ROBERTSON RESEARCH INTERNATIONAL LIMITED

WELLFILE

REPORT NO. 4123P

REPORT ON A GEOCHEMICAL EVALUATION OF THE 1/9-2 WELL, NORWEGIAN NORTH SEA

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SUMMARY

Shales 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-prone or gas-prone organic matter. Despite this, a number of horizons do have limited hydrocarbon generating potential at their present maturation levels. In particular, the Oligocene shales appear to be generating gaseous hydrocarbons and heavy condensates and would be likely to be prolific gas sources at optimum maturity. Shales in the Danian, Palaeocene and Lowermost Eocene have some gas and heavy, possibly to medium gravity oil, generating potential at present; some may become good oil source rocks at optimum maturity.

The maturation data implie that over the interval 2,200 to 2,500 metres either a reverse fault of 500 metres throw is present, or that tension fractures, similar to those in the nearby Ekofisk salt supported trap structures, have carried heated formation waters. Biostratigraphic data do not appear to support the former.

I

INTRODUCTION

A geochemical study of the 1/9-2 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 150 to 3,450 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.

109 fresh, unwashed ditch cuttings in sealed metal cans were available over 30 metre intervals from the analysed section. Samples for the maturation analyses were selected as follows : 79 headspace gas analyses were carried out on the canned samples at intervals of between 30 and 60 metres; spore colouration and vitrinite reflectivity analyses were carried out on 23 samples at intervals of approximately 90 metres. For the source rock analyses 109 organic carbon determinations were made, on all canned ditch cuttings samples containing argillaceous lithologies; extraction and fractionation was carried out at approximately 90 metre intervals depending on the results of the organic carbon determinations and the suitability and quantity of the material available. In addition 10 organic carbon determinations were carried out on hand-picked lithologies, in various mixed-lithology samples, as a supplement to the source rock analyses.

Detailed stratigraphic information is available for this well under the Robertson Research Project Number RRI/778/IIA/1145; briefly, the well section penetrates a thick, relatively complete Tertiary sequence, bottoming in sediments of Upper Cretaceous age.

II

RESULTS AND INTERPRETATION

The results of the geochemical evaluation of the 1/9-2 well are presented in Tables 1 to 4 and are represented graphically in Figures 1 to 8 and the Enclosures.

A. MATURATION EVALUATION

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

Hydrocarbons present 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 the 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, although somewhat erratic over the first 2,000 metres of the well, shows a general increase from approximately 5,000 ppm, to a maximum in the order of 100,000 ppm at 2,250 metres. Below this depth, abundances fall steadily to a minimum in the order of 1,000 ppm at depths of below 3,000 metres; this is considered to reflect lithological changes as the Upper Cretaceous is reached at the base of the well section.

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 content is encountered in the section until below 780 metres; below 1,620 metres the proportion of wet gases is interpreted to rise to more than 10% which suggests that the transition zone from immature to mature sediments has been reached. Below approximately 2,100 metres the proportion of wet gases exceeds, with minor fluctuations, 30%, indicating that an early level of thermal maturity has been reached. This is maintained to the base of the analysed well section, with an overall steady increase in the wet gas content to a maximum in the order of 80% near total depth.

b. Gaseous Hydrocarbons (C_1 to C_4)

As with 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. In this series of analyses, however, the wet gas content is very variable, fluctuating between maxima and minima of 100% and 0%, no real trend is apparent. The precise reason for this fluctuation is not known, the section being relatively uniform in terms of lithology and geochemical characteristics, but may relate to the small amounts of gaseous hydrocarbons present. Similar variability is encountered in the gaseous hydrocarbon abundance data with values alternating between less than 10 ppb and 200 ppb.

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 market abundance, but with an overall low total hydrocarbon abundance (less than 100 ppb).

Figure 3 shows that gasoline abundance is rarely high through the analysed section, maximum values being only in the order of 200 ppb. Fluctuations cannot be related to lithology or geochemical parameters; these data would imply that the whole analysed section is immature. In contrast the distribution of the constituent gasoline range hydrocarbons implies that the section is immature to a depth of at least 1,600 metres (high content of n-alkanes), transitionally mature to at least 2,500 metres, and at an early level of thermal maturity below the latter depth.

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 a 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 most of the 23 analysed samples. Though relatively abundant, identified spores were of poor quality making it difficult for a representative selection of colour indices to be obtained from indigenous spores. In general, the samples examined contained a higher proportion of humic rather than sapropelic organic matter.

An examination of Figure 4 shows that spore colour indices are interpreted to rise from 2.5 at 500 metres to 5.5 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 1,750 metres. The base of the analysed section is in the middle stages of thermal maturity and capable of generating medium gravity oils where suitably rich oil-prone sediments are present.

A slight inflection in the gradient line is seen at a depth of approximately 2,250 metres.

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 dependent on length of time of heating: however, it is the only reliable maturation indicater 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 begin generating hydrocarbons at vitrinite reflectivities of 0.4% and above.

Vitrinite reflectivity measurements have been carried out on 26 ditch cuttings samples; the majority of the measurements were made on kerogen concentrates since most of the cuttings themselves were either too soft to yield good quality samples, 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 the number of measurements represented by this mean value. A detailed compilation of all the vitrinite reflectivity data is given in the enclosures, though samples from which no data were obtained are excluded.

Overall, sample coverage of the analysed well section was good except through parts of the more sandy Upper Miocene, Pliocene and Pleistocene. Quality of the data was very good below 1,500 metres.

Reflectivity levels for indigenous vitrinite increase steadily from around 0.2% at 800 metres to 0.6% at 3,400 metres. This implies that for gas-prone humic organic matter, the transition from immature to mature sediments occurs over the interval 2,300 to 3,000 metres; minor gaseous hydrocarbons could be generated below these depths. Reflectivity levels sufficient for the generation of prolific quantities of gaseous hydrocarbons are not attained by the base of the analysed section, but could be anticipated within a further 1,000 to 2,000 metres of section.

A localised reflectivity "high" occurs around 2,250 metres where levels reach 0.1% above those expected from the reflectivity gradient line.

A.4. COMPARISON OF MATURATION INDICES

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 1,750 metres. Light hydrocarbon analysis concurs to some extent, indicating the appearance of significant wet gases over the interval 1,620 to 2,100 metres. Both spore colouration and light hydrocarbon analysis indicate an early to middle stage of maturity at the base of the analysed section. Vitrinite reflectivity levels show that the corresponding zone of transitional maturity for gas-prone organic matter is deeper occuring over the aporoximate interval 2,300 to 3,000 metres; the level of maturity at the base of the analysed section is insufficient for the generation of prolific quantities of gaseous hydrocarbons.

A slight inflection is seen in the spore colouration gradient line over the interval 2,200 to 2,500 metres; a similar more pronounced inflection occurs in the vitrinite reflectivity gradient line over a similar interval 2,100 to 2,500 metres. Light hydrocarbon data, specifically the airspace gases, whilst not showing (Figure 1) a definite inflection, do show a slight fluctuation in the rate of increase of wet gas proportions over the interval 2,250 to 2,750 metres. Inflections of this type are commonly associated with reverse faulting and in this instance a throw of some 500 metres would be deduced from the data. Biostratigraphic evidence does not, however, confirm the presence of faulting on such a magnitude and we would conclude that the anomalous data are the product of localised thermal activity, or an influx of heated formation waters along a sedimentary aquifer or unsealed fault plane of low displacement. Fracturing of a tension type (little vertical displacement) occurs in both Cretaceous/ Danian reservoir and Tertiary cap rocks in the nearby Ekofisk field *(Blair 1975) related to salt supported structural traps; such faults may also occur in the 1/9-2 well. The nature of the data suggests that the causes of the anomaly began to operate when the section was buried to a shallow depth and lasted for a limited time.

* BLAIR, D. G. In Petroleum and the Continental Shelf of N. W. Europe, 1975.

B. SOURCE ROCK EVALUATION (Tables 4 and 5 and Figures 6 to 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 Biostratigraphy report. (An extra copy of Figure 8 is included as an enclosure for ease of reference).

B.1. PLEISTOCENE - RECENT, 160 - 540 metres (Samples 1 to 13)

This interval comprises sands, silts and shell debris, with minor amounts of a soft grey, calcareous claystone. Organic carbon determinations were carried out on hand-picked claystone and indicate values of between 0.45% and 0.88%, these being below average for argillaceous lithologies. One anomalously high value of 8.57% probably relates to the presence of a drilling additive, present through parts of this interval.

Sample 13 at 510 metres was sufficiently homogeneous for extraction and fractionation to be carried out effectively. The low proportion of extractable organic matter and deficiency of hydrocarbons indicate that this lithology has no hydrocarbon sourcing potential at the present level of thermal maturity. This is unlikely to improve even at optimum maturity.

B.2. PLIOCENE, 550 to 780 metres, AND UPPER MIOCENE, 780 to 1,010 metres, (Samples 14 to 21 and 22 to 29)

These intervals comprise a soft, grey-green to grey-brown calcareous claystone with occasional sandstone horizons. Organic carbon contents fall generally between 0.40% and 1.30%, averaging 0.6%, these being in most instances below average for argillaceous lithologies. There is a very slight trend of increasing organic carbon content with depth through these two intervals.

Extraction and fractionation were carried out on only three samples, with all yielding low amounts of extractable organic matter and very low hydrocarbon contents, less than 20 ppm. of the rocks. These sediments have no hydrocarbon generating potential at the present levels of thermal maturity. At optimum maturity minor quantities of both gaseous and liquid hydrocarbons may be generated from those samples with organic carbon contents approaching or just exceeding 1.0%.

B.3. MIDDLE MIOCENE, 1,020 to 1,700 metres, AND LOWER MIOCENE, 1,710 to 1,780 metres (Samples 30 to 52 and 53 to 55)

This interval comprises grey, grey-brown and grey-green calcareous shales with some probable caving of grey-green claystone from the Upper Miocene in the first 200 metres. Organic carbon contents are relatively uniform at around 1.7%, ranging between 0.53% and 2.67%; these values are predominantly of an average level for argillaceous lithologies.

Extraction and fractionation have been carried out on 9 samples. The proportions of extractable organic matter are low at between 1.4% and 4.2% most being around 4%; similarly, hydrocarbon abundance is low, at less than 50 ppm, in all but two samples (sample 46 reaching a maximum of 235 ppm.). In general the data concurs with the low level of maturity established for the section and indicates that at present these sediments have a poor to, at best, fair, potential as a source for hydrocarbons. This potential would be expected to improve at optimum levels of thermal maturity.

A large (approximately 100 gms) fragment of "caved" grey-brown shale was encountered in the sample at 1,740 - 770 metres; although possibly not insitu the lithology was similar to that of the Middle and Lower Miocene and it was decided to carry out extraction and fractionation analyses. The data presented in Table 5 are compatible with those of the other analysed samples and suggest a gas-prone type of organic matter at a low level of thermal maturity.

B. 4. OLIGOCENE,1,790 to 2,280 metres (Samples 56 to 72)

This interval comprises a pale grey-brown, calcareous shale containing between 1.98% and 4.80% organic carbon, these values are above average for argillaceous lithologies. One low value of 0.70% occurs.

Extraction and fractionation were carried out on five samples in this interval with all but one sample showing similar geochemical characteristics: low extractability (3.0% to 5.3%), relatively abundant hydrocarbons (60 - 465 ppm), low to moderate proportions of hydrocarbons in the sample extracts (5% to 25%). These data indicate that the samples have a fair potential for generating gaseous hydrocarbons possibly with some heavy condensate at the present level of thermal maturity. At optimum levels of maturity these sediments are likely to have a good potential for generating hydrocarbons; the data suggest that the sediments may be both gas and oil-prone.

