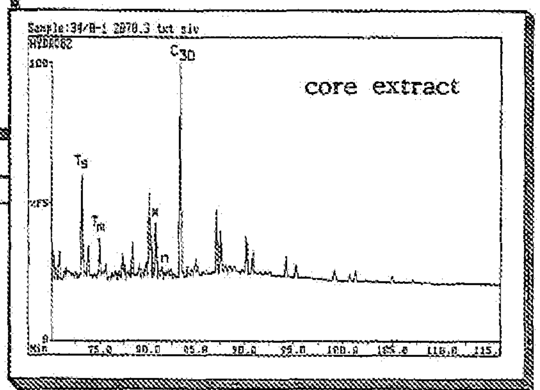
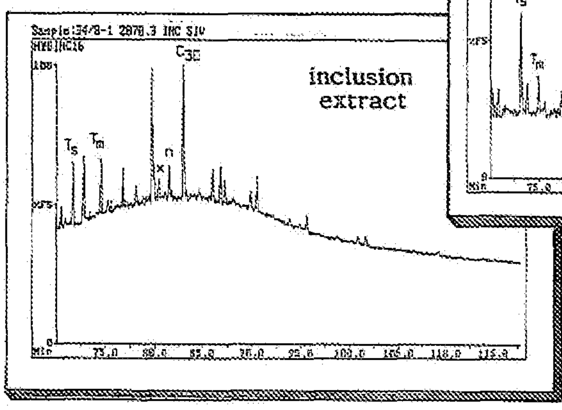
PETROLEUM INCLUSION GEOCHEMISTRY COMPARED TO CORE EXTRACT GEOCHEMISTRY IN THE VISUND FIELD





A project between
Hydro, IFE, and Department of Geology, University of Oslo
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3 SAMPLE SET

37 sandstone core samples were selected from 5 wells; 34/8-1, 34/8-3A, 34/8-4S, 34/8-4A, and 34/8-8, see **Fig. 1**. The selection was based partly on a pilot investigation of the distribution of fluorescing inclusions (i.e. petroleum inclusions) determined by UV-microscopy of thin sections from the same and other wells, and also partly on the occurrence of gas/petroleum/water contacts. Still, a major guideline for sampling was observations of sandstone lithology and cementation as observed on the cores during sampling.

In all, 330-340 thin sections were examined by UV microscopy at IFE to evaluate the occurrence of fluorescent petroleum inclusions. 25 selected samples were examined in great detail by IFE for studying microthermometrical behaviour of petroleum and water inclusions. The reader is referred to the IFE report for details on this particular study which also includes detailed descriptions on microscale occurrences of petroleum inclusions within diagenetic cements.

An other source of data for this study was existing Hydro data on petroleum geochemistry of the Visund field. Thus, this report integrates the organic results generated at the Univ. of Oslo with microthermometrical data produced at IFE, plus existing Hydro data.

All sandstone core samples were extracted/cleaned and analyzed quantitatively on Iatroscan TLC-FID.

On the basis of these data, and on the basis of the vertical extent of the presently defined gas/petroleum/water columns, 17 core samples were selected. From these 17 samples, petroleum inclusion extracts and the corresponding core extracts were produced and analyzed on GC-MS. Gas in inclusions of these 17 samples was analyzed on the same extracted/cleaned core samples.

Fig. 2 schematically illustrates the relative distributions of the 17 samples, while the list below shows the complete sample set.

CORE SAMPLES - VISUND

WELL	DEPTH (core depth)	ZONE	FORMATION ZONE
34/8-1	3825.3*	G	Tarbert
	2866.3*	W	Etive
	2878.3*	W	Etive
	2946.4		Rannoch
	3055.1		Cook
34/8-3A	3045.9*	G	Tarbert
	3086.8*	O	Ness
	3106.7*	W	Etive
	3131.9*	W	Rannoch
34/8-4S	3009.6*	C	Lunde
	3076.7		Lunde
	3078.4*	C	Lunde
	3079.2		Lunde
	3101.4		Lunde
	3121.5		Lunde
	3135.5*	C	Lunde
	3178.5		Lunde
	3200.5		Lunde
	3204.9*	C	Lunde
	3208.3		Lunde
	3209.8		Lunde
	3229.5*	C	Lunde
34/8-4A	3064.5		Statfjord
	3068.5		Statfjord
	3082.8		Statfjord
	3089.5*	O	Statfjord
	3105.5		Statfjord
	3135.2		Statfjord
	3184.5		Statfjord
	3249.5*	W	Lunde
	3252.5		Lunde
	3329.5*	W	Lunde
34/8-8	2925.5*	O	Tarbert
	2933.5		Tarbert
	2963.0		Ness
	2991.6		Ness/etive
	3008.2*	W	Etive/Rannoch

