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ROBERTSON RESEARCH INTERNATIONAL LIMITED

SECRET

NORWEGIAN OFFSHORE AREA - PRELIMINARY REPORT NO. 2A

Project No. RRI/789/IIB/2676

START OFF. 3

PRELIMINARY RESULTS OF PETROLEUM GEOCHEMICAL STUDIES
OF THE AMOCO NORWAY 2/5-1 WELL

9th JUNE, 1978

se 7/3-1
- biostratigraphic

I

INTRODUCTION

Petroleum geochemical studies have been carried out on samples received from the Amoco Norway 2/5-1 well. The samples were received at 30 feet intervals reducing to 20 and 10 feet intervals from 1530 feet below the 20" casing shoe and were selected for analysis by compositing at 60 feet intervals dependant on lithological and log data. After compositing, samples were washed with cold water as necessary to remove drilling mud, and air dried at 50°C. Representative samples of all the cores taken in the well were available and selected samples have been extracted with dichloromethane to provide oil samples in the oil bearing zone at a sample spacing of approximately 100 feet. A sample of oil has been provided by Amoco Norway and this is currently being analysed. The oil from DST 1 was recovered from an open hole test

of the interval 9981 - 10175 feet.

Relevant drilling information for this well is as follows:-

20" casing	-	1240 feet below K. B.
13 ³ / ₈ " casing	-	5218 feet below K. B.
9 ⁵ / ₈ " casing	-	9988 feet below K. B.
7" liner	-	10912 feet below K. B.
T. D.	-	103030 feet below K. B.

The well was drilled with a normal water-based drilling mud throughout and according to records only minor amounts of diesel were added below the 7" liner at about 11000 feet. According to records, diamond drilling bits were used intermittently between about 11800 and 13030 feet and in addition a very considerable cored interval of approximately 900 feet was cut in the chalk.

The samples were of good quality for geochemical analysis. Compositing was started at 4990 feet so that representative material below the mid-Miocene unconformity has been analysed. The analytical procedures used include organic carbon analysis on all the bulk cuttings samples at 60 feet intervals and also on individual lithologies where bulk samples consisted of more than one lithotype. Extractive source rock analysis has been carried out on samples containing more than 0.5% organic carbon at approximately 250 feet intervals and organic carbon contents have been determined both before and after extraction. Gas chromatographic analysis has been carried out on alkane fractions from samples containing greater than 100 ppm of hydrocarbon. Pyrolysis source rock evaluation using the IFP/Fina ROCK-EVAL apparatus has been carried out on the same samples as used for extractive analysis and also on samples where insufficient material was available for extractive analysis. Kerogen composition has been assessed on a semiquantitative basis by visual estimation of the

kerogen components in unsieved, unoxidised, palynological preparations.

Maturity levels have been assessed in this study using principally spore colouration analysis on sieved unoxidised palynological preparations and vitrinite reflectivity on kerogen concentrates. In assessing maturity level, reference may also be made to the temperatures of maximum pyrolysis rate which give useful indications of maturity level when used in conjunction with the kerogen type.

II

RESULTS AND INTERPRETATION

The results of the various analyses carried out on the 2/5-1 well are presented in Tables 1 to 3 and are represented graphically in Figures 1 to 3. Table 1 lists data on maturity level in the section along with the kerogen composition data for the same samples. The spore colouration and vitrinite reflectivity trends with depth are shown in Figures 1 and 2 respectively. Table 2 lists the organic carbon and extractive source rock evaluation data while pyrolysis data are presented in Table 3. Pyrolysis data are represented graphically against depth in Figure 3. A detailed graphic compilation of all the data will be presented later in the compilation report.

MATURITY DATA

Our assessment of the spore colouration data is that the interval down to about 6500 feet is immature and that the Lower Tertiary sediments below this depth are at an early stage of maturity for oil generation given the presence of oil-prone organic matter (see source rock evaluation). The Lower Cretaceous sediments have not given spore colour data but it is clear that the maturity level in the Lower Cretaceous

is considerably below that recorded in the Upper Jurassic section. This observation is unusual and indicates a marked discontinuity between the Lower Cretaceous and Upper Jurassic which would normally be attributed to a faulted contact or other tectonic feature particularly at such an advanced maturity level as is present in the Jurassic.

