

SAXO-1

Conventional core analysis for Amerada Hess
A/S. Well: Saxo-1, core: 1,2 and 3

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Conventional Core Analysis

For Amerada Hess A/S

Well: Saxo-1

Core 1,2 and 3

GEUS Core Laboratory

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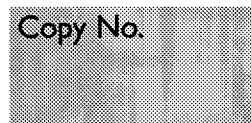
Core 1,2 and 3

GEUS Core Laboratory

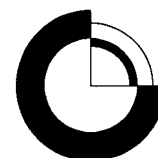
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1. Introduction

By request of AMERADA HESS A/S, GEUS Core Laboratory has carried out conventional core analysis on the exploration well Saxo-1.

The analytical programme was specified by Mr. Mads Sørensen and included the following services:

- Spectral core gamma log
- Preservation of core and plug samples
- Conventional plug analysis
- Core photography
- Lithological description of plugs

GEUS Core Laboratory received 3 cores from Saxo-1 on April 9 1997. A preliminary spectral core gamma log and several preliminary reports have been forwarded to AMERADA HESS A/S during April 1997.

2. Sampling and analytical procedure

The laboratory received 3 cores from Saxo-1 taken in the interval 3033 - 3103 meter measured depth. The 10 cm diameter cores were contained in aluminium sleeves and cut into sections of approximately 1 meter. A list of core boxes is given in table 2.1.

2.1 Spectral core gamma log

A spectral gamma log of the cores was recorded using a scanning speed of 1 cm per minute. The cores were retained in the aluminium sleeves. All data were later adjusted for an average activity from the sleeve and background.

Incomplete filling of the aluminium sleeves lead to erroneously low gamma activity at the junction between adjacent boxes. This effect has been corrected on the core gamma log. The extent of boxes are indicated as bars on the gamma log display to allow for evaluation.

2.2 Plugging

After the gamma scanning the sleeve was removed from the core and the following tasks were performed:

- 1 vertical plug was drilled at every meter of core (0 cm below top).
- 3 horizontal plugs were drilled at every meter of core (10, 40, 70 cm below top).
- 2 horizontal plugs were preserved at every second meter of core (75, 85 cm below top).
- 20 cm full core was preserved at every 3 meters (80 cm below top).

When a full core was preserved, then the preserved plugs were drilled at 55 and 60 cm below top. All the plugs were 1.5" diameter plugs and they were drilled using tap water as coolant. The full cores were cut using air as coolant. Figure 2.1 schematically shows the plugging program. A total of 335 plugs were drilled.

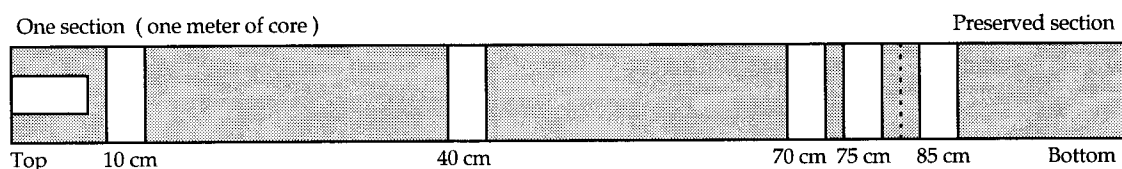


Figure 2.1: Plugging program illustrated on 1 meter of core. The grey areas represent the core and the white areas represent the plugs.

2.3 Preservation

A total of 23 full core sections were preserved by confinement in containers sealed by heat-shrinkable plastic hose. Brine was added in the containers to keep the samples wet. A list of the chemical composition is given in table 2.3 and a lists of preserved core sections are given in table 2.1. A total of 69 1.5" plugs were preserved in a similar way. A lists of preserved 1.5" plugs are given in table 2.2. The preserved core sections and plugs are stored at GEUS.

2.4 Slabbing and core photography

After plugging the cores were slabbed and photographed in white light as well as UV light. The photographs are attached to this report. During slabbing a slice with a thickness of 1 cm was cut, mounted on metal trays and later stored with the core material at GEUS.

2.5 Conventional core analysis

The plugs were cleaned in Soxhlet extractors and then dried at 110°C. Conventional core analysis including He-porosity, grain density and gas permeability was performed. The permeability was measured using a sleeve pressure of 400 psi.

2.6 Lithological description

The plugs were lithologically described by a geologist, and the descriptions are included with the core data tabulations.

2.7 Tables for Saxo-1

Table 2.1 Saxo-1. List of core boxes and preserved intervals.

Core no. 1: 3033.75 - 3052.00 m.

Box	Depth [m]	Preserved interval
1	3033.75 - 3034.75	3034.55 - 3034.75
2	3034.75 - 3035.75	
3	3035.75 - 3036.75	
4	3036.75 - 3037.75	3037.53 - 3037.75
5	3037.75 - 3038.75	
6	3038.75 - 3039.75	
7	3039.75 - 3040.75	3040.55 - 3040.75
8	3040.75 - 3041.75	
9	3041.75 - 3042.45	
10	3042.45 - 3042.75	
11	3042.75 - 3043.75	3043.55 - 3043.75
12	3043.75 - 3044.75	
13	3044.75 - 3045.75	
14	3045.75 - 3046.75	3046.55 - 3046.75
15	3046.75 - 3047.75	
16	3047.75 - 3048.75	
17	3048.75 - 3049.75	3049.57 - 3049.75
18	3049.75 - 3050.75	
19	3050.75 - 3051.60	
20	3051.60 - 3051.70	
21	3051.70 - 3051.85	
22	3051.85 - 3052.00	

Core no. 2: 3052.00 - 3079.72 m.

Box	Depth [m]	Preserved interval
1	3052.00 - 3053.00	3052.81 - 3053.00
2	3053.00 - 3054.00	
3	3054.00 - 3055.00	
4	3055.00 - 3056.00	3055.81 - 3056.00
5	3056.00 - 3057.00	
6	3057.00 - 3058.00	
7	3058.00 - 3059.00	3058.80 - 3059.00
8	3059.00 - 3060.00	
9	3060.00 - 3061.04	
10	3061.04 - 3062.00	3061.80 - 3062.00
11	3062.00 - 3063.00	
12	3063.00 - 3064.00	
13	3064.00 - 3065.00	3064.80 - 3065.00
14	3065.00 - 3066.00	
15	3066.00 - 3067.00	
16	3067.00 - 3068.00	3067.80 - 3068.00
17	3068.00 - 3069.00	
18	3069.00 - 3070.00	
19	3070.00 - 3070.22	
20	3070.22 - 3071.00	
21	3071.00 - 3072.00	3071.79 - 3072.00
22	3072.00 - 3073.00	
23	3073.00 - 3074.00	
24	3074.00 - 3075.00	3074.80 - 3075.00
25	3075.00 - 3076.00	
26	3076.00 - 3077.00	
27	3077.00 - 3078.00	3077.81 - 3078.00
28	3078.00 - 3079.00	
29	3079.00 - 3079.34	
30	3079.34 - 3079.72	

Core no. 3: 3079.72 - 3103.04 m.

Box	Depth [m]	Preserved interval
1	3079.34 - 3080.00	
2	3080.00 - 3081.00	3080.79 - 3081.00
3	3081.00 - 3082.00	
4	3082.00 - 3083.00	
5	3083.00 - 3084.00	3083.80 - 3084.00
6	3084.00 - 3084.55	
7	3084.55 - 3085.00	
8	3085.00 - 3086.00	
9	3086.00 - 3087.00	3086.80 - 3087.00
10	3087.00 - 3088.00	
11	3088.00 - 3089.00	
12	3089.00 - 3090.00	3089.80 - 3090.00
13	3090.00 - 3091.00	
14	3091.00 - 3092.00	
15	3092.00 - 3093.00	3092.82 - 3093.00
16	3093.00 - 3093.73	
17	3093.73 - 3094.00	
18	3094.00 - 3095.00	
19	3095.00 - 3096.00	3095.80 - 3096.00
20	3096.00 - 3097.00	
21	3097.00 - 3098.00	
22	3098.00 - 3099.00	3098.78 - 3099.00
23	3099.00 - 3100.00	
24	3100.00 - 3101.00	
25	3101.00 - 3102.00	3101.78 - 3102.00
26	3102.00 - 3102.90	
27	3102.90 - 3103.04	

Table 2.2 Saxo-1. List of preserved 1.5 inch plugs.

