DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2001/40

Rock-Eval/TOC screening data from selected wells in the Norwegian - Danish Basin

A compilation solicited by weXco aps., representing Amerada Hess and Sterling Resources

Jørgen A. Bojesen-Koefoed

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF ENVIRONMENT AND ENERGY

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Introduction

This compilation comprises existing Rock-Eval/TOC data from 11 selected wells in the Norwegian-Danish Basin. Unless otherwise stated, data were produced by GEUS or its predecessor institution DGU.

The selected wells are:

- Farsø-1
- Felicia-1
- Fjerritslev-2
- Kvols-1
- Lavø-1
- Mejrup-1
- Nøvling-1
- Rønde-1
- Slagelse-1
- Terne-1
- Års-1

The compilation was carried out for weXco aps, acting on behalf of Amerada Hess and Sterling resources, operators of licenses 4/99 and 5/97. Well selection was done by P. Willumsen of weXco aps.

In a few cases additional data exist, but have been left out of the compilation due to obvious and recognised data quality problems (sample contamination).

The compilation includes:

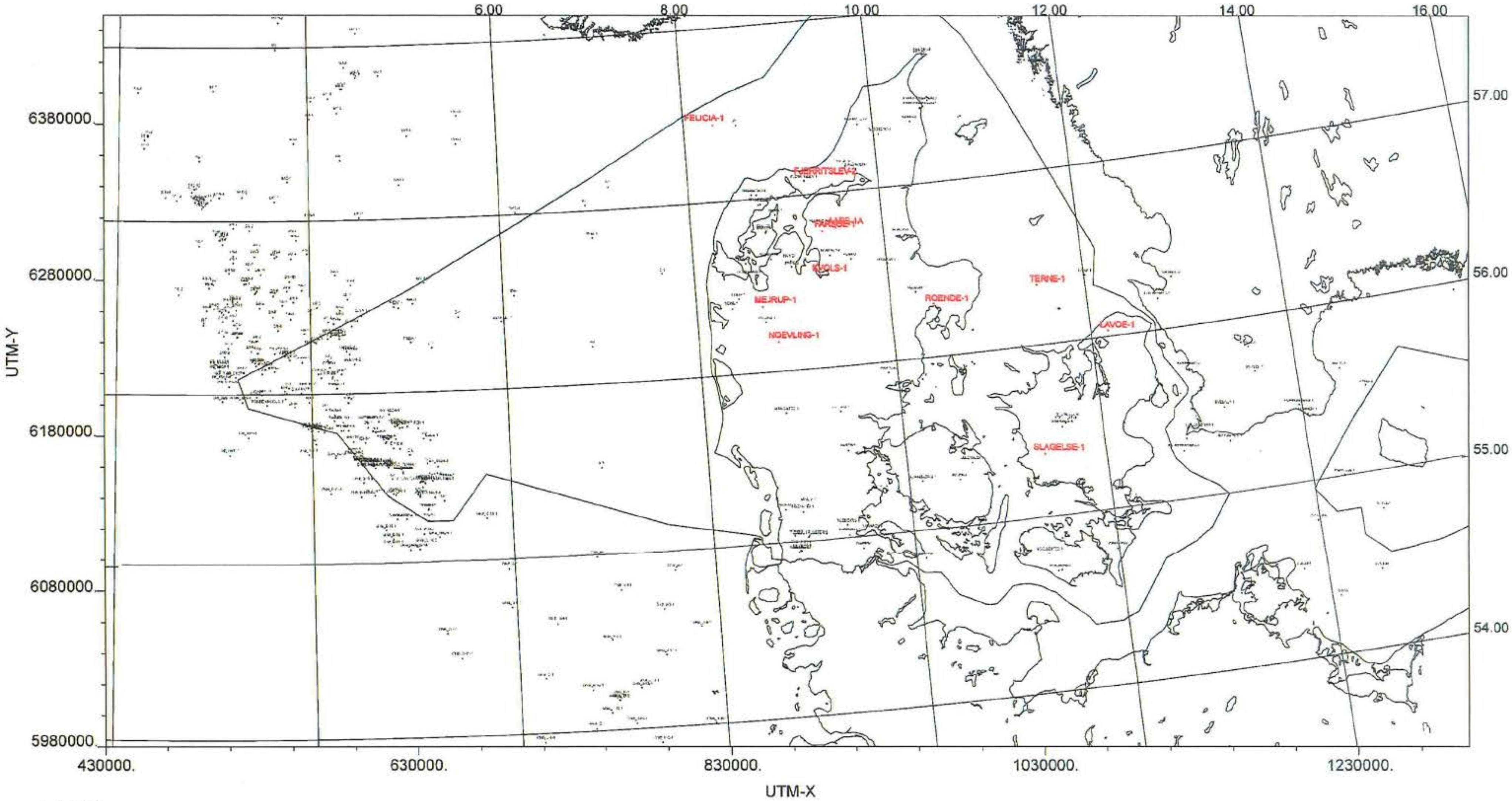
- Summary Table: well by well assessment of petroleum source potential in various stratigraphic units

- Tabulation of Rock-Eval/TOC screening data for each well.

- Tabulation of minimum, maximum and mean values of key parameters TOC, S2, and Hydrogen index in various stratigraphic units in each well.

- Plots of TOC, Hydrogen Index and Tmax versus depth for each well

- Preprint of paper (in press) by Petersen et al. on the establishment of a regional coalification curve for the Norwegian-Danish Basin



6.00
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6380000.
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1030000.
1230000.
UTM-Y
UTM-X
FELICIA-1
FJERRITSLEV-2
FARSOE-1
KVOLS-1
MEJRUP-1
NOEVLING-1
ROENDE-1
TERNE-1
LAVOE-1
SLAGELSE-1

Summary of petroleum source rock potential

	Farsø-1	Felicia-1	Fjerritslev-2	Kvols-1	Lavø-1	Mejrup-1	Nøvling-1	Rønde -1	Slagelse-1	Tørne-1	Års-1
Frederikshavn Formation			no source potential	no source potential		no source potential	no source potential	no source potential		excellent source potential	no source potential
Børglum Formation	no source potential	no source potential	marginal source potential in parts of succession	no source potential		no source potential	no source potential	no source potential			no source potential
Flyvbjerg Formation		no source potential	no source potential			no source potential				no source potential	no source potential
Haldager Sand Formation		marginal source potential in parts of succession	marginal source potential in parts of succession	no source potential		no source potential				excellent source potential	no source potential
Fjerritslev Formation F-IV	no source potential		marginal source potential in parts of succession	marginal source potential in parts of succession				excellent source potential		no source potential	marginal source potential in parts of succession
Fjerritslev Formation F-III	marginal to good source potential	marginal source potential in parts of succession	marginal source potential in parts of succession	good to excellent source potential		no source potential		good to excellent source potential		marginal source potential in parts of succession	marginal source potential in parts of succession
Fjerritslev Formation F-II	marginal source potential	no source potential	no source potential			no source potential	no source potential	marginal to good source potential		no source potential	marginal source potential in parts of succession
Fjerritslev Formation F-I	no source potential	no source potential	no source potential	no source potential		good source potential in parts of succession	no source potential	no source potential	no source potential	no source potential	marginal source potential in parts of succession
Gassum Formation		excellent source potential in parts of succession	no source potential	no source potential		marginal to good source potential	no source potential	no source potential	no source potential	no source potential	marginal source potential in parts of succession
Skagerrak Formation			no source potential								
Vinding Formation		no source potential		no source potential		good source potential in parts of succession	marginal source potential in parts of succession	no source potential	marginal source potential in parts of succession		no source potential
Oddesund Formation				no source potential			no source potential	marginal source potential in parts of succession	no source potential		
Tønder Formation							no source potential	no source potential	no source potential		
Falster Formation							no source potential	no source potential	no source potential		
Ørslev Formation							no source potential	Contamination ?, oil-based drilling mud	no source potential		
Bunter Sandstone Formation							no source potential	Contamination ?, oil-based drilling mud	no source potential		
Bunter Shale Formation							no source potential		no source potential		
Zechstein Group							no source potential	Contamination ?, oil-based drilling mud	no source potential		
Rotliegend Group								Contamination ?, oil-based drilling mud	no source potential		
Pre-Permian units							no source potential	Contamination ?, oil-based drilling mud	no source potential	no source potential	

Formation not penetrated by well (blue)

Formation absent (red)

Formation present, no data available (green)

Unit not defined in well (purple)

Criteria for assessment:

no source potential	$S2_{mean} < 2$, and $S2_{max} < 2$
marginal source potential in parts of succession	$S2_{mean} < 2$, and $2 < S2_{max} < 6$
marginal source potential	$2 < S2_{mean} < 6$,
good source potential	$6 < S2_{mean} < 10$
good source potential in parts of succession	$S2_{mean} < 2$, and $6 < S2_{max} < 10$
marginal to good source potential	$2 < S2_{mean} < 6$, and $6 < S2_{max} < 10$
excellent source potential	$S2_{mean} > 10$
excellent source potential in parts of succession	$S2_{mean} < 2$, and $S2_{max} > 10$
good to excellent source potential	$6 < S2_{mean} < 10$, and $S2_{max} > 10$

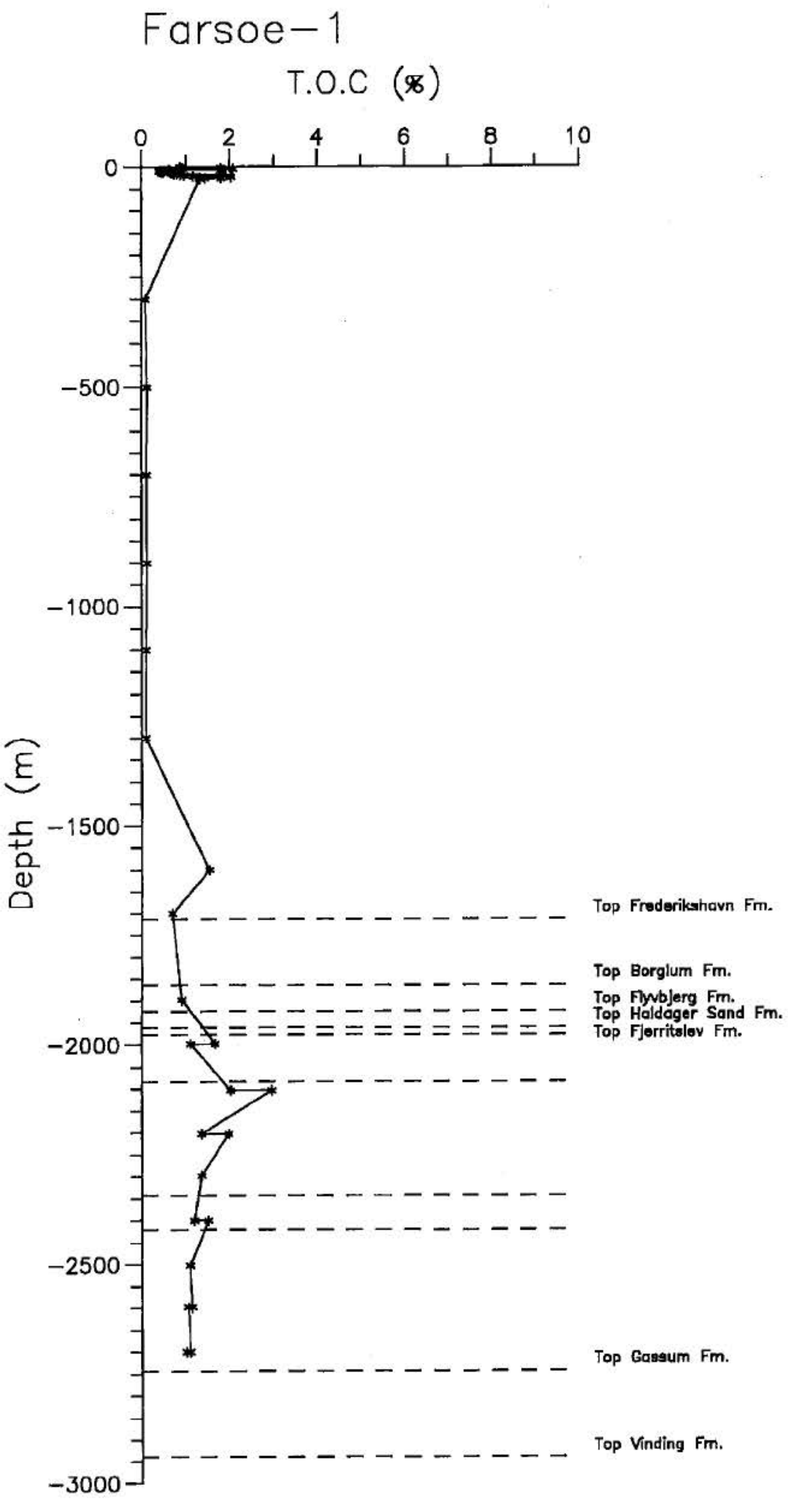
Farsø-1

Stratigraphy (b.rfl)	Rfl:	83 feet a. msl		
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	4708	1435	1410	279
Frederikshavn Fm.	5623	1714	1689	150
Børglum Fm.	6115	1864	1839	61
Flyvbjerg Fm.	6316	1925	1900	34
Haldager sand Fm.	6427	1959	1934	18
Fjerritslev Fm. F-IV	6486	1977	1952	107
Fjerritslev Fm. F-III	6837	2084	2059	259
Fjerritslev Fm. F-II	7687	2343	2318	77
Fjerritslev Fm. F-I	7940	2420	2395	323
Gassum Fm.	8999	2743	2718	198
Vinding Fm.	9649	2941	2916	9
TD	9678	2950	2925	

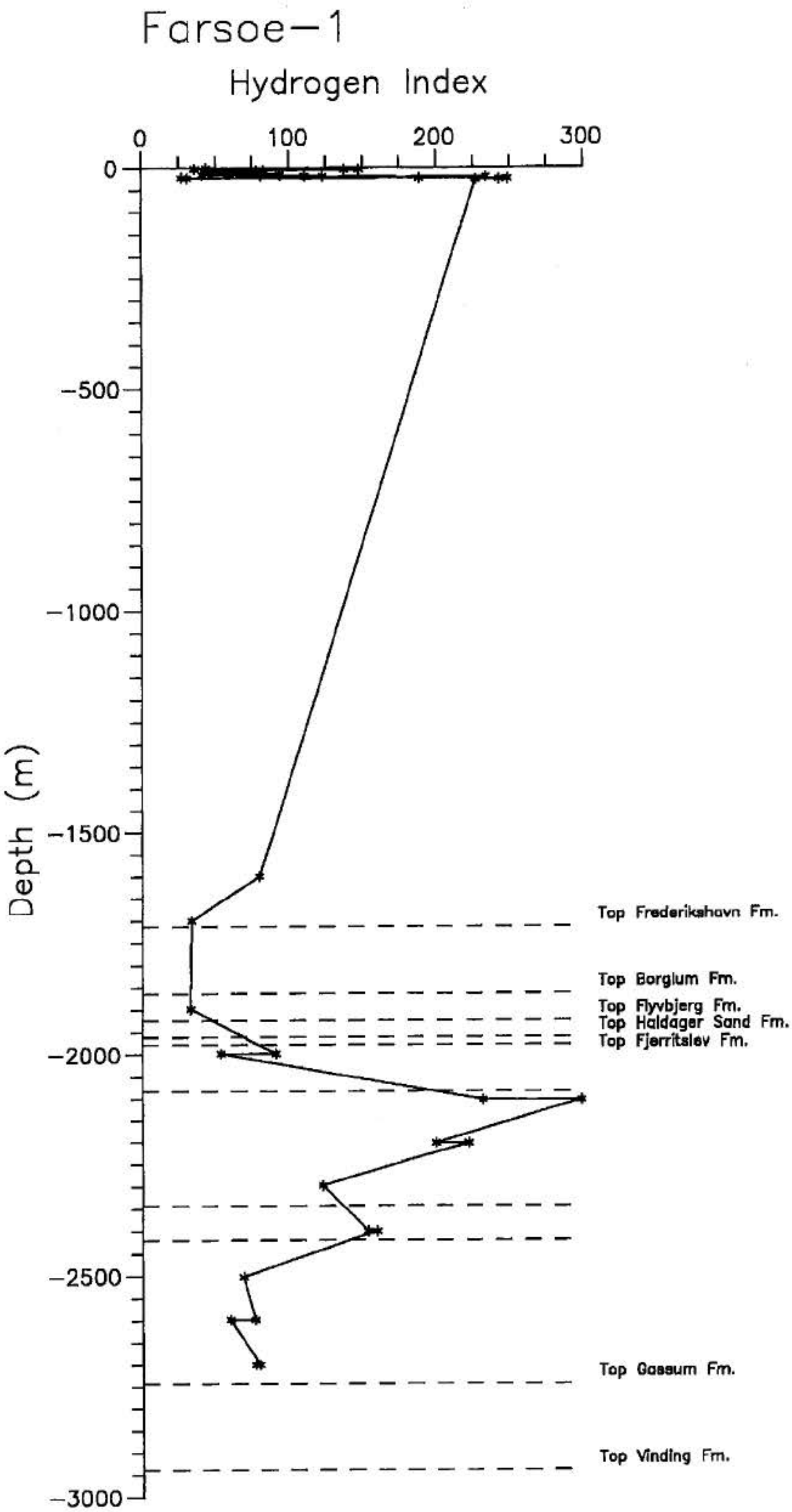
Cuttings

D (m)	D (feet)	TOC	Tmax	S1	S2	HI
1	3	0,87	419	0,08	0,38	44
2	7	0,89	423	0,04	0,39	44
3	10	0,92	420	0,04	0,33	36
4	13	1,82	431	0,10	2,51	138
5	16	2,08	429	7,00	3,08	148
6	20	0,82	430	0,69	0,68	83
7	23	0,63	428	0,27	0,49	78
8	26	0,49	416	0,03	0,23	47
9	30	0,46		0,05	0,22	48
10	33	0,41	423	0,03	0,24	59
11	36	0,80	428	0,05	0,34	43
12	39	0,46	419	0,14	0,36	78
13	43	0,50	415	0,04	0,23	46
14	46	0,68	414	0,05	0,40	59
15	49	0,81	432	0,22	0,76	94
16	52	0,73	417	0,03	0,30	41
17	56	1,84	426	0,11	1,73	94
18	59	0,89	429	0,11	0,72	81
19	62	0,96	433	0,23	1,18	123
20	66	1,78	429	0,15	1,97	111
21	69	1,17	430	0,20	2,74	234
22	72	2,03	424	0,07	0,55	27
23	75	2,03		0,08	0,62	31
24	79	1,32	429	0,23	2,50	189
25	82	1,81	431	0,25	4,50	249
26	85	1,44	430	0,45	3,50	243
27	89	1,32		0,07	0,35	27
300	984	0,09				
500	1640	0,13				
700	2297	0,11				
900	2953	0,13				
1100	3609	0,10				
1300	4265	0,10				
1600	5249	1,53	420	0,07	1,21	79
1700	5577	0,69	415	0,01	0,23	33
1898	6227	0,90	420	0,01	0,29	32
1998	6555	1,10	436	0,12	0,58	53
1998	6555	1,66	425	0,35	1,50	90
2103	6900	2,01	427	0,17	4,64	231
2103	6900	2,95	431	1,22	8,78	298
2202	7224	1,97	433	1,58	4,36	221
2202	7224	1,34	432	0,15	2,66	199
2298	7539	1,35	433	0,12	1,65	122
2400	7874	1,50	438	0,39	2,38	159
2400	7874	1,19	432	0,09	1,82	153
2502	8209	1,09	433	0,04	0,74	68
2598	8524	1,14	434	0,06	0,87	76
2598	8524	1,05	442	0,06	0,62	59
2700	8858	1,00	443	0,07	0,76	76
2700	8858	1,09	433	0,07	0,86	79

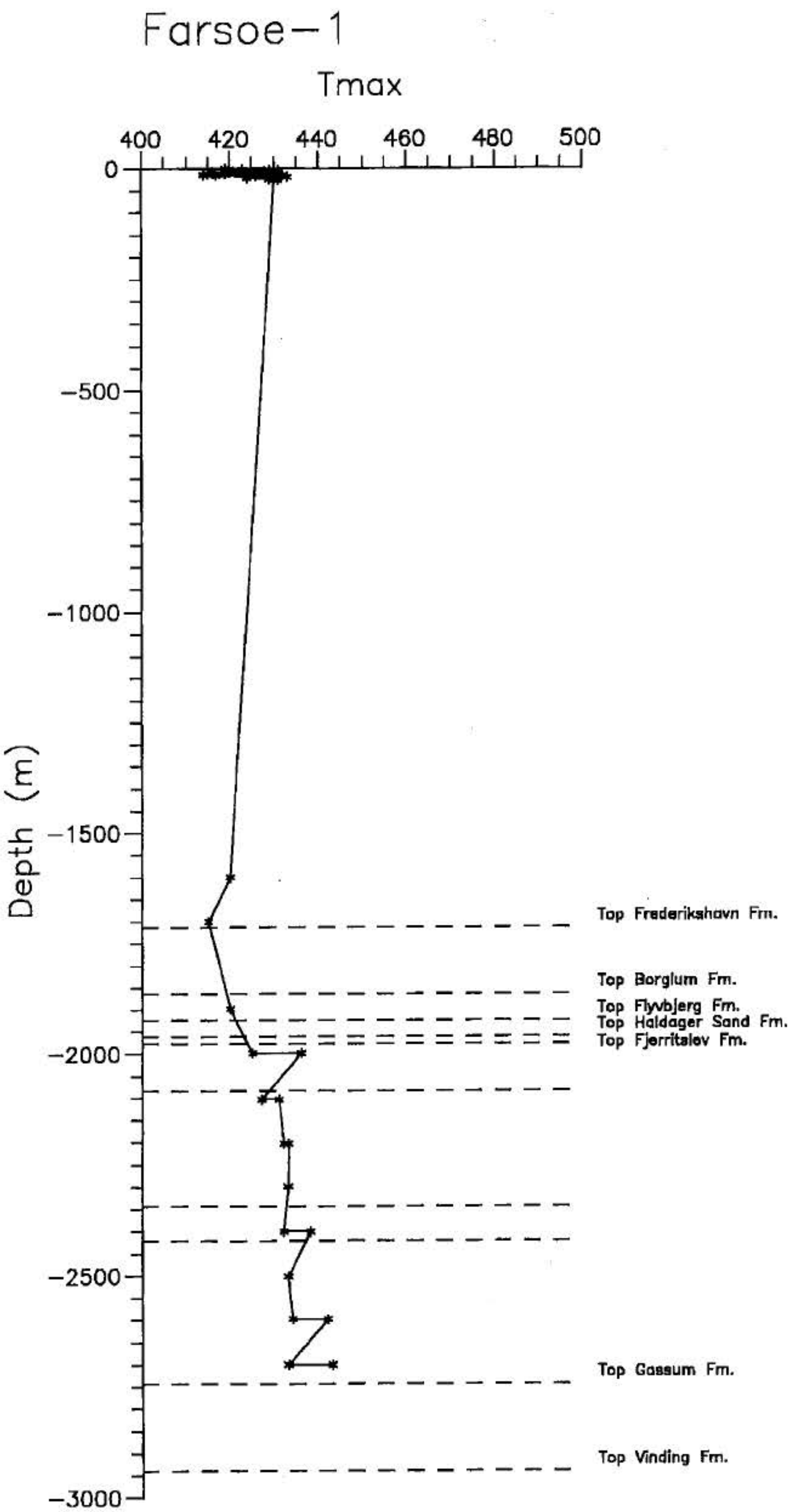
Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	150	no data	no data	no data	no data	no data	no data	no data	no data	no data
Børglum Fm.	61	0,90	0,90	***0,90***	0,29	0,29	***0,29***	32	32	***32***
Flyvbjerg Fm.	34	no data	no data	no data	no data	no data	no data	no data	no data	no data
Haldager sand Fm.	18	no data	no data	no data	no data	no data	no data	no data	no data	no data
Fjerritslev Fm. F-IV	107	1,10	1,66	***1,38***	0,58	1,50	***1,04***	53	90	***72***
Fjerritslev Fm. F-III	259	1,34	2,95	***1,92***	1,65	8,78	***4,42***	122	298	***214***
Fjerritslev Fm. F-II	77	1,19	1,50	***1,35***	1,82	2,38	***2,10***	153	159	***156***
Fjerritslev Fm. F-I	323	1,00	1,14	***1,07***	0,62	0,87	***0,77***	59	79	***72***
Gassum Fm.	198	no data	no data	no data	no data	no data	no data	no data	no data	no data
Vinding Fm.	9	no data	no data	no data	no data	no data	no data	no data	no data	no data



Farsoe-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.



Farsoe-1
Hydrogen Index
0
100
200
300
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.


Farsoe-1
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.

Felicia-1

Stratigraphy (b.rfl)	Rfl:	131 feet a. msl		
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	2467	752	712	113
Frederikshavn Fm.	2838	865	825	42
Børglum Fm.	2976	907	867	38
Flyvbjerg Fm.	3101	945	905	22
Haldager sand Fm.	3172	967	927	35
Fjerritslev Fm. F-IV	3287	1002	962	0
Fjerritslev Fm. F-III	3287	1002	962	134
Fjerritslev Fm. F-II	3727	1136	1096	148
Fjerritslev Fm. F-I	4211	1284	1244	262
Gassum Fm.	5069	1545	1505	230
Vinding Fm.	5823	1775	1735	140
Oddesund Fm.	6283	1915	1875	541
Skagerrak Fm.	8058	2456	2416	87
TD	8343	2543	2503	

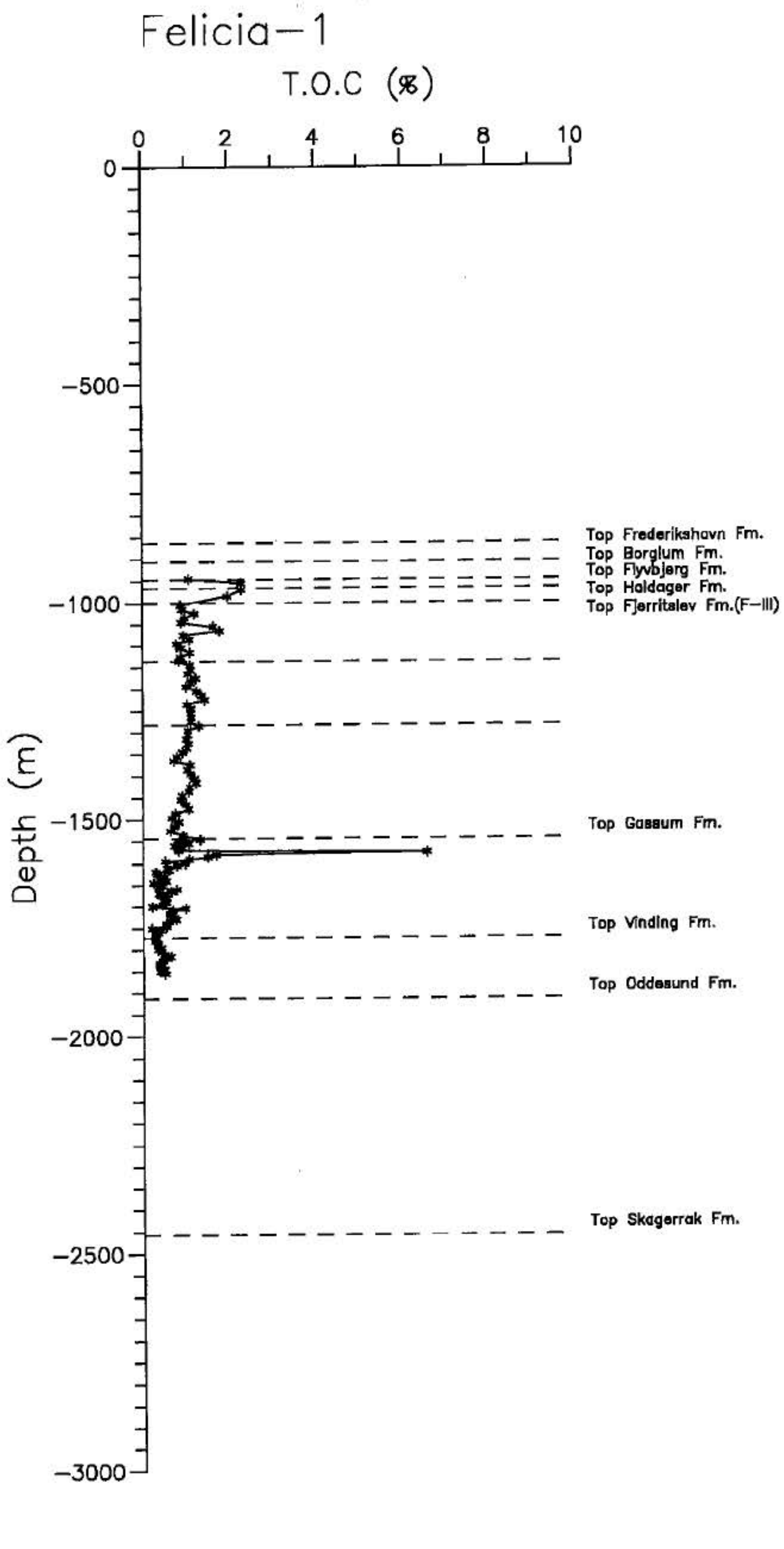
Revised stratigraphy, Lars Henrik Nielsen, GEUS 2000
GEUS data only, GEOCHEM data excluded due to improper cleaning of samples

Cuttings

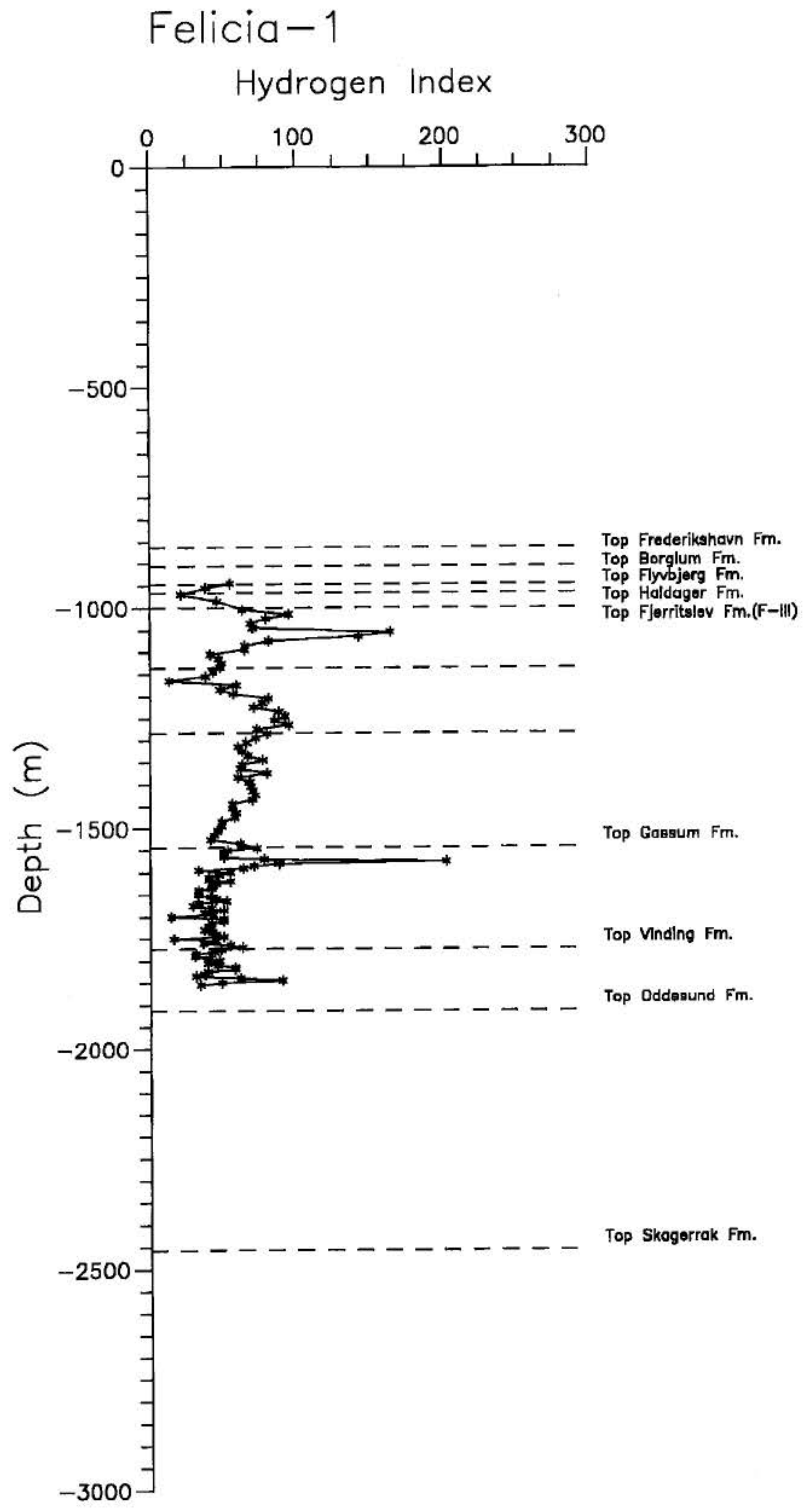
D (m)	D (feet)	TOC	Tmax	S1	S2	S3	HI	OI
945	3100	1,07	425	0,23	0,59		55	
955	3133	2,29	430	0,14	0,88		38	
970	3182	2,28	425	0,12	0,48		21	
985	3232	1,97	429	0,12	0,91		46	
1005	3297	0,87	426	0,1	0,55		63	
1015	3330	0,91	425	0,13	0,86		95	
1025	3363	1,2	428	0,16	0,95		79	
1035	3396	0,98	428	0,18	0,68		69	
1045	3428	0,89	426	0,13	0,62		70	
1055	3461	1,63	430	0,3	2,68		164	
1065	3494	1,79	428	0,3	2,55		142	
1075	3527	0,94	428	0,11	0,76		81	
1085	3560	1,08	430	0,12	0,7		65	
1095	3593	0,78	430	0,11	0,51		65	
1105	3625	0,88	429	0,05	0,36		41	
1115	3658	1,09	427	0,11	0,51		47	
1125	3691	0,87	431	0,09	0,43		49	
1135	3724	0,84	432	0,08	0,4		48	
1145	3757	1,1	428	0,12	0,47		43	
1155	3789	1,11	425	0,12	0,42		38	
1165	3822	1,04	431	0,06	0,14		13	
1175	3855	1,22	429	0,17	0,72		59	
1185	3888	1,11	428	0,11	0,53		48	
1195	3921	0,99	427	0,13	0,56		57	
1205	3953	1,25	430	0,25	1,01		81	
1215	3986	1,37	430	0,2	1,05		77	
1225	4019	1,43	428	0,22	1,02		71	
1235	4052	1,02	427	0,23	0,9		88	
1245	4085	1,12	428	0,22	1,03		92	
1255	4117	1,1	427	0,21	0,94		85	
1265	4150	1,12	430	0,28	1,06		95	
1275	4183	1,11	427	0,2	0,81		73	
1285	4216	1,29	427	0,22	1,03		80	
1295	4249	1,04	428	0,17	0,75		72	
1305	4281	1,04	426	0,16	0,69		66	
1315	4314	1	424	0,16	0,6		60	
1325	4347	1,05	424	0,21	0,66		63	
1335	4380	1,02	427	0,18	0,68		67	
1345	4413	0,91	429	0,18	0,7		77	
1355	4446	0,78	427	0,13	0,49		63	
1365	4478	0,71	427	0,14	0,44		62	
1375	4511	1,1	428	0,18	0,88		80	
1385	4544	1,02	430	0,13	0,61		60	
1395	4577	1,09	429	0,2	0,74		68	
1405	4610	1,2	431	0,23	0,83		69	
1415	4642	1,23	430	0,19	0,86		70	
1425	4675	1,08	429	0,15	0,78		72	
1435	4708	1,05	429	0,18	0,73		70	

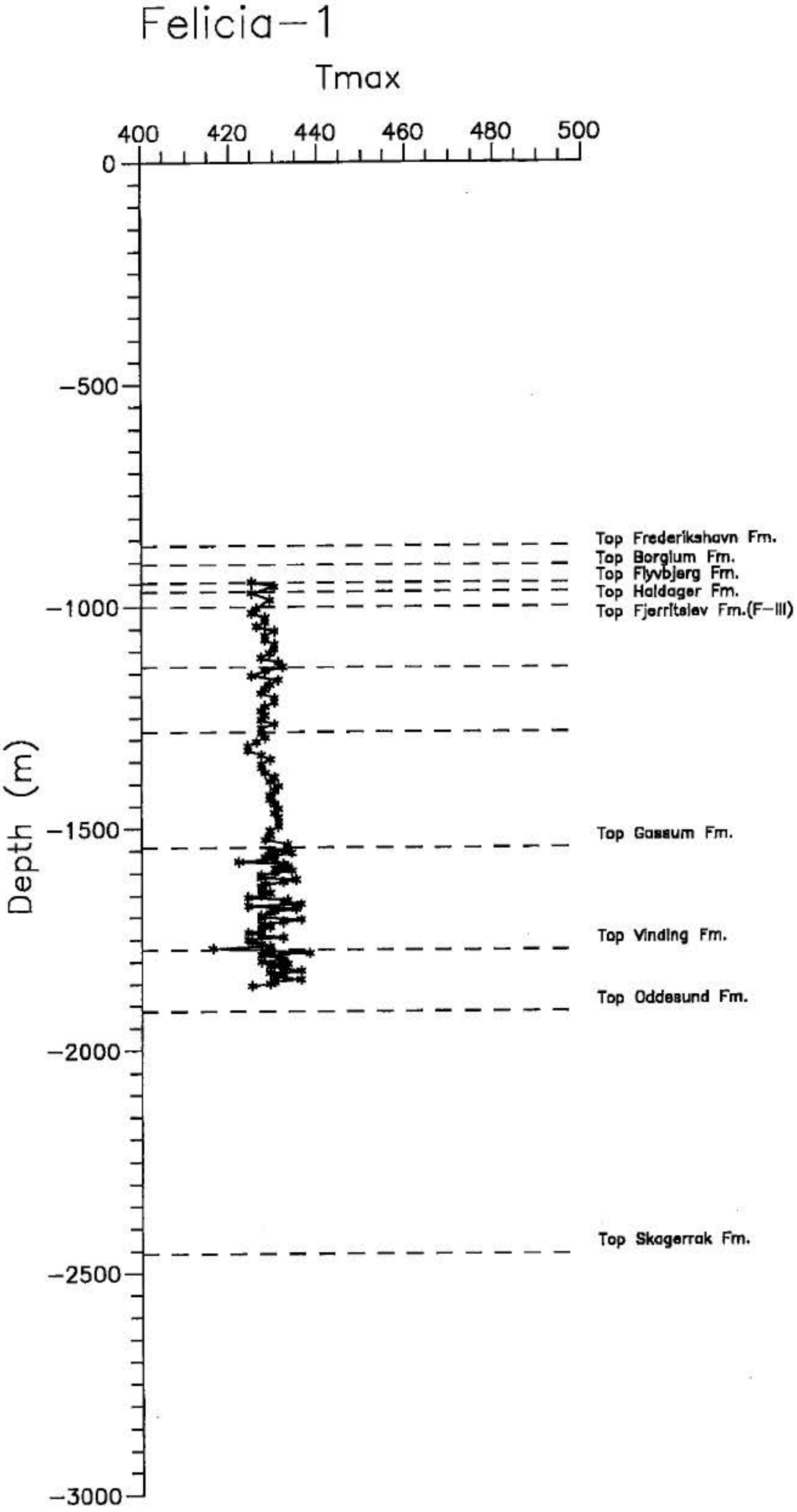
1445	4741	0,9	430	0,14	0,5		56	
1455	4774	0,87	431	0,12	0,49		56	
1465	4806	0,99	430	0,12	0,58		59	
1475	4839	1,06	431	0,13	0,61		58	
1485	4872	0,75	431	0,07	0,37		49	
1495	4905	0,65	431	0,08	0,32		49	
1505	4938	0,82	429	0,08	0,38		46	
1515	4970	0,72	429	0,08	0,32		44	
1525	5003	0,63	428	0,06	0,26		41	
1535	5036	0,91	433	0,12	0,56		62	
1545	5069	1,32	433	0,2	0,96		73	
1550	5085	0,83	429	0,01	0,44	1,15	53	139
1555	5102	1,06	434	0,01	0,53	1,30	50	123
1560	5118	0,72	430	0,01	0,36	1,35	50	187
1565	5135	0,88	428	0,01	0,44	1,42	50	161
1570	5151	0,81	430	0,01	0,63	1,14	78	141
1575	5167	6,58	422	0,14	13,29	1,68	202	26
1580	5184	1,70	432	0,03	1,50	2,63	88	155
1585	5200	1,50	433	0,02	1,06	1,45	71	97
1590	5217	1,07	430	0,02	0,68	1,17	64	109
1595	5233	0,51	434	0,03	0,17		33	
1600	5249	0,96	430	0,01	0,53	1,84	55	192
1605	5266	0,78	427	0,02	0,37	1,64	47	210
1610	5282	0,55	427	0,01	0,22	1,27	40	231
1615	5299	0,60	435	0,01	0,24	1,06	40	177
1620	5315	0,29	432	0,01	0,16	0,41	55	141
1625	5331	0,33	428	0,01	0,15	1,01	45	306
1630	5348	0,48	427	0,01	0,20	1,28	42	267
1635	5364	0,43	427	0,01	0,18	0,96	42	223
1640	5381	0,52	427	0,01	0,17	0,99	33	190
1645	5397	0,24	429	0,02	0,08		33	
1650	5413	0,40	427	0,01	0,13	0,92	32	230
1655	5430	0,37	424	0,01	0,15	0,98	41	265
1660	5446	0,77	433	0,02	0,35	1,24	45	161
1665	5463	0,64	432	0,01	0,33	1,67	52	261
1670	5479	0,36	436	0,00	0,12	1,07	33	297
1675	5495	0,41	424	0,01	0,12	0,93	29	227
1680	5512	0,53	435	0,01	0,22	1,31	42	247
1685	5528	0,48	430	0,01	0,24	1,22	50	254
1690	5545	0,52	429	0,01	0,19	1,22	37	235
1695	5561	0,44	427	0,01	0,19	1,16	43	264
1700	5577	0,21	427	0,01	0,03		14	
1705	5594	0,98	436	0,02	0,49	1,20	50	122
1710	5610	0,68	432	0,01	0,34	1,27	50	187
1715	5627	0,60	427	0,01	0,25	1,24	42	207
1720	5643	0,62	429	0,01	0,25	1,36	40	219
1725	5659	0,71	427	0,01	0,30	1,40	42	197
1730	5676	0,75	427	0,01	0,28	1,73	37	231
1735	5692	0,60	424	0,01	0,25	1,27	42	212
1740	5709	0,53	427	0,01	0,24	1,29	45	243
1745	5725	0,52	432	0,01	0,26	0,87	50	167
1750	5741	0,19	424	0,01	0,03		16	
1755	5758	0,42	425	0,00	0,19	1,05	45	250
1760	5774	0,33	427	0,00	0,12	0,86	36	261
1765	5791	0,29	429	0,00	0,16	0,90	55	310
1770	5807	0,27	416	0,01	0,17	0,75	63	278
1775	5823	0,27	429	0,00	0,13	0,76	48	281
1780	5840	0,27	438	0,00	0,12	0,79	44	293
1785	5856	0,32	427	0,00	0,10	0,95	31	297
1790	5873	0,33	431	0,00	0,10	0,84	30	255
1795	5889	0,40	432	0,00	0,16	1,03	40	257
1800	5906	0,34	427	0,00	0,16	0,95	47	279
1805	5922	0,41	433	0,00	0,16	1,16	39	283
1810	5938	0,48	429	0,00	0,22	0,93	46	194
1815	5955	0,62	432	0,01	0,36	1,25	58	202
1820	5971	0,50	436	0,00	0,29	1,12	58	224
1825	5988	0,46	429	0,00	0,18	1,48	39	322
1830	6004	0,38	432	0,01	0,14	1,12	37	295
1835	6020	0,36	430	0,00	0,11	1,07	31	297
1840	6037	0,39	436	0,00	0,24	1,12	62	287
1845	6053	0,48	430	0,01	0,43	1,14	90	238
1850	6070	0,39	429	0,01	0,19	0,80	49	205
1855	6086	0,50	425	0,01	0,17	0,93	34	186

Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	42	no data	no data	no data	no data	no data	no data	no data	no data	no data
Børglum Fm.	38	1,07	1,07	***1,07***	0,59	0,59	***0,59***	55	55	***55***
Flyvbjerg Fm.	22	2,29	2,29	***2,29***	0,88	0,88	***0,88***	38	38	***38***
Haldager sand Fm.	35	1,97	2,28	***2,13***	0,48	0,91	***0,70***	21	46	***34***
Fjerritslev Fm. F-III	134	0,78	1,79	***1,05***	0,36	2,68	***0,90***	41	164	***77***
Fjerritslev Fm. F-II	148	0,99	1,43	***1,15***	0,14	1,06	***0,76***	13	95	***66***
Fjerritslev Fm. F-I	262	0,63	1,32	***0,97***	0,26	1,03	***0,62***	41	80	***63***
Gassum Fm.	230	0,19	6,58	***0,73***	0,03	13,29	***0,59***	14	202	***49***
Vinding Fm.	140	0,27	0,62	***0,41***	0,10	0,43	***0,20***	30	90	***46***
Oddesund Fm.	541	no data	no data	no data	no data	no data	no data	no data	no data	no data
Skagerrak Fm.	87	no data	no data	no data	no data	no data	no data	no data	no data	no data



Felicia-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Fm.
Top Fjerritslev Fm.(F-III)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Skagerrak Fm.


