COMPLETION INTERVAL

COMPANY Statoil, Harstad Well No. 7121/4-2 Page 1 of 6

Casing Size		Meters		(Bit Size)		Meters	
30	" from	337	to 413	36	" hole from	337	to 417

Material Consumption for Interval:

Product	Units	Size	Cost/Unit	Total Cost
Bentonite	33	mt	325.00	10,725.00
Caustic Soda	7	25 kg	14.50	101.50
Soda Ash	4	50 kg	21.65	86.60

Material Cost for Interval $ 10,913.10 Average Cost per meter $ 136.41

Number of Days 2 Average Cost per Day $ 5,456.55

Comments Drilled 17½" pilot hole to 417 m. Spotted 2-3 m^3 high viscosity mud at each connection for maximum hole cleaning. Opened hole to 36". Ran 30" casing without any major problems.

COMPLETION INTERVAL

COMPANY Statoil, Harstad Well No. 7121/4-2 Page 2 of 6

Casing Size	Meters	(Bit Size)	Meters
20 " from	337 to 900	26" hole from	414 to 921

Material Consumption for Interval:

Product	Units	Size	Cost/Unit	Total Cost
Bentonite	126	mt	325.00	40,950.00
Caustic soda	75	25 kg	14.50	1,087.50
Barite	379	mt	123.90	46,958.10
Milpolymer 302	9	25 kg	200.00	1,800.00
Drispac Reg	52	50 lb	92.00	4,784.00

Material Cost for Interval $ 95,579.60 Average Cost per Meter $ 189.27

Number of Days 12 Average Cost per Day $ 7,964.97

Comments This section was drilled with prehydrated bentonite mud without any unexpected drilling problems. Due to BOP problems part of this section was drilled without riser.

COMPLETION INTERVAL

COMPANY Statoil, Harstad Well No. 7121/4-2

Casing Size Meters (Bit Size) Meters

13 3/8 " from 337 to 1759 17 1/2" hole from 900 to 1774

Material Consumption for Interval:

Product	Units	Size	Cost/Unit	Total Cost
Bentonite	54	mt	325.00	17,550.00
Caustic soda	79	25 kg	14.50	1,145.50
Barite	151	mt	123.90	18,708.90
Gypsum	428	40 kg	8.80	3,766.40
Drispac Reg	13	50 lb	92.00	1,196.00
Drispac SL	108	50 lb	92.00	9,936.00
Prothin	267	25 kg	13.50	3,604.50
Prodefoamer	15	5 gal	114.00	1,710.00
Nutplug C	213	25 kg	20.45	4,355.85
XL-polymer	6	25 kg	411.75	2,470.50
Drlg Detergent	6	55 gal	470.25	2,821.50
Bicarbonate	8	50 kg	25.25	202.00

Material Cost for Interval $ 67,467.15 Average Cost per meter $ 77.19

Number of Days 15 Average Cost per Day $ 4,497.81

Comments A gyp.lignosulfonate system was choosen for this section. The system was build of 25 ppb bentonite, 4 ppb excess gypsum and Drispac SL for water loss control. The formation was very reactive, causing increase in viscosity and heavy dilution was necessary. The section was drilled and casing completed without any major problems. It is Promuds recommendation not to drill formations with a gyp-lignosulfonate.

PROMUD AS

COMPLETION INTERVAL

COMPANY Statoil, Harstad Well No. 7121/4-2 Page 4 of 6

Casing Size	Meters	(Bit Size)	Meters
9 5/8 " from	337 to 2455	12 1/4 " hole from	1774 to 2460

Material Consumption for Interval:

Product	Units	Size	Cost/Unit	Total Cost
Bentonite	24	mt	325.00	7,800.00
Caustic Soda	46	25 kg	14.50	667.00
Soda Ash	2	50 kg	21.65	43.30
Barite	170	mt	123.90	21,063.00
Gypsum	189	40 kg	8.80	1,663.20
Drispac Reg	37	50 lb	92.00	3,404.00
Drispac SL	64	50 lb	92.00	5,888.00
Prothin	186	25 kg	13.50	2,511.00
Bicarb	2	50 kg	25.25	50.50
Prodefoamer	16	5 gal	114.00	1,825.00
Lubrisal	5	55 gal	857.85	4,289.25
XL-Polymer	4	25 kg	411.75	1,647.00

Material Cost for Interval $ 50,850.25 Average Cost per meter $ 74.13

Number of Days 13 Average Cost per Day $ 3,911.56

Comments After treated out the cmt the mud from previos section was used to drill the 12 1/4" hole. The YP was controlled with the addition of prehydrated bentonite and Drispac. Some reaming was necessary in this section due to hard shales. The gyp content was discontunued and allowed to drift out of the system.

COMPLETION INTERVAL

COMPANY Statoil, Harstad Well No. 7121/4-2 Page 5 of 6

Casing Size	Meters	(Bit Size)	Meters
" from	to	8 1/2 " hole from 2455	to 2800

Material Consumption for Interval:

Product	Units	Size	Cost/Unit	Total Cost
Bentonite	11	mt	325.00	3,575.00
Caustic Soda	44	25 kg	14.50	638.00
Barite	50	mt	123.90	6,195.00
Drispac Reg	7	50 lb	92.00	644.00
Drispac SL	57	50 lb	92.00	5,244.00
Prothin	54	25 kg	13.50	729.00
Bicarb	8	50 kg	25.25	202.00
Prodefoamer	2	5 gal	114.00	228.00
XL-Polymer	3	25 kg	411.75	1,235.25

Material Cost for Interval $ 18,690.25 Average Cost per meter $ 54.17

Number of Days 18 Average Cost per Day $ 1,038.35

Comments Continued with a dispesed lignosulfonate - bentonite fluid. Added Drispac SL forfluid loss control and Drispac Reg/ prehydrated bentonite/XC.Polymer for rheology control. Drilled to 2800 m. Completed logging without problems. Liner was set and cemented.

COMPLETION INTERVAL

COMPANY Statoil, Harstad Well No. 7121/4-2 Page 6 of 6

Liner + test programme

~~Casing Size~~ Meters (Ent Size) Meters

7 " from - to _____ _____ " hole from _____ to _____

Material Consumption for Interval:

Product	Units	Size	Cost/Unit	Total Cost
Caustic Soda	5	25 kg	14.50	72.50
Barite	38	mt	123.90	4,708.20
Drispac Reg	12	50 lb	92.00	1,104.00
Prothin	12	25 kg	13.50	162.00

Material Cost for Interval $ 6,046.70 Average Cost per meter $ -

Number of Days 15 Average Cost per Day $ 403.11

Comments

DAILY DRILLING MUD ADDITIONS

OPERATOR: STATOIL HARSTAD WELL NO.: 7121/4-2 RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 No.drlg days to TD: 75 TOTAL DEPTH: 2800

CONTRACTOR: WILHELMSEN WAREHOUSE: HAMMERFEST TOTAL COST: $ 249,547.05

Product :	Bento-nite	Caustic soda	Soda Ash	Barite	M.P. 302	Gypsum	Drispac Reg.	Drispac S/L.	Prothin	Bicarb	Pro-Defoamer	Nutplug C	XC Pol	C O S T	
Price	325.00	14.50	21.65	123.90	200.00	8.80	92.00	92.00	13.50	25.25	114.00	20.45	411.75		
Unit	mt	25 kg	50 kg	mt	25 kg	40 kg	50 lb	50 lb	25 kg	50 kg	5 gal	25 kg	25 kg		
Date	Depth													Daily	Cumulative
29-Jan		27	6	4										8,948.60	8,948.60
30-Jan	417	6	1											1,964.50	10,913.10
31-Jan	417	1	1		19									2,693.60	13,606.70
01-Feb	496	2	1		2									912.30	14,519.00
02-Feb	918	6	3											1,993.50	16,512.50
03-Feb	422	9	4		14									4,717.60	21,230.10
04-Feb	632	4	3											1,343.50	22,573.60
05-Feb	755	9	4		20									5,461.00	28,034.60
06-Feb	918	1	1		20									2,817.50	30,852.10
07-Feb	918	2			45									6,225.50	37,077.60
08-Feb	869	30	21		100									22,444.50	59,522.10
09-Feb	918	5	26		63	9		32						14,551.70	74,073.80
10-Feb	918	31	8		17			20						14,137.30	88,211.10
11-Feb	918	26	3		79									18,281.60	106,492.70
12-Feb	918	13	18		26									7,707.40	114,200.10
13-Feb	900	2	2		6		60			55		2		2,920.90	117,121.00
14-Feb	921	0	2		0		0			28	4			508.00	117,629.00
15-Feb	900	1	2		3		17			30	4			1,381.30	119,010.30
16-Feb	941	6	3		26		16			17				5,585.20	124,595.50
17-Feb	1140	5	9		25		90	4	25	8		53		9,504.85	134,100.35
18-Feb	1167		2				7	1	1	6		45		1,275.85	135,376.20
19-Feb	1250	5	1				20	1	10	21			6	5,581.50	140,957.70

DAILY DRILLING MUD ADDITIONS

OPERATOR: STATOIL HARSTAD WELL NO.: 7121/4-2 RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 No.drlg days to TD: 75 TOTAL DEPTH: 2800

CONTRACTOR: WILHELMSEN WAREHOUSE: HAMMERFEST TOTAL COST: $ 249,547.05

Product :	Bento-nite	Caustic soda	Soda Ash	Barite	M.P. 302	Gypsum	Drispac Reg.	Drispac S/L.	Prothin	Bicarb	Pro-Defoamer	Nutplug C	XC Pol	C O S T	
Price	325.00	14.50	21.65	123.90	200.00	8.80	92.00	92.00	13.50	25.25	114.00	20.45	411.75		
Unit	mt	25 kg	50 kg	mt	25 kg	40 kg	50 lb	50 lb	25 kg	50 kg	5 gal	25 kg	25 kg	Daily	Cumulative
20-Feb 1384	6	10		38		46	1	1	75		2	115 +2 MD		11,924.75	152,882.45
21-Feb 1460	0	6		20		100	5		26		11			5,510.00	158,392.45
22-Feb 1550	1	4						29						3,051.00	161,443.45
23-Feb 1625	4	10				1		20			+ 2 dr. Drlg.Det.			4,234.30	165,677.75
24-Feb 1719		6				51		5	1		+ 2 dr. Drlg.Det.			1,949.80	167,627.55
25-Feb 1774	1	4				20		17						2,123.00	169,750.55
26-Feb 1774	10			7			1							4,209.30	173,959.85
27-Feb 1774	8			21		24		3						5,689.10	179,648.95
28-Feb 1873	9	2	1	4		25	7	11	22					5,644.25	185,293.20
01-Mar 1932			1			20	22	4		2				2,640.15	187,933.35
02-Mar 2010	3					20			15					1,353.50	189,286.85
03-Mar 2133		3		17		15			39					2,808.30	192,095.15
04-Mar 2189		5		7		29		3	21		15	+ 5 Lubrisal		7,753.75	199,848.90
05-Mar 2277	1	5		4		16		23	23				4	5,107.40	204,956.30
06-Mar 2320	2	7		7				8	40					2,894.80	207,851.10
07-Mar 2374		4		2		10		8						1,129.80	208,980.90
08-Mar 2460		12		71		30		4	10					9,737.90	218,718.80
09-Mar 2460	1			7										1,192.30	219,911.10
10-Mar 2460		3		21			3		9	0	1			3,156.90	223,068.00
11-Mar 2460		5		9			5		7					1,742.10	224,810.10
12-Mar 2455				14						2				1,785.10	226,595.20
13-Mar 2463		1								3				90.25	226,685.45

D A I L Y D R I L L I N G M U D A D D I T I O N S

OPERATOR: STATOIL HARSTAD WELL NO.: 7121/4-2 RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 No.drlg days to TD: 75 TOTAL DEPTH: 2800

CONTRACTOR: WILHELMSEN WAREHOUSE: HAMMERFEST TOTAL COST: $ 249,547.05

Product :	Bento-nite	Caustic soda	Soda Ash	Barite	M.P. 302	Gypsum	Drispac Reg.	Drispac S/L.	Prothin	Bicarb	Pro-Defoamer	Nutplug C	XC Pol	C O S T	
Price	325.00	14.50	21.65	123.90	200.00	8.80	92.00	92.00	13.50	25.25	114.00	20.45	411.75		
Unit	mt	25 kg	50 kg	mt	25 kg	40 kg	50 lb	50 lb	25 kg	50 kg	5 gal	25 kg	25 kg		
Date Depth														Daily	Cumulative
14-Mar 2478	4	1		8				12	18	3	1			3,842.45	230,527.90
15-Mar 2499	3	1		8										1,980.70	232,508.60
16-Mar 2541		6						7	35		1			1,317.50	233,826.10
17-Mar 2556	3	5						4						1,415.50	235,241.60
18-Mar 2588		6						15						1,467.00	236,708.60
19-Mar 2628	1	6		4				10						1,827.60	238,536.20
20-Mar 2673		6							1				2	924.00	239,460.20
21-Mar 2676		6		3										458.70	239,918.90
22-Mar 2676														0.00	239,918.90
23-Mar 2679													1	411.75	240,330.65
24-Mar 2726		6		2			3	9						1,438.80	241,769.45
25-Mar 2744				9			1							1,207.10	242,976.55
26-Mar 2800							1							92.00	243,068.55
27-Mar 2800														0.00	243,068.55
28-Mar 2800				2			1							339.80	243,408.35
29-Mar 2800							1							92.00	243,500.35
30-Mar 2268		5							7					167.00	243,667.35
31-Mar 2800							3		5					343.50	244,010.85
01-Apr 2800				1										123.90	244,134.75
02-Apr 2800														0.00	244,134.75
03-Apr 2800				6			8							1,479.40	245,614.15
04-Apr 2800				5			1							711.50	246,325.65

DAILY DRILLING MUD ADDITIONS

OPERATOR: STATOIL HARSTAD WELL NO.: 7121/4-2 RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 No.drlg days to TD: 75 TOTAL DEPTH: 2800

CONTRACTOR: WILHELMSEN WAREHOUSE: HAMMERFEST TOTAL COST: $ 249,547.05

Product :	Bento-nite	Caustic soda	Soda Ash	Barite	M.P. 302	Gypsum	Drispac Reg.	Drispac S/L.	Prothin	Bicarb	Pro-Defoamer	Nutplug C	XC Pol	C O S T	
Price	325.00	14.50	21.65	123.90	200.00	8.80	92.00	92.00	13.50	25.25	114.00	20.45	411.75		
Unit	mt	25 kg	50 kg	mt	25 kg	40 kg	50 lb	30 lb	25 kg	50 kg	5 gal	25 kg	25 kg		
Date	Depth													Daily	Cumulative
05-Apr	2800													0.00	246,325.65
06-Apr	2800				2									247.80	246,573.45
07-Apr	2800				2									247.80	246,821.25
08-Apr	2800													0.00	246,821.25
09-Apr	2800				5									619.50	247,440.75
10-Apr	2800				5									619.50	248,060.25
11-Apr	2800				4									495.60	248,555.85
12-Apr	2800													0.00	248,555.85
13-Apr	2800				8									991.20	249,547.05

DRILLING MUD RECAP

OPERATOR: STATOIL HARSTAD | WELL NO.: 7121/4-2 | RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 | No.drlg days to TD: 75 | TOTAL DEPTH: 2800 M

CONTRACTOR: WILHELMSEN | WAREHOUSE: HAMMERFEST | TOTAL COST: $ 249,547.05

Date	Depth	Time	W.T.	FV API @	PV cp @	YP API @	GELS 0/10	pH	API FL	Cake	ALKALINITY Pm	Pf/Mf	Cl- mg/l	Ca- mg/l	Sand %	Solids %	Oil %	Water %	MBT	EX.GYP
29-Jan																				
30-Jan																				
31-Jan																				
01-Feb	496	2400	1.06	61	7	43														
02-Feb	918	2400	1.07	52	7	45														
03-Feb	422	2400	1.08	54	8	46														
04-Feb	632	2400	1.10	57	8	45														
05-Feb	755	2400	1.10	52	8	44														
06-Feb	918	2400	1.10	57	8	47														
07-Feb	918	2400	1.10	80	11	53														
08-Feb	869	2400	1.18	60	11	55														
09-Feb	918	2400	1.08	70	19	17														
10-Feb	918	2400	1.08	60	12	16														
11-Feb	918	2400	1.08	60	10	44														
12-Feb	918	2400	1.18	60	10	44														
13-Feb	900	2400	1.18	62	10	42	31/35	10.0	NC	2	0.6	.25/.4	2000	80	TR	6	94			
14-Feb	921	2400	1.15	70	11	38	30/31													
15-Feb	900	2400	1.15	50	10	42	26/30	12.1	NC	2	5.8	2.0/2.4	5200	640	TR	7	93	18.5		
16-Feb	941	2400	1.09	48	7	15	4/12	9.7	19.0	1	0.1	.05/.1	900	1700	TR	4	96	20.0	4.3	
17-Feb	1140	2200	1.13	68	11	22	3/19	10.5	15.0	2	2.0	.2/.6	500	1440	TR	10	90	30.0	6.0	
18-Feb	1167	0200	1.13	58	10	20	10/60	10.3	14.0	2	1.6	.16/.56	300	1200	TR	10	90	32.0	2.5	
19-Feb	1250	2230	1.15	70	13	18	14/26	10.0	10.0	2	1.0	.15/1.0	400	1240	TR	11	89	35.0		
20-Feb	1370	2000	1.20	51	11	19	18/25	9.5	10.0	2	0.7	.2/.8	300	1680	TR	10	90	37.0	2.5	
21-Feb	1445	2130	1.19	54	8	22	18/17	9.0	16.0	2	0.5	.15/.75	300	1700	TR	10	9	33.8	4.3	
22-Feb	1520	1400	1.20	56	10	20	17/25	9.0	18.0	2	0.5	.5/.7	300	1720	TR	10	90	45.0	7.6	