Vitrinite reflectivity data give a trend rising from about 0.3% at 5000 feet to about 0.55% at the base of the Tertiary. A value of 0.35%, which we consider can indicate the onset of maturity for oil generation in a Tertiary basin, is reached at about 6500 feet. The reflectivity level in the Lower Cretaceous/Upper Jurassic interval is poorly defined as no clearly identified vitrinite was seen in this interval. Some kerogen concentrates contain concentrations of very small particles of organic matter which had a reflectivity of around 1% to 1.4% particularly between 12000 and 12780 feet. Below 12780 feet tabular shaped organic fragments were seen with similar reflectivity values of 1 to 1.1% but small wisp-like fragments with reflectivity values of 0.6% to 0.8% were also seen in these samples. It seems likely, particularly in view of the other data obtained, that some of the fine grained material at high reflectivity was sapropelic in origin, and on this assumption it is likely that little significant oil generating potential remains.

HYDROCARBON SOURCE POTENTIAL DATA

On the basis of the geochemical data obtained, the following breakdown of the analysed interval of the 2/5-1 well is made:-

Interval 4990 to 5850 feet	-	Average to slightly above average carbon content but immature on-structure. Kerogen is dominantly humic and particularly is vitrinitic. No source potential. Evidence of contamination by migrant oil.
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Interval 5850 to 8900 feet

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Above average organic content and immature to early mature on-structure. Organic matter is again predominantly humic and vitrinitic. No significant hydrocarbon source potential at present but possibility of minor gas generation. Contamination by minor amounts of migrant oil is common.

Interval 8900 to 9940 feet

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About average carbon content but predominantly humic (vitrinitic) organic matter. Minor gas potential on-structure. Contamination by minor amounts of migrant oil is present in all the samples selected for extractive analysis.

Interval 9950 to 11930 feet

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Chalk - organically lean. Not analysed in detail. Chalk is an oil reservoir in this well and oils extracted from core chips and from DST-1 are being analysed.

Interval 11940 to 12630 feet

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Samples in this interval were of variable quality. Abundant caving of chalk is recognised while the in situ lithology is not clear. Pale brown marls, grey-red shale, light through to dark grey shales and occasional light grey sandstone are present. Organic carbon contents are widely variable and migrant oil contamination

Interval 12640 to 13030 feet

has been observed. It is considered that there is little significant hydrocarbon generating potential in this interval.

- This interval is represented predominantly by medium to dark grey shales with caved chalk and marl also present. The organic carbon content is above average. The organic matter seems to be of a sapropelic origin but is now at an advanced stage of maturity and little hydrocarbon generating potential remains. There are significant amounts of contaminant hydrocarbons indicated both by extractive source rock analysis and by very high pyrolysis production indices.

