Vitrinite reflectance data and analysis of the 920 - 8,510 foot interval of the Colorado Oil & Gas Dangerous River Unit No. 1 well

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VITRINITE REFLECTANCE ANALYSIS OF THE INTERVAL 920 - 8,510 FT

DANGEROUS RIVER #1 WELL, ALASKA

Introduction

This report describes the vitrinite reflectance analysis of 15 cuttings samples from the Dangerous River #1 oil exploration well.

Fifty vitrinite reflectance measurements for each sample are taken wherever possible utilizing a Zeiss 01K photometer attachment mounted on a Zeiss Photoscope 1. Each measurement is qualified as to poor (P), good (G) or excellent (E). Depending upon such factors as; particle size, pitting, scratching or the proximity to pyritic particles. The measurements of particles interpreted to be reworked vitrinite are labeled with an "R" while the measurements of particles interpreted to be caved material are labeled with a "C". A table and a plot of all measurements displayed as a histogram for each sample are given in Appendix A.

A vitrinite reflectance log is included which displays each histogram at the level of the sample. The material considered as caved is cross-hatched in blue while the material considered to be reworked is cross-hatched in red. The good and excellent samples are coloured in solid green while the poor measurements are coloured in cross-hatched green. Further colour copies of this log are available through the Bujak Davies Group.

The laboratory procedures for the mounting and polishing of the vitrinite samples follows the methodology described by Davies and Avery (1984) in a triple mount stub with standard 600 grit, .3 micron and .05 micron polishing procedure on Buehler Automet polishing equipment. This methodology results in a polished mount of unoxidized kerogen.

The levels of vitrinite reflectance are compared to the Thermal Alteration Index (TAI) of Bujak, Barss & Williams (1977a,b) in Table 1 and are subdivided into various levels of thermal maturation for the generation of liquid and gaseous hydrocarbons. This generation model will vary from basin to basin depending upon the geohistory and kerogen compositions.

VITRINITE REFLECTANCE SUMMARY

Maturity Zones based on Ro

920-1,030ft	Immature
1,550-16,20ft	Indeterminate
1,810-6,990ft	Highly Mature
7,500-8,060ft	Indeterminate
8,510-8,610ft	Overmature

Immature Zone: 920-1,030ft

The one sample in the immature zone indicates an Ro=0.456% from 20 readings. Little readable vitrinite was present in this sample and it should not be heavily relied upon.

Indeterminate:

Only two poor readings on reworked vitrinite were possible on this sample. No in situ vitrinite was found, thus the maturity could not be determined.

Highly Mature Zone: 1,810-6,990ft

The upper four samples in this zone contain large quantities of pyrite which is likely to cause the wider standard deviation present in these samples. The Ro for these first four samples ranges from 1.0% to 1.1%. At 5,090ft there was very little sample present and almost all readings were poor. The Ro, here, increases to 1.2% and is in aggrement with underlying samples. At 6,910ft only 5 readings were possible on the sample. The Ro=1.26% should not be heavily relied upon for this reason.

Indeterminate: 7,500-8,060ft

These samples were barren.

Overmature Zone: 8,510-8,610ft

Only 12 readings were possible on the one sample in this zone due to the presence of pyrite and a lack of kerogen. The Ro is 1.49% and should not be heavily relied upon.

REFERENCES

BUJAK, J.P., BARSS, M.S. & WILLIAMS, G.L.
1977 Offshore eastern Canada Part I. Offshore east Canada's organic type and colour and hydrocarbon potential. Oil and Gas Journal, vol.75, pp.198-202.

BUJAK; J.P., BARSS, M.S. & WILLIAMS, G.L.
1977 Offshore eastern Canada Part II. Offshore east Canada's organic type and colour and hydrocarbon potential. Oil and Gas Journal vol.75, pp.96-100.

DAVIES, E.H. & AVERY, M.P.
1984 A system for vitrinite reflectance analysis on dispersed organic matter for offshore eastern Canada. In: Current Research, Part A, Geological Survey of Canada, Paper 84-114, pp.367-372.

TABLE 1: TAI & Ro%

TAI	Spore colour	Approx. Ro equiv.	Amorphous kerogen	Herbaceous-woody kerogen
1	Green/Yellow		Immature	Immature
1+	Yellow	0.35%	Immature	Immature
2-	Yellow/orange	0.45%	Immature	Immature
2-to2	Orange	0.50%	Onset of maturity	Immature
2	Orange/brown	0.60%	Marginally mature	Immature
2to2+	Brown/orange	0.70%	Marginally mature	Onset of maturity
2+	Light brown	0.9%	Peak maturity	Onset of maturity
2+to3-	L.Brown/brown	1.0%	Highly mature	Peak maturity
3-	Brown	1.1%	Highly mature	Peak maturity
3-to3	Med. brown	1.2%	Highly mature	Peak maturity
3	Brown/dr.brown	1.5%	Overmature	Peak maturity
3+	Dark brown	2.0%	Overmature	Highly mature
4-	Black	2.5%	Overmature	Highly mature
4	Black/corroded	4.0%	Overmature	Overmature

Table 1: Comparison of Vitrinite Reflectance (Ro%) and the Thermal Alteration Index scale (TAI) of Bujak, Barss & Williams (1977a,b).

APPENDIX A

VITRINITE REFLECTANCE MEASUREMENTS AND HISTROGRAMS

Client: M.M.S.
Well: DANGEROUS RIVER #1
Area: ALASKA

Scientist: DUMCIUS
Date: JULY 1988
Samples are: F

VITRINITE DATA:
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Sample Depth : 920.0

0.380		0.380	P	0.400	P	0.420		0.420		0.420	P	0.420	P
0.430		0.430		0.440		0.450		0.460	P	0.460		0.480	
0.480		0.490	P	0.510		0.520	P	0.540		0.590			

Actual Mean = 0.456 Actual Standard Deviation = 0.054

Edited Mean = 0.456 Edited Standard Deviation = 0.054

Comment : Occasional large pyrite grains; little readable vitrinite present.

Sample Depth : 1550.0

2.580 R 2.680 R

Actual Mean = 2.630 Actual Standard Deviation = 0.071

Comment : Abundant inorganic material; little kerogen and vitrinite present.

Sample Depth : 1810.0

0.540	C	0.640	C	0.700	C	0.730		0.760		0.860		0.870	
0.870		0.890		0.900		0.900		0.910		0.910		0.910	
0.960		0.960		0.960		0.980		0.980		1.000		1.000	
1.029		1.059		1.070		1.080		1.080		1.080		1.090	
1.100		1.100		1.140		1.140		1.150		1.159		1.160	
1.160		1.160		1.169		1.209		1.220		1.230		1.340	
1.340		1.350		1.360		1.380		1.390		1.420	R	1.480	R
1.559	R												

Actual Mean = 1.069 Actual Standard Deviation = 0.218

Edited Mean = 1.070 Edited Standard Deviation = 0.167

Comment : Common pyrite; fair amount vitrinite and degraded amorphous material present.

Sample Depth : 2390.0

0.680	C	0.730		0.780		0.780		0.800		0.820		0.840	
0.890		0.900		0.900		0.920		0.930		0.940		0.940	
0.950		0.970		0.970		0.980		0.990		0.990		1.020	
1.030		1.040		1.050		1.050		1.060		1.080		1.090	
1.090		1.100		1.100		1.120		1.130		1.140		1.160	
1.160		1.210		1.240		1.240		1.250		1.250		1.280	
1.280		1.290		1.300		1.360		1.360		1.380		1.400	
1.610	R												

Actual Mean = 1.071 Actual Standard Deviation = 0.196

Edited Mean = 1.068 Edited Standard Deviation = 0.175

Comment : Occasional pyrite; fair amount vitrinite and degraded amorphous material present.

