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**REGISTRERT**  
OLJEDIREKTORATET

SOURCE ROCK ANALYSIS OF NOCS WELL 9/3-1

CLIENT: NORSKE SHELL

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ENCLOSURES: 3

INTRODUCTION

Bagged cuttings samples and sidewall cores from the well NOCS 9/3-1 were received at Geolab Nor. The cuttings samples covered the interval 1300 m to 1969 m and the sidewall cores covered the interval 1029 m to 1956 m. Cuttings samples from 1300 m to 1675 m and from 1750 to T.D. were selected for analysis at 9 m intervals, whereas samples within the interval 1675 to 1750 m were selected for analysis at 3 m intervals.

All the selected samples were described lithologically and analysed for Total Organic Carbon Content (T.O.C.). In the case of samples with T.O.C. values of  $>1$  % Rock-Eval pyrolysis was also performed. Vitrinite reflectance analysis and visual kerogen analysis were performed on twenty sidewall cores.

The total number of analyses are:

Lithology description	115 samples
T.O.C. Analysis	115 samples
Rock-Eval Analysis	81 samples
Visual kerogen Analysis	20 samples
Vitrinite Reflectance Analysis	20 samples

The objective of the report is to identify and characterise source rock horizons and also to locate accumulations of migrated hydrocarbons. The report firstly discusses the results of individual analyses within the lithostratigraphic framework. Following this discussion an interpretation of the source rock potential of the various stratigraphic horizons is made. A final conclusion section draws together salient points of each stratigraphic zone. No formation top information was supplied by Norske Shell and so arbitrary zones were erected, largely based on T.O.C. content and lithology changes, in order to aid discussion of the results.

These zones appear in the results discussion (Ch 3).

SAMPLE QUALITY

Most of the cuttings samples were covered in a fine coating of drilling mud but, apart from this sample quality was excellent throughout the well.

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1029.00	swc					093
	0.91	100	Sh/Clst:	ol gy, calc		093-1
1133.00	swc					094
	1.29	100	Sh/Clst:	ol gy, calc, carb, pyr, fos		094-1
1224.00	swc					095
	0.80	100	Sh/Clst:	ol gy, calc, carb, pyr, slt, mic		095-1
1300.00						001
	0.62	100	Sh/Clst:	ol gy, slt, mic		001-1
1310.00						002
	0.61	100	Sh/Clst:	ol gy, slt, mic		002-1
			tr Cont	: prp		002-2
1320.00						003
	0.43	90	Sh/Clst:	ol gy to lt ol gy, m drk gy, slt, mic		003-1
		10	Ca	: w		003-2
			tr Cont	: prp		003-3
			tr Other	: fos		003-4
1325.00	swc					096
	0.58	100	Sh/Clst:	ol gy		096-1

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1330.00						004
	0.54	80	Sh/Clst:	ol gy to lt ol gy, slt, mic		004-1
		20	Ca	: w to y gy		004-2
1340.00						005
	0.52	90	Sh/Clst:	ol gy to lt ol gy, slt, mic		005-1
		10	Ca	: w		005-2
1350.00						006
	0.53	90	Sh/Clst:	y gy, ol gy to lt ol gy, slt, mic		006-1
		10	Slstst	: y gy to or gy		006-2
		tr	Cont	: prp		006-3
1360.00						007
	0.57	90	Sh/Clst:	ol gy to lt ol gy, slt, mic		007-1
		10	Slstst	: y gy to or gy		007-2
1369.00						008
	0.61	100	Sh/Clst:	ol gy to lt ol gy, slt, mic		008-1
		tr	Cont	: cem, prp		008-2
1378.00						009
	0.67	95	Sh/Clst:	ol gy to lt ol gy, slt, mic		009-1
		5	Cont	: cem, prp		009-2
1387.00						010
	0.77	100	Sh/Clst:	ol gy, slt, mic		010-1
		tr	Cont	: dd, fib		010-2

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1396.00						011
		0.77	100	Sh/Clst: ol gy, mic		011-1
1405.00						012
		0.82	100	Sh/Clst: ol gy to lt ol gy, mic		012-1
1414.00						013
		0.96	100	Sh/Clst: ol gy to lt ol gy, mic tr Cont : prp, dd, fib		013-1 013-2
1416.00	swc					097
		1.43	100	Sh/Clst: brn blk		097-1
1423.00						014
		1.11	80	Sh/Clst: ol blk to lt ol gy, slt, mic		014-1
			20	Cont : dd		014-2
1432.00						015
		1.08	70	Sh/Clst: ol gy		015-1
			30	Cont : dd		015-2
			tr	Cont : fib		015-3
1441.00						016
		1.12	60	Cont : dd		016-2
			40	Sh/Clst: ol gy		016-1
			tr	Cont : fib		016-3

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1450.00						017
	1.12	100	Sh/Clst:	ol gy, slt		017-1
			tr Cont	: prp		017-2
1456.00	swc					098
	1.01	100	Sh/Clst:	ol blk, carb, mic		098-1
1459.00						018
	1.08	100	Sh/Clst:	ol gy, slt		018-1
			tr Ca	: gy pi to y gy		018-2
			tr Cont	: prp		018-3
1468.00						019
	1.13	100	Sh/Clst:	ol gy, slt		019-1
			tr Ca	: gy pi to y gy		019-2
			tr Cont	: prp		019-3
1477.00						020
	1.13	100	Sh/Clst:	ol gy, slt		020-1
			tr Ca	: y gy		020-2
			tr Cont	: prp		020-3
1486.00						021
	1.22	100	Sh/Clst:	ol gy, slt		021-1
			tr Cont	: prp, dd		021-2
1495.00						022
	1.19	100	Sh/Clst:	ol gy, slt		022-1
			tr Cont	: prp, dd		022-2



Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
1504.00						023	
	1.13	100	Sh/Clst: ol gy, slt tr Cont : prp, dd			023-1 023-2	
1513.00						024	
	1.18	100	Sh/Clst: ol gy, slt tr Cont : prp, dd			024-1 024-2	
1514.00	swc					099	
	1.73	100	Sh/Clst: ol blk, carb, mic			099-1	
1522.00						025	
	1.18	100	Sh/Clst: ol gy, slt tr Sltst : ol gy, mic			025-1 025-2	
1531.00						026	
	1.25	100	Sh/Clst: ol gy, slt tr Cont : prp			026-1 026-2	
1540.00						027	
	1.04	100	Sh/Clst: ol gy, slt tr Cont : prp, dd			027-1 027-2	
1549.00						071	
	0.84	100	Sh/Clst: ol gy, slt			071-1	

