ROBERTSON RESEARCH INTERNATIONAL LIMITED

REPORT NO. 4219P

REPORT ON A GEOCHEMICAL EVALUATION OF THE STATOIL 15/9 - 2 WELL, NORWEGIAN NORTH SEA

by,

B. S. COOPER

M. J. GIBBONS

P. C. BARNARD

J. McEWAN

G. E. H. HARRIMAN

PROJECT NO. RRPS/789/D/2736

Prepared by:

Robertson Research International Limited,
Ty'n-y-Coed,
Llanrhos,
Llandudno,
Gwynedd LL30 1SA,
Wales,
U.K.

Prepared for.

Statoil,
P.O. Box 300,
Lagardsveien 79,
4001 Stavanger,
Norway.

August, 1978

TABLES

FIGURES

APPENDIX

List of Abbreviations

ENCLOSURE

Additional Copies of Figures 1 to 7.

In the interval 170 to 3760 metres of the Statoil 15/9-2 well, Norwegian North Sea, oil-prone organic matter is fully mature below approximately 3080 metres although not yet in the zone of optimum hydrocarbon generation. Gas-prone organic matter is mature below approximately 3320 metres. Good oil source rocks in an early stage of maturity occur in the Upper Jurassic interval. At optimum maturity off-structure, their lateral equivalents will have sourced significant quantities of hydrocarbons.

INTRODUCTION

This report, based on the results of analyses of 113 canned samples of ditch cuttings (30 metre composites), 9 bagged samples of ditch cuttings (2 or 3 metre spot samples) and 24 sidewall cores, assesses the level of maturity and the hydrocarbon source potential of the interval 170 to 3760 metres of the Statoil 15/9-2 well, Norwegian North Sea. The age of the section ranges from Recent to Triassic. The Middle Jurassic rests unconformably on the Trias.

Following analysis of the airspace gases and selection of 39 wet splits for gasoline analysis, the cuttings were washed, dried and described. All the samples (except 16 rich in coal) and 11 picked lithologies were analysed for organic carbon and, on the basis of the results, 22 bulk cuttings samples were submitted for source rock evaluation by solvent extraction. Additionally, 20 cuttings samples, 6 picked lithologies and 14 sidewall cores were pyrolysed using the IFP/Fina Rock-Eval apparatus. Gas chromatographic analysis was carried out on saturate hydrocarbon fractions from a number of samples. To establish the level of maturity, kerogen concentrates for spore colour and vitrinite reflectance determinations were prepared from 45 samples. Coals from a further 5 samples were selected for vitrinite reflectance only.

RESULTS AND INTERPRETATION

A. MATURITY EVALUATION

A1: Light Hydrocarbon Analysis

(a) Airspace Gas Analysis

The airspace gas data presented in Table 1 and Figure 1 indicate that the section is transitionally mature between approximately 2100 and 2300 metres and fully mature below 2300 metres.

Aliquots of airspace gas from the sealed sample cans were analysed to determine the amounts and percentage compositions of the C_1 to C_4 hydrocarbons. Methane of probable biogenic origin is overwhelmingly the predominant component of the airspace gases to a depth of 2090 metres. Between 2090 and 2300 metres, small quantities of wet gases (C_2 to C_4) indicate the onset of maturity. The amounts of the C_2 to C_4 hydrocarbons below 2300 metres are sufficiently consistently high and the iso-butane/n-butane ratios sufficiently low to suggest that full maturity has been attained. The apparently anomalous results between 2810 and 3320 metres were obtained from organically-lean chalk samples.

(b) Gasoline Analysis

The gasoline hydrocarbon data presented in Table 2 and Figure 2 indicate that the section is fully mature by at least 3350 metres.

The presence of most of the C_4 to C_7 hydrocarbons in approximately equal amounts is considered to be diagnostic of full maturity. Transitionally mature sediments are generally distinguished from fully mature sediments by the predominance of a small number of individual compounds. Unfortunately the gasoline-range hydrocarbons in the 15/9-2 well do not appear to be present in

3350 metres, below which depth the gasoline hydrocarbon distributions show the section to be fully mature.

A2. Spore Colour

The spore colour data given in Table. 3 and Figure 3 indicate that the section is transitionally mature below 2150 metres and fully mature below 3080 metres.

The level of maturity of the oil-prone organic matter present in kerogen concentrates was assessed by visual examination of the indigenous sporomorphs. With increasing thermal maturity, spore colours change from pale yellow, through orange and brown , to black. Spore colouration indices used in this report are based on the Robertson Research Scale of 1 to 10, with values of 3.0 to 3.5 representative of the narrow transition zone between immaturity and maturity.

Spore colouration indices were estimated for 35 samples. A further 10 samples were examined but found to be lacking in spores. Where present, the assemblages were generally of good quality, although Tertiary spores were frequently stained. The results indicate that oil-prone organic matter is transitionally mature below 2150 ~~2500~~ metres and fully mature beolow, at least, 3080 metres.

A3. Vitrinite Reflectance

Vitrinite reflectivity values indicate that gas-prone organic matter in the 15/9-2 well is transitionally mature below approximately 2500 metres and fully mature by 3320 metres.

Vitrinite, a type of humic gas-prone organic matter, is considered to be transitionally mature over the reflectivity range 0.4 to 0.5 per cent, but would not be expected to yield prolific gas until values in excess of 0.8 to 1.0 per cent had been attained.

vitrinite reflectivity values were determined for 41 samples. Kerogen concentrates of a further 9 samples were examined but found to contain no vitrinite. With the exception of the Cretaceous samples, the numbers and quality of the vitrinite particles were generally high. The data presented in Table 3 and Figure 4 indicate that gas-prone organic matter in the 15/9-2 well is fully mature below 3320 metres although not yet in the zone of optimum gas generation.

A4. Comparison of Maturation Indices

The spore colour and vitrinite reflectivity data are compatible and imply that both oil and gas-prone organic matter are mature below approximately 3000 metres. In contrast, the airspace gas data suggest that the section is mature at 2300 metres. Although the airspace gas data are unusual in some respects, e.g. the anomalously high amounts of gas in the Tertiary and the fluctuation in wet gas content, they point to the possibility of wet gas being sourced by the kerogen of Lower Tertiary sediments. However, because of the predominantly humic nature of the kerogen in this interval, the quantities generated are unlikely to be significant. Unfortunately the amounts of gasoline hydrocarbons present above 3350 metres are insufficient to permit establishment of the transition zone between immaturity and maturity.

B1. Organic Carbon Content

Universally, shales contain an average of between 1 and 2 per cent organic carbon. As a general rule, sediments of below average organic carbon content are not capable of sourcing major hydrocarbon accumulations.

All samples, except those rich in coal, and 11 picked lithologies were analysed for their organic carbon contents. The results are shown in Table 4 and Figure 5. On the basis of these results, the Tertiary section may be divided into three intervals; 170 to 800 metres, fair to average organic carbon contents; 800 to 1910 metres, average to above average; 1910 to 2750 metres, fair to average. The lowest values generally coincide with sandstone intervals. The chalk is organically lean, although the picture is obscured by the presence of caved shale, and the Lower Creataceous shales have fair to average organic carbon contents. The Middle and Upper Jurassic intervals comprise shales sandstones and, towards the base, coals. The Kimmeridgian and Oxfordian shales are particularly rich in organic carbon, with values typically between 5 and 10 per cent. The shales become leaner towards the base of the Middle Jurassic. The samples from the Triassic interval contain abundant cavings and consequently the data obtained are not representative of this section.

B2. Solvent Extraction

On the basis of organic carbon content, 22 samples were submitted for extractive source rock analysis. The results are given in Table 4 and summarised in Figure 5. Many samples were oil- stained and in order to minimise the effect of this staining, all samples were washed in acetone prior to crushing and extraction.

of immature sediments of Tertiary age. Some of the EPOC (extract as per cent of organic carbon) , and hydrocarbon as ppm of rock, values are higher than expected, suggesting the presence of migrant hydrocarbons in the pore spaces. Traces of migrant hydrocarbons also show up in the extracts of the Mseozoic samples, although the greater maturity of the Jurassic samples is confirmed by the increased relative percentage of alkanes in the hydrocarbon fractions.

B3. Gas Chromatography

Following extractive source rock analysis, the saturate hydrocarbon (alkane) fractions of 7 samples were analysed by gas chromatography. Samples from the Tertiary interval gave bimodal distributions (see Figure 6a) interpreted as a combination of the products of immature, predominantly humic kerogen ($\underline{n}$-C_{23} to $\underline{n}$-C_{33} with marked odd-carbon number predominance, abundant steranes and triterpanes), and migrant light oil.

Consideration of the level of maturity of the Lower Cretaceous shales suggests that the relatively smooth distribution shown in Figure 6b is the product of migrant hydrocarbons generated at greater depths.

Figure 6c, the total alkanes of a Jurassic sample, has a distribution characteristic of an early mature source rock with a mixed marine and terrestrial organic input.

In addition to the above, an oil-saturated sand from a sidewall core at a depth of 3488 metres was extracted. The alkanes are shown in Figure 6d. The distribution of the alkanes in Figure 6d is smoother and the average chain length shorter compared to the alkanes depicted in Figure 6c. Consequently it is probable that the oil was sourced by rocks at greater depths off-structure.

The pyrolysis technique involves the heating of samples from 250° to 550°C over a period of approximately 15 minutes. 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 is of 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 550, 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

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 0.30 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.

The data presented in Table 5 and Figure 7 show that the immature Tertiary kerogens are predominantly humic and constitute poor to fair potential hydrocarbon sources. The Lower Cretaceous shales have no significant present or future hydrocarbon-generating capacity. In contrast, the Middle and Upper Jurassic olive-black shales are good present oil source rocks and will have even greater potential at depth off-structure.

B5. Visual Examination of Kerogen

Examination of spore colour slides and vitrinite blocks in transmitted and reflected light respectively showed vitrinite and inertinite, humic macerals with negligible oil-generating potential, to be pre-eminent in the samples of Tertiary age. The Lower Cretaceous shales yielded mostly inertinite, a maceral with no significant hydrocarbon-source potential. Kerogen concentrates of shales from the Jurassic interval were dominated by oil-prone liptinites, exinites and their amorphous derivative, sapropel. The Middle Jurassic coals are unusual in that normal vitrinite is frequently subordinate to higher reflecting semifusinite.

CONCLUSIONS

(1) Oil-prone organic matter in the 15/9-2 well is transitionally mature below 2150 metres and fully mature below 3080 metres.

(2) Gas-prone organic matter is transitionally mature below 2500 metres and fully mature below 3320 metres, although not yet in the zone of optimum gas generation.

(3) Good oil source rocks, rich in sapropel and presently capable of generating heavy oil and condensate, occur in the Upper Jurassic interval. At optimum maturity off-structure, their lateral equivalents will have sourced significant amounts of oil.

(4) The Tertiary section is largely immature and contains predominantly gas-prone organic matter. It is possible that the basal Tertiary sediments presently possess a limited wet-gas generating potential. The Cretaceous interval is too organically lean to source hydrocarbons.

