APPENDIX 9 FROM WCR

X-RAY DIFFRACTION

BOGGY CREEK - 1

W1053

APPENDIX-9

X-ray Diffraction Analysis

W1812

AMDEL
CORE
SERVICES

X-RAY DIFFRACTION REPORT

BOGGY CREEK #1

OTWAY BASIN

Report prepared for Gas and Fuel Exploration NL

by

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CONTENTS

1. INTRODUCTION

Gas and Fuel Exploration N.L. requested bulk and clay X-ray diffraction (XRD) analyses of 12 sidewall core from Boggy Creek #1. To determine bulk mineralogy by X-ray diffraction, samples were hand ground in acetone and smeared onto glass slides. Continuous scans were run of these smears from 3° to 75° 2 theta, at 1°/minute, using Co K alpha radiation, 50kV and 35mA, on a Philips PW1050 diffractometer. For detailed clay mineralogy a less than 5 micron size fraction was separated. This was done by hand crushing, addition of dispersion solution, mechanical shaking for 10 minutes and settling of the dispersed material in a water column according to Stokes' Law. The less than 5 micron fraction was pipetted off and prepared as an oriented sample on ceramic plates held under vacuum. Samples were saturated with Mg solution and treated with glycerol. Continuous scans of oriented clay samples were run from 3° to 35° 2 theta at 1°/minute. Peaks were identified by comparison with JCPDS files stored in a computer program called XPLOT.

The following samples were examined:

Sample No.	Depth (m)
1	857.0
2	914.5
3	939.5
4	1109.0
5	1343.0
6	1579.0
7	1675.0
8	1693.0
9	1715.0
10	1722.5
11	1826.0
12	1856.0

2. XRD RESULTS

2.1 Boggy Creek #1, Sample 1, depth 857.0m

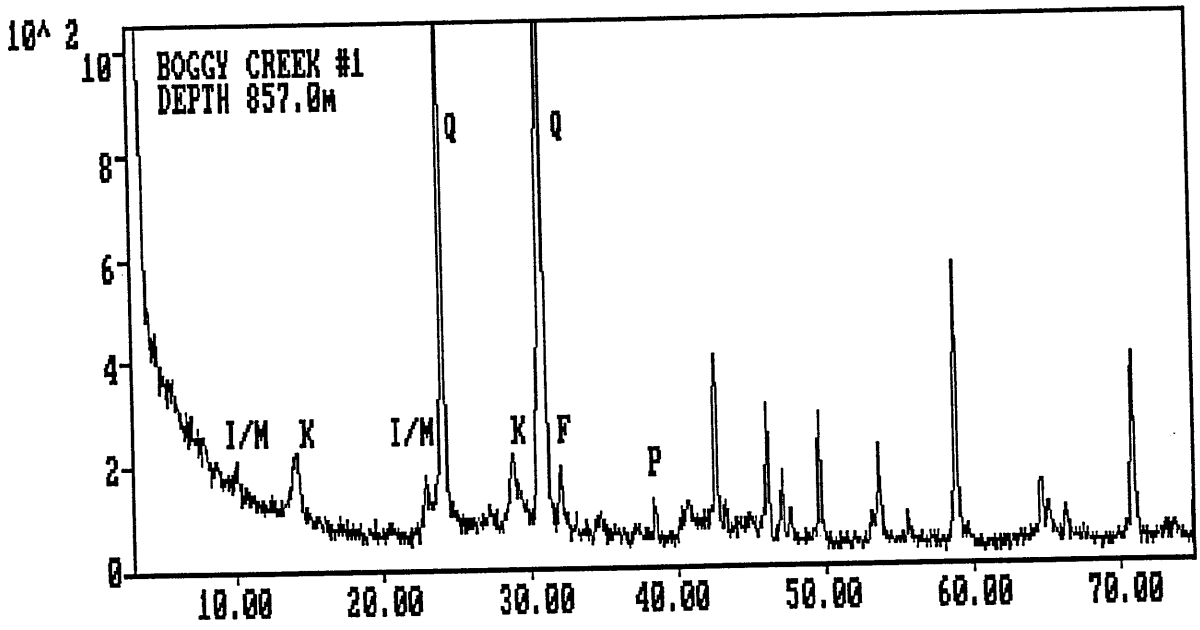

Figure 1a. Bulk XRD trace of Sample 1, depth 857.0m. Only the strongest peaks for each mineral identified have been labelled. I/M=illite/muscovite, K=kaolinite, Q=quartz, F=feldspar and P=pyrite. A high background at low 2 theta angles suggests the presence of interstratified clays.

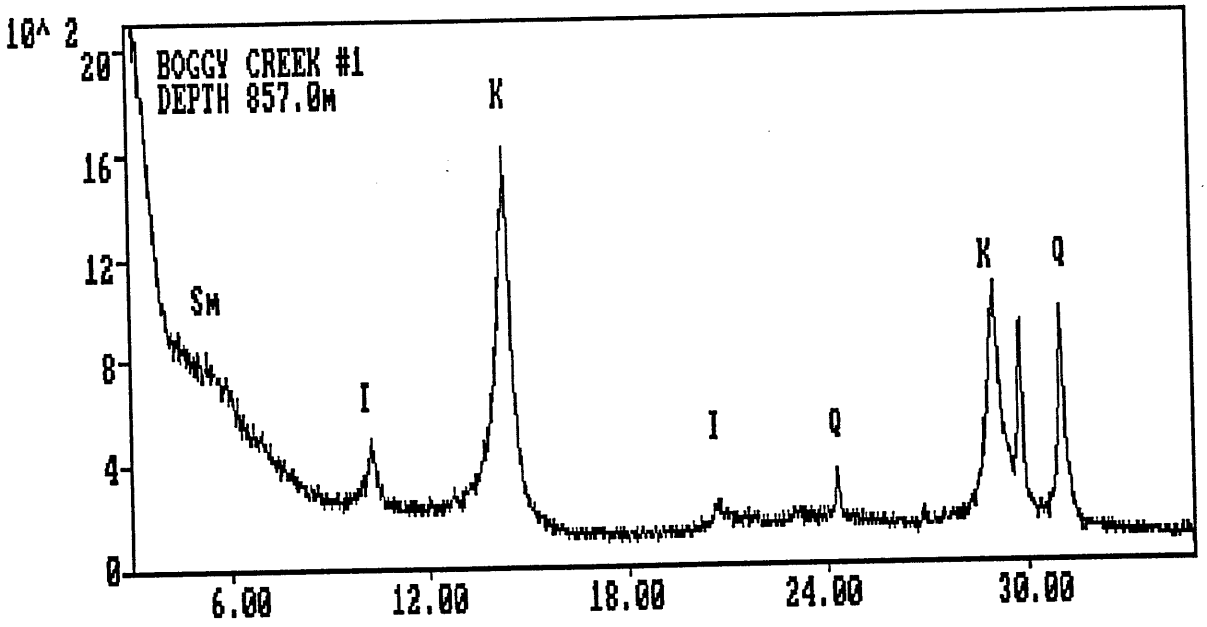

Figure 1b. XRD of the clay fraction. Sm=smectite, I=illite 2M1, K=kaolinite 1T and Q=quartz. The illite and smectite are interstratified.

2.2 Boggy Creek #1, Sample 2, depth 914.5m

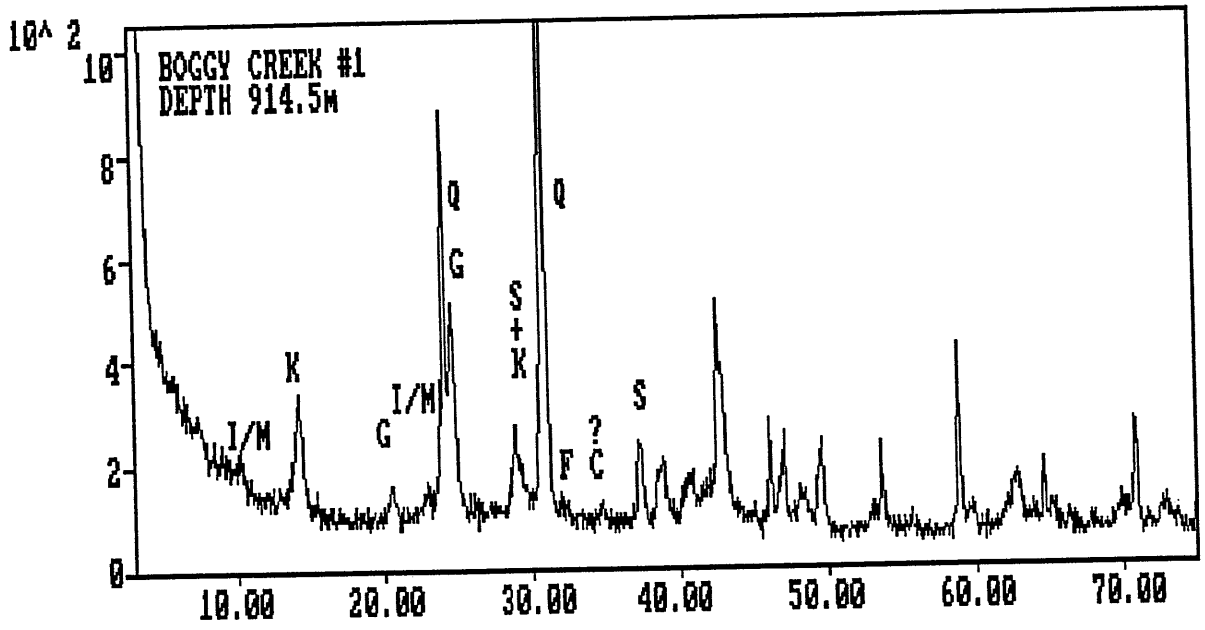

Figure 2a. Bulk XRD trace of Sample 2, depth 914.5m. Only the strongest peaks for each mineral identified have been labelled. I/M=illite/muscovite, K=kaolinite, Q=quartz, G=goethite, F=feldspar, ?C=?calcite and S=siderite. A high background at low 2 theta angles suggests the presence of interstratified clays.