DRILLING MUD RECAP

OPERATOR: STATOIL HARSTAD | WELL NO.: 7121/4-2 | RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 | No.drlg days to TD: 75 | TOTAL DEPTH: 2800 M

CONTRACTOR: WILHELMSEN | WAREHOUSE: HAMMERFEST | TOTAL COST: $ 249,547.05

Date	Depth	Time	W.T.	FV API @	PV cp @	YP API @	GELS 0/10	pH	API FL	Cake	ALKALINITY Pm	Pf/Mf	Cl- mg/l	Ca- mg/l	Sand %	Solids %	Oil %	Water %	MBT	EX.GYP
23-Feb	1579	1400	1.17	52	9	19	10/49	10.1	12.0	2	0.7	.08/.65	300	1080	TR	10		90	37.5	2.7
24-Feb	1692	1600	1.17	59	8	26	25/27	9.8	12.0	2	0.8	.1/.75	300	1600	TR	10		90	40.0	4.4
25-Feb	1774	1600	1.17	60	9	22	20/28	9.9	11.0	2	0.8	.1/.75	300	1440	TR	10		90	42.5	3.0
26-Feb	1774	1800	1.17	52	9	17	14/19	10.0	12.0	2	0.8	.1/.7	300	1080	TR	10		90	42.5	2.8
27-Feb	1774	1200	1.18	54	10	15	14/32	10.3	12.0	2	0.7	.1/.7	280	1080	TR	10		90	42.5	2.5
28-Feb	1804	2400	1.12	44	11	13	8/12	12.6	13.0	1	2.1	.3/1.	2300	1080	0.25	9		91	27.5	3.3
01-Mar	1877	1230	1.13	54	10	11	3/14	10.8	8.0	1	2.3	.2/1.1	2000	1140	0.25	6		94	30.0	3.0
02-Mar	1975	0915	1.13	46	12	15	8/25	10.3	7.8	1	1.7	.1/.6	2200	1560	TR	6		94	37.5	3.6
03-Mar	2081	1015	1.13	47	11	14	9/29	9.9	8.2	1	0.9	.1/.4	2500	1640	TR	6		94	37.5	3.0
04-Mar	2151	0400	1.20	47	11	12	6/27	9.8	8.6	1	0.7	.1/.5	2400	1560	TR	9		91	37.5	3.1
05-Mar	2277	2400	1.20	50	13	15	5/30	9.9	7.2	1	0.7	.1/.8	2300	1560	TR	10		90	37.5	2.6
06-Mar	2320	2400	1.20	50	12	15	5/30	10.1	7.2	1	0.7	.1/.7	2400	1760	TR	10		90	37.5	2.8
07-Mar	2374	2330	1.20	48	13	14	6/30	9.7	7.4	1		.1/.6	2300	1640	TR	9		91	37.5	2.8
08-Mar	2460	2300	1.35	48	15	14	6/27	9.9	7.6	1	0.7	.1/.6	2400	1760	TR	13		86	37.5	3.1
09-Mar	2460	0400	1.35	47	15	14	6/30	10.0	7.6	1	0.7	.1/.6	2400	1760	TR	14		86	37.5	3.1
10-Mar	2460	0400	1.37	50	15	14	6/31	9.9	7.6	1	0.7	.1/.65	2400	1760	TR	14		86	37.5	3.1
11-Mar	2460	0400	1.37	49	15	14	5/27	9.7	7.7	1	0.6	.15/.5	2500	1520	TR	14		86	37.5	2.5
12-Mar	2460	0400	1.37	50	15	15	5/28	9.6	7.6	1	0.5	.1/.45	2900	1360	TR	14		86	37.5	2.2
13-Mar	2455	0400	1.23	47	13	13	5/26	9.5	7.8	1	0.4	.1/.4	2900	1360	TR	11		89	37.5	2.2
14-Mar	2460	0400	1.23	49	11	13	5/30	11.0	8.0	1	2.5	.15/1.2	3000	1200	TR	11		89	32.5	2.0
15-Mar	2481	0400	1.23	51	13	15	4/18	10.3	6.8	1	1.7	.13/1.1	2700	1000	TR	11		89	32.5	
16-Mar	2499	0400	1.23	51	14	15	4/30	10.2	6.8	1	1.5	.1/1.0	2600	800	TR	11		89	32.5	
17-Mar	2548	0400	1.23	53	14	15	4/25	10.1	4.6	1	1.4	.1/1.0	2700	840	TR	11		89	32.5	
18-Mar	2564	0400	1.23	53	13	13	4/16	9.8	4.6	1	1.1	.1/1.3	3000	880	TR	11		89	32.5	
19-Mar	2598	0400	1.23	57	13	12	4/17	9.9	4.4	1	1.4	.15/1.5	2800	800	TR	11		89	32.5	

DRILLING MUD RECAP

OPERATOR: STATOIL HARSTAD | WELL NO.: 7121/4-2 | RIG NAME: WEST VANGUARD

SPUD DATE: 29-Jan-1985 | No.drlg days to TD: 75 | TOTAL DEPTH: 2800 M

CONTRACTOR: WILHELMSEN | WAREHOUSE: HAMMERFEST | TOTAL COST: $ 249,547.05

Date	Depth	Time	W.T.	FV API @	PV cp @	YP API @	GELS 0/10	pH	API FL	Cake	ALKALINITY Pm	Pf/Mf	Cl- mg/l	Ca- mg/l	Sand %	Solids %	Oil %	Water %	MBT	EX.GYP
20-Mar	2660	1100	1.23	60	14	12	4/15	9.9	4.2	1	0.6	.13/1.5	3000	840	TR	11		89	32.5	
21-Mar	2676	1930	1.23	60	16	14	4/16	10.0	4.0	1	0.8	.15/1.6	3000	680	TR	11		89	30.0	
22-Mar	2676	2400	1.23	60	16	14	4/16	10.0	4.0	1	0.8	.15/1.6	3000	680	TR	11		89	30.0	
23-Mar	2676	0400	1.23	60	16	14	4/16	10.0	4.0	1	0.8	.15/1.6	3000	680	TR	11		89	30.0	
24-Mar	2712	1930	1.23	62	16	14	4/18	9.8	4.8	1	0.8	.15/1.4	3600	760	TR	11		89	27.5	
25-Mar	2730	0730	1.23	69	17	13	4/19	10.3	4.6	1	0.8	.15/1.5	3200	680	TR	11		89	25.0	
26-Mar	2777	1045	1.23	59	14	15	4/19	10.1	4.6	1	0.7	.12/1.4	3400	720	TR	11		89	22.5	
27-Mar	2800	2400	1.23	61	15	14	4/18	9.8	4.4	1	0.9	.15/1.5	3800	800	TR	11		89	22.5	
28-Mar	2800	0940	1.23	60	15	14	4/19	9.8	4.6	1	0.8	.11/1.5	3700	840	TR	11		89	22.5	
29-Mar	2800	0530	1.23	70	14	13	4/18	10.0	4.6	1	0.8	.1/1.5	3700	760	TR	11		89	22.5	
30-Mar	2800	0100	1.23	73	16	14	5/17	10.0	4.8	1/32	0.9	.2/1.7	4000	800	TR	12		88	23.8	
31-Mar	2800	0200	1.23	51	15	14	3/44	12.0	5.2	2/32	1.1	.6/1.5	3400	640	TR	11		89	22.5	3.9
01-Apr	2800	0100	1.23	53	15	16	3/16	11.8	5.4	2/32	1.0	.6/1.4	3500	640	TR	11		89	22.5	3.6
02-Apr	2800	0100	1.23	52	15	14	3/15	11.9	5.2	2/32	1.1	.6/1.4	3600	720	TR	11		89	25.0	3.9
03-Apr	2800	2300	1.23	53	15	16	3/16	11.8	5.1	2/32	1.0	.5/1.4	3500	720	TR	11		89	22.5	3.9
04-Apr	2800	0100	1.23	52	14	17	3/18	11.2	4.8	1.32	1.0	.5/1.6	3500	720	TR	11		89	25.5	3.2
05-Apr	2800	0200	1.23	52	14	18	3/17	11.0	4.6	1/32	1.0	.4/1.6	3600	700	TR	11		89	21.3	3.5
06-Apr	2800	0100	1.23	53	14	17	3/17	11.0	4.6	1/32	1.0	.5/1.6	3600	700	TR	11		89	21.3	3.5
07-Apr	2800	0200	1.23	51	15	19	3/18	11.0	4.8	1/32	1.0	.5/1.6	3500	720	TR	11		89	21.3	3.5
08-Apr	2800	2230	1.23	47	14	15	3/16	10.8	4.6	1/32	0.9	.6/1.4	3500	640	TR	11		89	20.5	3.5
09-Apr	2800	2100	1.23	45	14	16	3/17	10.8	4.6	1/32	0.9	.5/1.4	3500	680	TR	11		89	22.3	3.6
10-Apr	2800	0100	1.23	46	13	18	3/16	11.0	4.8	1/32	1.1	.5/1.6	3500	720	TR	12		88	22.3	3.9
11-Apr	2800	0100	1.23	45	14	15	3/14	11.0	4.8	2/32	1.1	.5/1.3	3600	720	TR	12		88	21.3	3.4
12-Apr	2800	0100	1.23	43	13	15	3/15	10.8	5.1	2/32	0.9	.4/1.3	3600	720	TR	12		88	21.3	3.4
13-Apr	2800	0200	1.24	42	13	14	3/12	10.6	5.0	2/32	0.9	.4/1.1	3500	800	TR	11		89	20.0	3.6

5.2 REPEAT FORMATION TESTER

Pretest records:

Test no.	Depth mRKB	Temp. deg C	Formation pressure kPa	, gm/cc	Permeability	Comments
1	2480.5	60.0	27370	1.125	Good	Used
2	2485.0	60.0	-	-	Tight	-
3	2484.5	60.6	27460	1.127	Very good	Used
4	2487.0	60.6	27432	1.125	Very good	Used
5	2491.0	61.1	27453	1.124	Very good	Used
6	2495.5	61.1	-	-	Supercharged	-
7	2498.5	61.1	-	-	Tight	-
8	2504.0	62.6	-	-	Tight	-
9	2504.3	62.6	-	-	Tight	-
10	2512.0	63.6	-	-	Tight	-
11	2516.0	63.6	27605	1.119	Good	Used
12	2520.0	63.6	27667	1.120	Very good/exc	Used
13	2526.0	63.6	27772	1.119	Very good/exc	Used
14	2529.0	63.6	-	-	Tight	-
15	2535.0	66.1	27839	1.120	Very good	Used
16	2542.0	66.1	-	-	Tight	-
17	2544.0	66.1	27935	1.120	Very good	Used
18	2549.0	66.1	27977	1.119	Excellent	Used
19	2552.0	66.1	28004	1.119	Very good	Used
20	2562.0	68.8	-	-	Tight	-
21	2572.5	68.8	-	-	Tight	-
22	2584.3	70.6	-	-	Tight	-
23	2603.5	71.1	28590	1.120	Good	Used
24	2629.5	72.4	-	-	Tight	-
25	2637.5	72.4	28990	1.121	Good	Used
26	2641.5	72.4	-	-	Seal failure	-
27	2644.0	74.8	29052	1.121	Poor	Not used
28	2646.5	74.8	29066	1.120	Very good	Used
29	2661.0	76.2	-	-	Tight	-
30	2660.5	76.2	29225	1.120	Good	Used
31	2664.5	76.2	29239	1.119	Good	Used
32	2673.0	78.1	29376	1.121	Good	Used
33	2681.2	78.1	29418	1.119	Very good	Used
34	2701.7	78.7	29680	1.120	Very good	Used
35	2703.7	78.7	29694	1.120	Drifting	Not used
36	2706.6	78.7	-	-	Seal failure	-
37	2719.0	80.5	29832	1.119	Fair	Used
38	2734.0	81.1	29976	1.118	Good	Used
39	2768.0	82.0	30673	1.130	Very good	Used
40	2781.0	82.0	30473	1.118	Good	Used
41	2768.0	82.0	30686	1.131	Very good	Not used

Gas-water contact: 2517 m RKB

No gas gradient could be established from the measurements due to tight formation.

Water gradient between 2517 and 2702 m RKB : 1.110 gm/cc

SAMPLING

Sample no.1:

Segregated sample taken at 2484.5 m RKB. The 2 3/4 gallon chamber was bled off at wellsite:

Opening pressure	: 17338 kPa
Gas	: 0.9 m^3
Mudfiltrate, water and trace of condensate	: 0.003 m^3

The 1 gallon chamber was sent onshore for analysis. The chamber was leaking and had a opening pressure of 0 kPa, and contained 0.0005 m^3 mudfiltrate + traces of condensate.

Sample no. 2:

Segregated sample taken at 2516.0 m RKB.
The 2 3/4 gallon chamber was bled of at wellsite:

Opening pressure : 17237 kPa
Gas : 1.0 m^3
Mudfiltrate and water: 0.0042 m^3

The 1 gallon chamber was sent onshore for analysis:
Opening pressure: : 14580 kPa at 15.5 C
Gas: : 7.95 10^{-3} m^3
Condensate: : none
Mudfiltrate and water: 1.0 10^{-3} m^3

Component	Mol%
CO_2	2.71
N_2	0.65
Methane	88.36
Ethane	3.99
Propane	1.46
i-butane	0.20
n-butane	0.39
i-pentane	0.23
n-pentane	0.22
Hexanes	0.29
Heptanes	0.20
Octanes	0.50
Nonanes	0.32
Decanes+	0.48
Total	100.00

Expansion factor E : 233 sm^3/m^3

Calculated gas gravity (air = 1.0) : 0.697

Sample no.3:

Segregated sample taken at 2526 m RKB. The 2 3/4 gallons chamber was bled off at wellsite:

Opening pressure	: 4307 kPa
Gas	: traces
Mudfiltrate and water	: 0.01 m^3

The 1 gallon chamber was not analysed since we only had traces of gas in the 2 3/4 gallon chamber.

Sample no. 4:

Segregated sample taken at 2701.7 m RKB. The 2 3/4 gallon chamber was bled off at wellsite:

Opening pressure : 18028 kPa
Gas : 1.72 m^3
Mudfiltrate with traces of water : 0.001 m^3

The 1 gallon chamber was sent onshore for analysis:

Opening pressure: 8651 kPa at 15.6 C
Gas: 0.004 m^3 at 34575 kPa
Mudfiltrate: 100 %

Component	Mol%
CO_2	2.08
N_2	0.22
Methane	93.55
Ethane	2.60
Propane	0.72
i-butane	0.14
n-butane	0.24
i-pentane	0.07
n-pentane	0.08
Hexanes	0.16
Heptanes	0.02
Octanes	0.05
Nonanes	0.03
Decanes+	0.04
Total	100.00

Expansion factor E: 228 sm^3/m^3

Calculated gas gravity: 0.612

5.3 TESTING

DST NO.1 GAS TEST

Objectives:

- Collect formation fluid samples for analysis
- Determine formation pressure and temperature
- Estimate reservoir properties and productivity
- Evaluate reservoir limits (distance to fault)

Perforation intervall: 2484 - 2493 m RKB.

The test was performed by using the following test string:

- 3.5" tubing in a 7" liner
- Downhole tester valve
- 3 pressure gauges in gauge carriers
- Tubing conveyed perforation , 12 shots/foot

TEST PERFORMANCE

The well was perforated underbalanced using diesel as cushion.

The following flow and shut-in periods were performed:

- Initial flow : 56 min.
- Initial build-up : 605 min.
- Main flow : 669 min.
- Main build-up : 992 min.
- Multi-rate flow : 167 min.
- Final build-up : 295 min.

Two of three gauges performed well, but memory capacity on both gauges was exhausted during the main build-up, due to operational problems.

During the flow periode CO_2 and H_2S content was measured in the dissolved gas. Also density and BS&W was measured in addition to samples taken for trace element analysis.

Results from main flow: CO_2 : 3 %

H_2S : 1.6 ppm

BS&W : 0 %

TEST RESULTS

Testphase	Duration min.	WHP kPa	WHT C^0	BHP kPa	BHT C^0	Cond. Flow rate m^3/d	Gas Rate sm^3/D $x10^3$	Choke mm
Init.flow	56	8670	23	23836	86.2	-	-	25.4
Init.B-U	605	8300	22	27302	84.0	-	-	-
Main flow	669	9200	32	24608	91.3	77.5	866.9	25.4
Main B-U	992	9300	-4	27292	86.5	-	-	-
Multi-	61	9100	47	-	-	83.0	885.1	25.4
rate	51	12950	25	-	-	67.5	771.6	19.1
flow	55	18450	25	-	-	47.9	503.7	12.7
Final B-U	295	14700	0	-	-	-	-	-

Gas oil ratio: Main flow 11186 sm^3/m^3

7253

Institute for energy technology

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AVAILABILITY

Private
Confidential

REPORT TYPE

REPORT NO.
IFE/KR/F-85/095

DATE
1985-07-30

REPORT TITLE

REPORT ON STABLE ISOTOPES ($\delta^{13}C$, δD, $\delta^{18}O$) ON A NATURAL GAS FROM WELL 7121/4-2

DATE OF LAST REV.

REV. NO.