TABLE 1a MATURITY EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%)		
					INERTINITE	VITRINITE	SAPROPEL
5140-200	Ctgs	Ol-gy sh	3	*	35	60	5
5200-250	"	Ditto	-	0.35(4)?	-	-	-
5430-490	"	Ditto	3	*	5	90	5
5550-610	"	Ditto	-	0.28(23)	-	-	-
5670-730	"	Ditto	2.5-3	0.27(3)	5	90	5
5850-910	"	Ditto	-	0.31(9)	-	-	-
5970-6030	"	Ol-gy/med-dk gy sh	3	0.34(3)	5	90	5
6270-330	"	Ol-gy/gn-gy sh	3	*	5	90	5
6570-630	"	Dk gy sh	3.5	0.37(10)	5	90	5
6840-900	"	Med-dk gy sh	3-3.5	0.36(6)	15	80	5
6910-960	"	Ditto	-	0.35(28)	-	-	-
7080-140	"	Dk gy sh	3	0.40(12)	15	80	5
7200-230	"	Brn-gy sh	-	0.39(24)	-	-	-
7410-470	"	Ol-gy sh	3.5-4	0.42(10)	15	80	5
7470-530	"	Ditto	-	0.40(25)	-	-	-
7710-770	"	Lt ol-gy sh	3.5-4	0.40(16)	50	30	20
8000-060	"	Ditto+20% dk gy sh	4	0.46(4)	15	80	5
8120-180	"	Gn-gy sh	-	0.38(20); 0.52(9)	-	-	-
8240-300	"	Lt ol-gy sh	3.5-4	0.44(17)	15	80	5
8540-600	"	Ditto	-	0.47(7)	-	-	-
8600-660	"	Med-dk gy sh	3.5	*	15	80	5
8900-960	"	Lt ol-gy sh	4	0.46(1)	15	80	5
9020-080	"	Ditto	-		-	-	-
9260-320	"	Ditto	-	0.45(11)	-	-	-
9320-380	"	Ditto	-	0.41(26)	-	-	-
9570-630	"	Ditto	4.5	0.51(2)	-	-	-
9710-770	"	Ditto	-	0.49(7); 0.59(29)	-	-	-
9850-940	"	Ol-gy/med-dk gy sh	*	0.53(6)	15	85	*
10160	Core	Chk	*	*	*	*	*
10245	"	Ditto	*	*	*	*	*
11940-12000	Ctgs	Chk+marl	-	1.39(2)?	-	-	-
12080-140	"	Marl+chk	-	0.53(3)?	-	-	-

TABLE 1b MATURITY EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET)	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R _{av} %	KEROGEN COMPOSITION (%)		
					INERTINITE	VITRINITE	SAPROPEL
12220-280	Ctgs	Chk+marl	*	*	50	50	*
12290-350	"	Chk+mmr sh	-	0.55(1); 1.13(5)?	-	-	-
12500-560	"	Chk+60% gy sh	*	*	50	50	*
12640-700	"	Med-dk gy sh	8	*	*	*	100?
12710-770	"	Ditto	-	1.07(1)?	-	-	-
12780-840	"	Dk gy slty sh	8	0.62(2); 0.83(1)?	*	*	100?
12920-980	"	Ditto	-	1.24(10)?	-	-	-
12990-13030	"	Ditto	8	*	*	*	100?

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SOURCE ROCK EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH FEET OR NOTATION	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	TOTAL EXTRACT P.P.M.	EXTRACT % OF ORGANIC CARBON	HYDRO- CARBONS P.P.M. OF ROCK	HYDRO- CARBONS % OF EXTRACT	TOTAL ALKANE % HYDRO CARBON
4990- 5050	Ctgs	Pale brn sltst+40% ol-gy sh	2.34					
5080- 140	"	Ditto+50% ditto	2.50					
5140- 200	"	Ol-gy sh+mnr pale brn sltst	1.40					
5200- 250	"	Ditto+ditto	1.35					
5250- 310	"	Ditto+ditto+drilling mud	1.31					
5310- 370	"	Ditto+ditto+ditto	1.43					
5370- 430	"	Ditto+ditto+ditto	1.53					
5430- 490	"	Ol-gy sh+mnr med gy sh+mnr slt/sltst	1.68					
5490- 550	"	Ol-gy/gn-gy sh+mnr drilling mud	1.36					
5550- 610	"	Ol-gy sh+mnr drilling mud+mnr slt	2.28					
5610- 670	"	Ol-gy sh+mnr slt (Extracted rock)	1.92 2.16	2263	11.8	460	20	67
5670- 730	"	Ol-gy sh	2.23					
5730- 790	"	Ditto	1.72					
5790- 850	"	Ditto	1.83					
5850- 910	"	Ditto+mnr med-dk gy sh	2.11					
5910- 970	"	Ol-gy/med-dk gy sh+ drilling mud	2.62					
5970- 6030	"	Ditto	2.91					
6030- 090	"	Ditto	2.38					
6090- 150	"	Ditto	2.34					
6150- 210	"	Ol-gy/dk gy sh+mnr slt	2.34					
6210- 270	"	Ol-gy/gn-gy/dk gy sh	2.19					
6270- 330	"	Ol-gy/gn-gy sh+mnr dk gy sh	1.83					
6330- 390	"	Ol-gy/gn-gy/dk gy sh	2.16					
6390- 450	"	Med-dk gy sh+40% gn- gy sh	2.15					
6450- 510	"	Ditto+ditto	3.38					
6510- 570	"	Med-dk gy sh+30% gn- gy sh	2.95					