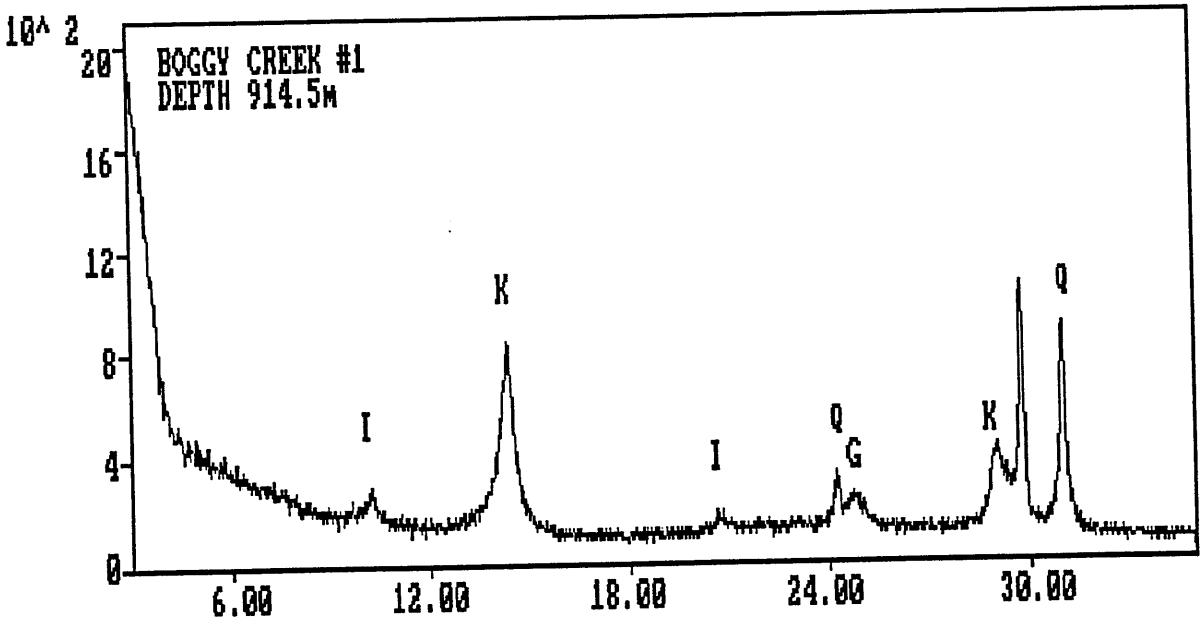

Figure 2b. XRD of the clay fraction. I=illite 2M1, K=kaolinite 1T, Q=quartz and G=goethite.

2.3 Boggy Creek #1, Sample 3, depth 939.5m

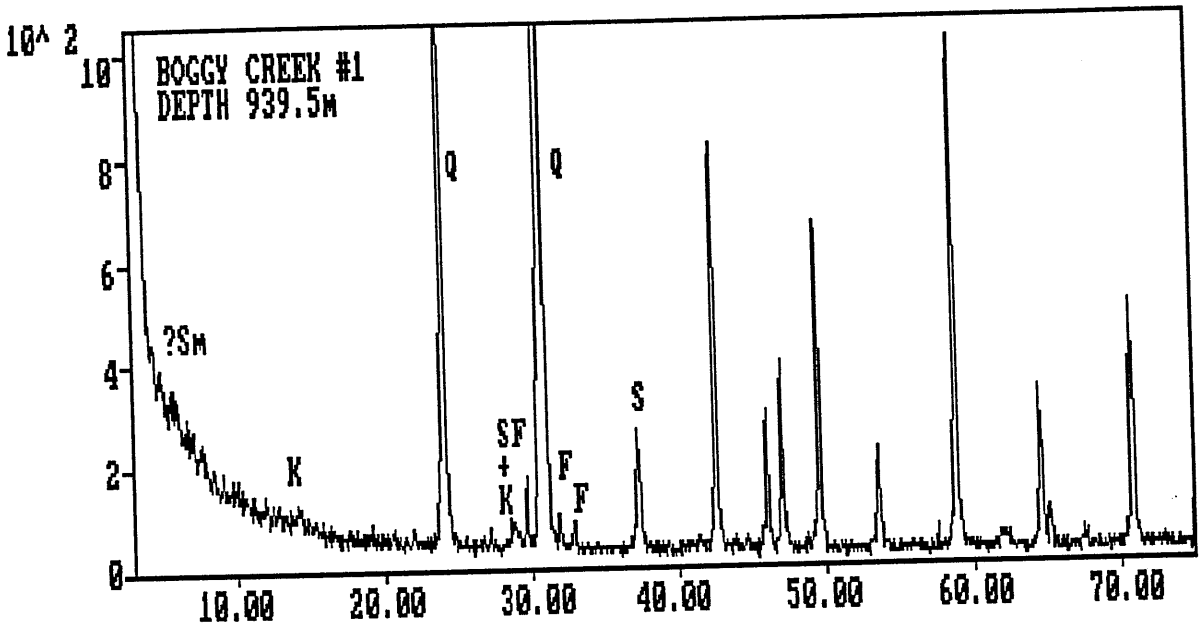

Figure 3a. Bulk XRD trace of Sample 3, depth 939.5m. Only the strongest peaks for each mineral identified have been labelled. ?Sm=?smectite, K=kaolinite, Q=quartz, F=feldspar (potassic and plagioclase) and S=siderite.

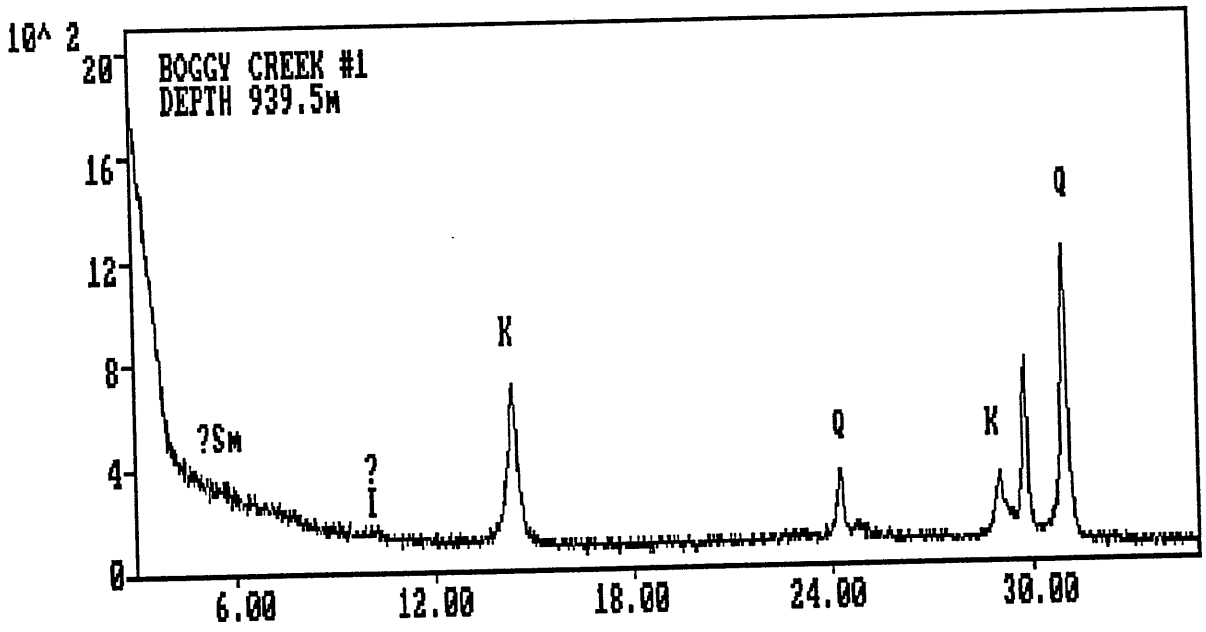

Figure 3b. XRD of the clay fraction. ?Sm=?smectite, ?I=?illite, K=kaolinite 1T and Q=quartz.

