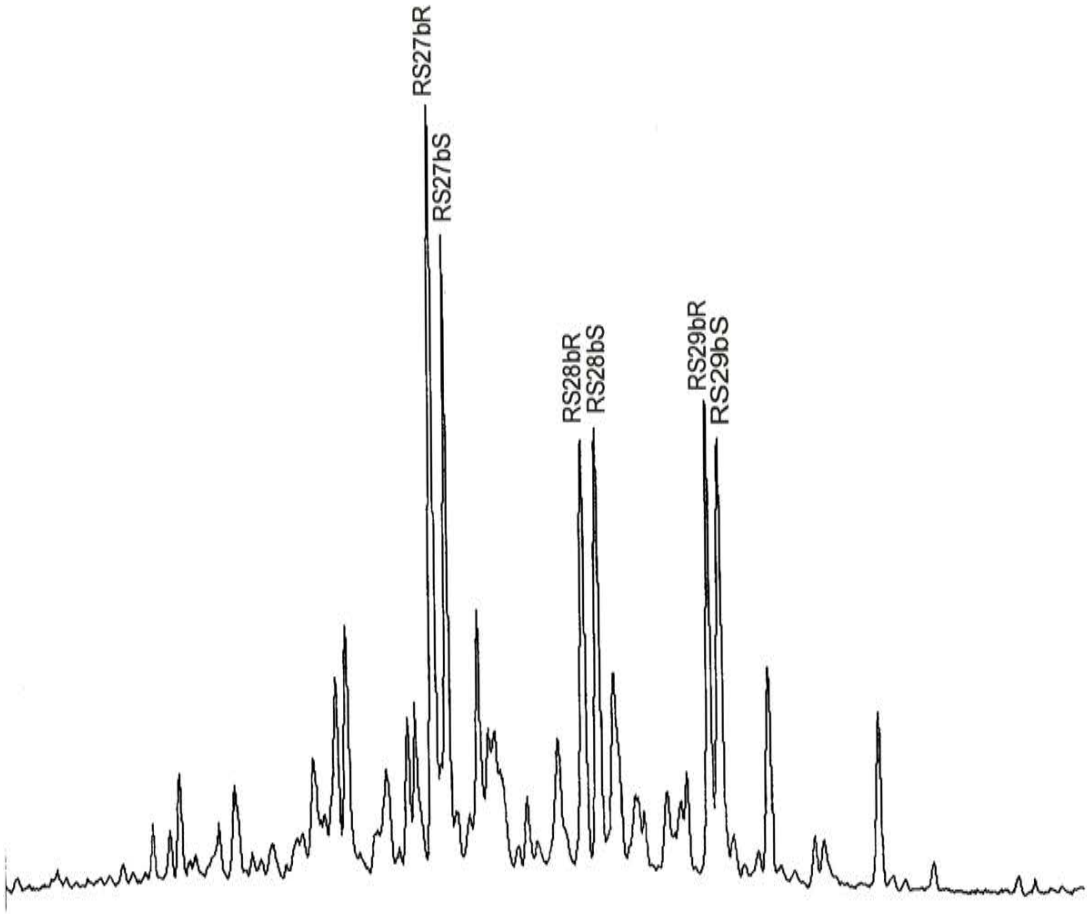
H35S	C_{35} pentakishomohopane 22S
H35R	C_{35} pentakishomohopane 22R
DS27	C_{27} diasterane, unknown isomer
RS29aS	C_{29} regular sterane, ααα-20S isomer
RS29bR	C_{29} regular sterane, αββ-20R isomer
RS29bS	C_{29} regular sterane, αββ-20S isomer
RS29aR	C_{29} regular sterane, ααα-20R isomer
RS27bR (m/z 218)	C_{27} regular sterane, αββ-20R isomer
RS27bS (m/z 218)	C_{27} regular sterane, αββ-20S isomer
RS28bR (m/z 218)	C_{28} regular sterane, αββ-20R isomer
RS28bS (m/z 218)	C_{28} regular sterane, αββ-20S isomer
RS29bR (m/z 218)	C_{29} regular sterane, αββ-20R isomer
RS29bS (m/z 218)	C_{29} regular sterane, αββ-20S isomer
RS30bR (m/z 218)	C_{30} regular sterane, αββ-20R isomer
RS30bS (m/z 218)	C_{30} regular sterane, αββ-20S isomer




m/z 191 (full)
T23
T24
Te24
T25
H30
H29
Tm
H31
S
R
M30
M29
M31
H32
S R
17β
Ts
29Ts
H33
S R
H34
S R
H35
S R
m/z 191 (partial)


DS27
RS29aS
RS29bR
RS29bS
RS29aR

m/z 217


RS27bR
RS27bS
RS28bR
RS28bS
RS29bR
RS29bS

m/z 218