

OPERATOR STATOIL

WELL NO. 7120/8-1

MATERIAL CONSUMPTION & COST ANALYSIS

26" HOLE DRILLED TO 750 Meters ~~FEET~~ 20" CASING SET AT 730 Meters ~~FEET~~

ACTUAL AMOUNT OF HOLE DRILLED 391,5 Meters ~~FEET~~ DAYS ON INTERVAL 7

DRILLING FLUID SYSTEM GEL/SEA WATER

MATERIAL	UNIT SIZE	PROG.	USED	VARIANCE ±	COST US \$
BARITE BULK	M/T	130	141	+11	16.638,-
BENTONITE BULK	M/T	30	33		10.824,-
BENTONITE SXS	50 kg	NIL	440	+440	7.788,-
CAUSTIC SODA	25 kg	40	91	+51	1.729,-
SODA ASH	50 kg	7	33	+26	610,50
LIGNOSULPHONATE	25 kg	NIL	46	+46	791,20
LIME	50 kg	NIL	1	+1	5,-
DRISPAC REG.	50 lbs	NIL	3	+3	435,75
XC-POLYMER	50 lbs	NIL	1	+1	332,-
DRILLING DETERGENT	200 l	14	NIL	-14	
ALUMINIUM STEARATE	25 kg	3	NIL	-3	

	US \$		US \$
COST/DAY	5.593,35	TOTAL COST FOR INTERVAL	39.153,45
COST/Mt. or Ft.	100,-	PROG. COST FOR INTERVAL	31.209,50
ENGR. COST	5.250,-	COST VARIANCE FOR INTERVAL	+ 7.943,95

WELL NO. 7120/8-1

36"	HOLE DRILLED TO	358,5	Meters Feet	30"	CASING SET AT	356,5	Meters Feet
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ACTUAL AMOUNT OF HOLE DRILLED	63	Meters Feet	DAYS ON INTERVAL	3
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DRILLING FLUID SYSTEM	SPUD MUD
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[illegible]

	US \$		US \$
COST/DAY	7.237,78	TOTAL COST FOR INTERVAL	21.713,35
COST/Mt. or Ft.	344,66	PROG. COST FOR INTERVAL	12.681,-
ENGR. COST	2.000,-	COST VARIANCE FOR INTERVAL	+9.032,32

OPERATOR STATOIL

WELL NO. 7120/8-1

MATERIAL CONSUMPTION & COST ANALYSIS

17 1/2" HOLE DRILLED TO 1822 Meters 13 3/8" CASING SET AT 1806 Meters

ACTUAL AMOUNT OF HOLE DRILLED 1072 Meters DAYS ON INTERVAL 15

DRILLING FLUID SYSTEM GEL/LIGNOSULPHONATE

MATERIAL	UNIT SIZE	PROG.	USED	VARIANCE ±	COST US \$
BARITE BULK	M/T	455	484	+29	57.112,-
BENIONITE	50 kg	960	607	- 353	10.743,90
LIGNOSUPHONATE	25 kg	750	494	- 256	8.496,80
DRISPAC REG.	50 lbs	NIL	24	+ 24	3.486,-
DRISPAC S.L.	50 lbs	NIL	44	+ 44	7.392,-
CAUSTIC SODA	25 kg	380	236	- 144	4.484,-
SODA ASH	50 kg	15	36	+ 21	277,50
BICARBONATE	50 kg	8	20	+ 12	385,-
CMC L.V.	25 kg	210	152	- 58	8.968,-
CMC H.V.	25 kg	NIL	3	+ 3	168,-
ALUMINIUM STEARATE	25 kg	6	7	+ 1	560,-
DRILLING DETERGENT	200 l	32	47	+ 15	16.450,-
XC-POLYMER	50 lbs	6	1	- 6	332,-

COST/DAY	US \$ 8.156,08	TOTAL COST FOR INTERVAL	US \$ 122.341,20
COST/Mt. or Ft.	114,12	PROG. COST FOR INTERVAL	123.593,50
ENGR. COST	10.500,-	COST VARIANCE FOR INTERVAL	- 1.253,30

OPERATOR STATOIL

WELL NO. 7120/8-1

MATERIAL CONSUMPTION & COST ANALYSIS

12 1/4" HOLE DRILLED TO 2610 Meters ~~2610~~ 9 5/8" CASING SET AT 2595 Meters ~~2595~~

ACTUAL AMOUNT OF HOLE DRILLED 788 Meters ~~788~~ DAYS ON INTERVAL 23

DRILLING FLUID SYSTEM GEL/LIGNOSULPHONATE/SEA WATER

MATERIAL	UNIT SIZE	PROG.	USED	VARIANCE ±	COST
BARITE BULK	M/T	230	375	+ 145	US \$ 44.250,-
BENTONITE	50 kg	315	712	+ 397	12.246,40
LIGNOSULPHONATE	25 kg	190	451	+ 261	7.757,20
CAUSTIC SODA	25 kg	180	203	+ 23	3.648,-
CMC L.V.	50 kg	100	298	+ 198	17.582,-
CMC H.V.	50 kg	NIL	66	+ 66	3.894,-
SODA ASH	50 kg	5	26	+ 21	481,-
BICARBONATE	50 kg	5	68	+ 63	1.309,-
ALUMINIUM STEARATE	25 kg	1	1	NIL	80,-
CALCIUM CHLORIDE	50 kg	0	5	+ 5	97,50
DRISPAC REG.	25 kg	NIL	4	+ 4	564,-
XC-POLYMER	25 kg	15	5	- 10	1.660,-
BARITE SXS	100 lbs	0	245	+ 245	1.372,-

COST/DAY	US \$ 4.127,87	TOTAL COST FOR INTERVAL	US \$ 94.941,10
COST/Mt. or Ft.	120,48	PROG. COST FOR INTERVAL	50.394,75
ENGR. COST	29.500,-	COST VARIANCE FOR INTERVAL	+ 44.546,35



ANCHOR DRILLING FLUIDS AS

OSLO -- STAVANGER

Drilling Fluid & Material Consumption Report

MUD SYSTEM SPUD MUD/GEL - SEA WATER/GEL - LIGNOSULPHONATE

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG ROSS RIG

ENGINEERS MIKE ALISON/ANSGAR AASE

Day No	DATE	ESTIMATED DAILY MUD VOLUMES			BULK MATERIALS		SACK MATERIALS			MATERIALS ADDED TO CONTROL PROPERTIES															
		LOSSES SUB SURFACE	LOSSES SURFACE	VOLUME MUD BUILT	BARITE M/T	BENTONITE	BARITE	BENT. API	CHROME LIGNO	THINNERS			DRISPAK REG.	DRISPAK S.L.	XC- POLYMER	CAUSTIC SODA	SODA ASH	LIME	CaCl ₂	BICARB	CMC L.V.	CMC H.V.	AL.	STEAR.	DRUG. DET.
1	28/6		45	1455	15	15											21	8	4						
2	29/6		617	627		9											22	4	2						
3	30/6		2250	1500	3	6	377										28	16	3						
4	1/7		270	900	29	7			2								16	1	1	9					
5	2/7		284	600	5	8			1								11	2							
6	3/7		280	220				6									9	3							
7	4/7		80	450	6		46		6								6	1							
8	5/7		350	450			24		17								18	11							
9	6/7		300	1800	33		70		5								13	4							
10	7/7		1300	2800	68	18	294		15				3		1		18	11							
11	8/7		50	100	5		60		3				9		1		5	2		4					
12	9/7		80	340	44		173		33								9	1		14		9			
13	10/7		150	310	72		47		48								24	2				5		1	12
14	11/7		40	350	47		121		45								5	3				22		3	8
FORWARD																									
ESTIMATED TOTALS			6096	11902	327	66	1218		175				12		2		205	69	10	9	18	36	3	1	20

REMARKS



ANCHOR DRILLING FLUIDS AS

OSLO — STAVANGER

Drilling Fluid & Material Consumption Report

UD SYSTEM GEL/LIGNOSLUPHONATE

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG ROSS RIG

ENGINEERS BOB JACK/EINAR KORSVOLD/MIKE ALISON

Day to	DATE	ESTIMATED DAILY MUD VOLUMES			BULK MATERIALS		SACK MATERIALS		MATERIALS ADDED TO CONTROL PROPERTIES																	
		LOSSES SUB SURFACE	LOSSES SURFACE	VOLUME MUD BUILT	BARITE M/T	BENTONITE	BARITE	BENT. API	CHROME LIGNO	THINNERS			POLYMERS				OTHERS									
													DRISPAC REG.	DRISPAC S.L.	XC- POLYMERS		CAUSTIC SODA	SODA ASH	LIME	CaCl ₂	BICARB.	CMC L.V.	CMC H.V.	AL.	STEAR.	DRUG. DET.
	1981																									
15	12/7		20	100	6			22	5								1	1								2
16	13/7		109						4													4				
17	14/7			940	41				55								21					19		1		5
18	15/7			630	32			28	35								35	5				28				4
19	16/7		95	630	23				43			2					31	5				29		3		6
20	17/7		340	660	20			63	66			4	16				22	4			2					
21	18/7		196	275	26				58			7	24				19	10								1
22	19/7		738	810	66			20	80			2	16				48	1				5		2		3
23	20/7		725	830	102			73	15								16	2				28				5
24	21/7		93																			1				1
25	22/7	118	232						4													2				
26	23/7		211						25								4				2	53				
27	24/7		293	400	32			43	66								34	1			3	62				
28	25/7		496	335	2			45	54								7	3				41				
FORWARD			6096	1902	327	66		1218	175			12		2			205	69		9	18	36	3	1		20
ESTIMATED TOTALS		118	9644	17512	677	66		1512	585			27	44	2			443	101		9	25	308	3	7		47

RE MARKS



ANCHOR DRILLING FLUIDS AS

OSLO -- STAVANGER

Drilling Fluid & Material Consumption Report

FLUID SYSTEM SEA WATER/GEL/LIGNOSULPHONATE

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG ROSS RIG

ENGINEERS MIKE ALISON/I. TORGENSEN/A. AASE/S. BJØRHEIM

Day No	DATE	ESTIMATED DAILY MUD VOLUMES			BULK MATERIALS		SACK MATERIALS			MATERIALS ADDED TO CONTROL PROPERTIES															
		LOSSES SUB SURFACE	LOSSES SURFACE	VOLUME MUD BUILT	BARITE M/T	BENTONITE	BARITE	BENT. API	CHROME LIGNO	THINNERS			POLYMERS			CAUSTIC SODA	SODA ASH	LIME	CaCl ₂	BICARB.	CMC L.V.	CMC H.V.	AL.	STEAR.	DRUG. DET.
	1981																								
29	26/7		208	200	48		88	9								11					22	7			
30	27/7		28	40	13		14	14								8					14	1			
31	28/7		158	120	40		21	16								5					4	8			
32	29/7		40	130			32	6								2	1				2				
33	30/7		196	150	12		17	2														7			
34	31/7		35	30	10			8														3			
35	1/8		97	80	3		20	21								6					1				
36	2/8		105	100			37	15								6						4			
37	3/8			100			30	4								1	1								
38	4/8		171	150			35	5								14	1				8	8			
39	5/8		113	60	2		25	2								2					15	1	1		
40	6/8		62	160	10		30	2								3					10	1			
41	7/8		90		5			4								7					6	3			
42	9/8		17	150			30	17								15					13				
FORWARD		118	9644	17512	677	66	1512	685					27	44	2		443	101		9	25	308	3	7	47
ESTIMATED TOTALS		118	10964	18982	820	66	1891	810					27	44	2		523	105		9	25	403	46	8	47

REMARKS:



ANCHOR DRILLING FLUIDS AS

OSLO — STAVANGER

Drilling Fluid & Material Consumption Report

FLUID SYSTEM SEA WATER/GEL/LIGNOSULPHONATE

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG ROSS RIG

ENGINEERS M. ALISON/I. TORGENSEN/A. AASE/E. KORSVOLD

Day to	DATE	ESTIMATED DAILY MUD VOLUMES			BULK MATERIALS		SACK MATERIALS		MATERIALS ADDED TO CONTROL PROPERTIES																	
		LOSSES SUB SURFACE	LOSSES SURFACE	VOLUME MUD BUILT	BARITE M/T	BENTONITE	BARITE	BENT. API	CHROME LIGNO	THINNERS			POLYMERS				CAUSTIC SODA	SODA ASH	LIME	CaCl ₂	BICARB.	CMC L.V.	CMC H.V.	AL. STEAR.	DRLG. DET.	
													DRISPAC REG.	DRISPAC S.L.	XC- POLYMER											
	1981																									
43	9/8		40	40			30	36									9	1				5	9			
44	10/8		24	150			30	28									20	1				8	14			
45	11/8		82	50				30									10					18				
46	12/8		15	90			25	14						5			11	1				10				
47	13/8		158	20				2									1					6				
48	14/8		0	0																						
49	15/8		0	0																						
50	16/8		146	0																						
51	17/8		0	0																						
52	18/8		360	10			5	2													2					
53	19/8		0	100	19		50	1									3	2								
54	20/8		0	0																						
55	21/8		35	0				4																		
56	22/8		45	90	5		25	24									1	1								
FORWARD		118	10964	8982	820	66	1891	810					27	44	2		523	105		9	25	403	46	8	47	
ESTIMATED TOTALS		118	11869	9532	844	66	2056	951					27	44	7		588	111		9	27	450	69	8	47	

REMARKS



WELL NAME 7120/8-1 AREA TROMS I, NORWAY

OPERATOR STATOIL RIG. ROSS RIG

ENGINEERS E. KORSVOLD/A. AASE

Drilling Fluid & Material Consumption Report

UD SYSTEM SEA WATER/LIGNOSULPHONATE/GELREMARKS:



Drilling Fluid & Material Consumption Report

FLUID SYSTEM SEA WATER/GEL/LIGNOSULPHONATE

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG. ROSS RIG

ENGINEERS E. KORSVOLD/A. AASE

REMARKS.



ANCHOR DRILLING FLUIDS AS

OSLO — STAVANGER

Drilling Mud Properties Record

MUD SYSTEM SPUDMUD, BENTONITE/SEA WATER, BENTONITE/LIGNOSULPHONATE

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG ROSS RIG

ENGINEERS M. ALISON/ A. AASE/B. JACK/E. KORSVOLD

Day No	DATE	DEPTH FEET ☐ METERS ☒	MUD PROPERTIES																				OPERATION REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
			DENSITY PPG ☐ SG ☒	VISCOSITY				GELS 0	FLUID LOSS 30 Min cc's	CAKE 32 nds	H.T.H.P. cc's	PH	Filtrate Analysis			RETORT		BENTONITE #/BBL	POTASH #/BBL	POLYMER #/BBL	"N"	"K"																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
				sec/qt	A.V. cps	P.V. cps	Y.P. #/100 sq.ft.						Ca. ++ ppm	PI	% OIL	% SOLIDS	% SAND																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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REMARKS



ANCHOR DRILLING FLUIDS AS

OSLO - STAVANGER

Drilling Mud Properties Record

MUD SYSTEM BENTONITE/LIGNOSULPHONATE/SEA WATER

WELL NAME 7120/8-1

AREA TROMS I, NORWAY

OPERATOR STATOIL

RIG ROSS RIG

ENGINEERS M. ALISON/A. AASE/B. JACK/ E. KORSVOLD/

I. TORGERSEN

Day No	DATE	DEPTH	MUD PROPERTIES																				OPERATION REMARKS		
			DENSITY PPG $\square$ SG $\star$	VISCOSITY				GELS 0	FLUID LOSS 30 Min cc's	CAKE 32 nds	H.T.H.P. cc's	PH	Filtrate Analysis			RETORT		BENTONITE #/BBL	POTASH #/BBL	POLYMER #/BBL	"N"	"K"			
				sec/qt	A.V. cps	P.V. cps	Y.P. #/100 sq ft.						Ca. ++ ppm	PI	% OIL	% SOLIDS	% SAND								
1981																									
15	12/7	1127	1,25	43	23,5	18	11	3	15	8,6	1	19,4	10,2	11,5	200	0,14		13	0,25	20					
16	13/7	1127	1,25	43	22	17	10	7	18	9,0	1	19	9,8	13,6	260	0,18		13	0,25	25					
17	14/7	1297	1,30	42	24	17	14	8	26	9,2	1,5	21,2	9,8	14,8	400	0,11		15	0,25	27,5					
18	15/7	1407	1,30	46	22	15	14	10	28	9,0	1,5	20,6	10,2	17	120	0,30		17	0,25	28					
19	16/7	1502	1,30	58	21	14	14	11	25	8,8	1,5	18,6	10,8	16,5	120	0,50		16	0,3	28					
20	17/7	1610	1,30	45	21	15	12	5	35	8,7	1,5	18,2	10,7	18,2	420	0,20		17	0,2	22,5					
21	18/7	1672	1,30	52	22,5	15	15	5	42	8,3	1	17,8	10,0	18	120	0,50		17	0,4	22,5					
22	19/7	1788	1,35	70	29	20	18	5	42	7,6	1,5	15,8	10,0	18,2	140	0,50		18	0,25	25					
23	20/7	1822	1,40	53	21	15	12	4	36	7,4	1	15,4	10,0	17,5	80	0,7		16,5	0,25	22,5					
24	21/7	1822	1,40	50	22	15	14	4	35	7,3	1	14,8	10,2	17,5	120	0,6		17	0,25	22,5					
25	22/7	1822	1,40	54	24	16	16	4	27	7,3	1	15,2	10,0	17,5	140	0,5		17	0,25	22,5					
26	23/7	1822	1,40	56	22	16	12	3	29	6,2	1	14,8	9,8	16,3	220	0,6		16	0,25	22,5					
27	24/7	1921	1,40	47	11	16	12	3	23	5,3	1	15,8	10,3	17	160	0,9		17	0,25	22,5					
28	25/7	1995	1,30	43	18	13	10	2	18	5,4	1	15,5	10,7	16	280	0,7		14	TRACE	20					

REMARKS Varying funnel viscosities are due to the fact that some tests are bit checks, others from the flowtime. Flowline viscosities have tended to be 10 secs more than the bit checks, due to aeration and that the mud has not been treated by any solids control equipment expect the shakers.



ANCHOR DRILLING FLUIDS AS

OSLO - STAVANGER

Drilling Mud Properties Record

MUD SYSTEM BENTONITE/LIGNOSULPHONATE/SEAWATER

WELL NAME 7120/8-1 AREA TROMS I, NORWAY

OPERATOR STATOIL RIG ROSS RIG

ENGINEERS M. ALISON/A. AASE/B. JACK/E. KORSVOLD/

I. TORGERSEN

Day No.	DATE	DEPTH	MUD PROPERTIES																				OPERATION REMARKS	
			DENSITY PPG SG	VISCOSITY				GELS 0	FLUID LOSS 30 Min cc's	CAKE 32 nds	H.T.H.P. cc's	pH	Filtrate Analysis			RETORT		BENTONITE #/BBL	POTASH #/BBL	POLYMER #/BBL	"N"	"K"		
				sec/qt	A.V. cps	P.V. cps	Y.P. #/100 sq. ft.						X CT ppm	Ca. ++ ppm	PI	% OIL	% SOLIDS							% SAND
1981																								
29	26/7	2112	1,40	46	23	17	12	3	23	5,2	1	14	10,6	16,5	240	0,5		16	TRACE	22,5				
30	27/7	2121	1,40	50	21	15	12	3	25	5,2	1	14	10,7	16	240	0,5		16	0,25	22,5				
31	28/7	2163	1,45	52	22,5	17	11	2	25	5,1	1	14,1	10,9	15,5	240	0,6		18	0,25	22,5				
32	29/7	2181	1,45	51	21,5	16	11	3	19	5,0	1	13,8	10,8	15,5	220	0,6		17	0,25	22,5				
33	30/7	2181	1,45	48	20,5	15	11	3	21	5,3	1	14,6	10,6	15,5	200	0,4		17	TRACE	22,5				
34	31/7	2195	1,44	48	20	15	10	3	19	5,2	1	15,0	11,0	15,5	120	0,8		16	"	20				
35	1/8	2232	1,41	48	19	14	10	2	18	5,1	1	14,4	10,6	15,5	200	0,55		16	"	22,5				
36	2/8	2270	1,40	50	20	15	10	3	20	5,2	1	14,8	10,8	15	180	0,6		16	"	22,5				
37	3/8	2270	1,40	49	19	14	10	2	18	5,1	1	-	10,8	15	180	0,6		17	"	22,5				
38	4/8	2238	1,36	48	20	15	10	2	21	4,9	1	-	10,8	15	180	0,6		17	"	22,5				
39	5/8	2291	1,36	46	19	14	10	3	21	5,2	1	14,2	10,4	15,5	160	0,55		16	"	20				
40	6/8	2337	1,35	48	20	15	10	3	25	5,3	1	-	10,4	15,5	160	0,5		17	"	22,5				
41	7/8	2373	1,35	48	21	16	10	3	27	4,9	1	14,0	10,5	15,5	160	0,5		17	"	20				
42	8/8	2429	1,34	47	22,5	18	11	2	16	5,0	1	-	10,6	16,8	200	0,6		14	"	21				

REMARKS

MUD SYSTEM BENTONITE/ LIGNOSULPHONATE/SEA WATER

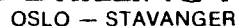
AREA, TROMS I, NORWAY

RIG. ROSS RIG

ENGINEERS S. BJØRHEIM/A. AASE/E. KORSVOLD

Day No	DATE	DEPTH FEET (1) METERS X	MUD PROPERTIES																				OPERATION REMARKS
			DENSITY PPG □ SG X	VISCOSITY				GELS 0 10	FLUID LOSS 30 Min cc's	CAKE 32 nds	H.T.H.P. cc's	PH	Filtrate Analysis			RETORT		BENTONITE #/BBL	POTASH #/BBL	POLYMER #/BBL	"N"	"K"	
				sec/qt	A.V. cps	P.V. cps	Y.P. #/100 sq. ft.						Ca. ++ ppm	PI	% OIL	% SOLIDS	% SAND						
1981																							
43	9/8	2470	1,33	48	22,5	17	11	2 15	5,0	1	14,3	10,5	15,5	160	0,5		16	TRACE					
44	10/8	2527	1,31	49	24	18	12	2 16	5,0	1	14,5	10,5	16,5	160	0,65		15	"	20				
45	11/8	2571	1,30	47	20,5	15	11	2 14	5,1	1	14,7	10,6	17	180	0,7		14	"	20				
46	12/8	2590	1,30	47	21,5	16	11	2 13	5,0	1	-	10,5	17	180	0,7		15	"	21				
47	13/8	2610	1,30	47	21,5	16	11	2 14	5,0	1	14,8	10,6	17,5	180	0,7		15	"	21				
48	14/8	2610	1,30	49	22	16	12	2 15	4,9	1	14,6	10,5	17	180	0,8		15	"	21				
49	15/8	2610	1,30	50	22	16	12	2 15	4,9	1	14,6	10,4	17,5	180	0,75		14	"	21				
50	16/8	2610	1,30	52	22	16	12	2 16	4,9	1	14,4	10,4	17,5	180	0,85		14	"	21				
51	17/8	2610	1,30	51	22	16	12	2 15	5,0	1	-	10,4	17,5	180	0,75		15	"	21				
52	18/8	2533	1,30	48	20,5	15	11	2 12	5,0	1	14,0	10,4	17,6	180	0,7		15	"	20				
53	19/8	2533	1,30	49	21	16	12	2 16	5,0	1	14,1	10,6	17	180	0,7		15	"	21				
54	20/8	2533	1,30	49	20,5	15	11	2 15	5,0	1	14,0	10,4	15,8	170	0,55		15	"	20				
55	21/8	2533	1,30	49	21	16	11	2 13	4,9	1	13,8	10,6	17	180	0,6		15	"	20				
56	22/8	2533	1,30	44	15,5	11	9	2 12	5,4	1	14,7	10,1	16,4	180	0,55		15	"	20				

REMARKS

MUD SYSTEM BENTONITE/LIGNOSULPHONATE/SEA WATER

ENGINEERS E. KORSVOLD/ A. AASE

Day No.	DATE	DEPTH	MUD PROPERTIES																				OPERATION REMARKS		
			DENSITY PPG $\square$ SG $\times$	VISCOSITY				GELS 0 10	FLUID LOSS 30 Min cc's	CAKE 32 nds	H.T.H.P. cc's	pH	Filtrate Analysis			RETORT			BENTONITE #/BBL	POTASH #/BBL	POLYMER #/BBL	"N"		"K"	
				sec/qt	A.V. cps	P.V. cps	Y.P. #/100 sq.ft.						Ca. ++ ppm	Pt	% OIL	% SOLIDS	% SAND								
1981																									
57	23/8	2533	1,30	47	19	14	10	22	5,8	1	15,0	10,1	16,7	300	0,7		15	0,25	20,0						
58	24/8	2170	1,30	49	19	14	10	20	5,8	1	15,0	10,3	16,8	220	0,6		15	0,25	20,0						
59	25/8	2153	1,30	49	17	12	10	25	5,9	1	15,3	10,4	17	260	0,65		15	0,25	20,0						
60	26/8	2153	1,30	47	16	11	10	16	6,5	1	16,5	10,4	17,2	260	0,65		14,5	0,25	19,0						
61	27/8	2153	1,30	47	15,5	11	9	15	6,4	1	16,3	10,5	17,2	240	0,6		14,5	0,25	19,0						
62	28/8	2153	1,30	46	17,5	13	9	17	6,5	1	16,5	10,5	16,8	220	0,6		14,5	0,25	18,0						
63	29/8	2127	1,30	47	16,5	11	11	35	7,0	1	17,2	10,7	17,5	360	0,8		14,5	0,25	18,0						
64	30/8	2127	1,30	49	20	14	12	45	7,3	1	18,0	10,9	16,8	220	1,2		14,0	0,25	20,0						
65	31/8	2127	1,30	48	19	13	12	40	7,2	1	17,8	10,9	16,8	260	1,2		14,0	0,25	20,0						
66	1/9	2127	1,30	47	19,5	13	13	60	7,1	1	17,5	11,0	16,8	400	1,3		14,0	0,25	20,0						
67	2/9	2088	1,30	45	15	10	10	37	7,2	1	17,7	10,9	17,6	200	0,85		14,0	0,25	20,0						
68	3/9	730	1,30	47	16,5	11	11	45	8,2	1	18,5	11,2	18,2	100	1,3		14,0	0,25	20,0						
69	4/9	680	1,30	49	21	15	12	44	7,5	1	18,5	11,5	16,5	220	1,6		13,0	TRACE	21,0						
70	5/9	480	1,30	47	19,5	14	11	50	7,6	1	-	11,4	17,2	260	1,4		14,0	"	20,5						

MUD SYSTEM BENTONITE/LIGNOSULPHONATE/SEA WATER

ENGINEERS A. AASE

[illegible]

Operation summary:

All depths are referred to the GR from LDT/CNL.

One RFT run was conducted 31 July 1981 as part of the first intermediate logging program in the 12 1/4" drilling sequence. RFT run no. 2, 3 and 4 was made 3 August 1981, during the second intermediate logging program.

RFT run no. 1: 6 pretests obtained from 6 attempts
(table 1)

RFT run no. 2: 12 pretests obtained from 12 attempts
(table 2). This includes 4 pretests taken in order to determine a suitable depth for sampling. A segregated sample (2 3/4 gal + 1 gal) was finally obtained at 2168 m (table 5). The 2 3/4 gal. chamber was opened and sealed at 2163 m before sampling at 2168 m.

RFT run no. 3: The main objective with this run was to achieve a segregated sample in the top of the hydrocarbon bearing sandstone. This was successfully achieved at 2094.0 m (table 6).

A second objective was to confirm/disprove an anomaly in the pressure gradient in the top of the sandstone sequence from RFT run no. 2. The pressure readings are listed in table 3.

RFT run no. 4: The well was cored with 8½" corebit from 2178.0 m (log depth) to preliminary TD (2271.0 m). In order to establish a gradient in this water bearing interval a separate RFT-run had to be made, using a smaller back up shoe on the RFT tool. 6 pressure readings were successfull out of 8 attempts (table 4).

WELL: 7120/8-1

DATE: 310781

RUN NO.: 1

MAX. REC. TEMP.: 130.130.130 (°F)

Test no	Depth...	Log hydr.pr. before test	Cor.hydr.pr. before test	Log pretest pres.	Cor.pretest pres.	Log hydr.pr after test	Cor.hydr.pr after test	Remarks
	m	psig	psig (g/cc)	psig	psig (g/cc)	psig	psig (g/cc)	
1	2094.0	4274	4288 (1.440)	3396	3408 (1.145)	4274	4288 (1.440)	
2	2114.0	4317	4331 (1.441)	3402	3414 (1.136)	4316	4330 (1.440)	
3	2122.5	4337	4351 (1.442)	3404	3416 (1.132)	4334	4348 (1.441)	
4	2136.5	4367	4381 (1.442)	3411	3423 (1.127)	4365	4379 (1.441)	
5	2163.0	4420	4434 (1.442)	3417	3429 (1.115)	4419	4433 (1.441)	
6	2169.0	4432	4446 (1.441)	3418	3430 (1.112)	4429	4443 (1.441)	

Table 1: RFT pretests

RUN NO.: 2 .

