Petroleum Geochemistry Report - Well 15/9-22T2

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1 Introduction

A total of 28 samples, all canned cuttings, covering the depth range from 620 to 3903 mRKB, were received by APT for analysis according to the program specified by ExxonMobil. *Table 1* below shows the types and numbers of analyses performed.

Prior to the analysis (after completion of headspace gas analysis) the samples were cleaned for drilling mud using mild soap/warm water and "mini-extracted" in order to remove the hydrocarbons present in additives to the drilling mud. However, as discussed below, this treatment apparently did not remove all contaminants from the samples, which, to varying degrees, affected the results. The well was drilled with water based mud containing mono-ethylene glycol. The mud additives included $CaCO_3$, barite, Citric Acid, KCl, Glycol, Sodium Bicarbonate, Polymer and Soda Ash.

7 Experimental Procedures

All procedures follow NIGOGA, 4th Edition. Below are brief descriptions of procedures/analytical conditions.

Sample preparation

Cuttings samples are washed in water to remove mud. When oil based mud is used, soap (Zalo) is added to the sample and the sample is washed thoroughly in warm water to remove mud and soap.

Extraction

A Soxtec Tecator instrument is used. Thimbles are pre extracted in dichloromethane with 7% (vol/vol) methanol, 10 min boiling and 20 min rinsing. The crushed sample is weighed accurately in the pre extracted thimbles and boiled for 1 hour and rinsed for 2 hours in approximately 80 cc of dichloromethane with 7% (vol/vol) methanol. Copper blades activated in concentrated hydrochloric acid are added to the extraction cups to cause free sulphur to react with the copper. An aliquot of 10% of the extract is transferred to a pre weighed bottle and evaporated to dryness. The amount of extractable organic matter is calculated from the weight of this 10% aliquot.

Deasphaltening

Extracts are evaporated almost to dryness before a small amount of dichloromethane (3 times the amount of EOM) is added. Pentane is added in access (40 times the volume of EOM and dichloromethane/oil). The solution is stored for at least 12 hours in a dark place before the solution is filtered or centrifuged and the weight of the asphaltenes measured.

TOC and Rock-Eval

A Rock-Eval 6 instrument is used. The analysis is performed in two steps, pyrolysis and oxidation, when TOC is measured. The separation between organic carbon and mineral carbon in the oxidation cycle is set automatically. As long as the CO signal in the IR-detector is greater than zero, the source of CO_2 is defined as organic. When the signal drops to zero, all remaining CO_2 is defined as coming from a mineral source. Normally this separation point is between 600-650°C
Jet-Rock 1 was run as every tenth sample and checked against the acceptable range given in NIGOGA.

Temperature programme
Pyrolysis: 300 °C (3 min.) - 25 °C/min. - 650 °C (0 min.)
Oxidation: 400 °C (3 min.) - 25 °C/min. - 850 °C (5 min.)

PyGC

A HP5890 II instrument with an MSSV injector and an FID is used. The column is a CP-Sil-5 CB-MS, length 25 m, i.d. 0.25 mm, film thickness 0.25 µm.

The pyrolysis oven is preheated to 330 °C. The sample tube is placed in the injector system and then broken. The temperature is then increased to 600 °C at a rate of 25 °C/min. The pyrolysis products are collected in the cold trap for fourteen minutes before being released into the GC column, whereupon the following temperature programme is run:

Initial temperature: 20 °C (15 min. from breaking of sample tube) – heating rate: 5 °C/min. – final hold temperature: 310 °C (23 min.)

GC analysis of gas components

Aliquots of the samples were transferred to exetainers. 0.1-1ml were sampled using a Gerstel MPS2 autosampler and injected into a Hewlett Packard 5890 Series II GC equipped with Porabond Q column, a flame ionisation detector (FID), a thermal conductivity detector (TCD) and a methylization unit. Hydrocarbons were measured by FID, CO_2 by metylization (to CH_4) and then FID and N_2 and O_2 by TCD.

Carbon isotope analysis of hydrocarbon compounds and CO2

The carbon isotopic composition of the hydrocarbon gas components was determined by a GC-C-IRMS system. Aliquots were sampled with a syringe and analysed on a Trace GC2000, equipped with a Poraplot Q column, connected to a Delta plus XP IRMS. The components were burnt to CO_2 and water in a 1000 °C furnace over Cu/Ni/Pt. The water was removed by Nafion membrane separation. Repeated analyses of standards indicate that the reproducibility of $\delta^{13}C$ values is better than 1 ‰ PDB (2 sigma).

Hydrogen isotope analysis of methane

The hydrogen isotopic composition of methane was determined by a GC-C-IRMS system. Aliquots were sampled with a GCPal and analysed on a Trace GC2000, equipped with a Poraplot Q column, connected to a Delta plus XP IRMS. The components were decomposed to H_2 and coke in a 1400 °C furnace. The international standard NGS-2 and an in-house standard (Std A) were used for testing accuracy and precision. The "true" value of NGS-2 is given to –172.5 ‰ V-SMOW (http://deuterium.nist.gov/standards.html). Repeated analyses of standards indicate that the reproducibility of δD values is better than 10 ‰ PDB (2 sigma).

GC of saturated fraction

A HP5890 II instrument is used. The column is a CP-Sil-5 CB-MS, length 60 m, i.d. 0.25 mm, film thickness 0.25 μm. C20D42 is used as an internal standards.

Temperature programme
50 °C (1 min.) - 4 °C/min. - 320 °C (25 min.)

GCMS of saturated and aromatic fractions

A Micromass ProSpec high resolution instrument is used. The instrument is tuned to a resolution of 3000 and data is acquired in Selected Ion Recording (SIR) mode. The column used is a 60 m CP-Sil-5 CB-MS with an i.d. of 0.25 mm and a film thickness 0.25 μm. D_4-27ααR is used as internal standard when quantitative results are requested for the saturated compounds. D_8-naphthalene and D_{10}-phenanthrene are used as internal standards when quantitative results are required for the aromatic compounds. The aromatic and aliphatic fractions may be analysed together or separately.

Temperature programme
50 °C (1 min.) - 20 °C/min. - 120 °C - 2 °C/min - 320 °C (20 min.)

Vitrinite reflectance analysis

The samples are prepared either as "whole rock" or are treated with hydrochloric and hydrofluoric acid prior to further preparation. The aim of the acid treatment is to avoid soft and expanding mineral phases in order to ensure good polishing quality. The whole rock or the kerogen resulting from the acid treatment is embedded in an epoxy resin to make

briquettes, ground flat and polished using 0.25 micron diamond paste and magnesium oxide as the two final steps.

The analytical equipment used is a Zeiss MPM 03 photometer microscope equipped with an Epiplan-Neofluar 40/0.90 oil objective. The sensitive measuring spot is kept constant for all measurements at about 2.5 micron in diameter. The measurements are made through a green band pass filter (546 nm) and in oil immersion (refractive index 1.515 at 18 °C). The readings are made without a polarizer and using a stationary stage. This procedure is called measurement of random reflectance (%Rm). The photometer is calibrated daily against a standard of known reflectance (%Rm = 0.588) and routinely (daily) checked against two other standards of significant different reflectances (%Rm = 0.879 and 1.696). A deviation from these values of less than ± 0.01 and ± 0.02 respectively is considered acceptable. The calibration is routinely checked during the course of measurements at least every hour, and a deviation of less than ± 0.005 is considered acceptable.

For each sample at least 20 points are measured if possible, and quality ratings are given to various important aspects, which may affect the measurements. These aspects are abundance of vitrinite, uncertainties in the identification of indigenous vitrinite, type of vitrinite, particle size, particle surface quality and abundance of pyrite.

Visual kerogen analysis

The samples are treated with hydrochloric and hydrofluoric acid to isolate the kerogen. The residual material for kerogen description is embedded on a cover glass, dried and finally mounted on an object glas using the preserving glue Entellan. The analytical equipment being used is a Zeiss MPM 03 photometer microscope equipped with a Neofluar 40/0.75 and a Neofluar 10/0.30 objective. UV light excitation and transmittent white light is used to make a visual classification of the kerogen.