Felicia-1
Hydrogen Index
0
100
200
300
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Fm.
Top Fjerritslev Fm.(F-III)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Skagerrak Fm.


Felicia-1
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Fm.
Top Fjerritslev Fm.(F-III)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Skagerrak Fm.

Fjerritslev-2

Stratigraphy (b.rfl)	Rfl:	26,25 feet a. msl		
	Top (feet)	Top (m)	B. msl (m)	Thk (m)
L. Cretaceous	991	302	294	707
Frederikshavn Fm.	3310	1009	1001	142
Børglum Fm.	3776	1151	1143	113
Flyvbjerg Fm.	4147	1264	1256	24
Haldager sand Fm.	4226	1288	1280	34
Fjerritslev Fm. F-IV	4337	1322	1314	77
Fjerritslev Fm. F-III	4590	1399	1391	279
Fjerritslev Fm. F-II	5505	1678	1670	179
Fjerritslev Fm. F-I	6093	1857	1849	376
Gassum Fm.	7326	2233	2225	96
Skagerrak Fm.	7641	2329	2321	16
TD	7694	2345	2337	

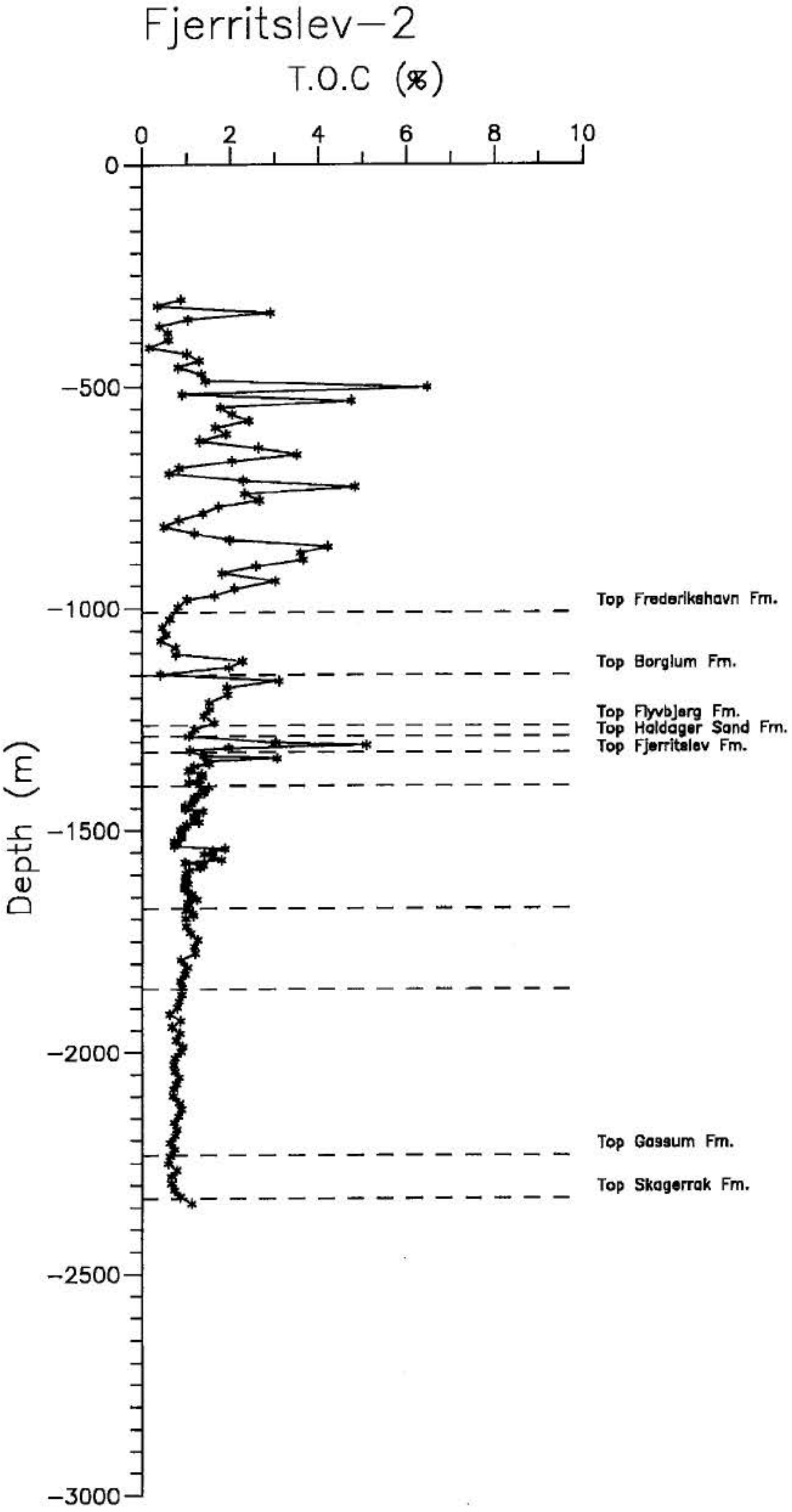
Cuttings

D (m)	D (feet)	TOC	Tmax	S1	S2	HI
304	997	0,87	401	0,03	0,08	9
319	1047	0,34		0	0,02	6
334	1096	2,91	419	0,08	0,68	23
349	1145	1,03	407	0,02	0,12	12
364	1194	0,39		0	0	0
379	1243	0,59		0	0,06	10
394	1293	0,60		0,01	0,05	8
412	1352	0,16		0	0	0
427	1401	1,01	417	0,04	0,56	55
442	1450	1,29	413	0,02	0,2	16
457	1499	0,81	415	0,02	0,21	26
472	1549	1,34		0,02	0,12	9
487	1598	1,43	416	0,07	0,45	31
502	1647	6,47	406	1,07	23,96	370
517	1696	0,90	415	0,1	0,69	77
532	1745	4,74	413	0,66	7,31	154
547	1795	1,78	416	0,17	1,07	60
562	1844	2,04	417	0,02	0,37	18
577	1893	2,43	415	0,03	0,27	11
592	1942	1,66	414	0,03	0,31	19
607	1991	1,90	420	0,04	0,59	31
622	2041	1,31	419	0,07	0,82	63
638	2093	2,64	409	0,04	0,11	4
653	2142	3,51		0	0,05	1
668	2192	2,04	416	0,02	0,2	10
683	2241	0,83		0,01	0,07	8
695	2280	0,61	469	0	0,07	11
711	2333	2,30	410	0,03	0,14	6
726	2382	4,83	419	0,03	0,58	12
741	2431	2,32	454	0,01	0,11	5
756	2480	2,66	459	0,01	0,27	10
771	2530	1,74	454	0,01	0,07	4
786	2579	1,36	415	0	0,17	12
801	2628	0,84	452	0	0,1	12
816	2677	0,49		0	0,06	12
831	2726	1,19	450	0,02	0,19	16
846	2776	1,98	410	0,03	0,21	11
861	2825	4,22	421	0,03	0,44	10
876	2874	3,59	456	0,01	0,13	4
891	2923	3,66	417	0,04	0,29	8
906	2972	2,58	421	0,01	0,07	3
921	3022	1,81		0,01	0,03	2
939	3081	3,02	412	0,1	0,31	10
957	3140	2,09	459	0	0,07	3
972	3189	1,65	417	0,01	0,12	7
981	3219	1,00	467	0,01	0,1	10
997	3271	0,81	449	0,04	0,07	9
1025	3363	0,63	418	0,03	0,3	48
1043	3422	0,45	418	0,04	0,22	49
1058	3471	0,54	421	0,03	0,29	54

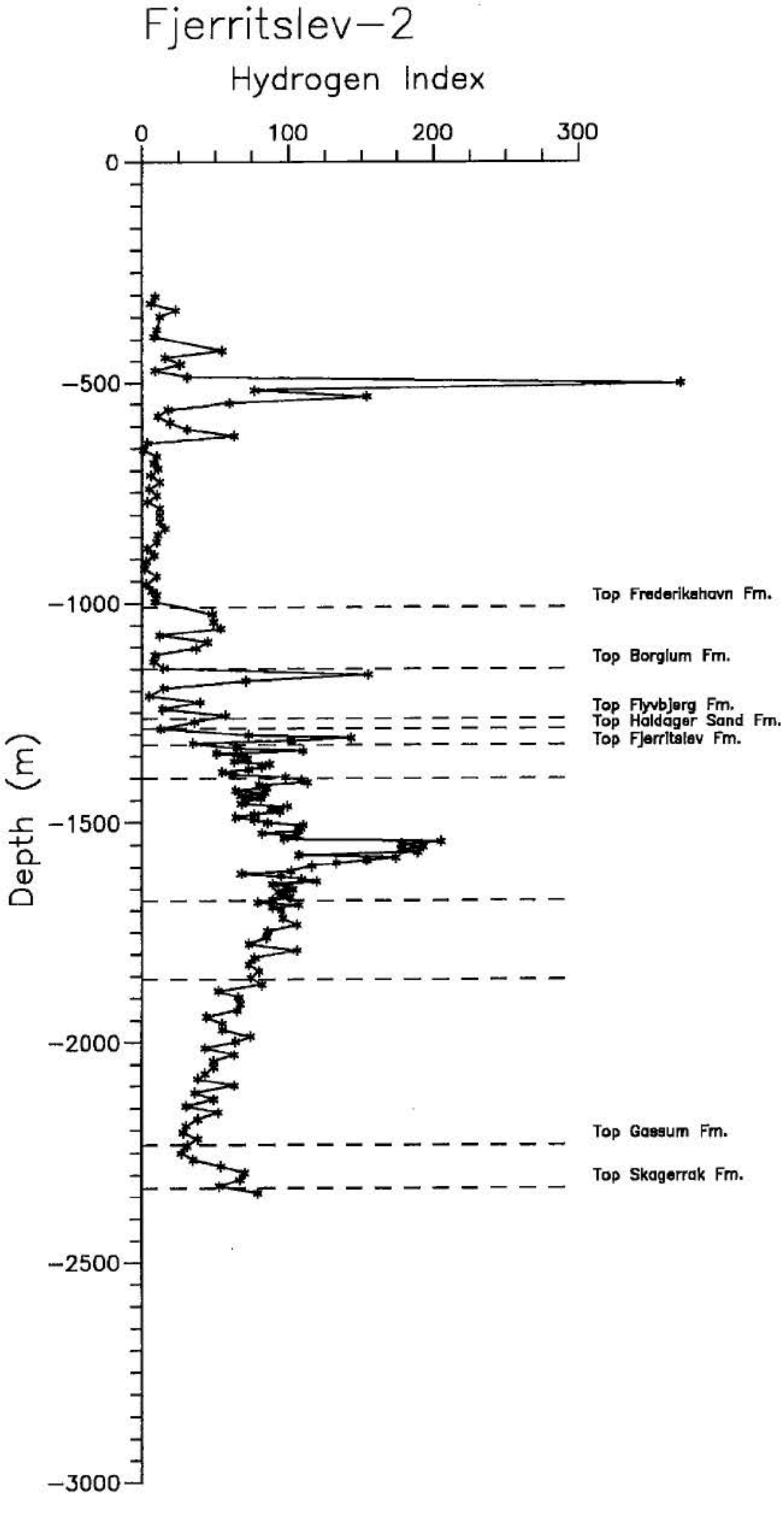
1073	3520	0,42	427	0,01	0,05	12
1088	3570	0,75	421	0,01	0,34	45
1103	3619	0,76	421	0,01	0,28	37
1118	3668	2,29	426	0,03	0,2	9
1133	3717	1,97	467	0,01	0,16	8
1148	3766	0,40	473	0	0,06	15
1163	3816	3,10	421	0,2	4,82	155
1178	3865	1,92	432	0,08	1,37	71
1194	3917	1,93	426	0,03	0,28	15
1212	3976	1,52	436	0,03	0,08	5
1227	4026	1,53	429	0,06	0,61	40
1242	4075	1,40	425	0,02	0,2	14
1257	4124	1,63	425	0,07	0,93	57
1272	4173	1,19	427	0,07	0,43	36
1287	4222	1,05	427	0,02	0,14	13
1302	4272	3,03	431	0,15	2,2	73
1308	4291	5,09	416	0,97	7,29	143
1314	4311	1,96	427	0,15	2	102
1320	4331	1,07	425	0,14	0,37	35
1332	4370	1,38	430	0,09	0,9	65
1338	4390	3,06	425	0,21	3,37	110
1344	4409	1,47	428	0,18	0,75	51
1350	4429	1,51	428	0,09	1,03	68
1356	4449	1,18	429	0,08	0,85	72
1362	4469	1,09	432	0,07	0,69	63
1368	4488	1,03	431	0,09	0,9	87
1374	4508	1,35	432	0,1	1,11	82
1380	4528	1,35	429	0,19	0,98	73
1386	4547	1,31	422	0,07	0,72	55
1392	4567	1,05	425	0,07	0,65	62
1398	4587	1,29	432	0,11	1,27	98
1404	4606	1,50	431	0,15	1,64	109
1410	4626	1,41	433	0,1	1,6	113
1416	4646	1,40	430	0,06	1,12	80
1422	4665	1,27	430	0,1	1,08	85
1428	4685	1,18	428	0,08	0,75	64
1434	4705	1,15	432	0,07	0,97	84
1440	4724	1,11	428	0,05	0,75	68
1446	4744	0,96	430	0,06	0,78	81
1452	4764	0,97	431	0,05	0,69	71
1458	4783	1,37	426	0,08	0,93	68
1464	4803	1,23	431	0,06	1,22	99
1470	4823	1,15	430	0,07	1,01	88
1476	4843	1,17	431	0,06	1,1	94
1482	4862	1,28	421	0,04	0,98	77
1488	4882	1,00	416	0,04	0,64	64
1494	4902	0,95	421	0,06	0,73	77
1500	4921	0,85	422	0,07	0,73	86
1506	4941	0,88	425	0,11	0,97	110
1512	4961	0,89	424	0,08	0,96	108
1518	4980	0,87	423	0,07	0,93	107
1524	5000	0,72	421	0,05	0,59	82
1530	5020	0,79	422	0,09	0,84	106
1536	5039	0,72	423	0,06	0,7	97
1542	5059	1,88	425	0,14	3,86	205
1548	5079	1,59	426	0,12	2,83	178
1554	5098	1,40	425	0,12	2,7	193
1560	5118	1,59	425	0,13	2,83	178
1567	5141	1,80	423	0,16	3,41	189
1573	5161	0,97	423	0,08	1,04	107
1579	5180	1,38	424	0,13	2,4	174
1585	5200	1,30	426	0,11	2	154
1591	5220	1,05	425	0,11	1,4	133
1597	5240	0,98	424	0,08	1,14	116
1609	5279	0,99	423	0,12	1,01	102
1615	5299	0,96	423	0,05	0,65	68
1621	5318	1,03	425	0,06	0,98	95
1627	5338	0,96	426	0,08	1,05	109
1633	5358	0,95	429	0,1	1,13	119
1639	5377	1,03	428	0,09	0,92	89
1645	5397	1,12	429	0,12	1,11	99
1651	5417	1,11	429	0,13	1,14	103
1657	5436	1,24	432	0,13	1,15	93
1663	5456	1,02	429	0,12	0,99	97
1669	5476	1,06	432	0,1	1,07	101
1675	5495	1,02	424	0,17	0,91	89
1681	5515	0,98	428	0,11	0,77	79

1687	5535	1,14	430	0,16	1,22	107
1693	5564	1,16	431	0,11	1,03	89
1699	5574	0,98	425	0,1	0,93	95
1717	5633	0,99	428	0,11	0,95	96
1732	5682	1,09	429	0,15	1,15	106
1747	5732	1,25	428	0,14	1,07	86
1762	5781	1,17	431	0,19	1	85
1777	5830	1,20	431	0,18	0,87	73
1792	5879	0,87	432	0,22	0,92	106
1809	5935	1,01	429	0,27	0,78	77
1824	5984	0,97	430	0,19	0,71	73
1839	6033	0,86	431	0,12	0,69	80
1854	6083	0,90	430	0,21	0,67	74
1869	6132	0,89	431	0,12	0,73	82
1884	6181	0,83	431	0,15	0,43	52
1898	6227	0,79	428	0,17	0,52	66
1913	6276	0,63	430	0,08	0,42	67
1928	6325	0,86	429	0,1	0,56	65
1942	6371	0,68	428	0,19	0,3	44
1957	6421	0,85	431	0,2	0,47	55
1972	6470	0,77	430	0,05	0,42	55
1987	6519	0,91	432	0,06	0,67	74
1999	6558	0,87	430	0,07	0,56	64
2013	6604	0,74	432	0,04	0,32	43
2028	6654	0,72	429	0,09	0,45	63
2043	6703	0,74	431	0,16	0,36	49
2057	6749	0,83	428	0,16	0,41	49
2072	6798	0,77	429	0,16	0,33	43
2084	6837	0,72	427	0,07	0,27	38
2099	6886	0,70	430	0,07	0,44	63
2115	6939	0,84	431	0,06	0,3	36
2130	6988	0,88	431	0,07	0,43	49
2145	7037	0,82	431	0,03	0,25	30
2160	7087	0,73	430	0,06	0,38	52
2175	7136	0,78	429	0,1	0,3	38
2190	7185	0,74	430	0,02	0,22	30
2205	7234	0,64	430	0,08	0,18	28
2220	7283	0,73	429	0,08	0,28	38
2235	7333	0,64	429	0,08	0,2	31
2251	7385	0,60	431	0,02	0,16	27
2266	7434	0,78	431	0,04	0,27	35
2281	7484	0,67	432	0,09	0,36	54
2296	7533	0,67	434	0,13	0,47	70
2311	7582	0,73	431	0,12	0,49	67
2326	7631	0,86	433	0,06	0,46	53
2341	7680	1,12	436	0,16	0,89	79

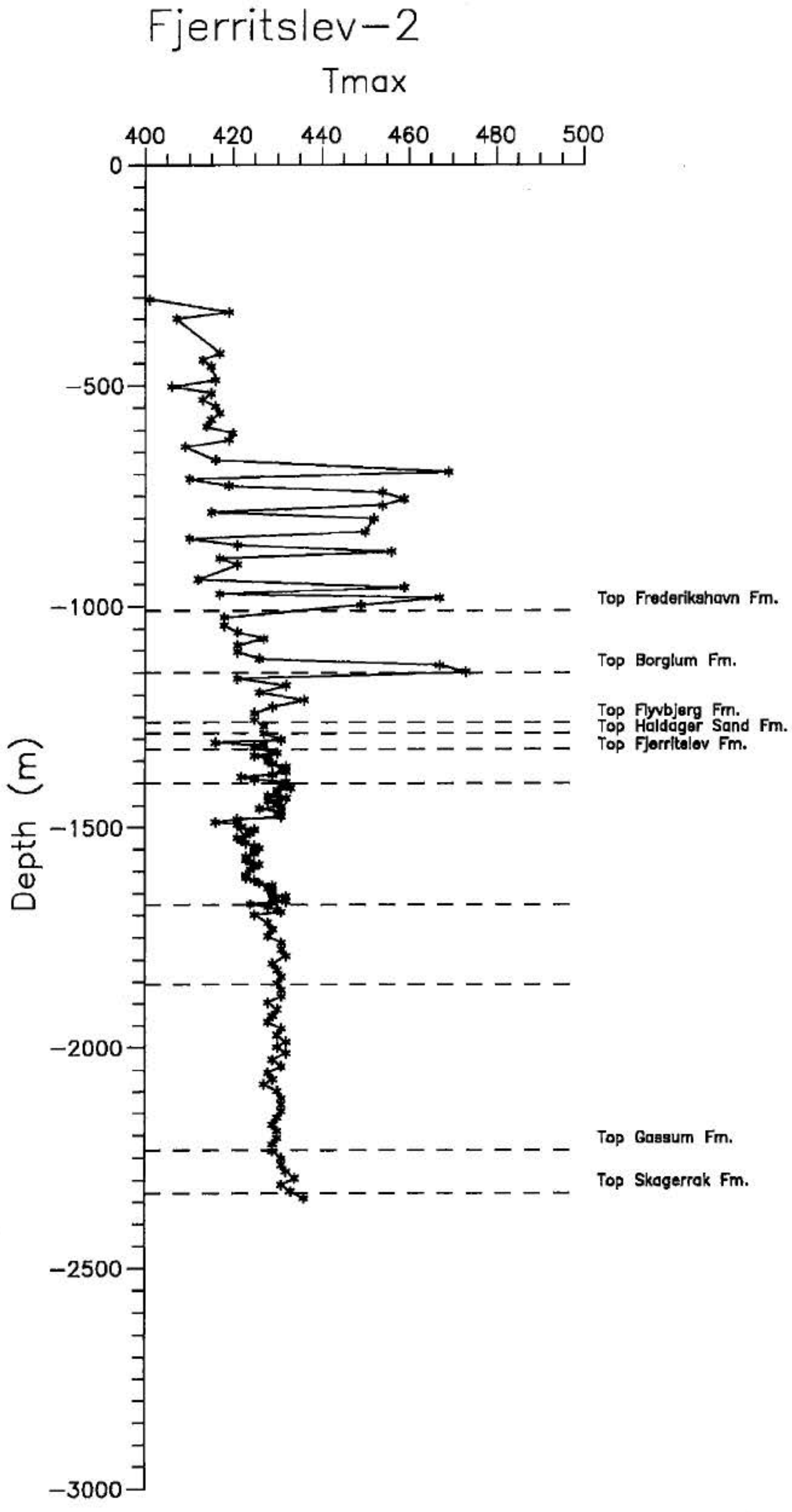
Unit	Thk (m)	TOC (min)	TOC (max)	*TOC (mean)*	S2 (min)	S2 (max)	*S2 (mean)*	HI (min)	HI (max)	*HI (mean)*
Frederikshavn Fm.	142	0,40	2,29	*0,91*	0,05	0,34	*0,21*	8	54	*31*
Børglum Fm.	113	1,40	3,10	*1,86*	0,08	4,82	*1,18*	5	155	*51*
Flyvbjerg Fm.	24	1,05	1,19	*1,12*	0,14	0,43	*0,29*	13	36	*25*
Haldager sand Fm.	34	1,07	5,09	*2,79*	0,37	7,29	*2,97*	35	143	*88*
Fjerritslev Fm. F-IV	77	1,03	3,06	*1,42*	0,65	3,37	*1,10*	51	110	*74*
Fjerritslev Fm. F-III	279	0,72	1,88	*1,14*	0,59	3,86	*1,28*	64	205	*107*
Fjerritslev Fm. F-II	179	0,86	1,25	*1,04*	0,67	1,22	*0,91*	73	107	*88*
Fjerritslev Fm. F-I	376	0,63	0,91	*0,78*	0,18	0,73	*0,40*	28	82	*51*
Gassum Fm.	96	0,60	0,86	*0,71*	0,16	0,49	*0,34*	27	70	*48*
Skagerrak Fm.	16	1,12	1,12	*1,12*	0,89	0,89	*0,89*	79	79	*79*



Fjerritslev−2
T.O.C (%)
0
2
4
6
8
10
0
−500
−1000
−1500
−2000
−2500
−3000
Depth (m)
Top Frederikshavn Fm.
Top Børglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Skagerrak Fm.



Fjerritslev-2
Hydrogen Index
0
100
200
300
Depth (m)
0
-500
-1000
-1500
-2000
-2500
-3000
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Skagerrak Fm.


Fjerritslev-2
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Skagerrak Fm.

Kvols-1

Stratigraphy (b.rfl)	Rfl:	63	feet a. msl.	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	5712	1741	1722	134
Frederikshavn Fm.	6152	1875	1856	56
Børglum Fm.	6335	1931	1912	28
Flyvbjerg Fm.	6427	1959	1940	0
Haldager sand Fm.	6427	1959	1940	15
Fjerritslev Fm. F-IV	6476	1974	1955	18
Fjerritslev Fm. F-III	6535	1992	1973	201
Fjerritslev Fm. F-II	7195	2193	2174	3
Fjerritslev Fm. F-I	7205	2196	2177	228
Gassum Fm.	7953	2424	2405	109
Vinding Fm.	8310	2533	2514	69
Oddesund Fm.	8537	2602	2583	39
TD	8665	2641	2622	

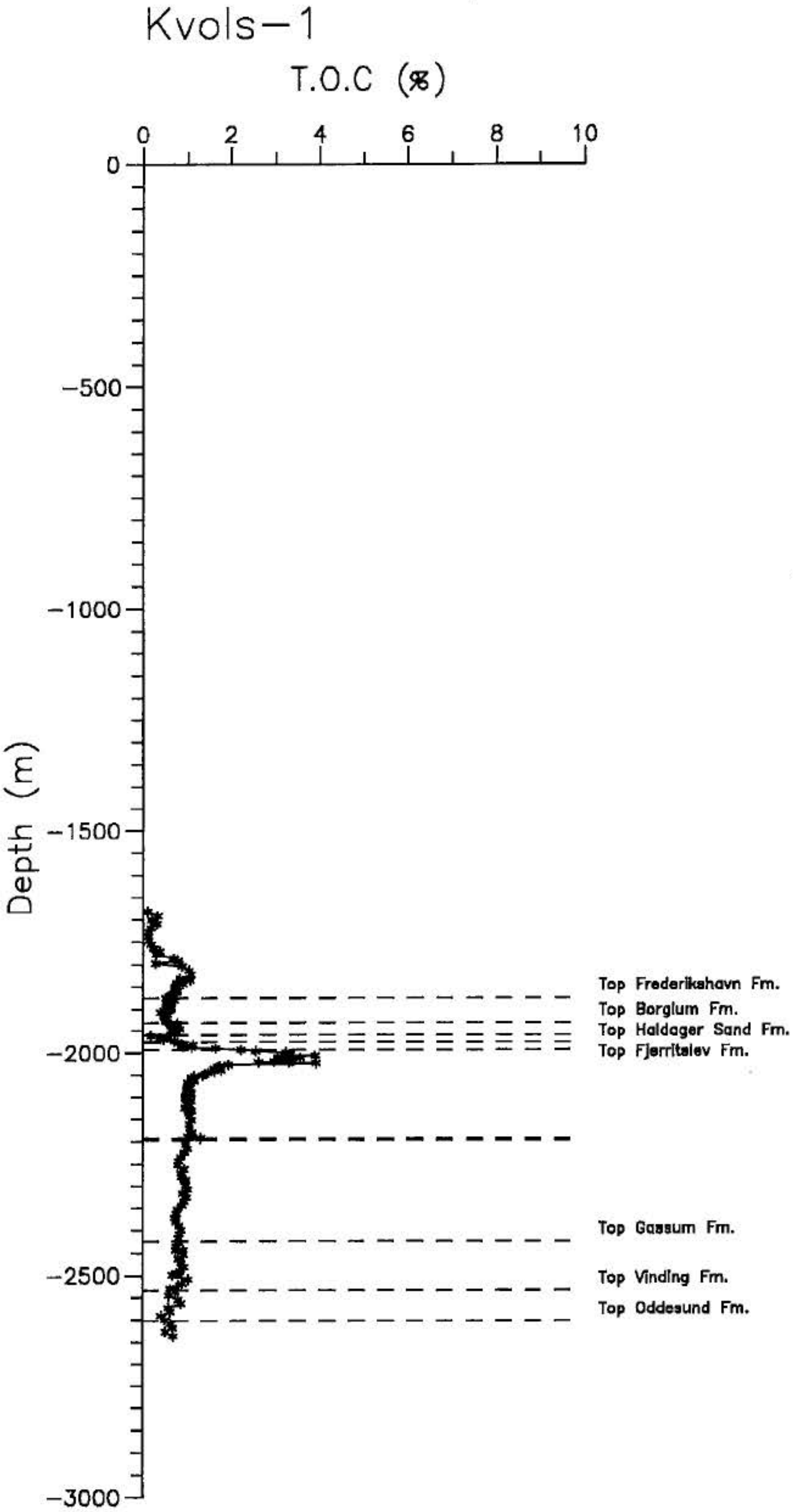
Cuttings

D (m)	D (feet)	TOC	Tmax	S1	S2	HI
1682	5520	0,10		0,01	0,01	10
1692	5550	0,33		0,07	0,10	30
1701	5580	0,20		0,03	0,07	35
1710	5610	0,31		0,04	0,10	32
1719	5640	0,18		0,01	0,01	6
1728	5670	0,13		0,01	0,00	0
1737	5700	0,13		0,01	0,00	0
1747	5730	0,13		0,02	0,00	0
1756	5760	0,18		0,03	0,05	28
1765	5790	0,25		0,00	0,00	0
1771	5810	0,38		0,18	0,16	42
1777	5830	0,30		0,02	0,03	10
1786	5860	0,69	428	0,10	0,28	41
1792	5880	0,79	427	0,07	0,27	34
1798	5900	0,29	428	0,05	0,13	45
1804	5920	0,88	426	0,05	0,24	27
1814	5950	1,04	432	0,07	0,44	42
1823	5980	1,10	432	0,07	0,43	39
1832	6010	0,83	427	0,05	0,22	27
1835	6020	1,07	429	0,07	0,42	39
1838	6030	0,83	427	0,07	0,25	30
1841	6040	0,76	426	0,13	0,36	47
1844	6050	0,90	427	0,05	0,24	27
1847	6060	0,74	426	0,07	0,20	27
1850	6070	0,72	424	0,04	0,15	21
1853	6080	0,71	425	0,05	0,19	27
1856	6090	0,71	424	0,07	0,19	27
1859	6100	0,77	425	0,07	0,20	26
1862	6110	0,75	435	0,08	0,34	45
1865	6120	0,66	427	0,10	0,32	48
1868	6130	0,63	425	0,04	0,17	27
1871	6140	0,62	423	0,07	0,15	24
1875	6150	0,51	417	0,08	0,11	22
1878	6160	0,61	421	0,08	0,18	30
1881	6170	0,71	420	0,09	0,14	20
1884	6180	0,63	422	0,11	0,20	32
1887	6190	0,52	424	0,10	0,19	37
1890	6200	0,61	422	0,10	0,20	33
1893	6210	0,53	423	0,10	0,23	43
1896	6220	0,62	428	0,11	0,43	69
1899	6230	0,62	427	0,09	0,32	52
1902	6240	0,60	427	0,12	0,40	67
1905	6250	0,47	425	0,15	0,39	83
1908	6260	0,39	412	0,06	0,13	33
1911	6270	0,52	425	0,09	0,20	38
1914	6280	0,54	423	0,08	0,20	37
1917	6290	0,47	428	0,05	0,11	23
1920	6300	0,48	427	0,07	0,16	33
1923	6310	0,51	427	0,09	0,28	55
1926	6320	0,51	427	0,08	0,32	63
1929	6330	0,53	426	0,06	0,21	40
1932	6340	0,77	428	0,09	0,41	53

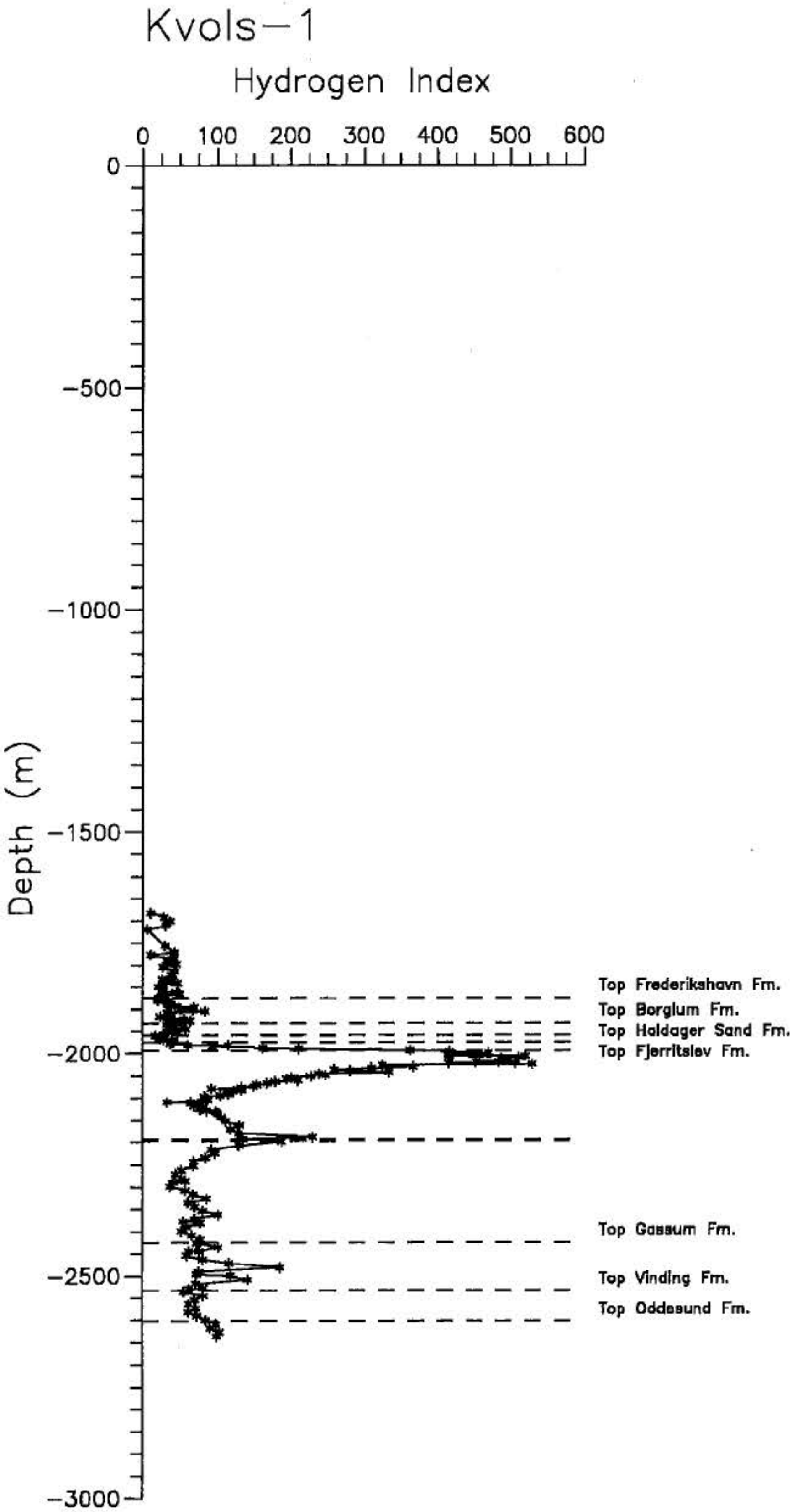
1935	6350	0,62	429	0,05	0,20	32
1939	6360	0,64	428	0,07	0,26	41
1942	6370	0,76	426	0,15	0,28	37
1945	6380	0,83	431	0,06	0,47	57
1948	6390	0,66	428	0,08	0,29	44
1951	6400	0,68	427	0,04	0,23	34
1954	6410	0,71	428	0,07	0,33	46
1957	6420	0,62	424	0,06	0,17	27
1960	6430	0,18		0,01	0,03	17
1963	6440	0,56	422	0,10	0,17	30
1966	6450	0,39		0,04	0,09	23
1966	6450	0,38				0
1969	6460	0,47	430	0,04	0,13	28
1972	6470	0,71	430	0,06	0,27	38
1975	6480	0,78	427	0,11	0,32	41
1978	6490	0,78	428	0,10	0,29	37
1981	6500	0,91	428	0,10	0,55	60
1981	6500	1,13	437	0,06	1,3	115
1984	6510	0,91	431	0,12	0,85	93
1987	6520	1,10	431	0,13	1,78	162
1990	6530	1,65	432	0,17	3,48	211
1993	6540	2,23	428	0,32	8,08	362
1996	6550	2,56	428	0,33	10,66	416
1999	6560	3,24	424	0,47	15,18	469
2003	6570	3,33	426	0,43	13,88	417
2003	6570	3,35	430	0,38	13,9	415
2006	6580	3,29	424	0,56	17,07	519
2006	6580	3,9	428	0,49	16,22	416
2009	6590	3,04	422	0,50	15,53	511
2012	6600	3,57	424	0,52	17,38	487
2015	6610	3,06	423	0,50	15,17	496
2018	6620	2,97	424	0,42	14,35	483
2018	6620	3,38	428	0,34	15,29	452
2021	6630	2,62	424	0,54	13,24	505
2021	6630	3,3	429	0,67	13,72	416
2024	6640	3,92	414	0,46	20,75	529
2027	6650	1,94	426	0,24	6,29	324
2030	6660	1,73	427	0,22	6,33	366
2033	6670	1,69	426	0,21	5,24	310
2036	6680	1,61	428	0,20	4,17	259
2039	6690	1,78	426	0,24	4,98	280
2042	6700	1,63	427	0,24	5,43	333
2045	6710	1,47	427	0,17	3,49	237
2048	6720	1,40	427	0,20	3,46	247
2051	6730	1,35	429	0,19	3,07	227
2054	6740	1,16	429	0,14	2,33	201
2057	6750	1,09	429	0,14	2,12	194
2060	6760	1,16	430	0,17	2,43	209
2063	6770	1,16	430	0,13	2,07	178
2067	6780	1,01	431	0,13	1,69	167
2070	6790	1,05	429	0,13	1,62	154
2073	6800	1,02	430	0,14	1,53	150
2076	6810	1,01	430	0,13	1,34	133
2079	6820	0,99	431	0,09	0,91	92
2082	6830	1,02	429	0,13	1,35	132
2085	6840	0,99	430	0,12	1,21	122
2088	6850	1,07	432	0,12	1,22	114
2091	6860	1,10	435	0,12	1,26	115
2094	6870	1,08	434	0,12	1,12	104
2097	6880	0,96	435	0,08	0,79	82
2100	6890	0,96	436	0,11	0,82	85
2103	6900	0,97	434	0,10	0,85	88
2106	6910	1,01	435	0,10	0,80	79
2109	6920	1,10	435	0,11	0,36	33
2109	6920	1,03	436	0,03	0,66	64
2112	6930	1,04	435	0,07	0,67	64
2115	6940	1,03	434	0,11	0,71	69
2118	6950	1,01	435	0,08	0,70	69
2121	6960	1,04	435	0,09	0,84	81
2124	6970	0,95	434	0,10	0,74	78
2128	6980	1,07	434	0,10	0,91	85
2131	6990	1,11	433	0,13	1,09	98
2134	7000	1,03	434	0,12	1,02	99
2143	7030	1,06	436	0,09	1,12	106
2152	7060	1,11	435	0,13	1,24	112
2161	7090	1,04	433	0,12	1,36	131
2170	7120	1,06	434	0,11	1,25	118
2179	7150	1,12	432	0,14	1,44	129
2188	7180	1,01	432	0,19	2,32	230

2192	7190	1,31	437	0,08	1,77	135
2198	7210	0,97	434	0,15	1,81	187
2207	7240	0,97	434	0,12	1,26	130
2216	7270	1,00	434	0,10	0,92	92
2225	7300	0,94	434	0,12	0,92	98
2234	7330	0,85	435	0,09	0,72	85
2243	7360	0,79	433	0,09	0,54	68
2252	7390	0,78	433	0,10	0,53	68
2262	7420	0,92	433	0,09	0,48	52
2271	7450	0,85	433	0,09	0,38	45
2280	7480	0,86	433	0,09	0,45	52
2286	7500	0,96	435	0,03	0,55	57
2289	7510	0,95	434	0,08	0,39	41
2298	7540	0,97	431	0,09	0,36	37
2307	7570	1,00	435	0,11	0,57	57
2316	7600	0,90	434	0,12	0,61	68
2326	7630	0,98	435	0,14	0,84	86
2335	7660	0,93	436	0,11	0,56	60
2344	7690	0,87	435	0,14	0,61	70
2353	7720	0,77	438	0,07	0,62	81
2362	7750	0,75	437	0,12	0,76	101
2371	7780	0,71	436	0,09	0,50	70
2377	7800	0,74	435	0,02	0,4	54
2380	7810	0,74	432	0,11	0,57	77
2390	7840	0,81	433	0,07	0,47	58
2399	7870	0,86	433	0,13	0,45	52
2408	7900	0,82	432	0,12	0,54	66
2417	7930	0,80	433	0,17	0,62	78
2426	7960	0,81	432	0,10	0,59	73
2435	7990	0,75	429	0,18	0,76	101
2444	8020	0,73	433	0,11	0,55	75
2444	8020	0,91	436	0,05	0,56	62
2454	8050	0,91	434	0,15	0,53	58
2463	8080	0,80	433	0,15	0,64	80
2472	8110	0,86	435	0,17	0,99	115
2481	8140	0,92	435	0,22	1,71	186
2490	8170	0,83	434	0,09	0,62	75
2496	8190	0,8	437	0,06	0,57	71
2499	8200	0,66	436	0,12	0,78	118
2509	8230	1,02	434	0,16	1,44	141
2518	8260	0,88	435	0,12	0,63	72
2527	8290	0,76	434	0,12	0,62	82
2530	8300	0,61	438	0,02	0,38	62
2536	8320	0,73	438	0,11	0,40	55
2545	8350	0,59	438	0,11	0,48	81
2554	8380	0,79	437	0,11	0,55	70
2563	8410	0,86	438	0,11	0,53	62
2573	8440	0,57	437	0,09	0,40	70
2582	8470	0,61	434	0,09	0,38	62
2591	8500	0,41	434	0,08	0,30	73
2600	8530	0,50	441	0,08	0,42	84
2609	8560	0,63	435	0,11	0,62	98
2618	8590	0,66	436	0,06	0,59	89
2627	8620	0,51	436	0,16	0,53	104
2637	8650	0,68	437	0,12	0,68	100

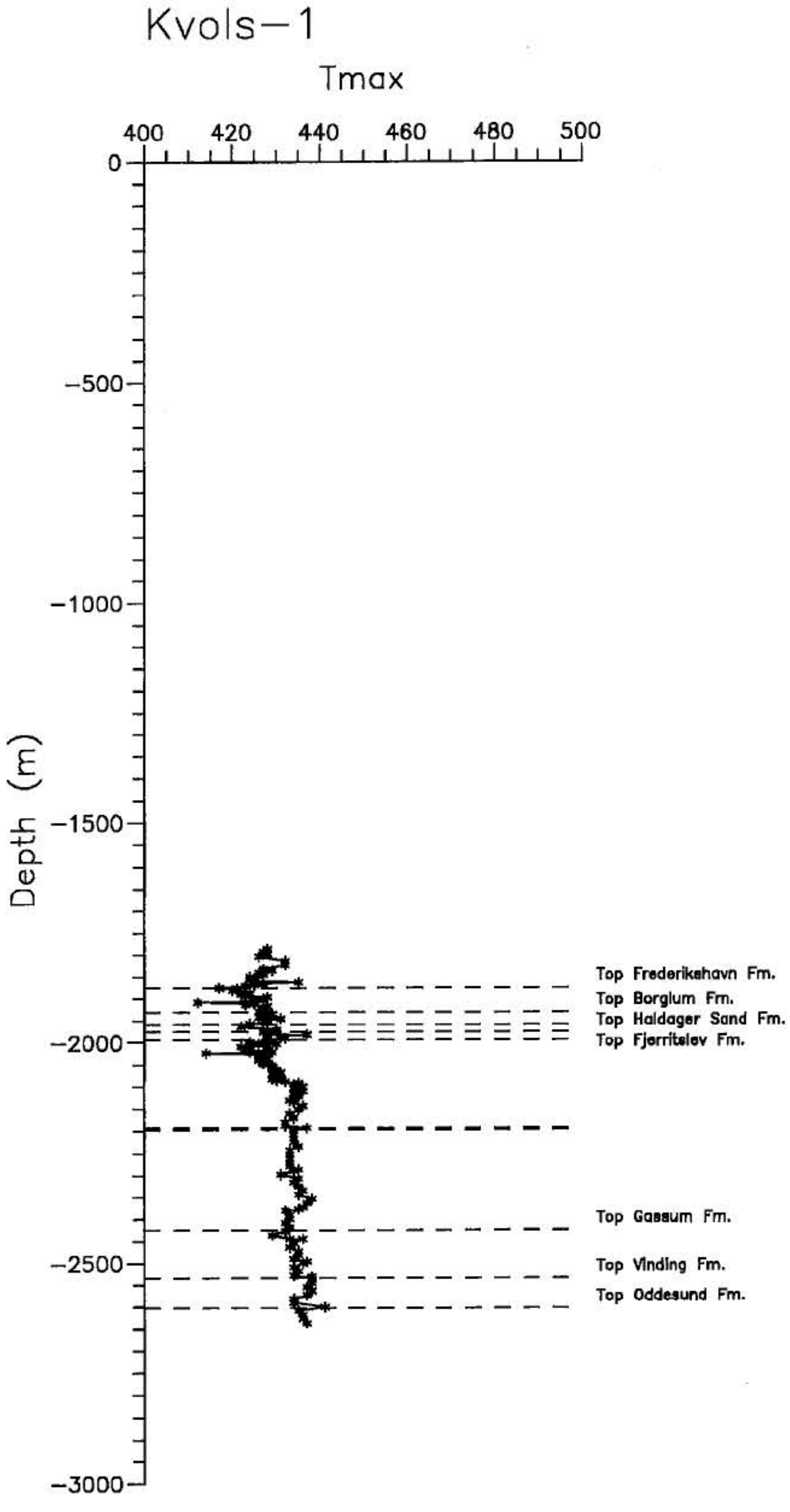
Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	56	0,39	0,71	***0,55***	0,11	0,43	***0,23***	20	83	***43***
Børglum Fm.	28	0,62	0,83	***0,70***	0,17	0,47	***0,29***	27	57	***41***
Haldager sand Fm.	15	0,18	0,71	***0,45***	0,03	0,27	***0,14***	0	38	***23***
Fjerritslev Fm. F-IV	18	0,78	1,65	***1,04***	0,29	3,48	***1,22***	37	211	***103***
Fjerritslev Fm. F-III	201	0,95	3,92	***1,68***	0,36	20,75	***5,20***	33	529	***230***
Fjerritslev Fm. F-II	3	no data	no data	no data	no data	no data	no data	no data	no data	no data
Fjerritslev Fm. F-I	228	0,71	1,00	***0,87***	0,36	1,81	***0,65***	37	187	***74***
Gassum Fm.	109	0,61	1,02	***0,82***	0,38	1,71	***0,76***	58	186	***91***
Vinding Fm.	69	0,41	0,86	***0,63***	0,30	0,55	***0,43***	55	84	***70***
Oddesund Fm.	39	0,51	0,68	***0,62***	0,53	0,68	***0,61***	89	104	***98***



Kvols-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.



