Vitrinite reflectance data and analysis of the 480 - 9,430 foot interval of the Consolidated Oil Iniskin Unit Beal No. 1 well

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VITRINITE REFLECTANCE ANALYSIS OF THE INTERVAL 480 - 9,430 FT

BEAL #1 WELL, ALASKA

Introduction

This report describes the vitrinite reflectance analysis of 20 cuttings samples from the Beal #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 unoxidozed 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

Vitrinite Reflectance Based on Ro

480-1,620ft	Onset of Maturation
1,970-9,430ft	Marginally Mature

Onset of Maturation Zone: 480-1,620ft

All three samples in this zone have execellent histogram distributions. The first, at 480ft has an Ro=0.525%. Other samples in this zone are also in agreement with this Ro.

Marginally Mature Zone: 1,970-9,430ft

The 1,970ft sample has an excellent histogram distribution (Ro=0.672%) and is a good indicator of maturity at this depth. Other samples in this zone also have good to excellent histogram distributions. Only the 9,000ft sample has a significant amount of cavings and reworked material. The Ro of the deepest sample is 0.652% which is on the upper edge of the oil window. Other samples in this zone also have similar Ro's.

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: BEAL #1
Area: ALASKA

Scientist: DUMCIUS
Date: AUGUST 1988
Samples are: F

VITRINITE DATA:
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Sample Depth : 480.0

0.360	0.430	0.430	0.450	0.470	0.470	0.480
0.480	0.480	0.480	0.490	0.490	0.490	0.490
0.490	0.490	0.490	0.500	0.500	0.510	0.510
0.510	0.510	0.510	0.510	0.520	0.520	0.520
0.520	0.520	0.520	0.530	0.530	0.530	0.540
0.540	0.540	0.540	0.540	0.550	0.550	0.580
0.590	0.610	0.620	0.620	0.640	0.640	0.680
0.730						

Actual Mean = 0.525 Actual Standard Deviation = 0.064

Edited Mean = 0.525 Edited Standard Deviation = 0.064

Comment : Abundant pyrite and degraded amorphous material present.

Sample Depth : 930.0

0.330	0.390	0.390	0.390	0.400	0.410	0.410
0.420	0.430	0.440	0.460	0.460	0.460	0.470
0.470	0.480	0.480	0.490	0.500	0.500	0.500
0.500	0.500	0.510	0.510	0.510	0.510	0.510
0.520	0.520	0.520	0.540	0.540	0.550	0.550
0.550	0.560	0.560	0.570	0.570	0.570	0.570
0.580	0.590	0.620	0.630	0.640	0.650	0.670
0.680						

Actual Mean = 0.512 Actual Standard Deviation = 0.078

Edited Mean = 0.512 Edited Standard Deviation = 0.078

Comment : Abundant pyrite and degraded amorphous material present.

Sample Depth : 1530.0

0.480	0.490	0.500	0.500	0.510	0.510	0.520
0.520	0.530	0.530	0.530	0.540	0.540	0.540
0.540	0.540	0.550	0.550	0.550	0.560	0.560
0.560	0.570	0.570	0.570	0.590	0.600	0.600
0.600	0.600	0.610	0.610	0.610	0.610	0.610
0.610	0.620	0.630	0.630	0.630	0.650	0.660
0.660	0.660	0.660	0.660	0.680	0.680	0.700
0.710						

Actual Mean = 0.585 Actual Standard Deviation = 0.059

Edited Mean = 0.585 Edited Standard Deviation = 0.059

Comment : Abundant pyrite and degraded amorphous material present.

Sample Depth : 1970.0

0.520	0.540	0.550	0.580	0.580	0.580	0.590
0.600	0.600	0.610	0.610	0.620	0.630	0.640
0.640	0.640	0.640	0.640	0.650	0.650	0.650
0.650	0.660	0.670	0.680	0.680	0.680	0.690
0.690	0.690	0.700	0.700	0.710	0.710	0.720
0.720	0.720	0.720	0.720	0.730	0.730	0.730
0.730	0.740	0.750	0.760 P	0.770	0.770	0.800
0.800						

Actual Mean = 0.672 Actual Standard Deviation = 0.067

Edited Mean = 0.672 Edited Standard Deviation = 0.067

Comment : Abundant pyrite and degraded amorphous material present.

Sample Depth : 2470.0

0.410 C	0.410 C	0.420 C	0.420 C	0.440	0.440	0.450
0.450	0.460	0.470	0.480	0.490	0.510	0.510
0.510	0.520	0.520	0.520	0.530	0.530	0.530
0.530	0.530	0.550	0.560	0.570	0.600	0.620
0.630	0.640	0.640	0.650	0.670	0.670	0.680
0.690	0.690	0.700	0.710	0.720	0.720	0.730
0.730	0.730	0.750	0.750	0.770	0.780	0.790
0.800						

Actual Mean = 0.592 Actual Standard Deviation = 0.119

Edited Mean = 0.608 Edited Standard Deviation = 0.111

Comment : Abundant pyrite and degraded amorphous material present.

Sample Depth : 2990.0

0.460	0.490	0.500	0.510	0.510	0.520	0.540
0.550	0.550	0.560	0.560	0.570	0.570	0.590
0.590	0.600	0.600	0.600	0.610	0.620	0.620
0.630	0.640	0.640	0.640	0.640	0.650	0.660
0.660	0.660	0.660	0.660	0.670	0.670	0.680
0.680	0.690	0.690	0.690	0.690	0.700	0.700
0.700	0.710	0.720	0.720	0.720	0.770	0.780
0.780						

Actual Mean = 0.632 Actual Standard Deviation = 0.077

Edited Mean = 0.632 Edited Standard Deviation = 0.077

Comment : Common pyrite; a fair amount good vitrinite present.

