TABLES

CASINGS

Table 1

Diameter	Depth below KB	
	m	ft.
36"	166	545
20"	413	1356
13 3/8"	1169	3837

HOLE DEVIATION

Table 2

Depth below KB		Degrees
m	ft.	
152	500	1.00
306	1004	1.00
413	1335	0.50
611	2005	1.00
909	2982	1.00
1165	3822	2.00
1390	4560	2.00
1542	5059	1.00
1726	5663	2.50
1784	5835	2.75
2035	6677	3.25
2348	7703	2.25

MUD PROGRAMME

Table 3

Mud properties					
Depth below KB		Weight	Funnel visc.,	Filter loss	Remarks
m	ft.	ppg	sec.	cm^3	
to 152	to 500	Sea water			
152	500	8.6	90		Displaced water with mud.
419	1375	9.1	36		Circulated out 130 bbls cement and cement cut mud.
1173	3850	9.8	42	14	Reamed tight spot at 1401'. Cleaned hole. Inflow 5 bbls/hr salt water
2195	7200	10.4	58	10.8	
2540	8333	10.4	42	6	Saturated mud with NaCl.
2681	8796	11.2	65	7.6	
3269	10726	11.5	53	6.2	Stuck Pipe. Spotted Pipe Lax. Circulated and conditioned Mg- and K-contaminated mud.

MUD ADDITIVES

Table 3 a

Function	Product
Bactericides	Lime, Caustic Soda.
Calcium Removers	Caustic Soda, Soda Ash, Sodium Bicarbonate.
Defoamer	Magconol.
Emulsifier	Drilling Detergent.
Lubricants	Lime, Bit Lube.
Flocculant	NaCl.
Filtrate Reducers	Magcogel, Spersene, XP-20, CMC, My-Lo-Jel.
Lost Circulation Material	LMC, Mica, Nut Plug, Cell-O-Seal, Mud Fiber.
pH Control, Alkalinity	Lime, Caustic Soda, Soda Ash, Sodium Bicarb.
Shale Control Inhibitors	Lime, XP-20, NaCl.
Surface Active Agent	Drilling Detergent.
Thinners. Dispersants.	Spersene, XP-20.
Viscosifiers	Salt Gel, Magcogel, CMC, Sodium Bicarbonate.
Weighting Materials	Barytes, NaCl.
Corrosion Inhibitors	Lime.

AVAILABLE LOGS

Table 4

Type	Run no.	Depth below KB		Scales available
		m	ft.	
IES	1	166- 419	545- 1374	1/200 1/500
«	2	415-1011	1360- 3318	«
«	3	1158-2195	3798- 7203	«
GR/BHC-Sonic	1	165- 411	1360- 3322	«
«	2	415-1013	1360- 3322	«
«	3	1158-2194	3798- 7197	«
GR/BHC-Sonic-C	1	2164-2679	7100- 8790	«
«	2	2649-3243	8690-10640	«
CAL	1	165- 415	540- 1360	«
LL-7	1	415-1160	1360- 3809	«
«	2	1158-2195	3798- 7200	«
«	3	2164-3246	3798-10648	«
MLL-C	1	415-1015	1360- 3329	1/500
«	2	1158-2195	3798- 7200	«
«	3	2164-3243	7100-10640	«
FDC	1	415-1160	1360- 3806	1/200 1/500
«	2	1158-2195	3798- 7203	«
«	3	2164-2681	7100- 8795	«
«	4	2651-3243	8700-10640	«
SNP	1	415-1161	1360- 3810	«
«	2	1158-2196	3798- 7204	«
«	3	2164-3243	7100-10640	«
CDM	1	1158-3237	3798-10620	1/200
CDM arrow plot	1	1158-3237	3798-10620	1/500
CBL	1	1067-1158	3500- 3798	1/200 1/500
SRS	1	121-3244	397-10643	1/500
TS	1	104- 442	341- 1450	1/1000
Mud	1	167-3269	547-10726	1/500

2.06 MUD DATA AND CHEMICAL CONSUMPTION

Depth interval	weight ppg	viscocity scc. MF	waterloss cc. API	plastic viscocity	gels 0 min	gels 10 min	alkalimity PH	alkalimity PF	solids %	Cl ppm	Ca+My ppm
0-1375	9.0	40	-	-	-	-	-	-	-	-	-
1375-3850	9.5	42	16	-	-	-	10	-	25	-	-
3850-7200	10.2	50	12	25	Flocogel 12	28	9½	0.3	18	22000	-
7200-8333	10.2	50	7	25	4	13	10	1.0	18	24000	400
8333-10726	11.3	50	6	20	0	8	12½	4.0	-	180000	600

