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REPORT ON A GEOCHEMICAL EVALUATION OF THE 1/9 - 4 WELL, NORWEGIAN NORTH SEA.

by

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SUMMARY

Argillaceous lithologies with a potential for generating significant quantities of oil have not been identified in this well, neither are optimum levels of maturity attained by either oil- or gas-prone organic matter. Prolific gas generation could be anticipated from the Lower Miocene and Oligocene at optimum levels of thermal maturity. Generation of gas, possibly with minor oil, could be expected at optimum thermal maturity from parts of the Danian, Palaeocene and Eocene; much contamination is present through these horizons, however, and any oil source rocks present may not have been located.

I

INTRODUCTION

A geochemical study of the 1/9-4 Norwegian North Sea well has been undertaken on behalf of Statoil. The study has involved both maturation and source rock potential evaluations of the interval 153 to 3,710 metres. Maturity has been ascertained using the following methods: light hydrocarbon analysis, including airspace gas analysis, spore colouration and vitrinite reflectivity. Evaluation of the source rock potential of the section has incorporated the use of organic carbon determinations and extraction with fractionation of the C_{15+} hydrocarbons.

A total of 128 fresh, unwashed ditch cuttings in sealed metal cans were available at 30 metre intervals through the analysed sections; these included 3 samples from sidetrack ST (2,963 to 3,050 metres), 5 samples from sidetrack ST 2 (3,020 to 3,200 metres), and 23 samples from sidetrack ST 3 (3,059 to 3,710 metres). Samples for the maturation analyses were selected as follows: 128 headspace gas analyses were carried out on the canned samples at intervals of 30 metres; spore colouration and vitrinite reflectivity analyses were carried out on 41 samples at intervals of approximately 90 metres. For the source rock analyses 128 organic carbon determinations were made on all the canned ditch cuttings samples containing argillaceous lithologies; extraction and fractionation were carried out at approximately 90 metre intervals depending on the results of the organic carbon determinations and the suitability and quantity of available material (total of 36 samples). In addition, 4 organic carbon determinations were carried out on hand-picked lithologies, in the more mixed lithology samples, as a supplement to the source rock analyses. Samples have been analysed from the sidetrack section, particularly where these penetrate different lithologies, or to provide extra controlling data for the maturation studies. Sidetrack 3 is taken to be the continuation of the main hole below 3,080 metres.

Detailed stratigraphic information is available for this well under the Robertson Research Project Number RRI/778/IIA/1258; briefly, the well section penetrates a thick Tertiary sequence, reaches Cretaceous and bottoms in either Lower Cretaceous or Permo-Triassic.

RESULTS AND INTERPRETATION

The results of the geochemical evaluation of the 1/9-4 well are presented in Tables 1 to 6, and are represented graphically in Figures 1 to 8 and the Enclosures.

A. MATURATION EVALUATION

The levels of thermal maturity attained through the well section have been established using a number of techniques. Below, each method is discussed in turn, followed by a general appraisal and comparison of the data with our overall conclusions.

A.1 LIGHT HYDROCARBONS (Tables 1 and 2, and Figures 1, 2 and 3)

Hydrocarbons presented in the can air-space gases were analysed, followed by analysis of the gaseous and gasoline range hydrocarbons in the ditch cuttings.

a. Headspace Gas Analysis

Prior to unsealing the canned samples, an aliquot of headspace gas was removed and analysed for gaseous C_1 to C_4 hydrocarbons. The results of these analyses are presented in Table 1 and Figure 1.

The abundance of gaseous hydrocarbons, though by no means uniform, shows a general increase from approximately 5,000 ppm (0.5%) near the surface to 50,000 ppm (5%) at the top of the Cretaceous (approximately 3,000 metres). Below approximately 3,300 metres, the abundance falls rapidly to less than 5,000 ppm (0.5%) through the organically lean chalk sections. An anomaly occurs over the interval 2,150 to 2,750 metres where abundances increase suddenly to the order of 500,000 ppm (50%). Several reasons may be put forward to explain this anomaly; either it relates to the increase in organic matter through the Oligocene, to the presence of non-indigenous hydrocarbon material, or to the differences in preservation/storage conditions for this individual sample batch.

The most significant parameter to be obtained from the airspace gas analyses is the proportion of wet gases (C_2 to C_4) in the gaseous hydrocarbon fraction (C_1 to C_4); only methane is found in immature sediments, with the wet gases being generated as maturity is reached. Low wet gas contents are encountered down to a depth of approximately 1,100 metres. Between 1,100 and 1,400 metres the proportion of wet gases increases to between 10% and 30%, suggesting that the transition zone from immature to mature sediments has been reached. Below 1,400 metres the proportion of wet gases increases relatively steadily, reaching a maximum of 90-100% between 3,000 and 3,500 metres; a slight increase is noted within the organically rich Oligocene shales. Below approximately 3,500 metres the proportion of wet gases decreases substantially, which in this case, is attributed to a distinct lack of organic matter with hydrocarbon generating capability in the chalk interval.

b. Gaseous Hydrocarbons (C_1 to C_4)

As with the airspace gas analyses it is possible to use the proportion of wet gases, in the gaseous hydrocarbons liberated from the ditch cuttings, to estimate the maturity of a section. The wet gas contents through the section are less than 5% down to a depth of 890 metres (immature sediments); from 980 metres they exceed 40%, indicating the onset of maturity. A decrease is noted from below 3,440 metres, though this is considered to represent the presence of organically lean chalk.

Absolute abundance is low, less than 100 ppb, down to a depth of 1,160 metres, rises to between 300 and 3,000 ppb over the interval 1,250 to 1,880 metres, increases to a maximum of around 20,000 ppb around 2,500 metres, and then falls rapidly again to less than 100 ppb towards the base of the section. The point of maximum abundance corresponds with the base of the organically rich Oligocene shales and may, in part, relate to the presence of non-indigenous hydrocarbons.

c. Gasoline Range (C_5 to C_7) Hydrocarbons

Maturity is normally indicated by the C_5 to C_7 hydrocarbons when the constituent gasolines (Table 2) are found to be present in approximately equal proportions. Immature sediments on the other hand show certain components of marked abundance but with an overall low total hydrocarbon abundance (less than 100 ppb).

Figure 3 shows an immature section down to a depth of 890 metres, where no significant gasoline range hydrocarbons are present. Between 980 and 2,060 metres, gasolines appear, but their abundance rarely exceeds 100 ppb; this part of the section is considered to be transitional in its abundance and relative proportions of constituent gasolines. Below 2,180 metres abundances rise to a maximum in excess of 100,000 ppb, the richer sections being in the Palaeocene (sands and shales) and at the top of the Danian chalk section; these high values are attributed to migrated non-indigenous hydrocarbons.

A.2 SPORE COLOURATION (Table 3 and Figure 4)

The level of maturity in oil-prone organic matter in the analysed sediments has been assessed by a visual examination of the indigenous sporomorphs. The colouration of spores; with increasing thermal maturity, changes from pale yellow, through orange and brown, to black. Spore colouration indices used in this report are based on the Robertson Research scale of 1 to 10, with values of 3 to 3.5 representing the narrow zone of transition between immature and mature sediments.

Data were obtained from all but 6 of the 41 analysed samples. Spore assemblages are fair down to a depth of approximately 2,000 metres and then, with a few localised exceptions, generally poor. Few spores were encountered through the chalk sections. Some reworked Jurassic with spore colours up to 5, was observed in the upper 2,000 metres of the well section.

An examination of Figure 4 shows that spore colour indices are interpreted to rise from 1.0-1.5 at 153 metres to 4.5 at total depth. This indicates that oil-prone organic matter passes from immaturity to early maturity over the transition zone between approximately 1,000 and 2,000 metres. The base of the analysed section is in the early stages of thermal maturity and capable of generating gas and heavy oil where suitably rich oil-prone sediments are present. The breaks in the spore colour gradient line at 200 and 950 metres are not supported by biostratigraphic evidence; the true spore colour gradient may in fact be interpreted as a larger rate of increase in spore colours over the first 1,000 metres of the well.

The kerogen generally consists of fine-grained humic material, principally inertinite and vitrinite; sapropel does occur,but rarely in significant proportions.

A.3 VITRINITE REFLECTIVITY (Table 3, Figure 5 and the Enclosures)

The examination of vitrinite particles in shales is now a frequently used extension of coal rank studies. Vitrinite is not an important oil source and its maturation, unlike oil-prone organic matter, is strongly dependant on length of time of heating: however, it is the only reliable maturation indicator in the organically metamorphosed zone. Humic, gas-prone organic matter is considered to be transitionally mature over the reflectivity range 0.4% to 0.5%, but would not be expected to yield prolific gas until levels in excess of 0.8% to 1.0% have been reached. In an early Tertiary sequence, oil-prone organic matter would be expected to being generating hydrocarbons at vitrinite reflectivities of 0.4% and above.

Vitrinite reflectivity measurements have been carried out on 41 ditch cuttings samples; the majority of the measurements were made on kerogen concentrates since many of the cuttings were either too soft to polish effectively or deficient in organic matter. The sample blocks were prepared by mounting the dry cuttings in an epoxy resin, followed by polishing with carborundum and alumina. Kerogen concentrates were prepared by standard palynological techniques, followed by mounting in resin on glass slides, and polishing as for the cuttings. The results presented in Table 3 are those mean values interpreted as being indigenous; the figures in brackets indicate those mean values based on less than 10 measurements. A detailed compilation of all the vitrinite reflectivity data is given in the enclosures.

Overall, sample coverage of the analysed well section was good, though data obtained were a little sparse above 1,800 metres and below 3,100 metres. Quality of the data was good through the Oligocene section.

Reflectivity levels for indigenous vitrinite increase steadily from around 0.2% at 500 metres, to around 0.55% at 3,600 metres. This implies that for gas-prone humic organic matter, the transition from immature to mature sediments occurs over the approximate interval 2,100 to 3,100 metres; minor gaseous hydrocarbons could be generated below these depths. Reflectivity levels sufficient for the generation of prolific quantities of gaseous hydrocarbons (in excess of 0.8%) are not attained by the base of the analysed section.

An examination of the organic matter under blue light shows fluorescence colours compatible with those observed during the spore colouration analyses.

A.4 COMPARISON OF MATURATION INDICES (Table 3 and Figure 8)

A number of parameters have been used to assess the maturation state of the analysed well section including light hydrocarbon analysis, spore colouration and vitrinite reflectivity.

Spore colouration data indicate that the zone of transitional maturity for oil-prone organic matter occurs over the approximate interval 1,000 to 2,000 metres. Light hydrocarbon analyses concern with this, indicating a transitional zone of maturity between approximately 990 and 1,480 metres. Both spore colouration and light hydrocarbon analyses suggest an early, tending towards middle stage of thermal maturity has been reached at the base of the analysed section. Heavy oil could be expected to be generated below a depth of approximately 2,000 metres, assuming the presence of suitably rich oil-prone sediments.

Vitrinite reflectivity levels show that the zone of transitional maturity for gas-prone organic matter is deeper, being between approximately 2,100 and 3,100 metres; the level of maturity at the base of the analysed section is insufficient for the generation of prolific quantities of gaseous hydrocarbons.

B. SOURCE ROCK EVALUATION (Tables 4 and 5, and Figures 6, 7 and 8)

The results of the source rock evaluation are discussed in groups related to the age of the well section, following closely the data available from our biostratigraphic studies. An extra copy of Figure 8 is included as an enclosure to this report for ease of reference.

B.1 PLEISTOCENE - RECENT AND PLIOCENE, Samples 153 to 680 Metres

This interval comprises sandstone, siltstone, shell, lignite and grey calcareous claystone; the claystone becomes dominant in the Pliocene. Organic carbon determinations carried out on the claystones give below average values in the general range 0.5% to 0.7%, with extremes of 0.06% to 3.42% in the sandstone or lignitic sections of the Pleistocene - Recent.

Four samples were chosen for extraction and fractionation of this interval, all of which contain very little extractable organic matter or hydrocarbons. No significant hydrocarbon generating potential is expected at any level of thermal maturity.

B.2 UPPER MIOCENE, Samples 680 to 1,040 Metres

This interval comprises grey-brown and grey-green claystones with minor siltstone and shell. Organic carbon determinations give below average values; these improve to just below average in the deepest three samples.

The three samples submitted for extraction and fractionation contain quite high proportions of extractable organic matter but are deficient in hydrocarbons. The interval would not be expected to yield significant hydrocarbons at any level of thermal maturity.

B.3 MIDDLE MIOCENE, Samples 1,040 to 1,850 Metres

This interval comprises three broad lithological groups with increasing depth:

a. grey-brown and grey-green claystones of just below average organic carbon content but deficient in extractable organic matter or hydrocarbons. Probably not a significant hydrocarbon source at any level of maturity.

b. dark grey-brown shales and mudstones of average organic carbon content and olive-grey shales and mudstones just below average organic carbon content. No present hydrocarbon generating potential, though the richer shales may generate some gaseous hydrocarbons at optimum maturity.

c. medium and dark olive-grey shales towards the base of this interval are of average organic carbon content and have a fair potential for sourcing very limited quantities of gaseous hydrocarbons at the present maturation level. This may improve to a limited potential for oil generation at optimum maturity.