Sample Depth : 3500.0

0.440	0.440	0.460	0.460	0.480	0.480	0.500
0.500	0.500	0.520	0.530	0.550 P	0.550	0.560
0.560	0.570	0.580	0.580	0.590	0.590	0.600
0.610	0.620	0.630	0.650	0.650	0.650	0.670
0.670	0.680	0.690	0.710	0.710	0.720	0.730
0.740 P	0.760	0.770	0.800			

Actual Mean = 0.603 Actual Standard Deviation = 0.099

Edited Mean = 0.603 Edited Standard Deviation = 0.099

Comment : Abundant pyrite; mostly small particles present.

Sample Depth : 3530.0

0.410 C	0.440	0.440	0.450	0.460	0.460	0.460
0.460 P	0.470	0.470	0.480	0.480	0.480	0.490
0.500 P	0.500	0.510	0.510	0.520	0.520	0.520
0.540	0.540	0.540	0.550	0.550	0.550	0.560
0.570	0.580	0.590	0.590	0.600	0.600	0.600
0.630	0.630	0.630	0.640	0.640	0.670	0.680
0.690	0.690	0.700	0.700	0.710	0.730 P	0.750
0.790 P						

Actual Mean = 0.565 Actual Standard Deviation = 0.094

Edited Mean = 0.569 Edited Standard Deviation = 0.092

Comment : Abundant pyrite and degraded amorphous material present.

Sample Depth : 3810.0

0.430		0.440		0.440		0.460		0.460		0.470		0.480
0.500		0.510		0.510	P	0.520		0.520		0.530		0.530
0.530		0.530		0.540		0.550		0.550		0.560		0.560
0.560		0.570		0.580		0.590		0.590		0.600		0.600
0.610		0.610		0.630	P	0.630		0.670	P	0.680		0.680
0.740		0.740		0.780		0.830	R	0.860	R	0.860	R	

Actual Mean = 0.586 Actual Standard Deviation = 0.111

Edited Mean = 0.565 Edited Standard Deviation = 0.085

Comment : Abundant pyrite; little vitrinite present.

Sample Depth : 5070.0

0.430		0.470		0.470		0.470		0.500		0.510		0.510
0.530		0.540		0.550		0.550		0.550		0.550		0.560
0.560		0.560		0.560		0.580		0.590		0.590		0.590
0.600		0.600		0.600		0.600		0.600		0.610		0.610
0.610		0.620		0.630		0.630		0.630		0.640	P	0.650
0.650		0.650		0.650		0.660		0.660		0.660		0.660
0.680		0.700		0.710		0.720		0.750		0.750		0.750
0.760	P											

Actual Mean = 0.605 Actual Standard Deviation = 0.078

Edited Mean = 0.605 Edited Standard Deviation = 0.078

Comment : Abundant pyrite; mostly fine vitrinite particles present.

Sample Depth : 5590.0

0.360	C	0.460		0.470		0.470		0.480		0.500		0.500
0.530		0.530		0.540		0.540		0.540		0.560		0.560
0.560		0.570		0.570		0.580		0.580		0.580		0.580
0.590		0.590		0.600		0.600		0.600		0.600		0.610
0.610		0.620		0.620		0.620		0.630		0.630		0.640
0.640		0.650		0.650		0.650		0.660		0.680		0.700
0.710		0.710		0.720		0.740		0.740		0.760		0.760
0.790												

Actual Mean = 0.604 Actual Standard Deviation = 0.087

Edited Mean = 0.609 Edited Standard Deviation = 0.081

Comment : Abundant pyrite; fair amount vitrinite present.

Sample Depth : 5930.0

0.490	0.550	0.550	0.560	0.560	0.570	0.570
0.570	0.580	0.580	0.580	0.600	0.610	0.610
0.610	0.620	0.620	0.620	0.630	0.630	0.640
0.640	0.640	0.650	0.650	0.650	0.650	0.660
0.660	0.660	0.660	0.660	0.660	0.670	0.670
0.680	0.680	0.680	0.690	0.690	0.690	0.700
0.700	0.700	0.720	0.720	0.730	0.750	0.750
0.790						

Actual Mean = 0.644 Actual Standard Deviation = 0.060

Edited Mean = 0.644 Edited Standard Deviation = 0.060

Comment : Common pyrite; fair amount vitrinite present.

Sample Depth : 6510.0

0.470	0.500	0.520	0.550	0.560	0.560	0.560
0.560	0.580	0.590	0.590	0.600	0.610 P	0.620
0.620	0.630	0.630	0.630	0.640	0.640	0.640
0.650	0.650	0.650	0.660	0.660	0.660	0.660
0.670	0.670	0.680	0.680	0.690	0.690	0.700
0.710	0.710	0.720	0.720	0.720	0.720	0.720
0.740	0.740	0.750	0.760	0.760	0.760	0.770
0.790						

Actual Mean = 0.655 Actual Standard Deviation = 0.074

Edited Mean = 0.655 Edited Standard Deviation = 0.074

Comment : Abundant fine pyrite and fine vitrinite particles present.

Sample Depth : 7000.0

0.500	0.510	0.510	0.520	0.520	0.530	0.530
0.530	0.530	0.530	0.530	0.540	0.540	0.540
0.540	0.560	0.580	0.580	0.580	0.580	0.580
0.580	0.580	0.590	0.590	0.590	0.600	0.600
0.600	0.600	0.600	0.600	0.610	0.610	0.610
0.610	0.620	0.650	0.650	0.650	0.660	0.670
0.670	0.680	0.690	0.690	0.690	0.730	0.730
0.870 R						

Actual Mean = 0.600 Actual Standard Deviation = 0.071

Edited Mean = 0.594 Edited Standard Deviation = 0.060

Comment : Abundant fine pyrite and fine vitrinite particles present.

Sample Depth : 7500.0

0.500	0.530	0.550	0.560	0.560	0.570	0.570
0.580	0.590	0.590	0.600	0.600	0.600	0.600
0.600	0.600	0.610	0.610	0.620	0.630	0.630
0.640	0.640	0.650	0.650	0.650	0.660	0.670
0.670	0.680	0.690	0.700	0.700	0.700	0.700
0.700	0.710	0.710	0.710	0.720	0.730	0.740
0.740	0.740	0.750	0.750	0.760	0.760	0.800
0.900						

Actual Mean = 0.658 Actual Standard Deviation = 0.078

Edited Mean = 0.658 Edited Standard Deviation = 0.078

Comment : Abundant fine pyrite and fine vitrinite particles present.