Sample Depth : 2980.0

0.690	C	0.720		0.760		0.770		0.800		0.800		0.810	
0.850		0.860		0.870		0.880		0.900		0.900		0.930	
0.940		0.960		0.990		0.990		1.000		1.020		1.020	
1.030		1.030		1.040		1.050		1.050		1.070		1.080	
1.080		1.080		1.080		1.090		1.090		1.090		1.160	
1.160		1.160		1.200		1.210		1.260		1.310		1.330	
1.410	R	1.440	R	1.440	R	1.450	R	1.470	R	1.510	R	1.530	R
1.590	R												

Actual Mean = 1.079 Actual Standard Deviation = 0.228

Edited Mean = 1.010 Edited Standard Deviation = 0.150

Comment : Common pyrite; fair amount vitrinite present.

Sample Depth : 3510.0

0.710	C	0.780	P	0.800	P	0.860	P	0.910	P	0.920	P	1.050	P
1.060	P	1.100	P	1.490	R	1.530	R						

Actual Mean = 1.019 Actual Standard Deviation = 0.272

Edited Mean = 0.935 Edited Standard Deviation = 0.122

Comment : Common large pyrite grains; small vitrinite particles and little sample present.

Sample Depth : 3990.0

0.740	0.780	0.810	0.810	0.810	0.830	0.840
0.860	0.860	0.860	0.870	0.880	0.890	0.900
0.900	0.900	0.900	0.910	0.920	0.920	0.930
0.930	0.950	0.950	0.950	0.970	0.970	0.980
0.980	0.990	1.010	1.020	1.020	1.020	1.030
1.030	1.030	1.030	1.050	1.060	1.070	1.120
1.140	1.160	1.170	1.180	1.250	1.270	1.280
1.370						

Actual Mean = 0.982 Actual Standard Deviation = 0.138

Edited Mean = 0.982 Edited Standard Deviation = 0.138

Comment : Occasional pyrite; fair amount vitrinite present.

Sample Depth : 4560.0

0.660 C	0.760	0.760	0.770	0.780	0.800	0.800
0.810	0.820	0.820	0.820	0.830	0.830	0.840
0.840	0.860	0.860	0.860	0.860	0.870	0.870
0.890	0.890	0.900	0.910	0.920	0.930	0.930
0.940	0.940	0.950	0.950	0.960	0.960	0.980
1.000	1.020	1.030	1.040	1.040	1.050	1.090
1.100	1.120	1.160	1.210	1.220	1.220	1.250
1.270						

Actual Mean = 0.940 Actual Standard Deviation = 0.143

Edited Mean = 0.946 Edited Standard Deviation = 0.139

Comment : Occasional large pyrite; fair amount vitrinite present.

Sample Depth : 5090.0

0.800	C	0.900	C	1.060	P	1.100	P	1.120	P	1.170	P	1.200
1.280		1.410	P									

Actual Mean = 1.116 Actual Standard Deviation = 0.185

Edited Mean = 1.191 Edited Standard Deviation = 0.120

Comment : Very little sample present.

Sample Depth : 5690.0

0.840	C	0.880	C	0.880	C	0.890	C	0.900	C	0.900	C	0.900	C
0.900	C	0.920	C	0.920	C	0.950		0.950		1.000		1.020	
1.020		1.040		1.050		1.060		1.070		1.070		1.080	
1.100		1.100		1.100		1.120		1.130		1.140		1.150	
1.150		1.180		1.200		1.240		1.260		1.270		1.300	
1.310		1.340		1.350		1.360		1.360		1.400		1.420	
1.420		1.430		1.440		1.480		1.520		1.669	R	1.760	R
1.780	R												

Actual Mean = 1.174 Actual Standard Deviation = 0.236

Edited Mean = 1.205 Edited Standard Deviation = 0.162

Comment : Occasional large pyrite grains present.

Sample Depth : 6300.0

0.660	C	0.730	C	0.730	C	0.740	C	0.750	C	0.750	C	0.760	C
0.800	C	0.830	C	0.840	C	0.860	C	0.890	C	0.910	C	0.930	
0.930		0.960		0.960		0.990		0.990		1.000		1.010	
1.020		1.030		1.050		1.050		1.080		1.080		1.100	
1.120		1.130		1.150		1.190		1.200		1.200		1.210	
1.220		1.250		1.250		1.260		1.270		1.270		1.280	
1.300		1.310		1.360		1.370		1.480		1.540		1.600	R
1.630	R												

Actual Mean = 1.080 Actual Standard Deviation = 0.238

Edited Mean = 1.158 Edited Standard Deviation = 0.155

Comment : Occasional large pyrite grains; fair amount vitrinite present.

Sample Depth : 6910.0

1.120	P	1.180	P	1.210	P	1.340	P	1.450	P

Actual Mean = 1.260 Actual Standard Deviation = 0.133

Edited Mean = 1.260 Edited Standard Deviation = 0.133

Comment : Little sample present.

Sample Depth : 7500.0

0.000

Actual Mean = 0.000 Actual Standard Deviation = 0.000

Edited Mean = 0.000 Edited Standard Deviation = 0.000

Comment : Very little sample and no vitrinite present.

Sample Depth : 7980.0

0.000

Actual Mean = 0.000 Actual Standard Deviation = 0.000

Edited Mean = 0.000 Edited Standard Deviation = 0.000

Comment : Insufficient sample; not processed.

Sample Depth : 8510.0

1.230	P	1.340	P	1.390	P	1.420	P	1.470	P	1.500	P	1.510	
1.620	P	1.630		1.820		1.890	R	1.990	R				

Actual Mean = 1.568 Actual Standard Deviation = 0.231

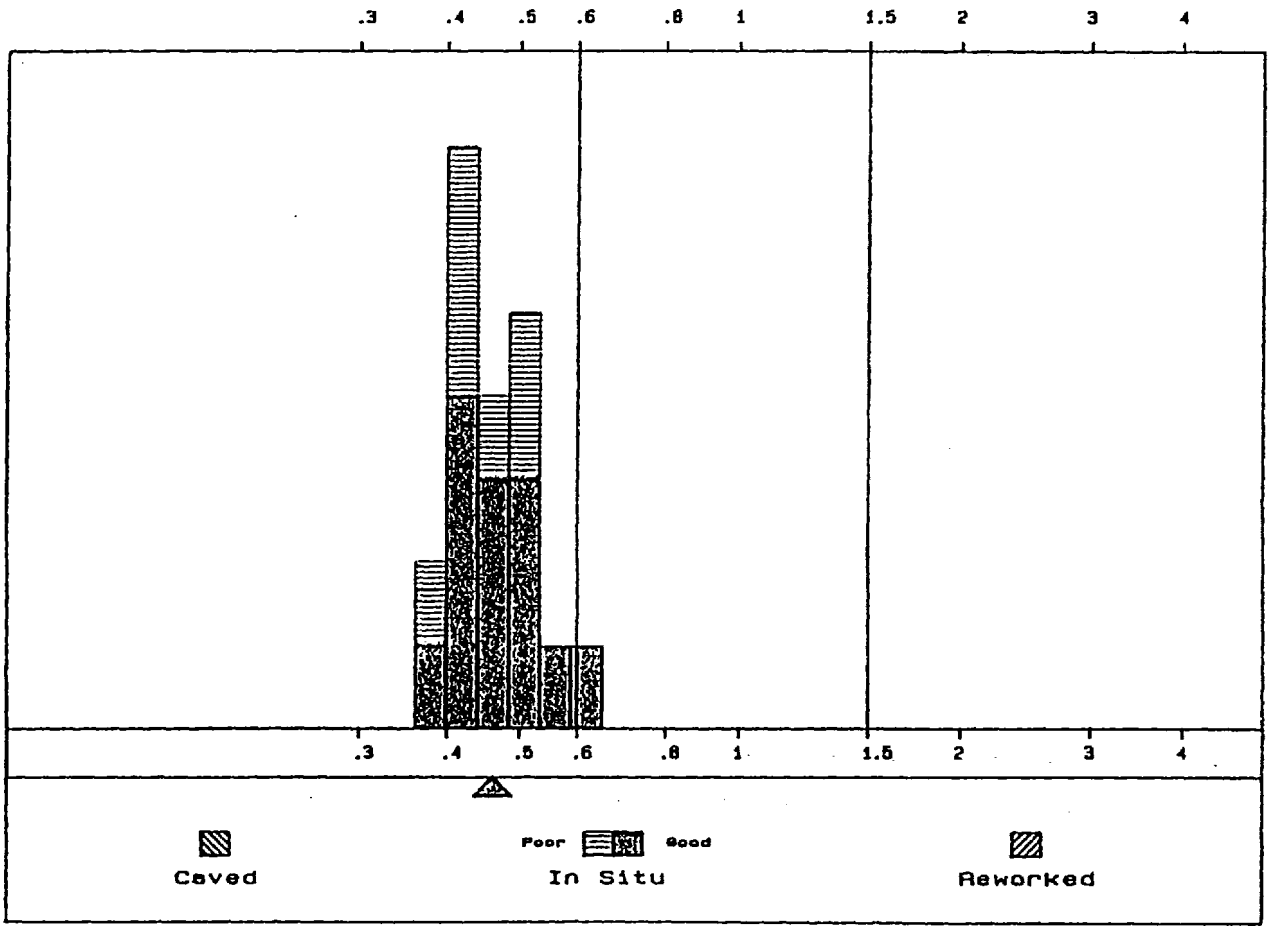
Edited Mean = 1.493 Edited Standard Deviation = 0.167