Kvols-1
Hydrogen Index
0
100
200
300
400
500
600
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.


Kvols-1
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.

Lavø-1

Stratigraphy (b.rfl)	Rfl:	92	feet a. msl.	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	6375	1943	1915	130
Frederikshavn Fm.	6801	2073	2045	0
Børglum Fm.	6801	2073	2045	0
Flyvbjerg Fm.	6801	2073	2045	0
Haldager sand Fm.	6801	2073	2045	0
Fjerritslev Fm. F-IV	6801	2073	2045	0
Fjerritslev Fm. F-III	6801	2073	2045	0
Fjerritslev Fm. F-II	6801	2073	2045	0
Fjerritslev Fm. F-I	6801	2073	2045	60
Gassum Fm.	6998	2133	2105	235
Vinding Fm.	7769	2368	2340	73
TD	8009	2441	2413	

Core

D (m)	D (feet)	TOC	Tmax	S1	S2	HI
594	1950	0,41				
633	2077,5	0,31				
659	2163	0,65				
695	2280	0,45				
730	2396,5	0,22				

Data from Gulf R & D Co. 1972, GEUS report file 2291

Mejrup-1

Stratigraphy (b.rfl)	Rfl:	155	feet a. msl	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	4690	1430	1382	219
Frederikshavn Fm.	5407	1648	1601	64
Børglum Fm.	5616	1712	1665	33
Flyvbjerg Fm.	5725	1745	1698	3
Haldager sand Fm.	5736	1748	1701	1
Fjerritslev Fm. F-IV	5740	1750	1702	0
Fjerritslev Fm. F-III	5740	1750	1702	55
Fjerritslev Fm. F-II	5922	1805	1758	51
Fjerritslev Fm. F-I	6088	1856	1808	369
Gassum Fm.	7297	2224	2177	105
Vinding Fm.	7640	2329	2281	204
TD	8308	2532	2485	

Cuttings and SWC   *=Litton Core Lab. data

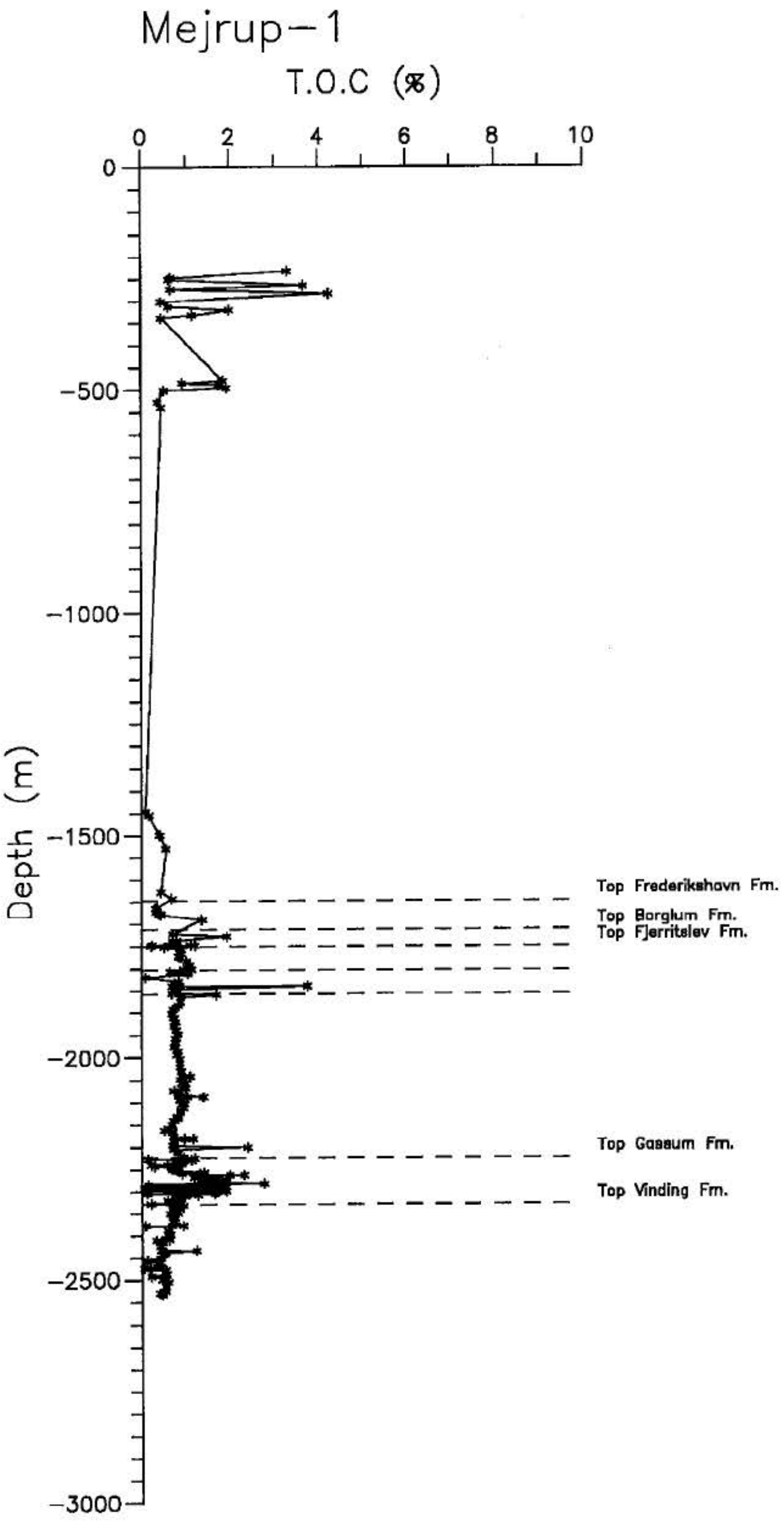
D (m)	D (feet)	TOC	Tmax	S1	S2	HI	
232	760	3,30	428	0,21	3,72	113	SWC*
247	812	0,66		0,10	0,54	82	SWC*
251	823	0,63	403	0,08	0,44	70	SWC*
265	870	3,67	427	0,31	3,07	84	*
273	896	0,67	400	0,10	0,61	91	SWC*
283	930	4,24	428	0,41	6,27	148	*
301	988	0,46		0,07	0,34	74	SWC*
312	1025	0,61		0,06	0,14	23	SWC*
320	1050	2,00	408	0,08	0,57	29	*
332	1090	1,15	404	0,08	0,46	40	SWC*
338	1110	0,45		0,04	0,14	31	SWC*
479	1573	1,85	416	0,15	2,66	144	SWC*
485	1590	0,93	418	0,31	6,02	647	*
488	1602	1,78		0,26	1,43	80	SWC*
495	1623	1,93	411	0,44	6,51	337	SWC*
501	1645	0,51		0,05	0,08	16	SWC*
527	1730	0,38		0,03	0,01	3	SWC*
539	1768	0,45	439	0,01	0,01	2	SWC*
1446	4743,3	0,08	436	0,20	0,08	100	SWC*
1454	4769	0,16		0,15	0,12	75	SWC*
1499	4919,5	0,40		0,20	0,16	40	SWC*
1530	5020	0,54	421	0,08	0,14	26	
1628	5341	0,43	417	0,22	0,39	91	SWC*
1643	5392	0,67	423	0,14	0,54	81	SWC*
1663	5456	0,35	423	0,14	0,40	114	SWC*
1665	5463	0,30		0,14	0,21	70	SWC*
1673	5487,9	0,31	418	0,12	0,28	90	SWC*
1677	5501	0,38		0,16	0,17	45	SWC*
1678	5504	0,40		0,10	0,17	43	SWC*
1679	5510	0,43		0,16	0,21	49	SWC*
1690	5545	1,35	420	0,15	0,44	33	SWC*
1722	5650	0,69	428	0,08	0,26	38	
1728	5670	1,92	422	0,11	0,21	11	*
1737	5700	0,77	431	0,24	0,71	92	
1737	5700	0,68	420	0,03	0,21	31	*
1746	5727,9	0,61		0,11	0,14	23	SWC*
1747	5730	1,09	425	0,05	0,58	53	*
1747	5730,9	0,23		0,22	0,14	61	SWC*
1748	5734	1,19	423	0,21	0,62	52	SWC*
1749	5738,5	0,20		0,22	0,15	75	SWC*
1751	5745	0,49	435	0,11	0,15	31	SWC*
1756	5760	0,83	426	0,16	0,51	61	*
1757	5764	0,89	430	0,16	0,87	98	SWC*
1757	5764	0,88	435	0,06	0,75	85	SWC
1765	5790	0,87	426	0,18	0,63	72	*
1772	5813	0,81	420	0,13	0,45	56	SWC*
1774	5820	0,86	414	0,18	0,60	70	*
1783	5850	0,99	425	0,26	1,10	111	*

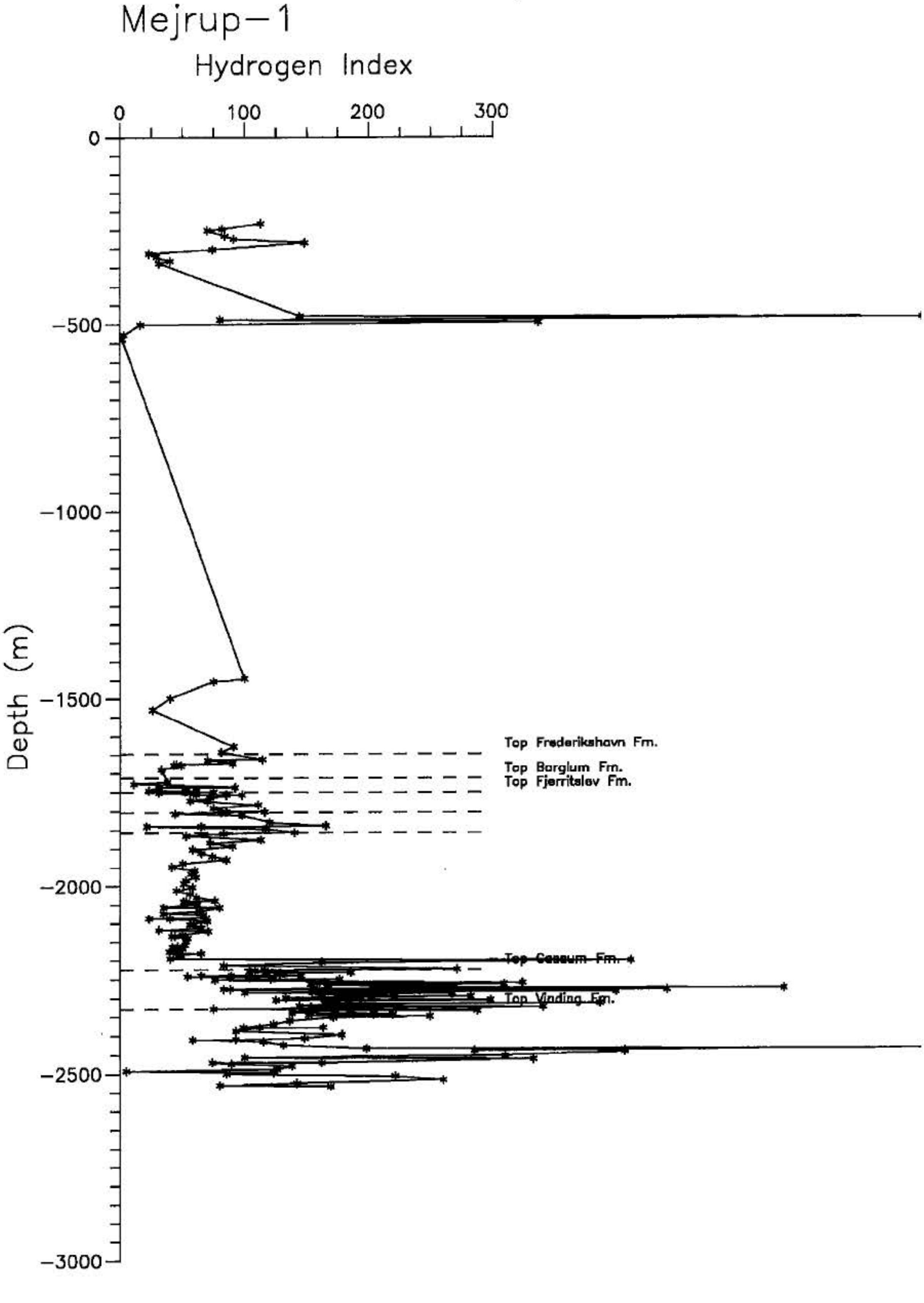
1792	5880	1,07	427	0,14	0,80	75	[a]
1801	5910	0,92	435	0,14	0,78	85	
1801	5910	1,11	429	0,11	1,29	116	[a]
1803	5915	0,94	435	0,13	0,76	81	
1807	5929,9	0,62	424	0,13	0,27	44	SWC[a]
1811	5940	1,03	430	0,13	1,01	98	[a]
1820	5970	0,08	431	0,13	1,04		[a]
1829	6000	0,81	427	0,15	0,97	120	[a]
1838	6030	0,85	428	0,21	1,40	165	[a]
1840	6038	0,66	429	0,04	0,43	65	SWC
1840	6038	3,74	426	0,14	0,79	21	SWC[a]
1847	6060	0,75	429	0,15	0,88	117	[a]
1856	6090	0,67	427	0,12	0,94	140	[a]
1859	6100	1,68	427	0,18	1,40	83	SWC[a]
1865	6120	0,86	432	0,09	0,46	53	[a]
1875	6150	0,86	429	0,12	0,97	113	[a]
1884	6180	0,81	428	0,14	0,58	72	[a]
1893	6210	0,69	426	0,14	0,62	90	[a]
1902	6240	0,67	430	0,04	0,39	58	[a]
1911	6270	0,71	425	0,06	0,46	65	[a]
1920	6300	0,74	424	0,08	0,55	74	[a]
1929	6330	0,72	425	0,10	0,61	85	[a]
1939	6360	0,76	424	0,05	0,38	50	[a]
1948	6390	0,79	425	0,02	0,32	41	[a]
1957	6420	0,75	425	0,05	0,45	60	[a]
1966	6450	0,74	425	0,04	0,42	57	[a]
1975	6480	0,72	426	0,07	0,44	61	[a]
1984	6510	0,80	425	0,05	0,42	53	[a]
1993	6540	0,77	425	0,06	0,39	51	[a]
2003	6570	0,85	431	0,05	0,49	58	[a]
2012	6600	0,85	433	0,07	0,38	45	[a]
2021	6630	0,85	432	0,06	0,48	56	[a]
2030	6660	0,88	430	0,09	0,54	61	[a]
2039	6690	0,89	426	0,11	0,68	76	[a]
2042	6700	1,07	435	0,06	0,57	53	SWC
2042	6700	1,08	426	0,18	0,55	51	SWC[a]
2048	6720	0,85	428	0,05	0,53	62	[a]
2057	6748	0,88	424	0,09	0,31	35	SWC[a]
2057	6750	0,98	429	0,15	0,78	80	[a]
2067	6780	0,98	426	0,15	0,63	64	[a]
2073	6800,4	0,71	396	0,07	0,25	35	SWC[a]
2076	6810	0,85	430	0,12	0,57	67	[a]
2085	6840	0,81	429	0,15	0,56	69	[a]
2087	6846,5	1,38	428	0,07	0,32	23	SWC[a]
2087	6847	1,02	431	0,06	0,41	40	SWC
2094	6870	0,83	430	0,11	0,58	70	[a]
2102	6897	0,95	427	0,07	0,56	59	SWC[a]
2103	6900	0,88	428	0,03	0,49	56	[a]
2112	6930	0,94	429	0,14	0,61	65	[a]
2118	6948	0,86	428	0,07	0,27	31	SWC[a]
2121	6960	0,86	427	0,13	0,61	71	[a]
2131	6990	0,78	430	0,16	0,39	50	[a]
2135	7004	0,78	427	0,07	0,32	41	SWC[a]
2135	7004	0,80	433	0,09	0,35	44	SWC
2140	7020	0,71	427	0,11	0,38	54	[a]
2149	7050	0,66	423	0,15	0,35	53	[a]
2158	7080	0,62	427	0,11	0,32	52	[a]
2162	7094	0,50	387	0,08	0,23	46	SWC[a]
2164	7101	0,67	425	0,08	0,28	42	SWC[a]
2167	7110	0,66	428	0,15	0,33	50	[a]
2176	7140	0,70	431	0,05	0,27	39	[a]
2180	7152	1,15	428	0,09	0,52	45	SWC[a]
2180	7152	0,95	433	0,06	0,62	65	SWC
2185	7170	0,70	429	0,09	0,34	49	[a]
2195	7200	0,68	432	0,07	0,27	40	[a]
2200	7217,5	2,39	424	0,34	9,83	411	SWC[a]
2204	7230	0,71	433	0,13	1,15	162	[a]
2213	7260	0,80	432	0,08	0,66	83	[a]
2222	7290	0,94	433	0,09	2,55	271	[a]
2225	7300	1,19	438	0,12	1,38	116	
2227	7308	0,13		0,09	0,14	108	SWC[a]
2228	7310	1,11	437	0,10	1,15	104	

2231	7320	0,93	436	0,11	1,10	118	
2231	7320	0,86	431	0,16	1,59	185	[a]
2234	7330	0,88	436	0,10	1,10	125	
2237	7340	0,88	435	0,11	1,13	128	
2240	7347,5	0,20		0,07	0,13	65	SWC[a]
2240	7350	0,74	434	0,08	0,66	89	
2240	7350	0,56	432	0,09	0,81	145	[a]
2242	7355,7	0,28	434	0,06	0,15	54	SWC[a]
2243	7360	0,69	434	0,11	0,61	88	
2246	7370	0,70	434	0,09	0,73	104	
2249	7380	0,76	430	0,17	0,92	121	
2249	7380	0,66	430	0,09	1,16	176	[a]
2252	7390	0,78	433	0,06	0,59	76	
2256	7400	1,40	434	0,13	2,29	164	
2259	7410	0,90	429	0,13	2,92	324	[a]
2259	7410	1,31	435	0,13	2,07	158	
2262	7420	1,24	435	0,14	1,90	153	
2262	7423	2,31	432	0,19	3,86	167	SWC
2262	7422,5	1,98	430	0,12	6,11	309	SWC[a]
2265	7430	1,26	435	0,14	2,10	167	
2268	7440	1,18	429	0,14	3,17	269	[a]
2268	7440	1,39	435	0,15	2,82	203	
2271	7450	1,69	434	0,19	3,76	222	
2274	7460	1,31	429	0,24	7,00	534	SWC[a]
2274	7460	1,89	433	0,12	2,93	155	
2276	7466	1,63	431	0,18	1,36	83	SWC[a]
2276	7466	1,45	430	0,14	1,28	88	SWC
2277	7470	1,59	429	0,24	7,00	440	[a]
2277	7470	1,82	433	0,11	2,91	160	
2280	7480	1,89	434	0,12	2,90	153	
2282	7486,4	2,76	430	0,21	11,00	399	SWC[a]
2283	7490	1,71	434	0,12	2,63	154	
2285	7498	0,14		0,15	0,14	100	SWC[a]
2286	7500	1,59	436	0,14	2,53	159	
2286	7500	1,44	431	0,14	3,84	267	[a]
2289	7510	1,65	437	0,14	2,67	162	
2290	7514,5	0,06		0,10	0,11	183	SWC[a]
2292	7520	1,69	438	0,17	2,95	175	
2294	7526,5	0,05	437	0,05	0,11	220	SWC[a]
2295	7530	1,87	436	0,17	3,78	202	
2295	7530	1,64	432	0,18	4,62	282	[a]
2298	7539	0,09		0,10	0,12	133	SWC[a]
2298	7540	1,90	437	0,16	3,66	193	
2301	7550	1,69	437	0,19	2,98	176	
2304	7558	0,12		0,11	0,15	125	SWC[a]
2304	7560	1,64	438	0,19	3,00	183	
2304	7560	1,07	432	0,14	3,19	298	[a]
2307	7570	1,27	437	0,15	2,21	174	
2310	7580	0,95	437	0,12	1,57	165	
2313	7590	0,74	438	0,09	1,21	164	
2313	7590	0,85	434	0,16	3,28	386	[a]
2316	7600	0,77	438	0,09	1,33	173	
2320	7610	0,57	439	0,07	0,82	144	
2323	7620	0,85	435	0,11	2,90	341	[a]
2323	7620	0,77	440	0,08	1,18	153	
2326	7630	0,87	439	0,11	1,63	187	
2328	7638	0,20		0,09	0,15	75	SWC[a]
2329	7640	0,79	440	0,10	1,46	185	
2332	7650	0,92	436	0,12	2,64	287	[a]
2332	7650	0,83	437	0,11	1,43	172	
2335	7660	0,71	438	0,11	0,98	138	
2338	7670	0,71	437	0,11	0,98	138	
2341	7680	0,69	436	0,08	1,51	219	[a]
2341	7680	0,84	435	0,17	1,71	204	
2344	7690	0,74	439	0,10	1,12	151	
2347	7700	0,80	435	0,43	1,99	249	
2350	7710	0,62	437	0,06	1,06	171	[a]
2359	7740	0,73	439	0,07	0,99	136	[a]
2368	7770	0,69	435	0,02	0,85	123	[a]
2377	7800	0,92	438	0,09	0,91	99	
2377	7799	0,08	353	0,09	0,13	163	SWC[a]
2377	7800	0,66	435	0,02	0,74	112	[a]
2387	7830	0,58	437	0,07	0,54	93	[a]
2396	7860	0,63	433	0,06	1,12	178	[a]
2405	7890	0,52	432	0,04	0,77	148	[a]
2408	7900	0,61	439	0,05	0,57	93	

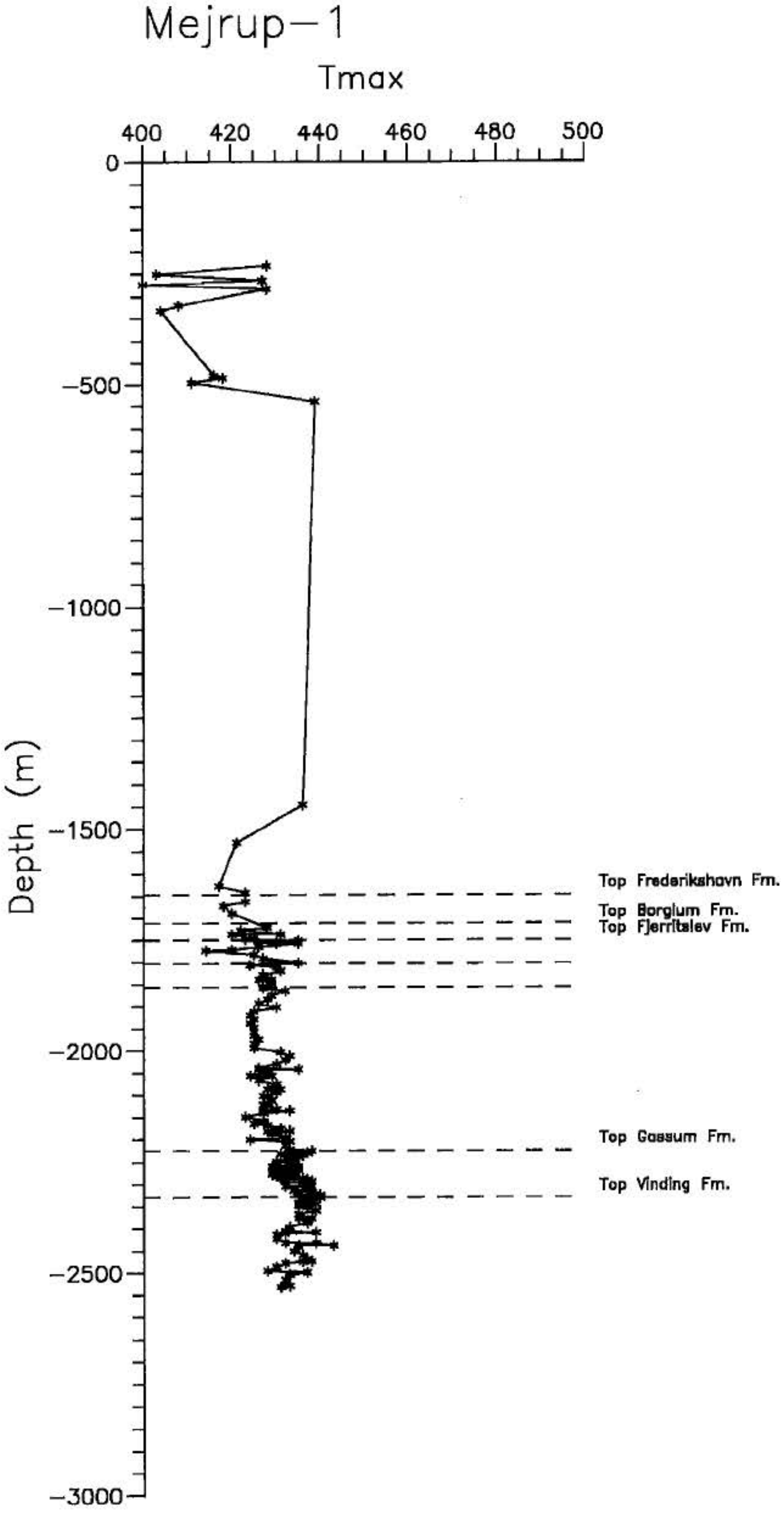
2410	7906	0,33	432	0,11	0,19	58	SWC[a]
2414	7920	0,46	430	0,04	0,53	115	[a]
2423	7950	0,42	430	0,02	0,55	131	[a]
2432	7980	0,43	432	0,05	0,85	198	[a]
2433	7981	1,23	439	0,45	8,57	697	SWC[a]
2438	8000	0,53	443	0,06	1,51	285	
2438	8000	0,50	435	0,08	2,03	406	SWC[a]
2441	8010	0,50	435	0,08	2,03	406	[a]
2451	8040	0,42	434	0,09	1,30	310	[a]
2456	8059	0,11		0,09	0,11	100	SWC[a]
2460	8070	0,39	436	0,05	1,30	333	[a]
2469	8100	0,42	437	0,05	0,68	162	[a]
2469	8100	0,34	437	0,05	0,25	74	
2473	8112	0,18	438	0,03	0,16	89	SWC[a]
2474	8117	0,05	436	0,01			SWC[a]
2478	8130	0,53	432	0,03	0,73	138	[a]
2487	8160	0,54	430	0,05	0,68	126	[a]
2492	8177	0,21		0,01	0,01	5	SWC[a]
2496	8190	0,52	428	0,06	0,64	123	[a]
2499	8200	0,46	437	0,06	0,39	85	
2505	8220	0,58	433	0,06	1,28	221	[a]
2515	8250	0,53	432	0,08	1,38	260	[a]
2524	8280	0,53	432	0,06	0,75	142	[a]
2530	8300	0,40	433	0,05	0,32	80	
2532	8308	0,45	431	0,09	0,76	169	[a]

Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	64	0,30	1,35	***0,50***	0,17	0,44	***0,27***	33	114	***63***
Børglum Fm.	33	0,68	1,92	***1,02***	0,21	0,71	***0,35***	11	92	***43***
Flyvbjerg Fm.	3	0,23	1,09	***0,64***	0,14	0,58	***0,29***	23	61	***46***
Haldager sand Fm.	1	0,20	1,19	***0,70***	0,15	0,62	***0,39***	52	75	***64***
Fjerritslev Fm. F-III	55	0,49	1,11	***0,89***	0,15	1,29	***0,72***	31	116	***78***
Fjerritslev Fm. F-II	51	0,08	3,74	***1,07***	0,27	1,40	***0,85***	21	165	***90***
Fjerritslev Fm. F-I	369	0,50	2,39	***0,86***	0,23	9,83	***0,70***	23	411	***71***
Gassum Fm.	105	0,05	2,76	***1,11***	0,11	11,00	***2,22***	54	534	***182***
Vinding Fm.	204	0,05	1,23	***0,55***	0,01	8,57	***1,13***	5	697	***181***


Mejrup-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.



Mejrup-1
Hydrogen Index
0
100
200
300
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Børglum Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.


Mejrup-1
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Børglum Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.

Nøvling-1

Stratigraphy (b.rfl)	Rfl:	227 feet a. msl.		
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	4357	1328	1259	67
Frederikshavn Fm.	4577	1395	1326	99
Børglum Fm.	4902	1494	1425	18
Flyvbjerg Fm.	4961	1512	1443	0
Haldager sand Fm.	4961	1512	1443	0
Fjerritslev Fm. F-IV	4961	1512	1443	0
Fjerritslev Fm. F-III	4961	1512	1443	0
Fjerritslev Fm. F-II	4961	1512	1443	60
Fjerritslev Fm. F-I	5157	1572	1503	275
Gassum Fm.	6060	1847	1778	85
Vinding Fm.	6339	1932	1863	66
Oddesund Fm.	6555	1998	1929	732
Tønder Fm.	8957	2730	2661	308
Falster Fm.	9967	3038	2969	74
Ørslev Fm.	10210	3112	3043	83
Bunter Sst. Fm	10482	3195	3126	45
Bunter Sh. Fm.	10630	3240	3171	183
Zechstein 2	11230	3423	3354	111
Nøvling Fm	11594	3534	3465	186
Rønde Fm.	12205	3720	3651	42
TD	12343	3762	3693	

Cuttings

D (m)	D (feet)	TOC	Tmax	S1	S2	S3	HI
27	90	11,30		1,53	4,45	9,73	39
55	180	4,73		0,63	0,92	7,10	19
82	270	2,48	400	0,26	0,66	3,01	26
110	360	5,23		0,77	1,88	5,89	36
137	450	3,56		0,49	0,75	5,10	21
165	540	0,17	401	0,16	0,13	4,60	74
192	630	0,23		0,00	0,00	0,79	0
219	720	1,81	426	0,08	0,27	2,25	15
247	810	1,42	403	0,17	0,53	3,40	37
274	900	3,54	424	0,23	1,10	4,66	31
302	990	3,29	426	0,13	0,63	4,58	19
329	1080	0,34		0,08	0,05	1,05	13
357	1170	0,73		0,11	0,15	1,60	20
384	1260	0,29		0,09	0,08	0,84	27
411	1350	0,35		0,06	0,05	0,87	13
439	1440	0,26		0,11	0,03	0,74	12
466	1530	0,47		0,11	0,11	0,70	24
494	1620	0,64		0,15	0,16	1,55	25
521	1710	0,67		0,09	0,08	1,32	12
549	1800	0,52		0,14	0,16	1,31	30
576	1890	0,26		0,14	0,10	1,18	36
604	1980	0,42		0,08	0,01	2,29	3
631	2070	0,29		0,06	0,03	0,84	12
658	2160	0,17		0,08	0,03	0,79	20
686	2250	0,27		0,01	0,02	0,98	9
713	2340	0,46		0,14	0,14	0,99	30
741	2430	0,26		0,07	0,03	0,80	13
768	2520	0,43		0,11	0,13	0,79	29
796	2610	0,39		0,08	0,08	0,73	20
823	2700	0,47		0,09	0,08	0,77	17
850	2790	0,31		0,07	0,02	0,78	7
860	2820	0,53		0,26	0,23	0,80	43
905	2970	0,36		0,06	0,07	0,85	19
933	3060	0,37		0,07	0,05	0,85	12
960	3150	0,33		0,08	0,14	0,78	41
988	3240	0,29		0,09	0,08	0,82	27
1015	3330	0,25		0,08	0,07	0,68	27
1042	3420	0,28		0,07	0,08	0,72	28
1070	3510	0,33		0,08	0,09	0,95	28
1097	3600	0,02		0,03	0,01	0,34	55
1125	3690	0,06		0,06	0,03	0,99	57
1152	3780	0,03		0,07	0,06	0,29	190
1161	3810	0,05	422	0,07	0,52	0,53	1038
1180	3870	0,03		0,06	0,07	0,39	227

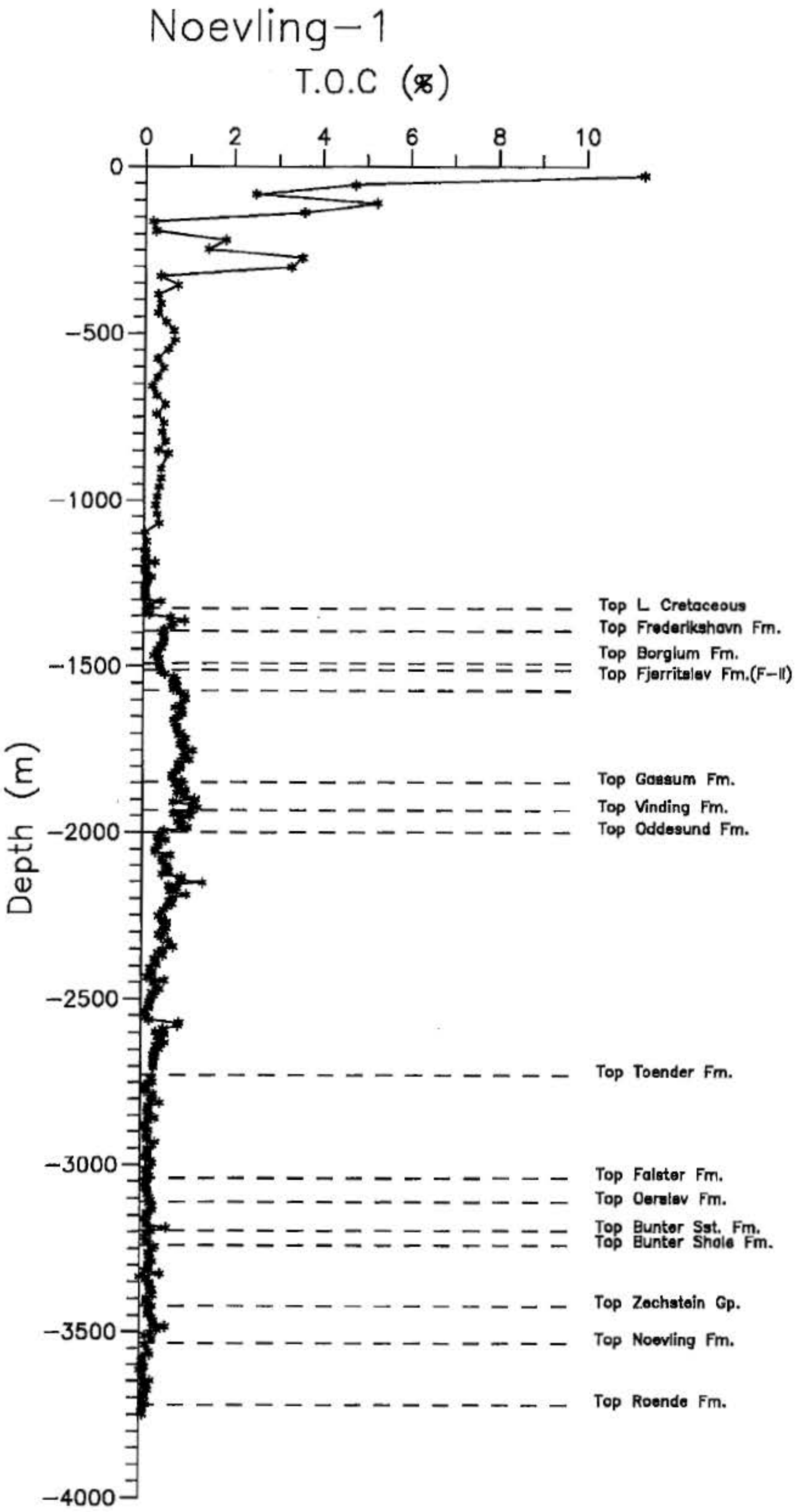
1189	3900	0,24		0,05	0,04	0,34	16
1198	3930	0,05		0,09	0,08	0,54	156
1207	3960	0,02		0,07	0,08	0,33	390
1216	3990	0,04		0,07	0,05	0,38	123
1225	4020	0,06		0,07	0,06	0,45	98
1234	4050	0,17	423	0,25	0,29	0,83	173
1244	4080	0,07		0,07	0,04	0,45	56
1253	4110	0,06		0,08	0,06	0,31	98
1262	4140	0,04		0,03	0,02	0,31	50
1271	4170	0,03		0,04	0,17	0,53	553
1280	4200	0,03		0,04	0,03	0,27	97
1289	4230	0,04		0,05	0,04	0,28	98
1298	4260	0,05		0,05	0,04	0,44	78
1308	4290	0,39		0,52	0,51	1,97	131
1317	4320	0,14		0,03	0,10	0,72	70
1326	4350	0,12		0,05	0,11	0,85	90
1337	4385	0,05		0,02	0,02	0,33	40
1346	4415	0,13		0,03	0,06	0,63	45
1355	4445	0,60	432	0,06	0,25	1,12	41
1364	4475	0,92	424	0,13	0,41	1,29	45
1373	4505	0,67	425	0,10	0,39	0,87	58
1382	4535	0,62	425	0,09	0,30	0,90	49
1391	4565	0,47		0,10	0,08	0,70	17
1401	4595	0,40		0,06	0,07	0,56	17
1410	4625	0,45		0,07	0,05	0,63	11
1419	4655	0,46		0,09	0,10	0,53	21
1428	4685	0,46		0,09	0,06	0,68	13
1437	4715	0,38		0,07	0,11	0,60	28
1446	4745	0,40		0,10	0,15	0,86	37
1451	4760	0,31		0,08	0,06	0,59	19
1460	4790	0,30		0,06	0,06	0,57	20
1469	4820	0,24		0,05	0,04	0,46	16
1478	4850	0,35		0,04	0,04	0,57	11
1487	4880	0,32		0,07	0,08	0,79	24
1497	4910	0,36		0,08	0,13	0,40	35
1506	4940	0,36		0,12	0,15	0,51	41
1515	4970	0,39		0,04	0,00	0,57	0
1524	5000	0,48		0,06	0,04	0,55	8
1533	5030	0,69	424	0,15	0,32	0,65	47
1542	5060	0,74	429	0,15	0,67	1,42	91
1551	5090	0,66	420	0,12	0,24	1,21	36
1561	5120	0,77	419	0,12	0,27	1,16	35
1570	5150	0,68	424	0,14	0,33	1,16	49
1579	5180	0,84	428	0,17	0,41	1,35	49
1588	5210	0,92	430	0,22	0,52	1,04	56
1597	5240	0,95	430	0,20	0,67	1,24	71
1615	5300	0,85	426	0,09	0,23	0,84	27
1625	5330	0,72	429	0,09	0,27	0,96	37
1634	5360	0,87	417	0,11	0,19	0,81	21
1643	5390	0,87		0,07	0,12	0,62	14
1652	5420	0,76		0,07	0,14	0,51	18
1661	5450	0,69		0,07	0,15	0,66	21
1670	5480	0,72		0,08	0,16	0,94	22
1679	5510	0,76		0,04	0,06	0,60	8
1689	5540	0,77		0,05	0,07	0,61	9
1698	5570	0,84		0,08	0,15	0,58	17
1707	5600	0,81	427	0,08	0,19	0,66	23
1716	5630	0,96		0,09	0,09	0,66	10
1725	5660	0,89		0,10	0,20	0,74	22
1728	5670	0,89	440	0,12	0,23	1,04	26
1734	5690	0,85		0,08	0,12	0,82	15
1743	5720	0,97		0,08	0,15	0,65	15
1753	5750	1,12	431	0,11	0,26	0,77	23
1762	5780	0,95	429	0,16	0,41	0,79	44
1771	5810	0,93	427	0,14	0,31	0,76	33
1780	5840	1,06	425	0,15	0,31	0,74	29
1789	5870	0,80	428	0,11	0,20	0,75	25
1798	5900	0,84	429	0,11	0,26	0,62	31
1807	5930	0,83	458	0,09	0,16	0,68	19
1817	5960	0,73		0,10	0,17	0,68	23
1826	5990	0,66		0,08	0,08	0,74	13
1835	6020	0,67		0,07	0,09	0,67	14
1844	6050	0,87		0,10	0,21	0,73	24
1853	6080	0,73		0,08	0,09	0,72	13
1862	6110	0,85	431	0,12	0,53	0,85	62
1871	6140	0,98	430	0,14	0,60	0,60	61
1881	6170	0,78	431	0,12	0,40	0,68	52
1890	6200	0,93	432	0,14	0,66	0,82	71
1899	6230	1,18	426	0,23	0,75	1,39	63