All samples analyzed on Iatroscan TLC-FID.
*=core and inclusion extract samples analyzed on GC-MS, and gas analyzed in inclusions

4 METHODS

Analytical

Cleansed sand samples used for UV-microscopic determination of amount of fluorescing inclusions and for inclusion gas analysis was prepared by disintegrating core samples with a hammer, dry sieving and visual inspection of the sieve fractions. The silt/clay fraction was then discarded. This procedure was repeated until the sample consisted of almost 100% single sand grains. The disintegrated samples were then extracted with dichloromethane:methanol=93:7 (vol %) in a Soxtec apparatus, and further cleaned by soaking in chromic acid (overnight + 30 min. ultrasonication). The total amount (volume) of fluorescing inclusions in each cleaned sand sample was subjectively determined by UV-microscopy on a scale from 0 to 5, where 5 represents amounts equal to the highest amount of fluorescing inclusions that has been encountered in a previous inclusion studies on the Ula field.

Inclusion gas samples were prepared by crushing 5.0 grams of cleansed sand in a gas tight sling mill chamber and extracting 1.0 ml with a gas tight syringe. The gas was then injected and analyzed on a Varian 3500 GC-FID using a 30m DB-1 column, 0.32 mm I.D., 5.0 μm film, carrier gas: nitrogen, temperature program: isothermal heating at 38°C for 4 minutes.
The amount of methane in inclusions, measured as mV FID signal, is used in this study as a simplistic measure of total amount of gases contained in inclusions.

Core extracts for quantitative Iatroscan TLC-FID and GC-FID analyses were prepared by extracting a weighed amount (2-3 grams) of fine crushed bulk sample with DCM:MeOH=93:7 (vol.) using a Soxtech instrument.

For Iatroscan TLC-FID analyses, the method described by Karlsen and Larter (1991) was used.

GC-FID analyses of core extracts were run on a Varian 3500 GC equipped with a 50 m Ultra-2 column, 0.2 mm I.D., 0.33 μm film; carrier gas: nitrogen, temperature program: 90°C (2 min) - 4.5°C/min. - 310°C (30 min.).

GC-MS analyses of inclusion- and core extracts were run on a Fisons MD800 running in SIR mode, equipped with a 60 m DB-5ms column, 0.25 I.D., 0.25 μm film; carrier gas: helium; temperature program: 80°C (10 min.) - 10°C/min. - 180°C (0 min.) - 1.7°C/min. - 310°C (30 min.).

