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ROBERTSON RESEARCH INTERNATIONAL LIMITED

NORWAY II STUDY - PRELIMINARY REPORTS G5 TO G8

AND PRELIMINARY REPORTS B8 TO B10

ROBERTSON RESEARCH INTERNATIONAL LIMITED

NORWAY II STUDY - PRELIMINARY REPORTS G5 TO G8

Project No. RRPS/801/B/2043

PRELIMINARY PETROLEUM GEOCHEMISTRY RESULTS OF

2/4-B19, 25/12-1, 30/5-1 AND 35/3-1 WELLS

FEBRUARY 1981

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ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY PHASE II STUDY PRELIMINARY REPORT G5 (25/2/81)

PRELIMINARY PETROLEUM GEOCHEMISTRY RESULTS OF 2/4-B19 WELL

SUMMARY

The Late Jurassic to Early Cretaceous analysed section (12900' to 15000') is late to post-mature for oil generation, but the shales possibly represent oil sources that have already generated and expelled most of their hydrocarbons. These horizons have little or no potential for further liquid hydrocarbon generation, but could have generated some of the oils in the reservoirs in the overlying sections. The likely remaining hydrocarbon potential in the source rock is for gas generation.

GENERAL COMMENTS

Well status: Oil production well (Ekofisk field)

Drilling data: The well was drilled with Lime drispac and lignosulphonate muds. Casing points at 566' (30"), 1632' (20"), 4497' (13 $\frac{3}{8}$ "), 9568' (9 $\frac{5}{8}$ ") and 12882' (7"). BHT 300°F at 15108' (T.D.).

Interval analysed: 12900' to 15000' (T.D. 15108').

Sample type and quality: 35 composite samples of ditch cuttings.
Sample quality was fair.

Maturation data quality: Adequate

Source rock data quality: Adequate

Gas chromatography run at: 12980'-13020', 13400'-13440', 13720'-13760',
14040'-14080', 14360'-14400', 14580'-14620',
15000'-15080'.

MATURATION (Table 1; Figures 1 and 2)

The analysed section is late to post-mature for oil generation, with spore colour indices of between 8 and 8.5, and vitrinite reflectivity levels of between 0.76% and 1.07%. A present bottom-hole temperature of 300°F is in reasonable accord with these values. Oil-prone kerogen at such levels of thermal maturity will have generated most of its potential hydrocarbons, and any further generation will be in the light oil to condensate range; gas-prone kerogen will be commencing gas generation.

OIL SOURCE ROCKS AND GEOCHEMICAL CHARACTERISTICS OF THE SEDIMENTS (Tables 1 and 2)

Due to the high level of thermal maturity within the analysed section there are no obvious oil source rocks. However, the kerogens in the analysed interval 12980' to 15080', contain at least 30% amorphous kerogen of sapropelic appearance. The same interval contains shales of average to above average (around 1% to 4%) organic carbon content which, if the amorphous kerogen is sapropelic, could have generated major quantities of oil.

The pyrolysis potential yield values of up to 3700 ppm (12980'-13100') and 2200 ppm (13060'-13100' and 13620'-13790') indicate that, if oil-prone, the analysed horizons would have been fair to good oil source rocks at optimum maturity, and could have generated up to 400,000 bbls/acre of 35° API gravity oil. These horizons could have produced the oil that is presently reservoired in the Ekofisk Field.

Solvent extraction of samples from a number of horizons, followed by gas chromatographic analysis of the alkane fractions, shows that the hydrocarbons are dominated by a mature, crude oil-like distribution of n-alkanes, in accord with the kerogen type and known levels of thermal maturity.

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)				
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL	
12900	Ctgs			*								
12980-13100	"	LST, med-1t gy+ 40% SH, dk gy	8	*	70	mnr	230					
13220	"	LST, a/a+30% SH, med gy		0.30(5)								
13400-520	"	LST, a/a+50% SH, dk gy	8.5	0.87(3)	20	10	70					
13520	"	LST, a/a+30% SH, a/a		0.82(3)								
13620-790	"	LST, a/a+50% SH, a/a	8.5	0.87(11)	50	20	30					
13720-760	"	LST, a/a+40% SH, a/a										
13800	"	A/a		0.31(4)								
13820-950	"	SH, a/a+40% LST	8.5	1.18(1)	50	220	230					
14120	"	A/a		0.76(4)								
14200-400	"	A/a	8.5	1.25(4)	50	220	230					
14360	"	A/a		*								
14510-660	"	SH, a/a+30% LST, a/a	8.5	1.04(1)	50	220	230					
14700	"	A/a		1.07(4)								
14900-15080	"	SH, a/a+20% LST, a/a	8.5	*	60	10	30					
15000	"	A/a		0.95(13)								

NOTE: CALCULATIONS OF KEROGEN COMPOSITION (%) FROM PYROLYSIS DATA NOT POSSIBLE BECAUSE OF HIGH LEVELS OF THERMAL MATURITY

TABLE 1 Maturity and Kerogen Data

GENERAL DATA			CHEMICAL ANALYSIS DATA																	
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION											
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	mg/g OF ORGANIC CARBON	% OF EXTRACT	ALKANES % OF HYDRO-CARBONS						
12980-13020	Ctgs	LST, med-lt gy+30% SH, dk gy	2.96																	
		After Extraction	2.58	434	103	161	*	2700												
12980-13100	"	LST, a/a+40% SH, a/a	1.49	440	247	237	0.02	3700												
13060-100	"	LST, a/a+10% SH, a/a	2.95																	
		After Extraction	2.35	*	92	162	*	2200												
13140-220	"	LST, a/a+30% SH, med gy	1.89																	
		After Extraction	1.60	429	143	208	*	2300												
13260-350	"	LST, a/a+20% SH, a/a	1.26																	
		After Extraction	0.81	430	222	267	*	1800												
13400-440	"	LST, a/a+40% SH, a/a	1.07																	
		After Extraction	1.02	445	75	62	0.1	800												
13400-520	"	LST, a/a+50% SH, dk gy	0.97	*	67	88	0.2	600												
	P	SH, dk gy	2.49	446	41	30	0.2	1000												
13480-520	Ctgs	LST, a/a+30% SH, a/a	1.67																	
		After Extraction	1.19	445	62	59	0.06	700												
13560-600	"	A/a	1.20																	
		After Extraction	0.88	446	79	55	0.1	700												
13620-790	"	SH, a/a+50% LST, med-lt gy	1.99	444	109	151	0.03	2200												
	P	SH, dk gy	2.38	446	55	44	0.1	1300												
13640-680	Ctgs	LST, a/a+20% SH, a/a	3.63																	
		After Extraction	3.01	437	81	137	*	2500												
13720-760	"	LST, a/a+40% SH, a/a	2.12																	
		After Extraction	1.36	*	68	94	*	1000												
13800-840	"	LST, a/a+50% SH, a/a	1.72																	
		After Extraction	1.21	440	62	55	0.1	800												
13820-950	"	SH, a/a+40% LST, med-lt gy	1.23	446	39	68	0.3	500												
	P	SH, dk gy	2.61	447	28	25	0.3	700												
13880-920	Ctgs	LST, a/a+20% SH, a/a	2.25																	
		After Extraction	1.34	450	50	48	0.1	700												
13960-14000	"	LST, a/a+40% SH, a/a	2.51																	
		After Extraction	1.51	450	49	25	0.06	800												
14040-080	"	SH, dk gy+40% LST, med-lt gy	2.77																	
		After Extraction	1.36	445	42	25	0.1	600												
14120-160	"	A/a	2.31																	
		After Extraction	1.43	445	34	32	0.06	500												
14200-240	"	SH, a/a+20% LST, a/a	2.02	429	37	40	0.4	800												
		After Extraction	1.67	442	37	30	0.06	700												

TABLE 2 A Chemical Analysis Data

GENERAL DATA			CHEMICAL ANALYSIS DATA										
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION				
				TEMP - ERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS	
					mg/OF ORGANIC CARBON	% OF EXTRACT							
14200-400	Ctgs	SH,dkgy+40% LST, med-lt gy	1.87	445	26	49	0.4	500					
14280-320	"	SH, a/a+40% LST, a/a	2.23	*	26	29	0.4	600					
		After Extraction	1.93	436	32	39	0.06	600					
14360-400	"	SH,a/a+30% LST, a/a	2.40	*	16	13	0.5	400					
		After Extraction	1.94	432	26	37	0.1	500					
14440-490	"	A/a	2.57	438	23	49	0.3	400					
		After Extraction	2.04	439	31	43	0.04	700					
14510-660	"	SH, a/a+30% LST, med-lt gy	1.85	445	29	53	0.3	500					
14520-560	"	SH, a/a+30% LST, a/a	3.01										
		After Extraction	2.31	425	49	70	0.05	1200					
14580-620	"	SH, a/a+20% LST, a/a	2.68	436	21	60	0.5	500					
		After Extraction	1.90	435	31	49	0.05	600					
14660-700	"	SH, a/a+10% LST, a/a	2.72	436	15	52	0.5	400					
		After Extraction	2.24	444	25	31	0.03	600					
14740-780	"	A/a	3.66	435	16	45	0.5	600					
		After Extraction	2.55	440	30	32	0.04	800					
14820-860	"	A/a	4.45	441	14	27	0.6	1100					
		After Extraction	2.91	442	27	20	0.07	800					
14900-960	"	A/a	4.13	437	13	34	0.6	800					
		After Extraction	2.96	440	27	22	0.03	800					
14900-15080	"	SH, a/a+20% LST, med-lt gy	2.95	445	18	36	0.5	500					
15000-080	"	SH, a/a+10% LST, a/a	4.45	449	17	22	0.6	900					
		After Extraction	2.77	445	33	17	0.06	900					