CHEMICAL CONSUMPTION ~~XXX~~. WELL 17/11-1

From 24/5 To 30/6/68

CHEMICALS		UNIT	Total Consumption ~~PREVIOUS WEEKS~~	UNIT COST ~~FOR WEEK~~	TOTAL COST $ ~~TOTAL~~
Barytes	sacks	100 lbs	2900	2.95	8555
Salt Gel	sacks	80 lbs	967	4.67	4516
Magcogel	sacks	100 lbs	1172	3.25	3809
Lime	sacks	25 kg	130	1.875	244
Spersene	sacks	50 lbs	1250	9.38	11725
XP-20	sacks	50 lbs	332	9.64	3200
CMC (L.V.)	sacks	56 lbs	290	12.28	3561
Caustic Soda	sacks	112 lbs	587	9.94	5835
Soda-Ash	sacks	112 lbs	604	5.08	3068
Drilling Detergent	drums	55 gal	9	242.00	2178
Magconol	drums	55 gal	9	325.26	2927
My-Lo-Gel LCM	sacks	56 lbs	449	7.11	3192
Mica	sacks	56 lbs	-	5.69	-
Nut Plug	sacks	25 kg	-	7.38	-
Cell-O-Seal	sacks	28 lbs	-	4.00	-
Mud Fiber	sacks	20 kg	-	5.79	-
Salt NaCl	sacks	50 kg	2484	2.16	5365
Bit Lube	drums	55 gal	37	126.39	4676
Pipe Lax	drums	55 gal	1	375.00	375
Sodium Bicarbonate	~~cartons~~ sacks	112 lbs	10	5.72	57
Total Mudchemicals					63283
Depth of well		10726'	Mud cost/ft.		$5.90
Days drilling		37	Mud cost/day		$1710
			~~Chemicals wasted or lost~~		~~$3222~~
~~Mud chemicals consumed~~		~~$63283~~			
~~Class G Cement~~	~~sacks~~	~~94 lbs~~			
~~Class B Cement + 20% Dykkx~~					
~~Class B Cement + 0.3% Retarder~~					
~~Class B Cement + 0.5% Retarder~~					

Mud chemicals consumed............ $63283

Chemicals wasted or lost.......... $ 3222

Total chemicals consumed and - wasted $66505

U-13

BA-78-100-1

Technical Service Report October 1973

RKTR 0305.73

SOURCE ROCK AND CARBONIZATION EVALUATION
WELL 17/11-1, NORWAY

by

K. Reiman & J.E.A.M. Dielwart

KONINKLIJKE/SHELL
EXPLORATIE EN PRODUKTIE LABORATORIUM
RIJSWIJK, THE NETHERLANDS

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by reg.

K. Reiman & J.E.A.M. Dielwart

Sponsor: SIPM-EP/Norske Shell

In co-operation with:

J. Alblas
J.H.H. Gales-Maas
M.C.M. v.d. Knaap-Holierhoek

Investigation

912.895

KONINKLIJKE/SHELL
EXPLORATIE EN PRODUKTIE LABORATORIUM
RIJSWIJK, THE NETHERLANDS

CONTENTS

I. INTRODUCTION

Geochemical investigations have been carried out on a suite of samples from the well as mentioned on the title page.

These investigations have been carried out to evaluate the presence and quality of source-rock layers, to establish the trend in fixed-carbon content, and to indicate the zone of possible oil and/or gas generation at the location of the well.

II. EVALUATION OF SOURCE-ROCK PROPERTIES

a. Source-rock indications

These indications have been determined for the original samples and, for those showing a high source-rock indication, also after extraction with warm chloroform.

The results are given in the geochemical log (enclosure 1). For the location of the well see figure 1.

The bars on the geochemical log are an approximate measure of the organic-carbon content of the samples. The column on the left represents indication of the organic-carbon content of the untreated samples, while the column on the right shows the organic-carbon content of the samples after chloroform extraction.