B.4 LOWER MIOCENE AND OLIGOCENE, Samples 1,850 to 2,540 Metres

This interval comprises dark olive-grey, dark grey and medium grey shales and some mudstones. Organic carbon contents are average to above average in the Lower Miocene increasing to above average (reaching 5%) in the Oligocene.

Extraction and fractionation on 8 samples from this interval show an increase in amounts of extractable organic matter, in hydrocarbon abundance and in the proportion of hydrocarbons in the extracts, towards the base of this interval. At a first examination these data suggest the interval to be a good to very good potential source for oil, particularly since at these depths the well section is just into the early stages of thermal maturity. However, the data do also indicate a distinct zone of non-indigenous hydrocarbon stain at the base of this interval (and the top of the underlying interval). Spore colouration and vitrinite reflectivity analyses do not indicate the presence of any significant quantities of sapropel (other than as stain). It is concluded that the true potential of this interval is at present good for gas and possibly minor heavy oil, this being likely to improve to very good for gas at optimum levels of thermal maturity.

B.5 EOCENE AND EOCENE - PALAEOCENE, Samples 2,540 to 2,810 Metres

This interval comprises shales, variously coloured grey, grey-green, olive-grey and brown-grey. Organic carbon contents for these samples are around

1%, just reaching average values for shales.

Two samples were extracted and fractionated from this interval and these contain abnormally high proportions of extractable organic matter and hydrocarbons; both are considered to be stained by non-indigenous hydrocarbons.

B.6 PALAEOCENE AND DANIAN Samples 2,810 to 3,230 Metres

This interval comprises grey, grey-green, olive-grey and grey-brown shales with interbedded glauconitic sandstone, coaly material (?drilling additive) and minor red-brown and dark grey shales. Organic carbon contents vary from just below average to just average for shales (0.84% to 1.12%) in the Palaeocene section; in the Danian section, although organic carbon contents are generally just below average (around 0.8%), some individual samples contain up to 1.98%. Chalk appears in samples from 3,110 metres in ST-3 but does not constitute a major element in ST-2, even as deep as 3,200 metres.

Extraction and fractionation have been carried out on a number of samples from both the main hole and Sidetrack ST-2. All but one sample contain high proportions of extractable organic matter, particularly in relation to the moderately low level of thermal maturity attained; hydrocarbon abundances are, on the other hand, much lower than in the overlying stained sections. It is not possible to identify any apparently major oil-generating horizons; inspection of the main kerogen types during the spore colouration and vitrinite reflectivity analyses has not identified any significant sapropel content.

B.7 MAASTRICHTIAN, CAMPANIAN-SANTONIAN, CONIACIAN AND ?LOWER CRETACEOUS, Samples 3,230 to 3,680 Metres (ST-3)

This interval comprises pinkish grey chalk, occasionally grey-green and marly, and with some interbedded (or caved) grey to dark grey shales. Organic carbon contents for the chalk are low at around 0.2%, though in those samples where there is a significant proportion (normally less than 10%) of dark grey shale, contents may rise to as high as 0.87%. The marly chalk at around

3,500 metres also has a low organic carbon content of 0.25% (hand-picked), whilst grey shale in the same sample has a near average organic carbon content of 0.96%. Dark grey shale from the sample at 3,620-50 metres also has an organic carbon content of 0.96%.

Extraction and fractionation were carried out on three samples, one of chalk, one of the grey-green marly chalk and one with a minor dark grey shale content. All three samples contained negligible extractable organic matter and hydrocarbons, and are not considered to represent a significant hydrocarbon generating section.

B.8 ?PERMO-TRIAS, Sample 3,680 to 3,710 Metres

Black shales appear at the very base of the analysed section, though these were noted to be rather badly contaminated by drilling additives. Contamination is indicated in particular by the variation in organic carbon contents between the whole sample (4.22%) and relatively clean hand-picked shale (1.56%).

Extraction and fractionation of this sample show a very low content of extractable organic matter and hydrocarbons the lithotype is not expected to be a significant source for hydrocarbons. Examination of the kerogen during the spore colouration analysis suggests a predominantly inertinitic organic matter.

CONCLUSIONS

From the present study of the Statoil 1/9-4 Norwegian North Sea well, the following main conclusions can be drawn:

i) Oil-prone, sapropelic organic matter in the well would be expected to be in the early stages of thermal maturity, capable of generating heavy oil, below a depth of approximately 2,000 metres. A brief examination of the kerogen has, however, failed to identify any significant occurrence of sapropelic source rocks.

ii) Gas-prone, humic organic matter, the most common type of organic matter in this well section, is sufficiently mature to generate minor gaseous hydrocarbons below a depth of approximately 3,100 metres; the zone of prolific gas generation is not reached at the base of the well section.

iii) The source rock potential of each interval is summarised in Table 6. Although there are source rocks of average to above average richness at an early level of maturity below 2,000 metres, few of these can be identified as oil-sources; gaseous hydrocarbons are the most likely product from these sediments. Much staining occurs at the base of the Eocene - Oligocene shales and tends to mask the true source rock characteristics of the insitu lithologies.

TABLE 1A

HEADSPACE GAS ANALYSIS DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SE

SAMPLE DEPTH (METRES)	TOTAL C_1-C_4 GAS (% v/v)	% C_1	% C_2	% C_3	% isoC_4	% n-C_4
153 - 170	0.74	100	0	0	0	0
170 - 200	0.30	100	0	0	0	0
200 - 230	2.51	100	0	0	0	0
260 - 290	1.62	100	0	0	0	0
290 - 320	0.43	100	0	0	0	0
320 - 350	5.86	100	0	0	0	0
350 - 380	3.21	100	0	0	0	0
380 - 410	3.22	100	0	0	0	0
410 - 440	2.51	100	0	0	0	0
440 - 470	0.74	100	0	0	0	0
470 - 500	1.23	100	0	0	0	0
500 - 530	0.41	100	0	0	0	0
530 - 560	*	*	*	*	*	*
560 - 590	0.31	100	tr	tr	0	0
590 - 620	1.27	94	4	2	0	0
620 - 650	0.61	82	11	7	0	0
650 - 680	1.41	92	2	6	0	0
680 - 710	0.53	94	tr	5	0	0
710 - 740	1.55	98	0	2	0	0
740 - 770	0.41	*	*	*	*	*
770 - 800	0.72	*	*	*	*	*
800 - 830	0.07	100	0	0	0	0
830 - 860	0.36	83	14	2	tr	0
860 - 890	1.47	90	3	4	tr	2
890 - 920	1.58	84	3	4	4	4
920 - 950	1.65	97	2	tr	0	0
950 - 980	1.16	96	2	1	0	0
980 - 1010	*	*	*	*	*	*
1010 - 1040	*	*	*	*	*	*
1040 - 1070	*	*	*	*	*	*
1070 - 1100	*	*	*	*	*	*

TABLE 1B

HEADSPACE GAS ANALYSIS DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

SAMPLE DEPTH (METRES)	TOTAL C_1-C_4 GAS (%v/v)	% C_1	% C_2	% C_3	% iso C_4	% n-C_4
1100 - 1130	*	*	*	*	*	*
1130 - 1160	*	*	*	*	*	*
1160 - 1190	*	*	*	*	*	*
1190 - 1220	0.40	90	5	0	0	5
1220 - 1250	*	*	*	*	*	*
1250 - 1280	4.36	66	6	11	4	12
1280 - 1310	1.02	68	3	14	5	10
1310 - 1340	*	*	*	*	*	*
1340 - 1370	*	*	*	*	*	*
1370 - 1400	1.14	67	10	14	2	7
1400 - 1430	*	*	*	*	*	*
1430 - 1460	0.28	50	13	9	*	27
1460 - 1490	0.80	56	14	25	5	*
1490 - 1520	0.75	57	10	17	2	13
1520 - 1550	2.46	64	10	14	3	8
1550 - 1580	0.98	41	10	29	4	16
1580 - 1610	0.57	45	11	26	1	17
1610 - 1640	1.46	49	10	16	4	19
1640 - 1670	1.63	55	10	17	7	11
1670 - 1700	0.56	69	8	11	5	6
1700 - 1730	4.12	38	13	23	6	19
1730 - 1760	1.22	63	13	13	2	8
1760 - 1790	1.85	56	14	16	3	11
1790 - 1820	2.35	59	13	14	3	10
1820 - 1850	*	*	*	*	*	*
1850 - 1880	*	*	*	*	*	*
1880 - 1910	1.17	57	12	17	2	11
1910 - 1940	1.06	58	12	15	6	9
1940 - 1970	2.75	56	14	16	4	10
1970 - 2000	1.60	48	15	18	6	12
2000 - 2030	1.35	56	14	15	3	12
2030 - 2060	0.78	33	14	26	11	15
2060 - 2090	1.06	38	16	28	4	13
2090 - 2120	0.27	26	19	25	4	26
2120 - 2150	*	*	*	*	*	*
2150 - 2180	40.10	23	21	29	8	19
2180 - 2210	51.00	31	21	24	7	17
2210 - 2240	46.80	22	22	29	8	19
2240 - 2270	48.40	33	21	25	6	15

TABLE 1C

HEADSPACE GAS ANALYSIS DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

SAMPLE DEPTH (METRES)	TOTAL C_1-C_4 GAS (% v/v)	% C_1	% C_2	% C_3	% iso C_4	% n-C_4
2270 - 2300	45.80	36	23	23	5	13
2300 - 2330	63.00	34	22	22	7	15
2330 - 2360	31.00	33	23	27	5	12
2360 - 2390	35.30	23	23	30	7	17
2390 - 2420	13.10	29	21	30	5	15
2420 - 2450	56.40	34	23	23	6	14
2450 - 2480	*	*	*	*	*	*
2480 - 2510	0.46	30	17	36	4	13
2510 - 2540	18.20	35	17	26	6	16
2540 - 2570	38.60	34	17	24	7	18
2570 - 2600	36.60	37	16	25	6	16
2600 - 2630	16.30	32	15	27	7	19
2630 - 2660	11.30	46	16	22	4	12
2660 - 2690	28.50	52	15	18	4	11
2690 - 2720	1.12	36	22	19	6	17
2720 - 2750	46.70	23	23	28	8	18
2750 - 2780	3.00	27	20	29	7	17
2780 - 2810	4.40	24	21	32	8	15
2810 - 2840	*	*	*	*	*	*
2840 - 2870	6.10	22	17	30	11	20
2870 - 2900	0.60	13	15	35	12	25
2900 - 2930	6.50	18	18	32	12	20
2930 - 2960	4.90	23	21	32	9	16
2960 - 2990	4.70	23	18	31	10	18
2990 - 3020	1.60	16	23	33	10	18
3020 - 3050	3.80	24	20	32	8	16
3050 - 3080	1.60	22	19	33	9	17
ST SIDETRACK						
2963 - 2990	0.10	7	3	8	*	82
2990 - 3020	0.20	24	18	29	8	21
3020 - 3050	0.30	73	12	12	1	2
ST-2 SIDETRACK						
3020 - 3050	0.40	35	23	28	5	9
3050 - 3080	2.10	22	26	32	7	13
3110 - 3140	2.70	45	18	21	6	10
3140 - 3170	1.50	45	17	22	6	10
3170 - 3200	0.10	12	10	29	27	22

TABLE 1D

HEADSPACE GAS ANALYSIS DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

SAMPLE DEPTH (METRES)	TOTAL C_1-C_4 GAS (% v/v)	% C_1	% C_2	% C_3	% iso C_4	% n-C_4
ST-3 SIDETRACK						
3059 - 3080	0.20	37	19	26	6	12
3080 - 3110	1.70	12	18	37	11	22
3110 - 3140	4.30	21	15	32	14	18
3140 - 3170	5.90	13	15	31	18	23
3170 - 3200	2.90	3	8	36	21	32
3200 - 3230	4.30	28	13	27	14	18
3230 - 3260	6.40	13	12	25	22	28
3260 - 3290	4.10	7	8	32	18	35
3290 - 3320	0.50	13	14	31	18	24
3320 - 3350	2.10	37	12	25	9	17
3350 - 3380	0.10	*	71	7	12	10
3380 - 3410	0.02	91	4	5	*	*
3410 - 3440	0.10	25	8	28	9	30
3440 - 3470	0.80	2	2	31	22	43
3470 - 3500	0.50	37	15	24	15	9
3500 - 3530	0.40	77	7	8	3	5
3530 - 3560	0.02	39	37	24	*	*
3560 - 3590 (A)	0.02	94	*	6	*	*
3560 - 3590 (B)	0.02	68	32	*	*	*
3590 - 3620	0.10	36	17	29	16	2
3620 - 3650	0.20	81	7	8	1	3
3650 - 3680	0.20	75	13	4	5	3
3680 - 3710	0.10	35	4	61	*	*

TABLE 2 A

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N.SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	153	260	350	440	530	620	710	800
C_1	71	97	100	100	100	100	100	100
C_2	25	3	tr	tr	tr	tr	tr	tr
C_3	*	tr	tr	tr	tr	tr	tr	tr
iso-C_4	*	tr	tr	tr	tr	tr	tr	tr
n-C_4	4	tr	tr	tr	tr	tr	tr	tr
TOTAL ABUNDANCE P.P.B	35	90	tr	5	tr	tr	tr	tr