The one anomalous sample contains only 0.7% organic carbon,but shows a high proportion of extractable organic matter 18.6%; hydrocarbon abundance and its proportion of the extract are similar to that of the adjacent samples. Slight staining may be present in this sample.

B. 5. EOCENE, 2,290 to 2,740 metres (Samples 73 to 87)

This interval comprises pale grey-brown, calcareous shale with some darker grey-brown shales towards the base. Organic carbon contents are above average at the top of the interval (around 2.5%), decreasing steadily to between 1% and 2%. These values are above average to average for argillaceous lithologies. Hand-picked dark brown shale contained an above average 4.55% organic carbon.

Extraction and fractionation has been carried out on seven samples, one of which yielded data supporting the presence of non-indigenous organic matter (high extractability of 37.7%). The majority of the samples contain low proportions of extractable organic matter (2.4% to 9.9%) with variable but generally low proportions of hydrocarbons (20 - 220 ppm). These sediments are considered to represent poor potential source rocks at the present level of thermal maturity and would appear to have low potential for hydrocarbon generation even at optimum levels of maturity. The darker shales, if not caved, may represent good hydrocarbon sources at more advanced levels of maturity.

B.6. LOWER EOCENE - PALAEOCENE, 2,750 to 2,917 metres, PALAEOCENE, 2,923 to 3,082 metres and DANIAN, 3085 to ?3,187 metres (Samples 88 to 93, 94 to 98 and 99 to 100)

These three intervals comprise a variety of interbedded shales (pale grey-brown, grey-green, grey-purple, red-brown and dark grey) together with siltstone in the Palaeocene. The individual lithologies are described seperately:

a. Grey-brown to grey-green calcareous shale (possibly caved) in samples 88 to 90: average carbon contents with relatively high extractability (11.8% to 15.6%) and hydrocarbon abundances (240 to 265 ppm). The low proportions of hydrocarbons in the extractable organic matter, (10% to 15%,) indicate that only gaseous and heavy liquid hydrocarbons are likely to be generated at the present level of maturity.

b. Grey to grey-green shale or mudstone in samples 91 and 92: well below average organic carbon contents (0.35% to 0.43%). High proportions of extractable organic matter and hydrocarbons in the sample 92 indicate the presence of non-indigenous hydrocarbon. These sediments are considered to have no significant hydrocarbon generating potential at any level of maturity.

c. Green shale in the sample 94 with an organic carbon content of an average level for shales (1.21%). This one sample contains 15.4% of extractable organic matter and 375 ppm hydrocarbons (20% of extractable organic matter). At the present early to middle stages of thermal maturity it is considered to represent a relatively good potential hydrocarbon source, for gas and some heavy to medium gravity liquid hydrocarbons.

d. Grey purple shales in the samples 96 to 99 have organic carbon contents of around 2.5% (sample 96 most homogeneous) which are above average for argillaceous lithologies. The low extractability (5.7%), relatively high hydrocarbon abundance (200 ppm), and low proportion of hydrocarbons in the extractable organic matter (15%), all indicate a more gas-prone type of organic matter. The potential at the present level of thermal maturity is low for liquid hydrocarbons, but good for gaseous hydrocarbons, the latter would be expected to improve at optimum levels of thermal maturity.

e. Red-brown, grey-brown and pale grey shales in the samples 97, 98 and 99 all have below average organic carbon contents and would not be expected to represent significant hydrocarbon sources.

f. Grey to dark grey shale in sample 100 (Danian) has a below average organic carbon content of 0.66%, an extractability of 10.7% and a relatively good hydrocarbon content of 355 ppm (this is, however, only 5% of the extractable organic matter). The shale is considered to represent a fair to good oil source capable of generating only gas and heavy liquid hydrocarbons at the present level of thermal maturity.

B.7. CRETACEOUS (UNDIFFERENTIATED), below 3,196 metres (Samples 101 to 109)

The dominant lithology through this interval is chalk. Of secondary importance is the occurrence of minor quantities of dark grey to grey-green shale, some of which may have caved from the overlying intervals.

The sample 106 was analysed for source rock potential to typify the chalk, since it contained the lowest proportion of shale. The shale itself has an organic carbon content of 1.31%, this being average for argillaceous lithologies. The chalk has an organic carbon content of 0.13%. Extraction and fractionation data for the chalk indicate that hydrocarbons are not present in any significant quantities.

At the base of the analysed section the samples 108 and 109 both contain high proportions (40% to 80%) of grey-green to dark grey-green shale. The organic carbon content of these shales, together with that of hand-picked shale from the samples 103, 104, 107, 108, and 109, is below average at between 0.46% and 0.76%. Source rock analysis of sample 109, the most homogeneous in terms of shale content, indicates a general lack of any hydrocarbon generating potential (low extractable organic matter content and low hydrocarbon abundance).

III

CONCLUSIONS

From our present study of the 150 to 3,450 metres section in the 1/9-2 Well, the following main conclusions can be made :

1. Oil-prone organic matter is considered to become mature over a zone of transition in the approximate interval 1,200 to 2,000 metres, and just attains the middle zone of thermal maturity at the base of the analysed section. Heavy passing to medium gravity oils would be generated from suitably rich oil-prone sediments.

2. Gas-prone organic matter becomes mature in the transition zone 2,300 to 3,000 metres; limited quantities of gaseous hydrocarbons would be generated below this transition zone. Prolific gas generation only occurs when reflectivities reach 0.8% to 1.0%; such levels are not attained at the base of this well section.

3. The maturation parameters imply that there is a significant maturation discontinuity over the interval 2,200 to 2,500 metres. The theory of a reverse fault with a vertical displacement of some 500 metres is not substantiated by evidence from our biostratigraphic studies. Wrench-faulting has not been described from this area. We conclude that heated formation waters have passed along a tension fault similar to those identified over the salt supported trap structures in the nearby Ekofisk field.

4. Source rock potential of the analysed well section is described in the following stratigraphic groups :

a. Pleistocene - Recent, 160 - 540 metres: Sand, silt, shell and grey claystones, latter generally of below average organic carbon content. This section is immature and has no hydrocarbon generating potential at any level of thermal maturity.

b. Pliocene, 550 - 780 metres, and Upper Miocene, 780 - 1,010 metres: soft grey-green to grey-brown claystones of generally below average organic carbon content. Immature and no hydrocarbon generating potential at present. Possibility of minor gaseous and liquid hydrocarbons at optimum levels of thermal activity.

c. Middle Miocene, 1,020 - 1,700 metres, and Lower Miocene, 1,710 - 1,780 metres: grey, grey-brown and grey-green, calcareous shales of average organic carbon content. Poor to fair, at best, potential as a source for gaseous hydrocarbons at the present low levels of thermal maturity. This might improve slightly at optimum levels of maturity.

d. Oligocene, 1,790 to 2,280 metres: pale grey-brown calcareous shale of above average organic carbon content. Possibly both oil and gas-prone and capable of generating only minor quantities of gaseous hydrocarbons, possibly with some heavy condensate at present. This interval would be expected to yield prolific quantities of gaseous hydrocarbons at optimum levels of thermal maturity, possibly with a significant proportion of liquid hydrocarbons.

e. Eocene, 2,290 to 2,740 metres: pale grey-brown calcareous shales, slightly darker towards base, generally of average organic carbon content. Generally of low hydrocarbon generating potential at the established early levels of thermal maturity. The darker shales may represent a slightly better hydrocarbon source at optimum maturity.

f. Lower Eocene - Palaeocene, 2,750 - 2,917 metres, Palaeocene, 2,923 - 3,082 metres, and Danian, 3,085 - ?3,187 metres: a variety of shales of several colours; most of these shales are of below average organic carbon content. Of particular significance is the presence of some rich, oil-prone grey-purple, grey-green and dark grey shales, at present capable of generating only limited quantities of gaseous and heavy liquid hydrocarbons. This could be expected to improve significantly at optimum maturity. Some grey-green shales, of average organic carbon content, are at present capable of generating gas and heavy to medium gravity oils. This might improve slightly at optimum maturity.

g. Cretaceous (undifferentiated), below 3,196 metres: mainly chalk, and interbedded dark grey-green shales of average to below average organic carbon content, these having no significant hydrocarbon generating potential.

TABLE 1A

HEADSPACE GAS ANALYSIS DATA

COMPANY: STATOIL WELL: 1/9-2 LOCATION: NORWEGIAN N. SEA

SAMPLE DEPTH (METRES)	TOTAL C_1-C_4 GAS (% v/v) +	PERCENT C_1	PERCENT C_2	PERCENT C_3	PERCENT iso C_4	PERCENT n-C_4
150- 180	0.0004	90+	tr	tr	tr	tr
180- 210	0.0003	90+	tr	tr	*	*
210- 240	0.2446	96.85	0.74	1.64	0.12	0.65
240- 270	0.4880	97.09	0.94	1.25	0.12	0.59
270- 300	1.8398	99.68	0.19	0.08	0.01	0.04
300- 330	1.3788	99.77	0.15	0.05	tr	tr
330- 360	0.0019	90+	tr	tr	*	*
360- 390	0.3069	99.61	0.36	0.03	tr	tr
390- 420	3.8324	99.70	0.26	tr	tr	tr
420- 450	1.8379	99.91	0.04	0.01	0.02	0.02
450- 480	3.1407	99.76	0.20	0.03	tr	0.01
480- 510	3.7138	99.80	0.18	0.01	tr	0.01
510- 540		CAN LEAKING - GAS LOST				
540- 570	1.5343	99.62	0.34	0.04	tr	*
570- 600	0.0106	90+	tr	tr	*	*
600- 630		CAN LEAKING - GAS LOST				
630- 660	1.3496	99.09	0.85	0.05	tr	tr
660- 690	5.3925	99.20	0.68	0.10	0.01	0.01
690- 720	3.6256	99.05	0.78	0.14	0.02	0.01
720- 750		CAN DAMAGED - GAS LOST				
750- 780	1.0823	98.85	0.90	0.20	0.03	0.02
780- 810	0.0193	93.26	3.12	1.55	0.52	1.55
810- 840	0.0058	91.38	3.45	3.45	tr	1.72
840- 870	2.5952	93.63	1.97	2.32	0.56	1.52
870- 900	0.0526	95.82	1.52	1.71	0.38	0.57
900- 930	0.0474	92.62	1.48	4.43	0.84	0.63
930- 960	1.1832	96.88	0.86	1.49	0.30	0.47
960- 990	0.3254	93.95	3.10	2.00	0.40	0.55
990-1020	1.2912	97.65	0.70	1.12	0.23	0.29
1020- 050	0.3150	98.25	0.70	0.70	0.16	0.19
1050- 080	0.7555	93.57	1.22	2.17	0.91	2.13
1080- 110	0.3995	93.72	1.22	2.23	0.98	1.85
1110- 140	1.0146	97.91	0.63	0.74	0.25	0.47
1140- 170	0.4435	94.77	1.89	1.78	0.59	0.97
1170- 200	2.2119	98.46	0.54	0.52	0.18	0.30
1200- 230		CAN DAMAGED - NO GAS SAMPLED				
1260- 290	0.0066	81.82	6.06	6.06	1.52	4.54
1320- 350	1.2804	98.48	0.92	0.45	0.06	0.09
1380- 410	0.6290	98.39	0.79	0.59	0.10	0.13
1440- 470	0.0179	96.10	1.67	1.67	0.56	tr
1500- 530	2.0339	97.69	1.48	0.42	0.22	0.19