Plug	Core	Box	Depth	Plug	Core	Box	Depth
501	1	2	3035.50	531	2	13	3064.55
502		2	3035.58	532		13	3064.60
503		4	3037.28	533		15	3066.75
504		4	3037.33	534		15	3066.85
505		6	3039.50	535		17	3068.75
506		6	3039.60	536		17	3068.85
507		8	3041.50	537		20	3070.77
508		8	3041.60	538		20	3070.82
509		10	3042.65	539		22	3072.75
510		10	3042.70	540		22	3072.85
511		12	3044.50	541		24	3074.55
512		12	3044.60	542		24	3074.60
513		14	3046.35	543		26	3076.75
514		14	3046.50	544		26	3076.85
515		16	3048.50	545		28	3078.75
516		16	3048.60	546		28	3078.85
517		18	3050.50	547	3	2	3080.55
518		18	3050.60	548		2	3080.60
519	2	1	3052.55	549		4	3082.75
520		1	3052.60	550		4	3082.85
521		3	3054.75	551		7	3084.80
522		3	3054.85	552		7	3084.85
523		5	3056.75	553		9	3086.50
524		5	3056.85	554		9	3086.55
525		7	3058.55	555		11	3088.75
526		7	3058.60	556		11	3088.85
527		9	3060.75	557		13	3090.75
528		9	3060.85	558		13	3090.85
529		11	3062.75	559		15	3092.55
530		11	3062.85	560		15	3092.60

Table 2.2 (continued) Saxo-1. List of preserved 1.5 inch plugs.

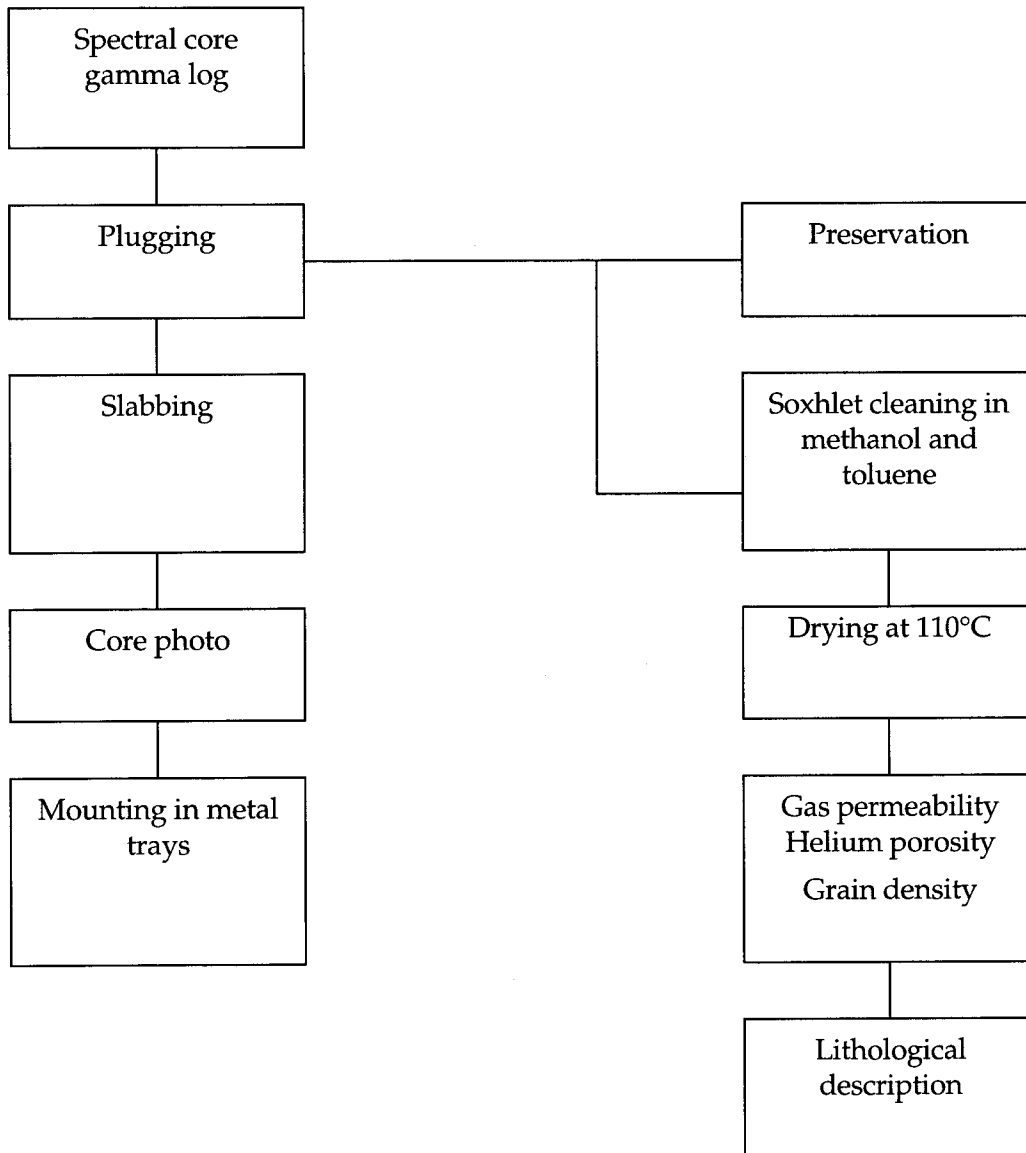
Plug	Core	Box	Depth
561	3	18	3094.75
562		18	3094.85
563		20	3096.75
564		20	3096.85
565		22	3098.20

Plug	Core	Box	Depth
566	4	24	3100.55
567		24	3100.70
568		26	3102.04
569		26	3102.59

Table 2.3 Chemical composition of the brine.

Component	Concentration [mg./l.]
Cl ⁻	109960
Na ⁺	60000
Ca ²⁺	8600
Mg ²⁺	1640
K ⁺	370

3. Flow chart of the analytical procedure



4. Analytical methods

The following is a short description of the methods used by the GEUS Core Laboratory. For a more detailed description of methods, instrumentation and principles of calculation the reader is referred to API recommended practice for core analysis procedure (API RP 40, 1960).

4.1 Spectral core gamma log

The natural gamma radiation of a core is recorded within an energy window of 0.5 - 3.0 MeV, using TI activated NaI scintillation detectors (Bicron), connected to a multichannel analyzer (Canberra).

The core is passed through a lead shielded tunnel at constant speed, with the gamma activity being continuously recorded. Refer to chapter 2 for the scanning speed used. The integrated gamma activity is recorded at regular intervals, either every 10 cm or every 3". The gamma activity represents the mean activity over a 10 cm or 3" interval, the assigned depth being the middle of the interval. The measured gamma activity is corrected for background activity, and in the case of sleeved core, also for activity of the sleeve. Gamma activity is reported in counts per minute (cpm). The following empirical relationship between cpm and GAPI has been established.

$$\text{cpm} = 18.2 * \text{GAPI}$$

The relationship should be used as a guideline only. Radiation from decay of potassium and the uranium and thorium decay series are recorded in separate energy windows. Concentrations are calculated using synthetical standards of concrete doped with radioactive minerals in decay equilibrium. Concentrations of K, U and Th are reported as % K, ppm U and ppm Th, respectively. Relevant ratios are given.