MAX. REC. TEMP.: 137°F

Test no	Depth	Log hydr.pr. before test	Cor.hydr.pr. before test	Log pretest pres.	Cor.pretest pres.	Log hydr.pr after test	Cor.hydr.pr after test	Remarks
	m RKB	psig	psig (g/cc)	psig	psig (g/cc)	psig	psig (g/cc)	
1	2095.0	4175	4189 (1.406)	3397	3409 (1.144)	4175	4189 (1.406)	
2	2115.5	4214	4228 (1.405)	3401	3413 (1.135)	4213	4227 (1.405)	
3	2124.0	4230	4244 (1.405)	3402	3414 (1.130)	4232	4246 (1.406)	
4	2135.0	4254	4268 (1.406)	3405	3417 (1.126)	4253	4267 (1.405)	
5	2150.5	4284	4298 (1.405)	3409	3423 (1.119)	4283	4297 (1.405)	
6	2163.0	4308	4322 (1.405)	3412	3424 (1.113)	4308	4322 (1.405)	
7	2175.5	4332	4346 (1.405)	3417	3429 (1.111)	4334	4348 (1.406)	
8	2179.0	4340	4354 (1.405)	4321	3433 (1.108)	4342	4356 (1.406)	
9	2169.0	4319	4333 (1.405)	3415	3427 (1.111)	4322	4336 (1.406)	Abort sample
10	2163.0	4308	4322 (1.405)	3414	3426 (1.114)	4305	4319 (1.404)	" "
11	2146.0	4273	4287 (1.405)	3412	3424 (1.122)	4279	4293 (1.407)	" "
12	2168.0	4322	4336 (1.406)	3418	3430 (1.113)	4322	4336 (1.406)	Seg. sample

Table 2: RFT Poretests

PRETEST RECORDED DATA

WELL: 7120/8-1

DATE: 030881

RUN NO.: 3

MAX. REC.TEMP.: 137°F

Test no	Depth...	Log hydr.pr. before test	Cor.hydr.pr. before test	Log pretest pres.	Cor.pretest pres.	Log hydr.pr. after test	Cor.hydr.pr. after test	Remarks
	m	psig	psig (g/cc)	psig	psig (g/cc)	psig	psig (g/cc)	
1	2094.0	4168	4182 (1.404)	3397	3409 (1.145)	4169	4183 (1.405)	Seg.sampl
2	2105.5	4192	4206 (1.404)	3405	3417 (1.141)	4194	4208 (1.405)	
3	2124.0	4229	4243 (1.405)	3406	3418 (1.132)	4230	4244 (1.405)	

Table 3: RFT Pretests

PRETEST RECORDED DATA

WELL: 7120/8-1

DATE: 030881

RUN NO.: 4

MAX. REC. TEMP.: 137°F

Test no	Depth	Log hydr.pr. before test	Cor.hydr.pr. before test	Log pretest pres.	Cor.pretest pres.	Log hydr.pr. after test	Cor.hydr.pr. after test	Remarks
	m	psig	psig (g/cc)	psig	psig (g/cc)	psig	psig (g/cc)	
1	2185.0	4349	4363 (1.404)	3427	3439 (1.107)	4348	4352 (1.401)	Superch.
2	2197.0	4370	4384 (1.403)	3443	3455 (1.106)	4368	4382 (1.403)	
3	2202.0	4378	4392 (1.403)	-	-	4380	4394 (1.403)	
4	2202.5	4378	4392 (1.402)	3451	3463 (1.106)	4379	3493 (1.403)	
5	2213.0	4400	4414 (1.403)	3464	3476 (1.105)	3497	4411 (1.402)	
6	2247.5	4469	4483 (1.403)	3519	3531 (1.105)	4469	4483 (1.403)	
7	2265.0	4504	4519 (1.403)	-	-	4504	4518 (1.403)	tight
8	2264.0	4499	4513 (1.402)	3542	3554 (1.104)	4498	4512 (1.401)	

Table 4: RFT pretests

RFT - sampling data

Well: 7120/8-1

Date: 030881

Run no: 2

Type of sample (segreg./separate): Seg.

Chamber sizes, lower: 2 3/4 gal bottle no:

upper: 1 gal

bottle no: RFS AB 1153

Choke sizes: 4 x 0.020"

Filter type: Standard

Depth	m	2168.0
Log hydr. pres. bef. setting	psi	4322
Log pretest pressure	psi	3418
Cor. pretest pressure	psi (g/cc)	3430 (1.113)
Lower/upper chamber:		See "Comments"
time opened		
log flowing pressure	psi	
log shut-in pressure	psi	
time sealed		
cor. flowing pressure	psi	
cor. shut-in pressure	psi (g/cc)	
Lower /upper chamber		
time opened		1915
log flowing pressure	psi	Slowly incr. 900-3409 psig
log shut-in pressure	psi	3409
time sealed		1929
cor. flowing pressure	psi	910-3412 (0.295-1.107)
cor. shut-in pressure	psi (g/cc)	3421 (1.110)
Log hydr. pres. after retracting	psi	4322 (1.402)
Max. recorded temp.	°F	137
Surf. pres., lower ch.	psi	2200 psig
Surf. pres., upper ch.	psi	Not measured

Comments: Sampling attempted at 2169.0, 2163.0, 2146.0, before
 successful sampling 1 gal. ch. at 2168.0 m.
 1 gal chamber sent to Statoil Pro.Lab for analysis
 2 3/4 gal. chamber bled off offshore.

RFT - sampling data

Well: 7120/8-1

Date: 030881

Run no: 3

Type of sample (segreg./separate): Seg.

Chamber sizes, lower: 2 3/4 gal bottle no:

upper: 1 gal bottle no: RFS AB 1166

Choke sizes: 4 x 0.020"

Filter type: Standard

Depth	m	2094.0
Log hydr. pres. bef. setting	psi	4168
Log pretest pressure	psi	3397
Cor. pretest pressure	psi (g/cc)	3409 (1.145)
Lower/ upper chamber:		
time opened		23.10
log flowing pressure	psi	approx. 2300
log shut-in pressure	psi	3390
time sealed		23.33
cor. flowing pressure	psi	approx. 2310
cor. shut-in pressure	psi (g/cc)	3402 (1.143)
Lower /upper chamber		
time opened		23.35
log flowing pressure	psi	approx. 2850
log shut-in pressure	psi	3385
time sealed		23.53
cor. flowing pressure	psi	approx. 2860
cor. shut-in pressure	psi (g/cc)	3397 (1.141)
Log hydr. pres. after retracting	psi	4160
Max. recorded temp.	°F	137
Surf. pres., lower ch.	psi	2500
Surf. pres., upper ch.	psi	Not measured.

Comments: 1 gal. chamber sent to Statoil Pro.Lab. for analysis
 2 3/4 gal chamber bled off offshore.

Tests in well 7120/8-1

A. Drill Stem Tests

Three drill stem tests were carried out in the hydrocarbon bearing zone.

DST no. 1: 2165 - 2172 m

DST no. 2: 2133 - 2138 m, 2140 - 2150 m

DST no. 3: 2092 - 2110 m

Flow data are given in table 1, 2 and 3..

7120/8-1, DST No. 1: 2165.0 - 2172.0 m RKB

P R E L I M I N A R Y

FLOW PERIOD	DURATION (mins)	WHP (psia)	WHT (°C)	* BHP (psia)	* BHT (°C)	RATE, COND. (STB/D)	RATE, GAS (MMSCF/D)	CHOKE (inch)
Initial flow	2	23	-	-	-	-	-	-
Initial build-up	64	27	-	3433	75	-	-	-
Clean up	434	2323	36	3145	79	-	-	44/64"
1st flow rate	570	2362	36	3090	81	200	21.7	44/64"
2nd flow rate	548	1575	41	3035	81	340	37.3	64/64"
Final build-up	1887	2855	-	3437	78	-	-	-

Condensate gravity:

0.777

Gas gravity:

0.662

CO₂:

4.5 %

H₂S:

0

B W & W:

4 % mud, 6 % H₂O, 0 % SOLIDS

* Lynes DMR-314, S/N 1236

Table 1

120/8-1, DST no. 2: 2133.0 - 2138.0, 2140.0 - 2150.0 (m RKB)

P R E L I M I N A R Y

FLOW PERIOD	DURATION (mins)	WHP (psia)	WHT (°C)	*BHP (psia)	*BHT (°C)	RATE, COND. (STB/D)	RATE, GAS (MMSCF/D)	CHOKE (inch)
Initial flow	10	-	-	-	-	-	-	-
Initial shut in	61	26	-	3387	73	-	-	-
Clean up	390	1163	-	1737	58	-	-	48/64"
	208	682	-	1474	55	-	-	64/64"
Clean up (sep.)	58	734	29	1493	56	-	-	64/64"
1st flow rate	606	1620	36	2189	68	85	14.6	40/64"
2nd flow rate	475	932	34	1661	61	168	19.7	64/64"
Final build-up	2237	2830	-	3423	72	-	-	-

Condensate Gravity: 0.774
 Gas Gravity: 0.666
 CO₂: 5 %
 H₂S: 0
 B S & W: Water 2 %, Sed.: trace

* Flopetrol SSDR (81049)

Table 2

P R E L I M I N A R Y

FLOW PERIOD	DURATION (mins)	WHP (psia)	WHT (°C)	*BHP (psia)	*BHT (°C)	RATE, COND. (STB/D)	RATE, GAS (MMSCF/D)	CHOKE (inch)
Initial flow	1	-	-	-	-	-	-	-
Initial build-up	63	36.5	-	-	-	-	-	-
Clean up	410	1946	45	2998	77	128	27	48/64"
1st flow	348	2640	42	3294	80	72	13.4	28/64"
2nd flow	453	2233	50	3118	79	216	24.7	44/64"
3rd flow	407	1598	47	2947	78	336	33.7	64/64"
Final build-up	1470	2820	-	2419	74	-	-	-

Condensate Gravity: 0.780

Gas Gravity: 0.666

CO₂: 5 %H₂S: 0

B S & W: Water: 5%, Sed.: trace

* Flopetrol SDR (81051)

Table 3

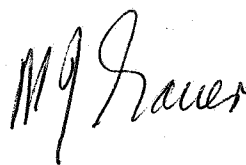
GEOCHEMICAL EVALUATION OF STATOIL'S 7120/8-1 WELL
TROMS CONCESSIONS, OFFSHORE NORWAY

SUMMARY

The Tertiary-Cretaceous shales and mudstone between 355 metres and 1930± metres are immature and, apart from scattered fair to good and very good interbeds, have a poor potential for gas and associated liquids.

Very good and rich shales and silts are abundant in the basal Cretaceous-Upper Jurassic (at 1930-2125± metres). They are marginally mature on-structure where minor hydrocarbon generation is taking place. Good shows of wet gas/condensate within this interval suggest that significant hydrocarbon generation is occurring in their off-structure lateral equivalents.

Within the Lower Jurassic-Triassic sands (2125± metres down to 2615 metres) are interbeds of shale which are a marginally mature but potentially good gas/condensate source. The thin coals within this interval are primarily a gas/condensate source although in the mature state would also generate significant volumes of paraffinic crude oil. Their more mature equivalents, if they exist down dip, are postulated to be the source of the produced gas at 2093-2110± metres, the kicks of dry gas below 2345± metres and, possibly, of the waxy crude oil detected at 2125-2330± metres.



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REGISTRERT
OIL & GAS

INTRODUCTION

This report presents a geochemical evaluation of the Statoil 7120/8-1 well drilled offshore northern Norway.

This project, in accordance with a proposal dated 28th September 1981, was designed to investigate the hydrocarbon source potential of the section and to detect and characterise shows of migrated hydrocarbons.

This study was authorised by Dr. A. Elvsborg, Statoil Geological Laboratory, Stavanger.

A. ANALYTICAL

A total of one hundred and forty four (144) canned cuttings and fifteen (15) sidewall core samples and duplicate gas samples were received from the 355-2615 metre interval in the 7120/8-1 well. The cuttings samples were composited over intervals of 15 metres (no samples were received from the 2170-2270 metre interval), sidewall cores have depths ranging from 1937 metres down to 2089.5 metres and the gas samples (A4898) were collected at 2093-2110± metres.

Traces of detergent but no severe contamination was observed during the sample washing process.

The samples were analysed in accordance with the above proposal. They were screened using the light hydrocarbons and organic carbon analyses and samples for subsequent analysis were selected on the basis of the screen results. A total of one hundred and forty four light hydrocarbon analyses, two hundred and sixty seven organic carbon determinations, fifty seven mini-pyrolysis analyses, fifty two kerogen analyses, thirty three vitrinite reflectance determinations, thirty two extractions with chromatography, thirty two high resolution paraffin-naphthene analyses, thirty four pyrolysis-GC analyses and two methane carbon isotope analyses were performed in this study.

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The data are presented in tables 1 to 8 and graphically in figures 1 to 7.

A brief description of the analytical techniques employed is included in the back of this report.

B. GENERAL INFORMATION

Ten (10) copies of this report have been forwarded to Dr. A. Elvsborg at Statoil together with the kerogen slides prepared for this study. A copy of the data has been retained by Geochem for future consultation with authorised Statoil personnel.

The remaining sample material will be handled as directed.

All of the results relating to this study are regarded as highly confidential and are proprietary to Statoil.

RESULTS AND DISCUSSION

Each parameter relevant to the evaluation of the section between 355 metres and 2615 metres will be considered in turn and then combined to form the 'Conclusions'.

No well logs were available for this study but the sediments are understood (communication from client) to be of Tertiary age at 360-750± metres, Cretaceous at 750-1990± metres, Upper Jurassic at 1990-2090± metres and of Middle to Lower Jurassic and Triassic age at 2090-2610± metres.

A. ZONATION

This zonation is based upon significant breaks in the geochemical data - a total of five (5) zones are recognised.

Zone A 355 metres down to 1135± metres, is a sequence of pale grey-olive grey mudstones and shales which become somewhat darker in colour as depth increases. Minor anhydrite occurs at 865-880± metres whilst limestones and traces of calcite are present in the basal 30± metres.

No fluorescence was detected.

Gaseous hydrocarbon abundances peak at 535-550± metres (9271 ppm), 820-835± metres (9590 ppm), 895-910± metres (24020 ppm) and at 1075-1090± metres (4551 ppm). With these exceptions the gases are poor (less than 1000 ppm, and generally less than 500 ppm). Gas wetness varies between 2% at 535± metres and 27.6-29.5% in the richer samples. In the leaner samples the values range erratically from 0% up to 60% but have little significance at such low levels of abundance. The gasoline (C_5 - C_7) fraction is generally sparse but modest improvements (to 812-3298 ppm), coinciding with the enhancements in the gaseous hydrocarbons, do occur. Isobutane to normal butane

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ratios, where measurable, range widely between 0.16-3.54.

Zone B (1135-1360± metres), is composed of interbedded medium grey shales and lighter coloured mudstones.

No fluorescence was observed.

The hydrocarbon gases, with one exception (179 ppm at 1290± metres) are richer (1411-12525 ppm) and wetter (36.2-87.8% C₂+ hydrocarbons) than they were in Zone A. The C₅-C₇ hydrocarbons are also more abundant, generally exceeding 1000 ppm (148-5727 ppm). Isobutane to normal butane ratios range narrowly between 0.47 and 0.88.

Zone C lies between 1360± metres and 1930± metres. Medium to dark grey shales and shaly mudstones pass below 1780± metres to an interval of interbedded grey shales and yellowish brown siltstones. Caved material is common in the samples above 1585± metres whereas those from below 1825± metres contain significant lost circulation material (cement).

No fluorescence was detected.

Within this interval the C₁-C₄ hydrocarbon abundances vary widely from 178 ppm up to 15332 ppm (the richest intervals are at 1555-1675± metres and at 1765-1810± metres); in general they are of fair abundance (greater than 1000 ppm). Gas wetness fluctuates between 25.9% and 95.1%, appears to be uncorrelated with abundance but increases significantly in the basal 200± metres. On average the ratios of isobutane to normal butane are higher (0.37-1.11) than in Zone B. Gasoline range hydrocarbons improve in abundance from poor (52-872 ppm) to generally fair (242-3467 ppm) above and below 1765± metres respectively.

Zone D (1930-2125± metres) approximately corresponds to the Upper

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Jurassic (picked at 1990-2090± metres). Dark grey shales overlie, at 1990± metres a sequence of dark yellowish brown siltstones and grey shales which extends down to 2080± metres. Below this depth the shales are silty and generally dark olive grey in colour. Pale grey limestones are present at 1975-1990± metres whilst the lowermost sample at 2110-2125± metres contains significant amounts of sandstone.

No fluorescence was detected.

Within this zone the C_1-C_4 hydrocarbons are generally of good (9775-75864 ppm) abundance but are poor to fair (333-4599 ppm) at 1960-1990± metres. Gasoline hydrocarbon abundances are poor (35-775 ppm) above 1990± metres but improve to fair (2691-8728 ppm) below this depth. The hydrocarbon gases are generally wet to very wet (43.8-96.4% C_{2+} hydrocarbons) and, together with the low (0.18-0.28) isobutane to normal butane ratios, suggest migrated hydrocarbons.

Zone E extends, with a sampling gap at 2170-2270± metres, from 2125± metres down to 2615 metres and is dominated by sandstones. Within the sands are interbeds of (carbonaceous) shale, coal (at 2345-2375± metres, 2500± metres and at 2600-2615± metres) and siltstone (below 2400± metres).

Apart from a yellow fluorescence at 2285-2300± metres the sands are non fluorescent although they yielded a milky cut at 2285-2390± metres.

Intermittant kicks of 11037-25648 ppm occur throughout this zone but, in general, the C_1-C_4 hydrocarbon abundances are less than 10,000 ppm (1150-8701 ppm). Gas wetness decreases, with depth, from 84% down to 15.5%, and in the richer samples is commonly less than 30%. Isobutane to normal butane ratios are somewhat higher (0.26-0.93) than those in Zone D. The gasoline range

hydrocarbons exceed 1000 ppm (1137-2549 ppm) at 2300-2345± metres but are increasingly sparse in the basal 300± metres.

B. AMOUNT AND TYPE OF ORGANIC MATTER

The amount of organic matter within a sediment is measured by its organic carbon content. Average shales contain approximately one percent organic carbon, and this is the standard to which these samples will be compared.

Organic matter type influences not only source richness but also the character of the hydrocarbon product (oil, gas) and the response of the organic matter to thermal maturation. Richness and oiliness decrease in the order: amorphous-algal-herbaceous-woody. Wood has a primary (but not exclusive) potential for gas whilst inertinitic (oxidised, mineral charcoal) material has only a limited hydrocarbon potential.

Shales and mudstones of above average richness (1.00-3.16% organic carbon) occur at 355-400± metres and at 595-865± metres. With these exceptions the Zone A sediments generally contain 0.45-0.94% organic carbon although values of less than 0.5% are common below 865± metres. Within Zone B the shales have fair to good (0.78-1.42%) organic carbon contents but the interbedded mudstones are leaner with values of 0.25-0.60(0.87)%.

Dominantly amorphous, and lesser quantities of inertinitic, herbaceous and woody, organic matter is present in the sediments of Zones A and B. Only traces of algal kerogen were observed. The amorphous fraction of the organic matter includes partially developed material but is commonly of poor quality (grainy in appearance) and, at 355-370± metres and at 550-670± metres resembles drilling introduced contamination. Herbaceous kerogen, frequently a significant fraction of the total organic matter, is largely composed of pollen spores in Zones A and B.

Although the Zone C shales and silts have above average (0.91-2.40%) organic carbon contents their organic matter is largely composed of reworked inertinitic and woody debris. Exceptions to this generalisation are the shales at

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1465-1480± metres, 1570-1585± metres and at 1675-1690± metres where significant amounts of grainy amorphous (± herbaceous) kerogen are also present.

In general, the dominant shales and silty shales of Zone D have good to very good (1.71-8.26%) organic carbon contents although even richer interbeds, with values of up to 11.6%, are present at 2065-2080± metres. These sediments are rich in amorphous, algal and algal, partially converted to amorphous, kerogen. They also contain significant amounts of inertinitic and woody debris, but only minor herbaceous, organic matter. The interbedded siltstones and, at 1975-1990± metres limestones, are lean containing less than 0.38% organic carbon.

The Zone E shales (occurring as interbeds in the more abundant sandstones) have organic carbon contents of 0.93 to 10.58% whilst the more coaly shales (carbargillites) and coals yielded values of 17.5-55.2%. The shales (up to 10.6% organic carbon) are rich in amorphous organic matter and also contain significant amounts of inertinite and woody but only minor algal and herbaceous kerogen. Mainly wood, with significant inertinite and traces of herbaceous and algal organic matter is present in the coals.

The nature of the dominant organic matter suggests that mildly oxidising conditions existed when the shales and mudstones of Zones A to C were deposited. A more reducing environment existed at the seawater-sediment interface during Zone D times and, with oxidising interludes, when Zone E was laid down.

C. LEVEL OF THERMAL MATURATION

Visual kerogen (spore colour) and vitrinite reflectance techniques have been used to assess thermal maturity.

Suitable organic matter for maturation determination by the visual kerogen method is sparse in Zones A-C and, as a consequence, the maturation indices lack their usual precision. Within Zones D and E the amorphous/algal fraction,

although abundant, largely consists of partially sapropelised material and is therefore difficult to assess for changes in colour. This assessment is further hindered by the coarse nature of the organic matter. Nonetheless, the more reliable evaluations of spore colour indicate that the transition from immaturity to marginal maturity (at an index of 2-) occurs at approximately $1950 \pm$ metres. The woody fraction of the organic matter achieves marginal maturity at an index of 2 and is, therefore, immature throughout the analysed section.

Woody organic matter, upon which vitrinite reflectance measurements are made, appears (visually) to be almost totally reworked in the sediments of Zones A to D. This conclusion is supported by the presence in many samples of four or more particle populations whose mean reflectances range from 0.31% up to 1.29% Ro. These data when plotted against depth produce a tenuous trend though the less mature (fresh vitrinite ?) populations which extends from 0.38% Ro at $350 \pm$ metres to 0.45% Ro at $2200 \pm$ metres. Unfortunately, vitrinite in the Zone D coals appears to be brecciated (suggesting that it is highly altered) and, furthermore, yields mean reflectances (0.60-0.71% Ro) which are considerably more mature than the extrapolated maturation trend. An upward extension of this trend, by many thousands of metres would be required to achieve a "surface" value of 0.20-0.25% Ro; this necessitates an unacceptably large loss of section by erosion. Similarly, if the trend is extended downward to 0.7% Ro (top of the "oil window") an equally large vertical movement would be involved. The proposed thermal gradient is therefore too low. Oxidation of the vitrinite, and consequent enhancement of its reflectance, at 625-820 $\pm$ metres is believed to be responsible for this effect. A value of 0.31% Ro (2 particles at $750 \pm$ metres), resulting in a higher geothermal gradient, may be more accurate. The Ro values (0.42-0.45%) at 2000-2170 $\pm$ metres appear to be more reliable and, furthermore, correlate with the spore colour based maturation index of 2- at this depth.

To summarise:

- the sediments in Zones A-C are immature and generating negligible volumes of gas and associated liquids.

- the amorphous rich sediments of Zones D and E are just marginally mature and starting to generate minor volumes of liquid hydrocarbons.
- the dominance of immature wood in the Zone E coals dictates their effective maturity. On-structure they are realising a small fraction of their potential for gas and associated liquids.

D. SOURCE RICHNESS

Preliminary assessments of source richness are based upon the abundance of light hydrocarbons and organic carbon.

The light hydrocarbons within Zone A are, apart from occasional fair to good kicks, poor, suggesting minimal source potential. In Zone B they are of fair abundance, fair to good in Zones C and E and good to very good in Zone D. Within Zone D the hydrocarbon gases are wetter than expected for immature or marginally mature sediments and migrated hydrocarbons are, therefore, suspected. Their abundance is clearly unrelated to source richness.

The shales and mudstones of Zones A and B are, from the organic carbon data, rated as a fair, with good and poor interbeds, hydrocarbon source. Zone C, apparently, has a good hydrocarbon potential. These ratings are however, since the organic matter is totally immature, potential rather than actual and, because of the dominance of poor quality amorphous, inertinitic and woody organic matter, optimistic. In contrast to the overlying sediments Zone D is composed of good to very good (1.71-8.26% organic carbon) and rich (up to 11.6%) shales and silty shales. Equally rich (0.93-10.58% organic carbon) shaly interbeds occur within Zone E whilst the thinly scattered coals are, per unit volume, a potentially rich (17.5-55.2% organic carbon) gas/condensate source.

The abundance of indigenous C_{15+} hydrocarbons is related to source richness. With few exceptions (477 ppm at 355-370± metres and 295-436 ppm at 745-835± metres) the sediments within Zones A to C yielded less than 123 ppm C_{15+} hydrocarbons. Chromatograms of the paraffin-naphthene fraction, however,

show that the "richer" sediments and most of the leaner ones are contaminated by mud additives (a mixture of diesel and naphthenic types). In several traces an odd carbon preference and a strong pristane peak are apparent, suggesting contributions from indigenous hydrocarbons. They are however minimal, estimated to be less than 100 ppm and, therefore, indicate a poor hydrocarbon potential. At 1870-1885± metres (basal Zone C) 918 ppm C_{15+} hydrocarbons were extracted from the yellowish brown siltstones. They constitute 48.1% of the total soluble extract and are not, therefore, entirely indigenous to the sediments. The paraffin-naphthene fraction traces resemble a mixture of drilling introduced (baseline hump) and indigenous (odd carbon preference) hydrocarbons. The latter are estimated to amount to 250-500 ppm - corresponding to a fair to good hydrocarbon potential. Zone D is significantly richer in heavy hydrocarbons than the overlying interval; they range in abundance from (423)724 ppm up to 2705 ppm. Furthermore, the relatively flat baseline and marked odd carbon preference in the paraffin-naphthene traces confirms that contamination is minimal and that the hydrocarbons are largely source related. With one possible exception, 44.2% at 2050-2065± metres, the hydrocarbon to total extract (21.1-37.0%) and hydrocarbon to organic carbon ratios (less than 4.7) also suggest that these hydrocarbons are indigenous and not migrated. Zone D is therefore rated as a potentially rich source by this parameter. The shales at 2125-2140± metres yielded 1239 ppm C_{15+} hydrocarbons but the relatively high hydrocarbon to total extract ratios (56.1) indicates that they are partly non-indigenous and, therefore, unrelated to source richness. Although the coaly shales, represented by the sample at 2480-2495± metres, are capable of yielding 1937 ppm C_{15+} hydrocarbons the low hydrocarbon to organic carbon ratio (0.77) shows that they have a primary potential for gas rather than oil.

The pyrolysis analysis measures source potential at optimum maturity. This analysis is normally unaffected by non-indigenous hydrocarbons but these sediments, particularly in Zone A, were affected by a heavy, sparingly soluble, contaminant. Thermal bitumen and pyrolysate yields were enhanced by this material and samples from Zone A, and elsewhere, were solvent extracted prior to reanalysis. Traces of the material remain in the sediments at 355-370± metres, 655-670± metres and possibly at 745-760± metres. The

Zone A shales and mudstones have, from the pyrolysis analysis, a fair (2192-2918 ppm pyrolysate) hydrocarbon potential down to 570± metres. They are poor to fair (745-3089 ppm pyrolysate) with very good interbeds (5657-6411 ppm at 595-760± metres), below this depth. Zone B is generally poor (less than 1622 ppm pyrolysate) although fair interbeds, with values of 2231-2742 ppm are present at 1225-1300± metres. Zone C is also poor (669-1739 ppm pyrolysate) with fair and good (3117-4181 ppm pyrolysate) interbeds at 1570-1690± metres.

In contrast to the shallower intervals, pyrolysate yield of 3330-13616 ppm indicate that the shales and siltstones of Zone D are generally good to very good or rich potential source rocks. Scattered poor and fair interbeds are also present. Pyrolysate to organic carbon ratios of less than 0.25 suggest that the sediments have a potential for gas/condensate rather than oil (see below). Within the dominant sandstones of Zone E are interbeds of shale, coaly shale (carbargillite) and coal. The shales are potentially fair to good (2909-4204 ppm pyrolysate) source rocks whereas the coals, yielding 19189-35982 ppm pyrolysate, are rich.

Potential hydrocarbon products (gas, condensate, oil) may be identified from the pyrolysis-GC traces. In general, the analysed sediments produced chromatograms in which methane (C_1) and an attenuated series of non normal paraffins (dying at nC_{15} - nC_{20}) are present. Exceptions to this rule are the Zone E coals which generated an additional series of alkane-alkene double peaks extending out to beyond nC_{25} . They have a primary potential for gas/condensate but are also capable of generating significant volumes of paraffinic crude oil. Apart from these coals the sediments, particularly the shales of Zones D and E, have a potential for gas and condensate.

To summarise:

- the shales and mudstones of Zones A-C are poor to fair source rocks with scattered good interbeds. They have a potential for gas and associated liquids.
- Zone D is a potentially very good gas/condensate source.

- interbeds of shale within Zone E are fair to good source rocks whilst the coals, per unit volume, are rich.

E. MIGRATED HYDROCARBONS

Minor limestones at 1105-1135± metres, at 1975-1990± metres, and sandstones, significant at 2095-2125± metres but dominant below this depth, represent potential reservoir facies.

Gas kicks were detected in the Zone A shales and mudstones at 535-550± metres, at 820-835± metres, at 895-910± metres and at 1075-1090± metres. Within Zones B and C the gases are moderately wet to wet and sufficiently abundant to suggest that wet gas or condensate has diffused into the shales. The best "shows" are at 1135-1285± metres and at 1765-1810± metres where the presence of a gasoline fraction indicates condensate rather than wet gas. Traces of wet gas, notably at 1570-1675± metres and at 1870-1885± metres, are also present. C₁₅₊ hydrocarbons, other than contaminants are sparse confirming that the shows are of gas/condensate and not of crude oil.

Zone D is rich in wet gases but the gasoline fraction is only of fair abundance, suggesting that the shows are of gas rather than condensate or crude oil. Although abundant (423-2705 ppm) the C₁₅₊ hydrocarbons have, with one exception (44.2% at 2050± metres) hydrocarbon to total extract ratios which are not diagnostic of migrated crude oil - a conclusion which is supported by the low (less than 4.7) hydrocarbon to organic carbon ratios. In addition chromatograms of the C₁₅₊ paraffin-naphthene fraction generally have immature features (strong pristane peak and odd carbon paraffin preference) and only in the lowermost sample does the smoother paraffin distribution suggest possible traces of crude oil.

Within Zone E the hydrocarbon gases fluctuate in abundance between 523 ppm and 25648 ppm. They are wet to very wet above 2170± metres but are comparatively dry (less than 40% C₂₊ hydrocarbons) below this depth. Kicks of somewhat drier gas are associated with the coals and this gas appears to have diffused upwards through the sands. The relatively low gas wetness

values (possibly for the reasons stated above) do not immediately suggested migrated crude oil. However, the shales at 2125-2140± metres and sands at 2270-2330± metres yielded 1239 ppm and 2004-2358 C₁₅₊ hydrocarbons, respectively. Hydrocarbons to total extract ratios of 48.4-56.1% indicate non indigenous hydrocarbons which, from the paraffin-naphthene fraction chromatograms, resemble a moderately mature, waxy crude oil. These hydrocarbons are enhanced by drilling introduced contaminants at 2315-2330± metres and traces of the same contamination were extracted from the sands at 2420-2435± metres and at 2585-2600± metres.