Comment : Abundant large pyrite grains; little sample present.

SAMPLE : 920f

Population	Mean	Standard Deviation
In Situ	0.46	0.05
Caved	-	-
Reworked	-	-
Total	0.46	0.05

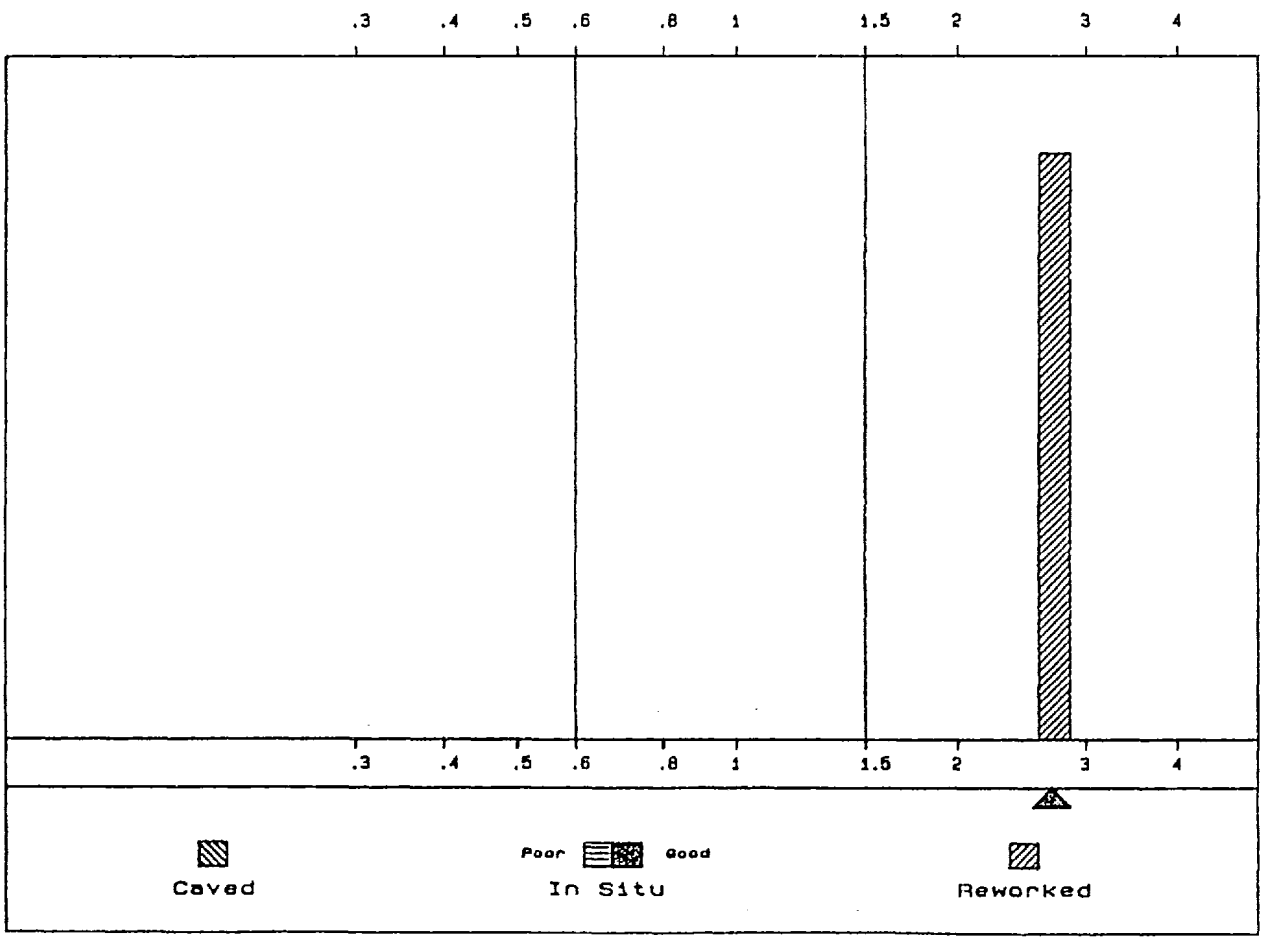
Total measurements this sample : 20



SAMPLE : 1550f

Population	Mean	Standard Deviation
In Situ	-	-
Caved	-	-
Reworked	2.63	0.07
Total	2.63	0.07