APPENDIX 1 – Tables and Figures

Table 1. Number of analyses performed

Analysis	Cuttings	Total
Lithology	28	28
Headspace	7	7
Stable isotopes of gas	7	7
TOC/Rock-Eval	28	28
Pyrolysis GC	28	28
GC of Saturated hydrocarbons	2	2
GC-MS of Saturated hydrocarbons	2	2
GC-MS of Aromatic hydrocarbons	2	2
Visual kerogen description	28	28
Vitrinite reflectance	28	28

Table 2. Lithology Description

Well	Sample type	Upper Depth (m)	Lower Depth (m)	API ID	%	Lithology	Attributes
15/9-22-T2	DCG	590	620	31371	100 %	CLYST	lt gy
15/9-22-T2	DCG	710	750	31375A	60%	CLYST	lt gy
15/9-22-T2	DCG	710	750	31375B	40%	SST	opaque, fine, loose
15/9-22-T2	DCG	890	920	31381	100 %	CLYST	lt gy- gy, slty
15/9-22-T2	DCG	1020	1040	31385	100 %	SLST	lt gy- gy
15/9-22-T2	DCG	1190	1220	31391	100 %	CLYST	gy- lt brn gy, slty
15/9-22-T2	DCG	1340	1370	31396	100 %	CLYST	gy- md drk brn gy
15/9-22-T2	DCG	1490	1400	31397	100 %	CLYST	gy- md drk brn gy
15/9-22-T2	DCG	1640	1670	31414	100 %	CLYST	gy- md drk brn gy
15/9-22-T2	DCG	1810	1850	31419	100 %	CLYST	md drk gy
15/9-22-T2	DCG	1850	1880	31420	100 %	CLYST	gy- md drk gy
15/9-22-T2	DCG	1880	1940	31421	100 %	CLYST	gy- md drk gy
15/9-22-T2	DCG	2090	2120	31426	100 %	CLYST	md drk gy
15/9-22-T2	DCG	2120	2150	31427A	100%	CLYST	gy- md drk gy - brn gy
15/9-22-T2	DCG	2120	2150	31427B	trace	SST	opaque, round, loose
15/9-22-T2	DCG	2240	2270	31431A	100%	CLYST	gy- md drk gy
15/9-22-T2	DCG	2240	2270	31431B	trace	LST	pale y gy
15/9-22-T2	DCG	2390	2420	31436	100 %	CLYST	gy-md drk gy
15/9-22-T2	DCG	2480	2510	31439A	90%	CLYST	gy- md dk gy, brn gy-gy brn
15/9-22-T2	DCG	2480	2510	31439B	10%	SLST	opaque- gy w
15/9-22-T2	DCG	2480	2510	31439C	trace	LST	w gy
15/9-22-T2	DCG	2570	2600	31442A	80%	CLYST	gy - md drk gy
15/9-22-T2	DCG	2570	2600	31442B	15%	CLYST	pale brn gy- gy brn
15/9-22-T2	DCG	2570	2600	31442C	5%	SLST	opaque- gy w
15/9-22-T2	DCG	2570	2600	31442D	trace	LST	w
15/9-22-T2	DCG	2660	2690	31445A	95%	CLYST	gy- md drk gy
15/9-22-T2	DCG	2660	2690	31445B	5%	LST	w- w gy
15/9-22-T2	DCG	2660	2690	31445C	trace	SLST	opaque - gy w
15/9-22-T2	DCG	3393	3403	31567A	85%	CLYST	drk brn gy
15/9-22-T2	DCG	3393	3403	31567B	15%	LST	w- w gy

Well	Sample type	Upper Depth (m)	Lower Depth (m)	APT ID	%	Lithology	Attributes
15/9-22-T2	DCG	3393	3403	31567C	trace	CLYST	pale grn gy
15/9-22-T2	DCG	3413	3423	31569A	100%	CLYST	brn gy - drk brn gy
15/9-22-T2	DCG	3413	3423	31569B	trace	LST	w- w gy
15/9-22-T2	DCG	3513	3523	31579A	100%	CLYST	brn gy
15/9-22-T2	DCG	3513	3523	31579B	trace	LST	w- w gy
15/9-22-T2	DCG	3571.5	3573	31585A	100%	CLYST	drk gy - brn blck, mic
15/9-22-T2	DCG	3571.5	3573	31585B	trace	LST	w - w gy
15/9-22-T2	DCG	3571.5	3573	31585C	trace	SST	opaque, loose
15/9-22-T2	DCG	3573	3603	31586A	80%	CLYST	drk brn - drk brn gy- brn blck, carb
15/9-22-T2	DCG	3573	3603	31586B	10%	LST	w-w gy
15/9-22-T2	DCG	3573	3603	31586C	5%	SST	opaque, loose, fine
15/9-22-T2	DCG	3573	3603	31586D	5%	COAL	blck
15/9-22-T2	DCG	3633	3663	31588A	100%	CLYST	lt brn gy - gy brn, slty, mic
15/9-22-T2	DCG	3633	3663	31588B	trace	SST	opaque- pale y w
15/9-22-T2	DCG	3633	3663	31588C	trace	LIG	blck
15/9-22-T2	DCG	3693	3753	31590A	90%	CLYST	ol brn-gy brn - drk brn gy, slty
15/9-22-T2	DCG	3693	3753	31590B	10%	SLST	opaque - pale pi gy
15/9-22-T2	DCG	3693	3753	31590C	trace	COAL	blck
15/9-22-T2	DCG	3786	3813	31592A	60%	SST	opaque- pale pi w, fine
15/9-22-T2	DCG	3786	3813	31592B	40%	CLYST	brn gy- drk gy brn
15/9-22-T2	DCG	3786	3813	31592C	trace	COAL	blck
15/9-22-T2	DCG	3843	3873	31594	100 %	LST	pale pi w - pale brn w
15/9-22-T2	DCG	3873	3903	31595A	100%	LST	pale brn w
15/9-22-T2	DCG	3873	3903	31595B	trace	CLYST	gy, md drk gy, pl grn gy
15/9-22-T2	DCG	3873	3903	31595C	trace	LIG	blck

Table 3. Gas Composition (volume-%)

Well	Sample type	Lower Depth (m)	APT ID	C1%	C2%	C3%	iC4%	nC4%	iC5%	nC5%	CO2%	Sum C1-C5	Wetness	iC4/nC4	ppm
15/9-22-T2	DCG	1880	31420	85.5	4.1	3.6	1.2	0.62	0.61	0.31	4.0	96.0	10.0	1.9	6195
15/9-22-T2	DCG	2150	31427	92.6	2.3	1.5	0.47	0.31	0.25	0.10	2.4	97.6	4.8	1.5	25840
15/9-22-T2	DCG	2420	31436	51.7	13.4	16.2	3.6	6.5	4.1	1.8	2.9	97.1	43.3	0.55	17578
15/9-22-T2	DCG	3573	31585	46.4	21.3	19.3	2.8	4.6	1.6	1.1	2.9	97.1	50.9	0.60	156324
15/9-22-T2	DCG	3603	31586	69.5	16.6	8.4	1.4	1.6	0.90	0.34	1.3	98.7	28.7	0.91	198967
15/9-22-T2	DCG	3753	31590	51.2	13.6	15.9	3.3	3.3	1.9	0.94	9.9	90.1	41.3	1.0	40721
15/9-22-T2	DCG	3813	31592	14.3	4.5	6.4	1.2	1.9	1.0	0.82	69.8	30.2	49.6	0.62	13796

Table 4. Gas Isotopes (δ13C, ‰ PDB)

Well	Sample type	Lower Depth (m)	APT ID	C1 δ13C	C2 δ13C	C3 δ13C	i-C4 δ13C	n-C4 δ13C	CO2 δ13C
15/9-22-T2	DCG	1880	31420	-63.8					-20.9
15/9-22-T2	DCG	2150	31427	-64.4					
15/9-22-T2	DCG	2420	31436	-55.6	-30.2	-30.5	-31.8	-32.5	-20.5
15/9-22-T2	DCG	3573	31585	-40.7	-29.1	-28.5	-26.7	-29.3	-21.6
15/9-22-T2	DCG	3603	31586	-40.8	-28.8	-27.6	-26.4	-29.3	-21.7
15/9-22-T2	DCG	3753	31590	-45.7	-30.2	-28.0	-26.3	-29.5	-21.6
15/9-22-T2	DCG	3813	31592	-43.8					