2.4 Boggy Creek #1, Sample 4, depth 1109.0m

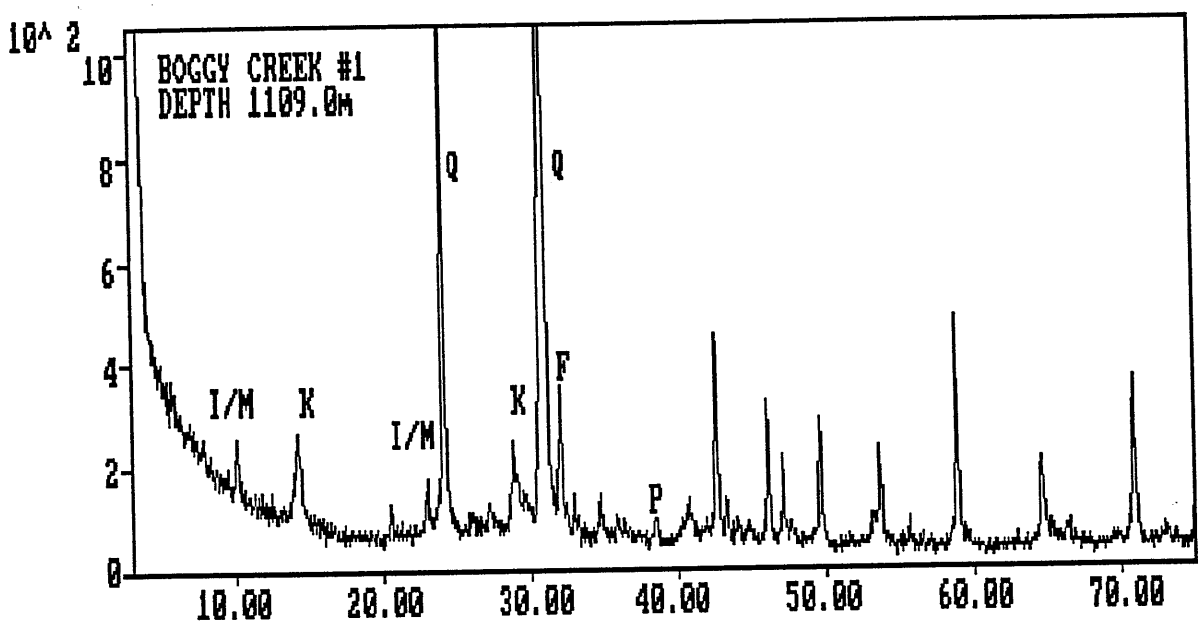

Figure 4a. Bulk XRD trace of Sample 4, depth 1109.0m. Only the strongest peaks for each mineral identified have been labelled. I/M=illite/muscovite, K=kaolinite, Q=quartz, F=feldspar and P=pyrite. A high background at low 2 theta angles suggests the presence of interstratified clays.

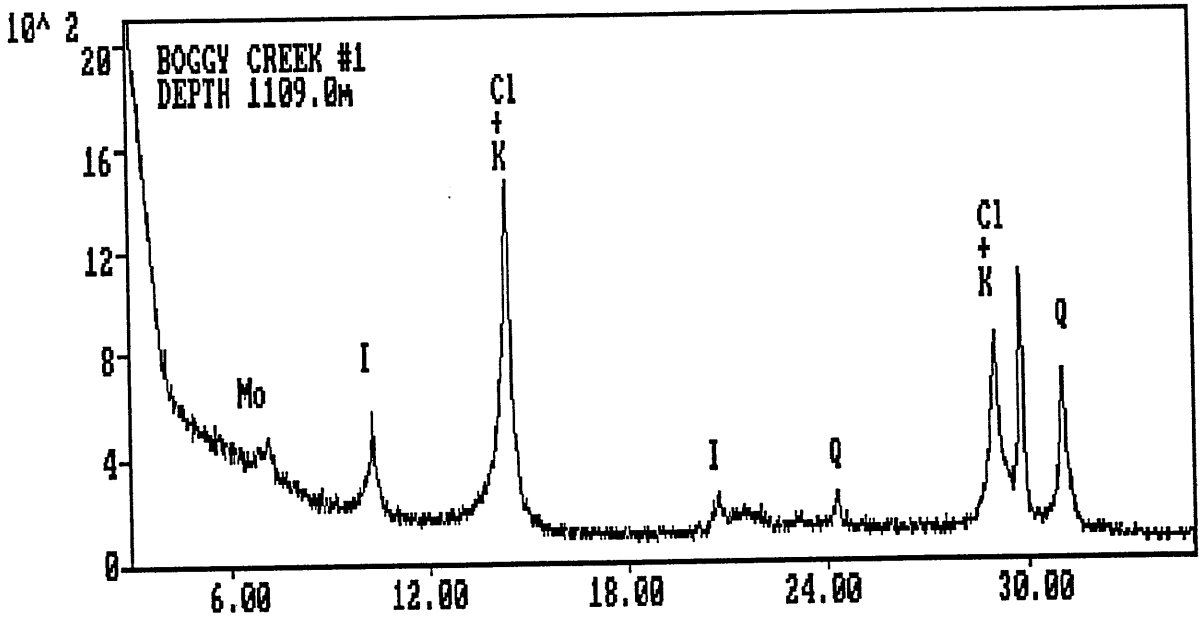

Figure 4b. XRD of the clay fraction. Mo=montmorillonite (15 Angstrom), Cl=clinochlore, I=illite, K=kaolinite 1T and Q=quartz.

2.5 Boggy Creek #1, Sample 5, depth 1343.0m

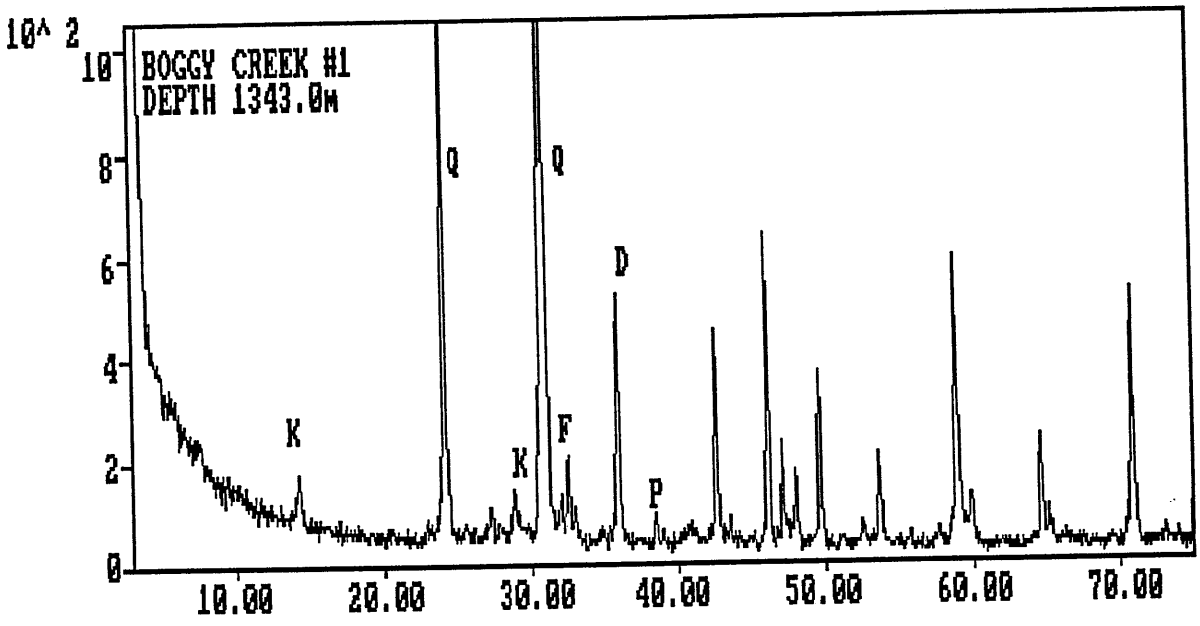

Figure 5a. Bulk XRD trace of Sample 5, depth 1343.0m. Only the strongest peaks for each mineral identified have been labelled. K=kaolinite, Q=quartz, F=feldspar (potassic and plagioclase), D=ankerite/ferroan dolomite and P=pyrite. A high background at low 2 theta angles suggests the presence of interstratified clays.