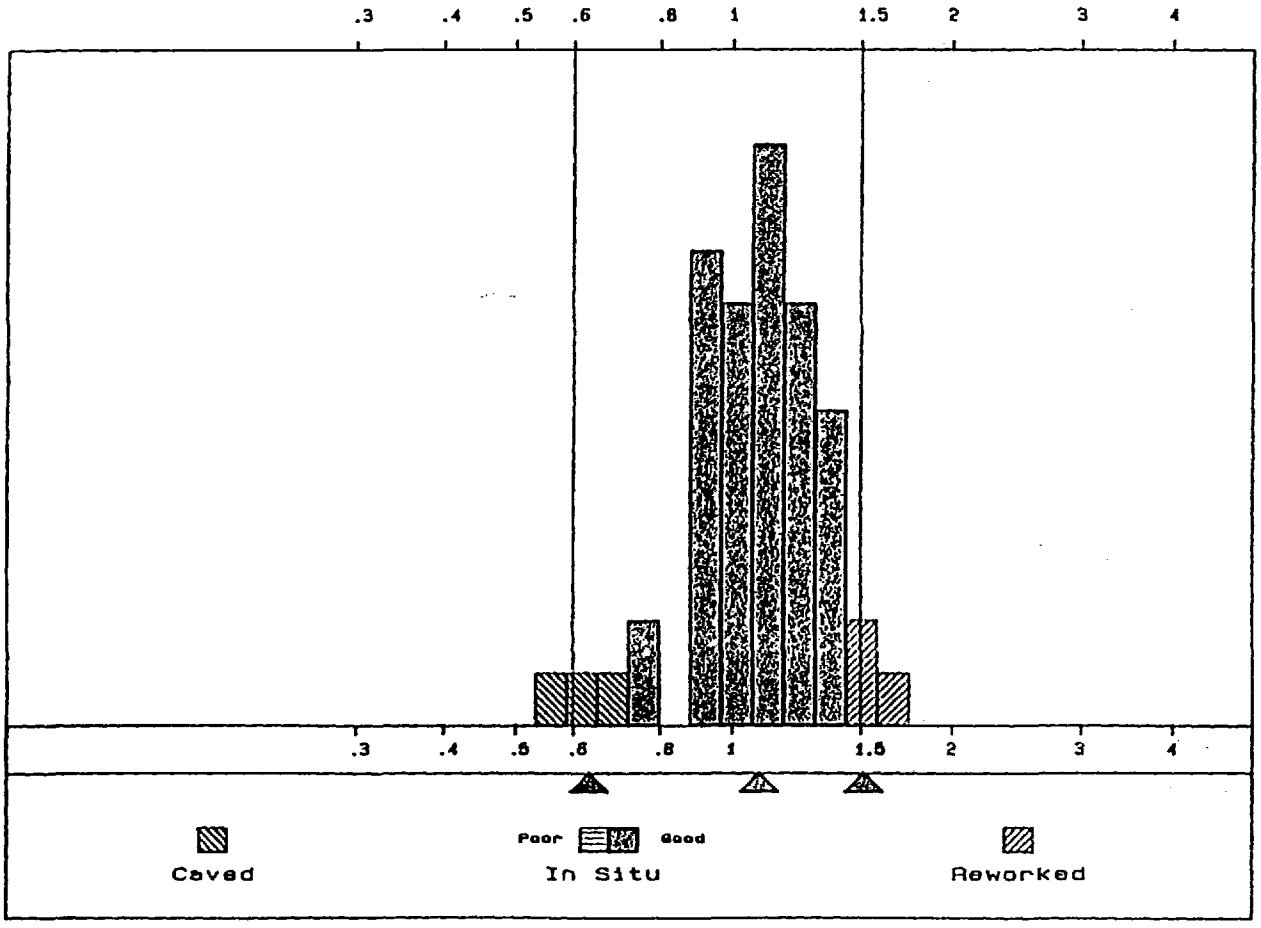
Total measurements this sample : 2



SAMPLE : 1810f

Population	Mean	Standard Deviation
In Situ	1.07	0.17
Caved	0.63	0.08
Reworked	1.49	0.07
Total	1.07	0.22

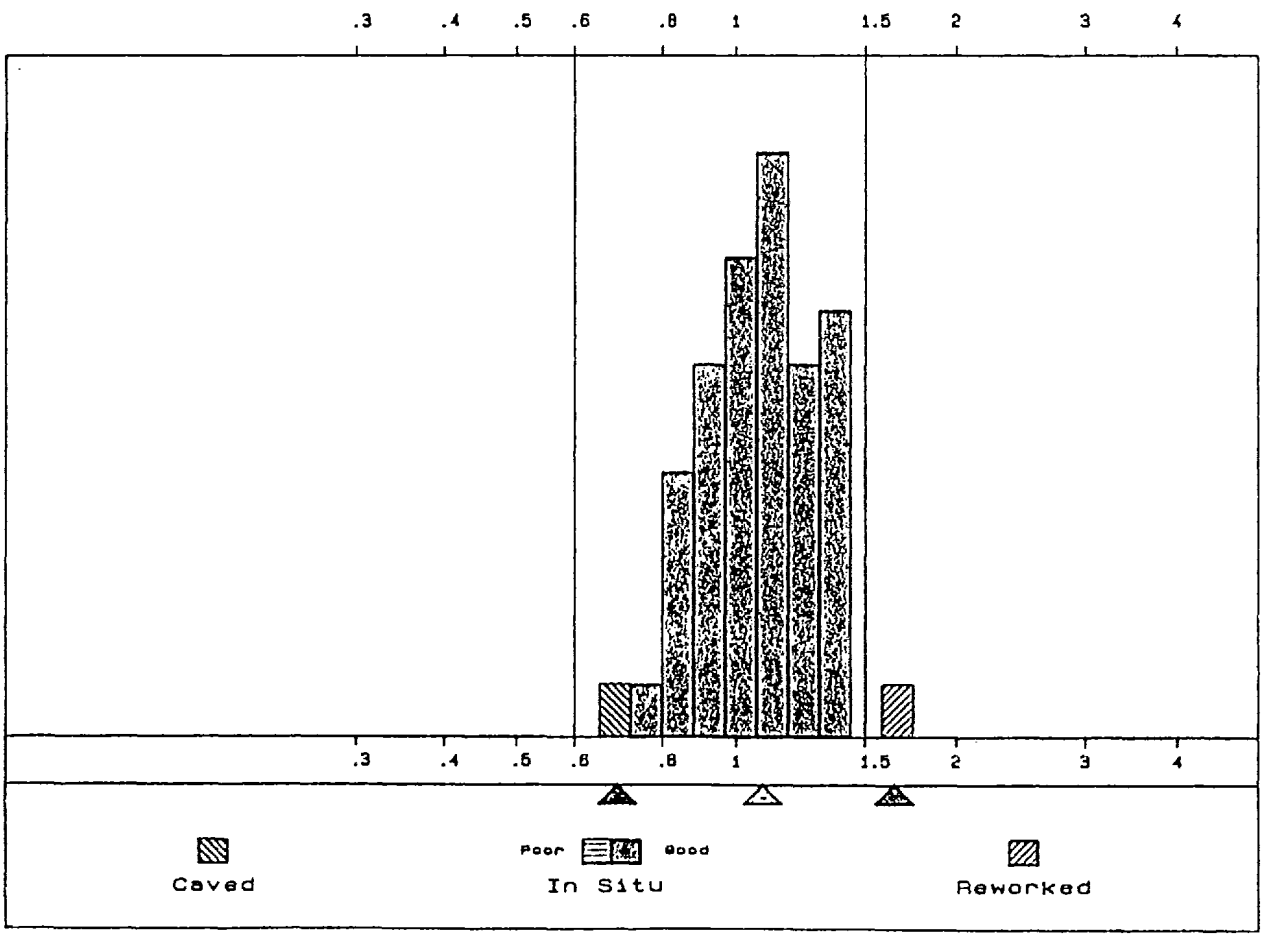
Total measurements this sample : 50



SAMPLE : 2390f

Population	Mean	Standard Deviation
In Situ	1.07	0.17
Caved	0.68	-
Reworked	1.61	-
Total	1.07	0.20