4.2 Conventional cleaning and drying

The plugs are drilled and trimmed to a size of 1.5" diameter and 2.5" length. The samples are then placed in a Soxhlet extractor, which continuously soaks and washes the samples with methanol. This process removes water and dissolves salt precipitated in the pore space of the rock. Extraction is terminated when no chloride ions are present in the methanol. Samples containing hydrocarbons are then cleaned in toluene until a clear solution is obtained. Samples are vacuum dried at 110°C.

4.3 Gas permeability

The plug is mounted in a Hassler core holder, and a confining pressure of 400 psi is applied to the sleeve. The specific permeability to gas is measured by flowing nitrogen gas through a plug of known dimensions at differential pressures between 0 and 1 bar. No back pressure is applied. The readings of the digital gas permeameter are checked regularly by routine measurement of permeable steel reference plugs.

4.4 He-porosity and grain density

The porosity is measured on cleaned and dried samples. The porosity is determined by subtraction of the measured grain volume and the measured bulk volume. The Helium technique, employing Boyle's Law, is used for grain volume determination, applying a double chambered Helium porosimeter with digital readout, whereas bulk volume is measured by submersion of the plug in a mercury bath using Archimedes principle. Grain density is calculated from the grain volume measurement and the weight of the cleaned and dried sample.

4.5 Precision of analytical data

The table below gives the precision (= reproducibility) at the 68% level of confidence (+/- 1 standard deviation) for routine core analysis measurements performed at the GEUS Core Laboratory.

Measurement	Range, mD	Precision
Grain density		0.003 g/cc
Porosity		0.1 porosity-%
Gas Permeability	0.001-0.01	25%
	0.01-0.1	15%
	> 0.1	4%

The reproducibility (precision) of the total gamma activity analysis is calculated from counting statistics. The following list shows the dependency of reproducibility on count rate at the 2 standard deviation level.

Count rate (cpm)	Reproducibility (cpm)
125	7.1
250	10.0
500	14.2
1000	20.1
2000	28.4
4000	40.2

Reproducibility (precision) of the amount of uranium, thorium and potassium from gamma radiation is dependent on concentration. Two values for reproducibility are given, one for normal to high concentration range, and one for low concentration range. The latter also defines the detection limit (LLD). The reproducibility values are applicable to total gamma activity above and below 800 cpm, respectively.

	K(%)	U(ppm)	Th(ppm)
Reproducibility			
Normal to high range	0.07	0.69	0.61
Low range (LLD)	0.01	0.27	0.19
Accuracy	0.05	0.24	0.21

Accuracy is calculated as mean deviation from the accepted concentration of one internal standard. This value is only applicable to low concentrations. For high concentrations the high range reproducibility may serve as an approximation to accuracy. Accuracy is reported as an arithmetic mean.

5. Results of conventional core analysis

The results are presented in the following data listing and in frequency plots of:

- Gas permeability
- Porosity
- Grain density

Attached to the presented report are:

- A core log plotting Depth vs.
Vertical Gas permeability , Horizontal Gas permeability , Porosity , Grain density.
- A gamma log plotting Depth vs.
Thorium , Uranium , Potassium , Total gamma activity.
- Core photography

ABBREVIATION FOR LITHOLOGICAL DESCRIPTIONS.

Rock type	carb	Carbonate	Miscellaneous	arg	Argillaceous
	cly	Claystone		art	Artificial
	slt	Siltstone		bit	Bituminous
	sst	Sandstone		calc	Calcareous
	cngl	Conglomerate		ccem	Calcite cemented
	htrl	Heterolith		cem	Cemented
Grain size	vf-	Very fine grained	dom	Dominantly	
	f-	Fine grained	hrd	Hard	
		ex. fsst = fine grained sst	hom	Homogeneous	
	m-	Medium grained	ids	Indistinct	
	c-	Coarse grained	mot	Mottled	
	vc-	Very coarse grained	prt	Partly	
	unsrt	Unsorted	slg	Slightly	
			sme	Some	
			sort	Sorting	
			str	Strongly	
Colour	blk	Black	thn	Thin	
	br	Brown	tot	Total	
	gn	Green	w	With	
	gy	Grey			
	ol	Olive			
	rd	Red	Fractures	FRC	Fracture
	wh	White		FT FRC	Fatal fracture
	vl-	Very light		SG FRC	Significant fracture
	l-	Light, ex. lgy = light grey		F FRC	Fine fracture
	ml-	Medium light		H FRC	Hairline
	m-	Medium	Minerals	cal	Calcitic
	md-	Medium dark		carb	Carbonate
	d-	Dark		kaol	Kaolinite
-sh	-ish, ex. brsh = brownish		mica	Mica flakes	
var	Varioloured		qtz	Quartz/silica	
			py	Pyrite	
Structures	bed	Bedding			
	bio	Bioturbation			
	bur	Burrow(-s)			
	cla	Clast(-s)			
	crs	Crossbedding			
	cvn	Calcite vein(-s)			
	domn	Domains			
	fos	Fossil (-s)			
	frg	Fragment(-s)			
	lam	Lamina/lamination			
	pynd	Pyrite nodule(-s)			
	shl	Shell fragment(-s)			
	slmp	Slumped			
	sol sm	Solution seam(-s)			
	strp	Stripe			
sty	Stylolite seam(-s)				

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
1	3033.75	VERT	31.2	23.29	2.658	msst, lgy, w thn cly lam
2	3033.85	HOR	24.5	22.22	2.654	msst, lgy, w thn cly lam
3	3034.15	HOR	265	23.64	2.648	msst, lgy, ids bed
4	3034.45	HOR	776	25.36	2.661	msst, lgy, ids bed
5	3034.75	VERT	560	26.47	2.653	msst, lgy, ids bed
6	3034.87	HOR		26.84	2.652	msst, lgy, ids bed
7	3035.15	HOR	971	27.89	2.655	msst, lgy, ids bed
8	3035.45	HOR	1920	29.18	2.660	msst, lgy, ids bed
9	3035.75	VERT		4.29	2.674	msst, lgy, ids bed, tot ccem
10	3035.85	HOR	0.077	3.16	2.670	msst, lgy, ids bed, tot ccem
11	3036.15	HOR	0.476	5.30	2.674	msst, lgy, ids bed, tot ccem
12	3036.45	HOR	0.106	4.80	2.671	msst, lgy, ids bed, tot ccem
13	3036.75	VERT	1280	29.40	2.655	msst, lgy, ids bed
14	3036.85	HOR	1530	29.93	2.653	msst, lgy, ids bed
15	3037.15	HOR	1850	31.05	2.651	msst, lgy, ids bed
16	3037.45	HOR	1630	30.01	2.652	msst to fsst, lgy, ids bed
17	3037.75	VERT	779	27.12	2.654	msst to fsst, lgy, ids bed
18	3037.85	HOR	1200	28.27	2.652	msst to fsst, lgy, ids bed
19	3038.15	HOR	1230	29.88	2.655	msst to fsst, lgy, ids bed
20	3038.45	HOR	524	28.82	2.649	msst to fsst, lgy, prt kaol cem
21	3038.75	VERT	9.69	10.09	2.672	msst to fsst, lgy, str ccem
22	3038.85	HOR	17.0	8.64	2.670	msst to fsst, lgy, str ccem

