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REPORT ON A GEOCHEMICAL EVALUATION OF THE NORSK HYDRO 15/5 - 2 WELL, NORWEGIAN NORTH SEA

by

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SUMMARY

Dark grey shales occur in the Valhal, Kimmeridge Clay and Heather formations (Lower Cretaceous - Jurassic) which, at optimum levels of thermal maturity, can be expected to be good to very good oil and gas source rocks. At the present early maturation levels these shales can only yield minor quantities of oil and gas. Tertiary and Upper Cretaceous shales and mudstones are lacking in oil or gas sources. The section is mature for hydrocarbon generation below 3,700 metres.

INTRODUCTION

This report presents the results of a geochemical study of the Norsk Hydro 15/5-2 wildcat well, Norwegian North Sea. The well is located in the Viking Graben, 7 kilometres NNW of the 15/5-1 gas and condensate (46^{o}API) discovery, latitude $58^{o}38'36.7''$N, longitude $01^{o}36'16.5''$E (Figure 1). It was drilled in the period 16 August to 16 December, 1978, in 120 metres of water, to a total depth of 4,323 metres before being plugged and abandoned. The objective of the hole was to reach the Jurassic; the well bottomed in possible Triassic sediments, with two thin, hydrocarbon bearing Jurassic pay zones encountered.

For the purpose of this study, 121 wet ditch cuttings samples in sealed cans were provided by Norsk Hydro over the interval 1,450 to 4,323 metres; these were at 50 metre intervals between 1,450 and 3,750 metres, 25 metre intervals between 4,000 and 4,323 metres, 5 metre intervals between 3,750 to 3,755 and 3,770 to 4,000 metres, and 2 to 3 metre intervals between 3,755 and 3,770 metres. Samples were submitted for maturation analyses (airspace gaseous hydrocarbons, gasoline range hydrocarbons, spore colouration and vitrinite reflectivity) and source rock analyses (organic carbon determination, pyrolysis, solvent extraction and fractionation). The mixed lithological nature of many of the samples made it necessary to hand-pick characteristic lithologies prior to some of the organic carbon and pyrolysis analyses. Table 4 is arranged to indicate the proportions of different lithologies in any one sample with their corresponding organic carbon contents, where analysed.

The following samples were analysed during this study:

i.	Sample preparation	:	121 samples
ii.	Organic carbon content	:	134 samples
iii.	Pyrolysis	:	32 samples
iv.	Solvent extraction/fractionation	:	27 samples
v.	Airspace gas analysis	:	73 samples
vi.	Gasoline range hydrocarbons analysis	:	38 samples
vii.	Spore colour/kerogen description	:	37 samples
viii.	Vitrinite reflectivity	:	43 samples

Assisting in the analytical work were A. G. Collins, G. E. Harriman, P. Brown and J. McEwan.

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RESULTS AND INTERPRETATION

A. THERMAL MATURITY

Both oil-prone and gas-prone organic matter are at an early level of thermal maturity between approximately 3,800 and 4,323 metres (T.D.).

1. Airspace Gas Analysis (Table 1 and Figure 2)

The section 1,450 to 3,700 metres has been analysed at 50 metre intervals, this being reduced to 10 or 25 metre intervals throughout the remainder of the section 3,700 to 4,323 metres.

In the transition from immature to mature, gaseous hydrocarbons released from shale cuttings increase in abundance and in the proportions of wet gas (see Appendix III). In the analysed section, high wet gas contents occur in the Tertiary section,but are associated with sandstone (Palaeocene) sections. Shale sections show high abundances of gas with high wet gas contents only in the Lower Cretaceous and Jurassic and the top of the maturation zone is taken to be at 3,700 metres, with migrant hydrocarbons being present at higher levels.

2. Gasoline Hydrocarbon Analysis (Table 2 and Figure 3)

The abundance of gasoline range hydrocarbons is relatively uniform at between 1,000 and 10,000 ppb over the range 2,000 to 3,700 metres. Above 2,000 metres the abundances are less than 1,000 ppb. Below 3,700 metres abundances vary between approximately 3,000 and 70,000 ppb; adjusted to a constant 1% organic carbon content, however, abundances gradually decrease to less than 1,000 ppb at the base of the section. An examination of the distribution of component hydrocarbons in the samples suggests that the section 2,000 to 3,700 metres may be more mature than the section below 3,700 metres; such components are concluded to be present in reservoir lithologies in the section 2,000 to 3,700 metres. The section is considered to reach the beginnings of maturity only at 3,700 metres.

3. Spore Colouration (Table 3 and Figure 4)

Spores are relatively abundant through the section below approximately 2,400 metres and no difficulties were encountered in establishing the spore colour gradient line. Above 2,400 metres, no suitable diagnostic spores were encountered. The sediments pass from immaturity to maturity over the interval 3,500 to 3,800 metres and are early mature below 3,800 metres; the beginning of middle maturity is just reached at total depth (4,323 metres). A relatively low rate of spore colour change with depth occurs through most of the section, but an increase is seen below approximately 3,500 metres.

4. Vitrinite Reflectivity (Table 3 and Figure 5)

Vitrinite is abundant through the analysed section, except over the Upper Cretaceous and Danian interval 2,500 to 3,300 metres. Although it was occasionally difficult to distinguish between indigenous vitrinite and semifusinite in the Jurassic section, it is felt that enough data are available to accurately define the reflectivity gradient for this well. Caving of Middle Jurassic coaly particles is suspected in the ?Triassic sediments below 4,113 metres. The data show a slow rate of increase of reflectivity with depth from 0.3% at around 2,000 metres, to 0.4% at around 3,800 metres; the rate of reflectivity increase is then much higher, reaching 0.65% at 4,110 metres in ?Middle Jurassic coals. The coals were unusual in containing mostly semifusinite and exinite with vitrinite being rare and difficult to distinguish. These data indicate that the sediments are immature down to 3,000 metres and are at an early level of maturity between 4,000 metres and total depth.

5. Pyrolysis (Table 5 and Figure 6)

In this well section the pyrolysis data does not give reliable maturation parameters due to the mixed kerogen types encountered in the samples. Low levels of maturity are implied by the high oxygen indices in the section down to 3,500 metres.

6. Discussion

The five maturation parameters enable the following conclusions to be made:

a. both oil- and gas-prone organic matter are immature down to a depth of approximately 3,800 metres.

b. both oil- and gas-prone organic matter are at an early level of maturity between 3,800 and 4,323 metres (T.D.).

c. oil-prone organic matter just reaches the beginning of the middle maturity zone at total depth.

d. migrant hydrocarbons are suspected to be present over the interval 2,200 to 2,800 metres.

B. SOURCE ROCKS (Tables 4 and 5, and Figures 6 and 7)

Dark grey Jurassic Shales have good to very good oil and gas generating capacity at optimum maturity; at the present early maturity levels they are only fair sources for oil and gas. The remainder of the analysed section, including Tertiary, Upper Cretaceous and probably the ?Triassic, are predominantly of a humic organic matter type and have no significant hydrocarbon generating capacity at either the present or optimum levels of thermal maturity.

Ages and formation names used in the following section are taken from our Biostratigraphic report.

1. Interval 1,450 to 2,650 metres

This interval comprises almost all the Tertiary age sediments (Palaeocene to Oligocene), and includes the lithostratigraphic Montrose to Hordaland groups. The sediments themselves include (a) grey, olive-grey and green-grey silty mudstone and claystone from the Frigg formation and the upper section of the Hordaland group. These sediments contain between 0.50% and 2.00% organic carbon, the majority being below average for argillaceous lithologies. No kerogen type was obtained by visual examination, but pyrolysis suggests a predominantly humic type of organic matter. Pyrolysis and solvent extraction both indicate these sediments to have no significant hydrocarbon generating capacity at either the present or optimum levels of maturity.

(b) grey, olive-grey, grey-red, grey-brown and dark grey claystone, mainly hand-picked from sandstone dominant samples, in the Maureen, Heimdal, Sele and Balder formations. Organic carbon contents are mostly below average at between 0.50% and 1.00%, occasionally rising to as high as 4.25%. The organic matter is again dominated by humic kerogen and no hydrocarbon generating capacity is apparent at either the present or optimum levels of maturity.

2. Interval 2,650 to 3,700 metres

This interval comprises the Upper Cretaceous and some indeterminate Upper to Lower Cretaceous aged sediments, including the lithostratigraphic Cromer Knoll, Chalk and basal part of the Montrose group.

The sediments comprise (a) grey shale and very light grey marl from the Ekofisk and Tor formations. These hand-picked lithologies contain below to well below average organic carbon contents of less than 0.10% to 0.50%; the kerogen is predominantly humic (mainly inertinite). The sediments have no hydrocarbon generating capacity at the present or optimum levels of maturity.

(b) light grey marl/limestone and grey, grey-green and grey-red shales from the Rødby, Hidra, Plenus Marl, Herring and Flounder - Hod formations. Both shales and marls/limestones in these formations contain well below average amounts of organic matter for either argillaceous or carbonate sediments, between 0.10% and 0.45%. Pyrolysis and visual examination indicate that the organic matter contains a predominantly humic kerogen type; minor amounts of sapropel appear towards the base of the interval, particularly in the Rødby to Herring formations. The data indicate that no significant hydrocarbon generating capacity exists in these sediments at either the present or at optimum maturity.

3. Interval 3,700 to 4,323 metres

This interval comprises Lower Cretaceous, Jurassic and ?Triassic sediments including the lithostratigraphic ?Triassic, Brent, Humber and base of the Cromer Knoll Groups.

The sediments comprise (a) variously coloured shales with marl (?caved) with dark grey shale of the Valhal formation. Hand-picked dark grey shale contains between 1.61% and 4.60% organic carbon, mainly above average for argillaceous lithologies. Pyrolysis and visual examination of the kerogen shows these shales to contain (sample 3,700-750 metres) approximately equal proportions of sapropel, vitrinite and inertinite, and as such the amount of sapropel present is of significance for the generation of oil. At the present immature to early levels of maturity these shales have only minor oil and gas generating capacity; at optimum maturity these shales may be expected to be good oil and gas sources.

(b) dark grey, silty, micaceous shales, found principally in the Kimmeridge Clay and Heather formations, but also seen interbedded with sands and coals in the Brent group (possibly caved) and with sands and red shales in the ?Triassic group. These shales have above average organic carbon contents of 3.55% to 11.74%, increasing to as much as 27% in the more coaly shales picked from the Brent Group. Pyrolysis and visual kerogen examination show these sediments to contain sapropel, vitrinite and inertinite in variable proportions; in almost all of the shales picked from the Kimmeridge Clay and Heather formations, the sapropel component of the organic matter is sufficiently high to class these shales as good oil sources. Solvent extraction and fractionation indicate that at the present early levels of maturity these shales have fair to good oil and gas generating capacity; pyrolysis indicates that at optimum maturity the oil and gas generating capacity is good to very good, the best source rocks being in the Kimmeridge Clay formation where a high pour point oil is likely to be produced. Shales picked from the Brent group contain a lower sapropel content, subordinate to a high inertinite content. The indigenous ?Triassic sediments are considered to have no hydrocarbon generating capacity.