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1558.00						072
		0.92	100	Sh/Clst: ol gy, slt tr Other : fos		072-1 072-2
1558.00	swc					100
		0.90	100	Sh/Clst: ol blk, carb, mic		100-1
1567.00						073
		0.89	100	Sh/Clst: ol gy, slt tr Cont : prp		073-1 073-2
1576.00						074
		0.82	100	Sh/Clst: ol gy, slt tr Ca : w tr Cont : prp		074-1 074-2 074-3
1585.00						075
		0.82	100	Sh/Clst: ol gy, slt		075-1
1594.00						076
		0.87	100	Sh/Clst: ol gy to m drk gy, pyr, slt		076-1
1603.00						077
		0.88	100	Sh/Clst: brn gy, m gy to m drk gy, slt		077-1

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1612.00						078
		0.90	100	Sh/Clst: ol blk to m drk gy, slt tr Cont : prp		078-1 078-2
1619.00	swc					101
		0.92	100	Sh/Clst: ol blk, calc		101-1
1621.00						079
		0.72	100	Sh/Clst: ol blk to m drk gy, slt tr Cont : prp		079-1 079-2
1630.00						080
		0.88	100	Sh/Clst: ol blk to m drk gy, slt tr Cont : prp		080-1 080-2
1642.00						081
		0.98	100	Sh/Clst: ol blk to m gy, slt tr Ca : w tr Cont : prp		081-1 081-2 081-3
1648.00						082
		0.98	100	Sh/Clst: ol blk to m gy, slt tr Ca : w tr Cont : prp		082-1 082-2 082-3
1657.00						083
		1.19	100	Sh/Clst: ol blk to m gy, slt tr Ca : w tr Cont : prp		083-1 083-2 083-3

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Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1657.00	swc					102
	1.04	100	Sh/Clst:	ol blk		102-1
1666.00						084
	1.12	100	Sh/Clst:	ol blk to m gy, slt		084-1
			tr Ca	: w		084-2
			tr Cont	: prp		084-3
1672.00						085
	1.14	100	Sh/Clst:	ol blk to m gy, slt		085-1
			tr Ca	: w		085-2
			tr Cont	: prp		085-3
1675.00						028
	1.21	100	Sh/Clst:	ol blk to m drk gy, calc, carb, pyr, slt		028-1
1678.00						029
	1.31	100	Sh/Clst:	ol blk to m drk gy, calc, carb, pyr, slt		029-1
1681.00						030
	1.33	100	Sh/Clst:	ol blk to m drk gy, calc, carb, pyr, slt		030-1
1684.00						031
	1.40	100	Sh/Clst:	ol blk to m drk gy, calc, carb, pyr, slt		031-1

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Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1687.00						032
		1.46	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		032-1
1688.00	swc					103
		3.21	100	Sh/Clst: brn blk, mic		103-1
1690.00						033
		1.64	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		033-1
1693.00						034
		1.98	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		034-1
1693.00	swc					104
		1.49	100	Sh/Clst: ol blk		104-1
1696.00						035
		1.47	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		035-1
1699.00						036
		4.38	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		036-1

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Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1699.00	swc					105
		2.99	100	Sh/Clst: ol blk		105-1
1702.00						037
		3.70	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		037-1
1702.00	swc					106
		4.35	100	Sh/Clst: ol blk, calc		106-1
1705.00						038
		1.97	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		038-1
				tr Cont : prp		038-2
1708.00						039
		1.86	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt, mic		039-1
1708.00	swc					107
		2.26	100	Sh/Clst: ol blk, calc		107-1
1711.00						040
		2.15	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		040-1

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1714.00						041
		3.44	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		041-1
1717.00						042
		3.07	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		042-1
1719.00	swc					108
		3.60	100	Sh/Clst: ol blk		108-1
1720.00						043
		3.50	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, mic		043-1
1723.00						044
		3.47	100	Sh/Clst: ol blk to m drk gy, calc, carb, mic		044-1
1724.00	swc					109
		3.64	100	Sh/Clst: ol blk, calc		109-1
1726.00						045
		3.33	100	Sh/Clst: ol blk to m drk gy, calc, carb		045-1

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1729.00						046
		3.57	100	Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt, mic		046-1
1732.00						047
		3.26	100	Sh/Clst: ol blk to m drk gy, calc, slt, mic		047-1
1733.00	swc					110
		1.19	100	Sh/Clst: ol blk, mic		110-1
1735.00						048
		2.84	100	Sh/Clst: ol blk to m drk gy, calc, carb, mic		048-1
1738.00						049
		2.91	100	Sh/Clst: ol blk to m drk gy, calc		049-1
1741.00						050
		2.42	100	Sh/Clst: ol blk to m drk gy, calc, carb, slt		050-1
1741.00	swc					111
		2.65	100	Slstst : ol gy, calc, cly		111-1



Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1744.00						051
	2.40	100		Sh/Clst: ol blk to m drk gy, calc, carb, pyr, slt		051-1
1747.00						052
	2.01	100		Sh/Clst: ol blk to m drk gy, calc, carb		052-1
1750.00						053
	2.09	100		Sh/Clst: ol blk to m drk gy, calc, carb, slt		053-1
1759.00						054
	1.84	80		Sh/Clst: ol blk to m drk gy, calc, carb		054-1
		20		Sltst : brn gy, calc, carb		054-2
1768.00						055
	1.48	60		Sh/Clst: ol blk to m drk gy, calc, carb		055-1
		30		Sltst : brn gy, calc, carb		055-2
		10		Cont : dd		055-3
1777.00						056
	1.76	90		Sh/Clst: ol blk to m drk gy		056-1
		10		Cont : dd		056-2
		tr		Sltst : brn gy, calc, carb		056-3
1785.50	swc					112
	1.98	100		Sh/Clst: brn blk		112-1