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA

DEPTH METRES	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCES (PER CENT)					TOTAL ABUND - ANCE (ppm)	TOTAL $C_2 - C_4$ (Per Cent)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
170-200	100	*	*	*	*	1100	*	*
200-230	100	*	*	*	*	1000	*	*
230-260	*	*	*	*	*	*	*	*
260-290	100	*	*	*	*	100	*	*
290-320	100	*	*	*	*	700	*	*
320-350	100	*	*	*	*	28300	*	*
350-380	100	*	*	*	*	1400	*	*
380-410	100	*	tr	*	*	28300	tr	*
410-440	100	*	*	*	*	2900	*	*
440-470	100	*	*	*	*	37900	*	*
470-500	100	*	*	*	*	26700	*	*
500-530	100	*	*	*	*	6200	*	*
530-560	100	*	*	*	*	27400	*	*
560-590	100	*	*	*	*	4600	*	*
590-620	100	*	*	*	*	6700	*	*
620-650	100	*	*	*	*	22800	*	*
650-680	99	tr	tr	*	*	18100	1	*
680-710	99	tr	tr	*	*	25600	1	*
710-740	100	*	*	*	*	25100	*	*
740-770	100	*	*	*	*	3800	*	*
770-800	100	*	*	*	*	22800	*	*
800-830	100	tr	*	*	*	1100	tr	*
830-860	100	*	*	*	*	15800	*	*
860-890	100	*	*	*	*	200	*	*
890-920	100	*	*	*	*	2300	*	*
920-950	100	*	*	*	*	1800	*	*
950-980	*	*	*	*	*	*	*	*

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

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA

DEPTH METRES	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCES (PER CENT)					TOTAL ABUND - ANCE (ppm)	TOTAL $C_2 - C_4$ (Per Cent)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
980-1010	100	*	*	*	*	400	*	*
1010-1040	100	*	*	*	*	50	*	*
1040-1070	100	*	*	*	*	100	*	*
1070-1100	100	*	*	*	*	300	*	*
1100-1130	99	tr	tr	*	*	28900	1	*
1130-1160	99	tr	tr	*	*	15800	1	*
1160-1190	94	5	1	*	*	9000	6	*
1190-1220	100	*	*	*	*	500	*	*
1220-1250	99	1	*	*	*	24300	1	*
1250-1280	100	*	*	*	*	3300	*	*
1280-1310	100	*	*	*	*	1400	*	*
1310-1340	100	tr	*	*	*	11400	tr	*
1340-1370	100	tr	*	*	*	9700	tr	*
1370-1400	97	2.5	0.5	*	*	36500	3	*
1400-1430	100	*	*	*	*	200	*	*
1430-1460	98.5	1.5	*	*	*	21100	1.5	*
-	-	-	-	-	-	-	-	-
1490-1520	100	*	*	*	*	1400	*	*
1520-1580	100	*	*	*	*	3000	*	*
1580-1610	*	*	*	*	*	*	*	*
1610-1640	100	*	*	*	*	2100	*	*
1640-1670	100	*	*	*	*	1500	*	*
1670-1700	100	*	*	*	*	1000	*	*
1700-1730	97.5	2.5	tr	*	*	23000	2.5	*
1730-1760	*	*	*	*	*	*	*	*
1760-1790	99	tr	tr	*	*	12500	1	*
1790-1820	100	*	*	*	*	700	*	*

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

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA

DEPTH METRES	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCES (PER CENT)					TOTAL ABUND - ANCE (ppm)	TOTAL $C_2 - C_4$ (Per Cent)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
1820-1850	100	*	*	*	*	5100	*	*
1850-1880	100	tr	*	*	*	6100	tr	*
1880-1910	98.5	1	0.5	*	*	7000	1.5	*
1910-1940	98.5	1	0.5	*	*	2600	1.5	*
1940-1970	100	tr	*	*	*	1400	tr	*
1970-2000	97.5	2	0.5	*	*	6500	2.5	*
2000-2030	100	*	*	*	*	900	*	*
2030-2060	96.5	2.5	1	*	*	6300	3.5	*
2060-2090	98	1	tr	*	*	2400	2	*
2090-2120	95	3	2	*	*	1500	5	*
2120-2150	92	5	3	*	*	4200	8	*
2150-2180	94	4	2	*	*	900	6	*
2180-2210	93	3	4	*	*	4800	7	*
2210-2240	89	6	4	1	tr	11500	11	*
2240-2270	87	7	5	1	tr	11500	13	*
2270-2300	82	9	7	1	1	28800	18	1
2300-2330	74	10	11	2	3	32400	26	0.67
2330-2360	70	12	13	2	3	34400	30	0.67
2360-2390	61	14	18	3	4	75900	39	0.75
2390-2420	50	19	31	*	*	400	50	*
2420-2450	35	16	49	*	*	200	65	*
2450-2480	46	17	26	4	7	19000	54	0.57
2480-2510	59	14	19	3	5	15600	41	0.60
2510-2540	58	17	18	3	4	17000	42	0.75
2540-2570	46	17	26	5	6	18200	54	0.83
2570-2600	27	23	33	7	9	5600	73	0.78
2600-2630	50	23	18	4	5	105600	50	0.80

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

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SI

DEPTH METRES	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCES (PER CENT)					TOTAL ABUND - ANCE (ppm)	TOTAL $C_2 - C_4$ (Per Cent)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
2630-2660	47	23	21	4	5	92000	53	0.80
2660-2690	64	19	17	tr	tr	1300	36	*
2690-2720	59	19	22	*	*	800	49	*
2720-2750	22	20	40	8	10	4400	78	0.80
-	-	-	-	-	-	-	-	-
2780-2810	27	23	37	5.5	7.5	3900	73	0.73
2810-2840	100	*	*	*	*	200	*	*
2840-2870	92	4	4	*	*	600	8	*
2870-2900	100	*	*	*	*	100	*	*
2900-2930	93	3	4	*	*	1100	7	*
2930-2960	93	4	3	*	*	1200	7	*
2960-2990	93	4	3	*	*	1100	7	*
2990-3020	100	*	*	*	*	100	*	*
3020-3050	100	*	*	*	*	200	*	*
3050-3080	90	2.5	7.5	*	*	500	10	*
3080-3110	82	tr	18	*	*	300	18	*
3110-3140	82	3	15	*	*	500	18	*
3140-3170	82.5	tr	17.5	*	*	300	17.5	*
3170-3200	86	5.5	8.5	*	*	400	14	*
3200-3230	92	7	1	*	*	500	8	*
3230-3260	84	5	11	*	*	400	16	*
3260-3290	93	7	*	*	*	300	7	*
3290-3320	94	6	*	*	*	500	6	*
3320-3350	73	13	10	tr	3.5	1300	27	*
3350-3380	65	17	17.5	tr	tr	1200	35	*
3380-3410	30	22	26	4.5	17.5	64300	70	0.26
3410-3440	63	17	16	tr	4	11000	37	*
3440-3470	63	17	15	0.5	4.5	31000	37	0.11

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

AIRSPACE GASEOUS HYDROCARBON ANALYSIS DATA

COMPANY: STATOIL **WELL:** 15/9-2 **LOCATION:** NORWEGIAN NORTH SI

DEPTH METRES	RELATIVE GASEOUS HYDROCARBON COMPONENT ABUNDANCES (PER CENT)					TOTAL ABUND - ANCE (ppm)	TOTAL $C_2 - C_4$ (Per Cent)	RATIO i - Butane / n - Butane
	C_1	C_2	C_3	i - C_4	n - C_4			
3470-3500	40	2.7	25.5	2	5.5	54600	60	0.36
3692-3722	63.5	30	*	*	6.5	91000	36.5	*
3722-3752	92	6.5	*	*	1.5	39900	8	*

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

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORTH SEA

DEPTH: METRES	170	290	410	530	650	770	890
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE							Tr
n - BUTANE							Tr
i - PENTANE							*
n - PENTANE							*
2,2 - DIMETHYL BUTANE							*
CYCLOPENTANE							*
2,3 - DIMETHYL BUTANE							*
2 - METHYL PENTANE							*
3 - METHYL PENTANE							*
n - HEXANE							*
METHYL CYCLOPENTANE							*
2,2 - DIMETHYL PENTANE							*
2,4 - DIMETHYL PENTANE							*
BENZENE							*
CYCLOHEXANE							*
3,3 - DIMETHYL PENTANE							*
2 - METHYL HEXANE							*
1,1 - DIMETHYL CYCLOPENTANE							*
3 - METHYL HEXANE							*
1, CIS - 3 - DIMETHYL CYCLOPENTANE							*
1, TRANS - 3 - DIMETHYL CYCLOPENTANE							*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE							*
3 - ETHYL PENTANE							*
n - HEPTANE							*
1, CIS - 2 - DIMETHYL CYCLOPENTANE							*
METHYL CYCLOHEXANE							*
ETHYL CYCLOPENTANE							*
TOLUENE							*
TOTAL ABUNDANCE (PPB)	*	*	*	*	*	*	Tr
ORGANIC CARBON (PER CENT)	0.64	0.66	0.60	0.65	0.42	0.61	3.20
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	*	*	*	*	*	*	*

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

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORTH SEA

DEPTH: METRES	1010	1070	1130	1250	1370	1490	1610
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	Tr	Tr	Tr				Tr
n - BUTANE	Tr	Tr	Tr				Tr
i - PENTANE	Tr	Tr	Tr				Tr
n - PENTANE	Tr	Tr	Tr				Tr
2,2 - DIMETHYL BUTANE	*	*	*				*
CYCLOPENTANE	*	*	*				*
2,3 - DIMETHYL BUTANE	*	*	*				*
2 - METHYL PENTANE	*	*	*				*
3 - METHYL PENTANE	*	*	*				*
n - HEXANE	*	*	*				*
METHYL CYCLOPENTANE	*	*	*				*
2,2 - DIMETHYL PENTANE	*	*	*				*
2,4 - DIMETHYL PENTANE	*	*	*				*
BENZENE	*	*	*				*
CYCLOHEXANE	*	*	*				*
3,3 - DIMETHYL PENTANE	*	*	*				*
2 - METHYL HEXANE	*	*	*				*
1,1 - DIMETHYL CYCLOPENTANE	*	*	*				*
3 - METHYL HEXANE	*	*	*				*
1, CIS - 3 - DIMETHYL CYCLOPENTANE	*	*	*				*
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*				*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	*	*	*				*
3 - ETHYL PENTANE	*	*	*				*
n - HEPTANE	*	*	*				*
1, CIS - 2 - DIMETHYL CYCLOPENTANE	*	*	*				*
METHYL CYCLOHEXANE	*	*	*				*
ETHYL CYCLOPENTANE	*	*	*				*
TOLUENE	*	*	*				*
TOTAL ABUNDANCE (PPB)	Tr	Tr	Tr	*	*	*	Tr
ORGANIC CARBON (PER CENT)	2.50	6.71	3.09	1.40	5.27	1.18	2.39
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	*	*	*	*	*	*	*