+ : (value) x 10^4 to express figures in ppm, as per 1/9-1 well

TABLE 1B

HEADSPACE GAS ANALYSIS DATA

COMPANY: STATOIL   WELL: 1/9-2   LOCATION: NORWEGIAN N. SEA

SAMPLED DEPTH (METRES)	TOTAL C_1-C_4 GAS (% v/v)	PERCENT C_1	PERCENT C_2	PERCENT C_3	PERCENT iso C_4	PERCENT n-C_4
1560- 590	1.3388	94.18	2.14	2.49	0.54	0.65
1620- 650	0.0870	87.36	3.45	5.75	1.15	2.29
1680- 710	5.3976	84.95	2.98	6.05	1.72	4.30
1740- 770	1.1270	78.19	3.23	10.94	2.28	5.36
1800- 830	4.5779	81.80	3.19	6.48	2.00	6.53
1860- 890	0.0109	66.97	3.97	10.09	3.67	15.60
1920- 950	5.3937	73.67	7.36	9.84	3.80	5.33
1980-2010	2.9908	70.27	10.96	15.50	2.88	0.39
2040- 070	7.0223	71.82	9.48	12.15	1.38	5.17
2100- 130	7.7945	66.64	11.30	14.28	2.18	5.57
2160- 190	9.2209	66.30	12.99	13.84	2.10	4.77
2220- 250	7.7369	79.02	10.52	7.58	0.90	1.98
2280- 310	4.0132	79.98	9.18	7.40	0.96	2.48
2340- 370	2.3533	73.47	9.79	12.22	1.44	3.08
2400- 430	1.8208	54.56	1.49	6.11	16.18	21.66
2460- 490	1.6371	77.02	9.38	8.61	2.24	2.75
2520- 550	1.7082	80.52	7.79	6.73	2.04	2.92
2580- 610	1.1068	82.85	5.55	5.86	2.36	3.38
2640- 670	0.9694	70.95	6.93	11.77	4.28	6.07
2700- 730	1.4110	64.99	10.34	16.04	5.34	3.29
2730- 760	1.9656	44.71	48.84	4.44	1.23	0.78
2760- 790	0.7132	66.97	10.58	14.05	4.84	3.56
2790- 820	0.5872	69.62	10.03	13.27	3.98	3.10
2820- 850	5.8393	94.88	1.81	2.21	0.60	0.50
2850- 880	0.5050	55.98	7.25	19.68	8.04	9.05
2880- 910	0.2876	42.52	12.83	23.23	9.15	12.27
2910- 940	1.7662	36.78	11.60	31.72	7.60	12.30
2940- 970	2.2734	24.20	19.14	36.88	6.84	12.94
2970-3000	1.6596	32.92	22.21	26.83	5.53	12.51
3000- 030	0.9695	33.11	37.76	17.61	3.38	8.14
3030- 060	0.2703	35.33	23.68	27.71	3.74	9.54
3060- 090	1.0671	31.15	20.87	30.94	5.89	11.15
3090- 120	0.2702	30.45	20.38	33.60	5.61	9.96
3120- 150	0.8211	14.89	9.98	41.12	11.76	22.25
3210- 240	0.1267	47.67	31.89	12.63	2.76	5.05
3240- 270	0.0460	41.52	27.82	17.61	4.57	8.48
3270- 300	0.0253	37.94	25.30	22.13	5.14	9.49
3300- 330	0.0575	23.65	15.83	32.35	9.74	18.43
3330- 360	0.0728	12.91	8.65	47.39	9.89	21.15
3360- 390	0.0891	11.56	7.74	47.92	10.44	22.34
3390- 420	0.2680	19.25	12.92	43.47	8.73	15.63
3420- 450	0.1609	22.81	15.29	40.38	7.52	13.55

TABLE 2A

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL   WELL: 1/9-2   LOCATION: NORWEGIAN N. SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	540	630	720	840	900	1020	1140	1230
C_1	33	89	100	53	100	*	*	*
C_2	67	*	*	36	*	*	*	*
C_3	*	11	*	11	*	*	*	*
iso-C_4	*	*	*	*	*	*	*	*
n-C_4	*	*	*	*	*	*	*	*
TOTAL ABUNDANCE P.P.B	1.53	4.15	1.1	1.8	2.9	*	*	*

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE	*	*	*	*	*	*	*	*
N-PENTANE	75	69	72	*	83	47	65	54
CYCLOPENTANE	1	tr	1	*	tr	2	*	*
2-ME.PENTANE	2	4	1	*	2	2	*	1
3-ME.PENTANE	1	2	3	*	1	3	*	5
N-HEXANE	1	2	1	*	4	3	*	tr
ME-CYCLOPENTANE	2	5	2	*	1	4	*	tr
CYCLOHEXANE	4	2	3	*	2	4	21	17
2-ME.HEXANE	3	2	2	*	2	2	*	1
3-ME.HEXANE	1	2	1	*	1	3	4	8
3-ETHYLPENTANE	2	4	2	*	1	2	10	1
N-HEPTANE	2	3	5	*	3	3	*	7
BENZENE	2	1	2	*	*	5	*	*
DIME.PENTANE	*	*	*	*	*	*	*	*
ME.CYCLOHEXANE	4	4	3	*	2	20	*	4
TOTAL ABUNDANCE P.P.B	88	47	55	*	44	49	13	24

TABLE 2B

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-2 LOCATION: NORWEGIAN N. SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	1320	1410	1500	1590	1680	1770	1860	1950
C_1	100	14	100	21	74	3	90	*
C_2	*	86	*	*	*	*	*	*
C_3	*	*	*	4	26	6	10	*
iso-C_4	*	*	*	*	*	*	*	*
n-C_4	*	*	*	75	*	91	*	*
TOTAL ABUNDANCE P.P.B	6	3	1	14	2	125	4	*

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE	*	*	*	*	*	*	*	*
N-PENTANE	46	100	36	*	10	18	22	23
CYCLOPENTANE	*	*	*	*	1	2	2	1
2-ME.PENTANE	tr	*	4	*	13	15	15	15
3-ME.PENTANE	*	*	10	*	6	7	5	7
N-HEXANE	5	*	5	*	13	22	19	18
ME-CYCLOPENTANE	tr	*	4	*	11	8	14	8
CYCLOHEXANE	4	*	4	*	13	8	13	6
2-ME.HEXANE	*	*	*	*	7	4	*	4
3-ME.HEXANE	*	*	6	*	6	4	*	3
3-ETHYLPENTANE	10	*	1	*	1	1	10	1
N-HEPTANE	*	*	14	*	3	3	*	8
BENZENE	*	*	*	*	*	*	*	*
DIME.PENTANE	*	*	*	*	*	*	*	*
ME.CYCLOHEXANE	35	*	16	*	16	8	*	6
TOTAL ABUNDANCE P.P.B	62	20	11	*	47	181	21	43

TABLE 2C

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-2 LOCATION: NORWEGIAN N. SEA

	% C_1 to C_4 (GASEOUS HYDROCARBONS)							
DEPTH (METRES)	2040	2130	2220	2310	2400	2490	2580	2640
C_1	73	50	24	9	2	100	*	*
C_2	27	50	*	8	5	*	*	*
C_3	*	*	76	66	40	*	*	*
iso-C_4	*	*	*	*	*	*	*	*
n-C_4	*	*	*	17	53	*	*	*
TOTAL ABUNDANCE P.P.B	1	2	20	144	168	2	*	*

	% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)							
ISO-PENTANE	*	*	*	*	*	*	*	*
N-PENTANE	20	14	57	14	47	10	8	25
CYCLOPENTANE	2	4	2	7	5	2	3	*
2-ME.PENTANE	9	6	2	7	3	11	6	30
3-ME.PENTANE	5	5	4	4	4	7	10	20
N-HEXANE	16	15	4	8	5	13	9	25
ME-CYCLOPENTANE	9	5	3	7	3	7	9	*
CYCLOHEXANE	13	15	4	8	7	8	8	*
2-ME.HEXANE	5	4	3	9	4	7	9	*
3-ME.HEXANE	2	1	4	8	3	9	8	*
3-ETHYLPENTANE	tr	20	5	7	4	3	8	*
N-HEPTANE	7	7	5	4	6	7	8	*
BENZENE	*	*	2	7	3	5	4	*
DIME.PENTANE	*	*	*	*	*	*	*	*
ME.CYCLOHEXANE	12	4	5	10	6	11	10	*
TOTAL ABUNDANCE P.P.B	28	34	62	32	49	29	15	2

TABLE 2D

GASEOUS AND GASOLINE HYDROCARBON DATA

COMPANY: STATOIL WELL: 1/9-2 LOCATION: NORWEGIAN N. SEA

% C_1 to C_4 (GASEOUS HYDROCARBONS)								
DEPTH (METRES)	2760	2850	2940	3030	3120	3240	3330	3420
C_1	*	*	4	90	34	42	5	75
C_2	*	*	1	*	66	7	1	*
C_3	*	*	21	10	*	21	13	25
iso-C_4	*	*	*	*	*	*	*	*
n-C_4	*	*	74	*	*	30	81	*
TOTAL ABUNDANCE P.P.B	*	*	95	5	1	17	74	1

% C_5 to C_7 (GASOLINE RANGE HYDROCARBONS)								
ISO-PENTANE	*	*	*	*	*	*	*	*
N-PENTANE	44	75	*	15	11	27	17	15
CYCLOPENTANE	1	*	*	3	4	5	2	3
2-ME.PENTANE	3	1	*	5	7	3	3	3
3-ME.PENTANE	1	tr	*	4	4	2	5	3
N-HEXANE	3	1	*	8	3	7	3	12
ME-CYCLOPENTANE	3	1	*	16	7	2	5	5
CYCLOHEXANE	7	1	*	4	6	4	7	7
2-ME.HEXANE	8	2	*	8	12	4	11	4
3-ME.HEXANE	12	3	*	7	6	9	3	6
3-ETHYLPENTANE	2	4	*	1	13	5	12	1
N-HEPTANE	4	4	*	14	3	12	5	9
BENZENE	5	*	*	*	8	2	5	11
DIME.PENTANE	*	*	*	*	*	*	*	*
ME.CYCLOHEXANE	7	8	*	15	16	18	22	21
TOTAL ABUNDANCE P.P.B	20	87	*	20	38	24	28	39

TABLE 3A

MATURATION EVALUATION DATA

COMPANY: STATOIL WELL: 1/9-2 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
10. 420-450	Ctgs	SHELL, SND, CLY	-	0.20 (0)	3.5	
22 780-900	"	CLYST, gy	-	0.26 (7)	3.5	IMMATURE
44. 1440-470	"	SH, gy-gn, gy-brn	-	0.26 (16)	3.5	
48. 1560-590	"	"	-	0.28 (2)	3.5-4.0	
51. 1650-680	"	"	-	0.27 (8)	*	
54. 1740-770	"	"	-	0.31 (20)	3.5	TRANSITIONAL
57. 1830-860	"	"	-	0.29 (10)	3.0	
59. 1890-920	"	"	-	0.31 (11)	4.0-4.5	MATURITY
63. 2010-040	"	"	-	0.36 (25)	5.0 ?	
66. 2100-130	"	"	-	0.40 (15)	4.0 ?	
69. 2190-220	"	"	-	0.43 (20)	4.5	
72. 2280-310	"	"	-	0.45 (18)	4.5	
74. 2370-400	"	"	-	0.44 (20)	4.0-4.5	
79. 2490-520	"	"	-	0.38 (23)	4.0	EARLY
83. 2610-640	"	"	-	0.40 (24)	4.5	MATURITY
87. 2730-760	"	SH, gy-gn	-	0.42 (20)	4.5	
89. 2790-820	"	"	-	0.45 (21)	4.5-5.0	
92. 2880-910	"	SH/MDST, gy-gy	-	0.45 (6)	* (2-5)	
95. 2970-3000	"	"	-	0.40 (16)	3.0&5.0	
98. 3060-090	"	"+SH,red-brn	-	0.48 (7)	*	
101.3180-210	"	CHK & SH, gy	-	0.54 (11)	5.5	