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
23	3039.11	HOR	1510	29.89	2.650	msst, lgy, ids bed
24	3039.45	HOR	2170	31.84	2.647	msst, lgy, ids bed
25	3039.75	VERT	2280	32.11	2.654	msst, lgy, ids bed
26	3039.85	HOR	2220	32.24	2.671	msst, lgy, ids bed
27	3040.15	HOR	2250	32.08	2.649	msst, lgy, ids bed
28	3040.45	HOR	1700	30.19	2.644	msst, lgy, ids bed
29	3040.75	VERT	1760	31.77	2.651	msst, lgy, ids bed
30	3040.85	HOR	1920	31.78	2.649	msst, lgy, ids bed
31	3041.15	HOR	1750	31.76	2.650	msst, lgy, ids bed
32	3041.42	HOR	2280	32.81	2.646	msst, lgy, ids bed
33	3041.75	VERT	1250	28.60	2.650	msst to fsst, lgy, ids bed
34	3041.85	HOR	1730	29.26	2.649	msst to fsst, lgy, ids bed
35	3042.15	HOR	1780	30.24	2.646	msst to fsst, lgy, slg kaol cem, w FRC
36	3042.35	HOR	1790	30.15	2.648	msst to fsst, lgy, ids bed
37	3042.75	HOR	1260	29.52	2.652	msst to fsst, lgy, slg kaol cem
38	3042.85	HOR	978	28.97	2.650	msst to fsst, lgy, prt kaol cem
39	3043.15	HOR	1220	29.20	2.647	msst to fsst, lgy, prt kaol cem
40	3043.45	HOR	1300	27.27	2.649	fsst, lgy, ids bed
41	3043.75	VERT	1100	28.04	2.650	fsst, lgy, ids bed
42	3043.85	HOR	1160	27.57	2.650	fsst, lgy, ids bed
43	3044.15	HOR	942	25.18	2.650	fsst, lgy, ids bed
44	3044.45	HOR	857	25.80	2.650	fsst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
45	3044.75	VERT	662	24.68	2.652	fsst, lgy, ids bed
46	3044.85	HOR	1060	26.14	2.651	fsst, lgy, ids bed
47	3045.15	HOR	582	21.19	2.660	fsst, lgy, ids bed
48	3045.45	HOR	817	19.77	2.650	msst to fsst, lgy, ids bed
49	3045.75	VERT	2690	26.54	2.647	msst, lgy, ids bed
50	3045.85	HOR	2540	25.76	2.649	msst, lgy, ids bed
51	3046.15	HOR	2380	25.21	2.648	msst, lgy, ids bed
52	3046.45	HOR	2310	25.22	2.651	msst, lgy, ids bed
53	3046.75	VERT	2290	24.40	2.650	msst, lgy, ids bed
54	3046.85	HOR	1990	24.66	2.650	msst, lgy, ids bed
55	3047.15	HOR	2230	25.32	2.649	msst, lgy, ids bed
56	3047.45	HOR	2080	25.14	2.651	msst, lgy, ids bed
57	3047.75	VERT	415	21.46	2.652	msst and fsst, lgy, bed, w cly lam
58	3047.85	HOR	2170	24.17	2.651	msst, lgy, ids bed
59	3048.15	HOR	2020	24.95	2.651	msst, lgy, ids bed
60	3048.45	HOR	1960	23.25	2.654	msst, lgy, ids bed
61	3048.75	VERT	1800	24.13	2.649	msst, lgy, ids bed
62	3048.85	HOR	2040	24.29	2.650	msst, lgy, ids bed
63	3049.15	HOR	1740	22.89	2.649	msst, lgy, ids bed
64	3049.45	HOR	2050	24.44	2.649	msst, lgy, ids bed
65	3049.75	VERT	2200	25.09	2.649	msst, lgy, ids bed
66	3049.85	HOR	1830	24.14	2.649	msst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS		GRAIN		COMMENT
			PERM mD	POROSITY %	DENS. G/CCM		
67	3050.15	HOR	2030	25.77	2.649	msst to fsst, lgy, ids bed	
68	3050.45	HOR	1810	25.44	2.649	msst to fsst, lgy, ids bed	
69	3050.75	VERT	1160	24.09	2.647	msst to fsst, lgy, ids bed	
70	3050.85	HOR	1470	24.67	2.648	msst to fsst, lgy, ids bed	
71	3051.15	HOR	1310	24.14	2.648	msst to fsst, lgy, ids bed	
72	3051.35	HOR	1540	25.50	2.646	msst, lgy, ids bed	
73	3051.80	HOR	1470	25.10	2.652	msst, lgy, ids bed	
74	3051.95	HOR	1320	25.20	2.650	msst, lgy, ids bed	
75	3052.00	VERT	701	23.79	2.651	fsst, lgy, ids bed	
76	3052.10	HOR	924	23.52	2.653	msst to fsst, lgy, ids bed	
77	3052.40	HOR	1300	23.86	2.650	msst to fsst, lgy, ids bed	
78	3052.70	HOR	1290	24.21	2.649	msst to fsst, lgy, ids bed	
79	3053.00	VERT	1380	25.13	2.648	msst to fsst, lgy, ids bed	
80	3053.10	HOR	1720	25.99	2.648	msst to fsst, lgy, ids bed	
81	3053.40	HOR	1510	23.85	2.650	msst to fsst, lgy, ids bed	
82	3053.70	HOR	1290	25.43	2.649	msst to fsst, lgy, ids bed	
83	3054.00	VERT	1060	25.28	2.651	fsst, lgy, ids bed	
84	3054.10	HOR	926	24.26	2.648	fsst, lgy, ids bed	
85	3054.40	HOR	562	22.27	2.652	fsst, lgy, ids bed	
86	3054.70	HOR	855	24.00	2.653	fsst, lgy, ids bed	
87	3055.00	VERT	1110	25.37	2.650	fsst, lgy, ids bed	
88	3055.10	HOR	1300	25.68	2.655	msst to fsst, lgy, ids bed	