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1786.00						057
	2.86	60	Sltst	: brn gy, calc		057-1
		35	Sh/Clst:	drk gy to m drk gy		057-2
		5	Ca	: w		057-3
		tr	Cont	: prp, dd		057-4
1795.00						058
	1.83	50	Sltst	: brn gy, calc		058-1
		35	Sh/Clst:	drk gy to m drk gy		058-2
		10	S/Sst	: w, l		058-4
		5	Ca	: w to lt gy		058-3
		tr	Coal			058-5
1804.00						059
	2.46	45	Sltst	: brn gy, calc		059-1
		30	Sh/Clst:	drk gy to m drk gy		059-2
		20	S/Sst	: w, l		059-4
		5	Ca	: w to lt gy		059-3
1816.00						060
	1.39	40	Sltst	: brn gy, calc		060-1
		30	Sh/Clst:	drk gy to m drk gy		060-2
		20	S/Sst	: w, l		060-4
		5	Ca	: w to lt gy		060-3
		5	Cont	: prp, fib		060-5
1822.00						061
	2.72	35	Sltst	: brn gy, calc		061-1
		30	Sh/Clst:	drk gy to m drk gy		061-2
		30	S/Sst	: w to lt gy, l		061-4
		5	Ca	: w to lt gy		061-3
		tr	Cont	: prp		061-5

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1831.00						062
	57.28	80	Coal	: brn gy to brn blk, cly		062-1
		10	Sltst	: brn gy, calc		062-2
		10	Sh/Clst:	drk gy to m drk gy		062-3
		tr	S/Sst	: w to lt gy, l		062-4
1840.00						063
		50	S/Sst	: w to lt gy, l		063-1
		20	Sltst	: brn gy, calc		063-3
		20	Sh/Clst:	drk gy to m drk gy		063-4
	42.67	10	Coal	: brn gy to brn blk, cly		063-2
		tr	Cont	: prp		063-5
1849.00						064
		60	S/Sst	: w to lt gy, l		064-1
	56.43	10	Coal	: brn gy to brn blk, cly		064-2
		10	Sltst	: brn gy, calc		064-3
		10	Sh/Clst:	drk gy to m drk gy		064-4
		10	Ca	: w, prp		064-5
1858.00						065
		60	S/Sst	: w to lt gy, cem, l		065-1
		15	Sh/Clst:	drk gy to m drk gy		065-4
	39.15	10	Coal	: blk, brn gy to brn blk, cly		065-2
		10	Ca	: w		065-5
		5	Sltst	: brn gy, calc		065-3
		tr	Cont	: prp, fib		065-6
1867.00						066
		50	S/Sst	: w to lt gy, cem, l		066-1
	66.11	25	Coal	: blk, brn gy to brn blk, cly		066-2
		15	Sh/Clst:	drk gy		066-4
		5	Sltst	: brn gy, calc		066-3
		5	Ca	: w		066-5
		tr	Cont	: prp, fib		066-6

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int Cvd	TOC%	%	Lithology description			
1876.00						067
	59.95	60	S/Sst	: w to lt gy, cem, l		067-1
		20	Coal	: blk, brn gy to brn blk, cly		067-2
		10	Sh/Clst:	drk gy		067-3
		10	Ca	: w		067-4
		tr	Cont	: prp		067-5
1880.50	swc					113
	0.63	100	Sh/Clst:	lt brn gy to m gy, calc, carb, pyr, slt, mic		113-1
1885.00						068
	2.18	50	Sltst	: brn gy, calc		068-3
		35	Sh/Clst:	m drk gy		068-4
		10	S/Sst	: w to lt gy, cem, l		068-1
		5	Coal	: blk, brn gy to brn blk, cly		068-2
		tr	Cont	: prp, fib		068-5
1894.00						069
	2.00	60	S/Sst	: w to lt gy, cem, l		069-1
		20	Sh/Clst:	m drk gy		069-4
		10	Coal	: blk, brn gy to brn blk, cly		069-2
		10	Sltst	: brn gy, calc		069-3
		tr	Cont	: prp, fib		069-5
		tr	Ca	: w		069-6
1903.00						070
	1.57	50	S/Sst	: w, crs, l		070-1
		40	Sh/Clst:	drk gy to m drk gy		070-4
		5	Coal	: blk, brn gy to brn blk, cly		070-2
		5	Ca	: w		070-6
		tr	Sltst	: brn gy, calc		070-3
		tr	Cont	: prp, fib		070-5

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample
Int	Cvd	TOC%	%	Lithology description		
1912.00						086
	1.64	80	Sh/Clst:	drk gy to m drk gy		086-3
		10	S/Sst	: w, crs, l		086-1
		10	Sltst	: brn gy, calc		086-2
		tr	Cont	: prp, fib		086-4
		tr	Ca	: w		086-5
1921.00						087
	55.51	50	S/Sst	: w, l		087-1
		20	Coal	: blk, brn gy to brn blk, cly		087-2
		20	Sltst	: brn gy to lt gy, calc		087-3
		10	Sh/Clst:	drk gy to m drk gy		087-4
		tr	Cont	: prp		087-5
		tr	Ca	: w		087-6
1930.00						088
	2.49	60	S/Sst	: w, l		088-1
		40	Sh/Clst:	m drk gy		088-2
		tr	Sltst	: lt gy		088-3
		tr	Cont	: prp		088-4
1930.00 swc						114
	0.39	100	Sltst	: lt brn gy to lt gy, carb, cly, mic		114-1
1939.00						089
	1.77	70	S/Sst	: w, l		089-1
		30	Sh/Clst:	m drk gy		089-2
		tr	Sltst	: lt gy		089-3
		tr	Cont	: prp		089-4

Table 1 : Lithology description for well NOCS 9/3-1

Depth unit of measure: m

Depth	Type	Grp	Frm	Age	Trb	Sample	
Int Cvd	TOC%	%	Lithology description				
1948.00						090	
	1.41	70	S/Sst	: w, l		090-1	
		30	Sh/Clst:	m drk gy		090-2	
			tr Sltst	: lt gy		090-3	
			tr Cont	: prp		090-4	
1956.00	swc					115	
	0.53	70	Sh/Clst:	brn gy, calc, mic		115-1	
		30	S/Sst	: red, lt gy, lt gn gy, mic		115-2	
1957.00						091	
	1.49	70	S/Sst	: w, l		091-1	
		30	Sh/Clst:	m drk gy		091-2	
			tr Sltst	: lt gy		091-3	
			tr Cont	: prp, dd		091-4	
1966.00						092	
	1.03	90	S/Sst	: w, l		092-1	
		10	Sh/Clst:	m drk gy		092-2	
			tr Cont	: prp, dd		092-3	