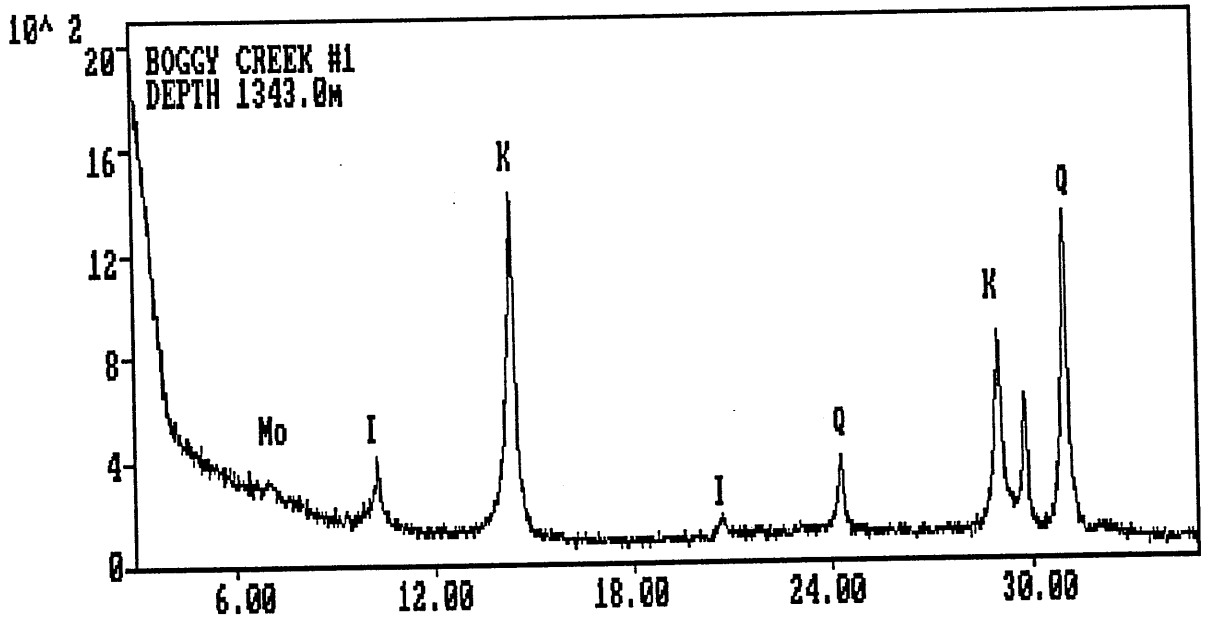

Figure 5b. XRD of the clay fraction. Mo=montmorillonite (15 Angstrom), I=illite 2M1, K=kaolinite 1T and Q=quartz.

2.6 Boggy Creek #1, Sample 6, depth 1579.0m

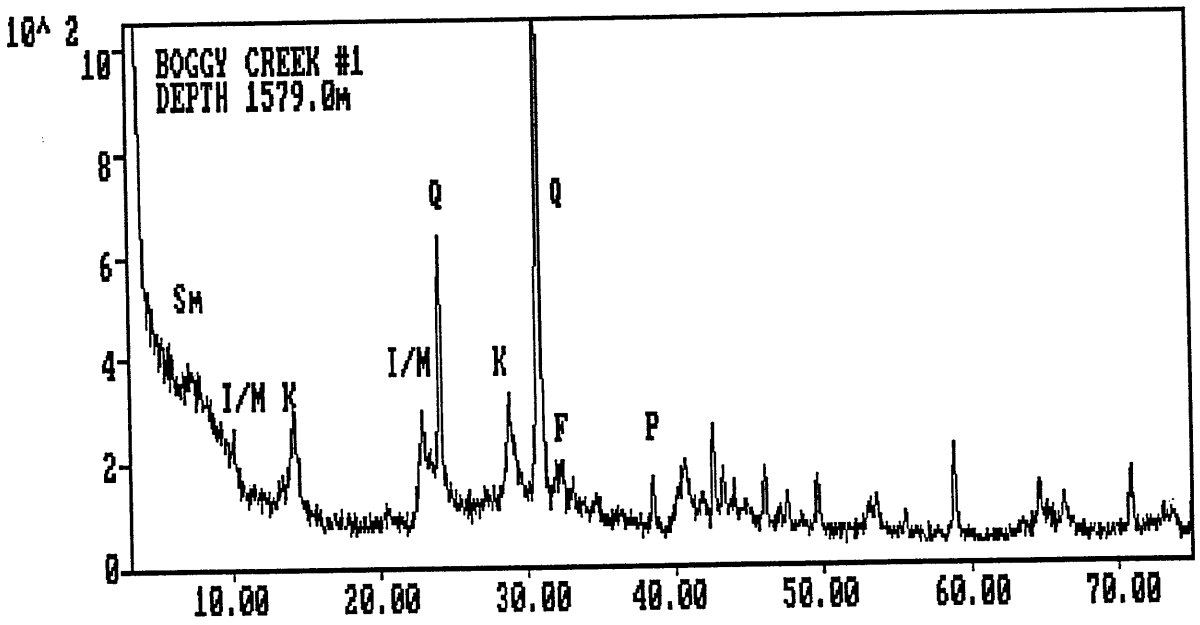

Figure 6a. Bulk XRD trace of Sample 6, depth 1579.0m. Only the strongest peaks for each mineral identified have been labelled. Sm=smectite, I/M=illite/muscovite, K=kaolinite, Q=quartz, F=feldspar and P=pyrite.

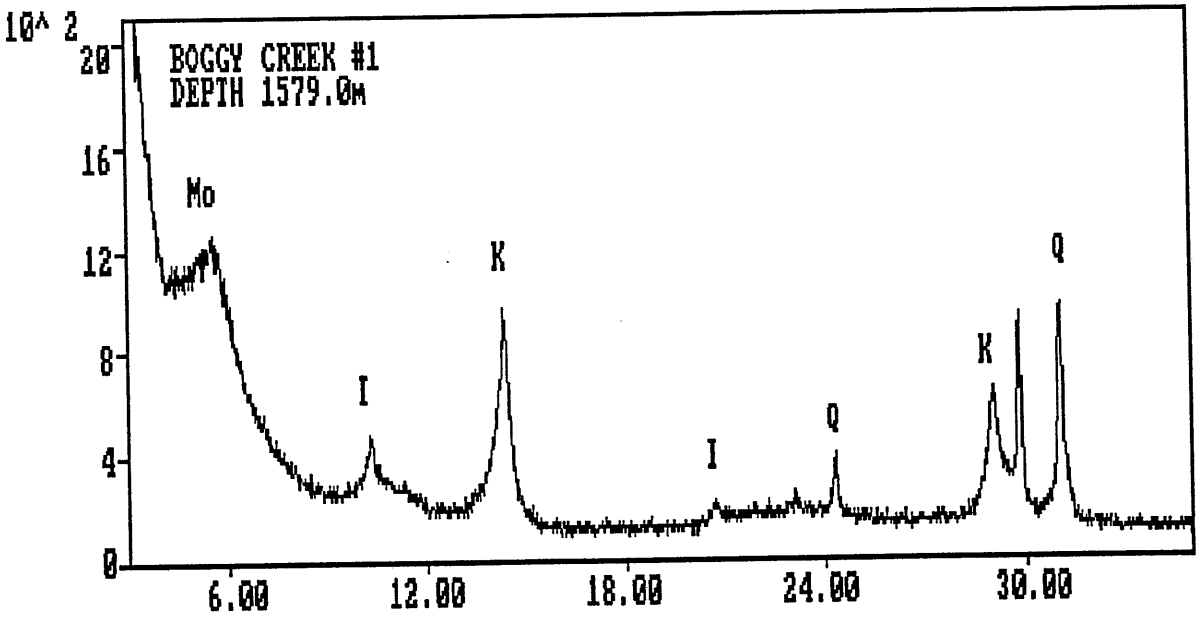

Figure 6b. XRD of the clay fraction. Mo=18 Angstrom montmorillonite, I=illite 2M1, K=kaolinite 1T and Q=quartz. Montmorillonite and illite are randomly interstratified.

2.7 Boggy Creek #1, Sample 7, depth 1675.0m

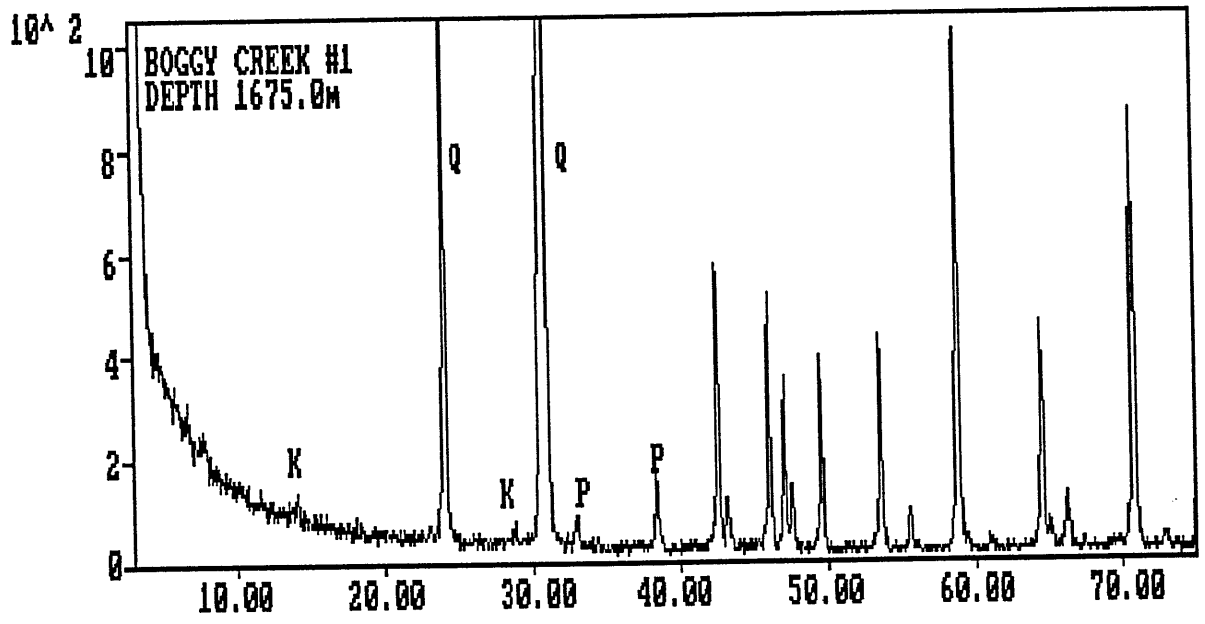

Figure 7a. Bulk XRD trace of Sample 7, depth 1675.0m. Only the strongest peaks for each mineral identified have been labelled. K=kaolinite, Q=quartz and P=pyrite.