1908	6260	0,69	434	0,09	0,18	0,82	26
1917	6290	1,11	432	0,14	0,73	0,92	66
1926	6320	1,23	428	0,21	1,13	0,81	92
1935	6350	1,11	432	0,16	1,12	0,71	101
1945	6380	0,70	425	0,10	0,23	0,89	33
1951	6400	1,07	435	0,16	1,19	0,58	111
1960	6430	0,87	435	0,16	0,86	0,71	99
1969	6460	0,80	432	0,11	0,55	0,68	68
1978	6490	0,88	436	0,14	1,85	0,68	211
1987	6520	1,02	433	0,21	2,10	0,79	206
1996	6550	0,49	434	0,07	0,32	0,54	64
2006	6580	0,38	430	0,05	0,16	0,65	43
2015	6610	0,34	427	0,07	0,25	0,57	74
2024	6640	0,52	435	0,08	0,44	1,46	84
2033	6670	0,37	429	0,04	0,14	0,60	38
2042	6700	0,35	432	0,07	0,33	0,42	93
2051	6730	0,30	430	0,03	0,11	0,42	36
2060	6760	0,30	432	0,07	0,17	0,59	58
2070	6790	0,64	430	0,09	0,48	0,56	75
2079	6820	0,44	428	0,07	0,24	0,55	55
2088	6850	0,47	428	0,09	0,47	0,47	100
2100	6890	0,54	432	0,11	0,76	0,48	141
2109	6920	0,57	428	0,05	0,23	0,49	40
2118	6950	0,60	429	0,08	0,38	1,11	64
2126	6975	0,45	431	0,07	0,33	1,22	73
2135	7005	0,88	434	0,12	1,01	1,26	115
2144	7035	0,85	434	0,07	0,56	1,39	65
2152	7060	1,36	432	0,16	1,96	1,86	144
2161	7090	0,60	431	0,03	0,26	1,47	44
2170	7120	0,78	428	0,04	0,48	1,40	62
2179	7150	0,62	427	0,04	0,23	1,47	37
2188	7180	0,99	426	0,11	0,81	1,69	82
2198	7210	0,70	426	0,07	0,35	1,37	50
2207	7240	0,61	428	0,07	0,32	1,49	52
2216	7270	0,69	430	0,09	0,51	1,36	74
2225	7300	0,57	424	0,07	0,27	1,41	48
2234	7330	0,49		0,09	0,16	1,33	33
2243	7360	0,45	428	0,05	0,21	1,37	46
2252	7390	0,37		0,07	0,13	1,11	35
2262	7420	0,46	424	0,05	0,26	1,24	57
2271	7450	0,56	431	0,11	0,46	1,54	82
2280	7480	0,50	428	0,07	0,24	1,18	48
2289	7510	0,54	430	0,11	0,44	1,38	81
2298	7540	0,50	422	0,08	0,17	1,40	34
2307	7570	0,38		0,03	0,05	1,34	14
2316	7600	0,44		0,07	0,18	1,40	41
2326	7630	0,58	428	0,08	0,39	1,49	67
2335	7660	0,62	428	0,04	0,18	1,33	29
2344	7690	0,70	429	0,07	0,38	1,27	54
2353	7720	0,48		0,03	0,10	1,32	20
2362	7750	0,37	422	0,06	0,18	1,15	48
2371	7780	0,47	426	0,06	0,21	1,66	45
2380	7810	0,28		0,03	0,01	1,08	4
2390	7840	0,31		0,05	0,13	1,12	41
2399	7870	0,34		0,06	0,12	1,31	34
2408	7900	0,19		0,05	0,06	0,92	33
2417	7930	0,23		0,07	0,11	1,03	46
2426	7960	0,23		0,06	0,13	1,12	55
2435	7990	0,13		0,06	0,08	0,90	65
2444	8020	0,51		0,70	0,59	1,45	115
2454	8050	0,27		0,12	0,15	1,09	54
2463	8080	0,34	428	0,17	0,28	1,13	84
2472	8110	0,40	426	0,18	0,38	1,07	95
2481	8140	0,24	438	0,14	0,14	1,08	57
2490	8170	0,28		0,11	0,14	1,01	49
2499	8200	0,22		0,13	0,14	0,68	62
2509	8230	0,19		0,17	0,15	0,79	77
2518	8260	0,18		0,12	0,11	0,83	58
2527	8290	0,16		0,11	0,08	0,67	53
2536	8320	0,09		0,05	0,01	0,36	12
2545	8350	0,08		0,06	0,01	0,34	14
2554	8380	0,11		0,07	0,01	0,55	10
2562	8405	0,18		0,14	0,11	0,64	58
2571	8435	0,85	432	0,24	0,69	1,30	82
2580	8465	0,82	431	0,24	0,62	1,47	76
2589	8495	0,50	440	0,13	0,26	1,20	53
2598	8525	0,33		0,12	0,17	0,92	51
2606	8550	0,53	428	0,44	0,63	1,14	119
2612	8570	0,37		0,13	0,20	1,04	54

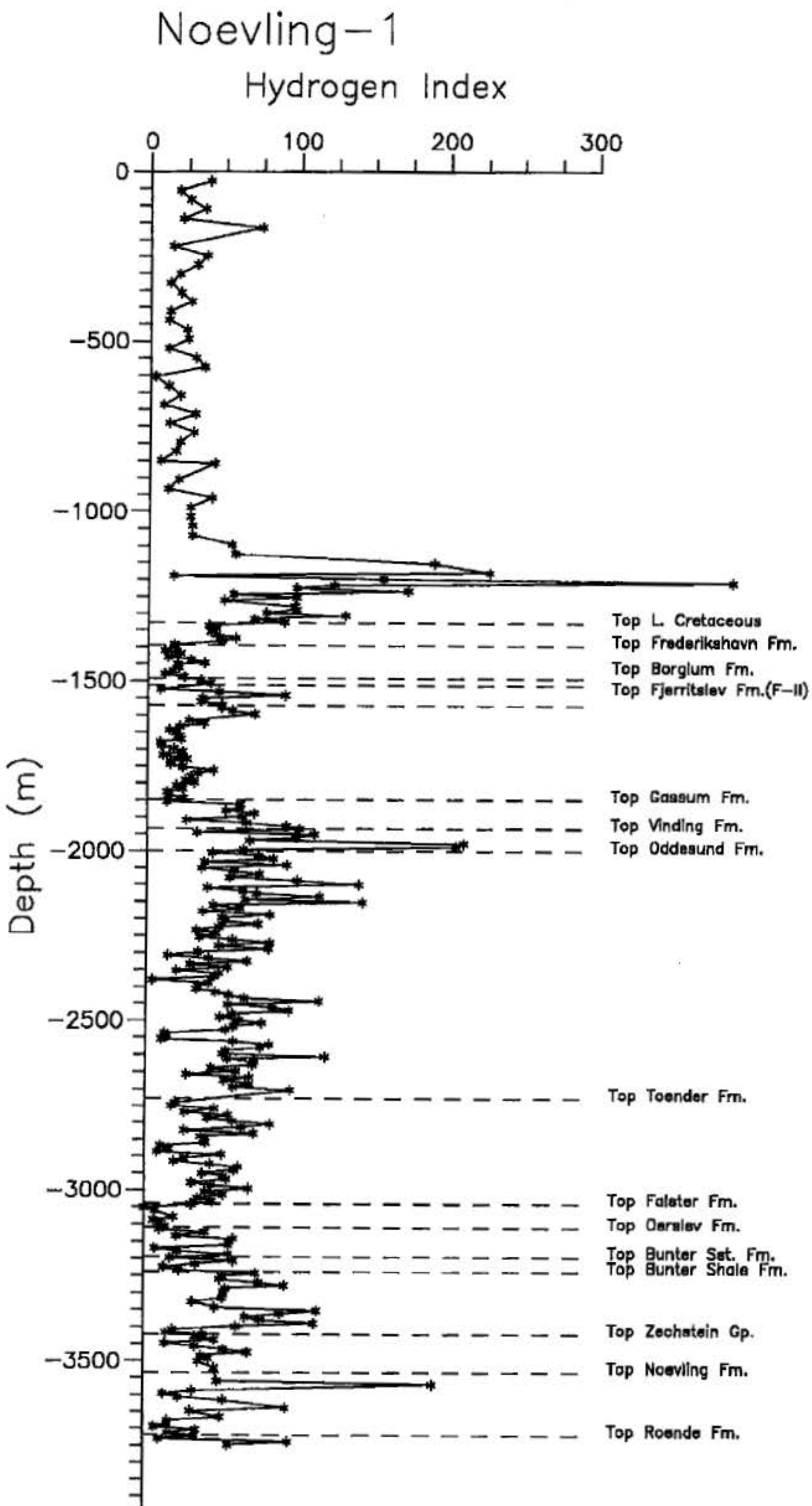
2621	8600	0,41	425	0,12	0,29	0,95	72
2630	8630	0,53	429	0,26	0,38	1,33	71
2640	8660	0,32	442	0,14	0,14	1,28	43
2649	8690	0,40	426	0,11	0,24	1,25	60
2658	8720	0,31		0,08	0,08	1,10	27
2667	8750	0,27		0,15	0,19	1,11	69
2676	8780	0,32		0,10	0,17	0,15	52
2685	8810	0,28		0,15	0,19	1,21	69
2694	8840	0,27		0,10	0,16	1,06	58
2704	8870	0,29	433	0,09	0,28	1,09	96
2740	8990	0,23		0,05	0,05	0,88	20
2749	9020	0,27		0,07	0,05	1,12	17
2758	9050	0,10		0,05	0,05	0,87	46
2768	9080	0,14		0,04	0,04	0,81	26
2777	9110	0,10		0,06	0,06	0,82	55
2786	9140	0,29		0,08	0,12	0,99	41
2795	9170	0,24		0,09	0,14	1,04	58
2804	9200	0,28		0,16	0,23	1,28	83
2813	9230	0,43	414	0,12	0,28	1,29	64
2822	9260	0,18		0,04	0,05	1,11	26
2832	9290	0,18		0,13	0,13	1,24	72
2841	9320	0,15		0,06	0,06	1,14	37
2850	9350	0,19		0,08	0,07	1,30	39
2859	9380	0,32		0,17	0,13	1,42	40
2868	9410	0,18		0,04	0,02	0,77	10
2877	9440	0,11		0,05	0,02	0,70	16
2886	9470	0,11		0,06	0,01	0,76	8
2896	9500	0,18		0,07	0,09	0,99	51
2905	9530	0,14		0,04	0,04	0,68	26
2914	9560	0,15		0,05	0,03	0,69	19
2923	9590	0,15		0,06	0,07	0,95	43
2932	9620	0,33		0,13	0,20	1,41	62
2941	9650	0,28		0,10	0,17	1,05	59
2950	9680	0,17		0,07	0,07	0,85	38
2960	9710	0,16		0,05	0,08	0,88	52
2969	9740	0,17		0,05	0,09	0,82	54
2978	9770	0,12		0,04	0,04	0,58	31
2987	9800	0,23		0,10	0,10	1,00	44
2996	9830	0,27		0,12	0,19	1,13	69
3005	9860	0,21		0,07	0,08	1,00	40
3014	9890	0,13		0,07	0,07	1,11	52
3024	9920	0,16		0,04	0,06	1,03	35
3033	9950	0,20		0,04	0,09	0,85	45
3042	9980	0,18		0,04	0,06	1,01	31
3051	10010	0,12		0,02	0,00	0,98	0
3060	10040	0,15		0,02	0,01	0,99	7
3069	10070	0,13		0,02	0,00	0,94	0
3078	10100	0,17		0,04	0,03	1,26	19
3088	10130	0,17		0,06	0,01	1,04	6
3097	10160	0,21		0,04	0,02	1,26	10
3106	10190	0,24		0,06	0,03	1,29	14
3115	10220	0,21		0,04	0,02	1,21	10
3124	10250	0,28		0,09	0,11	1,17	40
3133	10280	0,27		0,11	0,06	1,33	21
3142	10310	0,15		0,11	0,09	0,94	59
3152	10340	0,16		0,13	0,09	0,93	56
3161	10370	0,10		0,09	0,06	1,07	56
3170	10400	0,15		0,06	0,01	0,75	7
3179	10430	0,15		0,07	0,03	0,66	22
3188	10460	0,58	432	0,18	0,32	1,22	56
3197	10490	0,26		0,06	0,04	1,21	17
3206	10520	0,17	408	0,16	0,10	1,30	59
3216	10550	0,13		0,08	0,04	0,75	34
3225	10580	0,17		0,08	0,02	0,86	13
3234	10610	0,19		0,08	0,04	0,97	23
3243	10640	0,33		0,13	0,24	1,04	74
3252	10670	0,30		0,11	0,16	1,16	52
3261	10700	0,20	436	0,14	0,10	1,07	50
3271	10730	0,22	431	0,20	0,17	1,47	76
3280	10760	0,25	430	0,23	0,23	1,78	93
3289	10790	0,29	405	0,12	0,16	1,29	54
3298	10820	0,19		0,14	0,10	1,02	53
3307	10850	0,19	403	0,12	0,10	1,13	53
3316	10880	0,13		0,08	0,07	0,50	52
3325	10910	0,45	422	0,08	0,14	1,31	32
3335	10940			0,05	0,07	0,75	
3344	10970	0,14		0,05	0,07	0,73	47
3353	11000	0,22		0,23	0,25	1,64	115
3362	11030	0,23		0,18	0,21	1,42	90

3371	11060	0,28		0,16	0,19	1,50	67
3380	11090	0,23		0,15	0,18	1,22	77
3389	11120	0,30		0,21	0,34	1,02	113
3399	11150	0,17		0,09	0,10	0,60	61
3408	11180	0,15		0,04	0,03	0,62	19
3417	11210	0,19		0,04	0,03	0,89	15
3423	11230	0,29		0,09	0,11	0,96	39
3429	11250	0,22		0,09	0,08	1,28	34
3438	11280	0,22		0,09	0,10	1,16	47
3447	11310	0,20		0,07	0,03	1,10	14
3456	11340	0,28		0,07	0,09	1,27	34
3466	11370	0,32		0,14	0,17	1,37	53
3475	11400	0,30		0,23	0,21	1,47	69
3484	11430	0,57		0,24	0,22	1,36	38
3493	11460	0,39		0,13	0,17	1,52	43
3502	11490	0,26		0,11	0,09	0,97	36
3511	11520	0,13		0,05	0,00	1,06	0
3520	11550	0,28		0,09	0,13	1,42	47
3539	11610	0,14		0,02	0,00	1,14	0
3560	11680	0,21		0,11	0,10	3,55	49
3569	11710	0,23	439	0,17	0,44	1,56	192
3578	11740	0,08		0,03	0,00	0,86	0
3587	11770	0,06		0,09	0,02	0,43	32
3597	11800	0,07		0,06	0,01	0,43	13
3606	11830	0,12		0,11	0,03	0,85	23
3615	11860	0,02		0,09	0,01	0,95	53
3624	11890	0,07		0,09	0,00	0,66	0
3639	11940	0,08		0,36	0,08	2,43	94
3648	11970	0,24		0,22	0,08	1,18	31
3658	12000	0,14		0,08	0,00	0,83	0
3667	12030	0,13		0,10	0,07	1,82	51
3676	12060	0,18		0,05	0,03	0,91	16
3685	12090	0,12		0,11	0,02	0,90	16
3694	12120	0,13		0,05	0,01	0,34	7
3703	12150	0,08		0,04	0,03	0,33	35
3712	12180	0,12		0,05	0,02	0,86	16
3722	12210	0,14		0,05	0,05	1,07	34
3731	12240	0,09		0,06	0,01	0,65	10
3740	12270	0,05		0,03	0,05	0,30	96
3749	12300	0,07		0,04	0,04	0,34	56

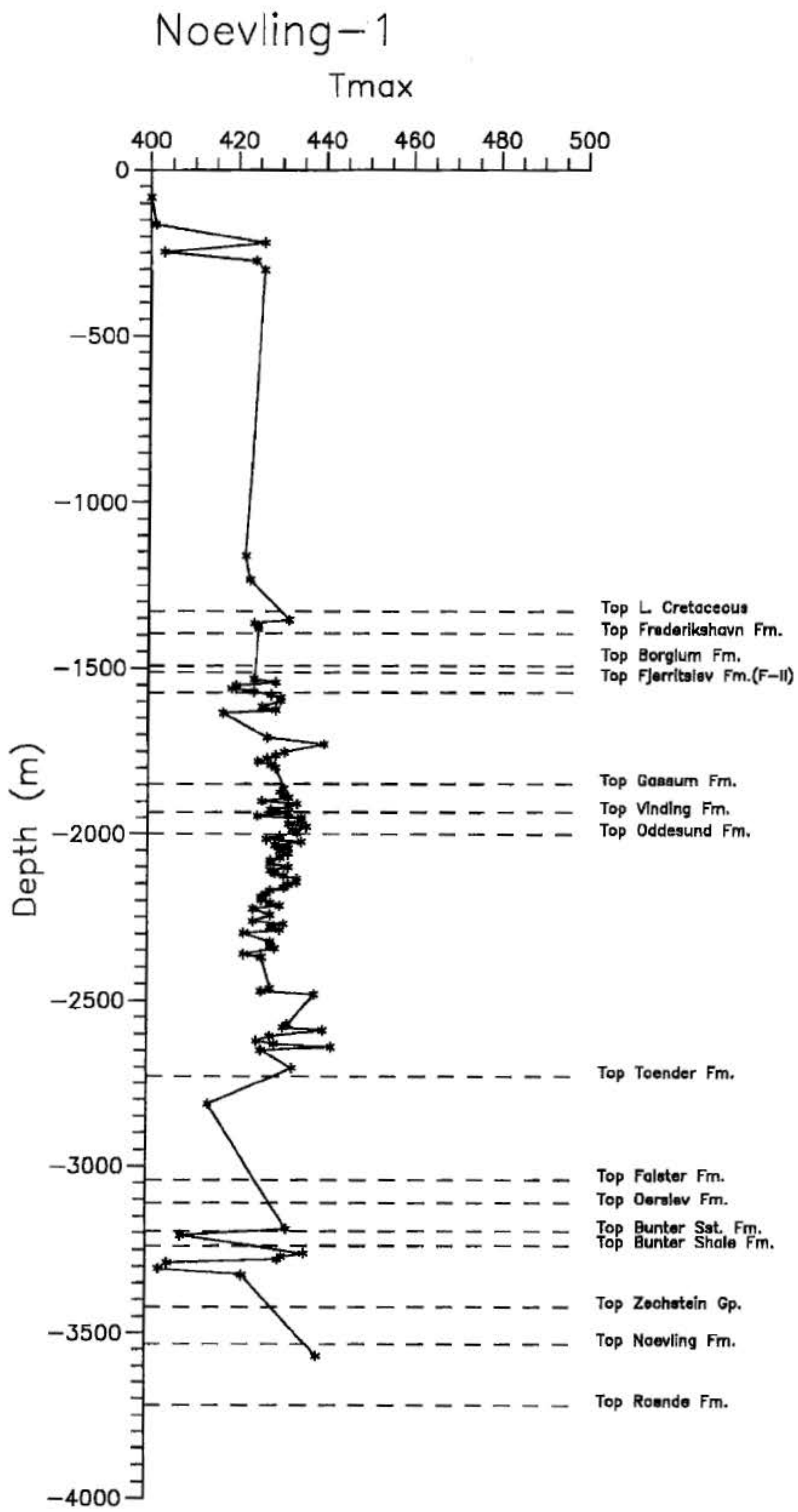
Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	99	0,24	0,46	***0,37***	0,04	0,15	***0,07***	11	37	***20***
Børglum Fm.	18	0,36	0,36	***0,36***	0,13	0,15	***0,14***	35	41	***38***
Fjerritslev Fm. F-II	60	0,39	0,77	***0,63***	0,00	0,67	***0,27***	0	91	***38***
Fjerritslev Fm. F-I	275	0,66	1,12	***0,85***	0,06	0,67	***0,22***	8	71	***25***
Gassum Fm.	85	0,69	1,23	***0,94***	0,09	1,13	***0,56***	13	92	***56***
Vinding Fm.	66	0,49	1,11	***0,87***	0,23	2,10	***1,03***	33	211	***112***
Oddesund Fm.	732	0,08	1,36	***0,44***	0,01	1,96	***0,29***	4	144	***59***
Tønder Fm.	308	0,10	0,43	***0,20***	0,01	0,28	***0,09***	8	83	***42***
Falster Fm.	74	0,12	0,24	***0,17***	0,00	0,06	***0,02***	0	31	***11***
Ørslev Fm.	83	0,10	0,58	***0,23***	0,01	0,32	***0,09***	7	59	***36***
Bunter Sst. Fm	45	0,13	0,26	***0,18***	0,02	0,10	***0,05***	13	59	***29***
Bunter Sh. Fm.	183	0,13	0,45	***0,23***	0,03	0,34	***0,15***	15	115	***63***
Zechstein 2	111	0,13	0,57	***0,29***	0,00	0,22	***0,12***	0	69	***38***
Nøvling Fm.	186	0,02	0,24	***0,12***	0,00	0,44	***0,05***	0	192	***35***
Rønde Fm.	42	0,05	0,14	***0,09***	0,01	0,05	***0,04***	10	96	***49***



Noevling-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
Depth (m)
Top L. Cretaceous
Top Frederikshavn Fm.
Top Borglum Fm.
Top Fjerritslev Fm.(F-II)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Toender Fm.
Top Falster Fm.
Top Oerslev Fm.
Top Bunter Sst. Fm.
Top Bunter Shale Fm.
Top Zechstein Gp.
Top Noevling Fm.
Top Roende Fm.



Noevling-1
Hydrogen Index
0
100
200
300
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
Depth (m)
Top L. Cretaceous
Top Frederikshavn Fm.
Top Borglum Fm.
Top Fjerritslev Fm.(F-II)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Toender Fm.
Top Falster Fm.
Top Oerslev Fm.
Top Bunter Sst. Fm.
Top Bunter Shale Fm.
Top Zechstein Gp.
Top Noevling Fm.
Top Roende Fm.



Noevling-1
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
Depth (m)
Top L. Cretaceous
Top Frederikshavn Fm.
Top Borglum Fm.
Top Fjerritslev Fm.(F-II)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Toender Fm.
Top Falster Fm.
Top Oerslev Fm.
Top Bunter Sst. Fm.
Top Bunter Shale Fm.
Top Zechstein Gp.
Top Noevling Fm.
Top Roende Fm.

Rønde-1

Stratigraphy (b.rfl)	Rfl:	139	feet a. msl.	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	6506	1983	1941	67
Frederikshavn Fm.	6726	2050	2008	50
Børglum Fm.	6890	2100	2058	38
Flyvbjerg Fm.	7014	2138	2096	0
Haldager sand Fm.	7014	2138	2096	0
Fjerritslev Fm. F-IV	7014	2138	2096	55
Fjerritslev Fm. F-III	7195	2193	2151	145
Fjerritslev Fm. F-II	7671	2338	2296	71
Fjerritslev Fm. F-I	7904	2409	2367	204
Gassum Fm.	8573	2613	2571	140
Vinding Fm.	9032	2753	2711	71
Oddesund Fm.	9265	2824	2782	633
Tønder Fm.	11342	3457	3415	241
Falster Fm.	12133	3698	3656	122
Ørslev Fm.	12533	3820	3778	235
Bunter Sst. Fm.	13304	4055	4013	579
Zechstein 4	15203	4634	4592	37
Zechstein 3	15325	4671	4629	86
Zechstein 2	15607	4757	4715	93
Zechstein 1	15912	4850	4808	23
Rotliegend Gp.	15987	4873	4830	87
Nøvling Fm.	16273	4960	4918	230
Rønde Fm.	17028	5190	5148	110
TD	17388	5300	5257	

Cuttings

D (m)	D (feet)	TOC	Tmax	S1	S2	HI
18	59	0,25		0,15	0,12	48
46	151	0,26		0,10	0,17	65
73	240	0,94		0,69	0,42	45
101	331	1,36		1,08	0,31	23
128	420	0,81		0,40	0,22	27
152	499	0,21		0,00	0,00	0
180	591	0,21		0,06	0,06	29
204	669	0,21		0,04	0,00	0
232	761	0,18		0,09	0,03	17
259	850	0,14		0,03	0,01	7
283	928	0,08		0,06	0,02	25
311	1020	0,08		0,11	0,04	50
335	1099	0,07		0,03	0,02	29
363	1191	0,15		0,10	0,02	13
390	1280	0,15		0,22	0,06	40
418	1371	0,07		0,13	0,06	86
445	1460	0,07		0,06	0,02	29
472	1549	0,07		0,01	0,00	0
500	1640	0,07		0,03	0,00	0
527	1729	0,07		0,06	0,10	143
555	1821	0,04		0,06	0,06	150
582	1909	0,05		0,04	0,00	0
610	2001	0,07		0,03	0,00	0
637	2090	0,01		0,02	0,00	0
664	2178	0,03		0,01	0,00	0
692	2270	0,03		0,03	0,01	33
719	2359	0,06		0,03	0,01	17
747	2451	0,05		0,01	0,00	0
774	2539	0,07		0,01	0,00	0
802	2631	0,07		0,02	0,00	0
829	2720	0,07		0,03	0,00	0
856	2808	0,04		0,01	0,00	0
884	2900	0,05		0,02	0,01	20
911	2989	0,04		0,04	0,02	50
939	3081	0,08		0,01	0,00	0
966	3169	0,06		0,02	0,00	0
988	3241	0,07		0,02	0,00	0
1015	3330	0,04		0,02	0,00	0
1042	3419	0,03		0,01	0,00	0
1070	3510	0,12		0,03	0,00	0
1097	3599	0,05		0,02	0,00	0

1125	3691	0,07		0,02	0,00	0
1152	3780	0,10		0,02	0,04	40
1180	3871	0,41	498	0,12	0,30	73
1207	3960	0,16		0,03	0,02	13
1234	4049	0,09		0,06	0,15	167
1256	4121	0,62	442	0,09	0,44	71
1283	4209	0,42		0,14	0,13	31
1311	4301	0,23		0,07	0,04	17
1338	4390	0,18		0,03	0,00	0
1366	4482	0,21		0,03	0,02	10
1393	4570	0,29		0,03	0,00	0
1420	4659	0,22		0,05	0,04	18
1448	4751	0,13		0,01	0,00	0
1475	4839	0,16		0,03	0,02	13
1503	4931	0,47		0,04	0,05	11
1530	5020	0,35		0,04	0,05	14
1539	5049	0,82	421	0,08	0,79	96
1548	5079	0,36		0,04	0,03	8
1558	5112	0,29		0,05	0,03	10
1570	5151	0,27		0,07	0,07	26
1579	5180	0,39		0,02	0,01	3
1588	5210	1,46	428	2,32	6,47	443
1597	5240	0,30		0,04	0,05	17
1606	5269	0,30		0,05	0,06	20
1615	5299	0,34		0,01	0,05	15
1625	5331	0,23		0,03	0,14	61
1634	5361	0,19		0,01	0,01	5
1643	5390	0,14		0,01	0,01	7
1652	5420	0,18		0,02	0,03	17
1661	5449	0,20		0,03	0,08	40
1670	5479	0,47	446	0,05	0,17	36
1679	5509	0,75		0,09	0,10	13
1689	5541	0,23		0,05	0,06	26
1698	5571	0,16		0,06	0,07	44
1707	5600	0,43		0,05	0,02	5
1716	5630	0,12		0,05	0,05	42
1725	5659	0,59	457	0,09	0,53	90
1734	5689	0,36		0,05	0,04	11
1743	5719	0,11		0,07	0,06	55
1753	5751	0,07		0,04	0,08	114
1762	5781	0,28	440	0,07	0,41	146
1771	5810	0,31		0,07	0,10	32
1780	5840	0,07		0,03	0,06	86
1789	5869	0,06		0,06	0,06	100
1798	5899	0,12		0,05	0,09	75
1807	5928	0,14		0,10	0,10	71
1817	5961	0,12		0,11	0,16	133
1826	5991	0,09		0,05	0,10	111
1835	6020	0,12		0,04	0,07	58
1844	6050	0,10		0,06	0,07	70
1853	6079	0,09		0,03	0,07	78
1862	6109	0,09		0,05	0,07	78
1871	6138	0,38		0,07	0,12	32
1881	6171	0,09		0,03	0,06	67
1890	6201	0,08		0,03	0,03	38
1899	6230	0,03		0,04	0,05	167
1908	6260	0,18	471	0,03	0,24	133
1917	6289	0,02		0,02	0,02	100
1926	6319	1,63	437	0,10	0,38	23
1935	6348	0,21		0,03	0,13	62
1945	6381	0,30		0,03	0,14	47
1954	6411	0,31	435	0,06	0,35	113
1963	6440	0,34	400	0,05	0,30	88
1972	6470	0,19		0,01	0,02	11
1981	6499	0,33	430	0,06	0,35	106
1992	6535	0,32	405	0,07	0,27	84
2001	6565	1,51		0,15	0,28	19
2006	6581	1,16	425	0,51	0,41	35
2006	6581	1,19	415	0,44	0,40	34
2010	6594	0,95		0,06	0,09	9
2019	6624	2,19	426	0,24	1,86	85
2028	6654	2,37	427	0,18	1,82	77
2038	6686	0,93	440	0,07	0,26	28
2047	6716	1,07	427	0,11	0,69	64
2056	6745	0,80	429	0,09	0,58	73
2065	6775	0,63		0,05	0,14	22
2074	6804	0,64		0,06	0,15	23
2074	6804	1,06	429	1,34	1,18	111
2088	6850	0,80	426	0,10	0,78	98

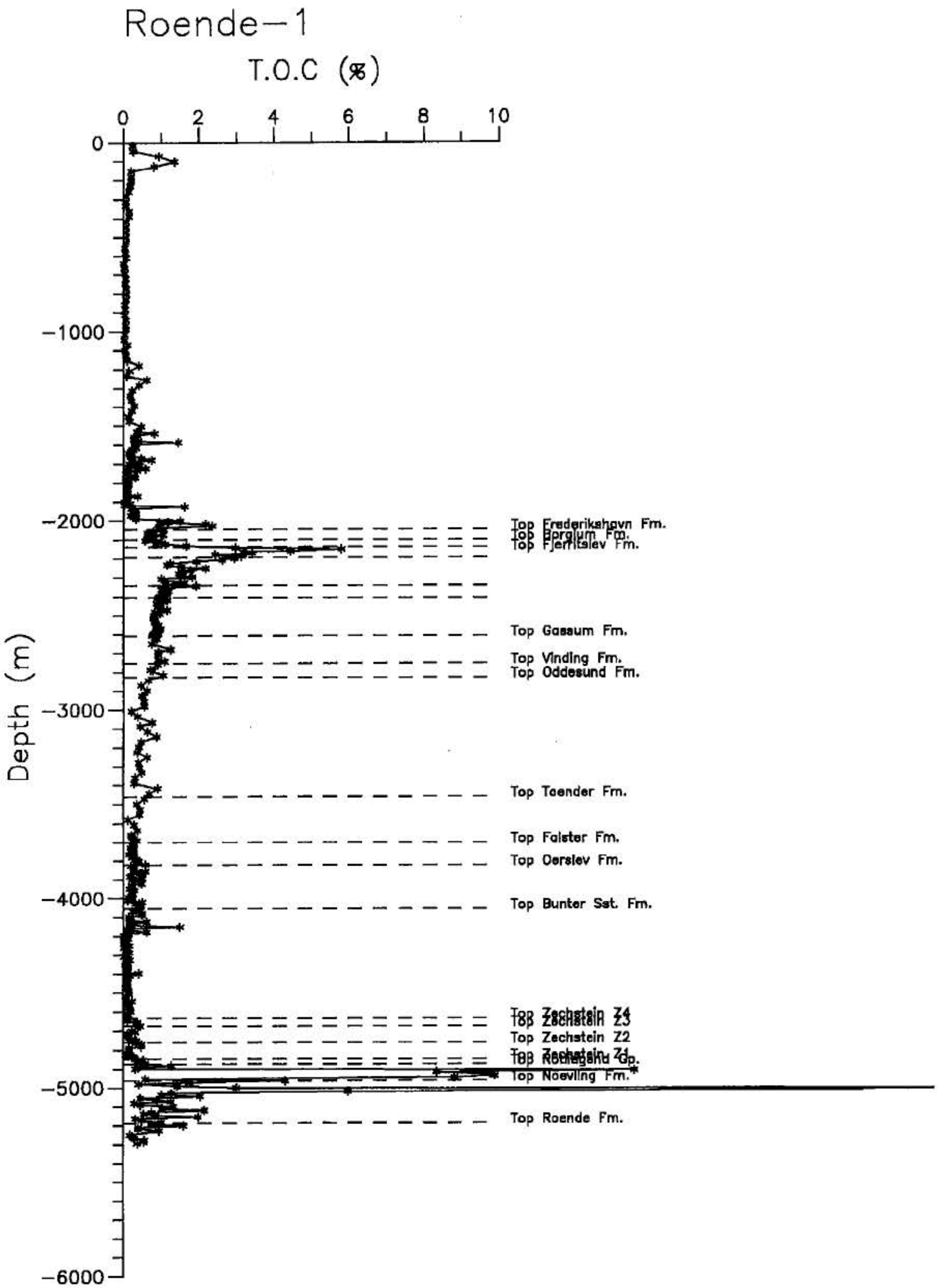
2097	6880	0,61	431	0,10	0,41	67
2106	6909	0,57	430	0,09	0,17	30
2115	6939	1,01	430	0,25	0,81	80
2124	6969	0,85	429	0,18	0,65	76
2124	6969	1,11	434	0,72	1,40	126
2134	7001	1,67	436	0,25	1,88	113
2143	7031	2,98	434	0,41	5,40	181
2152	7060	5,81	429	0,86	31,56	543
2161	7090	4,45	427	0,76	22,44	504
2166	7106	3,19	429	1,21	11,34	355
2170	7119	3,25	427	0,62	17,16	528
2170	7119	3,42	431	2,95	15,57	455
2179	7149	2,44	430	0,48	11,47	470
2188	7178	3,13	429	0,53	13,79	441
2198	7211	2,95	428	0,50	12,62	428
2207	7241	2,63	428	0,41	9,80	373
2216	7270	1,95	431	0,31	5,12	263
2225	7300	1,24	434	0,18	1,54	124
2234	7329	1,15	433	0,19	1,39	121
2243	7359	1,54	433	0,22	2,51	163
2252	7388	2,19	430	0,36	4,05	185
2262	7421	1,79	430	0,28	4,12	230
2271	7451	1,58	431	0,25	4,23	268
2280	7480	1,46	431	0,19	1,85	127
2289	7510	1,52	431	0,16	2,16	142
2289	7510	1,50	436	0,22	2,88	192
2298	7539	1,84	426	0,32	2,33	127
2307	7569	1,00	429	0,11	0,42	42
2316	7598	1,08	430	0,12	0,53	49
2326	7631	1,62	428	0,15	1,42	88
2335	7661	1,10	426	0,10	0,41	37
2344	7690	1,93	429	0,22	3,54	183
2353	7720	1,07	434	0,09	0,59	55
2362	7749	1,01	434	0,17	0,98	97
2371	7779	1,20	435	0,16	1,22	102
2380	7808	1,16	435	0,09	1,08	93
2380	7808	1,09	437	0,09	1,12	103
2390	7841	1,14	434	0,11	0,97	85
2399	7871	0,95	435	0,09	0,89	94
2408	7900	1,07	433	0,23	0,63	59
2408	7900	0,91	433	0,28	1,26	138
2417	7930	1,16	435	0,11	1,20	103
2426	7959	1,07	432	0,11	0,59	55
2435	7989	0,88	429	0,12	0,48	55
2444	8018	0,97	433	0,10	0,46	47
2454	8051	0,90	433	0,07	0,34	38
2463	8081	0,98	434	0,07	0,49	50
2472	8110	1,16	431	0,25	1,55	134
2481	8140	0,84	434	0,07	0,35	42
2490	8169	0,97	435	0,06	0,49	51
2499	8199	0,80	438	0,05	0,29	36
2499	8199	0,82	434	0,20	0,40	49
2509	8232	0,80		0,03	0,07	9
2518	8261	0,78		0,03	0,13	17
2527	8291	0,83	404	0,05	0,21	25
2536	8320	0,82	434	0,04	0,23	28
2545	8350	0,86	432	0,04	0,22	26
2551	8369	0,93	433	0,06	0,36	39
2560	8399	0,87	438	0,05	0,30	34
2569	8428	0,99	437	0,08	0,39	39
2579	8461	0,97	434	0,08	0,37	38
2588	8491	0,91	432	0,07	0,59	65
2591	8501	0,83	435	0,02	0,37	45
2597	8520	0,78	441	0,06	0,23	29
2606	8550	0,76	436	0,07	0,32	42
2615	8579	0,84	434	0,08	0,44	52
2624	8609	0,88	434	0,06	0,44	50
2652	8701	0,75		0,03	0,18	24
2679	8789	1,25	431	0,21	0,80	64
2682	8799	1,25	438	0,51	1,20	96
2694	8839	0,93	437	0,17	0,62	67
2707	8881	0,93	433	0,16	0,48	52
2734	8970	0,93	431	0,12	0,80	86
2743	8999	1,09	434	0,30	1,00	92
2761	9058	0,91	436	0,10	0,78	86
2789	9150	0,71	433	0,06	0,50	70
2792	9160	0,78	437	0,25	0,90	115
2816	9239	1,06	433	0,07	0,61	58
2843	9327	0,66		0,02	0,12	18

2871	9419	0,47		0,04	0,14	30
2899	9511	0,62	438	0,06	0,23	37
2926	9600	0,50	411	0,07	0,21	42
2954	9692	0,55	428	0,12	0,29	53
2981	9780	0,56	427	0,09	0,42	75
3008	9869	0,22		0,07	0,07	32
3036	9961	0,38	422	0,09	0,27	71
3066	10059	0,77	434	0,89	1,70	221
3088	10131	0,44	430	0,28	0,29	66
3115	10220	0,64	440	0,47	1,31	205
3142	10308	0,89	435	0,81	4,46	501
3170	10400	0,47		0,13	0,13	28
3197	10489	0,41		0,10	0,13	32
3225	10581	0,37		0,13	0,16	43
3252	10669	0,63	425	0,36	0,46	73
3280	10761	0,40		0,26	0,17	43
3307	10850	0,43	423	0,23	0,42	98
3334	10938	0,49		0,10	0,17	35
3359	11020	0,31		0,05	0,10	32
3389	11119	0,29		0,06	0,02	7
3417	11211	0,91	429	0,69	1,55	170
3444	11299	0,69	431	0,09	0,28	41
3472	11391	0,56	421	0,21	0,33	59
3499	11480	0,35	426	0,05	0,26	74
3527	11572	0,44		0,10	0,15	34
3554	11660	0,43	427	0,08	0,26	60
3581	11749	0,13		0,05	0,01	8
3609	11841	0,28		0,14	0,05	18
3636	11929	0,38		0,36	0,24	63
3664	12021	0,22		0,05	0,07	32
3673	12051	0,23		0,07	0,06	26
3682	12080	0,28		0,06	0,06	21
3691	12110	0,36		0,10	0,17	47
3700	12139	0,27		0,06	0,05	19
3709	12169	0,30		0,06	0,13	43
3719	12201	0,26		0,02	0,02	8
3728	12231	0,19		0,00	0,00	0
3737	12260	0,29		0,03	0,03	10
3746	12290	0,26		0,03	0,18	69
3755	12320	0,25		0,02	0,10	40
3764	12349	0,15		0,02	0,00	0
3773	12379	0,30		0,03	0,16	53
3783	12411	0,24		0,03	0,02	8
3792	12441	0,36		0,03	0,08	22
3801	12470	0,42		0,03	0,18	43
3810	12500	0,33		0,09	0,18	55
3819	12530	0,59	424	0,18	0,48	81
3828	12559	0,21		0,02	0,02	10
3837	12589	0,27		0,06	0,13	48
3847	12621	0,29		0,09	0,08	28
3856	12651	0,59	426	0,26	0,54	92
3865	12680	0,46		0,05	0,13	28
3874	12710	0,22		0,03	0,13	59
3883	12740	0,18		0,05	0,03	17
3892	12769	0,51	432	0,09	0,37	73
3901	12799	0,25		0,07	0,08	32
3911	12831	0,46	419	0,13	0,23	50
3920	12861	0,49	426	0,68	0,56	114
3929	12890	0,23		0,03	0,02	9
3938	12920	0,24	428	0,12	0,33	138
3947	12949	0,18		0,08	0,15	83
3956	12979	0,30		0,06	0,14	47
3965	13009	0,23	423	0,12	0,59	257
3975	13041	0,26		0,06	0,15	58
3984	13071	0,22		0,08	0,12	55
3993	13100	0,14		0,05	0,16	114
4002	13130	0,25		0,06	0,15	60
4011	13159	0,13		0,05	0,13	100
4020	13189	0,51	422	0,34	2,63	516
4029	13219	0,32	423	0,14	0,34	106
4039	13251	0,48	431	0,13	0,41	85
4048	13281	0,46	427	0,24	0,42	91
4057	13310	0,42	419	0,19	0,33	79
4069	13350	0,26	421	0,15	0,30	115
4078	13379	0,49	431	0,15	0,56	114
4087	13409	0,49	404	0,18	0,29	59
4097	13442	0,16		0,27	0,14	88
4106	13471	0,15		0,28	0,17	113
4115	13501	0,19	421	0,22	0,33	174