SOURCE ROCK EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET) OR NOTATION	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	TOTAL EXTRACT P.P.M.	EXTRACT % OF ORGANIC CARBON	HYDRO- CARBONS P.P.M. OF ROCK	HYDRO- CARBONS % OF EXTRACT	TOTAL ALKANE % HYDR CARBON
6570- 630	Ctgs	Dk gy sh+mnr med brn lst	2.83					
6630- 690	"	Ol-gy/dk gy sh+mnr med brn lst	2.79					
6690- 750	"	Lt ol-gy/dk gy sh+ mnr med brn lst	2.71					
6780- 840	"	Med-dk gy sh+10% lt ol-gy sh (Extracted rock)	3.25 2.76	3225	9.9	870	27	76
6840- 900	"	Med-dk gy sh+mnr lt ol-gy sh	3.35					
6910- 960	"	Ditto+ditto	3.38					
6960- 7020	"	Ditto+ditto	3.29					
7020- 050	"	Ditto+ditto	3.03					
7080- 140	"	Dk gy sh+mnr lt ol-gy sh	3.51					
7140- 200	"	Ditto+ditto	3.23					
7200- 230	"	Brn-gy sh+mnr lt ol- gy sh	2.93					
7260- 290	"	Ditto+ditto	3.66					
7290- 350	"	Brn-gy sh+mnr lt ol- gy/ol-gy sh	2.69					
7350- 410	"	Ol-gy sh+10% brn-gy sh	2.14					
7410- 470	"	Ditto+10% dk gy sh	2.02					
7470- 530	"	Lt ol-gy/ol-gy sh+ 20% med-dk gy sh (Extracted rock)	1.65 1.91	2490	15.1	980	39	66
7530- 590	"	Ol-gy sh+10% med-dk gy sh	1.96					
7590- 650	"	Lt ol-gy/ol-gy sh+ 15% med-dk gy sh	2.05					
7650- 680	"	Ol-gy sh+10% med-dk gy sh	1.88					
7680- 710	"	Lt ol-gy sh+mnr ol- gy/med-dk gy sh	2.03					
7710- 770	"	Ditto+ditto	1.97					
7770- 830	"	Ol-gy sh+10% med-dk gy sh+mnr lt ol-gy sh (Extracted rock)	2.07 2.35	4375	21.1	1480	34	72
7830- 890	"	Ditto+mnr lt ol-gy/ brn gy/dk gy sh	2.09					

SOURCE ROCK EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET) OR NOTATION	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	TOTAL EXTRACT P.P.M.	EXTRACT % OF ORGANIC CARBON	HYDRO- CARBONS P.P.M. OF ROCK	HYDRO- CARBONS % OF EXTRACT	TOTAL ALKANE % HYDR CARBON
7890- 950	Ctgs	Lt ol-gy sh+10% dk gy sh	2.00					
7950- 8000	"	Ditto+med-dk gy sh	2.40					
8000- 060	"	Ditto	2.57					
8060- 120	"	Gn-gy sh+mnr med-dk gy sh	2.19					
8120- 180	"	Ditto+ditto	2.69					
8180- 240	"	Ditto+10% ditto	2.58					
8240- 300	"	Lt ol-gy sh+mnr med-dk gy sh	2.59					
8300- 360	"	Lt ol-gy/gn-gy sh+20% med-dk gy sh	2.66					
8360- 420	"	Ditto+15% ditto	2.18					
8420- 480	"	Ditto+10% ditto	2.85					
8480- 540	"	Ditto+10% ditto	2.66					
8540- 600	"	Ditto+ditto	2.14					
8600- 660	"	Med-dk gy sh+30% gn-gy sh	3.08					
8660- 720	"	Gn-gy sh+20% med-dk gy sh	2.95					
8720- 780	"	Ditto+30% ditto (Extracted rock)	3.31 3.08	2490	7.5	850	34	59
8780- 840	"	Ditto+ditto	2.68					
8840- 900	"	Lt ol-gy/ol-gy sh+20% med-dk gy sh	2.55					
8900- 960	"	Ditto+ditto	1.97					
8960- 9020	"	Ditto+10% ditto	1.71					
9020- 080	"	Ditto+mnr ditto	1.46					
9080- 140	"	Ditto+ditto	1.74					
9140- 200	"	Ditto+ditto	1.75					
9200- 260	"	Lt ol-gy sh+mnr med-dk gy sh (Extracted rock)	1.49 1.75	2125	14.3	850	40	66
9260- 320	"	Ditto+ditto	1.41					
9320- 380	"	Lt ol-gy sh+10% med-dk gy sh	1.40					
9380- 420	"	Lt ol-gy/gn-gy sh+mnr dk gy sh	1.19					