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

DEPTH: METRES	1730	1850	1970	2090	2210	2330	2450
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE							
n - BUTANE							
i - PENTANE							
n - PENTANE							
2,2 - DIMETHYL BUTANE							
CYCLOPENTANE							
2,3 - DIMETHYL BUTANE							
2 - METHYL PENTANE							
3 - METHYL PENTANE							
n - HEXANE							
METHYL CYCLOPENTANE							
2,2 - DIMETHYL PENTANE							
2,4 - DIMETHYL PENTANE							
BENZENE							
CYCLOHEXANE							
3,3 - DIMETHYL PENTANE							
2 - METHYL HEXANE							
1,1 - DIMETHYL CYCLOPENTANE							
3 - METHYL HEXANE							
1, CIS - 3 - DIMETHYL CYCLOPENTANE							
1, TRANS - 3 - DIMETHYL CYCLOPENTANE							
1, TRANS - 2 - DIMETHYL CYCLOPENTANE							
3 - ETHYL PENTANE							
n - HEPTANE							
1, CIS - 2 - DIMETHYL CYCLOPENTANE							
METHYL CYCLOHEXANE							
ETHYL CYCLOPENTANE							
TOLUENE							
TOTAL ABUNDANCE (PPB)	*	*	*	*	*	*	*
ORGANIC CARBON (PER CENT)	2.75	2.28	0.77	0.23	1.32	1.47	0.90
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	*	*	*	*	*	*	*

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

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORTH SEA

DEPTH: METRES	2570	2630	2750	2930	3170	3350	3380
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE		Tr				Tr	Tr
n - BUTANE		Tr				Tr	Tr
i - PENTANE		Tr				3.5	4
n - PENTANE		Tr				7.5	8
2,2 - DIMETHYL BUTANE		*				Tr	Tr
CYCLOPENTANE		*				1	Tr
2,3 - DIMETHYL BUTANE		*				Tr	Tr
2 - METHYL PENTANE		*				5	5
3 - METHYL PENTANE		*				3	3.5
n - HEXANE		Tr				9	10
METHYL CYCLOPENTANE		*				8	9
2,2 - DIMETHYL PENTANE		*				Tr	Tr
2,4 - DIMETHYL PENTANE		*				Tr	Tr
BENZENE		*				2.5	2.5
CYCLOHEXANE		*				3.5	3
3,3 - DIMETHYL PENTANE		*				Tr	Tr
2 - METHYL HEXANE		*				4.5	6
1,1 - DIMETHYL CYCLOPENTANE		*				5	4
3 - METHYL HEXANE		*				2	2.5
1, CIS - 3 - DIMETHYL CYCLOPENTANE		*				2	2
1, TRANS - 3 - DIMETHYL CYCLOPENTANE		*				*	*
1, TRANS - 2 - DIMETHYL CYCLOPENTANE		*				5.5	4.5
3 - ETHYL PENTANE		*				Tr	Tr
n - HEPTANE		Tr				11	13
1, CIS - 2 - DIMETHYL CYCLOPENTANE		*				5.5	5
METHYL CYCLOHEXANE		*				12	10
ETHYL CYCLOPENTANE		*				3	2
TOLUENE		Tr				6.5	6
TOTAL ABUNDANCE (PPB)	*	20	*	*	*	843	920
ORGANIC CARBON (PER CENT)	0.28	1.98	0.50	0.19	0.66	0.01	1.22
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	*	10	*	*	*	84300	754

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

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORTH SEA

DEPTH: METRES	3692	3722	3730	3760			
GASOLINE HYDROCARBON COMPONENTS	RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (PER CENT)						
i - BUTANE	Tr	Tr	Tr	Tr			
n - BUTANE	Tr	Tr	Tr	Tr			
i - PENTANE	8	Tr	13.5	20			
n - PENTANE	7	Tr	10.5	13.5			
2,2 - DIMETHYL BUTANE	Tr	Tr	1	Tr			
CYCLOPENTANE	2.5	Tr	3	1.5			
2,3 - DIMETHYL BUTANE	Tr	Tr	1.5	Tr			
2 - METHYL PENTANE	7.5	Tr	6	10			
3 - METHYL PENTANE	3	Tr	3	3			
n - HEXANE	6	Tr	7.5	7			
METHYL CYCLOPENTANE	7.5	Tr	7.5	5.5			
2,2 - DIMETHYL PENTANE	Tr	Tr	1.5	Tr			
2,4 - DIMETHYL PENTANE	Tr	Tr	1.5	Tr			
BENZENE	14	Tr	3.5	6			
CYCLOHEXANE	4	Tr	6	2.5			
3,3 - DIMETHYL PENTANE	Tr	Tr	Tr	Tr			
2 - METHYL HEXANE	2	Tr	3.5	2.5			
1,1 - DIMETHYL CYCLOPENTANE	2	Tr	3.5	3			
3 - METHYL HEXANE	1	Tr	2	1.5			
1, CIS - 3 - DIMETHYL CYCLOPENTANE	1	Tr	Tr	1.5			
1, TRANS - 3 - DIMETHYL CYCLOPENTANE	*	*	*	*			
1, TRANS - 2 - DIMETHYL CYCLOPENTANE	2.5	Tr	3.5	2.5			
3 - ETHYL PENTANE	*	Tr	Tr	Tr			
n - HEPTANE	4	Tr	6	4.5			
1, CIS - 2 - DIMETHYL CYCLOPENTANE	1	Tr	2.5	1.5			
METHYL CYCLOHEXANE	9.5	Tr	6	6.5			
ETHYL CYCLOPENTANE	1.5	Tr	2	Tr			
TOLUENE	16	Tr	5	7.5			
TOTAL ABUNDANCE (PPB)	393	58	459	624			
ORGANIC CARBON (PER CENT)	4.52	1.34	-	-			
GASOLINE ABUNDANCE AT 1 PER CENT ORGANIC CARBON	87	43	*	*			

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

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA

SAMPLE DEPTH (METRES) OR NOTATION	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1-10)	VITRINITE REFLECTIVITY IN OIL, R av %	FLUORESCENT MATERIAL IN REFLECTED BLUE LIGHT
230- 260	Ctgs	Qtz snd + slt	*	0.16(20)	Yel-gn spores
350- 380	"	Calc sndy sltst	1.5	0.16(21)	Yel/yel-gn spores
530- 560	"	Gy calc mdst	1.5	0.15(18)	Yel-gn spores
710- 740	"	Ditto	*	0.21(20)	Yel/yel-gn spores
830- 860	"	Ditto	1.5	0.22(21)	*
950- 980	"	Qtz snd+ gy calc mdst	*	0.27(15)	*
1070-1100	"	Ol-gy calc mdst	*	0.26(8) 0.17(11)	Yel frags
1160-1190	"	Mdy mic sltst	*	0.26(18) 0.16(6)	*
1250-1280	"	Gy calc sltst/ mdst	*	0.29(31)	Yel-gn dinocysts
1340-1370	"	Ditto	*	0.27(26)	*
1430-1460	"	Qtz snd + mnr gy calc sltst	2	0.32(21)	Yel spores
1520-1550	"	Ol-gy calc sltst/ mdst	*	0.31(27)	*
1610-1640	"	Ol-gy/brn-gy mic calc sltst/mdst	2	0.33(23)	Yel-gn spores
1700-1730	"	Ditto	2.5	0.33(13)	*
1790-1820	"	Ditto	2.5	0.36(12)	*
1880-1910	"	Gn-gy/ol-blk sltst/mdst	2.5	0.36(18)	*
1970-2000	"	Ditto	2.5	0.34(12) 0.27(9)	Yel spores
2060-2090	"	Ditto	2.5	0.35(18) 0.53(6)	Ditto
2150-2180	"	Qtz snd + gy sltst/mdst	3	0.46(2)	*
2240-2270	"	Brn-gy/ol-gy sh	3	0.46(23) 0.28(7)	Yel-orng spores
2330-2360	"	Varicoloured sh	3	0.37(32) 0.26(2) 0.53(2)	Yel spores
2420-2450	"	Gn-gy/brn-gy sh	3	0.35(17) 0.47(5) 0.26(3)	Yel/yel-orng spores
2510-2540	"	Wht snd + mnr gy sh	3	0.41(21)	Ditto

SAMPLE DEPTH (METRES) OR NOTATION	SAMPLE TYPE	GENERALISED LITHOLOGY	SPORE COLOUR INDEX (1-10)	VITRINITE REFLECTIVITY IN OIL, R av %	FLUORESCENT MATERIAL IN REFLECTED BLUE LIGHT
3722-3752	Ctgs	Wht qtz snd + gn-gy sh + mnr coal	4	0.58(4) 0.52(3)	Gldn-yel spores
3754	SWC	Gn-gy/yel-gn sltst	3.5	0.55(7)	Ditto + gldn-yel algal frags

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
170- 200	Ctgs	Qtz snd+slt+shell debris	0.64	-	-	-	-	-
200- 230	"	Ditto+ditto+ditto+ calc mdst	0.68	-	-	-	-	-
230- 260	"	Ditto+ditto+ditto+ ditto	0.54	-	-	-	-	-
260- 290	"	Ditto+ditto+ditto+ ditto+LCM	2.46	-	-	-	-	-
290- 320	"	Ditto+ditto+ditto+ ditto+ditto+qtz gravel	0.66	-	-	-	-	-
320- 350	"	Ditto+ditto+ditto+ ditto+ditto+ditto	0.57	-	-	-	-	-
350- 380	"	Lt gy calc sndy sltst	0.58	-	-	-	-	-
380- 410	"	Lt gy/med gy slty sndy calc mdst+LCM+ drl md	0.59	-	-	-	-	-
410- 440	"	Med-lt gy slty sndy calc mdst+drl md+LCM	0.60	-	-	-	-	-
440- 470	"	Ditto+ditto+ditto	0.67	-	-	-	-	-
470- 500	"	Ditto+ditto+ditto	1.11	692	6.2	50	7	28
500- 530	"	Ditto+ditto+ditto	1.11	-	-	-	-	-
530- 560	"	Ditto+ditto+ditto	0.65	-	-	-	-	-
560- 590	"	Ditto+ditto+ditto	1.14	-	-	-	-	-
590- 620	"	Ditto+ditto+ditto	0.69	-	-	-	-	-
620- 650	"	Ditto+ditto+ditto	0.51	-	-	-	-	-
650- 680	"	Ditto+ditto+ditto+ mnr qtz snd	0.42	-	-	-	-	-
680- 710	"	Med-lt gy/gn-gy slty calc mdst+mnr snd+ LCM	0.50	-	-	-	-	-
710- 740	"	Ditto+ditto+ditto	0.52	-	-	-	-	-
740- 770	"	Ditto+ditto+ditto	0.81	-	-	-	-	-