Sample Depth : 8020.0

0.450	C	0.510		0.520	0.540	0.560	0.560	0.590
0.590		0.600		0.600	0.610	0.620	0.620	0.620
0.620		0.630		0.630	0.640	0.640	0.640	0.650
0.680		0.680	P	0.690	0.700	0.700	0.710	0.720
0.730		0.730		0.730	0.730	0.730	0.740	0.740
0.740		0.750		0.760	0.760	0.770	0.770	0.770
0.780		0.780		0.800	0.800	0.800	0.810	0.830
0.920								

Actual Mean = 0.686 Actual Standard Deviation = 0.095

Edited Mean = 0.691 Edited Standard Deviation = 0.090

Comment : Abundant fine pyrite and fine vitrinite particles present.

Sample Depth : 8520.0

0.500	0.510	0.510	0.550	0.550	0.560	0.560
0.560	0.570	0.570	0.570	0.580	0.580	0.580
0.590	0.590	0.600	0.600	0.610	0.610	0.610
0.614	0.620	0.620	0.620	0.630	0.640	0.640
0.650	0.650	0.660	0.680	0.680	0.690	0.690
0.700	0.700	0.710	0.720	0.720	0.720	0.730
0.750	0.750	0.760	0.780	0.800	0.810	0.820
0.830						

Actual Mean = 0.647 Actual Standard Deviation = 0.085

Edited Mean = 0.647 Edited Standard Deviation = 0.085

Comment : Abundant fine grained pyrite in a grey amorphous organic matrix.

Sample Depth : 8740.0

0.440	C	0.500	C	0.560		0.580	0.580	0.580	0.590
0.590		0.600		0.600		0.610	0.620	0.630	0.630
0.630		0.640		0.640		0.650	0.650	0.650	0.650
0.660		0.660		0.660		0.660	0.660	0.680	0.680
0.680		0.690		0.700		0.700	0.710	0.720	0.720
0.730		0.730		0.730		0.730	0.740	0.760	0.770
0.780		0.790		0.790		0.790	0.800	0.810	0.810
0.830									

Actual Mean = 0.676 Actual Standard Deviation = 0.083

Edited Mean = 0.684 Edited Standard Deviation = 0.073

Comment : Abundant fine grained pyrite and degraded amorphous material; mostly fine vitrinite particles

Sample Depth : 8995.0

0.410	C	0.420	C	0.430	C	0.450	C	0.510	0.520	0.540
0.560		0.600		0.630		0.630		0.630	0.650	0.650
0.660		0.670		0.680		0.700		0.730	0.760	0.780
0.800		0.860	R	0.880	R	0.930	R			

Actual Mean = 0.643 Actual Standard Deviation = 0.144

Edited Mean = 0.650 Edited Standard Deviation = 0.085

Comment : Abundant fine grained pyrite present.

Sample Depth : 9410.0

0.490	0.500	0.510	0.510	0.520	0.530	0.540
0.550	0.550	0.560	0.560	0.580	0.590	0.600
0.600	0.620	0.630	0.630	0.640	0.640	0.640
0.640	0.650	0.650	0.650	0.660	0.660	0.660
0.660	0.670	0.670	0.670	0.670	0.680	0.680
0.680	0.680	0.680	0.690	0.700	0.700	0.720
0.730	0.740	0.740	0.790	0.830	0.830	0.900
0.930						

Actual Mean = 0.652 Actual Standard Deviation = 0.096

Edited Mean = 0.652 Edited Standard Deviation = 0.096

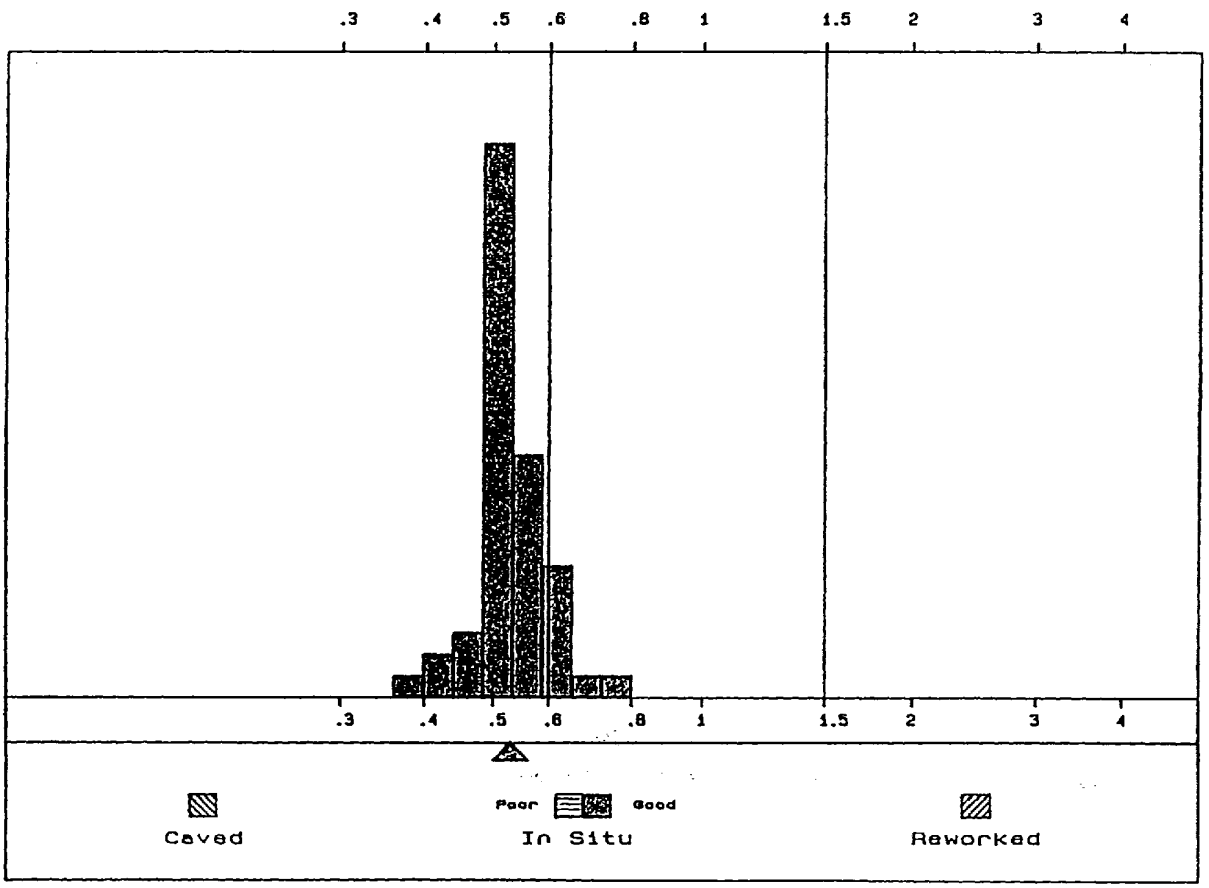
Comment : Abundant fine grained pyrite; fair amount vitrinite particles present.

BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 480f

Population	Mean	Standard Deviation
In Situ	0.52	0.06
Caved	-	-
Reworked	-	-
Total	0.52	0.06

Total measurements this sample : 50

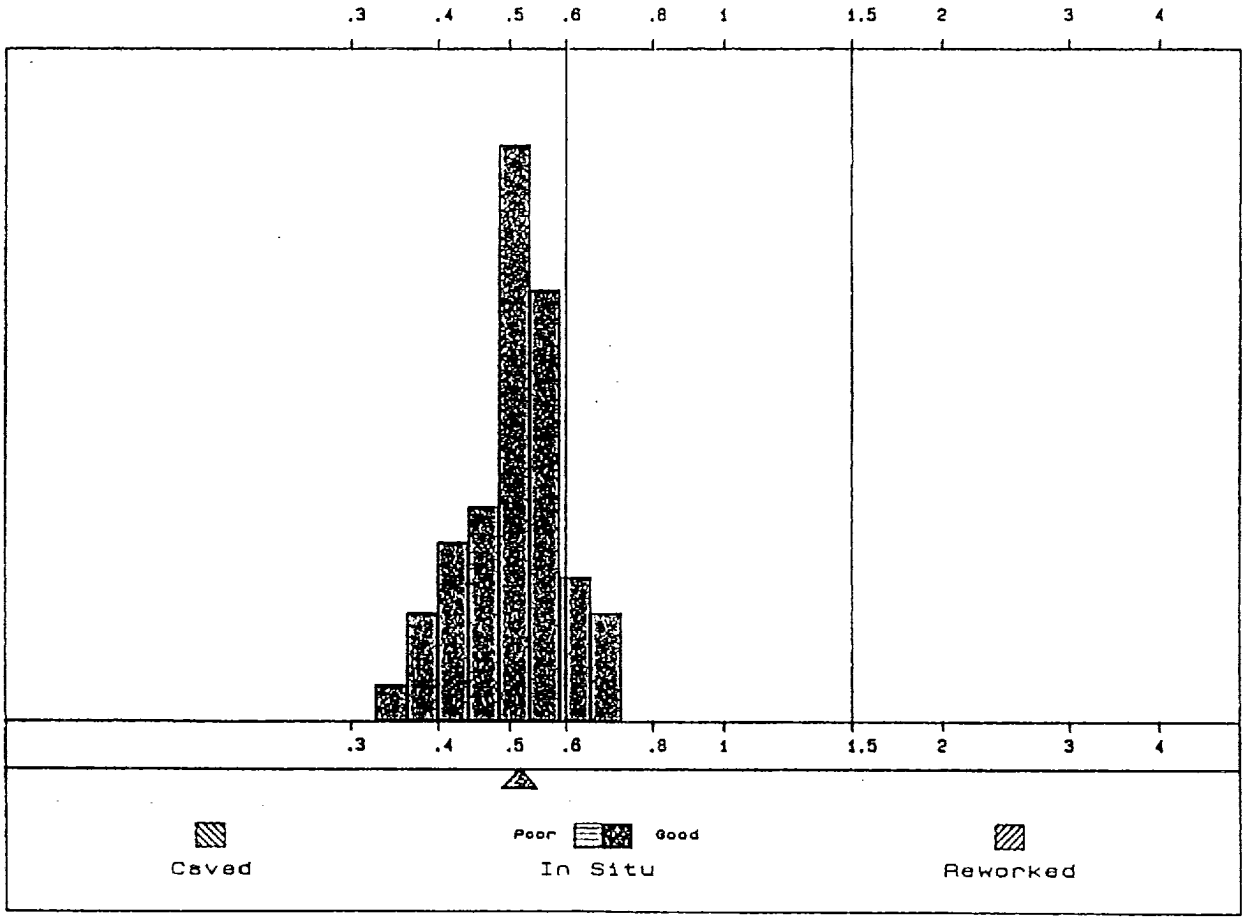


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 930f

Population	Mean	Standard Deviation
In Situ	0.51	0.08
Caved	-	-
Reworked	-	-
Total	0.51	0.08