Table 2 : Rock-Eval table for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1133.00	swc	Sh/Clst: ol gy	0.02	0.42	1.48	0.28	1.29	33	115	0.4	0.05	431	094-1
1416.00	swc	Sh/Clst: brn blk	0.06	2.13	0.28	7.61	1.43	149	20	2.2	0.03	436	097-1
1423.00	cut	Sh/Clst: ol blk to lt ol gy	0.25	1.94	1.86	1.04	1.11	175	168	2.2	0.11	429	014-1
1432.00	cut	Sh/Clst: ol gy	0.34	2.00	1.98	1.01	1.08	185	183	2.3	0.15	427	015-1
1441.00	cut	Sh/Clst: ol gy	0.11	1.83	1.11	1.65	1.12	163	99	1.9	0.06	430	016-1
1450.00	cut	Sh/Clst: ol gy	0.09	1.39	0.92	1.51	1.12	124	82	1.5	0.06	432	017-1
1456.00	swc	Sh/Clst: ol blk	0.03	1.02	0.28	3.64	1.01	101	28	1.0	0.03	431	098-1
1459.00	cut	Sh/Clst: ol gy	0.04	1.28	0.71	1.80	1.08	119	66	1.3	0.03	430	018-1
1468.00	cut	Sh/Clst: ol gy	0.06	1.37	0.81	1.69	1.13	121	72	1.4	0.04	433	019-1
1477.00	cut	Sh/Clst: ol gy	0.04	1.32	0.74	1.78	1.13	117	65	1.4	0.03	432	020-1
1486.00	cut	Sh/Clst: ol gy	0.05	1.29	0.81	1.59	1.22	106	66	1.3	0.04	432	021-1
1495.00	cut	Sh/Clst: ol gy	0.05	1.43	0.67	2.13	1.19	120	56	1.5	0.03	430	022-1
1504.00	cut	Sh/Clst: ol gy	0.05	1.15	0.56	2.05	1.13	102	50	1.2	0.04	431	023-1
1513.00	cut	Sh/Clst: ol gy	0.05	1.32	0.66	2.00	1.18	112	56	1.4	0.04	432	024-1
1514.00	swc	Sh/Clst: ol blk	0.04	3.93	0.55	7.15	1.73	227	32	4.0	0.01	441	099-1

Table 2 : Rock-Eval table for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1522.00	cut	Sh/Clst: ol gy	0.05	1.27	0.61	2.08	1.18	108	52	1.3	0.04	433	025-1
1531.00	cut	Sh/Clst: ol gy	0.05	1.55	0.55	2.82	1.25	124	44	1.6	0.03	433	026-1
1540.00	cut	Sh/Clst: ol gy	0.05	1.00	0.59	1.69	1.04	96	57	1.0	0.05	429	027-1
1657.00	cut	Sh/Clst: ol blk to m gy	0.07	1.10	0.98	1.12	1.19	92	82	1.2	0.06	430	083-1
1657.00	swc	Sh/Clst: ol blk	0.05	1.30	0.93	1.40	1.04	125	89	1.3	0.04	431	102-1
1666.00	cut	Sh/Clst: ol blk to m gy	0.05	1.05	0.96	1.09	1.12	94	86	1.1	0.05	428	084-1
1672.00	cut	Sh/Clst: ol blk to m gy	0.06	1.14	1.01	1.13	1.14	100	89	1.2	0.05	430	085-1
1675.00	cut	Sh/Clst: ol blk to m drk gy	0.05	1.08	1.22	0.89	1.21	89	101	1.1	0.04	429	028-1
1678.00	cut	Sh/Clst: ol blk to m drk gy	0.08	1.54	1.13	1.36	1.31	118	86	1.6	0.05	432	029-1
1681.00	cut	Sh/Clst: ol blk to m drk gy	0.07	1.52	1.02	1.49	1.33	114	77	1.6	0.04	434	030-1
1684.00	cut	Sh/Clst: ol blk to m drk gy	0.06	1.65	0.84	1.96	1.40	118	60	1.7	0.04	431	031-1
1687.00	cut	Sh/Clst: ol blk to m drk gy	0.05	1.62	0.93	1.74	1.46	111	64	1.7	0.03	432	032-1
1688.00	swc	Sh/Clst: brn blk	0.21	10.09	0.55	18.35	3.21	314	17	10.3	0.02	429	103-1
1690.00	cut	Sh/Clst: ol blk to m drk gy	0.08	2.73	0.79	3.46	1.64	166	48	2.8	0.03	434	033-1
1693.00	cut	Sh/Clst: ol blk to m drk gy	0.07	1.82	0.96	1.90	1.98	92	48	1.9	0.04	431	034-1



Table 2 : Rock-Eval table for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1693.00	swc	Sh/Clst: ol blk	0.09	4.57	0.33	13.85	1.49	307	22	4.7	0.02	479	104-1
1696.00	cut	Sh/Clst: ol blk to m drk gy	0.07	1.92	1.04	1.85	1.47	131	71	2.0	0.04	430	035-1
1699.00	cut	Sh/Clst: ol blk to m drk gy	0.27	9.49	1.11	8.55	4.38	217	25	9.8	0.03	430	036-1
1699.00	swc	Sh/Clst: ol blk	0.44	14.49	0.99	14.64	2.99	485	33	14.9	0.03	427	105-1
1702.00	cut	Sh/Clst: ol blk to m drk gy	0.37	12.18	1.32	9.23	3.70	329	36	12.6	0.03	425	037-1
1702.00	swc	Sh/Clst: ol blk	0.54	18.54	1.02	18.18	4.35	426	23	19.1	0.03	425	106-1
1705.00	cut	Sh/Clst: ol blk to m drk gy	0.10	3.45	1.04	3.32	1.97	175	53	3.5	0.03	434	038-1
1708.00	cut	Sh/Clst: ol blk to m drk gy	0.14	4.91	1.21	4.06	1.86	264	65	5.0	0.03	433	039-1
1708.00	swc	Sh/Clst: ol blk	0.29	4.19	1.33	3.15	2.26	185	59	4.5	0.06	438	107-1
1711.00	cut	Sh/Clst: ol blk to m drk gy	0.12	4.03	1.22	3.30	2.15	187	57	4.2	0.03	431	040-1
1714.00	cut	Sh/Clst: ol blk to m drk gy	0.25	9.73	1.46	6.66	3.44	283	42	10.0	0.03	429	041-1
1717.00	cut	Sh/Clst: ol blk to m drk gy	0.23	8.91	1.24	7.19	3.07	290	40	9.1	0.03	429	042-1
1719.00	swc	Sh/Clst: ol blk	0.21	9.83	0.46	21.37	3.60	273	13	10.0	0.02	432	108-1
1720.00	cut	Sh/Clst: ol blk to m drk gy	0.25	10.04	1.29	7.78	3.50	287	37	10.3	0.02	429	043-1
1723.00	cut	Sh/Clst: ol blk to m drk gy	0.24	9.24	1.48	6.24	3.47	266	43	9.5	0.03	431	044-1