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE								
N-PENTANE								
CYCLOPENTANE								
2-ME.PENTANE								
3-ME.PENTANE								
N-HEXANE								
ME-CYCLOPENTANE								
CYCLOHEXANE								
2-ME.HEXANE								
3-ME.HEXANE								
3-ETHYLPENTANE								
N-HEPTANE								
BENZENE								
DIME.PENTANE								
ME.CYCLOHEXANE								
TOTAL ABUNDANCE P.P.B	tr	tr	tr	tr	tr	tr	tr	tr

TABLE 2B

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	890	980	1070	1160	1250	1340	1430	1520
C_1	100	59	44	tr	4	4	2	3
C_2	tr	4	4	tr	1	3	2	2
C_3	tr	10	14	tr	14	18	18	16
iso-C_4	tr	12	9	tr	24	20	33	31
n-C_4	tr	15	29	tr	57	55	45	48
TOTAL ABUNDANCE P.P.B	tr	75	70	tr	365	330	1535	885

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE	*	*	*	*	*	tr	tr	*
N-PENTANE	tr	6	3	4	2	tr	tr	5
CYCLOPENTANE	tr	10	6	7	4	tr	tr	4
2-ME.PENTANE	tr	9	7	7	6	tr	tr	6
3-ME.PENTANE	tr	9	8	10	6	tr	tr	8
N-HEXANE	tr	12	7	12	10	tr	tr	9
ME-CYCLOPENTANE	tr	8	10	10	16	tr	tr	9
CYCLOHEXANE	tr	9	11	13	10	tr	tr	12
2-ME.HEXANE	tr	7	10	10	9	tr	tr	9
3-ME.HEXANE	tr	7	10	12	10	tr	tr	9
3-ETHYLPENTANE	tr	7	12	15	11	tr	tr	13
N-HEPTANE	tr	6	5	*	7	tr	tr	7
BENZENE	tr	*	*	*	*	*	*	*
DIME.PENTANE	tr	*	*	*	*	*	*	*
ME.CYCLOHEXANE	tr	10	11	*	9	tr	tr	9
TOTAL ABUNDANCE P.P.B	tr	65	125	80	65	tr	tr	60

TABLE 2C

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	1610	1700	1790	1880	1970	2060	2180	2270
C_1	1	2	7	4	2	2	*	1
C_2	2	4	8	6	7	7	*	5
C_3	20	30	18	32	36	37	*	34
iso-C_4	20	18	17	14	16	15	*	18
n-C_4	57	46	50	44	39	39	*	42
TOTAL ABUNDANCE P.P.B	1435	2975	1195	340	6685	5215	*	6175

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE	*	*	*	*	*	*	*	*
N-PENTANE	5	12	4	*	3	2	3	8
CYCLOPENTANE	8	2	9	*	13	6	8	7
2-ME.PENTANE	7	8	18	*	14	11	26	21
3-ME.PENTANE	8	7	12	*	8	8	7	10
N-HEXANE	7	16	17	*	15	16	29	25
ME-CYCLOPENTANE	8	6	11	*	10	9	7	8
CYCLOHEXANE	12	9	9	*	11	13	5	6
2-ME.HEXANE	9	8	5	*	4	6	3	3
3-ME.HEXANE	11	8	5	*	4	5	3	2
3-ETHYLPENTANE	14	5	2	*	5	7	1	1
N-HEPTANE	8	9	3	*	5	6	4	4
BENZENE	*	*	*	*	*	*	1	2
DIME.PENTANE	*	*	*	*	*	*	*	*
ME.CYCLOHEXANE	3	10	5	*	8	11	3	3
TOTAL ABUNDANCE P.P.B	50	100	85	*	45	70	1400	2285

TABLE 2D

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N.SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	2360	2450	2540	2630	2720	2810	2900	2990
C_1	1	1	1	3	1	tr	1	1
C_2	5	4	1	1	1	1	1	4
C_3	33	32	19	16	25	19	23	24
iso-C_4	15	17	21	22	20	16	17	13
n-C_4	47	46	58	58	53	64	58	58
TOTAL ABUNDANCE P.P.B	11920	22450	21675	4215	3635	180	180	65

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE	*	*	*	*	*	6	7	7
N-PENTANE	4	3	2	3	4	10	13	12
CYCLOPENTANE	8	7	5	6	8	1	1	tr
2-ME.PENTANE	22	19	22	21	28	6	6	6
3-ME.PENTANE	10	10	10	11	13	4	3	3
N-HEXANE	28	28	31	28	6	16	15	14
ME-CYCLOPENTANE	8	9	7	8	11	6	4	5
CYCLOHEXANE	6	6	4	5	7	7	6	9
2-ME.HEXANE	3	3	4	3	4	6	5	10
3-ME.HEXANE	2	2	3	3	4	4	5	5
3-ETHYLPENTANE	1	1	1	1	1	4	4	2
N-HEPTANE	4	4	5	5	6	13	14	9
BENZENE	2	3	1	2	2	1	2	1
DIME.PENTANE	*	*	*	*	*	tr	1	tr
ME.CYCLOHEXANE	2	5	5	5	6	16	14	17
TOTAL ABUNDANCE P.P.B	2220	8530	3565	1120	585	22420	30525	15800

TABLE 2E

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N.SEA

	% C_1 to C_4 (GASEOUS HYDROCARBONS)							
DEPTH (METRES)	3050	ST:	2990	ST-2:	3050	3110	3140	3170
C_1	2		2		16	1	41	*
C_2	tr		tr		6	4	10	*
C_3	13		17		17	24	14	8
iso-C_4	12		14		11	8	12	31
n-C_4	73		62		50	63	23	61
TOTAL ABUNDANCE P.P.B	70		30		135	55	185	40
	% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)							
ISO-PENTANE	*		9		8	6	6	6
N-PENTANE	*		15		10	10	10	7
CYCLOPENTANE	*		1		1	1	tr	tr
2-ME.PENTANE	*		6		5	5	6	5
3-ME.PENTANE	*		7		5	2	3	6
N-HEXANE	*		20		15	14	15	15
ME-CYCLOPENTANE	*		3		5	4	2	3
CYCLOHEXANE	*		6		12	11	4	3
2-ME.HEXANE	*		1		4	6	10	10
3-ME.HEXANE	*		7		2	3	7	18
3-ETHYLPENTANE	*		1		*	1	1	tr
N-HEPTANE	*		9		16	18	20	15
BENZENE	*		tr		tr	tr	tr	*
DIME.PENTANE	*		tr		*	*	2	*
ME.CYCLOHEXANE	*		14		17	19	14	15
TOTAL ABUNDANCE P.P.B	tr		2620		8385	7645	34350	5185

TABLE 2F

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N.SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	ST-3	3059	3140	3320	3350	3440	3530	3620
C_1		1	1	5	*	64	100	100
C_2		2	tr	*	*	*	*	*
C_3		19	17	3	*	*	*	*
iso-C_4		13	28	*	*	*	*	*
n-C_4		65	54	92	*	36	*	*
TOTAL ABUNDANCE P.P.B		65	1170	15	tr	5	5	5

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE		12	11	8	tr	6	tr	tr
N-PENTANE		13	13	4	tr	13	tr	tr
CYCLOPENTANE		1	1	11	tr	1	tr	tr
2-ME.PENTANE		5	7	tr	tr	7	tr	tr
3-ME.PENTANE		6	4	tr	tr	4	tr	tr
N-HEXANE		15	16	12	tr	18	tr	tr
ME-CYCLOPENTANE		4	3	tr	tr	tr	tr	tr
CYCLOHEXANE		12	4	tr	tr	3	tr	tr
2-ME.HEXANE		5	8	tr	tr	9	tr	tr
3-ME.HEXANE		2	6	tr	tr	8	tr	tr
3-ETHYLPENTANE		1	1	*	tr	1	tr	tr
N-HEPTANE		10	15	19	tr	18	tr	tr
BENZENE		tr	1	*	tr	*	tr	tr
DIME.PENTANE		*	*	*	tr	tr	tr	tr
ME.CYCLOHEXANE		14	10	46	tr	13	tr	tr
TOTAL ABUNDANCE P.P.B		8925	142330	1790	tr	14100	tr	tr

TABLE 3A

MATURATION EVALUATION DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N.SEA

SAMPLE DEPTH (METRES OR NOTATION	SAMPLE TYPE	GENERALISED LITHOLOGY	MAXIMUM PALAEOTEMP-ERATURE °F	VITRINITE REFLECTIVITY %	SPORE COLOURATION (1-10)	LIGHT HYDROCARBONS
1. 153	Ctgs	SHELL, SND, MDST	-	*	1.0 - 1.5	
6. 320	"	CLYST, SLTST, LIG	-	*	2.0 - 2.5	
11. 470	"	CLYST	-	*	2.5	IMMATURE
15. 590	"	"	-	(0.21)	2.5	
18. 680	"	"	-	*	2.5	
25. 890	"	"	-	(0.28)	2.5	
28. 980	"	"	-	*	3.0	
32. 1100	"	"	-	*	3.0	TRANSITIONAL
35. 1190	"	"	-	*	3.5	
37. 1250	"	MDST/SH	-	(0.33)	3.5	MATURITY
41. 1370	"	"	-	*	3.5	
44. 1460	"	"	-	(0.43)	3.5	
48. 1580	"	"	-	*	3.5 - 4.0	
52. 1700	"	SH/MDST	-	*	3.5	
55. 1790	"	"	-	(0.29)	3.5	
58. 1880	"	"	-	(0.35)	3.5	
60. 1940	"	"	-	*	*	
64. 2060	"	"	-	*	4.0	
66. 2120	"	"	-	0.41	*	
69. 2210	"	"	-	0.44	3.5 - 4.0	
72. 2300	"	SH	-	0.43	3.5	
75. 2390	"	SH/MDST/SLTST	-	0.44	4.0	
78. 2480	"	SH/SLTST	-	0.42	4.0	
81. 2570	"	"	-	*	4.0	
85. 2690	"	SH	-	*	4.0	
88. 2780	"	SH	-	0.46	4.5	
91. 2870	"	SH/SND	-	(0.50)	4.0	
94. 2960	"	SH/SND	-	0.44	4.5	
96. 3020	"	SH	-	(0.48)	4.5	
100. 3020 ST	"	SST	-	*	5.0	
101. 3020 ST-2	"	SH/SST	-	0.42	4.0	EARLY
106. 3059 ST-3	"	SH	-	(0.41)	4.5	MATURITY

TABLE 3 B

MATURATION EVALUATION DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

SAMPLE DEPTH (METRES OR NOTATION	SAMPLE TYPE	GENERALISED LITHOLOGY	MAXIMUM PALAEOTEMP- -ERATURE °F	VITRINITE REFLECTIVITY %	SPORE COLOURATION (1-10)	LIGHT HYDROCARBONS
103. 3110 ST-2	Ctgs	SH	-	(0.51)	4-0 - 4.5	EARLY MATURITY
108. 3110 ST-3	"	CHK, some LIG	-	*	*	(WITH
105. 3170 ST-2	"	SH/SND/CHK	-	*	4.5	APPARENT
112. 3230 ST-3	"	CHK & some SH	-	*	*	STAINING)
115. 3320 ST-3	"	"	-	(0.49)	*	
117. 3380 ST-3	"	"	-	*	*	
120. 3470 ST-3	"	"	-	(0.50)	4.5	
124. 3560 ST-3	"	"	-	*	4.5	
127. 3650 ST-3	"	"	-	*	*	

TABLE 4A

ORGANIC CARBON DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N. SEA

SAMPLE DEPTH (METRES)	ORGANIC CARBON % OF ROCK	SAMPLE DEPTH (METRES)	ORGANIC CARBON % OF ROCK	SAMPLE DEPTH (METRES)	ORGANIC CARBON % OF ROCK
1. 153-170	0.06	41. 1370- 400	1.13	81. 2570- 600	1.03
2. 170-200	0.47	42. 1400- 430	1.46	82. 2600- 630	0.93 +
3. 200-230	3.42	43. 1430- 460	1.31 +	83. 2630- 660	0.93
4. 260-290	1.92	44. 1460- 490	1.21	84. 2660- 690	1.04
5. 290-320	0.47 +	45. 1490- 520	1.19	85. 2690- 720	0.97 +
6. 320-350	0.57	46. 1520- 550	1.14	86. 2720- 750	0.96
7. 350-380	0.61	47. 1550- 580	1.01 +	87. 2750- 780	1.03
8. 380-410	0.63	48. 1580- 610	0.80	88. 2780- 810	0.97
9. 410-440	0.50	49. 1610- 640	0.86	89. 2810- 840	1.12 +
10. 440-470	0.60 +	50. 1640- 670	1.08 +	90. 2840- 870	0.84
11. 470-500	0.37	51. 1670- 700	1.19	91. 2870- 900	0.88
12. 500-530	0.53	52. 1700- 730	0.94	92. 2900- 930	0.88
13. 530-560	0.51	53. 1730- 760	1.27 +	93. 2930- 960	1.03 +
14. 560-590	0.64 +	54. 1760- 790	1.90	94. 2960- 990	1.04
15. 590-620	0.52	55. 1790- 820	1.91	95. 2990-3020	1.03
16. 620-650	0.73	56. 1820- 850	1.83 +	96. 3020- 050	1.22 +
17. 650-680	0.57 +	57. 1850- 880	3.00	97. 3050- 080	1.98 +
18. 680-710	0.50	58. 1880- 910	2.77		
19. 710-740	0.49	59. 1910- 940	1.87 +		
20. 740-770	0.45 +	60. 1940- 970	2.42		
21. 770-800	0.56	61. 1970-2000	2.54		
22. 800-830	0.54	62. 2000- 030	1.74 +		
23. 830-860	0.51	63. 2030- 060	2.00		
24. 860-890	0.52 +	64. 2060- 090	2.43		
25. 890-920	0.49	65 2090- 120	2.83 +		
26. 920-950	0.53	66. 2120- 150	2.91		
27. 950-980	0.89 +	67. 2150- 180	4.20 +		
28. 980-010	0.78	68. 2180- 210	*		
29. 1010-040	0.77	69. 2210- 240	*		
30. 1040-070	0.72	70. 2240- 270	3.95 +		
31. 1070-100	0.62 +	71. 2270- 300	4.03		
32. 1100-130	0.87	72. 2300- 330	4.08		
33. 1130-160	0.70 +	73. 2330- 360	4.89 +		
34. 1160-190	1.00	74. 2360- 390	4.70		
35. 1190-220	0.95	75. 2390- 420	4.49		
36. 1220-250	1.04 +	76. 2420- 450	3.13 +		
37. 1250-280	0.95	77. 2450- 480	3.85		
38. 1280-310	1.41	78. 2480- 510	3.20		
39. 1310-340	1.37 +	79. 2510- 540	4.38 +		
40. 1340-370	1.58	80. 2540- 570	1.88		