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
770- 800	Ctgs	Med-lt gy/gn-gy slty calc mdst+mnr LCM	0.61	-	-	-	-	-
800- 830	"	Ditto+mnr snd	1.97	1165	5.9	30	3	24
830- 860	"	Ditto+ditto	1.32	-	-	-	-	-
860- 890	"	Med-lt gy calc mdst+ snd+shell+LCM+bit	7.13	-	-	-	-	-
890- 920	"	Ditto+ditto+ditto+ ditto+ditto	3.20	-	-	-	-	-
920- 950	"	Ditto+ditto+ditto+ ditto+ditto	2.12	-	-	-	-	-
950- 980	"	Qtz snd+shell+med-lt gy calc mdst+LCM+bit +lig	0.65	-	-	-	-	-
980-1010	"	Ditto+ditto+ditto+ ditto+ditto	2.14	-	-	-	-	-
1010-1040	"	Ditto+ditto+ditto+ ditto+ditto	2.50	-	-	-	-	-
1040-1070	"	Ditto+ditto+ditto+ ditto+ditto	1.71	-	-	-	-	-
1070-1100	"	Lt gy/lt ol-gy slty calc mdst	6.71	1400	2.1	40	3	17
1100-1130	"	Lt ol-gy/brn-gy slty calc mdst+LCM+mica+ bit	3.13	-	-	-	-	-
1130-1160	"	Ditto+ditto+ditto+ ditto	3.09	-	-	-	-	-
1160-1190	"	Mdy mic sltst+LCM+ bit	3.62	-	-	-	-	-
1190-1220	"	Yel-gy/lt ol-gy/brn-gy mic calc sltst/ mdst+LCM+bit	2.84	-	-	-	-	-
1220-1250	"	Ditto+ditto+ditto	2.40	1115	4.6	40	3	16
1250-1280	"	Ditto+ditto+ditto+ qtz snd	1.40	-	-	-	-	-
1280-1310	"	Ditto+ditto+ditto+ ditto+shell	2.63	-	-	-	-	-

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
1310-1340	Ctgs	Lt ol-gy/ol-gy/brn-gy calc mic sltst/mdst+ LCM+bit	3.89	-	-	-	-	-
1340-1370	"	Ditto+ditto+ditto	5.04	-	-	-	-	-
1370-1400	"	Ditto+ditto+ditto	5.27	-	-	-	-	-
1400-1430	"	Ditto+ditto+ditto	4.30	1485	3.5	80	5	3
1430-1460	"	Qtz snd+lt ol-gy sl calc mic sltst/mdst+ LCM+shell+bit	0.77	-	-	-	-	-
1460-1490	"	Ditto+mnr ditto+ditto+ bit	0.86	-	-	-	-	-
1490-1520	"	Ditto+ditto+ditto+ ditto+shell	1.18	-	-	-	-	-
1520-1550	"	Lt ol-gy/ol-gy calc sltst/mdst+qtz snd+ LCM+bit	2.47	1410	5.7	110	8	20
1550-1580	"	Ditto+ditto+ditto+ ditto	2.30	-	-	-	-	-
1580-1610	"	Ol-gy/lt ol-gy/brn-gy mic calc sltst/mdst+ LCM+bit	2.14	-	-	-	-	-
1610-1640	"	Ditto+ditto+ditto	2.39	1136	4.8	40	3	6
1640-1670	"	Ditto+ditto+ditto	3.80	-	-	-	-	-
1670-1700	"	Ditto+ditto+ditto	3.03	-	-	-	-	-
1700-1730	"	Ditto+ditto+ditto	2.74	1058	3.9	80	8	23
1730-1760	"	Ditto+ditto+ditto	2.75	-	-	-	-	-
1760-1790	"	Ditto+ditto+ditto	3.47	-	-	-	-	-
1790-1820	"	Ditto+ditto+ditto	4.09	1759	4.3	100	6	19
1820-1850	"	Ditto+ditto+ditto	2.66	-	-	-	-	-
1850-1880	"	Lt ol-gy/gn-gy/ol-gy/ dk gn-gy/ol-blk sl calc sltst/mdst+bit+ LCM	2.28	-	-	-	-	-

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
1880-1910	Ctgs	Lt ol-gy/gn-gy/ol-gy/dk gn-gy/ol-blk sl calc sltst/mdst+bit+LCM	1.37	1148	8.4	80	7	19
1910-1940	"	Ditto+ditto+ditto+qtz snd	0.88	-	-	-	-	-
1940-1970	"	Ditto+ditto+ditto+ditto	0.67	-	-	-	-	-
1970-2000	"	Ditto+ditto+ditto	0.77	-	-	-	-	-
2000-2030	"	Ditto+ditto+ditto	0.82	1143	13.9	35	3	25
2030-2060	"	Ditto+ditto+ditto+qtz snd	0.50	-	-	-	-	-
2060-2090	"	Ditto+ditto+ditto	0.73	-	-	-	-	-
2090-2120	"	Qtz snd+ol-gy/gn-gy sltst/mdst+bit+LCM	0.23	-	-	-	-	-
2120-2150	"	Ditto+ditto+ditto+ditto	0.44	-	-	-	-	-
2150-2180	"	Wht qtz snd+ol-gy/gn-gy sltst/mdst+bit	0.21	-	-	-	-	-
2180-2210	"	Gn-gy/ol-gy/brn-gy sltst/mdst/sh+LCM+qtz snd	0.88	-	-	-	-	-
2210-2240	"	Lt ol-gy/gn-gy/brn-gy/ol-gy calc sltst/sh+LCM+bit	1.32	1163	8.8	35	3	29
2240-2270	"	Brn-gy/lt ol-gy/ol-gy sh+LCM	1.10	-	-	-	-	-
2270-2300	"	Gy-red/gy-purp/gn-gy/lt brn-gy/ol-gy sh+LCM+bit	1.11	-	-	-	-	-
2300-2330	"	Ditto+ditto+ditto	1.28	-	-	-	-	-
2330-2360	"	Ditto+ditto+ditto	1.47	-	-	-	-	-
2360-2390	"	Gn-gy/ol-gy/dk gn-gy/brn-gy sh+LCM+mnr bit	2.21	1385	6.3	45	3	14
2390-2420	"	Ditto+ditto+ditto	1.22	-	-	-	-	-

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
2420-2450	Ctgs	Gn-gy/ol-gy/dk gn-gy/brn-gy sh+LCM+mnr bit +qtz snd	0.90	-	-	-	-	-
2450-2480	"	Gn-gy/dk gn-gy/ol-gy/brn-gy/red-gy sh+50% qtz snd+LCM+bit	0.90	-	-	-	-	-
2480-2510	"	Wht qtz snd+30% gn-gy/dk gn-gy/ol-gy red-gy sh+LCM	0.94	-	-	-	-	-
2510-2540	"	Ditto+mnr ditto+ditto +bit	0.29	-	-	-	-	-
2540-2570	"	Ditto+ditto+ditto+ ditto	0.27	-	-	-	-	-
2570-2600	"	Ditto+ditto+ditto+ ditto	0.28	-	-	-	-	-
2600-2630	"	Ditto+ditto+ditto+ ditto	0.78	-	-	-	-	-
2630-2660	"	Ol-gy/lt ol-gy/gn-gy sh+wht qtz snd+LCM+ bit	1.98	1238	6.3	15	1	27
2660-2690	"	Wht qtz snd+mnr gn-gy /ol-gn/ol-gy sh+bit+ LCM	0.59	-	-	-	-	-
2690-2720	"	Gn-gy/dk gn-gy/ol-gy/ol-gn sh+wht qtz snd +LCM+bit	0.63	-	-	-	-	-
2720-2750	"	Ditto+mnr ditto+ditto +ditto	1.00	855	8.6	15	2	18
2750-2780	"	Ditto+wht chk+mnr qtz snd+LCM+mnr bit	0.50	-	-	-	-	-
2780-2810	"	Wht chk+50% ol-gy/dk gn-gy/gn-gy sh+LCM+ mnr bit	0.43	-	-	-	-	-
2810-2840	"	Ditto+mnr med gy sh	0.37	-	-	-	-	-
2840-2870	"	Ditto+ditto	0.19	-	-	-	-	-
2870-2900	"	Wht/pale yel-brn chk +mnr med-gy sh	0.29	-	-	-	-	-

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
2900-2930	Ctgs	Wht chk+mnr med gy sh	0.20	-	-	-	-	-
2930-2960	"	Ditto+ditto	0.19	-	-	-	-	-
2960-2990	"	Ditto+ditto	0.25	-	-	-	-	-
2990-3020	"	Gy-pnk chk+mnr med gy /med-gk gy sh	0.30	-	-	-	-	-
3020-3050	"	Ditto+ditto	0.24	-	-	-	-	-
3050-3080	"	Wht ckk+40% gy-pnk chk+mnr med gy sh	0.25	-	-	-	-	-
3080-3110	"	Ditto+ditto+ditto+bit	0.29	-	-	-	-	-
3110-3140	"	Ditto+ditto+ditto+ ditto	0.33	-	-	-	-	-
3140-3170	"	Ditto+ditto+10% ditto +ditto	0.45	-	-	-	-	-
3170-3200	"	Ditto+ditto+ditto+ ditto+LCM	0.66	-	-	-	-	-
3200-3230	"	Ditto+ditto+ditto+ ditto	0.44	-	-	-	-	-
3230-3260	"	Wht/gn-gy/lt bl-gy chk/marl/calc sh+LCM	0.64	-	-	-	-	-
3260-3290	"	Ditto+ditto	0.39	-	-	-	-	-
3290-3320	"	Ditto+ditto	0.32	-	-	-	-	-
3320-3350	"	Gy-red/dk red-brn/gn-gy sh + wht/bl-gy marl/lst	0.46	1188	25.8	55	5	11
3350-3380	"	Varicoloured sh	0.62	745	12.0	35	5	25
3380-3410	"	Ditto + mnr bit	1.22	1308	10.7	45	4	11
3410-3440 LCM	"	Ol-blk/gn-blk mic sh + ditto + ditto	2.50	1438	5.8	25	2	56
3440-3470	"	Ditto + ditto + ditto	3.37	2368	7.0	55	2	30
3470-3500	"	Ditto + ditto + ditto + 30% wht qtz snd	3.95	2453	6.2	15	1	67

COMPANY : STATOIL WELL 15/9-2 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
3568-3570	Ctgs	Ol-blk/gn-blk mic sh + varicoloured sh + mnr bit + mnr wht qtz snd	5.79	-	-	-	-	-
3588-3590	"	Ol-blk sh + 40% varicoloured sh + bit	5.80	4314	7.4	120	3	71
3626-3628	"	Wht qtz snd/sst + 15% varicoloured sh + mnr coal + bit	0.93	-	-	-	-	-
3692-3722		Wht qtz snd/sst + 15% pale gn/dk gn-gy sh/ sltst + 5% coal + bit	4.52	-	-	-	-	-
3722-3752	"	Wht qtz snd/sst + 10% pale gn/dk gn-gy sh/ sltst + mnr coal + mnr bit	1.34	-	-	-	-	-
		PICKED LITHOLOGIES						
3440-3470	"	Ol-blk/gn-blk sh	3.81	-	-	-	-	-
"	"	Gy-red/dk red-brn sh	0.31	-	-	-	-	-
"	"	Med gy sh	0.60	-	-	-	-	-
3470-3500	"	Ol-blk sh	5.34	-	-	-	-	-
"	"	Brn-blk sh	5.90	-	-	-	-	-
3568-3570	"	Med/dk gy sh	0.66	-	-	-	-	-
"	"	Brn-red sh	0.63	-	-	-	-	-
3588-3590	"	Dk gy sh	6.18	-	-	-	-	-
"	"	Brn-red sh	0.51	-	-	-	-	-