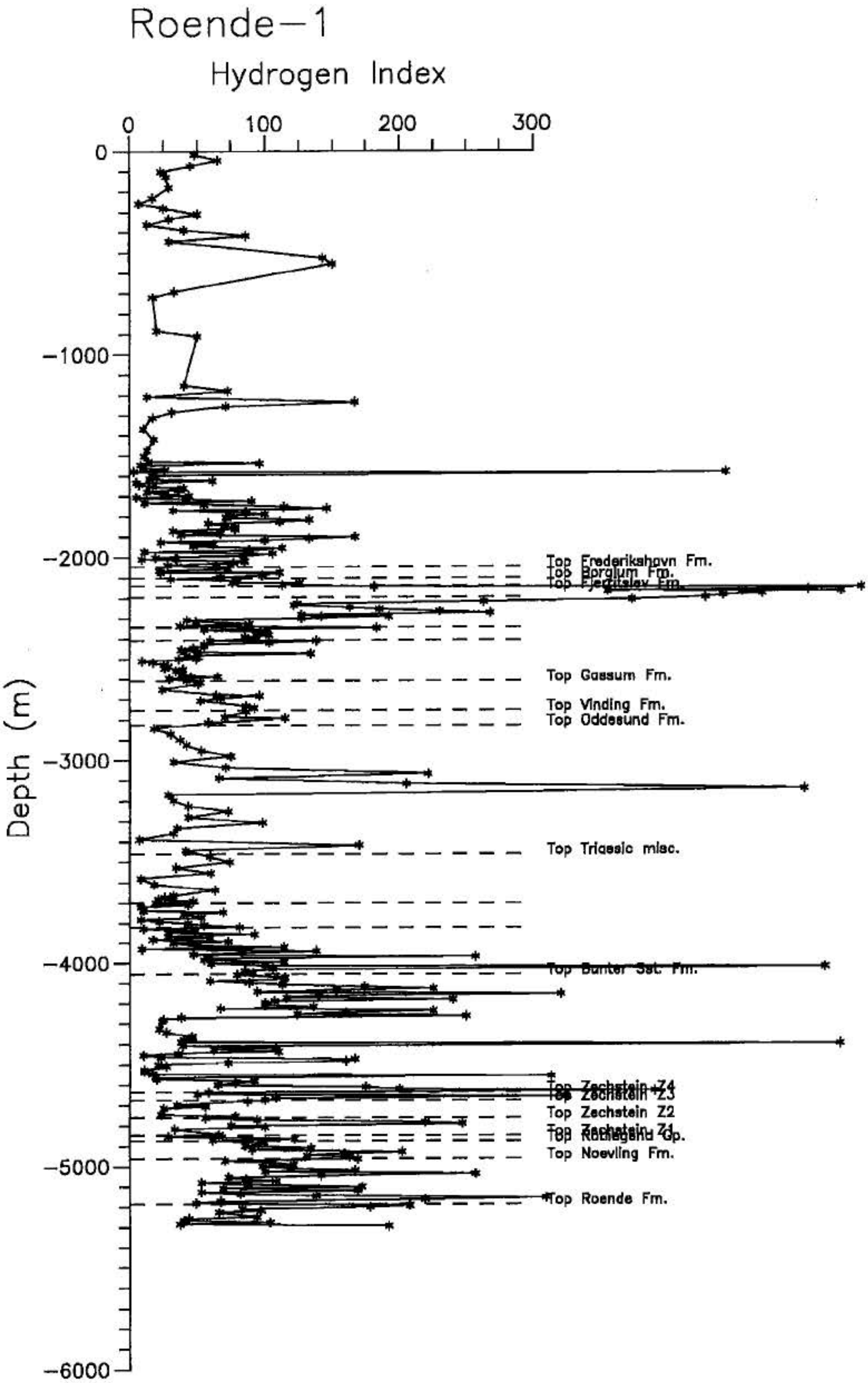
4124	13530	0,63	413	1,77	1,42	225
4133	13560	0,30	403	1,35	0,46	153
4142	13589	0,18		0,40	0,17	94
4151	13619	1,52		6,78	4,86	320
4161	13652	0,10		0,35	0,14	140
4170	13681	0,19		0,45	0,22	116
4179	13711	0,63	415	3,02	1,51	240
4188	13740	0,15		0,17	0,16	107
4197	13770	0,02		0,09	0,02	100
4206	13799	0,10		0,11	0,10	100
4215	13829	0,14		0,21	0,19	136
4225	13862	0,03		0,03	0,02	67
4234	13891	0,04		0,12	0,09	225
4243	13921	0,10		0,24	0,16	160
4252	13950	0,17		0,29	0,21	124
4261	13980	0,02		0,08	0,05	250
4270	14009	0,08		0,10	0,03	38
4279	14039	0,12		0,11	0,03	25
4288	14068	0,17		0,27	0,04	24
4298	14101	0,08		0,03	0,00	0
4307	14131	0,02		0,04	0,00	0
4316	14160	0,13		0,10	0,00	0
4325	14190	0,18		0,29	0,04	22
4334	14219	0,11		0,08	0,00	0
4343	14249	0,11		0,16	0,03	27
4353	14281	0,05		0,29	0,00	0
4362	14311	0,13		0,29	0,06	46
4371	14341	0,13		0,44	0,06	46
4380	14370	0,10		0,11	0,04	40
4389	14400	0,08		0,06	0,03	38
4398	14429	0,41	405	2,86	2,16	527
4407	14459	0,18		0,32	0,07	39
4417	14491	0,13		0,11	0,14	108
4426	14521	0,13		0,14	0,08	62
4435	14551	0,10		0,16	0,11	110
4444	14580	0,11		0,18	0,04	36
4453	14610	0,10		0,07	0,01	10
4462	14639	0,13		0,12	0,03	23
4471	14669	0,06		0,14	0,10	167
4481	14701	0,10		0,26	0,16	160
4490	14731	0,15		0,19	0,11	73
4499	14760	0,14		0,23	0,03	21
4508	14790	0,15		0,22	0,04	27
4517	14820	0,07		0,10	0,00	0
4526	14849	0,09		0,12	0,01	11
4535	14879	0,09		0,08	0,01	11
4545	14911	0,23		0,41	0,04	17
4554	14941	0,08		0,57	0,25	313
4563	14970	0,16		0,29	0,03	19
4572	15000	0,15		0,22	0,03	20
4581	15030	0,12		0,24	0,11	92
4590	15059	0,18		0,28	0,14	78
4599	15089	0,20		0,27	0,13	65
4609	15121	0,12		0,17	0,21	175
4618	15151	0,14		0,20	0,28	200
4627	15180	0,10	442	0,16	0,39	390
4636	15210	0,12		0,17	0,07	58
4645	15240	0,12		0,05	0,06	50
4654	15269	0,37	424	1,32	1,20	324
4663	15299	0,36		0,64	0,39	108
4673	15331	0,46		1,61	0,46	100
4679	15351	0,39	400	0,67	0,34	87
4697	15410	0,23		0,42	0,08	35
4706	15440	0,32		0,47	0,18	56
4715	15469	0,12		0,21	0,03	25
4724	15499	0,10		0,10	0,00	0
4734	15531	0,15		0,18	0,00	0
4743	15561	0,22		0,17	0,05	23
4752	15591	0,36	405	0,36	0,28	78
4761	15620	0,34	431	0,15	0,19	56
4770	15650	0,49	405	0,58	0,46	94
4779	15679	0,48	468	0,78	1,05	219
4788	15709	0,17	452	0,23	0,42	247
4798	15741	0,16		0,39	0,12	75
4807	15771	0,15		1,08	0,15	100
4816	15801	0,09		0,14	0,03	33
4825	15830	0,06		0,13	0,00	0
4834	15860	0,29		0,22	0,00	0
4843	15889	0,32	448	0,68	0,21	66

4852	15919	0,53		0,62	0,15	28
4862	15951	0,37	415	1,45	0,45	122
4871	15981	0,59		2,21	0,36	61
4881	16014	1,28	436	1,91	1,27	99
4891	16047	0,39	409	1,17	0,37	95
4898	16070	0,33		0,80	0,28	85
4907	16099	13,60	431	20,78	18,23	134
4916	16129	8,34	412	12,94	7,53	90
4926	16161	9,76		47,55	19,73	202
4935	16191	9,90	412	34,27	15,77	159
4944	16220	8,82		30,35	11,59	131
4953	16250	0,59		2,24	0,96	163
4962	16280	4,31		17,67	7,27	169
4971	16309	1,77	412	1,98	1,24	70
4980	16339	0,41	447	0,98	0,43	105
4990	16371	1,44		3,16	1,74	121
4999	16401	3,02		5,50	2,95	98
5008	16430	33,92		108,00	40,52	119
5017	16460	5,99		21,13	9,99	167
5026	16490	1,28		1,98	1,28	100
5035	16519	1,02		3,73	2,62	257
5044	16549	2,05		3,76	2,91	142
5054	16581	0,45		0,92	0,33	73
5063	16611	0,90		1,94	0,77	86
5072	16640	1,27	400	1,37	1,37	108
5081	16670	0,30		0,50	0,16	53
5090	16699	0,46		0,88	0,40	87
5099	16729	1,34		3,71	2,31	172
5108	16759	1,03		1,29	0,71	69
5118	16791	2,17		5,95	3,66	169
5127	16821	0,76		1,47	0,40	53
5136	16850	0,55	436	1,45	0,45	82
5145	16880	0,85		2,56	1,17	138
5154	16909	2,00		12,30	6,17	309
5163	16939	0,32		1,27	0,70	219
5172	16969	0,49		1,18	0,33	67
5182	17001	1,02		3,02	0,50	49
5191	17031	0,74		3,46	1,54	208
5200	17060	1,60		5,93	2,85	178
5209	17090	0,40		1,47	0,33	83
5218	17119	0,39		0,87	0,38	97
5227	17149	0,95		1,65	0,63	66
5249	17221	0,18		0,63	0,17	94
5258	17251	0,25		0,76	0,11	44
5267	17280	0,30		0,64	0,12	40
5276	17310	0,56	421	0,95	0,58	104
5285	17339	0,54		0,55	0,20	37
5294	17369	0,37		1,27	0,71	192

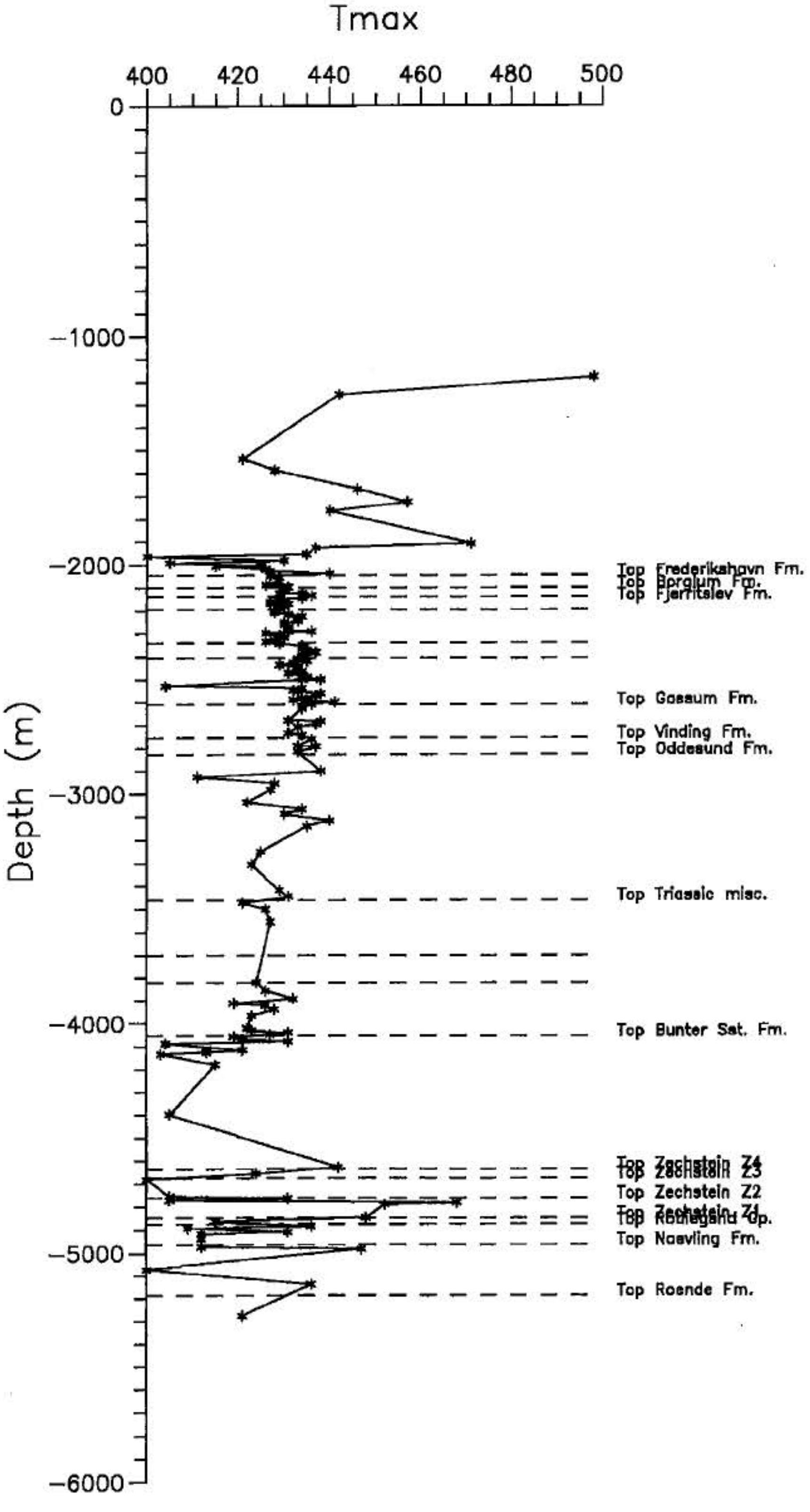
Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	50	0,61	1,06	***0,76***	0,14	1,18	***0,54***	22	111	***66***
Børglum Fm.	38	0,57	1,67	***1,04***	0,17	1,88	***0,98***	30	126	***85***
Fjerritslev Fm. F-IV	55	2,44	5,81	***3,58***	5,40	31,56	***16,09***	181	543	***435***
Fjerritslev Fm. F-III	145	1,00	2,95	***1,66***	0,41	12,62	***3,38***	37	428	***174***
Fjerritslev Fm. F-II	71	0,91	1,93	***1,15***	0,59	3,54	***1,23***	55	183	***101***
Fjerritslev Fm. F-I	204	0,76	1,16	***0,90***	0,07	1,55	***0,43***	9	134	***46***
Gassum Fm.	140	0,75	1,25	***0,98***	0,18	1,20	***0,66***	24	96	***65***
Vinding Fm.	71	0,71	1,06	***0,87***	0,50	0,90	***0,70***	58	115	***82***
Oddesund Fm.	633	0,22	0,91	***0,53***	0,02	4,46	***0,57***	7	501	***85***
Tønder Fm.	241	0,13	0,56	***0,33***	0,01	0,33	***0,15***	8	74	***40***
Falster Fm.	122	0,15	0,59	***0,30***	0,00	0,48	***0,12***	0	81	***32***
Ørslev Fm.	235	0,13	0,59	***0,32***	0,02	2,63	***0,32***	9	516	***91***
Bunter Sst. Fm.	579	0,02	1,52	***0,18***	0,00	4,86	***0,27***	0	527	***101***
Zechstein 4	37	0,12	0,37	***0,24***	0,06	1,20	***0,43***	50	324	***135***
Zechstein 3	86	0,10	0,46	***0,26***	0,00	0,46	***0,16***	0	100	***45***
Zechstein 2	93	0,06	0,49	***0,26***	0,00	1,05	***0,26***	0	247	***89***
Zechstein 1	23	0,37	0,59	***0,50***	0,15	0,45	***0,32***	28	122	***70***
Rotliegend Gp.	87	0,33	13,60	***5,89***	0,28	19,73	***8,41***	85	202	***129***
Nøvling Fm.	230	0,30	33,92	***2,76***	0,16	40,52	***3,62***	49	309	***123***
Rønde Fm.	110	0,18	1,60	***0,57***	0,11	2,85	***0,69***	37	208	***104***



Roende-1
T.O.C (%)
0 2 4 6 8 10
0
-1000
-2000
-3000
-4000
-5000
-6000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Toender Fm.
Top Falster Fm.
Top Oerslev Fm.
Top Bunter Sst. Fm.
Top Zechstein Z4
Top Zechstein Z3
Top Zechstein Z2
Top Zechstein Z1
Top Rotliegend Gp.
Top Noevling Fm.
Top Roende Fm.


Roende-1
Hydrogen Index
0
100
200
300
0
-1000
-2000
-3000
-4000
-5000
-6000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Triassic misc.
Top Bunter Sst. Fm.
Top Zechstein Z4
Top Zechstein Z3
Top Zechstein Z2
Top Zechstein Z1
Top Rotliegend Gp.
Top Noevling Fm.
Top Roende Fm.

Roende-1


Tmax
400
420
440
460
480
500
0
-1000
-2000
-3000
-4000
-5000
-6000
Depth (m)
Top Frederikshavn Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Triassic misc.
Top Bunter Sst. Fm.
Top Zechstein Z4
Top Zechstein Z2
Top Noavling Fm.
Top Roende Fm.

Slagelse-1

Stratigraphy (b.rfl)	Rfl:	134	feet a. msl.	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	3123	952	911	21
Frederikshavn Fm.	3192	973	932	0
Børglum Fm.	3192	973	932	0
Flyvbjerg Fm.	3192	973	932	0
Haldager sand Fm.	3192	973	932	0
Fjerritslev Fm. F-IV	3192	973	932	0
Fjerritslev Fm. F-III	3192	973	932	0
Fjerritslev Fm. F-II	3192	973	932	0
Fjerritslev Fm. F-I	3192	973	932	177
Gassum Fm.	3773	1150	1109	137
Vinding Fm.	4222	1287	1246	51
Oddesund Fm.	4390	1338	1297	293
Tønder Fm.	5351	1631	1590	0
Falster Fm.	5351	1631	1590	132
Ørslev Fm.	5784	1763	1722	102
Bunter Sst. Fm	6119	1865	1824	192
Bunter Sh. Fm.	6749	2057	2016	200
Zechstein 3	7405	2257	2216	21
Zechstein 2	7474	2278	2237	164
Zechstein 1	8012	2442	2401	187
Rotliegend	8625	2629	2588	6
Pre-permian	8645	2635	2594	340
TD	9760	2975	2934	

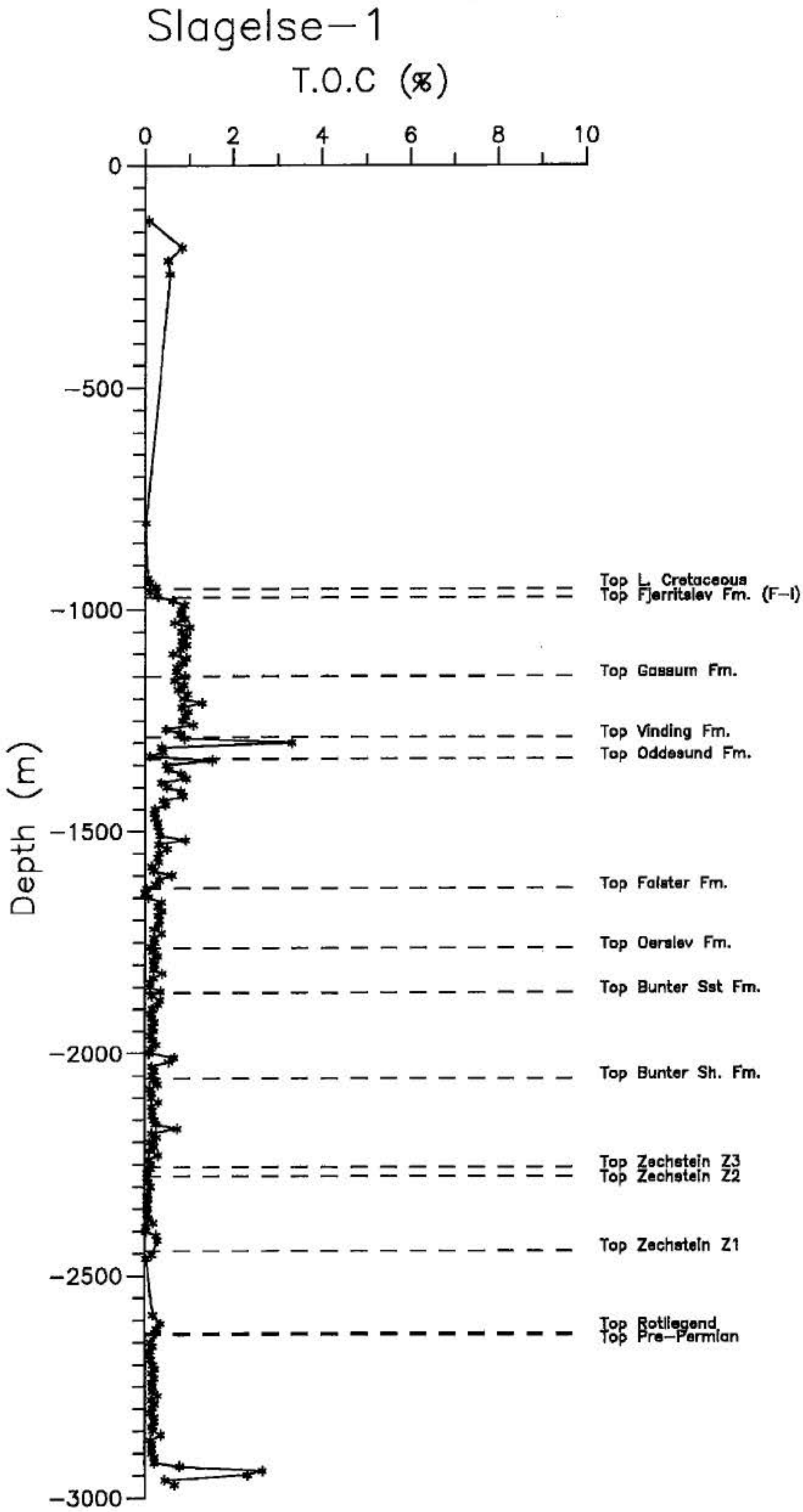
Cuttings

meter	feet	TC	TOC	Tmax	S1	S2	S3	HI
125	410	1,18	0,09		0,03	0,05	0,51	59
185	607	5,42	0,83	434	0,40	1,44	1,13	174
215	705	6,54	0,52		0,12	0,16	1,14	31
245	804	5,53	0,56		0,20	0,18	1,10	32
805	2641	7,69	0,02		0,02	0,00	0,75	0
930	3051	10,06	0,06		0,00	0,00	0,27	0
940	3084	10,82	0,10		0,01	0,00	0,37	0
950	3117	10,35	0,23		0,04	0,05	0,86	23
960	3150	7,53	0,12		0,03	0,00	0,77	0
970	3182	3,54	0,28		0,06	0,08	1,28	27
980	3215	5,48	0,63		0,08	0,17	1,65	27
990	3248	3,12	0,88	415	0,15	0,33	1,50	38
1000	3281	2,38	0,82		0,05	0,18	1,27	22
1010	3314	3,20	0,80		0,06	0,16	1,46	20
1020	3346	3,02	0,90	415	0,04	0,22	1,23	25
1030	3379	1,84	0,67		0,05	0,20	1,20	30
1040	3412	2,07	1,01	427	0,04	0,36	2,93	36
1050	3445	2,43	0,82	429	0,03	0,24	1,86	29
1060	3478	2,25	0,94	424	0,05	0,36	2,60	39
1070	3510	2,56	0,83		0,03	0,17	1,96	21
1080	3543	2,13	0,92	429	0,06	0,29	1,65	31
1090	3576	2,14	0,79	424	0,05	0,25	2,13	31
1100	3609	2,67	0,62	423	0,08	0,24	1,58	38
1110	3642	2,28	0,92	413	0,13	0,36	2,74	39
1120	3675	2,36	0,84	425	0,03	0,27	2,26	32
1130	3707	2,17	0,72		0,03	0,18	1,51	25
1140	3740	2,31	0,71		0,08	0,20	1,61	29
1150	3773	2,08	0,90	421	0,06	0,33	1,36	37
1160	3806	2,88	0,66	419	0,04	0,21	0,91	32
1170	3839	2,03	0,87		0,02	0,19	0,99	22
1180	3871	2,45	0,75		0,02	0,19	1,24	26
1190	3904	2,26	0,96	423	0,03	0,32	1,12	33
1200	3937	1,68	0,88	425	0,04	0,24	1,82	27
1210	3970	2,28	1,29	429	0,09	1,67	1,27	129
1220	4003	3,15	0,83	425	0,05	0,35	2,09	42
1230	4035	1,82	0,98	425	0,04	0,25	1,31	25
1240	4068	1,47	0,91	425	0,04	0,25	1,43	27
1250	4101	2,63	0,85	419	0,04	0,21	1,55	25
1260	4134	1,58	1,09	421	0,04	0,30	1,65	27
1270	4167	5,28	0,48		0,03	0,13	0,84	27
1280	4199	1,20	0,80		0,03	0,18	1,09	23
1290	4232	1,71	0,89	364	0,05	0,22	1,66	25

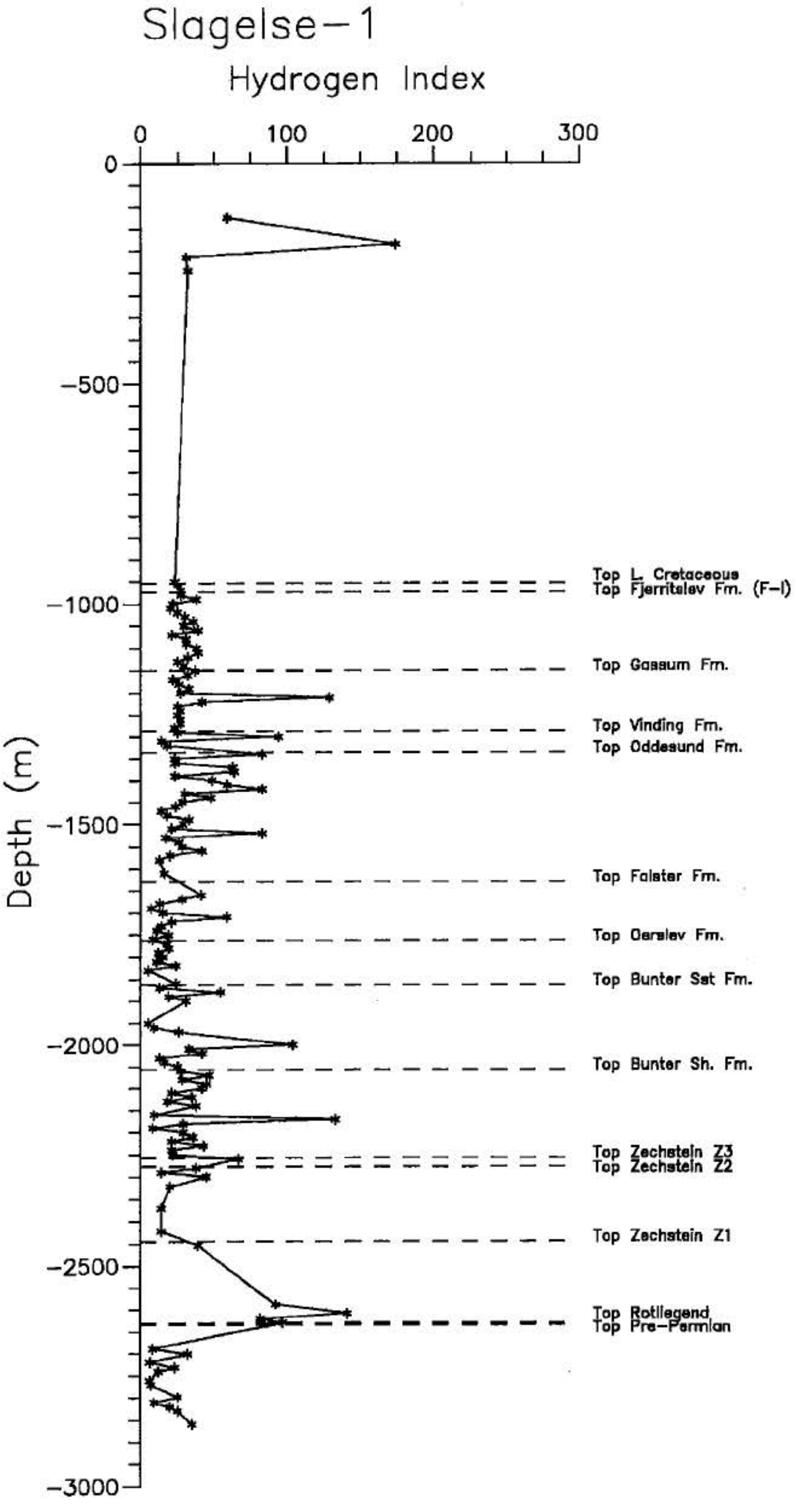
1300	4265	5,66	3,33	430	0,17	3,13	2,15	94
1310	4298	1,98	0,37		0,01	0,05	0,40	14
1320	4331	1,81	0,40		0,02	0,07	0,56	18
1330	4364	4,90	0,12		0,00	0,00	0,28	0
1340	4396	2,44	1,53	431	0,04	1,28	0,69	83
1350	4429	2,42	0,48		0,00	0,11	0,46	23
1360	4462	1,90	0,53		0,00	0,12	0,35	23
1370	4495	2,73	0,81	425	0,03	0,51	0,61	63
1380	4528	3,32	0,93	427	0,03	0,59	0,96	64
1390	4560	4,23	0,36		0,00	0,08	0,33	23
1400	4593	3,09	0,50	425	0,03	0,25	0,40	49
1410	4626	2,60	0,81	429	0,06	0,48	0,48	59
1420	4659	4,88	0,86	433	0,07	0,71	0,96	83
1430	4692	2,99	0,41		0,05	0,12	0,89	30
1440	4724	3,02	0,47	420	0,02	0,22	0,40	48
1450	4757	2,96	0,22		0,03	0,06	0,48	28
1460	4790	2,39	0,21		0,03	0,05	0,49	24
1470	4823	2,86	0,22		0,03	0,03	0,57	14
1480	4856	2,27	0,29		0,03	0,05	0,72	18
1490	4888	3,33	0,28		0,04	0,09	0,61	33
1500	4921	2,71	0,32		0,03	0,09	0,58	29
1510	4954	2,28	0,34		0,03	0,07	0,51	21
1520	4987	2,63	0,91	423	0,11	0,76	0,82	83
1530	5020	3,45	0,30		0,03	0,05	0,46	17
1540	5052	3,15	0,51		0,02	0,13	0,60	26
1550	5085	3,02	0,33		0,06	0,09	0,50	28
1560	5118	2,39	0,29		0,16	0,12	0,50	42
1570	5151	2,30	0,31		0,07	0,06	0,51	20
1580	5184	1,52	0,15		0,02	0,02	0,24	13
1590	5217	1,36	0,19		0,01	0,00	0,33	0
1600	5249	1,45	0,60		0,01	0,00	0,25	0
1610	5282	1,72	0,32		0,04	0,05	0,37	16
1620	5315	1,90	0,24		0,03	0,00	0,32	0
1630	5348	1,03	0,04		0,01	0,00	0,10	0
1640	5381	1,13	0,00		0,00	0,00	0,10	
1650	5413	0,85	0,08		0,03	0,00	0,21	0
1660	5446	2,35	0,37		0,02	0,15	0,82	41
1670	5479	4,56	0,29		0,02	0,08	1,01	28
1680	5512	2,53	0,39		0,02	0,05	1,01	13
1690	5545	1,72	0,28		0,01	0,02	0,93	7
1700	5577	3,13	0,33		0,02	0,05	1,22	15
1710	5610	4,45	0,31		0,03	0,18	1,09	59
1720	5643	5,00	0,20		0,01	0,04	1,33	21
1730	5676	4,24	0,38		0,00	0,05	1,39	14
1740	5709	4,20	0,19		0,01	0,02	0,95	11
1750	5741	4,59	0,22		0,01	0,04	0,94	19
1760	5774	3,23	0,13		0,00	0,01	0,63	8
1770	5807	5,31	0,17		0,00	0,03	0,82	18
1780	5840	3,99	0,28		0,01	0,05	1,11	19
1790	5873	3,04	0,18		0,02	0,02	1,32	12
1800	5906	2,97	0,21		0,01	0,03	1,05	15
1810	5938	2,96	0,19		0,01	0,02	0,92	11
1820	5971	2,85	0,39		0,02	0,09	0,89	24
1830	6004	2,79	0,19		0,01	0,01	0,48	5
1840	6037	2,77	0,12		0,02	0,00	0,56	0
1850	6070	3,24	0,12		0,01	0,00	0,57	0
1860	6102	2,68	0,35		0,01	0,08	1,06	24
1870	6135	3,40	0,16		0,01	0,02	0,41	13
1880	6168	2,69	0,34		0,02	0,19	0,52	55
1890	6201	1,94	0,28		0,01	0,05	0,83	19
1900	6234	2,54	0,17		0,00	0,05	0,78	31
1910	6266	2,61	0,13		0,00	0,00	0,85	0
1920	6299	2,93	0,15		0,02	0,00	0,81	0
1930	6332	2,62	0,21		0,01	0,00	0,64	0
1940	6365	2,12	0,15		0,01	0,00	0,80	0
1950	6398	3,12	0,19		0,01	0,01	0,81	5
1960	6430	2,27	0,11		0,01	0,01	1,01	9
1970	6463	2,29	0,16		0,03	0,04	0,96	26
1980	6496	2,77	0,24		0,00	0,00	0,58	0
1990	6529	2,51	0,13		0,01	0,00	0,57	0
2000	6562	2,57	0,09		0,01	0,09	0,61	104
2010	6594	2,74	0,66	408	0,06	0,22	2,10	33
2020	6627	2,49	0,54	423	0,03	0,23	0,62	42
2030	6660	2,62	0,16		0,02	0,02	0,57	13
2040	6693	2,12	0,20		0,02	0,03	0,82	16
2050	6726	2,43	0,17		0,02	0,04	1,04	25
2060	6759	2,75	0,19		0,02	0,05	0,87	27
2070	6791	2,26	0,29		0,04	0,14	1,08	47
2080	6824	3,75	0,11		0,01	0,03	0,95	28

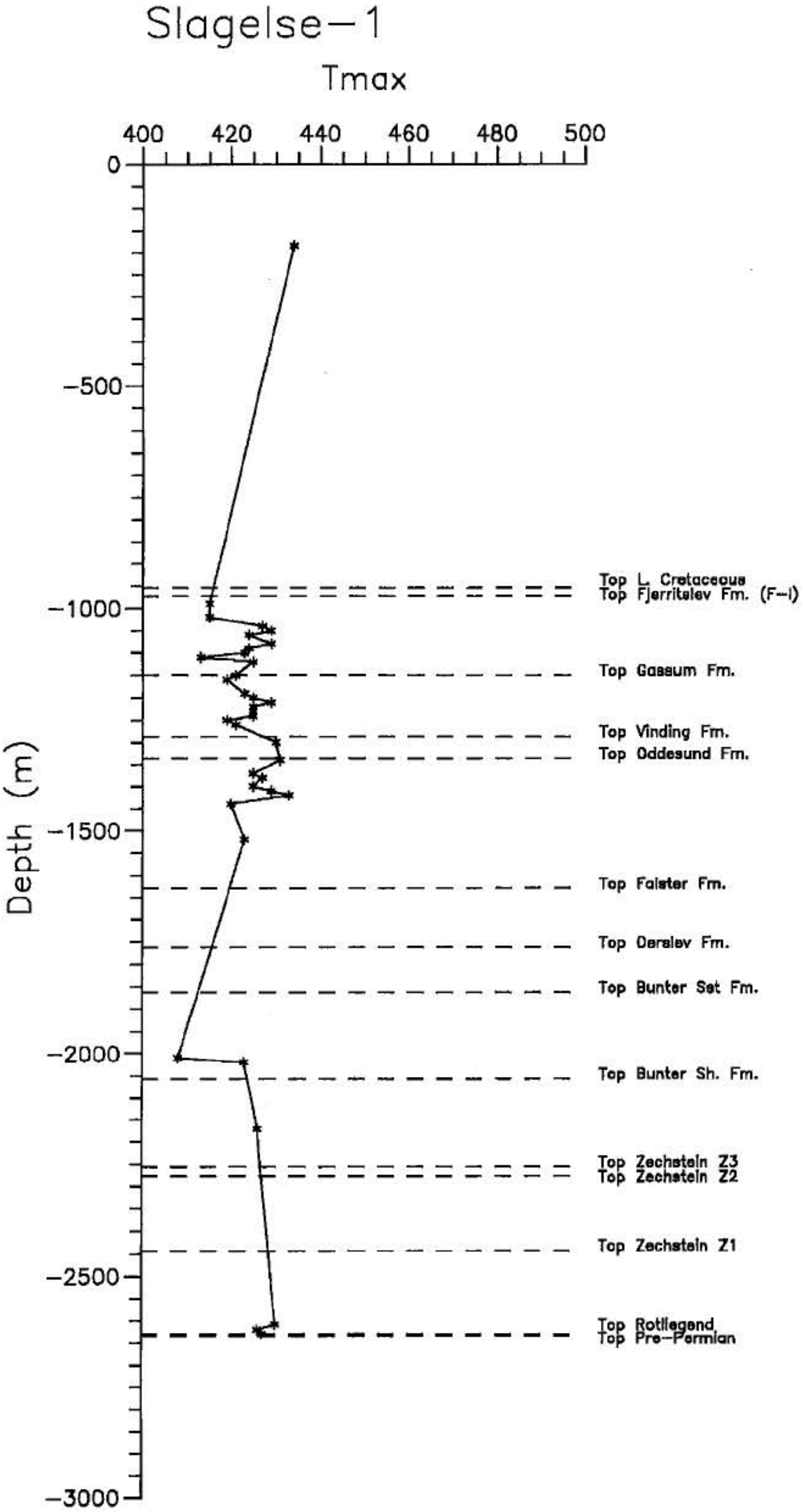
2090	6857	3,05	0,14		0,03	0,06	1,35	45
2100	6890	2,24	0,15		0,03	0,06	0,79	42
2110	6923	2,84	0,30		0,03	0,06	1,45	21
2120	6955	2,50	0,15		0,02	0,05	1,16	35
2130	6988	2,50	0,17		0,03	0,03	0,57	18
2140	7021	2,15	0,17		0,02	0,06	0,78	38
2150	7054	2,45	0,21		0,00	0,00	0,79	0
2160	7087	2,48	0,24		0,01	0,02	1,40	9
2170	7119	2,49	0,73	426	0,09	0,97	1,27	133
2180	7152	1,90	0,15		0,02	0,04	0,92	29
2190	7185	1,78	0,26		0,00	0,02	1,07	8
2200	7218	1,81	0,11		0,02	0,03	0,69	29
2210	7251	1,91	0,21		0,02	0,08	1,05	36
2220	7283	1,92	0,10		0,01	0,02	0,81	21
2230	7316	2,05	0,30		0,02	0,13	0,98	43
2240	7349	1,70	0,09		0,01	0,02	0,72	21
2250	7382	1,92	0,13		0,02	0,03	0,79	22
2260	7415	2,02	0,13		0,06	0,09	1,07	67
2270	7448	1,96	0,05		0,00	0,00	0,66	0
2280	7480	1,34	0,05		0,01	0,02	0,42	38
2290	7513	0,90	0,07		0,02	0,01	0,32	14
2300	7546	0,86	0,13		0,03	0,06	0,50	45
2319	7608	0,70	0,06		0,00	0,00	0,25	0
2322	7618	0,94	0,05		0,00	0,01	0,42	20
2328	7638	1,22	0,07		0,00	0,00	0,74	0
2340	7677	1,04	0,05		0,00	0,00	0,51	0
2349	7707	0,87	0,06		0,00	0,00	0,46	0
2361	7746	1,37	0,05		0,00	0,00	0,61	0
2370	7776	1,36	0,07		0,01	0,01	0,80	14
2381	7812	0,87	0,18		0,00	0,00	0,81	0
2390	7841	0,44	0,03		0,00	0,00	0,30	0
2400	7874	0,10	0,02		0,00	0,00	0,15	0
2409	7904	1,23	0,25		0,00	0,00	0,59	0
2421	7943	1,99	0,28		0,03	0,04	1,06	14
2453	8048	1,14	0,15		0,02	0,06	1,00	39
2462	8077	0,44	0,03		0,01	0,00	0,31	0
2588	8491	4,33	0,18		0,14	0,17	0,54	92
2608	8556	10,73	0,35	430	0,17	0,49	0,81	141
2620	8596	9,63	0,26	426	0,16	0,21	0,84	82
2629	8625	11,50	0,24	427	0,22	0,23	0,56	97
2650	8694	0,61	0,13		0,02	0,00	0,29	0
2659	8724	1,86	0,16		0,01	0,00	0,84	0
2671	8763	0,91	0,12		0,01	0,00	0,49	0
2677	8783	0,32	0,09		0,03	0,00	0,45	0
2689	8822	0,79	0,13		0,02	0,01	0,83	8
2701	8862	0,94	0,18		0,03	0,06	0,91	32
2710	8891	1,14	0,22		0,02	0,00	0,76	0
2719	8921	1,08	0,16		0,02	0,01	0,68	6
2731	8960	1,07	0,21		0,04	0,05	1,11	23
2740	8990	0,63	0,16		0,03	0,02	0,52	12
2749	9019	1,40	0,17		0,02	0,00	0,76	0
2761	9058	0,71	0,17		0,03	0,01	0,54	6
2770	9088	0,79	0,28		0,09	0,02	0,73	7
2780	9121	0,70	0,14		0,02	0,00	0,37	0
2789	9150	0,82	0,22		0,03	0,00	0,92	0
2798	9180	0,89	0,17		0,03	0,04	0,97	25
2810	9219	0,52	0,12		0,01	0,01	0,74	9
2820	9252	0,81	0,21		0,02	0,04	0,74	20
2829	9281	0,88	0,21		0,04	0,05	0,94	25
2841	9321	1,05	0,16		0,01	0,00	0,83	0
2850	9350	1,02	0,18		0,02	0,00	0,86	0
2859	9380	0,76	0,36		0,08	0,13	0,63	35
2871	9419	0,50	0,13		0,01	0,00	0,54	0
2880	9449	1,30	0,15		0,00	0,00	0,80	0
2889	9478	0,55	0,15		0,00	0,00	0,41	0
2901	9518	0,81	0,15		0,00	0,00	0,96	0
2909	9544	1,25	0,21		0,01	0,00	0,75	0
2921	9583	0,45	0,21		0,00	0,00	0,50	0
2930	9613	1,30	0,78		0,08	0,00	0,47	0
2940	9646	3,22	2,67		0,17	0,00	0,87	0
2949	9675	2,93	2,32		0,42	0,00	0,80	0
2960	9711	1,11	0,46		0,04	0,00	0,42	0
2971	9747	0,68	0,67		0,01	0,00	0,35	0

Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Fjerritslev Fm. F-I	177	0,62	1,01	***0,81***	0,16	0,36	***0,25***	20	39	***30***
Gassum Fm.	137	0,48	1,29	***0,88***	0,13	1,67	***0,34***	22	129	***36***
Vinding Fm.	51	0,12	3,33	***1,02***	0,00	3,13	***0,70***	0	94	***30***
Oddesund Fm.	293	0,04	1,53	***0,46***	0,00	1,28	***0,21***	0	83	***32***
Falster Fm.	132	0,00	0,39	***0,24***	0,00	0,18	***0,05***	0	59	***20***
Ørslev Fm.	102	0,12	0,39	***0,22***	0,00	0,09	***0,03***	0	24	***13***
Bunter Sst. Fm	192	0,09	0,66	***0,22***	0,00	0,23	***0,05***	0	104	***21***
Bunter Sh. Fm.	200	0,09	0,73	***0,21***	0,00	0,97	***0,10***	0	133	***33***
Zechstein 3	21	0,05	0,13	***0,09***	0,00	0,09	***0,04***	0	67	***33***
Zechstein 2	164	0,02	0,28	***0,09***	0,00	0,06	***0,01***	0	45	***10***
Zechstein 1	187	0,03	0,35	***0,19***	0,00	0,49	***0,19***	0	141	***71***
Rotliegend	6	0,24	0,24	***0,24***	0,23	0,23	***0,23***	97	97	***97***
Pre-permian	340	0,09	2,67	***0,36***	0,00	0,13	***0,01***	0	35	***6***



Slagelse-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top L. Cretaceous
Top Fjerritslev Fm. (F-I)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Falster Fm.
Top Oerslev Fm.
Top Bunter Sst Fm.
Top Bunter Sh. Fm.
Top Zechstein Z3
Top Zechstein Z2
Top Zechstein Z1
Top Rotliegend
Top Pre-Permian


Slagelse-1
Hydrogen Index
0
100
200
300
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top L. Cretaceous
Top Fjerritslev Fm. (F-I)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Falster Fm.
Top Oerslev Fm.
Top Bunter Sst Fm.
Top Bunter Sh. Fm.
Top Zechstein Z3
Top Zechstein Z2
Top Zechstein Z1
Top Rotliegend
Top Pre-Permian



Slagelse-1
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top L. Cretaceous
Top Fjerritslev Fm. (F-I)
Top Gassum Fm.
Top Vinding Fm.
Top Oddesund Fm.
Top Falster Fm.
Top Ørslev Fm.
Top Bunter Sst Fm.
Top Bunter Sh. Fm.
Top Zechstein Z3
Top Zechstein Z2
Top Zechstein Z1
Top Rotliegend
Top Pre-Permian

Terne-1

Stratigraphy (b.rfl)	Rfl:	122	feet a. msl.	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	358	109	72	45
Frederikshavn Fm.	505	154	117	258
Børglum Fm.	1352	412	375	8
Flyvbjerg Fm.	1378	420	383	37
Haldager sand Fm.	1499	457	420	173
Fjerritslev Fm. F-IV	2067	630	593	72
Fjerritslev Fm. F-III	2303	702	665	156
Fjerritslev Fm. F-II	2815	858	821	42
Fjerritslev Fm. F-I	2953	900	863	66
Gassum Fm.	3169	966	929	326
Skagerrak Fm.	4239	1292	1255	971
Zechstein Gp.	7424	2263	2226	38
Prepermian	7549	2301	2264	1060
TD	11027	3361	3324	