+ Samples analysed for source rock potential

TABLE 4B

ORGANIC CARBON DATA

SIDETRACK SECTIONS

COMPANY: STATOIL | WELL: 1/9-4 | LOCATION: NORWEGIAN N. SEA

	SAMPLE DEPTH (METRES)	ORGANIC CARBON % OF ROCK
	SIDETRACK ST	
	98. 2963 - 990	0.93
	99. 2990 -3020	1.03
	100. 3020 - 050	1.04
	SIDETRACK ST-2	
	101. 3020 - 050	0.68
	102. 3050 - 080	0.90 +
	103. 3110 - 140	0.72
	104. 3140 - 170	0.89 +
	105. 3170 - 200	0.89
	SIDETRACK ST-3	
	106. 3059 - 080	0.81
(uncertain)	107. 3080 - 110	1.01
	108. 3110 - 140	1.84
	109. 3140 - 170	1.00
	110. 3170 - 200	0.53
	111. 3200 - 230	0.60
	112. 3230 - 260	0.47
	113. 3260 - 290	0.32
	114. 3290 - 320	0.18
	115. 3320 - 350	0.87
	116. 3350 - 380	0.27 +
	117. 3380 - 410	0.42
	118. 3410 - 440	0.19
	119. 3440 - 470	0.41
	120. 3470 - 500	1.89
	121. 3500 - 530	1.19 +
	122. 3530 - 560	0.67
A. (	123. 3560 - 590	0.56
B. (	124. 3560 - 590	0.51
	125. 3590 - 620	0.63
	126. 3620 - 650	0.62 +
	127. 3650 - 680	0.69
	128. 3680 - 710	4.22 +

+ Samples analysed for source rock potential

TABLE 5A

SOURCE ROCK EVALUATION DATA

COMPANY : STATOIL WELL: 1/9-4 LOCATION : NORWEGIAN N.SEA

SAMPLE DEPTH (METRES 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 ALKANES % HYDRO-CARBONS
5. 290	Ctgs	CLYST/SLTST,gy,calc	0.47	155	3.3	<20	3	90+
10. 440	"	CLYST, gy-brn, calc	0.60	405	6.8	35	9	95
14. 560	"	"	0.64	725	11.3	<20	2	90+
17. 650	"	"	0.57	635	11.1	30	4	90+
20. 740	"	"	0.45	1260	28.0	40	3	90+
24. 860	"	CLYST, gy-brn/gy-gn, calc	0.52	1320	25.4	60	5	90+
27. 950	"	"	0.89	1100	12.4	40	4	66
31. 1070	"	"	0.62	755	12.2	25	4	48
33. 1130	"	"	0.70	920	13.1	<20	1	95
36. 1220	"	MDST/SH, dk gy-brn	1.04	1340	12.9	65	5	90+
39. 1310	"	"	1.37	910	6.6	35	4	90+
43. 1430	"	MDST/SH, gy/ol-gy, calc	1.31	835	6.4	20	2	79
47. 1550	"	"	1.01	1410	14.0	95	7	90+
50. 1640	"	"	1.08	1085	10.0	45	4	77
53. 1730	"	SH/MDST, med & dk ol-gy	1.27	1875	14.8	190	10	74
56. 1820	"	"	1.83	1630	8.9	140	9	57
59. 1910	"	"	1.87	1885	10.1	70	4	90+
62. 2000	"	"	1.74	2010	11.6	190	9	78
65. 2090	"	"	2.83	5305	18.7	835	16	87
67. 2150	"	"	2.42	3695	15.2	1570	43	36
70. 2240	"	"	2.79	4210	15.0	2035	48	87
73. 2330	"	"	3.25	3975	12.2	1360	34	75
76. 2420	"	SLTY SH, dk gy with mnr MDST, gy-gn	2.82	5800	20.6	2985	51	80
79. 2510	"	"	1.76	5100	29.0	4175	82	84
82. 2600	"	SH, med/ol-gy with mnr SLTST	1.21	3530	29.2	2365	67	80
85. 2690	"	"	1.81	4290	23.7	2990	70	79
89. 2810	"	"	1.12	2825	25.2	820	29	57
93. 2930	"	"	1.03	2095	20.3	375	18	60
96. 3020	"	SH, gn-gy/med-dk gy with mnr SST	1.22	2820	23.1	785	28	79
97. 3050	"	SH, dk gy, with brn & gy	1.98	2115	10.7	330	16	84

90+ : greater than 90

TABLE 5B

SOURCE ROCK EVALUATION DATA

COMPANY: STATOIL WELL: 1/9-4 LOCATION: NORWEGIAN N.SEA

SAMPLE DEPTH METRES 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 ALKANES % HYDRO CARBONS
ST-2								
102. 3050	Ctgs	SH,med dk gy & mnr SST	0.90	1995	22.2	220	11	81
104. 3140	"	" , some CHK	0.89	2665	30.0	380	14	73
ST-3								
116. 3350	Ctgs	CHK,pnk gy with mnr SH dk gy	0.27	140	5.2	<20	2	90+
121. 3500	"	CHK,gy-gn,marly & SH, dk gy	1.19	880	7.4	55	6	63
126. 3620	"	" , with mnr SH,blk	0.62	470	7.6	<20	3	90+
128. 3680	"	SH,blk to dk gy	4.22	1545	3.7	50	3	62
		HAND-PICKED ORGANIC CARBONS						
121A.(ST-3)	Ctgs	SH, dk gy	0.96					
121B.(")	"	MARLY CHK, gy-gn	0.25					
126A.(")	"	SH, blk	0.96					
100A.(ST)	"	SH, gy (from SST)	0.66					

90+ : greater than 90

LOWER MIOCENE & OLIGOCENE	4. 1,850-2,540	Dark olive-grey, dark grey, medium grey shales and some mudstones.	Early maturity	Immature to transitionally mature	Average to above average organic carbon contents with abundant hydrocarbons. Some gas generation but otherwise stained by non-indigenous hydrocarbons.	A good potential source for gas at optimum maturity possibly with some minor oil potential.
EOCENE & EOCENE - PALAEOCENE	5. 2,540-2,810	Grey, grey-green, olive-grey, brown-grey shales.	Early maturity	Transitionally mature	Just average organic carbon contents and with abnormally high hydrocarbon contents. Stained.	Possibly minor gas potential at optimum maturity.
PALAEOCENE & DANIAN	6. 2,810-3,230	Grey, grey-green, olive-grey and grey-brown shales, with interbedded sandstone. Minor chalk at base.	Early maturity	Transitionally mature	Just below average to average organic carbon contents. High proportion of extractable organic matter but relatively few hydrocarbons. Contaminated.	Probably only minor gas generating potential.
MAASTRICHTIAN, CAMPANIAN - SANTONIAN CONIACIAN & ?LOWER CRETACEOUS	7. 3,230-3,680	Chalk, pink-grey to grey-green marly; interbedded grey shale.	Early maturity	Early maturity	Chalk and shales of below average organic carbon content and no hydrocarbon generating potential.	No hydrocarbon generation likely.
?PERMO-TRIAS	8. 3,680-3,710	Black shale.	Early maturity	Early maturity	Average to above average organic carbon content, but negligible hydrocarbon content.	No hydrocarbon generating potential.