COMPANY : STATOIL WELL : [illegible] LOCATION :

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
		SIDEWALL CORES						
3218	SWC	Med gy sh	0.10	-	-	-	-	-
3359	"	Gy-red/dk red-brn sh	0.25	-	-	-	-	-
3378	"	Dk gn-gy sh	1.18	-	-	-	-	-
3404	"	Ol-blk sh	9.57	-	-	-	-	-
3430	"	Ditto	7.54	-	-	-	-	-
3455	"	Ditto	6.83	-	-	-	-	-
3460	"	Ditto	8.00	-	-	-	-	-
3465	"	Ditto	7.13	-	-	-	-	-
3521.25	"	Brn-blk/ol-blk sh	5.43	-	-	-	-	-
3652.55	"	Ol-blk/ol-gy sh	5.82	-	-	-	-	-
3663	"	Dk ol-gy sh	1.31	-	-	-	-	-
3679.50	"	Brn-blk/ol-blk sh	2.83	-	-	-	-	-
3708	"	Gn-gy/pale ol sltst	0.11	-	-	-	-	-
3760	"	Ditto	0.09	-	-	-	-	-

SAMPLE DEPTH (METRES) OR NOTATION	GENERALISED LITHOLOGY	ORGANIC CARBON (%)	TEMPERATURE (°C)	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (PPM)
470-500	Med-lt gy slty sndy calc mdst	1.11	427	116	538	0.4	1300
800-830	Med-lt gy/gn-gy slty calc mdst+ mnr snd	1.97	409	14	96	0.3	300
1070-1100	Lt gy/lt ol-gy slty calc mdst	6.71	421	8	89	0.4	500
1220-1250	Yel-gy/lt ol-gy/ brn-gy calc mic sltst/mdst+bit	2.40	416	78	120	0.4	1900
1400-1430	Lt ol-gy/ol-gy/ brn-gy calc mic sltst/mdst+bit	4.30	418	100	111	*	4300
1420-1550	Lt ol-gy/ol-gy calc sltst/mdst +qtz snd+bit	2.47	432	84	18	0.5	2100
1610-1640	Ol-gy/lt ol-gy/ brn-gy calc mic siltst/mdst+bit	2.39	426	72	47	0.3	1700
1700-1730	Ditto+ditto	2.74	423	88	15	0.5	2400
1790-1820	Ditto+ditto	4.09	422	54	26	*	1500
1880-1910	Lt ol-gy/gn-gy/ ol-gy/dk gn-gy/ ol-blk sl calc sltst/mdst+bit	1.37	421	10	6	*	100
2000-2030	Ditto+ditto	0.82	425	325	12	0.4	2700
2210-2240	Lt ol-gy/gn-gy/ brn-gy/ol-gy calc sltst/sh+bit	1.32	421	21	68	0.7	300
2360-2390	Gn-gy/ol-gy/dk gn-gy/brn-gy sh+mnr bit	2.21	434	29	25	0.6	700
2630-2660	Ol-gy/lt ol-gy/ gn-gy sh+wht qtz snd+bit	1.98	433	10	22	0.7	200
2720-2750	Gn-gy/dk gn-gy/ ol-gy/ol-gn sh+ wht qtz snd+bit	1.00	417	7	68	0.9	100
3218	Med gy sh	0.10	*	*	881	*	*
3320-3350	Gy-red/dk red-brn/ gn-gy sh+wht/bl-gy marl/lst	0.03	*	*	*	*	*
3350-3380	Varicoloured sh	0.01	437	*	*	0.3	1000

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

SAMPLE DEPTH (METRES) OR NOTATION	GENERALISED LITHOLOGY	ORGANIC CARBON (%)	TEMPERATURE (°C)	HYDROGEN INDEX	OXYGEN INDEX	PRODUCTION INDEX	POTENTIAL YIELD (PPM)
3359	Gy-red/dk red-brn sh	0.25	*	*	302	*	*
3378	Dk gn-gy sh	1.18	429	7	77	0.9	100
3380-3410	Ol-blk/gn-blk sh +varicoloured sh	1.22	429	17	64	0.4	800
3404	Ol-blk sh	9.57	427	220	5	0.06	21100
3410-3440	Ol-blk/gn-blk sh +varicoloured sh	2.50	425	66	43	0.1	1700
3430	Ol-blk sh	7.54	432	191	7	0.1	14400
3440-3470	Ol-blk/gn-blk sh +varicoloured sh	3.37	429	112	21	0.02	3800
3455	Ol-blk sh	6.83	439	296	2	0.1	20300
3460	Ditto	8.00	433	238	4	0.1	19100
3465	Ditto	7.13	434	179	3	0.1	12800
3521.25	Brn-blk/ol-blk sh	5.43	439	130	2	*	7100
3652.55	Ol-blk/ol-gy sh	5.82	440	180	3	0.08	10500
3663	Dk ol-gy sh	1.31	443	195	5	*	2600
3679.50	Brn-blk/ol-blk sh	2.83	444	357	5	*	10100
3708	Gn-gy/pale ol sltst	0.11	*	*	353	*	*
3760	Ditto	0.09	*	*	342	*	*
	PICKED LITHOLOGIES						
3470-3500	Ol-blk sh	5.34	436	241	6	0.06	12900
3470-3500	Brn-red sh	5.90	*	*	26	*	*
3568-3570	Med gy sh	0.66	436	1723	44	0.09	11400
3568-3570	Gy-red sh	0.63	433	38	152	*	200
3588-3590	Ol-blk sh	6.18	435	193	5	0.08	12000
3588-3590	Gy-red sh	0.51	431	10	150	*	100

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

No.23

FIGURE 1 AIRSPACE (C_1 - C_4) HYDROCARBONS

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA

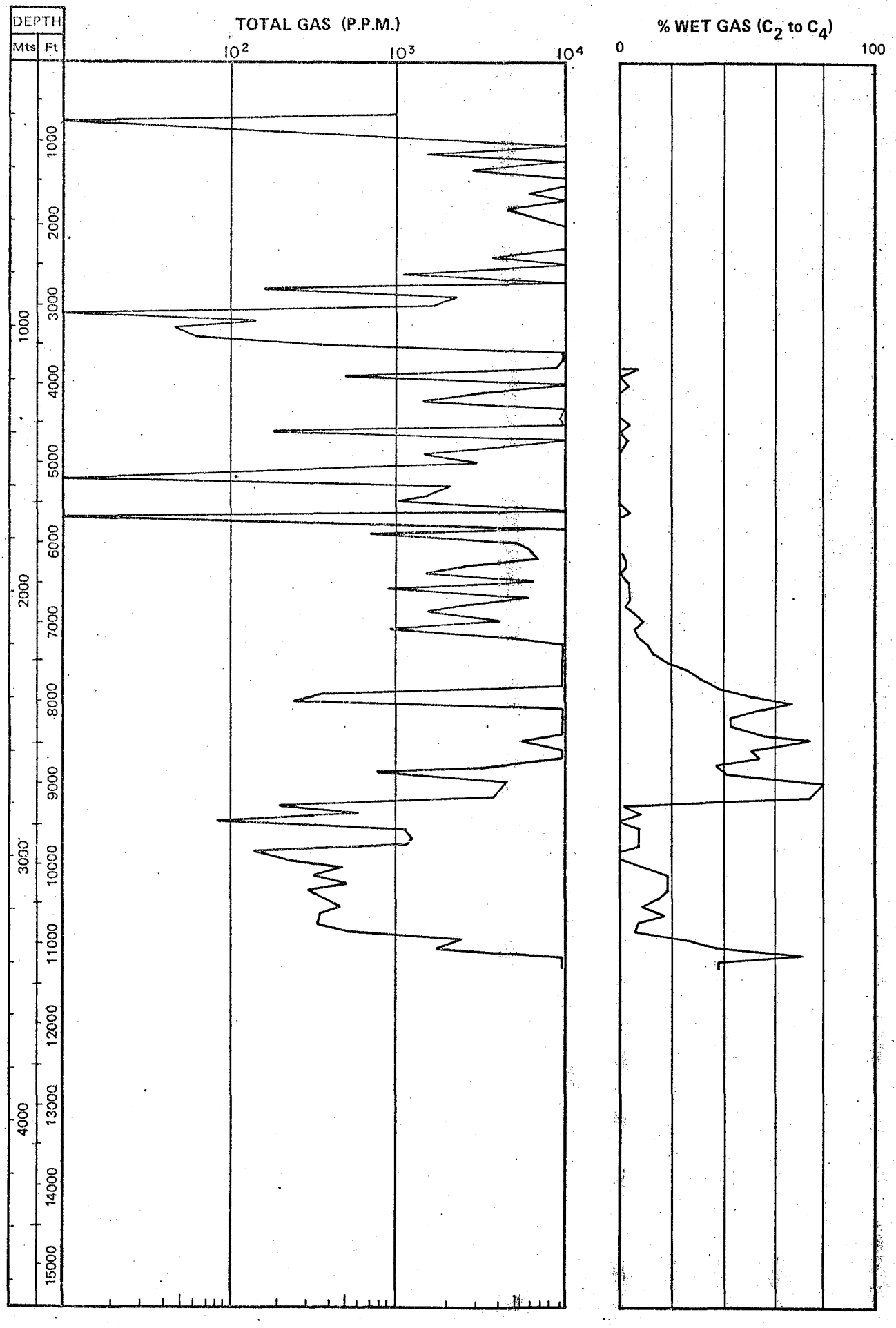
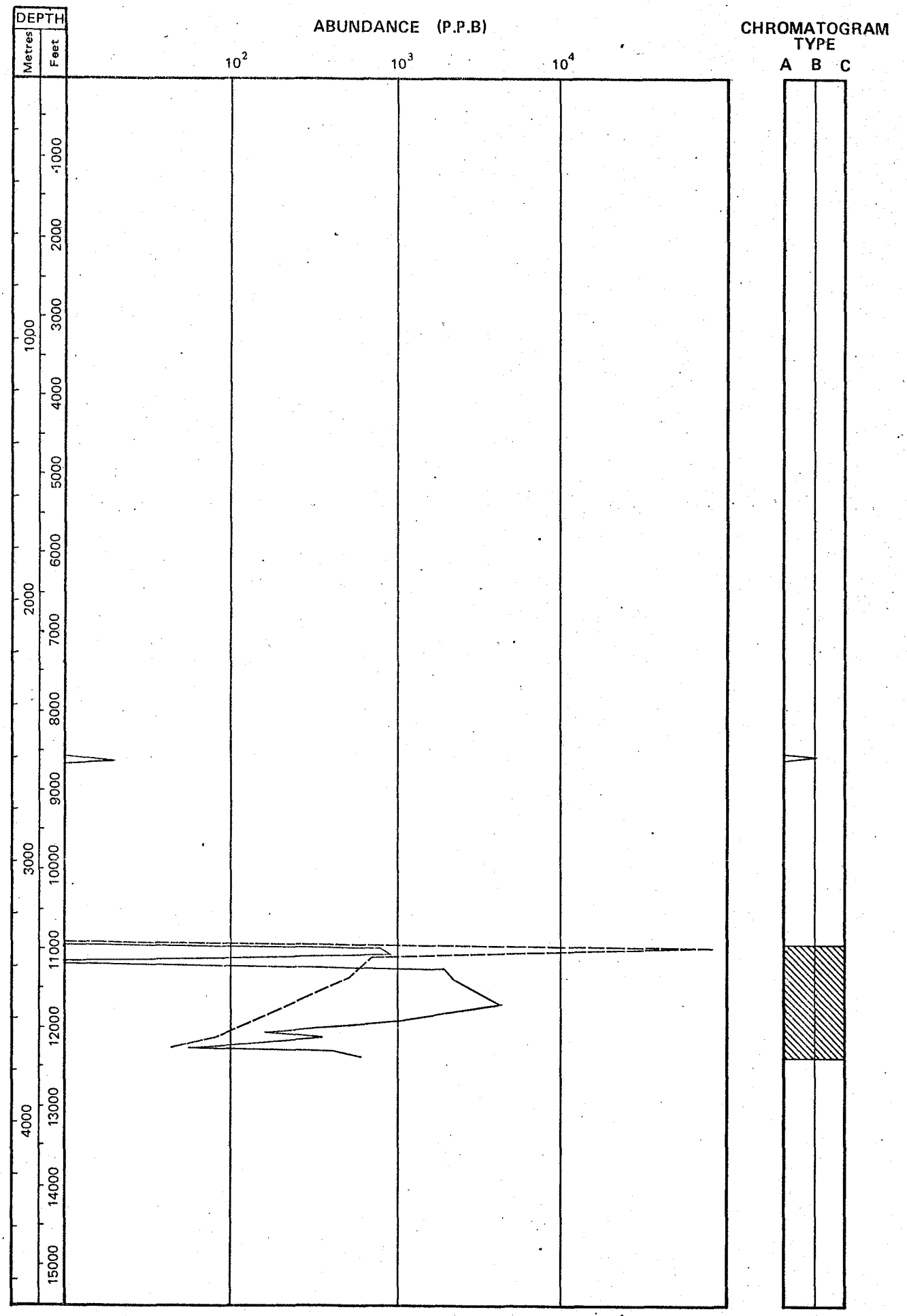