Table 5. TOC and Rock-Eval data

Well	Sample type	Lower Depth (m)	APT ID	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	Tmax (°C)	PP (mg/g)	PI (wt ratio)	HI (mg HC/ g TOC)	OI (mg CO2/ g TOC)	TOC (%)
15/9-22-T2	DCG	620	31371	0.22	1.31	2.96	368	1.53	0.14	152	344	0.86
15/9-22-T2	DCG	750	31375	0.11	0.89	2.19	370	1.00	0.11	141	348	0.63
15/9-22-T2	DCG	920	31381	0.22	1.67	2.55	377	1.89	0.12	178	271	0.94
15/9-22-T2	DCG	1040	31385	0.13	1.03	1.45	377	1.16	0.11	202	284	0.51
15/9-22-T2	DCG	1220	31391	0.52	7.65	2.79	410	8.17	0.06	298	109	2.57
15/9-22-T2	DCG	1370	31396	0.46	10.65	3.42	405	11.11	0.04	394	127	2.70
15/9-22-T2	DCG	1520	31401	0.26	5.29	2.56	379	5.55	0.05	288	139	1.84
15/9-22-T2	DCG	1670	31414	0.36	5.98	2.20	375	6.34	0.06	322	118	1.86
15/9-22-T2	DCG	1850	31419	0.37	6.76	1.83	358	7.13	0.05	335	91	2.02
15/9-22-T2	DCG	1880	31420	0.30	5.88	2.12	365	6.18	0.05	281	101	2.09
15/9-22-T2	DCG	1940	31421	15.19	11.90	2.44	343	27.09	0.56	384	79	3.10
15/9-22-T2	DCG	2120	31426	0.38	4.93	2.11	354	5.31	0.07	444	190	1.11
15/9-22-T2	DCG	2150	31427	0.40	6.21	2.37	361	6.61	0.06	383	146	1.62
15/9-22-T2	DCG	2270	31431	0.37	5.70	2.53	360	6.07	0.06	393	174	1.45
15/9-22-T2	DCG	2420	31436	0.37	5.99	1.28	428	6.36	0.06	384	82	1.56
15/9-22-T2	DCG	2510	31439	0.29	3.91	1.86	357	4.20	0.07	296	141	1.32
15/9-22-T2	DCG	2600	31442	0.30	4.57	2.54	358	4.87	0.06	307	170	1.49
15/9-22-T2	DCG	2690	31445	0.24	3.04	1.75	357	3.28	0.07	230	133	1.32
15/9-22-T2	DCG	3403	31567	0.49	27.60	1.53	430	28.09	0.02	809	45	3.41
15/9-22-T2	DCG	3423	31569	1.84	37.12	0.84	434	38.96	0.05	853	19	4.35
15/9-22-T2	DCG	3523	31579	0.75	16.35	1.27	432	17.10	0.04	560	43	2.92
15/9-22-T2	DCG	3573	31585	3.21	38.50	1.03	432	41.71	0.08	814	22	4.73
15/9-22-T2	DCG	3603	31586	2.89	51.42	0.90	435	54.31	0.05	989	17	5.20
15/9-22-T2	DCG	3663	31588	0.89	10.67	1.45	436	11.56	0.08	508	69	2.10
15/9-22-T2	DCG	3753	31590	1.15	25.81	0.81	440	26.96	0.04	672	21	3.84
15/9-22-T2	DCG	3813	31592	0.07	0.90	0.40	438	0.97	0.07	118	53	0.76
15/9-22-T2	DCG	3873	31594	0.50	4.26	1.75	436	4.76	0.11	177	73	2.41
15/9-22-T2	DCG	3903	31595	0.31	2.94	2.15	435	3.25	0.10	173	126	1.70

Table 6. Pyrolysis GC (peak area)

Well	Sample type	Lower Depth (m)	APT ID	%C1(UCM)	%C2-C5 (UCM)	%C6-C14 (UCM)	%C15+ (UCM)	%C1 (X-UCM)	%C2-C5 (X-UCM)	%C6-C14 (X-UCM)	%C15+ (X-UCM)	C1	C2-C5	C6-C14	C15+	C6-C14 (UCM)	C15+ (UCM)	n-Heptene	Tol	n-Octene
15/9-22-T2	DCG	620	31371	4.29	29.47	43.78	22.46	5.77	39.60	47.85	6.78	1.24e6	8.49e6	1.03e7	1.46e6	1.26e7	6.48e6	1.03e5	4.54e5	7.83e4
15/9-22-T2	DCG	750	31375	3.95	30.66	49.73	15.66	5.07	39.36	49.78	5.79	8.68e5	6.74e6	8.53e6	9.92e5	1.09e7	3.44e6	1.22e5	3.84e5	8.41e4
15/9-22-T2	DCG	920	31381	3.88	40.00	43.05	13.08	4.69	48.38	44.19	2.74	9.06e5	9.35e6	8.54e6	5.28e5	1.01e7	3.06e6	1.12e5	3.73e5	5.62e4
15/9-22-T2	DCG	1040	31385	3.68	41.04	45.88	9.40	4.38	48.86	45.97	0.79	5.43e5	6.05e6	5.70e6	9.81e4	6.77e6	1.39e6	5.50e4	2.28e5	3.29e4
15/9-22-T2	DCG	1220	31391	3.47	27.62	46.98	21.93	4.61	36.72	50.47	8.19	4.72e6	3.75e7	5.16e7	8.37e6	6.38e7	2.98e7	2.53e5	1.10e6	3.05e5
15/9-22-T2	DCG	1370	31396	3.65	20.56	41.94	33.85	5.41	30.47	49.36	14.77	6.50e6	3.66e7	5.93e7	1.78e7	7.47e7	6.03e7	3.68e5	1.41e6	3.61e5
15/9-22-T2	DCG	1520	31401	2.71	35.24	42.87	19.19	3.32	43.22	46.29	7.17	2.07e6	2.69e7	2.88e7	4.46e6	3.27e7	1.46e7	1.15e5	7.74e5	2.14e5
15/9-22-T2	DCG	1670	31414	3.34	37.36	43.48	15.82	3.86	43.15	46.29	6.70	4.25e6	4.75e7	5.10e7	7.38e6	5.53e7	2.01e7	8.88e4	9.66e5	2.48e5
15/9-22-T2	DCG	1850	31419	4.60	38.25	42.75	14.40	5.34	44.43	44.28	5.95	6.08e6	5.06e7	5.04e7	6.77e6	5.65e7	1.90e7	9.60e4	1.36e6	3.67e5
15/9-22-T2	DCG	1880	31420	4.70	42.06	41.83	11.41	5.18	46.39	43.83	4.60	6.16e6	5.52e7	5.21e7	5.48e6	5.49e7	1.50e7	2.09e5	1.28e6	3.23e5
15/9-22-T2	DCG	1940	31421	1.34	63.51	34.00	1.15	1.38	65.42	33.01	0.19	1.22e6	5.76e7	2.91e7	1.65e5	3.08e7	1.04e6	1.38e5	6.26e5	5.73e4
15/9-22-T2	DCG	2120	31426	1.17	65.96	32.87	0.00	1.18	66.85	31.97	0.00	1.02e6	5.78e7	2.76e7	0.00e0	2.88e7	0.00e0	1.01e5	4.24e5	4.08e4
15/9-22-T2	DCG	2150	31427	2.84	51.55	41.42	4.20	3.06	55.58	40.23	1.13	3.64e6	6.62e7	4.79e7	1.35e6	5.32e7	5.39e6	5.14e5	9.63e5	1.75e5
15/9-22-T2	DCG	2270	31431	2.87	56.27	36.74	4.13	3.04	59.65	36.50	0.80	3.30e6	6.48e7	3.97e7	8.69e5	4.23e7	4.75e6	1.55e5	9.14e5	1.22e5
15/9-22-T2	DCG	2420	31436	2.76	43.53	45.81	7.90	3.05	48.03	44.96	3.96	2.38e6	3.75e7	3.51e7	3.09e6	3.95e7	6.80e6	1.53e5	8.41e5	2.70e5
15/9-22-T2	DCG	2510	31439	2.86	57.74	38.19	1.21	2.93	59.27	37.30	0.50	1.98e6	4.00e7	2.52e7	3.34e5	2.64e7	8.39e5	1.67e5	6.28e5	1.05e5
15/9-22-T2	DCG	2600	31442	2.91	55.95	37.72	3.42	3.07	58.84	37.39	0.70	2.70e6	5.18e7	3.29e7	6.17e5	3.49e7	3.16e6	1.74e5	6.89e5	1.25e5
15/9-22-T2	DCG	2690	31445	4.33	52.43	38.79	4.45	4.70	57.00	37.75	0.55	2.44e6	2.96e7	1.96e7	2.84e5	2.19e7	2.51e6	1.61e5	5.47e5	6.92e4
15/9-22-T2	DCG	3403	31567	3.24	16.97	41.20	38.60	5.41	28.35	53.06	13.18	1.31e7	6.85e7	1.28e8	3.19e7	1.66e8	1.56e8	2.93e6	3.24e6	1.99e6
15/9-22-T2	DCG	3423	31569	3.17	14.73	39.85	42.25	5.57	25.89	54.31	14.23	1.60e7	7.44e7	1.56e8	4.09e7	2.01e8	2.13e8	3.62e6	3.76e6	2.48e6
15/9-22-T2	DCG	3523	31579	4.78	19.31	39.52	36.40	7.44	30.06	49.96	12.54	1.55e7	6.28e7	1.04e8	2.62e7	1.29e8	1.18e8	1.15e6	2.98e6	1.39e6
15/9-22-T2	DCG	3573	31585	10.24	16.97	29.11	43.68	16.23	26.88	38.92	17.97	6.11e7	1.01e8	1.46e8	6.76e7	1.74e8	2.60e8	1.21e6	4.16e6	1.26e6
15/9-22-T2	DCG	3603	31586	10.62	15.83	28.20	45.35	17.27	25.74	38.70	18.29	7.24e7	1.08e8	1.62e8	7.66e7	1.92e8	3.09e8	1.86e6	4.50e6	1.41e6
15/9-22-T2	DCG	3663	31588	10.41	20.91	29.59	39.09	15.62	31.39	37.53	15.46	2.21e7	4.44e7	5.31e7	2.18e7	6.28e7	8.30e7	5.44e5	1.67e6	4.29e5
15/9-22-T2	DCG	3753	31590	10.38	16.68	30.20	42.74	15.92	25.58	39.92	18.58	4.87e7	7.82e7	1.22e8	5.68e7	1.42e8	2.00e8	1.57e6	3.30e6	1.40e6
15/9-22-T2	DCG	3813	31592	9.17	16.22	29.07	45.53	17.07	30.18	39.18	13.58	2.29e6	4.06e6	5.27e6	1.83e6	7.27e6	1.14e7	9.61e4	1.94e5	7.16e4
15/9-22-T2	DCG	3873	31594	9.11	20.65	38.75	31.50	13.02	29.52	45.44	12.03	7.10e6	1.61e7	2.48e7	6.56e6	3.02e7	2.46e7	4.04e5	6.89e5	2.48e5
15/9-22-T2	DCG	3903	31595	9.55	24.78	42.84	22.84	12.35	32.07	46.65	8.93	8.54e6	2.22e7	3.23e7	6.18e6	3.83e7	2.04e7	1.98e5	1.11e6	2.95e5