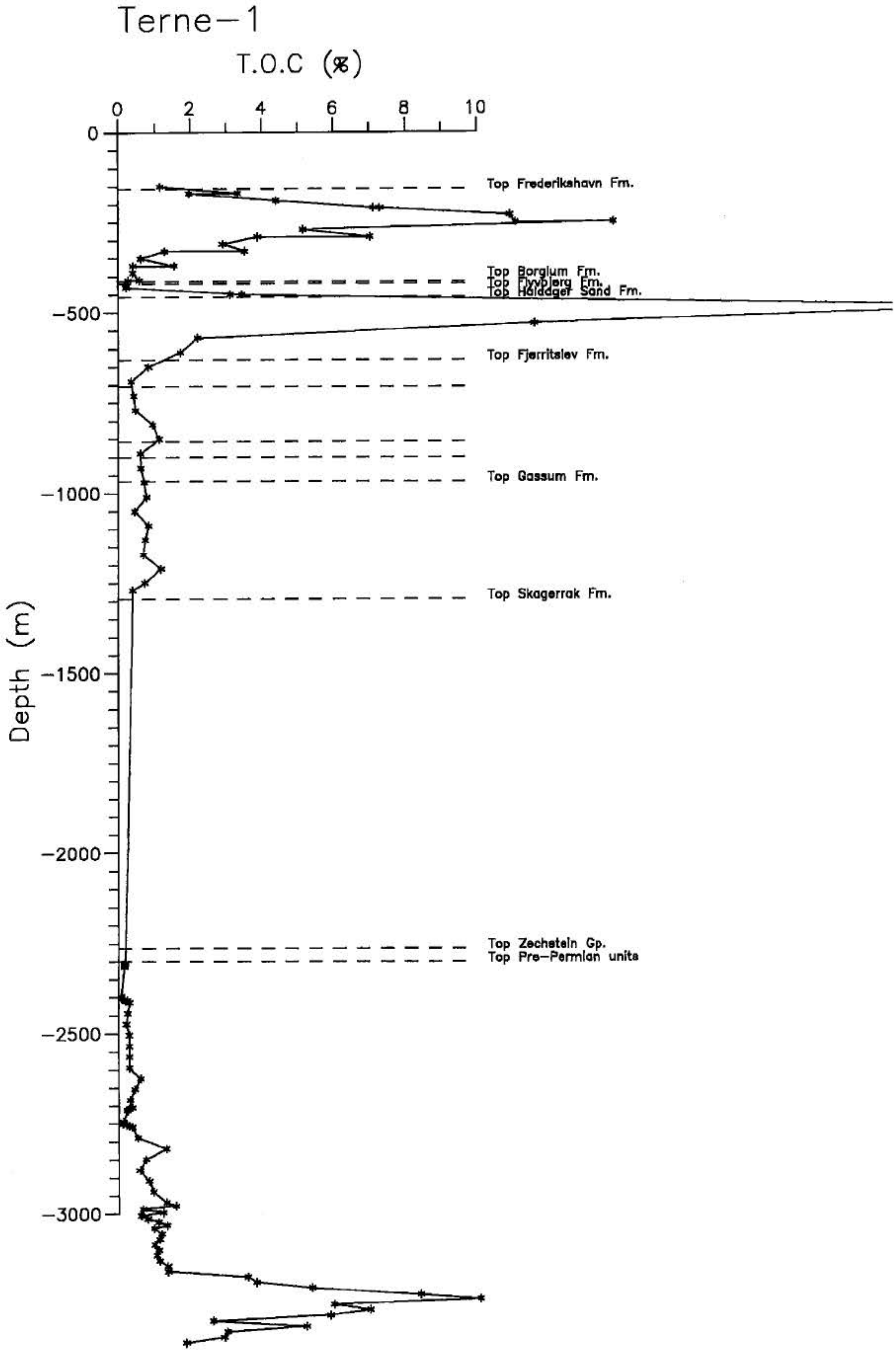
Cuttings   *= solvent extracted cuttings

D (m)	D (feet)	TOC	Tmax	S1	S2	HI	
150	492	1,16	439	0,01	4,76	410	*
170	558	3,34	434	0,11	29,62	887	
170	558	1,97	438	0,01	7,38	375	*
190	623	4,40	439	0,03	18,78	427	*
210	689	7,13	441	0,20	80,24	1125	
210	689	7,30	438	0,08	36,38	498	*
230	755	10,94	438	0,14	57,98	530	*
250	820	11,10	439	0,30	1,56	14	
250	820	13,85	444	0,20	76,62	553	*
270	886	5,16	439	0,06	24,72	479	*
290	951	7,03	440	0,29	75,79	1078	
290	951	3,90	440	0,07	22,62	580	*
310	1017	2,92	444	0,04	13,14	450	*
330	1083	3,54	437	0,05	14,18	400	
330	1083	1,29	444	0,02	2,98	231	*
350	1148	0,63	444	0,01	1,06	168	*
370	1214	1,55	442	0,10	6,67	429	
370	1214	0,41	438	0,04	0,64	156	*
390	1280	0,40	441	0,01	0,96	240	*
410	1345	0,59	440	0,03	4,02	686	
410	1345	0,27	439	0,00	0,28	104	*
430	1411	0,22	432	0,01	0,14	64	*
450	1476	3,46	434	0,09	2,92	84	
450	1476	3,12	441	0,03	1,90	61	*
490	1608	25,63	420	1,18	65,59	256	
530	1739	11,64	420	0,68	30,46	262	
570	1870	2,22	425	0,12	3,29	148	
610	2001	1,74	423	0,10	1,73	99	
650	2133	0,84	433	0,02	0,69	82	
690	2264	0,36	431	0,01	0,31	86	
730	2395	0,43	429	0,01	0,28	65	
770	2526	0,48	427	0,02	0,53	110	
810	2657	0,95	429	0,07	2,13	225	
850	2789	1,14	433	0,04	0,93	82	
890	2920	0,61	433	0,03	0,54	89	
930	3051	0,63	433	0,03	0,31	49	
970	3182	0,72	432	0,03	0,44	61	
1010	3314	0,78	432	0,03	0,66	84	
1050	3445	0,45	437	0,03	0,31	69	
1090	3576	0,83	436	0,03	0,61	73	
1130	3707	0,74	436	0,03	0,35	48	
1170	3839	0,69	434	0,04	0,80	117	
1210	3970	1,18	435	0,07	1,85	156	
1250	4101	0,73	437	0,04	1,00	138	
1270	4167	0,39	435	0,03	0,30	77	
2303	7556	0,18		0,01	0,04	23	
2306	7566	0,17		0,02	0,05	29	
2309	7575	0,15		0,02	0,04	27	
2312	7585	0,15		0,01	0,02	14	

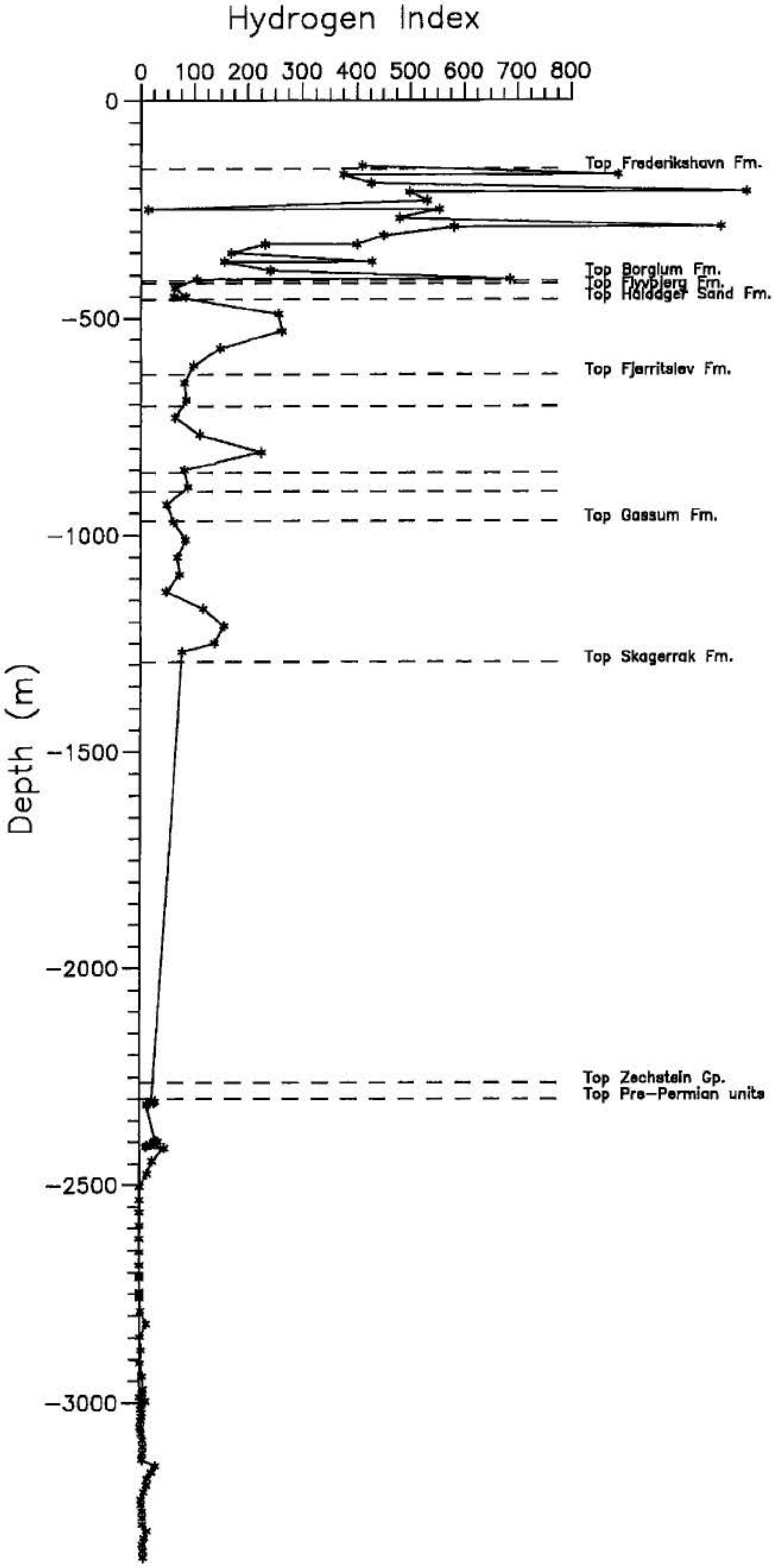
2315	7595	0,15		0,01	0,02	13
2396	7861	0,07		0,02	0,02	29
2399	7871	0,06		0,02	0,02	34
2402	7881	0,08		0,03	0,02	27
2405	7890	0,14		0,02	0,03	21
2408	7900	0,23		0,02	0,03	13
2411	7910	0,18		0,02	0,02	11
2414	7920	0,30		0,04	0,14	46
2444	8018	0,25		0,03	0,06	24
2474	8117	0,21		0,04	0,03	14
2504	8215	0,28		0,03	0,00	0
2534	8314	0,26		0,05	0,00	0
2564	8412	0,28		0,03	0,00	0
2594	8510	0,29		0,06	0,00	0
2624	8609	0,60		0,05	0,00	0
2654	8707	0,44		0,03	0,00	0
2684	8806	0,31		0,04	0,00	0
2705	8875	0,36		0,04	0,00	0
2708	8885	0,28		0,03	0,00	0
2711	8894	0,24		0,04	0,00	0
2714	8904	0,23		0,02	0,00	0
2744	9003	0,13		0,03	0,00	0
2750	9022	0,11		0,03	0,00	0
2753	9032	0,22		0,06	0,00	0
2756	9042	0,28		0,06	0,00	0
2759	9052	0,37		0,06	0,00	0
2789	9150	0,52		0,10	0,01	2
2819	9249	1,32		0,27	0,16	12
2849	9347	0,74		0,11	0,01	1
2879	9446	0,56		0,09	0,02	3
2909	9544	0,83		0,09	0,01	1
2939	9642	0,95		0,16	0,05	5
2969	9741	1,32		0,23	0,09	7
2978	9770	1,58		0,32	0,10	6
2987	9800	0,67		0,08	0,01	1
2996	9829	1,22		0,26	0,13	11
3005	9859	0,61		0,08	0,02	3
3014	9888	0,79		0,08	0,02	3
3023	9918	1,10		0,19	0,06	5
3032	9948	1,33		0,22	0,05	4
3041	9977	0,96		0,11	0,03	3
3056	10026	1,17		0,15	0,02	2
3071	10075	1,12		0,19	0,04	4
3086	10125	0,98		0,25	0,06	6
3101	10174	1,10		0,25	0,08	7
3116	10223	1,04		0,18	0,06	6
3131	10272	1,12		0,11	0,06	5
3146	10322	1,35	407	0,43	0,40	30
3161	10371	1,36		0,33	0,31	23
3176	10420	3,59		0,43	0,54	15
3191	10469	3,83		0,41	0,51	13
3206	10518	5,39		0,40	0,44	8
3224	10577	8,41		0,37	0,37	4
3236	10617	10,08		0,43	0,43	4
3251	10666	6,00		0,34	0,38	6
3266	10715	7,01		0,41	0,42	6
3281	10764	5,89		0,37	0,36	6
3296	10814	2,61		0,34	0,38	14
3311	10863	5,23		0,48	0,45	9
3326	10912	3,00		0,27	0,19	6
3341	10961	2,92		0,35	0,20	7
3356	11010	1,86		0,26	0,13	7

Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***

Frederikshavn Fm.	258	0,27	13,85	***4,39***	0,28	80,24	***23,78***	14	1125	***471***
Børglum Fm.	8	no data	no data	***no data***	no data	no data	***no data***	no data	no data	***no data***
Flyvbjerg Fm.	37	0,22	3,46	***2,27***	0,14	2,92	***1,65***	61	84	***70***
Haldager sand Fm.	173	1,74	25,63	***10,31***	1,73	65,59	***25,27***	99	262	***191***
Fjerritslev Fm. F-IV	72	0,36	0,84	***0,60***	0,31	0,69	***0,50***	82	86	***84***
Fjerritslev Fm. F-III	156	0,43	1,14	***0,75***	0,28	2,13	***0,97***	65	225	***120***
Fjerritslev Fm. F-II	42	0,61	0,61	***0,61***	0,54	0,54	***0,54***	89	89	***89***
Fjerritslev Fm. F-I	66	0,63	0,63	***0,63***	0,31	0,31	***0,31***	49	49	***49***
Gassum Fm.	326	0,39	1,18	***0,72***	0,30	1,85	***0,70***	48	156	***91***
Skagerrak Fm.	971	no data	no data	***no data***	no data	no data	***no data***	no data	no data	***no data***
Zechstein Gp.	38	no data	no data	***no data***	no data	no data	***no data***	no data	no data	***no data***
Prepermian	1060	0,06	10,08	***1,46***	0,00	0,54	***0,11***	0	46	***9***

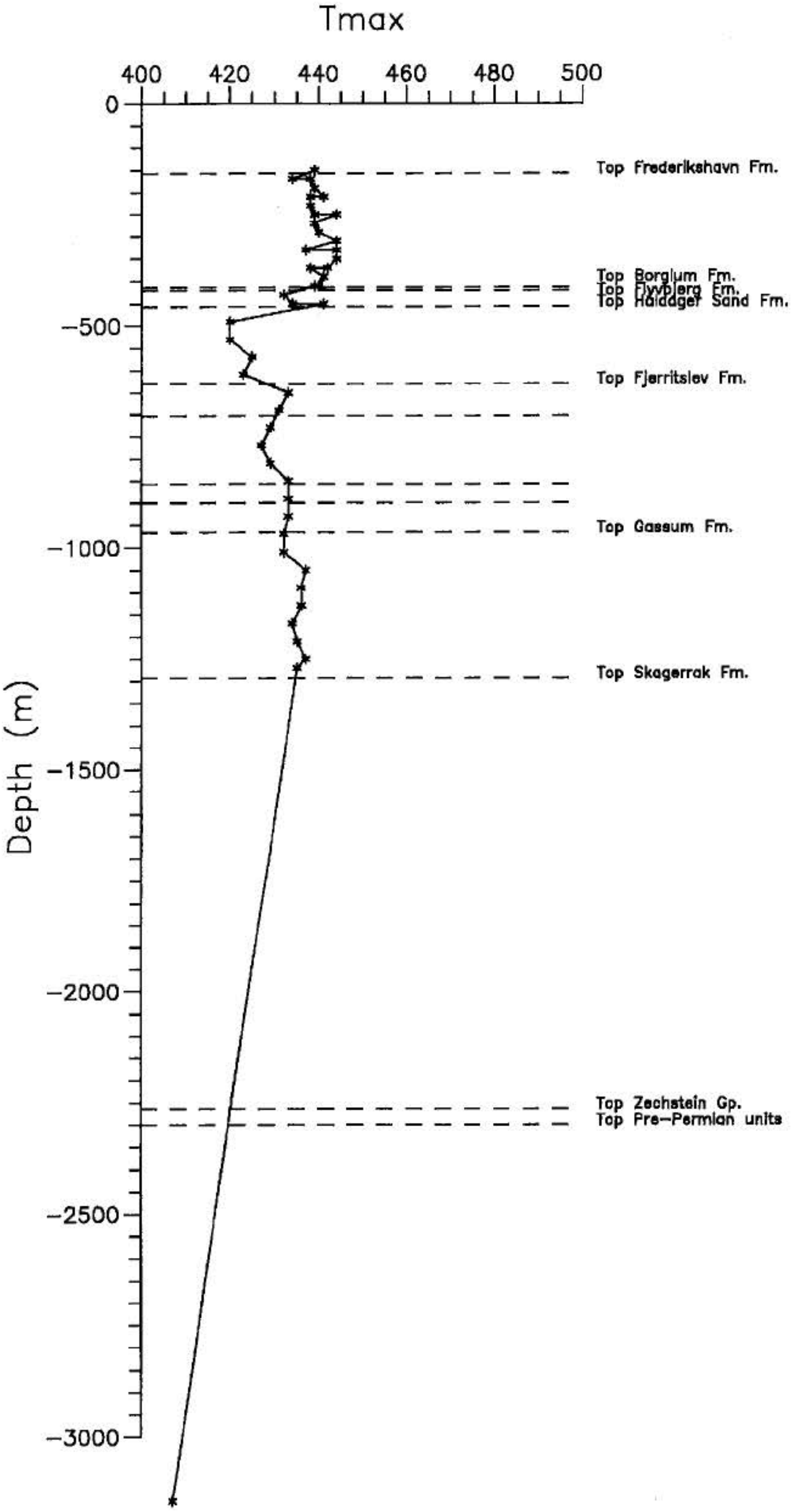

Terne-1
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Børglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Skagerrak Fm.
Top Zechstein Gp.
Top Pre-Permian units

Terne-1



Hydrogen Index
0 100 200 300 400 500 600 700 800
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Skagerrak Fm.
Top Zechstein Gp.
Top Pre-Permian units

Terne-1



Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Skagerrak Fm.
Top Zechstein Gp.
Top Pre-Permian units

Års-1

Stratigraphy (b.rfl)	Rfl:	146	feet a. msl.	
	Top (feet)	Top (m)	b. msl (m)	Thk (m)
L. Cretaceous	5883	1793	1749	401
Frederikshavn Fm.	7198	2194	2149	180
Børglum Fm.	7789	2374	2330	65
Flyvbjerg Fm.	8002	2439	2395	26
Haldager sand Fm.	8087	2465	2420	35
Fjerritslev Fm. F-IV	8202	2500	2455	113
Fjerritslev Fm. F-III	8573	2613	2569	252
Fjerritslev Fm. F-II	9400	2865	2821	85
Fjerritslev Fm. F-I	9678	2950	2905	255
Gassum Fm.	10515	3205	3160	180
Vinding Fm.	11106	3385	3341	16
TD	11158	3401	3356	

Cuttings * = Solvent extracted cuttings

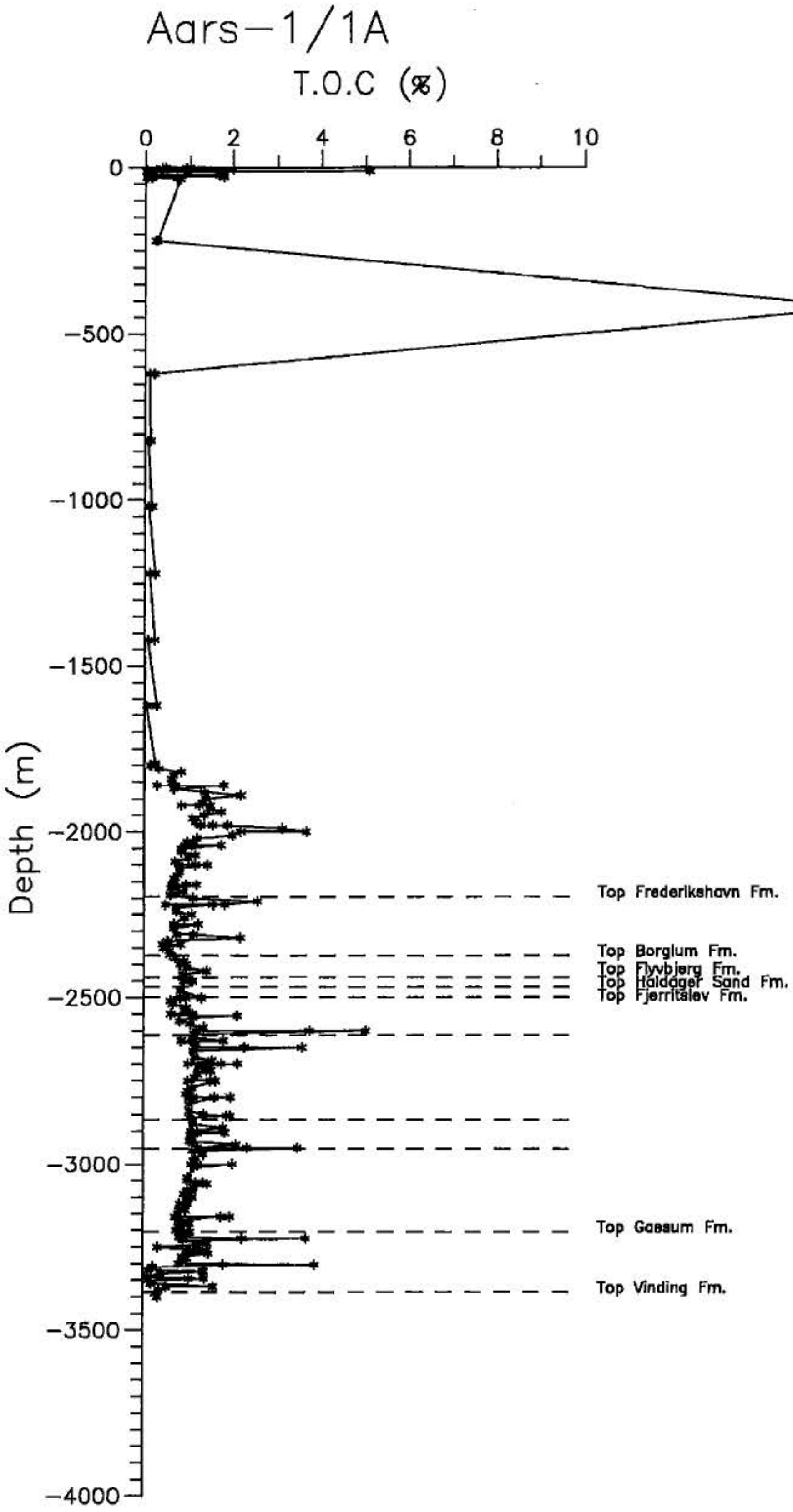
D (m)	D (feet)	TOC	Tmax	S1	S2	HI
1	3	1,00	431	0,03	0,30	30
2	7	0,45	426	0,02	0,25	55
3	10	0,37	423	0,05	0,26	71
4	13	0,92	444	0,08	0,41	45
5	16	0,91	444	0,11	0,35	38
6	20	2,00	431	0,11	1,99	100
7	23	0,23		0,00	0,08	33
8	26	0,02		0,07	0,25	
9	30	0,02		0,08	0,29	
10	33	0,94		0,31	1,55	165
11	36	5,09	442	0,74	12,17	239
12	39	0,03		0,02	0,08	260
13	43	0,06		0,03	0,12	195
20	66	0,15		0,02	0,08	52
21	69	0,05		0,03	0,09	176
22	72	0,04		0,05	0,16	388
23	75	1,66	443	0,29	2,02	122
24	79	1,77	446	0,24	2,07	117
25	82	0,12		0,24	2,99	
26	85	0,04		0,03	2,27	
27	89	0,15		0,01	0,31	203
28	92	1,79	444	0,15	1,81	101
29	95	0,15	478	0,01	0,15	102
30	98	0,02		0,09	0,40	
31	102	0,05	495	0,02	0,32	632
32	105	0,13		0,03	0,09	72
33	108	0,70	463	0,05	0,39	56
34	112	0,78	468	0,08	0,26	33
220	722	0,27		0,05	0,07	24
220	722	0,23		0,13	0,19	84
420	1378	16,28	424	4,60	25,52	157
620	2034	0,21		0,08	0,07	31
620	2034	0,10		0,03	0,02	21
820	2690	0,13		0,01	0,00	0
820	2690	0,08		0,03	0,13	164
1020	3346	0,16		0,04	0,00	0
1020	3346	0,09		0,02	0,14	157
1220	4003	0,23		0,05	0,00	0
1220	4003	0,11		0,01	0,10	88
1420	4659	0,22		0,03	0,01	2
1420	4659	0,08		0,01	0,09	108
1620	5315	0,27		0,03	0,01	2
1620	5315	0,05	434	0,01	0,25	496
1795	5889	0,24	428	0,39	0,18	75
1800	5906	0,15		0,04	0,00	0
1800	5906	0,14		0,01	0,05	39
1810	5938	0,33		0,22	0,07	21
1820	5971	0,83	414	0,20	0,11	13
1830	6004	0,66	422	0,22	0,11	17
1840	6037	0,61	419	0,28	0,15	25
1850	6070	0,63	422	0,32	0,19	30

1860	6102	0,70	409	0,49	0,49	70
1860	6102	0,28		0,01	0,00	0
1860	6102	1,82	457	0,08	0,55	30
1870	6135	0,66	427	0,40	0,34	52
1880	6168	1,36	427	0,49	0,49	36
1890	6201	2,20	427	0,51	0,68	31
1900	6234	1,38	425	0,41	0,34	25
1910	6266	1,30	426	0,47	0,44	34
1920	6299	1,24	427	0,54	0,47	38
1920	6299	0,84		0,06	0,09	11
1920	6299	1,49	445	0,11	0,28	19
1930	6332	1,48	430	1,10	1,00	68
1940	6365	1,76	437	1,46	2,00	114
1940	6365	1,75	434	0,08	1,14	65
1950	6398	1,35	429	0,53	0,77	57
1960	6430	1,08	429	0,32	0,56	52
1970	6463	1,15	429	0,36	0,72	63
1980	6496	1,27	428	0,34	0,94	74
1980	6496	1,55	425	0,04	0,42	27
1980	6496	1,89	433	0,06	0,58	31
1990	6529	3,13	426	0,73	10,40	332
2000	6562	3,69	422	0,78	15,17	411
2000	6562	2,20	428	0,11	4,62	210
2010	6594	2,01	427	0,43	4,51	224
2020	6627	1,19	431	0,32	1,49	125
2030	6660	0,97	428	0,28	0,87	90
2040	6693	0,93	426	0,20	0,71	76
2040	6693	1,08	427	0,08	0,38	35
2040	6693	1,76	425	0,39	1,91	109
2050	6726	0,82	425	0,24	0,51	62
2060	6759	0,84	427	0,20	0,64	76
2070	6791	1,16	428	0,38	1,12	97
2080	6824	1,00	430	0,28	0,88	88
2090	6857	0,69	427	0,22	0,58	84
2100	6890	0,78	425	0,12	0,56	72
2100	6890	1,16	424	0,12	0,48	41
2100	6890	1,44	428	0,17	1,07	74
2110	6923	0,80	427	0,13	0,51	64
2120	6955	0,80	428	0,19	0,53	66
2130	6988	0,76	428	0,21	0,51	67
2140	7021	0,66	425	0,18	0,37	56
2150	7054	0,70	427	0,14	0,45	64
2160	7087	0,66	425	0,24	0,54	82
2160	7087	0,63	429	0,02	0,38	60
2160	7087	0,94	425	0,09	0,37	39
2160	7087	1,19		0,06	0,54	45
2170	7119	0,61	423	0,23	0,51	84
2180	7152	0,88	423	0,15	0,47	53
2190	7185	0,59	428	0,14	0,50	85
2200	7218	1,11	428	0,05	0,72	65
2210	7251	2,57	433	0,09	1,40	54
2220	7283	1,84	431	0,09	1,14	62
2220	7283	0,48		0,02	0,15	32
2220	7283	1,56	427	0,33	1,52	97
2230	7316	0,72	425	0,05	0,45	63
2240	7349	0,73	427	0,07	0,46	63
2250	7382	1,08	427	0,15	0,59	55
2260	7415	0,91	426	0,05	0,59	65
2280	7480	0,66	424	0,15	0,43	65
2280	7480	0,66	419	0,03	0,22	34
2280	7480	1,23	427	0,10	0,60	49
2290	7513	0,67	427	0,14	0,46	69
2310	7579	0,73	429	0,27	0,60	82
2310	7579	1,12	433	0,04	0,60	54
2320	7612	2,19	433	0,22	1,36	62
2330	7644	0,53	428	0,20	0,47	89
2340	7677	0,42	426	0,15	0,26	62
2340	7677	0,83	422	0,07	0,40	48
2350	7710	0,43	423	0,17	0,29	67
2360	7743	0,57	425	0,18	0,39	68
2370	7776	0,59	423	0,13	0,30	51
2380	7808	0,70	424	0,20	0,43	61
2390	7841	0,90	424	0,27	0,55	61
2400	7874	0,81	420	0,19	0,36	44
2400	7874	0,82	427	0,05	0,33	40
2400	7874	0,95	422	0,11	0,37	39
2410	7907	0,97	425	0,19	0,49	51

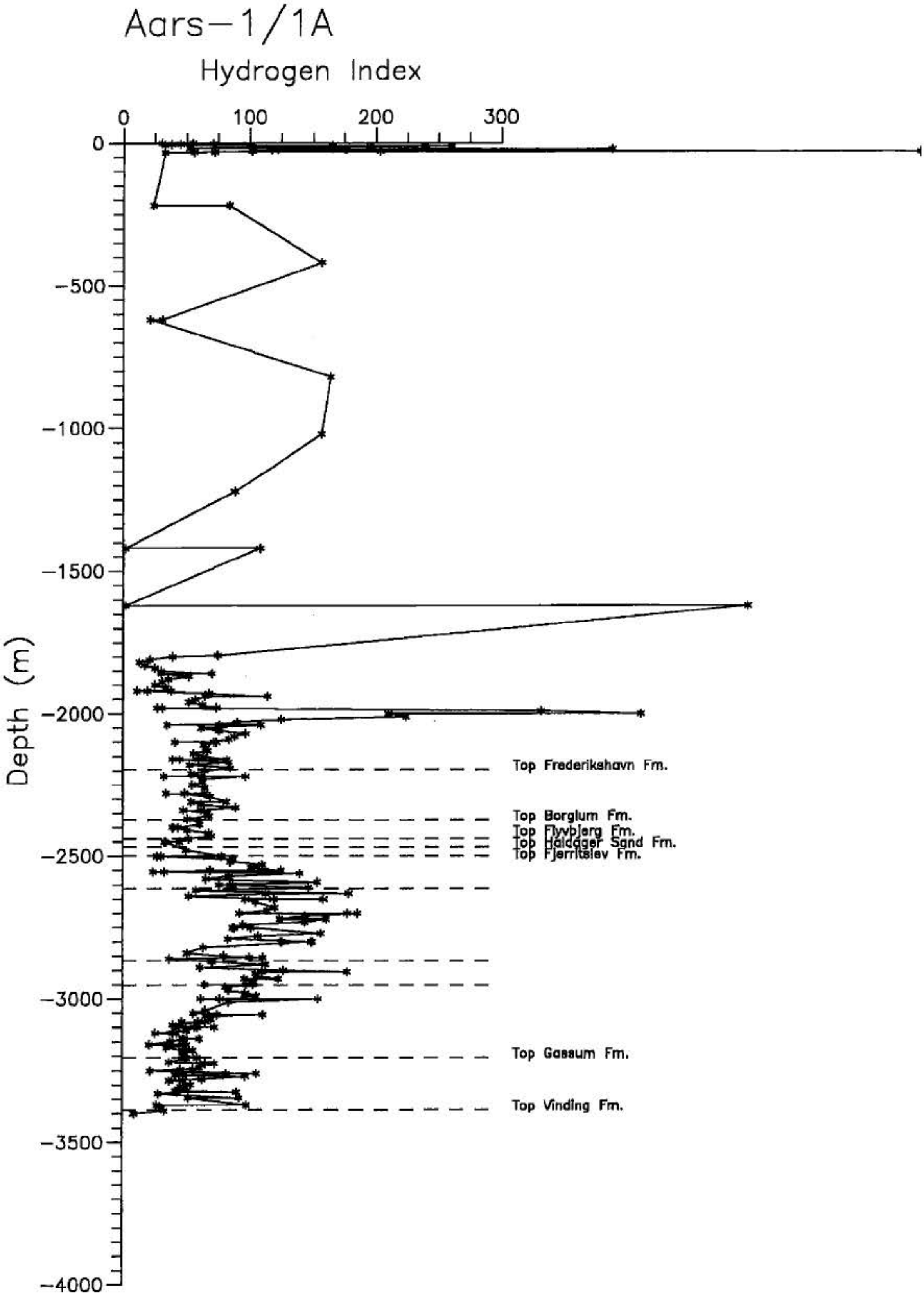
2420	7940	1,42	431	0,13	0,96	68
2430	7972	0,89	427	0,19	0,62	70
2440	8005	0,87	427	0,03	0,45	52
2450	8038	1,11	429	0,07	0,50	45
2450	8038	1,05	424	0,09	0,35	33
2450	8038	0,90	425	0,05	0,31	34
2480	8136	0,82	431	0,09	0,41	50
2500	8202	1,30	430	0,46	1,01	78
2500	8202	0,82	432	0,07	0,23	27
2500	8202	0,95	423	0,08	0,28	30
2510	8235	0,60	431	0,11	0,52	87
2520	8268	0,65	432	0,09	0,55	85
2530	8301	0,96	432	0,13	1,06	110
2540	8333	0,92	431	0,17	0,93	101
2550	8366	1,11	433	0,38	1,39	125
2550	8366	0,61	437	0,05	0,42	69
2555	8383	1,12	422	0,11	0,27	24
2555	8383	2,13	431	0,06	0,70	33
2560	8399	1,12	434	0,30	1,57	140
2570	8432	0,81	434	0,14	0,68	84
2580	8465	1,05	435	0,09	0,69	66
2590	8497	1,36	434	0,50	2,10	154
2600	8530	1,20	432	0,18	0,91	76
2600	8530	3,77	431	0,51	3,22	85
2600	8530	5,05	436	0,31	4,37	87
2610	8563	1,14	433	0,35	1,68	147
2620	8596	1,10	431	0,23	0,64	58
2630	8629	1,82	436	0,29	3,25	179
2630	8629	0,85	438	0,05	0,96	113
2640	8661	1,18	435	0,05	0,61	52
2650	8694	1,15	434	0,26	1,37	119
2650	8694	2,29	429	1,61	3,64	159
2650	8694	3,60	427	0,72	3,50	97
2660	8727	1,12	434	0,11	1,18	105
2680	8793	1,15	434	0,28	1,38	120
2690	8825	1,55	431	0,29	1,76	114
2700	8858	1,01	431	0,19	0,93	92
2700	8858	2,14	428	1,37	3,80	178
2700	8858	1,76	429	0,38	3,27	186
2710	8891	1,25	431	0,09	1,80	144
2720	8924	1,53	434	0,25	1,90	124
2720	8924	1,42	438	0,14	2,28	161
2730	8957	1,23	435	0,17	1,77	144
2740	8990	1,15	435	0,13	1,09	95
2750	9022	1,01	435	0,07	0,88	87
2750	9022	1,51	431	0,19	1,34	88
2750	9022	1,63	432	0,19	1,65	101
2770	9088	1,09	433	0,23	1,71	157
2780	9121	1,01	433	0,19	1,08	107
2790	9154	0,95	432	0,16	0,79	83
2800	9186	1,05	434	0,29	1,56	149
2800	9186	1,14	437	0,09	1,44	126
2800	9186	1,98	429	0,59	2,48	125
2800	9186	1,60	432	0,24	2,40	150
2820	9252	1,03	435	0,11	0,66	64
2840	9318	1,03	435	0,07	0,53	51
2850	9350	1,36	435	0,13	1,09	80
2855	9367	1,97	427	0,38	2,19	111
2855	9367	1,89	435	0,14	1,89	100
2860	9383	1,05	429	0,05	0,39	37
2870	9416	1,12	432	0,07	0,79	71
2880	9449	1,12	434	0,17	1,26	113
2890	9482	1,81	432	0,13	1,10	61
2900	9514	1,07	434	0,20	1,36	127
2905	9531	1,86	427	3,60	3,31	178
2905	9531	1,22	435	0,18	1,34	110
2910	9547	1,06	437	0,09	1,11	105
2920	9580	1,11	436	0,15	1,18	106
2930	9613	1,04	436	0,21	1,28	123
2930	9613	1,10	441	0,05	1,06	96
2940	9646	2,11	436	0,13	2,19	104
2950	9678	1,23	436	0,13	1,20	98
2950	9678	2,35	434	0,34	1,53	65
2950	9678	3,50	431	0,73	3,61	103
2960	9711	1,11	436	0,11	0,90	81
2970	9744	1,36	438	0,15	1,14	84
2980	9777	1,18	437	0,15	1,15	97

2990	9810	1,14	437	0,15	1,21	106
3000	9843	1,08	437	0,11	0,83	77
3000	9843	1,23	430	0,34	0,76	62
3000	9843	2,03	430	0,58	3,16	155
3010	9875	1,15	436	0,16	0,97	84
3040	9974	1,01	440	0,15	0,67	66
3050	10007	0,99	437	0,11	0,55	56
3055	10023	1,20	430	0,22	0,90	75
3055	10023	1,34	435	0,19	1,49	111
3060	10039	1,45	435	0,09	0,96	66
3070	10072	1,13	437	0,13	0,79	70
3080	10105	1,08	438	0,13	0,65	60
3080	10105	1,00	428	0,20	0,47	47
3080	10105	1,12	436	0,14	0,74	66
3090	10138	0,93	436	0,05	0,37	40
3100	10171	1,02	438	0,11	0,58	57
3100	10171	0,98	444	0,06	0,72	73
3100	10171	1,00	429	0,13	0,43	43
3100	10171	1,12	436	0,12	0,66	59
3110	10203	1,00	437	0,11	0,51	51
3120	10236	0,82	436	0,03	0,21	26
3120	10236	1,00	421	0,47	0,40	40
3120	10236	1,00	436	0,10	0,43	43
3140	10302	0,81	436	0,09	0,40	49
3140	10302	0,95	431	0,24	0,58	61
3140	10302	0,97	437	0,12	0,46	48
3150	10335	0,78	434	0,11	0,30	38
3160	10367	0,72	432	0,05	0,15	21
3160	10367	1,97	435	0,19	0,94	48
3160	10367	1,76	436	0,07	0,90	51
3170	10400	0,81	435	0,03	0,28	35
3180	10433	0,86	435	0,09	0,41	48
3180	10433	1,02	434	0,15	0,57	56
3180	10433	1,06	436	0,06	0,53	50
3190	10466	0,79	440	0,07	0,38	48
3200	10499	0,74	434	0,07	0,36	49
3205	10515	0,92	433	0,12	0,54	59
3205	10515	1,07	437	0,06	0,53	50
3207	10522	1,04	439	0,05	0,53	51
3220	10564	0,81	438	0,05	0,30	37
3225	10581	2,26	434	0,29	1,49	66
3225	10581	3,70	436	0,18	2,69	73
3230	10597	0,91	440	0,09	0,56	62
3240	10630	1,45	438	0,19	0,88	61
3245	10646	1,23	431	0,25	0,69	56
3245	10646	1,21	440	0,07	0,56	46
3250	10663	0,32	455	0,01	0,07	22
3260	10696	1,43	440	0,09	1,52	106
3260	10696	0,98	447	0,07	0,80	82
3265	10712	1,05	430	0,18	0,50	48
3265	10712	1,04	441	0,05	0,44	42
3270	10728	1,47	440	0,07	1,43	97
3280	10761	0,88	434	0,13	0,55	63
3285	10778	0,99	432	0,18	0,37	37
3285	10778	0,92	437	0,04	0,45	48
3300	10827	0,79	437	0,09	0,43	54
3305	10843	3,89	429	0,44	1,78	46
3305	10843	1,83	439	0,08	0,87	48
3310	10860	0,22	436	0,05	0,11	50
3320	10892	0,12	469	0,01	0,05	42
3325	10909	1,38	434	0,18	1,25	90
3325	10909	1,36	439	0,05	0,58	43
3330	10925	0,40	409	0,05	0,11	28
3340	10958	0,10		0,01	0,00	0
3345	10974	1,38	427	0,85	1,27	92
3345	10974	1,03	437	0,07	0,54	52
3350	10991	0,12		0,03	0,00	0
3360	11024	0,18		0,01	0,00	0
3370	11056	1,59	434	0,29	1,56	98
3370	11056	0,52	444	0,01	0,14	27
3380	11089	0,36	439	0,05	0,11	31
3390	11122	0,27	442	0,01	0,09	33
3400	11155	0,32	437	0,01	0,03	9

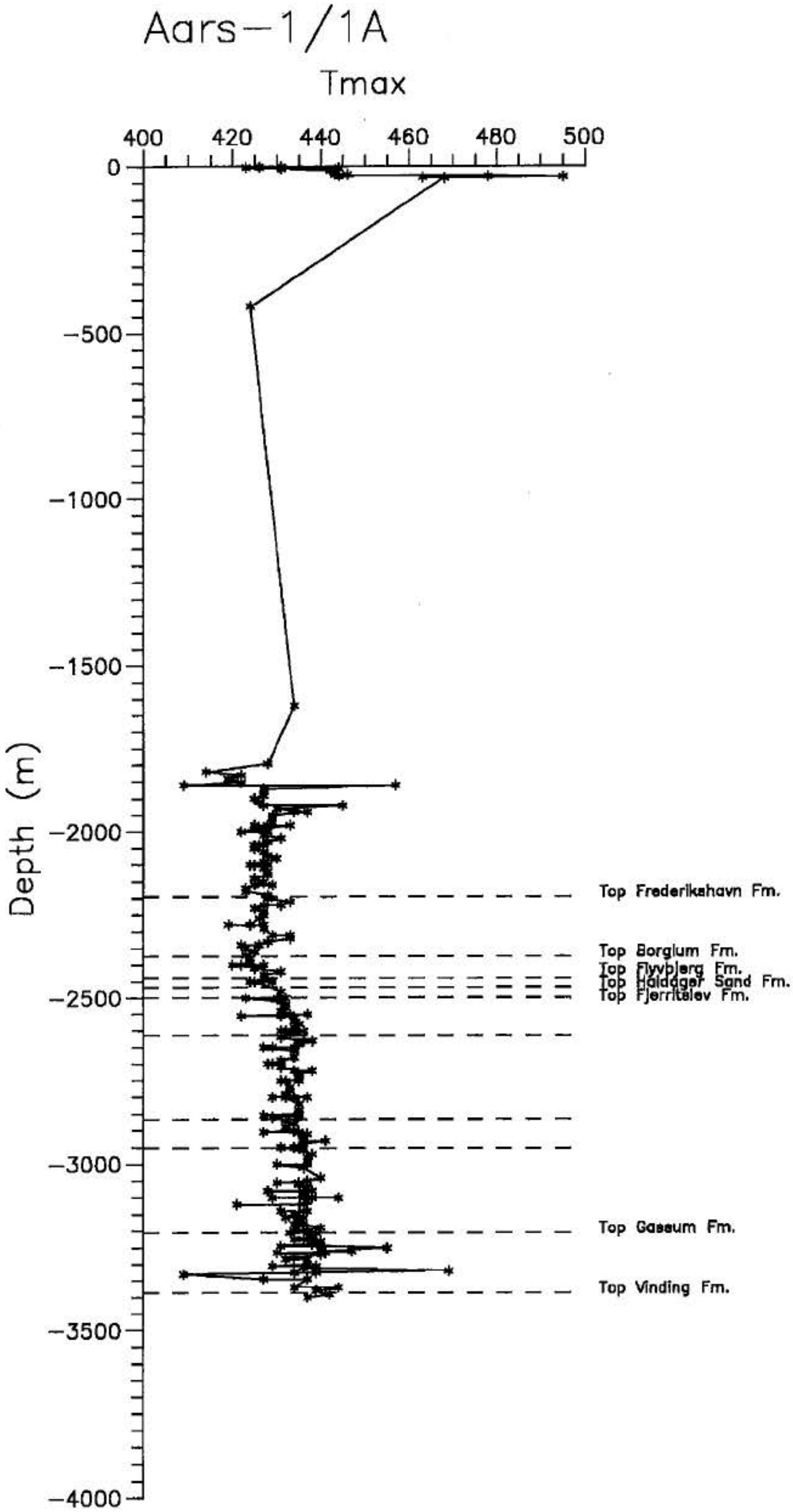
Unit	Thk (m)	TOC (min)	TOC (max)	***TOC (mean)***	S2 (min)	S2 (max)	***S2 (mean)***	HI (min)	HI (max)	***HI (mean)***
Frederikshavn Fm.	180	0,42	2,57	***0,98***	0,15	1,52	***0,61***	32	97	***62***
Børglum Fm.	65	0,70	1,42	***0,93***	0,33	0,96	***0,51***	39	70	***54***
Flyvbjerg Fm.	26	0,87	1,11	***0,98***	0,31	0,50	***0,40***	33	52	***41***
Haldager sand Fm.	35	0,82	0,82	***0,82***	0,41	0,41	***0,41***	50	50	***50***
Fjerritslev Fm. F-IV	113	0,60	5,05	***1,40***	0,23	4,37	***1,19***	24	154	***85***
Fjerritslev Fm. F-III	252	0,85	3,60	***1,43***	0,39	3,80	***1,68***	37	186	***113***
Fjerritslev Fm. F-II	85	1,04	2,11	***1,33***	0,79	3,31	***1,45***	61	178	***108***
Fjerritslev Fm. F-I	255	0,72	3,50	***1,19***	0,15	3,61	***0,81***	21	155	***63***
Gassum Fm.	180	0,10	3,89	***1,11***	0,00	2,69	***0,68***	0	106	***52***
Vinding Fm.	16	0,27	0,32	***0,30***	0,03	0,09	***0,06***	9	33	***21***



Aars-1/1A
T.O.C (%)
0
2
4
6
8
10
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.