FIGURE 2 GASOLINE RANGE ($C_4 - C_7$) HYDROCARBONS

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA



A - IMMATURE B - TRANSITIONAL C - OIL LIKE

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

FIGURE 3 SPORE COLOURATION INDICES AGAINST DEPTH

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA

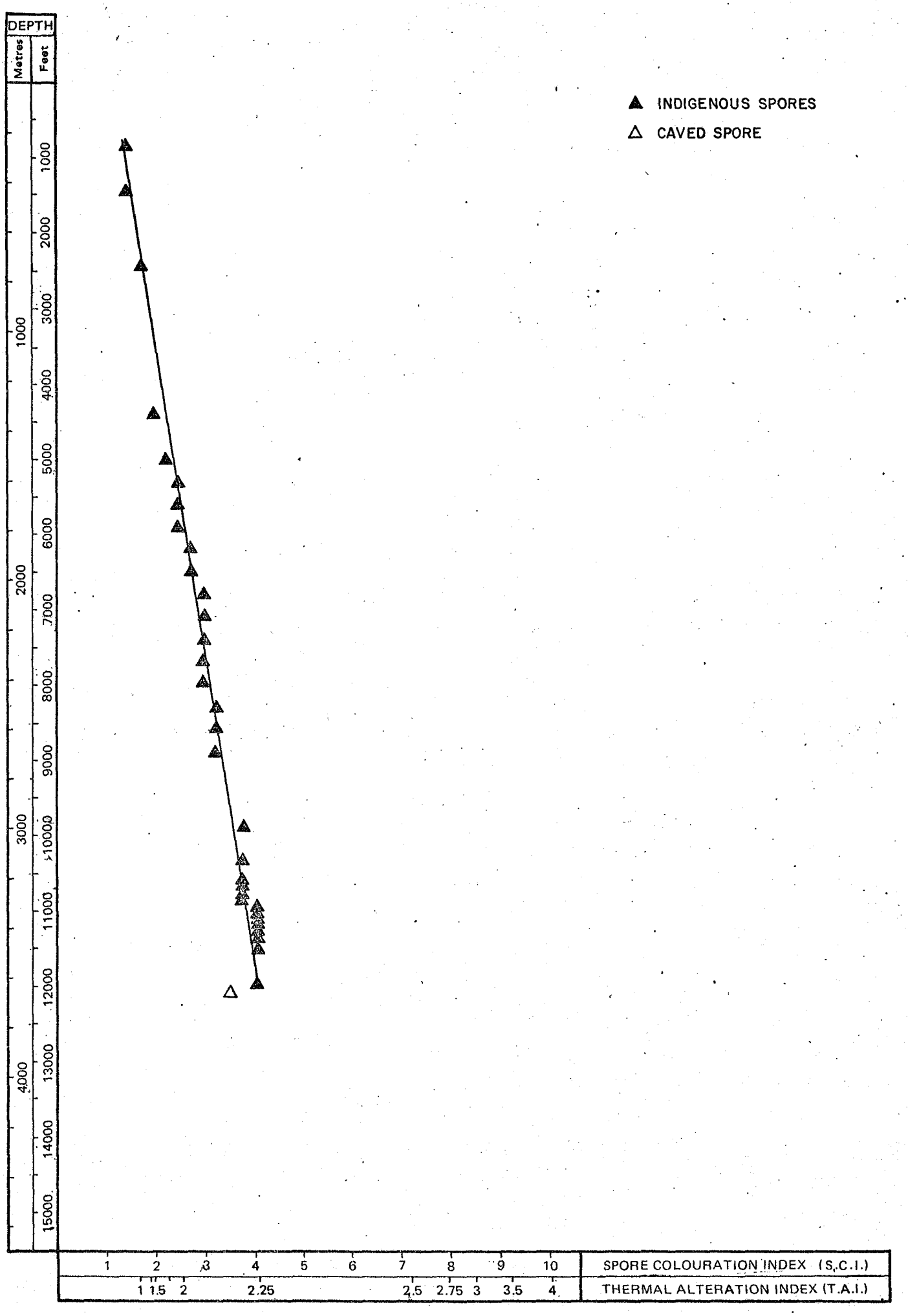
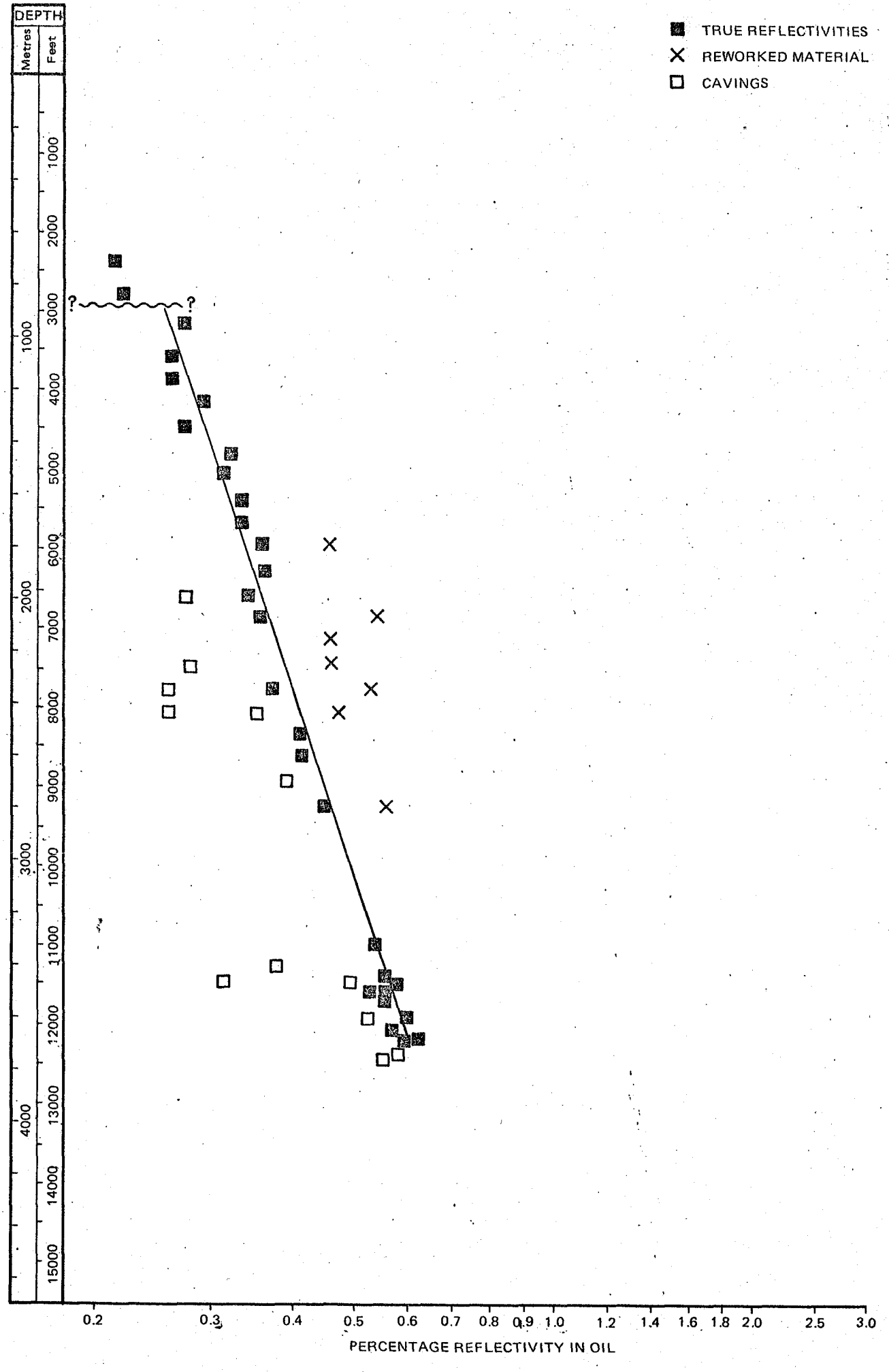


FIGURE 4 VITRINITE REFLECTIVITY AGAINST DEPTH

COMPANY: STATOIL WELL: 15/9-2 LOCATION: NORWEGIAN NORTH SEA



Drawing No. 219P/2736/4226

GEOCHEMICAL SUMMARY CHART

FIGURE 5

COMPANY: STATOIL

WELL: 15/9-2

LOCATION: NORWEGIAN NORTH SEA

SOURCE ROCK DATA

DEPTH (Metres / Feet)

STRATIGRAPHY

LITHOLOGY

ORGANIC CARBON % OF ROCK — 0.1 0.3 0.5 0.75 1.0 2.0 2.5 5.0 10.0

HYDROCARBONS PPM OF ROCK — 50 100 250 500 1000 2500

EXTRACT % OF ORGANIC CARBON — 1 2.5 5 10 20 30 50

LIKELY HYDROCARBON PRODUCT — Gas; Gas + Oil + Gas; Oil + Gas; Oil; Oil Stain or Contam.