CLIENT
Statoil

NUMBER OF PAGES
5

CLIENT REF.
T-6269, Avrop nr. 54

NUMBER OF ISSUES
15

SUMMARY

The gas components C_1-C_4 and CO_2 have been separated from a natural gas of well 7121/4-2, and the $\delta^{13}C$ values of these components have been measured. The isotopic composition of hydrogen which was made from the H_2O during the combustion of CH_4 have also been measured.

DISTRIBUTION

Statoil (10)
Andresen, B.
Brevik, E.M.
Råheim, A.

KEYWORDS

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	Einar M. Brevik	1985-07-30	Einar Brevik
	Arne Råheim	1985-07-30	Arne Råheim
REVIEWED BY			
APPROVED BY	Karen Garder	1985-07-30	Karen Garder

1. ANALYTICAL PROCEDURE

The natural gas has been separated into the different gas components by a Carlo-Erba 4200 instrument. This gas chromatograph is equipped with a special injection loop in order to concentrate the samples, in the case of low concentration of the gas components. The hydrocarbon gas components were oxidized in separate CuO-ovens in order to prevent cross contamination. The combustion products CO_2 and H_2O were frozen into collection vessels and separated.

The water was reduced with zinc metal in a sealed tube to prepare hydrogen for isotopic analysis. The isotopic measurements were performed on a Finnigan Mat 251 mass spectrometer. Our $\delta^{13}C$ value on NBS-22 is -29.77 $\pm$ .06 o/oo.

2. RESULTS

The composition of the sample are given in Table 1. The results have not been normalized to 100%. The rest is air. The stable isotope results are given in Table 2.

Our uncertainty on the $\delta^{13}C$ value is estimated to be $\pm$ 0.3 o/oo and includes all the different analysis step. The uncertainty on the δD value is likewise estimated to be $\pm$ 5 o/oo.

Table 1 Composition of a natural gas from well 7121/4-2

Sample	C_1	C_2	C_3	i-C_4	n-C_4	CO_2
			%			
7121/4-2 811121	92	2.7	0.8	0.09	0.12	2.52

Table 2 Isotopic composition of a natural gas from well 7121/4-2

Sample	C_1		C_2	C_3	i-C_4	n-C_4	CO_2	
	$\delta^{13}C$	δD	$\delta^{13}C$	$\delta^{13}C$	$\delta^{13}C$	$\delta^{13}C$	$\delta^{13}C$	$\delta^{18}O$
7121/4-2 811121	-40.8	-170	-28.2	-26.6	-27.9	-25.5	-11.8	-15.5

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13

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REPORT TYPE		
	REPORT NO. IFE/KR/F-86/093	DATE 1986-08-15
	REPORT TITLE REPORT ON STABLE ISOTOPES ($\delta^{13}C$, δD, $\delta^{18}O$) ON A NATURAL GAS FROM WELL 7121/4-2	DATE OF LAST REV. REV. NO.
	CLIENT Statoil	NUMBER OF PAGES 5
	CLIENT REF. T 6269 no. 76	NUMBER OF ISSUES 15

SUMMARY

The gas components C_1-C_4 and CO_2 have been separated from a natural gas of well 7121/4-2, and the $\delta^{13}C$ values of these components have been measured. The isotopic composition of hydrogen from CH_4 has also been measured.

DISTRIBUTION

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Brevik, E.M.
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	Einar M. Brevik	1986-08-18	E.M. Brevik
	Arne Råheim	1986-08-18	Arne Råheim
REVIEWED BY			
APPROVED BY	Karen Garder	1986-08-18	Karen Garder

1. INTRODUCTION

One gas sample from well 7121/4-2, DST1, was received early August 1986.

On the sample C_1-C_4 and CO_2 are quantified, and the $\delta^{13}C$ value is measured on methane, ethane, propane, the butanes and CO_2. The δD value is also measured on methane.

2. ANALYTICAL PROCEDURE

The natural gas has been quantified and separated into the different gas components by a Carlo-Erba 4200 instrument. This gas chromatograph is equipped with a special injection loop in order to concentrate the samples, in the case of low concentration of the gas components. The hydrocarbon gas components were oxidized in separate CuO-ovens in order to prevent cross contamination. The combustion products CO_2 and H_2O were frozen into collection vessels and separated.

The water was reduced with zinc metal in a sealed tube to prepare hydrogen for isotopic analysis. The isotopic measurements were performed on a Finnigan Mat 251 mass spectrometer. Our $\delta^{13}C$ value on NBS-22 is -29.77 $\pm$ .06 o/oo PDB.

3. RESULTS

The volume composition of the sample are given in Table 1. The results have been normalized to 100%. The stable isotope results are given in Table 2.

Our uncertainty on the $\delta^{13}C$ value is estimated to be $\pm$ 0.3 o/oo and includes all the different analysis step. The uncertainty on the δD value is likewise estimated to be $\pm$ 5 o/oo.

Table 1 Volume composition of a gas sample from well 7121/4-2

Sample	IFE no.	C_1 %	C_2 %	C_3 %	i-C_4 %	n-C_4 %	CO_2 %	ΣC_1-C_4	$\frac{\Sigma C_2\text{-}C_4}{\Sigma C_1\text{-}C_4}$	$\frac{\text{i-}C_4}{\text{n-}C_4}$
7121/4-2 A10915 DST 1	5223	91.1	3.9	1.6	0.2	0.5	2.9	97.3	0.06	0.48

Table 2 Isotopic composition of a gas sample from well 7121/4-2

Sample	IFE no.	C_1 $\delta^{13}C$ PDB	C_1 δD SMOW	C_2 $\delta^{13}C$ PDB	C_3 $\delta^{13}C$ PDB	i-C_4 $\delta^{13}C$ PDB	n-C_4 $\delta^{13}C$ PDB	CO_2 $\delta^{13}C$ PDB	CO_2 $\delta^{18}O$ PDB
7121/4-2 A10915 DST 1	5223	-41.0	-153	-30.9	-29.4	-27.3	-29.4	-10.4	-14.4

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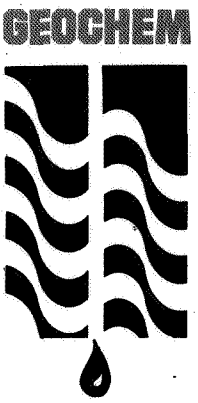
Prepared for

STATOIL

GEOCHEMICAL EVALUATION AND CORRELATION STUDY OF THE STATOIL 7121/4-2 WELL TROMS CONCESSION, OFFSHORE NORWAY



August 1985

Petroleum Geochemistry Division

INTRODUCTION

This report presents a geochemical evaluation and correlation study of the 7121/4-2 well drilled by Statoil on the Troms concession, offshore Norway.

The study was designed to evaluate the hydrocarbon potential of the section in terms of richness, maturity and potential for oil or gas. Additional tests were performed to detect and characterise shows of migrated hydrocarbons, and to detect what, if any, correlations exist between them.

This project was authorised by K. Oeygard, Statoil, Stavanger.

A. ANALYTICAL

A total of one hundred and fifty nine (159) canned cuttings samples and fourteen (14) core samples were received and assigned to the Geochem job number 1101. Seventy eight (78) samples were subsequently selected, by the client, for analysis.

No serious contamination was observed during the sample washing process.

The samples were analysed in accordance with telexed specifications (12/5/85 and 4/6/85), under project number T-6192 No. 9. A total of eighty two light hydrocarbons analyses (thirteen free of charge), one hundred and thirteen organic carbon determinations, eighty Rockeval pyrolysis analyses, thirty one vitrinite reflectance determinations, thirty one visual kerogen analyses, nineteen C_{15+} extractions with chromatography, nineteen paraffin naphthene analyses, nineteen aromatics analyses, thirty six pyrolysis-GC analyses, thirty carbon isotopes analyses and thirteen 8 ion mass fragmentograms were performed in this study.

The data are listed in tables 1 to 13 and presented graphically in figures 1 to 16.

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-001	420-435m	A 70% Shaly mudstone, subfissile, soft to mod. hard, non-calc., abundant cavings, medium light grey	N6	1.00
		B 30% Mudstone, blocky, soft, non-calc., sig. to abundant cavings, light grey LCM - cement	N7	0.86
1101-007	510-525m	A 50% Mudstone, as 1101-001B, sig. to abundant cavings	N7	0.87
		B 50% Shaly mudstone, as 1101-001A, abundant cavings Minor LCM - cement	N6	0.81,0.84
1101-013	600-615m	A 98% Mudstone, shaly in part, blocky to subfissile, soft to mod. hard, non-calc., sig. cavings, medium light grey Minor other mudstone	N6	0.90
1101-019	690-705m	A 98% Shaly mudstone, subfissile to blocky, soft to mod. hard, non-calc., sig. to abundant cavings, medium light grey Minor other mudstone	N6	0.81
1101-025	780-795m	A 98% Shaly mudstone/claystone, blocky, soft to mod. hard, non-calc., sig. to abundant cavings, medium light grey to light olive grey Minor other mudstone	N6-5Y6/1	0.67
1101-031	870-885m	A 98% Shaly mudstone, as 1101-025A, sig. to abundant cavings Minor other mudstone	N6-5Y6/1	0.63
1101-037	960-975m	A 55% Mudstone, blocky, mod. hard, non-calc., minor cavings, medium light grey	N6	0.64
		B 45% Shaly mudstone, subfissile, mod. hard, non-calc., minor to sig. cavings, medium grey	N5	0.76,0.77
1101-043	1050-065m	A 40% Shaly mudstone, subfissile, mod. hard, non-calc., minor to sig. cavings, medium grey	N5	0.35
		B 30% Mudstone, as 1101-037A, sig. cavings	N6	0.44
		C 15% Mudstone, blocky, mod. hard, non-calc., sig. cavings, light grey	N7	0.28
		D 5% Mudstone, blocky, soft to mod. hard, non-calc., sig. cavings, greyish red	5R4/2	0.19,0.20
		E 5% LCM - walnut shell		
		F 5% Shaly mudstone, subfissile, mod. hard, non-calc., dark grey to medium dark grey	N3-4	0.40
1101-049	1140-155m	A 55% Shale, platy, mod. hard, non-calc., minor cavings, medium dark grey to medium grey	N4-5	0.78

Abbreviations = **arena**ceous, **argil**laceous, **calc**areous, Cut, **dol**omitic, Fluorescence, **foram**inifera, **foss**iliferous Lost Circulation Material, **mod**erately, **occ**asionally, **sl**ightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-049	1140-155m	B 25% Mudstone, blocky, soft to mod. hard, non-calc., sig. cavings, medium grey to medium light grey	N5-6	0.44
		C 20% LCM - walnut shell		
1101-055	1230-245m	A 60% Shale, platy, mod. hard, non-calc., sig. cavings, medium dark grey to medium grey	N4-5	0.80
		B 35% Mudstone, as 1101-049B, sig. to abundant cavings	N5-6	0.55
		C 5% LCM - walnut shell Minor pyrites		
1101-061	1320-335m	A 70% Shale, platy to thinly fissile, mod. hard, minor cavings, dark grey to medium dark grey	N3-4	0.85,0.86
		B 30% Mudstone, blocky, soft to mod. hard, non-calc., sig. cavings, medium dark grey to medium grey	N4-5	0.69
		LCM - walnut shell		
1101-067	1410-425m	A 80% Shale, as 1101-061A, minor to sig. cavings	N3-4	0.69
		B 20% Mudstone, as 1101-061B, sig. cavings	N4-5	0.75
1101-073	1500-515m	A 60% Shale, fissile to platy, mod. hard, non-calc., minor cavings, medium dark grey	N4	0.82
		B 40% Shaly mudstone, subfissile to blocky, soft to mod. hard, non-calc., minor to sig. cavings, medium grey	N5	0.71,0.73
		Minor LCM		
1101-079	1590-605m	A 55% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	0.78
		B 45% Mudstone, blocky to subfissile, shaly in part, non-calc., cavings, medium dark grey to medium grey	N4-5	0.89
1101-085	1680-695m	A 60% Shale, as 1101-079A, minor to sig. cavings	N4	1.01
		B 40% Mudstone, as 1101-079B, minor cavings	N4-5	1.09
1101-091	1770-785m	A 60% Mudstone, blocky, soft to mod. hard, non-calc., minor cavings, medium grey	N5	0.95
		B 40% Shale, as 1101-079A, minor to sig. cavings	N4-5	1.02,1.03
1101-097	1860-875m	A 75% Shale, platy to thinly fissile, mod. hard, non-calc., minor cavings, dark grey to medium dark grey	N3-4	0.93
		B 25% Mudstone, blocky, soft, shaly in part, non-calc., medium grey	N5	1.03
		Minor sand		

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Lost Circulation Material, **mod**erately, **occ**asionally, **sl**ightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-098	1875-890m	A 55% Shale, platy to fissile, mod. hard, brittle, non-calc., sig. cavings, dark grey to medium dark grey	N3-4	1.11
		B 40% Mudstone, blocky, soft to mod. hard, non-calc., sl. silty, sig. cavings, medium grey	N5	0.88
		C 5% Sand, mostly unconsolidated, fine to medium grained, subangular, fairly well sorted, clear, white	N9	
1101-100	1905-920m	A 55% Shale, as 1101-098A, sig. to abundant cavings	N3-4	1.10,1.10
		B 35% Mudstone, as 1101-098B, sig. cavings	N5	0.77
		C 10% Sand, as 1101-098C	N9	
		Minor limestone and pyrites		
1101-102	1935-950m	A 70% Shale, as 1101-098A, sig. to abundant cavings	N3-4	1.07
		B 30% Mudstone, as 1101-098B, minor to sig. cavings	N5	0.97
		Minor sand and pyrites		
1101-104	1965-980m	A 60% Shale, subfissile, mod. hard, non-calc., sig. cavings, dark grey	N3	1.40
		B 40% Mudstone, blocky, shaly in part, soft to mod. hard, non-calc., sig. cavings, medium dark grey	N4	1.35
		Minor sandstone		
1101-106	1995-2010m	A 65% Shale, as 1101-104A, sig. cavings	N3	1.65,1.67
		B 35% Shaly mudstone, subfissile, soft to mod. hard, non-calc., medium dark grey to brownish grey	N4-5YR4/1	1.77
1101-108	2025-040m	A 60% Shaly mudstone, as 1101-106B, minor to sig. cavings	N4-5YR4/1	2.18
		B 40% Shale, 1101-104A, sig. cavings	N3	1.52
1101-110	2055-070m	A 65% Shaly mudstone, subfissile, soft to mod. hard, sl. silty, non-calc., minor to sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	2.38
		B 35% Shale, as 1101-104A, sig. cavings	N3	1.34,1.35
		Minor pyrites		
1101-112	2085-100m	A 55% Silty mudstone, subfissile, soft to mod. hard, non-calc., sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	2.00
		B 45% Shale, as 1101-104A, sig. cavings	N3	1.41
		Minor pyrites		
1101-114	2115-130m	A 55% Silty mudstone, as 1101-112A, sig. cavings	N4-5YR4/1	2.16
		B 45% Shale, as 1101-104A, sig. cavings	N3	2.14,2.12
		Minor sand and pyrites		
1101-116	2145-160m	A 55% Silty mudstone, as 1101-112A, sig. cavings	N4-5YR4/1	2.20
		B 45% Shale, as 1101-104A, sig. cavings	N3	1.59
		Minor pyrites		

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Lost Circulation Material, **mod**erately, **occ**asionally, *sl*ightly, *very*

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-118	2175-190m	A 60% Shale, subfissile, mod. hard, non-calc., sig. cavings, dark grey	N3	1.10
		B 40% Silty mudstone, subfissile, soft to mod. hard, non-calc., sig. to abundant cavings, medium dark grey to brownish grey	N4-5YR4/1	1.20,1.24
1101-120	2205-220m	A 70% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, dark grey to medium dark grey	N3-4	0.80
		B 30% Silty mudstone, blocky, soft, non-calc., sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	1.26
1101-122	2235-250m	A 65% Shale, subfissile, soft to mod. hard, non-calc., sl. silty, dark grey to dark brownish grey	N3-5YR3/1	4.15
		B 30% Shale, as 1101-120A, sig. to abundant cavings	N3-4	1.29
		C 5% Silty shale, as 1101-120B, abundant cavings	N4-5YR4/1	
1101-124	2265-280m	A 55% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey to dark grey grey	N4-3	1.41
		B 40% Silty shale, blocky to subfissile, soft to mod. hard, non-calc., sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	2.23,2.19
		C 5% Silty mudstone, blocky, soft to mod. hard, non-calc., greyish red Minor other shale	5R4/2	0.30
1101-126	2295-310m	A 90% Shale, as 1101-124A, sig. to abundant cavings	N4-3	1.43
		B 10% Silty mudstone, as 1101-124C, sig. cavings Minor other shale	5R4/2	0.25
1101-128	2325-340m	A 80% Shale, platy to thinly fissile, mod. hard, brittle, non-calc., sig. to abundant cavings, medium dark grey	N4	1.28
		B 20% Silty mudstone, subfissile, soft to mod. hard, non-calc., minor cavings, medium grey to medium light grey Minor other mudstone	N5-6	0.51,0.48
1101-129	2340-355m	A 55% Silty shale, subfissile, soft to mod. hard, non-calc., minor to sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	2.82
		B 40% Shale, as 1101-128A, abundant cavings	N4	1.65
		C 5% Silty mudstone, as 1101-128B, abundant cavings Minor red mudstone	N5-6	0.64

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Lost Circulation Material, **mod**erately, **occ**asionally, **sl**ightly, **v**ery