Table 6. continued, Pyrolysis GC (peak area)

Well	Sample type	Lower Depth (m)	API ID	m-Xyl	Weight (mg)	Comment
15/9-22-T2	DCG	620	31371	1.78e5	0.0	
15/9-22-T2	DCG	750	31375	1.36e5	0.0	
15/9-22-T2	DCG	920	31381	1.51e5	0.0	
15/9-22-T2	DCG	1040	31385	8.69e4	0.0	
15/9-22-T2	DCG	1220	31391	7.80e5	0.0	
15/9-22-T2	DCG	1370	31396	1.03e6	0.0	
15/9-22-T2	DCG	1520	31401	4.35e5	0.0	
15/9-22-T2	DCG	1670	31414	6.01e5	0.0	
15/9-22-T2	DCG	1850	31419	8.48e5	0.0	
15/9-22-T2	DCG	1880	31420	7.63e5	0.0	
15/9-22-T2	DCG	1940	31421	2.35e5	0.0	
15/9-22-T2	DCG	2120	31426	1.49e5	0.0	
15/9-22-T2	DCG	2150	31427	4.50e5	0.0	
15/9-22-T2	DCG	2270	31431	3.88e5	0.0	
15/9-22-T2	DCG	2420	31436	5.08e5	0.0	
15/9-22-T2	DCG	2510	31439	2.97e5	0.0	
15/9-22-T2	DCG	2600	31442	3.37e5	0.0	
15/9-22-T2	DCG	2690	31445	2.25e5	0.0	
15/9-22-T2	DCG	3403	31567	2.38e6	0.0	
15/9-22-T2	DCG	3423	31569	2.75e6	0.0	
15/9-22-T2	DCG	3523	31579	1.96e6	0.0	
15/9-22-T2	DCG	3573	31585	3.39e6	0.0	
15/9-22-T2	DCG	3603	31586	3.94e6	0.0	
15/9-22-T2	DCG	3663	31588	1.24e6	0.0	
15/9-22-T2	DCG	3753	31590	2.79e6	0.0	
15/9-22-T2	DCG	3813	31592	1.47e5	0.0	
15/9-22-T2	DCG	3873	31594	4.86e5	0.0	
15/9-22-T2	DCG	3903	31595	6.29e5	0.0	

Table 7. GC of saturated compounds (parameters)

Well	Sample type	Lower Depth (m)	APT ID	CPI 1	Pr/n-C17	Ph/n-C18	(Pr/n-C17)/(Ph/n-C18))	Pr/Ph	n-C17/(n-C17+C27)
15/9-22-T2	DCG	3603	31586C	1.26		1.47		2.95	
15/9-22-T2	DCG	3753	31590A	1.24	1.82	0.43	4.20	5.11	0.45

Table 8. GC of saturated compounds (peak area)

Well	Sample type	Lower Depth (m)	APT ID	n-C10	n-C11	n-C12	i-C13	i-C14	n-C13	i-C15	n-C14	i-C16	n-C15	n-C16	i-C18	n-C17	Pr	n-C18	Ph	n-C19
15/9-22-T2	DCG	3603	31586C	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	6.67e3	1.55e3	2.27e3	1.53e3
15/9-22-T2	DCG	3753	31590A	1.50e4	3.39e4	6.39e4	1.27e4	2.45e4	2.29e5	4.14e4	2.83e5	7.10e4	1.44e5	9.07e4	3.58e4	8.76e4	1.59e5	7.19e4	3.11e4	8.83e4

Table 8. continued, GC of saturated compounds (peak area)

Well	Sample type	Lower Depth (m)	APT ID	n-C20	n-C21	n-C22	n-C23	n-C24	n-C25	n-C26	n-C27	n-C28	n-C29	n-C30	n-C31	n-C32	n-C33	n-C34	n-C35	n-C36
15/9-22-T2	DCG	3603	31586C	1.15e3	1.76e3	1.89e3	1.75e3	1.62e3	2.03e3	1.89e3	2.23e3	1.71e3	1.92e3	1.10e3	1.24e3	8.39e2	0.00e0	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590A	8.20e4	9.02e4	9.25e4	1.06e5	9.84e4	1.14e5	9.21e4	1.08e5	7.74e4	8.52e4	4.84e4	4.91e4	4.51e4	2.60e4	1.32e4	9.48e3	3.98e3

Table 9. GC of saturated compounds (amounts in ng/g)

Well	Sample type	Lower Depth (m)	APT ID	n-C10	n-C11	n-C12	i-C13	i-C14	n-C13	i-C15	n-C14	i-C16	n-C15	n-C16	i-C18	n-C17	Pr	n-C18	Ph	n-C19
15/9-22-T2	DCG	3603	31586C	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0	1.61e6	3.73e5	5.46e5	3.68e5
15/9-22-T2	DCG	3753	31590A	1.30e5	2.93e5	5.53e5	1.10e5	2.12e5	1.98e6	3.58e5	2.45e6	6.14e5	1.25e6	7.84e5	3.09e5	7.57e5	1.38e6	6.21e5	2.69e5	7.64e5

Table 9. continued, GC of saturated compounds (amounts in ng/g)

Well	Sample type	Lower Depth (m)	APT ID	n-C20	n-C21	n-C22	n-C23	n-C24	n-C25	n-C26	n-C27	n-C28	n-C29	n-C30	n-C31	n-C32	n-C33	n-C34	n-C35	n-C36
15/9-22-T2	DCG	3603	31586C	2.77e5	4.25e5	4.55e5	4.23e5	3.91e5	4.91e5	4.56e5	5.37e5	4.12e5	4.64e5	2.66e5	3.00e5	2.02e5	0.00e0	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590A	7.09e5	7.80e5	8.00e5	9.18e5	8.51e5	9.86e5	7.97e5	9.32e5	6.70e5	7.36e5	4.18e5	4.24e5	3.90e5	2.24e5	1.14e5	8.19e4	3.44e4

Table 10. GCMS SIR of saturated compounds (parameters)

Well	Sample type	Lower Depth (m)	APT ID	%23:3	%28αβ	%30D	%27Ts	%22S	%29Ts	%20S	%ββ	%27dβS	%C27	%C29	28/29	24:4/23:3
15/9-22-T2	DCG	3603	31586	18.77	54.82	6.15	9.98	62.06	8.11	49.13	65.24	34.05	23.67	59.79		0.34
15/9-22-T2	DCG	3753	31590	0.61	1.01	5.30	2.26	61.68	4.11	51.36	48.78	41.55	11.70	72.36	0.21	10.61

%23:3	23:3/(23:3+30αβ)*100
%28αβ	28αβ/(28αβ+30αβ)*100
%30D	30D/(30D+30αβ)*100
%27Ts	27Ts/(27Ts+27Tm)*100
%22S	(32αβS/(32αβS+32αβR)*100
%29Ts	(29Ts/29Ts+30αβ)*100
%20S	(29ααS/29ααS+29ααR)*100

%ββ	(29ββ(R+S)/(29ββ(R+S)+29αα(R+S)*100
%27dβS	27dβS/(27dβS+27αα(R+S))*100
%C27	(27ββ(R+S)/(27ββ(R+S)+28ββ(R+S)+29ββ(R+S))*100
%C29	(29ββ(R+S)/(27ββ(R+S)+28ββ(R+S)+29ββ(R+S))*100
28/29	(28αα(R+S)+28ββ(R+S))/(29αα(R+S)+29ββ(R+S))
24:4/23:3	24:4/23:3

Table 11. GCMS SIR of saturated compounds (peak height)

m/e				177				191												
Well	Sample type	Lower Depth (m)	APT ID	25nor28αβ	25nor29αβ	25nor30αβ	25nor31αβ	19/3	20/3	21/3	23/3	24/3	25/3R	25/3S	24/4	26/3R	26/3S	28/3R	28/3S	29/3R
15/9-22-T2	DCG	3603	31586	0.00e0	0.00e0	0.00e0	1.24e4	6.72e4	1.37e5	3.21e4	3.90e4	1.32e4	0.00e0	0.00e0	1.34e4	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	0.00e0	0.00e0	7.72e4	1.66e6	8.08e5	5.61e5	1.13e5	1.61e5	4.35e4	2.13e4	2.72e4	1.71e6	2.29e4	3.56e4	0.00e0	0.00e0	0.00e0