TABLE 2 B Chemical Analysis Data

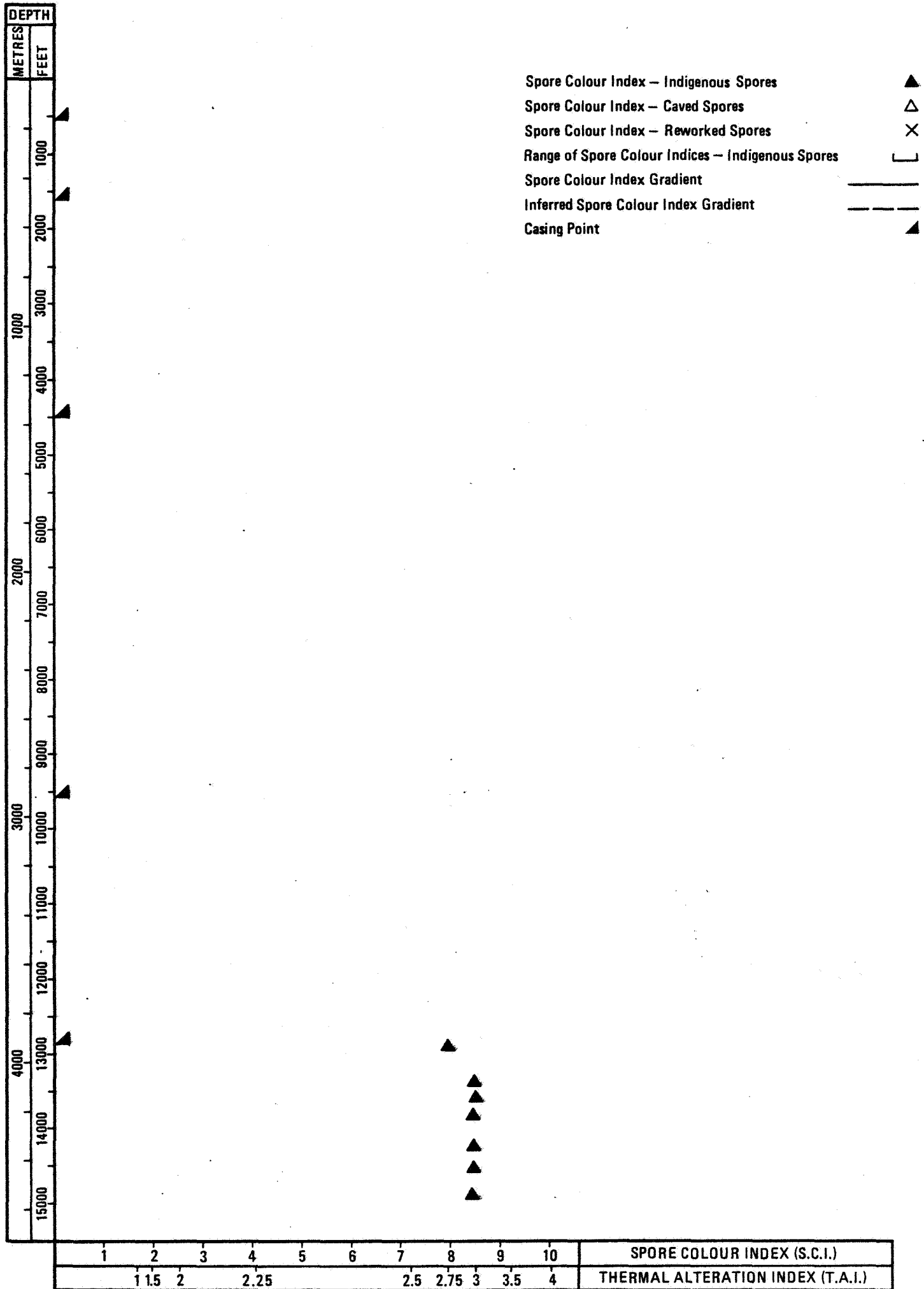


FIGURE 1 Spore Colour Indices against Depth

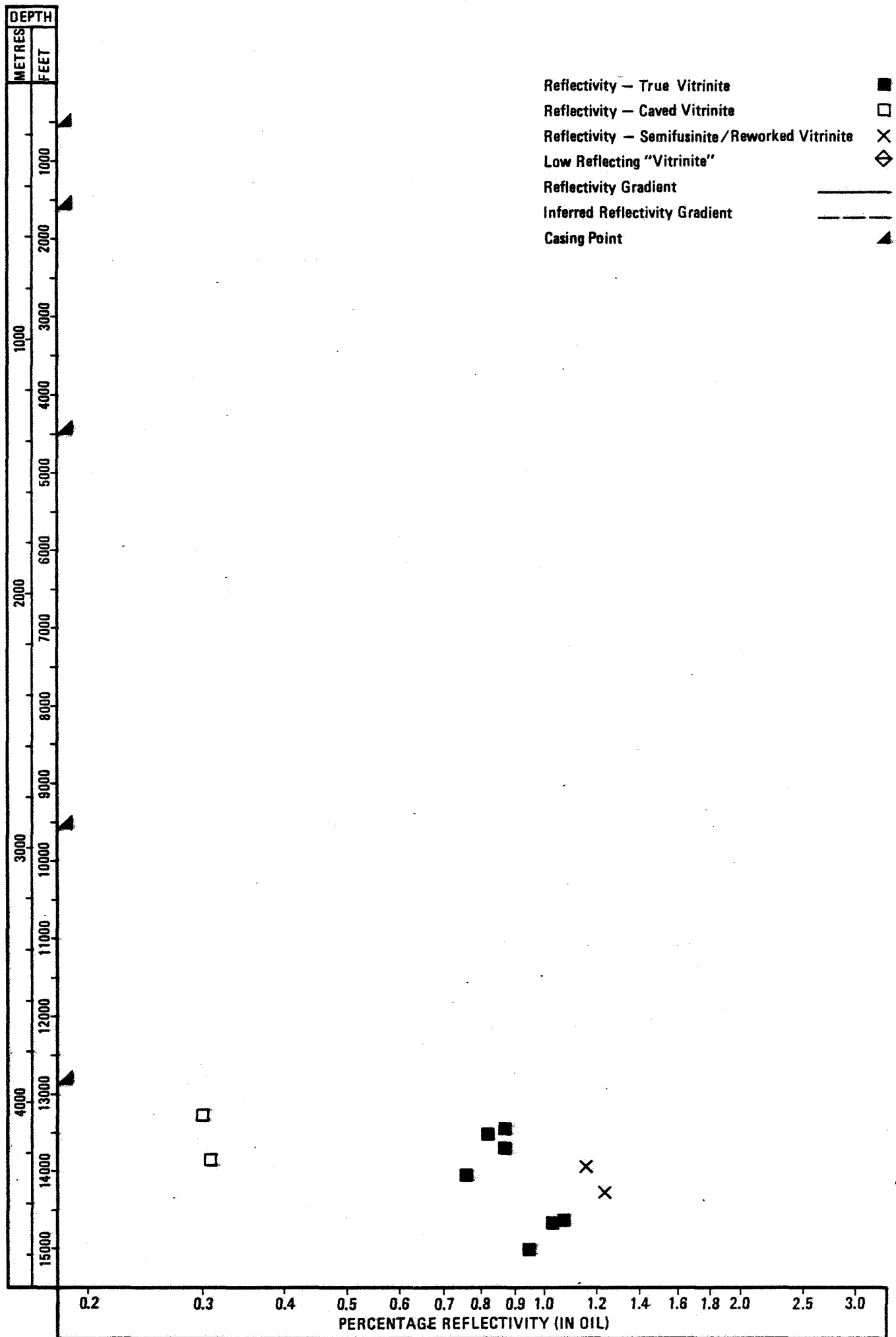


FIGURE 2 Vitrinite Reflectivity against Depth

ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY II STUDY - PRELIMINARY REPORT G6 (25/2/81)

PRELIMINARY PETROLEUM GEOCHEMISTRY RESULTS OF 25/12-1 WELL

SUMMARY

Good to very good oil source rocks, that are in an early mature state, have been identified in the analysed samples from between 7170' and 8000'. They are ascribed to the interval 7175' to 7363' (middle Volgian to late Ryazanian). At increased levels of thermal maturity, major oil generation may be expected from these Late Jurassic to Early Cretaceous shales. The overlying Early Cretaceous analysed section between 6200' and 7160' is organically lean and has no significant oil or gas generating potential. Similarly, the underlying shales and sandstones (?Middle to Late Jurassic) between 7363' and 7957' have no hydrocarbon generating potential.

GENERAL COMMENTS

Well status: Plugged and abandoned, dry hole.

Drilling data: The well was drilled with sea water/lignosulphonate mud. Casing points at 803' (30"), 1497' (20"), 4452' (13 $\frac{3}{8}$ "), 6491' (9 $\frac{5}{8}$ "). BHT 180°F at approximately 8000'.

Interval analysed: 6200' to 8120' (T.D. 9400'). Many of the samples in the lower part of this interval are caved.

Age of analysed interval: ?Middle Jurassic to Early Cretaceous.

Sample type and quality: 21 composited dried ditch cuttings samples of generally fair quality.

Maturation data quality: Adequate to good, dependent on kerogen type.

Source rock data quality: Good.

Gas chromatography run at: 7170'-7230', 7240'-7290', 7300'-7360', 7370'-7420', 7430'-7500', 7510'-7580'.

MATURATION (Table 1; Figures 1 and 2)

The spore colour indices increase from 3-3.5 at 6530'-6650' to 3.5-4 at 7810'-7910', and the vitrinite reflectivity data increase from 0.35% at 6530'-6650' to 0.38% at 8120'. These data are in reasonable accord, and infer early thermal maturity with respect to oil-prone kerogen. At these levels of thermal maturity minor quantities of hydrocarbons are generated.

OIL SOURCE ROCKS (Tables 1 and 2)

The shale samples between 7170' and 8000' yield high to very high quantities of hydrocarbons on pyrolysis (e.g. 35,500 ppm potential yield at 7170'-7230' and 26,300 ppm potential yield at 7300'-7360'). Most of the shales in the lower part of this section, however, are considered to be caved from the Late Jurassic - Early Cretaceous interval between 7175' and 7363', as the in situ lithology below 7363' is dominated by sandstones of ?Middle to Late Jurassic age. The shales between 7175' and 7363' have a characteristically high gamma ray log response, in accord with their organic richness, and give a log gas response on the composite log.

Extraction and fractionation analyses show that the shales have begun to generate oil and contain up to 990 ppm of free hydrocarbons (7370'-7420' sample), which by alkane percentage and distribution appear to be indigenous. Pyrolysis analysis shows that these hydrocarbons are being generated from generally oxygen deficient waxy sapropel. With increased levels of thermal maturity, major oil generation would occur from the Late Jurassic - Early Cretaceous interval (7175'-7363').

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS

The ?Middle to Late Jurassic shales and sandstones between 7363' and 7957' are considered to have no hydrocarbon source potential.

Most of the Early Cretaceous shales analysed between 6200' and 7160' have low organic carbon contents. Those shales that do have average organic carbon contents contain mainly inertinitic kerogen. This interval is considered to have no hydrocarbon source potential.

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R av%	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)			
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL
6200-250	P	SH, ol-gy, slty						90	10	*	*
6260-340	Ctgs	SH, lt gy, slty+ tr LST, wht						95	5	*	*
6530-650	"	CMT+30% SH, a/a	3-3.5	0.35(1); 0.28(21)	70	20	10				
6720-810	"	SH, med gy, slty +CMT						70	30	*	*
6820-900	"	SH, med gy+SH, gy -red+CMT									
6900	"	A/a		*							
6910-970	"	SH, gn-gy, slty+ 30% SH, gy-red +CMT	3.5	0.29(8); 0.52(7)	90+	mnr	mnr				
7170-230	"	SH, a/a+30% SH, a/a+10% SH, dk gy	3.5	*	20	20	?60	45	50	5	*
	P	SH, dk gy						10	20	10	60
7200	Ctgs	SH, gn-gy, slty+ 30% SH, gy-red+ 20% SH, dk gy		0.26(7)							
7240-290	"	A/a						65	10	5	20
	P	SH, dk gy						40	10	10	40
7300-360	Ctgs	SH, gn-gy, slty+ 30% SH, gy red+ 30% SH, dk gy						35	20	10	35
	P	SH, dk gy						50	15	20	15
7370-420	Ctgs	SH, gn-gy, slty+ 20% SH, gy-red+ 20% SH, dk gy	3.5	0.28(6)	20	20	?60	50	20	10	20
	P	SH, dk gy						45	20	10	25
7430-500	Ctgs	SH, gn-gy, slty+ 20% SH, gy-red+ 30% SH, dk gy						70	*	5	25
	P	SH, dk gy						50	10	15	30
7510-580	Ctgs	SH, a/a+10% SH, gn-gy, slty+30% SH, gy-red+20% SH, pp-gy	3.5-4	0.39(2); 0.59(1)	20	20	?60	75	10	10	5
	P	SH, dk gy						50	10	10	30
7520	P	SH, a/a+10% SH gn-gy, slty+30% SH, gy-red+20% SH, pp-gy		0.34(21)							
7700-800	P	SH, dk gy						45	20	15	20
7800	Ctgs	SH, gy-red+20% SH, dk gy+10% SH, gn-gy, slty+20% SH, pp-gy		0.34(18)							
7810-910	"	A/a	3.5-4	0.38(2); 0.56(7)	20	20	?60				
	P	SH, dk gy						50	15	15	25
7920-8000	P	SH, dk gy						50	15	15	20

TABLE 1 A Maturity and Kerogen Data

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)				
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL	
8120	Ctgs	SH, gy-red+20% SH, dk gy+10% SH, gn-gy, slty+20% SH, pp-gy (Caved)		0.38(5)								