BULK COMPOSITION OF CORE EXTRACTS - VISUND FIELD								
SAMPLE ID	SATURATES		AROMATICS		POLARS		SUM	
	(mg/g rock)	(%)	(mg/g rock)	(%)	(mg/g rock)	(%)	(mg/g rock)	(%)
34/8-1 2825.3	0.23	62.2	0.07	18.9	0.07	18.9	0.37	100.0
34/8-1 2866.3	0.38	48.1	0.31	39.2	0.10	12.7	0.79	100.0
34/8-1 2946.4	0.11	44.0	0.11	44.0	0.03	12.0	0.25	100.0
34/8-1 3055.1	0.06	25.0	0.05	20.8	0.13	54.2	0.24	100.0
34/8-3A 3045.9	0.26	79.5	0.00	0.0	0.07	20.5	0.33	100.0
34/8-3A 3086.8	0.12	63.2	0.04	21.1	0.03	15.8	0.19	100.0
34/8-3A 3106.7	0.60	71.4	0.16	19.0	0.08	9.5	0.84	100.0
34/8-3A 3131.9	0.19	63.3	0.07	23.3	0.04	13.3	0.30	100.0
34/8-4A 3064.5	1.27	63.5	0.47	23.5	0.26	13.0	2.00	100.0
34/8-4A 3068.5	2.24	67.7	0.78	23.6	0.29	8.8	3.31	100.0
34/8-4A 3082.8	1.96	47.3	1.92	46.4	0.26	6.3	4.14	100.0
34/8-4A 3089.5	0.53	66.3	0.15	18.8	0.12	15.0	0.80	100.0
34/8-4A 3105.5	0.98	68.1	0.31	21.5	0.15	10.4	1.44	100.0
34/8-4A 3135.2	0.48	66.7	0.16	22.2	0.08	11.1	0.72	100.0
34/8-4A 3184.5	0.94	70.7	0.25	18.8	0.14	10.5	1.33	100.0
34/8-4A 3249.5	0.74	71.2	0.21	20.2	0.09	8.7	1.04	100.0
34/8-4A 3252.5	1.42	71.4	0.43	21.6	0.14	7.0	1.99	100.0
34/8-4A 3329.5	0.82	51.3	0.27	16.9	0.51	31.9	1.60	100.0
34/8-4S 3009.6	0.31	64.6	0.13	27.1	0.04	8.3	0.48	100.0
34/8-4S 3076.7	0.27	55.1	0.14	28.6	0.08	16.3	0.49	100.0
34/8-4S 3078.4	0.32	61.5	0.10	19.2	0.10	19.2	0.52	100.0
34/8-4S 3079.2	0.29	50.0	0.13	22.4	0.16	27.6	0.58	100.0
34/8-4S 3101.4	0.40	47.6	0.14	16.7	0.30	35.7	0.84	100.0
34/8-4S 3121.5	0.26	66.7	0.08	20.5	0.05	12.8	0.39	100.0
34/8-4S 3135.5	0.60	63.2	0.22	23.2	0.13	13.7	0.95	100.0
34/8-4S 3178.5	3.44	17.9	2.86	14.8	12.97	67.3	19.27	100.0
34/8-4S 3200.5	3.43	52.4	1.31	20.0	1.81	27.6	6.55	100.0
34/8-4S 3204.9	4.76	42.6	1.94	17.4	4.47	40.0	11.17	100.0
34/8-4S 3208.3	2.24	24.5	1.48	16.2	5.43	59.3	9.15	100.0
34/8-4S 3209.8	11.25	13.5	18.13	21.8	53.75	64.7	83.13	100.0
34/8-4S 3229.5	0.27	12.8	0.40	19.0	1.44	68.2	2.11	100.0
34/8-8 2925.5	0.86	58.5	0.36	24.5	0.25	17.0	1.47	100.0
34/8-8 2933.5	0.15	62.5	0.06	25.0	0.03	12.5	0.24	100.0
34/8-8 2963.0	0.83	65.9	0.26	20.6	0.17	13.5	1.26	100.0
34/8-8 2991.6	0.06	33.3	0.08	44.4	0.04	22.2	0.18	100.0
34/8-8 3008.2	0.07	31.8	0.08	36.4	0.07	31.8	0.22	100.0