SOURCE ROCK RICHNESS — Poor; Fair; Good; Very Good; Stain

SAMPLE DEPTH (Metres / Feet) AND SAMPLE TYPE

MATURATION DATA

MATURATION LEVEL OF ORGANIC MATTER

OIL-PRONE | GAS-PRONE

SUMMARY OF PRESENT POTENTIAL

Stratigraphy	Lithology	Sample depth (m)
TERTIARY	Grey Calcareous Silty Mudstones	470m
		800m
		1070m
	Qtz Sst	1220m
	Grey Calcareous Silty Mudstones	1400m
		1520m
		1610m
		1700m
		1790m
		1880m
		2000m
	Qtz Sst and Grey Shale	2210m
	Varicoloured Shale	2360m
	Qtz Sst	2630m
	Shale and Sst	2720m
CRETACEOUS	Chalk	
	Chalk, Marl, and Grey Shale	3320m 3350m
JURASSIC	Olive-Black Shale	3380m 3410m
	Shale, Sst and Coal	3440m 3470m
TRIAS	Siltst, Sst	3588m

Maturation level of organic matter		Summary of present potential
Oil-prone	Gas-prone	
IMMATURE	IMMATURE	No present hydrocarbon sourcing capability
TRANSITIONALLY MATURE	TRANSITIONALLY MATURE	Possible wet-gas sourcing capability
MATURE	MATURE	No present hydrocarbon sourcing capability
		Good present heavy oil and condensate source
		No present capability

Casing Point

SCALE 1:20,000

Lean | Fair | Aver. | Above average

Lean | Average | Above average

Gas-prone ⟷ Oil-prone | Contamin.

Good gas source *

Conv. Core

S W C

Ditch ctgs.