TABLE 1 B Maturity and Kerogen Data

GENERAL DATA			CHEMICAL ANALYSIS DATA															
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION									
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	mg/g OF ORGANIC CARBON	% OF EXTRACT	ALKANES % OF HYDRO-CARBONS				
6200-250	Ctgs	SH, ol-gy, slty+20% LST, wht +mnr SH, gy-red	-															
	P	SH, ol-gy, slty	1.69	430	18	30	0.1	300										
6260-340	Ctgs	SH, lt gy, slty+tr LST, a/a	1.11	*	9	78	0.4	100										
6440-520	"	SH, lt gy, slty+20% LST, a/a +tr SH, gy-red+CMT	0.70															
6530-650	"	CMT+30% SH, lt gy, slty	0.66															
6720-810	"	A/a	1.88	422	75	183	0.1	1400										
6910-970	"	SH, gn-gy, slty+30% SH, gy-red+CMT	0.30															
	P	SH, gn-gy, slty	0.51															
6980-7040	Ctgs	SH, a/a+30% SH, gy-red	0.49															
7050-160	"	SH, a/a+40% SH, a/a	0.64															
	P	SH, gn-gy, slty	0.58															
7170-230	Ctgs	SH, a/a+30% SH, gy-red+10% SH, dk gy	2.04	425	142	34	0.05	2900	595	245	2.9	12	41	58				
	P	SH, gn-gy, slty	0.34															
	P	SH, dk gy	6.04	432	588	19	0.02	35500										
7240-290	Ctgs	SH, gn-gy, slty+30% SH, gy-red+20% SH, dk gy	2.22	427	203	19	0.05	4500	745	250	3.4	11	34	48				
	P	SH, dk gy	5.96	426	434	13	0.02	25900										
7300-360	Ctgs	SH, gn-gy, slty+30% SH, gy-red+30% SH, dk gy	3.98	427	407	16	0.03	16200	1455	965	3.7	24	67	47				
	P	SH, dk gy	7.57	417	347	13	0.03	26300										
7370-420	Ctgs	SH, gn-gy, slty+20% SH, gy-red+20% SH, dk gy	4.31	424	317	14	0.04	13700	1770	990	4.1	23	56	48				
	P	SH, dk gy	6.02	424	337	15	0.03	20300										
7430-500	Ctgs	SH, gn-gy, slty+20% SH, gy-red+30% SH, dk gy	3.24	423	218	15	0.04	7100	1430	845	4.4	26	59	45				
	P	SH, dk gy	6.84	424	360	11	0.02	24700										
7510-580	Ctgs	SH, a/a+10% SH, gn-gy, slty+30% SH, gy-red+20% SH, pp-gy	2.67	424	143	14	0.05	3800	445	233	1.7	9	53	48				
	P	SH, dk gy	6.38	425	351	12	0.02	22400										
7700-800	Ctgs	SH, gy-red+20% SH, dk gy+10% SH, gn-gy, slty+30% SH, pp-gy	-															
	P	SH, dk gy	6.10	421	336	15	0.03	20500										
7810-910	Ctgs	SH, gy-red+20% SH, dk gy+10% SH, gn-gy, slty+20% SH, pp-gy	-															
	P	SH, dk gy	7.16	423	350	13	0.03	25100										

TABLE 2 A Chemical Analysis Data

WELL: 25/12-1

GENERAL DATA			CHEMICAL ANALYSIS DATA															
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION									
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	mg/100 ORGANIC CARBON	% OF EXTRACT	ALKANES % OF HYDRO-CARBONS				
7920-8000	Ctgs	SH, gy-red+30% SH, dk gy+10% SH, gn-gy, silty+20% SH, pp-gy	-															
	P	SH, dk gy	7.01	422	316	13	0.04	22100										

TABLE 2^B Chemical Analysis Data

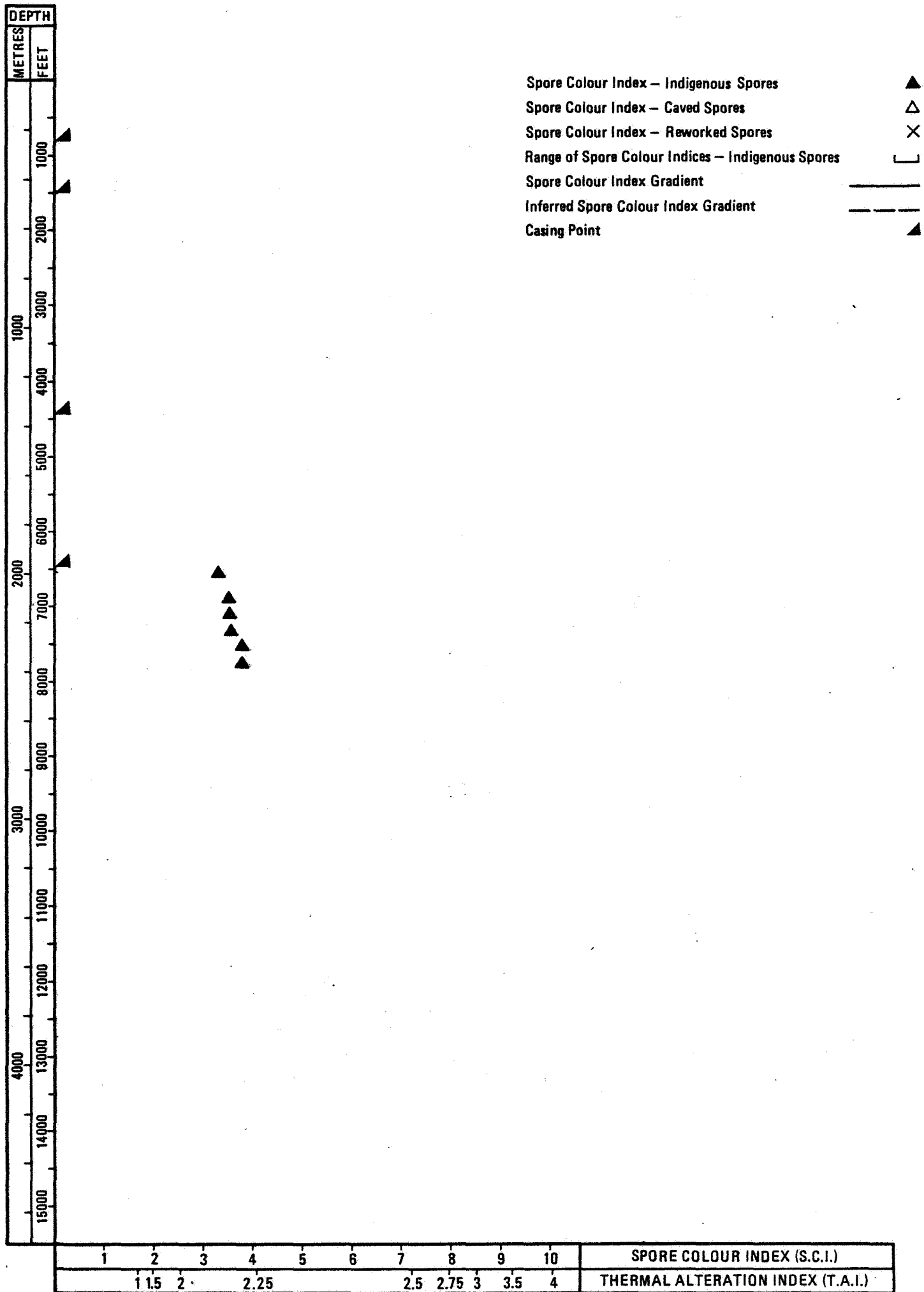


FIGURE 1 Spore Colour Indices against Depth

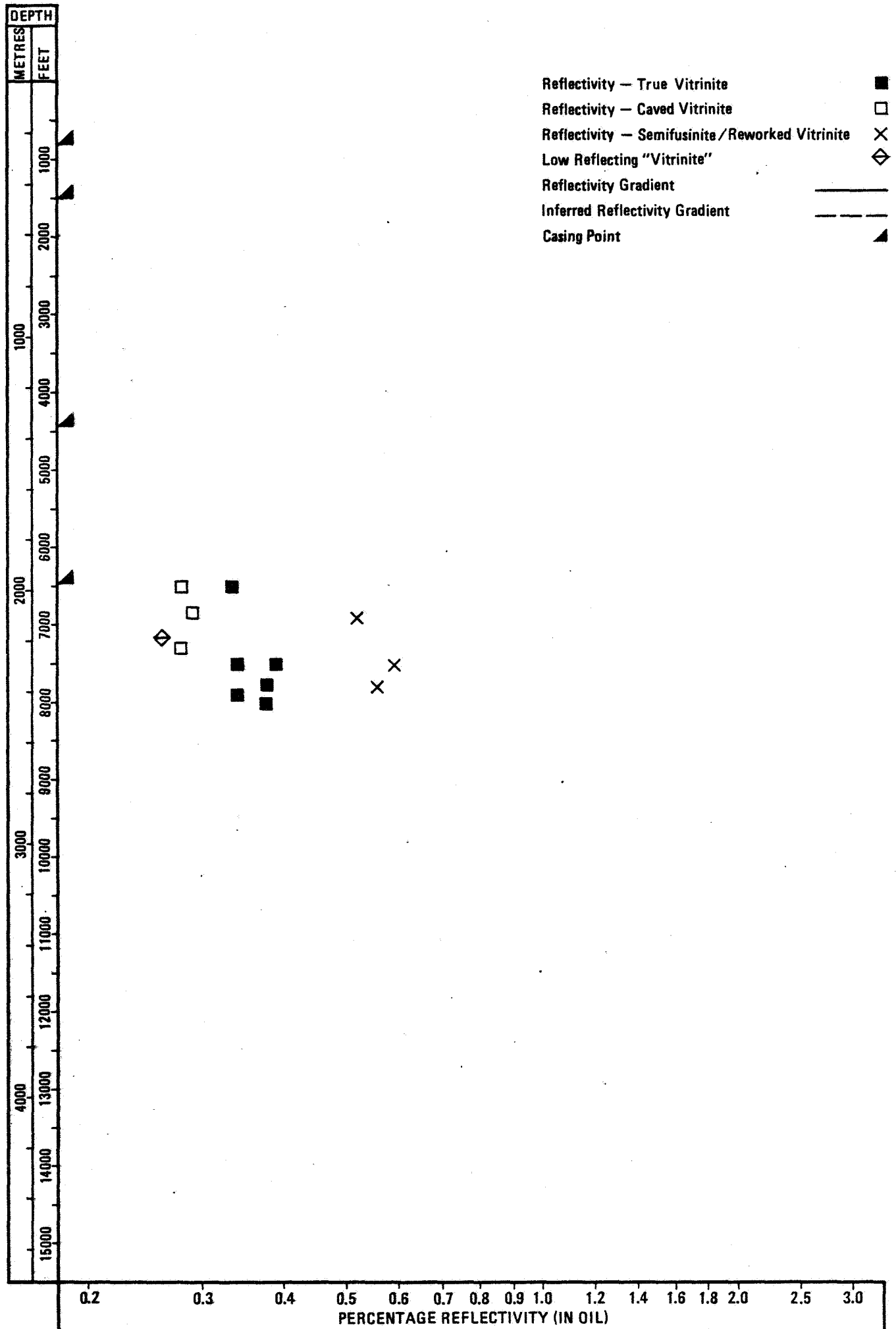


FIGURE 2 Vitrinite Reflectivity against Depth

ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY II STUDY - PRELIMINARY REPORT G7 (25/2/81)

PRELIMINARY PETROLEUM GEOCHEMISTRY RESULTS OF 30/5-1 WELL

SUMMARY

The Early Cretaceous to Tertiary analysed section, 1010' to 13500', contains no significant oil source rocks. The maturation profile indicates that sediments below about 11000' are sufficiently thermally mature to allow major oil generation. Anomalously high maturation parameters close to the surface suggest that more than 2000' of section has been eroded in the Late Tertiary.

GENERAL COMMENTS

Well status: Plugged and abandoned, dry hole.

Drilling data: The well was drilled with sea water/lignosulphonate mud. Casing points at 688' (30"), 1301' (20"), 3511' (13 $\frac{3}{8}$ "), 7747' (9 $\frac{5}{8}$ "). BHT 229°F at 13510'.

Interval analysed: 1010' to 13500' (T.D. 13530').

Age of analysed interval: Early Cretaceous to Tertiary.

Sample type and quality: 109 dried ditch cuttings samples of fair quality.

Maturation data quality: Adequate to fair.

Source rock data quality: Good.

Gas chromatography: Not run.

MATURATION (Table 1; Figures 1 and 2)

The vitrinite reflectivity data show a progressive increase from 0.23% at 2060'-2560' in the Tertiary, up to 0.67% at 13450'-13500' in the Early Cretaceous. Data are sparse between 8000' and T.D. because of a dominance of inertinitic rather than vitrinitic kerogen. From extrapolation of the vitrinite reflectivity gradient to the surface it may be inferred that about 2000' of section is missing.

Spore colour indices increase from 2.5 at 1010' to 5-5.5 at 13450'-13500'. If the spore colour gradient found in the Cretaceous section is extrapolated to the surface, uplift and erosion of 2500' of Tertiary section is inferred.

Overall, the maturation data are in reasonable accord, and indicate a transition to early thermal maturity at around 6000', and to middle maturity at around 11000'. It is estimated that between 2000' and 2500' of section have

been removed by regional uplift and erosion in the Late Tertiary.

OIL SOURCE ROCKS (Tables 1 and 2)

No oil source rocks have been identified in the analysed interval of this well.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS

The organic matter throughout the Early Cretaceous to Tertiary interval is inertinitic so that the sediments have no hydrocarbon generating potential. Organic carbon contents vary from below average to average throughout the section.