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-130	2355-370m	A 70% Silty shale, subfissile, soft to mod. hard, non-calc., minor to sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	3.49
		B 30% Shale, platy to thinly fissile, mod. hard, brittle, non-calc., abundant cavings, medium dark grey Minor mudstone	N4	1.24
1101-131	2370-385m	A 85% Silty shale, as 1101-130A, minor cavings	N4-5YR4/1	3.93,3.92
		B 15% Shale, as 1101-130B, abundant cavings Minor mudstone	N4	1.29
1101-132	2385-400m	A 85% Shale, subfissile, soft to mod. hard, non-calc., sl. silty, sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	4.47
		B 15% Shale, as 1101-130B, dominant cavings Minor mudstone	N4	1.85
1101-133	2400-415m	A 80% Shale, as 1101-132A, sig. cavings	N4-5YR4/1	4.11
		B 20% Shale, as 1101-130B, dominant cavings	N4	1.30,1.32
1101-134	2415-430m	A 95% Shaly mudstone, grading to shale, subfissile, soft to mod. hard, non-calc., minor to sig. cavings, dark grey to brownish grey	N3-5YR4/1	5.59
		B 5% Shale, as 1101-130B, dominant cavings Minor mudstone	N4	
1101-135	2430-445m	A 98% Shaly mudstone, as 1101-134A, minor to sig. cavings Minor caved shale	N3-5YR4/1	10.10
1101-136	2445-460m	A 90% Shaly mudstone, as 1101-134A, minor to sig. cavings	N3-5YR4/1	0.80
		B 10% Shale, platy to thinly fissile, mod. hard, non-calc., abundant cavings, medium dark grey	N4	1.26
1101-137	2460-475m	A 50% Silty mudstone, blocky to subfissile, soft to mod. hard, non-calc., minor to sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	1.69
		B 35% Shale, platy to subfissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	1.26,1.27
		C 15% LCM - cement Minor other mudstone and sandstone		
1101-138	2475-490m	A 40% Silty mudstone, as 1101-137A, minor cavings	N4-5YR4/1	1.77
		B 35% Shale, as 1101-137B, sig. cavings	N4	1.48
		C 15% LCM - cement		

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Lost Circulation Material, **mod**erately, **occ**asionally, **sl**ightly, **very**

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-138	2475-490m	D 10%	Sandstone, mostly unconsolidated, fine grained, angular to sub-angular, fairly well sorted, non-calc. matrix, minor other mudstone, v. pale milky cut, pinkish grey	5YR8/1	
1101-160 CORE	2486.83-2486.88m	A 98%	Sandstone, blocky, medium grained, sub-angular, well sorted, non-calc. matrix, pinkish grey	5YR8/1	
1101-139	2490-505m	A 35%	Shale, platy to subfissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	1.09
		B 30%	Silty mudstone, blocky to subfissile, soft to mod. hard, non-calc., sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	1.75
		C 20%	LCM - cement		
		D 15%	Sandstone, as 1101-138D, v. pale milky cut	5YR8/1	
1101-161 CORE	2505.82-2505.87m	A 98%	Sandstone, blocky, fine to medium grained, sub-rounded to sub-angular, well sorted, non-calc. matrix, muddy laminations, pinkish grey	5YR8/1	
1101-140	2505-520m	A 40%	Shale, as 1101-139A, sig. cavings	N4	1.13,1.14
		B 40%	Silty mudstone, as 1101-139B, sig. cavings	N4-5YR4/1	1.37
		C 15%	Sandstone, as 1101-138D, v. pale milky cut	5YR8/1	
		D 5%	LCM - cement		
1101-162 CORE	2511.30-2511.35m	A 98%	Sandstone, blocky, fine to medium grained, sub-angular, well sorted, non-calc. matrix, pinkish grey	5YR8/1	
1101-163 CORE	2513.74-2513.79m	A 98%	Sandstone, blocky, medium grained, sub-angular, well sorted, non-calc. matrix, dull creamy F., milky cut, pinkish grey	5YR8/1	
1101-164 CORE	2515.70-2515.75m	A 98%	Sandstone, blocky, medium grained, sub-angular, well sorted, non-calc. matrix, creamy F, milky cut, dark yellowish brown	10YR4/2	
1101-165 CORE	2518.94-2518.99m	A 98%	Sandstone, blocky, fine grained, sub-angular, well sorted, non-calc. matrix, pale milky cut, v. light brownish grey to pinkish grey	5YR7/1-5YR8/1	
1101-166 CORE	2523.95-2524.00m	A 98%	Sandstone, blocky, fine to medium grained, sub-angular, well sorted, non-calc. matrix, pale milky cut, v. light bronwish grey to pinkish grey	5YR7/1-5YR8/1	

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Lost Circulation Material, **mod**erately, **occ**asionally, **sl**ightly, **v**ery

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-141	2520-535m	A 35% Shale, platy to subfissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	1.22
		B 30% Silty mudstone, blocky to subfissile, soft to mod. hard, non-calc., sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	2.09
		C 10% LCM - cement		
		D 15% Sandstone, mostly unconsolidated, fine grained, angular to sub-angular, fairly well sorted, non-calc. matrix, minor other mudstone, v. pale milky cut, pinkish grey	5YR8/1	
1101-167 CORE	2529.92-2529.97m	A 98% Sandstone, blocky, fine to medium grained, sub-angular, well sorted, non-calc. matrix, v. pale milky cut, light grey to v. light brownish grey	N7-5YR7/1	
1101-142	2535-550m	A 40% Shale, as 1101-141A, sig. cavings	N4	1.00
		B 35% Silty mudstone, as 1101-141B, sig. cavings	N4-5YR4/1	1.31
		C 20% Sand, unconsolidated, fine to medium grained, sub-angular, fairly well sorted, clear, v. pale milky cut, white	N9	
		D 5% LCM - cement and metal		
1101-168 CORE	2541.45-2541.50m	A 98% Sandstone, blocky, medium grained, sub-angular, well sorted, non-calc. matrix, yellow F., milky cut, v. light olive grey to dusky yellow	5Y6/2-5Y6/4	
1101-169 CORE	2545.69-2545.74m	A 98% Sandstone, blocky, fine to medium grained, sub-angular, well sorted, non-calc. matrix, pale yellow F., milky cut, v. light brownish grey to pinkish grey	5YR7/1-5YR8/1	
1101-170 CORE	2551.90-2551.95m	A 98% Sandstone, blocky, medium grained, sub-angular, well sorted, non-calc. matrix, dull yellow F., milky cut, v. pale yellowish brown	10YR7/2	
1101-143	2550-565m	A 40% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	1.08,1.12
		B 35% Sandstone, unconsolidated in part, fine grained, sub-angular, well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	
		C 15% LCM - cement		
		D 15% Silty mudstone, blocky, soft, non-calc., sig. cavings, medium dark grey to brownish grey	N4-5YR4/1	1.23

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ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-171 CORE	2566.23-2566.28m	A 98% Sandstone, blocky, fine to medium grained, sub-angular, well sorted, non-calc. matrix, sl. micaceous, v. light brownish grey	5YR7/1	
1101-144	2565-580m	A 60% Sandstone, unconsolidated in part, fine grained, sub-angular, well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	
		B 25% Shale, platy to thinly fissile, mod. hard, non-calc., sig. cavings, medium dark grey	N4	1.15
		C 15% LCM - metal and cement Minor mudstone		
1101-172 CORE	2585.45-2585.50m	A 98% Sandstone, blocky, fine to medium grained, sub-angular, well sorted, non-calc. matrix, sl. micaceous, v. light brownish grey to pinkish grey	5YR7/1-5YR8/1	
1101-145	2580-595m	A 45% Shale, platy to thinly fissile, mod. hard, non-calc., minor cavings, medium dark grey to dark grey	N4-3	1.23
		B 35% Sandstone, as 1101-144A, v. pale milky cut	5YR8/1	
		C 10% Silty mudstone, blocky, soft, non-calc., brownish grey	5YR4/1	1.20
		D 10% LCM - cement and metal		
1101-173 CORE	2596.45-2596.50m	A 98% Sandstone, blocky, fine grained, sub-angular, well sorted, non-calc. matrix, v. light brownish grey to pinkish grey	5YR7/1-5YR8/1	
1101-146	2595-610m	A 80% Sandstone, blocky, fine grained, well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	
		B 10% Shale, as 1101-145A, sig. cavings	N4-3	1.36,1.40
		C 10% Silty mudstone, as 1101-145C, sig. cavings	5YR4/1	1.46
		Minor LCM		
1101-147	2610-625m	A 95% Sandstone, as 1101-146A, v. pale milky cut	5YR8/1	
		B 5% Shale, as 1101-145A, sig. cavings	N4-3	1.45
1101-148	2625-640m	A 98% Sandstone, as 1101-146A, v. pale milky cut Minor caved shales	5YR8/1	
1101-149	2640-655m	A 98% Sandstone, as 1101-146A, v. pale milky cut Minor caved shale	5YR8/1	
1101-150	2655-670m	A 98% Sandstone, as 1101-146A, v. pale milky cut Minor caved shale	5YR8/1	

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Lost Circulation Material, **mod**erately, **occ**asionally, **sl**ightly, very

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ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1101-151	2670-685m	A 65% Shaly mudstone/shale, platy to blocky, soft to mod. hard, non-calc., sl. silty, minor cavings, dark brownish grey	5YR3/1	1.27
		B 35% Sandstone, blocky, fine grained, well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	
1101-152	2685-700m	A 90% Sandstone, blocky, fine grained, sub-angular, fairly well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	
		B 10% Shaly mudstone, as 1101-151A, sig. cavings	5YR3/1	2.39
1101-153	2700-715m	A 85% Sandstone, as 1101-152A, v. pale milky cut	5YR8/1	
		B 15% Shaly mudstone, as 1101-151A, sig. cavings	5YR3/1	1.82,1.78
1101-154	2715-730m	A 75% Sandstone, as 1101-152A, v. pale milky cut	5YR8/1	
		B 15% Silty mudstone, as 1101-151A, sig. cavings	5YR3/1	3.00
		C 10% Shale, platy, soft to mod. hard, non-calc., sig. cavings, dark grey	N3	21.30
1101-155	2730-745m	A 80% Sandstone, as 1101-152A, v. pale milky cut	5YR8/1	
		B 15% Silty mudstone, as 1101-151A, sig. cavings	5YR3/1	1.45
		C 5% Shale, as 1101-154C, sig. cavings	N3	10.00
1101-156	2745-760m	A 50% Sandstone, as 1101-152A, v. pale milky cut	5YR8/1	
		B 25% Shale, platy, mod. hard, non-calc., sl. silty, sig. cavings, medium dark grey to dark grey	N4-3	0.72
		C 25% Siltstone, blocky, soft to mod. hard, dolomitic?, light grey Minor other shale	N7	0.36,0.35
1101-157	2760-775m	A 90% Sandstone, as 1101-152A, minor cavings	5YR8/1	
		B 10% Shale, as 1101-156B, abundant cavings Minor siltstone and other shale	N4-3	1.10
1101-158	2775-790m	A 90% Sandstone, as 1101-152A, sig. cavings	5YR8/1	
		B 10% Shale, as 1101-156B, sig. to abundant cavings Minor siltstone	N4-3	2.43
1101-159	2790-800'	A 90% Sandstone, as 1101-152A, sig. cavings	5YR8/1	
		B 10% Shale, as 1101-156B, sig. to abundant cavings	N4-3	1.80

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TABLE 2A

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-001	420-435	3554	12	1	1	2	3571	16	0.4	12	0.82
1101-003	450-465	3435	9	2	0	0	3447	11	0.3	17	0.00
1101-005	480-495	4943	28	22	22	6	5021	78	1.5	23	3.98
1101-007	510-525	4154	447	150	69	33	4852	699	14.4	93	2.06
1101-009	540-555	3927	454	289	83	77	4830	903	18.7	94	1.08
1101-011	570-585	2890	761	367	98	64	4180	1290	30.9	79	1.54
1101-013	600-615	4829	626	312	78	66	5912	1083	18.3	86	1.17
1101-015	630-645	4431	502	356	100	110	5498	1068	19.4	127	0.90
1101-017	660-675	11487	632	363	85	75	12641	1154	9.1	98	1.12
1101-019	690-705	16345	938	643	185	179	18289	1944	10.6	280	1.04
1101-021	720-735	9554	241	202	68	62	10127	573	5.7	56	1.10
1101-023	750-765	13361	490	338	97	91	14377	1016	7.1	164	1.06
1101-025	780-795	5340	462	326	90	98	6316	976	15.5	168	0.91
1101-027	810-825	3717	303	232	61	55	4368	651	14.9	118	1.11
1101-029	840-855	5134	227	180	41	38	5620	486	8.6	107	1.07
1101-031	870-885	5493	230	174	38	36	5972	479	8.0	112	1.04
1101-033	900-915	4766	281	224	68	56	5394	629	11.7	130	1.22
1101-035	930-945	1184	27	54	28	25	1318	134	10.2	86	1.13
1101-037	960-975	502	8	20	12	10	551	49	8.8	47	1.21
1101-039	990-1005	4505	66	150	79	80	4880	375	7.7	296	1.00
1101-041	1020-1035	3676	83	75	33	30	3897	221	5.7	106	1.12
1101-043	1050-1065	6387	137	116	51	44	6735	348	5.2	179	1.16
1101-045	1080-1095	2586	104	68	24	21	2804	218	7.8	48	1.18
1101-047	1110-1125	943	37	22	9	6	1017	74	7.3	11	1.45
1101-049	1140-1155	463	8	10	5	3	489	26	5.4	9	1.82
1101-051	1170-1185	685	27	16	6	2	735	51	6.9	3	2.42
1101-053	1200-1215	1505	56	27	11	5	1604	99	6.2	7	2.45
1101-055	1230-1245	1157	35	17	8	3	1220	63	5.2	5	2.77
1101-057	1260-1275	1128	29	11	5	2	1175	47	4.0	4	2.54
1101-059	1290-1305	1545	29	13	6	2	1594	50	3.1	4	2.61

TABLE 2A

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-061	1320-1335	1046	17	7	3	2	1075	29	2.7	4	1.81
1101-063	1350-1365	1281	44	21	8	3	1357	76	5.6	5	2.44
1101-067	1410-1425	951	45	16	2	2	1015	65	6.4	2	0.79
1101-073	1500-1515	283	10	6	2	1	303	20	6.5	4	2.05
1101-079	1590-1605	77	3	2	1	0	83	6	7.2	2	3.86
1101-085	1680-1695	76	5	4	2	1	89	12	13.9	3	2.87
1101-091	1770-1785	969	332	56	10	5	1372	403	29.4	5	1.90
1101-097	1860-1875	1167	319	81	3	4	1574	407	25.9	1	0.76
1101-098	1875-1890	1693	515	240	29	53	2530	837	33.1	46	0.56
1101-100	1905-1920	1323	337	183	28	53	1924	601	31.2	22	0.52
1101-102	1935-1950	1879	483	293	61	81	2797	918	32.8	57	0.76
1101-104	1965-1980	1157	500	255	38	37	1987	830	41.8	21	1.03
1101-106	1995-2010	2469	1072	736	120	101	4498	2030	45.1	48	1.18
1101-108	2025-2040	3851	1584	1032	158	130	6755	2904	43.0	63	1.22
1101-110	2055-2070	2457	964	771	121	109	4422	1965	44.4	55	1.11
1101-112	2085-2100	1343	561	425	64	53	2444	1102	45.1	30	1.21
1101-114	2115-2130	1979	806	593	87	83	3547	1568	44.2	60	1.05
1101-116	2145-2160	2228	937	690	101	84	4040	1812	44.9	94	1.20
1101-118	2175-2190	1467	610	281	33	25	2416	949	39.3	39	1.34
1101-120	2205-2220	2219	962	270	33	26	3511	1291	36.8	68	1.27
1101-122	2235-2250	1285	518	145	15	11	1975	690	34.9	25	1.37
1101-124	2265-2280	1371	580	165	20	17	2153	782	36.3	60	1.12
1101-126	2295-2310	1560	630	249	29	32	2501	941	37.6	37	0.90
1101-128	2325-2340	1983	941	972	180	611	4687	2704	57.7	560	0.30
1101-129	2340-2355	2725	1524	1654	692	1876	8472	5746	67.8	1643	0.37
1101-130	2355-2370	1253	743	832	600	1028	4457	3204	71.9	1659	0.58
1101-131	2370-2385	2220	1462	1612	1192	1980	8467	6248	73.8	3227	0.60
1101-132	2385-2400	3352	2076	2381	1755	2926	12490	9138	73.2	5125	0.60
1101-133	2400-2415	4041	2715	3351	1270	1324	12702	8661	68.2	9281	0.96
1101-134	2415-2430	2179	1653	2253	801	182	7068	4889	69.2	2882	4.41