Tab. 1

GAS CONTAINED IN INCLUSIONS

WELL	CORE DEPTH (m)	%C1	%C2	%C3	%n-C4	%i-C4	%n-C5	%"i-C5"	C2/C3	C1/ (C2+C3)	C1/SUM (C2-C5)	iC4/nC4	total amount of gas (mV FID signal)	C1 in 5 g sample
34/8-1	2825.3	83.0	7.8	4.6	1.6	1.2	0.8	1.1	1.7	6.7	4.9	0.8	1410	1170
34/8-1	2866.3	82.3	9.5	5.1	1.4	0.8	0.5	0.4	1.9	5.6	4.7	0.5	9098	7488
34/8-1	2878.3	79.0	9.2	6.2	2.5	1.2	0.9	1.0	1.5	5.1	3.8	0.5	2411	1904
34/8-3A	3045.9	82.7	8.4	5.2	1.6	0.9	0.5	0.6	1.6	6.1	4.8	0.6	1375	1137
34/8-3A	3086.8	92.2	3.9	3.9	0.0	0.0	0.0	0.0	1.0	11.9	11.9		342	315
34/8-3A	3106.7	90.8	5.0	2.4	1.1	0.8	0.0	0.0	2.1	12.4	9.9	0.7	822	746
34/8-3A	3131.9	88.2	7.0	4.8	0.0	0.0	0.0	0.0	1.5	7.5	7.5		286	252
34/8-4A	3089.5	70.2	10.9	9.9	3.9	2.1	1.6	1.4	1.1	3.4	2.4	0.5	485	341
34/8-4A	3249.5	59.7	15.0	14.8	5.2	2.3	1.5	1.3	1.0	2.0	1.5	0.4	4185	2500
34/8-4A	3329.5	56.4	12.8	13.6	7.0	2.6	4.4	3.3	0.9	2.1	1.3	0.4	1187	670
34/8-4S	3009.6	58.2	14.0	14.2	6.0	2.8	2.6	2.1	1.0	2.1	1.4	0.5	4069	2369
34/8-4S	3078.4	61.0	13.9	14.1	5.2	2.5	1.7	1.5	1.0	2.2	1.6	0.5	4466	2724
34/8-4S	3135.5	59.2	15.0	14.6	5.4	2.2	1.9	1.7	1.0	2.0	1.4	0.4	7417	4389
34/8-4S	3204.9	59.0	14.7	14.5	5.5	2.8	2.1	1.5	1.0	2.0	1.4	0.5	5429	3204
34/8-4S	3229.5	63.8	16.1	14.3	3.3	2.5	0.0	0.0	1.1	2.1	1.8	0.8	2951	1884
34/8-8	2925.5	81.2	7.8	5.7	2.1	1.6	0.6	0.9	1.4	6.0	4.3	0.8	636	517
34/8-8	3008.2	94.8	3.7	1.5	0.0	0.0	0.0	0.0	2.4	18.1	18.1		591	560

Tab. 2

Well	Test	Depth	%C1	%C2	%C3	%IC4	%C4	%IC5	%C5	%CO2	C1-C4	C1-C5	Wetness	IC4/nC4
34/8-1	2	2854.1-2857.1	88,4	5,8	2,9	0,5	1,0			1,4	98,4		0,10	0,47
34/8-1	3	2767.9-2806.9	89,4	5,3	2,7	0,4	1,0			1,3	98,7		0,09	0,42
34/8-3	1	2935.0	85,7	7,9	2,7	0,4	0,9			2,0	98,0		0,12	0,46
34/8-3	2	2905.0-2921-0	89,0	5,5	2,5	0,4	0,9			1,2	98,8		0,10	0,44
34/8-3	3	2868.0-2880.00	87,1	6,8	2,4	0,4	0,9			2,0	98,0		0,11	0,43
34/8-4S	1	3219.0-3241.0	78,1	9,7	6,6	0,9	2,0	0,43	0,53	1,6	97,4	98,4	0,21	0,46
34/8-4S	3	3001.0-3018.0	74,6	10,8	7,9	1,2	2,6	0,51	0,65	1,7	97,1	98,3	0,24	0,45
34/8-4S	4	2903.0-2917.0	83,2	7,2	4,6	0,7	1,6	0,40	0,53	1,8	97,3	98,2	0,15	0,44
34/8-4A	1	3324.0-3342	82,5	8,5	5,3	0,6	1,3	0,20	0,23	1,4	98,2	98,6	0,16	0,48
34/8-4A	2	3214.0-3228.0	77,6	9,4	7,5	0,9	2,5	0,45	0,57	1,2	97,3	98,8	0,21	0,36
34/8-4A	3	3161.0-3185.0	80,8	9,5	5,6	0,7	1,5	0,03	0,03	1,9	98,1	98,1	0,18	0,47
34/8-4A	4	3056.0-3108.0	81,5	9,1	5,5	0,7	1,5	0,03	0,04	1,7	98,2	98,3	0,17	0,46
34/8-4A	5	2988.5-3019.5	81,6	9,3	5,5	0,6	1,4	0,02	0.03	1,5	98,4	98,5	0,17	0,46
34/78-7R	2	4617.7-4731.0	81,3	7,0	2,7	0,6	0,9	0,32	0,32	6,9	92,5	93,1	0,13	0,60