Table 11. continued, GCMS SIR of saturated compounds (peak height)

m/e				191																
Well	Sample type	Lower Depth (m)	APT ID	29/3S	27Ts	27Tm	30/3R	30/3S	28αβ	25nor30αβ	29αβ	29Ts	30d	29βα	30O	30αβ	30βα	31αβS	31αβR	30G
15/9-22-T2	DCG	3603	31586	0.00e0	7.42e3	6.70e4	0.00e0	0.00e0	2.05e5	0.00e0	2.06e5	1.49e4	1.11e4	2.12e4	0.00e0	1.69e5	4.13e4	1.06e5	6.58e4	0.00e0
15/9-22-T2	DCG	3753	31590	0.00e0	3.01e5	1.30e7	0.00e0	2.43e5	2.68e5	0.00e0	2.82e7	1.13e6	1.48e6	2.53e6	0.00e0	2.64e7	4.32e6	1.60e7	1.06e7	4.89e5

Table 11. continued, GCMS SIR of saturated compounds (peak height)

m/e				191									217							
Well	Sample type	Lower Depth (m)	APT ID	31βα	32αβS	32αβR	33αβS	33αβR	34αβS	34αβR	35αβS	35αβR	21ααα	21βββ	22ααα	22βββ	27dβS	27dβR	27dαR	27dαS
15/9-22-T2	DCG	3603	31586	2.52e4	6.19e4	3.78e4	3.76e4	2.46e4	2.78e4	2.18e4	1.98e4	1.65e4	7.74e3	1.28e4	5.44e3	5.20e3	3.95e3	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	2.64e6	7.78e6	4.84e6	3.34e6	2.12e6	1.79e6	1.13e6	6.49e5	4.05e5	5.71e4	4.43e4	3.04e4	2.19e4	1.34e5	8.94e4	4.59e4	4.76e4

Table 11. continued, GCMS SIR of saturated compounds (peak height)

m/e				217															
Well	Sample type	Lower Depth (m)	APT ID	28dβS#1	28dβS#2	28dβR#1	28dβR#2	28dααR	27ααS	27ββR+29dββS	27ββS	28dααS	27ααR	29dβR	29dαR	28ααS	29dαS	29ββR	28ββS	28ααR
15/9-22-T2	DCG	3603	31586	7.01e3	7.11e3	0.00e0	6.18e3	0.00e0	0.00e0	3.48e4	0.00e0	0.00e0	7.65e3	2.50e4	9.72e3	0.00e0	1.27e4	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	9.98e4	1.20e5	5.78e4	1.18e5	9.85e4	9.40e4	7.30e5	1.08e5	7.15e4	9.46e4	4.86e5	1.94e5	7.55e4	4.45e5	1.59e5	1.91e5	1.94e5

Table 11. continued, GCMS SIR of saturated compounds (peak height)

m/e				217								218							
Well	Sample type	Lower Depth (m)	APT ID	29ααS	29ββR	29ββS	29ααR	30ααS	30ββR	30ββS	30ααR	27ββR	27ββS	28ββR	28ββS	29ββR	29ββS	30ββR	30ββS
15/9-22-T2	DCG	3603	31586	1.04e4	2.54e4	1.44e4	1.08e4	0.00e0	0.00e0	0.00e0	0.00e0	1.18e4	4.10e3	5.21e3	5.89e3	2.20e4	1.81e4	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	7.75e5	7.72e5	6.64e5	7.33e5	7.76e5	0.00e0	0.00e0	0.00e0	2.66e5	1.04e5	2.19e5	2.87e5	1.19e6	1.11e6	0.00e0	0.00e0

Table 12. GCMS SIR of saturated compounds (amounts in ng/g)

m/e				177				191												
Well	Sample type	Lower Depth (m)	APT ID	25nor28αβ	25nor29αβ	25nor30αβ	25nor31αβ	19/3	20/3	21/3	23/3	24/3	25/3R	25/3S	24/4	26/3R	26/3S	28/3R	28/3S	29/3R
15/9-22-T2	DCG	3603	31586	0.00e0	0.00e0	0.00e0	1.23e4	6.68e4	1.36e5	3.19e4	3.88e4	1.31e4	0.00e0	0.00e0	1.33e4	0.00e0	0.00e0	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	0.00e0	0.00e0	9.76e2	2.09e4	1.02e4	7.09e3	1.43e3	2.04e3	5.50e2	2.69e2	3.44e2	2.17e4	2.89e2	4.51e2	0.00e0	0.00e0	0.00e0

Table 12. continued, GCMS SIR of saturated compounds (amounts in ng/g)

m/e				191																
Well	Sample type	Lower Depth (m)	APT ID	29/3S	27Ts	27Tm	30/3R	30/3S	28αβ	25nor30αβ	29αβ	29Ts	30d	29βα	30O	30αβ	30βα	31αβS	31αβR	30G
15/9-22-T2	DCG	3603	31586	0.00e0	7.38e3	6.66e4	0.00e0	0.00e0	2.04e5	0.00e0	2.05e5	1.48e4	1.10e4	2.11e4	0.00e0	1.68e5	4.10e4	1.05e5	6.54e4	0.00e0
15/9-22-T2	DCG	3753	31590	0.00e0	3.81e3	1.65e5	0.00e0	3.08e3	3.40e3	0.00e0	3.57e5	1.43e4	1.87e4	3.20e4	0.00e0	3.33e5	5.46e4	2.03e5	1.34e5	6.18e3

Table 12. continued, GCMS SIR of saturated compounds (amounts in ng/g)

m/e				191									217							
Well	Sample type	Lower Depth (m)	APT ID	31βα	32αβS	32αβR	33αβS	33αβR	34αβS	34αβR	35αβS	35αβR	21ααα	21βββ	22ααα	22βββ	27dβS	27dβR	27dαR	27dαS
15/9-22-T2	DCG	3603	31586	2.50e4	6.15e4	3.76e4	3.74e4	2.44e4	2.77e4	2.17e4	1.97e4	1.64e4	7.69e3	1.27e4	5.40e3	5.17e3	3.93e3	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	3.34e4	9.84e4	6.12e4	4.23e4	2.68e4	2.27e4	1.43e4	8.21e3	5.12e3	7.22e2	5.60e2	3.85e2	2.77e2	1.70e3	1.13e3	5.80e2	6.02e2

Table 12. continued, GCMS SIR of saturated compounds (amounts in ng/g)

m/e				217															
Well	Sample type	Lower Depth (m)	APT ID	28dβS#1	28dβS#2	28dβR#1	28dβR#2	28dααR	27ααS	27βββR+29dββS	27βββS	28dααS	27ααR	29dββR	29dααR	28ααS	29dααS	28βββR	28βββS	28ααR
15/9-22-T2	DCG	3603	31586	6.97e3	7.06e3	0.00e0	6.14e3	0.00e0	0.00e0	3.46e4	0.00e0	0.00e0	7.60e3	2.48e4	9.67e3	0.00e0	1.26e4	0.00e0	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	1.26e3	1.52e3	7.31e2	1.49e3	1.25e3	1.19e3	9.23e3	1.37e3	9.05e2	1.20e3	6.15e3	2.45e3	9.54e2	5.63e3	2.02e3	2.41e3	2.46e3

Table 12. continued, GCMS SIR of saturated compounds (amounts in ng/g)

m/e				217								218							
Well	Sample type	Lower Depth (m)	APT ID	29ααS	29βββR	29βββS	29ααR	30ααS	30βββR	30βββS	30ααR	27βββR	27βββS	28βββR	28βββS	29βββR	29βββS	30βββR	30βββS
15/9-22-T2	DCG	3603	31586	1.04e4	2.52e4	1.43e4	1.07e4	0.00e0	0.00e0	0.00e0	0.00e0	1.17e4	4.08e3	5.18e3	5.85e3	2.18e4	1.80e4	0.00e0	0.00e0
15/9-22-T2	DCG	3753	31590	9.80e3	9.76e3	8.40e3	9.28e3	9.81e3	0.00e0	0.00e0	0.00e0	3.37e3	1.32e3	2.76e3	3.63e3	1.50e4	1.40e4	0.00e0	0.00e0