FIGURE 1

HEADSPACE GASEOUS ($C_1 - C_4$) HYDROCARBONS

COMPANY : STATOIL WELL : 1/9-4 LOCATION : NORWEGIAN NORTH SEA

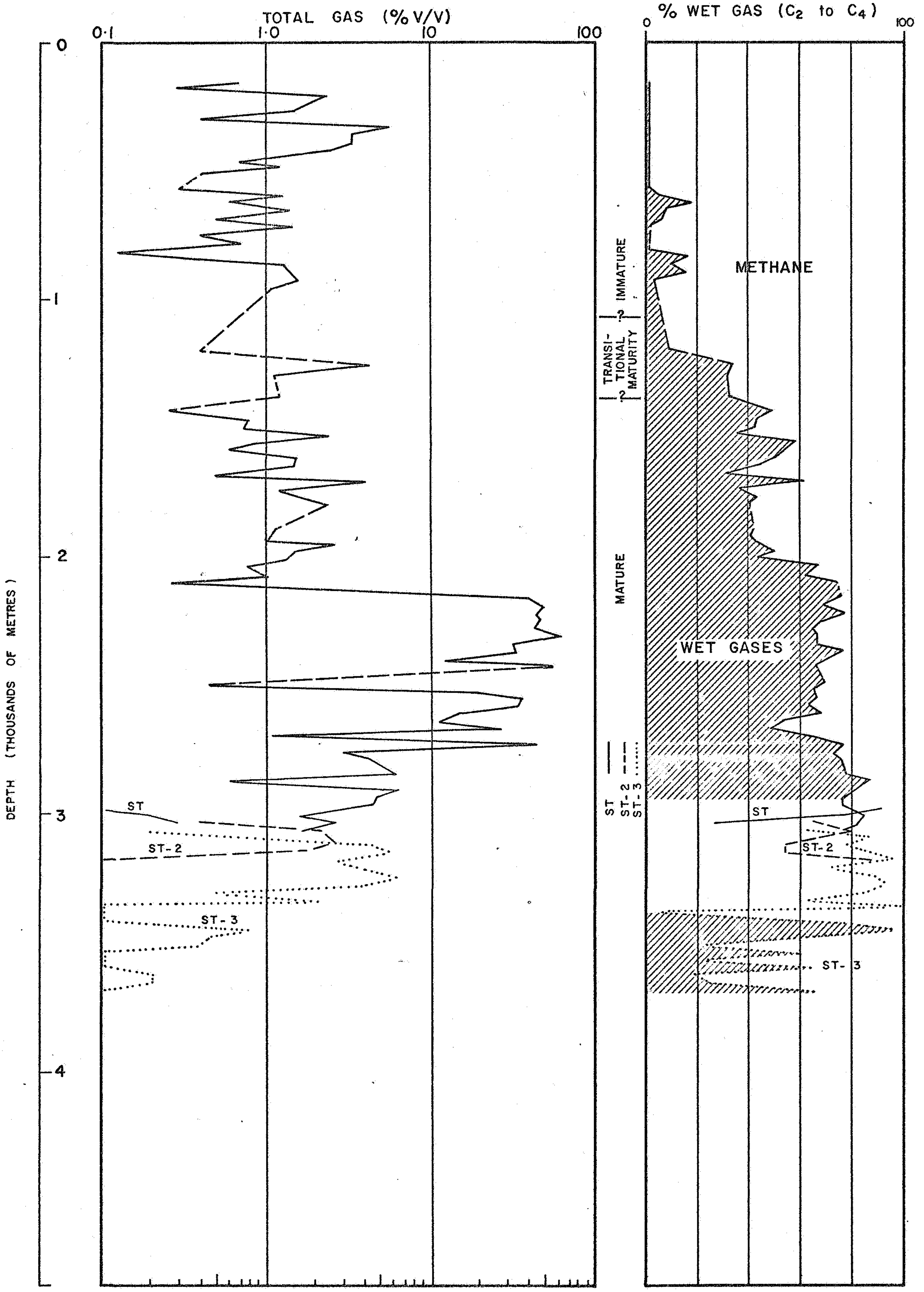


FIGURE 2

GASEOUS ($C_1 - C_4$) HYDROCARBONS

COMPANY : STATOIL   WELL : 1/9-4   LOCATION : NORWEGIAN NORTH SEA

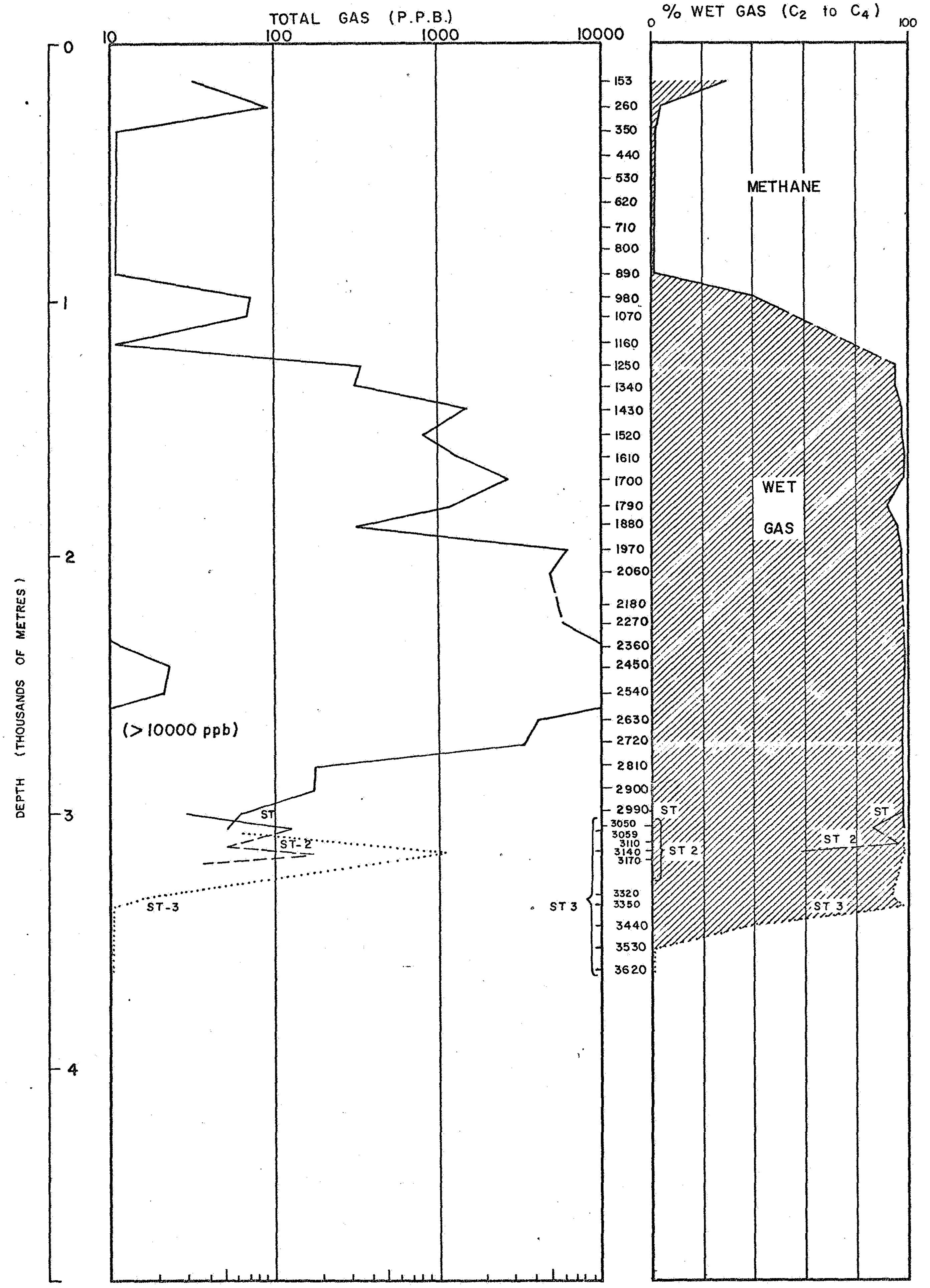
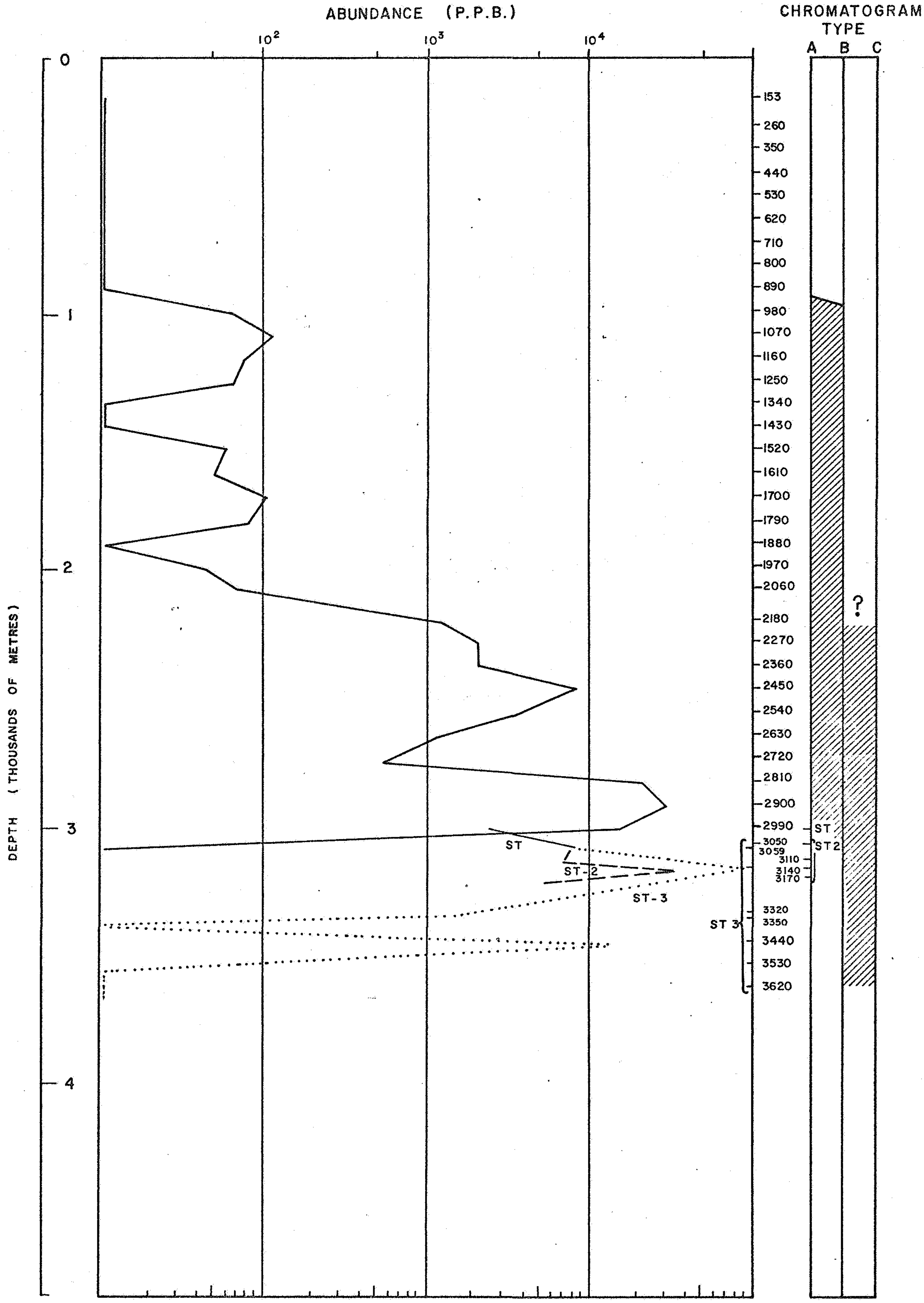


FIGURE 3

GASOLINE RANGE (C_5-C_7) HYDROCARBONS

COMPANY: STATOIL   WELL: 1/9-4   LOCATION: NORWEGIAN NORTH SEA



A, IMMATURE ; B, TRANSITIONAL ; C, OIL-LIKE

FIGURE 4.