TABLE 2A

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-135	2430-2445	3755	2355	2450	228	228	9015	5260	58.3	3902	1.00
1101-136	2445-2460	2108	1703	2099	444	1291	7644	5536	72.4	785	0.34
1101-137	2460-2475	838	1139	1595	627	1798	5998	5159	86.0	1573	0.35
1101-138	2475-2490	1847	1108	1312	432	1132	5831	3985	68.3	1298	0.38
1101-139	2490-2505	1374	869	1089	214	625	4171	2797	67.1	957	0.34
1101-140	2505-2520	1420	766	1078	122	397	3782	2362	62.4	459	0.31
1101-141	2520-2535	1646	902	1328	159	504	4539	2893	63.7	376	0.32
1101-142	2535-2550	1559	896	989	103	288	3835	2276	59.4	218	0.36
1101-143	2550-2565	1275	759	942	166	457	3598	2323	64.6	440	0.36
1101-144	2565-2580	3057	1545	2004	296	804	7705	4648	60.3	896	0.37
1101-145	2580-2595	4697	2787	3203	377	1033	12097	7400	61.2	906	0.36
1101-146	2595-2610	2656	1360	1256	197	570	6040	3383	56.0	671	0.35
1101-147	2610-2625	1411	335	298	70	145	2259	848	37.5	349	0.48
1101-148	2625-2640	926	220	196	46	95	1482	556	37.5	227	0.48
1101-149	2640-2655	2263	1041	586	74	215	4179	1916	45.9	280	0.34
1101-150	2655-2670	1238	559	550	63	167	2578	1339	52.0	209	0.38
1101-151	2670-2685	1011	533	561	98	231	2435	1424	58.5	172	0.43
1101-152	2685-2700	2167	709	429	62	157	3525	1357	38.5	185	0.39
1101-153	2700-2715	2335	1077	756	150	246	4564	2229	48.8	281	0.61
1101-154	2715-2730	4828	1846	899	199	352	8125	3297	40.6	422	0.57
1101-155	2730-2745	2067	478	339	44	152	3079	1012	32.9	102	0.29
1101-156	2745-2760	1067	401	300	32	103	1902	836	43.9	67	0.31
1101-157	2760-2775	330	156	140	25	41	692	362	52.3	52	0.62
1101-158	2775-2790	2017	933	758	111	197	4017	2000	49.8	247	0.56
1101-159	2790-2800	17	3	2	0	2	25	8	31.6	6	0.23

TABLE 2B

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-001	420-435	3953	9	3	6	1	3972	18	0.5	25	6.01
1101-003	450-465	6085	12	3	0	0	6100	15	0.2	146	3.00
1101-005	480-495	8194	109	82	102	51	8538	344	4.0	326	2.01
1101-007	510-525	7500	204	137	74	68	7983	483	6.1	358	1.09
1101-009	540-555	9190	394	395	146	222	10346	1157	11.2	430	0.66
1101-011	570-585	9593	549	420	135	180	10878	1285	11.8	396	0.75
1101-013	600-615	7728	289	284	91	130	8521	793	9.3	318	0.70
1101-015	630-645	5743	222	326	129	226	6646	903	13.6	418	0.57
1101-017	660-675	3170	137	222	93	151	3772	602	16.0	93	0.62
1101-019	690-705	1263	57	102	45	82	1549	286	18.5	248	0.55
1101-021	720-735	1207	55	97	51	90	1499	292	19.5	336	0.57
1101-023	750-765	1258	55	119	66	109	1607	349	21.7	481	0.60
1101-025	780-795	3868	93	121	44	90	4216	348	8.3	408	0.49
1101-027	810-825	3530	76	107	35	59	3808	277	7.3	402	0.59
1101-029	840-855	3130	72	97	30	57	3386	256	7.6	377	0.53
1101-031	870-885	3026	691	85	31	52	3885	859	22.1	357	0.60
1101-033	900-915	4273	74	124	52	78	4600	327	7.1	367	0.66
1101-035	930-945	554	16	41	23	41	675	121	17.9	440	0.56
1101-037	960-975	1115	34	111	76	114	1450	335	23.1	1238	0.67
1101-039	990-1005	596	13	39	26	48	723	127	17.5	533	0.54
1101-041	1020-1035	1864	17	19	8	13	1921	57	3.0	211	0.61
1101-043	1050-1065	142	8	7	4	6	167	25	15.1	196	0.67
1101-045	1080-1095	4356	35	24	9	12	4436	80	1.8	63	0.76
1101-047	1110-1125	1092	15	11	5	7	1130	38	3.3	47	0.78
1101-049	1140-1155	782	28	43	23	20	897	115	12.8	44	1.14
1101-051	1170-1185	857	27	31	14	90	1019	162	15.9	59	0.16
1101-053	1200-1215	689	26	23	13	11	761	72	9.5	44	1.15
1101-055	1230-1245	796	22	19	11	9	858	62	7.2	20	1.30
1101-057	1260-1275	563	28	26	23	15	655	92	14.1	70	1.57
1101-059	1290-1305	424	21	22	16	12	496	71	14.3	41	1.32

TABLE 2B

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-061	1320-1335	435	20	19	14	11	498	63	12.7	58	1.18
1101-063	1350-1365	243	20	19	11	11	304	61	20.0	34	1.01
1101-067	1410-1425	231	17	16	10	7	281	49	17.6	29	1.29
1101-073	1500-1515	52	7	7	4	3	73	21	28.5	18	1.22
1101-079	1590-1605	119	18	25	22	17	202	83	40.9	40	1.33
1101-085	1680-1695	157	29	55	34	22	297	140	47.0	27	1.55
1101-091	1770-1785	533	289	140	34	37	1033	500	48.4	45	0.91
1101-097	1860-1875	215	159	125	3	15	515	301	58.3	19	0.21
1101-098	1875-1890	491	305	419	61	222	1498	1006	67.2	311	0.28
1101-100	1905-1920	156	82	102	16	91	448	291	65.1	112	0.18
1101-102	1935-1950	540	210	297	80	183	1309	769	58.7	274	0.44
1101-104	1965-1980	827	687	845	139	212	2710	1883	69.5	143	0.65
1101-106	1995-2010	3335	2645	3530	672	854	11037	7702	69.8	528	0.79
1101-108	2025-2040	3188	2500	3791	673	735	10887	7698	70.7	540	0.91
1101-110	2055-2070	1562	1177	2659	575	810	6784	5222	77.0	512	0.71
1101-112	2085-2100	3456	1634	1669	262	415	7435	3979	53.5	362	0.63
1101-114	2115-2130	4416	2267	2686	475	701	10545	6129	58.1	672	0.68
1101-116	2145-2160	5315	1746	1734	281	474	9549	4234	44.3	945	0.59
1101-118	2175-2190	1283	1271	1283	192	323	4353	3069	70.5	466	0.60
1101-120	2205-2220	1811	1697	1484	260	417	5668	3858	68.1	574	0.62
1101-122	2235-2250	6748	4106	603	70	100	11628	4880	42.0	191	0.70
1101-124	2265-2280	5150	1778	566	69	101	7664	2514	32.8	241	0.68
1101-126	2295-2310	6753	2436	1015	130	191	10525	3772	35.8	349	0.68
1101-128	2325-2340	3002	2136	1651	184	743	7717	4715	61.1	1840	0.25
1101-129	2340-2355	3371	4176	6522	1480	8106	23655	20284	85.7	8904	0.18
1101-130	2355-2370	4927	5508	7771	3025	10640	31871	26944	84.5	14390	0.28
1101-131	2370-2385	6229	6226	9004	6525	13117	41101	34872	84.8	26586	0.50
1101-132	2385-2400	4909	6056	9215	7215	13080	40476	35567	87.9	26506	0.55
1101-133	2400-2415	1936	5266	8534	6394	12681	34812	32875	94.4	27058	0.50
1101-134	2415-2430	4048	5868	9366	7916	13843	41041	36993	90.1	38073	0.57

TABLE 2B

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-135	2430-2445	5803	7230	10342	11001	11153	45530	39726	87.3	34806	0.99
1101-136	2445-2460	5487	8039	11037	11278	11426	47267	41780	88.4	25997	0.99
1101-137	2460-2475	1164	1540	5947	2504	9373	20527	19363	94.3	23855	0.27
1101-138	2475-2490	2562	1748	5724	1823	7867	19724	17162	87.0	15872	0.23
1101-139	2490-2505	3428	2320	5568	1919	7191	20426	16997	83.2	23755	0.27
1101-140	2505-2520	3092	1350	4278	852	2792	12363	9271	75.0	2870	0.31
1101-141	2520-2535	1190	340	897	224	837	3488	2298	65.9	2253	0.27
1101-142	2535-2550	917	770	3615	958	3799	10059	9142	90.9	9924	0.25
1101-143	2550-2565	1700	940	2940	902	3387	9870	8170	82.8	7844	0.27
1101-144	2565-2580	1554	1204	4105	778	2444	10086	8531	84.6	2203	0.32
1101-145	2580-2595	2834	2561	5544	1094	4029	16062	13228	82.4	3612	0.27
1101-146	2595-2610	5231	2363	4807	1087	3949	17436	12205	70.0	6691	0.28
1101-147	2610-2625	3893	1407	2553	672	2059	10584	6691	63.2	5866	0.33
1101-148	2625-2640	2217	563	867	286	861	4795	2577	53.8	4250	0.33
1101-149	2640-2655	5120	1909	1351	213	738	9330	4210	45.1	2484	0.29
1101-150	2655-2670	919	411	735	130	469	2665	1746	65.5	1387	0.28
1101-151	2670-2685	1006	494	2860	770	3107	8237	7231	87.8	3844	0.25
1101-152	2685-2700	3802	1809	1996	417	1385	9408	5607	59.6	3269	0.30
1101-153	2700-2715	3553	821	905	188	711	6178	2626	42.5	2259	0.26
1101-154	2715-2730	7512	4624	3915	819	1899	18768	11256	60.0	1959	0.43
1101-155	2730-2745	2926	1548	2528	498	1747	9248	6322	68.4	2424	0.29
1101-156	2745-2760	582	343	491	95	298	1809	1227	67.8	1512	0.32
1101-157	2760-2775	2248	1237	1137	131	483	5237	2989	57.1	2437	0.27
1101-158	2775-2790	878	374	175	14	36	1477	599	40.5	1724	0.38
1101-159	2790-2800	431	254	370	40	191	1286	855	66.5	816	0.21

TABLE 2 C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-001	420-435	7508	20	4	7	3	7542	34	0.5	37	2.65
1101-003	450-465	9520	21	5	0	0	9547	26	0.3	164	3.00
1101-005	480-495	13137	137	105	124	56	13559	422	3.1	350	2.20
1101-007	510-525	11653	651	287	143	101	12835	1182	9.2	451	1.41
1101-009	540-555	13116	848	685	228	298	15176	2059	13.6	525	0.76
1101-011	570-585	12483	1310	787	233	244	15058	2575	17.1	475	0.96
1101-013	600-615	12557	915	596	168	196	14433	1876	13.0	404	0.86
1101-015	630-645	10173	723	683	228	337	12144	1971	16.2	545	0.68
1101-017	660-675	14658	769	584	177	226	16414	1756	10.7	191	0.79
1101-019	690-705	17608	995	744	230	260	19838	2230	11.2	529	0.89
1101-021	720-735	10761	296	299	119	152	11627	866	7.4	391	0.78
1101-023	750-765	14619	545	457	162	200	15983	1365	8.5	645	0.81
1101-025	780-795	9208	556	447	134	188	10532	1325	12.6	577	0.71
1101-027	810-825	7248	379	339	96	114	8176	928	11.4	520	0.84
1101-029	840-855	8265	299	277	71	95	9006	741	8.2	484	0.75
1101-031	870-885	8519	921	259	69	88	9856	1338	13.6	470	0.78
1101-033	900-915	9039	355	348	120	133	9994	956	9.6	497	0.90
1101-035	930-945	1738	42	96	51	66	1992	255	12.8	525	0.77
1101-037	960-975	1617	42	131	88	124	2001	384	19.2	1285	0.71
1101-039	990-1005	5101	80	189	105	128	5603	502	9.0	829	0.82
1101-041	1020-1035	5540	100	95	41	42	5818	278	4.8	317	0.96
1101-043	1050-1065	6529	145	123	55	50	6902	373	5.4	375	1.10
1101-045	1080-1095	6942	139	92	34	33	7240	297	4.1	111	1.03
1101-047	1110-1125	2036	53	33	14	13	2147	112	5.2	57	1.10
1101-049	1140-1155	1245	37	52	29	23	1387	141	10.2	54	1.23
1101-051	1170-1185	1542	54	47	20	92	1755	213	12.1	62	0.22
1101-053	1200-1215	2194	81	50	24	16	2365	171	7.2	50	1.54
1101-055	1230-1245	1953	58	36	19	12	2078	124	6.0	26	1.66
1101-057	1260-1275	1691	56	38	28	17	1830	139	7.6	74	1.69
1101-059	1290-1305	1969	49	35	22	14	2090	121	5.8	45	1.52

TABLE 2 C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-061	1320-1335	1480	36	26	17	13	1572	92	5.9	62	1.27
1101-063	1350-1365	1525	63	40	19	14	1661	136	8.2	38	1.33
1101-067	1410-1425	1182	61	32	11	10	1296	114	8.8	31	1.17
1101-073	1500-1515	335	17	13	6	4	375	40	10.8	22	1.44
1101-079	1590-1605	196	21	27	23	17	284	89	31.1	41	1.37
1101-085	1680-1695	234	34	59	36	23	386	152	39.4	30	1.60
1101-091	1770-1785	1503	621	196	44	42	2405	903	37.5	49	1.03
1101-097	1860-1875	1382	477	206	6	19	2090	708	33.9	20	0.33
1101-098	1875-1890	2184	819	659	91	274	4028	1843	45.8	356	0.33
1101-100	1905-1920	1479	419	285	44	144	2371	892	37.6	134	0.30
1101-102	1935-1950	2419	692	590	141	264	4106	1688	41.1	331	0.54
1101-104	1965-1980	1984	1188	1100	177	249	4697	2713	57.8	164	0.71
1101-106	1995-2010	5804	3718	4267	791	955	15535	9731	62.6	576	0.83
1101-108	2025-2040	7039	4083	4823	830	865	17641	10602	60.1	603	0.96
1101-110	2055-2070	4019	2141	3430	696	920	11206	7187	64.1	567	0.76
1101-112	2085-2100	4798	2195	2094	325	467	9879	5081	51.4	392	0.70
1101-114	2115-2130	6395	3073	3279	562	784	14092	7698	54.6	732	0.72
1101-116	2145-2160	7543	2683	2423	383	558	13589	6046	44.5	1039	0.69
1101-118	2175-2190	2750	1881	1564	226	347	6768	4018	59.4	505	0.65
1101-120	2205-2220	4030	2660	1754	292	443	9179	5149	56.1	641	0.66
1101-122	2235-2250	8033	4624	749	85	111	13603	5570	40.9	216	0.77
1101-124	2265-2280	6521	2358	731	88	118	9817	3296	33.6	302	0.75
1101-126	2295-2310	8313	3066	1264	159	223	13026	4713	36.2	386	0.71
1101-128	2325-2340	4985	3077	2623	365	1354	12404	7419	59.8	2400	0.27
1101-129	2340-2355	6096	5700	8176	2173	9982	32127	26031	81.0	10547	0.22
1101-130	2355-2370	6180	6251	8603	3625	11669	36328	30148	83.0	16050	0.31
1101-131	2370-2385	8449	7689	10616	7717	15097	49568	41119	83.0	29813	0.51
1101-132	2385-2400	8261	8132	11596	8970	16006	52966	44705	84.4	31631	0.56
1101-133	2400-2415	5978	7981	11886	7664	14005	47514	41536	87.4	36340	0.55
1101-134	2415-2430	6227	7521	11619	8717	14025	48109	41882	87.1	40955	0.62

TABLE 2 C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
1101-135	2430-2445	9559	9585	12792	11228	11381	54545	44986	82.5	38708	0.99
1101-136	2445-2460	7595	9742	13136	11722	12716	54911	47316	86.2	26782	0.92
1101-137	2460-2475	2002	2679	7541	3130	11172	26525	24523	92.5	25428	0.28
1101-138	2475-2490	4408	2856	7037	2255	8999	25555	21147	82.7	17169	0.25
1101-139	2490-2505	4802	3188	6656	2134	7816	24596	19794	80.5	24712	0.27
1101-140	2505-2520	4512	2116	5356	974	3188	16146	11633	72.1	3329	0.31
1101-141	2520-2535	2836	1241	2225	383	1342	8028	5192	64.7	2629	0.29
1101-142	2535-2550	2476	1667	4604	1060	4087	13894	11418	82.2	10142	0.26
1101-143	2550-2565	2974	1699	3882	1068	3844	13467	10493	77.9	8284	0.28
1101-144	2565-2580	4612	2749	6108	1074	3248	17791	13179	74.1	3100	0.33
1101-145	2580-2595	7531	5347	8747	1471	5062	28159	20627	73.3	4518	0.29
1101-146	2595-2610	7887	3723	6063	1284	4519	23476	15588	66.4	7362	0.28
1101-147	2610-2625	5304	1742	2851	742	2204	12843	7539	58.7	6214	0.34
1101-148	2625-2640	3143	783	1063	332	956	6277	3134	49.9	4477	0.35
1101-149	2640-2655	7383	2950	1937	287	953	13509	6126	45.3	2764	0.30
1101-150	2655-2670	2158	970	1285	194	636	5243	3085	58.8	1596	0.30
1101-151	2670-2685	2017	1028	3421	868	3338	10672	8655	81.1	4017	0.26
1101-152	2685-2700	5969	2518	2425	479	1542	12933	6964	53.8	3455	0.31
1101-153	2700-2715	5887	1898	1661	338	957	10742	4855	45.2	2540	0.35
1101-154	2715-2730	12340	6470	4814	1018	2251	26893	14553	54.1	2381	0.45
1101-155	2730-2745	4994	2026	2867	542	1899	12327	7334	59.5	2526	0.29
1101-156	2745-2760	1648	743	791	127	401	3711	2063	55.6	1579	0.32
1101-157	2760-2775	2578	1393	1278	156	523	5929	3351	56.5	2489	0.30
1101-158	2775-2790	2895	1308	933	125	233	5494	2598	47.3	1972	0.53
1101-159	2790-2800	448	257	372	41	193	1311	863	65.9	822	0.21