Tab. 3

WELL	SAMPLE ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
34/8-1	2825.3 INC	1.00	0.57	0.90	3.45	0.50	1.81	0.57	0.45	33	30	38	0.78	0.84	1.94	0.84	0.63	3.53	1.27	0.90	1.25	0.77	0.54	8.25	0.11	0.20
34/8-1	2825.3 TXT	1.63	0.78	0.89	1.68	0.24	1.86	0.61	0.48	44	27	29	0.84	0.59	0.88	0.67	0.42	4.06	0.89	0.80	0.77	0.81	0.72	8.65	0.22	0.35
34/8-1	2866.3 INC	1.14	0.63	0.92	1.19	0.23	1.59	0.58	0.47	40	26	34	0.57	0.51	0.97	0.74	0.45	2.86	0.93	0.84	0.85	0.72	0.47	6.95	0.14	0.23
34/8-1	2866.3 TXT	2.48	0.85	0.92	1.49	0.22	1.54	0.59	0.51	45	28	27	0.91	0.43	0.76	0.66	0.38	3.65	0.82	0.79	0.68	0.78	0.71	8.54	0.27	0.42
34/8-1	2878.3 INC	1.13	0.67	0.90	2.63	0.44	1.11	0.54	0.45	44	25	31	0.67	0.48	2.02	0.65	0.63	3.60	1.28	0.79	1.25	0.77	0.53	6.95	0.14	0.23
34/8-1	2878.3 TXT	2.50	0.85	0.92	1.21	0.17	1.67	0.60	0.51	42	29	30	0.81	0.65	0.75	0.62	0.37	3.71	0.81	0.77	0.66	0.78	0.68	9.29	0.30	0.42
34/8-3A	3045.9 INC	1.30	0.71	0.92	2.11	0.33	1.79	0.56	0.45	39	25	37	0.74	0.38	1.66	0.67	0.60	3.32	1.19	0.80	1.17	0.75	0.47	7.29	0.14	0.21
34/8-3A	3045.9 TXT	2.14	0.82	0.91	1.32	0.17	1.71	0.59	0.47	41	28	31	0.80	0.70	0.91	0.60	0.43	4.85	0.91	0.76	0.80	0.86	0.68	9.02	0.24	0.40
34/8-3A	3086.8 INC	1.01	0.67	0.91	2.07	0.42	1.30	0.58	0.48	42	25	33	0.71	0.38	1.72	0.68	0.59	3.74	1.21	0.81	1.16	0.78	0.52	6.25	0.11	0.21
34/8-3A	3086.8 TXT	1.84	0.86	0.93	2.21	0.30	1.08	0.59	0.48	44	29	27	0.82	0.63	0.90	0.69	0.43	4.85	0.90	0.82	0.79	0.86	0.73	8.59	0.25	0.43
34/8-3A	3106.7 INC	1.45	0.76	0.91	1.32	0.19	1.93	0.57	0.44	38	26	36	0.61	0.60	1.55	0.76	0.57	3.34	1.16	0.86	1.11	0.75	0.52	9.84	0.16	0.28
34/8-3A	3106.7 TXT	2.92	0.87	0.93	2.59	0.32	1.09	0.59	0.51	44	30	26	0.88	0.54	0.87	0.64	0.42	5.04	0.88	0.79	0.77	0.88	0.75	8.47	0.23	0.45
34/8-3A	3131.9 INC	0.99	0.58	0.92	2.04	0.31	1.94	0.56	0.44	40	24	36	0.61	1.00	2.03	0.76	0.63	3.66	1.29	0.85	1.24	0.78	0.51	6.85	0.10	0.21
34/8-3A	3131.9 TXT	1.84	0.77	0.91	1.34	0.17	0.91	0.57	0.46	39	29	32	0.74	0.69	0.95	0.65	0.43	3.84	0.93	0.79	0.79	0.79	0.56	10.41	0.36	0.35
34/8-4A	3089.5 INC	1.16	0.69	0.91	1.18	0.20	1.84	0.57	0.44	38	27	35	0.56	0.51	1.80	0.97	0.62	2.63	1.23	0.98	1.22	0.70	0.50	8.91	0.15	0.24
34/8-4A	3089.5 TXT	2.38	0.86	0.92	1.55	0.20	1.21	0.58	0.48	41	29	30	0.76	0.71	0.66	0.31	0.33	3.47	0.75	0.58	0.57	0.76	0.68	9.89	0.36	0.39
34/8-4A	3249.5 INC	2.13	0.82	0.91	1.15	0.14	1.37	0.58	0.52	41	29	30	0.80	0.62	0.56	0.28	0.29	3.50	0.67	0.57	0.48	0.77	0.65	10.07	0.36	0.38