SPORE COLOURATION INDICES AGAINST DEPTH

COMPANY : STATOIL　　WELL : 1/9-4　　LOCATION : NORWEGIAN NORTH SEA

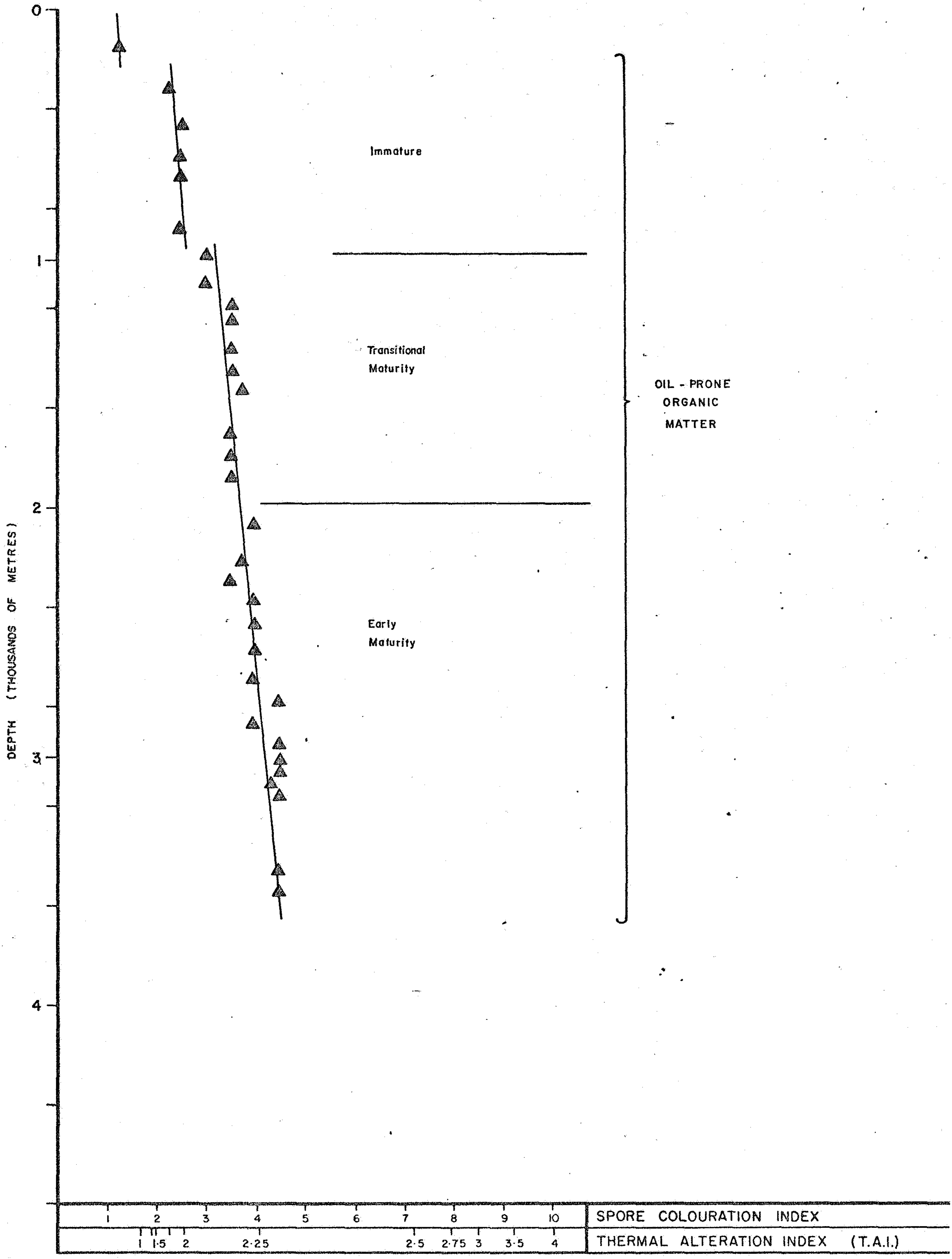


FIGURE 5

VITRINITE REFLECTIVITY AGAINST DEPTH

COMPANY : STATOIL   WELL : 1/9-4   LOCATION : NORWEGIAN NORTH SEA

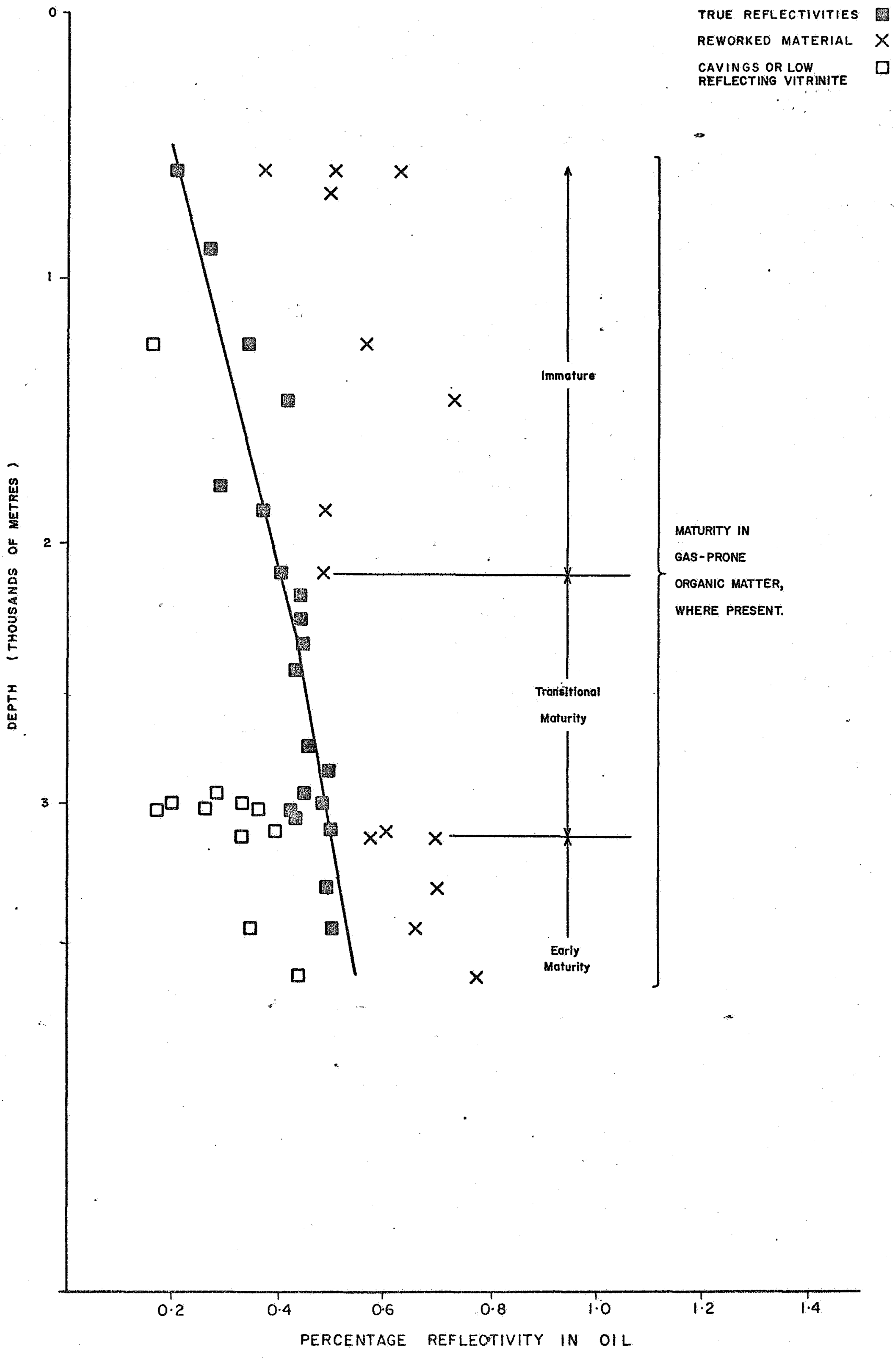


FIGURE 6

TYPE OF HYDROCARBON PRODUCT FROM SOURCE ROCKS

COMPANY : STATOIL WELL : 1/9-4 LOCATION : NORWEGIAN NORTH SEA

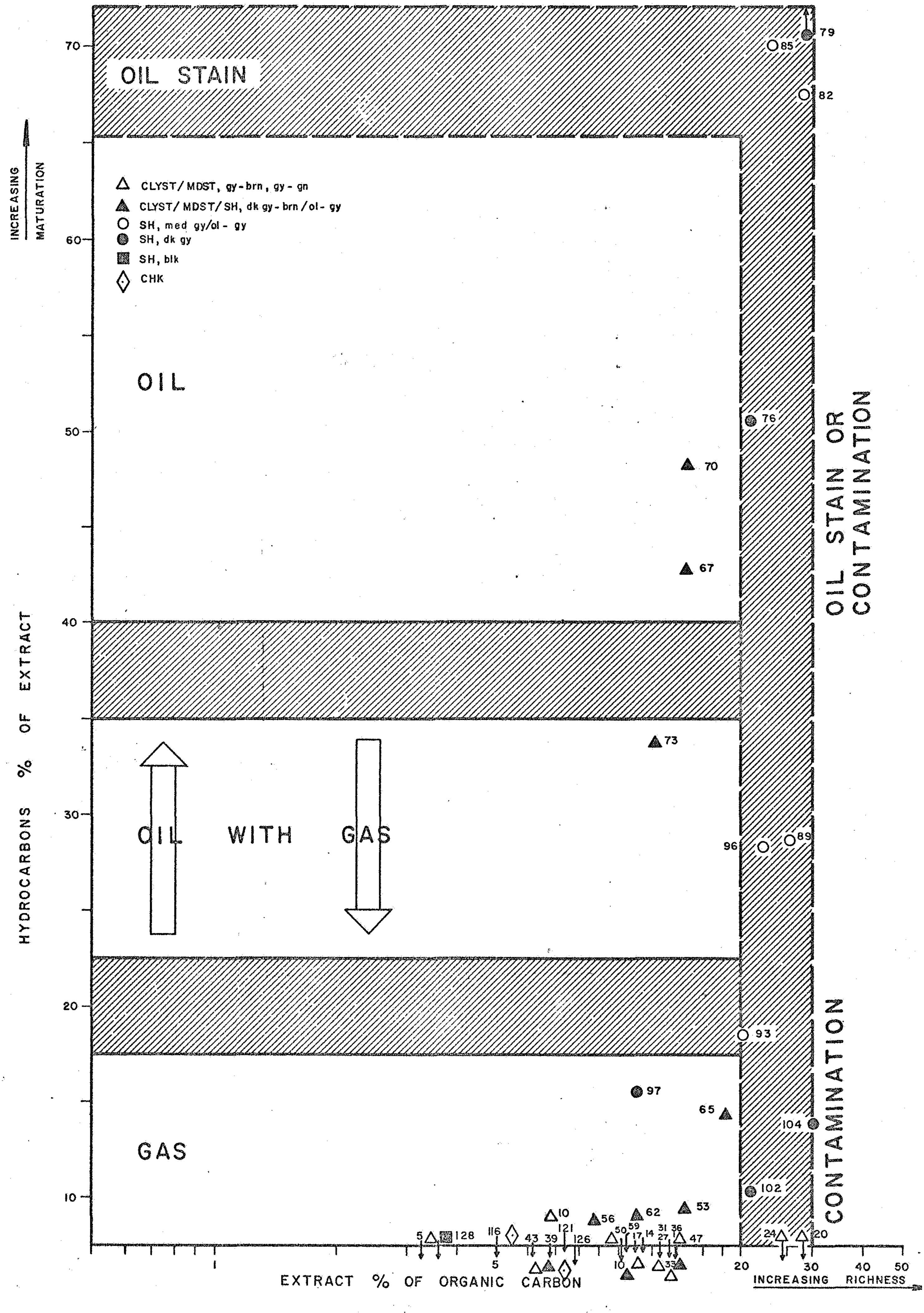
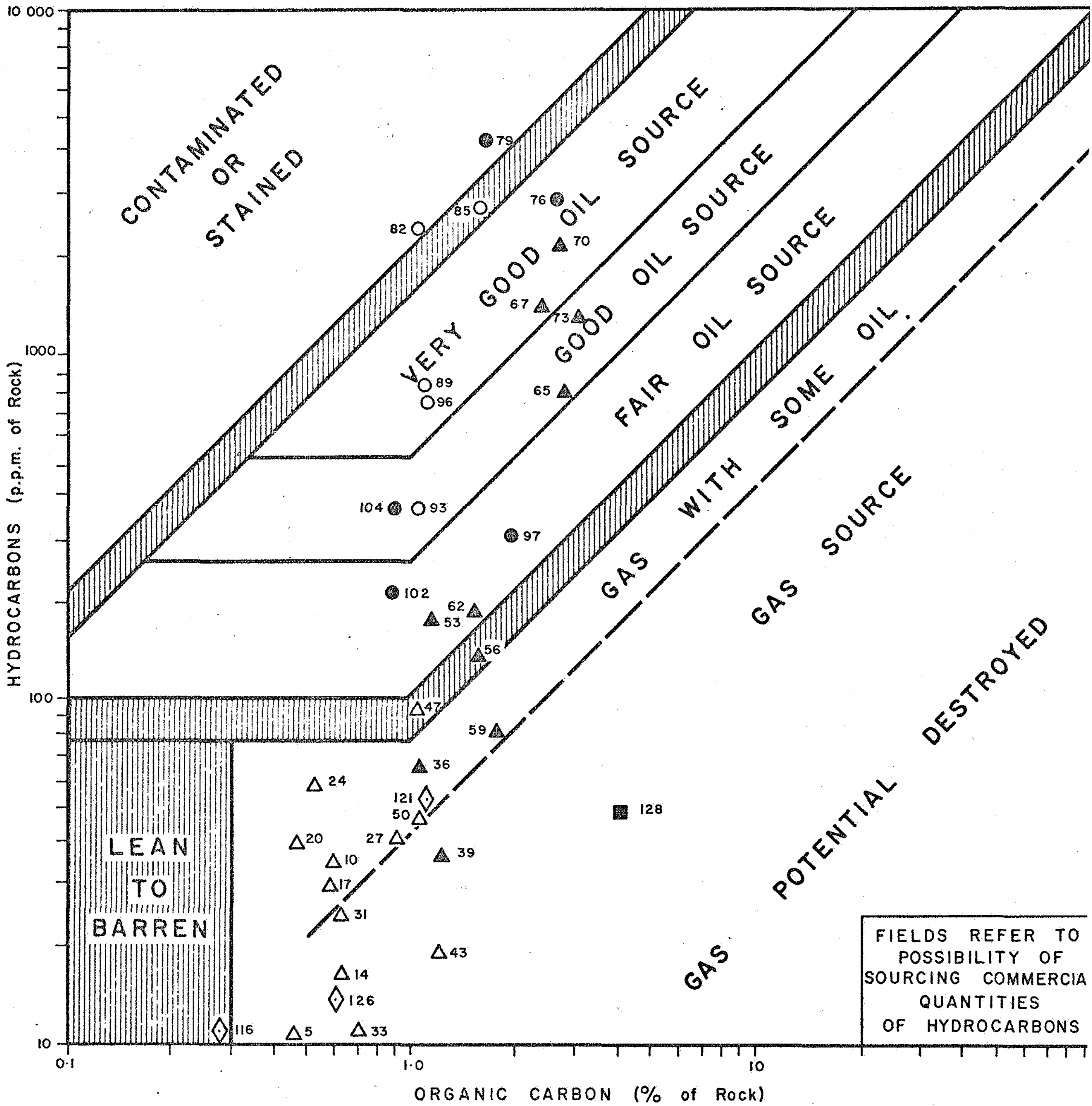


FIGURE 7

MATURE SOURCE ROCK RICHNESS

COMPANY : STATOIL WELL : 1/9-4 LOCATION : NORWEGIAN NORTH SEA



LEGEND

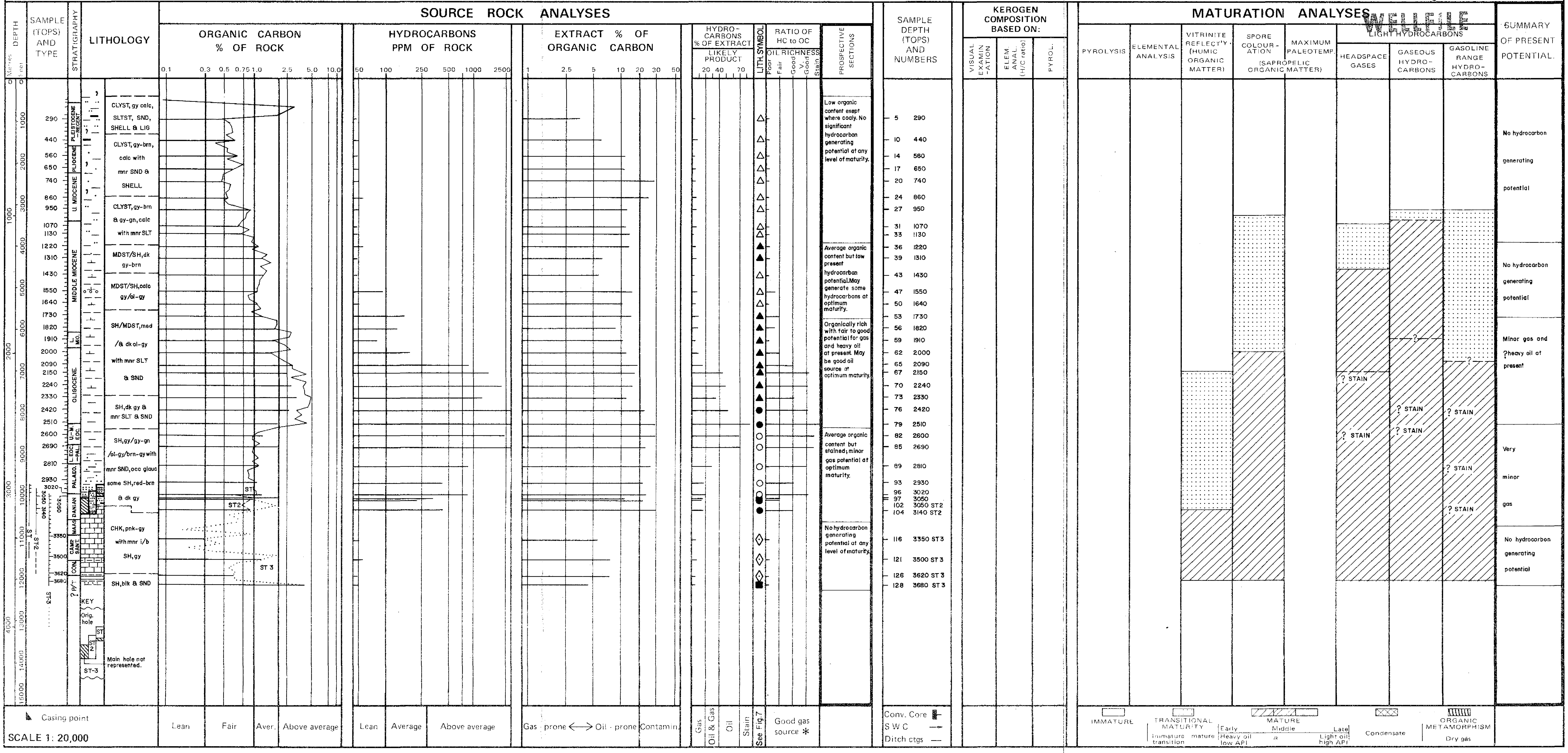
- △ CLYST/MDST, gy-brn, gy-gn
- ▲ CLYST/MDST/SH, dk gy-brn/ol-gy
- ○ SH, med gy/ol-gy
- ● SH, dk gy
- ■ SH, blk
- ◇ CHK