TABLE 3B

MATURATION EVALUATION DATA

COMPANY: STATOIL   WELL: 1/9-2   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
104.3270-300	Ctgs	CHK & SH, gy	-	0.55 (1)	5.0	?
108.3390-420	"	"	-	0.57 (9)	5.0	

TABLE 4

Organic Carbon Content Data

Company: STATOIL **Well:** 1/9-2 **Location:** Norwegian North Sea

Sample Depth (metres)	Organic Carbon %	Sample Depth (metres)	Organic Carbon %	Sample Depth (metres)	Organic Carbon %
1. 150- 180	*	37.1230- 260	1.87	74. 2340- 370	2.92
2. 180- 210	*	38.1260- 290	1.97	75. 2370- 400	2.42
3. 210- 240†	8.57	39.1290- 320	1.92	76. 2400- 430	2.92
4. 240- 270†	*	40.1320- 350	1.76	77. 2430- 460	3.42
5. 270- 300	*	41.1350- 380	2.05	78. 2460- 490	2.51
6. 300- 330	*	42.1380- 410	1.75	79. 2490- 520	2.64
7. 330- 360	*	43.1410- 440	1.96	80. 2520- 550	2.76
8. 360- 390	*	44.1440- 470	1.59	81. 2550- 580	1.61
9. 390- 420	*	45.1470- 500	1.57	82. 2580- 610	1.38
10. 420- 450	*	46.1500- 530	1.85	83. 2610- 640	1.63
11. 450- 480†	0.53	47.1530- 560	2.67	84. 2640- 670	*
12. 480- 510†	0.88	48.1560- 590	1.39	85. 2670- 700	2.33
13. 510- 540†	0.45	49.1590- 620	0.93	86. 2700- 730	1.29
14. 540- 570†	0.48	50.1620- 650	1.89	87. 2730- 760	1.16
15. 570- 600	0.45	51.1650- 680	1.33	88. 2760- 790	1.03
16. 600- 630†	0.40	52.1680- 710	1.47	89. 2790- 820	1.63
17. 630- 660	0.88	53.1710- 740	1.43	90. 2820- 850	1.67
18. 660- 690	0.85	54.1740- 770	0.85	91. 2850- 880	0.35
19. 690- 720	1.30	55.1770- 800	1.37	92. 2880- 910	0.43
20. 720- 750	0.59	56.1800- 830	2.06	93. 2910- 940	*
21. 750- 780	0.54	57.1830- 860	2.40	94. 2940- 970	1.21
22. 780- 810	0.82	58.1860- 890	2.57	95. 2970-3000	0.14
23. 810- 840	1.00	59.1890- 920	3.06	96. 3000- 030	2.50
24. 840- 870	0.71	60.1920- 950	2.68	97. 3030- 090†	0.60
25. 870- 900	0.59	61.1950- 980	3.58	98. 3030- 090†	0.16
26. 900- 930	0.71	62.1980-2010	3.28	99. 3090- 120	*
27. 930- 960	0.96	63.2010- 040	4.66	100. 3120- 150	0.66
28. 960- 990	1.00	64.2040- 070	0.70	101. 3180- 210	*
29. 990-1020	0.82	65.2070- 100	1.98	102. 3210- 240	*
30.1020- 050	0.94	66.2100- 130	4.80	103. 3240- 270†	0.46
31.1050- 080	0.53	67.2130- 160	4.47	104. 3270- 300†	0.76
32.1080- 110	1.64	68.2160- 190	4.36	105. 3300- 330	*
33.1110- 140	0.95	69.2190- 220	4.50	106. 3330- 360†	1.31
34.1140- 170	1.80	70.2220- 250	4.15	107. 3360- 390†	0.51
35.1170- 200	2.28	71.2250- 280	2.92	108. 3390- 420†	0.52
36.1200- 230	1.92	72.2280- 310	2.50	109. 3420- 450†	0.65
		73.2310- 340	1.35		

† = hand-picked lithology (see also Table 5)

TABLE 5A

SOURCE ROCK EVALUATION DATA

COMPANY : STATOIL WELL : 1/9-2 LOCATION : NORWEGIAN NORTH 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
13. 510-540	Ctgs	CLYST, sft, calc gy	0.45	390	8.7	<20	*	*
17. 630-660	"	"	0.88	895	10.1	<20	*	*
23. 810-840	"	"	1.00	570	5.7	<20	*	*
27. 930-960	"	"	0.96	645	6.7	<20	*	*
31. 1050-080	"	"	0.53	500	9.4	<20	*	*
33. 1110-140	"	CLYST, sft, calc,gy-brn	0.95	440	4.6	30	10	>95
38. 1260-290	"	"	1.97	440	2.2	<20	*	*
41. 1350-380	"	SH, calc, gy/gy-brn	2.05	415	2.0	<20	*	*
44. 1440-470	"	SH, calc, gy-gn/gy-brn	1.59	230	1.4	<20	*	*
46. 1500-530	"	"	1.85	915	4.9	235	25	73
48. 1560-590	"	"	1.39	410	2.9	120	30	>95
52. 1680-710	"	"	1.47	220	1.5	<20	*	*
55. 1770-800	"	"	1.37	1965	14.2	80	5	>95
58. 1860-890	"	"	2.57	1125	4.4	210	20	71
61. 1950-980	"	"	3.58	1900	5.3	60	5	>95
64. 2040-070	"	"	0.71	1320	18.6	225	15	67
67. 2130-160	"	"	4.47	2020	4.5	465	25	72
70. 2220-250	"	"	4.15	1265	3.0	75	5	69
73. 2310-340	"	"	1.35	1335	9.9	220	15	64
76. 2400-430	"	"	2.92	1105	3.8	170	15	*
78. 2460-490	"	"	2.51	730	2.9	35	5	>95
80. 2520-550	"	"	2.76	875	3.2	45	5	68

TABLE 5B

SOURCE ROCK EVALUATION DATA

COMPANY: STATOIL WELL: 1/9-2 LOCATION: NORWEGIAN NORTH 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
82. 2580-610	Ctgs	SH, calc, gy-gn/gy-brn	1.38	340	2.4	<20	*	*
84. 2640-670	"	"	1.30	850	6.5	60	5	70
86. 2700-730	"	" + occ SH, dk brn	1.29	4860	37.7	380	10	76
88. 2760-790	"	" + "	1.03	1615	15.6	265	15	56
90. 2820-850	"	" + "	1.67	1970	11.8	240	10	64
92. 2880-910	"	SH/MDST, gy/gy-gn	0.43	1475	34.3	420	30	65
94. 2940-970	"	SH, gn	1.21	1845	15.4	375	20	77
96. 3000-030	"	SH, gy/gy-pp+mnr SLT	2.50	1420	5.7	200	15	67
100. 3120-150	"	SH, gy/dk-gy	0.66	7080	10.7	355	5	72
106. 3330-360	"	CHK + 5% SH dk gy	0.13	200	1.5	<20	10	64
109. 3420-450	"	SH, dk gy-gn + mnr CHK	0.65	215	3.3	30	15	>95
		HAND PICKED LITHOLOGIES						
210-240	"	CLYST, sft, ol-gy	8.57					
450-480	"	CLYST, gy	0.53					
480-510	"	"	0.88					
540-570	"	"	0.48					
600-630	"	"	0.40					
2400-430	"	SH, dk brn	4.55					
3030-090	"	SH, gy-brn	0.60					
3030-090	"	SH, red-brn	0.16					
3090-120	"	SH, gy/gy-gn	0.50					
3090-120	"	SH, red-brn	*					
1740-770	"	Large 'caved' fragment of SH, gy-brn	2.21	1370	6.2	135	10	35
3330-360	"	SH, dk gy	1.31					