Table 2 : Rock-Eval table for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1724.00	swc	Sh/Clst: ol blk	0.40	14.01	2.18	6.43	3.64	385	60	14.4	0.03	428	109-1
1726.00	cut	Sh/Clst: ol blk to m drk gy	0.29	10.65	1.29	8.26	3.33	320	39	10.9	0.03	429	045-1
1729.00	cut	Sh/Clst: ol blk to m drk gy	0.27	10.48	1.47	7.13	3.57	294	41	10.8	0.03	430	046-1
1732.00	cut	Sh/Clst: ol blk to m drk gy	0.18	8.53	0.93	9.17	3.26	262	29	8.7	0.02	434	047-1
1733.00	swc	Sh/Clst: ol blk	0.07	0.90	0.72	1.25	1.19	76	61	1.0	0.07	426	110-1
1735.00	cut	Sh/Clst: ol blk to m drk gy	0.20	8.82	0.82	10.76	2.84	311	29	9.0	0.02	431	048-1
1738.00	cut	Sh/Clst: ol blk to m drk gy	0.22	7.84	1.31	5.98	2.91	269	45	8.1	0.03	430	049-1
1741.00	cut	Sh/Clst: ol blk to m drk gy	0.16	5.65	1.01	5.59	2.42	233	42	5.8	0.03	435	050-1
1744.00	cut	Sh/Clst: ol blk to m drk gy	0.16	5.45	0.94	5.80	2.40	227	39	5.6	0.03	435	051-1
1747.00	cut	Sh/Clst: ol blk to m drk gy	0.14	5.04	1.10	4.58	2.01	251	55	5.2	0.03	433	052-1
1750.00	cut	Sh/Clst: ol blk to m drk gy	0.14	4.58	0.97	4.72	2.09	219	46	4.7	0.03	432	053-1
1759.00	cut	Sh/Clst: ol blk to m drk gy	0.09	3.06	0.83	3.69	1.84	166	45	3.1	0.03	434	054-1
1768.00	cut	Sh/Clst: ol blk to m drk gy	0.06	1.63	0.98	1.66	1.48	110	66	1.7	0.04	431	055-1
1777.00	cut	Sh/Clst: ol blk to m drk gy	0.07	2.31	1.36	1.70	1.76	131	77	2.4	0.03	434	056-1
1785.50	swc	Sh/Clst: brn blk	0.15	2.29	1.17	1.96	1.98	116	59	2.4	0.06	439	112-1

Table 2 : Rock-Eval table for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1786.00	cut	Sltst : brn gy	0.13	3.44	2.15	1.60	2.86	120	75	3.6	0.04	432	057-1
1795.00	cut	Sltst : brn gy	0.08	2.07	1.75	1.18	1.83	113	96	2.1	0.04	434	058-1
1804.00	cut	Sltst : brn gy	0.15	6.51	0.86	7.57	2.46	265	35	6.7	0.02	434	059-1
1816.00	cut	Sltst : brn gy	0.07	2.03	1.44	1.41	1.39	146	104	2.1	0.03	433	060-1
1822.00	cut	Sltst : brn gy	0.16	5.31	0.87	6.10	2.72	195	32	5.5	0.03	433	061-1
1831.00	cut	Coal : brn gy to brn blk	13.07	210.76	4.61	45.72	57.28	368	8	223.8	0.06	416	062-1
1840.00	cut	Coal : brn gy to brn blk	10.70	198.42	4.38	45.30	42.67	465	10	209.1	0.05	428	063-2
1849.00	cut	Coal : brn gy to brn blk	14.36	229.01	5.63	40.68	56.43	406	10	243.4	0.06	425	064-2
1858.00	cut	Coal : blk, brn gy to brn blk	8.40	149.80	4.80	31.21	39.15	383	12	158.2	0.05	426	065-2
1867.00	cut	Coal : blk, brn gy to brn blk	28.30	247.28	6.10	40.54	66.11	374	9	275.6	0.10	412	066-2
1876.00	cut	Coal : blk, brn gy to brn blk	16.00	188.70	6.23	30.29	59.95	315	10	204.7	0.08	413	067-2
1885.00	cut	Sltst : brn gy	0.34	5.25	1.71	3.07	2.18	241	78	5.6	0.06	432	068-3
1894.00	cut	Sh/Clst: m drk gy	0.14	4.76	0.98	4.86	2.00	238	49	4.9	0.03	433	069-4
1903.00	cut	Sh/Clst: drk gy to m drk gy	0.09	2.78	0.99	2.81	1.57	177	63	2.9	0.03	433	070-4
1912.00	cut	Sh/Clst: drk gy to m drk gy	0.14	3.53	0.98	3.60	1.64	215	60	3.7	0.04	435	086-3

Table 2 : Rock-Eval table for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1921.00	cut	Coal : blk, brn gy to brn blk	12.50	224.00	4.83	46.38	55.51	404	9	236.5	0.05	423	087-2
1930.00	cut	Sh/Clst: m drk gy	0.14	5.38	0.76	7.08	2.49	216	31	5.5	0.03	434	088-2
1939.00	cut	Sh/Clst: m drk gy	0.16	3.65	0.96	3.80	1.77	206	54	3.8	0.04	434	089-2
1948.00	cut	Sh/Clst: m drk gy	0.10	2.33	0.83	2.81	1.41	165	59	2.4	0.04	435	090-2
1957.00	cut	Sh/Clst: m drk gy	0.24	3.31	0.99	3.34	1.49	222	66	3.5	0.07	435	091-2
1966.00	cut	Sh/Clst: m drk gy	0.15	1.72	0.55	3.13	1.03	167	53	1.9	0.08	434	092-2