SOURCE ROCK EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET) OR NOTATION	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	TOTAL EXTRACT P.P.M.	EXTRACT % OF ORGANIC CARBON	HYDRO- CARBONS P.P.M. OF ROCK	HYDRO- CARBONS % OF EXTRACT	TOTAL ALKANE % HYDRO CARBON
9430- 480	Ctgs	Ol-gy sh+mnr med-dk gy sh	1.21					
9500- 560	"	Lt ol-gy sh+mnr gn- gy/ol-gy/dk gy/red- brn sh	1.20					
9570- 630	"	Lt ol-gy sh+20% red- brn sh+mnr ol-gy/gn- gy/dk gy sh (Extracted rock)	1.54 1.32	3240	21.0	1090	34	67
9630- 700	"	Ditto+ditto+ditto	1.69					
9710- 770	"	Lt ol-gy/ol-gy sh+ mnr med-dk gy/gn-gy sh	1.76					
9780- 840	"	Ol-gy sh+lt ol-gy/gn- gy/med-dk gy sh (Extracted rock)	1.87 1.43	1770	9.5	850	48	65
9850- 940	"	Ditto+mnr gn-gy/red- brn sh	1.23					
9950- 985	"	Wht/pnk-gy chk+ol-gy sh+mnr gn-gy/bl-gy/ brn-gy sh	0.96					
10890- 950	"	Pnk-gy chk (oil stain?)	0.38					
10960-11030	"	Ditto	0.30					
11030- 090	"	Ditto+pale brn calc mdst	1.34					
11100- 160	"	Ditto+ditto	1.17					
11170- 230	"	Ditto+60% ditto	1.35					
11240- 300	"	Ditto+50% ditto	2.52					
11310- 370	"	Ditto+40% pale brn marl	0.80					
11380- 440	"	Ditto+20% ditto	1.34					
11450- 510	"	Ditto+ditto	0.88					
11520- 580	"	Ditto+ditto	1.06					
11590- 650	"	Ditto+ditto	0.40					
11660- 720	"	Ditto+ditto	0.90					
11730- 790	"	Ditto+ditto	0.80					
11800- 860	"	Ditto+ditto	0.49					
11870- 930	"	Ditto+ditto	0.62					
11940-12000	"	Ditto+ditto+mnr med- lt gy sh	1.50					