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES 40%; 10-40%; 10%	REMARKS	RE-WORKED (%)	PARTICLE SIZE	PRESERV-ATION	INDEX	1 – 10 SCALE
1101-001A	420-435m	W;I-Al-H;Am		50	F-M	F	1+	
1101-007B	510-525m	W;I-Al-H;Am	H at 2- and 2	70	F-M	F	1+/1+ to 2-	
1101-013A	600-615m	W;I-H-Al;Am		65	F-M	F	1+	
1101-019A	690-705m	W;I-Al-H-Am;-	H at 2- through 2	65	F-M	F	1+/1+ to 2-	
1101-025A	780-795m	W;I-H-Al;Am	significant marginally mature H	60	F-M/C	F	1+	
1101-031A	870-885m	W;I-H-Al;Am	H at 2- through 2	70	F-M	F	1+ to 2-(max)	
1101-037B	960-975m	W-I;H;Al-Am	H at 2- through 2	75	F-M/C	F	1+ to 2-	
1101-043A	1050-1065m	W-I;H;Al-Am	H at 2- to 2	70	F-C	F	1+ to 2-	
1101-049A	1140-1155m	-;I-W-Al-H;Am	contamination. H at 2-	60	M-C	F	1+/1+ to 2-	
1101-055A	1230-1245m	I-W;-;H-Al-Am		75	F-C	F-G	1+	
1101-061A	1320-1335m	I-W;-;H-Al-Am	H at 2- through 2 to 2+	80	M	G	1+	
1101-067A	1410-1425m	I-W;-;Am-H-Al	H at 2- to 2	75	F-C	F-G	1+	
1101-073A	1500-1515m	I-W;Al;H-Am	H at 2- through 2	80	M-C	F-G	1+	
1101-079A	1590-1605m	I-W;-;Al-H-Am		80	F-C	F-G	1+ to 2-	
1101-085A	1680-1695m	W-I;H;Al-Am	H at 2- and 2	80	M	F	1+ to 2-	
1101-091A	1770-1785m	W-I;-;H-Al	material at 2- and 2	75	F-C	F	1+ to 2-	
1101-098A	1875-1890m	W-I;-;H-Al	minor material at 1+ to 2-. H at 2	90	M	F-G	2-(?)	
1101-104A	1965-1980m	W-I;-;H-Al-Am	H at 2	85	M	F	2-(?)	
1101-108A	2025-2040m	W;I-H-Am;Al	good H at 2	50	F-M/C	F	2-	
1101-112A	2085-2100m	W;I-H;Am-Al		60	F-C	F	2-	
1101-116A	2145-2160m	W:I-H:Am-Al	good at H at 2	60	F-C	F-G	2- to 2	

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

postscript = coarse, cuticle, cysts, degraded, fine, other,. structured, spore-pollen, thick-walled, unstructured

Dominant, Major, Significant, Minor

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES 40%; 10-40%; 10%	REMARKS	RE-WORKED (%)	PARTICLE SIZE	PRESERV-ATION	INDEX	1 – 10 SCALE
1101-122A	2235-2250m	Am;W;I-Al-H	material at 2	10	M-C	G	2- to 2(?)	
1101-126A	2295-2310m	W-I;H;Am-Al	H variable between 2- to 2 and 2 to 2+	60	M-C	F-G	2(?)	
1101-132A	2385-2400m	Am**;Al*-W;H-I	**includes incompletely developed material *includes material passing to amorphous	10	M-C	G	2- to 2/2	
1101-135A	2430-2445m	Am**;Al*-W;I-H	differentiation difficult ** * as 132A		F-C	F	---	
1101-138A	2475-2490m	-;W-Am-I-H-Al;-	differentiation difficult. H at 2- to 2	40	M-C	F-G	2	
1101-142A	2535-2550m	Am**;W-Al*-I-H;-	** * as 132A material at 2- to 2	35	F-C	F	2(?)	
1101-145A	2580-2595m	Am;W-Al-H;I	differentiation difficult	30	M-C	F-G	2(?)	
1101-151A	2670-2685m	W;I-Am-H;Al	H at 2 to 2+	60	M-C	F	2	
1101-154C	2715-2730m	W;Am**-Al*-H*;I	differentiation extremely difficult, largely unrecognisable. **includes material passing to amorphous	-	F-C	F-G	2 to 2+ max	
1101-158B	2775-2790m	Am;W;I-H-Al	H at 2 to 2+	20	F-C	G	2(?)	

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

postscript = coarse, cuticle, cysts, degraded, fine, other,. structured, spore-pollen, thick-walled, unstructured

Dominant, Major, Significant, Minor

TABLE 4
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)			REMARKS
			1	2	3	
1101-001A	420-435m	WR	0.38(6)	0.83(11)	-	
1101-007B	510-525m	WR	0.37(4)	0.84(13)	-	
1101-013A	600-615m	WR	0.40(6)	0.84(11)	-	
1101-019A	690-705m	WR	0.42(4)	0.83(11)	-	
1101-025A	780-795m	WR	0.45(5)	0.84(7)	-	
1101-031A	870-885m	WR	0.46(4)	0.85(11)	-	
1101-037B	960-975m	WR	0.47(4)	0.84(12)	-	
1101-043A	1050-065m	WR	0.97(13)	-	-	
1101-049A	1140-155m	WR	1.09(9)	-	-	
1101-055A	1230-245m	WR	0.49(6)	0.99(7)	-	
1101-061A	1320-335m	WR	0.49(2)	0.54(1)	1.19(11)	
1101-067A	1410-425m	WR	0.47(2)	0.54(2)	1.14(11)	
1101-073A	1500-515m	WR	0.44(2)	0.54(3)	1.17(12)	
1101-079A	1590-605m	WR	0.51(2)	1.15(12)	-	
1101-085A	1680-695m	WR	0.50(5)	1.19(12)	-	
1101-091A	1770-785m	WR	0.49(3)	0.55(5)	1.22(9)	
1101-098A	1875-890m	WR	1.25(15)	-	-	
1101-104A	1965-980m	WR	0.58(7)	1.27(12)	-	
1101-108A	2025-040m	KC	0.54(30)	-	-	
1101-112A	2085-100m	KC	0.60(15)	-	-	
1101-116A	2145-160m	KC	0.60(30)	-	-	
1101-122A	2235-250m	KC	1.20(13)	-	-	
1101-126A	2295-310m	WR	0.58(9)	1.20(8)	-	
1101-132A	2385-400m	KC	0.61(13)	-	-	
1101-135A	2430-445m	KC	0.73(30)	-	-	
1101-138A	2475-490m	WR	0.60(15)	-	-	
1101-142A	2535-550m	WR	0.69(30)	-	-	
1101-145A	2580-595m	WR	0.68(5)	1.30(7)	-	
1101-151A	2670-685m	WR	0.72(18)	-	-	
1101-154C	2715-730m	KC	0.78(30)	-	-	
1101-158B	2775-790m	KC	0.80(22)	-	-	

CT—ditch cuttings; CO—core; WR—whole rock; KC—kerogen concentrate. Colours — spore fluorescence. *Reworked

TABLE 5a

CONCENTRATION (PPM) OF EXTRACTED C_{15+} MATERIAL IN ROCK

GEOCHEM SAMPLE NUMBER	DEPTH	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS			
			Paraffin - Naphthenes	Aromatics	TOTAL	Precipitd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	Sulphur
1101-019A	690-705	112	23	16	39	37	30	4	3
1101-031A	870-885	263	31	22	54	155	44	10	1
1101-037	960-975	184	40	41	82	36	56	10	0
1101-049A	1140-1155	425	79	109	188	61	136	36	4
1101-067A	1410-1425	252	46	50	96	40	96	19	0
1101-085A	1680-1695	499	150	58	209	159	92	31	8
1101-091A	1770-1785	163	44	36	80	28	52	3	0
1101-098	1875-1890	56	17	8	25	13	14	2	1
1101-108A	2025-2040	287	60	70	130	41	96	14	7
1101-116	2145-2160	233	51	47	98	60	61	10	4
1101-122A	2235-2250	1104	173	271	444	330	253	58	19
1101-130A	2355-2370	2024	836	578	1414	180	324	83	23
1101-135A	2430-2445	11293	4587	3768	8355	1057	1539	311	32
1101-138	2475-2490	622	225	132	357	143	103	19	0
1101-163	2513.74-	2363	1677	398	2074	94	152	31	12
1101-168	2541.45-	8539	6510	1381	7891	131	382	120	16
1101-145A	2580-2595	1242	368	331	700	267	237	26	13
1101-173	2596.45	142	60	20	80	35	22	2	2
1101-154	2715-2730	1489	405	363	767	455	219	35	12

TABLE 5b

COMPOSITION (NORMALISED %) OF C_{15+} MATERIAL EXTRACTED FROM ROCK

GEOCHEM SAMPLE NUMBER	DEPTH	HYDROCARBONS		NON HYDROCARBONS			
		Paraffin – Naphthenes	Aromatics	Precipitd. Asphaltenes	Eluted NSO's	Non eluted NSO's	Sulphur
1101-019A	690-705	20.79	14.04	32.58	26.40	3.93	2.25
1101-031A	870-885	11.86	8.47	58.77	16.66	3.67	0.56
1101-037	960-975	21.85	22.52	19.54	30.46	5.63	0.00
1101-049A	1140-1155	18.60	25.58	14.42	32.09	8.37	0.93
1101-067A	1410-1425	18.29	20.00	16.00	38.29	7.43	0.00
1101-085A	1680-1695	30.17	11.73	31.84	18.44	6.15	1.68
1101-091A	1770-1785	26.84	22.11	17.37	32.11	1.58	0.00
1101-098	1875-1890	29.60	15.20	23.20	25.60	4.00	2.40
1101-108A	2025-2040	21.03	24.21	14.29	33.33	4.76	2.38
1101-116	2145-2160	21.86	20.21	25.77	26.19	4.12	1.86
1101-122A	2235-2250	15.67	24.53	29.90	22.93	5.22	1.74
1101-130A	2355-2370	41.29	28.55	8.91	16.01	4.08	1.16
1101-135A	2430-2445	40.62	33.37	9.36	13.63	2.75	0.28
1101-138	2475-2490	36.12	21.29	23.02	16.55	3.02	0.00
1101-163	2513.74-	70.97	16.83	3.97	6.42	1.31	0.50
1101-168	2541.45-	76.24	16.17	1.53	4.47	1.40	0.18
1101-145A	2580-2595	29.65	26.66	21.46	19.12	2.08	1.04
1101-173	2596.45	42.36	14.04	24.56	15.79	1.75	1.50
1101-154	2715-2730	27.17	24.35	30.56	14.73	2.35	0.83

TABLE 6

SIGNIFICANT RATIOS (%) OF C_{15+} FRACTIONS AND ORGANIC CARBON

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC CARBON (wt. %)	HYDROCARBONS / TOTAL EXTRACT	HYDROCARBONS / ORG. CARBON	TOTAL EXTRACT / ORG. CARBON	P-NAPHTHENES / AROMATICS
1101-019A	690-705	0.88	34.83	0.44	1.28	1.48
1101-031A	870-885	0.64	20.33	0.84	4.11	1.40
1101-037	960-975	0.72	44.37	1.13	2.56	0.97
1101-049A	1140-1155	1.09	44.19	1.72	3.90	0.73
1101-067A	1410-1425	0.75	38.29	1.29	3.36	0.91
1101-085A	1680-1695	1.04	41.90	2.01	4.79	2.57
1101-091A	1770-1785	1.07	48.95	0.75	1.52	1.21
1101-098	1875-1890	0.97	44.80	0.26	0.58	1.95
1101-108A	2025-2040	2.20	45.24	0.59	1.31	0.87
1101-116	2145-2160	1.77	42.06	0.55	1.32	1.08
1101-122A	2235-2250	3.58	40.20	1.24	3.08	0.64
1101-130A	2355-2370	3.49	69.84	4.05	5.80	1.45
1101-135A	2430-2445	9.47	73.98	8.82	11.93	1.22
1101-138	2475-2490	0.89	57.41	4.01	6.98	1.70
1101-163	2513.74-	0.13	87.80	159.58	181.75	4.22
1101-168	2541.45-	0.08	92.41	986.39	1067.38	4.71
1101-145A	2580-2595	1.28	56.31	5.46	9.71	1.11
1101-173	2596.45	0.08	56.39	9.98	17.70	3.02
1101-154	2715-2730	2.23	51.52	3.44	6.68	1.12

TABLE 7

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	Production INDEX	Hydrogen INDEX	Oxygen INDEX	Tmax (°C)
1101-001A	420-435	0.05	0.50	0.65	0.09	50.0	65.0	427
1101-007A	510-525	0.05	0.35	0.50	0.13	40.2	57.5	425
1101-007B	510-525	0.05	0.21	0.29	0.19	25.0	34.5	421
1101-013A	600-615	0.08	0.34	0.85	0.19	37.8	94.4	425
1101-019A	690-705	0.05	0.34	0.49	0.13	42.0	60.5	425
1101-025A	780-795	0.03	0.20	0.21	0.13	29.9	31.3	426
1101-031A	870-885	0.04	0.29	0.17	0.12	46.0	27.0	425
1101-037A	960-975	0.02	0.32	0.20	0.06	50.0	31.2	424
1101-037B	960-975	0.20	0.32	0.35	0.38	42.1	46.1	428
1101-043A	1050-1065	0.02	0.08	0.23	0.20	22.9	65.7	414
1101-049A	1140-1155	0.03	0.28	0.23	0.10	35.9	29.5	421
1101-049B	1140-1155	0.03	0.09	0.17	0.25	20.5	38.6	418
1101-055A	1230-1245	0.03	0.14	0.28	0.18	17.5	35.0	428
1101-061A	1320-1335	0.04	0.25	0.21	0.14	29.4	24.7	426
1101-067A	1410-1425	0.04	0.08	0.23	0.33	11.6	33.3	405
1101-073A	1500-1515	0.02	0.15	0.14	0.12	18.3	17.1	426
1101-073B	1500-1515	0.02	0.13	0.14	0.13	18.1	19.4	425
1101-079A	1590-1605	0.03	0.13	0.28	0.19	16.7	35.9	396
1101-085A	1680-1695	0.08	0.37	0.24	0.18	36.6	23.8	432
1101-091A	1770-1785	0.09	0.36	0.48	0.20	37.9	50.5	434
1101-091B	1770-1785	0.08	0.31	0.42	0.21	30.4	41.2	434
1101-097B	1860-1875	0.05	0.13	0.22	0.28	12.6	21.4	433
1101-098A	1875-1890	0.06	0.16	0.17	0.27	14.4	15.3	434
1101-098B	1875-1890	0.04	0.21	0.19	0.16	23.9	21.6	436
1101-100A	1905-1920	0.09	0.29	0.26	0.24	26.4	23.6	391
1101-102A	1935-1950	0.05	0.29	0.18	0.15	27.1	16.8	434
1101-102B	1935-1950	0.05	0.32	0.21	0.14	33.0	21.6	438
1101-104A	1965-1980	0.09	0.50	0.21	0.15	35.7	15.0	437
1101-104B	1965-1980	0.10	0.47	0.22	0.18	34.8	16.3	437
1101-106A	1995-2010	0.10	0.78	0.25	0.11	47.0	15.1	441
1101-106B	1995-2010	0.13	1.24	0.27	0.09	70.1	15.3	439
1101-108A	2025-2040	0.15	1.48	0.55	0.09	67.9	25.2	439
1101-108B	2025-2040	0.10	0.72	0.21	0.12	47.4	13.8	438
1101-110A	2055-2070	0.16	1.61	0.62	0.09	67.6	26.1	438
1101-112A	2085-2100	0.15	1.55	0.32	0.09	77.5	16.0	436
1101-112B	2085-2100	0.09	0.52	0.16	0.15	36.9	11.3	440
1101-114A	2115-2130	0.13	1.32	0.33	0.09	61.1	15.3	438
1101-114B	2115-2130	0.14	1.52	0.18	0.08	71.4	8.5	442
1101-116A	2145-2160	0.15	1.70	0.27	0.08	77.3	12.3	436
1101-116B	2145-2160	0.08	0.53	0.25	0.13	33.3	15.7	329
1101-118A	2175-2190	0.07	0.35	0.19	0.17	31.8	17.3	437
1101-120A	2205-2220	0.04	0.20	0.21	0.17	25.0	26.2	438
1101-120B	2205-2220	0.05	0.41	0.26	0.11	32.5	20.6	445
1101-122A	2235-2250	0.21	4.23	0.27	0.05	101.9	6.5	440
1101-122B	2235-2250	0.07	0.27	0.29	0.21	20.9	22.5	448
1101-124A	2265-2280	0.08	0.60	0.23	0.12	42.6	16.3	443
1101-124B	2265-2280	0.11	1.28	0.22	0.08	57.9	10.0	439
1101-126A	2295-2310	0.06	0.67	0.18	0.08	46.9	12.6	441
1101-128A	2325-2340	0.08	0.53	0.17	0.13	41.4	13.3	442
1101-129A	2340-2355	0.49	5.69	0.38	0.08	201.8	13.5	441