III

CONCLUSIONS

Our geochemical study of the 15/5-2 well enables us to conclude that:

i. Both oil-prone and gas-prone organic matter are at an early level of maturity between approximately 3,800 metres and T.D.

ii. Tertiary silty mudstones and claystones in the interval 1,450 to 2,650 metres contain a predominantly humic type of organic matter and have no hydrocarbon generating capacity at either the present or optimum levels of maturity.

iii. Upper Cretaceous marls and variously coloured shales in the interval 2,650 to 3,700 metres contain a predominantly humic organic matter type and no hydrocarbon generating capacity exists at either the present or at optimum levels of maturity.

iv. Lower Cretaceous and Jurassic dark grey shales in the interval 3,700 to 4,323 metres contain mixtures of humic and sapropelic organic matter; these have fair oil and gas generating capacity at present maturity levels and can be expected to be good to very good oil and gas sources at optimum maturity.

v. Oils generated from the section are liable to be of high pour point

vi. Migrant hydrocarbons are suspected in the interval 2,200 to 2,800 metres.

TABLE 1a AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: NORSK HYDRO **WELL:** 15/5-2 **LOCATION:** NORWEGIAN NORTH SEA

DEPTH (METRES)	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCE (PER CENT)					TOTAL ABUNDANCE (ppm)	TOTAL C_2 - C_4 (%)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
1450-500	100	*	*	*	*	23400	0	*
1500-550	100	*	*	*	*	26000	0	*
1550-600	100	*	*	*	*	41600	0	*
1600-650	100	*	*	*	*	5500	0	*
1650-700	*	*	*	*	*	*	*	*
1700-750	*	*	*	*	*	*	*	*
1750-800	100	*	*	*	*	22000	0	*
1800-850	100	*	*	*	*	6900	0	*
1850-900	100	*	*	*	*	9700	0	*
1900-950	99	1	*	*	*	28400	1	*
1950-960	100	*	*	*	*	3200	0	*
1960-2000	97	3	*	*	*	7400	3	*
2000-050	79	14	7	*	*	4200	21	*
2050-100	78	14	8	*	*	7600	22	*
2100-150	82	12	6	*	*	12200	18	*
2150-200	*	*	*	*	*	*	*	*
2200-250	65	20	15	*	*	4700	35	*
2250-300	*	*	*	*	*	*	*	*
2300-350	*	*	*	*	*	*	*	*
2350-400	48	21	31	*	*	2000	52	*
2400-450	56	15	16	3	10	5100	44	0.30
2450-500	-	-	-	-	-	-	-	-
2500-550	20	14	41	7	18	1800	80	0.39
2550-600	36	24	29	4	7	21400	64	0.57
2600-650	-	-	-	-	-	-	-	-
2650-700	81	9	7	Tr	3	6800	19	*
2700-750	73	19	8	Tr	Tr	13100	27	*
2750-800	18	13	38	11	20	16300	82	0.55
2800-850	-	-	-	-	-	-	-	-
2850-900	73	12	11	1	3	4400	27	0.33
2900-950	78	10	7	2	3	27200	22	0.67
2950-3000	74	10	10	3	3	5000	26	1.00
3000-050	70	10	12	3	5	6200	30	0.60

NOTE: TOTAL GASEOUS HYDROCARBON ABUNDANCE VALUES ARE EXPRESSED AS VOLUME OF HYDROCARBON GASES RELATIVE TO VOLUME OF AIRSPACE

TABLE 1b AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: NORSK HYDRO **WELL:** 15/5-2 **LOCATION:** NORWEGIAN NORTH SEA

DEPTH (METRES)	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCE (PER CENT)					TOTAL ABUNDANCE (ppm)	TOTAL C_2 - C_4 (%)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
3050-100	92	6	2	Tr	Tr	3000	8	*
3100-150	71	10	10	4	5	4600	29	0.80
3150-200	-	-	-	-	-	-	-	-
3200-250	-	-	-	-	-	-	-	-
3250-300	74	11	15	Tr	Tr	1300	26	*
3300-350	95	5	Tr	Tr	Tr	800	5	*
3350-400	86	5	9	Tr	Tr	500	14	*
3400-450	52	11	20	4	13	9600	48	0.31
3450-500	98	2	Tr	*	*	700	2	*
3500-550	100	*	*	*	*	400	0	*
3550-600	100	*	*	*	*	400	0	*
3650-700	-	-	-	-	-	-	-	-
3700-750	30	13	35	5	17	64000	70	0.29
3720-725	30	15	48	Tr	7	33700	70	*
3730-735	36	16	33	3	12	38100	64	0.25
3740-745	-	-	-	-	-	-	-	-
3750-755	-	-	-	-	-	-	-	-
3760-765	52	14	24	2	8	43600	48	0.25
3770-775	-	-	-	-	-	-	-	-
3780-785	35	16	33	3	13	37600	65	0.23
3790-795	29	13	37	4	17	43400	71	0.24
3800-805	38	13	34	3	12	60000	62	0.25
3810-815	57	12	23	2	6	37900	43	0.33
3820-825	55	14	24	1	6	44600	45	0.16
3830-835	65	15	16	1	3	94500	35	0.33
3840-845	63	15	18	1	3	57600	37	0.33
3850-855	65	13	17	1	4	89000	35	0.25
3860-865	63	15	18	1	3	85900	37	0.33
3870-875	87	7	6	Tr	Tr	62900	13	*
3880-885	78	10	10	Tr	2	99900	22	*
3890-895	-	-	-	-	-	-	-	-
3900-905	51	12	29	3	5	100700	49	0.60
3910-915	54	14	21	4	7	168100	46	0.57
3920-925	-	-	-	-	-	-	-	-

NOTE: TOTAL GASEOUS HYDROCARBON ABUNDANCE VALUES ARE EXPRESSED AS VOLUME OF HYDROCARBON GASES RELATIVE TO VOLUME OF AIRSPACE

TABLE 1c AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: NORSK HYDRO **WELL:** 15/5-2 **LOCATION:** NORWEGIAN NORTH SEA

DEPTH (METRES)	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCE (PER CENT)					TOTAL ABUNDANCE (ppm)	TOTAL C_2 - C_4 (%)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
3930-935	-	-	-	-	-	-	-	-
3940-945	64	15	15	2	4	174500	36	0.50
3950-955	53	16	20	3	8	86200	47	0.38
3960-965	-	-	-	-	-	-	-	-
3970-975	-	-	-	-	-	-	-	-
3980-985	52	19	19	4	6	201400	48	0.67
3985-990	61	22	13	2	2	332400	39	1.00
4000-025	88	11	1	Tr	Tr	458100	12	*
4025-050	89	9	2	Tr	Tr	320200	11	*
4050-075	*	*	*	*	*	*	*	*
4075-100	83	15	2	Tr	Tr	355500	17	*
4100-125	89	9	2	Tr	Tr	128900	11	*
4125-150	89	9	2	*	*	128900	11	*
4150-175	89	9	2	*	*	118900	11	*
4175-200	95	5	*	*	*	59200	5	*
4200-225	88	10	2	*	*	577900	12	*
4225-250	95	5	*	*	*	165700	5	*
4250-275	91	7	2	*	*	439600	9	*
4275-300	91	6	3	*	*	139400	9	*
4300-323	93	5	2	*	*	215700	7	*

NOTE: TOTAL GASEOUS HYDROCARBON ABUNDANCE VALUES ARE EXPRESSED AS VOLUME OF HYDROCARBON GASES RELATIVE TO VOLUME OF AIRSPACE

TABLE 2A

GASOLINE HYDROCARBON ANALYSIS DATA

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

DEPTH: (METRES)	1450	1550	1650	1750	1850	1950	2000
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	Tr	Tr	Tr	*	*	Tr	Tr
n - BUTANE	Tr	Tr	Tr	*	*	Tr	Tr
i - PENTANE	Tr	Tr	Tr	*	*	2	12
n - PENTANE	Tr	Tr	Tr	*	*	2	27
2,2 - DIMETHYL BUTANE	*	42	*	*	*	2	Tr
CYCLOPENTANE	Tr	40	Tr	*	*	3	5
2,3 - DIMETHYL BUTANE	*	*	*	*	*	3	6
2 - METHYL PENTANE	Tr	2	*	*	*	*	3
3 - METHYL PENTANE	Tr	*	*	*	*	2	3
n - HEXANE	Tr	Tr	Tr	*	*	3	8
METHYL CYCLOPENTANE	Tr	*	Tr	*	*	5	1
2,2 - DIMETHYL PENTANE	*	*	*	*	*	3	*
2,4 - DIMETHYL PENTANE	*	*	*	*	*	3	*
BENZENE	Tr	Tr	Tr	*	*	9	1
CYCLOHEXANE	Tr	11	Tr	*	*	5	6
3,3 - DIMETHYL PENTANE	*	*	*	*	*	4	*
2 - METHYL HEXANE	Tr	*	Tr	*	*	5	Tr
1,1 - DIMETHYL CYCLOPENTANE	Tr	*	*	*	*	4	*
3 - METHYL HEXANE	Tr	*	*	*	*	5	Tr
1, CIS - 3 - DIMETHYL CYCLOPENTANE	Tr	*	*	*	*	4	Tr
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*	*	*	*	*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	Tr	*	*	*	*	5	Tr
3 - ETHYL PENTANE	*	*	*	*	*	*	*
n - HEPTANE	Tr	*	*	*	*	12	12
1, CIS - 2 - DIMETHYL CYCLOPENTANE	*	*	*	*	*	3	Tr
METHYL CYCLOHEXANE	Tr	*	Tr	*	*	3	Tr
ETHYL CYCLOPENTANE	Tr	*	Tr	*	*	2	5
TOLUENE	Tr	5	Tr	*	*	11	11
TOTAL ABUNDANCE (PPB)	Tr	400	<100	*	*	8000	3300
ORGANIC CARBON (PER CENT)	1.84	1.86	0.91	0.91	0.92	0.68	1.06
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	Tr	215	<100	*	*	11800	3100

NOTE: TOTAL GASOLINE ABUNDANCE VALUES ARE EXPRESSED AS WEIGHT OF GAS RELATIVE TO WEIGHT OF WET ROCK.

TABLE 2B

GASOLINE HYDROCARBON ANALYSIS DATA

COMPANY: NORSK HYDRO **WELL:** 15/5-2 **LOCATION:** NORWEGIAN NORTH SEA

DEPTH: (METRES)	2100	2200	2300	2400	2500	2650	2900
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	*	Tr	Tr	Tr	Tr	3	*
n - BUTANE	*	Tr	Tr	Tr	3	5	3
i - PENTANE	*	5	*	Tr	10	11	12
n - PENTANE	*	52	*	3	15	13	16
2,2 - DIMETHYL BUTANE	*	4	*	*	Tr	Tr	Tr
CYCLOPENTANE	*	30	*	2	2	2	2
2,3 - DIMETHYL BUTANE	*	Tr	*	1	Tr	Tr	Tr
2 - METHYL PENTANE	*	2	*	5	5	4	5
3 - METHYL PENTANE	*	7	*	3	3	3	2
n - HEXANE	*	Tr	Tr	7	6	6	7
METHYL CYCLOPENTANE	*	Tr	*	13	3	3	4
2,2 - DIMETHYL PENTANE	*	*	*	Tr	Tr	Tr	Tr
2,4 - DIMETHYL PENTANE	*	*	*	Tr	Tr	Tr	Tr
BENZENE	*	Tr	Tr	6	4	5	4
CYCLOHEXANE	*	Tr	Tr	6	6	6	7
3,3 - DIMETHYL PENTANE	*	Tr	*	Tr	*	*	*
2 - METHYL HEXANE	*	Tr	*	4	Tr	Tr	Tr
1,1 - DIMETHYL CYCLOPENTANE	*	*	*	4	3	3	3
3 - METHYL HEXANE	*	Tr	*	4	3	3	2
1, CIS - 3 - DIMETHYL CYCLOPENTANE	*	Tr	*	2	2	2	3
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*	*	*	*	*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	*	Tr	*	5	3	3	2
3 - ETHYL PENTANE	*	*	*	*	Tr	Tr	1
n - HEPTANE	*	Tr	Tr	6	8	8	7
1, CIS - 2 - DIMETHYL CYCLOPENTANE	*	*	*	6	Tr	1	Tr
METHYL CYCLOHEXANE	*	Tr	Tr	9	7	6	7
ETHYL CYCLOPENTANE	*	Tr	*	3	2	1	1
TOLUENE	*	Tr	Tr	11	14	14	12
TOTAL ABUNDANCE (PPB)	*	1500	Tr	6200	3850	1150	1350
ORGANIC CARBON (PER CENT)	-	0.96	0.88	0.80	0.20	0.28	0.24
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	*	1600	Tr	7800	19250	4170	5670

NOTE: TOTAL GASOLINE ABUNDANCE VALUES ARE EXPRESSED AS WEIGHT OF GAS RELATIVE TO WEIGHT OF WET ROCK.