FIGURE I

HEADSPACE GAS (C_1 - C_4) HYDROCARBONS

COMPANY : STATOIL WELL 1/9-2 LOCATION : NORWEGIAN NORTH SEA

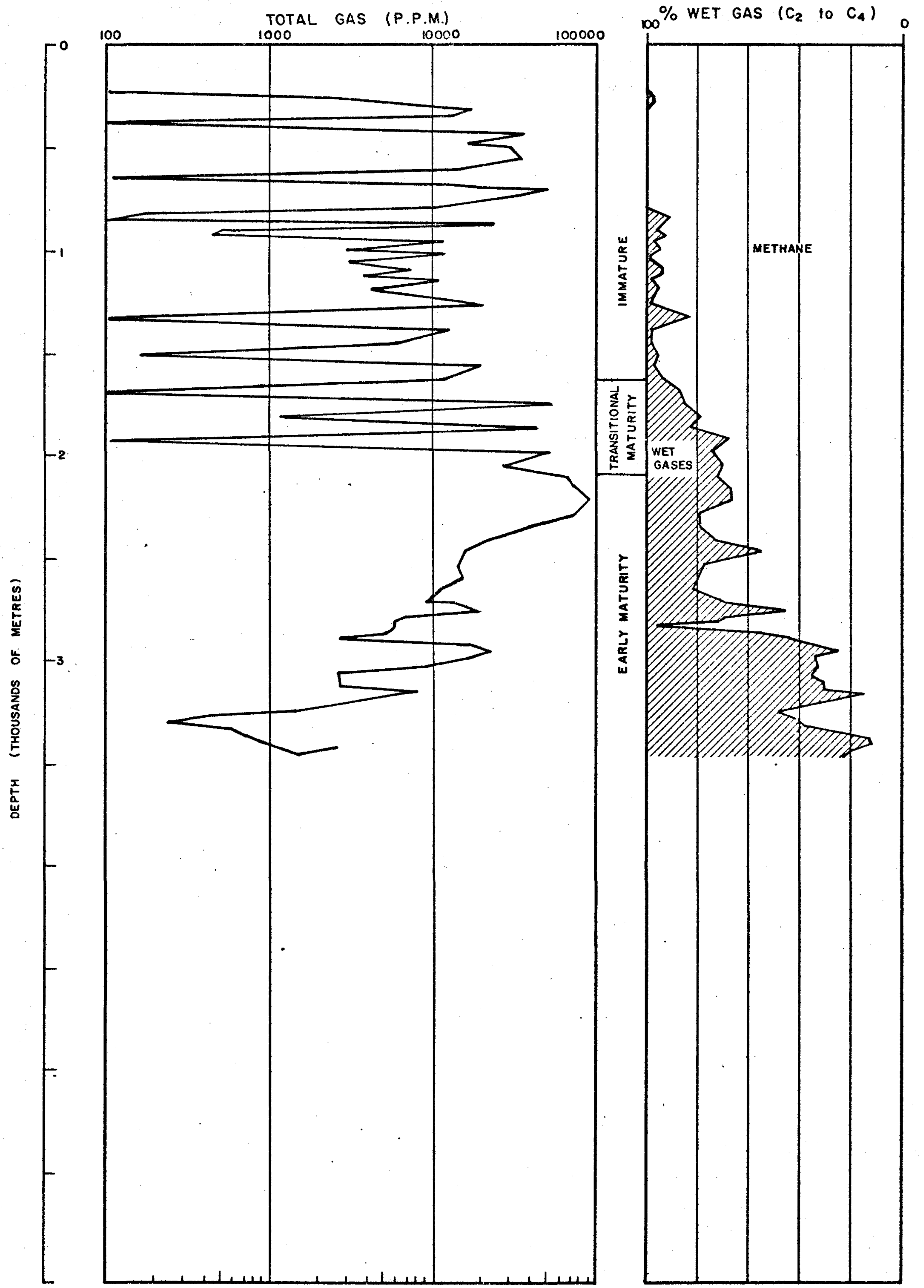


FIGURE 2

GASEOUS ($C_1 - C_4$) HYDROCARBONS

COMPANY : STATOIL   WELL : 1/9-2   LOCATION : NORWEGIAN NORTH SEA

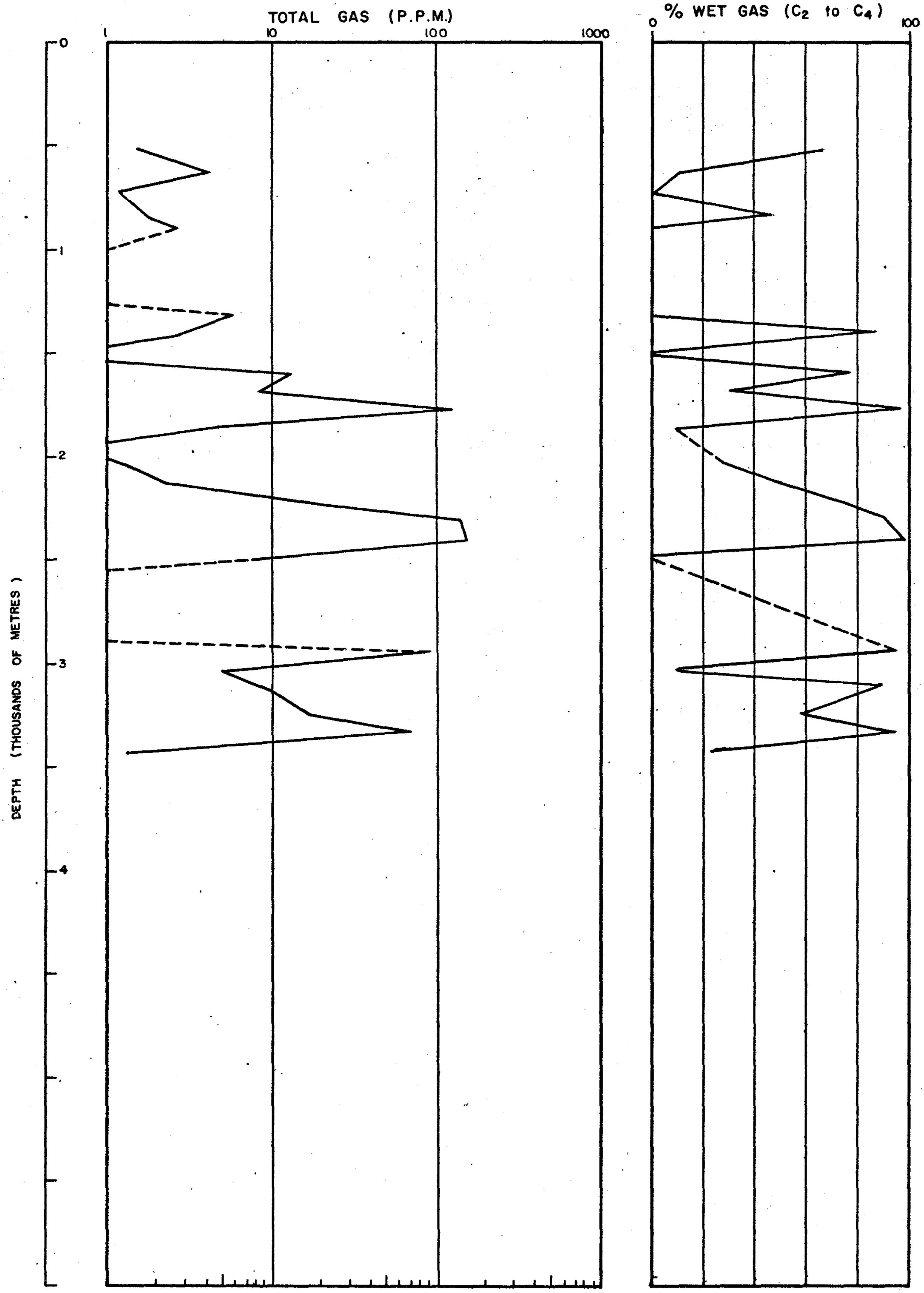
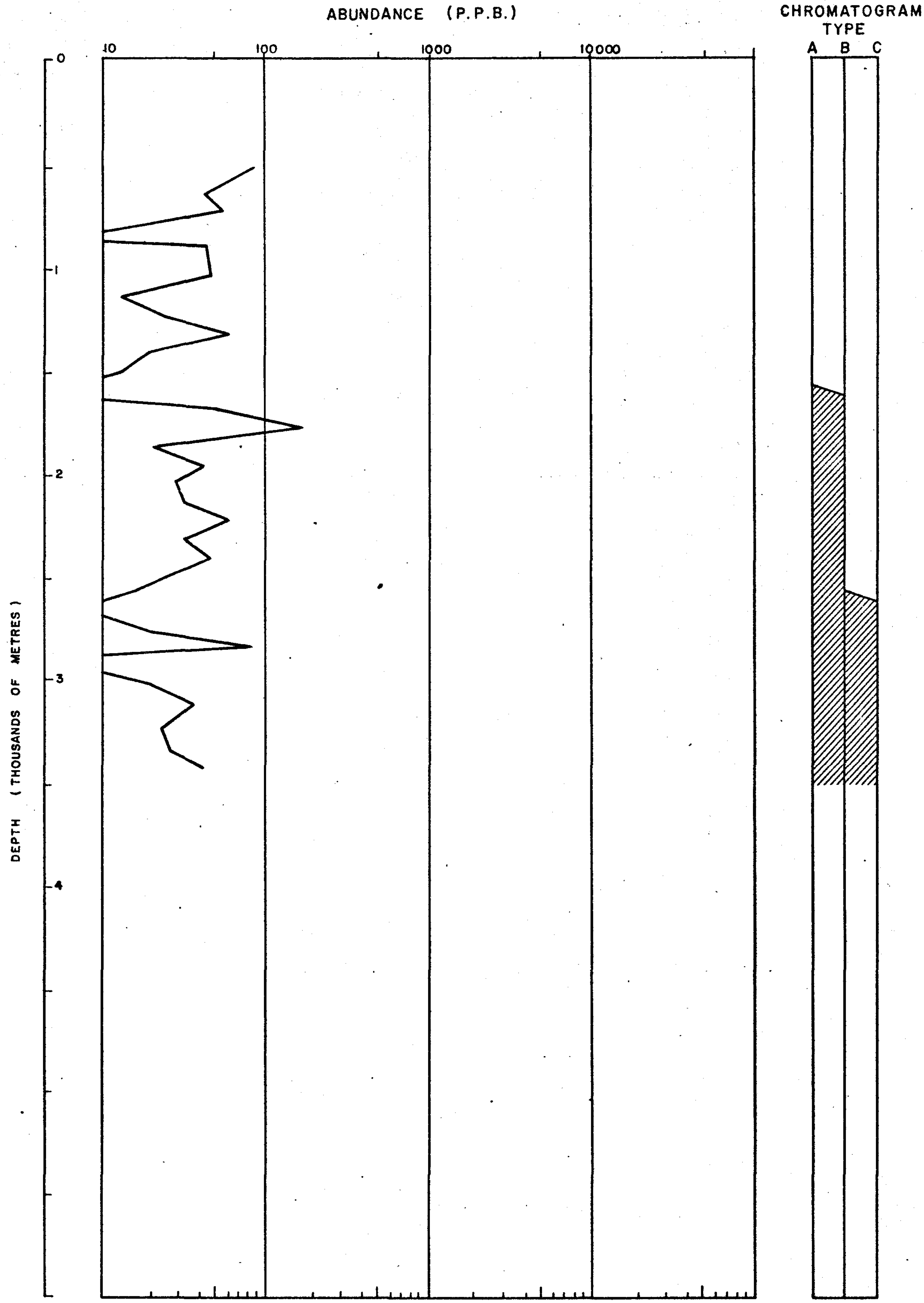