TABLE 7

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	Production INDEX	Hydrogen INDEX	Oxygen INDEX	Tmax (°C)
1101-129B	2340-2355	0.11	0.84	0.34	0.12	50.9	20.6	443
1101-130A	2355-2370	0.97	7.93	0.54	0.11	227.2	15.5	443
1101-130B	2355-2370	0.07	0.43	0.25	0.14	34.7	20.2	444
1101-131A	2370-2385	1.23	10.96	0.73	0.10	279.6	18.6	444
1101-132A	2385-2400	1.50	11.56	0.81	0.11	258.6	18.1	446
1101-133A	2400-2415	1.62	10.80	0.97	0.13	262.8	23.6	446
1101-134A	2415-2430	2.68	11.79	1.30	0.19	210.9	23.3	448
1101-135A	2430-2445	5.32	21.52	2.47	0.20	213.1	24.5	448
1101-136A	2445-2460	5.50	23.17	2.43	0.19	214.5	22.5	447
1101-137A	2460-2475	0.32	1.65	0.45	0.16	97.6	26.6	445
1101-137B	2460-2475	0.17	0.87	0.36	0.16	69.0	28.6	442
1101-138A	2475-2490	0.27	1.70	0.36	0.14	96.0	20.3	446
1101-139A	2490-2505	0.24	1.19	0.37	0.17	109.2	33.9	445
1101-140A	2505-2520	0.19	1.27	0.30	0.13	112.4	26.5	445
1101-141A	2520-2535	0.17	1.01	0.40	0.14	82.8	32.8	449
1101-141B	2520-2535	0.53	3.93	0.47	0.12	188.0	22.5	443
1101-142A	2535-2550	0.16	1.10	0.29	0.13	110.0	29.0	443
1101-142B	2535-2550	0.27	1.72	0.48	0.14	131.3	36.6	442
1101-143A	2550-2565	0.14	0.91	0.32	0.13	82.7	29.1	448
1101-144B	2565-2580	0.19	1.05	0.26	0.15	91.3	22.6	444
1101-145A	2580-2595	0.23	1.41	0.26	0.14	114.6	21.1	448
1101-146B	2595-2610	0.32	1.83	0.24	0.15	132.6	17.4	447
1101-151A	2670-2685	0.23	1.27	0.22	0.15	100.0	17.3	447
1101-152B	2685-2700	0.26	2.14	0.26	0.11	89.5	10.9	447
1101-153B	2700-2715	0.30	1.97	0.26	0.13	109.4	14.4	449
1101-154B	2715-2730	0.57	5.13	0.39	0.10	171.0	13.0	445
1101-154C	2715-2730	5.22	55.22	2.73	0.09	259.2	12.8	449
1101-155C	2730-2745	2.36	21.84	1.51	0.10	218.4	15.1	449
1101-156B	2745-2760	0.08	0.71	0.32	0.10	98.6	44.4	445
1101-158B	2775-2790	0.26	2.17	0.40	0.11	89.3	16.5	450

TABLE 8

COMPOSITION (NORMALISED %) OF C_{15+} PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-019A	-031	-037	-049A	-067A	-085A	-091A
DEPTH	690-705m	870-885m	960-975m	1140-1155m	1410-1425m	1680-1695m	1770-1785m
SAMPLE TYPE							
nC_{15}	4.95	2.62	1.45	6.84	9.78	2.71	6.45
nC_{16}	9.64	6.56	3.91	12.31	15.01	7.39	10.87
nC_{17}	10.16	11.51	6.23	12.11	12.70	7.68	9.96
nC_{18}	6.87	8.54	6.82	12.41	11.38	9.57	9.79
nC_{19}	7.07	3.97	7.24	10.55	5.34	5.09	6.34
nC_{20}	6.24	8.07	5.54	6.60	8.28	7.52	7.03
nC_{21}	6.72	3.31	3.75	3.30	3.65	3.44	4.22
nC_{22}	4.19	4.27	3.45	4.08	2.75	2.98	3.22
nC_{23}	2.61	4.42	3.29	2.98	2.78	3.14	3.65
nC_{24}	3.70	5.50	2.67	1.91	1.90	3.42	3.05
nC_{25}	2.94	4.80	4.84	2.70	1.92	5.85	4.65
nC_{26}	3.94	3.62	4.60	1.86	1.53	3.54	3.22
nC_{27}	4.72	6.44	6.90	5.27	2.61	5.32	4.68
nC_{28}	4.44	3.29	7.05	5.18	3.52	8.51	5.10
nC_{29}	4.13	9.03	8.32	3.98	3.12	6.55	4.34
nC_{30}	4.73	2.47	4.80	1.17	1.83	4.69	1.93
nC_{31}	3.94	5.64	5.87	3.34	3.28	5.09	2.95
nC_{32}	3.80	1.72	2.51	0.95	3.24	3.10	2.61
nC_{33}	1.73	2.62	4.61	1.48	2.10	1.87	2.04
nC_{34}	2.51	0.88	2.11	0.76	1.97	1.36	1.75
nC_{35}	0.98	0.72	4.04	0.49	1.32	1.18	2.15
PARAFFIN	20.55	12.81	15.17	11.78	10.92	19.44	16.09
ISOPRENOID	2.65	2.09	1.86	3.72	1.49	1.61	1.89
NAPHTHENE	76.80	85.10	82.97	84.50	87.59	78.94	82.02
CPI INDEX A	0.99	1.01	1.11	1.04	0.94	0.99	1.11
CPI INDEX B	0.93	2.04	1.36	1.59	1.17	1.14	1.27
PRISTANE/PHYTANE	3.40	0.92	1.58	1.78	2.63	1.83	3.08
PRISTANE/nC_{17}	0.98	0.68	1.21	1.67	0.78	0.70	0.89

TABLE 8

COMPOSITION (NORMALISED %) OF C_{15+} PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-098	-108A	-116	-122A	-130A	-135A	-138
DEPTH	1875-1890m	2025-2040m	2145-2160m	2235-2250m	2355-2370m	2430-2445m	2475-2490m
SAMPLE TYPE							
nC_{15}	0.96	1.46	5.25	6.14	7.26	15.30	7.01
nC_{16}	4.91	6.26	8.18	7.07	6.69	14.04	8.90
nC_{17}	10.38	11.41	8.89	7.50	7.12	9.59	10.10
nC_{18}	14.51	11.50	10.38	6.86	6.09	8.77	11.08
nC_{19}	16.60	12.19	10.06	6.82	6.98	8.29	10.18
nC_{20}	9.66	10.33	8.53	6.40	5.11	7.16	8.08
nC_{21}	6.20	7.55	6.02	5.93	4.97	6.92	6.35
nC_{22}	5.56	6.54	6.16	5.66	4.87	4.87	6.11
nC_{23}	4.11	5.34	5.58	5.95	4.85	3.93	4.93
nC_{24}	4.68	3.98	4.84	4.35	4.63	3.49	5.26
nC_{25}	3.56	3.76	5.62	4.87	4.64	3.67	4.28
nC_{26}	3.28	3.41	3.24	4.40	3.88	2.99	3.89
nC_{27}	2.33	3.18	3.63	5.11	4.26	1.94	3.32
nC_{28}	2.86	3.36	2.96	3.52	3.70	1.98	3.03
nC_{29}	2.49	2.42	2.79	4.42	3.70	1.64	2.27
nC_{30}	1.43	0.96	1.50	4.37	2.58	1.31	1.19
nC_{31}	1.71	1.41	1.93	2.64	2.20	0.79	0.99
nC_{32}	1.43	1.46	0.98	2.11	1.36	0.70	0.87
nC_{33}	1.19	1.25	1.57	2.63	1.41	0.76	0.62
nC_{34}	1.20	1.18	1.17	2.05	1.29	1.13	0.93
nC_{35}	0.95	1.06	0.72	1.20	12.40	0.73	0.63
PARAFFIN	21.88	32.00	19.63	21.13	18.58	12.10	18.84
ISOPRENOID	3.37	6.50	3.67	2.57	2.70	1.86	2.35
NAPHTHENE	74.76	61.50	76.70	76.30	78.72	86.04	78.82
CPI INDEX A	0.84	0.98	1.06	1.13	1.05	1.06	0.92
CPI INDEX B	0.97	1.05	1.36	1.10	1.14	0.99	1.01
PRISTANE/PHYTANE	0.91	2.20	2.34	3.87	2.94	1.31	1.34
PRISTANE/nC_{17}	0.71	1.22	1.47	1.29	1.52	0.91	0.71

TABLE 8

COMPOSITION (NORMALISED %) OF C_{15+} PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-145A	-154	-163	-168	-173
DEPTH	2565-2595m	2715-2730m	2513.74-2513.79m	2541.45-2541.50m	2596.45-2596.50m
SAMPLE TYPE					
nC_{15}	9.52	10.02	2.39	2.86	1.70
nC_{16}	10.64	9.15	3.64	4.64	3.34
nC_{17}	9.88	9.04	4.71	6.01	5.21
nC_{18}	9.12	8.56	5.83	6.22	6.09
nC_{19}	7.43	8.51	7.68	8.73	8.10
nC_{20}	6.73	7.19	6.89	7.72	7.92
nC_{21}	5.71	6.72	6.86	7.39	8.34
nC_{22}	5.55	6.13	7.69	8.00	8.77
nC_{23}	5.36	5.73	7.57	6.74	7.97
nC_{24}	5.30	5.20	6.70	6.52	6.60
nC_{25}	4.45	4.83	7.17	7.31	7.64
nC_{26}	3.92	3.77	6.14	5.40	5.47
nC_{27}	3.84	3.42	5.43	4.72	4.80
nC_{28}	2.98	2.86	4.53	3.74	4.42
nC_{29}	2.82	2.48	3.94	3.24	3.53
nC_{30}	1.63	1.83	3.18	2.47	2.38
nC_{31}	1.58	1.42	2.48	2.23	2.32
nC_{32}	1.08	0.73	1.73	1.48	1.47
nC_{33}	1.17	1.16	2.10	1.61	1.58
nC_{34}	0.85	0.74	2.00	1.79	1.36
nC_{35}	0.46	0.51	1.34	1.18	1.01
PARAFFIN	32.58	29.73	25.30	24.96	28.11
ISOPRENOID	2.41	2.23	1.78	1.97	2.15
NAPHTHENE	65.01	68.04	72.92	73.06	69.74
CPI INDEX A	1.00	1.04	1.03	1.03	1.07
CPI INDEX B	1.12	1.11	1.07	1.15	1.15
PRISTANE/PHYTANE	2.96	3.27	1.31	1.43	1.76
PRISTANE/nC_{17}	0.56	0.64	0.85	0.77	0.94

TABLE 9

METHYL PHENANTHRENE INDEX

GEOCHEM SAMPLE NUMBER	DEPTH	% AREA	% HEIGHT
1101-019A	690-705	0.58	0.53
1101-031A	870-885	0.60	0.63
1101-037	960-975	0.73	0.73
1101-049A	1140-1155	0.67	0.67
1101-067A	1410-1425	0.56	0.56
1101-085A	1680-1695	0.51	0.49
1101-091	1770-1785	0.54	0.67
1101-098	1875-1890	0.58	0.54
1101-108A	2025-2040	0.62	0.72
1101-116	2145-2160	0.64	0.71
1101-122A	2235-2250	0.67	0.75
1101-130A	2355-2370	0.62	0.67
1101-135A	2430-2445	0.49	0.59
1101-138	2475-2490	0.73	0.68
1101-163	2513.74-2513.79	0.90	0.68
1101-168	2541.45-2541.50	0.74	0.70
1101-145A	2580-2595	0.59	0.67
1101-173	2596.45-2596.50	0.71	0.69
1101-154	2715-2730	0.66	0.68

TABLE 10

MOLECULAR MATURATION PARAMETERS

GEOCHEM SAMPLE NO.	DEPTH	STERANES M/Z 217 (259) $\frac{C_{29}\ 20S\ (\alpha\alpha)}{C_{29}\ 20R\ (\alpha\alpha)}$	STERANES M/Z 217 (259) $\frac{C_{29}\ 20R\ (\beta\beta)}{C_{29}\ 20R\ (\alpha\alpha)}$	STERANES M/Z 217 (259) $\frac{C_{27}\ (20S)\ \text{Diasteranes}}{C_{27}\ (20R)\ \text{Diasteranes}}$	TERPANES M/Z 191 $\frac{Tm}{Ts}$	TERPANES M/Z 191 $\frac{C_{30}\ \text{Moretane}}{C_{30}\ \text{Hopane}}$	TERPANES M/Z 191 $\frac{C_{29}\ \text{normoretane}}{C_{29}\ \text{norhopane} + C_{29}\ \text{normoretane}}$	TERPANES M/Z 191 $\frac{\text{Bisnorhopane}\ (C_{28})}{Tm + \text{Bisnorhopane} + C_{29}\ \text{norhopane}}$	TERPANES M/Z 191 $\frac{C_{31}\ (20S)}{C_{31}\ (20S) + C_{31}\ (20R)} \times 100$
1101-049	1140-155m	C O N T A M I N A T I O N							
1101-085	1680-695m	C O N T A M I N A T I O N			10.43	0.52	0.34	-	55%
1101-091	1770-785m	0.19	0.69	1.53	21.2	0.60	0.38	0.01	58.5%
1101-108	2025-040m	0.53	0.53	1.44	27	0.42	0.25	0.01	59.5%
1101-116	2145-160m	0.56	0.46	1.50	19.3	0.47	0.29	0.02	59.5%
1101-122	2235-250m	0.70	0.52	1.59	26.8	0.38	0.13	0.02	57%
1101-130	2355-370m	1.25	1.77	1.46	0.95	0.10	0.07	0.19	58%
1101-135	2430-445m	1.41	1.92	1.44	0.50	0.08	0.13	0.17	60%
1101-138	2475-490m	1.08	1.32	1.46	1.70	0.17	0.15	0.10	60%
1101-163 CORE	2513.74-.97m	1.23	1.73	1.42	1.00	0.10	0.08	0.17	60.5%
1101-168 CORE	2541.45-.74m	1.39	1.85	1.43	1.08	0.09	0.07	0.15	58%
1101-145	2580-595m	1.10	1.75	1.51	2.38	0.11	0.09	0.15	58%
1101-173 CORE	2596.45-.50m	1.19	1.83	1.58	1.31	0.12	0.07	0.18	59%
1101-154	2715-730m	1.16	1.93	1.55	1.05	0.10	0.09	0.25	60%

TABLE 11

COMPOSITION (NORMALISED %) OF C_{15+} AROMATIC HYDROCARBONS

- DIBENZOTHIOPHENE SERIES

GEOCHEM SAMPLE NUMBER	DEPTH	DIBENZOTHIOPHENE (M/Z 184)	METHYL DIBENZOTHIOPHENE M/Z 198)	DIMETHYL DIBENZOTHIOPHENE (M/Z 212)
1101-049	1140-1155m	11.0	47.4	41.6
1101-085	1680-1695m	2.4	55.3	42.3
1101-091	1770-1785m	4.8	57.1	38.1
1101-108	2025-2040m	7.4	59.6	33.0
1101-116	2145-2160m	14.0	60.0	26.0
1101-122	2235-2250m	13.0	57.6	29.4
1101-130	2355-2370m	22.0	45.6	32.4
1101-135	2430-2445m	16.7	41.6	41.7
1101-138	2475-2490m	17.6	42.1	40.3
1101-163 CORE	2513.74-2513.79m	9.3	37.6	53.1
1101-168	2541.45-2541.74m	8.3	38.3	53.4
1101-145	2580-2595m	22.0	44.1	33.9
1101-173	2596.45-2596.50m	10.2	40.5	49.3
1101-154	2715-2730m	20.5	47.1	32.4

TABLE 12

COMPOSITION (NORMALISED %) OF C_{15+} AROMATIC HYDROCARBONS

- PHENANTHRENE SERIES

GEOCHEM SAMPLE	DEPTH	PHENANTHRENE (M/Z 178)	METHYL PHENANTHRENE (M/Z 192)	DIMETHYL PHENANTHRENE (M/Z 206)	TRIMETHYL PHENANTHRENE (M/Z 220)
1101-049	1140-1155m	15.0	34.3	31.5	19.2
1101-085	1680-1695m	7.7	38.7	31.8	21.8
1101-091	1770-1785m	12.8	43.2	28.8	15.2
1101-108	2025-2040m	19.8	39.0	27.5	13.7
1101-116	2145-2160m	26.2	40.8	22.8	10.2
1101-122	2235-2250m	19.7	37.5	28.5	14.3
1101-130	2355-2370m	17.1	38.9	29.8	14.2
1101-135	2430-2445m	12.5	37.9	33.9	15.7
1101-138	2475-2490m	14.0	38.1	32.2	15.7
1101-163 CORE	2513.74-2513.79m	9.2	34.5	35.3	21.0
1101-168 CORE	2541.45-2541.74m	7.2	33.1	37.5	22.2
1101-145	2580-2595m	13.4	37.2	33.1	16.3
1101-173 CORE	2596.45-2596.50m	8.5	32.3	37.8	21.4
1101-154	2715-2730m	13.2	39.0	32.2	15.6

TABLE 13

CARBON ISOTOPE RESULTS

$^{O}/_{OO}$ PDB

GEOCHEM SAMPLE NUMBER	DEPTH	PARAFFIN-NAPHTHENE	AROMATICS	TOTAL EXTRACT
1101-049A	1140-155m	TOO SMALL	TOO SMALL	-27.69
1101-085A	1680-695m	TOO SMALL	TOO SMALL	-28.56
1101-091A	1770-785m	TOO SMALL	TOO SMALL	-28.19
1101-108A	2025-040m	TOO SMALL	TOO SMALL	-25.43
1101-116A	2145-160m	TOO SMALL	TOO SMALL	-25.56
1101-122	2235-250m	-28.80*	-27.25*	-28.27
1101-130A	2355-370m	-29.48	-28.56	-28.86
1101-135A	2430-445m	-28.90	-27.72	-28.08
1101-138A	2475-490m	-28.33	-27.05	-27.47
1101-163 CORE	2513.74-.97m	-29.66	-27.98	-28.82
1101-168 CORE	2541.45-.74m	-29.63	-27.88	-28.89
1101-145	2580-595m	TOO SMALL	-26.48	-26.70
1101-173	2596.45-.50m	-29.72*	TOO SMALL	-28.67
1101-154	2715-730m	-30.47	-29.02	-29.17

* - very small sample

BRIEF DESCRIPTION OF THE ANALYSES PERFORMED BY GEOCHEM

"Screen Analyses" are described in sections A, C and D, "Sample Preparation" in section B, "Follow-up Analyses" in sections E through K and "Correlation Studies" in section L. The analyses can be run on either core or cuttings material with the proviso that samples must be canned for the C_1-C_7 analysis and should be canned (or at least wet) for the C_4-C_7 analysis. The other analyses can be run on both canned and bagged samples.