More mature off structure equivalents of the fair to good shales and mudstones (e.g. at 685-875± metres, at 1150-1200± metres and at 1675-1855± metres) are believed to be the source of the shows of gas, wet gas and condensate in Zones A-C.

The very good, and rich, shales and siltstones within Zone D have a potential for gas/condensate (light oil ? at 1930-1945± metres and at 2050-2065± metres); they are, however, immature on-structure. The gases within this zone are wet and are characterised by low (generally less than 0.3) isobutane to normal butane ratios. These values suggest that the hydrocarbons were locally generated, in more mature equivalents of the host sediments.

Per unit volume the Zone E coals/carbargillites are a potentially rich gas (and oil) source although the gas kicks detected in this interval were most probably generated down dip. These gases are drier (less than 40% C₂₊ hydrocarbons) and have higher (0.46-0.93) isobutane to normal butane ratios than those in Zone D. The light hydrocarbon data suggest that wet gas (and crude oil ?) from Zone D has diffused into the top 50± metres of Zone E.

Two gas samples from the 2093-2110± metre interval were submitted for analysis. The gases contain 14.6-17.9% C₂₊ hydrocarbons and have isobutane to normal butane ratios of 0.63-0.67. The available data suggest that the gases were generated off structure, either in more mature equivalents of the Zone D shales/silts or, alternatively, in the interbeds of coal and carbargillite in Zone E. Gas wetness values would, apparently, eliminate the first

alternative (th Zone D gases are wet) although the effect of migration upon this parameter is uncertain. The ratios of isobutane to normal butane in the samples of produced gas differ significantly from those in Zone D but are similar to those in Zone E. On balance the light hydrocarbon data suggest a correlation between the produced gas and the Zone E coals or, more probably, their down dip equivalents. Methane carbon isotope ratios $-34.4^{\circ}/\text{oo}$ and $-35.0^{\circ}/\text{oo}$ indicate either a very mature or, in the context of this study, a dominantly land plant type source (e.g. the Zone E coals). These results are not unequivocal and a more definitive correlation, based upon methane carbon isotope ratios, in both cuttings gas and produced gas samples, is recommended for any projected wells on this block.

The oil detected above $2330 \pm$ metres in Zone E is both waxy and moderately mature; suggesting that it was locally generated in sediments containing a high proportion of land plant debris. Within the analysed section the sediments have primary potential for gas or condensate and are not paraffinic crude oil. The Zone E coals are an exception and if they thicken off structure would be prospective not only for gas/condensate but also for paraffinic crude oil.

To summarise:

- intermittant gas kicks were detected in Zone A.
- minor shows of wet gas/condensate are present in Zone B.
- traces (minor show at $1765-1810 \pm$ metres) of wet gas occur throughout Zone C.
- shows of wet gas (notably at $1990-2110 \pm$ metres) were observed in the Zone D shales and silts.
- minor shows of waxy crude oil were detected in the shales and sands at $2125-2330 \pm$ metres in Zone E. Below $2330 \pm$ metres the gases are drier although scattered gas kicks were detected down to $2615 \pm$ metres.

F. CONCLUSIONS

Five (5) zones are recognised in the interval between 355 metres and 2615 metres in the 7120/8-1 well.

Zone A (355-1135± metres) consists largely of pale grey shales and (shaly) mudstones of Tertiary-Cretaceous age. Traces of anhydrite are present at 865-880± metres and minor limestones occur in the basal 30± metres. The shales and mudstones generally have poor to fair (0.45-0.94%) organic carbon contents although somewhat richer interbeds at 1.0-3.16% organic carbon are present at 355-400± metres and at 595-760± metres. Their organic matter chiefly consists of poor quality amorphous (occasionally resembles drilling introduced contaminants) inertinitic and woody material. Herbaceous kerogen, often a significant fraction is largely composed of pollen spores. The sediments are immature on-structure and have a potential for gas/condensate. Apart from interbeds of very good shaly mudstone at 595-760± metres the Zone A sediments are fair, above 570± metres, or poor to fair source rocks.

Zone B (Cretaceous) lies between 1135± metres and 1360± metres. The dominant, medium grey, shales within this interval have fair to good (0.78-1.42%) contents of inertinitic (± atypical amorphous), woody and herbaceous kerogen. They are interbedded with poor to fair (0.25-0.78% organic carbon) mudstones. The sediments are immature and, apart from potentially fair shales at 1225-1300± metres, have a poor potential for gas and associated liquids.

Zone C, 1360± metres down to 1930± metres, is composed of Cretaceous sediments. Yellowish brown siltstones occur below 1780± metres but the interval is dominated by medium-dark grey shales. The shales are of above average richness (0.91-2.40% organic carbon) but their organic matter is largely composed of reworked inertinitic and woody debris (which has a minimal hydrocarbon potential). Significant amounts of herbaceous (± amorphous), and minor, algal, kerogen are also present. Interbeds of fair and good shale occur at 1570-1690± metres but Zone C generally has a poor potential for gas/condensate. The sediments are immature and only minor hydrocarbon

generation is occurring on-structure.

Zone D (1930-2125± metres) is dominated by dark grey and dark brownish grey (Upper Jurassic) shales. They are interbedded with siltstones (between 1990± metres and 2080± metres), limstones (at 1975-1990± metres) and sandstones (below 2100± metres). The shales (silty below 2080± metres) have good to very good (1.71-8.26%) and occasionally rich (10.8-11.6%) organic carbon contents. This richness is enhanced by the good quality of their, dominantly amorphous and algal, organic matter. Below 1950± metres the sediments are just marginally mature and have started to realise their potential for gas and condensate. The oil window is not penetrated in the analysed well section and the depth at which it would occur is difficult to predict from the available data. It is estimated that additional burial, possibly by up to 2000± metres, would be necessary to achieve optimum maturity.

Zone D is therefore rated as a very good to rich, but marginally mature, gas condensate source.

Zone E extends, with a sampling gap at 2170-2270± metres, from 2125± metres down to the deepest sample at 2615± metres. The sediments, dominantly sandstones, with interbeds of shale, coal and siltstone, are of Middle Jurassic-Triassic age. Abundant (0.93-10.58% organic carbon), chiefly amorphous, with significant inertinitic and woody (± algal), organic matter is present in the shales whilst the carbargillites and coals are rich (17.5-55.2% organic carbon), in woody, inertinitic and herbaceous debris. The shales and coals have a primary potential for gas and associated liquids although the coals are also capable of generating a paraffinic crude oil. Hydrocarbon generation on-structure will however be limited, by the marginal maturity of the sediments, to minor volumes. Zone E although dominated by sandstones, contains interbeds of shale which constitute a potentially very good gas/condensate source. Per unit volume the coals are a rich, but effectively immature source for gas (and crude oil).

Intermittant dry gas kicks were observed in Zone A (355-1135± metres). Traces of wet gas/condensate, amounting to minor shows at 1135-1285± metres,

at 1570-1675± metres, at 1765-1810± metres and at 1870-1885± metres, were detected throughout Zones B and C (1135-1930± metres).

The good shows of gas/condensate in Zone D (1930-2125± metres) are partially due to hydrocarbon generation in the host sediments but are believed to be largely the result of a localised movement of hydrocarbons from their more mature equivalents off structure. The gaseous hydrocarbons are wet to very wet, containing (43.8)51.4-96.4% C₂₊ hydrocarbons, and have low (less than 0.3) isobutane to normal butane ratios. They differ markedly from the duplicate samples produced when the interval at 2093-2110± metres was tested; corresponding values for the latter are 14.6-17.9% and 0.63-0.67. In fact, these parameters suggest a better correlation with Zone E than Zone D.

Shows of wet gas/condensate detected above 2345± metres in Zone E have similar characteristics to those in Zone D. Higher isobutane to normal butane ratios, however, indicate that some hydrocarbon generation is also occurring in the host sediments or more probably their mature equivalents off structure. Below 2345± metres the gases are drier and have a higher isobutane to normal butane ratio. Their source is believed to be down dip, in more mature equivalents of the Zone E coals (the coals are effectively immature on-structure). These gases also correlate with those tested at 2093-2110± metres; a conclusion which is supported by their carbon isotope ratios (-34.4⁰/oo to -35.0⁰/oo).

In addition to wet gas/condensate, minor shows of a waxy crude oil were detected in the shales and sands lying above 2330± metres in Zone E. This oil, generated from sediments rich in land plant debris is moderately mature and believed to be locally generated. The Zone E coals contain abundant land plant derived organic matter but are effectively immature - suggesting that the source of the oil lies off structure.

TABLE 1A

CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ 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	$\frac{iC_4}{nC_4}$
606-001	355-370	268	0	0	0	0	268	0	0.0	0	0.00
606-002	370-385	11	0	0	0	0	11	0	0.0	0	0.00
606-003	385-400	14	0	0	0	0	14	0	0.0	0	0.00
606-004	400-415	4	0	0	0	0	4	0	0.0	0	0.00
606-005	415-430	10	0	0	0	0	10	0	0.0	0	0.00
606-006	430-445	5	0	0	0	0	5	0	0.0	0	0.00
606-007	445-460	73	0	0	0	0	73	0	0.0	0	0.00
606-008	460-475	46	0	0	0	0	46	0	0.0	0	0.00
606-009	475-490	2	0	0	0	0	2	0	0.0	0	0.00
606-010	490-505	4	0	0	0	0	4	0	0.0	0	0.00
606-011	505-520	29	15	4	3	2	54	25	45.9	1	1.59
606-013	535-550	8869	21	47	47	54	9037	169	1.9	356	0.87
606-014	550-565	291	36	29	41	15	412	121	29.3	176	2.74
606-015	565-580	11	2	2	0	0	15	4	26.2	0	0.00
606-016	580-595	5	4	4	0	0	13	8	64.8	0	0.00
606-019	625-640	22	5	10	6	2	45	23	51.8	5	2.91
606-020	640-655	11	7	4	2	3	28	17	59.1	1	0.55
606-021	655-670	23	9	11	9	5	56	33	59.2	3	1.96
606-022	670-685	29	16	24	15	18	101	72	70.9	14	0.84
606-023	685-700	16	0	0	0	0	16	0	0.0	0	0.00
606-024	700-715	70	0	0	0	0	70	0	0.0	0	0.00
606-026	730-745	7	0	0	0	0	7	0	0.0	0	0.00
606-027	745-760	92	2	0	0	0	94	2	2.6	0	0.00
606-028	760-775	161	1	0	0	0	162	1	0.8	0	0.00
606-029	775-790	61	0	0	0	0	61	0	0.0	0	0.00
606-030	790-805	47	0	0	0	0	47	0	0.0	0	0.00

TABLE 1A
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ 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	$\frac{iC_4}{nC_4}$
606-031	805-820	7	0	0	0	0	7	0	0.0	0	0.00
606-032	820-835	6561	941	736	176	293	8708	2146	24.6	731	0.60
606-033	835-850	16	4	5	1	3	29	13	45.3	1	0.53
606-034	850-865	15	2	2	0	0	19	4	23.5	0	0.00
606-036	880-895	503	272	328	69	105	1277	774	60.6	69	0.66
606-037	895-910	16846	2758	2238	499	755	23096	6250	27.1	1228	0.66
606-038	910-925	75	17	16	16	40	164	89	54.3	204	0.39
606-039	925-940	8	0	0	0	0	8	0	0.0	0	0.00
606-040	940-955	31	22	65	15	43	176	144	82.2	279	0.35
606-041	955-970	7	0	0	0	0	7	0	0.0	0	0.00
606-042	970-985	2	0	0	0	0	2	0	0.0	0	0.00
606-043	985-1000	3	0	0	0	0	3	0	0.0	0	0.00
606-044	1000-1015	14	21	14	2	3	54	40	73.7	2	0.53
606-045	1015-1030	174	16	2	0	0	192	18	9.3	0	0.00
606-046	1030-1045	18	6	1	0	0	25	7	27.1	0	0.00
606-047	1045-1060	7	0	0	0	0	7	0	0.0	0	0.00
606-048	1060-1075	11	0	0	0	0	11	0	0.0	0	0.00
606-049	1075-1090	3012	371	375	157	272	4187	1175	28.1	2760	0.58
606-050	1090-1105	125	18	19	26	37	224	99	44.2	2929	0.70
606-051	1105-1120	5	0	0	0	0	5	0	0.0	0	0.00
606-052	1120-1135	3	14	21	1	2	42	39	92.2	2	0.53
606-053	1135-1150	3108	752	915	368	671	5814	2706	46.5	1612	0.55
606-054	1150-1165	256	1193	758	319	412	2937	2681	91.3	1442	0.77
606-055	1165-1180	2409	734	760	283	466	4651	2242	48.2	2098	0.61
606-056	1180-1195	1077	434	520	181	291	2503	1426	57.0	1474	0.62
606-057	1195-1210	3326	1244	1712	658	705	7645	4319	56.5	2215	0.93
606-058	1210-1225	3339	955	935	264	485	5978	2639	44.1	1067	0.54
606-059	1225-1240	6417	1515	1944	682	1383	11940	5524	46.3	1837	0.49
606-060	1240-1255	824	339	367	125	185	1840	1016	55.2	181	0.68

TABLE 1A
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ 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	$\frac{iC_4}{nC_4}$
606-061	1255-1270	1665	451	514	199	273	3102	1437	46.3	385	0.73
606-062	1270-1285	1483	599	568	196	268	3114	1631	52.4	325	0.73
606-063	1285-1300	45	16	39	26	43	169	124	73.5	148	0.61
606-064	1300-1315	644	288	382	141	192	1648	1003	60.9	573	0.74
606-065	1315-1330	413	224	250	83	123	1093	680	62.2	536	0.68
606-066	1330-1345	1796	380	352	97	138	2763	967	35.0	460	0.70
606-067	1345-1360	2863	825	817	227	331	5063	2200	43.5	1201	0.69
606-068	1360-1375	252	150	232	81	111	827	574	69.5	334	0.74
606-069	1375-1390	72	33	50	21	24	202	129	64.0	82	0.87
606-070	1390-1405	138	109	161	63	69	540	402	74.4	216	0.91
606-071	1405-1420	7	4	15	8	12	45	38	84.6	79	0.67
606-072	1420-1435	981	240	176	61	67	1526	545	35.7	149	0.91
606-073	1435-1450	778	186	165	56	65	1250	472	37.8	247	0.86
606-074	1450-1465	1295	235	169	55	55	1809	514	28.4	170	0.99
606-075	1465-1480	651	118	110	40	39	957	307	32.0	139	1.03
606-076	1480-1495	340	62	48	15	12	477	137	28.7	13	1.28
606-077	1495-1510	11	3	4	1	4	23	12	51.6	9	0.36
606-078	1510-1525	1201	288	169	38	41	1736	535	30.8	78	0.92
606-079	1525-1540	1626	341	191	48	43	2249	623	27.7	125	1.10
606-080	1540-1555	14	4	5	1	2	27	13	47.1	2	0.74
606-081	1555-1570	2424	521	344	75	75	3439	1016	29.5	164	1.00
606-082	1570-1585	3984	1126	767	162	159	6198	2214	35.7	196	1.02
606-083	1585-1600	2737	612	382	98	89	3919	1182	30.2	58	1.10
606-084	1600-1615	545	313	387	131	128	1503	958	63.7	130	1.02
606-085	1615-1630	5445	1765	1274	251	231	8966	3521	39.3	180	1.09
606-086	1630-1645	3006	1235	994	209	210	5655	2649	46.8	86	1.00
606-087	1645-1660	6150	749	773	222	249	8144	1994	24.5	226	0.89
606-088	1660-1675	3590	1350	1397	308	373	7017	3428	48.8	296	0.82
606-089	1675-1690	48	27	43	13	17	149	101	67.5	31	0.79
606-090	1690-1705	8	4	12	4	6	35	27	75.9	12	0.63

TABLE 1A
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ 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	$\frac{iC_4}{nC_4}$
606-091	1705-1720	12	15	19	6	8	60	48	79.7	17	0.76
606-092	1720-1735	42	30	28	7	8	116	74	63.4	13	0.81
606-093	1735-1750	6	4	6	0	0	16	10	63.2	0	0.00
606-094	1750-1765	2	1	3	0	0	6	4	63.6	0	0.00
606-095	1765-1780	3933	2344	2098	545	570	9490	5557	58.6	541	0.96
606-096	1780-1795	5381	2708	2261	493	707	11549	6168	53.4	842	0.70
606-097	1795-1810	3950	2649	2680	597	701	10577	6627	62.7	618	0.85
606-098	1810-1825	29	116	313	95	179	733	704	96.1	154	0.53
606-099	1825-1840	24	2	1	9	7	43	19	43.4	8	1.34
606-100	1840-1855	7	9	37	18	31	102	95	93.2	26	0.59
606-101	1855-1870	17	63	289	98	132	599	582	97.1	170	0.74
606-102	1870-1885	4758	2677	5014	1235	1627	15311	10553	68.9	1542	0.76
606-103	1885-1900	19	30	55	13	17	134	115	85.9	25	0.80
606-104	1900-1915	3022	1294	1622	361	430	6730	3708	55.1	946	0.84
606-105	1915-1930	1961	645	861	159	204	3830	1869	48.8	366	0.78
606-106	1930-1945	3886	1470	1817	266	413	7852	3966	50.5	359	0.64
606-107	1945-1960	6576	1929	1685	196	304	10690	4114	38.5	588	0.64
606-108	1960-1975	2651	640	691	117	166	4265	1614	37.9	247	0.70
606-109	1975-1990	53	26	87	8	19	193	140	72.5	15	0.45
606-110	1990-2005	2659	1474	2291	220	1024	7669	5009	65.3	1695	0.22
606-111	2005-2020	643	372	512	47	220	1794	1151	64.2	452	0.22
606-112	2020-2035	2912	1240	1489	129	619	6390	3478	54.4	997	0.21
606-113	2035-2050	10331	5467	7561	795	4417	28571	18240	63.8	8280	0.18
606-114	2050-2065	12858	8297	10856	1299	6188	39498	26640	67.4	8641	0.21
606-115	2065-2080	15481	6666	4108	332	1109	27696	12215	44.1	1618	0.30
606-116	2080-2095	17468	8316	5433	610	2292	34119	16651	48.8	3486	0.27
606-117	2095-2110	17373	7531	4956	426	1695	31981	14608	45.7	2165	0.25
606-118	2110-2125	17	45	72	11	29	174	156	90.0	56	0.39
606-119	2125-2140	5374	2511	2018	258	692	10852	5479	50.5	1293	0.37
606-120	2140-2155	208	242	498	107	299	1354	1146	84.6	1827	0.36

TABLE 1A
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ 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	$\frac{iC_4}{nC_4}$
606-121	2155-2170	4	3	6	0	0	13	9	70.0	0	0.00
606-122	2270-2285	6606	1568	751	145	279	9347	2742	29.3	834	0.52
606-123	2285-2300	7027	2974	1441	197	388	12027	5000	41.6	518	0.51
606-124	2300-2315	1967	445	275	63	120	2870	903	31.5	289	0.53
606-125	2315-2330	3171	1514	820	122	192	5820	2648	45.5	243	0.63
606-126	2330-2345	822	517	330	39	85	1793	971	54.2	700	0.46
606-127	2345-2360	113	54	30	5	12	213	100	47.0	36	0.42
606-128	2360-2375	3313	996	313	35	76	4733	1420	30.0	95	0.46
606-129	2375-2390	2854	688	482	63	116	4204	1350	32.1	138	0.55
606-130	2390-2405	9373	2542	1099	112	215	13341	3968	29.7	285	0.52
606-131	2405-2420	2296	670	382	55	92	3495	1199	34.3	89	0.60
606-132	2420-2435	3975	1575	907	146	241	6844	2869	41.9	200	0.60
606-133	2435-2450	12622	4055	1627	233	328	18866	6244	33.1	537	0.71
606-134	2450-2465	15527	3124	902	86	115	19755	4228	21.4	23	0.74
606-135	2465-2480	5482	1457	760	125	148	7971	2489	31.2	170	0.84
606-136	2480-2495	12494	4598	1584	195	179	19050	6555	34.4	166	1.09
606-137	2495-2510	7729	781	329	41	46	8926	1197	13.4	51	0.90
606-138	2510-2525	3319	797	458	76	96	4746	1427	30.1	90	0.80
606-139	2525-2540	10797	2423	883	69	78	14250	3453	24.2	54	0.88
606-140	2540-2555	6832	889	461	64	79	8325	1493	17.9	79	0.81
606-141	2555-2570	859	263	240	40	57	1459	600	41.1	48	0.70
606-142	2570-2585	4419	1189	876	120	166	6771	2352	34.7	176	0.72
606-143	2585-2600	8422	1723	912	96	122	11274	2852	25.3	76	0.78
606-144	2600-2615	13047	1989	915	70	106	16127	3081	19.1	27	0.66

TABLE 1B
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
606-001	355-370	31	0	0	0	0	31	0	0.0	0	0.00
606-002	370-385	29	1	0	0	0	30	1	4.2	0	0.00
606-003	385-400	35	0	0	0	0	35	0	0.0	0	0.00
606-004	400-415	36	0	0	0	0	36	0	0.0	0	0.00
606-005	415-430	36	0	0	0	0	36	0	0.0	0	0.00
606-006	430-445	27	1	0	0	0	28	1	2.9	0	0.00
606-007	445-460	44	0	0	0	0	44	0	0.0	0	0.00
606-008	460-475	31	0	0	0	0	31	0	0.0	0	0.00
606-009	475-490	51	6	5	0	0	63	12	18.4	0	0.64
606-010	490-505	41	4	4	0	0	50	9	17.9	0	0.53
606-011	505-520	39	2	2	0	0	44	5	11.2	0	0.00
606-012	520-535	19	4	5	0	0	28	9	32.6	0	0.00
606-013	535-550	216	5	5	6	1	234	17	7.5	457	3.98
606-014	550-565	29	1	6	8	2	45	17	36.3	281	4.25
606-015	565-580	58	15	7	4	1	84	27	31.5	3	3.54
606-016	580-595	22	7	3	0	0	32	10	30.2	0	0.00
606-017	595-610	24	7	3	0	0	35	11	31.3	0	0.00
606-018	610-625	22	8	3	0	0	34	12	34.6	0	0.00
606-019	625-640	27	5	5	1	3	41	15	35.7	2	0.55
606-020	640-655	33	4	1	1	2	43	9	21.9	2	0.65
606-021	655-670	51	10	10	2	4	77	26	33.3	2	0.48
606-022	670-685	56	10	12	6	17	100	45	44.5	33	0.34
606-023	685-700	47	11	11	3	7	78	32	40.3	6	0.44
606-024	700-715	38	7	7	0	0	52	14	26.7	0	0.00
606-025	715-730	36	4	6	3	6	55	19	35.2	3	0.47
606-026	730-745	60	10	22	12	40	143	83	58.0	8	0.29
606-027	745-760	40	5	4	0	0	49	9	19.0	0	0.00
606-028	760-775	59	0	0	0	0	59	0	0.0	0	0.00
606-029	775-790	36	7	3	3	6	53	18	33.4	4	0.50
606-030	790-805	40	7	7	0	0	53	13	24.6	0	0.00

TABLE 1B
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
606-031	805-820	29	6	12	0	0	47	17	37.2	0	0.00
606-032	820-835	386	133	143	54	166	882	497	56.3	884	0.32
606-033	835-850	72	19	14	5	22	131	60	45.5	221	0.22
606-034	850-865	94	26	17	7	27	171	76	44.7	16	0.25
606-035	865-880	33	0	0	0	0	33	0	0.0	0	0.00
606-036	880-895	76	30	64	24	64	259	182	70.4	28	0.37
606-037	895-910	420	125	164	53	162	924	504	54.6	401	0.33
606-038	910-925	107	35	22	9	43	216	109	50.3	323	0.20
606-039	925-940	24	7	0	0	0	31	7	22.5	0	0.00
606-040	940-955	116	33	17	10	22	198	82	41.5	8	0.47
606-041	955-970	50	16	8	1	2	77	27	34.7	1	0.53
606-042	970-985	63	13	5	1	1	84	20	24.1	1	0.53
606-043	985-1000	95	24	13	2	4	138	43	31.3	1	0.53
606-044	1000-1015	60	17	7	1	2	87	27	30.9	1	0.46
606-045	1015-1030	88	20	11	2	11	131	43	33.0	190	0.16
606-046	1030-1045	102	28	13	2	3	148	45	30.7	3	0.59
606-047	1045-1060	47	20	9	3	10	91	43	48.0	183	0.34
606-048	1060-1075	57	20	10	12	59	159	102	64.1	46	0.21
606-049	1075-1090	197	57	34	26	51	364	167	45.9	35	0.50
606-050	1090-1105	280	140	77	13	78	587	307	52.3	369	0.17
606-051	1105-1120	34	0	0	0	0	34	0	0.0	0	0.00
606-052	1120-1135	55	4	3	3	5	71	16	21.9	7	0.57
606-053	1135-1150	89	24	15	23	13	164	75	45.6	36	1.84
606-054	1150-1165	208	187	196	78	203	872	664	76.1	1375	0.39
606-055	1165-1180	216	148	199	81	236	880	664	75.5	1509	0.35
606-056	1180-1195	125	72	82	35	104	418	293	70.1	752	0.34
606-057	1195-1210	121	49	67	25	72	334	214	63.9	1645	0.35
606-058	1210-1225	218	77	77	24	67	463	245	52.9	2131	0.37
606-059	1225-1240	182	22	44	89	247	584	402	68.8	3891	0.36
606-060	1240-1255	499	283	607	304	679	2372	1872	78.9	4714	0.45

TABLE 1B
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
606-061	1255-1270	156	71	169	113	231	740	584	78.9	1926	0.49
606-062	1270-1285	401	190	337	179	352	1460	1059	72.5	3580	0.51
606-063	1285-1300	9	1	1	0	0	10	1	13.7	0	0.00
606-064	1300-1315	43	27	59	37	87	253	209	82.9	464	0.42
606-065	1315-1330	90	45	66	30	86	317	227	71.7	622	0.35
606-066	1330-1345	206	48	57	21	44	375	169	45.0	233	0.48
606-067	1345-1360	206	127	219	86	207	845	639	75.6	781	0.42
606-068	1360-1375	64	43	66	25	80	278	214	77.0	82	0.31
606-069	1375-1390	125	74	193	99	215	706	581	82.4	767	0.46
606-070	1390-1405	62	36	64	28	62	253	191	75.4	202	0.45
606-071	1405-1420	80	17	23	16	38	175	95	54.4	316	0.43
606-072	1420-1435	180	86	110	47	94	516	336	65.2	200	0.50
606-073	1435-1450	180	106	145	59	148	638	458	71.8	625	0.40
606-074	1450-1465	336	148	191	74	131	880	545	61.9	231	0.56
606-075	1465-1480	152	75	113	53	99	493	340	69.1	91	0.53
606-076	1480-1495	83	21	23	12	12	151	68	45.0	39	0.94
606-077	1495-1510	59	12	19	18	48	155	96	62.0	200	0.37
606-078	1510-1525	220	119	129	45	86	598	379	63.3	318	0.53
606-079	1525-1540	192	93	99	38	53	475	283	59.6	33	0.72
606-080	1540-1555	192	97	185	81	137	692	500	72.3	132	0.59
606-081	1555-1570	337	166	201	71	121	897	560	62.4	144	0.58
606-082	1570-1585	299	137	168	41	77	722	423	58.6	348	0.53
606-083	1585-1600	139	60	62	26	42	329	189	57.6	163	0.62
606-084	1600-1615	77	30	69	14	22	212	135	63.8	36	0.64
606-085	1615-1630	99	89	127	32	55	403	304	75.5	189	0.58
606-086	1630-1645	42	39	66	24	41	213	171	80.1	207	0.59
606-087	1645-1660	131	35	74	41	58	339	207	61.3	306	0.71
606-088	1660-1675	65	27	49	22	31	194	129	66.6	69	0.69
606-089	1675-1690	103	10	22	11	33	179	76	42.5	280	0.34
606-090	1690-1705	216	21	99	43	98	477	261	54.7	441	0.44

TABLE 1B
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
606-091	1705-1720	295	201	553	152	261	1462	1167	79.8	640	0.58
606-092	1720-1735	190	169	314	74	141	888	698	78.6	348	0.53
606-093	1735-1750	828	1146	1699	348	594	4616	3788	82.1	530	0.59
606-094	1750-1765	75	37	148	55	118	433	359	82.8	721	0.47
606-095	1765-1780	896	917	1253	282	590	3938	3042	77.2	2926	0.48
606-096	1780-1795	275	424	665	168	414	1945	1671	85.9	2634	0.41
606-097	1795-1810	321	584	1386	341	708	3340	3019	90.4	2551	0.48
606-098	1810-1825	8	3	11	2	4	28	20	70.9	86	0.48
606-099	1825-1840	61	15	80	52	132	339	278	82.1	1555	0.40
606-100	1840-1855	89	9	16	114	93	321	232	72.4	1768	1.23
606-101	1855-1870	63	34	183	81	201	562	499	88.9	1206	0.40
606-102	1870-1885	10	4	7	0	0	21	11	52.2	0	0.00
606-103	1885-1900	184	455	1350	329	678	2996	2812	93.9	547	0.49
606-104	1900-1915	147	172	405	136	224	1085	938	86.4	449	0.61
606-105	1915-1930	826	778	2189	377	828	4998	4172	83.5	779	0.46
606-106	1930-1945	220	362	1388	160	488	2619	2399	91.6	297	0.33
606-107	1945-1960	224	291	551	65	215	1345	1121	83.3	187	0.30
606-108	1960-1975	139	50	83	16	46	334	195	58.3	72	0.35
606-109	1975-1990	61	11	33	8	27	140	79	56.7	20	0.31
606-110	1990-2005	388	589	2406	326	2285	5994	5607	93.5	2571	0.14
606-111	2005-2020	1104	1760	5458	669	3592	12583	11479	91.2	2591	0.19
606-112	2020-2035	1853	2517	7407	1339	7186	20303	18450	90.9	6489	0.19
606-113	2035-2050	65	54	145	21	150	434	370	85.1	403	0.14
606-114	2050-2065	73	113	273	31	176	665	593	89.1	86	0.17
606-115	2065-2080	14281	11985	13013	1953	6936	48168	33887	70.4	2567	0.28
606-116	2080-2095	5577	816	386	28	113	6921	1344	19.4	161	0.25
606-117	2095-2110	1377	1316	2090	244	1542	6569	5192	79.0	1321	0.16
606-118	2110-2125	333	713	3446	779	4331	9601	9268	96.5	2636	0.18
606-119	2125-2140	527	438	1003	182	846	2996	2469	82.4	2883	0.22
606-120	2140-2155	12	7	7	0	0	27	15	54.9	0	0.00