SOURCE ROCK EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET) OR NOTATION	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	TOTAL EXTRACT P.P.M.	EXTRACT % OF ORGANIC CARBON	HYDRO- CARBONS P.P.M. OF ROCK	HYDRO- CARBONS % OF EXTRACT	TOTAL ALKANE % HYDRO- CARBON
12010- 070	Ctgs	Pale brn marl+pnk-gy chk+med-lt gy sh (Extracted rock)	2.55 1.60	11185	43.9	*	*	*
12080- 140	"	Ditto+ditto+mnr dk gy sh	3.44					
12150- 220	"	Ditto+ditto+mnr lt gy sst+dk gy/gy-red sh	3.66					
12220- 280	"	Med-lt gy chk	0.96					
12290- 350	"	Lt gy/pnk gy chk+mnr med gy sh	0.88					
12360- 420	"	Ditto+mnr gn-gy/dk gy sh	1.16					
12430- 490	"	Ditto+10% ditto	2.08					
12500- 560	"	Ditto+40% bl gy/dk gy sh	1.08					
12570- 630	"	Pnk-gy/lt gy sh+lt gy sst+lt gy/gn-gy/ brn-gy/dk gy sh	1.10					
12640- 700	"	Med-dk gy sh+mnr pnk- gy chk/pale brn marl +v mnr fine sst (Extracted rock)	2.06 1.25	3925	19.1	2060	52	68
12710- 770	"	Med gy/dk gy sl slty sh+10% pnk-gy chk/ pale brn marl	3.04					
12780- 840	"	Ditto+ditto	2.80					
12850- 910	"	Ditto+ditto (Extracted rock)	2.74 2.05	5760	21.0	2480	43	69
12920- 980	"	Ditto+ditto	4.29					
12990-13030	"	Ditto+ditto (Extracted rock)	4.09 3.10	6835	16.7	2940	43	75
<u>PICKED LITHOLOGIES</u>								
6390- 450	"	Gn-gy sh	2.35					
6390- 450	"	Med-dk gy sh	3.48					
6450- 510	"	Gn-gy sh	2.25					
6450- 510	"	Med-dk gy sh	3.49					
6510- 570	"	Gn-gy sh	2.18					
6510- 570	"	Med-dk gy sh	3.99					
6630- 690	"	Ol-gy/dk gy sh	4.38					
6910- 960	"	Med-dk gy sh	4.67					

Vdga

SOURCE ROCK EVALUATION DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (FEET) OR NOTATION	SAMPLE TYPE	ANALYSED LITHOLOGY	ORGANIC CARBON % OF ROCK	TOTAL EXTRACT P.P.M.	EXTRACT % OF ORGANIC CARBON	HYDRO- CARBONS P.P.M. OF ROCK	HYDRO- CARBONS % OF EXTRACT	TOTAL ALKANI % HYDR CARBON
7200- 230	Ctgs	Brn-gy sh	4.60					
7470- 530	"	Ol-gy sh	1.23					
7470- 530	"	Med-dk gy sh	5.01					
7680- 710	"	Ol-gy sh	2.34					
7890- 950	"	Ditto	1.95					
7950- 8000	"	Lt ol-gy sh	1.68					
7950- 8000	"	Med-dk gy sh	5.33					
8120- 180	"	Lt ol-gy sh	1.35					
8120- 180	"	Gn-gy sh	4.57					
8300- 360	"	Med-dk gy sh	4.63					
8360- 420	"	Lt ol-gy sh	1.39					
8540- 600	"	Lt ol-gy sh	1.23					
8540- 600	"	Med-dk gy sh	5.14					
8660- 720	"	Gn-gy sh	1.87					
8780- 840	"	Gn-gy sh	1.91					
8780- 840	"	Med-dk gy sh	5.55					
8840- 900	"	Lt ol-gy sh	2.21					
8840- 900	"	Med-dk gy sh	4.80					
9020- 080	"	Ol-gy sh	1.61					
9320- 380	"	Lt ol-gy sh	0.98					
9320- 380	"	Med gy sh	4.70					
9430- 480	"	Ol-gy sh	1.06					
9430- 480	"	Med-dk gy sh	2.08					
9630- 700	"	Ol-gy sh	1.62					
9950- 985	"	Ditto	1.67					
9950- 985	"	Brn-gy sh	2.48					
9950- 985	"	Chk	0.45					
12500- 560	"	Bl-gy sh/sltst	0.49					
12500- 560	"	Dk gy sh	1.09					
12570- 630	"	Ditto	0.86					
12710- 770	"	Med gy sh	0.43					
12710- 770	"	Dk gy sh	2.29					
12780- 840	"	Ditto	2.32					
12920- 980	"	Ditto	2.28					