TABLE 2C

GASOLINE HYDROCARBON ANALYSIS DATA

COMPANY: NORSKE HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

DEPTH: (METRES)	3000	3100	3300	3400	3500	3550	3700
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	Tr	Tr	Tr	Tr	Tr	*	9
n - BUTANE	Tr	1	Tr	1	Tr	*	9
i - PENTANE	2	2	3	1	2	*	21
n - PENTANE	3	3	5	2	1	*	26
2,2 - DIMETHYL BUTANE	Tr	Tr	Tr	Tr	Tr	*	Tr
CYCLOPENTANE	1	1	2	1	1	*	1
2,3 - DIMETHYL BUTANE	1	1	1	1	1	*	Tr
2 - METHYL PENTANE	3	4	3	2	2	*	5
3 - METHYL PENTANE	2	3	2	3	2	*	3
n - HEXANE	12	10	10	7	10	*	3
METHYL CYCLOPENTANE	3	2	3	3	2	*	2
2,2 - DIMETHYL PENTANE	2	3	3	3	3	*	Tr
2,4 - DIMETHYL PENTANE	3	3	3	2	3	*	Tr
BENZENE	4	4	4	4	3	*	Tr
CYCLOHEXANE	4	5	5	4	7	*	1
3,3 - DIMETHYL PENTANE	*	*	*	*	*	*	*
2 - METHYL HEXANE	5	4	4	4	4	*	3
1,1 - DIMETHYL CYCLOPENTANE	5	3	3	4	4	*	2
3 - METHYL HEXANE	6	6	5	7	6	*	Tr
1, CIS - 3 - DIMETHYL CYCLOPENTANE	5	5	4	5	5	*	Tr
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*	*	*	*	*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	5	4	5	5	4	*	17
3 - ETHYL PENTANE	Tr	Tr	Tr	1	Tr	*	Tr
n - HEPTANE	8	7	7	8	7	*	5
1, CIS - 2 - DIMETHYL CYCLOPENTANE	2	3	2	4	3	*	1
METHYL CYCLOHEXANE	8	7	9	8	8	*	2
ETHYL CYCLOPENTANE	8	8	7	6	8	*	Tr
TOLUENE	10	12	14	10	14	*	Tr
TOTAL ABUNDANCE (PPB)	1280	1500	500	1930	2010	*	13100
ORGANIC CARBON (PER CENT)	0.11	0.17	0.28	0.17	0.19	-	0.86
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	11700	8830	1790	11630	10470	-	15230

NOTE: TOTAL GASOLINE ABUNDANCE VALUES ARE EXPRESSED AS WEIGHT OF GAS RELATIVE TO WEIGHT OF WET ROCK.

TABLE 2D

GASOLINE HYDROCARBON ANALYSIS DATA

COMPANY: NORSKE HYDRO **WELL:** 15/5-2 **LOCATION:** NORWEGIAN NORTH SEA

DEPTH: (METRES)	3715	3755	3758	3795	3800	3845	3850
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	5	12	11	2	7	Tr	Tr
n - BUTANE	6	13	13	3	7	Tr	Tr
i - PENTANE	12	14	13	4	14	12	12
n - PENTANE	22	24	26	9	25	18	18
2,2 - DIMETHYL BUTANE	Tr	Tr	Tr	Tr	Tr	Tr	Tr
CYCLOPENTANE	2	4	2	1	3	3	3
2,3 - DIMETHYL BUTANE	Tr	Tr	Tr	Tr	Tr	Tr	Tr
2 - METHYL PENTANE	6	3	6	2	5	5	4
3 - METHYL PENTANE	4	2	2	1	3	3	3
n - HEXANE	11	6	7	4	8	6	7
METHYL CYCLOPENTANE	3	3	2	2	4	4	5
2,2 - DIMETHYL PENTANE	Tr	Tr	Tr	Tr	Tr	1	1
2,4 - DIMETHYL PENTANE	Tr	Tr	Tr	Tr	Tr	2	2
BENZENE	1	2	1	Tr	Tr	4	4
CYCLOHEXANE	2	2	1	10	Tr	7	5
3,3 - DIMETHYL PENTANE	*	*	*	*	*	*	*
2 - METHYL HEXANE	5	2	1	2	4	Tr	3
1,1 - DIMETHYL CYCLOPENTANE	3	1	1	1	2	3	4
3 - METHYL HEXANE	1	1	1	Tr	2	4	4
1, CIS - 3 - DIMETHYL CYCLOPENTANE	1	1	1	Tr	Tr	2	3
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*	*	*	*	*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	3	2	2	2	3	4	3
3 - ETHYL PENTANE	Tr	Tr	Tr	Tr	Tr	Tr	Tr
n - HEPTANE	9	3	3	36	4	6	6
1, CIS - 2 - DIMETHYL CYCLOPENTANE	Tr	Tr	Tr	2	Tr	Tr	Tr
METHYL CYCLOHEXANE	3	2	2	8	2	5	5
ETHYL CYCLOPENTANE	1	1	1	6	1	2	2
TOLUENE	Tr	3	Tr	3	3	8	8
TOTAL ABUNDANCE (PPB)	27000	25800	15500	20100	58200	9900	3400
ORGANIC CARBON (PER CENT)	0.95	9.83	11.21	0.81	1.36	3.28	4.59
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	28420	2630	1380	24820	42720	3010	740

NOTE: TOTAL GASOLINE ABUNDANCE VALUES ARE EXPRESSED AS WEIGHT OF GAS RELATIVE TO WEIGHT OF WET ROCK.

TABLE 2E

GASOLINE HYDROCARBON ANALYSIS DATA

COMPANY: NORSKE HYDRO **WELL:** 15/5-2 **LOCATION:** NORWEGIAN NORTH SEA

DEPTH: METRES	3885	3915	3950	3995	4025	4075	4125
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	2	2	*	19	10	9	8
n - BUTANE	8	6	*	36	19	11	10
i - PENTANE	16	17	*	18	18	27	23
n - PENTANE	21	19	*	13	17	24	23
2,2 - DIMETHYL BUTANE	Tr	Tr	*	Tr	Tr	Tr	Tr
CYCLOPENTANE	3	3	*	Tr	2	2	2
2,3 - DIMETHYL BUTANE	Tr	Tr	*	Tr	Tr	Tr	Tr
2 - METHYL PENTANE	5	5	*	Tr	4	7	6
3 - METHYL PENTANE	3	2	*	Tr	2	2	3
n - HEXANE	5	5	*	Tr	3	3	4
METHYL CYCLOPENTANE	3	4	*	Tr	2	Tr	Tr
2,2 - DIMETHYL PENTANE	Tr	Tr	*	Tr	Tr	Tr	Tr
2,4 - DIMETHYL PENTANE	Tr	Tr	*	Tr	Tr	Tr	Tr
BENZENE	4	4	*	Tr	5	4	4
CYCLOHEXANE	6	6	*	Tr	2	1	3
3,3 - DIMETHYL PENTANE	*	*	*	*	*	*	*
2 - METHYL HEXANE	Tr	Tr	*	Tr	1	1	2
1,1 - DIMETHYL CYCLOPENTANE	2	3	*	Tr	Tr	Tr	Tr
3 - METHYL HEXANE	2	2	*	Tr	Tr	Tr	Tr
1, CIS - 3 - DIMETHYL CYCLOPENTANE	1	2	*	Tr	Tr	Tr	Tr
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*	*	*	*	*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	3	3	*	Tr	1	Tr	2
3 - ETHYL PENTANE	Tr	Tr	*	Tr	Tr	Tr	Tr
n - HEPTANE	4	4	*	Tr	7	3	6
1, CIS - 2 - DIMETHYL CYCLOPENTANE	2	2	*	Tr	Tr	Tr	Tr
METHYL CYCLOHEXANE	4	3	*	Tr	Tr	Tr	Tr
ETHYL CYCLOPENTANE	2	2	*	Tr	Tr	Tr	Tr
TOLUENE	6	6	*	Tr	5	2	3
TOTAL ABUNDANCE (PPB)	9410	14110	*	2460	3000	69600	23200
ORGANIC CARBON (PER CENT)	4.54	3.18	8.89	35.00	5.74	24.27	11.51
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	2070	4430	*	70	520	2870	2020

NOTE: TOTAL GASOLINE ABUNDANCE VALUES ARE EXPRESSED AS WEIGHT OF GAS RELATIVE TO WEIGHT OF WET ROCK.

TABLE 2F

GASOLINE HYDROCARBON ANALYSIS DATA

COMPANY: NORSKE HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

DEPTH: METRES	4175	4225	4250				
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	10	8	6				
n - BUTANE	12	17	19				
i - PENTANE	21	18	19				
n - PENTANE	24	23	22				
2,2 - DIMETHYL BUTANE	Tr	Tr	Tr				
CYCLOPENTANE	2	2	2				
2,3 - DIMETHYL BUTANE	Tr	Tr	Tr				
2 - METHYL PENTANE	6	3	4				
3 - METHYL PENTANE	3	2	2				
n - HEXANE	4	4	4				
METHYL CYCLOPENTANE	Tr	2	2				
2,2 - DIMETHYL PENTANE	Tr	Tr	Tr				
2,4 - DIMETHYL PENTANE	Tr	Tr	Tr				
BENZENE	3	4	4				
CYCLOHEXANE	4	3	3				
3,3 - DIMETHYL PENTANE	*	*	*				
2 - METHYL HEXANE	1	3	1				
1,1 - DIMETHYL CYCLOPENTANE	Tr	Tr	Tr				
3 - METHYL HEXANE	Tr	Tr	Tr				
1, CIS - 3 - DIMETHYL CYCLOPENTANE	Tr	Tr	Tr				
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*				
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	2	Tr	1				
3 - ETHYL PENTANE	Tr	Tr	Tr				
n - HEPTANE	4	5	6				
1, CIS - 2 - DIMETHYL CYCLOPENTANE	Tr	Tr	Tr				
METHYL CYCLOHEXANE	2	1	1				
ETHYL CYCLOPENTANE	Tr	Tr	Tr				
TOLUENE	3	4	5				
TOTAL ABUNDANCE (PPB)	12100	1500	2800				
ORGANIC CARBON (PER CENT)	12.67	10.44	8.45				
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	950	140	330				

NOTE: TOTAL GASOLINE ABUNDANCE VALUES ARE EXPRESSED AS WEIGHT OF GAS RELATIVE TO WEIGHT OF WET ROCK.