Aars-1/1A
Hydrogen Index
0
100
200
300
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.


Aars-1/1A
Tmax
400
420
440
460
480
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
Depth (m)
Top Frederikshavn Fm.
Top Borglum Fm.
Top Flyvbjerg Fm.
Top Haldager Sand Fm.
Top Fjerritslev Fm.
Top Gassum Fm.
Top Vinding Fm.

Burial depth and post-Early Cretaceous uplift of Lower–Middle Jurassic strata in the Fennoscandian Border Zone based on organic maturity

Henrik I. Petersen, Lars H. Nielsen, Torben Bidstrup *and* Erik Thomsen

The burial depth and the magnitude of Late Cretaceous – Early Tertiary and Neogene–Pleistocene uplift of Lower–Middle Jurassic strata in the Fennoscandian Border Zone are estimated from measurements of huminite reflectance and comparison with a regional coalification gradient. The regional coalification curve is constructed by plotting uplift-corrected sample depths against more than 300 huminite/vitrinite reflectance values from Upper Triassic – Lower Cretaceous deposits in the Danish Basin and the Fennoscandian Border Zone. The present sample depths are corrected for Late Cretaceous inversion in the Sorgenfrei–Tornquist Zone and for Neogene – Pleistocene regional uplift. A coalification curve is erected; it cuts the abscissa at 0.2 $\%R_0$ corresponding to the reflectance of peat. This curve is considered to approximate to a reliable coalification profile over much of the study area.

The Jurassic coals from the Fennoscandian Border Zone are of low rank and, based on the regional coalification curve, they have been buried to *c.* 625–2000 m. In the eastern part of the Rønne Graben and in the Kolobrzeg Graben, the Jurassic strata were subsequently uplifted *c.* 900–1400 m, corresponding to the amount of Late Cretaceous – Early Tertiary inversion observed on seismic sections. Thus, it appears that Neogene–Pleistocene uplift did not influence the Bornholm area significantly. The data from the Höganäs Basin and Fyledal indicate a total uplift of *c.* 1400–2000 m, corresponding to estimates from the inversion zone in the Kattegat. The data from Anholt, on the eastern margin of the inversion zone, indicate *c.* 925 m of uplift.

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Keywords: Danish Basin, Fennoscandian Border Zone, Lower–Middle Jurassic, organic maturity, coalification curve, burial depth, Late Cretaceous – Early Tertiary inversion, Neogene–Pleistocene uplift

Maturation of organic matter with increasing temperature is one of the most important parameters when evaluating the thermal history and hydrocarbon potential of a basin. A common way to assess the maturation depth-trend is to construct coalification curves by plotting measured huminite/vitrinite reflectances against depth. Various attempts have been made to construct such curves for the Danish Basin and the Fennoscandian Border Zone (Thomsen 1980; Thomsen *et al.* 1983; Schmidt 1985; Thomsen *et al.* 1987). However, these attempts have to some extent overlooked the significant amounts of post-Early Cretaceous differential uplift that have influenced the Danish Basin and the Fennoscandian Border Zone.

Forchhammer (1835) recognised the pronounced erosional unconformity at the base of the Quaternary. The hiatus at this surface increases significantly toward the northern and eastern margin of the Danish Basin. It is now widely accepted that significant regional uplift occurred in Neogene and Pleistocene times in the North Atlantic area and along the Norwegian west coast into the Skagerrak and the Kattegat to the Swedish coast (Manum & Throndsen 1978; Jensen & Michelsen 1992; Jensen & Schmidt 1992, 1993; Nyland *et al.* 1992; Japsen 1993, 1998; Michelsen & Nielsen 1993). In addition to the regional Neogene–Pleistocene uplift, significant inversion occurred in the Sorgenfrei–Tornquist Zone in Late

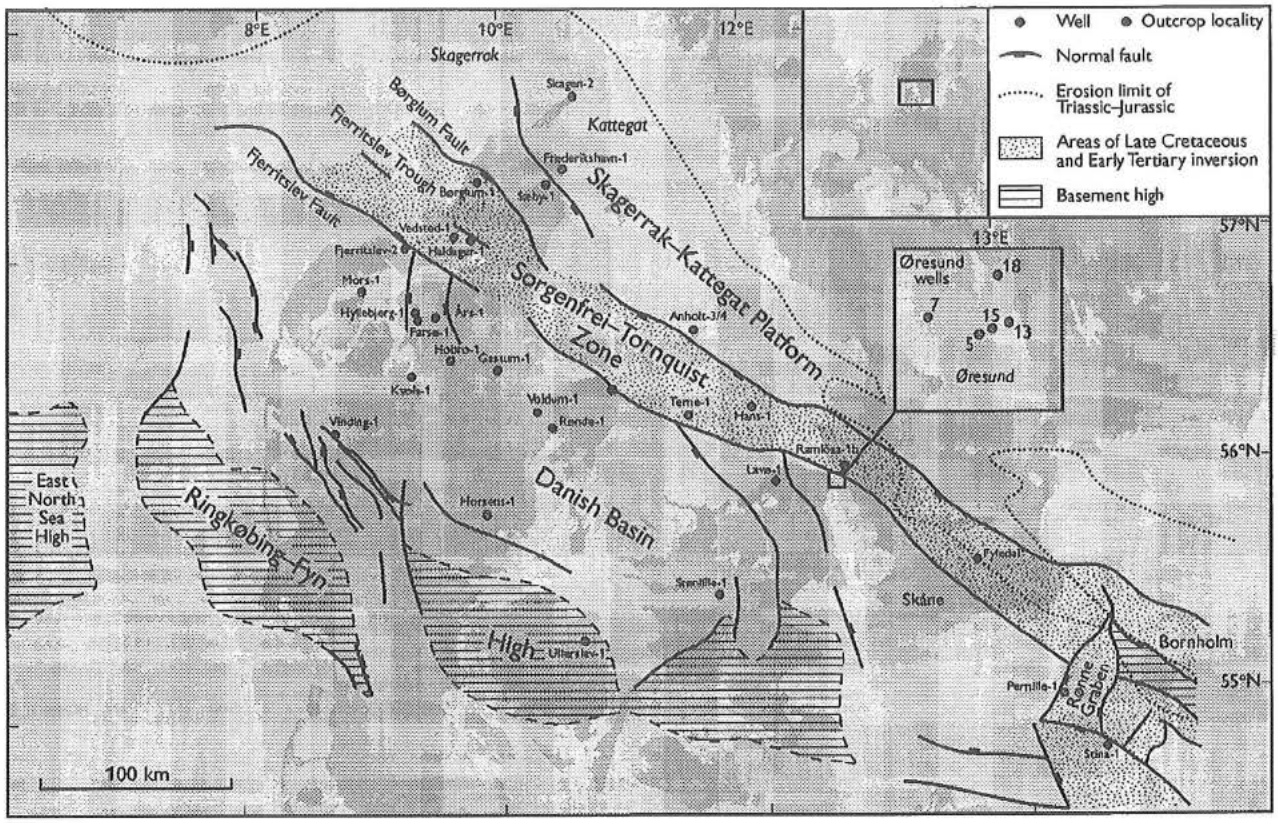


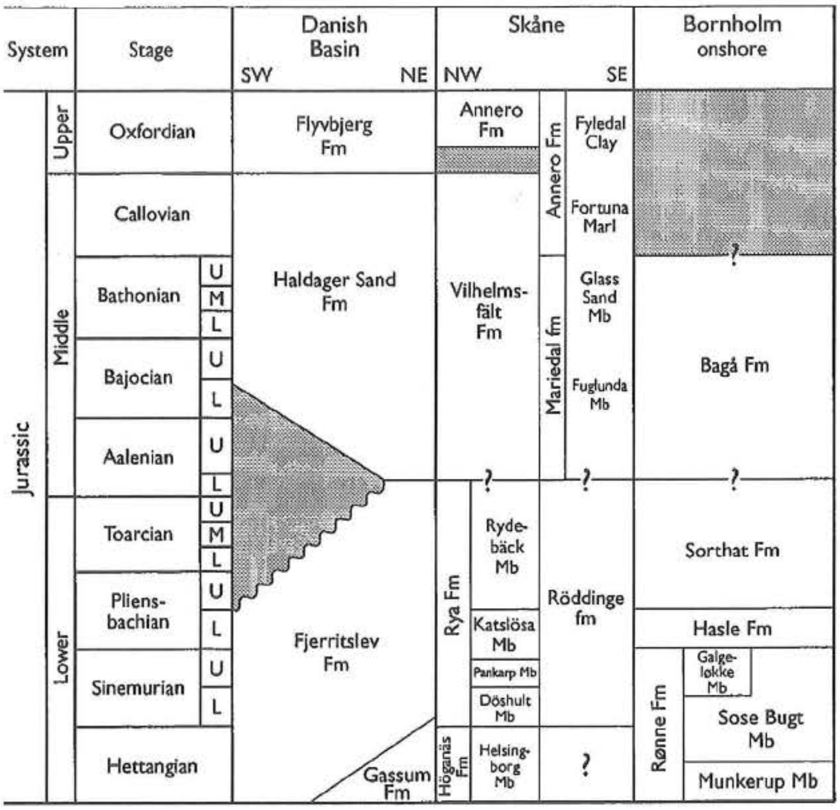
Fig. 1. Structural map showing the Danish Basin and the Fennoscandian Border Zone, and locations of the study wells and the outcrop at Fyleverken Sand Pit, Fyledal, Skåne (see also Fig. 9). Inset map shows the location of the wells in the Helsingør–Helsingborg area. Studied wells and outcrops on Bornholm are shown in Fig. 6. Modified from Liboriussen *et al.* (1987) and EUGENO-S Working Group (1988).

Cretaceous – Early Tertiary times due to right-lateral transpression (Liboriussen *et al.* 1987; Norling & Bergström 1987; EUGENO-S Working Group 1988; Michelsen & Nielsen 1991, 1993; Mogensen 1994). The amount and distribution of the two types of uplift of the Danish Basin and Sorgenfrei–Tornquist Zone have been estimated by comparing the lateral variation of the sonic velocities of a uniform unit of Lower Jurassic marine mudstones with the structural and stratigraphic development of the area (Jensen & Michelsen 1992; Japsen 1993; Michelsen & Nielsen 1993). These estimates indicate uplift of 100–2000 m, emphasising that variable amounts of uplift have to be considered when huminite/vitrinite reflectances are used to interpret the thermal history and predict maturity of undrilled sections. We have used 311 reflectance measurements (corrected for uplift) from 20 well-sections (Fig. 1) in order to construct a reliable coalification curve which can be used to evaluate the thermal history and maturation of organic matter in the Danish Basin and the Fennoscandian Border Zone. The amount of uplift was primarily estimated from seismic interval velocities (Japsen 1993). The aims of the paper are: (1) to construct a regional coalification curve for the Danish Basin and the Fennoscandian Border Zone and (2) to use the curve to estimate the burial depth and later uplift of Lower–Middle Jurassic strata exposed or cored in shallow wells in the Fennoscandian Border Zone by comparing huminite reflectances with the curve. The maturation of organic matter provides the best estimate of the burial and uplift history, as measurements of sonic velocities in general are not available from these localities.

Geological setting

The Fennoscandian Border Zone is divided into the Skagerrak–Kattegat Platform and the Sorgenfrei–Tornquist Zone (Fig. 1; Sorgenfrei & Buch 1964; EUGENO-S Working Group 1988; Michelsen & Nielsen 1991, 1993). The Skagerrak–Kattegat Platform is a large stable platform area to the north-east where the Mesozoic

Fig. 2. Stratigraphic scheme of the Lower–Middle Jurassic of the Danish Basin, Bornholm and Skåne. Compiled from Nielsen (1995; 2000, this volume), Ahlberg *et al.* (2000, this volume) and Michelsen *et al.* (2000, this volume).



succession onlaps Palaeozoic and crystalline basement rocks and thins towards the north-east. The Sorgenfrei–Tornquist Zone is 20–50 km wide and strongly block-faulted. The zone demarcates the stable Baltic Shield and forms the north-western extension of one of Europes most prominent tectonic structures, the Tornquist Zone. The Sorgenfrei–Tornquist Zone converges at the Rønne Graben, offshore Bornholm, with the Teisseyre–Tornquist Zone which constitutes a tectonic lineament extending to the Black Sea (Ziegler 1982). The Rønne Graben is a pull-apart basin that formed by dextral wrench-faulting in Late Carboniferous – Early Permian times (Vejbæk 1985; Liboriussen *et al.* 1987). During the Late Palaeozoic – Mesozoic break-up of the supercontinent Pangaea, the Tornquist Zone was dominated by transtensional stress resulting in subsidence and tilting of fault blocks, and deposition of Mesozoic sedimentary successions up to 8 km thick.

The Sorgenfrei–Tornquist Zone demarcates the transition from the Baltic Shield to the WNW–ESE trending intracratonic Danish Basin that was formed during a Late Carboniferous – Early Permian rift phase accompanied by formation of both extrusive and intrusive volcanic rocks. After rifting, the basin subsided due to thermal cooling (Sørensen 1986; Vejbæk 1989, 1990). The post-rift basin-fill consists of a relatively complete section of Zechstein, Mesozoic and Tertiary deposits which are 6–7 km thick along the axis of the basin. A gradual shallowing of the basin towards the high-lying basement blocks of the Ringkøbing–Fyn High to the south-west is indicated by thinning of the section. This is most pronounced for the Upper Permian (Zechstein) strata. The Ringkøbing–Fyn High was periodically subjected to erosion. In the Fjerritslev Trough, within the Sorgenfrei–Tornquist Zone, an important thickness anomaly was formed due to transtensional strike-slip movements possibly accompanied by salt withdrawal causing relatively fast subsidence and deposition (Bertelsen 1980; Liboriussen *et al.* 1987; Vejbæk 1990; Christensen & Korstgård 1994). Late Early Jurassic – early Middle Jurassic uplift of the Ringkøbing–Fyn High, presumably connected to the updoming of the Central North Sea, caused north-eastward tilting of the basin and erosion both on the high and in the southern part of the basin (Michelsen 1978; Koch 1983; Nielsen 1993, 1995, 2000, this volume). Extensive volcanism and uplift occurred in Skåne, possibly connected to general updoming (Klingspor 1976; Norling & Bergström 1987; F. Surlyk, personal communication 1996). In late Middle – Late Jurassic times, the Ringkøbing–Fyn High began

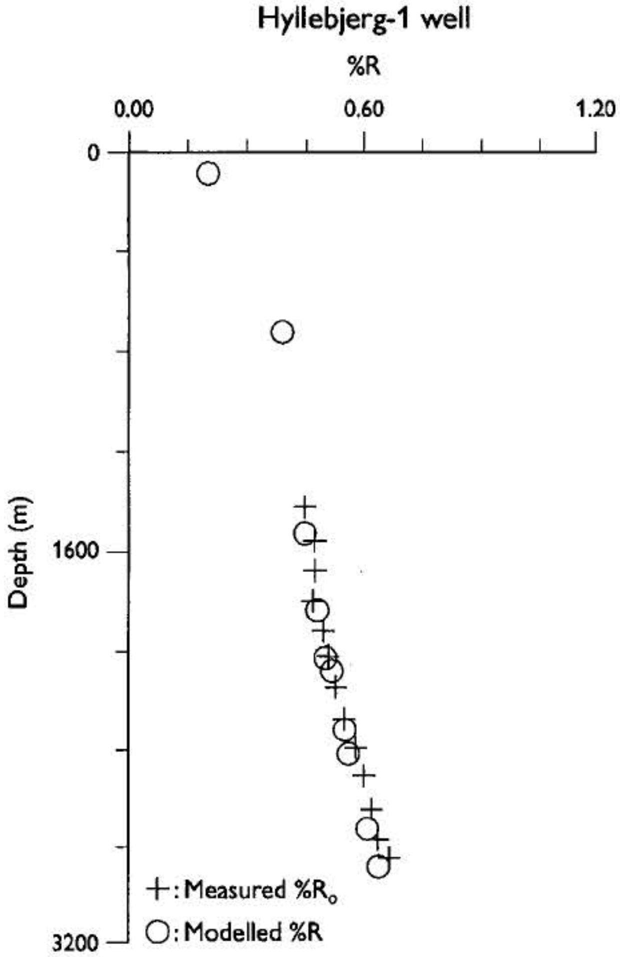


Fig. 3. Modelled reflectance values and selected measured reflectance values from the Hyllebjerg-1 well. The uplift determined by basin modelling is 600 m compared to 575 m obtained from shale velocities. This confirms that the area around Hyllebjerg-1 is a good reference area.

to subside again and gradually the basin expanded toward the south-west, attaining its previous size towards the end of the Early Cretaceous (Nielsen 1995).

During Late Cretaceous – Early Tertiary times, transpressional tectonism in the Sorgenfrei–Tornquist Zone and the Rønne Graben, caused by the Alpine orogenesis, led to reactivation and pronounced inversion of fault blocks in the zone, which together with Neogene–Pleistocene regional uplift resulted in erosion of the Mesozoic deposits (Gry 1969; Gravesen *et al.* 1982; Liboriussen *et al.* 1987; Norling & Bergström 1987; Japsen 1993, 1998; Michelsen & Nielsen 1991, 1993).

The Lower–Middle Jurassic stratigraphy of the Danish Basin, Bornholm and Skåne is shown in Figure 2. Note that the Upper Pliensbachian – Lower Aalenian section on Bornholm has previously been referred to the lower Bagå Formation (Koppelhus & Nielsen 1994), but is now assigned to the Sorthat Formation (Michelsen *et al.*2000, this volume).

Prerequisites for construction of a regional coalification curve

Construction of a regional coalification curve requires that the following conditions are fulfilled: (1) many geographically widespread data, (2) exclusion of data from well-sections with an abnormal thermal history, (3) reliable corrections for uplift and (4) a relatively constant temperature gradient both in time and space.

Although totalling more than 300, the reflectance measurements from the Triassic – Lower Cretaceous deposits in the Danish Basin and the Fennoscandian Border Zone only partly fulfill the first condition (Fig. 1). Close to half of the data points come from the central part of the basin from wells such as Mors-1, Hyllebjerg-1, Års-1 and Farsø-1. However, this is not a serious problem because in this area there is good agreement between uplift values determined from shale velocities and results from modelling of the maturation history. For example, in the Hyllebjerg-1 well (Fig. 3), the uplift determined by basin modelling is 600 m compared with 575 m obtained from shale velocities.

Reflectance values from deposits directly overlying salt diapirs clearly indicate a locally increased heat flow (Uglev-1; Schmidt 1985), and have been omitted in the construction of the regional curve.

The corrections for uplift of the selected well-sections have been mainly calculated from seismic velocity data (Japsen 1993). The amount of correction is further controlled by the well-known stratigraphy and structures of the area as shown by interpreted seismic sections and preserved thicknesses of lithostratigraphic units in well-sections.

The basin subsided due to thermal contraction after the Permian rift phase with raised heat flow (Vejbæk 1989). The initial phase of the basin development was probably characterised by lateral variations in heat flow, but after the deposition of a thick sedimentary cover of Zechstein and Lower–Middle Triassic deposits, the lateral variations in heat flow probably ceased due to the effect of sediment blanketing (Nielsen & Balling 1990). Recent mapping and modelling of the subsurface temperature at various depths demonstrate a uniform regional temperature distribution in the study area (J.J. Møller, personal communication 1997). Furthermore, regional corrected measurements of heat flow at the surface are uniform, in the range 60–70 mW/m2 (Balling 1995). Based on the structural and thermal evolution of the basin, therefore, we assume that the lateral variation in heat flow from the Late Triassic to Recent times in general was relatively small, and that lateral heat flow variations did not influence the maturation of the organic matter significantly.

The necessary prerequisites for the construction of a regional coalification curve are thus fulfilled to a large extent. In order to avoid complications due to the late Early Jurassic – Middle Jurassic uplift of the Ringkøbing–Fyn High and the southern parts of the basin, the majority of the data used for construction of the curve comes from well-sections that experienced continued subsidence or only limited uplift and erosion during this phase (Nielsen 1995).

Influence of temperature on maturation

The increase in rank with depth in a well-section is mainly caused by rising temperature with depth, and the rate of rank increase is strongly dependent on the geothermal gradient. In a sandstone succession, for instance, the rank gradient is much lower than in a mudstone succession due to the higher thermal conductivity of sandstones (Damberger 1968). Raised heat flow and thus a higher geothermal gradient also raises the rank gradient (Teichmüller 1979). However, in a basin with a relatively constant heat flow and a laterally uniform lithology, the rank of coals is primarily dependent on the maximum temperature to which the organic matter was subjected, which corresponds to the maximum burial depth. Since coalification of organic matter is irreversible, later uplift does not influence the measured reflectance values.

As demonstrated below, the majority of the reflectance values from the Danish Basin and the Fennoscandian Border Zone are interpreted to show a normal coalification trend. The rank of the coals thus reflects the maximum burial depth of the strata.

Construction of the coalification curve

A total of 311 reflectance measurements from the Upper Triassic, Jurassic and Lower Cretaceous successions in twenty wells from the Fennoscandian Border Zone and the Danish Basin are used in the construction of the coalification curve (Fig. 1). All the reflectance values are random measurements. Samples from drill cores were available from the Frederikshavn-1, Fjerritslev-2, Gassum-1, Haldager-1, Horsens-1, Lavø-1, Skagen-2, Ullerslev-1, Vedsted-1 and Vinding-1 wells. Where possible, samples with coal, coaly inclusions, or dark-coloured shales or siltstones were selected for reflectance measurements as these rocks contain the best organic matter for rank determination (Thomsen 1980). Untreated rock samples were studied as they more easily allow identification of oxidised and bituminous organic matter (unsuitable for reflectance measurements) than is the case for kerogen concentrates. In coal or coaly samples, approximately 50–100 measurements were carried out in each sample; in samples with disseminated organic matter, as many particles as possible were measured, usually 20–50. Core samples from the Børglum-1 well were analysed in the same fashion (Schmidt 1985), whereas coaly or dark-coloured shaly intervals were selected from sidewall cores and core samples in the Farsø-1 well (Thomsen 1983). Cuttings and a limited number of core samples were available from the Års-1

Table 1. Correction for post-Early Cretaceous uplift

Well	Total post-Early Cretaceous uplift (amount of correction)	Comments on the estimated amounts of uplift
Års-1	558 m	After Japsen (1993)
Børglum-1	1273 m	After Japsen (1993)
Farsø-1	481 m	After Japsen (1993)
Fjerritslev-2	1531 m	After Japsen (1993)
Frederikshavn-1	1000 m	By comparison to Sæby-1, 997 m (Japsen 1993)
Gassum-1	1190 m	By comparison to Voldum-1, 942 m (Japsen 1993) and 248 m deeper truncation of chalk
Haldager-1	1400 m	By comparison to Børglum-1 and Fjerritslev-2
Hans-1	1733 m	After Japsen (1993)
Hobro-1	550 m	By comparison to Års-1
Horsens-1	200 m	By using fig. 1C in Japsen (1993)
Hyllebjerg-1	575 m	After Japsen (1993)
Kvols-1	448 m	After Japsen (1993)
Lavø-1	1000 m	By using fig. 1C in Japsen (1993) and Stenlille-1, 850 m
Mors-1	785 m	After Japsen (1993)
Rønde-1	513 m	After Japsen (1993)
Skagen-2	1100 m	By comparison to Sæby-1, 997 m
Terne-1	1405 m	After Japsen (1993)
Ullerslev-1	500 m	By using fig. 1C in Japsen (1993)
Vedsted-1	1400 m	By comparison to Børglum-1 and Fjerritslev-2
Vinding-1	250 m	By comparison to Mejrup-1, 327 m, and Vemb-1, 309 m (Japsen 1993)

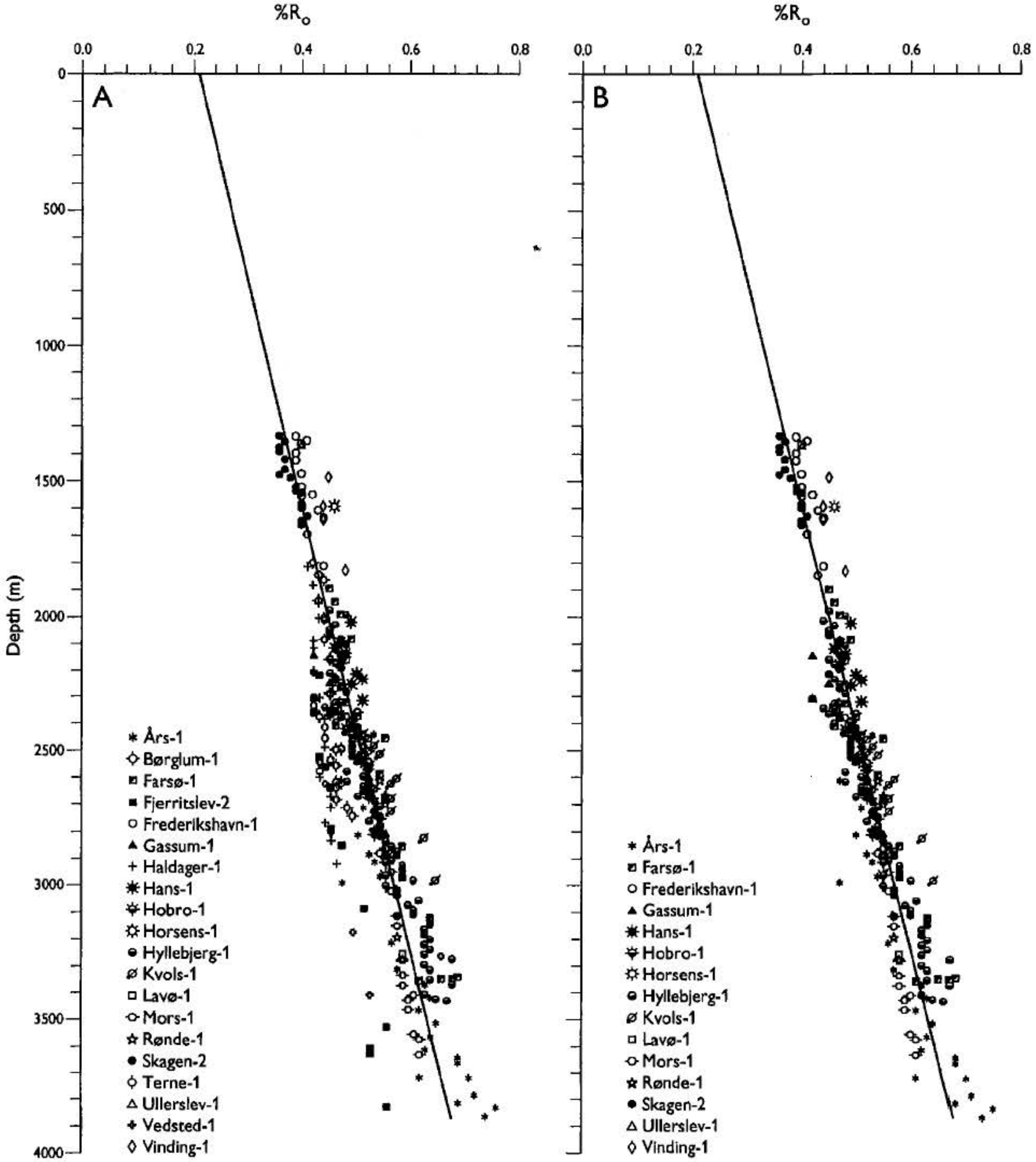


Fig. 4. **A**: Coalification profile for the 20 investigated wells (n = 311); the depths are corrected for post-Cretaceous uplift. Data from Thomsen (1980, 1983, 1984), Schmidt (1985, 1988) and unpublished GEUS data. **B**: Coalification profile (uplift-corrected depths) for 15 wells in the Danish Basin, the Fennoscandian Border Zone and the Skagerrak–Kattegat Platform (n = 249). The regression line has a correlation coefficient of 0.88, and intercepts the reflectance axis at 0.21 $\%R_o$.

well, whereas only cuttings were available from the rest of the wells (Rønde-1: Thomsen 1980; Hyllebjerg-1: Schmidt 1985; Hans-1, Hobro-1, Kvols-1, Mors-1, Terne-1: GEUS, unpublished data). All sample depths were corrected for post-Early Cretaceous net uplift before being plotted against reflectance (Table 1). The correction for the well-sections was based on the analysis of sonic velocities of shales by Japsen (1993). The main uncertainties related to this method are the requirement of a uniform shale unit covering the entire study area and a valid reference curve (discussed in Japsen 1993).

The analyses of the velocity data provide an uplift pattern that is compatible with structural interpretations of seismic sections and stratigraphic well data. The present sample depths are thus corrected by adding the amount of uplift proposed by Japsen (1993). The uplift of wells not included by Japsen (1993) is estimated by comparison to nearby wells and interpolation (Table 1). The Gassum-1 well, for example, is situated on a salt structure, in a setting comparable to the nearby Voldum-1 well, which was uplifted 942 m (Japsen 1993). The chalk section in Gassum-1 seems to be more deeply truncated than that in Voldum-1 (*c.* 250 m), and an uplift of *c.* 1190 m is thus estimated for the Gassum-1 section. The uplift of the Horsens-1 and Ullerslev-1 wells is estimated to be 200 m and 500 m, respectively, by using the general uplift map of Japsen (1993). The uplift of the Lavø-1 well is estimated to be 1000 m based on the same map and comparison with the Stenlille-1 well (850 m).

Two coalification trends are recognised when the reflectance measurements are plotted against uplift-corrected depths: a well-defined main trend to the right and a less pronounced trend to the left (Fig. 4A).The main coalification trend is based on well data from the Danish Basin and the Skagerrak–Kattegat Platform (Fig. 4B), whereas well data from the Fjerritslev Trough (Børglum-1, Fjerritslev-2, Haldager-1, Vedsted-1) and the Terne-1 well define the other coalification trend.

Huminite/vitrinite reflectance is largely unaffected by the formation of mainly isolated aromatic rings up to a reflectance of *c.* 0.7 $\%R_o$, resulting in a slow and more or less linear increase in reflectance (Carr & Williamson 1990). However, as maturation proceeds past this point the formation of polycyclic aromatic units significantly increases the reflectance. As the level of coalification in the studied sections is in the low rank range (< 0.7 $\%R_o$), it is possible to approximate this 'straight' section of the curve with a linear regression line. The linear regression line for the Danish Basin/Skagerrak–Kattegat Platform intersects the $\%R_o$-axis at 0.2 $\%R_o$, which is the expected reflectance at the surface (Fig. 4B; Dow 1977). The rank gradient is 0.12 $\%R_o$/km. The absence of significant anomalies indicates that the assumption of a relatively uniform geothermal gradient in the study area is justified, and that the corrections for uplift are reasonable. The regression line of the coalification curve is based on 249 samples; it has a correlation coefficient of 0.88, and is considered to be a good approximation of the coalification profile. This relationship can then be used to estimate the maximum burial depths and later uplift of Jurassic coal seams in the Fennoscandian Border Zone. The reasonable and stratigraphically consistent estimates are taken as indirect evidence of the reliability of the coalification curve, and the coalification curve is considered as a valid approximation of the maturation trend over most of the study area.

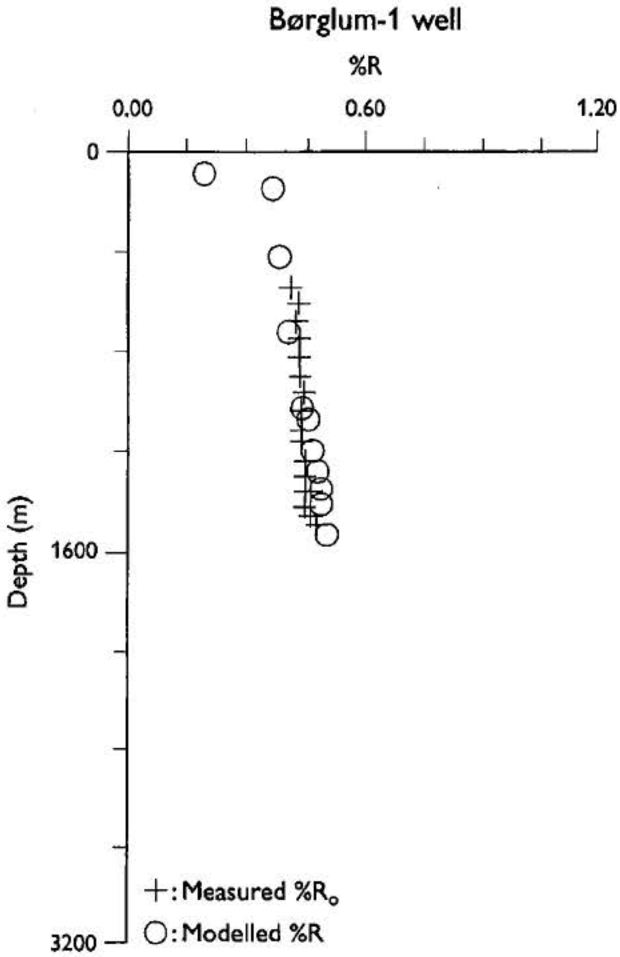


Fig. 5. Modelled reflectance values and measured reflectance values from the Børglum-1 well. The amount of uplift determined by basin modelling is 800 m compared to the 1300 m obtained from shale velocities. It is suggested that the uplift of the wells in the Fjerritslev Trough (and the Terne-1 well) determined from the shale velocities is overestimated due to the sand-rich nature of the succession in these wells.

The data from Børglum-1, Fjerritslev-2, Haldager-1, Vedsted-1 and Terne-1 form an atypically steep coalification trend which was investigated by modelling of the basin development. Modelled vitrinite reflectances for the Børglum-1 well are shown in Figure 5, together with the measured values. The basin modelling indicates uplift of only 800 m, compared with 1300 m derived from shale velocities. Interval velocities for the chalk section in the Fjerritslev Trough are low, and new data based on Chalk Group velocities yield significantly lower uplift values (Japsen 1998). The data suggest correction for uplift of only 817 m for Børglum-1, 1012 m for Fjerritslev-2, and 644 m for Haldager-1. If the present depths of these wells are uplift-corrected according to the new Chalk Group data, the huminite reflectance values would fit the coalification curve shown in Figure 4B.

This suggests that uplift values determined from shale velocities are probably overestimates. The relatively high shale velocities in this area (Japsen 1993) may be the result of an increased coarse-grained component within the lowermost Fjerritslev Formation than is typical of the rest of the basin.

Estimation of burial depth and later uplift of Lower–Middle Jurassic coal seams in the Fennoscandian Border Zone

Determination of coal rank

The rank, or the level of thermal maturity, of the coals was determined by random reflectance measurements on eu-ulminite, the brown coal equivalent of collotelinite, following the standard procedure outlined in Stach *et al.* (1982). Up to 100 measurements were made on each sample and a mean reflectance (%R_o) was calculated. Parameters obtained by organic geochemical methods, when available, were used to support the estimation of the maturity.

Rock-Eval pyrolysis was used to determine the T_{max} value which is the temperature at which maximum pyrolysis occurs (Peters 1986). The value of T_{max} increases with increasing maturity of the organic matter, but is also influenced by the composition of the organic matter, as a high content of inert components may result in an elevated T_{max} value.

Biomarker data were obtained from the saturated fraction of solvent extracts from the coal samples using gas chromatography/mass spectrometry. Pentacyclic hopanes were identified by detecting the most characteristic fragmentation ion, the m/z 191. The occurrence of the thermally unstable hopenes and 17ß(H),21ß(H) forms in the coals is indicative of immaturity, and the C_{31}-homohopane 22S/(22R+22S) epimerisation ratio approaches an equilibrium value of approximately 0.6 with increasing maturity. The sensitivity of the hopanes to thermal influence at low maturity levels may be a valuable criterion when evaluating the validity of maturity differences obtained by reflectance measurements.

The carbon preference index (CPI) was calculated from traces obtained from gas chromatography. The CPI is a measure of the predominance of odd carbon numbered *n*-alkanes calculated over a specified range (Bray & Evans 1961; Cooper & Bray 1963). In the present study, the range was from nC_{22} to nC_{32}. The dominance of odd carbon numbered *n*-alkanes together with a prominent heavy-end fraction are characteristic features of terrestrially derived organic matter (Waples 1985). However, increasing maturity seems to minimise the CPI due to alkane cleavage reactions and dilution of the odd carbon numbered *n*-alkanes (Radke *et al.* 1980). Hence, the CPI tends to reach an equilibrium of 1 with increasing maturity.

Huminite reflectances of the coals

The following section focuses on the degree of coalification of Lower and Middle Jurassic coal seams and strata from the island of Bornholm, the Rønne and Kolobrzeg Grabens (offshore Bornholm), Skåne, the Øresund area, and Kattegat in order to present the rank distribution.

Hettangian–Sinemurian Rønne Formation, Bornholm

Two coal seams in the Hettangian Munkerup Member of the Rønne Formation in the Arnager–Sose Fault Block have reflectances of 0.40 %R_o and 0.41 %R_o (Figs 2, 6; Table 2). However, samples from carbonaceous seams in the overlying Hettangian–Sinemurian Sose Bugt Member display significantly lower reflectance values (0.28 %R_o and 0.30 %R_o) (Figs 2, 6; Table 2).

The coal seam in the Sinemurian Galgeløkke Member of the Rønne Formation at the Galgeløkke coastal cliff (Rønne–Hasle Fault Block) has a reflectance of 0.38 %R_o (Figs 2, 6; Table 2). The Galgeløkke-2 well was drilled close to the Galgeløkke cliff and cored *c.* 400 m of Hettangian–Sinemurian strata (Nielsen 1995). A Hettangian coal seam situated at a depth of 383 m has a reflectance value of 0.42 %R_o. This is compatible with a T_{max} value of 427°C and a C_{31}-homohopane 22S/(22S+22R) epimerisation ratio of only 0.06. The coal seam is estimated to lie 50–75 m above the base of the Jurassic, as suggested by log correlations between the Galgeløkke-2, Pernille-1 and Stina-1 wells (Nielsen 1995).

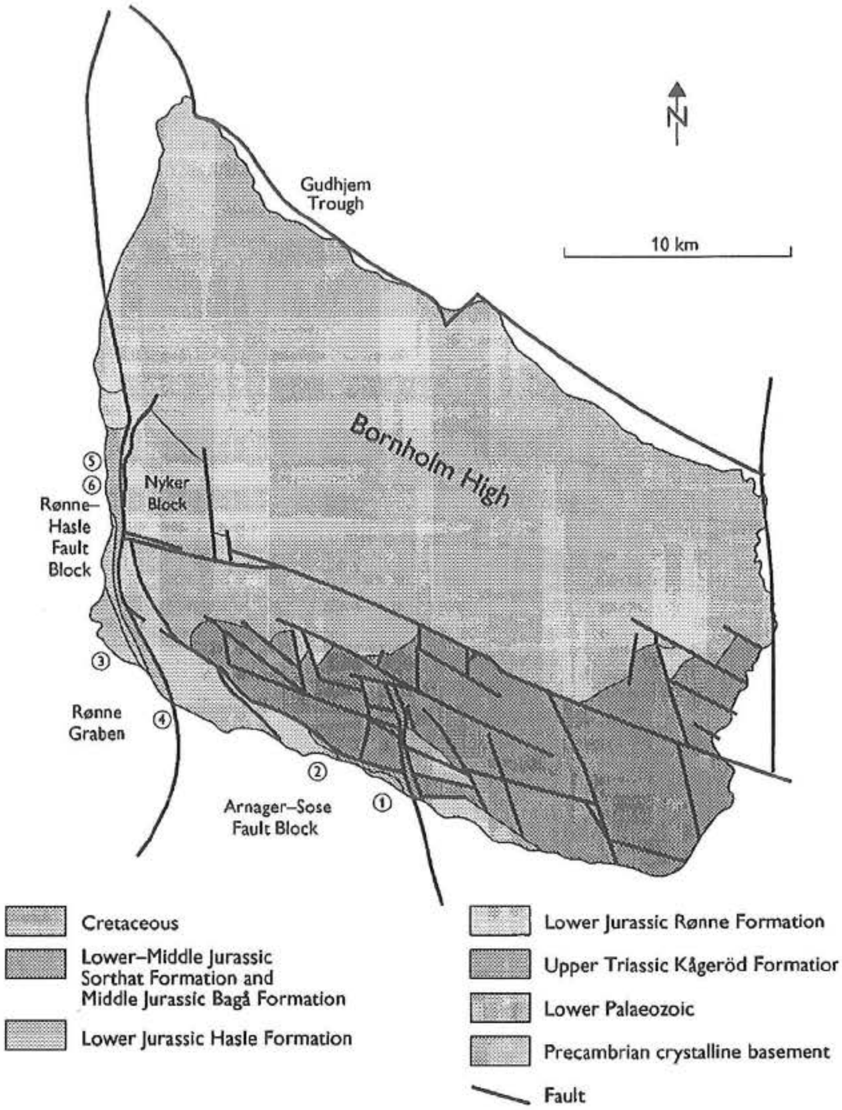


Fig. 6. Geological map of Bornholm showing the investigated localities: **1**, exposed Munkerup Member (Rønne Formation); **2**, type section of the Sose Bugt Member (Rønne Formation); **3**, type section of the Galgeløkke Member (Rønne Formation) at the Galgeløkke coastal exposures and the Galgeløkke-2 well; **4**, Korsodde coastal cliff, Sorthat Formation; **5**, Levka-1 well, Sorthat Formation; **6**, Hasle Klinkerfabrik clay pit, upper Bagå Formation. Modified from Gravesen *et al.* (1982).

Table 2. Maturity data, estimated burial depth/magnitude of later uplift

Locallity	Age	Average reflectance $\%R_o$#	Number of mean random reflectances	Average T_{max} (C°) (n)	C_{31}-homohopane 22S/(22S+22R)	Maximum burial depth (m)	Net uplift (m)
Sose Bugt section	Hettangian–Sinemurian	0.29	2	-	-	625	625
Anholt well*	Lower Jurassic	0.33	12	-	-	975	975
Levka-1 well / Korsodde section**	Upper Pliensbachian – Lower Toarcian	0.36	13	420(60)	0.06–0.1	1210	1210
Øresund-15 well+	Sinemurian	0.36	1	419(1)	-	1210	1210
Galgeløkke section	Sinemurian	0.38	2	-	-	1400	1400
Øresund-5 well+	Bajocian	0.39	1	421(2)	-	1450	1450
Fyleverken Sand Pit	Bajocian	0.39	2	430(2)	-	1450	1450
Munkerup section	Hettangian	0.41	2	-	-	1660	1660
Galgeløkke-2 well	Hettangian	0.42	1	427(1)	0.06	1700	1700
Hasle Kl. Clay Pit	Bathonian	0.42	6	-	-	1700	1700
Øresund-7 well+	Bajocian–Bathonian	0.43	5	418(9)	0.05–0.09	1875	1875
Øresund-13 well+	Hettangian–Sinemurian	0.46	1	426(1)	0.23	2100	2100
Øresund-18 well+	Hettangian–Sinemurian	0.51	2	426(7)	0.37–0.42	2440	2440

The average reflectance is calculated from mean random reflection (nos of analyses). A mean random reflectance value is based on *c.* 100 measurements in each sample.