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
89	3055.40	HOR	1050	24.82	2.653	msst to fsst, lgy, ids bed
90	3055.70	HOR	1260	24.86	2.650	msst to fsst, lgy, ids bed
91	3056.00	VERT	1560	26.33	2.650	fsst, lgy, ids bed
92	3056.10	HOR	1240	25.98	2.650	msst to fsst, lgy, ids bed
93	3056.40	HOR	1320	26.01	2.650	msst to fsst, lgy, ids bed
94	3056.70	HOR	1300	26.45	2.650	msst to fsst, lgy, ids bed
95	3057.00	VERT	959	26.89	2.653	msst to fsst, lgy, ids bed
96	3057.10	HOR	810	25.76	2.654	msst to fsst, lgy, ids bed
97	3057.40	HOR	236	20.40	2.655	fsst, lgy, ids bed
98	3057.70	HOR	1490	30.10	2.650	msst to fsst, lgy, ids bed
99	3058.00	VERT	1540	29.97	2.652	msst to fsst, lgy, ids bed
100	3058.10	HOR	1500	29.95	2.650	msst to fsst, lgy, ids bed
101	3058.40	HOR	1580	29.05	2.649	msst, lgy, ids bed
102	3058.70	HOR	1920	29.52	2.648	msst, lgy, ids bed
103	3059.00	VERT	1850	30.51	2.651	msst, lgy, ids bed
104	3059.10	HOR	1500	29.75	2.650	msst, lgy, ids bed
105	3059.40	HOR	1580	30.18	2.651	msst to fsst, lgy, ids bed
106	3059.70	HOR	1200	29.44	2.652	msst to fsst, lgy, ids bed
107	3060.00	VERT	804	29.50	2.649	msst to fsst, lgy, ids bed
108	3060.10	HOR	1290	30.65	2.650	msst to fsst, lgy, ids bed
109	3060.40	HOR	1350	30.59	2.653	msst to fsst, lgy, ids bed
110	3060.70	HOR	1190	28.61	2.654	msst to fsst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
111	3061.25	VERT	1530	30.33	2.652	msst to fsst, lgy, ids bed
112	3061.34	HOR	1490	29.44	2.649	msst to fsst, lgy, ids bed
113	3061.44	HOR	1100	28.90	2.649	msst, lgy, ids bed
114	3061.74	HOR	1470	31.34	2.650	msst to fsst, lgy, ids bed
115	3062.00	VERT	262	27.12	2.660	fsst, lgy, ids bed
116	3062.10	HOR	327	26.72	2.661	fsst, lgy, ids bed
117	3062.40	HOR	1450	30.64	2.653	msst to fsst, lgy, ids bed
118	3062.68	HOR	1320	30.34	2.655	msst to fsst, lgy, ids bed
119	3063.00	VERT	907	31.08	2.654	msst to fsst, lgy, ids bed
120	3063.10	HOR	1240	30.76	2.654	msst to fsst, lgy, ids bed
121	3063.40	HOR	511	28.95	2.661	fsst, lgy, ids bed
122	3063.70	HOR	1200	32.25	2.654	msst to fsst, lgy, ids bed
123	3064.00	VERT	917	30.67	2.646	msst to fsst, lgy, ids bed
124	3064.10	HOR	650	28.90	2.651	msst to fsst, lgy, ids bed
125	3064.40	HOR	742	29.77	2.653	fsst, lgy, ids bed
126	3064.70	HOR	433	28.46	2.655	fsst, lgy, ids bed
127	3065.00	VERT	49.4	24.48	2.661	vfsst, lgy, ids bed
128	3065.09	HOR	452	28.58	2.657	fsst, lgy, ids bed
129	3065.40	HOR	11.6	27.99	2.660	fsst, lgy, ids bed
130	3065.70	HOR	264	27.75	2.658	fsst, lgy, ids bed
131	3066.00	VERT	13.4	24.98	2.660	vfsst, lgy, ids bed
132	3066.10	HOR	193	27.39	2.658	fsst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
133	3066.40	HOR	249	27.31	2.656	fsst, lgy, ids bed
134	3066.70	HOR	486	29.76	2.651	fsst, lgy, ids bed
135	3067.00	VERT	38.0	25.42	2.657	fsst, lgy, ids bed
136	3067.10	HOR	161	25.26	2.656	fsst, lgy, ids bed
137	3067.40	HOR	273	27.43	2.656	fsst, lgy, ids bed
138	3067.70	HOR	294	27.07	2.656	vfsst, lgy, ids bed
139	3068.00	VERT	609	29.35	2.653	fsst, lgy, ids bed
140	3068.10	HOR	685	27.98	2.651	fsst, lgy, ids bed
141	3068.40	HOR	1.20	11.83	2.677	fsst, lgy, tot ccem, w kaol veins
142	3068.70	HOR	730	27.99	2.652	msst to fsst, lgy, ids bed
143	3069.00	VERT	883	27.49	2.649	msst, lgy, ids bed
144	3069.10	HOR	1370	28.19	2.646	msst, lgy, ids bed
145	3069.35	HOR	1530	28.23	2.644	msst, lgy, ids bed
146	3069.70	HOR	2010	28.51	2.644	msst, lgy, ids bed
147	3070.10	HOR		31.10	2.641	msst, lgy, ids bed
148	3070.22	VERT	1960	30.60	2.646	msst, lgy, ids bed
149	3070.32	HOR	2120	29.89	2.645	msst, lgy, ids bed
150	3070.42	HOR	2110	29.28	2.643	msst, lgy, ids bed
151	3070.90	HOR	2320	29.73	2.649	msst, lgy, ids bed
152	3071.00	VERT	2420	29.72	2.645	msst, lgy, ids bed
153	3071.10	HOR	2930	31.22	2.643	msst, lgy, ids bed
154	3071.40	HOR	1960	27.57	2.646	msst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
155	3071.70	HOR	1570	24.34	2.643	msst to fsst, lgy, ids bed
156	3072.00	VERT	399	22.91	2.646	msst to fsst, lgy, ids bed
157	3072.10	HOR	2440	25.65	2.646	csst to msst, lgy, ids bed
158	3072.40	HOR	1700	26.43	2.644	msst to fsst, lgy, ids bed
159	3072.70	HOR	3030	26.74	2.643	csst to msst, lgy, ids bed
160	3073.00	VERT	2010	26.46	2.645	csst to msst, lgy, hom
161	3073.10	HOR	2880	26.99	2.645	csst to msst, lgy, hom
162	3073.40	HOR	2590	26.75	2.641	csst to msst, lgy, hom
163	3073.75	HOR		14.13	2.642	cngl, msst to pebble, hom, w kaol cem
164	3074.00	VERT	2900	25.51	2.643	msst, lgy, hom
165	3074.10	HOR	1150	24.02	2.643	msst to fsst, lgy, ids bed
166	3074.40	HOR	2450	20.39	2.644	cngl, msst to pebble, hom, w kaol cem
167	3074.70	HOR	2650	25.31	2.643	msst, lgy, ids bed
168	3075.00	VERT	2500	24.99	2.645	msst, lgy, ids bed
169	3075.10	HOR	2340	24.73	2.645	msst, lgy, ids bed
170	3075.40	HOR	1740	24.13	2.644	msst, lgy, ids bed
171	3075.70	HOR	2420	24.71	2.646	msst, lgy, ids bed
172	3076.00	VERT	2490	24.96	2.643	msst, lgy, ids bed
173	3076.10	HOR	2160	25.34	2.645	msst, lgy, ids bed
174	3076.40	HOR	2090	23.89	2.644	msst, lgy, ids bed
175	3076.70	HOR	2240	23.88	2.644	msst, lgy, ids bed
176	3077.00	VERT	2410	24.49	2.644	msst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS		GRAIN		COMMENT
			PERM mD	POROSITY %	DENS. G/CCM		
177	3077.10	HOR	2170	23.58	2.645	msst, lgy, ids bed	
178	3077.40	HOR	2110	23.23	2.646	msst, lgy, ids bed	
179	3077.70	HOR	2180	23.94	2.645	msst, lgy, ids bed	
180	3078.00	VERT	1960	23.69	2.644	msst, lgy, ids bed	
181	3078.10	HOR	2280	25.10	2.645	msst, lgy, ids bed	
182	3078.40	HOR	2230	24.07	2.644	msst, lgy, ids bed	
183	3078.70	HOR	2270	24.03	2.645	msst, lgy, ids bed	
184	3079.00	VERT	2150	23.43	2.645	msst, lgy, ids bed	
185	3079.10	HOR	1950	22.60	2.646	msst, lgy, ids bed	
186	3079.35	HOR	2040	24.02	2.646	msst, lgy, ids bed	
187	3079.60	HOR	2280	24.43	2.644	msst, lgy, ids bed	
188	3079.72	VERT	1630	22.79	2.646	msst, lgy, ids bed	
189	3079.82	HOR	2170	24.70	2.645	msst, lgy, ids bed	
190	3080.00	VERT	1880	24.20	2.644	msst, lgy, ids bed	
191	3080.10	HOR	1920	23.33	2.645	msst, lgy, ids bed	
192	3080.40	HOR	2100	23.64	2.643	msst, lgy, ids bed	
193	3080.70	HOR	2260	24.50	2.644	msst, lgy, ids bed	
194	3081.00	VERT	1710	24.12	2.644	msst to fsst, lgy, ids bed	
195	3081.10	HOR	1830	24.77	2.641	msst to fsst, lgy, ids bed	
196	3081.40	HOR	1650	23.70	2.643	msst to fsst, lgy, ids bed	
197	3081.70	HOR	1600	24.04	2.643	msst to fsst, lgy, ids bed	
198	3082.00	VERT	1540	22.90	2.649	msst, lgy, ids bed	

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS		GRAIN		COMMENT
			PERM mD	POROSITY %	DENS. G/CCM		
199	3082.10	HOR	1740	23.07	2.649		csst to msst, lgy, ids bed
200	3082.40	HOR	2180	23.77	2.647		csst to msst, lgy, ids bed
201	3082.70	HOR	1660	20.66	2.647		msst, lgy, ids bed
202	3083.00	VERT	1840	23.34	2.643		msst, lgy, ids bed
203	3083.10	HOR	2240	24.48	2.644		msst, lgy, ids bed
204	3083.40	HOR	2530	24.27	2.635		msst, lgy, ids bed, w coal
205	3083.70	HOR	2110	22.84	2.644		msst, lgy, ids bed
206	3084.00	VERT	2400	24.16	2.644		msst, lgy, ids bed
207	3084.10	HOR	1780	24.54	2.644		msst, lgy, ids bed
208	3084.40	HOR	2240	24.00	2.642		msst, lgy, ids bed, w coal
209	3084.67	HOR	2100	22.79	2.642		msst, lgy, ids bed
210	3085.00	VERT	1810	23.28	2.645		msst, lgy, ids bed
211	3085.10	HOR	1570	22.67	2.646		msst, lgy, ids bed
212	3085.40	HOR	2280	23.56	2.647		msst, lgy, ids bed
213	3085.70	HOR	2540	25.07	2.646		msst, lgy, ids bed
214	3086.00	VERT	2470	25.00	2.644		msst, lgy, ids bed
215	3086.10	HOR	2390	24.78	2.646		msst, lgy, ids bed
216	3086.40	HOR	2930	26.15	2.644		msst, lgy, ids bed
217	3086.70	HOR	2310	24.75	2.647		msst, lgy, ids bed, w koal vein
218	3087.00	VERT	2530	25.07	2.647		msst, lgy, ids bed
219	3087.10	HOR	2630	25.22	2.645		msst, lgy, ids bed
220	3087.40	HOR	2690	24.82	2.646		msst, lgy, ids bed