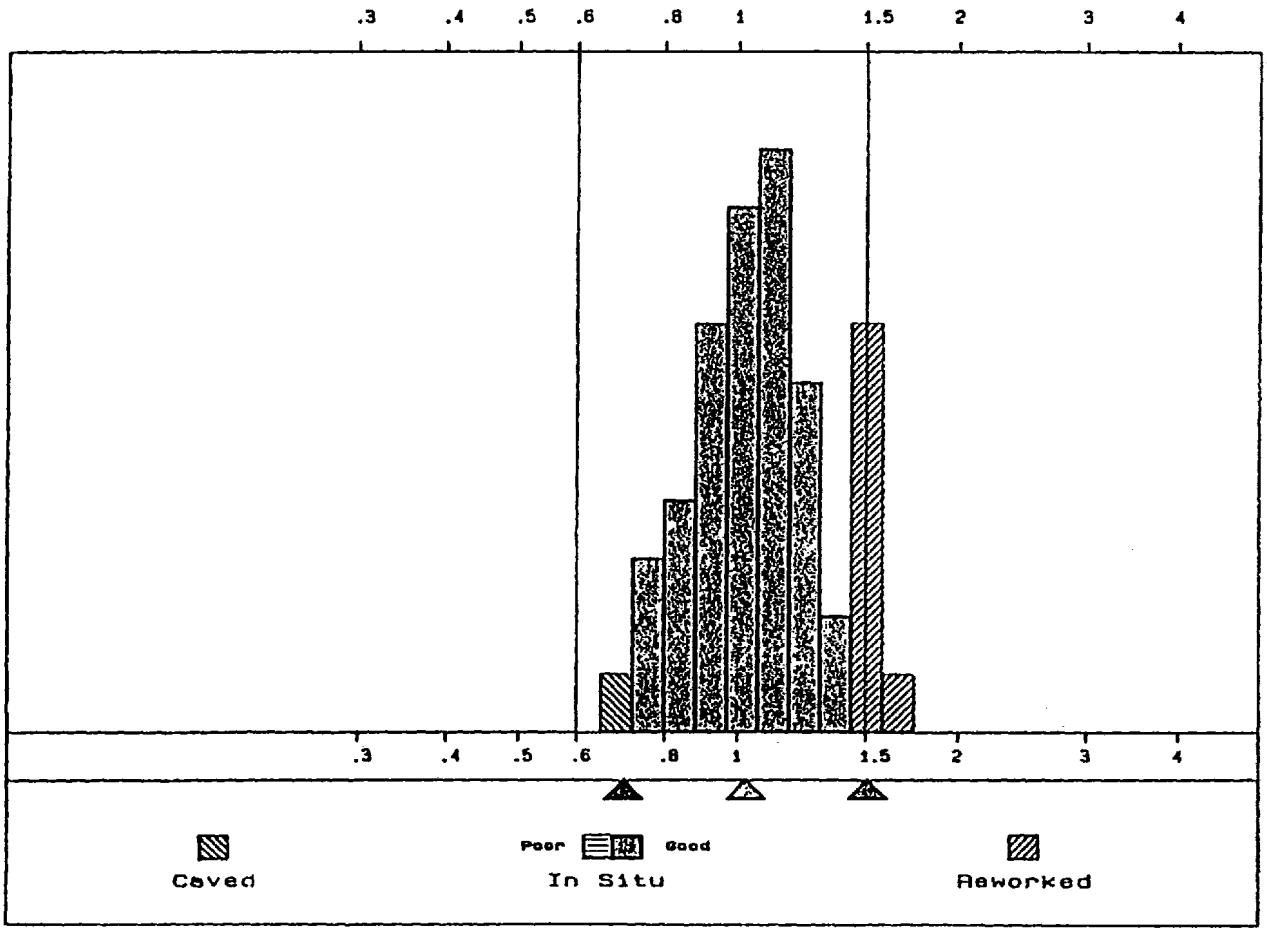
Total measurements this sample : 50



SAMPLE : 2980f

Population	Mean	Standard Deviation
In Situ	1.01	0.15
Caved	0.89	-
Reworked	1.48	0.06
Total	1.08	0.23

Total measurements this sample : 50

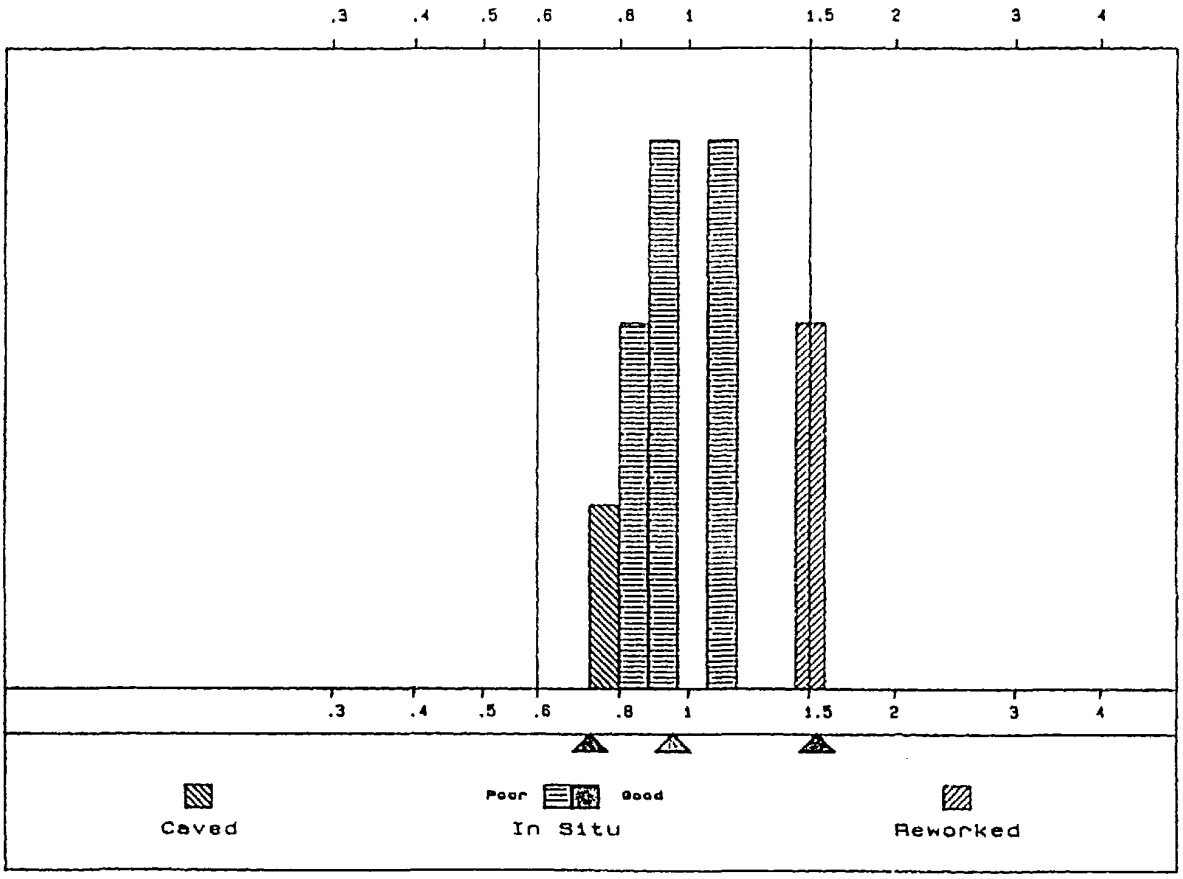


BUJAK DAVIES GROUP : VITRINITE DANGEROUS RIVER #1

SAMPLE : 3510f

Population	Mean	Standard Deviation
In Situ	0.94	0.12
Caved	0.71	-
Reworked	1.51	0.03
Total	1.02	0.27