FIGURE 6

GAS CHROMATOGRAMS OF TOTAL SATURATE HYDROCARBON FRACTIONS

a. 1790-1820 m

b. 3320-3350 m

c. 3588-3590 m

d. 3488 m

FIGURE 6a
1790-1820m

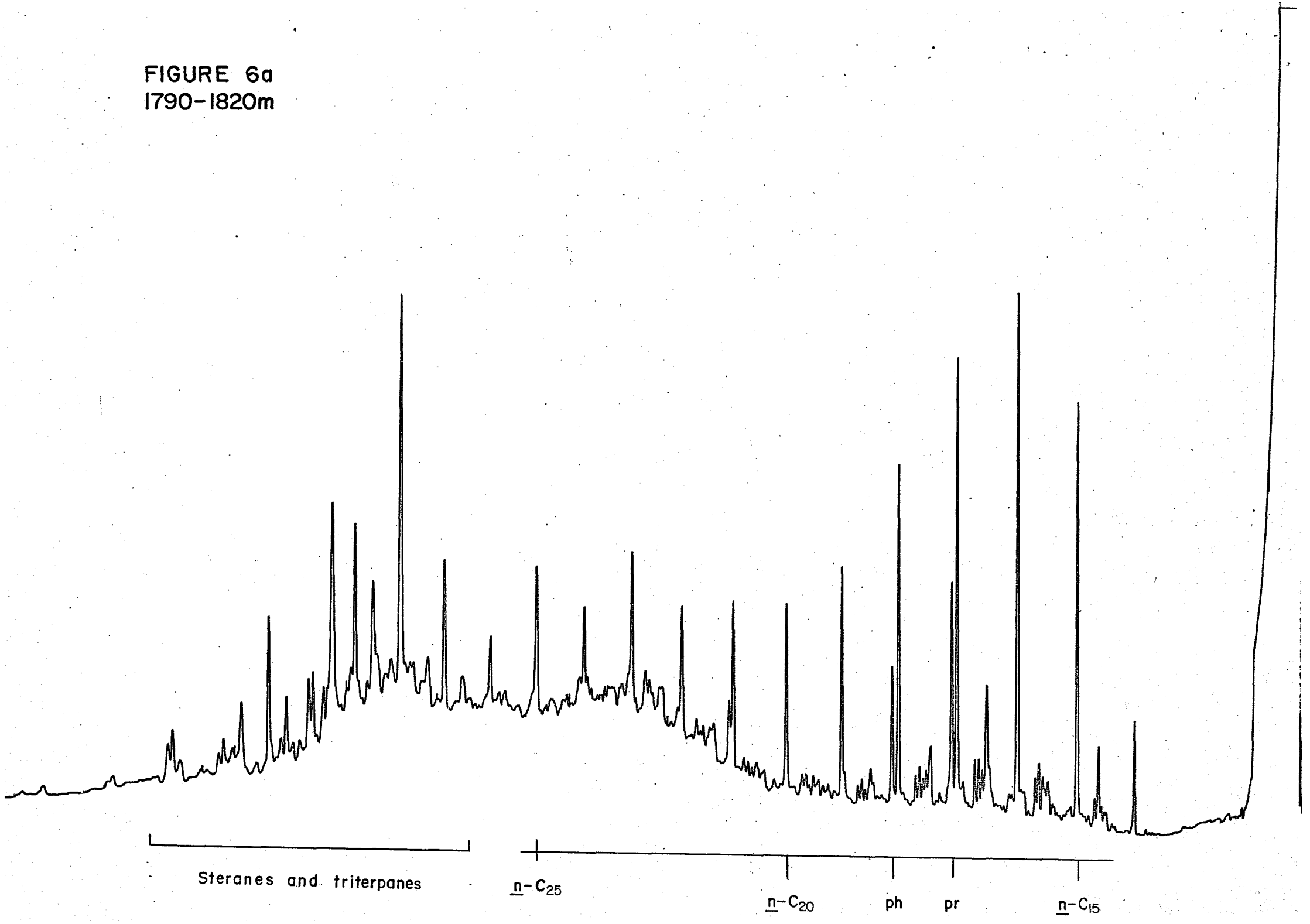


FIGURE 6b
3320-3350m

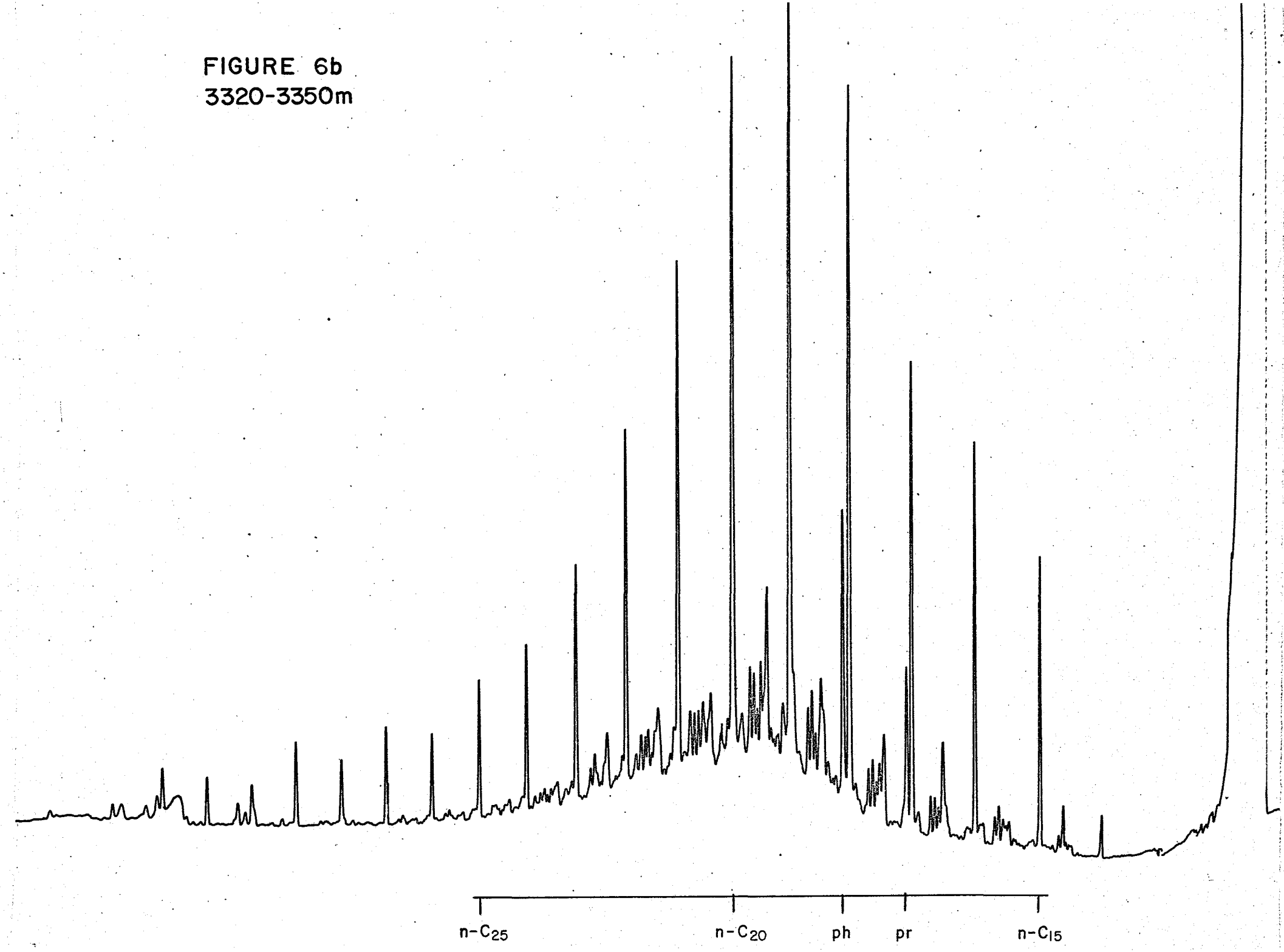


FIGURE 6c
3588-3590m

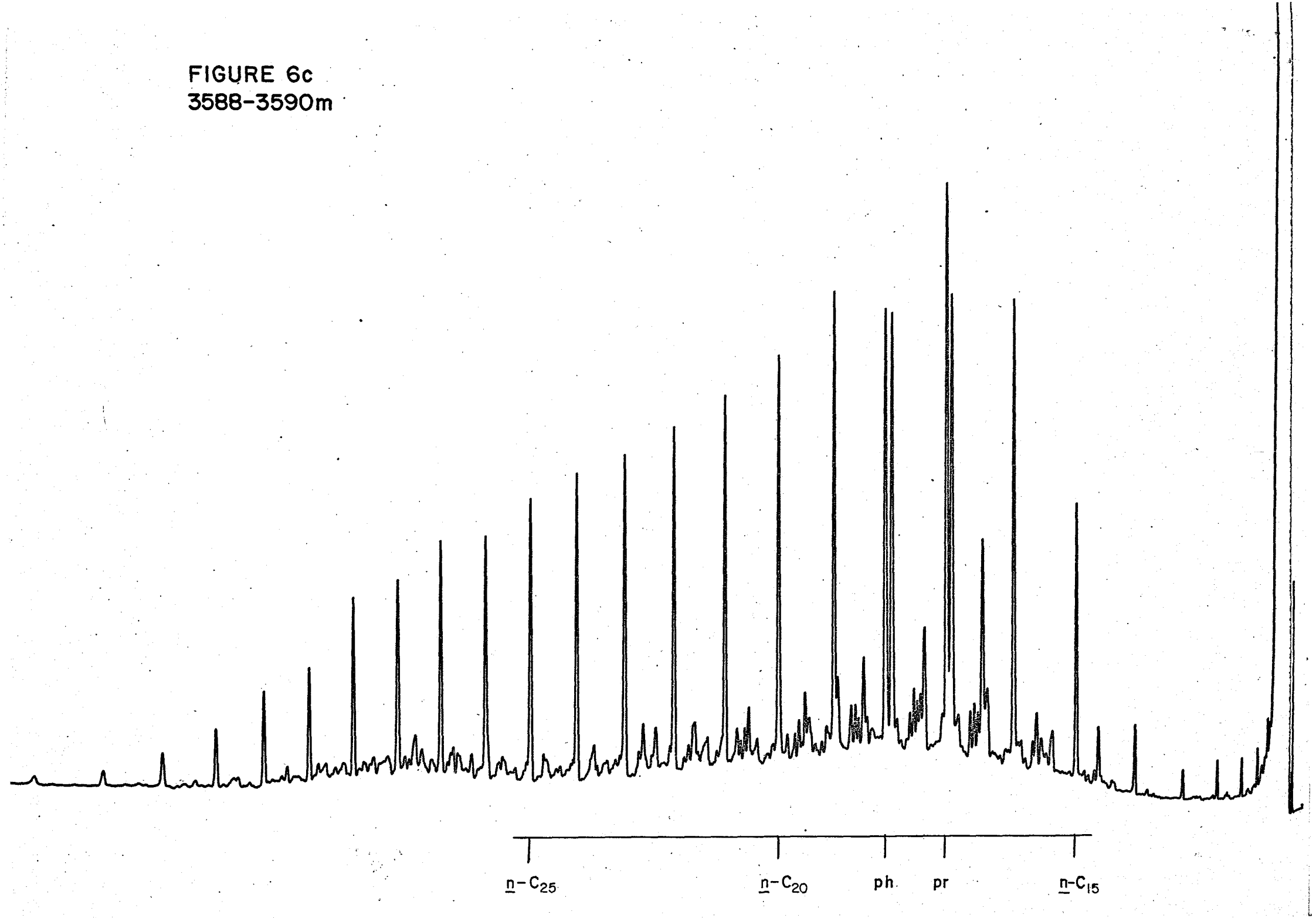


FIGURE 6d
3488m

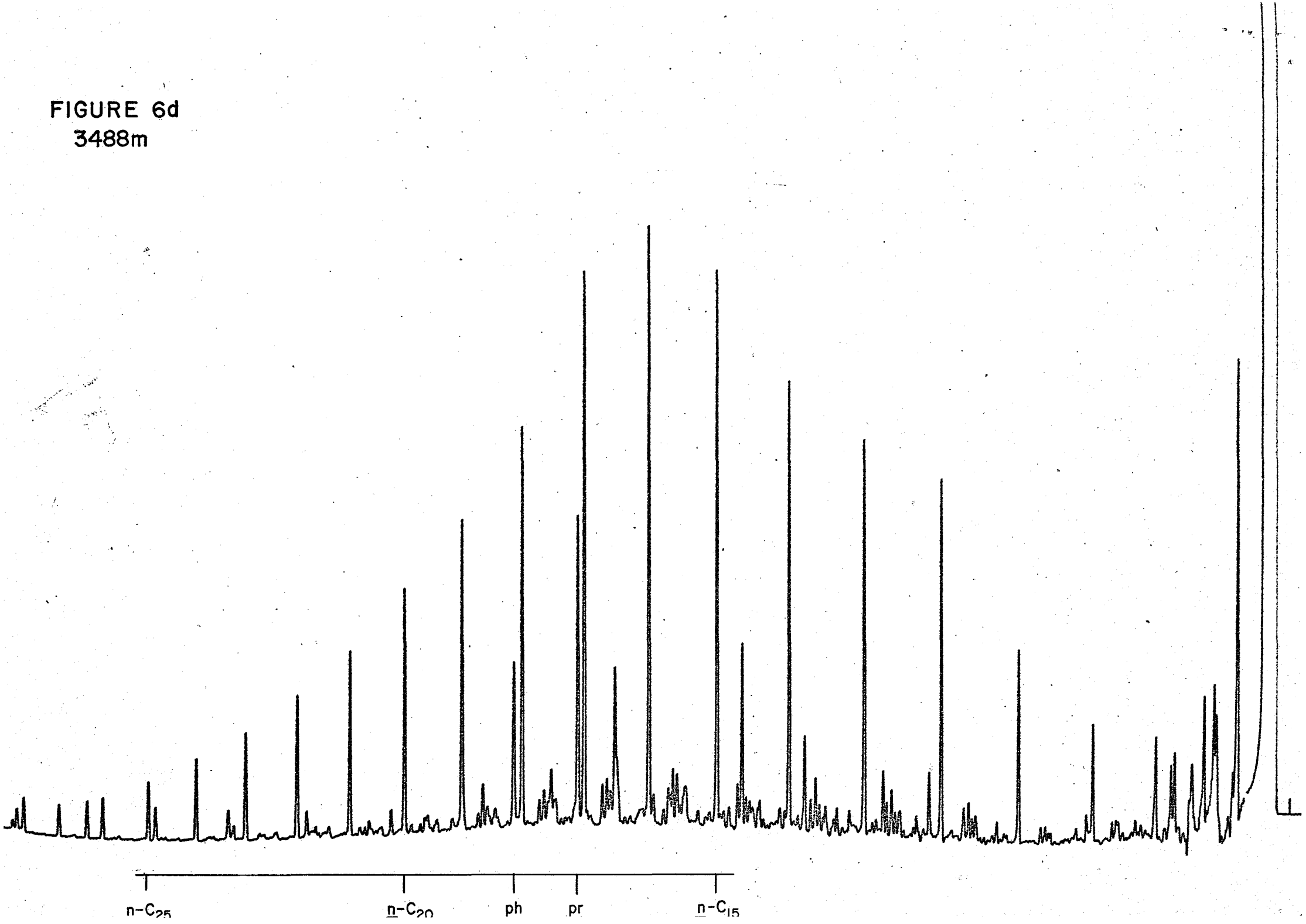
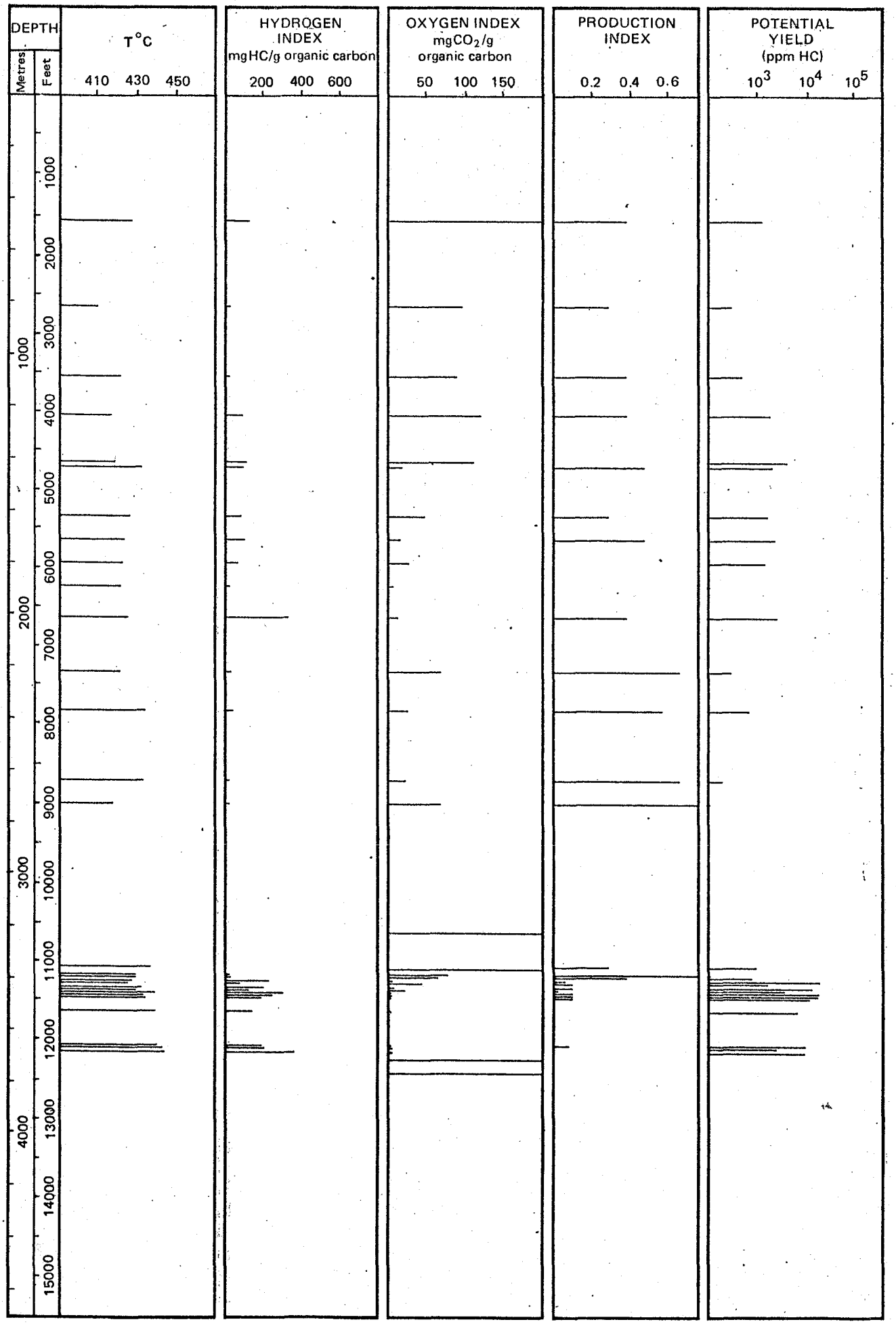


FIGURE 7 PYROLYSIS DATA SUMMARY CHART

COMPANY: STATOIL **WELL:** 15/9-2 **LOCATION:** NORWEGIAN NORTH SEA



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 litholog
Med	-	Medium	i/b	-	Interbedded
Mic	-	Micaceous			
Mnl	-	Mineral			
Mnr	-	Minor			