Drawing No. 162P/2606/4071

GEOCHEMICAL DATA SUMMARY CHART

COMPANY: STATOIL — WELL: 1/9-4 — LOCATION: NORWEGIAN NORTH SEA

No 24 — FIGURE 8



No. 24

VITRINITE REFLECTIVITY DATA SUMMARY CHART I

WELLFILE

COMPANY: STATOIL | WELL: 1/9-4 | LOCATION: NORWEGIAN NORTH SEA

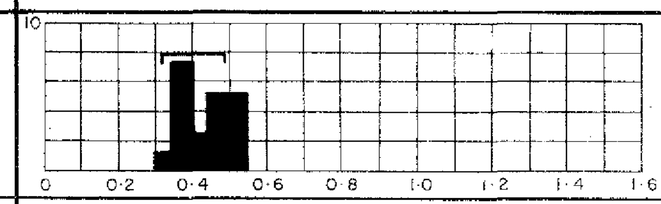
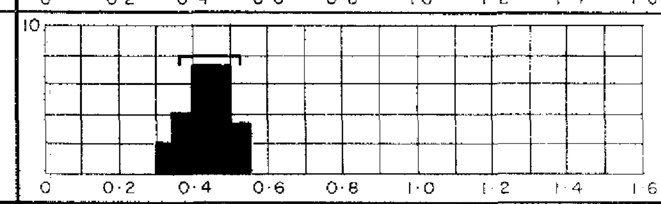
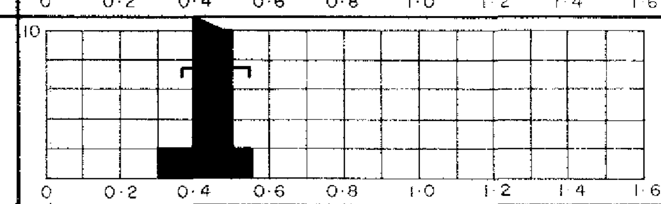
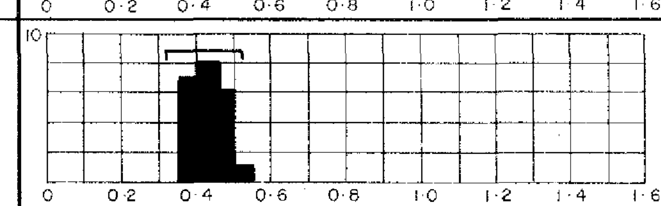
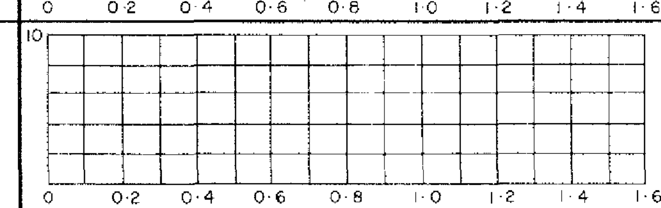
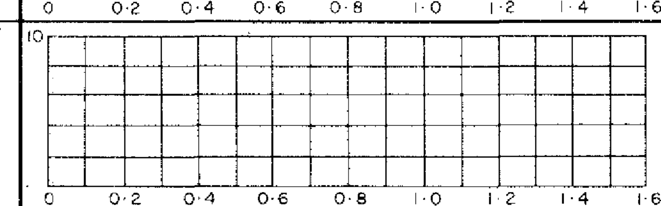
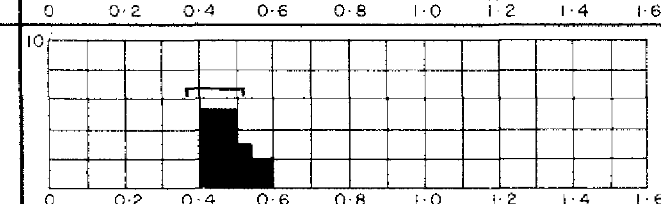
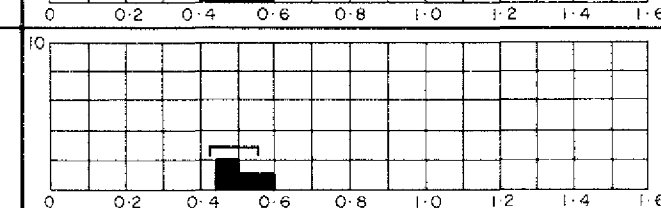
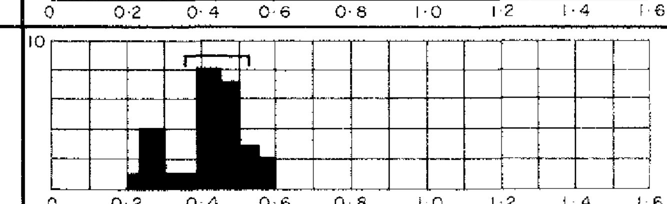
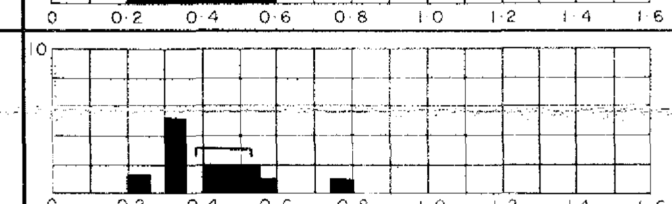
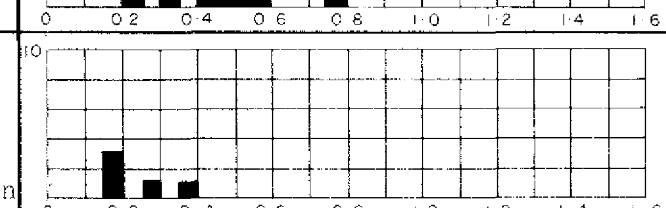
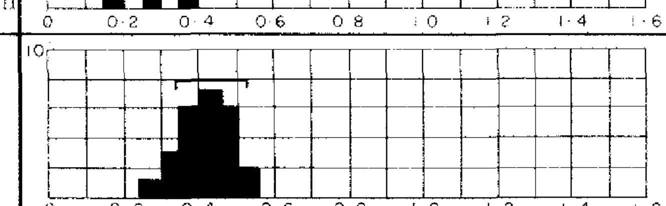
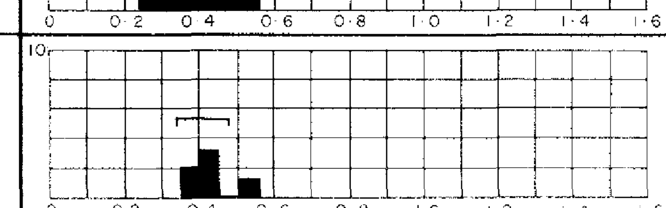
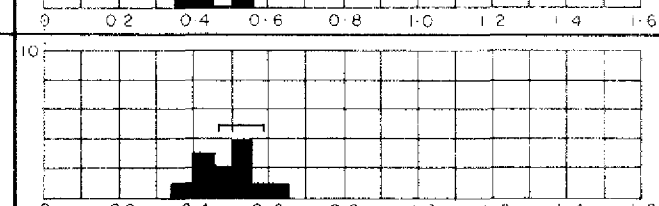
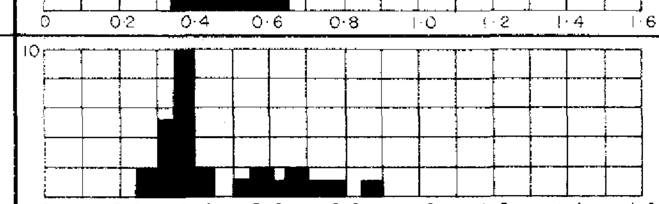
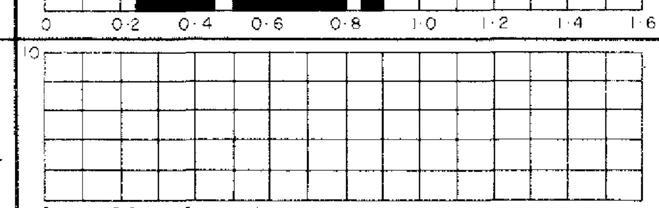
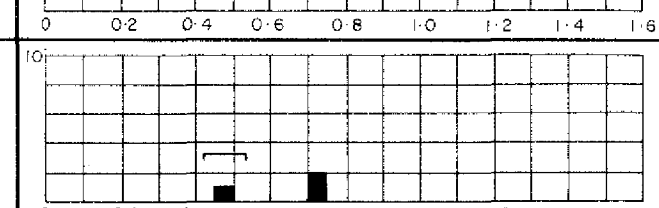
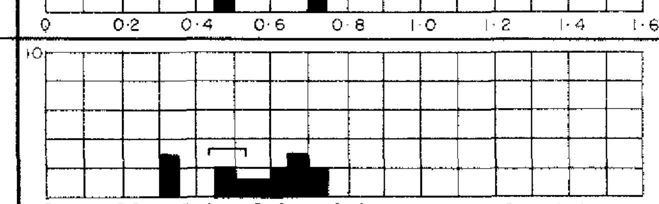
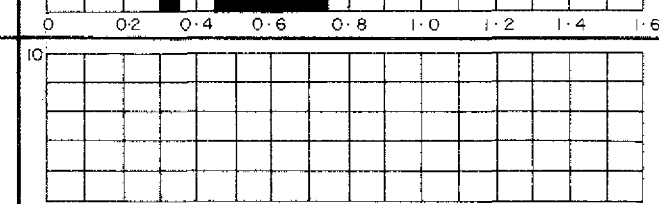
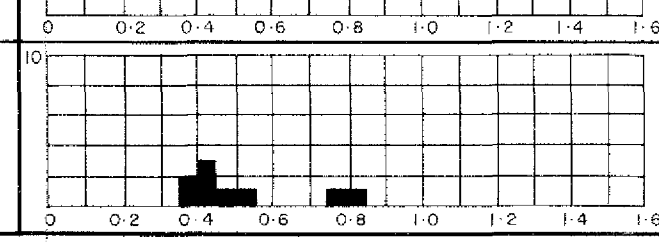
DEPTH METRES	LITHOLOGY & MINERALOGY	TYPE OF ORGANIC MATTER	HISTOGRAM SHOWING REFLECTIVITY VALUES/No. OF MEASUREMENTS	R (av) (%)	No. of PARTICLES	FLUORESCENCE IN BLUE LIGHT
153-170	Kerogen Concentrate	Organic matter sparse. No reliable vitrinite		-	-	None
				-	-	Rare yel resin and spores.
320-350	Sandstone and pyrite	Very poor organic matter		-	-	Pale yel-gn/yel-orng ? spores.
320-350	Kerogen Concentrate	Some cell-like structured humic material low reflecting.		-	-	Abundant yel spores and dinos
470-500	Mixed shales	Some semifusinite and poor quality vitrinite		-	-	Occ gold frags.
470-500	Kerogen Concentrate	Some humic material, including inertinite and poor quality vitrinite.		-	-	Yel and yel-gold frags and gold frags in mineral matrix.
590-620	Mixed shales	No vitrinite seen		-	-	Carbonate flu. Yel-gn algae
590-620	Kerogen Concentrate	Low rank brown organic matter and mineral resin, inertinite and structured woody material		0.21 0.37 0.51 0.63	1 10 2 7	Yel-gold spores and pollen, also background (? sapropel).
680-710	Mixed shales	No vitrinite; some inertinite		-	-	Carbonate flu
680-710	Kerogen Concentrate	No good vitrinite; some low rank collinite. Inertinite present. Reworked vitrinite at 0.5%		0.50	7	A few rare yel spores and frags.
890-920	Shales	Some inertinite		-	-	Dull carbonate flu
890-920	Kerogen Concenrtate	Inertinite. Some poor quality vitrinite. Brownish pyrite aggregates		0.28	3	Gold/yel-gold spore frags.
980-1010	Shales	Brown, low reflecting humic material. Some spores.		-	-	Dull carbonate flu. Occ yel-gn spores and algae
980-1010	Kerogen Concentrate	Brown mineral matter, resin, inertinite and orange-brown exinite.		-	-	Rare yel/yel-gold spores and frags
1100-130	Kerogen Concentrate	No vitrinite. Inertinite shards and brown mineral matter		-	-	Dull pale brn carbonate flu. Yel-gold spores
						Rare yel/yel-gold spores and frags.
1190-220	Shales	Algal stringers? Moderate organic content, mainly inertinite and low reflecting vitrinite		-	-	Yel spores and frags.
1190-220	Kerogen Concentrate	Brown mineral matter. Occasional inertinite shards.		-	-	Occ yel/yel-gold spore fragments.
1250-280	Silty shale	Some brownish vitrinite and ? algal stringers		-	-	Rare yel-orng ? spore frags.
1250-280	Kerogen Concentrate	Occasional inertinite and vitrinite		0.16 0.33 0.57	5 9 11	Occ yel/yel-gold spore frags
1370-400	Some shales	No obvious organic content		-	-	Bright carbonate flu. Yel-gold/yel spore frags and algae
1370-400	Kerogen Concentrate	Brown mineral matter and inertinite; no vitrinite or resin.		-	-	V rare dull yel-gold
1460-490	Silty shales	Rare organic matter, some reworked vitrinite.		-	-	Gold spores and spore frags.
1460-490	Kerogen Concentrate	Brown mineral matter with occasional inertinite. Some good cell-structured fusinite. Resinite. Telinite.		0.43 0.74	3 3	Yel/yel-gold spores, dinos, pollen
1580-610	Soft calcareous silty shale	No identifiable or measurable organic matter.		-	-	Rare yel-gold. Some carbonate flu
1580-610	Kerogen Concentrate	Occasional inertinite and resinite but no vitrinite.		-	-	Yel-gold spores and frags
1700-730	Shales	Rare organic matter, some spores and algae		-	-	Rare yel spores
1700-730	Kerogen Concentrate	Occasional humic organic matter, some vitrinite and resinite.		-	-	Yel spores and spore frags
1790-820	Shales	Abundant brown organic matter (?vitrinite)		-	-	Rare yel spores
1790-820	Kerogen Concentrate	Brown organic matter, other small fragments Some resin and semifusinite. Some large fragments of vitrinite.		0.29	17	Occ yel frags. Some gold spores and algae
1880-910	Shales	Some large corroded vitrinite particles		0.37 0.49	11 4	Yel-gold spores and frags. Abundant bright yel-brn carbonate flu
1880-910	Kerogen Concentrate	Brown unidentifiable organic matter. Resin. Amorphous humic fragments. Some good vitrinite fragments, though rather small.		0.34 Total (0.35	21 32)	Gold spores and algae
1940-970	Shales	Some barren shales and some humic material.		-	-	Yel-brn carbonate flu. Rare gold/yel-gold spores.
1940-970	Kerogen Concentrate	Brown unidentifiable organic matter with very rare humics		-	-	Rare gold spores and algae.
2060-090	Shales	No measurable organic matter		-	-	Rare gold spores
2060-090	Kerogen Concentrate	Brown unidentifiable organic matter with very rare humics		-	-	Small gold frags
2120-150	Slightly silty shale	No measurable organic matter		-	-	Rare yel-gold spores
2120-150	Kerogen Concentrate	Some inertinite and humic aggregates; also good vitrinite, both small and large		0.41 0.49	23 2	Yel/yel-brn spores