Total measurements this sample : 50

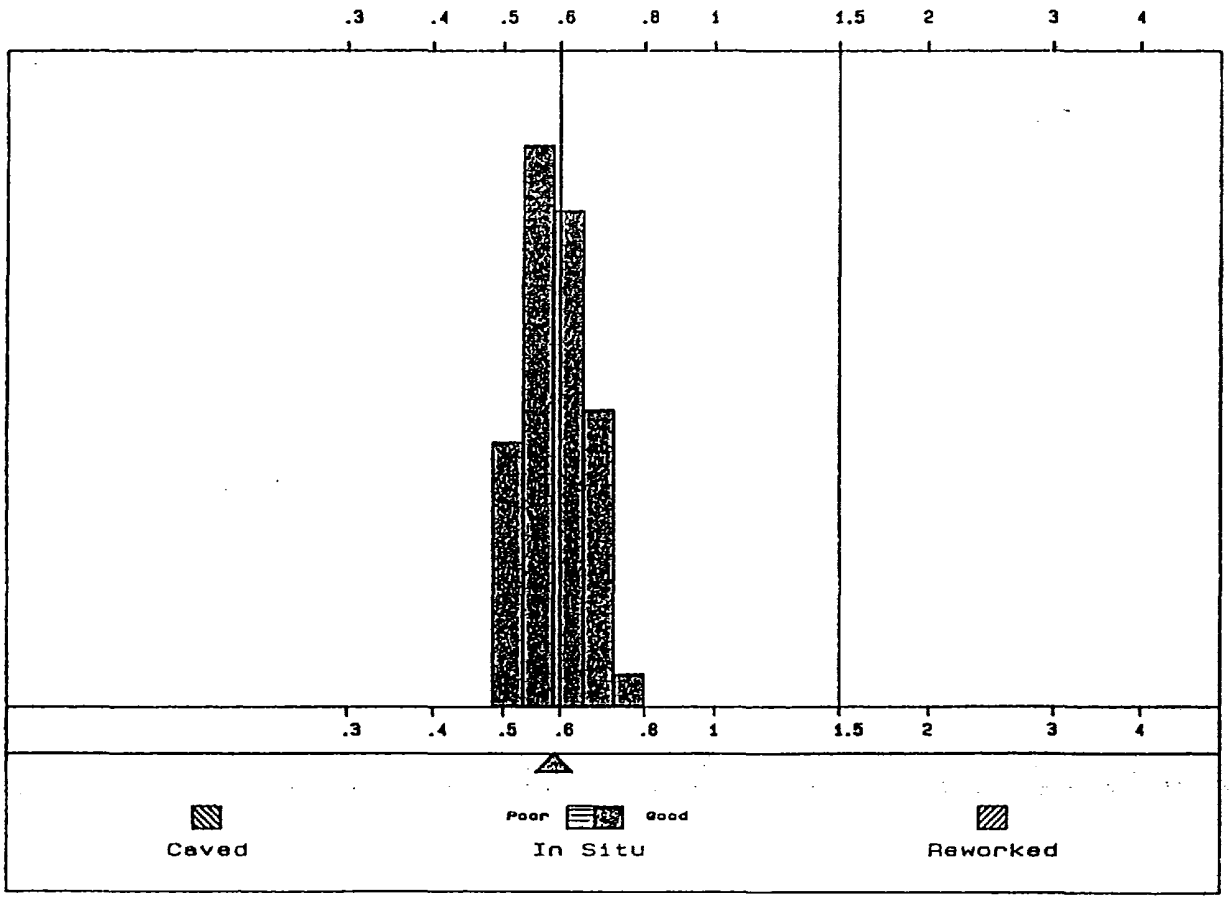


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 1530f

Population	Mean	Standard Deviation
In Situ	0.58	0.06
Caved	-	-
Reworked	-	-
Total	0.58	0.06