Table 3 : Thermal Maturity Data for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	T <sub>max</sub> (°C)	Sample
1029.00	swc bulk	0.41	8	0.05	5	-	-	093-0
1029.00	swc Sh/Clst: ol gy	-	-	-	-	2	-	093-1
1133.00	swc bulk	0.44	14	0.06	4	-	-	094-0
1133.00	swc Sh/Clst: ol gy	-	-	-	-	2.5?	431	094-1
1224.00	swc bulk	NDP	-	-	5	-	-	095-0
1224.00	swc Sh/Clst: ol gy	-	-	-	-	2.5	-	095-1
1325.00	swc bulk	0.40	9	0.04	4	-	-	096-0
1325.00	swc Sh/Clst: ol gy	-	-	-	-	2.5-3?	-	096-1
1416.00	swc bulk	0.43	5	0.02	4+5	-	-	097-0
1416.00	swc Sh/Clst: brn blk	-	-	-	-	3-4?	436	097-1
1456.00	swc bulk	0.45	2	0.03	5	-	-	098-0
1456.00	swc Sh/Clst: ol blk	-	-	-	-	3?	431	098-1
1514.00	swc bulk	NDP	-	-	0	-	-	099-0
1514.00	swc Sh/Clst: ol blk	-	-	-	-	3?-4?	441	099-1

Table 3 : Thermal Maturity Data for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	T <sub>max</sub> (°C)	Sample
1558.00	swc	bulk	0.43	4	0.07	5	-	-	100-0
1558.00	swc	Sh/Clst: ol blk	-	-	-	-	3.5-4	-	100-1
1619.00	swc	bulk	0.47	3	0.08	5	-	-	101-0
1619.00	swc	Sh/Clst: ol blk	-	-	-	-	4	-	101-1
1657.00	swc	bulk	0.43	12	0.04	5	-	-	102-0
1657.00	swc	Sh/Clst: ol blk	-	-	-	-	4	431	102-1
1688.00	swc	bulk	0.45	17	0.04	5	-	-	103-0
1688.00	swc	Sh/Clst: brn blk	-	-	-	-	4-4.5	429	103-1
1699.00	swc	bulk	0.43	11	0.04	5	-	-	105-0
1699.00	swc	Sh/Clst: ol blk	-	-	-	-	4-4.5?	427	105-1
1708.00	swc	bulk	0.47	5	0.04	5	-	-	107-0
1708.00	swc	Sh/Clst: ol blk	-	-	-	-	4.5-5?	438	107-1
1719.00	swc	bulk	0.48	15	0.03	5	-	-	108-0
1719.00	swc	Sh/Clst: ol blk	-	-	-	-	5?	432	108-1

Table 3 : Thermal Maturity Data for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ Lithology	Vitrinite Reflectance (%)	Number of Readings	Standard Deviation	Spore Fluorescence Colour	SCI	T <sub>max</sub> (°C)	Sample
1733.00	swc bulk	0.46	6	0.05	5	-	-	110-0
1733.00	swc Sh/Clst: ol blk	-	-	-	-	5?	426	110-1
1741.00	swc bulk	0.44	3	0.01	5	-	-	111-0
1741.00	swc Sltst : ol gy	-	-	-	-	5?	-	111-1
1785.50	swc bulk	0.47	15	0.04	5	-	-	112-0
1785.50	swc Sh/Clst: brn blk	-	-	-	-	5-5.5	439	112-1
1880.50	swc bulk	NDP	-	-	5	-	-	113-0
1880.50	swc Sh/Clst: lt brn gy to m gy	-	-	-	-	5?	-	113-1
1930.00	swc bulk	NDP	-	-	-	-	-	114-0
1930.00	swc Sltst : lt brn gy to lt gy	-	-	-	-	NDP	-	114-1
1956.00	swc bulk	0.44	5	0.04	5	-	-	115-0
1956.00	swc Sh/Clst: brn gy	-	-	-	-	NDP	-	115-1

Table 4 : Visual Kerogen Composition Data for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	L	A	L	S	C	D			I	S	I	M	S	V	C	V	A	V	V	Smple							
			P	m	i	u	R	A	A	B	N	F	e	n	i	c	I	T	O				i						
			T	r	D	P	e	s	g	a	f	i	t	R	u	s	F	D	r	e	n	I	T	e	l	l	D	r	t
			%	L	t	l	l	n	e	l	t	L	%	n	s	t	n	o	I	%	n	n	t	V	V				
1029.00	swc	Sh/Clst: ol gy	TR		*			*				10	* **						90	** *									093-1
1133.00	swc	Sh/Clst: ol gy	5		* **							40	* **						55	* ** *									094-1
1224.00	swc	Sh/Clst: ol gy	5		** *			*				70	* *						25		*	*							095-1
1325.00	swc	Sh/Clst: ol gy	20		** *			*				20	* **						60		*	*							096-1
1416.00	swc	Sh/Clst: brn blk	20		** *			?				10		*					70		** *								097-1
1456.00	swc	Sh/Clst: ol blk	20		** *			*				20		*					60		*								098-1
1514.00	swc	Sh/Clst: ol blk	50		** *	?		*				20		*					30		*								099-1
1558.00	swc	Sh/Clst: ol blk	20		** *			?				10		*					70		** *								100-1
1619.00	swc	Sh/Clst: ol blk	10		** *							30	* **						60		** *								101-1
1657.00	swc	Sh/Clst: ol blk	10		** *							30	* **						60		** *								102-1
1688.00	swc	Sh/Clst: brn blk	30		* *	?		*				20	* **						50		** *								103-1
1699.00	swc	Sh/Clst: ol blk	25	*	** *	?		*				20		*					55		*	**							105-1
1708.00	swc	Sh/Clst: ol blk	25		* **	?		*				15		*					60		** *								107-1



Table 4 : Visual Kerogen Composition Data for well NOCS 9/3-1

Depth unit of measure: m

Depth	Typ	Lithology	L	A	L	S	C	D	I	S	I	M	S	V	C	V	A	Sample				
			%	L	t	l	l	n	e	l	t	L	%	n	s	t	n		o	I	%	n
1719.00	swc	Sh/Clst: ol blk	25	*	**	?		*	20	*	*			55	**	*		108-1				
1733.00	swc	Sh/Clst: ol blk	10	*	**				60	?	*	**		30	**	*		110-1				
1741.00	swc	Sltst : ol gy	20	*	**	?		*	10		*			70	**	*		111-1				
1785.50	swc	Sh/Clst: brn blk	10	**	*			?	15	*	*	**		75	**	*		112-1				
1880.50	swc	Sh/Clst: lt brn gy to m gy	60	**	*	**		?	10	?	*			30	**	*		113-1				
1930.00	swc	Sltst : lt brn gy to lt gy	NDP						NDP					NDP				114-1				
1956.00	swc	Sh/Clst: brn gy	NDP						NDP					NDP				115-1				

APPENDIX II:  
EXPERIMENTAL PROCEDURE

## EXPERIMENTAL PROCEDURES

### Headspace gas analysis

The analysis is performed using a PERKIN ELMER 8310 gas chromatograph with a 2 mm PORA PAK Q 80/100 packed column and a loop injector. The carrier gas used is nitrogen and the column is run isothermally at 150°C, with backflush.