TABLE 3A MATURITY EVALUATION DATA

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH METRES	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R av%	KEROGEN COMPOSITION (%)		
					INERTINITE	VITRINITE	SAPROPEL
1450-500	Ctgs	SLTY MDST	*	*	*	*	*
1550-600	"	"	*	0.26(6)	*	*	*
1650-700	"	MDST/CLYST	*	*	*	*	*
1750-800	"	"	*	0.27(1)	*	*	*
1850-900	"	"	*	*	*	*	*
1950-960	"	"	*	*	*	*	*
2000-050	"	"	*	0.28(3)	*	*	*
2100-150	"	CLYST	*	0.27(8)	*	*	*
2200-250	"	"	*	0.31(19)	*	*	*
2300-350	"	"	*	0.33(16)	*	*	*
2400-450	"	CLYST,+SST	*	0.28(8)	*	*	*
2500-550	"	SST	2.0	0.31(30)	40	60	tr
2600-650	"	CLYST+SST	2.5	*	20	80	tr
2700-750	"	MARL+SH+SST	2.5-3.0	*	80	20	tr
2800-850	"	" + "+ "	*	*	100	tr	tr
2900-950	"	" + "+ "	3.0	*	90	10	tr
3000-050	"	"	*	*	100	tr	*
3100-150	"	"	2.0-3.0	*	100	*	*
3200-250	"	MARL/SH	2.0-3.0	*	80	20	*
3300-350	"	MARL/SH/SST	2.0-3.0	*	70	30	*
3400-450	"	LST/MARL+SH	?3.0	0.37(6)	40	40	?20
3500-550	"	" + "	?3.0	0.35(6)	80	10	?10
3650-700	"	MARL/SH	?3.0	0.41(4)	60	20	?20
3700-750	"	MARL/SH + SH, dk	3.5	0.37(1)	60	10	?30
3755-758	"	SH, dk gy	3.5	0.35(3)	60	20	20
3790-795	"	"	3.0	0.38(4)	40	10	50
3850-855	"	" +MARL	3.5-4.0	0.41(5)	30	10	60
3880-885	"	" + "	3.5	0.38(14)	60	10	30
3915-920	"	" +SND	3.5-4.0	0.48(13)	60	10	30
3950-955	"	" +COAL	3.0-4.0	*	30	tr	70
3960	HP	"	-	0.53(7)	-	-	-
3990	HP	"	-	0.58(9)	-	-	-
3995	HP	"	-	0.56(14)	-	-	-
4000-025	Ctgs	SH, dk gy +SND/ COAL	4.0	0.61(11)	70	30	tr
4050-075	"	" + "	4.0-4.5	0.66(13)	60	40	tr

TABLE 3B MATURITY EVALUATION DATA

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH METRES	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1 - 10)	VITRINITE REFLECTIVITY IN OIL, R av%	KEROGEN COMPOSITION (%)		
					INERTINITE	VITRINITE	SAPROPEL
4050-075	HP	COAL	-	0.64(13)	-	-	-
4100-125	Ctgs	SH, dk gy +SND COAL	4.0	* (CAVED DATA)	50	50	tr
4100-125	HP	COAL	-	* (CAVED DATA)	-	-	-
4150-175	"	" + "	4.5	* (CAVED DATA)	60	35	5
4200-225	"	" + "	4.5	* (CAVED DATA)	70	30	tr
4250-275	"	" + "	5.0	* (CAVED DATA)	80	20	tr
4300-325	HP	"	-	* (CAVED DATA)	-	-	-
4300-323	Ctgs	" + "	4.5	* (CAVED DATA)	70	30	tr

TABLE 4A

SOURCE ROCK EVALUATION DATA

COMPANY: NORSK HYDRO   WELL: 15/5-2   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
1450-500	Ctgs	SLTY MDST, sft, ol-gy	1.84	770	4.2	45	6	95
1500-550	"	"	1.81					
1550-600	"	"	1.86					
1600-650	"	85% SLTY MDST, ol-gy 15% SLTY MDST yel-gy	0.16 -					
1650-700	"	MDST/CLYST, ol-gn-gy	0.91	605	6.6	<20	*	*
1700-750	"	"	0.72					
1750-800	"	"	0.91					
1800-850	"	"	1.04	255	2.5	<20	*	*
1850-900	"	"	0.92					
1900-950	"	"	0.74					
1950-960	"	"	0.68					
1950-2000	"	"	0.64	905	14.2	<20	*	*
2000-050	"	"	1.08					
2050-100	"	80% CLYST, gy-red 20% CLYST, ol-gy	0.14 0.70					
2100-150	"	CLYST, ol-gy, slty CLYST, lt ol-gy, slty CLYST, med lt ol-gy	4.25 1.61 0.83					
2150-200	"	CLYST, med/lt ol-gy	1.90	1295	6.8	30	2	75
2200-250	"	70% CLYST, ol-gy 30% CLYST, gy-red	0.96 -					
2250-300	"	CLYST, gy-red/ol-gy	0.72	855	11.9	<20	*	*
2300-350	"	CLYST, gy-red/ol-gy	0.88					
2350-400	"	CLYST, ol-gy mnr CLYST, gy-red	0.46 -	*	*	*	*	*
2400-450	"	CLYST, ol-gy+SST, yel-gy	0.80					
2450-500	"	SST, lt gy, calc mnr CLYST, gy-red-gn	- 0.73					
2500-550	"	SST, a/a mnr CLYST, a/a	- 3.20					
2550-600	"	SST, a/a mnr CLYST, a/a	- 0.63					

TABLE 4B

SOURCE ROCK EVALUATION DATA

COMPANY : NORSK HYDRO　　WELL: 15/5-2　　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
2600-650	Ctgs	60% CLYST, gy-red-brn 40% SST, a/a (tr COAL)	0.70 -					
2650-700	"	60% CLYST, a/a 40% SST, a/a	0.43 -					
2700-750	"	70% MARL, v lt gy 20% SH, gy, calc, sft 10% SND/SST/COAL	0.24 0.46 -					
2750-800	"	70% MARL, a/a 20% SH, a/a 10% SND, a/a	- 0.38 -					
2800-850	"	70% MARL, a/a 20% SH, a/a 10% SST, a/a	0.25 0.25 -					
2850-900	"	70% MARL, a/a 20% SH, a/a 10% SST, a/a	- 0.31 -					
2900-950	"	70% MARL, a/a 20% SH, a/a 10% SST, a/a	- 0.30 -					
2950-3000	"	80% MARL, a/a 20% SH, gy, calc	0.27 0.13					
3000-050	"	MARL, lt gy to pink	0.11					
3050-100	"	"	0.12					
3100-150	"	"	0.17					
3150-200	"	"	0.19					
3200-250	"	MARL/SH, gy/lt gy mnr SND	0.42 -					
3250-300	"	MARL/SH/SND, a/a	0.27					
3300-350	"	"	0.28					
3350-400	"	80% LST/MARL, lt gy 20% SH, calc, gy	0.13 0.22					

TABLE 4C

SOURCE ROCK EVALUATION DATA

COMPANY : NORSK HYDRO WELL: 15/5-2 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
3400-450	Ctgs	80% LST/MARL, lt gy 20% SH, calc gy	- 0.31					
3450-500	"	80% LST/MARL, a/a 20% SH, a/a	0.17 0.23					
3500-550	"	80% LST/MARL, a/a 20% SH, a/a	- 0.40					
3550-600	"	80% LST/MARL, a/a 20% SH a/a	- 0.45					
3693-695	"	80% SH, gy-red, calc 20% SH, gy-gn/gy	0.16 -					
3650-700	"	70% MARL/SH, lt gy 30% SH, gy/gy-gn	0.25 0.39					
3700-750	"	60% MARL, lt gy 40% { SH, dk gy SH, gy-red SH, gy-gn	- 4.60 0.41 0.29					
3715-720	"	80% MARL, lt gy & SH, a/a 20% SH, dk gy	- 3.74					
3720-725	"	80% MARL & SH, a/a 20% SH, dk gy	- 4.33					
3735-730	"	" "	- 3.50					
3730-735	"	" "	- 3.44					
3735-740	"	" "	- 4.01					
3740-745	"	" "	- 2.64					
3745-750	"	" "	- 1.88					
3750-755	"	" "	- 1.61					

TABLE 4D

SOURCE ROCK EVALUATION DATA

COMPANY : NORSK HYDRO WELL: 15/5-2 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
3755-758	Ctgs	SH, dk gy, slty, mic mnr SH, gy-gn-red mnr SLT/SND/MARL/COAL	9.83 - -					
3758-760	"	"	11.21					
3760-763	"	"	4.85	6850	14.1	1605	23	50
3760-765	"	"	8.99					
3765-768	"	"	8.43					
3765-770	"	"	8.18					
3770-773	"	"	5.27	8450	16.0	1330	16	65
3770-775	"	"	9.89					
3775-780	"	"	6.11	12660	20.7	2030	16	67
3780-785	"	"	11.74					
3785-790	"	"	10.39					
3790-795	"	"	7.88	8830	11.2	2015	23	69
3795-800	"	15% SH, dk gy, mic 60% MARL, gy 10% SH, gy-red 15% SLT/SND	4.07 0.27 0.29 -					
3800-805	"	15% SH, dk gy, mic 85% MARL/SH/SLT, a/a	7.93 -					
3805-810	"	70% " 30% "	5.15 -					
3810-815	"	" "	3.55 -	)5150)	14.5	1025	20	41
3815-820	"	" "	6.24 -	6680	10.7	1200	18	46
3820-825	"	" "	6.79 -					
3825-830	"	" "	4.67 -					
3830-835	"	" "	7.22 -					
3835-840	"	" "	2.84 -	) 3440)	12.1	600	18	46

TABLE 4E

SOURCE ROCK EVALUATION DATA

COMPANY: NORSK HYDRO WELL: 15/5-2 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
3840-845	Ctgs	70% SH, dk gy, mic 30% MARL/SH/SLT a/a	7.23 -					
3845-850	"	" "	4.60 -					
3850-855	"	" "	6.48 -					
3855-860	"	" "	4.34 -	) 2690)	6.2	505	19	42
3860-865	"	" "	6.17 -					
3865-870	"	" "	4.47 -					
3870-875	"	85% " 15% "	3.30 -	) 2000)	6.0	360	18	38
3875-880	"	" "	4.60 -					
3880-885	"	" "	5.98 -					
3885-890	"	80% " 20% "	5.66 -					
3890-895	"	70% " 30% "	4.44 -	) 1910)	4.3	340	18	41
3895-900	"	60% " 40% SLT/SND	5.39 -					
3900-905	"	" "	4.70 -					
3905-910	"	" "	5.63 -					
3910-915	"	" "	2.48 -	) 1790)	7.2	410	23	48
3915-920	"	" "	5.27 -					
3920-925	"	" "	5.49 -	) 2640)	4.8	380	14	35