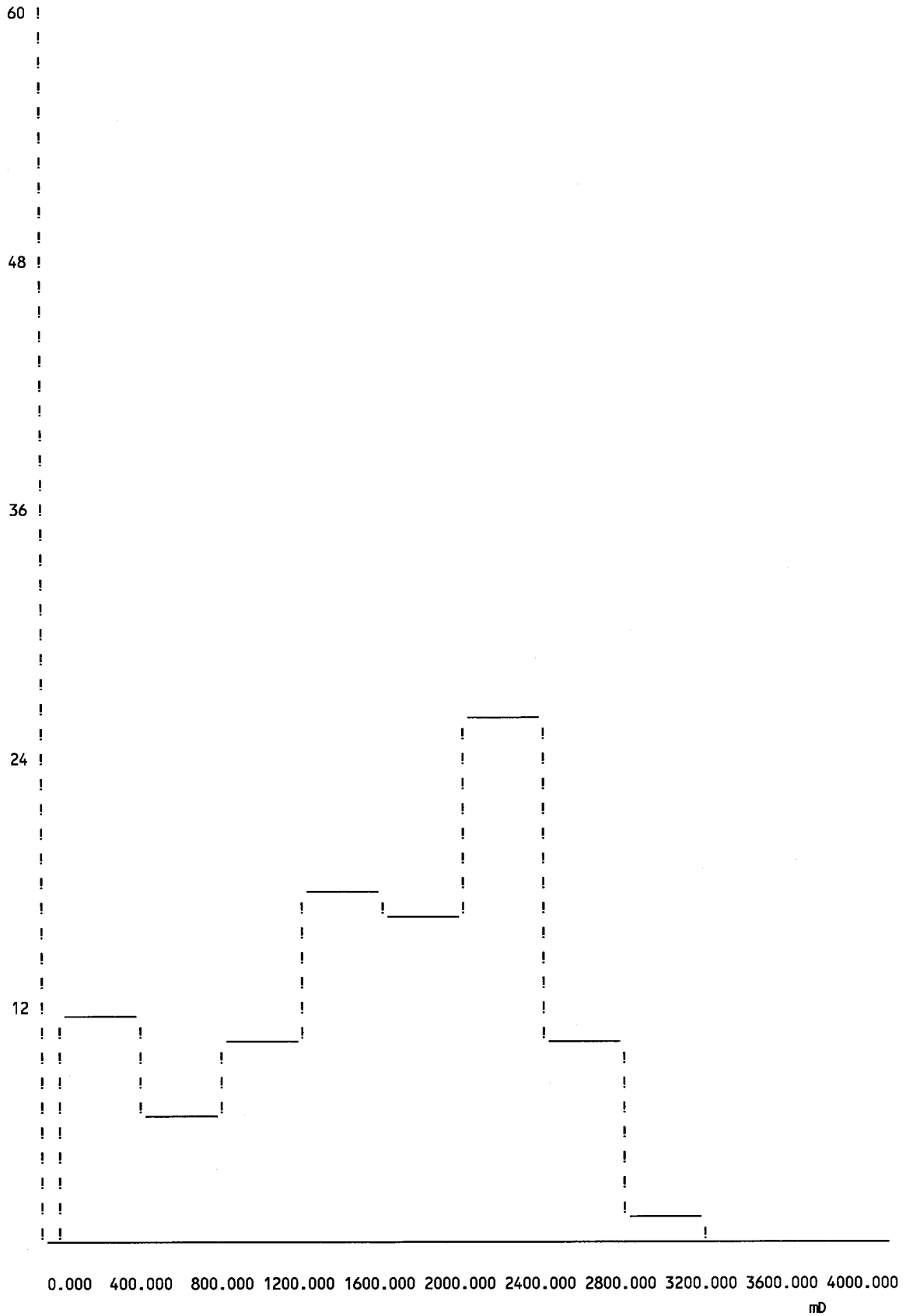
SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS PERM mD	POROSITY %	GRAIN DENS. G/CCM	COMMENT
221	3087.70	HOR	2760	24.52	2.643	msst, lgy, ids bed, w coal frg
222	3088.00	VERT	2760	23.42	2.646	msst/cngl, lgy, hom
223	3088.10	HOR		21.90	2.647	msst/cngl, lgy, hom
224	3088.40	HOR	2260	23.60	2.648	msst, lgy, ids bed
225	3088.70	HOR	2550	24.27	2.644	msst, lgy, ids bed
226	3089.00	VERT	2420	23.76	2.646	msst, lgy, ids bed
227	3089.10	HOR	2340	24.18	2.648	msst, lgy, ids bed
228	3089.40	HOR	2280	24.32	2.646	msst, lgy, ids bed
229	3089.70	HOR	2430	24.48	2.648	msst, lgy, ids bed
230	3090.00	VERT	2290	23.41	2.647	msst, lgy, ids bed
231	3090.10	HOR	2140	23.38	2.646	msst, lgy, ids bed
232	3090.40	HOR	2150	22.29	2.646	msst, lgy, ids bed, w shl
233	3090.70	HOR	2040	22.86	2.645	msst, lgy, ids bed, w shl
234	3091.00	VERT	2130	23.03	2.646	msst, lgy, ids bed
235	3091.10	HOR	2410	23.43	2.647	msst, lgy, ids bed
236	3091.40	HOR	2240	23.12	2.647	msst, lgy, ids bed
237	3091.70	HOR	2240	23.47	2.648	msst, lgy, ids bed
238	3092.00	VERT	2260	23.54	2.647	msst, lgy, ids bed
239	3092.10	HOR	2330	23.98	2.648	msst to csst, lgy, ids bed
240	3092.40	HOR	2530	25.13	2.646	msst, lgy, ids bed, w coal frgs
241	3092.70	HOR	2210	23.82	2.648	msst, lgy, ids bed
242	3093.00	VERT	2020	23.23	2.644	msst, lgy, ids bed