FIGURE 3

GASOLINE RANGE ($C_5 - C_7$) HYDROCARBONS

COMPANY: STATOIL | WELL: 1/9-2 | LOCATION: NORWEGIAN NORTH SEA



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

FIGURE 4

SPORE COLOURATION INDICES AGAINST DEPTH

COMPANY : STATOIL WELL : 1/9-2 LOCATION : NORWEGIAN NORTH SEA

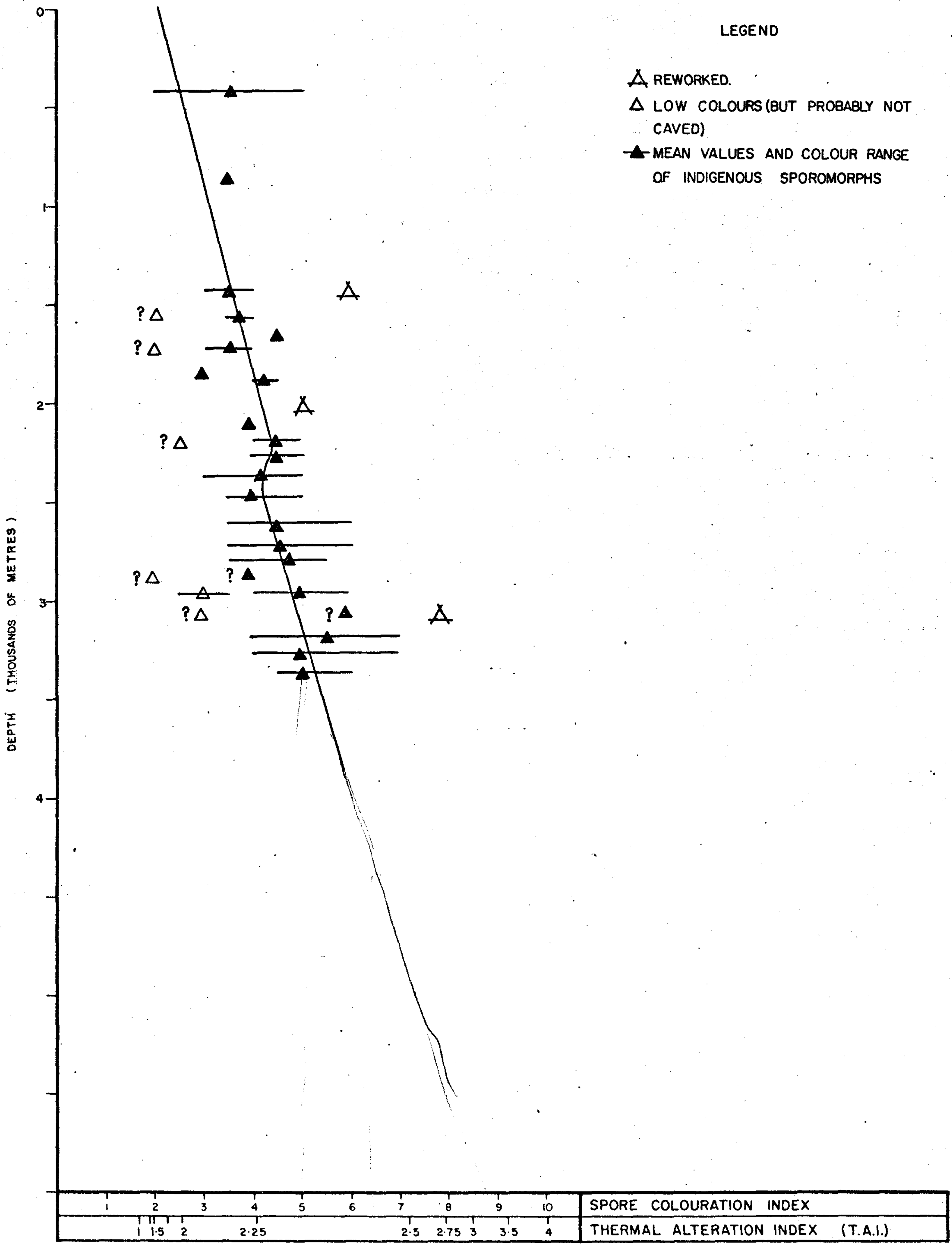


FIGURE 5

VITRINITE REFLECTIVITY AGAINST DEPTH

COMPANY : STATOIL WELL : 1/9-2 LOCATION : NORWEGIAN NORTH SEA

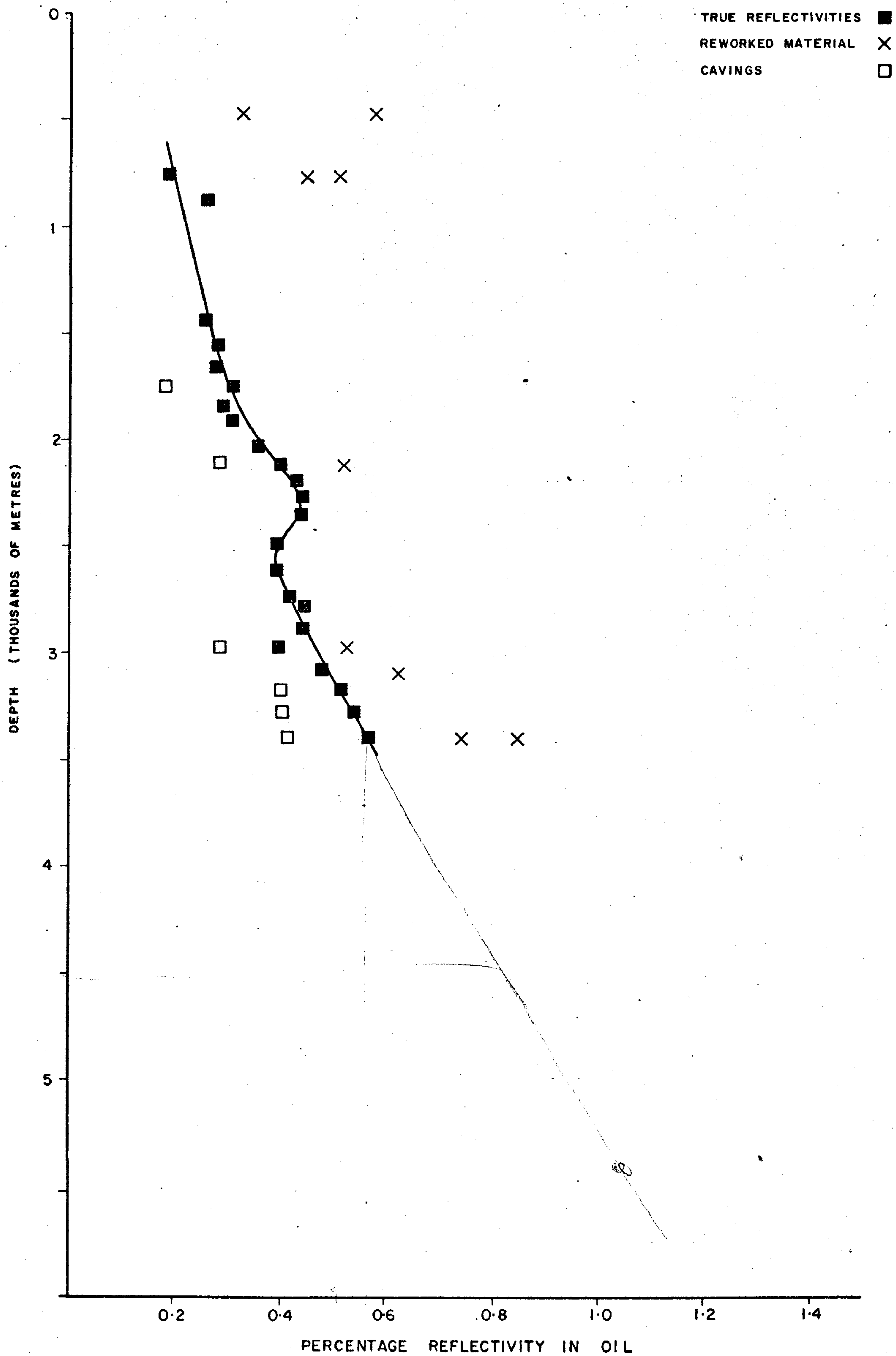


FIGURE 6

TYPE OF HYDROCARBON PRODUCT FROM SOURCE ROCKS

COMPANY : STATOIL WELL : 1/9-2 LOCATION : NORWEGIAN NORTH SEA

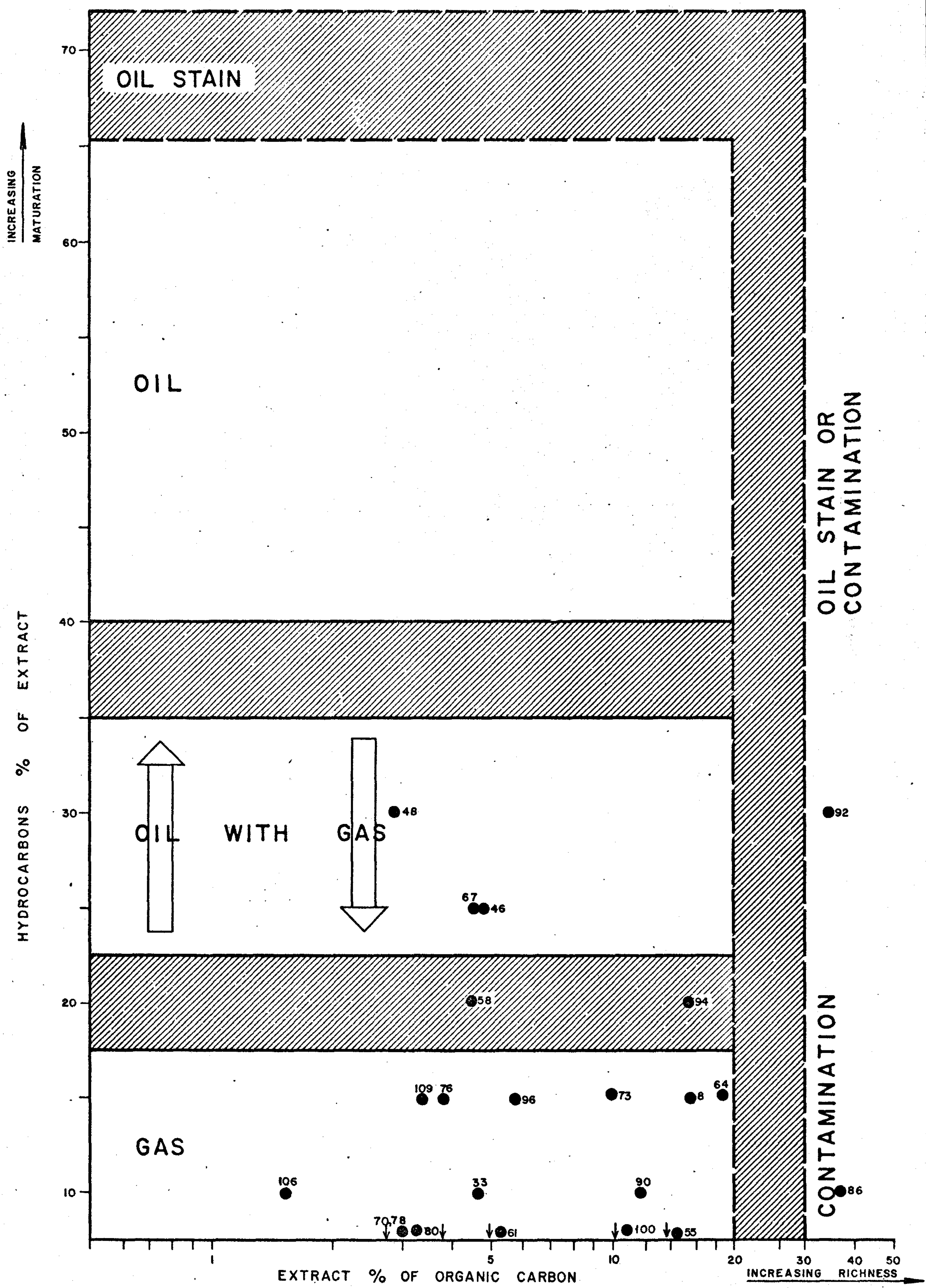
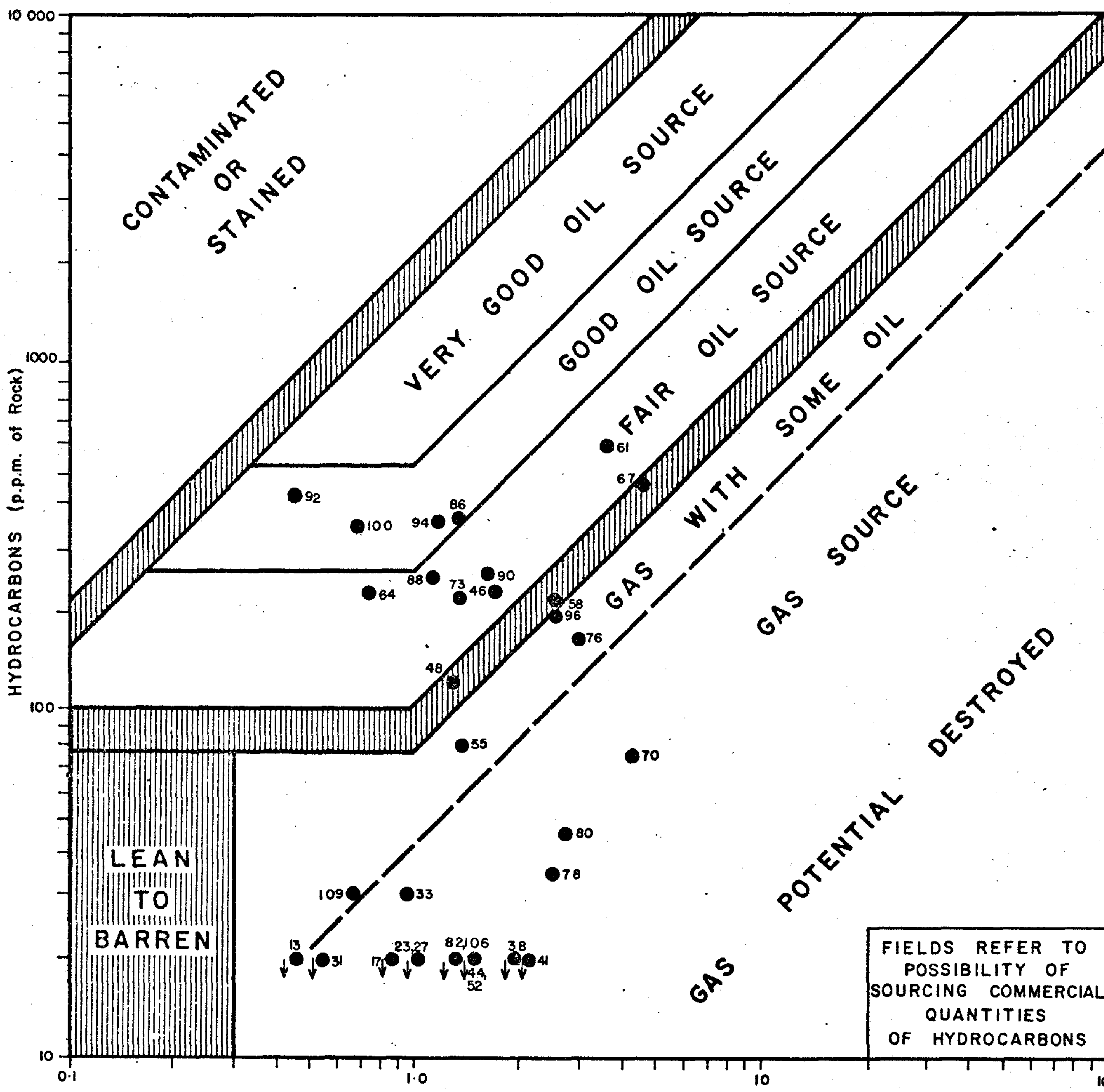