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1-10)	VITRINITE REFLECTIVITY IN OIL, R av%	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)				
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL	
1010-510	Ctgs	SLTST, ol-gy	2.5	*	10	90	*					
1540-2040	"	SLTST, lt ol-gy	3	*	20	80	*					
2060-560	"	A/a	3?	0.23(20)	20	80	*					
2580-3070	"	SLTST, a/a	2.5	0.25(15)	10	90	*					
3100-600	"	A/a	2.5	0.24(22)	10	90	*	-80	20	*	*	
3620-4120	"	SLTST, a/a	2.5-3	0.28(20)	10	90	*					
4140-640	"	SH, slty, dk yel- brn+30% SLTST, a/a	2.5-3	0.29(22)	10	90	*					
4660-5160	"	SH, a/a+20% SLTST, a/a	3	0.31(21)	10	90	*	-95	5	*	*	
5180-680	"	SH, a/a	3	0.33(21)	10	90	*					
5700-6200	"	SH, dk gyn-gy+20% SH, a/a	3-3.5	0.34(21)	10	90	*					
6200-720	"	SH, lt ol-gy+10% SH, ol-gy+10% SH, mod brn	3	0.36(17)	10	90	*	-90	10	*	*	
6740-7240	"	SH, med gy/med-dk gy+30% SH, gn-gy +mnr SH, mod brn	3.5?	0.40(20)	10	90	*					
7260-700	"	SH, dk gn-gy+20% SH, med-dk gy+ 10% SH, lt ol-gy +30% SH, dk yel- brn+mnr LST, wht	3.5	0.41 (9); 0.32(11)	10	90	*					
7710-760	"	SH, med-dk gy+20% SH, dk yel-brn+ 30% SH, lt ol-gy +10% LST, v pale orng	3-3.5	0.42 (6); 0.31 (4)	30	70	*	-100	*	*	*	
7770-820	"	MDST, pnk-gy+20% SH, dk gn-gy+10% SH, lt ol-gy						-90	10	*	*	
7830-880	P	MDST, pnk-gy						-90	10	*	*	
7950-8000	Ctgs	SH, ol-gy/gn-gy+ 20% LST, pnk-gy						-90	10	*	*	
8070-120	"	SH, a/a+10% LST, a/a						-90	10	*	*	
8130-170	"	SH, med gy+10% LST, a/a	3-3.5	0.42 (8)	80	10	*					
8510-560	"	SH, a/a	3.5-4	0.47 (6); 0.35 (2)	90	10	*	90	10	*	*	
8630-680	"	SH, a/a+10% MD, pale brn										
8930-980	"	SH, a/a+mnr LST, pale yel-brn	*	*	90	10	*	90	10	*	*	
8990-9040	"	A/a						95	5	*	*	
9050-100	"	SH, a/a						95	5	*	*	
9350-400	"	SH, ol-gy+10% SH, mod brn+mnr LST, a/a	3.5	0.44(4); 0.62(2)	90	10	*					
9410-460	"	SH, a/a						-100	*	*	*	

TABLE 1 A Maturity and Kerogen Data

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1-10)	VITRINITE REFLECTIVITY IN OIL, R av%	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)			
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL
9710-770	Ctgs	SH, med gy+10% SH, dk gn-gy+10% SH, mod brn	4?	*	-100	mnr	*	-100	*	*	*
9780-830	"	SH, a/a+10% SH, a/a+mnr SH, a/a						-100	*	*	*
9900-950	"	SH, med gy+mnr LST, pnk-gy						-100	*	*	*
10080-130	"	SH, a/a+mnr SH, mod brn+mnr SLTST, brn-gy	4?	0.51(16)	100	mnr	*	-100	*	*	*
10260-310	"	SH, med gy+10% LST, lt gy						-100	*	*	*
10440-490	"	SH, ol-gy+20% LST, pnk-gy	3.5-5	0.54 (2)	90	10	*				
10620-680	"	SH, med gy/med- dk gy+10% SH, mod brn						-100	*	*	*
10870-920	"	SH, med gy/med- dk gy	4.5-5	*	90	10	*				
11230-280	"	SH, med-dk gy	4.5	*	-100	*	*				
11410-460	"	SH, a/a+20% CLYST, pnk-gy						-100	*	*	*
11650-700	"	SH, a/a+mnr CLYST, a/a	5?	*	90	10	*				
12010-060	"	SH, a/a+mnr SH, mod brn+mnr CLYST, a/a	4.5	*	-100	*	*	-100	*	*	*
12130-180	"	SH, gn-gy+20% SH, med gy/dk gy+mnr CLYST, a/a						-100	*	*	*
12430-480	"	SH, med-dk gy+ mnr SH, mod brn +20% SH, dk gn- gy+10% CLYST, a/a	4.5	*	-100	mnr	*				
12670-720	"	SH, gn-gy+20% SH, dk gy+20% CLYST, lt brn-gy						-100	*	*	*
12790-840	"	SH, a/a+10% SH, a/a+mnr SH, mod brn+mnr CLYST, a/a	5	0.70 (4)	-100	*	*				
	P	SH, dk gy						-100			
12850-900	P	SH, dk gy						-100			
12910-960	Ctgs	SH, gn-gy+40% SH, a/a+10% SH, mod brn+10% CLYST, a/a						-100			
	P	SH, dk gy						-100			
12970- 13020	P	SH, gy-blk						-100			
13030-080	Ctgs	SH, med gy+30% SH, a/a+mnr SH, gy-brn+mnr CLYST, a/a						-100			
13090-140	"	A/a						-100			

TABLE 1 B Maturity and Kerogen Data

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R av%	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)			
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL
13090-140	P	SH, gy-blk						~100	*	*	*
13150-200	Ctgs	SH, med gy+40% SH, a/a+mnr SH, gy-brn+mnr CLYST, pnk-gy	4.5?	*	~100	mnr	*				
13210-260	P	SH, gy-blk						~100	*	*	*
13270-320	Ctgs	SH, med gy+40% SH, a/a+mnr SH, gy-brn+mnr CLYST, a/a						~100	*	*	*
	P	SH, gy-blk						~100	*	*	*
13330-380	Ctgs	SH, med gy+40% SH, a/a+mnr SH, gy-brn+mnr CLYST, a/a						~100	*	*	*
	P	SH, gy-blk						~100	*	*	*
13390-440	Ctgs	SH, med gy+30% SH, gy-blk+mnr SH, gy-brn+mnr CLYST, a/a						~100	*	*	*
13450-500	"	A/a	5-5.5	0.67(13)	~100	mnr	*	~100	*	*	*
	P	SH, gy-blk						~100	*	*	*

TABLE 1 c Maturity and Kerogen Data

GENERAL DATA			CHEMICAL ANALYSIS DATA																	
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION											
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDROCARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS (ppm/OF ORGANIC CARBON)	% OF EXTRACT	ALKANES % OF HYDROCARBONS						
1010-510	Ctgs	SLTST, lt ol-gy	-																	
1540-2040	"	SLTST, a/a+SND+CHT	-																	
2060-560	"	A/a	-																	
2580-3070	"	SLTST, a/a+SND+GLC	-																	
3100-600	"	A/a	1.01	428	64	63	0.1	600												
3620-4120	"	SLTST, a/a+CHT	1.44																	
4140-640	"	SH, dk yel-brn, slty+30% SLTST a/a	1.45																	
4660-5160	"	SH, a/a+20% SLTST, a/a	1.47	414	31	57	0.2	400												
5180-680	"	SH, a/a	1.33																	
5700-6200	"	SH, dk gn-gy+20% SH, a/a	0.84																	
6220-720	"	SH, lt ol-gy+10% SH, ol-gy +10% SH, mod brn	0.60	433	44	74	0.1	300												
6740-7240	"	SH, med gy/med-dk gy+30% SH, gn-gy+mnr SH, mod brn	0.65																	
7260-700	"	SH, dk gn-gy+20% SH, med-dk gy+10% SH, lt ol-gy+30% SH, dk yel-brn+mnr LST, wht	0.79																	
7710-760	"	SH, med-dk gy+20% SH, dk yel-brn+30% SH, lt ol-gy+10% LST, v pale orng	0.83	431	19	59	0.1	200												
7770-820	"	MDST, pnk-gy+20% SH, dk gn-gy +10% SH, lt ol-gy	0.84	*	50	262	0.1	400												
	P	SH, dk gn-gy	0.29																	
7830-880	Ctgs	MDST, a/a+mnr SH, ol-gy/gn-gy	0.67																	
	P	MDST, pnk-gy	0.99	410	37	321	0.7	400												
7890-940	Ctgs	LST, pnk-gy+50% SH, a/a	0.56																	
	P	LST, pnk-gy	0.22																	
7950-8000	Ctgs	SH, a/a+20% LST, a/a	0.59	438	49	287	0.04	300												
8010-060	"	SH, ol-gy/gn-gy+mnr LST, pnk-gy	0.59																	
8070-120	"	SH, a/a+10% LST, a/a	0.58	440	52	107	0.1	300												
8130-170	"	SH, med gy+10% LST, a/a	0.60																	
8210-260	"	SH, a/a+mnr LST, a/a	0.52																	
8270-320	"	A/a	0.59																	
8330-380	"	A/a	0.52																	
8390-440	"	A/a	0.61																	
8450-500	"	SH, a/a	0.58																	
8510-560	"	A/a	0.83	*	23	166	0.1	200												
8570-620	"	A/a	0.61																	
8630-680	"	SH, a/a+10% MD, pale brn	0.60	425	66	258	0.2	400												
8690-740	"	SH, a/a+mnr SH, mod brn	0.65																	

TABLE 2 A Chemical Analysis Data

WELL: 30/5-1

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS				SOLVENT EXTRACTION						
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS		ALKANES % OF HYDRO-CARBONS
												mg/g OF ORGANIC CARBON	% OF EXTRACT	
8750-800	Ctgs	SH, med gy+mnr SH, mod brn	0.64											
8810-860	"	A/a	0.67											
8870-920	"	SH, a/a+tr SH, a/a	0.66											
8930-980	"	SH, med gy+mnr LST, pale yel-brn	0.71	427	73	275	0.1	500						
8990-9040	"	A/a	0.71	435	58	194	0.1	400						
9050-100	"	SH, a/a+tr LST, a/a	0.63	438	60	207	0.1	400						
9110-160	"	SH, ol-gy	0.56											
9170-220	"	A/a	0.65											
9230-280	"	SH, dk gn-gy+mnr SH, mod brn	0.47											
9290-340	"	SH, ol-gy+mnr SH, mod brn	0.60											
9350-400	"	SH, a/a+10% SH, a/a+mnr LST, pale yel-brn	0.55											
9410-460	"	SH, a/a+tr SH, a/a	0.56	440	35	214	0.1	200						
9470-520	"	SH, a/a+mnr SH, pale yel-brn	0.59											
9530-580	"	SH, med gy+mnr SH, mod brn	0.61											
9590-640	"	SH, med gy+mnr SH, pale yel-brn	0.51											
9650-700	"	SH, med gy+30% SH, dk gn-gy+mnr SH, mod brn	0.57											
9710-770	"	SH, a/a+10% SH, a/a+10% SH, a/a	0.71	440	24	87	0.1	200						
9780-830	"	SH, a/a+10% SH, a/a+mnr SH, a/a	0.58	441	35	95	0.1	200						
9840-890	"	SH, med gy+10% LST, pnk-gy	0.67											
9900-950	"	SH, a/a+mnr LST, a/a	0.45	443	44	133	0.1	200						
9960-10010	"	SH, a/a+10% LST, pale yel-brn+mnr SLTST, brn-gy	0.69											
10020-070	"	SH, a/a+mnr LST, a/a+mnr SLTST, a/a	0.61											
10080-130	"	SH, a/a+mnr SH, mod brn+mnr SLTST, a/a	0.51	440	32	56	0.1	200						
10140-180	"	SH, med gy+20% SLTST, a/a	0.66											
10200-250	"	SH, med gy/med-dk gy+10% SH dk gn-gy+10% LST, lt gy	0.76											
10260-310	"	SH, med gy+10% LST, a/a	0.58	445	42	112	0.1	200						
12320-370	"	SH, ol-gy+10% SH, med-lt gy+20% SH, med-dk gy+mnr SH, mod brn	0.62											
10380-430	"	SH, ol-gy+10% LST, pnk-gy	0.54											
10440-490	"	SH, a/a+20% LST, a/a	0.52											
10500-550	"	SH, a/a+mnr LST, a/a	0.51											
10560-610	"	SH, med gy/med-dk gy+10% SH mod brn	0.57											
10620-680	"	A/a	0.53	449	30	116	0.1	200						