TABLE 4F

SOURCE ROCK EVALUATION DATA

COMPANY : NORSK HYDRO WELL : 15/5-2 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
3925-930	Ctgs	60% SH, dk gy, mic 40% SLT/SND	5.14 -					
3930-935	"	" "	2.88 -	) 2990)	10.4	285	10	50
3935-940	"	" "	5.12 -					
3940-945	"	90% " 10% "	4.88 -	2850	5.8	550	19	31
3945-950	"	90% " 10% SLT/COAL	5.68 -					
3950-955	"	90% " 10% COAL	2.95 -	) 2870)	9.7	330	11	52
3955-960	"	80% " 20% COAL	6.17 -					
3960-965	"	70% " 30% COAL	7.13 -					
3965-970	"	90% " 10% COAL	6.60 -					
3970-975	"	90% " 10% COAL	7.65 -	) 4730)	6.1	565	12	38
3975-980	"	85% " 15% COAL	6.64 -					
3980-985	"	85% " 15% COAL	6.52 -					
3985-990	"	70% " 30% COAL	6.58 -					
3990-995	"	5% " 95% COAL	5.94 -					
3995-4000	"	5% " 95% COAL	8.68 -					
4000-025	"	60% " 20% SH, lt gy 20% SST+COAL	11.06 - -					
4025-050	"	60% " 40% SH, SST, COAL	5.74 -					

TABLE 4G

SOURCE ROCK EVALUATION DATA

COMPANY: NORSK HYDRO WELL: 15/5-2 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
4050-075	Ctgs	60% SH, dk gy, mic 40% SH, SST, COAL	6.16 -	5260	8.5	740	14	26
4075-100	"	90% COAL 10% SH+SST	24.27 -					
4100-125	"	50% SH, dk gy, mic 50% SST+COAL	7.80 -					
4125-150	"	30% SH, dk gy, mic 20% SH, lt gy-red 50% COAL	11.51 - -					
4150-175	"	30% SH, dk gy, mic 10% SH, brn 60% COAL	27.77 - -	10040	3.6	835	8	29
4175-200	"	30% SH, dk gy mic 10% SH, brn 60% COAL	12.67 - -					
4200-225	"	30% SH, dk gy, mic 10% SH, brn 60% COAL	10.25 - -					
4225-250	"	30% SH, dk gy, mic 10% SH, brn 60% COAL	10.44 - -	5070	4.9	695	14	25
4250-275	"	SH, dk gy, mic) SH, gy-brn-red) mnr SST) COAL abundant	8.45 - - -	5820	6.9	725	13	25
4275-300	"	SH, dk gy, mic) SH, gy-brn-red) mnr SST) COAL abundant	4.26 - - -					
4300-323	"	SH, dk gy, mic) SH, gy-brn-red) mnr SST) COAL abundant	2.77 - - -					

TABLE 5

ROCK - EVAL. PYROLYSIS DATA

COMPANY: NORSK HYDRO   WELL: 15/5-2   LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (metres) OR NOTATION	GENERALISED LITHOLOGY	ORGANIC CARBON (%)	TEMPERATURE (°C)	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (PPM)
1450-500	SLTY MDST, ol	1.84	434	70	111	*	1300
1650-700	MDST/CLYST, ol-gn-gy	0.91	436	24	99	*	200
1800-850	"	1.04	430	14	129	*	200
1950-2000	"	0.64	431	20	225	*	100
2200-250	HP CLYST, ol-gy	0.96	425	27	47	*	300
2350-400	HP "	0.46	424	28	129	*	100
2600-650	HP CLYST, gy-brn	0.70	424	23	66	*	200
2800-850	HP SH, gy	0.25	*	*	196	*	*
3150-200	HP MARL, lt gy	0.19	426	28	526	0.7	50
3450-500	HP SH, gy	0.23	*	*	166	*	*
3700-750	HP SH, dk gy	4.60	438	224	24	0.2	10300
3755-758	HP SH, dk gy, slty mic	9.83	432	399	4	0.1	39300
3790-795	HP "	11.70	436	150	11	0.2	17500
3810-815	HP "	5.57	432	359	6	0.1	20000
3825-830	HP "	4.67	437	338	22	0.1	15800
3840-845	HP "	7.23	432	284	5	0.2	20500
3855-860	HP "	5.90	436	213	21	0.2	12600
3870-875	HP "	5.93	430	224	7	0.1	13300
3885-890	HP "	5.66	439	166	11	0.1	9400
3900-905	HP "	4.70	440	178	25	0.1	8400
3915-920	HP "	5.27	440	175	19	0.2	9200
3930-935	HP "	4.83	441	192	19	0.1	9300
3945-950	HP "	5.68	442	147	20	0.1	8400
3960-965	HP "	7.13	441	205	15	0.1	14600
3975-980	HP "	6.64	437	205	14	0.1	13600
3990-995	HP "	5.94	439	171	14	0.1	10200
3990-995	COAL	39.82	449	314	9	0.1	125200
3995-4000	COAL	36.71	448	299	9	0.1	109800
4050-075	HP SH, dk gy, mic	6.16	442	194	12	0.2	12000
4150-175	HP "	27.77	443	104	3	0.3	28900
4225-250	HP "	10.44	440	151	7	0.1	15800
4250-275	HP "	8.45	447	139	12	0.1	11700

ORGANIC CARBON VALUES ON HAND-PICKED SHALE; CORRESPONDING VALUES IN TABLE 4 MAY BE LOWER WHERE SOURCE ROCK ANALYSIS HAS BEEN CARRIED OUT, SINCE LATTER IS ON COMPOSITE SAMPLE