FIGURE 7

MATURE SOURCE ROCK RICHNESS

COMPANY :STATOIL WELL :1/9-2 LOCATION :NORWEGIAN NORTH SEA



LEGEND

Drawing No. 123P/2564/3907

GEOCHEMICAL DATA SUMMARY CHART

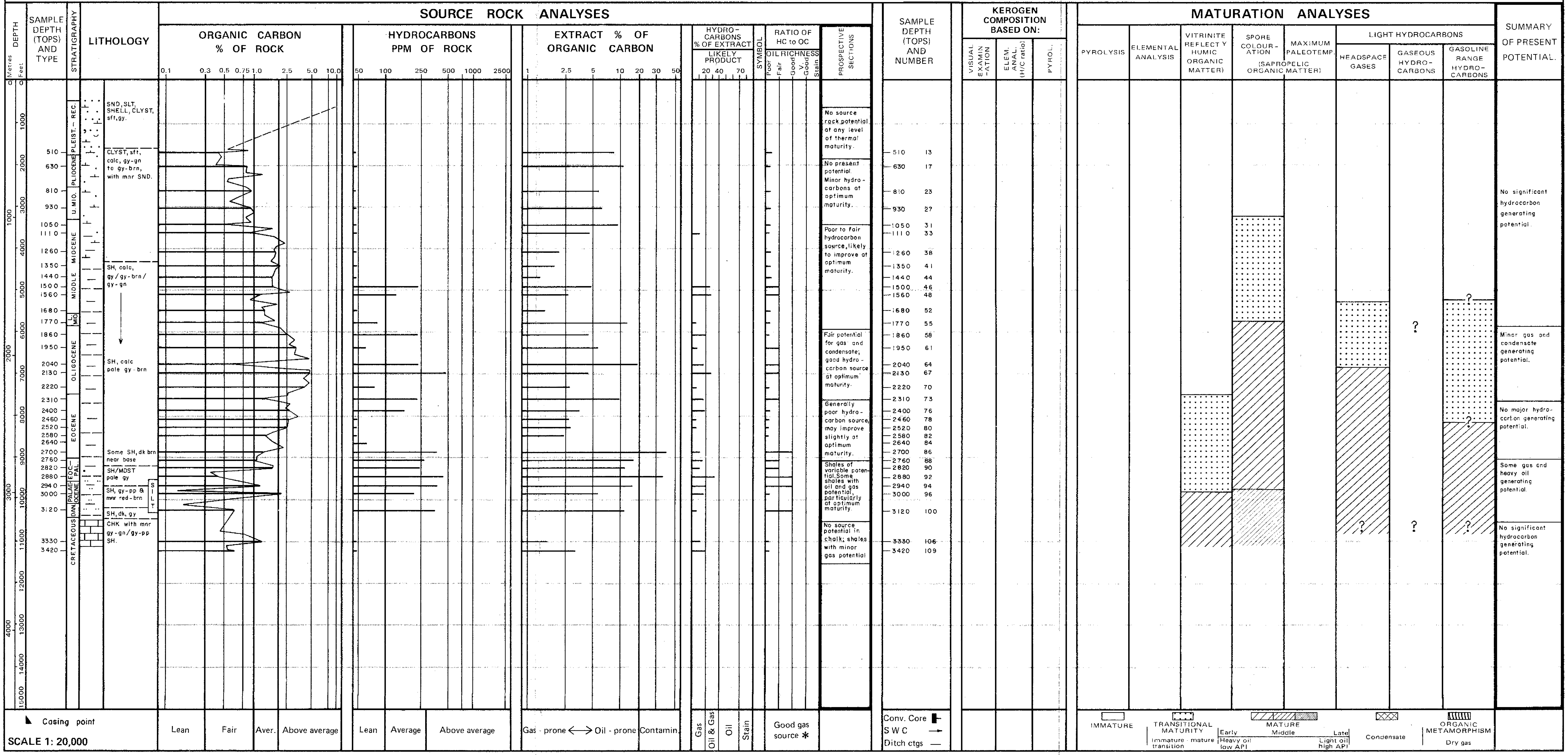
N. 17 WELLFILE

FIGURE 8

COMPANY: STATOIL

WELL: 1/9-2

LOCATION: NORWEGIAN NORTH SEA



APPENDIX I

ABBREVIATIONS USED IN ANALYTICAL DATA SHEETS

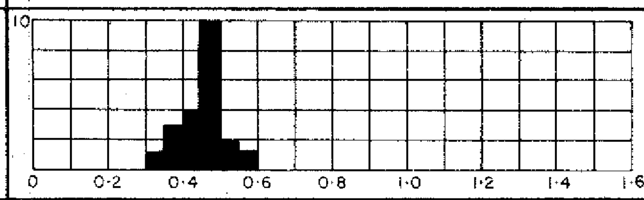
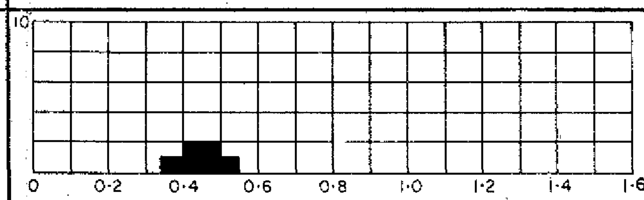
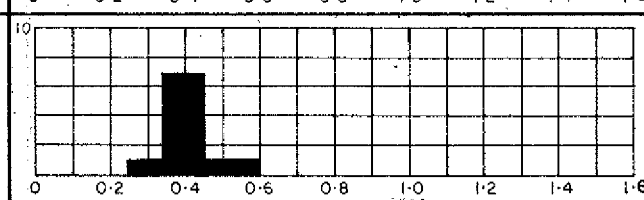
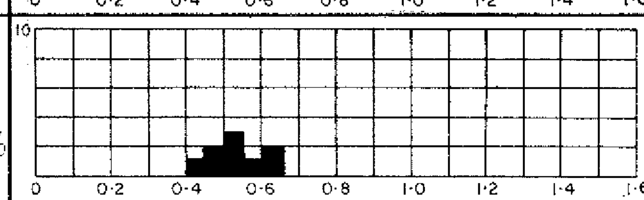
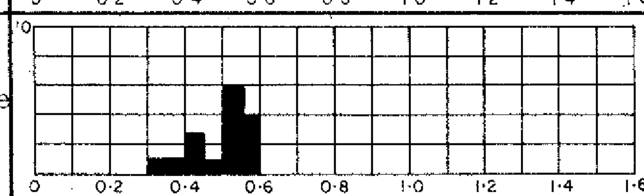
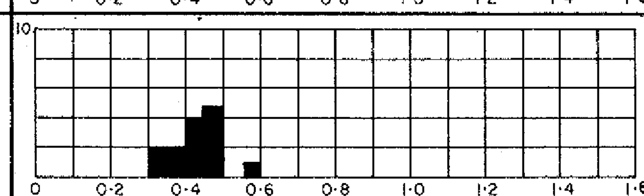
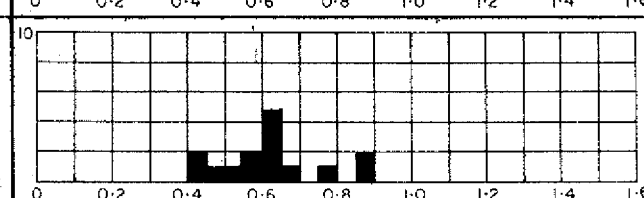
Alg	-	Algae	Mtl	-	Mottled
Aren	-	Arenaceous	Musc	-	Muscovite
Arg	-	Argillaceous	NS	-	No sample
Bit	-	Bitumen/bituminous	Occ	-	Occasional
Bl	-	Blue	Ol	-	Olive
Blk	-	Black	Ool	-	Oolite/oolitic
Brn	-	Brown	Orng	-	Orange
Calc	-	Calcareous	Pnk	-	Pink
Carb	-	Carbonaceous	Pop	-	Population
Chk	-	Chalk	Pp	-	Purple
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			