TABLE 2 B Chemical Analysis Data

GENERAL DATA			CHEMICAL ANALYSIS DATA																
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION										
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	mg/g OF ORGANIC CARBON	% OF EXTRACT	ALKANES % OF HYDRO-CARBONS					
10690-740	Ctgs	SH, med-dk gy+10% SH, dk gn-gy	0.52																
10750-800	"	SH, med-dk gy+10% LST, v lt orng.	0.64																
10810-860	"	SH, a/a	0.54																
10870-920	"	SH, med gy/med-dk gy	0.43																
10930-980	"	SH, med-dk gy+10% LST, v pale orng	0.45																
10990-11040	"	SH, a/a+20% LST, a/a	0.47																
11050-100	"	SH, a/a+10% SH, mod brn	0.47																
11110-160	"	SH, a/a+10% LST, pnk-gy	0.45																
1170-220	"	SH, dk gn-gy+20% SH, v lt gy	0.44																
11230-280	"	SH, med-dk gy	0.31																
11290-340	"	A/a	0.47																
11350-400	"	A/a	0.50																
11410-460	"	SH, a/a+20% CLYST, pnk-gy	0.57	435	10	117	0.1	600											
11470-520	"	SH, a/a+mnr CLYST, a/a	0.47																
11530-580	"	A/a	0.48																
11590-640	"	A/a	0.47																
11650-700	"	A/a	0.51																
11710-760	"	A/a	0.40																
11770-820	"	A/a	0.35																
11830-880	"	A/a	0.41																
11890-940	"	A/a	0.36																
11950-12000	"	A/a+mnr SH, mod brn	0.48																
12010-060	"	A/a	0.45	450	11	78	0.4	<100											
12070-120	"	SH, med gy+10% SH, dk gy+mnr CLYST, a/a	0.72																
12130-180	"	SH, gn-gy+20% SH, med gy/dk gy+mnr CLYST, a/a	0.56	448	15	52	0.3	100											
12190-240	"	A/a	0.54																
12250-300	"	SH, a/a+10% SH, a/a+10% CLYST a/a	0.56																
12310-360	"	SH, med-dk gy+10% SH, dk gn-gy+10% CLYST, a/a	0.51																
12370-420	"	SH, a/a+20% SH, a/a+mnr CLYST, a/a	0.44																
12430-480	"	SH, a/a+20% SH, a/a+mnr SH, mod brn+10% CLYST, a/a	0.51																
12490-540	"	SH, a/a+30% SH, a/a+mnr SH, a/a+mnr CLYST, a/a	0.58																
12550-600	"	SH, dk gy+30% SH, gn-gy+10% CLYST, lt brn-gy	0.47																
	P	SH, dk gy	0.44																

TABLE 2 c Chemical Analysis Data

GENERAL DATA			CHEMICAL ANALYSIS DATA															
SAMPLE DEPTH (FEET)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION									
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS (ppm)	ALKANES % OF HYDRO-CARBONS					
12610-660	Ctgs	SH, gn-gy+40% SH, dk gy+mnr CLYST, lt brn-gy	0.60															
12670-720	"	SH, a/a+20% SH, a/a+20% CLYST a/a	0.68	455	16	59	0.2	100										
12730-780	"	SH, a/a+30% SH, a/a+10% CLYST a/a	0.67															
12790-840	"	SH, a/a+10% SH, a/a+mnr SH, mod brn+mnr CLYST, a/a	0.67															
	P	SH, dk gy	1.22	445	33	10	0.3	400										
12850-900	Ctgs	SH, gn-gy+30% SH, a/a+10% SH, mod brn+10% CLYST, a/a	0.61															
	P	SH, dk gy	1.20	451	16	8	0.4	200										
12910-960	Ctgs	SH, gn-gy+40% SH, a/a+10% SH, mod brn+10% CLYST, a/a	0.58	*	9	36	0.5	<100										
	P	SH, dk gy	0.95	454	17	7	0.4	200										
12970-13020	Ctgs	SH, med gy+30% SH, gy-blk+mnr SH, gy-brn+mnr CLYST, pnk-gy	0.64															
	P	SH, gy-blk	1.46	440	21	11	0.3	300										
13030-080	Ctgs	SH, med gy+30% SH, a/a+mnr SH, gy-brn+mnr CLYST, a/a	0.69	*	6	13	0.4	<50										
13090-140	"	A/a	0.67	*	8	33	0.4	<100										
	P	SH, gy-blk	0.99	*	7	10	0.5	100										
13150-200	Ctgs	SH, med gy+40% SH, a/a+mnr SH gy-brn+mnr CLYST, a/a	0.62															
13210-260	"	SH, a/a+30% SH, a/a+mnr SH, a/a+mnr CLYST, a/a	0.63															
	P	SH, gy-blk	1.40	445	8	11	0.5	100										
13270-320	Ctgs	SH, med gy+40% SH, a/a+mnr SH, gy-brn+mnr CLYST, a/a	0.79	450	14	47	0.5	100										
	P	SH, gy-blk	1.69	450	8	7	0.5	100										
13330-380	Ctgs	SH, med gy+40% SH, a/a+mnr SH gy-brn+mnr CLYST, a/a	0.91	456	20	31	0.4	200										
	P	SH, gy-blk	1.60	456	3	2	0.5	<100										
13390-440	Ctgs	SH, med gy+30% SH, a/a+mnr SH gy-brn+mnr CLYST, a/a	0.94	455	22	33	0.2	200										
	P	SH, gy-blk	0.83															
13450-500	Ctgs	SH, med gy+30% SH, a/a+mnr SH gy-brn+mnr CLYST, a/a	0.91	453	44	48	0.2	400										
	P	SH, gy-blk	1.27	455	7	4	0.4	100										

TABLE 2 D Chemical Analysis Data

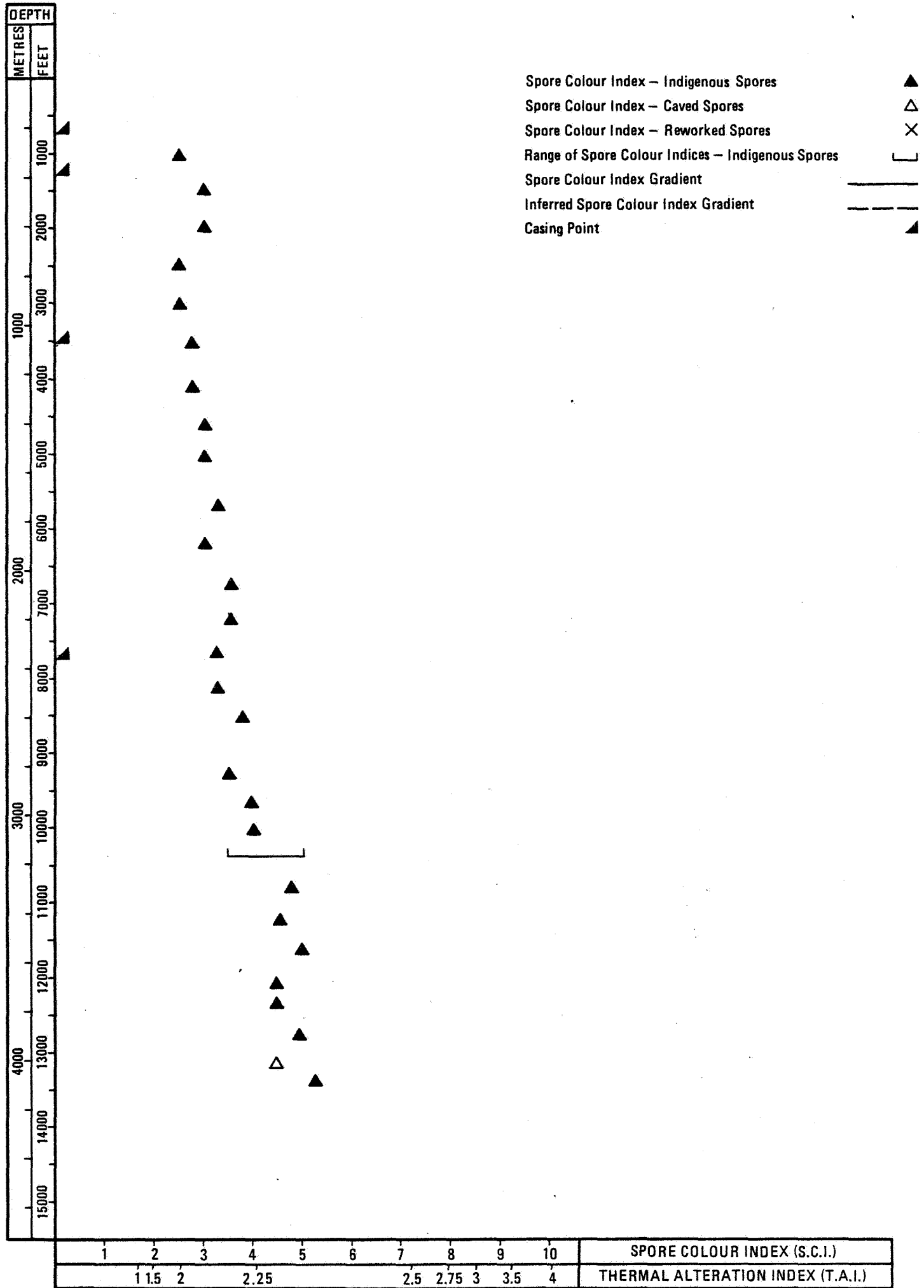


FIGURE 1 Spore Colour Indices against Depth

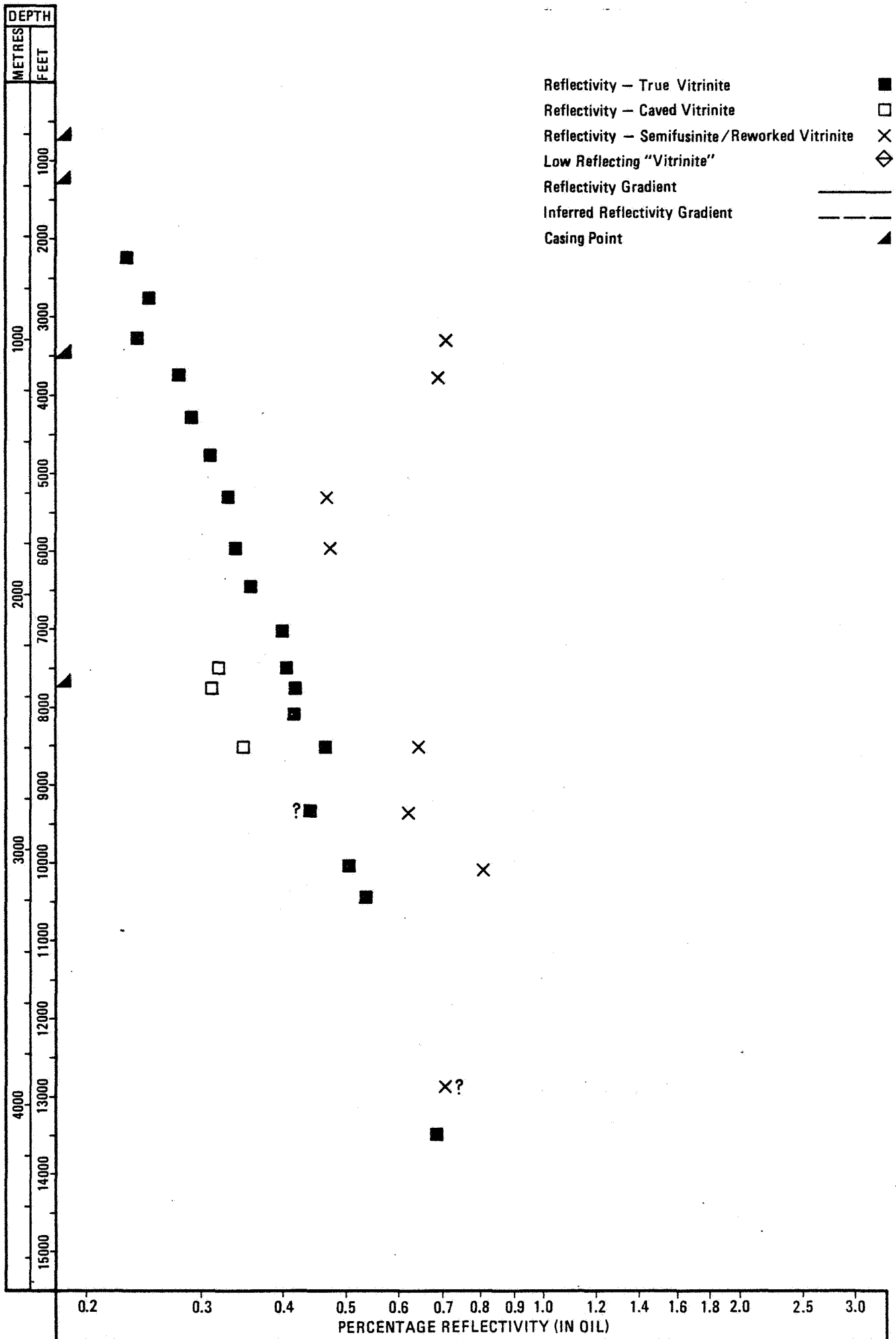


FIGURE 2 Vitrinite Reflectivity against Depth

ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY II STUDY - PRELIMINARY REPORT G8 (25/2/81)

PRELIMINARY PETROLEUM GEOCHEMISTRY RESULTS OF 35/3-1 WELL

SUMMARY

The analysed section is mature for oil generation between 3940m and 4475m (T.D.) but contains no significant oil source rocks. Traces of hydrocarbons in which the alkanes have a mature, crude oil-like distribution are present in the analysed samples between 4180m and 4430m, but these are considered to have migrated as they are incompatible with the indigenous kerogens.