Two ml of headspace gas are removed from each sample can and injected into the gas chromatograph for analysis of the C<sub>1</sub> to C<sub>7</sub> range of hydrocarbons.

### Occluded gas analysis

The gas chromatograph used for this analysis is identical to that used for headspace gas analysis and is operated under the same conditions.

The canned samples are washed in tempered water to remove drilling contaminants and sieved on a 2 mm mesh sieve to remove large, caved rock fragments. Approximately 25 mg of sieved sample are then immersed in 25 ml of water and crushed in an airtight ball mill. After crushing, 2 ml of the headspace gas are removed from the ball mill and injected into the gas chromatograph.

### Total organic carbon (TOC) analysis

This analysis is performed using a LECO CS244 Carbon Analyser.

Hand-picked lithologies from cutting samples are crushed in a mortar and pestle and approximately 200 mg (50 mg for coals) are accurately weighed into LECO crucibles.

The samples are then treated three times with dilute hydrochloric acid, to remove oxidised (carbonate) carbon, and washed four times with distilled water. The samples are dried on a hotplate at 100°C and then loaded into the instrument for analysis of total organic carbon. Total carbon is analysed on the same instrument using approximately 200 mg of whole rock and this allows oxidised (carbonate) carbon to be calculated by weight difference.

Total organic carbon can also be analysed on the ROCK EVAL II Pyrolyser during the normal run of the instrument.

#### Extractable organic matter (EOM) analysis

Samples are selected for extraction on the basis of screening analysis results. Approximately 30 - 50 g of whole rock are accurately weighed and immersed in 300 ml of dichloromethane (DCM). Extraction is then performed, using a YTRON CHEMCOL Mixer, at 7000 rpm, for 3 minutes. The extract and residue are then separated by centrifuging for 1-2 minutes, at 1200 rpm, and then supernatant liquid is removed and filtered under vacuum. The solvent is then removed from the filtered extract by rotary evaporation, at 35°C, using activated copper filings in the rotating flask to remove sulphur. When completely dry, the amount of recovered EOM is weighed.

#### Extractable organic matter (EOM) by soxtec.

Selected samples for extraction can be extracted by a Tecator Soxtec HT- system. The thimbles and the cotten wool are pre-extracted before used for sample extraction. The extraction cups are filled with 50 ml dichlormethane (DCM) together with boiling chips. The thimbles are extracted by setting the soxtec in boiling position for 10 min. and then at the rinsing position for 20 min. at 130°C. The thimbles are then dried in a drying cabinet till dryness is obtained.

Approximately 10g of whole rock is accurately weighed into the thimbles. The extraction cups are filled with 50 ml dichlormethane (DCM), boiling chips and activated copper filings. The soxtec is set at boiling position for 1 hour and 2 hours in rinsing position at 80°C.

The extract is then evaporated in a preweighed rotating flask on a BUCHI rotavapor at 35°C. When complete dryness is obtained, the flask is reweighed and the EOM is calculated by weight difference.

#### Removal of asphaltenes

Asphaltenes are removed from the EOM by precipitation in n-hexane. The amount of n-hexane to be used is prescribed by the formula:

$$\frac{\text{wt of EOM(g)} \times 40}{\text{density of n-hexane (g/cc)} \times 1000} = \text{amnt. of n-hexane (ml)}$$

The n-hexane and EOM are poured into a pre-weighed plastic column containing a small amount of activated silica. The column is allowed to run and then dried and weighed. The amount of asphaltenes recovered is calculated by weight difference.

After the removal of asphaltenes the solvent is evaporated from the remaining EOM by rotary evaporation, at 35°C and the dried sample either processed immediately, or stored in a freezer.

#### Chromatographic separation

Chromatographic separation is performed using an MPLC system developed by the company. The EOM (minus asphaltenes) is injected into the MPLC and separated using hexane as an eluant. The saturated and aromatic fractions are collected and dried on a rotary evaporator, at 35°C, to remove the

bulk of the hexane. The fractions are then transferred to small pre-weighed vials and evaporated to dryness in a stream of nitrogen. The vials are re-weighed to obtain the weights of both the saturated and aromatic fractions. The weight of the NSO fraction, which is retained on the column, is obtained by weight difference.

#### Gas chromatographic analyses

##### Saturated fraction:

The instrument used for this analysis is a PERKIN ELMER 8320 Gas Chromatograph with a 15 m OV1 column, split injector and FID detector. The carrier gas is helium and the temperature program runs isothermally at 60°C, for 2 minutes and then rises to 290°C at a rate of 5°C/min.

The sample of saturated fraction is diluted by 1:20 and a 1 microlitre aliquot of this is injected into the instrument.

##### Aromatic fraction:

The instrument used is a PERKIN ELMER SIGMA 2000 Gas Chromatograph with a 50 m SE-54 packed column, split injector and a column splitter leading to an FID and an FPD detector, which allows simultaneous analysis of co-eluting hydrocarbons and sulphur compounds. The carrier gas is helium and the temperature program runs from 60°C to 300°C at a rate of 4°C/min.

The sample of aromatic fraction is diluted by 1:20 and a 1 microlitre aliquot of this is injected into the instrument.

#### Rock Eval pyrolysis

This analysis is performed using a ROCK EVAL II Pyrolyser into which approximately 100 mg of whole rock are loaded. Analysis involves heating the sample, from 300°C to 600°C, in an inert atmosphere (helium) to release naturally generated hydrocarbons (S1 peak) and then pyrolysed

bulk of the hexane. The fractions are then transferred to small pre-weighed vials and evaporated to dryness in a stream of nitrogen. The vials are re-weighed to obtain the weights of both the saturated and aromatic fractions. The weight of the NSO fraction which is retained on the column, is obtained by weight difference.