Total measurements this sample : 50

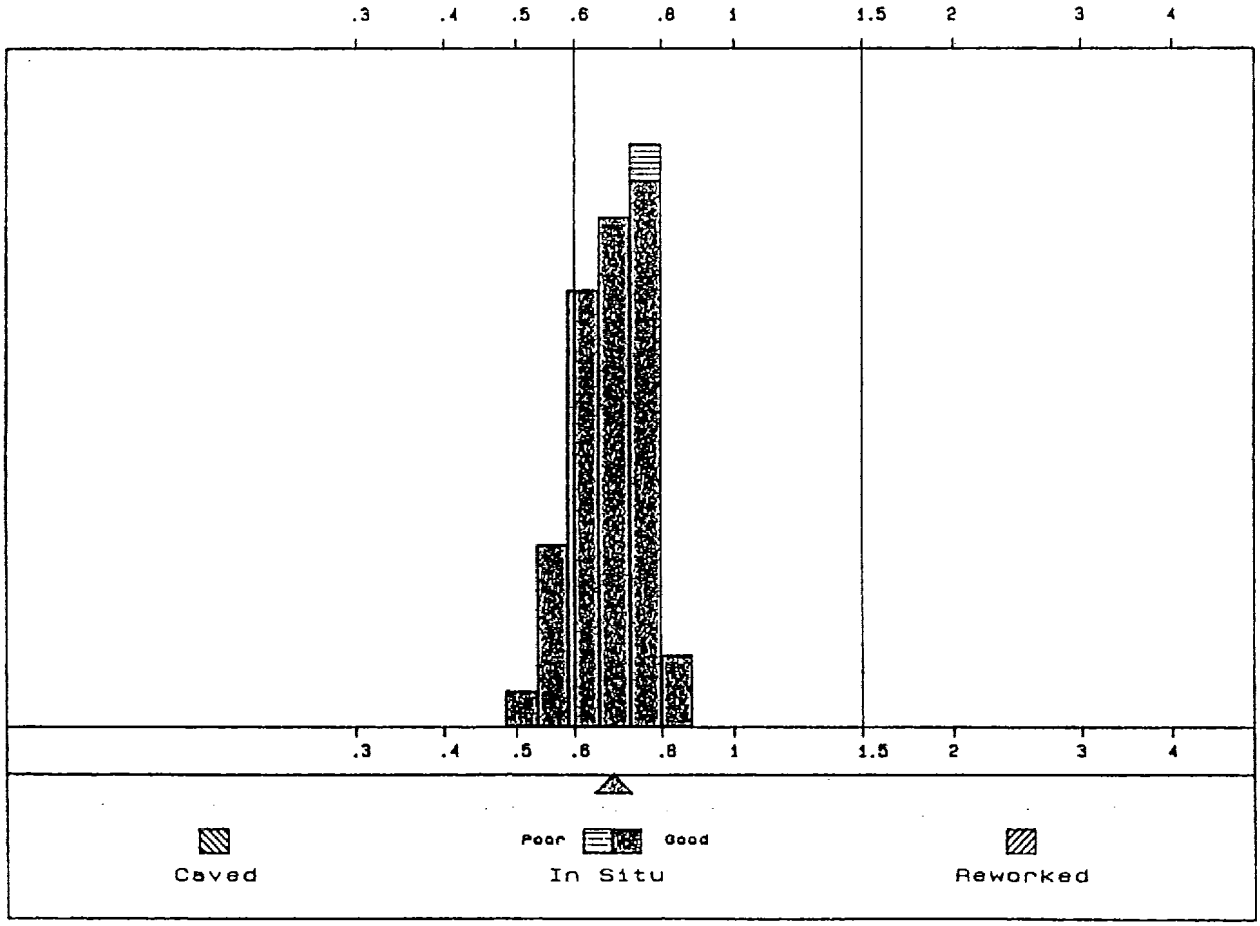


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 1970f

Population	Mean	Standard Deviation
In Situ	0.67	0.07
Caved	-	-
Reworked	-	-
Total	0.67	0.07

Total measurements this sample : 50

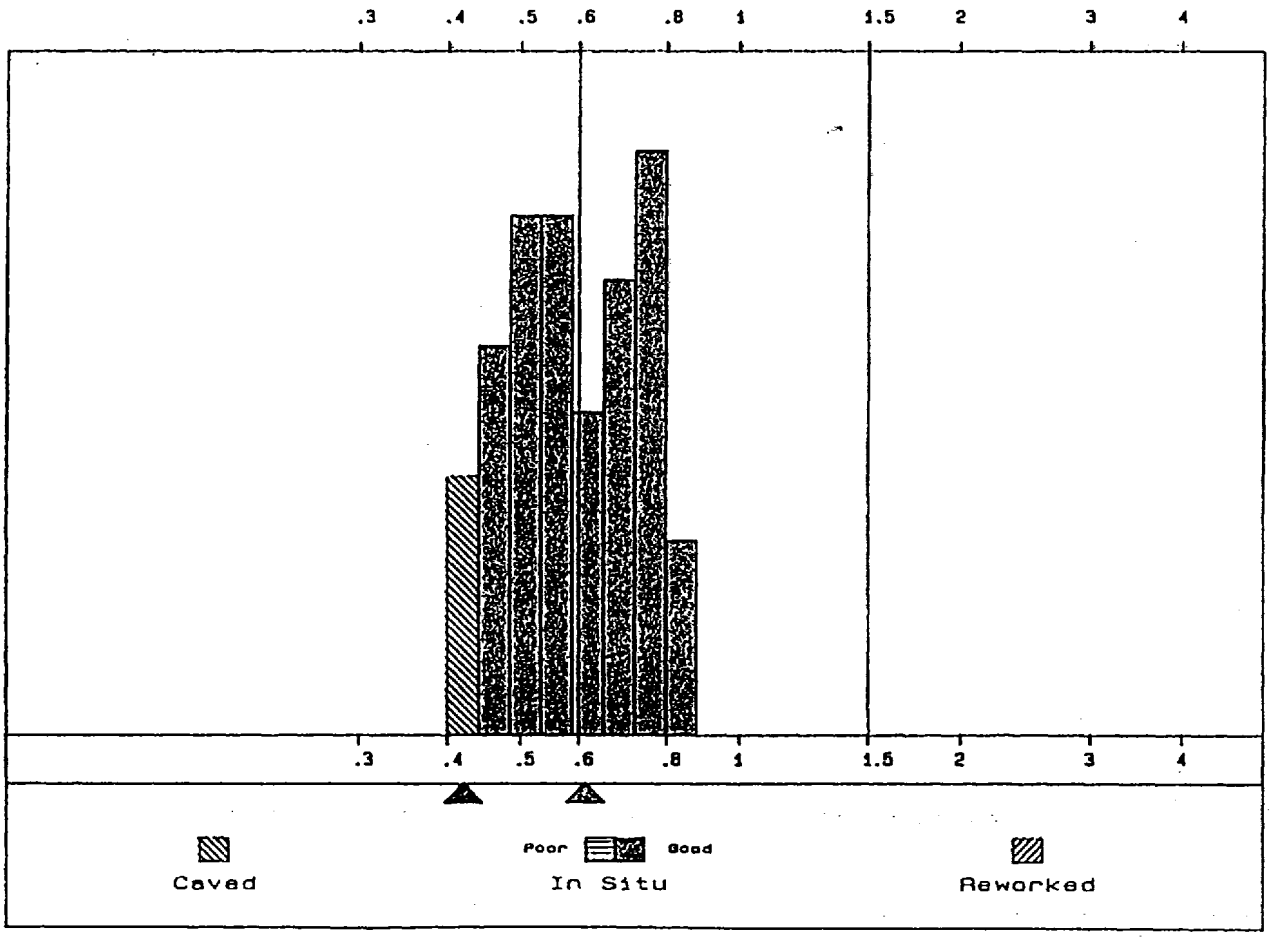


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 2470f

Population	Mean	Standard Deviation
In Situ	0.61	0.11
Caved	0.41	0.00
Reworked	-	-
Total	0.59	0.12