GENERAL COMMENTS

Well status: Plugged and abandoned, gas shows.

Drilling data: Drilled with sea water/gel to 969m, gypsum/lignosulphonate mud to 2474m and sea water/lignosulphonate mud to 4475m (T.D.). The interval 3245m to 3835m was turbo-drilled. Casing points at 505m (30"), 969m (20"), 2465m (13 $\frac{3}{8}$ "), 4180m (9 $\frac{5}{8}$ "). BHT 208°F at 4202m and 260°F at 4475m (T.D.).

Interval analysed: 710m to 4475m (T.D.).

Age of analysed interval: Middle Jurassic to Tertiary.

Sample type and quality: 165 composite and spot ditch cuttings samples. Sample quality was fair.

Maturation data quality: Good throughout the section except the interval between 3245m and 3835m which was turbo-drilled.

Source rock data quality: Good.

Gas chromatography run at: 3950m-3980m, 3983m-4010m, 4013m-4040m, 4180m-4210m, 4253m-4260m, 4273m-4280m, 4343m-4360m, 4363m-4380m, 4403m-4430m.

MATURATION (Table 1; Figures 1 and 2)

Between 710m and 3210m, the maturation parameters show a progressive increase, from spore colour index 2-2.5 and (interpreted) vitrinite reflectivity 0.27% up to spore colour index 4 and vitrinite reflectivity 0.53%. No reliable maturity data exist between 3245m and 3835m because of turbo-drilling, but between 3835m and 4475m (T.D.) there is a more rapid rate of increase in maturation than in the upper part of the section; spore colour indices increase from 5.5 up to 7-7.5, and vitrinite reflectivity values increase from 0.64% up to 0.76% (interpreted) with increasing depth. These levels of thermal maturity are

in accord with the B.H.T. data of 208°F at 4202m and 260°F at 4475m (T.D.).

The section is considered to be immature to a depth of 1850m and early mature below this depth, at least to 3210m, such that any oil-prone kerogen present may yield only minor quantities of hydrocarbons. Between 3940m and 4475m (T.D.), the section is middle mature, such that optimal oil generation may be expected from any oil-prone kerogen in this part of the section.

OIL SOURCE ROCKS

There are no significant oil source rocks within the analysed section.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2)

The Jurassic section analysed between 4147m and 4475m (T.D.) contains average amounts of organic carbon and, for the level of thermal maturity, apparently fair to good pyrolysis yields. However, the kerogen composition is considered to be humic rather than oil-prone, so that no oil generation may be expected from these sediments regardless of maturity. At its present level of thermal maturity, traces of gas may be generated from this interval, improving to minor gas generation at optimum maturity levels. It is possible that the gas traces recorded on the well logs at 4142m, 4220m, 4225m and 4249m are indigenous to these horizons.

Below average to average organic carbon contents are recorded for the shales of the Cretaceous section analysed between 1580m and 4145m. However, as in the underlying Jurassic rocks, the kerogen composition is humic - in this case predominantly inertinitic - and even the richer horizons yield only insignificant quantities of hydrocarbons as measured by pyrolysis analysis. These horizons exhibit no hydrocarbon generating potential, regardless of thermal maturity.

Minor oil traces are noted in the well log at various horizons between 3890m and 4056m. Gas chromatography analysis of the alkane fractions of material extracted from samples at 3950m-3980m, 3983m-4010m and 4013m-4040m, indicates the presence of possibly significant quantities of migrant oil. The alkane distributions show a rather narrow range of normal alkanes superimposed on a poorly resolved background of polycyclic alkanes, suggestive of a mixture of two oils, one of which is biodegraded. In this interval the mud log records the presence of 'dead' oil.

The samples analysed by gas chromatography between 4180m-4210m and 4430m contain traces of hydrocarbons in which the alkanes have typically high maturity, crude oil-like distributions. The lack of potential source rocks in this interval however, indicates that they are migrated hydrocarbons.

SAMPLE DEPTH (METRES)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)					
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL		
710	Ctgs	SND, crs, glc	2-2.5		*	*	*						
790	"	SLTST, ol-gy	2.5	0.21(20)	15	65	20						
860-880	"	A/a	2.5-3	0.23(24)	10	80	10						
940-960	"	A/a	3.5	0.25(25)	20	70	10						
1040-050	"	SND, crs+mnr SH, med-dk gy	2.5-3	0.24(23)	10	80	10						
1110-120	"	A/a	3-3.5	0.27(24)	15	50	35						
1180-1190	"	A/a	*		*	*	*						
1240-260	"	A/a	3	0.27(20)	15	65	20						
1310-340	"	COAL		0.30(29)									
1320-330	"	SND, a/a+mnr SH, a/a	3	0.32(20)	20	60	20						
1410	"	SH, med gy/gn-gy	3	0.30(20)	30	15+45	10						
1500	"	A/a	3	0.31(19)	50	40	10						
1590	"	A/a	2.5-3.5	0.33(8)	20	10+45	25						
1680	"	A/a	3	0.34(10); 0.22(6)	50	40	10						
1770	"	A/a	3-4	0.34(3)?	40	50	10						
1860	"	A/a	3.5	*	60	40	mnr						
1950	"	A/a	3.5-4.5	0.28(6)?	60	35	5						
2040	"	A/a	3.5	0.39(1)	80	10	10						
2130	"	A/a	3.5	*	80	10	10						
2220	"	A/a	3.5	0.36(2)	90	10	mnr						
2310	"	A/a	3.5	0.38(6)	80	10	10						
2400	"	A/a	3.5	*	70	20	10						
2490	"	A/a	3	0.42(5)	80	10	10						
2580	"	A/a	3.5	0.39(5)	70	30	*						
2670	"	A/a	3.5-4	*	70	25	5						
2760	"	A/a	3.5-4	0.50(9)	70	30	mnr						
2850	"	A/a	3.5-4	0.49(10)	20	70	10						
2940	"	A/a	3.5	0.51(6)	30	70	mnr						
3030	"	A/a	3.5-4	0.48(15)	20	80	*						
3070-097	"	SH, slty, med gy+ mnr SH, med-dk gy						25	75	*	*		
3120	"	SST, yel-gy+mnr SH, med gy	3.5-4	*	20	80	*						
3210	"	A/a	4	0.51(21)	20	70	10						
3300	"	SH, med-dk gy	3	*	10	90	*						
3340-367	"	SH, a/a, slty						95	5	*	*		
3370-417	"	A/a						90	10	*	*		
3390	"	A/a	*	*	20	75	5						
3420-447	"	A/a						95	5	*	*		

TABLE 1 A Maturity and Kerogen Data

SAMPLE DEPTH (METRES)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)			
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL
3450-477	Ctgs	SH, med-dk gy, silty						95	25	*	*
3480-507	"	A/a	3.5?	*	20	80	*	95	25	*	*
3510-537	"	A/a						95	25	*	*
3570-597	"	A/a	*	*	10	90	*	95	25	*	*
3660	"	A/a	*	*	10	90	*				
3750	"	A/a	4	0.65(4)	70	30	*				
3750-777	P	A/a						75	25	*	*
3780-807	Ctgs	SH, a/a+30% SH, med gy						90	10	*	*
3810-837	P	SH, silty, med-dk gy						80	20	*	*
3940	Ctgs	SND, crs+SH, dk gy	4-4.5	0.65(14)	90	10	*				
4050	"	A/a		*							
4080-117	"	SH, med-dk gy+20% SH, med gy+10% SST, yel-gy						90	10	*	*
4100	"	SND, crs+SH, dk gy	5.5	0.73(12); 0.59(2); 0.81(19)	90	10	*				
4120-145	"	SH, med-dk gy+20% SH, med gy						90	10	*	*
4147	"	SST, brn-gy+SH, med-dk gy	5.5	0.71(19); 0.56(11)	50	50	*				
4157	"	A/a	5.5	0.70(14); 0.48(12)	70	30	*				
4157-165	"	SH, a/a+20% SH, med gy						75	25	*	*
4167-175	"	SH, a/a+30% SH, a/a						80	20	*	*
4177-185	"	SH, a/a+20% SH, a/a						70	30	*	*
4187	"	SST, brn-gy+SH, med-dk gy	6	0.70(21)	80	20	*				
4187-195	"	SH, med-dk gy+20% SH, med gy+10% SST, yel-gy						65	35	*	*
4197-205	"	SH, a/a+20% SH, med gy						65	35	*	*
4200-215	"	COAL		*							
4207-215	"	SST, brn-gy+10% SH, med-dk gy						75	25	*	*
4217-225	"	A/a						80	20	*	*
4230-233	"	SST, a/a+30% SH, a/a						75	25	*	*
4237-245	"	SST, a/a+10% SH, a/a						65	35	*	*
4247-255	"	SST, a/a+20% SH, a/a	6	0.70(13)	60	40	mnr	60	40	*	*

TABLE 1 B Maturity and Kerogen Data

SAMPLE DEPTH (METRES)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%) (by microscopic examination)			KEROGEN COMPOSITION (%) (by calculation from pyrolysis data)			
					INERTINITE	VITRINITE	SAPROPEL	INERTINITE	VITRINITE	ALGAL SAPROPEL	WAXY SAPROPEL
4257-265	Ctgs	SST, brn-gy+10% SH, med-dk gy						65	35	*	*
4267-275	"	SST, a/a+40% SH, a/a						60	40	*	*
4277-283	"	SST, a/a+20% SH, a/a						55	45	*	*
4287-295	"	SST, a/a+10% SH, a/a+tr COAL						80	20	*	*
4297	"	COAL		*							
4297-305	"	SST, a/a+20% SH, a/a+10% COAL						70	30	*	*
4307	"	SST, a/a+SH, a/a	7	0.67(14); 0.53(6)	40	60	*				
4307-315	"	SST, a/a+20% SH, a/a+10% COAL						60	40	*	*
4317-325	"	SST, a/a+20% SH, a/a+mnr COAL						70	30	*	*
4320	"	COAL		*							
4327-335	"	SST, a/a+10% SH, a/a+mnr COAL						70	30	*	*
4337-345	"	A/a						70	30	*	*
4347-355	"	SST, a/a+20% SH, a/a+mnr COAL						65	35	*	*
4357-365	"	SST, a/a+30% SH, a/a						55	45	*	*
4367-375	"	SST, a/a+10% SH, a/a	6.5	*	30	70	*	70	30	*	*
4370-375	"	COAL		*							
4377-385	"	SST, a/a+10% SH, a/a						70	30	*	*
4387-395	"	SST, a/a+30% SH, a/a						75	25	*	*
4397-405	"	SST, a/a+20% SH, a/a						80	20	*	*
4407-415	"	SST, a/a+30% SH, a/a						80	20	*	*
4417-425	"	SST, a/a+20% SH, a/a						80	20	*	*
4427-435	"	A/a	7	*	10	90	*	80	20	*	*
4437-445	"	SST, a/a+10% SH, a/a						80	20	*	*
4447-455	"	A/a						80	20	*	*
4457-465	"	A/a						80	20	*	*
4467-475	"	A/a						75	25	*	*
4475	"	A/a	7-7.5	*	20	75	5				