TABLE 1B
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN CUTTINGS 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	$\frac{iC_4}{nC_4}$
606-121	2155-2170	140	24	161	37	147	509	369	72.5	456	0.26
606-122	2270-2285	205	34	21	7	14	282	77	27.2	108	0.48
606-123	2285-2300	39	17	2	0	0	57	19	32.3	0	0.00
606-124	2300-2315	247	105	158	91	203	805	558	69.4	2260	0.45
606-125	2315-2330	950	428	336	92	187	1993	1043	52.3	1300	0.49
606-126	2330-2345	104	296	259	33	88	779	675	86.7	437	0.37
606-127	2345-2360	402	270	160	29	76	937	535	57.1	880	0.38
606-128	2360-2375	327	287	138	15	41	807	480	59.5	135	0.36
606-129	2375-2390	251	98	125	26	65	566	315	55.6	361	0.41
606-130	2390-2405	587	595	425	44	126	1777	1190	67.0	268	0.35
606-131	2405-2420	62	11	15	1	1	90	28	31.1	2	0.53
606-132	2420-2435	100	34	22	5	8	170	70	41.0	42	0.56
606-133	2435-2450	258	148	95	20	38	559	301	53.8	41	0.52
606-134	2450-2465	4233	959	492	70	138	5893	1660	28.2	41	0.51
606-135	2465-2480	505	133	92	23	37	791	286	36.1	12	0.61
606-136	2480-2495	4720	1052	493	69	104	6439	1718	26.7	30	0.66
606-137	2495-2510	1599	270	177	23	42	2111	512	24.2	21	0.55
606-138	2510-2525	222	85	83	23	34	447	224	50.2	12	0.68
606-139	2525-2540	2196	1020	808	73	145	4242	2046	48.2	17	0.50
606-140	2540-2555	113	24	20	4	6	168	54	32.3	7	0.57
606-141	2555-2570	220	103	130	28	66	548	328	59.8	24	0.43
606-142	2570-2585	36	23	27	7	15	107	72	66.9	7	0.49
606-143	2585-2600	49	18	17	5	12	101	53	51.8	4	0.38
606-144	2600-2615	452	141	83	8	13	697	245	35.2	2	0.59

TABLE 1C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
606-001	355-370	300	0	0	0	0	300	0	0.0	0	0.00
606-002	370-385	40	1	0	0	0	41	1	3.1	0	0.00
606-003	385-400	49	0	0	0	0	49	0	0.0	0	0.00
606-004	400-415	41	0	0	0	0	41	0	0.0	0	0.00
606-005	415-430	46	0	0	0	0	46	0	0.0	0	0.00
606-006	430-445	32	1	0	0	0	33	1	2.5	0	0.00
606-007	445-460	117	0	0	0	0	117	0	0.0	0	0.00
606-008	460-475	78	0	0	0	0	78	0	0.0	0	0.00
606-009	475-490	54	6	5	0	0	65	12	17.7	0	0.64
606-010	490-505	45	4	4	0	0	53	9	16.6	0	0.53
606-011	505-520	69	18	7	3	2	98	30	30.4	1	1.59
606-012	520-535	19	4	5	0	0	28	9	32.6	0	0.00
606-013	535-550	9085	26	52	53	55	9271	186	2.0	812	0.95
606-014	550-565	320	37	35	49	17	458	137	30.0	457	2.90
606-015	565-580	69	17	9	4	1	99	30	30.7	3	3.54
606-016	580-595	27	11	7	0	0	45	18	40.2	0	0.00
606-017	595-610	24	7	3	0	0	35	11	31.3	0	0.00
606-018	610-625	22	8	3	0	0	34	12	34.6	0	0.00
606-019	625-640	48	11	15	8	5	86	38	44.1	6	1.60
606-020	640-655	45	11	6	3	6	71	26	36.6	4	0.59
606-021	655-670	74	19	21	11	9	133	59	44.3	4	1.27
606-022	670-685	85	25	36	21	35	201	116	57.8	47	0.59
606-023	685-700	62	11	11	3	7	94	32	33.6	6	0.44
606-024	700-715	108	7	7	0	0	122	14	11.3	0	0.00
606-025	715-730	36	4	6	3	6	55	19	35.2	3	0.47
606-026	730-745	67	10	22	12	40	150	83	55.2	8	0.29
606-027	745-760	132	8	4	0	0	144	12	8.2	0	0.00
606-028	760-775	220	1	0	0	0	222	1	0.6	0	0.00
606-029	775-790	96	7	3	3	6	114	18	15.6	4	0.50
606-030	790-805	87	7	7	0	0	100	13	13.1	0	0.00

TABLE 1C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
606-031	805-820	36	6	12	0	0	54	17	32.3	0	0.00
606-032	820-835	6947	1074	879	230	460	9590	2643	27.6	1614	0.50
606-033	835-850	87	23	18	6	25	160	73	45.5	222	0.25
606-034	850-865	109	28	19	7	27	190	81	42.5	16	0.25
606-035	865-880	33	0	0	0	0	33	0	0.0	0	0.00
606-036	880-895	579	302	393	93	169	1535	956	62.3	97	0.55
606-037	895-910	17265	2883	2401	552	917	24020	6754	28.1	1630	0.60
606-038	910-925	182	51	38	25	83	380	198	52.0	526	0.29
606-039	925-940	32	7	0	0	0	39	7	18.1	0	0.00
606-040	940-955	147	55	81	25	65	373	226	60.7	287	0.39
606-041	955-970	57	16	8	1	2	84	27	31.9	1	0.53
606-042	970-985	66	13	5	1	1	86	20	23.4	1	0.53
606-043	985-1000	98	24	13	2	4	141	43	30.6	1	0.53
606-044	1000-1015	74	37	21	3	6	141	67	47.4	4	0.50
606-045	1015-1030	262	36	13	2	11	323	61	18.9	190	0.16
606-046	1030-1045	121	34	14	2	3	173	52	30.2	3	0.59
606-047	1045-1060	54	20	9	3	10	98	43	44.5	183	0.34
606-048	1060-1075	68	20	10	12	59	170	102	59.8	46	0.21
606-049	1075-1090	3209	428	409	182	323	4551	1342	29.5	2795	0.56
606-050	1090-1105	405	157	96	39	114	811	406	50.1	3298	0.34
606-051	1105-1120	38	0	0	0	0	38	0	0.0	0	0.00
606-052	1120-1135	59	18	24	4	8	113	54	48.1	9	0.56
606-053	1135-1150	3197	776	930	391	684	5978	2781	46.5	1648	0.57
606-054	1150-1165	464	1380	954	397	615	3809	3345	87.8	2817	0.65
606-055	1165-1180	2625	882	958	365	702	5532	2906	52.5	3607	0.52
606-056	1180-1195	1202	506	602	216	395	2921	1719	58.9	2226	0.55
606-057	1195-1210	3447	1293	1779	683	777	7979	4532	56.8	3860	0.88
606-058	1210-1225	3557	1032	1012	288	552	6441	2884	44.8	3198	0.52
606-059	1225-1240	6599	1537	1988	771	1629	12525	5926	47.3	5727	0.47
606-060	1240-1255	1324	622	974	429	864	4212	2888	68.6	4896	0.50

TABLE 1C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
606-061	1255-1270	1821	522	683	312	504	3841	2020	52.6	2310	0.62
606-062	1270-1285	1884	789	905	375	620	4574	2690	58.8	3905	0.60
606-063	1285-1300	53	17	40	26	43	179	125	70.2	148	0.61
606-064	1300-1315	688	315	441	178	279	1900	1213	63.8	1036	0.64
606-065	1315-1330	503	269	317	113	209	1411	908	64.3	1158	0.54
606-066	1330-1345	2002	428	409	118	181	3138	1136	36.2	692	0.65
606-067	1345-1360	3069	952	1036	313	538	5907	2838	48.1	1982	0.58
606-068	1360-1375	316	193	298	106	191	1105	788	71.4	416	0.56
606-069	1375-1390	197	107	244	120	240	907	710	78.3	849	0.50
606-070	1390-1405	200	145	226	91	131	793	592	74.7	418	0.69
606-071	1405-1420	87	21	38	24	50	220	133	60.6	395	0.48
606-072	1420-1435	1161	326	286	108	162	2042	881	43.2	349	0.67
606-073	1435-1450	958	293	309	115	213	1889	930	49.3	872	0.54
606-074	1450-1465	1630	383	361	128	187	2689	1059	39.4	401	0.69
606-075	1465-1480	803	193	223	93	138	1450	647	44.6	230	0.67
606-076	1480-1495	423	82	71	27	24	628	205	32.6	52	1.11
606-077	1495-1510	70	15	23	19	51	178	108	60.7	209	0.37
606-078	1510-1525	1421	407	297	83	127	2335	914	39.1	395	0.66
606-079	1525-1540	1818	433	290	86	96	2724	906	33.3	157	0.89
606-080	1540-1555	206	101	190	83	139	719	513	71.3	134	0.59
606-081	1555-1570	2761	687	545	146	197	4336	1575	36.3	308	0.74
606-082	1570-1585	4283	1263	934	203	236	6919	2637	38.1	544	0.86
606-083	1585-1600	2876	673	444	124	131	4247	1371	32.3	221	0.95
606-084	1600-1615	622	343	455	145	150	1715	1093	63.7	166	0.97
606-085	1615-1630	5544	1854	1401	284	286	9369	3825	40.8	369	0.99
606-086	1630-1645	3048	1274	1060	234	251	5868	2820	48.1	293	0.93
606-087	1645-1660	6281	784	847	263	307	8482	2201	25.9	532	0.86
606-088	1660-1675	3654	1377	1446	329	405	7211	3557	49.3	364	0.81
606-089	1675-1690	151	38	64	25	50	328	177	53.9	311	0.50
606-090	1690-1705	224	25	111	47	105	512	288	56.2	453	0.45

TABLE 1C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
606-091	1705-1720	307	216	572	158	268	1522	1215	79.8	657	0.59
606-092	1720-1735	232	199	342	81	149	1004	772	76.9	361	0.54
606-093	1735-1750	834	1151	1705	348	594	4632	3798	82.0	530	0.59
606-094	1750-1765	77	39	151	55	118	440	363	82.5	721	0.47
606-095	1765-1780	4829	3261	3351	828	1159	13428	8599	64.0	3467	0.71
606-096	1780-1795	5656	3131	2926	661	1120	13495	7839	58.1	3477	0.59
606-097	1795-1810	4271	3233	4067	938	1409	13917	9646	69.3	3169	0.67
606-098	1810-1825	37	119	324	97	183	760	723	95.1	241	0.53
606-099	1825-1840	85	17	81	61	138	382	297	77.8	1563	0.44
606-100	1840-1855	96	19	53	132	124	423	327	77.4	1793	1.07
606-101	1855-1870	80	97	472	179	333	1161	1081	93.1	1377	0.54
606-102	1870-1885	4768	2681	5020	1235	1627	15332	10564	68.9	1542	0.76
606-103	1885-1900	203	485	1405	342	695	3130	2927	93.5	572	0.49
606-104	1900-1915	3170	1467	2027	498	653	7815	4645	59.4	1395	0.76
606-105	1915-1930	2787	1423	3050	536	1032	8828	6041	68.4	1145	0.52
606-106	1930-1945	4106	1833	3205	426	901	10471	6364	60.8	655	0.47
606-107	1945-1960	6800	2220	2236	261	519	12035	5235	43.5	775	0.50
606-108	1960-1975	2790	690	774	133	212	4599	1809	39.3	319	0.63
606-109	1975-1990	114	37	120	17	45	333	219	65.8	35	0.36
606-110	1990-2005	3047	2063	4697	546	3309	13663	10616	77.7	4265	0.17
606-111	2005-2020	1747	2132	5969	716	3812	14377	12630	87.9	3043	0.19
606-112	2020-2035	4765	3757	8896	1469	7805	26693	21928	82.1	7485	0.19
606-113	2035-2050	10395	5521	7706	815	4567	29005	18610	64.2	8683	0.18
606-114	2050-2065	12931	8410	11129	1330	6364	40164	27233	67.8	8728	0.21
606-115	2065-2080	29762	18651	17121	2284	8046	75864	46101	60.8	4185	0.28
606-116	2080-2095	23045	9132	5819	638	2406	41040	17995	43.8	3647	0.27
606-117	2095-2110	18749	8846	7046	671	3237	38550	19800	51.4	3486	0.21
606-118	2110-2125	350	758	3518	790	4359	9775	9425	96.4	2691	0.18
606-119	2125-2140	5900	2949	3020	440	1538	13848	7948	57.4	4176	0.29
606-120	2140-2155	221	249	506	107	299	1381	1161	84.0	1827	0.36

TABLE 1C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS (1A + 1B)

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	$\frac{iC_4}{nC_4}$
606-121	2155-2170	144	27	168	37	147	523	379	72.4	456	0.26
606-122	2270-2285	6811	1602	772	151	293	9629	2818	29.3	942	0.52
606-123	2285-2300	7066	2991	1442	197	388	12084	5018	41.5	518	0.51
606-124	2300-2315	2213	550	434	154	323	3675	1461	39.8	2549	0.48
606-125	2315-2330	4121	1942	1156	215	380	7813	3691	47.2	1543	0.57
606-126	2330-2345	926	813	588	72	173	2572	1646	64.0	1137	0.42
606-127	2345-2360	515	324	189	34	88	1150	635	55.2	916	0.38
606-128	2360-2375	3640	1283	451	49	116	5540	1900	34.3	229	0.42
606-129	2375-2390	3105	786	608	90	181	4770	1665	34.9	499	0.50
606-130	2390-2405	9960	3138	1524	156	341	15118	5158	34.1	553	0.46
606-131	2405-2420	2358	682	397	56	93	3586	1228	34.2	91	0.60
606-132	2420-2435	4075	1610	929	150	250	7014	2939	41.9	242	0.60
606-133	2435-2450	12880	4204	1722	253	366	19425	6545	33.7	578	0.69
606-134	2450-2465	19760	4084	1394	156	254	25648	5887	23.0	64	0.62
606-135	2465-2480	5987	1590	852	147	185	8761	2774	31.7	182	0.80
606-136	2480-2495	17215	5650	2077	264	283	25489	8274	32.5	195	0.93
606-137	2495-2510	9328	1051	506	64	88	11037	1709	15.5	71	0.73
606-138	2510-2525	3541	882	541	99	129	5193	1651	31.8	102	0.77
606-139	2525-2540	12993	3443	1691	142	223	18491	5499	29.7	71	0.64
606-140	2540-2555	6945	913	481	68	85	8493	1547	18.2	86	0.79
606-141	2555-2570	1080	367	371	68	122	2007	927	46.2	72	0.56
606-142	2570-2585	4455	1212	903	128	181	6879	2424	35.2	183	0.71
606-143	2585-2600	8471	1741	929	100	134	11375	2904	25.5	80	0.75
606-144	2600-2615	13498	2130	998	78	120	16824	3326	19.8	29	0.65

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-001	355-370m	A 98% Shale, platy to blocky, soft to mod. hard, fissile, non calc., light grey to very light olive grey Minor lost circulation material, other shale Minor igneous	N7-5Y7/1	2.84
606-002	370-385m	A 98% Shale, as 606-001A, mod. caving Minor lost circulation material	N7-5Y7/1	2.30, 2.32
606-003	385-400m	A 98% Shale, as 606-001A, mod. caving Minor lost circulation material	N7-5Y7/1	1.21
606-004	400-415m	A 90% Shale, blocky to platy, mod. hard, fissile, mod. caving, non calc., very light olive grey to very light brownish grey B 10% Shale, blocky to platy, mod. hard, fissile, non calc., minor caving, medium light to light grey Minor iron staining	5Y7/1- 5YR7/1 N6-N7	0.66 0.47
606-005	415-430m	A 98% Shale, as 606-004A, mod. caving Minor other shale and iron stained shale	5Y7/1- 5YR7/1	0.55
606-006	430-445m	A 98% Shale, as 606-004A, mod. caving Minor other shale and iron stained shale	5Y7/1- 5YR7/1	0.64
606-007	445-460m	A 98% Shale, as 606-004A, sig. caving Minor other shale	5Y7/1- 5YR7/1	0.49, 0.46
606-008	460-475m	A 98% Shale, as 606-004A, sig. caving Minor other shale	5Y7/1- 5YR7/1	0.50
606-009	475-490m	A 98% Shale, as 606-004A, sig. caving Iron stained shale	5Y7/1- 5YR7/1	0.66
606-010	490-505m	A 98% Shale, blocky to platy, soft to mod. hard, fissile, non calc., silty, light grey Minor other shale, iron stained shale	N7	0.61
606-011	505-520m	A 98% Shale, s 606-010A, sig. caving Minor other shale	N7	0.45
606-012	520-535m	A 98% Shale, as 606-010A, mod. caving Minor other shale	N7	0.55
606-013	535-550m	A 98% Shale, blocky to platy, mod. hard, non calc., mod. caving, medium light to light grey Minor other shale	N6-N7	0.56, 0.53

Abbreviations = argillaceous, calcareous, Cut, Fluorescence, slightly

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-014	550-565m	A 60% Mudstone, blocky, soft, becoming shaly mudstone, mod. hard, non calc., very light grey to light grey	N8-N7	1.06
		B 40% Shale, blocky, mod. hard, sl. silty, non calc., mod. caving, medium light to light grey		0.46
606-015	565-580m	A 70% Shale, as 606-014B, abundant caving	N6-N7	0.54
		B 30% Mudstone, as 606-014A, mod. caving Minor lost circulation material, other shale	N8-N7	0.41
606-016	580-595m	A 55% Mudstone, blocky, soft to mod. hard, grading to shaly mudstone, becoming silty, non calc., mod. caving, medium light to light grey	N6-N7	0.61
		B 45% Silty Mudstone, blocky, soft to mod. hard, iron stained in part, non calc., mod. caving, light grey to very light olive grey Minor lost circulation material, shale	N7-5Y7/1	1.58, 1.55
606-017	595-610m	A 65% Shaly Mudstone, as 606-016A, mod. caving	N6-N7	0.76
		B 35% Mudstone, as 606-016B Minor lost circulation material, other shale	N7-5Y7/1	3.51
606-018	610-625m	A 98% Shaly Mudstone, blocky, mod. hard, subfissile in part, occ. silty, rare mica, non calc., iron staining in part, mod. to sig. caving, medium light grey to light olive grey Minor lost circulation material	N6-5Y6/1	0.62
606-019	625-640m	A 98% Shaly Mudstone, blocky, mod. hard, subfissile, becoming silty, mod. caving, light to medium light grey Minor other mudstone, lost circulation material	N7-N6	1.57
606-020	640-655m	A 98% Shaly Mudstone, as 606-019A, sig. caving Minor lost circulation material	N7-N6	1.68
606-021	655-670m	A 98% Shale, blocky, fissile, soft, grading to shaly mudstone, blocky, mod. hard, silty, medium light to light grey Minor lost circulation material	N6-N7	0.94

Abbreviations = argillaceous, calcareous, Cut, Fluorescence, slightly

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-022	670-685m	A 98% Shale, blocky, fissile, soft, grading to shaly mudstone, blocky, mod. hard, silty, medium light to light grey Minor lost circulation material	N6-N7	1.50
606-023	685-700m	A 60% Shaly Mudstone, blocky, mod. hard, non calc., medium light grey B 40% Shaly Mudstone, blocky, soft to mod. hard, sl. silty, minor caving, light grey	N6 N7	0.88 2.21
606-024	700-715m	A 90% Shale, blocky, soft, fissile, grading to shaly mudstone, sl. silty, non calc., medium light grey B 10% Shaly Mudstone, as 606-023B	N6 N7	1.03 3.98
606-025	715-730m	A 98% Shale, platy to blocky, fissile, mod. hard, sl. silty, non calc., medium light grey occ. light olive grey Minor lost circulation material other shale	N6 occ 5Y6/1	1.06,1.10
606-026	730-745m	A 98% Shale, as 606-025A, sig. caving Minor lost circulation material, mudstone	N6 occ. 5Y6/1	1.08
606-027	745-760m	A 40% Shale, as 606-025A, mod. caving B 40% Lost circulation material - cement, metal, drilling mud C 20% Mudstone, as 606-023B, caved	N6 occ. 5Y6/1 N7	3.16
606-028	760-775m	A 90% Shaly Mudstone, blocky, mod. hard, fissile, non calc., medium light grey to medium grey B 10% Mudstone, blocky, soft to mod. hard, non calc., light grey Minor lost circulation material	N6 occ. N5 N7	1.07 3.00
606-029	775-790m	A 90% Shaly Mudstone, as 606-028A, mod. caving B 10% Lost circulation material, as 606-027B	N6 occ. N5	1.41
606-030	790-805m	A 98% Shaly Mudstone, as 606-028A, minor caving Minor lost circulation material	N6 occ. N5	1.01,0.96

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-031	805-820m	A 98% Shaly Mudstone, blocky, subfissile, silty, non calc., mod. caving, light to medium light grey Minor lost circulation material	N7-N6	2.74
606-032	820-835m	A 98% Mudstone, blocky, mod. hard, grading to shaly mudstone, non calc., sig. caving, medium light grey to light grey Minor lost circulation material	N6-N7	0.89
606-033	835-850m	A 98% Mudstone, as 606-032A, mod. caving Minor lost circulation material - cement	N6-N7	1.18
606-034	850-865m	A 65% Shaly Mudstone, blocky to platy, mod. hard, fissile, non calc., mod. cavings, medium light grey	N6	0.91
		B 35% Mudstone, blocky, soft to mod. hard, silty, non calc., minor caving, light to very light grey Minor lost circulation material	N7-N8	3.00
606-035	865-880m	A 85% Shaly Mudstone, as 606-034A, sig. cavings	N6	0.79, 0.79
		B 15% Anhydrite, blocky, soft, white Minor lost circulation material, other mudstone	N9	
606-036	880-895m	A 98% Mudstone, blocky, mod. hard, occ. silty, grading to shaly mudstone, non calc., mod. caving, medium light grey Minor anhydrite, shale	N6	0.80
606-037	895-910m	A 98% Mudstone, as 606-036A Minor other shale, lost circulation material	N6	0.68
606-038	910-925m	A 85% Shale, blocky, occ. platy, sub-fissile, mod. hard, non calc., sig. caving, medium light grey to medium grey	N6-N5	0.75
		B 15% Mudstone, blocky, soft to mod. hard, non calc., light grey Minor lost circulation material	N7	0.59
606-039	925-940m	A 98% Shale, as 606-038A, mod. caving Minor lost circulation material, other shale	N6-N5	0.69

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-040	940-955m	A 70% Shaly Mudstone, blocky, mod. hard, mod. caving, non calc., medium light grey	N6	0.66,0.67
		B 20% Mudstone, blocky, silty, mod. hard, non calc., light to very light grey	N7-N8	0.47
606-041	955-970m	A 65% Shale, blocky, mod. hard, sub-fissile, grading to shaly mudstone, non calc., mod. caving, medium light grey to medium grey	N6-N5	0.53
		B 30% Mudstone, as 606-040B, minor cavings	N7-N8	0.46
		C 5% Lost circulation material - metal		
606-042	970-985m	A 50% Shale, as 606-041A, mod. caving	N6-N5	0.35
		B 40% Mudstone, blocky, soft to mod. hard, becoming subfissile, non calc., mod. caving, light grey to very light olive grey	N7-5Y7/1	0.35
		C 10% Shale, blocky, soft to mod. hard, subfissile, non calc., medium dark grey to medium grey Minor lost circulation material	N4-N5	0.49
606-043	985-1000m	A 55% Mudstone, blocky, soft to mod. hard, non calc., light to very light grey	N7-N8	0.28
		B 45% Shale, blocky, mod. hard, sub-fissile, non calc., medium grey to medium light grey Minor other shale, lost circulation material	N5-N6	0.46,0.43
606-044	1000-015m	A 80% Mudstone, as 606-043A, mod. caving	N7-N8	0.67
		B 20% Shale, as 606-043B Minor lost circulation material	N5-N6	0.53
606-045	1015-030m	A 65% Mudstone, as 606-043A	N7-N8	0.49
		B 35% Shale, as 606-043B Minor lost circulation material	N5-N6	0.42
606-046	1030-045m	A 75% Shale, as 606-043B, mostly caved	N5-N6	0.47
		B 25% Mudstone, as 606-043A, mostly caved Minor lost circulation material	N7-N8	0.08,0.13
606-047	1045-060m	A 75% Shale, blocky, soft, subfissile, non calc., mod. caving, medium grey to medium dark grey	N5-N4	0.72

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-047	1045-060m	B 15% Shale, blocky, subfissile, soft to mod. hard, non calc., light olive grey	5Y6/1	0.28
		C 10% Mudstone, blocky, soft to mod. hard, non calc., sig. caving, light to very light grey Minor other caved shale, lost circulation material		0.10
606-048	1060-075m	A 65% Shaly Mudstone, blocky, soft to mod. hard, sl. silty, occ. silty-mod. caving, light olive grey to medium light grey	5Y6/1-N6	0.08
		B 35% Shale, as 606-047B, sig. caving Minor mudstone, lost circulation material	5Y6/1	0.73
606-049	1075-090m	A 60% Mudstone, blocky, soft to mod. hard, non calc., medium light grey to light grey	N6-N7	0.16
		B 40% Shale, blocky, soft, subfissile, non calc., mod. caving, medium grey to medium dark grey	N5-N4	0.86
606-050	1090-105m	A 45% Shale, as 606-049B	N5-N4	0.96, 1.04
		B 45% Mudstone, as 606-049A	N6-N7	0.26
		C 10% Lost circulation material - metal, mud Minor other mudstone		
606-051	1105-120m	A 65% Mudstone, blocky, soft to mod. hard, pyritic, non calc., medium light grey to light grey	N6-N7	0.27
		B 20% Shale, as 606-049B, mostly caved	N5-N4	0.84
		C 5% Limestone, blocky, hard, micro-crystalline, arg., medium dark grey to medium grey	N4-N5	0.19, 0.21
		D 5% Calcite, crystalline, greyish yellow	5Y8/4	
		E 5% Free pyrite		
606-052	1120-135m	A 85% Mudstone, as 606-051A	N6-N7	0.38
		B 10% Calcite, as 606-051D	5Y8/4	
		C 5% Limestone, as 606-051C Minor other mudstone, shale, pyrite	N4-N5	0.23
606-053	1135-150m	A 65% Mudstone, blocky, soft to mod. hard, pyritic in part, non calc., medium light grey to light grey	N6-N7	0.35

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-053	1135-150m	B 35% Shale, platy to blocky, mod. hard, non calc., medium to medium light grey Minor limestone, calcite, pyrite	N5-N6	0.87
606-054	1150-165m	A 70% Mudstone, blocky, soft to mod. hard, pyritic in part, non calc., minor caving, medium light to light grey	N6-N7	0.26
		B 30% Shale, as 606-053B, minor caving Minor pyrite, limestone	N5-N6	1.17
606-055	1165-180m	A 50% Shale, platy to blocky, mod. hard, rare shell fragments, mod. caving, medium grey	N5	0.90,0.86
		B 50% Mudstone, blocky, mod. hard, rarely pyritic, non calc., light olive grey to light grey Minor pyrites	5Y6/1-N7	0.26
606-056	1180-195m	A 50% Shale, as 606-055A, mod. caving	N5	1.48
		B 50% Mudstone, as 606-055B, mod. caving Minor lost circulation material, pyrites	5Y6/1-N7	0.55
606-057	1195-210m	A 50% Shale, as 606-055A, sig. caving	N5	1.34
		B 50% Mudstone, as 606-055B, sig. caving Minor lost circulation material, pyrites	5Y6/1-N7	0.37,0.32
606-058	1210-225m	A 65% Mudstone, as 606-055B, mod. to abundantly caved	5Y6/1-N7	0.46,0.43
		B 35% Shale, as 606-055A, minor caving Minor pyrite	N5	0.94
606-059	1225-240m	A 75% Shale, platy, fissile to sub- fissile, soft to mod. hard, non calc., minor cavings, medium grey	N5	1.17
		B 25% Mudstone, blocky, mod. hard, non calc., light grey Minor other mudstone	N7	0.28
606-060	1240-255m	A 60% Shale, as 606-059A, minor cavings	N5	0.87
		B 40% Mudstone, as 606-059B, minor cavings Minor other mudstone	N7	0.25
606-061	1255-270m	A 70% Shale, as 606-059A, minor cavings	N5	1.42
		B 30% Mudstone, as 606-059B, minor cavings Minor other mudstone and pyrite	N7	0.22