* Data from Nielsen *et al.* (2000, this volume).

** Data from Petersen & Nielsen (1995).

\+ Data from Petersen (1994).

Upper Pliensbachian – Lower Toarcian part of the Sorthat Formation, Bornholm

Reflectance values of coal seams from the Upper Pliensbachian – Lower Toarcian part of the Sorthat Formation in cores from the Levka-1 well and in the Korsodde coastal cliff (Rønne–Hasle Fault Block) average 0.36 %R_o (Figs 2, 6; Table 2). T_{max} values average 421°C, and C_{31}-homohopane 22S/(22S+22R) epimerisation ratios for eight samples from the Levka-1 well are in the range 0.06–0.1, which conforms with low rank coals. Thermally sensitive hopenes and ßß-forms occur, and CPI values greater than 3 are compatible with immature low rank coals (Petersen & Nielsen 1995).

Bathonian part of the Bagå Formation, Bornholm

The coal-bearing Aalenian–Bathonian Bagå Formation is exposed in the Hasle Klinkerfabrik Clay Pit (Figs 2, 6). The clay pit is situated in the Rønne–Hasle Fault Block, close to the faulted margin of the Rønne Graben. Reflectance values from eight coal seams in the uppermost part of the Bagå Formation (Bathonian) are in the range 0.36–0.46 %R_o, averaging 0.42 %R_o (Table 2).

Lower Jurassic in the Rønne and Kolobrzeg Grabens

The Lower Jurassic from the western part of the Rønne Graben is represented by the Pernille-1 well, and from the Kolobrzeg Graben by the Stina-1 well (Fig. 7). In Pernille-1, the Lower Jurassic from 980–1470 m is referred to the Hettangian–Sinemurian Rønne Formation (Nielsen 1995). The reflectance values show a well-defined coalification trend with increasing depth (Fig. 8).

In Stina-1, the Lower Jurassic from 180–560 m possibly includes the Hettangian to Upper Pliensbachian (Nielsen 1995). The reflectance values vary between 0.31 %R_o and 0.40 %R_o (Fig. 8).

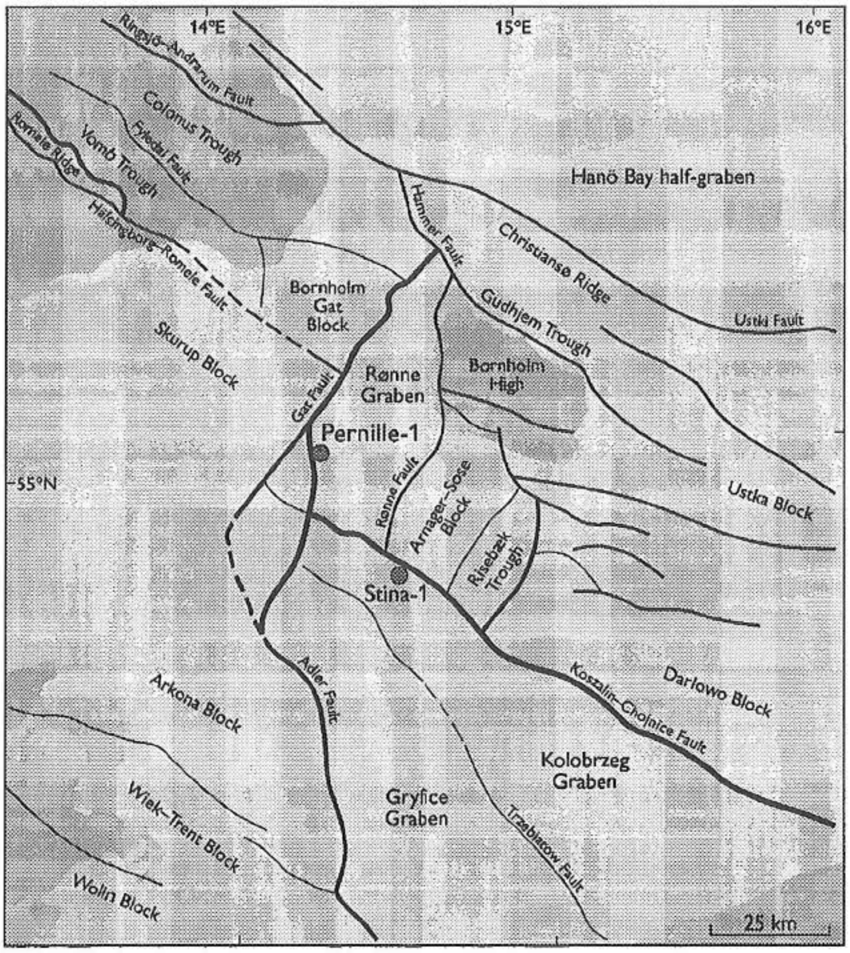


Fig. 7. Structural map showing the block mosaic of the Bornholm region and the position of the Pernille-1 and Stina-1 wells. The relative significance of the faults is indicated by varying line thickness. Slightly modified from Hamann (1994).

Bajocian Fuglunda Member of Skåne

Bajocian coal-bearing sediments of the Fuglunda Member (Mariedal formation) are exposed in the Fyleverken Sand Pit, Fyledal at Eriksdal (Figs 1, 2). The sediments are part of a 400–600 m thick succession that was deposited close to the boundary between the Vomb Trough and the Palaeozoic Colonus Trough (Fig. 9). Two coal samples from the lower part of the Fuglunda Member show reflectance values of 0.38 $\%R_o$ and 0.39 $\%R_o$ (Table 2), and T_{max} values of 427°C and 433°C.

Jurassic of the northern Øresund

Knowledge of the Jurassic in the Helsingør–Helsingborg area is derived from sea cliff and quarry exposures, from tunnel excavations, and from cored shallow wells in the Øresund and Skåne (Fig. 1). The deposits belong to the fault- and flexure-bounded Höganäs Basin within the Sorgenfrei–Tornquist Zone (Fig. 9).

Hettangian–Sinemurian sediments occur in the Øresund-13 and -18 wells. A coal seam in the former well yielded a reflectance of 0.46 $\%R_o$, whereas a coal seam in the latter well yielded a reflectance of 0.51 $\%R_o$ (Table 2). A Sinemurian coal seam in the Øresund-15 well has a reflectance of 0.36 $\%R_o$ (Table 2). The relatively low reflectance value of the seam from the Øresund-15 well may be suppressed, as the pronounced content of huminite and the presence of pyrite indicate

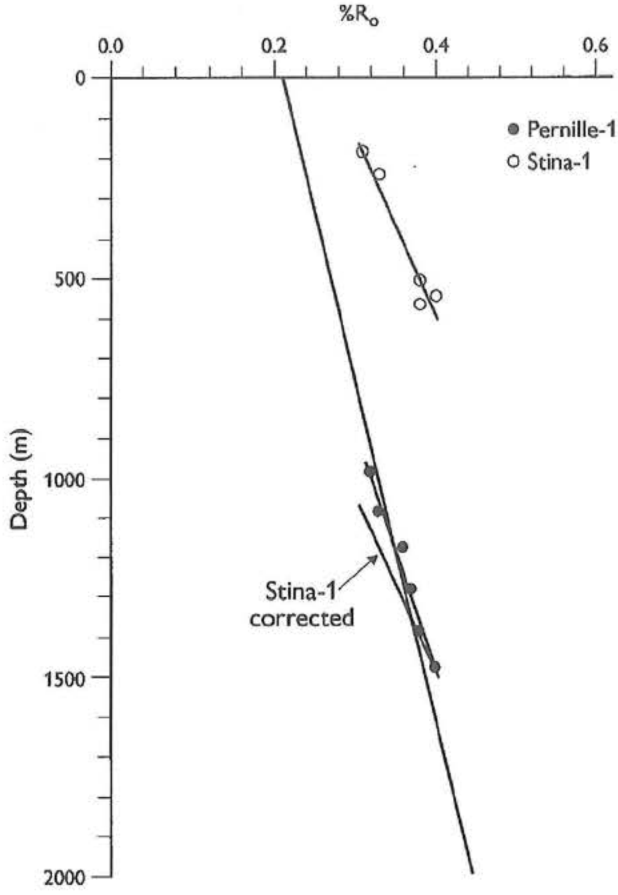


Fig. 8. Coalification profiles for the Pernille-1 well in the Rønne Graben and the Stina-1 well in the Kolobrzeg Graben. The regional coalification profile for the Danish Basin/Skagerrak–Kattegat Platform is also shown. The profile from Pernille-1 falls on the regional trend indicating that the section has not been uplifted. The Stina-1 section has been uplifted *c.* 900 m.

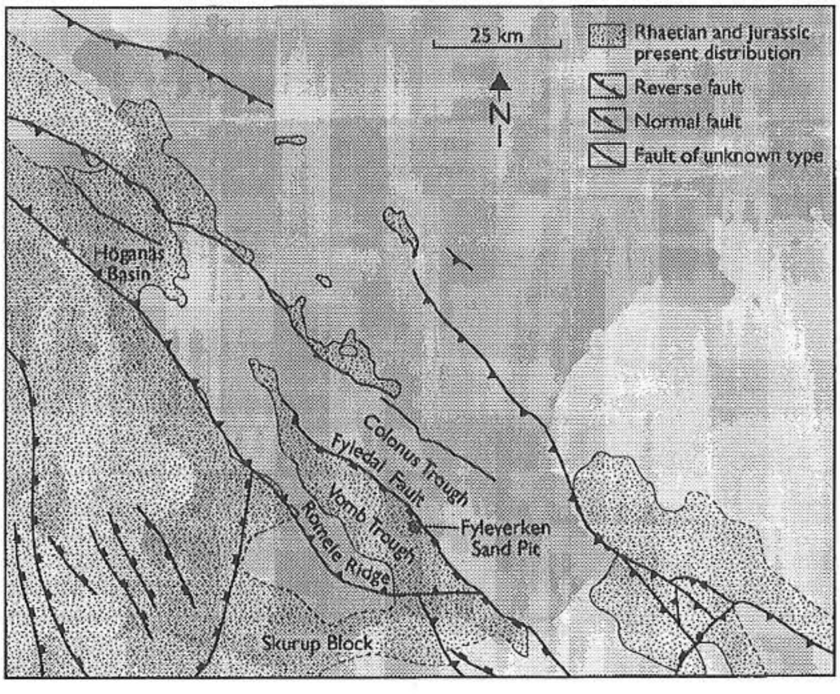


Fig. 9. Structural map of Skåne showing the present distribution of Rhaetian and Jurassic deposits. Modified from Norling & Bergström (1987).

that anoxic and possibly occasional saline conditions were present in the precursor mire. This may have resulted in the formation of hydrogen-enriched huminite, which matures at a lower rate (Petersen & Rosenberg 1998). The T_{max} is also low (419°C). The T_{max} value of the coal from the Øresund-13 well is 426°C and the values from the Øresund-18 well are 424–428°C. The C_{31}-homohopane 22S/(22S+22R) epimerisation ratio is 0.23 for the Øresund-13 well, whereas the ratio is in the range 0.37–0.42 for the Øresund-18 well. Together with the reflectance values, these data are consistent with a higher rank of the coals from the Øresund-18 well compared to the coal from the Øresund-13 well.

The Bajocian–Bathonian coal from the Øresund-5 well has a reflectance of 0.39 $\%R_o$, and the coals from the Øresund-7 well have reflectances in the range 0.41–0.46 $\%R_o$, averaging 0.43 $\%R_o$ (Table 2). Relative proportions of the thermally unstable hopenes and ßß-forms are high in the Øresund-7 coals, and the C_{31}-homohopane 22S/(22S+22R) epimerisation ratios are low (0.05–0.09). The average T_{max} value and the hopane ratios are similar to the values obtained from the Upper Pliensbachian – Lower Toarcian (Sorthat Formation) coal seams in the Levka-1 well on Bornholm. However, the reflectance values of the coal seams from the Øresund-7 well are higher, possibly due to increased oxidation during the humification process in the early stages of biochemical gelification (Diessel 1992; Hao & Chen 1992).

Lower–Middle Jurassic Fjerritslev and Haldager Sand Formations, Kattegat

Approximately 200 m of Lower and Middle Jurassic deposits of the Fjerritslev and Haldager Sand Formations overlain by *c.* 100 m of Quaternary deposits were cored by a shallow well on the island of Anholt located in the Kattegat (Figs 1, 2). Reflectance measurements by Nielsen *et al.* (2000, this volume) give an average value of 0.33 $\%R_o$ (Table 2).

Estimation of burial depths and later uplift

The average reflectance values of the coals and the constructed regional coalification curve are used to estimate the maximum burial depth of the coal-bearing Lower and Middle Jurassic strata in the Fennoscandian Border Zone. The amount of later uplift equals the maximum burial depth in most cases as the majority of the samples were collected close to present sea level.

Bornholm

A burial depth of *c.* 1660 m is suggested for the outcropping coals of the Hettangian Munkerup Member, whereas the data from the overlying Hettangian to Sinemurian Sose Bugt Member (both of the Rønne Formation) indicate only *c.* 625 m of burial (Fig. 10; Table 2). The thickness of the non-exposed section between the seams in the Munkerup Member and those in the Sose Bugt Member is less than a few tens of metres (Gry 1969; Gravesen *et al.* 1982); a difference of approximately 1000 m in estimated burial depth between the seams is therefore impossible. The reflectance values from the Munkerup Member are considered to be too high, possibly due to hydrothermal influence; this aspect is discussed further below. The Sose Bugt Member in the Arnager–Sose Fault Block is overlain by at least 60 m of sediments assigned to the Hasle Formation (Gravesen *et al.* 1982; Surlyk *et al.* 1995), which in turn are unconformably overlain by Lower Cretaceous sediments. The base of the Lower Cretaceous was buried to *c.* 290 m followed by a similar amount of uplift (Petersen *et al.* 1996). This suggests that part of the uplift experienced by the Sose Bugt Member was a Jurassic event, and only *c.* 290 m of the total uplift was caused by post-Early Cretaceous uplift.

The coal seams of the Sinemurian Galgeløkke Member exposed at the Galgeløkke coastal cliff have been buried to *c.* 1400 m with a later uplift of the same magnitude (Fig. 10; Table 2). The Hettangian coal seam in the nearby Galgeløkke-2 well was buried to *c.* 1700 m, corresponding to a burial depth for the base of the Jurassic of *c.* 1750–1775 m. The difference in estimated burial depths of the two seams is thus *c.* 300 m which corresponds reasonably well with the estimated thickness of *c.* 400 m of the intervening strata.

The coal seams in the Upper Pliensbachian – Lower Toarcian part of the Sorthat Formation have been buried to *c.* 1210 m. (Fig. 10; Table 2). The difference between the estimated burial depths of the seam from the Galgeløkke coastal cliff and the seams from the Levka-1 and Korsodde sections is *c.* 200 m which conforms well with an estimated thickness of 225–290 m of intervening strata. However, it should be noted that the estimated burial depth of the Levka-1 and Korsodde coals may be an under-estimate as the reflectance values of the coals may be slightly suppressed (Petersen *et al.* 2000, this volume).

The data from the Bathonian coal seams in the uppermost part of the Bagå Formation indicate a burial depth of *c.* 1700 m (Fig. 10; Table 2). This corresponds to *c.*

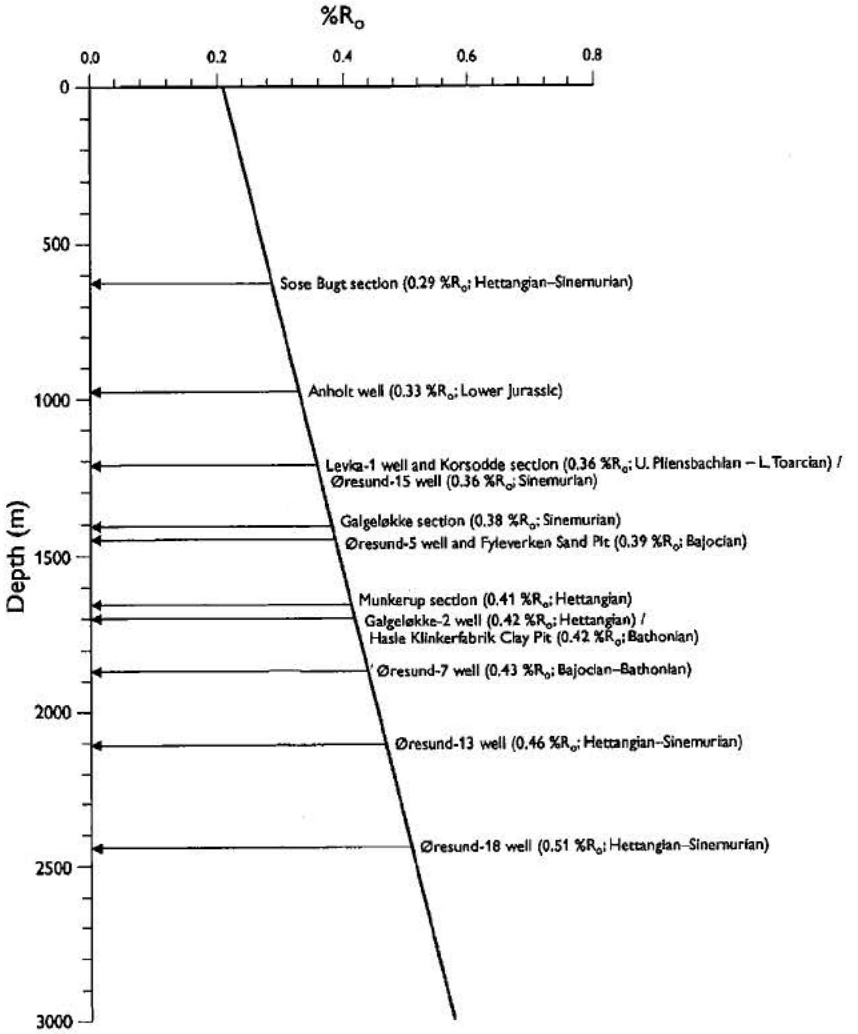


Fig. 10. The standard coalification curve for the Danish Basin/Skagerrak–Kattegat Platform used to estimate the burial depth of Lower and Middle Jurassic coal-bearing strata from the islands of Anholt and Bornholm, the Øresund area and Skåne by means of huminite reflectance values.

800 m deeper burial than the Levka-1 and Korsodde sections, and is unrealistic when the structural and stratigraphic development of the two closely-situated localities is considered (Gry 1969; Gravesen *et al.* 1982; Jensen & Hamann 1989). Hence, it is likely that the high reflectance values of the coals in the upper part of the Bagå Formation were caused by an additional factor linked to the proximity of the major Rønne–Hasle Fault as discussed below.

These estimates suggest that the base of the Jurassic in the Rønne–Hasle Block at Galgeløkke-2 was buried to *c.* 1750–1775 m and later uplifted *c.* 1320 m. This is consistent with the seismic interpretation by Hamann (1994) indicating up to 1400 m of inversion along the Rønne–Hasle Fault. The maximum burial depth of 1750–1775 m is compatible with the likely cumulative thicknesses of the Jurassic–Cretaceous section in the Rønne–Hasle Block. In Pernille-1, for instance, the Jurassic–Cretaceous section has a minimum thickness of *c.* 1450 m, comprising *c.* 600 m of Lower Jurassic deposits overlain by *c.* 850 m of probable Lower to Upper Cretaceous deposits. In the Rønne–Hasle Block, the cumulative thickness may have been up to 2000 m, as *c.* 1000 m of Jurassic deposits are preserved, and the original thickness of the Cretaceous succession may have been up to *c.* 1000 m, as suggested by reference to the adjacent Nyker Block and Pernille-1.

Rønne and Kolobrzeg Grabens

The reflectance values of the Rønne Formation in Pernille-1 plot on the trend of the coalification curve (Fig. 8). Interpretation of a seismic section through the Pernille-1 well indicates *c.* 270 msec (*c.* 400 m) of inversion relative to the stable Skurup Block (Fig. 11). Thus the present depth of the Jurassic deposits approximately corresponds to the maximum burial depth before inversion.

The data from the Stina-1 section situated in the Kolobrzeg Graben suggest a burial depth of *c.* 1500 m for the base of the Jurassic and *c.* 900 m of later uplift (Figs 7, 8). Seismic interpretation suggests a similar

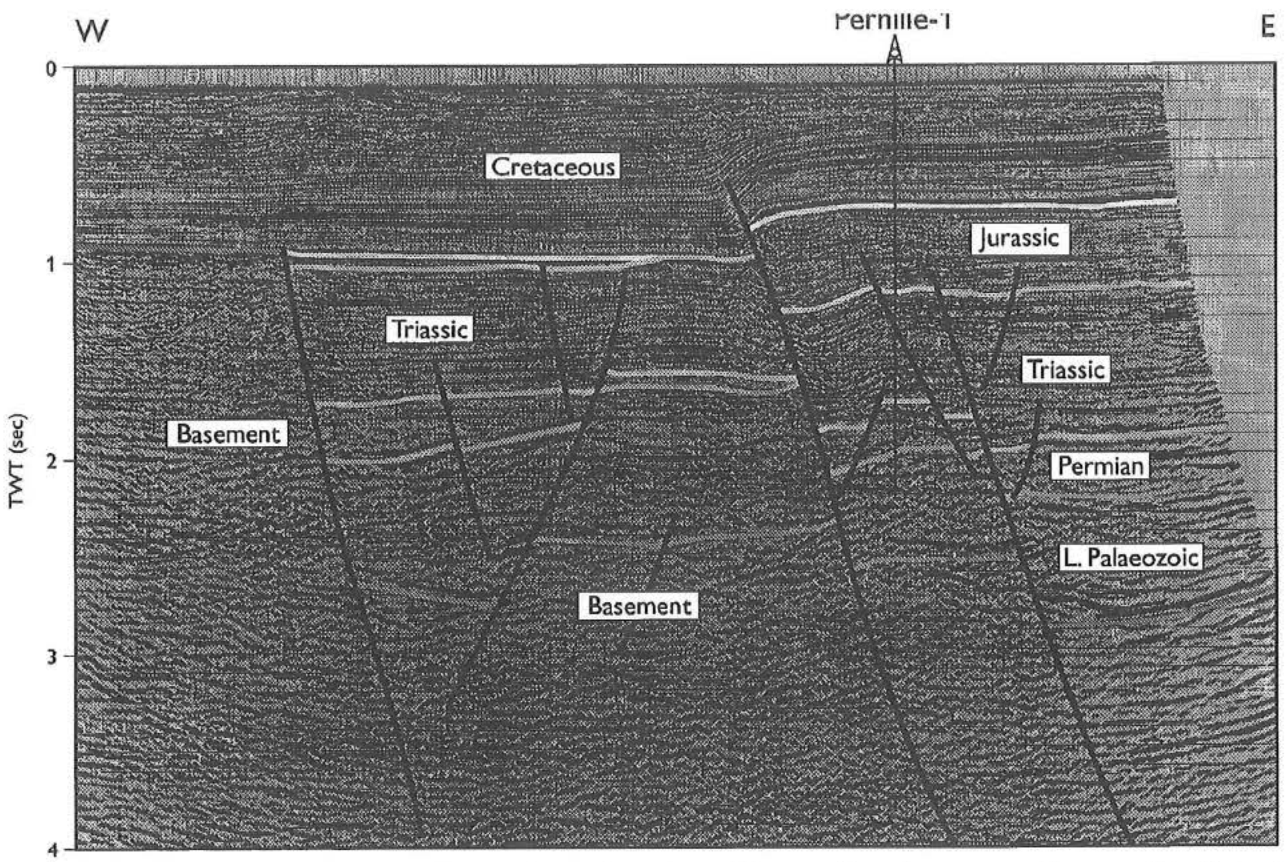


Fig. 11. Interpreted seismic section through the Pernille-1 well showing *c.* 270 msec of inversion corresponding to *c.* 400 m (interval velocity = 2942 m/sec; Nielsen & Japsen 1992). Slightly modified from Vejbæk *et al.* (1994).

amount of uplift during the inversion phase (Hamann 1994; Vejbæk *et al.* 1994). Stina-1 is located close to the section shown in Figure 12B, which indicates inversion of 1000–1100 m within the Kolobrzeg Graben. Evidence of inversion is also prominent on a SW–NE section east of Bornholm (Fig. 12C).

The Lower Jurassic strata in the Pernille-1 and Stina-1 wells were buried to the same depth in the two areas prior to uplift at Stina-1. The Lower Jurassic is unconformably overlain by Quaternary deposits in Stina-1, whereas the Lower Jurassic is overlain by *c.* 850 m of Upper Cretaceous deposits in Pernille-1; this is consistent with the estimate of *c.* 900 m of uplift at Stina-1 as suggested by reference to the adjacent Nyker Block and Pernille-1 (Figs 6, 7).

Fyleverken Sand Pit, Fyledal, Skåne

The reflectance values of the Bajocian coals from Fyledal suggest a burial depth of *c.* 1450 m in the Eriksdal area and a similar amount of later uplift (Fig. 10; Table 2). In the Vomb Trough, crystalline basement is overlain by up to 200 m of Jurassic – Lower Cretaceous strata and *c.* 1000 m of Upper Cretaceous deposits, but a large part of the Santonian–Campanian succession accumulated contemporaneously with the inversion of the Sorgenfrei–Tornquist Zone (Erlström & Guy-Ohlson 1994). The thickness of the Santonian–Campanian succession thus reflects the relative fault movements and not directly the uplift. In the Fyleverken Sand Pit section in Fyledal, *c.* 400 m of Jurassic deposits of post-Bajocian age are found, and the Lower Cretaceous – Turonian section was probably *c.* 200 m thick before tilting of the section during Santonian–Campanian inversion (Norling & Bergström 1987). Erlström (1994) suggested that *c.* 300 m of Maastrichtian deposits were eroded during Neogene uplift. The Jurassic–Cretaceous succession may thus have attained a thickness of *c.* 900 m. Paleocene and Eocene deposits seem to be confined to the basin south-west of the Helsingborg–Romele Fault. However, Tertiary deposits may have covered eastern Skåne and are thought to be present in the Hanö Bay area (Lidmar-Bergström 1982; Norling & Bergström 1987). It is thus very difficult to evaluate in detail the thickness of strata that has been removed on the basis of the preserved stratigraphy, and to support the burial estimate of *c.* 1450 m. In addition, hydrother-

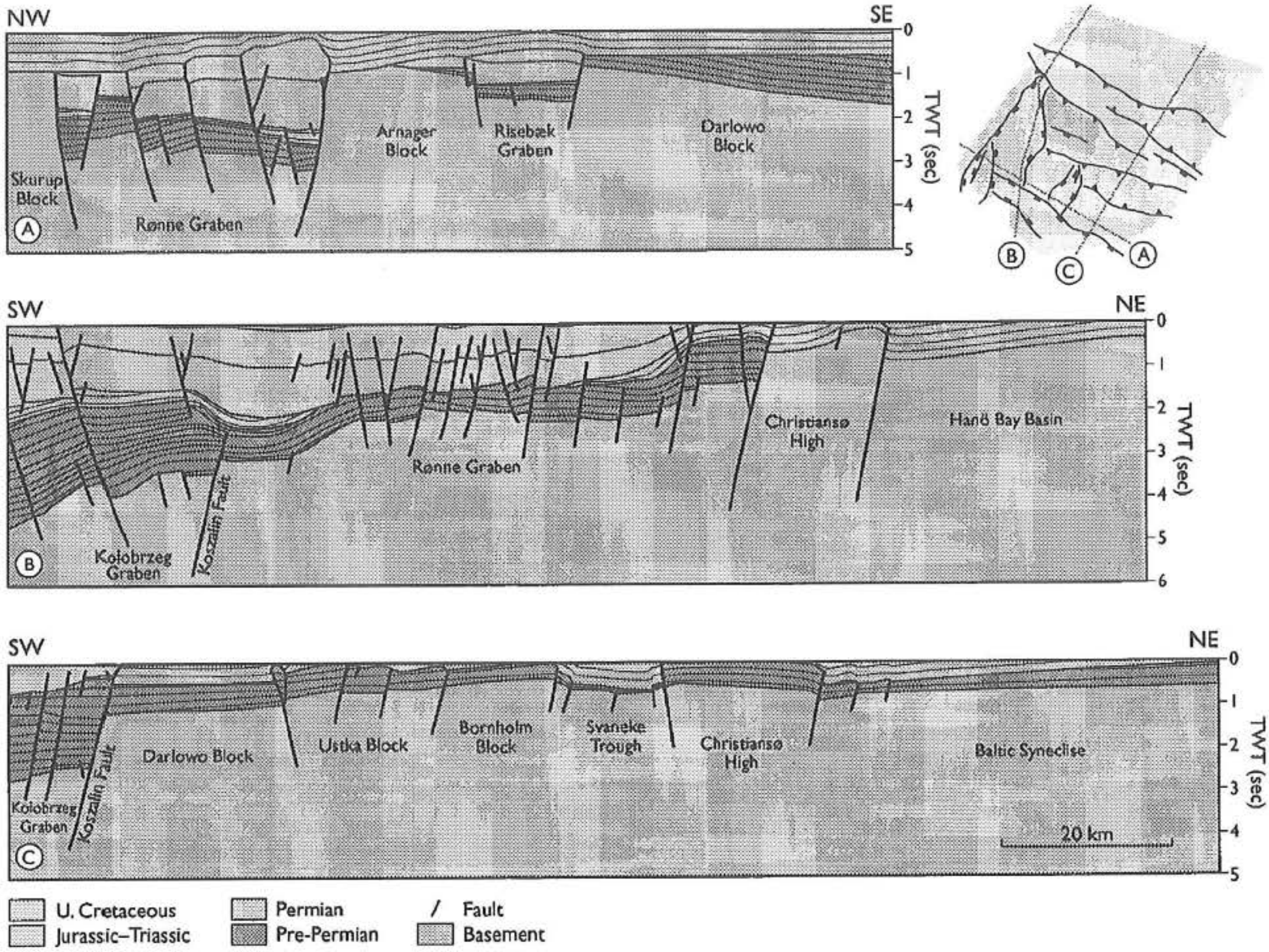


Fig. 12. Geosections around Bornholm (see inset map) with depths in two-way travel time (TWT), based on interpreted seismic sections. **A**: Note the lack of significant inversion relative to the Skurup Platform at the western margin of the Rønne Graben in contrast to the marked inversion relative to the Arnager Block in the south-eastern part of the graben. **B**: Note the very significant inversion of the Kolobrzeg Graben relative to the Hanö Bay Basin. Stina-1 is located in the Kolobrzeg Graben close to the Koszalin Fault. **C**: Inversion of the Kolobrzeg Graben is also evident on the SW–NE section, east of Bornholm. Slightly modified from Vejbæk *et al.* (1994).

mal influence on the rank cannot be precluded (see below). The amount of inversion in the north-western part of the Sorgenfrei–Tornquist Zone is typically suggested to be up to 1000 m (Jensen & Michelsen 1992; Japsen 1993; Michelsen & Nielsen 1993). Extension of the regional trend of Neogene uplift shown by Jensen & Michelsen (1992) and Japsen (1993) into Skåne may suggest 1000–1500 m of uplift in this area. However, this trend is mainly based on data to the north-west of Skåne and thus may not be directly applicable.

Northern Øresund

In the Höganäs Basin, the data from the Hettangian–Sinemurian coal seams in the Øresund-13 and -18 wells indicate burial depths of *c.* 2100 m and 2440 m respectively (Fig. 10; Table 2). Uplift in the Øresund area was evaluated by modelling of a pseudo-well. The pseudo-well is based on a stratigraphic reconstruction from the shallow wells and the stratigraphic information given in plate 21 of Larsen *et al.* (1968). The reconstruction is referred to the location of the Øresund-1 well and is shown together with the modelled reflectances (Fig. 13). The modelling shows that the differences in reflectance (%R_o) can be explained by the thickness of the intervening strata with the exception of the Øresund-15 well. The low value obtained from this well may be due to suppression, as mentioned earlier. The basin modelling indicates an uplift of 1200 m for the Øresund-1 well location, corresponding to uplift of 2100 m at the Øresund-13 well location and 2550 m at the Øresund-18 well location. This is in close agreement with the values determined from the coalification curve and is

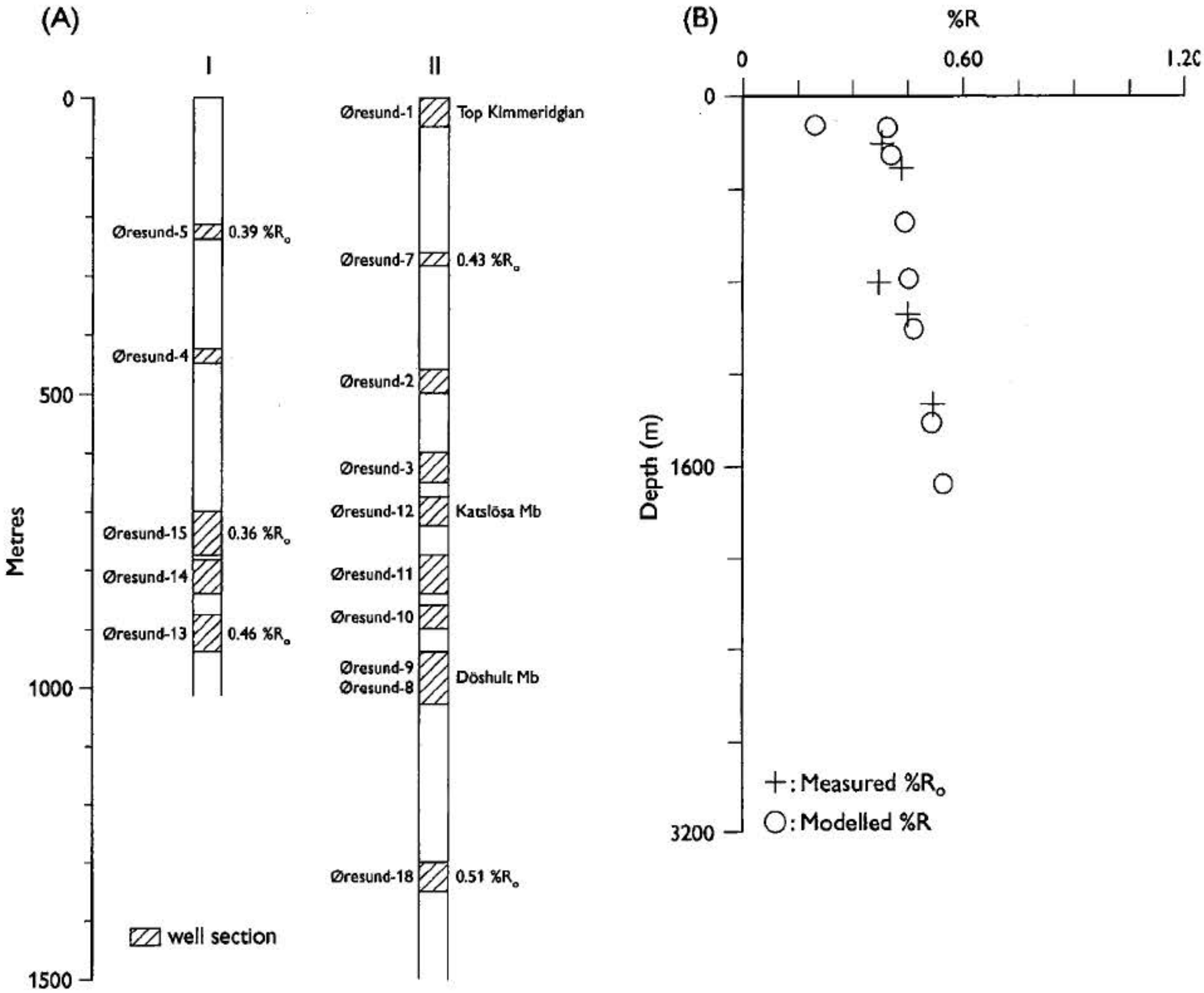


Fig. 13. **A**: Reconstructed stratigraphic columns at the location of the Øresund-1 well. The reconstructions are based on the geological profiles along the tunnel transect (column I) and the bridge transect (column II) shown on plate 21 in Larsen *et al.* (1968). **B**: Modelled reflectance values from the constructed pseudo-well compared to measured values.

compatible with the stratigraphy (Fig. 13; plate 21 in Larsen *et al.* 1968).

Reflectance values of three Hettangian coal samples from the nearby Helsingborg railway tunnel range from 0.48 %R_o to 0.57 %R_o, and dispersed huminite from Hettangian deposits in the nearby Ramlösa-1b well give a value of 0.48 %R_o (Ahlberg 1994). These data suggest burial depths between 2440 m and 3050 m.

The Bajocian–Bathonian coal seams in the Øresund-5 and Øresund-7 wells situated immediately west of the inversion zone, were buried and later uplifted *c.* 1450 m and *c.* 1875 m, respectively, corresponding to modelled values of *c.* 1400 m for the Øresund-5 well and *c.* 1500 m for the Øresund-7 well (Figs 10, 13; Table 2).

Anholt well, Kattegat

The Lower–Middle Jurassic strata encountered in the Anholt well were buried and uplifted *c.* 975 m (Fig. 10; Table 2). The island of Anholt is located on the boundary between the Skagerrak–Kattegat Platform and the inversion zone. The uplift is mainly interpreted as being of Neogene–Pleistocene age, and the degree of uplift is slightly less than that inferred for the Sæby-1 well (Japsen 1993; Michelsen & Nielsen 1993). Approximately 1200 m of uplift was estimated by Nielsen *et al.* (2000, this volume) based on the same reflectance data but utilising a general North Sea coalification curve.

Hydrothermal influence on the maturation of organic matter

The vast majority of the reflectance values provide reasonable estimates of burial depths that are consistent with stratigraphic thicknesses and other evidence of burial depths. However, the rank of the coals from the Munkerup Member, the uppermost Bagå Formation, and possibly the Fuglunda Member appear anomalously high. An additional mechanism other than thermal influence with burial depth is needed to explain these anomalies.

The precursor peats of the uppermost Bagå Formation coals were formed in a relatively well-aerated environment, which may have produced hydrogen-poor and oxygen-rich huminite precursor material that matured at an enhanced rate (Hao & Chen 1992). However, this explanation cannot be applied to the coals of the Munkerup Member, and may not be sufficient to explain the large difference in reflectance between the coals from the Sorthat and Bagå Formations on Bornholm. Therefore, it is proposed that the elevated maturity was the result of a local rise in temperature due to hydrothermal activity.

Hydrothermal processes associated with fault movements have been proposed to explain the occurrence of sideritic iron ores and copper mineralisation along the Fyledal Fault Zone and zeolites in Campanian deposits in the Vomb Trough (Norling & Bergström 1987; Erlström 1994). Middle Jurassic volcanic activity occurred in Skåne along fault and fracture zones, and hot brines influenced the diagenesis of Rhaetian and Lower Jurassic sandstones and caused anomalously high vitrinite reflectances (Klingspor 1976; Norling & Bergström 1987; Ahlberg 1994; Ahlberg & Goldstein 1994). The silica-cemented Höör Sandstone (a lateral equivalent of the Höganäs Formation, Fig. 2), which has not been buried more than a few hundred metres, was indurated at temperatures from 100–200°C, and the organic matter shows reflectance values that locally reach 0.9 $\%R_0$ corresponding to a burial depth of *c.* 5700 m. Bottomhole temperatures in the Hans-1 well in the Kattegat were high in Lower Jurassic strata at very shallow depths (45°C at 316 m) whereas normal temperatures were recorded at deeper levels. The real temperature of the Jurassic deposits is even higher than indicated by the borehole measurement, because of the cooling effect of the drilling mud.

The occurrence of hydrothermal activity along faults and the effect on the diagenesis of organic as well as siliciclastic deposits is thus well-documented. Some of the observed anomalies in the Jurassic coals may therefore be related to the Middle Jurassic volcanic activity in Skåne.

The upper Bagå Formation coals are situated close to the fault that separates the Rønne Graben from the crystalline basement of the Bornholm High, and it is possible that hot formation waters expelled from deeply buried deposits percolated upwards along the fault and into the coal-bearing strata. The occurrence of abundant epigenetic pyrite in the coals and large pyrite nodules in sand interbeds lend support to this interpretation, as the most likely source of the sulphur is saline formation water from older sediments containing salt and gypsum (Petersen *et al.* 2000, this volume). A similar situation has been reported from the Carboniferous St. Rose and Chimney Corner coalfields in Nova Scotia, Canada (Beaton *et al.* 1993).

The Munkerup Member coals occur close to the northern and eastern bounding faults of the Arnager–Sose Fault Block, and these faults may also have functioned as conduits for hot formation waters, thus explaining the high rank of the coals.

Discussion and conclusions

A well-constrained, uplift-corrected coalification curve has been constructed from reflectance data representing a wide range of burial depths of the Upper Triassic–Lower Cretaceous succession in the Danish Basin and the Fennoscandian Border Zone. We suggest that this curve may be used as a standard with which new data can be compared. The reflectance values from wells in the Fjerritslev Trough and the Terne-1 well deviate from the main coalification trend. Basin modelling and velocity data obtained from the Chalk Group (Japsen 1992) suggest that the correction for uplift may be erroneous due to overestimation of the burial depth based on sonic velocities from the Fjerritslev Formation. These data have thus not been incorporated in the standard curve.

Average reflectance values from the Lower–Middle Jurassic coals in the Fennoscandian Border Zone range from 0.29 $\%R_0$ to 0.51 $\%R_0$ (Table 2), which are compatible with low rank coals, and directly indicate relatively shallow burial depths. The use of the regional curve to assess the burial depths and later uplift of coal-bearing Lower–Middle Jurassic strata in the Fennoscandian Border Zone has provided reliable and consistent results (Table 2). Hydrothermal activity related to the Middle Jurassic volcanic event may locally have influenced the maturation of the coals in the Hettangian–Sinemurian of the Höganäs Basin, and possibly the coals in the Fuglunda Member at Fyledal. The rank of the coals in the Munkerup Member (Rønne Formation) and upper Bagå Formation on Bornholm was probably raised by hot formation waters expelled from deeply buried layers.

The reflectance data indicate *c.* 290–1400 m of post-Early Cretaceous uplift of the Jurassic succession in the Rønne–Hasle Fault Block, the Arnager–Sose Fault Block and the Kolobrzeg Graben (Table 2). This degree of uplift is compatible with the amount of Late Cretaceous–Early Tertiary inversion based on seismic interpretation (Hamann 1994; Vejbæk *et al.* 1994), and is similar to the 550–1000 m of inversion that has been interpreted from the Sorgenfrei–Tornquist Zone further to the northwest (Japsen 1993; Michelsen & Nielsen 1993). Thus the total post-Early Cretaceous uplift in the Bornholm area determined from reflectance values can be explained by inversion alone, without the need for significant Neogene–Pleistocene uplift. The relatively small amount of burial and later uplift is clearly indicated by the very low reflectance values from the Arnager–Sose Fault Block, the well-preserved delicate roots and stems, and the poorly lithified, uncompacted nature of the Jurassic onshore sediments.

The estimated uplift of the Jurassic section in the Höganäs Basin, reflecting both inversion and Neogene–Pleistocene uplift, amounts to a minimum of 2000 m. This is similar to the total uplift of 1730–2000 m of the Hans-1 well-section in the Kattegat (Japsen 1993; Michelsen & Nielsen 1993). The *c.* 1600 m of uplift indicated by the Øresund-5 and -7 data, west of the inversion zone, is a function of both Neogene uplift and drag along the inversion zone. The rank of the Bajocian Fuglunda Member coal bed suggests *c.* 1450 m of total uplift, which appears to be a reasonable estimate based on the likely overburden and regional evidence, but it cannot be precluded that the rank has been increased due to hydrothermal influence. The total uplift of the Anholt well-section is estimated to be *c.* 975 m, rather than the *c.* 1200 m suggested by Jensen & Michelsen (1992) and Nielsen *et al.* (2000, this volume). The data from Anholt and Bornholm may suggest that the amount of Neogene–Pleistocene uplift in Skåne was relatively small compared to the northern part of the Danish Basin and the Fennoscandian Border Zone, but further data are needed for confirmation.

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