Total measurements this sample : 50

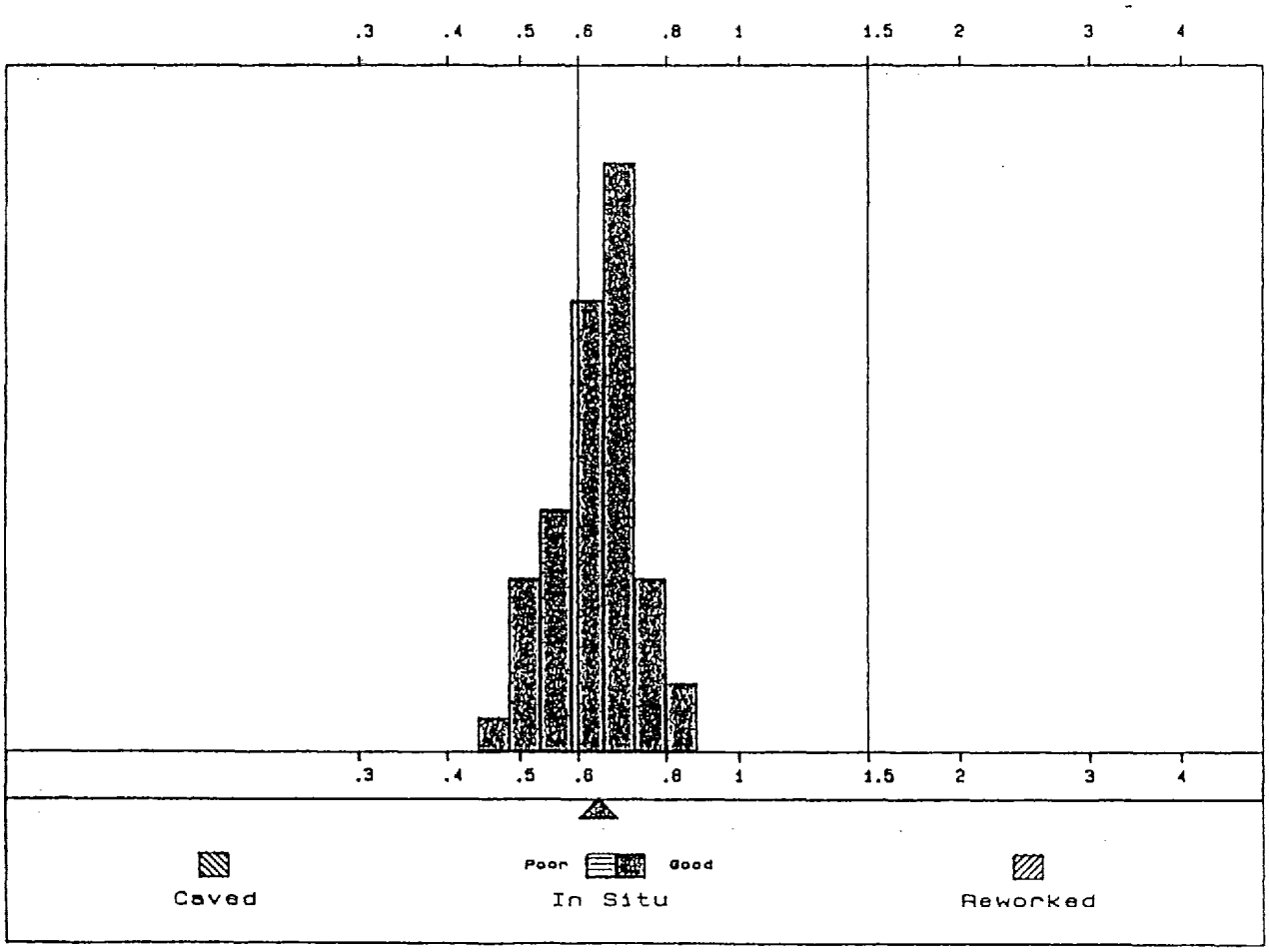


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 2990f

Population	Mean	Standard Deviation
In Situ	0.63	0.08
Caved	-	-
Reworked	-	-
Total	0.63	0.08