Moderate to high indications obtained for the original samples may indicate genuine source-rock properties or migrated oil, or may be due to the presence of contaminants such as diesel oil used in the drilling fluid. To distinguish between the first possibility and the latter two, original samples with strong indications are remeasured after extraction with chloroform. Intervals or samples with high indications after extraction are investigated microscopically to ensure that the high values indicate genuine source-rock properties and are not due to contaminants insoluble in chloroform (such as walnut shells or other lost circulation material of an organic nature).

b. Type of organic matter

Knowledge of the type of organic matter is important because it is known that organic matter rich in hydrogen[1] (kerogen, kerogenous) is a precursor of oil. Organic matter poor in hydrogen (humic) yields only gas. The types of organic matter recognised range from kerogenous, through mainly kerogenous, mixture and mainly humic, to humic. In this order, the type indicates decreasing concentrations of hydrogen in the organic matter.

The type of organic matter was determined by gas chromatography[2] as well as by microscopic inspection. Organic matter of humic type is a precursor of gas. Organic matter of mainly humic type is also considered to be a precursor of gas; if sufficient quantities are present it may also yield oil. Organic matter of mixed type is a precursor of light oil (usually of a paraffinic nature) and gas. Organic matter of mainly kerogenous and kerogenous types are precursors of oil and gas.

The results have been included in the geochemical log.

III. MATURITY OF THE ORGANIC MATTER

a. General remarks and results

It is important to determine the effect of temperature on the organic matter present in source rocks, since the generation of oil and gas is closely connected with the influence of relatively high temperatures. The effect of temperature (or the degree of maturity) was established by determining the rank of constituent coal particles[3] by measurement of vitrinite reflectance[4-6]. Some 50 (maximum) reflectance measurements have been made for each sample, provided there was sufficient vitrinite present. The average value of these reflectances has been converted to fixed-carbon content (100 - volatile matter).

The results are plotted as function of depth in figure 2 in the form of fixed-carbon histograms. Any histogram that could not be accommodated on figure 2 is given in subsequent figures.

In general, the mode value of the histogram may or may not represent the true-layer fixed-carbon content (coal rank) of the stratum from which the sample is taken. The rank obtained from cuttings may have been influenced by vitrite from cavings. Alternatively, the rank may refer to reworked, resedimented or allochthonous vitrinite. However, it is probable that the coal rank obtained for samples with fixed-carbon histograms that have a rather sharp mode value does represent the true rank of the stratum from which the sample originates.

b. Compatible fixed-carbon content

The compatible fixed-carbon content (compatible FCC) is that which is in accordance with the present depth of burial and age of the formation in question. Knowledge of the compatible FCC is required to indicate the zone of possible oil generation (so-called cooking pot) [7,8].

The dashed line in figure 2 indicates the compatible FCC. If only a solid line is given, the compatible FCC coincides with the so-called true-layer fixed-carbon content (true-layer FCC).

The compatible FCC values 60 and 75 indicate the limits of the zone in which oil generation may take place. Oil source rocks located within these limits are expected to generate oil. The major gas generation takes place below the level indicated by the compatible FCC 75.

In those cases where it can be assumed that the strata are presently at their maximum depth of burial, the compatible FCC also indicates the predicted true-layer FCC.

c. True-layer fixed-carbon content

The true-layer fixed-carbon content (true-layer FCC) is the FCC that a humic coal would have when subjected to the same burial as the formation in question.

The solid line in figure 2 is considered to indicate the trend of the true-layer FCC. It is based on those FCC values that are believed to be realiable. In this connection, it can be remarked that the standard deviation in the FCC measurement, including the variability occurring in nature, is 4 FCC units. The shape of the line, that is the rate of increase as a function of FCC is based on accumulated experience.

If the area has been uplifted, in the sense that the strata were once at greater depth, the true-layer FCC is higher than the compatible FCC. Source rocks with a true-layer FCC between 60 and 75 are mature for oil. If these source rocks have been uplifted, the true layer FCC is incompatible.

Mature source rocks for oil have generated oil when the relevant strata have dropped below the level of the compatible FCC 60. Mature source rocks for oil lying outside the interval between the compatible FCC 60 and 75 levels are not expected to generate oil at present.

IV. DISCUSSION AND CONCLUSIONS

Interval 6830 - 7100 ft (Kimmeridgian/Oxfordian) and interval 7280 - 7790 ft (Jurassic/Triassic ?) contain source rocks for oil.