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS		GRAIN		COMMENT
			PERM mD	POROSITY %	DENS. G/CCM		
243	3093.10	HOR	2190	23.75	2.650	msst, lgy, ids bed	
244	3093.40	HOR	1960	22.55	2.648	msst to fsst, lgy, ids bed	
245	3093.65	HOR	1610	22.06	2.647	msst to fsst, lgy, ids bed	
246	3094.00	VERT	1880	23.62	2.647	msst to fsst, lgy, ids bed	
247	3094.10	HOR	2130	24.32	2.649	msst, lgy, ids bed, slg koal cem	
248	3094.40	HOR	2160	24.40	2.648	msst, lgy, ids bed	
249	3094.70	HOR	2030	24.26	2.648	msst to fsst, lgy, ids bed	
250	3095.00	VERT	2700	26.18	2.651	msst, lgy, ids bed	
251	3095.10	HOR	2290	25.61	2.649	msst, lgy, ids bed, w coal frgs	
252	3095.40	HOR	2360	25.77	2.649	msst, lgy, ids bed	
253	3095.70	HOR	1510	23.13	2.648	msst to fsst, lgy, bed, w coal frgs	
254	3096.00	VERT	926	24.16	2.655	msst to fsst, lgy, bed, w cly lam	
255	3096.10	HOR	1170	23.22	2.659	msst to fsst, lgy, bed, w coal frgs	
256	3096.40	HOR	2.43	9.13	2.677	msst to fsst, lgy, bed, tot ccem	
257	3096.70	HOR	346	18.78	2.689	fsst, lgy, w mny cly cla, sme ccem	
258	3097.00	VERT	4.94	16.69	2.711	fsst, lgy, mny cly cla, sme ccem	
259	3097.12	HOR	6.86	13.04	2.761	cngl, lgy, w slt & cly cla, fsst matrix	
260	3097.40	HOR	1.27	11.63	2.697	fsst, lgy, w cly cla, sme ccem	
261	3097.66	HOR	0.296	10.00	2.701	fsst, lgy, w cly cla, sme ccem	
262	3098.10	HOR		13.43	2.808	htrl, slt/cly, lgy, lam, slg calc,SG FRC	
263	3099.55	HOR		12.20	2.820	htrl, slt/cly, lgy, lam, slg calc,FT FRC	
264	3100.10	HOR		11.69	2.764	htrl, slt/cly, lgy, lam, slg clac,FT FRC	

SAMPLE NO.	DEPTH METER	PLUG TYPE	GAS		GRAIN		COMMENT
			PERM mD	POROSITY %	DENS. G/CCM		
265	3101.08	HOR		14.18	2.800	htrl, slt/cly, lgy, lam, slg calc,FT FRC	
266	3102.09	HOR		13.37	2.740	htrl, slt/cly, lgy, lam, slg clac,FT FRC	