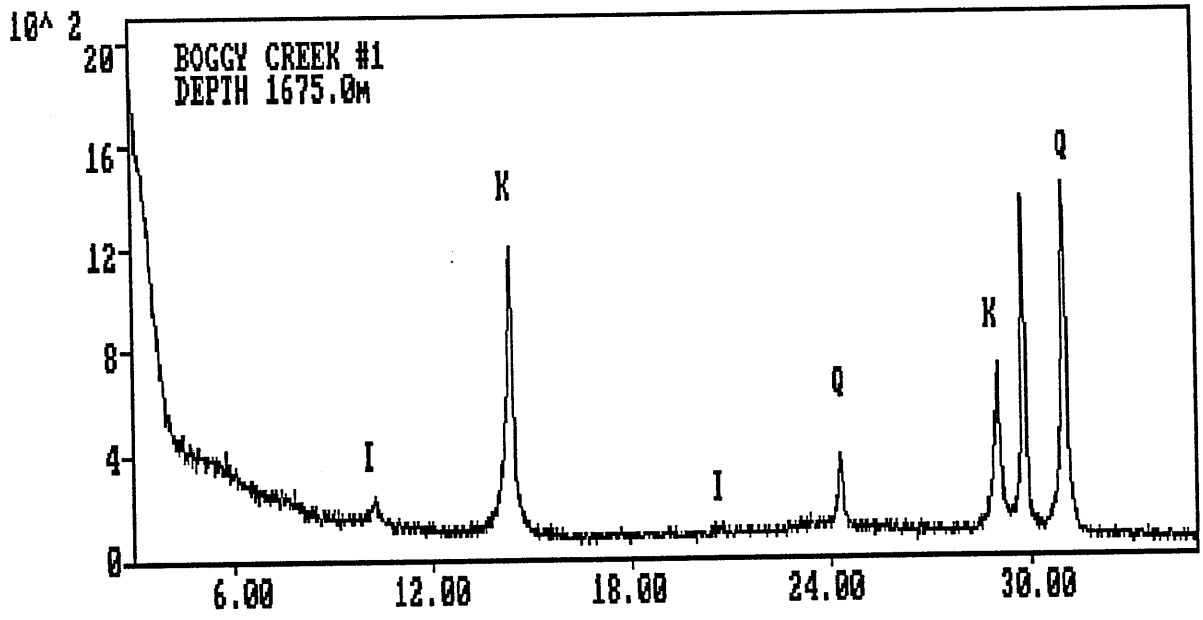

Figure 7b. XRD of the clay fraction. I=illite 2M1, K=kaolinite 1T and Q=quartz.

2.8 Boggy Creek #1, Sample 8, depth 1693.0m

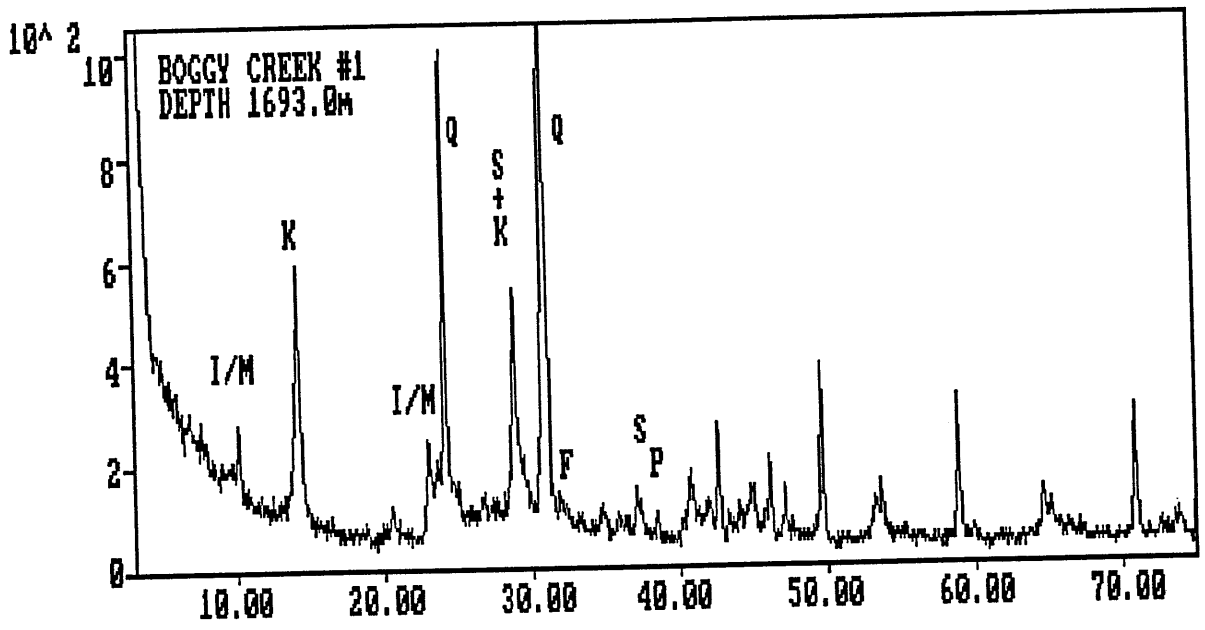

Figure 8a. Bulk XRD trace of Sample 8, depth 1693.0m. Only the strongest peaks for each mineral identified have been labelled. I/M=illite/muscovite, K=kaolinite, Q=quartz, F=feldspar, S=siderite and P=pyrite. A high background at low 2 theta angles suggests the presence of interstratified clays.

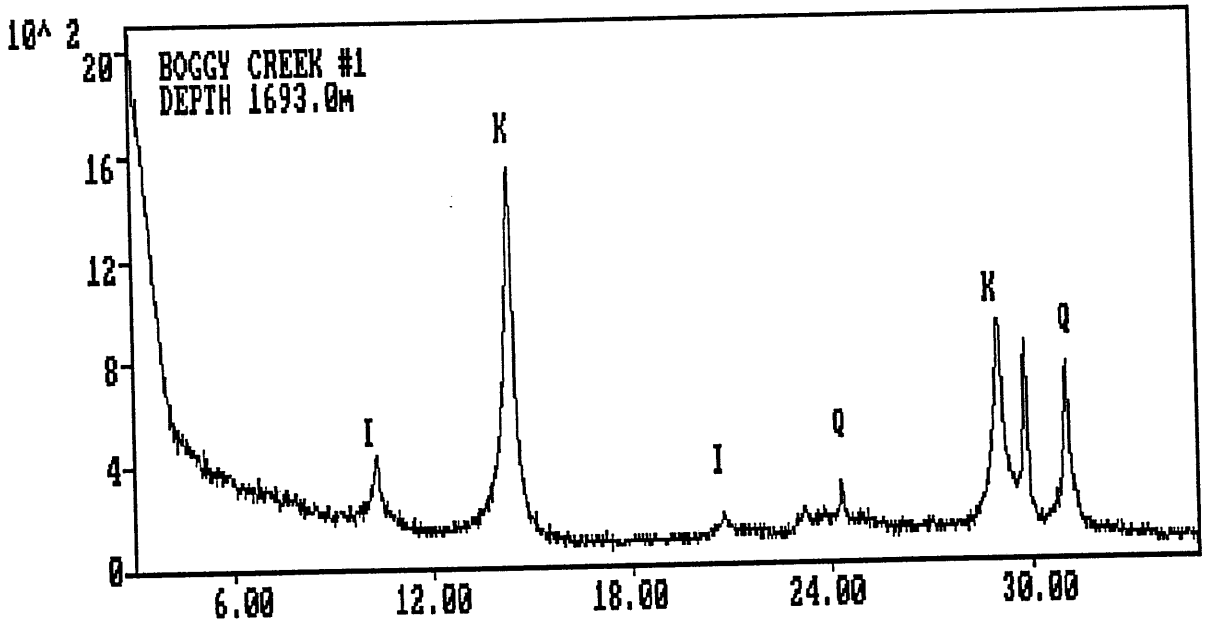

Figure 8b. XRD of the clay fraction. I=illite 2M1, K=kaolinite 1T and Q=quartz.