TABLE 3a

ROCK - EVAL. PYROLYSIS DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SE

SAMPLE DEPTH (FEET) OR NOTATION	GENERALISED LITHOLOGY	ORGANIC CARBON (%)	TEMPERATURE (°C)	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (PPM)
5080- 140	Pale brn sltst+ 40% ol-gy sh	2.50	429	79	85	*	2000
5310- 370	Ol-gy sh+mnr sltst	1.31	*	165	177	*	2400
5610- 670	Ditto+mnr slt	2.28	435	236	96	*	4500
5970- 6030	Ol-gy/med-dk gy sh	2.91	430	136	89	*	4000
6330- 390	Ol-gy/gn-gy/dk gy sh	2.16	431	148	92	*	3200
6570- 630	Dk gy sh+med brn lst	2.83	426	94	91	*	2100
6780- 840	Med-dk gy sh+10% lt gy sh	3.55	426	97	50	*	3400
7020- 050	Ditto+mnr ditto	3.03	427	117	100	*	3500
7260- 290	Brn-gy sh+mnr lt gy sh	3.66	429	132	52	*	4800
7530- 590	Ol-gy sh+10% med- dk gy sh	1.96	430	111	96	*	2200
7770- 830	Ditto+10% ditto	2.45	435	148	62	*	3600
8000- 060	Lt ol-gy sh+20% med-dk gy sh	2.57	431	122	85	*	3100
8240- 300	Ditto+mnr ditto	2.59	431	81	65	*	2100
8480- 540	Ditto+20% ditto	2.66	423	100	43	*	2700
8720- 780	Gn-gy sh+30% ditto	3.31	430	80	47	*	2600
8960- 9020	Ol-gy sh+10% ditto	1.71	431	87	58	*	1500
9200- 260	Ditto+mnr ditto	1.49	425	120	84	*	1800
9570- 630	Ditto+20% red-brn sh	1.35	*	44	91	*	600
9780- 840	Ditto+mnr gy sh	1.87	432	24	81	*	400
12010- 070	Pale brn marl+ chk+med-lt gy sh	2.55	*	*	129	*	*
12640- 700	Med-dk gy sh+mnr chk+pale brn marl	2.06	*	*	148	*	*
12710- 770	Ditto+ditto+10% ditto	3.04	437	78	693	0.85	2400
12780- 840	Ditto+ditto+ ditto	2.80	448	45	115	0.82	1200
12850- 910	Ditto+ditto+ ditto	2.74	439	*	65	0.87	700

TEMPERATURE (°C) = TEMPERATURE AT MAXIMUM RATE OF PYROLYSIS
PRODUCTION INDEX = AN ESTIMATE OF PRESENT HYDROCARBON GENERATING POTENTIAL
COMPARED TO THAT AT OPTIMUM MATURITY
POTENTIAL YIELD = AN ESTIMATE OF HYDROCARBON PRODUCTION AT OPTIMUM MATURITY

TABLE 3b

ROCK - EVAL. PYROLYSIS DATA

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH S

SAMPLE DEPTH (FEET) OR NOTATION	GENERALISED LITHOLOGY	ORGANIC CARBON (%)	TEMPERATURE (°C)	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (PPM)
12920-12980	Med-dk gy sh+mnr chk+10% pale brn marl	4.29	442	64	317	0.68	2800
12990-13030	Ditto+ditto+ ditto	4.09	439	52	45	0.75	2100

TEMPERATURE (°C) = TEMPERATURE AT MAXIMUM RATE OF PYROLYSIS
 PRODUCTION INDEX = AN ESTIMATE OF PRESENT HYDROCARBON GENERATING POTENTIAL
 COMPARED TO THAT AT OPTIMUM MATURITY
 POTENTIAL YIELD = AN ESTIMATE OF HYDROCARBON PRODUCTION AT OPTIMUM MATURITY

FIGURE 1

SPORE COLOURATION INDICES AGAINST DEPTH

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SE.