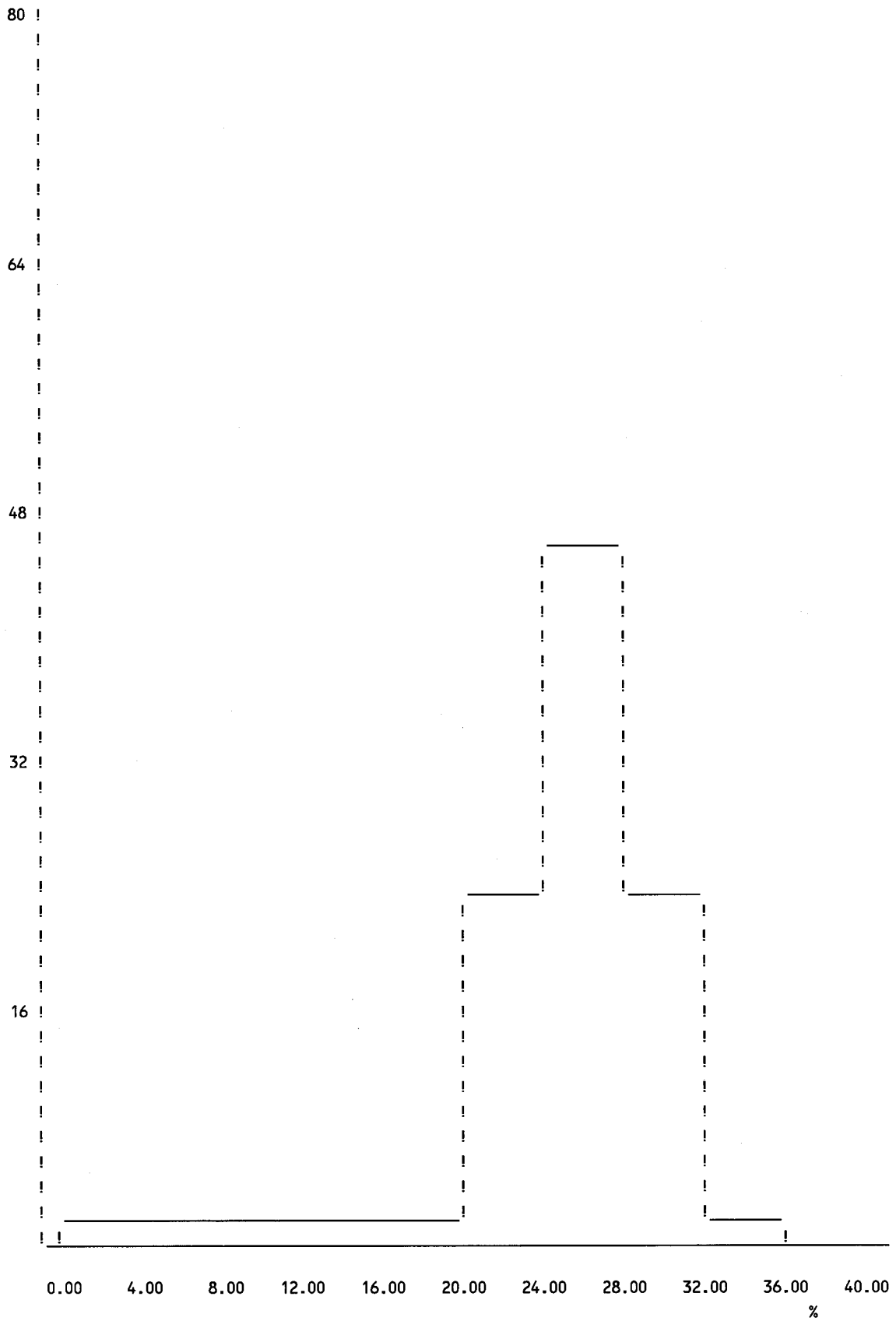
% OF SAMPLES

DISTRIBUTION OF GAS PERMEABILITY
N = 256



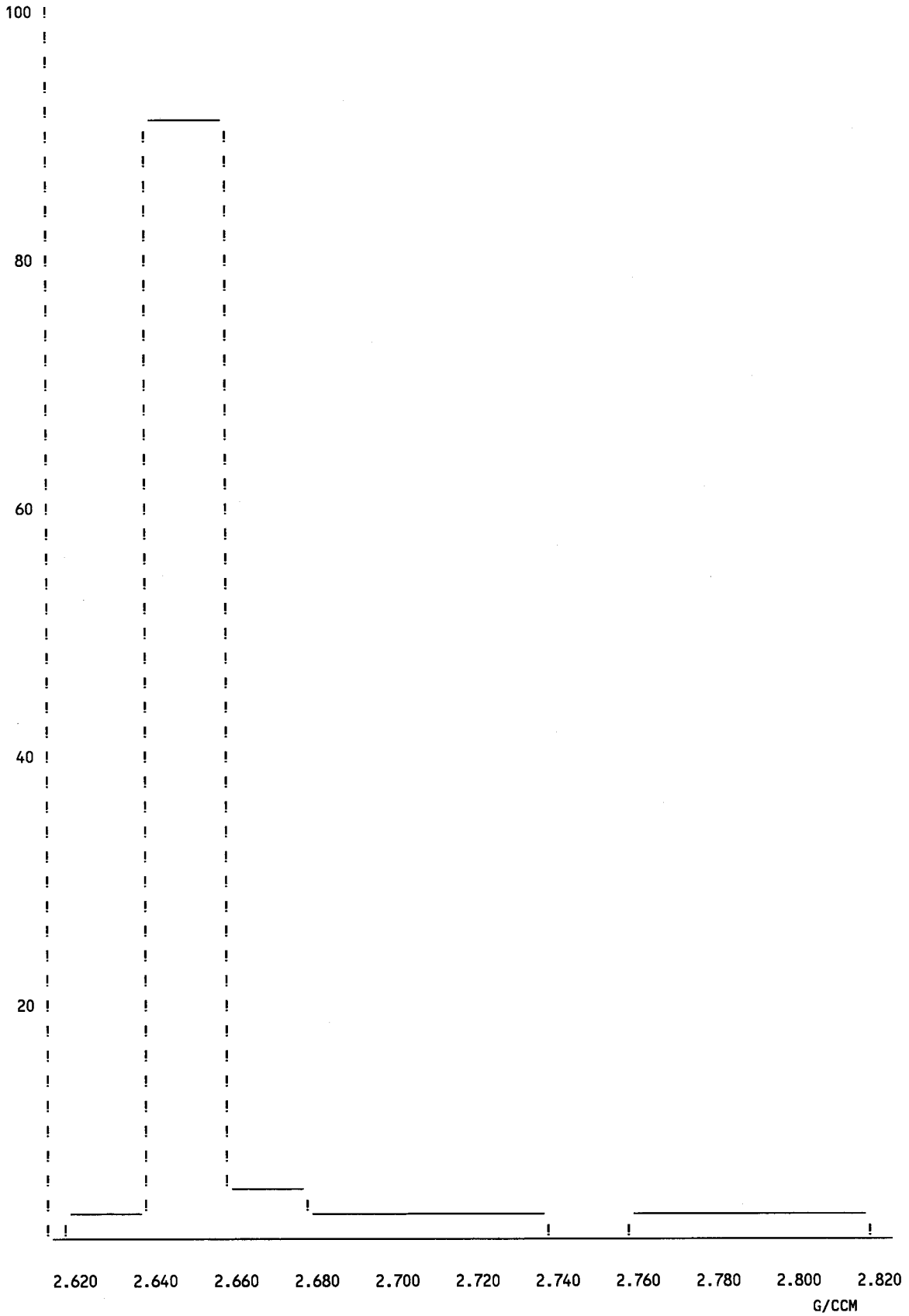
% OF SAMPLES

DISTRIBUTION OF POROSITY
N = 266



% OF SAMPLES

DISTRIBUTION OF GRAIN DENSITY
N = 266



STATISTICAL INFORMATION ON THE POROSITY - GAS PERMEABILITY RELATIONSHIP
CALCULATED ONLY FROM SAMPLES WITH NON-ZERO PERMEABILITY.

NUMBER OF SAMPLES : 256

SINGLE-SAMPLE STATISTICS:

POROSITY:

MEAN POROSITY : 25.29 %
VARIANCE ON POROSITY : 19.51 %**2

PERMEABILITY:

GEOMETRIC AVERAGE : 994.68 mD
ARITHMETRIC AVERAGE : 1566.26 mD
HARMONIC AVERAGE : 8.28 mD

STATISTICS CALCULATED FROM LINEAR REGRESSION OF PERMEABILITY ON POROSITY:

MODEL: $\text{LOG}_{10}(\text{PERMEABILITY}) = \text{INTERCEPT} + \text{SLOPE} * \text{POROSITY} + \text{RESIDUAL}$

DEGREES OF FREEDOM : 254
COEFFICIENT OF DETERMINATION : 0.434
STANDARD ERROR ON THE REGRESSION : 0.548 log(mD)
ESTIMATED INTERCEPT : 0.256 log(mD)
ESTIMATED STANDARD ERROR ON INTERCEPT : 0.200 log(mD)
ESTIMATED SLOPE : 0.10841 log(mD)/%
ESTIMATED STANDARD ERROR ON SLOPE : 0.00777 log(mD)/%

PLEASE REMARK THAT THE REGRESSION STATISTICS PERTAIN TO LOG PERMEABILITY VALUES.
THE COEFFICIENT OF DETERMINATION GIVES THE FRACTION OF THE TOTAL VARIATION SQUARED
WHICH IS EXPLAINED BY THE MODEL.
THE STANDARD ERROR ON THE REGRESSION GIVES THE MEAN 1 SIGMA ERROR ON THE LOG
PERMEABILITY ESTIMATES.

Well: Saxo-1
Core: 1,2,3.

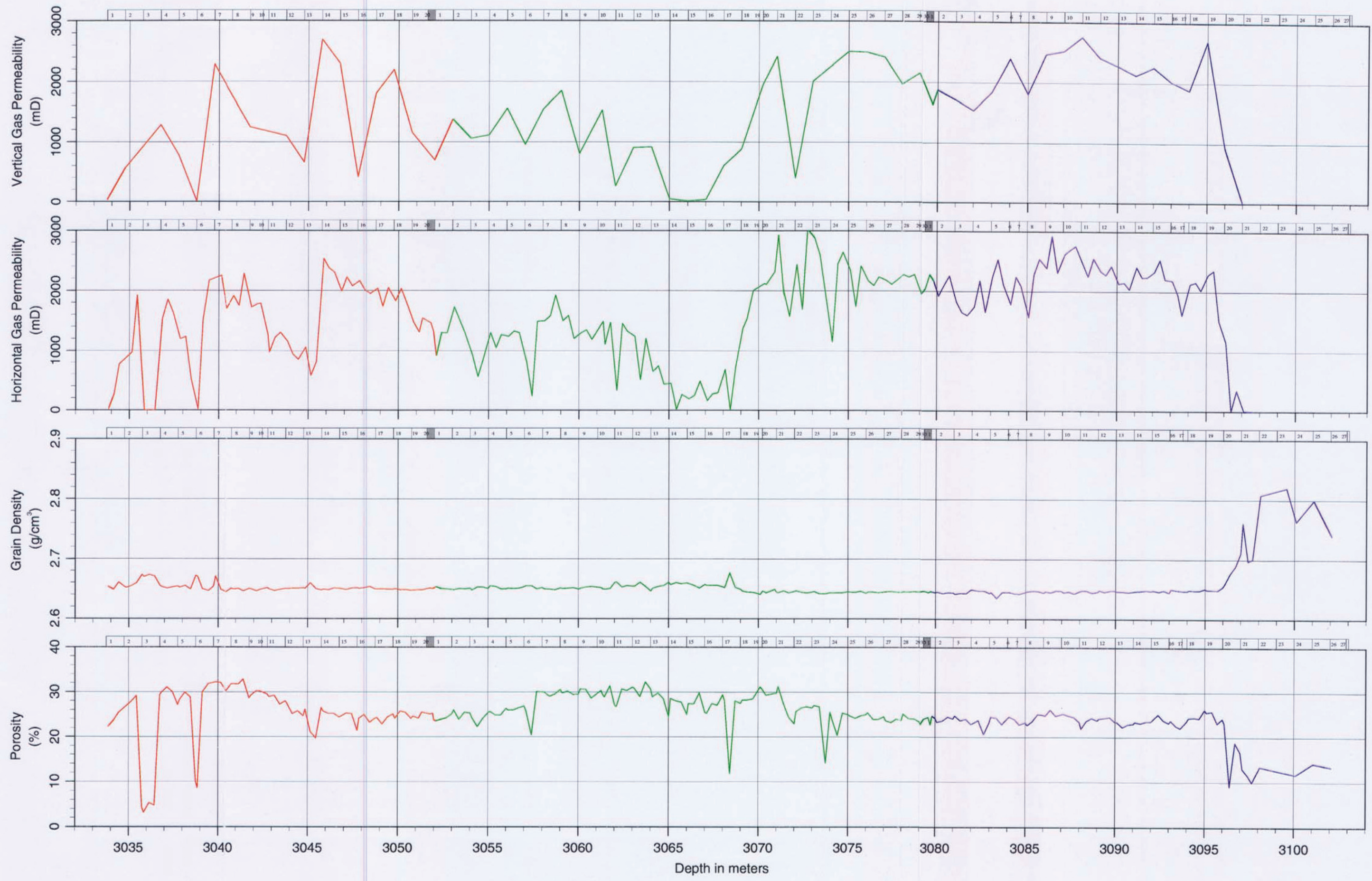
Core log

Depth vs.
Horizontal Gas Permeability
Vertical Gas Permeability
Grain density
Porosity

Scale 1:200

Legend

- Core 1
- Core 2
- Core 3






Well: Saxo-1
Core: 1,2,3.

Spectral core gamma log

Depth vs.
Thorium
Uranium
Potassium
Total Gamma

Scale 1:200

Legend

-  Core 1
-  Core 2
-  Core 3