34/8-4A	3249.5 TXT	2.80	0.86	0.93	3.40	0.42	0.97	0.58	0.53	45	30	25	0.91	0.48	0.55	0.24	0.28	3.50	0.66	0.54	0.47	0.77	0.79	7.16	0.33	0.44
34/8-4A	3329.5 INC	1.36	0.74	0.91	1.31	0.21	1.69	0.59	0.46	38	26	35	0.63	0.56	1.66	0.69	0.60	3.10	1.19	0.82	1.17	0.74	0.54	9.11	0.21	0.27
34/8-4A	3329.5 TXT	3.02	0.86	0.92	2.16	0.27	1.28	0.59	0.51	43	30	27	0.89	0.56	0.55	0.24	0.29	3.41	0.67	0.55	0.49	0.76	0.75	8.29	0.32	0.42
34/8-4S	3009.6 INC	1.45	0.77	0.92	1.21	0.17	1.70	0.57	0.46	39	26	36	0.63	0.63	1.63	0.67	0.57	3.53	1.18	0.80	1.12	0.77	0.52	9.88	0.23	0.27
34/8-4S	3009.6 TXT	2.21	0.85	0.92	3.46	0.38	0.81	0.57	0.48	45	28	27	0.88	0.59	0.56	0.22	0.28	3.50	0.67	0.53	0.47	0.77	0.76	7.61	0.34	0.41
34/8-4S	3078.4 INC	1.43	0.79	0.91	1.01	0.16	1.90	0.58	0.45	39	27	34	0.63	0.66	1.31	0.57	0.53	3.00	1.08	0.74	1.02	0.73	0.53	10.12	0.22	0.29
34/8-4S	3078.4 TXT	1.51	0.87	0.92	3.28	0.41	0.81	0.57	0.47	40	35	25	0.87	0.66	0.52	0.19	0.26	3.41	0.64	0.51	0.43	0.76	0.74	7.47	0.33	0.41
34/8-4S	3135.5 INC	1.72	0.80	0.91	0.92	0.13	1.78	0.57	0.45	35	27	37	0.61	0.71	1.43	0.59	0.53	3.63	1.12	0.76	1.03	0.77	0.54	11.18	0.27	0.31
34/8-4S	3135.5 TXT	2.71	0.85	0.92	1.68	0.23	1.35	0.59	0.48	42	29	28	0.88	0.61	0.50	0.22	0.26	3.60	0.62	0.53	0.42	0.77	0.72	8.76	0.31	0.41
34/8-4S	3204.9 INC	1.95	0.82	0.91	0.98	0.13	0.18	0.60	0.46	36	28	36	0.66	0.70	1.17	0.64	0.49	3.15	1.03	0.79	0.93	0.74	0.57	11.02	0.27	0.34
34/8-4S	3204.9 TXT	2.48	0.88	0.91	1.37	0.18	1.45	0.60	0.51	40	28	32	0.82	0.75	0.54	0.23	0.27	3.00	0.65	0.54	0.43	0.73	0.67	9.88	0.33	0.39
34/8-4S	3229.5 INC	1.51	0.80	0.91	0.96	0.15	1.91	0.61	0.47	36	27	38	0.51	0.60	1.37	1.38	0.55	2.41	1.10	1.23	1.07	0.69	0.53	10.59	0.21	0.30
34/8-4S	3229.5 TXT	2.83	0.88	0.92	1.48	0.22	1.37	0.57	0.51	40	30	30	0.86	0.80	0.48	0.18	0.25	3.34	0.60	0.51	0.39	0.75	0.64	9.05	0.32	0.40
34/8-8	2925.5 INC	1.38	0.75	0.92	1.51	0.26	1.66	0.57	0.48	38	27	35	0.63	0.49	1.77	0.70	0.62	3.50	1.22	0.82	1.22	0.77	0.55	8.26	0.13	0.25
34/8-8	2925.5 TXT	3.31	0.86	0.93	3.85	0.49	0.92	0.57	0.54	48	30	22	0.91	0.45	0.88	0.61	0.43	4.88	0.89	0.77	0.81	0.87	0.80	6.73	0.25	0.46
34/8-8	3008.2 INC	0.97	0.65	0.89	1.70	0.29	1.79	0.56	0.44	39	25	35	0.59	0.44	2.13	0.82	0.65	3.76	1.31	0.89	1.30	0.78	0.48	7.55	0.11	0.19
34/8-8	3008.2 TXT	1.74	0.79	0.90	0.95	0.13	1.16	0.56	0.47	38	27	35	0.68	0.70	1.02	0.59	0.44	3.82	0.96	0.75	0.81	0.79	0.51	11.15	0.33	0.34