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-062	1270-285m	A 80% Shale, platy, fissile to sub-fissile, soft to mod. hard, non calc., minor cavings, medium grey	N5	1.06,1.08
		B 20% Mudstone, blocky, mod. hard, non calc., minor cavings, light grey Minor other mudstone and pyrite	N7	0.60
606-063	1285-300m	A 90% Shale, as 606-062A, minor cavings	N5	1.27
		B 10% Mudstone, as 606-062B, minor cavings Minor other mudstone and pyrite	N7	0.87
606-064	1300-315m	A 50% Shale, platy to subfissile, soft to mod. hard, non calc., mod. caved, medium grey	N5	0.82,0.78
		B 50% Mudstone, blocky, soft to mod. hard, non calc., abundantly caved, light grey Minor other mudstone and lost circulation material	N7	0.41
606-065	1315-330m	A 65% Mudstone, as 606-064B, abundantly caved	N7	0.25
		B 35% Shale, as 606-064A, minor cavings Minor other mudstone	N5	1.11
606-066	1330-345m	A 75% Shale, as 606-064A, mod. cavings	N5	0.78
		B 25% Mudstone, as 606-064B, mod. caved Minor other mudstone and pyrite	N7	0.15
606-067	1345-360m	A 90% Shale, as 606-064A, mod. caved	N5	0.96,0.93
		B 10% Mudstone, as 606-064B, mod. caved Minor other mudstone and pyrite	N7	0.32
606-068	1360-375m	A 98% Shale, platy, soft to mod. hard, brittle, non calc., minor cavings, medium grey Minor mudstone and pyrite	N5	0.96
606-069	1375-390m	A 98% Shale, as 606-068A, mod. caved Minor mudstone and pyrite	N5	0.91
606-070	1390-405m	A 98% Shale, as 606-068A, mod. to abundantly caved Minor mudstone and pyrite	N5	1.14
606-071	1405-420m	A 98% Shale, as 606-068A, mod. caved Minor mudstone and lost circulation material	N5	1.12
606-072	1420-435m	A 98% Shaly Mudstone, platy to sub-fissile, soft to mod. hard, non calc., mod. to abundantly caved, medium grey Minor other mudstone	N5	0.99,0.95

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-073	1435-450m	A 98%	Shaly Mudstone, platy to sub-fissile, soft to mod. hard, non calc., mod. caved, medium grey Minor other mudstone, caved	N5	1.09
606-074	1450-465m	A 98%	Shaly Mudstone, as 606-073A, mod. caved Minor other mudstone	N5	0.78
606-075	1465-480m	A 98%	Shale, platy to subfissile, soft to mod. hard, non calc., minor cavings, medium grey Minor caved mudstone and pyrite	N5	1.15
606-076	1480-495m	A 98%	Shale, as 606-075A, minor cavings Minor caved mudstone and pyrite	N5	1.12
606-077	1495-510m	A 98%	Shale, as 606-075A, minor cavings Minor caved mudstone and pyrite	N5	1.06
606-078	1510-525m	A 98%	Shaly Mudstone, platy to blocky, soft to mod. hard, non calc., mod. caved, medium grey Minor other mudstone, mostly caved	N5	1.08,1.12
606-079	1525-540m	A 98%	Shaly Mudstone, as 606-078A mod. to abundantly caved Minor other mudstone, mostly caved	N5	1.22
606-080	1540-555m	A 98%	Shaly Mudstone, as 606-078A mod. caved Minor other mudstone, mostly caved	N5	1.02
606-081	1555-570m	A 98%	Shaly Mudstone, as 606-078A, abundantly caved Minor other mudstone, mostly caved	N5	1.31
606-082	1570-585m	A 98%	Shaly Mudstone, as 606-078A abundantly caved Minor other mudstone, mostly caved	N5	0.98
606-083	1585-600m	A 98%	Shaly Mudstone, platy to sub-fissile, soft to mod. hard, non calc., mod. caved, medium dark grey to medium grey Minor other mudstone, mostly caved and pyrite	N4-N5	0.96
606-084	1600-615m	A 98%	Shale, platy, mod. hard, non calc., minor cavings, medium dark grey to medium grey Minor mudstone and pyrite Minor lost circulation material - fibre	N4-N5	1.06,1.08

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-085	1615-630m	A 98%	Shale, platy, mod. hard, non calc., mod. caved, medium dark grey to medium grey Minor other mudstone and pyrite Minor lost circulation material	N4-N5	1.21
606-086	1630-645m	A 98%	Shale, as 606-085A, minor cavings Minor mudstone	N4-N5	1.15
606-087	1645-660m	A 98%	Shale, as 606-085A, minor cavings Minor mudstone and sandstone	N4-N5	1.26
606-088	1660-675m	A 98%	Shale, as 606-085A, minor cavings Minor mudstone, sandstone and pyrite	N4-N5	1.18
606-089	1675-690m	A 85%	Shale, platy to subfissile, soft to mod. hard, non calc., mod. caved, medium grey	N5	1.18
		B 15%	Mudstone, blocky, mod. hard, non calc., minor cavings, medium light grey Minor other mudstone and pyrite	N6	1.20, 1.19
606-090	1690-705m	A 85%	Shale, as 606-089A, mod. caved	N5	1.18
		B 15%	Mudstone, as 606-089B Minor other mudstone and sandstone	N6	1.03
606-091	1705-720m	A 85%	Shale, as 606-089A, minor cavings	N5	1.29
		B 15%	Mudstone, as 606-089B Minor other mudstone and siltstone	N6	1.49
606-092	1720-735m	A 90%	Shale, as 606-089A, minor cavings	N5	1.46
		B 10%	Mudstone, as 606-089B Minor other mudstone and siltstone	N6	1.98
606-093	1735-750m	A 80%	Shale, as 606-089A, mod. caved	N5	1.77
		B 20%	Mudstone, as 606-089B, minor cavings Minor other mudstone	N6	1.77, 1.70
606-094	1750-765m	A 85%	Shale, as 606-089A, minor cavings	N5	1.41
		B 15%	Mudstone, as 606-089B Minor other mudstone	N6	1.49
606-095	1765-780m	A 98%	Shale, platy to subfissile, mod. hard, non calc., minor cavings, medium dark grey to medium grey Minor mudstone, siltstone and pyrite	N4-N5	1.77
606-096	1789-795m	A 80%	Shale, as 606-095A, minor cavings	N4-N5	2.01, 1.90
		B 20%	Siltstone, blocky, soft to mod. hard, non calc., medium brownish grey Minor mudstone and pyrite	5YR5/1	1.74

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-097	1795-810m	A 65% Shale, platy to subfissile, mod. hard, non calc., minor cavings, medium dark grey to medium grey	N4-N5	1.86
		B 35% Siltstone, blocky, soft to mod. hard, non calc., medium brownish grey Minor mudstone and pyrite	5YR5/1	1.86
606-098	1810-825m	A 60% Shale, as 606-097A, mod. caved	N4-N5	1.49
		B 30% Siltstone, as 606-097B, minor cavings	5YR5/1	2.19
		C 10% Lost circulation material - cement Minor mudstone and pyrite		
606-099	1825-840m	A 65% Lost circulation material - cement		
		B 35% Shale, as 606-097A Minor siltstone and pyrite	N4-N5	2.38
606-100	1840-855m	A 65% Siltstone, blocky, soft, non calc., medium yellowish brown	10YR5/2	2.22
		B 30% Lost circulation material - cement		
		C 5% Shale, as 606-097A Minor pyrite	N4-N5	1.92
606-101	1855-870m	A 55% Siltstone, as 606-100A	10YR5/2	2.38
		B 35% Lost circulation material - cement		
		C 10% Shale, as 606-097A Minor pyrite	N4-N5	2.04
606-102	1870-885m	A 85% Siltstone, as 606-100A	10YR5/2	2.08, 1.98
		B 10% Lost circulation material - cement, rubber		
		C 5% Shale, as 606-097A	N4-N5	2.40
606-103	1885-900m	A 80% Siltstone, as 606-100A	10YR5/2	1.59
		B 20% Shale, as 606-097A, mod. caved Minor mudstone and pyrite Minor lost circulation material - cement	N4-N5	2.20
606-104	1900-915m	A 65% Siltstone, as 606-100A	10YR5/2	1.74
		B 35% Shale, as 606-097A, mod. caved Minor mudstone and pyrite Lost circulation material - cement	N4-N5	1.60
606-105	1915-930m	A 60% Shale, 606-097A, minor cavings	N4-N5	1.98
		B 40% Siltstone, as 606-100A Minor mudstone and pyrite Minor lost circulation material	10YR5/2	2.32
606-106	1930-945m	A 80% Shale, platy, fissile, mod. hard, brittle, non calc., minor cavings, dark to medium dark grey	N3-N4	3.06

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-106	1930-945m	B 20% Lost circulation material - mud Minor sand and pyrite		
606-145	1937m SWC	A 98% Shale, blocky to subfissile, mod. hard, non calc., dark to medium dark grey	N3-N4	1.71,1.80
606-146	1943m SWC	A 98% Shale, platy to fissile, soft, non calc., carbonaceous, patchy pearly lustre, medium brownish grey	5YR5/1	6.88
606-147	1964.5m SWC	A 98% Silty Mudstone, blocky to sub- fissile, soft, non calc., pale brown occ. medium light brown	5YR5/2 occ. N6	0.36
606-107	1945-960m	A 90% Shale, platy, fissile, mod. hard, brittle, non calc., minor cavings, dark to medium dark grey B 10% Lost circulation material - mud Minor sand, siltstone and pyrite	N3-N4	3.40,3.30
606-108	1960-975m	A 65% Shale, as 606-107A, minor cavings B 25% Lost circulation material - cement C 10% Siltstone, blocky to platy, soft, non calc., shaly in part, greyish red Minor pyrite	N3-N4 10R4/2	3.46 0.38
606-109	1975-990m	A 65% Shale, as 606-107A, mod. caved B 25% Limestone, blocky, mod. hard, very light grey C 10% Siltstone, as 606-108C Minor pyrite Minor lost circulation material - metal, cement	N3-N4 N8 10R4/2	2.07 0.12 0.24,0.20
606-148	1988m SWC	A 98% Siltstone, blocky, soft, very sl. calc., very light to pinkish brownish grey	5YR7/1-8/1	0.23
606-149	1991m SWC	A 98% Mudstone, blocky, soft, non calc., very dark brownish grey	5YR3/1	1.52
606-150	1993m SWC	A 98% Siltstone, blocky, soft, shaly in part, non calc., very dark brownish grey	5YR3/1	2.11
606-110	1990-2005m	A 90% Shale, as 606-107A, minor cavings B 10% Siltstone, as 606-108C Minor limestone and pyrite Minor lost circulation material	N3-N4 10R4/2	2.17 0.22

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-151	1999m SWC	A 65% Mudstone, shaly, blocky to sub-fissile, soft, non calc., medium dark grey to olive grey	N4-5Y4/1	1.12,1.15
606-152	2008m SWC	A 98% Silty Shale, platy to subfissile, soft, non calc., oil stained, dark to dusky yellowish brown	10YR3/2	5.07
606-111	2005-020m	A 85% Siltstone, blocky to subfissile, mod. hard, non calc., medium dark grey to brownish grey	N4-5YR4/1	4.02
		B 10% Shale, as 606-107A, minor cavings	N3-N4	3.79
		C 5% Siltstone, as 606-108C Minor pyrite Lost circulation material - cement	10R4/2	0.33
606-153	2018m SWC	A 98% Silty Shale, platy to subfissile, soft to mod. hard, non calc., oil stained, dark and dusky to dusky yellowish brown	10YR3/2- 10YR2/2	5.86
606-112	2020-035m	A 90% Siltstone, as 606-111A, minor cavings	N4-5YR4/1	3.56,3.54
		B 10% Shale, as 606-107A Minor other siltstone	N3-N4	2.63
606-113	2035-050m	A 98% Siltstone, as 606-111A, minor cavings Minor other siltstone and shale	N4-5YR4/1	4.23
606-114	2050-065m	A 98% Siltstone, as 606-111A Minor other siltstone and shale	N4-5YR4/1	7.30
606-154	2061m SWC	A 98% Silty Shale, platy to subfissile, soft, non calc., oil stained, medium dark grey to olive grey	N4-5Y4/1	8.70
606-155	2065.5m SWC	A 98% Shale, platy to subfissile, soft to mod. hard, non calc., oil stained, medium dark grey to brownish grey	N4-5YR4/1	8.07
606-156	2069m SWC	A 98% Shale, fissile, mod. hard, non calc., sl. silty, oil stained, very dark brownish grey	5YR3/1	11.35,11.30
606-115	2065-080m	A 98% Silty Shale, blocky to subfissile, soft to mod. hard, non calc., sl. micaceous, dark grey to very dark brownish grey	N3-5YR3/1	6.98
606-157	2075m SWC	A 98% Shale, fissile to subfissile, mod. hard, non calc., sl. silty, oil stained, very dark brownish grey	5YR3/1	11.61

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-158	2079m SWC	A 98% Silty Shale, subfissile to blocky, soft to mod. hard, non calc., oil stained, medium dark grey to brownish grey	N4-5YR4/1	9.35
606-116	2080-095m	A 98% Silty Shale, blocky to subfissile, soft to mod. hard, non calc., sl. micaceous, dark grey to very dark brownish grey Minor sandstone	N3-5YR3/1	8.26
606-159	2087m SWC	A 98% Shaly Mudstone, blocky to sub- fissile, mod. hard, non calc., patchy pearly lustre, medium dark grey	N4	1.63
606-160	2089.5m SWC	A 98% Silty Shale, blocky to subfissile, platy in part, soft, non calc., very dark brownish grey	5YR3/1	1.76
606-117	2095-110m	A 90% Silty Shale, as 606-116A, minor cavings B 10% Sandstone, blocky, very fine grained, subangular, quartz, well sorted, non calc. matrix, pinkish grey	N3-5YR3/1 5YR8/1	7.62, 7.52
606-118	2110-125m	A 85% Silty Shale, as 606-116A, minor cavings	N3-5YR3/1	5.19
606-118	2110-125	B 15% Sandstone, blocky, very fine grained, subangular, quartz, well sorted, non calc. matrix, pinkish grey Minor pyrite, minor lost circulation material	5YR8/1	
606-119	2125-140m	A 50% Shale, thinly fissile to platy, mod. hard, non calc., sl. silty, medium dark grey B 50% Quartz sandstone, as 606-117B, sl.C.	N4 5YR8/1	5.90
606-120	2140-155m	A 80% Quartz sandstone, as 606-117B, sl.C. B 20% Shale, as 606-119A, minor cavings	5YR8/1 N4	4.22
606-121	2155-170m	A 55% Shale, as 606-119A, minor cavings B 45% Sandstone, as 606-117B Minor lost circulation material	N4 5YR8/1	7.39

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-122	2270-285m	A 60% Quartz, sandstone, blocky, very fine grained, subangular, well sorted, non calc. matrix, strong milky C., very pale yellowish brown	10YR7/2	
		B 40% Shale, thinly fissile to subfissile, N4 mod. hard, brittle, non calc., sl. carbonaceous in part, medium dark grey Minor siltstone Minor lost circulation material - mica		2.48
606-123	2285-300m	A 65% Quartz sandstone, as 606-122A, minor cavings, patchy pale yellow F. strong C.	10YR7/2	
		B 20% Shale, as 606-122B, minor cavings	N4	3.34, 3.31
		C 15% Siltstone, blocky, soft, non calc., medium dark grey to brownish grey	N4-5YR4/1	3.72
606-124	2300-315m	A 85% Quartz Sandstone, as 606-122A, minor cavings, sl. C.	10YR7/2	
		B 15% Shale, as 606-122B Minor siltstone	N4	3.42
606-125	2315-330m	A 80% Quartz sandstone, as 606-122A, milky C.	10YR7/2	
		B 10% Shale, as 606-122B	N4	9.29
		C 10% Siltstone, as 606-123C Minor coal	N4-5YR4/1	2.64
606-126	2330-345m	A 90% Quartz sandstone, as 606-122A, milky C.	10YR7/2	
		B 5% Shale, as 606-122B	N4	3.38
		C 5% Lost circulation material - mica, fibre		
606-127	2345-360m	A 90% Quartz sandstone, mostly unconsolidated, milky C., fine to medium grained, angular to subangular, fairly well sorted, pinkish grey	5YR8/1	
		B 10% Shale, platy to subfissile, non calc., carbonaceous, dark grey Minor mudstone and shale	N3	40.56
606-128	2360-375m	A 95% Quartz sandstone, as 606-127A, milky C.	5YR8/1	
		B 5% Coaly Shale, blocky to subfissile, non calc., greyish black to dark grey Lost circulation material - cement and mica	N2-N3	33.00

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-129	2375-390m	A 80% Quartz sandstone, mostly uncon- solidated, fine to medium grained, angular to subangular, fairly well sorted, milky C., pinkish grey	5YR8/1	
		B 20% Shale, platy, mod. hard, non calc., N3 sl. carbonaceous in parts, dark grey Minor siltstone		3.80
606-130	2390-405m	A 90% Quartz sand, as 606-129A, milky C.	5YR8/1	
		B 5% Shale, as 606-129B	N3	8.44
		C 5% Siltstone, blocky, soft, non calc., N4-5YR4/1 medium dark grey to brownish grey Minor lost circulation material - cement and mica		7.66
606-131	2405-420m	A 75% Quartz Sandstone, blocky, very fine grained, subrounded to subangular, non calc. matrix, pinkish grey	5YR8/1	
		B 20% Siltstone, as 606-130C	N4-5YR4/1	4.70, 5.15
		C 5% Shale, as 606-129B, minor cavings Minor lost circulation material - fibre and mica	N3	10.58
606-132	2420-435m	A 80% Quartz sandstone, as 606-131A	5YR8/1	
		B 10% Shale, as 606-129B	N3	2.25
		C 10% Siltstone, as 606-130C Minor lost circulation material	N4-5YR4/1	1.85
606-133	2435-450m	A 80% Quartz sandstone, as 606-131A	5YR8/1	
		B 15% Shale, as 606-129B	N3	17.50
		C 5% Siltstone, as 606-130C Minor lost circulation material	N4-5YR4/1	1.85
606-134	2450-465m	A 85% Quartz sandstone, as 606-131A	5YR8/1	
		B 10% Shale, as 606-129B	N3	32.04
		C 5% Siltstone, as 606-130C Lost circulation material - fibre	N4-5YR4/1	2.59
606-135	2465-480m	A 75% Quartz sandstone, as 606-131A	5YR8/1	
		B 25% Shale, blocky to subfissile, mod. hard, non calc., carbonaceous, dark grey to medium dark grey Minor siltstone	N3-N4	4.48
606-136	2480-495m	A 75% Quartz sandstone, as 606-131A	5YR8/1	
		B 25% Shale, as 606-135B, minor cavings Minor siltstone	N3-N4	21.60
606-137	2495-510m	A 85% Quartz sandstone, as 606-131A, milky C.	5YR8/1	

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-137	2495-510m	B 10%	Siltstone, platy to blocky, soft, non calc., sl. carbonaceous in part, medium dark grey to brownish grey	N4-5YR4/1	3.70
		C 5%	Coal, blocky, brittle, non calc., greyish black	N2	55.26
606-138	2510-525m	A 90%	Quartz sandstone, blocky, very fine grained, subrounded to sub- angular, non calc. matrix, pinkish grey	5YR8/1	
		B 10%	Siltstone, as 606-137B Minor coal and shale Minor lost circulation material - fibre	N4-5YR4/1	3.32, 3.30
606-139	2525-540m	A 65%	Quartz sandstone, blocky, fine grained, subrounded to subangular, well sorted, non calc. matrix, pinkish grey	5YR8/1	
		B 20%	Shale, platy, mod. hard, non calc., medium dark grey	N4	2.51
		C 15%	Siltstone, blocky, soft, non calc., brownish grey Minor other shale and coal Minor lost circulation material - fibre	5YR4/1	0.79
606-140	2540-555m	A 85%	Quartz sandstone, as 606-139A	5YR8/1	
		B 15%	Shale, as 606-139B, minor cavings Minor siltstone and coal Minor lost circulation material - fibre and mica	N4	2.65
606-141	2555-570m	A 70%	Quartz sandstone, as 606-139A	5YR8/1	
		B 20%	Siltstone, as 606-139C	5YR4/1	1.01
		C 10%	Shale, as 606-139B, minor cavings Lost circulation material - fibre	N4	2.69
606-142	2570-585m	A 60%	Quartz sandstone, as 606-139A	5YR8/1	
		B 25%	Siltstone, as 606-139C	5YR4/1	1.22, 1.14
		C 15%	Shale, as 606-139B, minor cavings Lost circulation material - fibre	N4	3.81
606-143	2585-600m	A 70%	Quartz sandstone, as 606-139A, pale milky C.	5YR8/1	
		B 20%	Shale, as 606-139B, mod. caved	N4	3.27
		C 10%	Siltstone, as 606-139C Minor lost circulation material - fibre Minor coal	5YR4/1	0.93

TABLE 2
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (% of Rock)
606-144	2600-615m	A 75% Quartz sandstone, blocky, fine grained, subrounded to subangular, well sorted, non calc. matrix, pinkish grey	5YR8/1	
		B 25% Coal, blocky, brittle, non calc., greyish black Minor siltstone and shale Lost circulation material - fibre	N2	42.69

TABLE 3
VISUAL KEROGEN DATA

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION				THERMAL MATURATION INDEX
		TYPES	REMARKS	PARTICLE SIZE	PRESERV- ATION	
606-001A	355-370m	Am*;I;H-W-Al	*poor quality, frequently incompletely developed - contaminant?	F-M	P	1+ to 2-(?)
606-004A	400-415m	Am*;I-H-W-Al;-	*grainy, not prime quality, includes incompletely developed material.	F-M	P-F	1+
606-009A	475-490m	Am*;I-H;W-Al	*as 004A.	F-M/C	P-F	1+ to 2-max.
606-014A	550-565m	Am*;I-H;W	*poor quality, atypical, frequently resembles contamination.	F-M	P	1+ to 2-(?)
606-016B	580-595m	-;Am*-I-H-W;Al	*as 014A.	F-M/C	P	1+/1+ to 2-
606-017B	595-610m	Am*;I;H-W-Al	*grainy, poor quality, includes incompletely developed material.	F-C	P	1+(?)
606-018A	610-625m	-;H-I-Am*-W;Al	*as 017B	M	P-F	1+
606-019A	625-640m	Am*;I-H-W;Al	*poor quality, incompletely developed, frequently resembles contamination.	F-M	P	1+(?)
606-023B	685-700m	-;Am*-I-W;Al	H at 2- and 2- to 2. *grainy, disseminated, poor quality, included incompletely developed material.	F-M	P	1+ to 2-(?)
606-025A	715-730m	-;I-W-Am*-H;Al	*as 023B.	F-M/C	P-F	1+ to 2-max.
606-027A	745-760m	-;I-W-H-Am*;Al	significant H at 2-, 2- to 2 and 2. *as 023B.	F-M/C	P-F	1+ to 2-(?)
606-031A	805-820m	I-W;H;Am		M	F	1+ to 2-
606-033A	835-850m	I-W;Am*-H;Al	H at 2- and 2- to 2. *as 023B.	M	F	1+ to 2-(?)
606-036A	880-895m	I-W;H-Am*;-	*grainy, poor quality, includes incompletely developed material.	F-C	F	1+ to 2-
606-041A	955-970m	Am*;I-W-H;-	*grainy, poor quality, highly disseminated.	F-M	P	1+ to 2-(?)
606-047A	1045-060m	I-H;W-Am*;Al	significant H at 2-, 2- to 2 and 2. Foraminifera. *not prime quality, includes incompletely developed material.	F-M/C	P	1+ to 2-(?)

Algal, Amorphous, Coaly, Herbaceous, Stem, Woody.

TABLE 3
VISUAL KEROGEN DATA

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION				THERMAL MATURATION INDEX
		TYPES	REMARKS	PARTICLE SIZE	PRESERV- ATION	
606-053B	1135-150m	I;H-Am*-W;Al	H at 2- and 2- to 2. *grainy, disseminated, poor quality.	M	F	1+ to 2-(?)
606-056A	1180-195m	Am*-I;W-H;Al	H at 2. *grainy, atypical, poor quality.	F-M	P	1+ to 2-(?)
606-059A	1225-255m	-;H-I-W-Am*;Al	*includes incompletely developed material.	M	F	1+
606-063A	1285-300m	-;I-H-W;Al-Am		M	F	1+
606-067A	1345-360m	I-Am*;W-H;Al	*grainy, atypical, includes incompletely developed material.	F-M	P-F	1+
606-072A	1420-435m	I;W-H;Am-Al		M	F	1+ to 2-max.
606-075A	1465-480m	I;W-Am*-H;Al	*as 067A.	M	F	1+ to 2-
606-078A	1510-525m	I;W-H;Am-Al	H at 2-.	M	F	1+ to 2-
606-082A	1570-585m	I;Am*-W-H;-	H at 2-. *grainy, disseminated, poor quality.	M	F	1+ to 2-
606-087A	1645-660m	I;W;H-Am		F-M	F-G	1+ to 2-
606-089A	1675-690m	I;Am*-W;H-Al	H at 2-. *grainy, disseminated.	M	F	1+ to 2-
606-091B	1705-720m	I;W-Am*;H-Al	H at 2. *as 089A.	M	F	1+ to 2-(?)
606-095A	1765-780m	I;W-H;Am-Al	significant H at 2-.	M	F-G	1+ to 2-
606-098B	1810-825m	I-W;H;Am	significant H at 2-.	M	F-G	1+ to 2-
606-100A	1840-855m	I-W;H-Am;Al	H at 2-.	M	F	1+ to 2-
606-103A	1885-900m	I-W;H;Am-Al	H at 2-.	M	F	1+ to 2-
606-106A	1930-945m	Am*;Al**-I-W;H	significant H at 2-. *after Al includes incompletely developed material. **frequently passing to Am.	F-VC	P	1+ to 2-(?)
606-146A	1943m SWC	Am*;-;Al**-I-W-H	*after Al, includes incompletely developed material. **frequently passing to Am.	F-C	F	2-(?)

Algal, Amorphous, Coaly, Herbaceous, Stem, Woody.

TABLE 3
VISUAL KEROGEN DATA

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION				THERMAL MATURATION INDEX
		TYPES	REMARKS	PARTICLE SIZE	PRESERV- ATION	
606-108A	1960-975m	Am*;I-Al**-W;H	H at 2-. * **as 106A.	F-VC	P	1+ to 2-
606-150A	1993m SWC	-;Al**-Am*-W-I;H	H at 2-. **as 146A. *frequently incom- pletely developed.	F-M/C	P	1+ to 2-/2-
606-152A	2008m SWC	Al**-Am*;-;W-I-H	H at 2-. * **as 146A.	F-C	F	1+ to 2-
606-111A	2005-020m	Am*-Al**;-;I-H-W	significant H at 2-.	F-C	P	1+ to 2-(?)
606-114A	2050-065m	Am*;Al**-I;W-H	H at 2-. * **as 106A.	F-VC	P	1+ to 2-(?)
606-156A	2069m SWC	Am*;-;I-Al**-W-H	* **as 146A.	F-VC	P	2-
606-116A	2080-095m	Am*-Al**;-;I-W-H	* **as 106A.	F-VC		1+ to 2-/2-
606-160A	2089.5m SWC	-;H-W-I-Am;Al	significant H at 2-.	M	F	1+ to 2-/2-
606-119A	2125-140m	Am*;I-W;Al-H	significant H at 2- and 2- to 2. *as 106A.	F-VC	P-F	1+ to 2-/2- (?)
606-121A	2155-170m	Am*;I-W;Al-H	*as 106A. H at 1+ to 2-.	F-VC	P	2- max.
606-122B	2270-285m	Am*;I-W;Al-H	*as 106A.	F-C	F	2-
606-125B	2315-330m	Am*;W-Al**;I-H	*after Al, includes incompletely developed material. **frequently passing to Am.	F-VC	P-F	2-(?)
606-127B	2345-360m	W;-;I-Am-H		F-M/C	F	2-(?)
606-129B	2375-390m	Am*;I-W-Al**;H	H at 2- to 2. * **as 125B.	F-C	F	2-
606-132B	2420-435m	Am*;Al**-W-I;H	* **as 125B.	F-VC	P-F	2-
606-136B	2480-495m	W;I;H-Am		F-VC	P-F	2-(?)
606-140B	2540-555m	Am*;I-W;Al-H	*as 125B. H at 1+ to 2-.	F-C	F	2-
606-144B	2600-615m	W;I;H-Am		F-C	P-F	2-(?)

Algal, Amorphous, Coaly, Herbaceous, Stem, Woody.