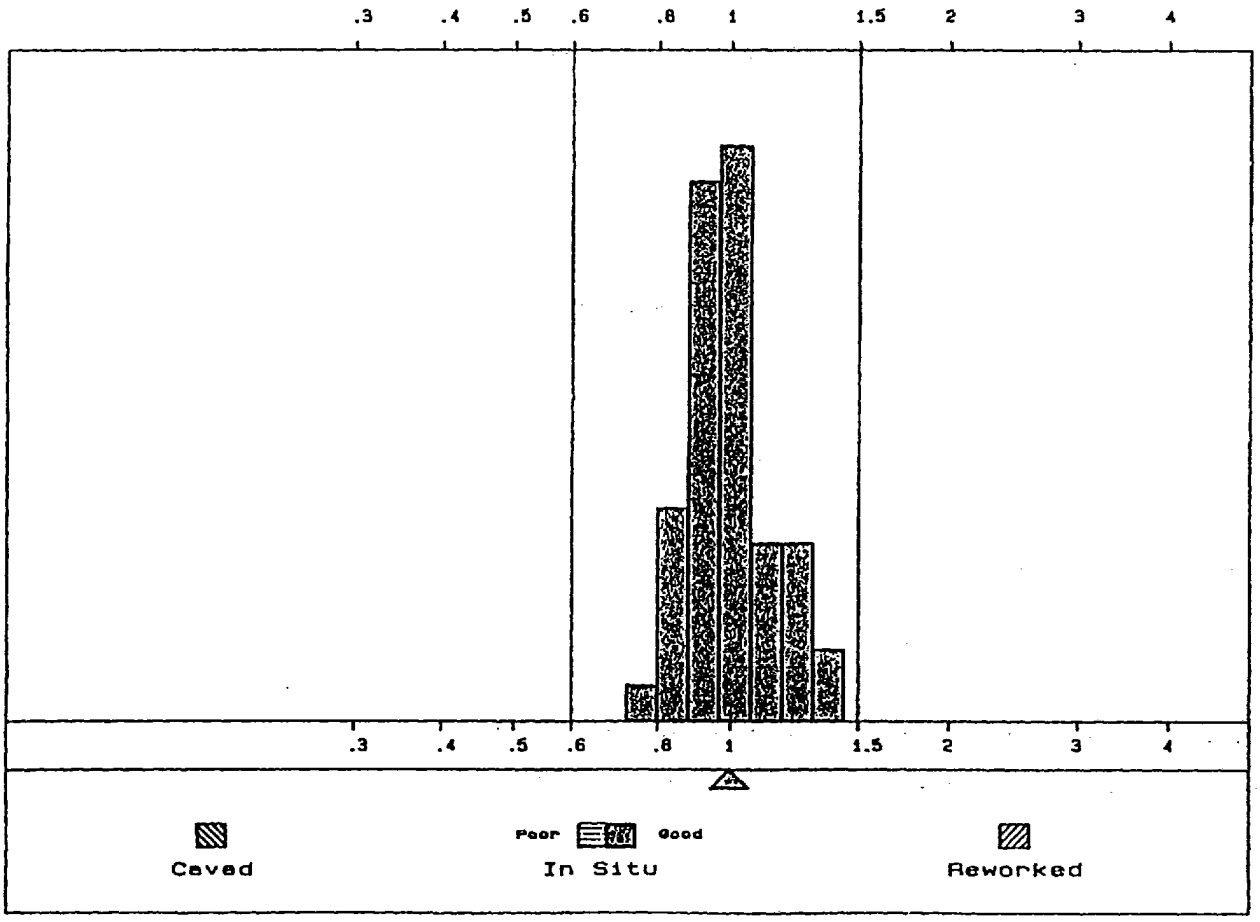
Total measurements this sample : 11



SAMPLE : 3990f

Population	Mean	Standard Deviation
In Situ	0.98	0.14
Caved	-	-
Reworked	-	-
Total	0.98	0.14

Total measurements this sample : 50

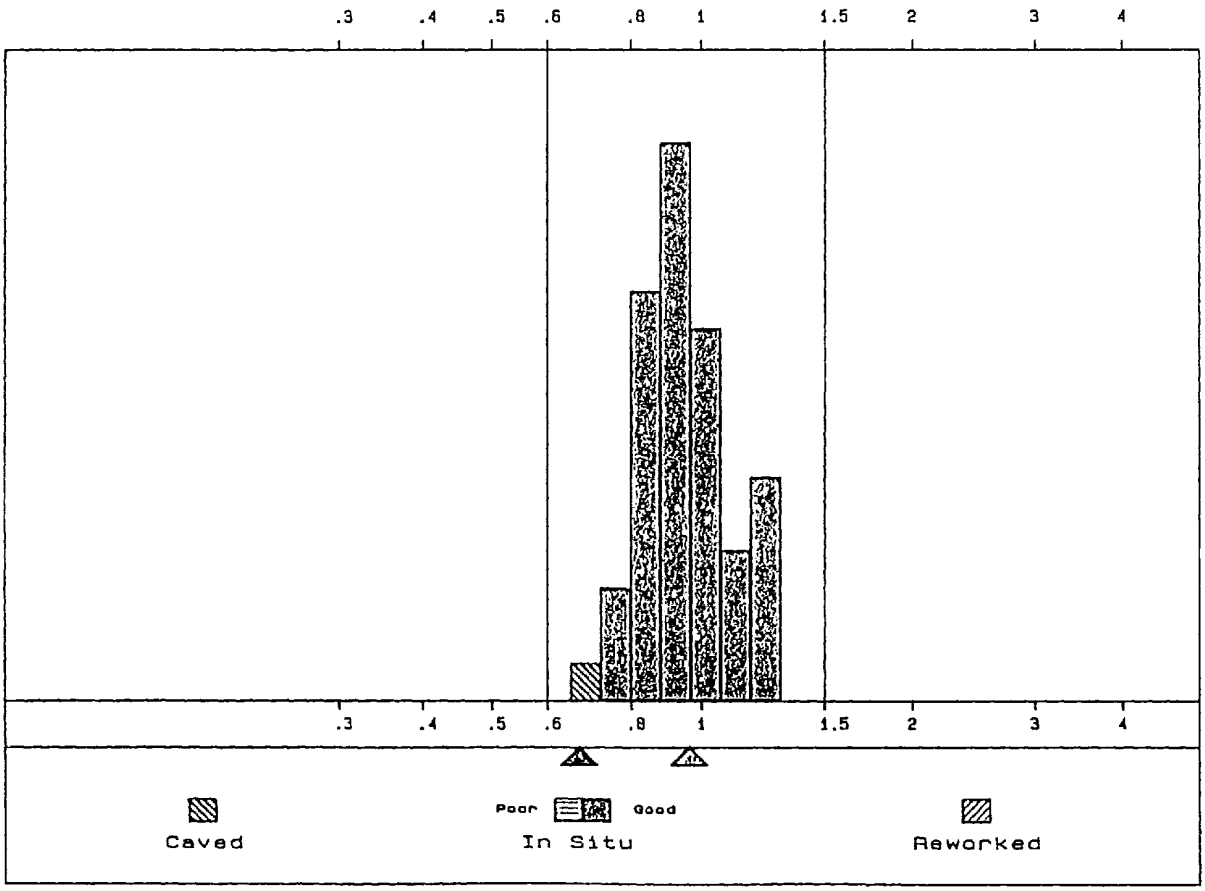


BUJAK DAVIES GROUP : VITRINITE DANGEROUS RIVER #1

SAMPLE : 4560f

Population	Mean	Standard Deviation
In Situ	0.95	0.14
Caved	0.66	-
Reworked	-	-
Total	0.94	0.14