Tab. 4

1: Ts/Tm (SEIFERT and MOLDOWAN, 1978)
2: diahopane/(diahopane + normorethane) (CORNFORD et al., 1986)
3: C30 αβ-hopane/(C30 αβ-hopane + C30-morethane), (MACKENZIE et al., 1985)
4: C23-C29 tricyclic terpanes/C30 αβ-hopane (modified from MELLO et al., 1988)
5: C24-tetracyclic terpane/C30 αβ-hopane (MELLO et al., 1988)
6: hopane/sterane (MACKENZIE et al., 1984)
7: ββ/(ββ+αα) of C29 (20R+20S) sterane isomers (MACKENZIE et al., 1980)
8: 20S/(20S+20R) of C29 αα-sterane isomers (MACKENZIE, 1984)
9: % C27 of C27+C28+C29 ββ-steranes
10: % C28 of C27+C28+C29 ββ-steranes
11: % C29 of C27+C28+C29 ββ-steranes
12: C20/(C20+C28) triaromatic steroids (TA)
13: C28 TA/(C28 TA+C29 MA)

Items 9–13: (MACKENZIE et al., 1985)

14: Methylphenanthrene ratio, MPR (RADKE et al., 1982b)
15: Methylphenanthrene index 1, MPI1 (RADKE et al., 1982a)
16: Methylphenanthrene distribution fraction, MPDF (F1) (KVALHEIM et al., 1987)

Items 14–16: Based on m/z 178 and m/z 192 fragmentograms (cf. MACKENZIE, et al. 1985)

17: Methyldibenzothiophene ratio, MDR (RADKE, 1988) Based on m/z 198 fragmentogram
18: Calculated vitrinite reflectance, %Rm = 1.10*log MPR + 0.95 (RADKE, 1988)
19: Calculated vitrinite reflectance, %Rc = 0.60*MPI1 + 0.40 (RADKE and WELTE, 1983)
20: Calculated vitrinite reflectance, %Ro = 2.242*F1 - 0.166 (KVALHEIM et al., 1987)
21: Calculated vitrinite reflectance, %Rm = 0.073*MDR + 0.51 (RADKE, 1988)
22: C27 20R+S diasteranes/(C27 20R+S diasteranes + C29 αα+ββ 20S+R steranes)
23: C30 ββ 20S sterane/SUM(C27-C30) ββ 20S steranes
24: bisnorhopane/(bisnorhopane + norhopane)
25: 29Ts/(29Ts+norhopane)

SAMPLE ID: 2866.3 = core depth in metres
INC = extract of petroleum occuring in inclusions
TXT = extract of petroleum occuring in intergranular porosity

Tab. 4