TABLE 4
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%)			NUMBER OF PARTICLES			REMARKS
			1	2	3	1	2	3	
606-001A	355-370m	WHOLE ROCK	0.38	0.65	0.87	1	2	5	
606-004A	400-415m	WHOLE ROCK	0.57	0.84	1.01	1	4	2	
606-009A	475-490m	WHOLE ROCK	0.68	0.85	-	7	9	-	
606-014A	550-565m	WHOLE ROCK	NO DETERMINATION POSSIBLE						
606-019A	625-640m	WHOLE ROCK	0.39	0.53	0.72	5	1	1	
606-023B	685-700m	WHOLE ROCK	0.40	-	-	4	-	-	
606-027A	745-760m	WHOLE ROCK	0.31	0.40	0.51	2	12	4	
606-031A	805-820m	WHOLE ROCK	0.40	0.50	-	3	15	-	
606-036A	880-895m	WHOLE ROCK	0.40	0.58	0.80	2	14	2	4th pop. 0.96(2)
606-041A	955-970m	WHOLE ROCK	0.47	0.70	0.94	1	3	5	4th pop. 1.48(2)
606-047A	1045-060m	WHOLE ROCK	0.55	0.71	0.95	3	6	1	
606-053B	1135-150m	WHOLE ROCK	0.70	1.11	-	4	2	-	
606-059A	1225-240m	WHOLE ROCK	0.51	0.65	0.81	4	2	2	
606-063A	1285-300m	WHOLE ROCK	0.39	0.51	0.72	5	7	2	
606-072A	1420-435m	WHOLE ROCK	0.51	0.65	0.83	1	3	12	4th pop. 1.06(4)
606-078A	1510-525m	WHOLE ROCK	0.61	0.79	0.94	10	4	4	4th pop. 1.10(2)
606-087A	1645-660m	WHOLE ROCK	0.81	1.01	1.29	5	8	7	
606-089A	1675-690m	WHOLE ROCK	0.68	1.00	-	9	3	-	
606-091B	1705-720m	WHOLE ROCK	0.57	0.87	1.18	5	11	4	
606-095A	1765-780m	WHOLE ROCK	0.65	0.91	-	8	4	-	
606-100A	1840-855m	WHOLE ROCK	0.44	0.58	0.69	1	15	6	4th pop. 0.80(2)
606-106A	1930-945m	WHOLE ROCK	0.70	0.90	-	24	1	-	
606-146A	1943m SWC	KER. CON.	0.72	0.96	-	20	3	-	
606-152A	2008m SWC	KER. CON.	0.45	0.56	-	29	2	-	

TABLE 4
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%)			NUMBER OF PARTICLES			REMARKS
			1	2	3	1	2	3	
606-111A	2005-020m	KER. CON.	0.37	0.44	0.54	2	8	12	4th pop. 0.62(1)
606-156A	2069m SWC	KER. CON.	0.62	0.74	0.95	10	4	6	
606-116A	2080-095m	KER. CON.	0.37	0.44	0.52	1	4	19	4th pop. 0.63(4); 5th pop. 0.76(1)
606-121A	2155-170m	KER. CON.	0.35	0.42	0.51	1	4	13	4th pop. 0.67(9)
606-122B	2270-285m	KER. CON.	0.51	0.60	0.73	8	11	8	
606-127B	2345-360m	KER. CON.	0.60	-	-	40	-	-	
606-136B	2480-495m	KER. CON.	0.71	0.85	-	21	9	-	
606-137C	2495-510m	WHOLE ROCK	0.81	-	-	30	-	-	
606-144B	2600-615m	KER. CON.	0.65	0.79	-	24	16	-	

TABLE 4A

VITRINITE REFLECTANCE - RAW DATA

<u>GEOCHEM</u> <u>SAMPLE</u> <u>NUMBER</u>	<u>DEPTH</u>	<u>READINGS</u>
606-001A	355-370m	0.92, 1.01, 0.86, 0.63, 0.67, 0.38, 0.77, 0.81.
606-004A	400-415m	0.78, 0.88, 0.99, 1.02, 0.86, 0.85, 0.57.
606-009A	475-490m	0.72, 1.00, 0.90, 0.84, 0.68, 0.81, 0.80, 0.70, 0.88, 0.70, 0.62, 0.64, 0.73, 0.80, 0.80, 0.80.
606-019A	625-640m	0.53, 0.40, 0.42, 0.72, 0.41, 0.37, 0.37.
606-023B	685-700m	0.37, 0.39, 0.40, 0.42
606-027A	745-760m	0.39, 0.41, 0.31, 0.54, 0.38, 0.43, 0.36, 0.52, 0.41, 0.49, 0.40, 0.45, 0.31, 0.49, 0.39, 0.41, 0.44, 0.36.
606-031A	805-820m	0.52, 0.52, 0.55, 0.50, 0.41, 0.45, 0.48, 0.47, 0.48, 0.46, 0.45, 0.46, 0.52, 0.62, 0.39, 0.41, 0.55, 0.50.
606-036A	880-895m	0.64, 0.66, 0.52, 0.48, 0.96, 0.51, 0.54, 0.95, 0.69, 0.57, 0.50, 0.68, 0.61, 0.77, 0.46, 0.38, 0.42, 0.63, 0.58, 0.83.
606-041A	955-970m	0.47, 0.70, 0.93, 0.99, 1.00, 0.92, 0.85, 0.69, 0.70, 1.22, 1.34.
606-047A	1045-060m	0.72, 0.71, 0.67, 0.52, 0.59, 0.95, 0.75, 0.73, 0.54, 0.67.
606-053B	1135-150m	0.64, 1.19, 0.69, 1.02, 0.79, 0.69.
606-059A	1225-240m	0.85, 0.49, 0.52, 0.54, 0.76, 0.50, 0.63, 0.67, 0.47.
606-063A	1285-300m	0.46, 0.41, 0.59, 0.44, 0.41, 0.50, 0.38, 0.73, 0.46, 0.38, 0.71, 0.60, 0.38, 0.52.
606-072A	1420-435m	0.62, 1.11, 0.95, 1.08, 0.68, 0.64, 0.77, 0.61, 0.57, 0.94, 0.53, 0.53, 0.78, 0.79, 0.59, 0.97, 0.83, 0.58, 0.70, 0.90.
606-087A	1645-660m	1.24, 1.11, 1.17, 1.19, 0.76, 1.35, 0.72, 0.86, 1.39, 1.36, 1.01, 1.36, 1.06, 0.97, 0.88, 0.82, 1.05, 0.97, 1.01, 0.92.

TABLE 4A

VITRINITE REFLECTANCE - RAW DATA

<u>GEOCHEM</u> <u>SAMPLE</u> <u>NUMBER</u>	<u>DEPTH</u>	<u>READINGS</u>
606-089A	1675-690m	0.70, 0.62, 0.73, 0.74, 0.76, 0.74, 1.10, 0.60, 0.95, 0.96, 0.69, 0.57.
606-091B	1705-720m	0.60, 0.87, 1.12, 1.25, 0.95, 0.88, 0.89, 1.14, 0.54, 0.96, 1.21, 0.79, 0.89, 0.55, 0.59, 0.93, 0.80, 0.55, 0.80, 0.80.
606-095A	1765-780m	0.75, 0.59, 0.59, 0.55, 0.99, 0.68, 0.64, 0.63, 0.73, 0.89, 0.84, 0.90.
606-100A	1840-855m	0.81, 0.71, 0.44, 0.63, 0.61, 0.55, 0.53, 0.56, 0.66, 0.67, 0.71, 0.59, 0.56, 0.57, 0.69, 0.79, 0.56, 0.57, 0.62, 0.60, 0.70, 0.60, 0.58, 0.50.
606-106A	1930-945m	0.76, 0.76, 0.73, 0.81, 0.69, 0.77, 0.79, 0.75, 0.90, 0.67, 0.63, 0.59, 0.64, 0.73, 0.68, 0.69, 0.73, 0.79, 0.81, 0.68, 0.63, 0.65, 0.63, 0.68, 0.61.
606-146A	1943m SWC	0.97, 0.66, 1.02, 0.68, 0.68, 0.73, 0.75, 0.65, 0.79, 0.69, 0.66, 0.73, 0.79, 0.75, 0.67, 0.80, 0.74, 0.90, 0.70, 0.69, 0.71, 0.77, 0.66.
606-152A	2008m SWC	0.42, 0.40, 0.42, 0.47, 0.44, 0.48, 0.51, 0.49, 0.38, 0.39, 0.48, 0.46, 0.51, 0.40, 0.42, 0.47, 0.45, 0.43, 0.39, 0.55, 0.56, 0.50, 0.44, 0.45, 0.52, 0.52, 0.43, 0.42, 0.43, 0.49, 0.45.
606-111A	2005-020m	0.44, 0.40, 0.58, 0.46, 0.52, 0.49, 0.62, 0.35, 0.58, 0.47, 0.38, 0.56, 0.46, 0.55, 0.41, 0.46, 0.56, 0.49, 0.50, 0.42, 0.54, 0.53, 0.50.
606-156A	2069m SWC	0.57, 0.69, 0.68, 0.66, 0.98, 1.02, 0.58, 0.79, 0.73, 0.77 0.65, 0.55, 0.63, 0.62, 0.95, 0.63, 0.74, 0.87, 0.88, 1.00.

TABLE 4A

VITRINITE REFLECTANCE - RAW DATA

<u>GEOCHEM</u> <u>SAMPLE</u> <u>NUMBER</u>	<u>DEPTH</u>	<u>READINGS</u>
606-116A	2080-095m	0.65, 0.57, 0.52, 0.58, 0.55, 0.60, 0.51, 0.49, 0.52, 0.54, 0.44, 0.60, 0.49, 0.54, 0.48, 0.76, 0.37, 0.54, 0.67, 0.43, 0.44, 0.49, 0.57, 0.49, 0.55, 0.49, 0.49, 0.53, 0.45.
606-121A	2155-170m	0.62, 0.55, 0.48, 0.45, 0.52, 0.42, 0.42, 0.40, 0.35, 0.49, 0.70, 0.61, 0.51, 0.50, 0.67, 0.63, 0.51, 0.68, 0.54, 0.49, 0.52, 0.55, 0.47, 0.48, 0.67, 0.67, 0.80.
606-122B	2270-285m	0.67, 0.71, 0.62, 0.74, 0.51, 0.54, 0.73, 0.82, 0.50, 0.58, 0.78, 0.52, 0.68, 0.74, 0.60, 0.52, 0.60, 0.59, 0.60, 0.59, 0.49, 0.48, 0.60, 0.58, 0.62, 0.60, 0.51.
606-127B	2345-360m	0.60, 0.59, 0.61, 0.62, 0.63, 0.57, 0.58, 0.58, 0.59, 0.61, 0.63, 0.64, 0.67, 0.56, 0.57, 0.55, 0.58, 0.52, 0.61, 0.65, 0.58, 0.59, 0.61, 0.63, 0.64, 0.62, 0.59, 0.59, 0.58, 0.72, 0.58, 0.66, 0.66, 0.63, 0.53, 0.53, 0.53, 0.52, 0.65, 0.56.
606-136B	2480-495m	0.88, 0.86, 0.65, 0.67, 0.72, 0.80, 0.67, 0.76, 0.73, 0.83, 0.71, 0.77, 0.71, 0.83, 0.90, 0.79, 0.63, 0.70, 0.74, 0.74, 0.83, 0.70, 0.77, 0.65, 0.87, 0.81, 0.75, 0.72, 0.66, 0.70.
606-137C	2495-510m	0.85, 0.76, 0.78, 0.82, 0.80, 0.80, 0.74, 0.83, 0.84, 0.86, 0.88, 0.82, 0.83, 0.77, 0.89, 0.78, 0.78, 0.83, 0.70, 0.91, 0.87, 0.89, 0.83, 0.78, 0.73, 0.77, 0.79, 0.82, 0.78, 0.70.
606-144B	2600-615m	0.74, 0.63, 0.71, 0.69, 0.76, 0.74, 0.66, 0.76, 0.81, 0.81, 0.70, 0.60, 0.64, 0.79, 0.69, 0.65, 0.69, 0.80, 0.79, 0.69, 0.60, 0.63, 0.80, 0.73, 0.56, 0.62, 0.78, 0.89, 0.71, 0.56, 0.69, 0.68, 0.71, 0.62, 0.65, 0.76, 0.80, 0.82, 0.63, 0.68.

TABLE 5A
WEIGHT (GRAMMES) OF C₁₅+ EXTRACTS AND CHROMATOGRAPHIC FRACTIONS

GEOCHEM SAMPLE NUMBER	INTERVAL	ROCK EXTRACTED	TOTAL EXTRACT OBTAINED	TOTAL EXTRACT		nC ₅ SOLUBLE FRACTION				
				Precipitd. Asphaltenes	nC ₅ soluble	Paraffin — Naphthenes	Aromatics	Eluted NSO's	Non-eluted NSO's	Sulphur
606-001	355- 370	7.0400	0.11436	0.10182	0.01254	0.00191	0.00145	0.00528	0.00390	0.00000
606-013	535- 550	11.8600	0.00290	0.00174	0.00116	0.00009	0.00027	0.00032	0.00048	0.00000
606-022	670- 685	13.4600	0.01200	0.00962	0.00238	0.00082	0.00028	0.00104	0.00024	0.00000
606-027A	745- 760	2.3400	0.06513	0.06253	0.00260	0.00055	0.00047	0.00148	0.00010	0.00000
606-032	820- 835	5.1600	0.00486	0.00260	0.00226	0.00084	0.00068	0.00066	0.00008	0.00000
606-037	895- 910	12.6400	0.00529	0.00245	0.00284	0.00064	0.00076	0.00125	0.00019	0.00000
606-044	1000-1015	14.2600	0.00348	0.00254	0.00094	0.00006	0.00017	0.00040	0.00031	0.00000
606-049	1075-1090	6.1500	0.00176	0.00080	0.00096	0.00014	0.00024	0.00055	0.00003	0.00000
606-053	1135-1150	14.8700	0.00377	0.00227	0.00150	0.00074	0.00040	0.00034	0.00002	0.00000
606-056	1180-1195	12.0600	0.00287	0.00148	0.00139	0.00029	0.00049	0.00048	0.00013	0.00000
606-059	1225-1240	15.5700	0.00410	0.00108	0.00302	0.00076	0.00086	0.00130	0.00010	0.00000
606-062	1270-1285	15.3100	0.00540	0.00249	0.00291	0.00098	0.00090	0.00089	0.00014	0.00000
606-067A	1345-1360	7.5400	0.00305	0.00120	0.00185	0.00041	0.00047	0.00088	0.00009	0.00000
606-073	1435-1450	14.8000	0.00383	0.00218	0.00165	0.00076	0.00036	0.00045	0.00008	0.00000
606-079	1525-1540	15.8200	0.00433	0.00159	0.00274	0.00058	0.00059	0.00130	0.00027	0.00000
606-082	1570-1585	15.3000	0.00465	0.00185	0.00280	0.00081	0.00075	0.00109	0.00015	0.00000
606-085	1615-1630	14.0700	0.00413	0.00214	0.00199	0.00068	0.00071	0.00048	0.00012	0.00000
606-087	1645-1660	14.7700	0.00473	0.00266	0.00207	0.00079	0.00077	0.00049	0.00002	0.00000
606-095	1765-1780	18.4000	0.00377	0.00216	0.00161	0.00049	0.00048	0.00054	0.00010	0.00000
606-102	1870-1885	11.5300	0.02202	0.00857	0.01345	0.00638	0.00421	0.00238	0.00048	0.00000
606-146A	1943	10.1000	0.02859	0.01918	0.00941	0.00233	0.00498	0.00189	0.00021	0.00000
606-108A	1960-1975	3.6200	0.00725	0.00473	0.00252	0.00068	0.00085	0.00096	0.00003	0.00000
606-111A	2005-2020	5.7100	0.02471	0.01283	0.01188	0.00280	0.00544	0.00294	0.00070	0.00000
606-152A	2008	12.2900	0.06231	0.02890	0.03341	0.00697	0.01578	0.00709	0.00357	0.00000
606-114	2050-2065	15.6100	0.07374	0.02564	0.04810	0.01313	0.01947	0.00988	0.00562	0.00000
606-156A	2069	11.4000	0.08348	0.04421	0.03927	0.01033	0.02051	0.00551	0.00292	0.00000
606-119	2125-2140	16.8900	0.03730	0.01127	0.02603	0.00936	0.01157	0.00473	0.00037	0.00000
606-122A	2270-2285	5.1800	0.02146	0.00990	0.01156	0.00698	0.00340	0.00117	0.00001	0.00000
606-125A	2315-2330	8.8800	0.04236	0.01575	0.02661	0.01363	0.00731	0.00354	0.00213	0.00000
606-132A	2420-2435	10.7500	0.01170	0.00917	0.00253	0.00096	0.00045	0.00076	0.00036	0.00000

TABLE 5A
WEIGHT (GRAMMES) OF C₁₅+ EXTRACTS AND CHROMATOGRAPHIC FRACTIONS

GEOCHEM SAMPLE NUMBER	INTERVAL	ROCK EXTRACTED	TOTAL EXTRACT OBTAINED	TOTAL EXTRACT		nC ₅ SOLUBLE FRACTION				
				Precipd. Asphaltenes	nC ₅ soluble	Paraffin — Naphthenes	Aromatics	Eluted NSO's	Non-eluted NSO's	Sulphur
606-136B	2480-2495	3.9600	0.08130	0.07121	0.01009	0.00159	0.00608	0.00158	0.00084	0.00000
606-143A	2585-2600	8.0100	0.01355	0.01142	0.00213	0.00078	0.00037	0.00084	0.00014	0.00000

TABLE 5B
CONCENTRATION (PPM) OF EXTRACTED C₁₅+ MATERIAL IN ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS				
			Paraffin – Naphthenes	Aromatics	TOTAL	Precipitd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	Sulphur	TOTAL
606-001	355- 370	16244	271	206	477	14463	750	554	0	15767
606-013	535- 550	245	8	23	30	147	27	40	0	214
606-022	670- 685	892	61	21	82	715	77	18	0	810
606-027A	745- 760	27833	235	201	436	26722	632	43	0	27397
606-032	820- 835	942	163	132	295	504	128	16	0	647
606-037	895- 910	419	51	60	111	194	99	15	0	308
606-044	1000-1015	244	4	12	16	178	28	22	0	228
606-049	1075-1090	286	23	39	62	130	89	5	0	224
606-053	1135-1150	254	50	27	77	153	23	1	0	177
606-056	1180-1195	238	24	41	65	123	40	11	0	173
606-059	1225-1240	263	49	55	104	69	83	6	0	159
606-062	1270-1285	353	64	59	123	163	58	9	0	230
606-067A	1345-1360	405	54	62	117	159	117	12	0	288
606-073	1435-1450	259	51	24	76	147	30	5	0	183
606-079	1525-1540	274	37	37	74	101	82	17	0	200
606-082	1570-1585	304	53	49	102	121	71	10	0	202
606-085	1615-1630	294	48	50	99	152	34	9	0	195
606-087	1645-1660	320	53	52	106	180	33	1	0	215
606-095	1765-1780	205	27	26	53	117	29	5	0	152
606-102	1870-1885	1910	553	365	918	743	206	42	0	991
606-146A	1943	2831	231	493	724	1899	187	21	0	2107
606-108A	1960-1975	2003	188	235	423	1307	265	8	0	1580
606-111A	2005-2020	4327	490	953	1443	2247	515	123	0	2884
606-152A	2008	5070	567	1284	1851	2352	577	291	0	3219
606-114	2050-2065	4724	841	1247	2089	1643	633	360	0	2635
606-156A	2069	7323	906	1799	2705	3878	483	256	0	4617
606-119	2125-2140	2208	554	685	1239	667	280	22	0	969
606-122A	2270-2285	4143	1347	656	2004	1911	226	2	0	2139
606-125A	2315-2330	4770	1535	823	2358	1774	399	240	0	2412
606-132A	2420-2435	1088	89	42	131	853	71	33	0	957

TABLE 5B
CONCENTRATION (PPM) OF EXTRACTED C₁₅+ MATERIAL IN ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS				
			Paraffin — Naphthenes	Aromatics	TOTAL	Precipd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	Sulphur	TOTAL
606-136B	2480-2495	20530	402	1535	1937	17982	399	212	0	18593
606-143A	2585-2600	1692	97	46	144	1426	105	17	0	1548

TABLE 5C
COMPOSITION (NORMALISED %) OF C₁₅+ MATERIAL EXTRACTED FROM ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	HYDROCARBONS			NON HYDROCARBONS					HC NON HC
		Paraffin -- Naphthenes	Aromatics	P - N AROM	Preciptd. Asphaltenes	Eluted NSO's	Non eluted NSO's	Sulphur	ASPH NSO	
606-001	355- 370	1.67	1.27	1.32	89.03	4.62	3.41	0.00	11.09	0.03
606-013	535- 550	3.10	9.31	0.33	60.00	11.03	16.55	0.00	2.17	0.14
606-022	670- 685	6.83	2.33	2.93	80.17	8.67	2.00	0.00	7.52	0.10
606-027A	745- 760	0.84	0.72	1.17	96.01	2.27	0.15	0.00	39.58	0.02
606-032	820- 835	17.28	13.99	1.24	53.50	13.58	1.65	0.00	3.51	0.46
606-037	895- 910	12.10	14.37	0.84	46.31	23.63	3.59	0.00	1.70	0.36
606-044	1000-1015	1.72	4.89	0.35	72.99	11.49	8.91	0.00	3.58	0.07
606-049	1075-1090	7.95	13.64	0.58	45.45	31.25	1.70	0.00	1.38	0.28
606-053	1135-1150	19.67	10.61	1.85	60.21	9.06	0.44	0.00	6.33	0.43
606-056	1180-1195	10.10	17.07	0.59	51.57	16.72	4.53	0.00	2.43	0.37
606-059	1225-1240	18.54	20.98	0.88	26.34	31.71	2.44	0.00	0.77	0.65
606-062	1270-1285	18.15	16.67	1.09	46.11	16.48	2.59	0.00	2.42	0.53
606-067A	1345-1360	13.44	15.41	0.87	39.34	28.85	2.95	0.00	1.24	0.41
606-073	1435-1450	19.84	9.40	2.11	56.92	11.75	2.09	0.00	4.11	0.41
606-079	1525-1540	13.39	13.63	0.98	36.72	30.02	6.24	0.00	1.01	0.37
606-082	1570-1585	17.42	16.13	1.08	39.78	23.44	3.23	0.00	1.49	0.50
606-085	1615-1630	16.46	17.19	0.96	51.82	11.62	2.91	0.00	3.57	0.51
606-087	1645-1660	16.70	16.28	1.03	56.24	10.36	0.42	0.00	5.22	0.49
606-095	1765-1780	13.00	12.73	1.02	57.29	14.32	2.65	0.00	3.38	0.35
606-102	1870-1885	28.97	19.12	1.52	38.92	10.81	2.18	0.00	3.00	0.93
606-146A	1943	8.16	17.40	0.47	67.09	6.60	0.74	0.00	9.13	0.34
606-108A	1960-1975	9.38	11.72	0.80	65.24	13.24	0.41	0.00	4.78	0.27
606-111A	2005-2020	11.33	22.02	0.51	51.92	11.90	2.83	0.00	3.52	0.50
606-152A	2008	11.19	25.33	0.44	46.38	11.37	5.73	0.00	2.71	0.58
606-114	2050-2065	17.81	26.40	0.67	34.77	13.40	7.62	0.00	1.65	0.79
606-156A	2069	12.38	24.57	0.50	52.96	6.60	3.50	0.00	5.25	0.59
606-119	2125-2140	25.09	31.02	0.81	30.21	12.68	0.99	0.00	2.21	1.28
606-122A	2270-2285	32.53	15.84	2.05	46.13	5.45	0.05	0.00	8.39	0.94
606-125A	2315-2330	32.18	17.26	1.86	37.18	8.36	5.03	0.00	2.78	0.98
606-132A	2420-2435	8.21	3.85	2.13	78.38	6.50	3.08	0.00	8.19	0.14

TABLE 5C
COMPOSITION (NORMALISED %) OF C₁₅+ MATERIAL EXTRACTED FROM ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	HYDROCARBONS			NON HYDROCARBONS					HC NON HC
		Paraffin — Naphthenes	Aromatics	P — N AROM	Preciptd. Asphaltenes	Eluted NSO's	Non eluted NSO's	Sulphur	ASPH NSO	
606-136B	2480-2495	1.96	7.48	0.26	87.59	1.94	1.03	0.00	29.43	0.10
606-143A	2585-2600	5.76	2.73	2.11	84.28	6.20	1.03	0.00	11.65	0.09

TABLE 6
SIGNIFICANT RATIOS (%) OF C₁₅₊ FRACTIONS AND ORGANIC CARBON

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC CARBON	<u>HYDROCARBONS</u> TOTAL EXTRACT	<u>HYDROCARBONS</u> ORGANIC CARBON	<u>TOTAL EXTRACT</u> ORGANIC CARBON
606-001	355- 370	2.45	2.94	1.95	66.30
606-013	535- 550	0.63	12.41	0.48	3.88
606-022	670- 685	2.33	9.17	0.35	3.83
606-027A	745- 760	2.93	1.57	1.49	94.99
606-032	820- 835	0.67	31.28	4.40	14.06
606-037	895- 910	0.86	26.47	1.29	4.87
606-044	1000-1015	0.64	6.61	0.25	3.81
606-049	1075-1090	0.40	21.59	1.54	7.15
606-053	1135-1150	0.43	30.28	1.79	5.90
606-056	1180-1195	0.69	27.18	0.94	3.45
606-059	1225-1240	0.69	39.51	1.51	3.82
606-062	1270-1285	0.82	34.81	1.50	4.30
606-067A	1345-1360	0.71	28.85	1.64	5.70
606-073	1435-1450	0.82	29.24	0.92	3.16
606-079	1525-1540	0.97	27.02	0.76	2.82
606-082	1570-1585	0.86	33.55	1.19	3.53
606-085	1615-1630	0.94	33.66	1.05	3.12
606-087	1645-1660	1.03	32.98	1.03	3.11
606-095	1765-1780	1.36	25.73	0.39	1.51
606-102	1870-1885	1.38	48.09	6.66	13.84
606-146A	1943	6.50	25.57	1.11	4.35
606-108A	1960-1975	2.69	21.10	1.57	7.45
606-111A	2005-2020	3.05	33.35	4.73	14.19
606-152A	2008	4.21	36.52	4.40	12.04
606-114	2050-2065	4.98	44.22	4.19	9.49
606-156A	2069	10.83	36.95	2.50	6.76
606-119	2125-2140	2.46	56.11	5.04	8.98
606-122A	2270-2285	0.39	48.37	51.38	106.23
606-125A	2315-2330	0.19	49.43	124.11	251.07
606-132A	2420-2435	0.16	12.05	8.20	68.02

TABLE 6
SIGNIFICANT RATIOS (%) OF C₁₅₊ FRACTIONS AND ORGANIC CARBON

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC CARBON	<u>HYDROCARBONS</u> TOTAL EXTRACT	<u>HYDROCARBONS</u> ORGANIC CARBON	<u>TOTAL EXTRACT</u> ORGANIC CARBON
606-136B	2480-2495	25.16	9.43	0.77	8.16
606-143A	2585-2600	0.10	8.49	14.36	169.16

TABLE 7

PYROLYSIS ANALYSIS

#1

SAMPLE NUMBER	DEPTH	ORGANIC CARBON	PPM BITUMEN*	PPM PYROLYSATE+	<u>PYROLYSATE</u>		<u>BITUMEN</u>
					ORGANIC	CARBON	PYROLYSATE
606-001A	355-370	2.84	1494	3481	0.12	1006	0.429
606-004A	400-415	0.66	174	2192	0.33		0.079
606-009A	475-490	0.66	260	2918	0.44		0.089
606-014A	550-565	1.06	333	2908	0.27		0.114
606-016B	580-595	1.58	210	1443	0.09		0.145
606-017B	595-610	3.51	72	6411	0.18		0.011
606-019A	625-640	1.57	188	4981	0.32		0.038
606-021A	655-670	0.94	796	982	0.10		0.811
606-023B	685-700	2.21	35	5831	0.26		0.006
606-025A	715-730	1.06	90	3084	0.29		0.029
606-027A	745-760	3.16	927	5657	0.18		0.164
606-031A	805-820	2.74	38	2254	0.08		0.017
606-033A	835-850	1.18	173	2652	0.22		0.065
606-036A	880-895	0.80	26	2198	0.27		0.012
606-041A	955-970	0.73	30	3089	0.42		0.010
606-044B	1000-1015	0.53	81	745	0.14		0.108
606-047A	1045-1060	0.72	52	904	0.13		0.058
606-050A	1090-1105	0.96	126	1652	0.17		0.076
606-053B	1135-1150	0.87	38	996	0.11		0.038
606-056A	1180-1195	1.48	241	1622	0.11		0.148
606-059A	1225-1240	1.17	3	2742	0.23		0.001
606-063A	1285-1300	1.27	366	2231	0.18		0.164
606-065B	1315-1330	1.11	39	1398	0.13		0.028
606-067A	1345-1360	0.96	170	1002	0.10		0.169
606-070A	1390-1405	1.14	59	1645	0.14		0.036
606-072A	1420-1435	0.95	76	1739	0.18		0.044
606-075A	1465-1480	1.15	83	669	0.06		0.124
606-078A	1510-1525	1.12	91	1734	0.15		0.052
606-082A	1570-1585	0.98	164	3117	0.32		0.053
606-085A	1615-1630	1.21	14	3568	0.29		0.004

TABLE 7

PYROLYSIS ANALYSIS

SAMPLE NUMBER	DEPTH	ORGANIC CARBON	PPM BITUMEN*	52	41	BITUMEN PYROLYSATE
				PPM PYROLYSATE+	PYROLYSATE ORGANIC CARBON	
606-087A	1645-1660	1.26	60	878	0.07	0.068
606-089A	1675-1690	1.18	469	4181	0.35	0.112
606-091B	1705-1720	1.49	82	1413	0.09	0.058
606-095A	1765-1780	1.77	120	1299	0.07	0.092
606-098B	1810-1825	2.19	274	1640	0.07	0.167
606-100A	1840-1855	2.22	141	891	0.04	0.158
606-103A	1885-1900	1.59	73	2001	0.13	0.037
606-106A	1930-1945	3.06	175	2319	0.08	0.075
606-146A	1943 <i>shallow</i>	6.88	748	6838	0.10	0.109
606-108A	1960-1975	3.46	243	6555	0.19	0.037
606-150A	1993	2.11	557	2689	0.13	0.207
606-111A	2005-2020	4.02	1348	9940	0.25	0.136
606-152A	2008 <i>older</i>	5.07	693	3330	0.07	0.208
606-114A	2050-2065 <i>good</i>	7.30	2371	13616	0.19	0.174
606-156A	2069	11.30	959	7634	0.07	0.126
606-116A	2080-2095 <i>Rich</i>	8.26	639	8825	0.11	0.072
606-160A	2089.5	1.76	532	1328	0.08	0.401
606-119A	2125-2140	5.90	575	2909	0.05	0.198
606-121A	2155-2170 <i>dry</i>	7.39	328	3081	0.04	0.106
606-122B	2270-2285	2.48	1217	3836	0.15	0.317
606-125B	2315-2330 <i>dry</i>	9.29	1634	7589	0.08	0.215
606-127B	2345-2360	40.56	4952	19645	0.05	0.252
606-129B	2374-2390	3.80	129	895	0.02	0.144
606-132B	2420-2435 <i>alter</i>	9.25	475	4204	0.05	0.113
606-136B	2480-2495	21.60	3427	35982	0.17	0.095
606-140B	2540-2555 <i>Amn</i>	2.65	1348	3723	0.14	0.362
606-144B	2600-2615	42.69	3047	19189	0.04	0.159