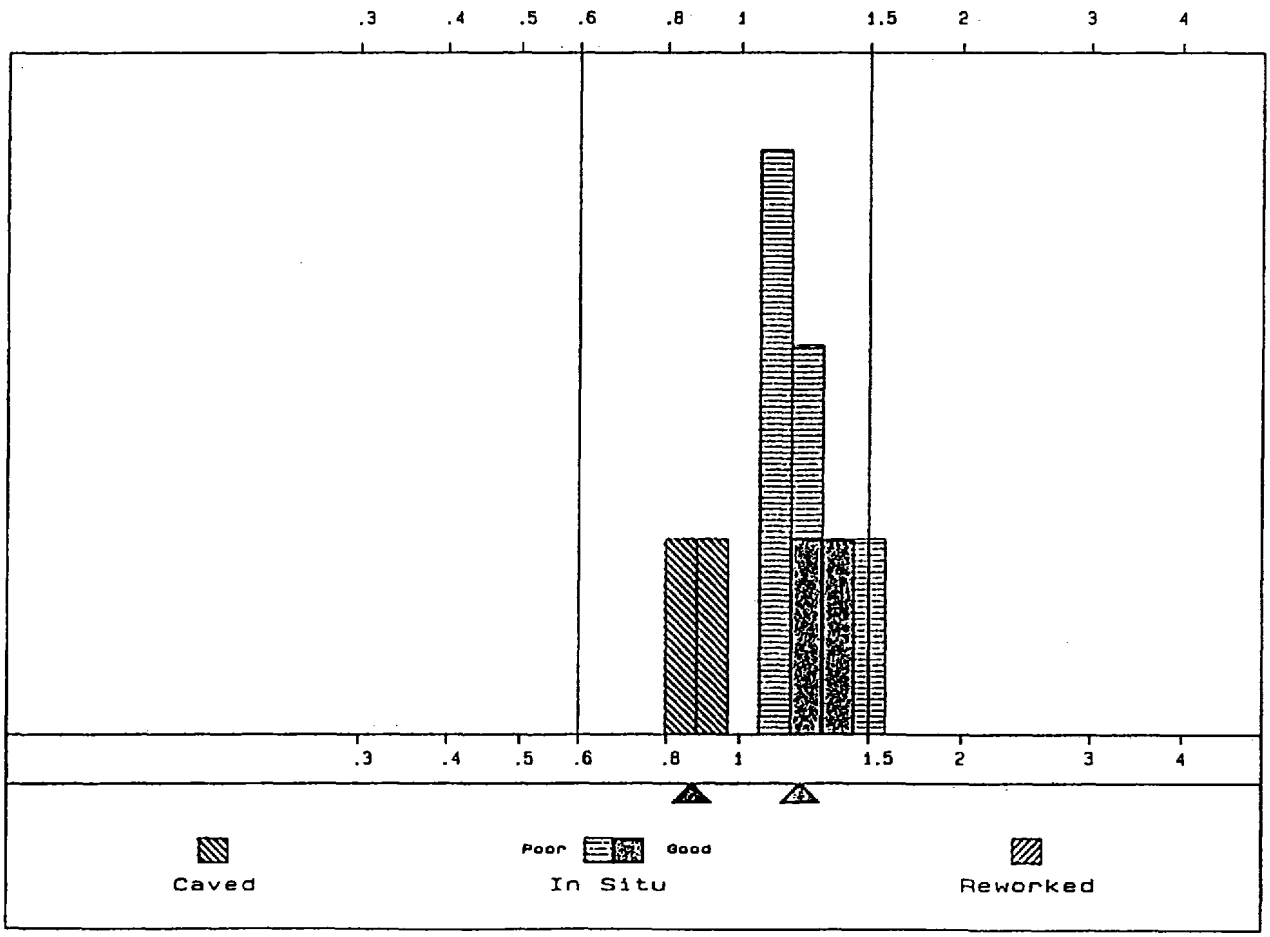
Total measurements this sample : 50



SAMPLE : 5090f

Population	Mean	Standard Deviation
In Situ	1.19	0.12
Caved	0.85	0.07
Reworked	-	-
Total	1.12	0.18

Total measurements this sample : 9

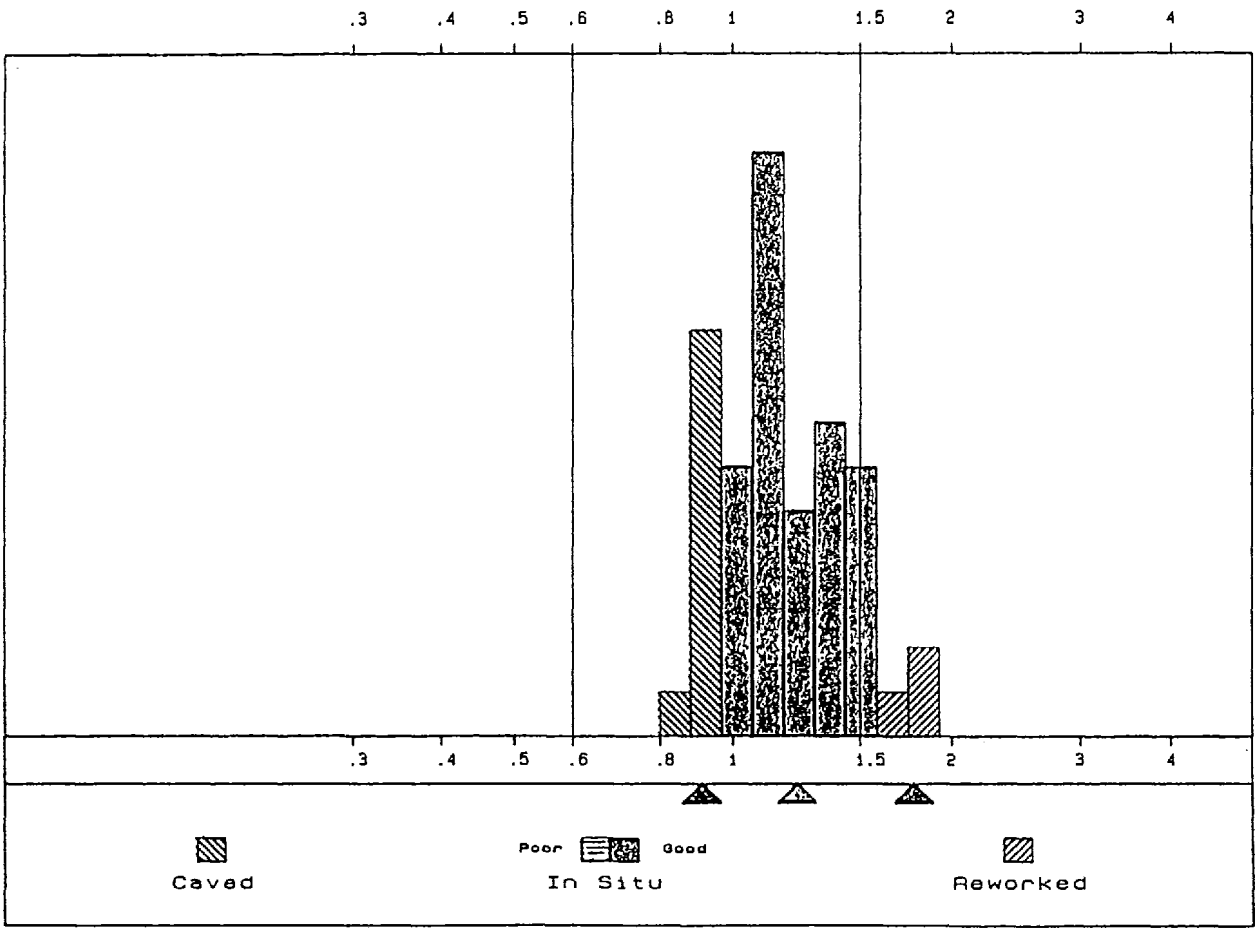


BUJAK DAVIES GROUP : VITRINITE DANGEROUS RIVER #1

SAMPLE : 5690f

Population	Mean	Standard Deviation
In Situ	1.20	0.16
Caved	0.89	0.02
Reworked	1.74	0.06
Total	1.17	0.24