Interval 7920 - 8950 ft (Triassic/Permian) and interval 10360 - 10540 ft (Permian) contain source rocks for oil. In these two intervals only interval 8885 - 8895 ft shows a gamma ray intensity which could confirm the presence of source rock. The gamma ray intensity of the other source rock intervals below 7920 ft is somewhat higher than the background radiation but does not reach a level beyond that of indicating clay or potassium salt.

Reliable true-layer DOM values could not be obtained.

The top of the zone of possible oil generation or cooking pot at the location of well 17/11-1, as indicated by the level of compatible FCC 60, is at about 8000 ft.

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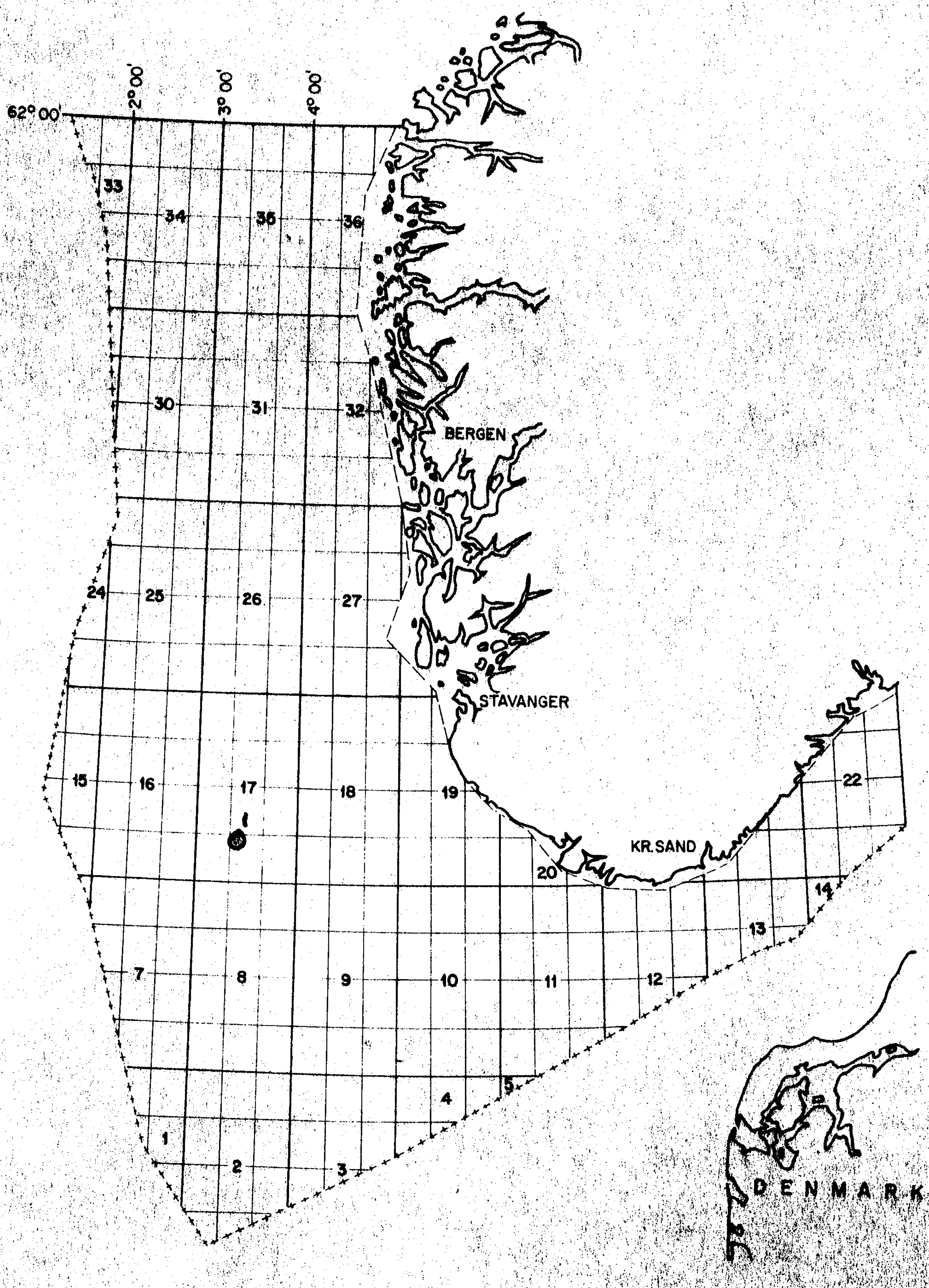
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2° 00'
3° 00'
4° 00'
33
34
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36
30
31
32
BERGEN
24
25
26
27
STAVANGER
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16
17
18
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22
KR. SAND
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14
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7