2.9 Boggy Creek #1, Sample 9, depth 1715.0m

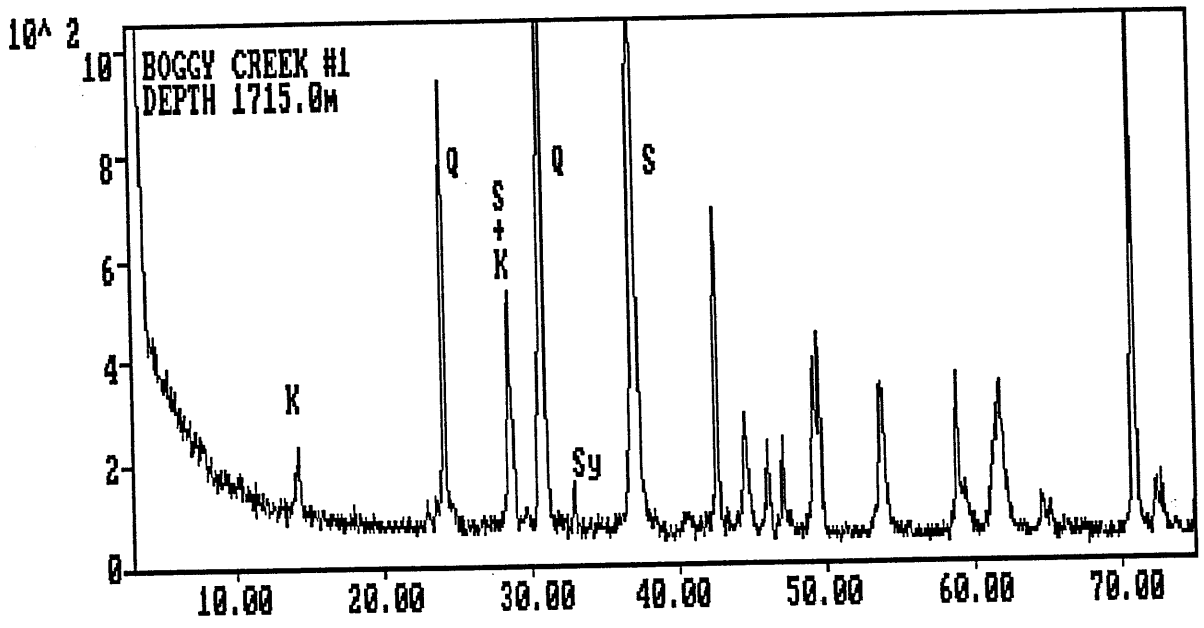

Figure 9a. Bulk XRD trace of Sample 9, depth 1715.0m. Only the strongest peaks for each mineral identified have been labelled. K=kaolinite, Q=quartz, Sy=sylvite and S=siderite.

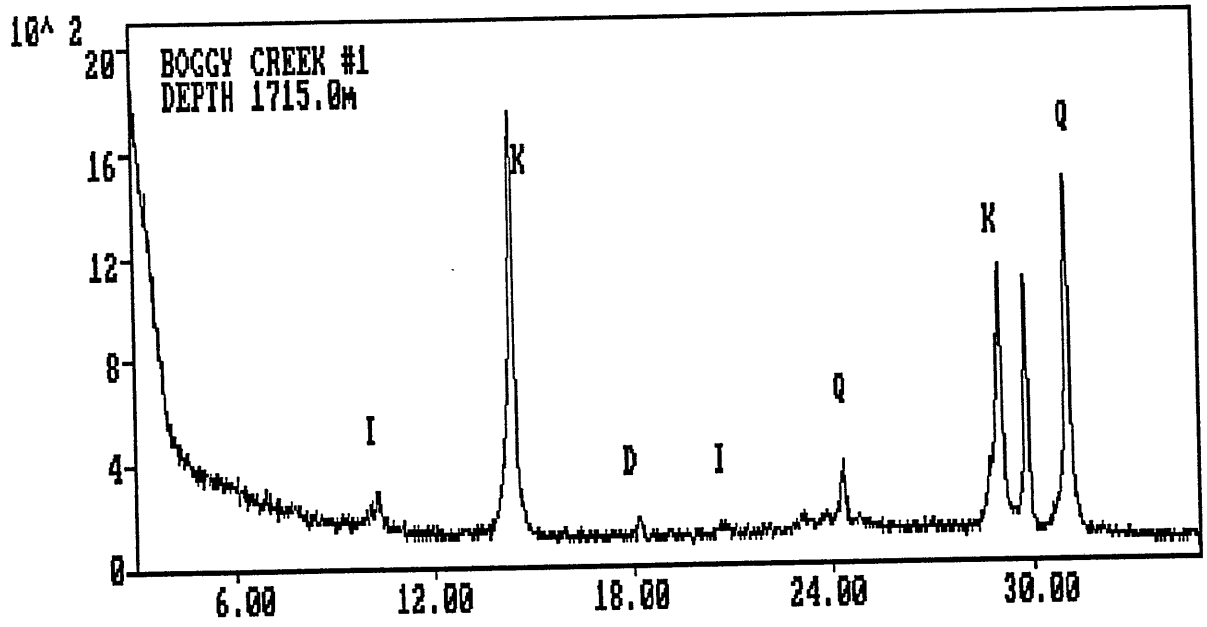

Figure 9b. XRD of the clay fraction. I=illite 2M1, K=kaolinite 1T, D=dawsonite and Q=quartz.

2.10 Boggy Creek #1, Sample 10, depth 1722.5m

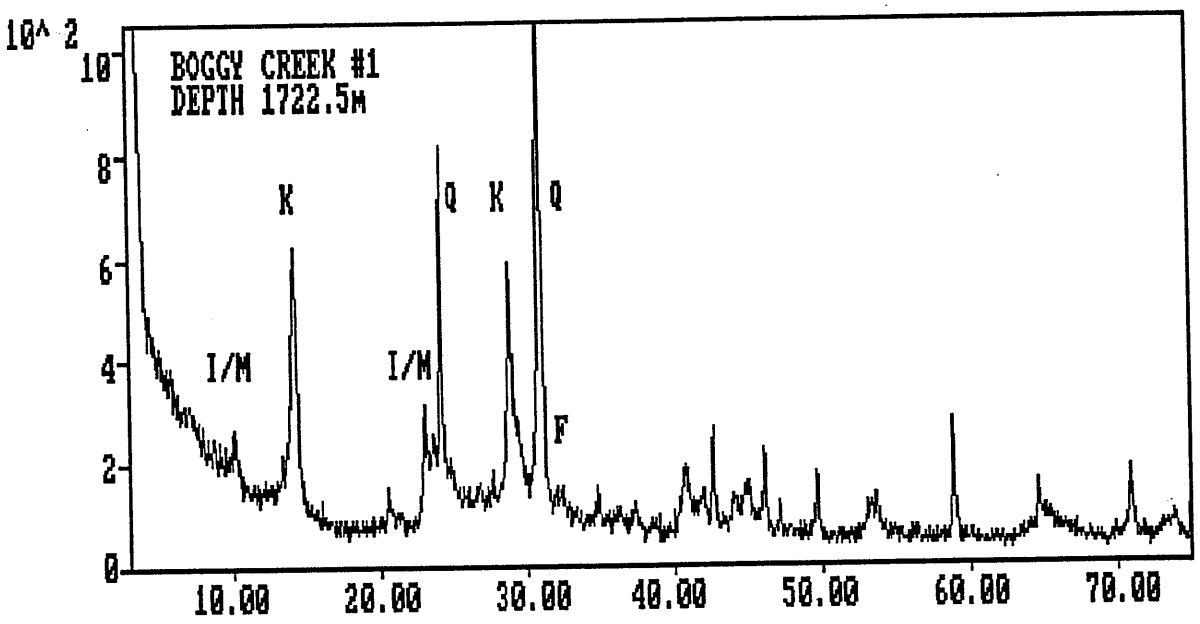

Figure 10a. Bulk XRD trace of Sample 10, depth 1722.5m. Only the strongest peaks for each mineral identified have been labelled. I/M=illite/muscovite, K=kaolinite, Q=quartz and F=feldspar (potassic and plagioclase). A high background at low 2 theta angles suggests the presence of interstratified clays.