Abbreviations of saturated biomarkers

17α(H), 21β(H)-25,28,30-trisnorhopane	25nor28αβ
17α, 21β-25,30-bisnorhopane	25nor29αβ
17α(H), 21β(H)-25-norhopane	25nor30αβ
17α, 21β, 22(R/S)-25-norhomohopane	25nor31αβ
$C_{19}H_{34}$ tricyclic terpane	19/3
$C_{20}H_{36}$ tricyclic terpane	20/3
$C_{21}H_{38}$ tricyclic terpane	21/3
$C_{23}H_{42}$ tricyclic terpane	23/3
$C_{24}H_{44}$ tricyclic terpane	24/3
$C_{25}H_{46}$ tricyclic terpane	25/3R
$C_{25}H_{46}$ tricyclic terpane	25/3S
$C_{24}H_{42}$ tetracyclic terpane	24/4
$C_{26}H_{48}$ tricyclic terpane	26/3R
$C_{26}H_{48}$ tricyclic terpane	26/3S
$C_{28}H_{52}$ tricyclic terpane	28/3R
$C_{28}H_{52}$ tricyclic terpane	28/3S
$C_{29}H_{54}$ tricyclic terpane	29/3R
$C_{29}H_{54}$ tricyclic terpane	29/3S
18α(H)-22,29,30-trisnorneohopane	27Ts
17α(H)-22,29,30-trisnorhopane	27Tm
$C_{30}H_{56}$ tricyclic terpane	30/3R
$C_{30}H_{56}$ tricyclic terpane	30/3S
17α(H), 21β(H)-28,30-bisnorhopane	28αβ
17α(H), 21β(H)-30-norhopane	29αβ
18α(H)-30-norneohopane	29Ts
15α-methyl-17α(H)-27-norhopane (diahopane)	30d
17β(H), 21α(H)-30-norhopane (normoretane)	29βα
18α(H)-oleanane	30O
17α(H), 21β(H)-hopane	30αβ
17β(H), 21α(H)-hopane (moretane)	30βα
17α(H), 21β(H), 22(S)-homohopane	31αβS
17α(H), 21β(H), 22(R)-homohopane	31αβR
Gammacerane	30G
17β(H), 21α(H)-homohopane	31βα
17α(H), 21β(H), 22(S)-bishomohopane	32αβS
17α(H), 21β(H), 22(R)-bishomohopane	32αβR
17α(H), 21β(H), 22(S)-trishomohopane	33αβS

17α(H), 21β(H), 22(R)-trishomohopane	33αβR
17α(H), 21β(H), 22(S)-tetrakishomohopane	34αβS
17α(H), 21β(H), 22(R)-tetrakishomohopane	34αβR
17α(H), 21β(H), 22(S)-pentakishomohopane	35αβS
17α(H), 21β(H), 22(R)-pentakishomohopane	35αβR
C21-5α(H), 14α(H), 17α(H)-pregnane	21αα
C21-5α(H), 14β(H), 17β(H)-pregnane	21ββ
C22-5α(H), 14α(H), 17α(H)-pregnane	22αα
C22-5α(H), 14β(H), 17β(H)-pregnane	22ββ
13β(H), 17α(H), 20(S)-cholestane (diasterane)	27dβS
13β(H), 17α(H), 20(R)-cholestane (diasterane)	27dβR
13α(H), 17β(H), 20(R)-cholestane (diasterane)	27dαR
13α(H), 17β(H), 20(S)-cholestane (diasterane)	27dαS
24-methyl-13β(H), 17α(H), 20(S)-cholestane (diasterane)	28dβS
24-methyl-13β(H), 17α(H), 20(R)-cholestane (diasterane)	28dβR
24-methyl-13α(H), 17β(H), 20(R)-cholestane (diasterane)	28dαR
5α(H), 14α(H), 17α(H), 20(S)-cholestane	27ααS
5α(H), 14β(H), 17β(H), 20(R)-cholestane	27ββR
24-ethyl-13β(H), 17α(H), 20(S)-cholestane (diasterane)	29dβS
5α(H), 14β(H), 17β(H), 20(S)-cholestane	27ββS
24-methyl-13α(H), 17β(H), 20(S)-cholestane (diasterane)	28dαS
5α(H), 14α(H), 17α(H), 20(R)-cholestane	27ααR
24-ethyl-13β(H), 17α(H), 20(R)-cholestane (diasterane)	29dβR
24-ethyl-13α(H), 17β(H), 20(R)-cholestane (diasterane)	29dαR
24-methyl-5α(H), 14α(H), 17α(H), 20(S)-cholestane	28ααS
24-ethyl-13α(H), 17β(H), 20(S)-cholestane (diasterane)	29dαS
24-methyl-5α(H), 14β(H), 17β(H), 20(R)-cholestane	28ββR
24-methyl-5α(H), 14β(H), 17β(H), 20(S)-cholestane	28ββS
24-methyl-5α(H), 14α(H), 17α(H), 20(R)-cholestane	28ααR
24-ethyl-5α(H), 14α(H), 17α(H), 20(S)-cholestane	29ααS
24-ethyl-5α(H), 14β(H), 17β(H), 20(R)-cholestane	29ββR
24-ethyl-5α(H), 14β(H), 17β(H), 20(S)-cholestane	29ββS
24-ethyl-5α(H), 14α(H), 17α(H), 20(R)-cholestane	29ααR
24-propyl-5α(H), 14α(H), 17α(H), 20(S)-cholestane	30ααS
24-propyl-5α(H), 14β(H), 17β(H), 20(R)-cholestane	30ββR
24-propyl-5α(H), 14β(H), 17β(H), 20(S)-cholestane	30ββS
24-propyl-5α(H), 14α(H), 17α(H), 20(R)-cholestane	30ααR

Table 13. GCMS SIR of aromatic compounds (parameters)

Well	Sample type	Lower Depth (m)	APT ID	AROM2	Crack1	Crack2	MSAro1	MSAro2	MSAro3	MSAro4	MSAro5	MSAro6	MSAro7	MSAro8	MSAro9
15/9-22-T2	DCG	3603	31586C	0.86	0.36	0.24	0.51	2.31	0.42	1.61	3.12	0.35	0.07	0.91	0.73
15/9-22-T2	DCG	3753	31590A	0.94	0.39	0.25	0.34	1.93	0.41	1.47	4.03	0.59	0.06	0.19	0.93

AROM2: $(C_{20}TA+C_{21}TA+SC_{26}TA+RC_{26}TA+SC_{27}TA+SC_{28}TA+RC_{27}TA+RC_{28}TA/(C_{20}TA+C_{21}TA+SC_{26}TA+RC_{26}TA+SC_{27}TA+SC_{28}TA+RC_{27}TA+RC_{28}TA+C_{21}MA+C_{22}MA+\beta SC_{27}MA+\beta RC_{27}MA+\beta RC_{27}DMA+\alpha SC_{27}MA+\beta SC_{28}MA+\beta SC_{28}DMA+\alpha RC_{27}DMA+\alpha SC_{27}DMA+\alpha RC_{27}MA+\alpha SC_{28}MA+\alpha SC_{29}MA+\alpha RC_{29}MA)$

Crack1: $(C_{20}TA)/(C_{20}TA+RC_{28}TA)$

Crack2: $(C_{20}TA+C_{21}TA)/(C_{20}TA+C_{21}TA+SC_{26}TA+RC_{26}TA+SC_{27}TA+SC_{28}TA+RC_{27}TA+RC_{28}TA)$

MSAro1: $(C_{21}MA+C_{22}MA)/(C_{21}MA+C_{22}MA+\beta SC_{27}MA+\beta RC_{27}MA+\beta RC_{27}DMA+\alpha SC_{27}MA+\beta SC_{28}MA+\beta SC_{28}DMA+\alpha RC_{27}DMA+\alpha SC_{27}DMA+\alpha RC_{27}MA+\alpha SC_{28}MA+\alpha SC_{29}MA+\alpha RC_{29}MA)$

MSAro2: 4-MDBT/1-MDBT

MSAro3: (2-MP+3-MP)/(1-MP+2-MP+3-MP+9-MP)

MSAro4: 2-MN/1-MN

MSAro5: (2,6-DMN+2,7-DMN)/1,5-DMN

MSAro6: 4-MDBT/DBT

MSAro7: DBT/P

MSAro8: 3-MP/Retene

MSAro9: $RC_{28}TA/(RC_{28}TA+\alpha RC_{28}MA+\beta RC_{29}MA+\beta RC_{29}DMA)$

Table 14. GCMS SIR of aromatic compounds (peak height)

m/e				142		156										170				
Well	Sample type	Lower Depth (m)	APT ID	2-MN	1-MN	2-EN	1-EN	2,6-DMN	2,7-DMN	1,3-+1,7-DMN	1,6-DMN	2,3-+1,4-DMN	1,5-DMN	1,2-DMN	1,8-DMN	1,3,7-TMN	1,3,6-TMN	1,3,5-+1,4,6-TMN	2,3,6-TMN	1,2,7-TMN
15/9-22-T2	DCG	3603	31586C	8.51e7	5.27e7	5.59e6	5.48e6	1.15e7	1.33e7	2.44e7	2.43e7	9.96e6	7.97e6	5.69e6	6.36e4	3.98e6	5.61e6	5.22e6	4.12e6	3.21e6
15/9-22-T2	DCG	3753	31590A	1.23e9	8.40e8	8.30e7	4.28e7	2.46e8	2.19e8	5.60e8	6.45e8	2.22e8	1.15e8	1.25e8	8.60e5	1.43e8	2.05e8	2.00e8	1.51e8	6.54e7