TABLE 1 c Maturity and Kerogen Data

GENERAL DATA			CHEMICAL ANALYSIS DATA											
SAMPLE DEPTH (METRES)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION					
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS		ALKANES % OF CARBONS
												mg/gg OF ORGANIC CARBON	% OF EXTRACT	
1350-370	Ctgs	MARL, gn-gy+10% SLTST/SH, ol-gy+10% SND	0.68											
1380-1400	"	MARL, a/a+mnr SLTST/SH, a/a+10% SND+mnr COAL+mnr SH, red	0.31											
1410-435	"	SND, crs+15% SLTST/SH, a/a+mnr SLTST, lt brn	0.25											
1470-495	"	SH, slty, gn-gy/lt gn-gy+15% SH, slty, med gy	0.67											
1500-525	"	SH, a/a+10% SH, a/a	0.68											
1530-550	"	SH, slty, med gy+10% SH, slty, gn-gy	0.59											
1560-585	"	SND, crs+40% SH, slty med gy	0.46											
1590-617	"	SH, slty, ol-gy+10%LST, wht+mnr SH, a/a	0.64											
1620-645	"	SH, slty, ol-gy+10% LST, a/a	0.70											
1650-675	"	SH, med gy+mnr SH, gn-gy+mnr SH, red-gy	0.67											
1680-715	"	A/a	0.76											
1720-745	"	A/a	0.65											
1750-775	"	A/a	0.66											
1780-805	"	A/a	0.70											
1810-835	"	A/a	0.69											
1840-865	"	A/a	0.72											
1870-895	"	A/a	0.67											
1900-925	"	A/a	0.70											
1930-955	"	A/a	0.68											
1960-985	"	A/a	0.45											
1990-2015	"	A/a	0.67											
2020-047	"	A/a	0.71											
2050-077	"	A/a	0.62											
2080-107	"	A/a	0.61											
2110-137	"	A/a	0.71											
2140-167	"	SH, slty, med gy+mnr SH, gn-gy	0.70											
2170-197	"	A/a	0.77											
2200-227	"	SH, a/a+10% SH, a/a	0.77											
2230-257	"	A/a	0.78											
2260-287	"	A/a	0.78											
2290-317	"	SH, slty, med gy	0.75											
2320-347	"	A/a	0.80											

TABLE 2 A Chemical Analysis Data

WELL: 35/3-1

GENERAL DATA			CHEMICAL ANALYSIS DATA										
SAMPLE DEPTH (METRES)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION				
				TEMP - °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS	
											mg/gf ORGANIC CARBON	% OF EXTRACT	
2350-377	Ctgs	SH, slty, med gy	0.73										
2380-407	"	A/a	0.70										
2410-437	"	A/a	0.70										
2440-467	"	A/a	0.67										
2470-497	"	A/a	0.85										
2500-527	"	A/a	0.63										
2530-557	"	A/a	0.69										
2560-587	"	A/a	0.84										
2590-617	"	A/a	0.74										
2687-707	"	A/a	0.64										
2710-737	"	A/a	0.52										
2740-767	"	A/a	0.60										
2770-795	"	A/a	0.59										
2800-827	"	A/a	0.63										
2830-857	"	A/a	0.64										
2860-887	"	SH, a/a+10% SH, med-dk gy	0.72										
2890-917	"	SH, a/a+mnr SH, a/a	0.80										
2920-947	"	SH, a/a+10% SH, a/a	0.74										
2950-977	"	SH, a/a+30% SH, a/a	0.72										
	P	SH, slty, med-dk gy	0.71										
2980-3007	Ctgs	SH, slty, med gy+40% SH, a/a	0.57										
3010-037	"	SH, a/a+30% SH, a/a	0.64										
	P	SH, slty, med-dk gy	0.87										
3040-067	Ctgs	SH, slty, med gy+20% SH, a/a	0.93										
3070-097	"	SH, a/a+mnr SH, a/a	1.02	428	41	167	*	400					
3100-127	"	SH, a/a+30% SH, a/a	0.95										
3130-155	"	SH, a/a+mnr SH, a/a	0.74										
3160-187	"	SH, a/a+30% SH, a/a	0.71										
	P	SH, slty, med-dk gy	0.64										
3190-217	Ctgs	SH, slty, med gy+40% SH, a/a	0.67										
3220-247	"	SH, a/a+30% SH, a/a	0.99										
3250-277	"	SH, slty, med-dk gy	0.93										
3280-307	"	A/a	0.90										
3310-337	"	A/a	0.98										
3340-367	"	A/a	0.92	*	10	53	*	100					
3370-417	"	A/a	1.05	430	21	62	*	200					

TABLE 2 B Chemical Analysis Data

GENERAL DATA			CHEMICAL ANALYSIS DATA														
SAMPLE DEPTH (METRES)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION								
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	ORG/OF ORGANIC CARBON	% OF EXTRACT	ALKANES % OF HYDRO-CARBONS			
3420-447	Ctgs	SH, slty, med-dk gy	0.89	*	*	72	*	*									
3450-477	"	A/a	1.01	*	*	82	*	*									
3480-507	"	A/a	0.99	*	*	58	*	*									
3510-537	"	A/a	1.04	*	10	59	*	100									
3540-567	"	A/a	0.91														
3570-597	"	A/a	0.82	*	10	73	*	100									
3600-627	"	A/a	0.83														
	P	SH, slty, med-dk gy	0.85														
3630-657	Ctgs	A/a	0.80														
3660-687	"	A/a	0.83														
3690-717	"	A/a	0.80														
3720-747	"	A/a	0.84														
3750-777	"	A/a+20% SH, med gy	0.92														
	P	SH, slty, med-dk gy	0.95	436	39	28	0.07	400									
3780-807	Ctgs	SH, slty, med-dk gy+30% SH, med gy	0.97	423	10	66	*	100									
3810-837	"	SH, a/a+20% SH, a/a	0.95														
	P	SH, slty, med-dk gy	1.42	436	33	11	0.09	500									
3843-850	Ctgs	SH, a/a+20% SH, med gy+40% SST, yel-gy	0.63														
3950-980	"	SND+10% SH, dk gy	-														
3983-4010	"	A/a	-														
4000-017	"	SST, a/a+20% SH, med-dk gy+10% COAL	0.37														
4013-040	"	SND+20% SH, dk gy	-														
4020-047	"	SST, a/a+10% SH, a/a+10% COAL	0.41														
4050-077	"	SH, a/a+30% SH, med gy+10% SST, a/a	0.87														
4080-117	"	SH, a/a+20% SH, a/a+10% SST, a/a	1.02	424	12	34	0.2	100									
	P	SH, med-dk gy	1.69	434	13	8	0.2	200									
4120-145	Ctgs	SH, a/a+20% SH, med gy+mnr SST, a/a	1.36	*	15	65	0.2	200									
4147-155	"	SH, a/a+10% SH, a/a+10% SST, a/a+tr COAL	0.97														
4157-165	"	SH, a/a+20% SH, a/a+mnr SST, a/a	1.16	437	38	73	0.2	400									
4167-175	"	SH, a/a+30% SH, a/a+mnr SST, a/a	1.43	441	33	59	0.3	500									
4177-185	"	SH, a/a+20% SH, a/a+mnr SST, a/a	1.49	425	43	84	0.3	600									

TABLE 2 c Chemical Analysis Data

GENERAL DATA			CHEMICAL ANALYSIS DATA																			
SAMPLE DEPTH (METRES)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION													
				TEMP - ERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS mg/g OF ORGANIC CARBON	% OF EXTRACT	ALKANES % OF HYDRO-CARBONS								
4180-210	Ctgs	SH, dk gy, mic+SST, v pale orng After Extraction	-																			
	P	SH, dk gy	2.32	450	52	50	0.01	1200														
4187-195	Ctgs	SH, med-dk gy+20% SH, med gy +10% SST, yel-gy	1.46	450	50	72	0.3	700														
4197-205	"	SH, a/a+20% SH, a/a+mnr SST, a/a	2.24	440	54	52	0.2	1200														
4207-215	"	SST, brn-gy (oil stained)+10% SH, med-dk gy	3.89	445	38	84	0.1	1500														
4213-240	"	SH, dk gy+SST, v pale orng After Extraction	-																			
	P	SH, dk gy	2.61																			
	P	SH, dk gy	2.51	453	50	32	0.2	1300														
4217-225	Ctgs	SST, brn-gy (oil stained)+10% SH, med-dk gy	3.98	442	28	102	0.3	1100														
4230-233	"	SST, a/a+30% SH, a/a	2.06	446	41	74	0.3	900														
	P	SH, med-dk gy	3.16	*	77	8	0.2	2400														
4237-245	Ctgs	SST, a/a+10% SH, a/a	4.15	449	50	90	0.1	2100														
4240-250	"	SH, a/a+SND+SST, v pale orng	-																			
	P	SH, med-dk gy	2.00																			
4247-255	Ctgs	SST, brn-gy (oil stained)+ 20% SH, a/a	2.08	449	55	75	0.2	1100														
4253-260	"	SH, a/a+SST, v pale orng	-																			
4257-265	"	SST, brn-gy (oil stained)+10% SH, a/a	1.74	449	52	65	0.3	900														
4263-270	"	SH, a/a+SST, v pale orng	3.23																			
4267-275	"	SST, brn-gy (oil stained)+10% SH, a/a	2.06	446	57	58	0.3	1200														
	P	SH, med-dk gy	2.78	440	62	10	0.2	1700														
4273-280	Ctgs	SH, a/a+SST, v pale orng	-																			
4277-283	"	SST, brn-gy (oil stained)+20% SH, a/a	2.21	447	65	44	0.3	1400														
4287-295	"	SST, a/a+10% SH, a/a+tr COAL	3.01	448	26	80	0.2	800														
4297-305	"	SST, a/a+20% SH, a/a+10% COAL	2.25	*	48	59	0.1	1100														
4300-320	"	SH, dk gy+SND After Extraction	-																			
	P	SH, dk gy	2.81	451	30	60	0.02	800														
	P	SH, dk gy	3.08	450	47	28	0.2	1500														
4307-315	Ctgs	SST, a/a+20% SH, med-dk gy+ 10% COAL	4.37	439	58	93	0.2	2500														
4317-325	"	SST, a/a+20% SH, a/a+mnr COAL	5.43	439	42	110	0.2	2300														
4323-337	"	SH, dk gy+SND	-																			
4327-335	"	SST, brn-gy (oil stained)+10% SH, med-dk gy+mnr COAL	3.33	449	42	89	0.2	1400														
4337-345	"	A/a	4.11	445	42	88	0.2	1700														

TABLE 2 D Chemical Analysis Data

GENERAL DATA			CHEMICAL ANALYSIS DATA										
SAMPLE DEPTH (METRES)	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	PYROLYSIS					SOLVENT EXTRACTION				
				TEMPERATURE °C	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (ppm)	TOTAL EXTRACT (ppm)	HYDRO-CARBONS (ppm)	EXTRACT % OF ORGANIC CARBON	HYDROCARBONS	
					mg/gf ORGANIC CARBON	% OF EXTRACT							
4343-360	Ctgs	SH, dk gy+SND After Extraction	- 4.85	452	33	68	0.02	1600					
4347-355	"	SST, brn-gy (oil-stained)+20% SH, med-dk gy+mnr COAL	4.74	446	54	88	0.2	2600					
4357-365	"	SST, a/a+30% SH, a/a	4.28	*	65	73	0.2	2800					
4363-380	"	SH, dk gy+SND After Extraction	- 3.81	453	27	61	0.03	1000					
4367-375	"	SST, a/a+10% SH, med-dk gy	3.71	445	47	65	0.2	1800					
4377-385	"	A/a	3.24	446	43	65	0.3	1400					
4385-400	"	SH, dk gy+SND	-										
4387-395	"	SST, a/a+30% SH, med-dk gy	4.42	445	35	70	0.2	1500					
4397-405	"	SST, a/a+20% SH, a/a	3.77	446	33	73	0.3	1300					
4403-430	"	SH, dk gy+SND After Extraction	- 2.51										
4407-415	"	SST, a/a+30% SH, med-dk gy	2.66	447	28	70	0.4	800					
4417-425	"	SST, a/a+20% SH, a/a	2.51	*	30	62	0.4	700					
4427-435	"	A/a	2.66	449	27	60	0.4	700					
4437-445	"	SST, a/a+10% SH, a/a	2.80	449	28	47	0.5	800					
4440-470	"	SH, dk gy, mic+SST, v pale orng After Extraction	- 2.70	450	15	61	0.1	400					
	P	SH, dk gy	2.95	455	25	34	0.3	700					
4447-455	"	A/a	2.82	447	32	59	0.5	900					
4457-465	"	A/a	2.53	446	30	65	0.5	800					
4467-475	"	A/a	2.13	446	39	90	0.4	800					