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

<u>FIGURE 1</u>

<u>MAP SHOWING LOCATION OF 15/5-2 WELL</u>

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

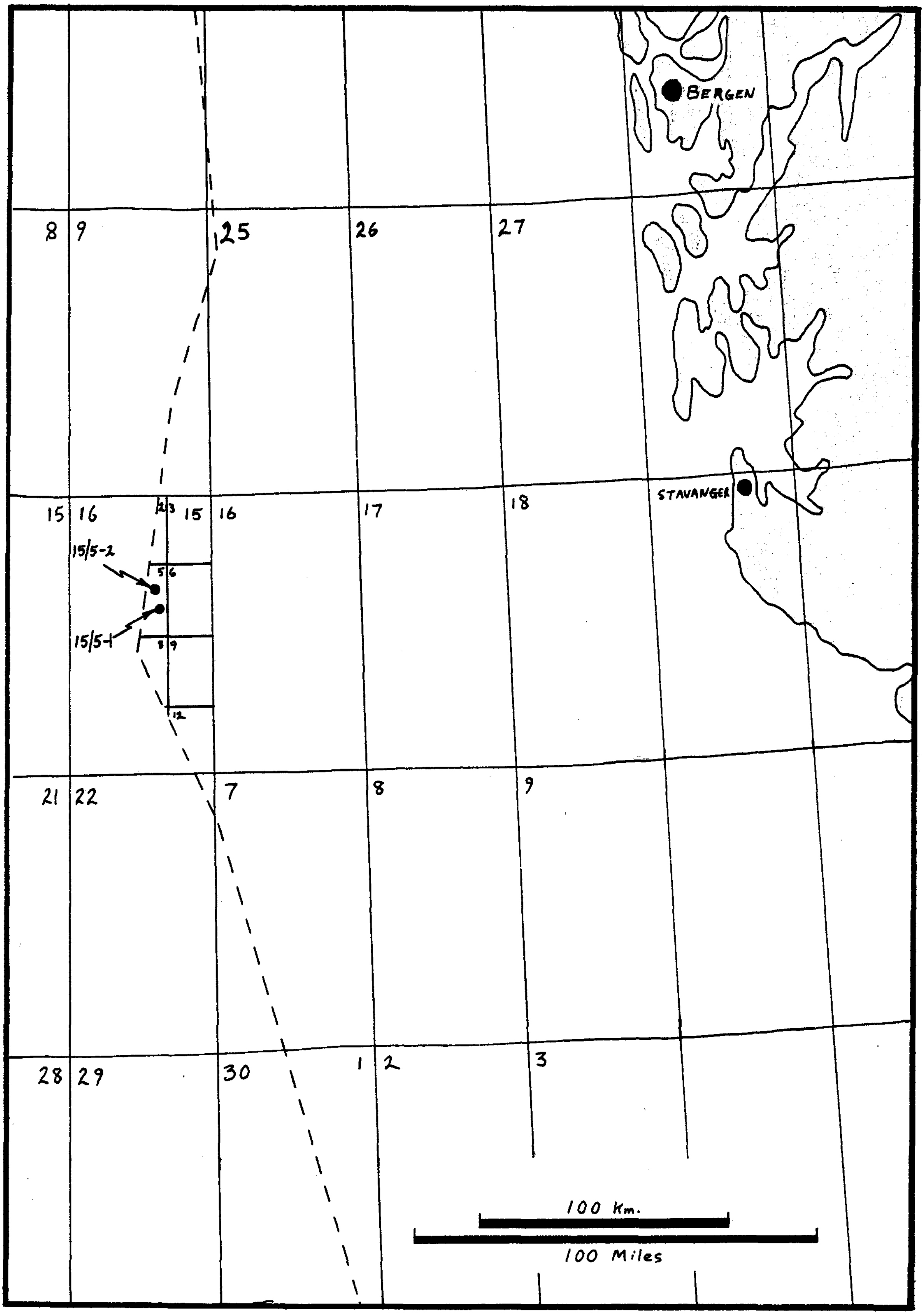


FIGURE 2 AIRSPACE (C_1 - C_4) HYDROCARBONS

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

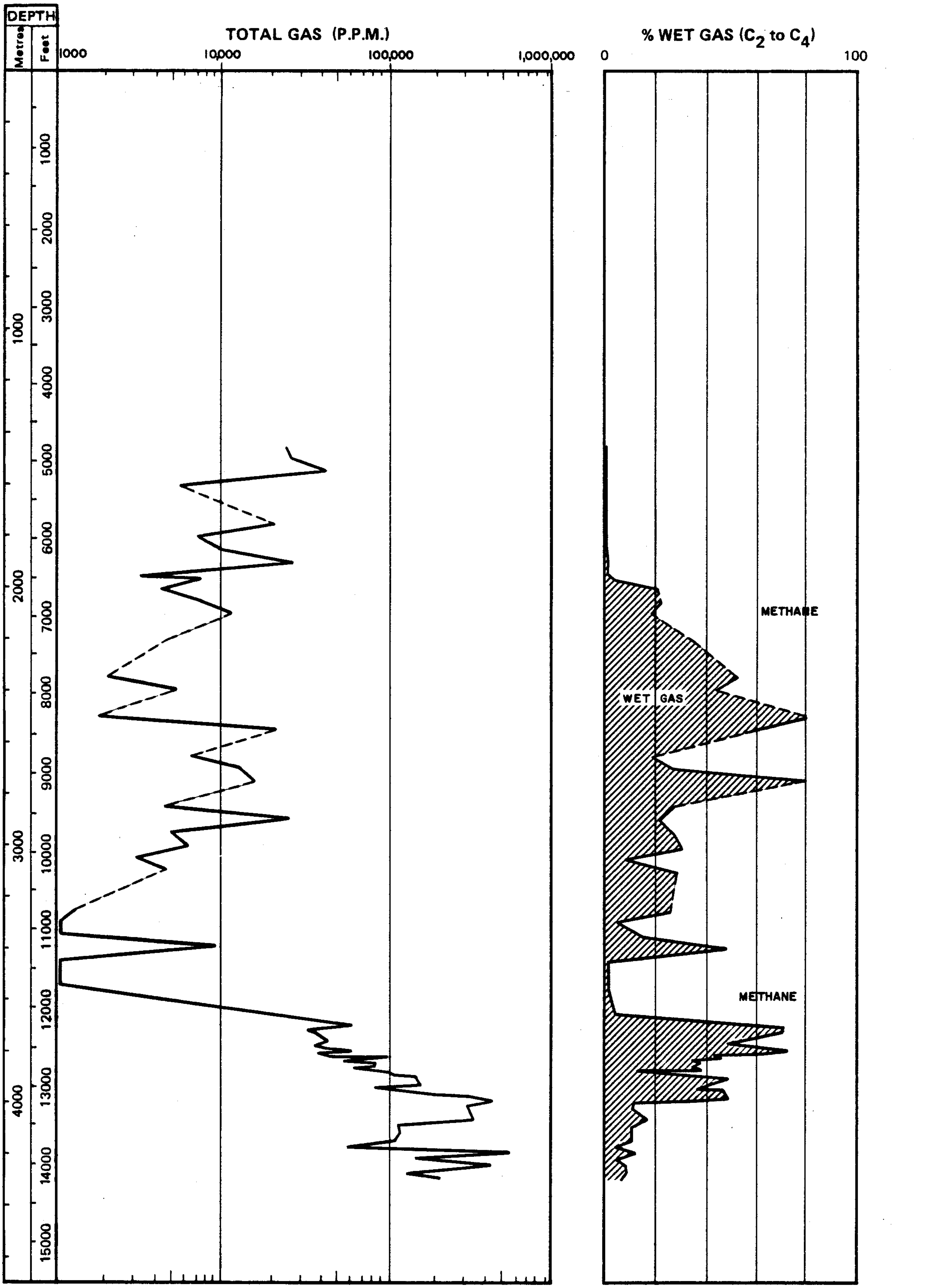
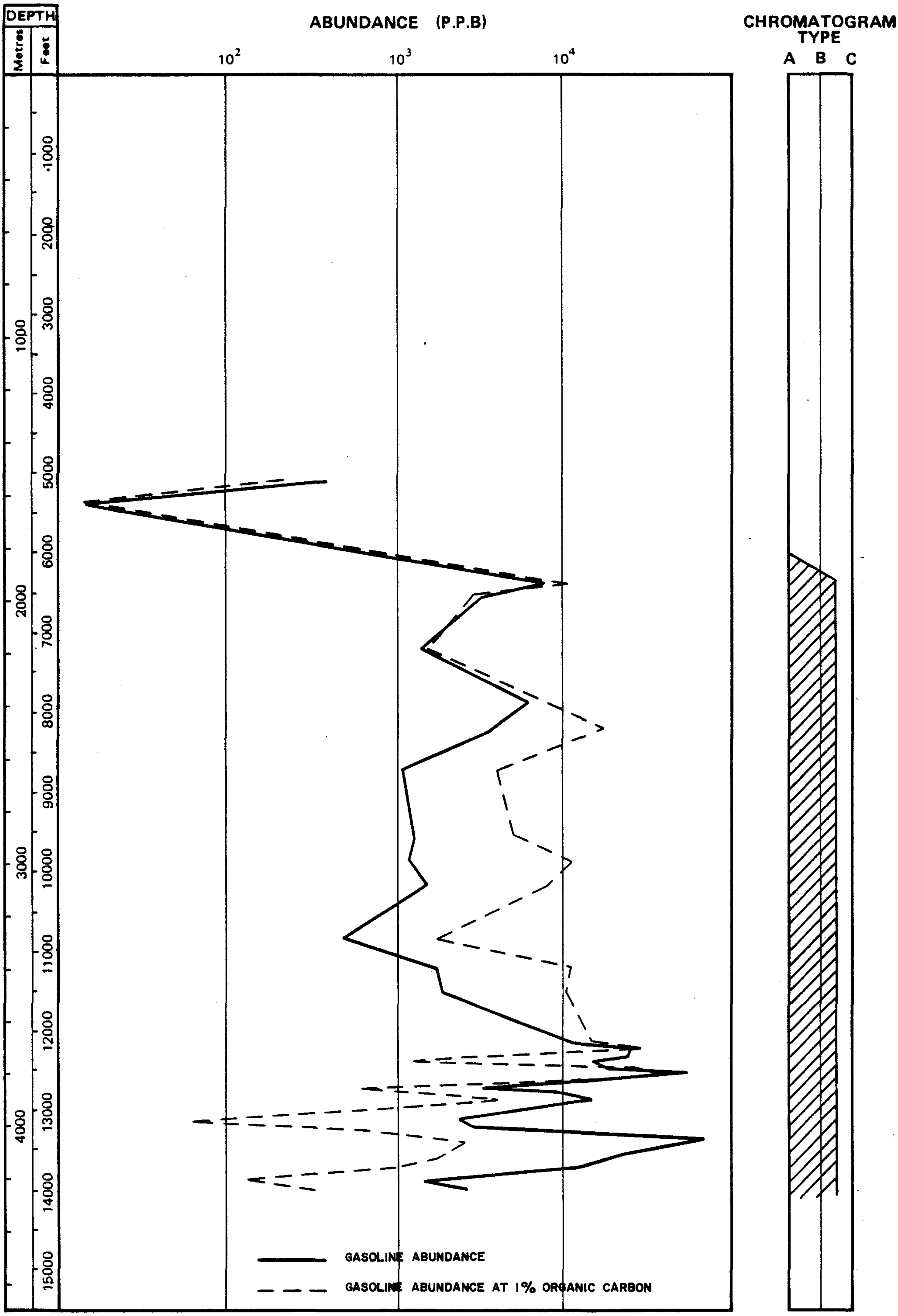