Table 14. continued, GCMS SIR of aromatic compounds (peak height)

m/e				170			178	192				206				206				
Well	Sample type	Lower Depth (m)	APT ID	1,6,7-+1,2,6-TMN	1,2,4-TMN	1,2,5-TMN	P	3-MP	2-MP	9-MP	1-MP	2-EP+9-EP+3,6-DMP	1-EP	2,6-+2,7-+3,5-DMP	1,3-+2,10-+3,9-+3,10-DMP	1,6-+2,5-+2,9-DMP	1,7-DMP	2,3-DMP	1,9-+4,9-+4,10-DMP	1,8-DMP
15/9-22-T2	DCG	3603	31586C	8.45e6	1.05e6	1.12e7	4.29e7	8.72e6	1.13e7	1.45e7	1.28e7	1.10e6	1.58e6	9.49e5	5.95e6	3.83e6	4.23e6	1.61e6	2.24e6	1.07e6
15/9-22-T2	DCG	3753	31590A	2.14e8	2.52e7	3.35e8	5.19e8	1.65e8	2.22e8	2.09e8	3.56e8	2.49e7	5.09e7	2.82e7	1.32e8	9.90e7	2.05e8	4.96e7	5.98e7	3.83e7

Table 14. continued, GCMS SIR of aromatic compounds (peak height)

m/e				206	219	184	198			253										
Well	Sample type	Lower Depth (m)	APT ID	1,2-DMP	Retene	DBT	4-MDBT	(3+2)-MDBT	1-MDBT	C21MA	C22MA	βSC27MA	βSC27DMA	βRC27MA+βRC27DMA	αSC27MA	βSC28MA+βSC28DMA+αRC27DMA	αSC27DMA	αRC27MA	αSC28MA	βRC28MA+βRC28DMA
15/9-22-T2	DCG	3603	31586C	1.65e6	9.60e6	2.82e6	1.00e6	9.93e5	4.34e5	1.58e4	1.76e4	0.00e0	5.29e3	3.97e3	0.00e0	1.82e4	9.50e3	0.00e0	0.00e0	1.65e4
15/9-22-T2	DCG	3753	31590A	8.67e7	8.69e8	3.15e7	1.87e7	2.04e7	9.73e6	3.07e5	2.70e5	4.74e4	2.00e5	1.76e5	0.00e0	4.30e5	1.08e5	0.00e0	1.18e5	2.72e5

Table 14. continued, GCMS SIR of aromatic compounds (peak height)

m/e				253				231						
Well	Sample type	Lower Depth (m)	APT ID	βSC29MA+ βSC29DMA	αSC29MA	αRC28MA+ βRC29MA+ βRC29DMA	αRC29MA	C20TA	C21TA	SC26TA	RC26TA+ SC27TA	SC28TA	RC27TA	RC28TA
15/9-22-T2	DCG	3603	31586C	4.57e4	0.00e0	3.15e4	0.00e0	4.80e4	5.34e4	9.42e3	7.77e4	9.14e4	4.78e4	8.65e4
15/9-22-T2	DCG	3753	31590A	7.15e5	1.49e5	4.73e5	1.13e5	4.07e6	2.48e6	1.37e6	4.34e6	5.73e6	2.38e6	6.25e6

Table 15. GCMS SIR of aromatic compounds (amounts in ng/g)

m/e				142		156										170				
Well	Sample type	Lower Depth (m)	APT ID	2-MN	1-MN	2-EN	1-EN	2,6-DMN	2,7-DMN	1,3-+1,7-DMN	1,6-DMN	2,3-+1,4-DMN	1,5-DMN	1,2-DMN	1,8-DMN	1,3,7-TMN	1,3,6-TMN	1,3,5-+1,4,6-TMN	2,3,6-TMN	1,2,7-TMN
15/9-22-T2	DCG	3603	31586C	3.65e6	2.26e6	2.40e5	2.35e5	4.94e5	5.71e5	1.04e6	1.04e6	4.27e5	3.42e5	2.44e5	2.73e3	1.70e5	2.41e5	2.24e5	1.77e5	1.38e5
15/9-22-T2	DCG	3753	31590A	1.54e6	1.05e6	1.04e5	5.35e4	3.07e5	2.73e5	6.99e5	8.05e5	2.77e5	1.44e5	1.56e5	1.07e3	1.78e5	2.56e5	2.50e5	1.88e5	8.17e4

Table 15. continued, GCMS SIR of aromatic compounds (amounts in ng/g)

m/e				170			178	192				206					206			
Well	Sample type	Lower Depth (m)	APT ID	1,6,7-+1,2,6-TMN	1,2,4-TMN	1,2,5-TMN	P	3-MP	2-MP	9-MP	1-MP	2-EP+9-EP+3,6-DMP	1-EP	2,6-+2,7-+3,5-DMP	1,3-+2,10-+3,9-+3,10-DMP	1,6-+2,5-+2,9-DMP	1,7-DMP	2,3-DMP	1,9-+4,9-+4,10-DMP	1,8-DMP
15/9-22-T2	DCG	3603	31586C	3.62e5	4.48e4	4.80e5	2.38e6	4.84e5	6.26e5	8.07e5	7.14e5	6.11e4	8.81e4	5.28e4	3.31e5	2.13e5	2.35e5	8.94e4	1.24e5	5.95e4
15/9-22-T2	DCG	3753	31590A	2.67e5	3.14e4	4.19e5	6.18e5	1.96e5	2.64e5	2.49e5	4.24e5	2.97e4	6.07e4	3.37e4	1.57e5	1.18e5	2.44e5	5.91e4	7.12e4	4.56e4

Table 15. continued, GCMS SIR of aromatic compounds (amounts in ng/g)

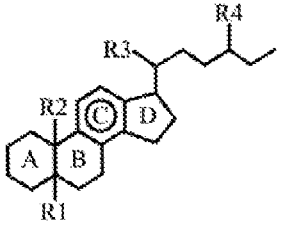
m/e				206	219	184	198			253										
Well	Sample type	Lower Depth (m)	APT ID	1,2-DMP	Retene	DBT	4-MDBT	(3+2)-MDBT	1-MDBT	C21MA	C22MA	βSC27MA	βSC27DMA	βRC27MA+βRC27DMA	αSC27MA	βSC28MA+βSC28DMA+αRC27DMA	αSC27DMA	αRC27MA	αSC28MA	βRC28MA+βRC28DMA
15/9-22-T2	DCG	3603	31586C	9.19e4	5.34e5	1.57e5	5.56e4	5.52e4	2.41e4	9.93e2	1.10e3	0.00e0	3.32e2	2.49e2	0.00e0	1.14e3	5.96e2	0.00e0	0.00e0	1.03e3
15/9-22-T2	DCG	3753	31590A	1.03e5	1.04e6	3.76e4	2.23e4	2.44e4	1.16e4	3.56e2	3.13e2	5.50e1	2.32e2	2.04e2	0.00e0	4.98e2	1.26e2	0.00e0	1.36e2	3.15e2

Table 15. continued, GCMS SIR of aromatic compounds (amounts in ng/g)

m/e				253				231						
Well	Sample type	Lower Depth (m)	APT ID	βSC29MA+ βSC29DMA	αSC29MA	αRC28MA+ βRC29MA+ βRC29DMA	αRC29MA	C20TA	C21TA	SC26TA	RC26TA+ SC27TA	SC28TA	RC27TA	RC28TA
15/9-22-T2	DCG	3603	31586C	2.87e3	0.00e0	1.98e3	0.00e0	3.02e3	3.35e3	5.91e2	4.88e3	5.74e3	3.00e3	5.43e3
15/9-22-T2	DCG	3753	31590A	8.30e2	1.73e2	5.49e2	1.31e2	4.73e3	2.87e3	1.58e3	5.03e3	6.64e3	2.77e3	7.25e3

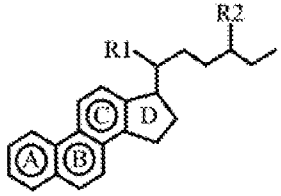
Abbreviation of aromatic biomarkers

C-ring monoaromatic steroid



Substituents				
R_1	R_2	R_3	R_4	Label
				$C_{21}MA$
				$C_{22}MA$
β(H)	CH_3	$S(CH_3)$	H	$\beta SC_{27}MA$
$\beta(CH_3)$	H	$S(CH_3)$	H	$\beta SC_{27}DMA$
$\beta(CH_3)$	H	$RCH_3)$	H	$\beta RC_{27}DMA+$
β(H)	CH_3	$R(CH_3)$	H	$\beta RC_{27}MA$
α(H)	CH_3	$S(CH_3)$	H	$\alpha SC_{27}MA$
β(H)	CH_3	$S(CH_3)$	CH_3	$\beta SC_{28}MA+$
$\alpha(CH_3)$	H	$R(CH_3)$	H	$\alpha RC_{27}DMA+$
$\beta(CH_3)$	H	$S(CH_3)$	CH_3	$\beta SC_{28}DMA$
$\alpha(CH_3)$	H	$S(CH_3)$	CH_3	$\alpha SC_{27}DMA$
α(H)	CH_3	$R(CH_3)$	H	$\alpha RC_{27}MA$
α(H)	CH_3	$S(CH_3)$	CH_3	$\alpha SC_{28}MA$
β(H)	CH_3	$R(CH_3)$	CH_3	$\beta RC_{28}MA+$
$\beta(CH_3)$	H	$R(CH_3)$	CH_3	$\beta RC_{28}DMA$
β(H)	CH_3	$S(CH_3)$	C_2H_5	$\beta SC_{29}MA+$
$\beta(CH_3)$	H	$S(CH_3)$	C_2H_5	$\beta SC_{29}DMA$
α(H)	CH_3	$S(CH_3)$	C_2H_5	$\alpha SC_{29}MA$
α(H)	CH_3	$R(CH_3)$	CH_3	$\alpha RC_{28}MA+$
β(H)	CH_3	$R(CH_3)$	C_2H_5	$\beta RC_{29}MA+$
$\beta(CH_3)$	H	$R(CH_3)$	C_2H_5	$\beta RC_{29}DMA$
α(H)	CH_3	$R(CH_3)$	C_2H_5	$\alpha RC_{29}MA$