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9
10
11
12
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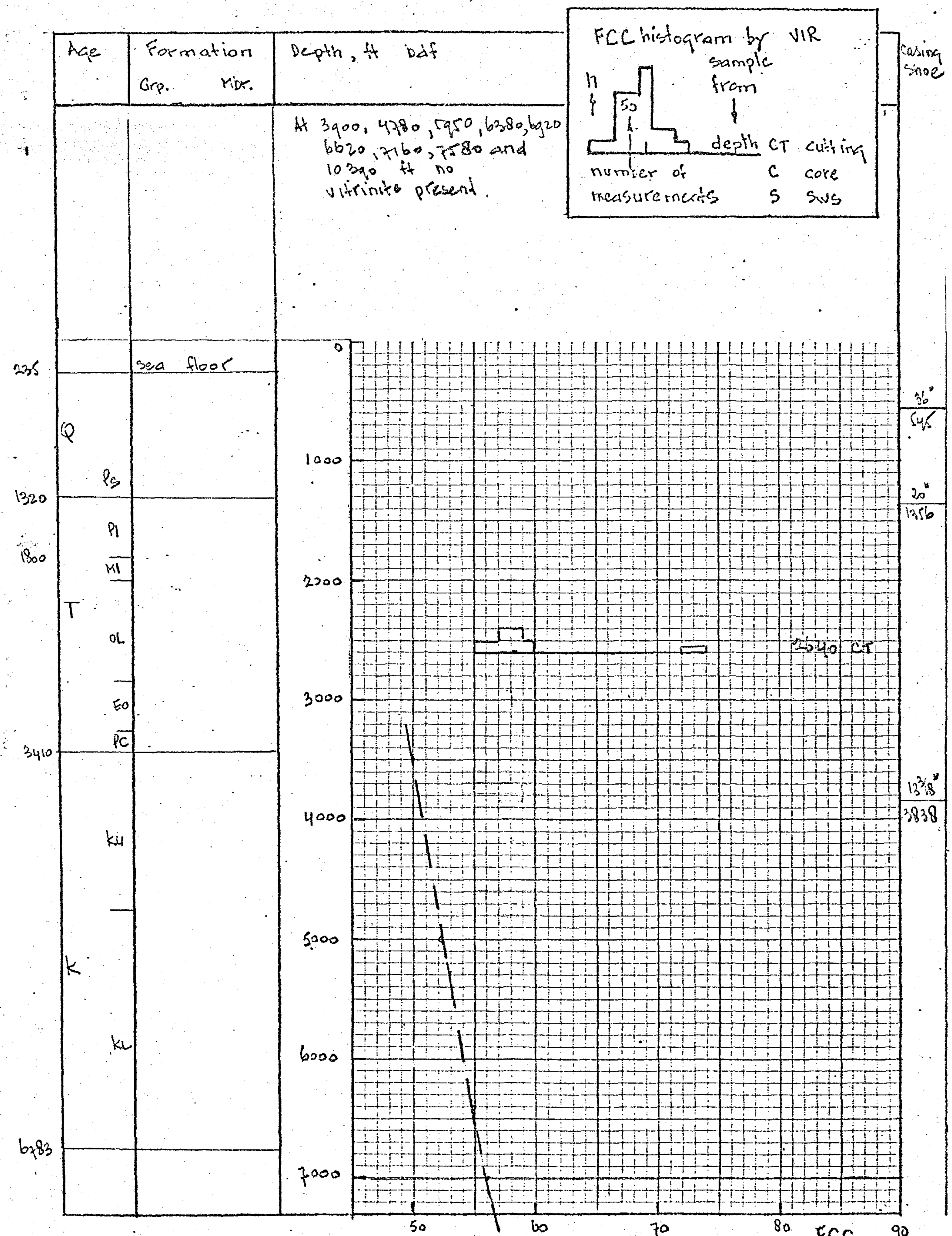
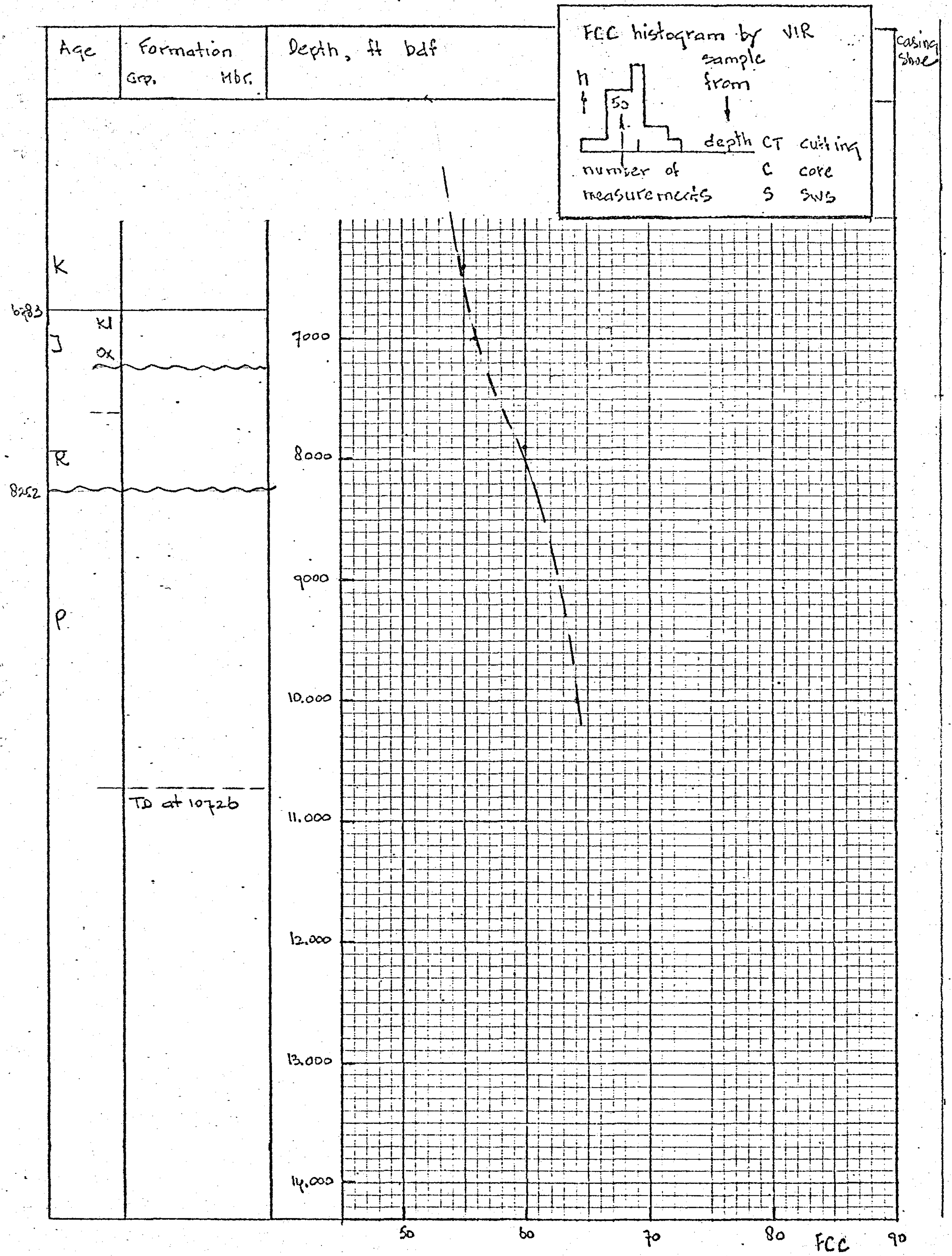
4
1
2
3
DENMARK

Fig. 1



FCC AS A FUNCTION OF DEPTH, WELL 17/11-1

FIG: 2a



FCC AS A FUNCTION OF DEPTH, WELL 17/11-1

FIG: 2b

GEOCHEMICAL LOG

WELL 17/11- 1

SCALE 1:5000

Koninklijke/Shell
Exploratie en Produktie Laboratorium

GEOCHEMICAL LOG
OF
17/11- 1
NORWAY

Author: DIW		Date: 23.10.73.
Rep: RKTR 0305.73	Encl: 1	Draw.no: II

9.12.895