FIGURE 3 GASOLINE RANGE ($C_4 - C_7$) HYDROCARBONS

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA



A - IMMATURE B - TRANSITIONAL C - OIL LIKE

- - - - ABUNDANCE (PPB) CALCULATED AT 1% ORGANIC CARBON CONTENT

FIGURE 4 SPORE COLOURATION INDICES AGAINST DEPTH

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA

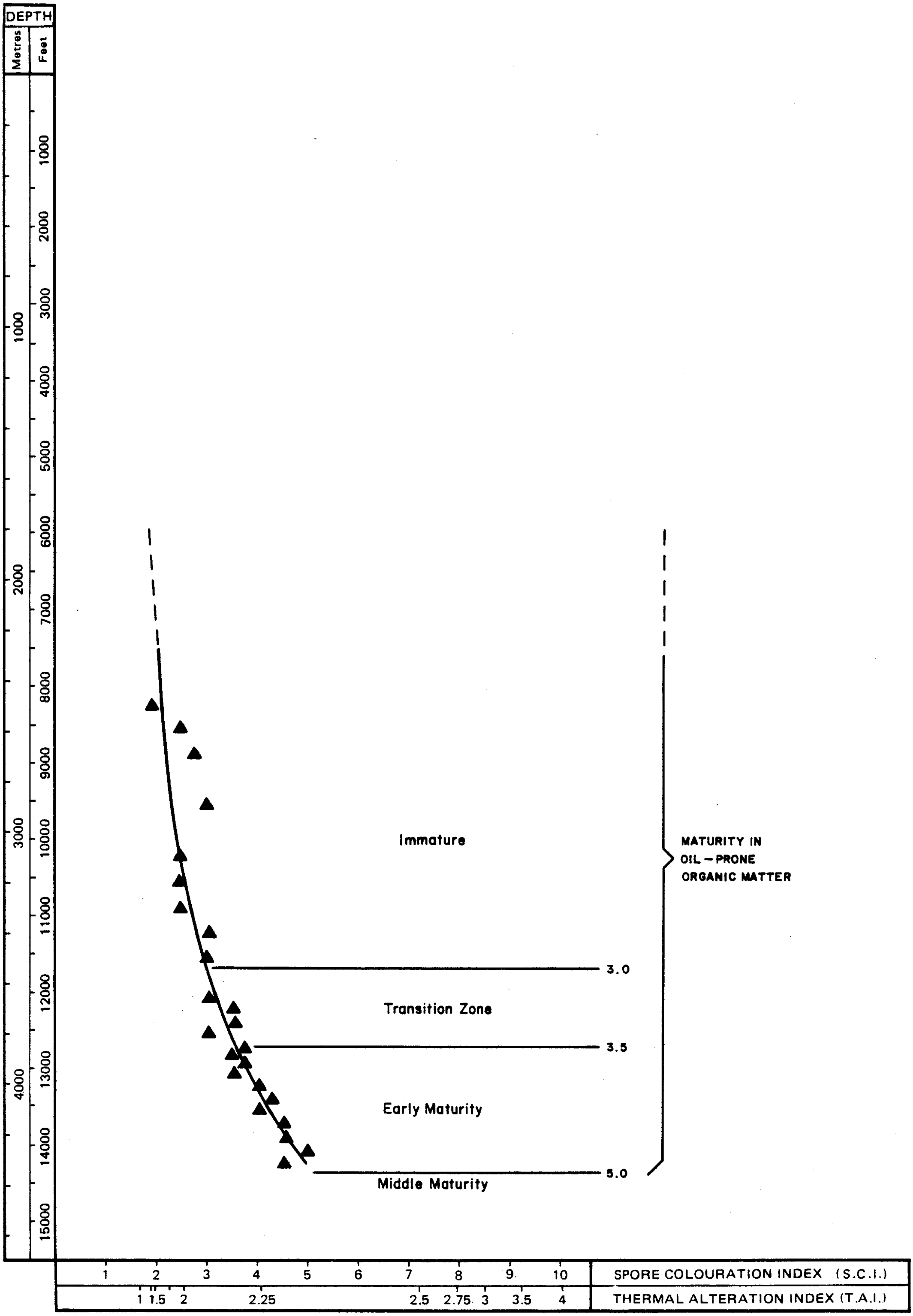


FIGURE 5 VITRINITE REFLECTIVITY AGAINST DEPTH

COMPANY: NORSK HYDRO WELL: 15/5 – 2 LOCATION: NORWEGIAN NORTH SEA

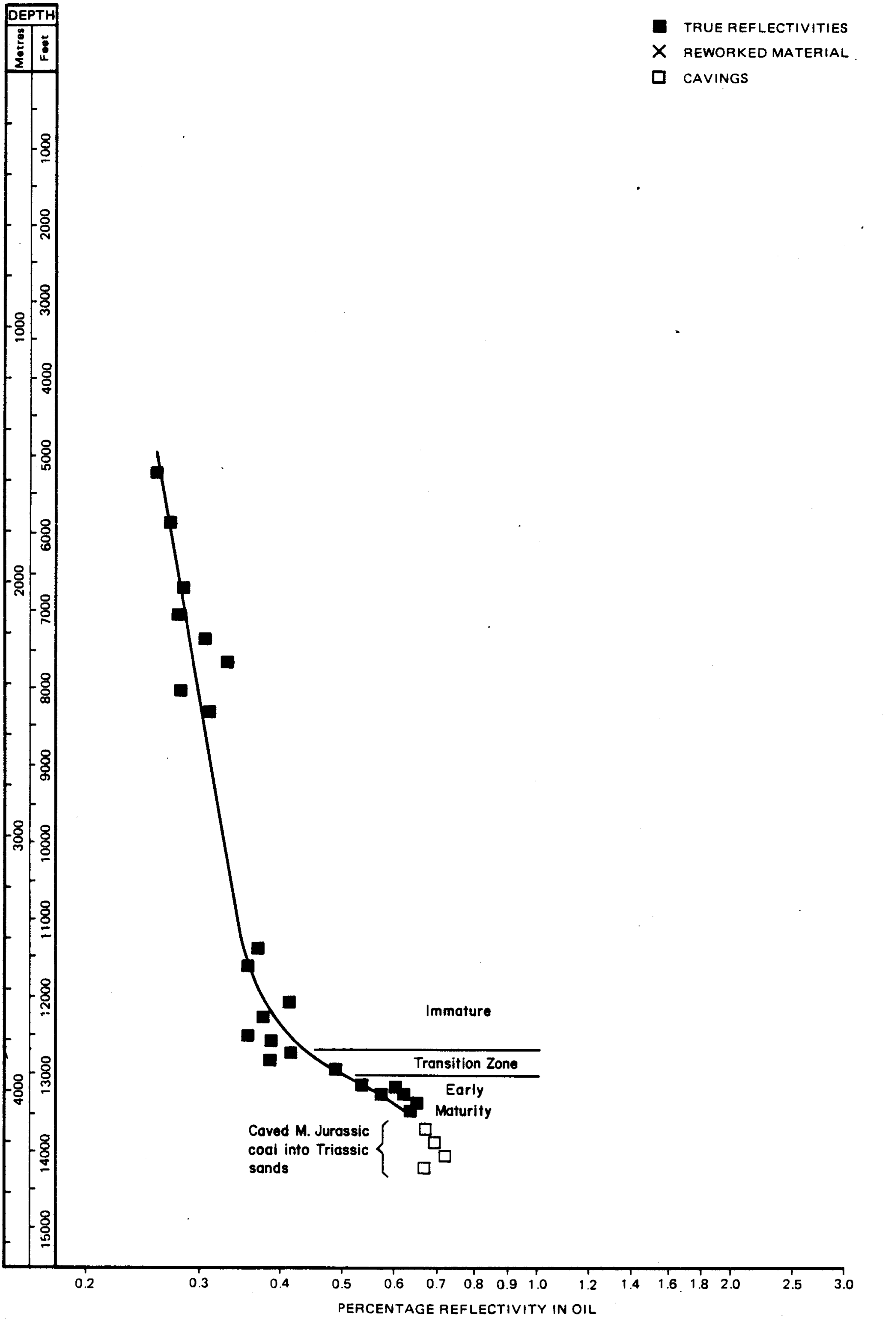
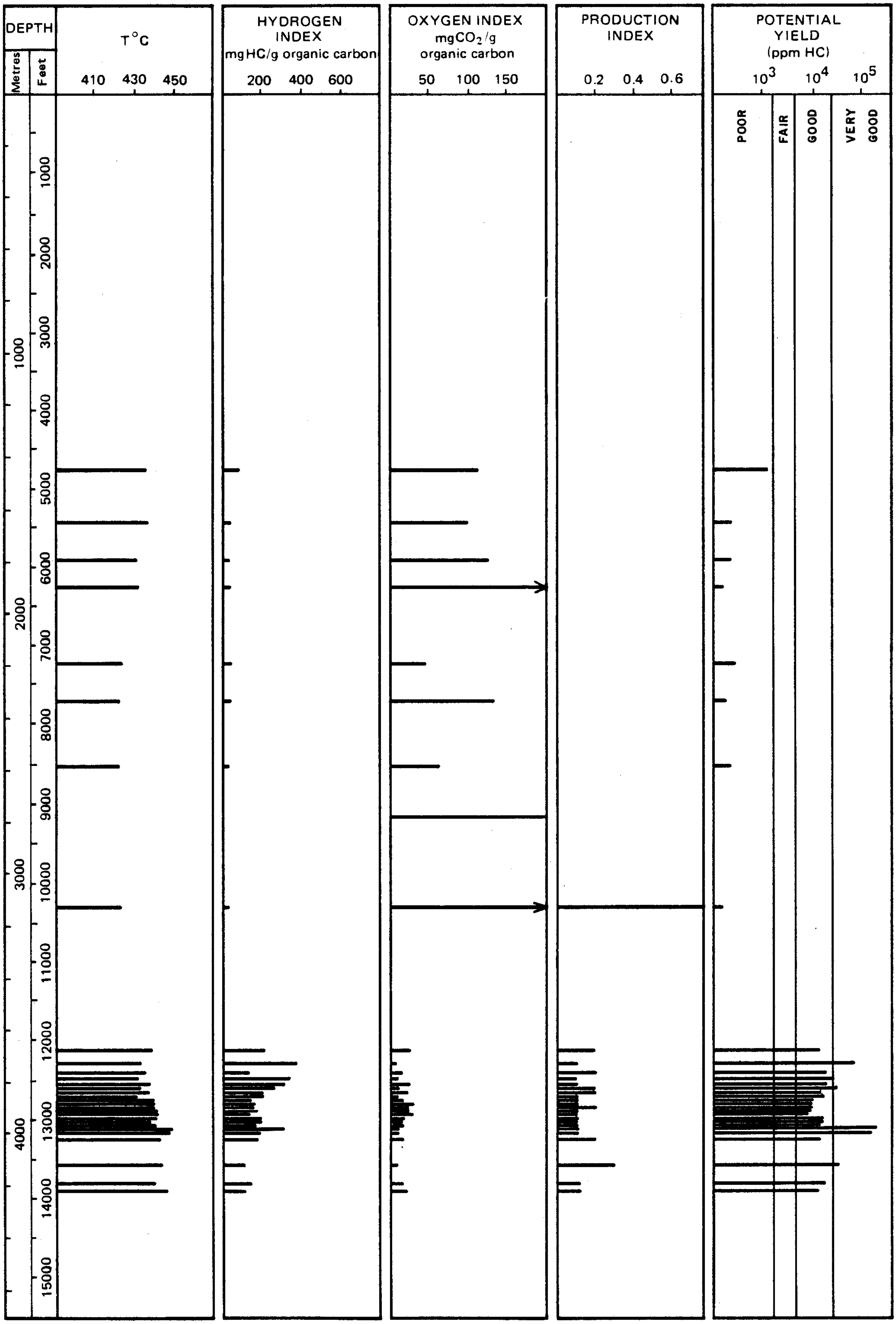


FIGURE 6 PYROLYSIS DATA SUMMARY CHART

COMPANY: NORSK HYDRO WELL: 15/5-2 LOCATION: NORWEGIAN NORTH SEA



Drawing No. 293P/2859/4389

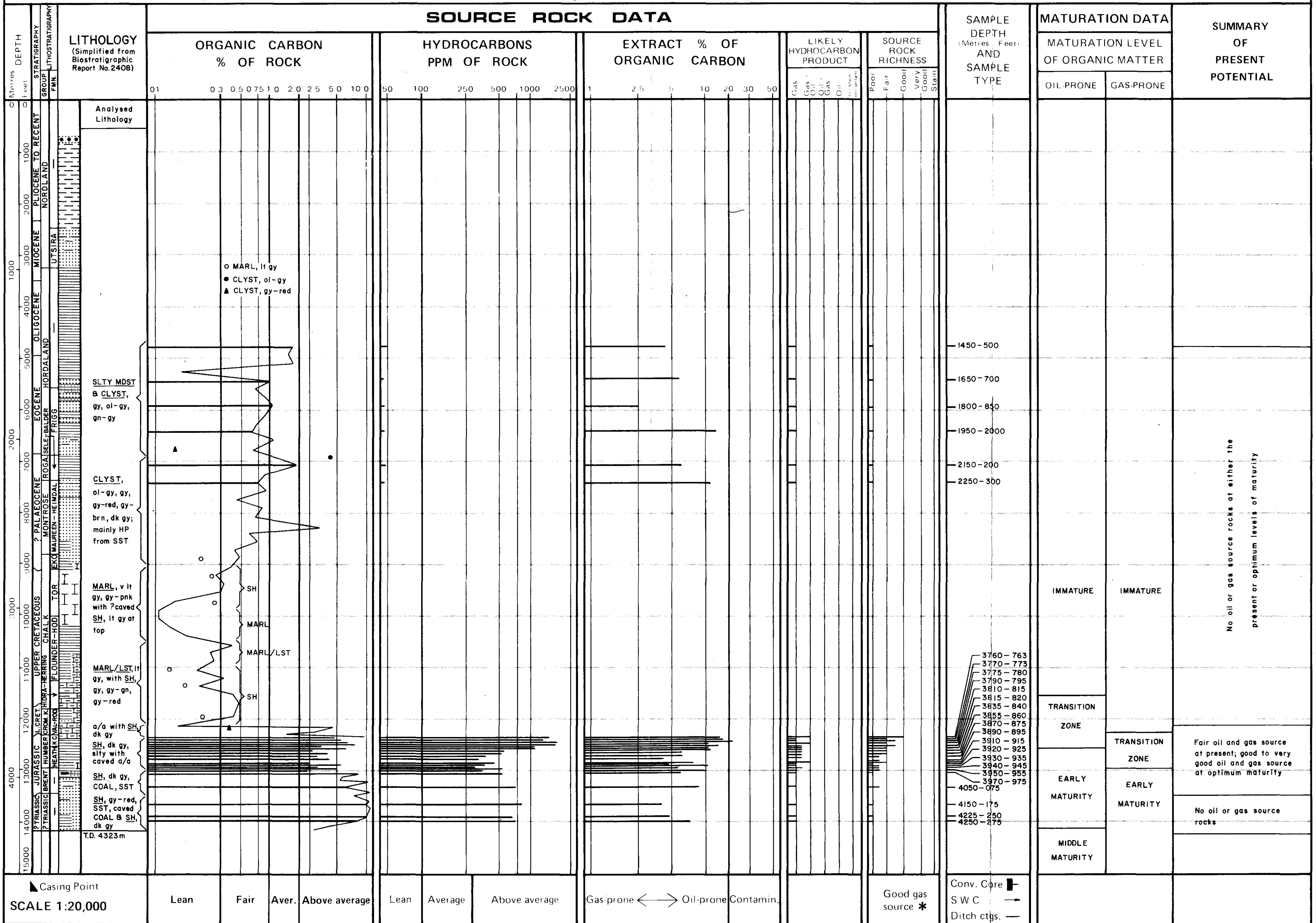
COMPANY: NORSK HYDRO

GEOCHEMICAL SUMMARY CHART

WELL: 15/5-2

LOCATION: NORWEGIAN NORTH SEA

FIGURE 7



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	HP	-	Hand picked lithology
Med	-	Medium	i/b	-	Interbedded
Mic	-	Micaceous			
Mnl	-	Mineral			
Mnr	-	Minor			

<table>
<tr><th colspan="2">TYPE OF KEROGEN / DOMINANT HYDROCARBON PRODUCT</th><th>OIL</th><th>GAS</th><th>NONE</th></tr>
<tr><td rowspan="5">SAPROPELIC</td><td rowspan="2">EXINITES</td><td>SPOROPOLLENIN
(Spores and pollen)</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>CUTINITE
(Land plant cuticle)</td></tr>
<tr><td rowspan="3">LIPTINITES</td><td>ALGINITE
(Algal fragments and masses in oil shales)</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>RESINITE
(Land plant exudates, e.g. Amber)</td></tr>
<tr><td>AMORPHOUS SAPROPEL</td></tr>
<tr><td rowspan="5">HUMIC</td><td rowspan="2">VITRINITES
Most abundant coal maceral</td><td rowspan="2"></td><td>TELINITE
(Cellular tissue)</td><td rowspan="2"></td></tr>
<tr><td>COLLINITE
(Amorphous)</td></tr>
<tr><td rowspan="3">INERTINITES
Mainly oxidised woody organic matter</td><td rowspan="3"></td><td></td><td>FUSINITE
(Opaque, often as broken cell walls)</td></tr>
<tr><td colspan="2">SEMI-FUSINITE
(Intermediate between fusinite and vitrinite)</td></tr>
<tr><td colspan="2">MICRINITE
(Granular inertinite)</td></tr>
</table>

APPENDIX II KEROGEN COMPONENTS OF ORGANIC MATTER AND THEIR DOMINANT HYDROCARBON PRODUCTS.