*50-340°C

+ 350-550°C

TABLE 8
COMPOSITION (NORMALISED %) OF C₁₅₊ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-001	-013	-022	-027A	-032	-037	-044
DEPTH	355-370m	535-550m	670-685m	745-760m	820-835m	895-910m	1000-015m
SAMPLE TYPE							
nC ₁₅	5.18	3.75	4.25	4.48	5.65	2.69	4.36
nC ₁₆	9.85	10.36	9.82	7.45	9.95	6.49	9.81
nC ₁₇	9.20	8.92	5.67	6.08	9.50	6.09	8.35
nC ₁₈	9.92	10.84	7.84	6.41	12.72	7.99	10.77
nC ₁₉	10.21	7.17	6.61	5.76	10.13	6.09	7.02
nC ₂₀	9.35	6.77	7.08	5.60	9.14	7.12	7.38
nC ₂₁	8.99	6.69	6.89	6.89	8.24	7.91	8.11
nC ₂₂	7.76	6.37	6.70	8.09	6.72	8.62	8.84
nC ₂₃	6.33	7.89	10.20	10.17	6.36	10.92	8.72
nC ₂₄	5.68	7.33	10.39	11.05	5.47	10.52	8.11
nC ₂₅	5.03	7.81	11.43	10.49	5.82	10.76	7.14
nC ₂₆	4.39	5.42	7.55	7.85	3.94	7.28	4.60
nC ₂₇	3.24	3.19	2.83	4.72	2.69	4.51	2.54
nC ₂₈	2.08	2.71	0.66	2.40	1.52	1.03	1.33
nC ₂₉	1.37	1.51	0.57	1.04	0.99	0.63	1.09
nC ₃₀	0.79	1.35	0.47	0.64	0.45	0.47	0.73
nC ₃₁	0.29	0.88	0.38	0.32	0.27	0.32	0.48
nC ₃₂	0.14	0.48	0.28	0.24	0.18	0.24	0.24
nC ₃₃	0.07	0.32	0.19	0.16	0.09	0.16	0.12
nC ₃₄	0.07	0.16	0.09	0.08	0.09	0.08	0.12
nC ₃₅	0.07	0.08	0.09	0.08	0.09	0.08	0.12
PARAFFIN	44.38	30.68	29.30	39.89	46.13	34.97	35.24
ISOPRENOID	4.37	4.74	4.26	4.95	5.87	2.99	3.58
NAPHTHENE	51.24	64.58	66.44	55.16	48.00	62.05	61.18
CPI INDEX A	1.03	1.08	1.11	1.04	1.11	1.13	1.04
CPI INDEX B	1.05	1.07	1.25	1.12	1.23	1.32	1.20
PRISTANE/PHYTANE	1.08	1.26	3.05	3.56	1.18	2.00	1.63
PRISTANE/nC ₁₇	0.55	0.96	1.93	1.59	0.73	0.94	0.75

TABLE 8
COMPOSITION (NORMALISED %) OF C₁₅₊ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-049	-053	-056	-059	-062	-067A
DEPTH	1075-090m	1135-150m	1180-195m	1225-240m	1270-285m	1345-360m
SAMPLE TYPE						
nC ₁₅	6.11	4.81	5.75	3.63	12.33	8.80
nC ₁₆	11.75	10.28	12.89	10.58	14.20	14.53
nC ₁₇	10.82	10.46	12.31	12.30	11.14	13.10
nC ₁₈	10.18	12.69	13.23	13.51	11.74	11.19
nC ₁₉	8.42	9.35	8.52	8.67	8.48	6.69
nC ₂₀	7.59	9.26	7.71	7.76	6.90	5.54
nC ₂₁	7.86	7.78	6.79	6.85	6.51	5.07
nC ₂₂	7.22	6.02	6.56	7.36	5.62	5.16
nC ₂₃	7.49	6.20	7.25	8.57	5.03	5.64
nC ₂₄	7.12	6.20	6.90	7.36	4.44	6.69
nC ₂₅	6.11	6.30	5.75	5.34	4.73	6.31
nC ₂₆	3.89	4.81	3.11	2.92	2.86	5.07
nC ₂₇	2.22	2.50	1.15	1.41	2.76	2.87
nC ₂₈	1.30	1.11	0.46	1.11	1.28	1.63
nC ₂₉	0.93	0.74	0.35	0.91	0.89	0.48
nC ₃₀	0.46	0.65	0.35	0.60	0.39	0.29
nC ₃₁	0.19	0.28	0.35	0.40	0.30	0.29
nC ₃₂	0.09	0.19	0.23	0.30	0.10	0.29
nC ₃₃	0.09	0.19	0.12	0.20	0.10	0.19
nC ₃₄	0.09	0.09	0.12	0.10	0.10	0.10
nC ₃₅	0.09	0.09	0.12	0.10	0.10	0.10
PARAFFIN	38.80	32.27	30.07	32.29	34.81	38.57
ISOPRENOID	4.20	4.00	5.33	6.12	6.21	7.52
NAPHTHENE	57.00	63.73	64.60	61.59	58.98	53.91
CPI INDEX A	1.07	1.06	1.05	1.03	1.15	0.98
CPI INDEX B	1.19	1.11	1.27	1.15	1.42	1.05
PRISTANE/PHYTANE	1.44	1.27	1.85	1.65	1.87	2.34
PRISTANE/nC ₁₇	0.59	0.66	0.93	0.96	1.04	1.04

TABLE 8
COMPOSITION (NORMALISED %) OF C₁₅₊ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-073	-079	-082	-085	-087	-095
DEPTH	1435-450m	1525-540m	1570-585m	1615-630m	1645-660m	1765-780m
SAMPLE TYPE						
nC ₁₅	11.13	10.45	8.11	6.49	13.27	12.49
nC ₁₆	15.67	13.93	12.61	12.25	16.40	13.29
nC ₁₇	12.68	12.74	10.57	9.55	14.24	11.87
nC ₁₈	10.52	11.00	10.40	12.61	14.24	11.34
nC ₁₉	7.01	8.07	7.62	6.76	9.71	10.01
nC ₂₀	5.15	6.97	6.39	6.76	7.23	9.30
nC ₂₁	5.26	6.23	6.39	6.13	4.96	7.71
nC ₂₂	4.85	6.23	6.96	6.31	4.21	6.29
nC ₂₃	5.98	6.78	8.19	7.21	3.99	5.76
nC ₂₄	5.57	6.23	7.70	6.76	3.34	4.16
nC ₂₅	5.67	6.96	7.48	3.45	3.90	5.31
nC ₂₆	3.61	2.84	4.01	4.68	1.94	1.86
nC ₂₇	2.68	1.65	2.13	3.06	1.19	0.97
nC ₂₈	1.34	0.37	0.82	1.35	0.54	0.35
nC ₂₉	1.03	0.27	0.41	1.17	0.43	0.18
nC ₃₀	0.72	0.18	0.33	0.72	0.32	0.18
nC ₃₁	0.52	0.18	0.08	0.27	0.11	0.09
nC ₃₂	0.21	0.09	0.08	0.18	0.11	0.09
nC ₃₃	0.21	0.09	0.08	0.09	0.11	0.09
nC ₃₄	0.10	0.09	0.08	0.09	0.11	0.09
nC ₃₅	0.10	0.09	0.08	0.09	0.11	-
PARAFFIN	43.26	46.17	49.57	33.98	49.07	56.03
ISOPRENOID	7.27	8.34	6.78	4.25	7.41	10.17
NAPHTHENE	49.46	45.49	43.65	61.77	43.52	33.80
CPI INDEX A	1.15	1.10	1.08	1.11	1.08	1.15
CPI INDEX B	1.28	1.49	1.29	1.31	1.31	1.43
PRISTANE/PHYTANE	2.70	2.79	2.34	2.97	2.18	2.87
PRISTANE/nC ₁₇	0.97	1.04	0.91	0.98	0.73	1.13

TABLE 8
COMPOSITION (NORMALISED %) OF C₁₅+ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-102	-146A	-108A	-152A	-111A	-114	-156A
DEPTH	1870-885m	1943m	1960-975m	2008m	2005-020m	2050-065m	2069m
SAMPLE TYPE	SWC		SWC		SWC		
nC ₁₅	11.21	1.97	7.37	7.05	10.52	13.40	10.90
nC ₁₆	10.84	4.19	9.23	8.33	9.79	11.49	11.11
nC ₁₇	9.51	5.68	8.47	8.12	7.73	8.00	8.18
nC ₁₈	8.26	6.85	8.98	7.26	7.42	7.32	8.60
nC ₁₉	7.01	7.09	8.01	7.80	7.01	6.98	8.49
nC ₂₀	6.42	6.85	7.45	6.52	5.98	6.42	7.23
nC ₂₁	6.49	7.83	7.71	6.52	6.49	5.74	6.92
nC ₂₂	5.90	7.40	7.11	6.20	6.08	5.74	6.29
nC ₂₃	5.97	8.64	7.71	6.62	6.60	5.86	5.77
nC ₂₄	5.53	8.08	7.28	5.88	5.36	5.41	5.35
nC ₂₅	5.31	7.83	7.87	6.30	5.88	5.29	4.61
nC ₂₆	4.28	5.98	5.50	4.81	4.74	4.17	3.88
nC ₂₇	3.83	6.48	3.81	5.45	5.36	4.17	3.56
nC ₂₈	3.17	4.75	1.44	3.53	3.71	2.93	2.73
nC ₂₉	2.65	4.94	0.68	3.74	3.81	3.15	2.83
nC ₃₀	1.55	2.41	0.42	2.67	1.86	1.80	1.78
nC ₃₁	1.11	1.91	0.25	1.71	1.03	0.90	1.05
nC ₃₂	0.44	0.68	0.17	0.75	0.31	0.68	0.31
nC ₃₃	0.29	0.25	0.08	0.43	0.10	0.34	0.21
nC ₃₄	0.15	0.12	0.08	0.21	0.10	0.11	0.10
nC ₃₅	0.07	0.06	0.08	0.11	0.10	0.11	0.10
PARAFFIN	52.82	50.08	45.42	50.30	46.63	46.32	52.53
ISOPRENOID	7.44	5.68	7.62	11.39	10.19	11.53	12.89
NAPHTHENE	39.74	44.24	46.96	38.31	43.17	42.15	34.58
CPI INDEX A	1.06	1.13	1.13	1.14	1.16	1.06	1.03
CPI INDEX B	1.13	1.26	1.27	1.24	1.27	1.18	1.13
PRISTANE/PHYTANE	2.54	4.11	3.40	2.66	2.59	2.25	1.85
PRISTANE/nC ₁₇	1.06	1.61	1.53	2.03	2.04	2.15	1.95

TABLE 8
COMPOSITION (NORMALISED %) OF C₁₅+ PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-119	-122A	-125A	-132A	-136B	-143A
DEPTH	2125-140m	2270-285m	2315-330m	2420-435m	2480-495m	2585-600m
SAMPLE TYPE						
nC ₁₅	8.56	0.86	2.93	3.53	10.69	3.19
nC ₁₆	8.31	1.29	4.19	5.55	10.91	5.35
nC ₁₇	7.51	1.59	5.26	8.48	8.92	7.05
nC ₁₈	6.96	2.51	6.58	12.92	9.66	14.11
nC ₁₉	7.08	3.91	7.89	12.92	9.07	14.45
nC ₂₀	6.96	5.45	8.55	14.23	7.96	15.36
nC ₂₁	6.90	6.50	8.19	11.00	7.30	11.38
nC ₂₂	6.83	7.54	7.89	7.27	6.34	7.05
nC ₂₃	6.96	8.27	7.72	5.85	6.12	5.23
nC ₂₄	6.47	8.81	7.30	5.55	5.31	4.21
nC ₂₅	5.85	9.07	6.58	5.05	5.09	4.21
nC ₂₆	4.99	8.39	5.26	3.53	4.06	2.96
nC ₂₇	4.74	8.21	4.90	1.92	3.39	2.16
nC ₂₈	3.69	6.92	3.71	0.91	2.06	1.02
nC ₂₉	3.39	6.25	3.59	0.40	1.47	0.80
nC ₃₀	2.03	4.72	2.57	0.40	0.59	0.57
nC ₃₁	1.42	3.92	2.39	0.10	0.44	0.23
nC ₃₂	0.62	2.45	1.56	0.10	0.29	0.23
nC ₃₃	0.43	1.59	1.20	0.10	0.15	0.23
nC ₃₄	0.25	1.04	0.96	0.10	0.07	0.11
nC ₃₅	0.06	0.67	0.78	0.10	0.07	0.11
PARAFFIN	63.26	55.49	47.74	39.20	71.59	30.95
ISOPRENOID	8.69	1.12	3.83	3.96	9.77	2.82
NAPHTHENE	28.05	43.39	48.43	56.84	18.64	66.23
CPI INDEX A	1.04	1.04	1.04	1.08	1.08	1.14
CPI INDEX B	1.13	1.09	1.13	1.11	1.17	1.20
PRISTANE/PHYTANE	2.19	1.36	1.44	1.13	5.17	1.16
PRISTANE/nC ₁₇	1.25	0.73	0.90	0.63	1.28	0.69

TABLE 9

ANALYSIS OF GAS SAMPLES

GEOCHEM SAMPLE NO.	GAS WETNESS %	iC/ nC ₄	METHANE CARBON ISOTOPE RATIO ‰
606-161A	17.9	0.67	-34.4
606-161B	14.6	0.63	-35.0

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 C₁-C₇ analysis and should be canned (or at least wet) for the C₄-C₇ analysis. The other analyses can be run on both canned and bagged samples.

A) C₁-C₇ LIGHT HYDROCARBON ANALYSIS

The abundance and composition of the C₁-C₇ 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 C₁-C₄ gaseous hydrocarbons (methane, ethane, propane, isobutane and normal butane) and a partial resolution of the C₅-C₇ gasoline-range hydrocarbons (for their complete resolution see Section E). The ppm abundance of the five gases and of the total C₅-C₇ 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 C₁-C₇ 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 ANALYSIS

The organic carbon content of a rock is a measure of its total organic richness. Combined with the visual kerogen, C₁-C₇, C₄-C₇, pyrolysis and C₁₅₊ 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 C₁-C₇ 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 diagrammatically 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 C₄-C₇ HYDROCARBON ANALYSIS

The abundance and composition of the C₄-C₇ gasoline-range hydrocarbons in sediments reflects their source quality, level of thermal maturation and organic facies. In addition, the data also reveal the presence 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 C₁₅₊ 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 C₁₅₊ 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 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 ($\pm$ 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 conjunction 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) C₁₅+ 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 organic 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, high 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 diagrammatically.

J) GC ANALYSIS OF C₁₅+ PARAFFIN-NAPHTHENE HYDROCARBONS

The gas chromatographic configurations of the heavy C₁₅+ 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 rock 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 nC₃₅. 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 than 1) normal paraffins are dominant. Strong odd preferences ($\neq$ strong pristane peaks) are characteristic of immature land plant organic matter whilst even preferences ($\neq$ 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:

$$\begin{aligned} \text{C.P.I.A} &= \frac{\text{C}_{21} + \text{C}_{23} + \text{C}_{25} + \text{C}_{27}}{\text{C}_{20} + \text{C}_{22} + \text{C}_{24} + \text{C}_{26}} + \frac{\text{C}_{21} + \text{C}_{23} + \text{C}_{25} + \text{C}_{27}}{\text{C}_{22} + \text{C}_{24} + \text{C}_{26} + \text{C}_{28}} \\ &\quad \quad \quad 2 \\ \text{C.P.I.B} &= \frac{\text{C}_{25} + \text{C}_{27} + \text{C}_{29} + \text{C}_{31}}{\text{C}_{24} + \text{C}_{26} + \text{C}_{28} + \text{C}_{30}} + \frac{\text{C}_{25} + \text{C}_{27} + \text{C}_{29} + \text{C}_{31}}{\text{C}_{26} + \text{C}_{28} + \text{C}_{30} + \text{C}_{32}} \\ &\quad \quad \quad 2 \end{aligned}$$

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 nC₁₇ 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 C₁₅₊ 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 C₁ (methane) out towards C₃₅ 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 C₄-C₇ 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 C₁₅+ paraffin-naphthenes. See section J. The branched+normal paraffin distributions are used to "fingerprint" the samples.
- capillary chromatograms of whole oils and of the C₈+ fraction of source rocks.
- capillary gas chromatography of C₁₅+ 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 CS₂) 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.

5

SNEA (P)
DIRECTION EXPLORATION
LABORATOIRE DE GEOLOGIE DE BOUSSENS
GEO/LAB Bss n° 2/4 N
AR/im

7120/8-1 WELL (NORWAY)

GEOCHEMICAL ANALYSIS OF GASES AND CONDENSATE (DST 3)

PRELIMINARY RESULTS OF THE ORGANIC MATTER STUDY

(INTERVAL 1934-2603 m)

DIFFUSION	
Original	EXPLORATION ELF NORGE (M. MICHOT)
Copie	EXPLORATION DIG EUROPE (M. BERRIER)
Photo-copies	EXPERT REGIONAL EXPLOR. EUR (M. MAZELET) M. SOURISSE (GEO/LAB PAU)

This study takes into account the results previously communicated by 3 telex* additional data are given concerning the composition of gases and the geochemistry of 4 samples from the Early Jurassic and Upper Trias.

1 - GEOCHEMICAL ANALYSIS OF THE CONDENSATE SAMPLE

(DST 3 : 2093-2110 m)

The analysis is carried out on the condensate fraction of the gas sample recovered by DST 3 in the upper Jurassic sandstones (shipping bottle n° 12689-58). Its specific gravity is 0,769. Its composition is given in table 1 and its chromatograms, in figure 1.

1.1 - COMPOSITION

Its high distillate (80.7 %) is consistent with the nature of the fluid

The very small quantity of resins ($\leq 0,1$ %) is noticeable.

- 9 FEB. 1982

REGISTRER
CLARET

- * - Preliminary results on organic geochemistry study of the well 7120/8-1 - (23/12/81) - J. CLARET
- Preliminary results on the 7120/8-1 condensate (30/12/81) - P. CAILLEAUX - A. RICHARD
- Analyses isotopiques sur gaz 7120/8-1 (14/01/82) - C. SOURISSE

1.2 - CHARACTERISTICS OF THE CHROMATOGRAMS

Typical characteristics of a condensate are found in the three fractions :

- strong decrease in n-alkanes after n-C8 in the thermovaporized fraction,
- very strong decrease in n-alkanes with the increasing number of carbon atoms no heavy HC ($nC > 23$) in the saturated fraction,
- predominance of the lightest mono and diaromatic compounds in the aromatic fraction and of the lightest mono and dibenzothiophenes in the thiophenic fraction.

Some other features characterize the 7120/8-1 condensate :

- thermovaporized fraction : relatively high X2 (= 5,85), abundance of light aromatic HC (benzene, toluene [$X1 = 0,62$] and xylenes), presence of iso and cycloalkanes in the range C8-C10,
- saturated fraction : neither odd nor even predominance of n-alkanes ($CPI \approx 1$), a relatively high A/B ratio (= 2), moderate Pr/n-C17 and Ph/n-C18 ratios (0, and 0,40).

1.3 - THERMAL EVOLUTION AND ORIGIN

According mainly to X2, presence of iso and cycloalkanes and Pr/n-C17, Ph/n-C18 ratios, the degree of thermal evolution of the condensate is thought to be medium. Its source rock may be located at the end of the oil generation zone.

Some genetical characteristics (abundance of light aromatic HC, relatively high A/B ratio) suggest the source rock organic matter to be partially or mainly humic.

2 - DST 3 GASES ANALYSES

The analysis (composition and isotopes) carried out on two samples of gas from shipping bottles n° 12107 and 10535 are very similar, so only average analysis is given in table 2.

2.1 - ANALYTICAL RESULTS

This wet gas ($C1 \% \leq Cn = 92,2$) is characterized by a relatively high proportion of CO2 (6,06 mole %).

2.2 - THERMAL EVOLUTION

The $\delta^{13}C$ of the methane, suggests the gas source rock to be at a level of maturation lower than 1,2 Ro % (Fig. 2, after STAHL 1977).

The low iC_4/nC_4 ($= 0,58$), shows that the level of the source rock maturation is higher than 0,6 Ro % (Fig. 3 after CONNAN 1980).

2.3 - ORIGIN

Due to the $\delta^{13}C$ of methane and ethane values, these gases are cogenetic.

The very high $\delta^{13}C$ of CO_2 suggests that this gas fraction is not cogenetic ; the CO_2 could have a deeper origin (endogenetic ?).

3 - PRELIMINARY RESULTS OF THE ORGANIC MATTER STUDY (1934-2603 m INTERVAL)

Geochemistry was carried out on 12 cutting samples (2 in early Cretaceous, 6 in upper Jurassic, 1 in early Jurassic, 3 in upper Trias).

Optical observations were performed on 5 cutting samples (Cretaceous + Upper Jurassic) in transmitted light and on one cutting sample (2069 m) in reflectance and fluorescence.

The lithology of the Cretaceous-Upper Jurassic samples is homogeneous and represented by dark grey shales.

The lithology of the 4 samples under the gas reservoir (depth < 2100 m) is composed of predominant sandstones, interbeds of shales and traces of coal. Due to heterogeneity, analyses were carried out on separated fractions (shales and co bitumen (?)).

3.1 - CATAGENESIS DATA

The thermal alteration indexes in the 1934-2081 m interval are estimated at 3

The analysis by reflectance of the 2069 m sample gives two values of Ro, 0,55-0,95 %, both determined on vitrinite-bitumen associations ; the analysis by fluorescence of the same sample show a population of algae (10 Tasmanacea and 5 Bac tryococcus) at 0,9-1 % Ro equivalent and one Tasmanacea at 0,6 % Ro éq. The presence of bitumen and the analysis of one sample only do not enable us to draw any conclusions.

The temperature of pyrolysis are not very high (Table 3) ($435 < T_m < 445^\circ C$ - except for one coaly/bitumen sample : $475^\circ C$). They do not increase significantly with depth.

Some characteristics of the 2069 m sample chromatograms (Fig. 4 and 5), abundance of iso and cycloalkanes and weak proportion of n-alkanes in the thermovaporized fraction, high proportion of isoprenoids and odd predominance in the n-C25-29 range in the saturated fraction suggest, a relatively low degree of the organic matter maturation.

The chromatograms of Triassic samples (2468 and 2603 m) are characterized by a large proportion of Pristane ($\text{Pr/n-C17} = 2,7$ and $2,26$ respectively - on table 4) and by the presence of iso or cycloalkanes in the C28 - C31 range (Fig. 6 and 7). These features indicate a medium degree of maturation of the o. m.

The degree of catagenesis of the Early Cretaceous - Upper Jurassic interval may be thought to be at the beginning of the oil generation zone. In the Triassic interval, the degree of catagenesis could be a little higher but does not reach the end of the oil generation zone.

3.2 - O.M. CONTENT, NATURE AND OIL POTENTIAL (Table 3)

3.2.1 - Early Cretaceous

The content in organic matter is medium ($\text{TOC} = 1,9 \%$). The palynofacies is made up of coaly-ligneous material with a prevailing detrital continental character.

The HI and OI values (type III kerogen) are in agreement with this ligneous nature.

The potential of these two samples is mediocre ($1,5 \text{ kg HC/t}$ of rock).

3.2.2 - Upper Jurassic

The content in organic matter is medium to high ($1,9 < \text{TOC} < 10,5 \%$) increasing near the bottom of the interval.

The amorphous material is preponderant in the palynofacies (70 to 90 % of amorphous OM), but it does not present the same facies as the sapropelic amorphous material of the Viking Graben Kimmeridgian estimated to be of good quality.

According to the 2069 m sample analysis by reflected light and fluorescence the particulate organic matter is mainly composed of vitrinite and bitumen associations and contains also cutinite, sporinite, fusinite, Tasmanacea and Botryococcus ; the groundmasses have a low fluorescence.

The range of HI values ($120 < \text{HI} < 280$) places the o.m. in an intermediate stage between type II and III kerogen (Fig. 8), in agreement with optical observations.

Some genetical characteristics of the 2069 m sample autochthonous HC (odd predominance in the C25-C30 range, A/B ratio = $1,9$ and abundance of toluene and xylenes in the thermovaporized fraction), are typical of a material with humic participation.

The potential of upper Jurassic is medium, due to partly humic o.m.

3.2.3 - Early Jurassic and upper Trias

Data are scattered on this interval and concern only handpicked shales and coal/bitumen.

The content in TOC is medium in shales ($\approx 3,4 \%$) and very high in coal/bitumen (35 and 69 %).

HI and OI index values, plotted on Fig. 8, suggest the shales o.m. to be at least partly humic.

The coal/bitumen (?) samples with very low OI may have a predominantly bitumen nature.

The autochthonous HC are characterized by a high A/B ratio, suggesting a humic nature of o.m.

The residual potentials of shales and coal/bitumen are very different : mediocre for shales (3 kgHC/t of rock) and very good for coal/bitumen (16 and 70 kg HC/t of rock).

4 - MAIN RESULTS AND CONCLUSIONS

4.1 - CONDENSATE AND GAS

The characteristics of both the condensate and gas enable us to locate their source rock near the end of the oil generation zone.

The source rock o.m. of the condensate may be thought to be partially or mainly humic.

4.2 - SOURCE ROCK(S)

Somme levels exhibiting source rock characteristics are present in the Jurassic and Trias :

- in the Upper Jurassic, the dark shales are rich in o.m., whose content increases towards the bottom of this interval. The o.m. nature is mixed and its degree of maturation is relatively low (at the beginning of the oil generation zone) ;
- in the Early Jurassic and Trias, some coaly/bitumen intercalations show a high residual potential, contrasting with the weak potential of the interbedded shales.

4.3 - ORIGIN OF FLUIDS

From the data available at present, the most probable origin is thought to be Upper Jurassic shales, in areas where their maturity is higher than in the 7120/8-1 well. The occurrence of a deeper source rock, not encountered by this well, is not excluded.

A. RICHARD

TABLE 1

7120/8-1 WELL
CONDENSATE ANALYSIS

SPECIFIC GRAVITY	0,769
COMPOSITION OF THE TOTAL PRODUCT	
Distillate (%)	80,7
Asphaltenes	-
Resins	0,05
Saturated HC (S)	15,5
Aromatic HC (A)	3,75
S/A	4,13
THERMOVAPORISATION (C5 to C15)	
TV % Total Product	70
n-Alk. % TV	29
X1 = n-C6/MCP	1,77
X2 = n-C7/DMCP	5,85
Y1 = n-C7/Toluene	0,62
Z1 = n-C10/iso C11	6,40
SATURATED HC (C15 to C30)	
n-Alk. % Sat.	33
Pristane/n-C17 = A	0,80
Phytane/n-C18 = B	0,40
Pristane/Phytane	2,90
A/B	2,0
CPI (C16 to C20)	1,03

CPI : Carbon Preference Index

MCP : methylcyclopentane DMCP : dimethylcyclopentane

iso C11 : dimethylnonane isoprenoid

TABLE 2

DST 3 GAS ANALYSIS* (2093-2110 m)

$\delta^{13}\text{C}$ of CH_4 (‰/PDB)	- 40,2
$\delta^{13}\text{C}$ of C_2H_6 (‰/PDB)	- 30,1
$\delta^{13}\text{C}$ of CO_2 (‰/PDB)	- 8,8
GAS COMPOSITION (mol. %)	
N_2	0,945
CO_2	6,06
n-C1	87,16
n-C2	3,89
n-C3	1,25
iso-C4	0,17
n-C4	0,30
> C4	1,75
iso C4/n-C4	0,58
$\text{C}_1 \leq \text{C}_n$	92,2

* Average of 2 analysis of gases from the shipping bottles
n° 10535 and 12107, except for $\delta^{13}\text{C}$ of CO_2 (bottle n° 12107 only)

TABLE 3

WELL 7120/8-1

GEOCHEMICAL ANALYSIS OF THE ORGANIC MATTER

AGE	n°	DEPTH (m)	TOC %	S1 mgHC/g rock	S2 mgHC/g rock	H1 mgHC/g TOC	O1 mgCO2/g TOC	Tm °C	IP × 100	Chromatograms
EARLY	1	1934	1,85	0,28	1,50	80	167	437	16	
CRETACEOUS	2	1961	1,9	0,27	1,26	66	75	445	17	
UPPER	3	1997	1,9	0,36	2,30	120	45	441	13,5	
	4	2009	3,2	0,84	6,50	205	25	442	11	
JURASSIC	5	2018	3,8	1,16	10,05	260	17	443	10	
	6	2045	3,8	1,48	10,70	280	18	443	12	
	7	2069	8,1	3,05	21,2	263	15	437	12,5	**
	8	2081	10,5	3,37	27,2	260	5	438	11	
EARLY JUR.	9	2378	3,5	0,33	3,50	100	7	441	8,5	
UP. TRIAS	10	2468	3,37	0,30	2,75	80	10	444	10	*
"	11	2537	69,0	8,95	162,4	235	2	457	5	
"	12	2603	35,0	3,30	70,6	200	3	444	4,5	*

Samples 1 to 8 : analysis on black shales

Samples 9 and 10 : analysis on shaly separated fraction

Samples 11 and 12 : analysis on coaly or bituminous (?) separated fraction

TABLE 4

SOME CHARACTERISTICS OF THE SATURATED FRACTION
(C 15+) IN AUTOCHTONOUS HC

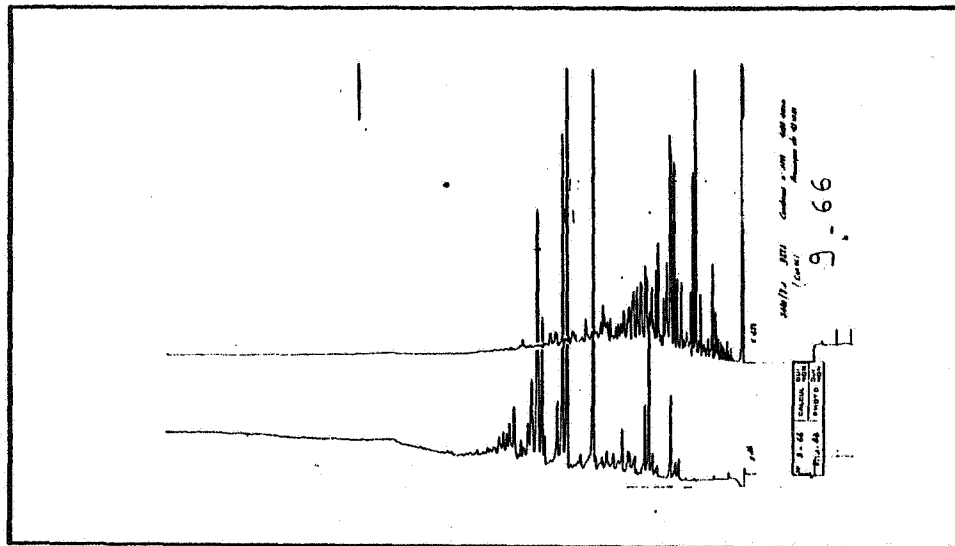
NATURE	DEPTH (m)	AGE	Pr/n-C17 (A)	Ph/n-C18 (B)	Pr/Ph	A/B
Shale	2069	U. Jur.	2,30	1,20	2,35	1,93
Shale	2468	U. Tri.	2,70	0,58	4,80	4,60
Coal/Bit.	2603	U. Tri.	2,26	0,30	6,55	7,35

Fig. 1

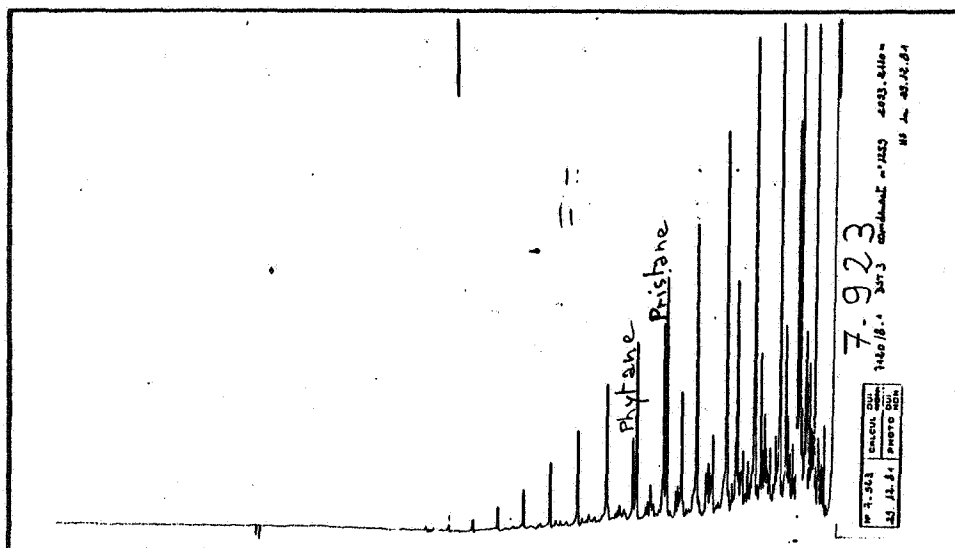
S. N. E. A. (P)

DEPARTEMENT LABORATOIRE DE GEOLOGIE DE BOUSSENS

PAYS : NORWAY
Country
SONDAGE : 7120/8.1
Well



HC AROMATIQUES AROMATIC HC.