#### Gas chromatographic analyses

##### Saturated fraction:

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The sample of aromatic fraction is diluted by 1:20 and a 1 microlitre aliquot of this is injected into the instrument.

#### Rock Eval pyrolysis

This analysis is performed using a ROCK EVAL II Pyrolyser into which approximately 100 mg of whole rock are loaded. Analysis involves heating the sample, from 300°C to 600°C, in an inert atmosphere (helium) to release naturally generated hydrocarbons (S1 peak) and then pyrolysed

hydrocarbons (S2 peak), both of which are detected by an FID. In the temperature interval between 300°C and 390°C, the released gasses are split and a proportion passed through a carbon dioxide trap, which is connected to a thermal conductivity detector (TCD). The value obtained from the TCD corresponds to the amount of oxygen contained in the kerogen of the sample and is reported as the S3 peak.

The ROCK EVAL II Pyrolyser also analyses the TOC of each sample subsequent to pyrolysis.

#### Thermal extraction/pyrolysis gas chromatography

The instrument used for this analysis is a PERKIN ELMER SIGMA 2000 Gas Chromatograph connected to a pyrolysis oven. A very small amount ( 2 mg) of whole rock sample is loaded into the oven and heated isothermally, at 300°C, for 3 minutes, during which time thermal extraction of the generated hydrocarbons occurs (equivalent to the S1 peak of Rock Eval). The released gasses pass to a 15 m OV1 column with a nitrogen-cooled trap.

After 3 minutes the pyrolysis oven heats up to 510°C, at a rate of 40°C per minute, causing bound hydrocarbons to be released from the kerogen of the sample (equivalent to the S2 peak of Rock Eval). These gasses are passed through a 25 m DB1 packed column with a nitrogen-cooled trap.

The temperature program for the oven, in which both columns are situated, rises from 0°C to 290°C at a rate of 4°C/min. Both columns are linked to an FID detector.

#### Vitrinite reflectance analysis

Samples to be analysed for vitrinite reflectance are ground to small granules in a mortar and pestle and then mounted in a fast setting resin. The resin blocks are ground on coarse corundum paper to expose the rock granule surfaces and then



ground on three finer grades of corundum paper to improve these surfaces and reduce scratches. The resin blocks are finally polished on a rotating Selvyt-covered lap using three grades of polishing alumina. Isopropyl alcohol is used to lubricate the entire grinding and polishing process except in the case of coal samples, when water is used.

Reflectance measurements are taken under oil immersion ( $n = 1.518$ ) using a ZEISS MPM03 microscope photometer with a 546 nm interference filter. The polished blocks are mounted on the microscope stage and scanned manually in order to locate and measure particles of vitrinite. An attempt is made to obtain readings from 20 individual particles per sample but this is not always possible in samples with low amounts of phytoclasts.

Spore fluorescence colour

Samples are also analysed microscopically in U.V. light, using an exciter filter with a band pass of 400 - 440 nm and a barrier filter with a long pass of 470 nm, and the colour of the spore fluorescence is determined. This is used as an alternative maturity parameter to verify the result obtained from vitrinite reflectance and is reported on a numerical scale from 1 to 9:

Fluorescence Colour	Colour Index	Corresp. Vitrinite Reflectance
Green	1	0.2%
Green/Yellow	2	0.2/0.3%
Yellow	3	0.3%
Yellow/Orange	4	0.4%
Light Orange	5	0.5%
Mid-Orange	6	0.6%
Dark Orange	7	0.8%
Orange/Red	8	1.0%
Red	9	1.1%

NB. This table only provides a rough correlation as vitrinite reflectance and spore fluorescence colour are both independantly affected by factors such as depositional environment and catagenic history.

APPENDIX III:  
LIST OF ABBREVIATIONS USED FOR  
LITHOLOGY DESCRIPTION

List of abbreviations used for lithology description  
(sorted alphabetically).

and	= angular
bar	= Baryte (mud additive)
bl	= blue/blueish
blk	= black
br	= brittle
brn	= brown/brownish
Ca	= Carbonate (Limestone/Chalk/Dolomite/Siderite)
calc	= calcareous
carb	= carbonaceous
cem	= cement used as additive (under "Cont") or to describe cemented S/Sst
Chert	= Chert
chk	= Chalk/chalky
cly	= clayey/shaley
cngr	= conglomeratic
Coal	= Coal
Coal-ad	= Coal-like additive (e.g. chromlignosulfonate)
Congl	= Conglomerate
Cont	= Contamination
crs	= coarse grained
cvd	= caved
dd	= dried drilling mud
dol	= Dolomite/dolomitic
drk	= dark (colour)
dsk	= dusky (colour)
evap	= Salt/Gypsum/Halite (natural "Other" or as additive "Cont")
f	= fine grained
fib	= fibres (mud additive/contamination)
fis	= fissile
fos	= fossiliferous
glauc	= Glauconite/glauconitic
gn	= green/greenish
gy	= grey/greyish

hd = hard  
ign = Igneous (material derived from igneous source)  
int = percentage interpreted from logs  
Kaolin = Kaolin(ite)  
kln = kaolinitic  
l = loose  
lam = laminated/laminae  
lt = light (colour)  
m = medium (colour or grain size)

List of abbreviations used for lithology description  
(sorted alphabetically).

Marl	= Marl (calcareous claystone/mudstone)
mic	= micaceous
Mica-ad	= Mica used as mud additive
mr1	= marly
No Mat.	= No material left after washing
ns	= nutshells (mud additive)
ol	= olive
ool	= Oolite/oolitic
or	= orange
Other	= Other lithology/mineral, specified after this word
pi	= pink/pinkish
pl	= pale (colour)
prp	= paint/rust/plastic contamination/additives
pu	= purple
pyr	= Pyrite/pyritic
red	= red/reddish
rnd	= round/rounded
s	= sandy
S/Sst	= Sand and/or sandstone
Sh/Clst	= Shale and/or claystone
sid	= Siderite/sideritic
sil	= siliceous/cherty
slt	= silty
Sltst	= Siltstone
st	= stained (with natural oil or oil-like additive)
tar-ad	= Tar-like additive (e.g. "Black Magic")
Tuff	= Tuff
tuff	= tuffaceous
v col	= Various colours
w	= white
wx	= waxy
y	= yellow/yellowish