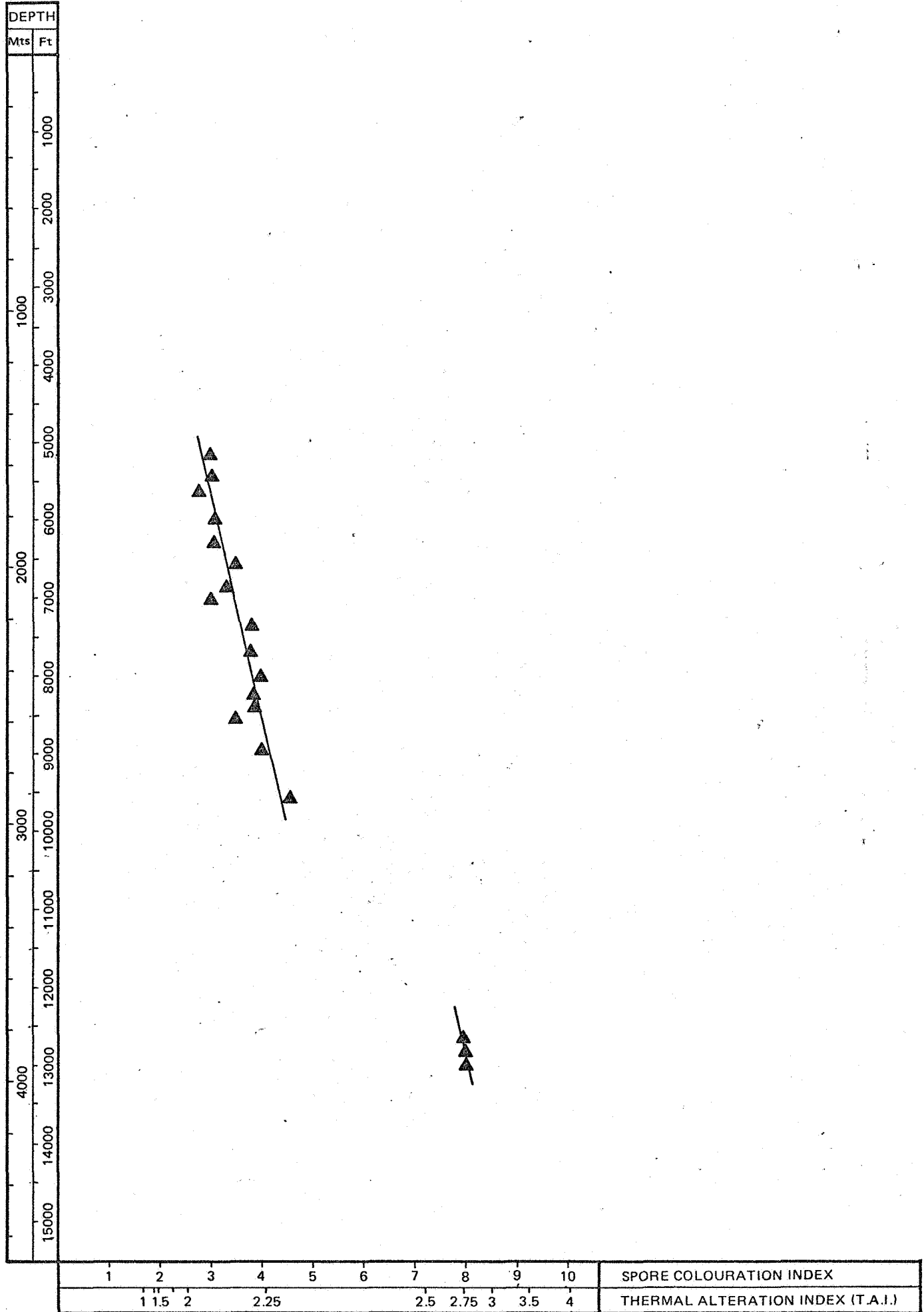


FIGURE 2 VITRINITE REFLECTIVITY AGAINST DEPTH

WELL: 2/5-1

LOCATION: NORWEGIAN NORTH SE