No 17

VITRINITE REFLECTIVITY DATA SUMMARY CHART II

WELLFILE

COMPANY : STATOIL | WELL : 1/9-2 | LOCATION : NORWEGIAN NORTH SEA

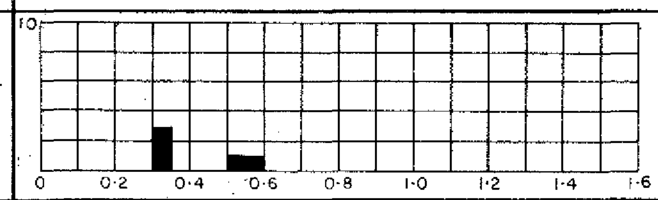
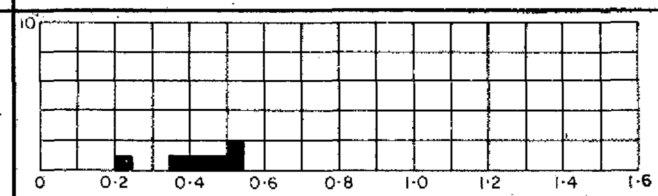
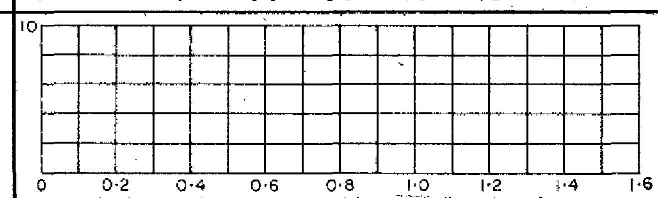
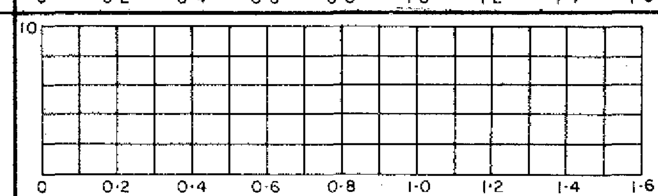
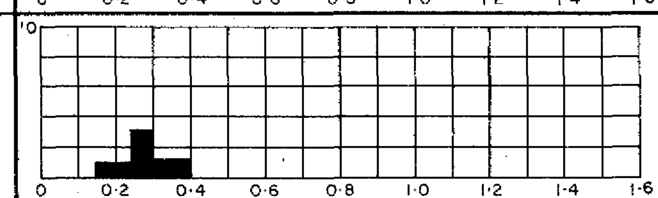
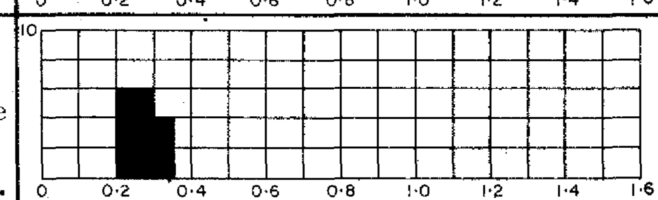
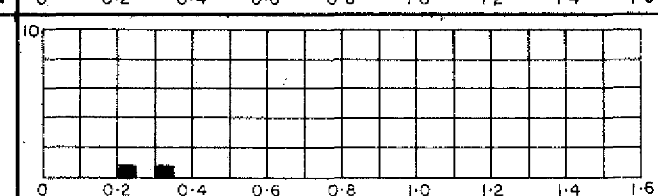
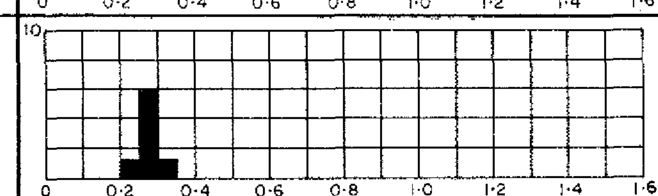
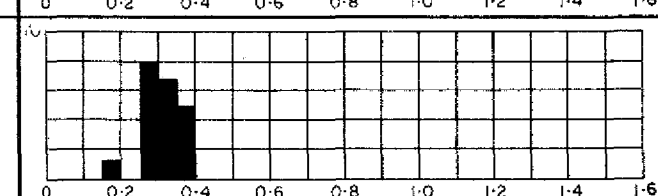
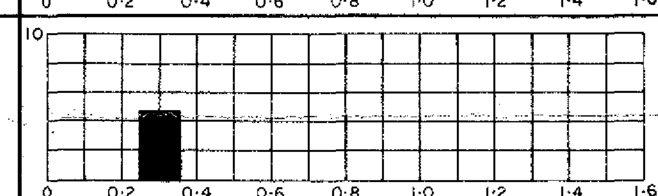
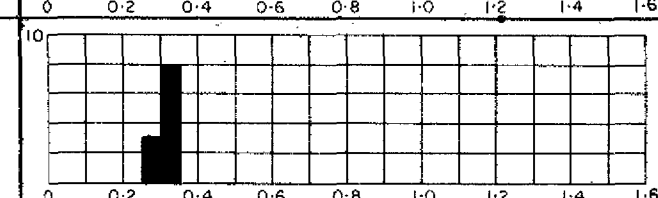
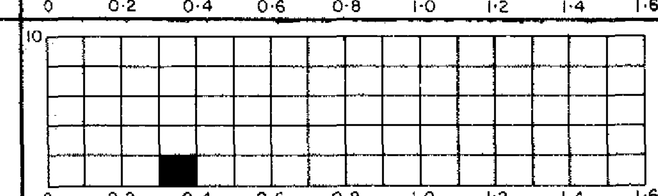
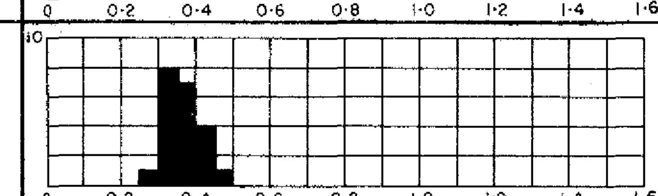
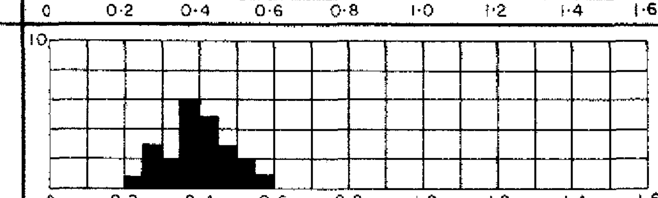
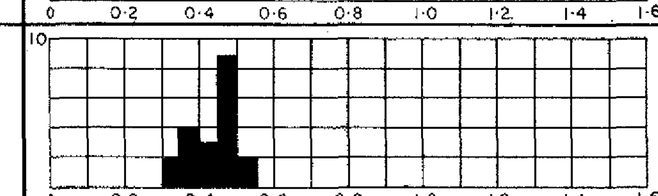
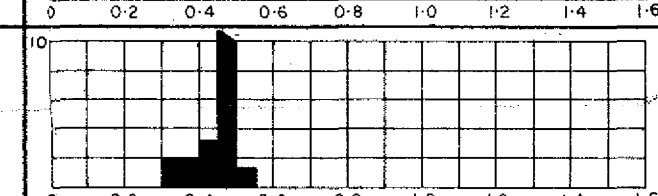
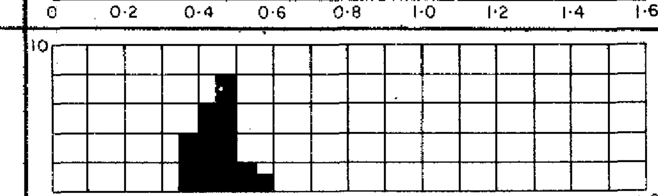
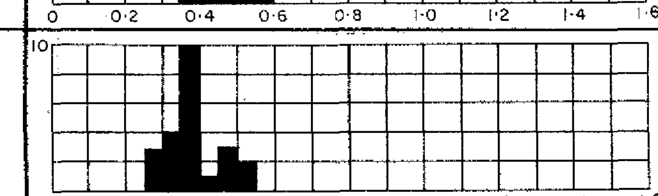
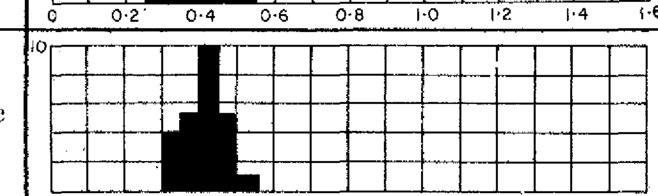
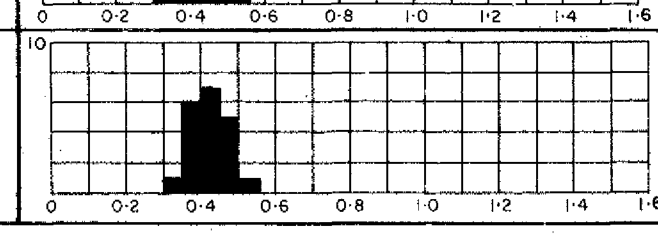
DEPTH (FEET)	LITHOLOGY & MINERALOGY	TYPE OF ORGANIC MATTER	HISTOGRAM SHOWING REFLECTIVITY VALUES/NO.OF MEASUREMENTS	R (av) (%)	NO OF PARTICLES	FLUORESCENCE IN BLUE LIGHT
2790	Kerogen Concentrate	As per 1440 m.		0.45	21	Yellow-orange spores. Yellow carbonate fluorescence in rock chip samples.
2880	Kerogen Concentrate	As per 1440 m. Some coaly fragments with resinite; vitrinite at Ro 0.43%.		0.45	6	Yellow/yellow-orange spores
2970	Kerogen Concentrate.	As per 1440 m. Some large collinite and telinite fragments at Ro. 0.3 - 0.4%		0.29 0.40 0.52	1 16 2	Yellow dinoflagellates Yellow-orange spores
3060	Kerogen Concentrate	Organic matter sparse. Small collinite particles and some large inertinite fragments. Inertinite at greater than 0.56%		0.48 0.63	7 2	Yellow spores and dinoflagellates
3180	Kerogen Concentrate	Small irregular collinite particles. Vitrinite often corroded. Good vitrinite at Ro 0.48%		0.40 0.54	5 11	Yellow-orange spores. Yellow carbonate fluorescence in rock chip sample.
3270	Kerogen Concentrate	Micro-particles of humic matter with high proportions of inertinite relative to vitrinite.		0.41 0.55	13 1	Rare yellow algal fragments
3390	Kerogen Concentrate	As per 1440 m. Inertinite-rich; semifusinite at Ro - 0.86%		0.42 0.57 0.75 0.86	2 9 1 2	Dull yellow-brown background. Occasional yellow micro-algal fragments

REF: RRI/778/IID/2564 | DRAWING NO: 123P/2564/3919 | DATE: OCTOBER, 1977

No 17

VITRINITE REFLECTIVITY DATA SUMMARY CHART I

COMPANY : STATOIL   WELL : 1/9-2   LOCATION : NORWEGIAN NORTH SEA

DEPTH (FEET)	LITHOLOGY & MINERALOGY	TYPE OF ORGANIC MATTER	HISTOGRAM SHOWING REFLECTIVITY VALUES/NO. OF MEASUREMENTS	R (av) (%)	NO OF PARTIC-LES	FLUORESCENCE IN BLUE LIGHT
420	Kerogen Concentrate	Various semifusinite and reworked vitrinite from 0.33% Ro up. Possible low-reflecting vitrinite at less than 0.20% Ro.		0.33 0.57 ?0.20	3 2 -	Yellow spores and algal fragments
780	Kerogen Concentrate	Various semifusinite and reworked vitrinite from 0.33% Ro up. Possible low-reflecting vitrinite at less than 0.20% Ro.		0.20 0.45 0.52	1 3 2	Yellow spores and resin
810	Kerogen Concentrate Pyritic	Only a few humic particles		-	-	Yellow spores Bright yellow dinoflagellate
840	Kerogen Concentrate	Very little organic matter		-	-	Finely dispersed yellow ? sapropel.
870	Kerogen Concentrate Some pyrite	Some small sapropel-like particles. Very little vitrinite		0.26	7	Rare yellow
1440	Kerogen Concenetrate	Clumps of sapropel (or fine-grained amorphous organic matter bounded by oily residue)studded with virtinite and inertinite particles and some pyrite. Occasional large telinite fragments, tabular to rounded.		0.26	16	Abundant yellow-orange spores
1560	Kerogen Concentrate Pyritic	As per 1440 m.		0.28	2	Yellow and yellow-orange spores and dinos.
1650	Kerogen Concentrate	As per 1440 m. Rounded collinite particles with Ro around 0.3%.		0.27	8	Yellow and yellow-orange spores and dinos.
1740	Kerogen Concentrate	As per 1440 m		0.18 0.31	1 20	Yellow and yellow-orange spores and dinos
1830	Kerogen Concentrate	As per 1440 m.		0.29	10	Yellow and yellow-orange spores and dinos.
1890	Kerogen Concentrate	As per 1440 m.		0.31	11	Yellow spores
2010	Red-brown shale.	Some bitumen at Ro - 0.24%. A few small blocky, vitrinite-like particles		0.36	4	Orange fragments
2010	Kerogen Concentrate Pyritic	Abundant degraded vitrinite		0.36 (0.36	21 25)	Yellow-orange spores (Composite)
2100	Kerogen Concentrate.	As per 1440 m. Rather large range of reflectivity on similar macerals		0.28 0.40 0.52	5 15 3	Yellow, yellow-orange and orange spores and pollen
2190	Kerogen Concentrate	As per 1440 m.		0.43	20	Yellow, yellow-orange spores and algal fragments.
2280	Red-brown shale Kerogen Concentrate	Poor sample; a few humic particles As per 1440 m.		- 0.45	- 18	Yellow algal fragments Yellow cuticle; yellow, yellow-orange spores.
2370	Kerogen Concentrate	As per 1440 m.		0.44	20	Yellow, yellow-orange spores.
2490	Kerogen Concentrate.	As per 1440 m. Some large collinite particles of 3 levels of Ro (0.30, 0.38 and and 0.48.)		0.35 0.48 - 0.38	18 5 - 23	Yellow-orange/orange spores.
2610	Kerogen Concentrate	Small rounded collinite particles set in groundmass of finely divided humic organic matter.		0.40	24	Dull yellow/yellow-orange spores.
2730	Kerogen Concentrate	As per 1440 m.		0.42	20	Yellow-orange spores. Occasional yellow algal fragments.

REF: RRI/778/IID/2564   DRAWING NO: 123P/2564/3918   DATE: OCTOBER, 1977