ABC-ring triaromatic steroids



Substituents		
R_1	R_2	Label
CH_3	H	$C_{20}TA$
CH_3	CH_3	$C_{21}TA$
$S(CH_3)$	C_6H_{13}	$SC_{26}TA$
$R(CH_3)$	C_6H_{13}	$RC_{26}TA+$
S(CH3)	C_7H_{15}	$SC_{27}TA$
$S(CH_3)$	C_8H_{17}	$SC_{28}TA$
$R(CH_3)$	C_7H_{15}	$RC_{27}TA$
$R(CH_3)$	C_8H_{17}	$RC_{28}TA$

Polycyclic aromatic hydrocarbons and sulphur compounds

MN	Methylnaphthalene
EN	Ethylnaphthalene
DMN	Dimethylnaphthalene
TMN	Trimethylnaphthalene
P	Phenanthrene
MP	Methylphenanthrene
EP	Ethylphenanthrene
DMP	Dimethylphenanthrene
DBT	Dibenzothiophene
MDBT	Methyldibenzothiophene

Table 16. Visual Kerogen Description

Well	Sample type	Lower Depth (m)	APT ID	FA(%)	HA(%)	AL(%)	HE(%)	WO(%)	CO(%)	SCI
15/9-22-T2	DCG	620	31371	5	65	10	5	5	10	4-6
15/9-22-T2	DCG	750	31375	10	70	5	5	3	7	4-6
15/9-22-T2	DCG	920	31381	25	40	20	5	0	10	3-5
15/9-22-T2	DCG	1040	31385	25	55	0	5	0	15	nd
15/9-22-T2	DCG	1220	31391	10	50	10	10	5	15	3-5
15/9-22-T2	DCG	1370	31396	5	55	10	10	10	10	3-5
15/9-22-T2	DCG	1520	31401	5	75	5	5	5	5	4-6
15/9-22-T2	DCG	1670	31414	10	45	20	5	5	15	4-6
15/9-22-T2	DCG	1850	31419	15	55	5	15	5	5	3-5
15/9-22-T2	DCG	1880	31420	5	70	5	10	5	5	4-6
15/9-22-T2	DCG	1940	31421	5	80	5	5	0	5	nd
15/9-22-T2	DCG	2120	31426	5	60	10	10	5	10	4-6
15/9-22-T2	DCG	2150	31427	5	60	10	10	5	10	4-6
15/9-22-T2	DCG	2270	31431	15	45	15	10	5	10	4-6
15/9-22-T2	DCG	2420	31436	5	55	10	10	5	15	4-6
15/9-22-T2	DCG	2510	31439	5	65	10	5	5	10	4-6
15/9-22-T2	DCG	2600	31442	5	80	5	5	0	5	4-6
15/9-22-T2	DCG	2690	31445	5	70	5	5	5	10	4-6
15/9-22-T2	DCG	3403	31567	10	45	10	10	5	20	5-7
15/9-22-T2	DCG	3423	31569	10	50	0	5	5	30	6-8
15/9-22-T2	DCG	3523	31579	10	50	0	10	10	20	6-8
15/9-22-T2	DCG	3573	31585	10	35	5	10	20	20	6-8
15/9-22-T2	DCG	3603	31586	5	10	40	10	20	15	6-8
15/9-22-T2	DCG	3663	31588	5	55	10	10	5	15	6-8
15/9-22-T2	DCG	3753	31590	10	30	15	15	15	15	6-8
15/9-22-T2	DCG	3813	31592	15	55	10	5	5	10	6-8
15/9-22-T2	DCG	3873	31594	10	55	10	10	5	10	6-8
15/9-22-T2	DCG	3903	31595	5	65	10	5	5	10	6-8

Table 17. Vitrinite Reflectance

Well	Sample type	Lower Depth (m)	APT ID	Sample prep	%Lithology	%Ro	Std. dev.	No. of measurements	Quality rating	Overall quality	Comment
15/9-22-T2	DCG	620	31371	HF	clyst	0.22	0.04	16	-oo-oo	M	
15/9-22-T2	DCG	750	31375	HF	clyst	0.26	0.04	21	ooo-oo	M/G	
15/9-22-T2	DCG	920	31381	HF	clyst	0.22	0.04	12	-oo--o	M	
15/9-22-T2	DCG	1040	31385	HF	clyst	0.20	0.04	4	-oo--o	P	
15/9-22-T2	DCG	1220	31391	HF	clyst	0.22	0.03	20	ooo-oo	M	
15/9-22-T2	DCG	1370	31396	HF	clyst	0.22	0.04	20	ooo--o	M	
15/9-22-T2	DCG	1520	31401	HF	clyst	0.28	0.03	20	ooo-oo	M	
15/9-22-T2	DCG	1670	31414	HF	clyst	0.24	0.04	20	ooo-oo	M	
15/9-22-T2	DCG	1850	31419	HF	clyst	0.29	0.04	21	ooo-oo	M	
15/9-22-T2	DCG	1880	31420	HF	clyst	0.33	0.04	21	ooo-oo	M	
15/9-22-T2	DCG	1940	31421	HF	clyst	0.34	0.07	3	-oo--o	P	
15/9-22-T2	DCG	2120	31426	HF	clyst	0.31	0.03	11	-oo--o	P	
15/9-22-T2	DCG	2150	31427	HF	clyst	0.34	0.05	8	-oo--o	P	Some surface staining
15/9-22-T2	DCG	2270	31431	HF	clyst	0.37	0.04	5	-oo--o	P	
15/9-22-T2	DCG	2420	31436	HF	clyst	0.46	0.05	5	-oo--o	P	
15/9-22-T2	DCG	2510	31439	HF	clyst	0.46	0.05	4	-oo--o	P	
15/9-22-T2	DCG	2600	31442	HF	clyst	0.35	0.05	7	-oo--o	P	
15/9-22-T2	DCG	2690	31445	HF	clyst	0.44	0.04	15	-oo-oo	M	
15/9-22-T2	DCG	3403	31567	HF	clyst	0.51	0.05	14	-oo--o	M	
15/9-22-T2	DCG	3423	31569	HF	clyst	0.45	0.06	10	ooo-oo	M	
15/9-22-T2	DCG	3523	31579	HF	clyst	0.35	0.06	13	-oo-oo	M	
15/9-22-T2	DCG	3573	31585	HF	clyst	0.44	0.04	22	oooo-+	M/G	
15/9-22-T2	DCG	3603	31586	HF	clyst	0.51	0.06	20	oooo-+	M	
15/9-22-T2	DCG	3663	31588	HF	clyst	0.54	0.06	24	oooo-+	M	
15/9-22-T2	DCG	3753	31590	HF	clyst	0.44	0.05	20	oooo-+	M	
15/9-22-T2	DCG	3813	31592	HF	clyst	0.50	0.05	20	ooo-o+	M	
15/9-22-T2	DCG	3873	31594	HF	clyst	0.49	0.06	21	ooo--o	M	
15/9-22-T2	DCG	3903	31595	HF	clyst	0.47	0.05	13	-oo--o	M	

Legend to Vitrinite reflectance data

Lithology code		Sample quality		Sample preparation	
sst	Sandstone	G	Good	HF	Sample treatment with hydrofluoric acid prior to analysis
slst	Siltstone	M	Moderate		
clyst	Claystone	P	Poor	Bulk	Sample treated as bulk rock
sh	Shale	st	Hydrocarbon staining		
lst	Limestone				
coal	Coal				

Sample description and measurement evaluation (perfect sample characterised as: oooooo)

Sign order	Parameter	Sign	Sign legend:	
1	Abundance of vitrinite	-o	-	May give too low vitrinite reflectance sample value
2	Identification of vitrinite	-o+	o	Reliable vitrinite reflectance sample value
3	Type of vitrinite	-o+	+	May give too high vitrinite reflectance sample value
4	Vitrinite fragment size	-o		
5	Vitrinite surface quality	-o		
6	Abundance of pyrite	o+		