A) C_1-C_7 LIGHT HYDROCARBON ANALYSIS

The abundance and composition of the C_1-C_7 hydrocarbons in sediments reflects their source richness, maturity and the character of the hydrocarbons they can yield. Most importantly, it is extremely sensitive to the presence of migrated hydrocarbons and is an excellent method for their detection. As it provides the information on most of the critical parameters and is also economical, this analysis is excellent for screening samples to decide which of them merit further analysis.

During the time which elapses between the collection of the sample at the wellsite and its analysis in the laboratory, a fraction of the total gas passes from the rock to the air space at the top of the can. For this reason, both the air space and the cuttings are analysed.

The analysis involves the gas chromatographic separation of the individual C_1-C_4 gaseous hydrocarbons (methane, ethane, propane, isobutane and normal butane) and a partial resolution of the C_5-C_7 gasoline-range hydrocarbons (for their complete resolution see Section E). The ppm abundance of the five gases and of the total C_5-C_7 hydrocarbons are calculated from their electronically integrated peak areas (not from peak height) by comparison with a standard.

In the report, the following data are tabulated: the abundance and composition of the air space gas, of the cuttings gas and of the combined air space and cuttings gases. The combined results are also presented graphically.

B) SAMPLE WASHING AND HAND PICKING

All of the analyses described in subsequent sections are run on washed and hand picked samples.

Cuttings are washed to remove the drilling mud, care being taken not to remove soft clays and fine sand during the washing procedure. Using the C_1-C_7 hydrocarbon data profile of the well, or the organic carbon profile (if this analysis is used for screening), electric logs (if supplied) and the appearance of the cuttings under the binocular microscope, samples are selected to represent the lithological and geochemical zones penetrated by the well. These samples are then carefully hand picked and the lithology of the uncaved material is described. It is these samples which are submitted for further analysis.

Sample material remaining after analysis is retained for six months. Unless instructions are received to the contrary, Geochem Laboratories may then destroy the samples.

Our reports incorporate a gross lithological description of all the samples which have been analysed and litho percentage logs. As screen analyses are recommended at narrow intervals, a complete lithological profile is obtained.

C) ORGANIC CARBON ANLYSIS

The organic carbon content of a rock is a measure of its total organic richness. Combined with the visual kerogen, C_1-C_7, C_4-C_7, pyrolysis and C_{15+} analyses, the organic carbon content is used to evaluate the potential (not necessarily actual) hydrocarbon source richness of the sediment. This analysis is an integral part of a total evaluation and it can also be used as an economical screen analysis for dry samples (when the C_1-C_7 analysis cannot be used).

Hand picked samples are dried, crushed and then acidised to remove the inorganic calcium and magnesium carbonates. The actual analysis involves combustion in a Leco carbon analyser. Blanks, standards and duplicates are run routinely for purposes of quality control at no extra cost to the client.

The data are tabulated and presented diagramatically in our reports in a manner which facilitates comparison with the gross lithology (see Section B) of the samples.

D) MINI-PYROLYSIS

An ideal screen analysis which provides a definitive measure of potential source richness upon those samples whose organic carbon contents suggest fair or good source potential. This is described in detail in section K.

E) DETAILED C_4-C_7 HYDROCARBON ANALYSIS

The abundance and composition of the C_4-C_7 gasoline-range hydrocarbons in sediments reflects their source quality, level of thermal maturation and organic facies. In addition, the data also reveal the present of migrated hydrocarbons and can be used for crude oil-parent source rock correlation studies.

This powerful analysis, performed upon hand picked lithologies, is employed as a follow-up to confirm the potential of samples which have been selected using the initial screen analysis. It is used in conjunction with the organic carbon, visual kerogen and C_{15+} analyses.

The individual normal paraffins, isoparaffins, naphthenes and aromatics with between four and seven carbon atoms in the molecule (but also including toluene) are resolved by capillary gas chromatography and their peak areas electronically integrated.

Normalised compositions, selected ratios and the ppm abundance of the total gasoline-range fraction are tabulated in the report and also presented graphically.

F) KEROGEN TYPE AND MATURATION

Kerogen is the insoluble organic matter in rocks. Visual examination of the kerogen gives a direct measure of thermal maturity and of the composition of the organic matter (organic facies) and indicates the source quality of the sediment - which is confirmed using the organic carbon, light hydrocarbon, pyrolysis and C_{15+} analyses.

The type of hydrocarbon (oil or gas) generated by a source rock is a function of the types and level of thermal maturation of the organic matter which are present. Both of these parameters are measured directly by this method.

Kerogen is separated from the inorganic rock matrix by acid digestion and flotation methods which avoid oxidation of the organic matter. It is then mounted on a glass slide and examined at high and low magnifications with a Leitz microscope. Chemical methods measure the total kerogen population but, with this technique, individual particles can be selected for examination and spurious material identified. This is particularly valuable in reworked, contaminated and turbodrilled sediments.

The following data are generated: the types of the organic matter present and their relative abundances, an estimate of the proportion of reworked material, preservation state, the thermal maturity of the non-reworked organic matter using the spore colouration technique.

Our maturation scale has been developed to digitise small but recognisable changes in organic matter colouration resulting from increasing maturity and to place particular emphasis upon the immature to mature transition. In the absence of a universal colouration scale, the most significant points on our scale have been calibrated against equivalent vitrinite reflectance values. The following maturation stages are recognised at the low end of the scale:-

a) immature; thermal index less than 2- (0.45% Ro)
b) marginally mature; indices between 2- and 2.
Minor hydrocarbon generation from amorphous and herbaceous (± algal) organic matter
c) mature; indices between 2 (0.53% Ro) and 2 to 2+ (0.72% Ro), significant generation from amorphous, algal and herbaceous organic matter but wood only marginally mature
d) oil window; indices of 2 to 2+ (0.72% Ro) through to 3 (1.2% Ro). Peak hydrocarbon generation.

The condensate zone starts at a thermal index of 3 whilst indices of 3+ (2.0% Ro) and higher indicate the eometamorphic dry gas stage.

A total of fourteen types of organic matter are sought based upon the major categories of algal, amorphous, herbaceous (spore, pollen, cuticle), wood, inertinite and resin. This detail is essential for a proper understanding of hydrocarbon source potential as the different sub-groups within each category have different properties.

Upon completion of the study, the kerogen slides are sent to the client.

G) VITRINITE REFLECTANCE

Vitrinite reflectance is an alternative/confirmatory method for evaluating thermal maturation which is used in conjection with the visual kerogen analysis. The reflectivity of vitrinite macerals increases in response to thermal alteration and is used to define maturation levels and, by projection, to predict maturity at depth or the thicknesses of section removed by erosion.

Measurements are made upon kerogen separations in conjunction with polished whole rock samples. In general, this analysis is performed upon the same samples as the visual kerogen analysis, thus facilitating a direct comparison of the two sets of results.

If possible, forty to fifty measurements are taken per sample - unless the sediments are organically lean, vitrinite is sparse or only a single uniform population is present. The data are plotted in a histogram which

distinguishes the indigenous vitrinite from possible reworked or caved material. Averages are calculated for each population. Comments upon exinite fluorescence and upon the character of the phytoclasts are noted on the histograms. The reports contain the tabulated data, histograms and the reflectivities plotted against depth.

The vitrinite and visual kerogen techniques provide mutually complementary information upon maturity, organic matter type and diagenesis.

H) C_{15+} EXTRACTION, DEASPHALTENING AND CHROMATOGRAPHIC SEPARATION

Sections "A" and "E" dealt with analyses covering the light end of the hydrocarbon spectrum. This section is concerned with the solvent extractable oranic material in the rock with more than fourteen carbon atoms in the molecule (i.e. the heavy end). The amount and composition of this extract indicates source richness and type, the level of thermal maturation and the possible presence of migrated hydrocarbons.

These results are integrated with those derived from the pyrolysis, visual kerogen, organic carbon and light hydrocarbon analyses.

The techniques involved in this analysis employ pure solvents and have been designed to give reproducible results. Hand picked samples are ground and then solvent extracted in a soxhlet apparatus, or by blending, with dichloromethane (the solvent system can be adapted to client's specifications). After asphaltene precipitation, the total extract is separated by column chromatography or high pressure liquid chromatography into the following fractions: paraffin-naphthene hydrocarbons, aromatic hydrocarbons, eluted NSO's (nitrogen-, sulphur-, and oxygen- containing non-hydrocarbons) and non-eluted NSO's. Note that the non-hydrocarbons are split into three fractions and not reported as a gross value. These fractions can be submitted for further analyses (carbon isotopes, gas chromatography, mass spectroscopy) including correlation studies.

For convenience and thoroughness, the data are reported in three formats: the weights of the fractions, ppm abundances and normalised percentage compositions. The data are also presented diagramatically.

J) GC ANALYSIS OF C_{15+} PARAFFIN-NAPHTHENE HYDROCARBONS

The gas chromatographic configurations of the heavy C_{15+} paraffin-naphthene hydrocarbons reflect source type, the degree of thermal maturation and the presence and character of migrated hydrocarbons or contamination.

Not only is this analysis an integral part of any source rocks study but it also provides a fingerprint for correlation purposes and helps to define the geochemical/palynological environmental character of the source rocks from which crude oils were derived.

The paraffin-naphthene hydrocarbons obtained by column chromatography are separated by high resolution capillary chromatography. Excellent resolution of the individual normal paraffins, isoprenoids and significant individual isoparaffins and naphthenes is achieved. Runs are normally terminated at nC_{35}. A powerful in-house microprocessor system is being introduced to correct for the change in response factor with chain length.

The normal paraffin carbon preference indices (C.P.I.) indicate if odd (values in excess of 1) or even (values less than1) normal paraffins are dominant.

Strong odd preferences (± strong pristane peaks) are characteristic of immature land plant organic matter whilst even preferences (± strong phytane peaks) suggest a reducing environment of deposition. With increasing maturity, values approach 1.0 and oils are typically close to 1.0. The indices are calculated using the following formulae:

$$C.P.I_A = \frac{\frac{C_{21} + C_{23} + C_{25} + C_{27}}{C_{20} + C_{22} + C_{24} + C_{26}} + \frac{C_{21} + C_{23} + C_{25} + C_{27}}{C_{22} + C_{24} + C_{26} + C_{28}}}{2}$$

$$C.P.I_B = \frac{\frac{C_{25} + C_{27} + C_{29} + C_{31}}{C_{24} + C_{26} + C_{28} + C_{30}} + \frac{C_{25} + C_{27} + C_{29} + C_{31}}{C_{26} + C_{28} + C_{30} + C_{32}}}{2}$$

Chromatograms are reproduced in the report for use as visual fingerprints and in addition, the following data are tabulated: normalised normal paraffin distributions; proportions of paraffins, isoprenoids and naphthenes in the total paraffin-naphthene fraction; $C.P.I_A$ and $C.P.I_B$; pristane to phytane ratio; pristane to nC_{17} ratio.

K) PYROLYSIS

The process of thermal maturation can be simulated in the laboratory by pyrolysis, which involves heating the sample under specified conditions and measuring the oil-like material which is freed/generated from the rock. With this analysis, the potential richness of immature sediments can be determined and, by coupling the pyrolysis unit to a gas chromatograph, the liberated material can be characterised. These results are correlated with those obtained from the organic carbon, kerogen and C_{15+} analyses.

Small amounts of powdered sample are heated in helium to release the thermal bitumen (up to 340°C) and pyrolysate (340-550°C). The thermal bitumen correlates with the solvent extractable material (see above) whilst the pyrolysate fraction does not exist in a "free" state but is generated from the kerogen, thus simulating maturation in the subsurface. Abundances (weight ppm of rock) are measured with a flame ionisation detector against a standard. Thermal bitumen includes source indigenous, contaminant and migrated hydrocarbons but the pyrolysate abundance is a measure of ultimate source richness. The capillary gas chromatogram of the pyrolysate is used to evaluate the character of the parent organic matter and whether it is oil or gas prone. Peak temperature(s) of pyrolysate evolution is recorded. Carbon dioxide can be measured if requested but is normally ignored as the separation of the organic and inorganic species has been found to be artificial and unreliable.

Pyrolysate yields provide a definitive measure of potential source richness which avoids the ambiguities of the organic carbon data and the problem of contamination. This analysis is also used to evaluate the quality and character of the organic matter and the degree to which it has realised its ultimate hydrocarbon potential. Geochem does not employ the pyrolysis technique to evaluate maturation, preferring the kerogen and vitrinite reflectance analyses which avoid the problem of reworking and hence, are more reliable.

Capillary chromatograms produced for the pyrolysate hydrocarbons range from C_1 (methane) out towards C_{35} but exhibit considerable variations. They are used to define whether a source rock will yield oil, condensate or gas. With this new technique, it is now possible to complete the evaluation of a source rock.

The data are tabulated and presented graphically. MINI-PYROLYSIS includes ppm thermal bitumen and ppm pyrolysate. PYROLYSIS also provides the above together with the temperature of peak pyrolysate evolution. The capillary chromatograms of the pyrolysate obtained by PYROLYSIS-GC are reproduced in the report. The Mini-Pyrolysis analysis is recommended as a screening technique.

L) CORRELATION STUDY ANALYSES

Oil to oil and oil to parent source rock correlation studies require high resolution analytical techniques. This requirement is satisfied by some of the analyses discussed above but others have been selected specifically for correlation work. Many of these analyses also provide information upon the character of the environment of deposition of the parent source rocks.

- detailed C_4-C_7 hydrocarbon (gasoline range) analysis. See Section E. Although these hydrocarbons can be affected by migrational/alteration processes, they commonly provide a very useful correlation parameter.

- capillary gas chromatography of the C_{15+} paraffin-naphthenes. See section J. The branched:normal paraffin distributions are used to "fingerprint" the samples.

- capillary chromatograms of whole oils and of the C_{4+} fraction of source rocks.

- capillary gas chromatography of C_{15+} aromatic hydrocarbons. Separate chromatograms of the hydrocarbons and of the sulphur-bearing species are reproduced.

- high pressure liquid chromatograms.

- mass spectrometric carbon isotope analyses of crude oil and rock extract fractions and of kerogen separations. A powerful tool for comparing hydrocarbons and correlating hydrocarbons to organic matter. With this technique the problem of source rock contamination can be avoided. The data are recorded on x-y or Galimov plots.

- mass fragmentograms (mass chromatograms) of fragment ions characteristic of selected hydrocarbon groups such as the steranes and terpanes. The fragmentograms provide a convenient and simple means of presenting detailed mass spectrometric data and are used as a sophisticated fingerprinting technique. This provides the ultimate resolution for correlating hydrocarbons and facilitates the examination of hydrocarbon classes.

- vanadium and nickel contents.

Suites of (rather than single) analyses are employed in correlation studies, the actual selection depending upon the complexity of the problem. See also section N.

M) ANALYSES FOR SPECIAL CASES

M-1) ELEMENTAL KEROGEN ANALYSIS

This analysis evaluates source quality, whether the sediments are oil or gas prone, the character of the organic matter and its level of thermal maturation. It is the chemical equivalent of the visual kerogen analysis. The pyrolysis analysis is generally preferred to this technique, both methods providing similar information.

M-2) SULPHUR ANALYSIS

The abundance of sulphur in source rocks and crude oils.

M-3) CARBONATE CONTENT

The mineral carbonate content of sediments is determined by acid treatment. These data are particularly useful when used in conjunction with organic carbon contents as a screening technique.

M-4) NORMAL PARAFFIN ANALYSIS

Following the removal of the branched paraffins and naphthenes from the total paraffin-naphthene fraction, a chromatogram of the normal paraffins is obtained. The resulting less complicated chromatogram facilitates the examination of normal paraffin distributions.

M-5 SOLID BITUMEN EVALUATION

Residual solid bitumen after crude oil is generated by three prime processes; the action of waters, gas deasphalting, thermal alteration. Thus it provides a means of determining the reservoir history of a crude and of evaluating whether adjacent traps will or will not be prospective for oil. In carbonate sections, where organic matter is sometimes sparse, this technique is also used to evaluate thermal maturation levels.

The analysis involves the determination of the solubility (in CS_2) of the solid bitumen and of the atomic hydrogen to carbon ratio of the insoluble fraction.

N) CRUDE OIL ANALYSIS

N-1) API GRAVITY

This can be performed upon large (hydrometer) and small (SG bottle, pycnometer) samples and even upon stains extracted from sediments (refractive index).

N-2) SULPHUR CONTENTS (ASTM E30-47)

N-3) POUR POINT (ASTM D97-66, IP15/67)

N-4) VISCOSITY (ASTM D445-72, IP71/75)

N-5) FRACTIONAL DISTILLATION

Graph of cumulative distillation yield against temperature. Five percent cuts taken for further analysis. Mass spectrometric studies of these fractions provide a detailed picture of the distribution of paraffins and of the various naphthene and aromatic groups within a crude, which is useful both for correlation and for refinery evaluation purposes.