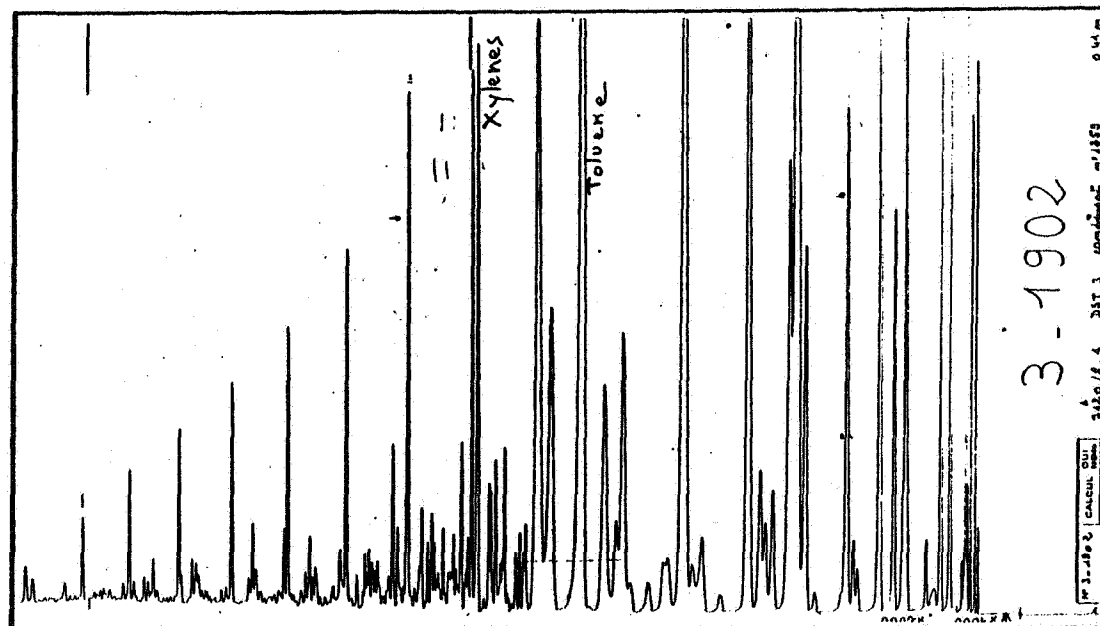
SATURATED HC

Cote Depth
Identification Identification DST 3
Formation Formation —
Age Age UPPER JURASSIC

$$d = 0,749$$

Composition du produit total (%)
Composition of total product

Asphaltènes Asphaltenes	As	:	
Résines Resins	R	:	0,05
HC saturés Saturated HC	S	:	15,5
HC aromatiques Aromatic HC	A	:	3,75
Distillat Distillate	D	:	80,7

$$\frac{S}{A} = 4,13$$


HC THERMOVAPORISÉS THERMOVAPORIZED HC.

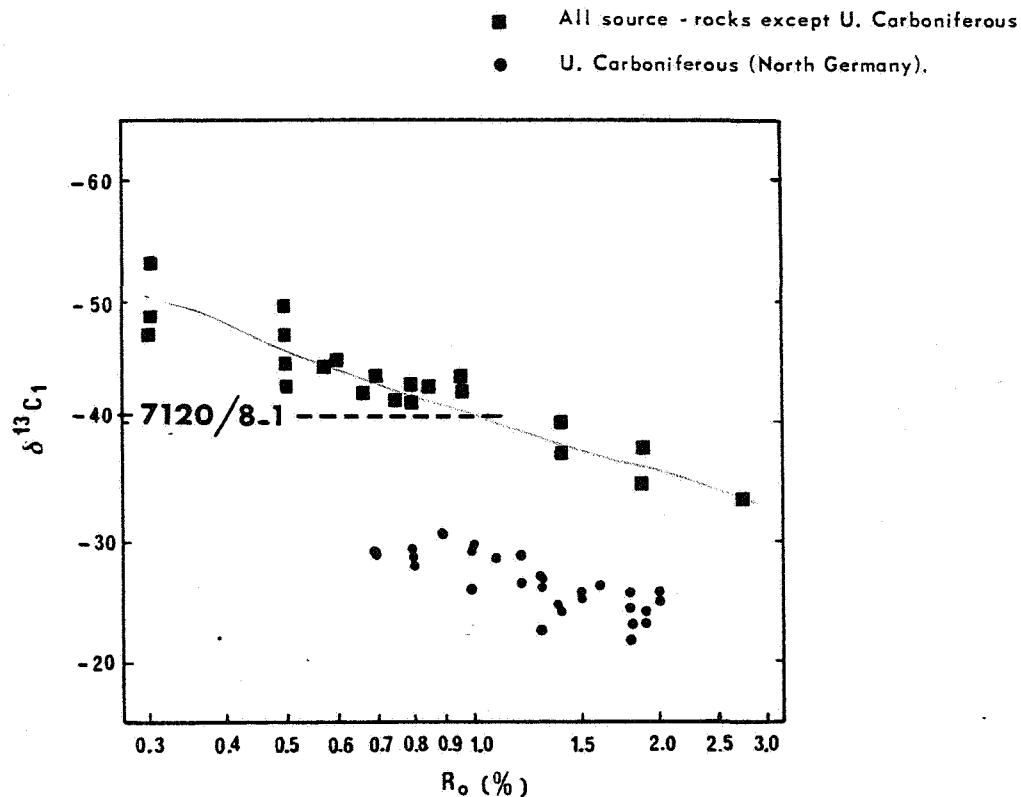


Plate 2 - $\delta^{13}C_1$ data of natural gases originated from source rocks of different geological age in relationship to the maturity of their source material. (After STAHL - 1977).

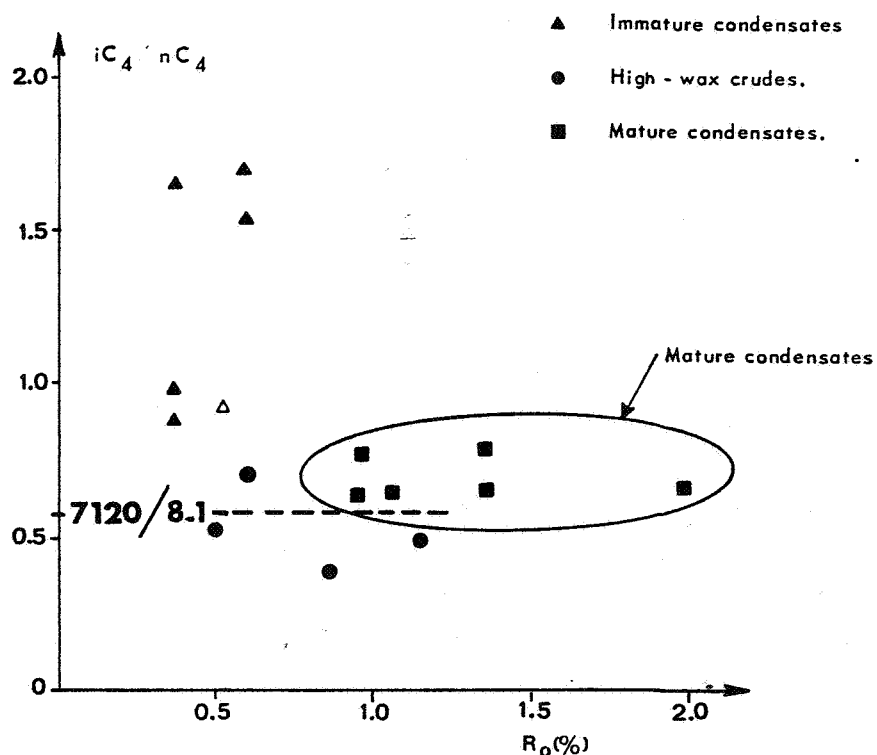
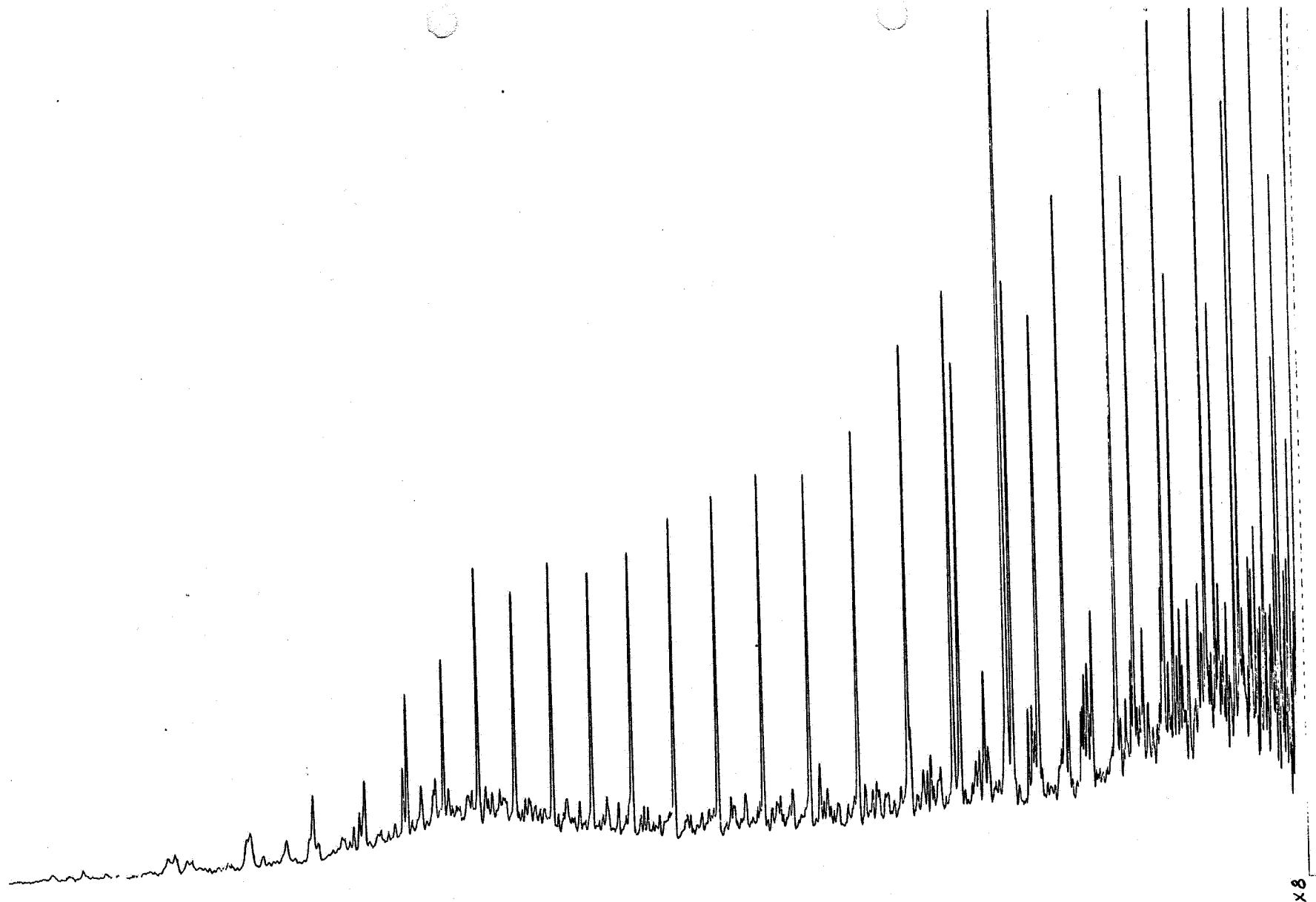


Plate 3 - Changes in $i-C_4$ to $n-C_4$ ratios of natural gases through increasing maturity. (After Connan and Cassou - 1980).



x8

7120/8-1 2069-72m Liblain Lib. Labo SR 01

N° 7-315	CALCUL	OUI
	NON	
18.12.81	PHOTO	OUI
	NON	

Fig. 4 : Autochthonous hydrocarbons (C15⁺ fraction) of the 2069-2072 m shale sample

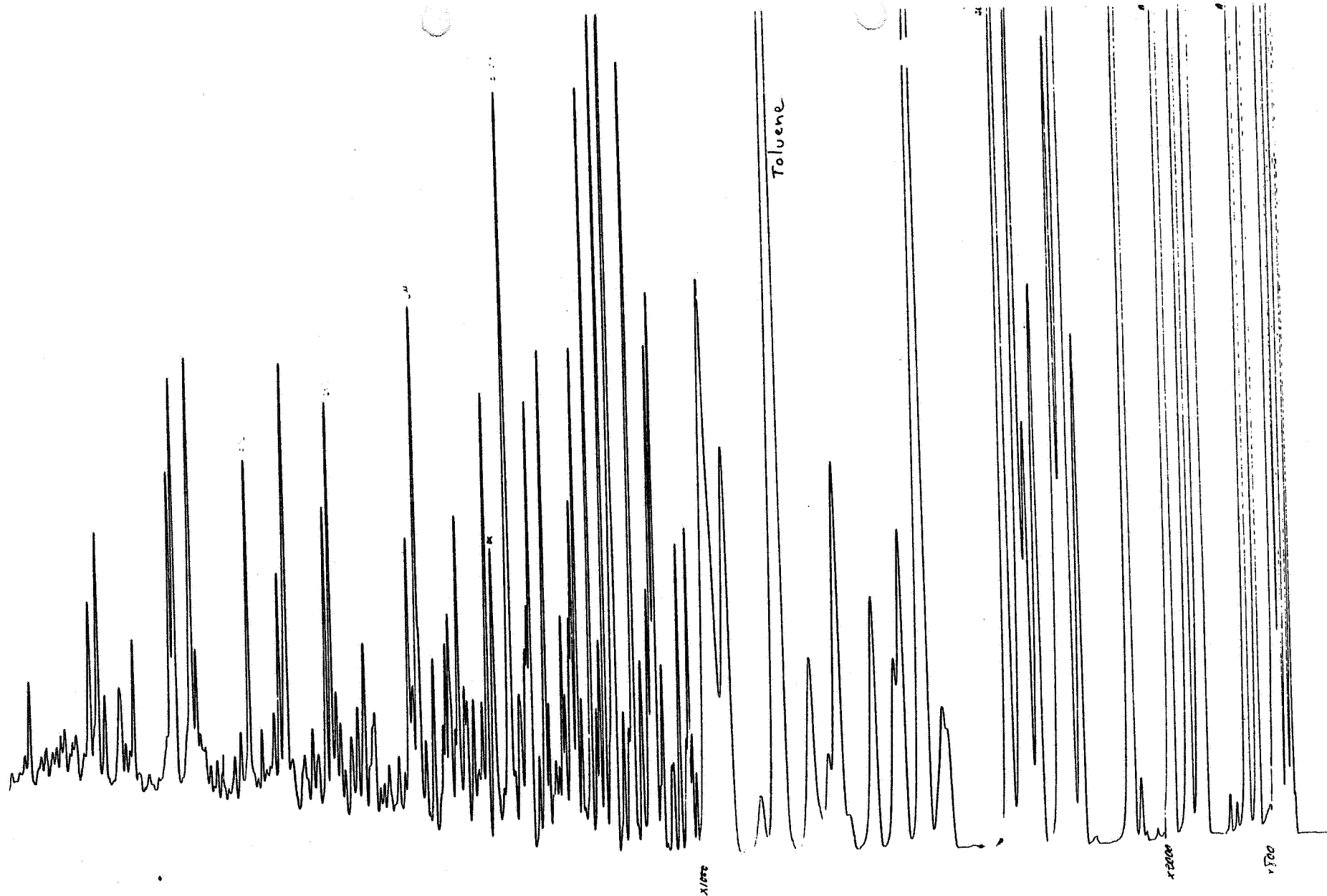


Fig. 5 : Autochthonous HC (TV fraction) of the 2069-2072 m shale sample

N°	CALCUL		OUI
	PHOTO		NON
5-1900			

2400 / 7.1, 2069-2072 m
17.12.1981

silphiole

13/2/82

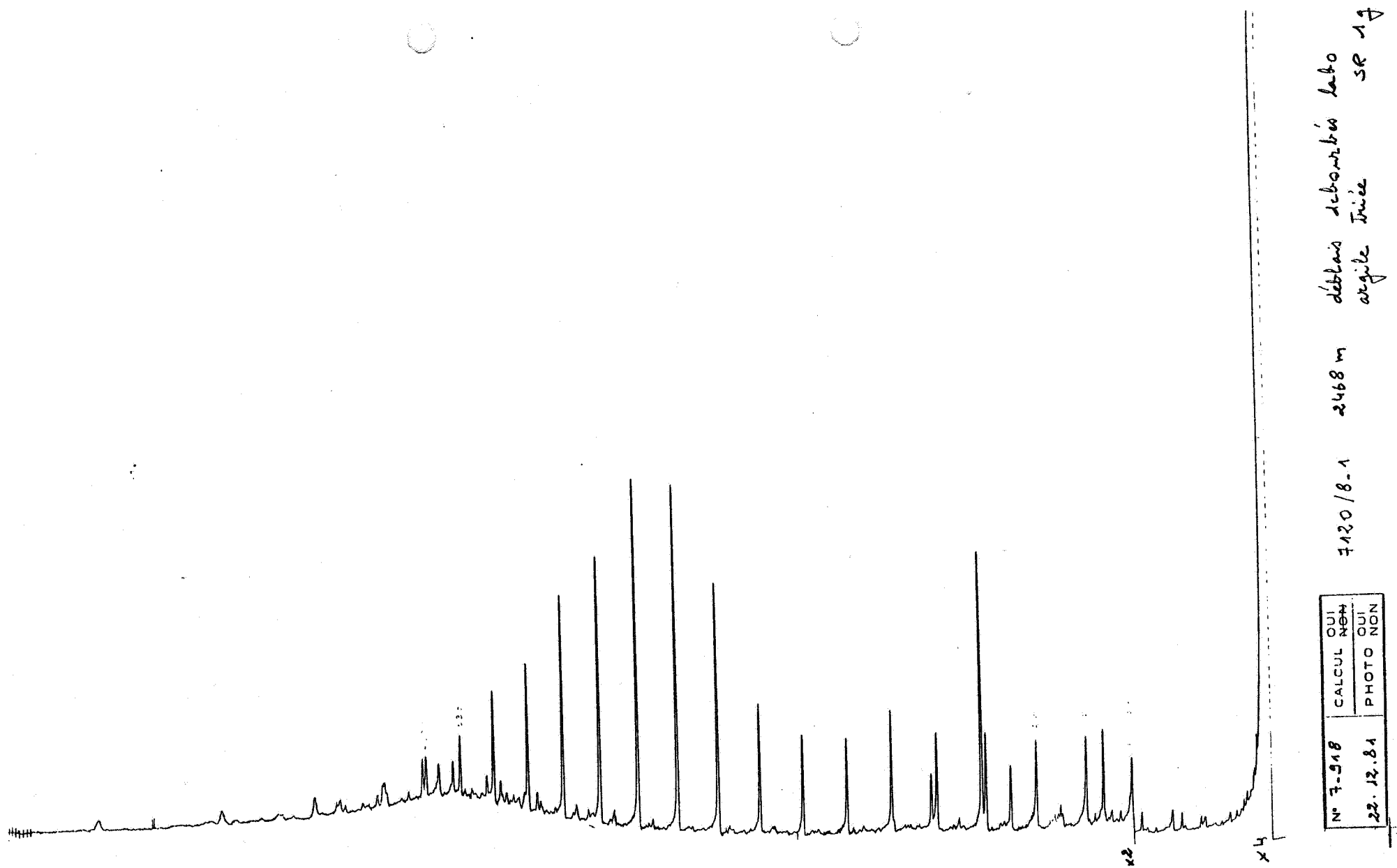


Fig. 6 : Autochthonous HC (C15⁺ fraction) of the 2468 m sample (shales)

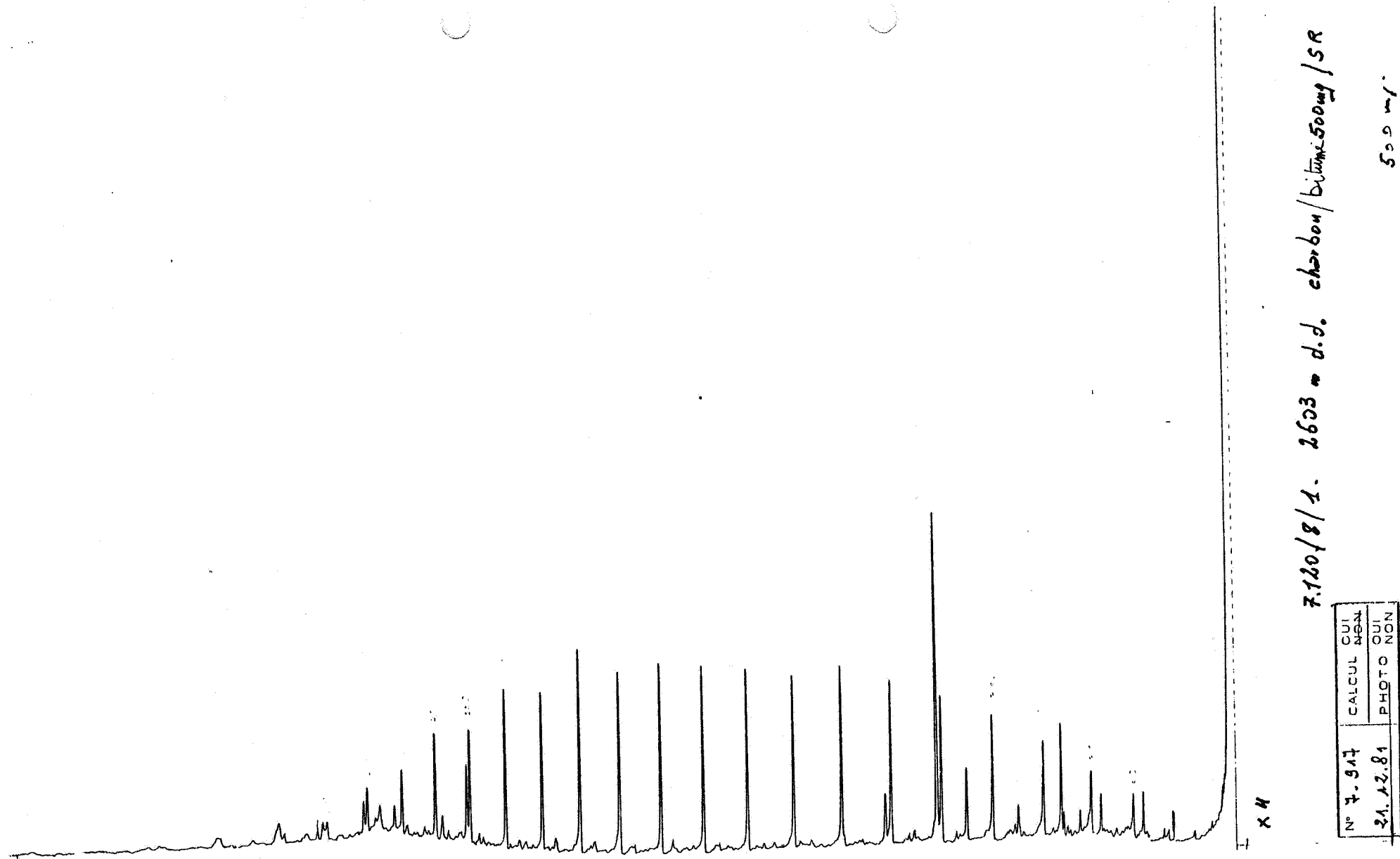
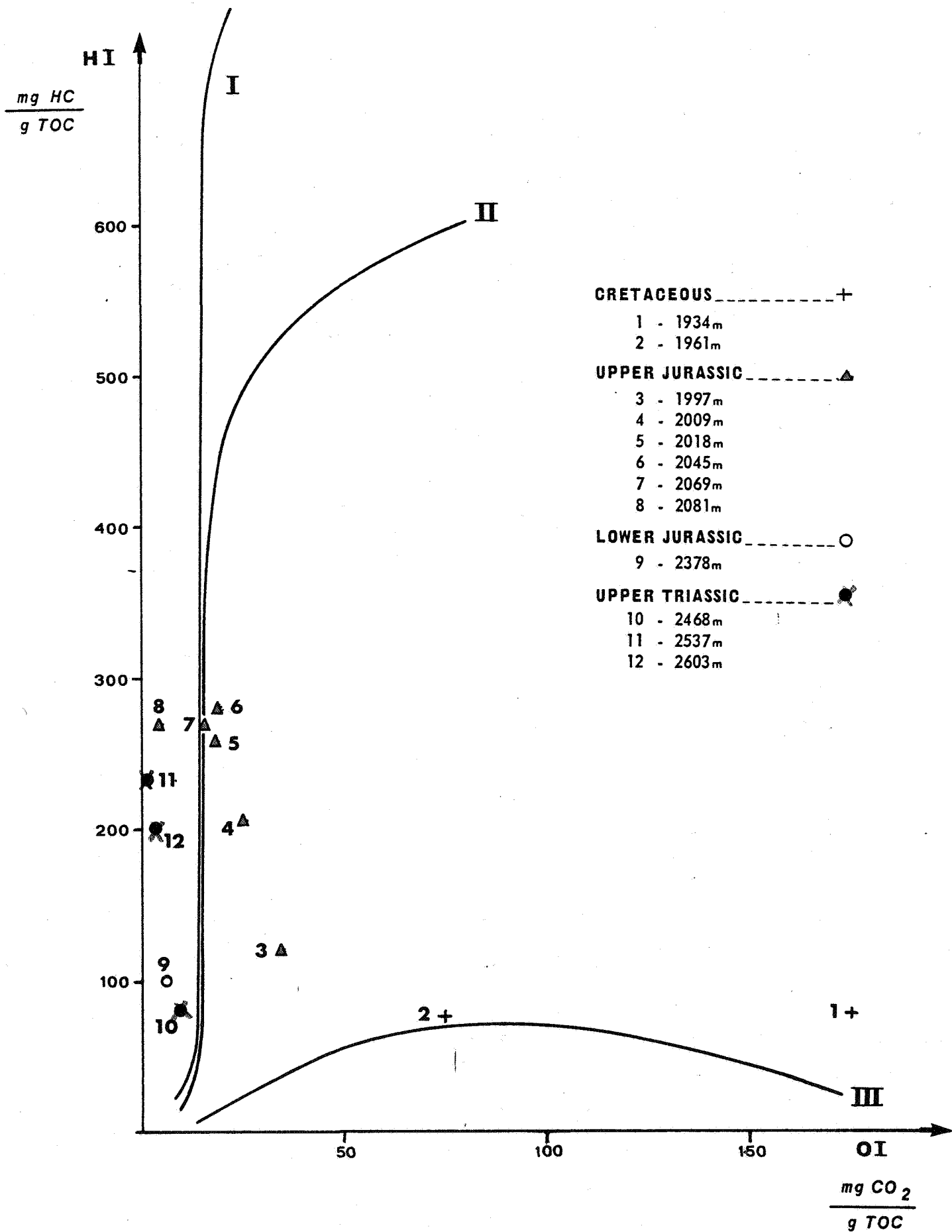


Fig. 7 : Autochthonous HC (C15+ fraction) of the 2603 m sample (coal/bitumen)



7120 / 8. 1

Plate 8 - HI - OI DIAGRAM.