For further information see STACH'S textbook of COAL PETROLOGY, Gebruder Borntraeger, Berlin - Stuttgart, 1975

APPENDIX III. ANALYTICAL PROCEDURES AND TECHNIQUES

This appendix summarises the main steps in the analyses carried out in the Robertson Research geochemistry laboratories. Conditions for chemical analyses are given and interpretation guidelines are defined. Techniques may in certain circumstances be adapted to suit particular samples or conditions.

1. Sample Preparation

Following airspace gas analysis of the canned samples, the cuttings are washed. After setting aside a wet sub-sample for gasoline analysis, the remainder is oven-dried at 50°C and described. Obvious cavings and particulate contaminants are removed and the significant lithologies hand-picked for organic carbon screening analysis. Coals if present are picked for vitrinite reflectivity measurement and splits of the total cuttings are made for the preparation of kerogen concentrates. Subsequently the bulk samples except those containing much loose sand or coal are crushed to pass through a 250 micron (60 - mesh) sieve and submitted for organic carbon screening analysis.

2. Maturity Evaluation

Maturation is assessed by measurement of spore colour and vitrinite reflectivity and the analysis of airspace gas and gasolines. Kerogen concentrates for microscopic analysis are prepared using standard palynological procedures (i.e. acid maceration) but without oxidation and acetolysis. Mineral residues, particularly pyrite, are separated from the kerogen by a combination of ultrasonic vibration and zinc bromide flotation. For spore colour measurement and kerogen typing, mounts are prepared of both the total kerogen and the coarser-than-20-micron size fraction. Sample blocks for measurement of vitrinite reflectivity are prepared by mounting the coarser-than-20-micron kerogen fraction in an epoxy resin, followed by polishing with carborundum and alumina.

Airspace Gas Analysis

If samples of wet cuttings are collected at the well-site and sealed in an airtight can, the headspace gases can be analysed in the laboratory to provide a rapid assessment of maturity. The gas is extracted from the sealed can using a can piercer fitted with a septum and analysed by gas liquid chromatography. The proportions of methane, ethane, propane and butane are calculated by comparison with a standard mixture of these gases. Methane is usually the dominant gas and comprises 90-100% from immature sediments and 30-70% from mature sediments. Abrupt departures from composition/depth trends may indicate faults with migrant gases or reservoir rocks.

Gasoline Analysis

Cuttings samples received wet, preferably in sealed containers, are suitable for gasoline analysis. A portion of the washed cuttings sample is retained wet, pulverised in a sealed shaker and warmed to expel the gasoline components into the shaker airspace. A sample of this airspace gas is then removed and analysed by gas chromatography. 28 hydrocarbon species are identified in the C_4 to C_7 range and their relative proportions calculated with reference to standard mixtures. Immature source rocks yield mixtures dominated by a small number of components but mature source rocks usually contain a full range of identified hydrocarbons in similar orders of concentration. The onset of maturity may also be indicated by an increase in total gasolines relative to the organic carbon content of the host rock (+200 ppm hydrocarbons per 1% organic carbon). Occasionally, oil stain will be recognised by the presence of anomalous amounts and it may be possible to identify its source rock by a similarity in distribution of components.

Spore Colouration

The maturity of oil-prone organic matter present in kerogen concentrates is assessed by visual examination of the indigenous sporomorphs. With increasing thermal maturity, spore colours change from pale yellow, through orange and brown, to black. Measurement is made using a standard reference set of sporomorphs. Spore colouration indices measured are on the Robertson Research scale of 1 to 10. Our experience shows that values of 3.0 to 3.5 are representative of the transition zone between immaturity and maturity. The range 3.5 to 8.0 is arbitrarily divided into zones of organic maturity: 3.5 to 5.0, early maturity; 5.0 to 7.0, middle maturity; 7.0 to 8.0 late maturity. Direct comparison with source rock data indicates that, given the presence of oil-prone organic matter, low gravity oils are likely to be generated in the zone of early maturity, medium gravity oils in the zone of middle maturity and high gravity oils in the zone of late maturity. The onset of generation of condensate, wet gas and, ultimately, dry gas is characterised by spore colour indices above 8.0.

Vitrinite Reflectivity

Vitrinite, a humic degradation product largely derived from the anaerobic decomposition of the lignin, cellulose and nitrogen-containing compounds of woody tissues, is the chief component of coals and is also common in fine-grained clastic rocks. The reflectivity of an optically flat surface is defined as the percentage of normally incident light reflected from the surface. Reflectivity can be used to define the level of thermal maturity of sedimentary organic matter since it increases from approximately 0.2% to 5.0% at a relatively uniform rate through the coal rank series. Zones of oil and gas generation can be related to the coal rank series and therefore defined in terms of vitrinite reflectivity, even though vitrinite is not an oil source but generates gas. The onset of oil generation has been placed at between 0.35% and 0.6% reflectivity, depending on the type of sedimentary basin; 0.5% is a widely accepted threshold value. The floor for oil generation is characterised by a vitrinite reflectivity of approximately 1.2%. Wet gas generation peaks at a reflectivity of about 1.0% and ceases at the 2.0% level. Dry gas generation peaks at a reflectivity of about 1.5% and ceases at the 3% level. However, to define the appropriate limits for a particular basin, vitrinite reflectivity must be correlated with other thermal maturation parameters.

3. Source Rock Evaluation

Organic Carbon Content

On average, between 1% and 2% of argillaceous sediments consist of organic carbon. Since major hydrocarbon accumulations are the exception rather than the rule it is likely that their sources are of above average organic carbon content. Sediments containing less than 0.3% organic carbon are regarded as having no source potential, and those containing between 0.3% and 1.0% are marginal sources. Obviously the kerogen type is also of fundamental importance in determining the source potential of a rock.

Organic carbon values are obtained as follows. A 0.1 or 0.5 g sample, depending on lithotype, of crushed rock is treated with concentrated hydrochloric acid to remove carbonates and the residue filtered onto a glass fibre paper prior to ignition in a 'Leco' carbon analyser.

Extract Analysis

The soluble organic materials present in rocks can be extracted with organic solvents, fractionated and analysed. The type and amount of material extracted depends largely upon the nature of the contained organic matter and its maturity.

A maximum of 40 g of crushed sample is extracted for a minimum of 12 hours in a 'Soxhlet' apparatus by a 2 : 1 mixture of laboratory redistilled dichloromethane and methanol. The weight of the 'total extract' after final evaporation is expressed as ppm of the total rock. The more volatile components (up to C-15) are lost during extraction. The total extract is dissolved in hexane and a known volume separated by high pressure liquid chromatography into saturate hydrocarbon (alkanes), aromatic hydrocarbon and resene-asphaltene fractions.

Extract analysis provides a measure of source-rock richness in the oil-generation maturity zone. In addition to organic carbon contents, five parameters are calculated; total extract, extract/organic carbon x 100 i.e. extractability or EPOC, hydrocarbons as ppm of rock, hydrocarbons as percent of extract and alkanes as percent of hydrocarbons.

The extractability of oil-prone sapropelic organic matter increases rapidly in the oil generation zone and diminishes to very low values in post-mature sediments. Overall the extractability of sapropelic organic matter is greater than that of gas-prone humic organic matter for similar levels of maturity. Samples with extractabilities of greater than 20% generally contain migrated oil or are contaminated with mud additives.

The hydrocarbon content of a rock is the sum of the alkane and aromatic fractions of the total extract. As maturation proceeds in the oil generation zone the proportion of hydrocarbons in the total extract increases from less than 20% to a maximum in the most productive horizons of around 60%. This trend is reversed as the oil-condensate zone is entered. The relative proportions of alkanes to aromatics can be used as a check for low levels of contamination.

Pyrolysis

Pyrolysis data are obtained using the IFP-Fina "ROCK-EVAL" apparatus. The method involves the heating of samples from 250° to 550°C at 25°C/minute in a stream of inert gas. During this time, three pulses of gases are released and recorded as weights of gas. The first of these pulses relates to hydrocarbons present in the sediment which could normally be extracted by organic solvents; these are either the adsorbed hydrocarbons indicating present source potential, or reservoired hydrocarbons. The second gas pulse is of hydrocarbons released by the thermal breakdown of kerogen (optimum source potential), and simultaneously the temperature of maximum rate of evolution is measured. The third pulse comprises carbon dioxide.

The parameters used in interpretation are the hydrogen index (ratio of released hydrocarbons to organic carbon content), the oxygen index (ratio of released carbon dioxide to organic carbon content), the temperature of maximum rate of pyrolysis, and the production index (ratio of the amount of hydrocarbons released in the first stage of heating to the total amount of released hydrocarbons). Kerogens rich in sapropelic matter exhibit a high hydrogen index and a low oxygen index while those in which humic debris predominates will display a low hydrogen index and a high oxygen index. Hydrogen and oxygen indices for a particular type of kerogen are also susceptible to a reduction in their values during the course of thermal maturation.

The hydrogen index is a measure of the hydrocarbon generating potential of the kerogen. Immature, organically rich source rocks and oil shales give values above 500, mature oil source rocks give values between 200 and 550.

The temperature of maximum rate of pyrolysis depends on the nature of the organic matter, but the transition from immature to mature organic matter is marked by temperatures between 415° and 435°C. The maturity transition from oil and wet gas generation to dry gas generation is marked by temperatures between 455° and 460°C. In practice, greater variation than these ideal temperature ranges may be seen, but they are nevertheless useful as general guides to the level of maturity attained by the sediment.

The production index increases with maturity from values near zero for immature organic matter to maximum values of 0.15 during the late stages of oil generation. Anomalously high values indicate the presence of free oil. The hydrocarbon yield is an indication of the potential yield of hydrocarbons from the source rock at optimum maturity and is a measure of the quality of the source rock. A value of 0 to 2000 of hydrocarbon in ppm of rock characterises a poor source rock, 2000 to 6000 ppm fair, 6000 to 20,000 ppm good and above 20,000 ppm very good.

Visual Examination of Kerogen Concentrates

All palynological preparations are examined in transmitted white and ultraviolet light and the relative abundances of vitrinite, inertinite and sapropel (essentially a fine-grained, apparently amorphous mixture of liptinite and exinite) estimated. The coarser-than-20-micron fractions are also examined in reflected white and ultraviolet light.

Gas Chromatography of C-15+ Alkanes

A portion of the "total extract" obtained from Soxhlet extraction is eluted with pentane through a short silica column to yield the saturate hydrocarbon fraction. This fraction is evaporated to dryness in a stream of dry nitrogen at room temperature. A small portion of the fraction is then taken up in methylene dichloride and injected on to a 25 metre, wall-coated, open-tubular, glass capillary column coated with OV-1 mounted in a Perkin Elmer F-17 gas chromatograph and programmed from 80°C to 260°C at 4°C/minute.

Distributions of n-alkanes and the relative abundances of steranes and triterpanes are noted and the ratios pristane/n-C_{17} and phytane/n-C_{18} are measured. The CPI may also be measured. Inspection of the chromatograms may reveal information about the kerogen type of the source rock, its maturity and conditions of deposition and, if migrant oil is present, whether this has been water-flushed or biodegraded. Drilling mud additives may be identified.