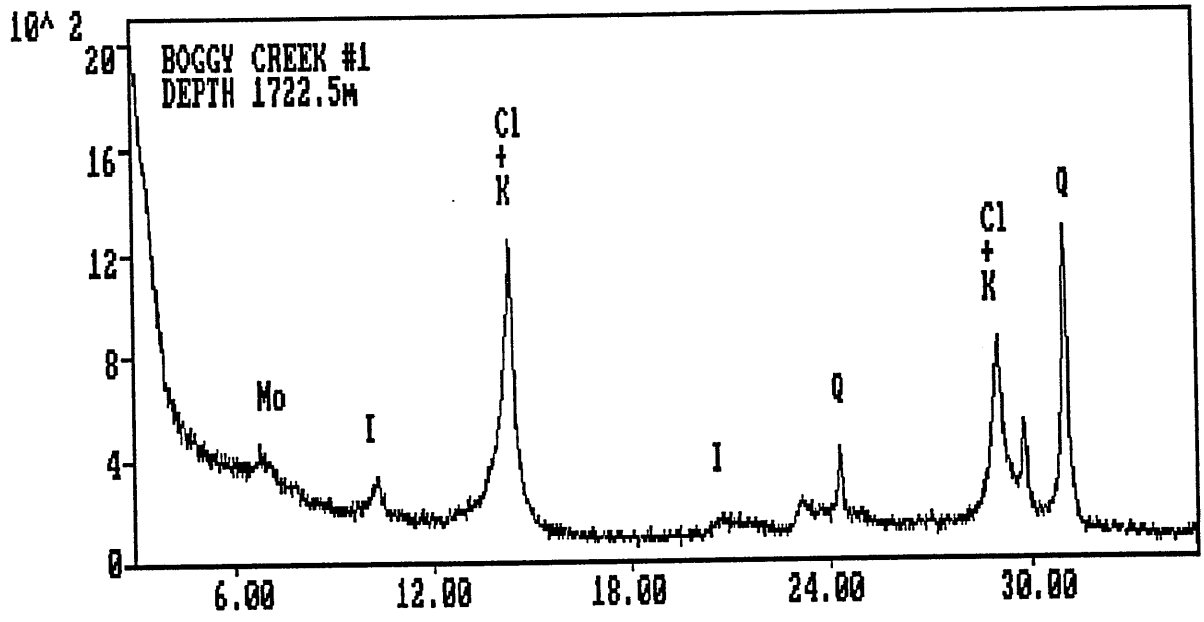

Figure 10b. XRD of the clay fraction. Mo=montmorillonite (15 Angstrom), Cl=clinochlore, I=illite 2M1, K=kaolinite 1T and Q=quartz.

2.11 Boggy Creek #1, Sample 11, depth 1826.0m

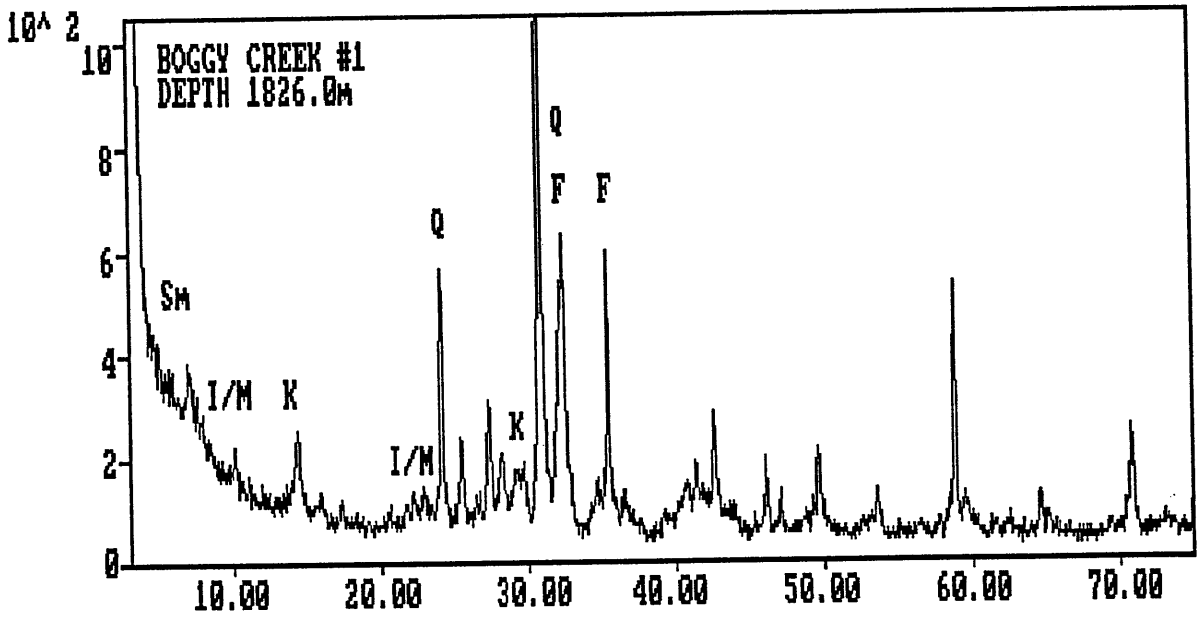

Figure 11a. Bulk XRD trace of Sample 11, depth 1826.0m. Only the strongest peaks for each mineral identified have been labelled. Sm=smectite, I/M=illite/muscovite, K=kaolinite, Q=quartz and F=feldspar (plagioclase).

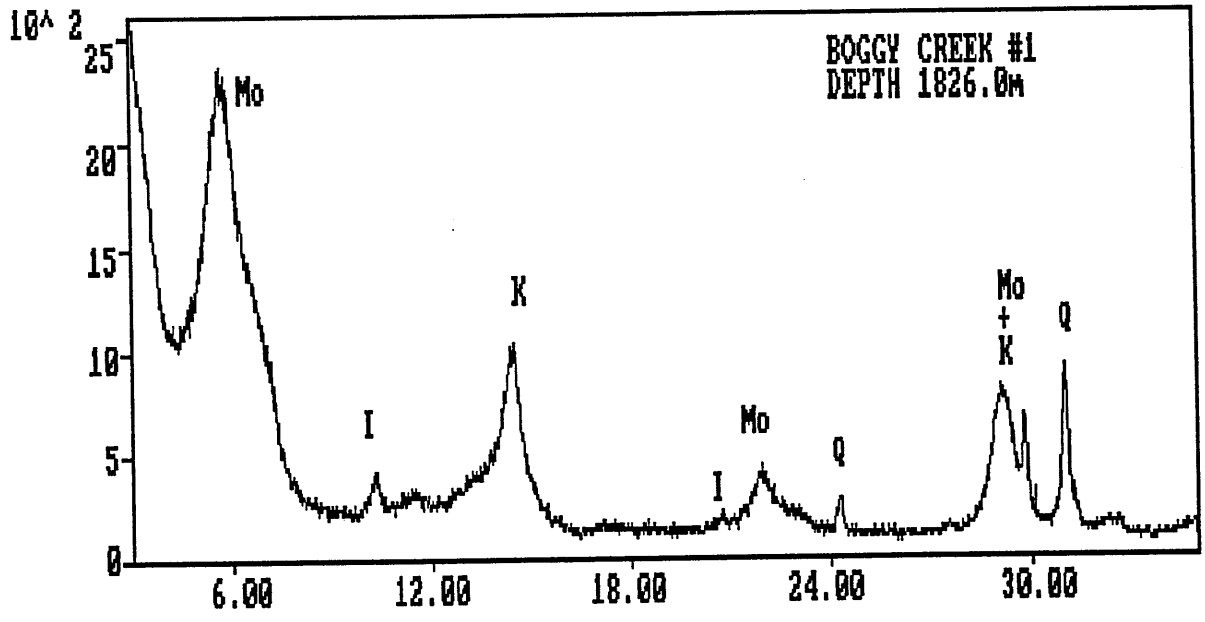

Figure 11b. XRD of the clay fraction. Mo=18 Angstrom montmorillonite, I=illite 2M1, K=kaolinite 1T and Q=quartz. Montmorillonite and illite are randomly interstratified. Note the change in scale.