REF: RRI/778/HD/2606 | DRAWING No: 163P.2606/4071 | DATE: January, 1978

VITRINITE REFLECTIVITY DATA SUMMARY CHART II

No 24 WELLFILE

COMPANY: STATOIL | WELL: 1/9-4 | LOCATION: NOWEGIAN NORTH SEA

DEPTH METRES	LITHOLOGY & MINERALOGY	TYPE OF ORGANIC MATTER	HISTOGRAM SHOWING REFLECTIVITY VALUES/No. OF MEASUREMENTS	R (av) (%)	No. of PARTICLES	FLUORESCENCE IN BLUE LIGHT
2210-240 2210-240	Shale Kerogen Concentrate	No measurable organic matter Relatively abundant humics, some good vitrinite but as small particles.		- 0.36 0.49 0.44	- 8 12 20)	Rare yel spores. Dull brn yel-brn carbonate flu. Some yel spores and yel-brn resinite.
2300-330 2300-330	Mixed shales Kerogen Concentrate	Organic particles unmeasurable Relatively abundant humics, some good vitrinite but as small particles.		- 0.43	- 23	Rare flu; occ orng-gold frags. Mod abundant yel-orng spores.
2390-420 2390-420	Various shales Kerogen Concentrate	Very little organic matter Relatively abundant humics, some good vitrinite but as small particles. Some resin and semifusinite.		- 0.44	- 26	Bright yel carbonate flu. Rare dull orng-gold spores. Mod abundant yel yel-orng, orng-brn spores.
2480-510 2480-510	Shales Kerogen Concentrate	Very little organic matter Some good humic material. Measurable fragments not common		- 0.42	- 22	Bright yel-gold carbonate flu. Rare yel-gold spores. A few yel-brn, brn spores
2570-600 2570-600	Shale Kerogen Concentrate	Barren Only occasional inertinite		- -	- -	Bright yel-gn carbonate flu. V rare gold and orng frags. A few gold, yel-orng spores.
2690-720 2690-720	Shale Kerogen Concentrate	No vitrinite Some collinite (? additive). Occasional inertinite		- -	- -	No organic flu. Rare yel, yel-gold spores and some brn resinite.
2780-810 2780-810	Shales Kerogen Concentrate	No measurable vitrinite Tabular humic particles in mineral matter Vitrinite and some fusinite.		- 0.46	- 15	Carbonate flu of variable intensity. Some spores and algae with yel and gold flu. Flu rare, occ yel-brn spores
2870-900 2870-900	Shales Kerogen Concentrate	No definite organic matter seen Mineral with some tabular humic matter. Few particles.		- 0.50	- 4	Rare organic flu, some bright yel algae. Yel spores, yel-brn frags, low abundance.
2960-990 2960-990	Shales and siltstone Kerogen Concentrate	Mineral matter and very occasional inertinite Fine grained organic matter with various humic particles		- 0.28 0.44	- 6 21	Variable flu, some dull gold orng-brn spores. Rare flu, occ gold yel-orng frags.
3020-050 3020-050	Shales and limestone, chalk Kerogen Concentrate	Very little organic matter. ?oil stain in chalk. Fine grained organic matter with various humic particles		- 0.20 0.33 0.48	- 1 5 7	Rare gold, gold orng frags. Yel, orng and brn algae.
3020-050 ST 3020-050	Shales and silty shales Kerogen Concentrate	Organic matter abundant but high reflecting. High reflecting inertinite and reworked vitrinite, sapropel-like material may be stain		- 0.18 0.26 0.37	- 3 1 1	Rare Yel-orng spores, yel-brn ? sapropel.
3020-050 ST-2 3020-050	Shales, silty shales and sandstones Kerogen Concentrate	Barren or brown-stained organic matter (may be of vitrinitic composition). Some tabular humic material in pyrite masses. Some high reflecting humics		0.34 0.42	3 22	Brn stain does not flu (probably vit), occ gold gold-orng spores frags and algae. Yel spores and brn ? sapropel
3059-080 ST-3 3059-080	Various shales Kerogen Concentrate	Very rare organic matter, particles small and indeterminate [illegible] mainly [illegible]. Fine-grained mineral matter with some high reflecting organic matter.		- 0.41	- 5	Dull yel-brn carbonate flu. Dull gold frags. Rare flu. Occ. brn spore.
3110-140 ST-2 3110-140	Shale, sandstone and chalk Kerogen Concentrate	No identifiable organic matter, possibly some staining. Mixture of fine-grained mineral, humic material. Some larger angular fragments		- 0.39 0.51 0.60	- 4 [illegible] [illegible]	V rare organic flu, orng-gold. Rare, occ yel-brn frags.
3110-140 ST-3 3110-140	Calcareous shales (?chalk) Kerogen Concentrate	Barren Some large vitrinite sheets with embedded inertinite fragments		- 0.34 0.57 0.79	- 19 4 4	Yel to brn carbonate flu. V rare orng frags. A few yel-gold, yel-brn spores
3170-200 ST-2 3170-200	Shale, chalk Kerogen Concentrate	Essentially barren. No vitrinite seen Mineral matter and humic material; mainly inertinite, resin and some vitrinite.		- -	- -	No organic flu. Brn resin and particles
*3320-350 ST-3 3320-350	Shale, chalk Kerogen Concentrate	Barren. Some ? bitumen stain Abundant low reflecting organic matter. Some vitrinite but difficult to measure		- 0.45 0.71	- 1 2	Dull yel-brn carbonate flu. Yel-orng spores, yel algae, orng resin.
*3470-500 ST-3 3470-500	Shale, chalk Kerogen Concentrate	Some observed vitrinite may be additive Mineral, organic aggregates plus additive. Some poor quality vitrinite.		- 0.34 0.50 0.66	- 3 3 8	Dull yel carbonate flu Some yel-orng spores and brn resin.
3560-590 ST-3(B) 3560-590	Shale, chalk Kerogen Concentrate	Barren Mineral, organic aggregates plus additive Some poor quality vitrinite.		- -	- -	A few dull orng-brn particles Yel and orng spores, brn resin
3650-680 ST-3 3650-680	Shale, chalk Kerogen Concentrate	Some possible oil stain Mineral organic aggregates plus additive Some poor quality vitrinite		- 0.43 0.78	- 7 2	Occ gold-orng frags. Occ yel-orng spores and brn resin

* 3230, 3380 No determinations possible

REF: RRI/778, ED 2606 | DRAWING No 163P, 2606, 4971 | DATE: January, 1978

APPENDIX I

ABBREVIATIONS USED IN ANALYTICAL DATA SHEETS

Alg	Algae	Mtl	Mottled
Aren	Arenaceous	Musc	Muscovite
Arg	Argillaceous	NS	No sample
Bit	Bitumen/bituminous	Occ	Occasional
Bl	Blue	Ol	Olive
Blk	Black	Ool	Oolite/oolitic
Brn	Brown	Orng	Orange
Calc	Calcareous	Pnk	Pink
Carb	Carbonaceous	Pop	Population
Chk	Chalk	Pp	Purple
Cht	Chert	Pyr	Pyrite/pyritic
Cgl	Conglomerate	Qtz	Quartz
Cly	Clay	Ref	Reflectivity
CMT	Cement	Sap	Sapropel
Crs	Coarse	Sft	Soft
Ctgs	Ditch cuttings	Sh	Shale
Dk	Dark	Shly	Shaly
Dol	Dolomite	Sil	Siliceous
F	Fine	Slt	Silt
Fer	Ferruginous	Sltst	Siltstone
Flu	Fluorescence	Slty	Silty
Fm	Formation	Snd	Sand
Foram	Foraminifera	Sndy	Sandy
Fr	Friable	Sst	Sandstone
Frags	Fragments	SWC	Sidewall core
Glc	Glauconite	Tr	Trace
Gn	Green	V	Very
Gy	Grey	Vgt	Variegated
Gyp	Gypsum	Vit	Vitrinite
Hd	Hard	Wht	White
Inert	Inertinite	Yel	Yellow
Lam	Laminae/laminated	-	Sample not analysed
LCM	Lost circulation material	*	No results obtained
Lig	Lignite/lignitic	Gy-gn	Greyish green
Lst	Limestone	Gn/gy	Green to/and grey
Lt	Light	Gn-gy	Greenish grey
Mdst	Mudstone		
Med	Medium		
Mic	Micaceous		
Mnl	Mineral		
Mnr	Minor		

APPENDIX II

LIST OF SAMPLES

This appendix presents a list of samples received below a depth of 2,780 metres, that is, the section of the well where sidetrack material was available. Many of the samples received were not correctly annotated and some difficulty was experienced in assigning samples to their correct sidetrack hole. The Table presents a list of samples as received and is amended to show the arrangement used in the report (Table 4A/B).

TABLE

NO NOTATION	ST NOTATION	ST-2 NOTATION	ST-3 NOTATION
88. 2780 - 810			
89. 2810 - 840			
90. 2840 - 870			
91. 2870 - 900			
92. 2900 - 930			
93. 2930 - 960			
94. 2960 - 990			
2963 - 990 →	98. →		
95. 2990 -3020	99. 2990 - 3020		
96. 3020 - 050	100. 3020 - 050	101. 3020 - 050	
97. 3050 - 080		102. 3050 - 080	106. 3059 - 080
3080 - 110 →			107. →
		103. 3110 - 140	108. 3110 - 140
		104. 3140 - 170	109. 3140 - 170
3170 - 200 →		105. →	110. 3170 - 200
			111. 3200 - 230
			112. 3230 - 260
			113. 3260 - 290
			114. 3290 - 320
			115. 3320 - 350
116. 3350 - 380			→
117. 3380 - 410			
118. 3410 - 440			
119. 3440 - 470			
120. 3470 - 500			
121. 3500 - 530			
122. 3530 - 560			
123. 3560 - 590A			
124. 3560 - 590B			
125. 3590 - 620			
126. 3620 - 650			
127. 3650 - 680			
128. 3680 - 710			