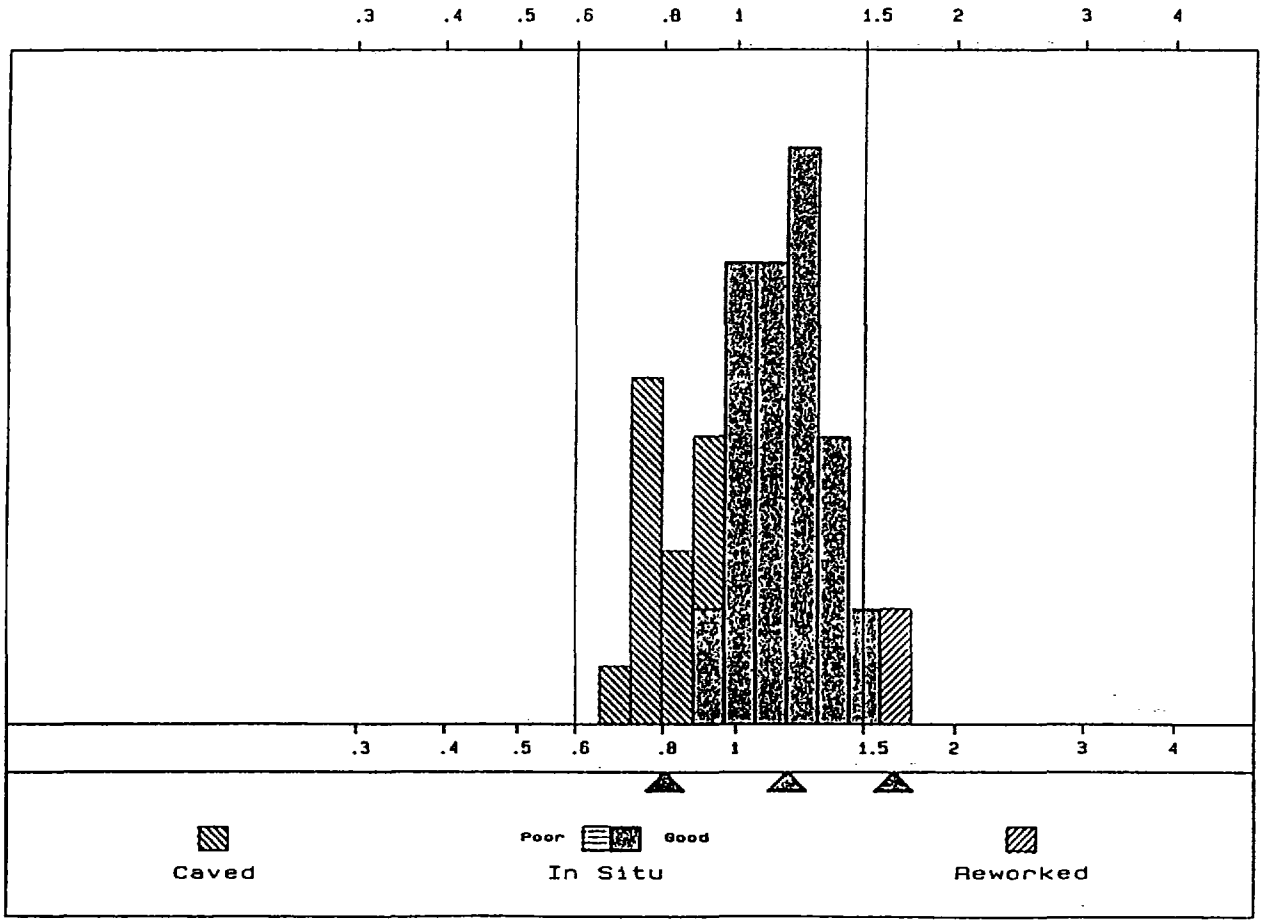
Total measurements this sample : 50



SAMPLE : 6300f

Population	Mean	Standard Deviation
In Situ	1.16	0.16
Caved	0.79	0.07
Reworked	1.62	0.02
Total	1.08	0.24

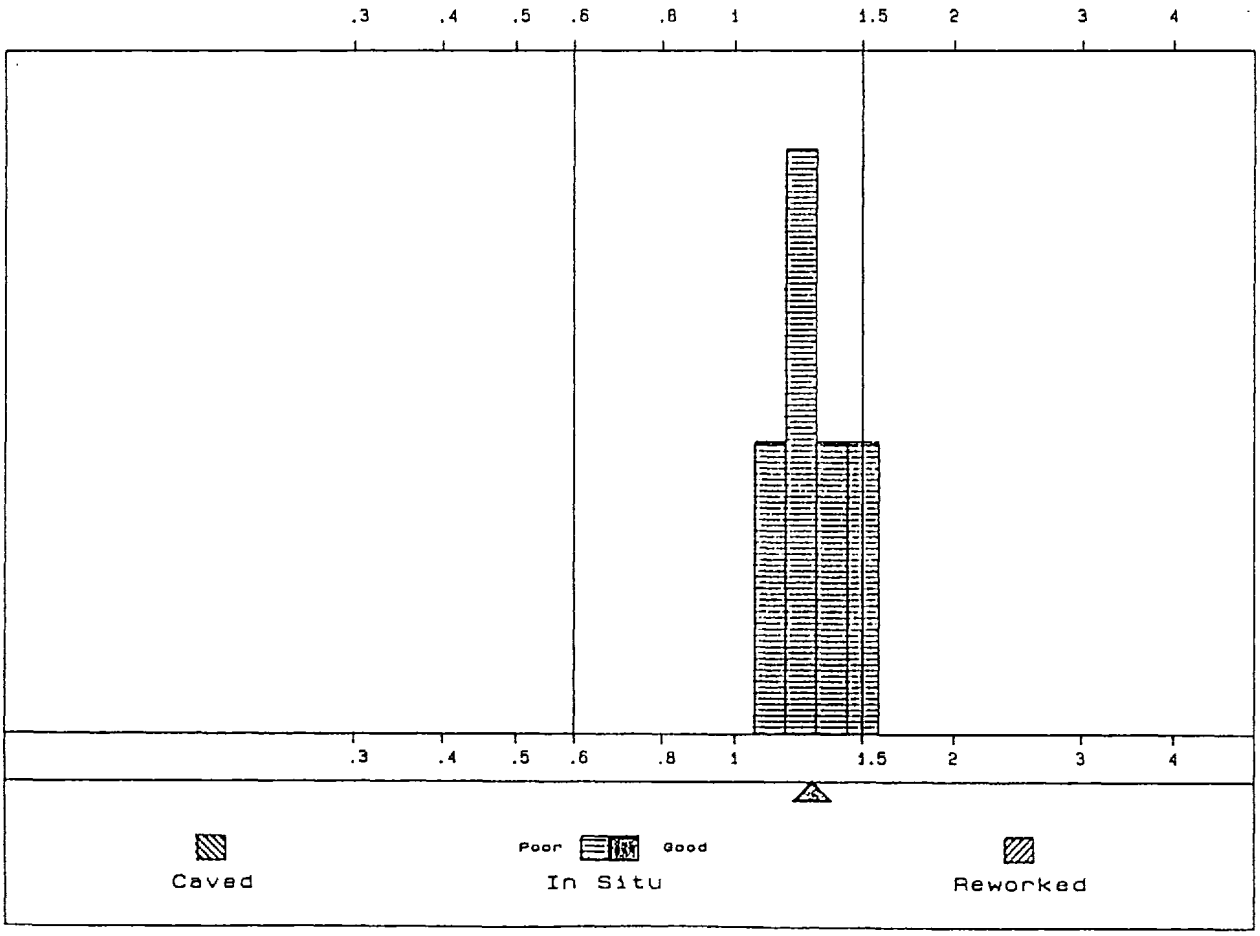
Total measurements this sample : 50



SAMPLE : 6910f

Population	Mean	Standard Deviation
In Situ	1.26	0.13
Caved	-	-
Reworked	-	-
Total	1.26	0.13

Total measurements this sample : 5



BUJAK DAVIES GROUP : VITRINITE DANGEROUS RIVER #1

SAMPLE : 8510f

Population	Mean	Standard Deviation
In Situ	1.49	0.17
Caved	-	-
Reworked	1.94	0.07
Total	1.57	0.23

Total measurements this sample : 12