2.12 Boggy Creek #1, Sample 12, depth 1856.0m

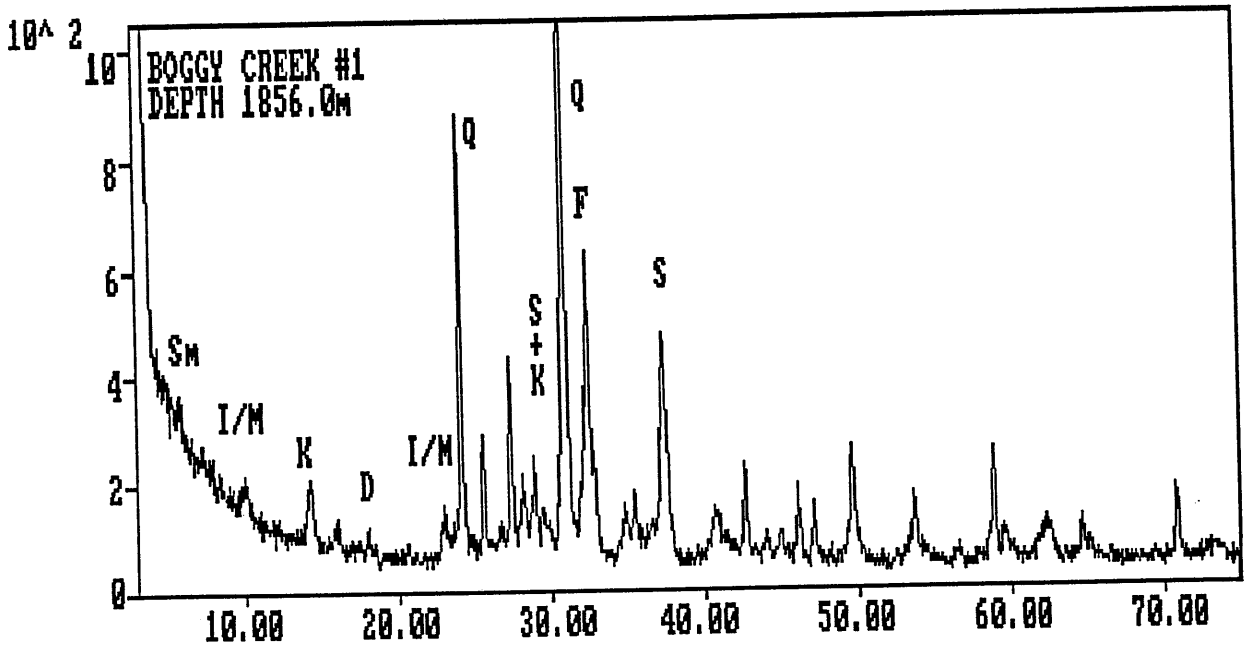

Figure 12a. Bulk XRD trace of Sample 12, depth 1856.0m. Only the strongest peaks for each mineral identified have been labelled. Sm=smectite, I/M=illite/muscovite, K=kaolinite, D=dawsonite, Q=quartz, F=feldspar and S=siderite.

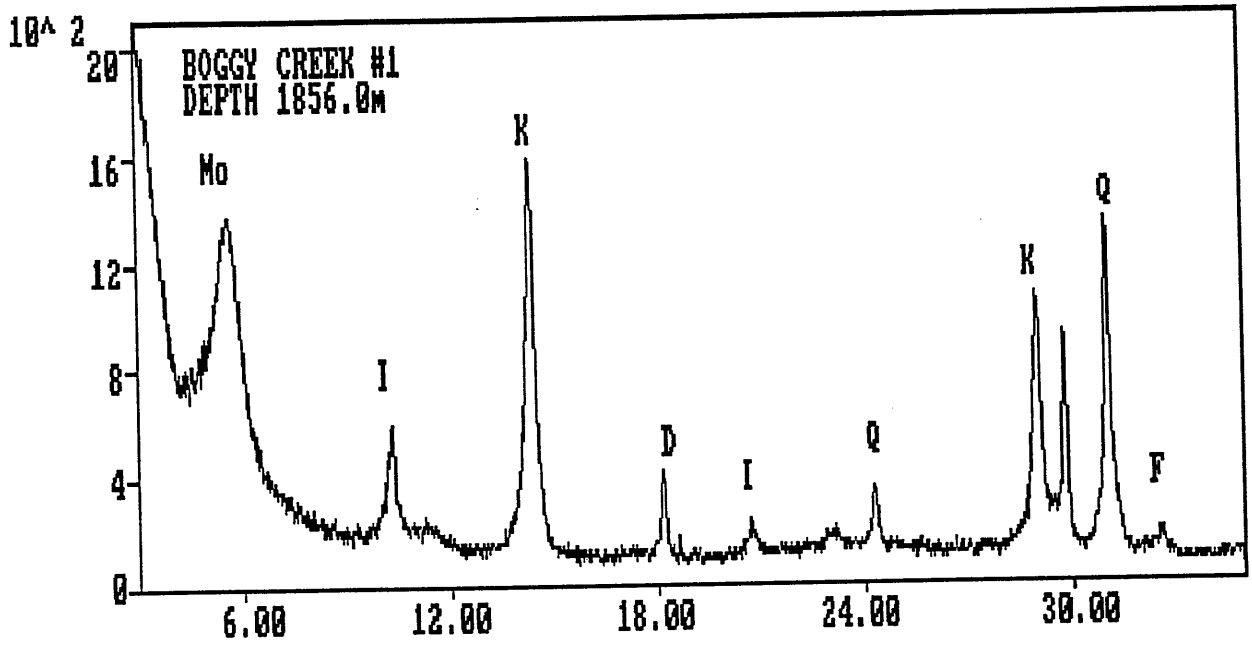

Figure 12b. XRD of the clay fraction. Mo=montmorillonite (18 Angstrom), I=illite 2M1, K=kaolinite 1T, D=dawsonite, Q=quartz and F=feldspar.

3. TABLES

3.1 BULK XRD MINERALOGY BOGGY CREEK #1

Sample	Depth (m)	Qtz	Feld	Kaol	I/M	Sm	Sid	Dol
		Strongest peak height in counts						
1	857.0	6428	192	228	205	-	-	-
2	914.5	6420	tr	338	205	-	244	-
3	939.5	13146	103	128	-	?tr	268	-
4	1109.0	7558	353	268	254	-	-	-
5	1343.0	7307	206	173	-	-	-	522
6	1579.0	2276	203	302	262	390	-	-
7	1675.0	13368	-	tr	-	-	-	-
8	1693.0	4174	tr	592	274	-	148	-
9	1715.0	3805	-	234	-	-	1636	-
10	1722.5	2926	tr	620	261	-	-	-
11	1826.0	2418	572	254	241	383	-	-
12	1856.0	3394	631	210	196	360	474	-

3.1 cont.

Sample	Depth (m)	Pyr	Goeth	Others
		Strongest peak height in counts		
1	857.0	56	-	?In
2	914.0	-	500	?In, ?Cal
3	939.0	-	-	-
4	1109.0	96	-	?In
5	1343.0	96	-	?In
6	1579.0	169	-	-
7	1675.0	179	-	-
8	1693.0	82	-	?In
9	1715.0	-	-	Syl
10	1722.5	-	-	?In
11	1826.0	-	-	-
12	1856.0	-	-	Daws

Qtz=quartz, Feld=feldspar, Kaol=kaolinite, I/M=illite/muscovite, Sm=smectite, In=interstratified clays, Cal=calcite, Dol=ankerite/ferroan dolomite, Sid=siderite, Pyr=pyrite, Goeth=goethite, Daws=dawsonite and Syl=sylvite.

3.2 CLAY XRD MINERALOGY BOGGY CREEK #1

Sample	Depth (m)	Qtz	Kaol	Ill	Mont	Daws	Goeth	Clino
		Strongest peak height in counts						
1	857.0	965	1618	503	Sm	-	-	-
2	914.0	891	831	290	-	-	150	-
3	939.0	1196	691	176	?Sm	-	-	-
4	1109.0	704	1467	571	454	-	-	tr
5	1343.0	1323	1425	417	tr	-	-	-
6	1579.0	969	968	474	1216	-	-	-
7	1675.0	1418	1200	236	-	-	-	-
8	1693.0	758	1541	435	-	-	-	-
9	1715.0	1472	1750	350	-	200	-	-
10	1722.5	1272	1239	339	410	-	-	tr
11	1826.0	925	1028	422	2341	-	-	-
12	1856.0	1347	1582	594	1306	422	-	-

Qtz=quartz, Kaol=kaolinite, I=illite 2M1, Mont=montmorillonite, Sm=smectite, Daws=dawsonite, Goeth=goethite and Clino=clinochlore.

All the XRD results are summarised in the table above. To facilitate between-sample comparisons of relative abundance for the same mineral, the results in each table are given in counts of peak height. These figures are based on the strongest line for each mineral detected. Caution should be used in assessing relative abundance from these figures since peak height is also significantly affected by factors such as crystal size and crystallinity. For these reasons the figures are even more unreliable when comparing different minerals in the same sample. For example, based on peak height alone carbonate minerals will always appear less abundant than similar proportions of quartz because of differences in crystallinity. Clay minerals will also appear to be less abundant than quartz in a bulk XRD trace because of differences in crystal size.

Furthermore, comparison should not be made between peak heights given for bulk samples and those for the clay fractions because results have been influenced by the sampling and preparation methods. XRD will not detect minerals which represent less than approximately 5% of the total rock composition.

Trends in the clay mineralogy are not immediately obvious from relative peak heights. Most clay traces are dominated by kaolinite, with the exception of samples 6 (1579.0m) and 11 (1826.0m) where 18 Angstrom montmorillonite dominates. A significant proportion of 18 Angstrom montmorillonite is also evident in sample 12 (1856.0m). This species of montmorillonite is Na rich and therefore highly reactive. Where there are only traces of montmorillonite it is typically a 15 Angstrom variety. Minor illite 2M1 occurs in all samples and this is randomly interstratified with the montmorillonite in samples 1 (857.0m), 6 (1579.0m) and 11 (1826.0m). Traces of clinochlore IIB were also detected.