TABLE 2 E Chemical Analysis Data

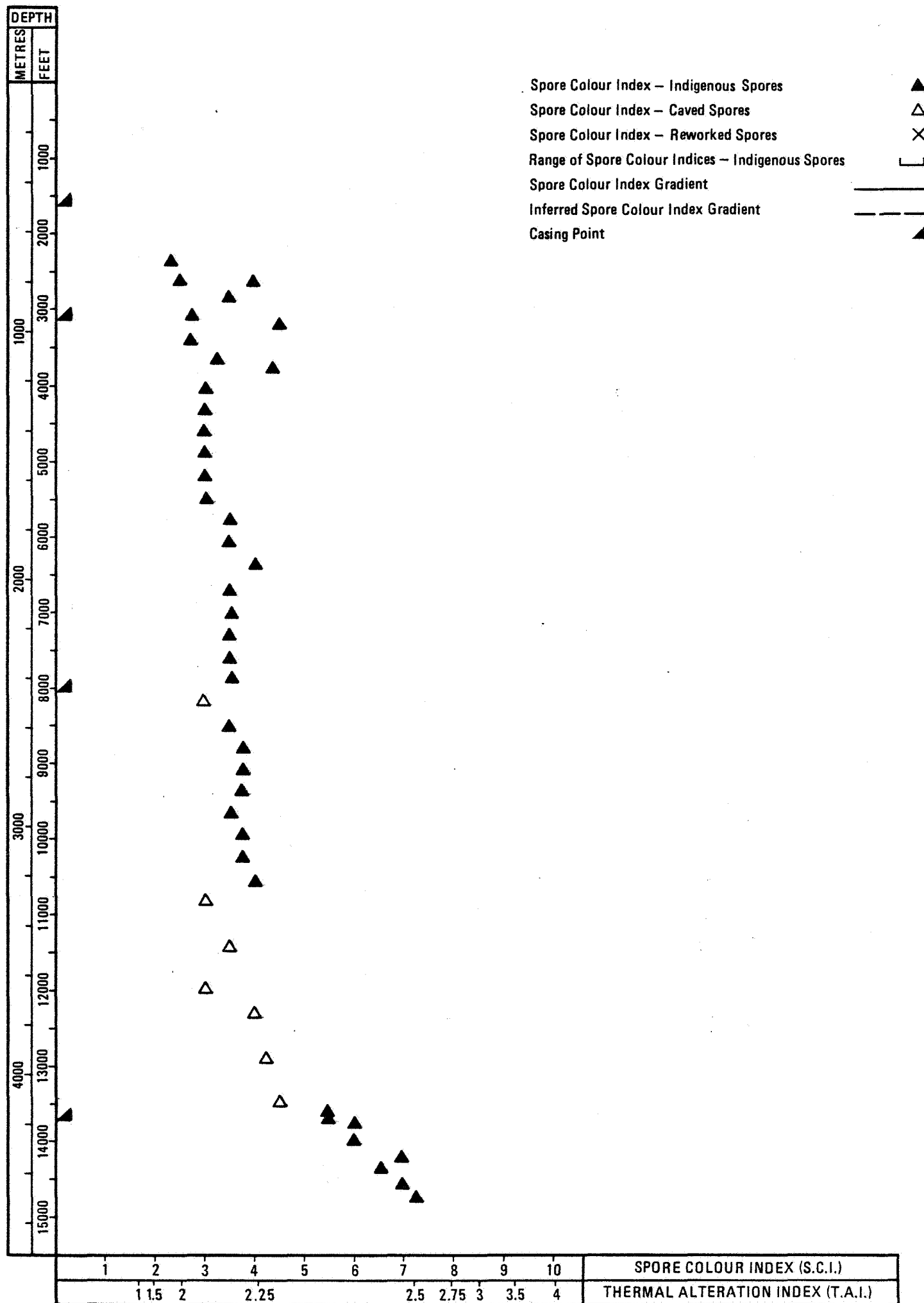


FIGURE 1 Spore Colour Indices against Depth

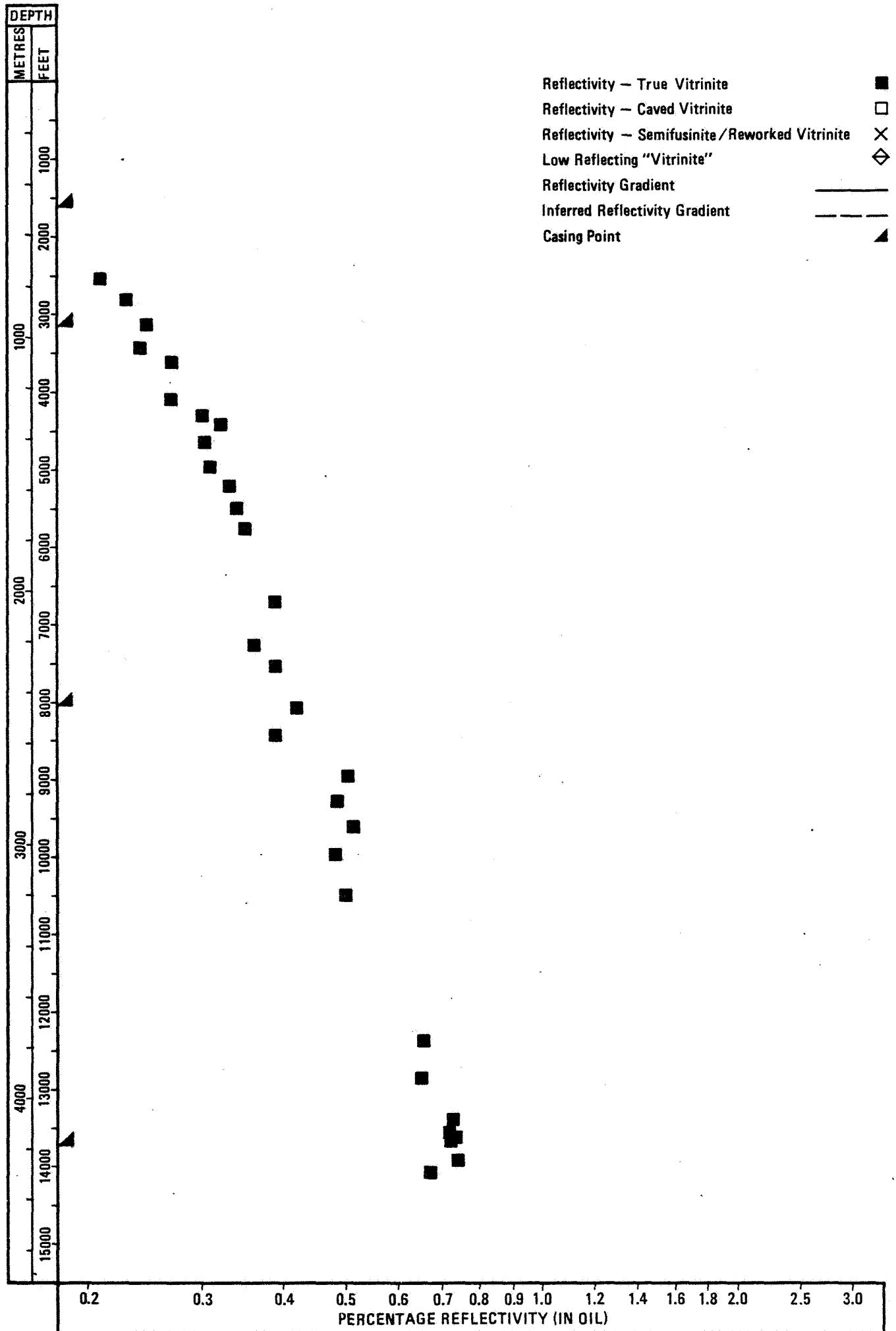


FIGURE 2 Vitrinite Reflectivity against Depth

ROBERTSON RESEARCH INTERNATIONAL LIMITED

NORWAY II STUDY - PRELIMINARY REPORTS B8 TO B10

Project No. RRPS/801/B/2043

PRELIMINARY BIOSTRATIGRAPHIC BREAKDOWNS

OF 33/9-1, 33/9-3 AND 33/12-2 WELLS

FEBRUARY 1981

LIST OF CONTENTS

B8 : 33/9-1

B9 : 33/9-3

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ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY II STUDY - PRELIMINARY REPORT B8 (25/2/81)

PRELIMINARY BIOSTRATIGRAPHIC BREAKDOWN OF 33/9-1 WELL

	<u>Tops (in feet)</u>
Late Cretaceous	7900 (top not seen)
-----Unconformity-----	
Early Cretaceous Barremian - Neocomian	7970 (log)
Early Cretaceous - Late Jurassic Ryazanian - Volgian	8033 (log)
-----Unconformity-----	
Late Jurassic Callovian	8050 (log)
-----?Unconformity-----	
	(Bathonian - late? Bajocian 8083 (log)
Middle Jurassic	(-----?Unconformity-----
	(middle - early Bajocian 8148 (log)
	(Toarcian 8751 (log)
Early Jurassic	(late Pliensbachian 9070
	(Pliensbachian - 9350
	(Sinemurian
Early Jurassic - Late Triassic	9590 (lith)
Triassic	c.10100 (lith) to 10244 T.D.

ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY II STUDY - PRELIMINARY REPORT B9 (25/2/81)

PRELIMINARY BIOSTRATIGRAPHIC BREAKDOWN OF 33/9-3 WELL

	<u>Tops (in feet)</u>
?Pleistocene	1560 (top not seen)
Pliocene	1620
Miocene	2680
-----Unconformity-----	
Oligocene	?3220
Oligocene - ?Eocene	4100
Early Eocene	4800
Late Palaeocene	5453 (log)
-----Unconformity-----	
	(late Maastrichtian 6120
	(
Late Cretaceous	(Maastrichtian - late? 6140
	(Campanian
	(
	(early Campanian 6800
-----Unconformity-----	
Early Cretaceous Barremian - Neocomian	7838 (log)
-----Unconformity-----	
Late Jurassic Callovian	7890 (log)
-----?Unconformity-----	

33/9-3 well continued.....

	<u>Tops (in feet)</u>
	(Bathonian - late? Bajocian 7910 (log)
Middle Jurassic	(-----?Unconformity-----
	(middle - early Bajocian 8028
	(Toarcian 8551 (log)
Early Jurassic	(late Pliensbachian 8860
	(Pliensbachian? - 9120
	(?Sinemurian
Early Jurassic - Late Triassic	9345 (lith)
Triassic	c.9650 (lith) to 9815 T.D.

ROBERTSON RESEARCH INTERNATIONAL LIMITED

Project No. RRPS/801/B/2043

NORWAY II STUDY - PRELIMINARY REPORT B 10 (25/2/81)

PRELIMINARY BIOSTRATIGRAPHIC BREAKDOWN OF 33/12-2 WELL

	<u>Tops (in feet)</u>
Pleistocene	1680 (top not seen)
Pliocene	1800
Miocene	2440
-----Unconformity-----	
Oligocene	3260
Oligocene - ?Eocene	4120
Early Eocene	4580
Late Palaeocene	5475 (log)
-----Unconformity-----	
(late Maastrichtian	6120
(
(Maastrichtian	6160
(
Late Cretaceous (early Maastrichtian	6400
(
(Campanian	6640
(
(?Santonian	7960
-----Unconformity-----	
Early Cretaceous Ryazanian? - ?Volgian	8140 (log)
- Late Jurassic	
-----Unconformity-----	
Late Jurassic ?Callovia	8148 (log)
-----Unconformity-----	

33/12-2 well continued.....

	<u>Tops (in feet)</u>
	8288 (log)
Early Jurassic (Toarcian	
(late Pliensbachian	8390
(Pliensbachian - Sinemurian	8630
Early Jurassic	
- Late Triassic	8861 (lith)
Triassic	
	9681 (lith)
	to 14286 T.D.