Total measurements this sample : 50

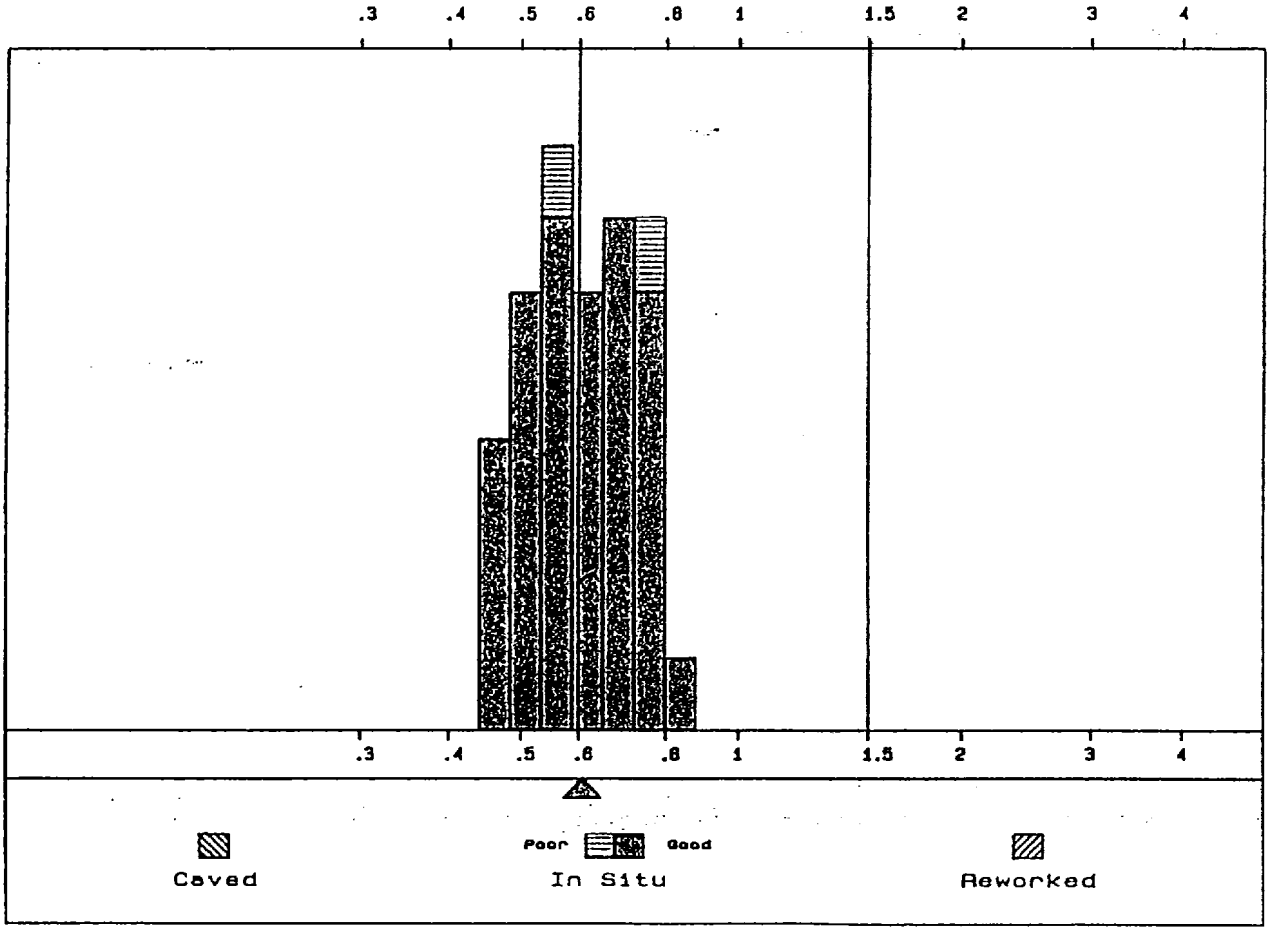


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 3500f

Population	Mean	Standard Deviation
In Situ	0.60	0.10
Caved	–	–
Reworked	–	–
Total	0.60	0.10

Total measurements this sample : 39

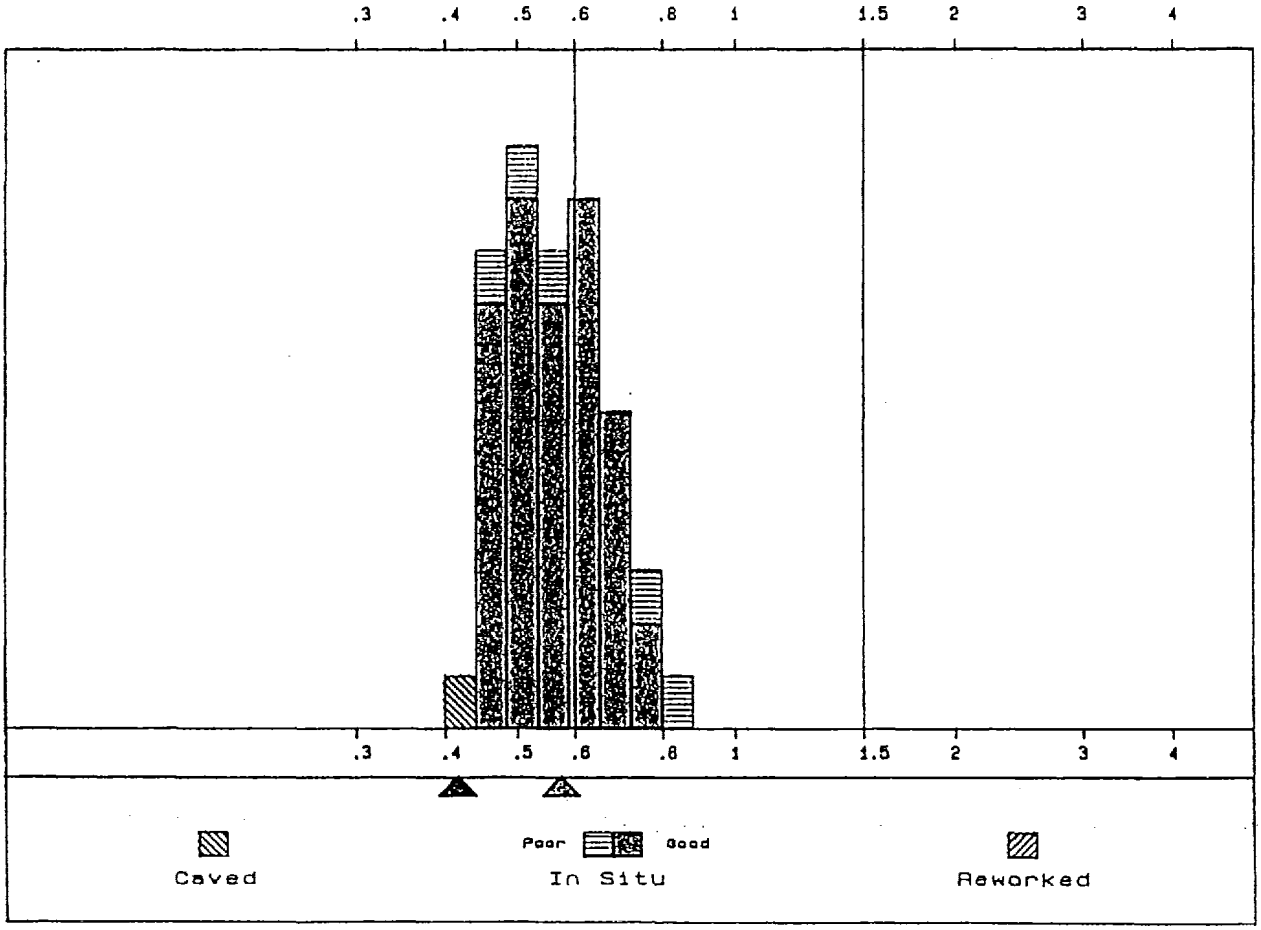


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 3530f

Population	Mean	Standard Deviation
In Situ	0.57	0.09
Caved	0.41	-
Reworked	-	-
Total	0.57	0.09

Total measurements this sample : 50

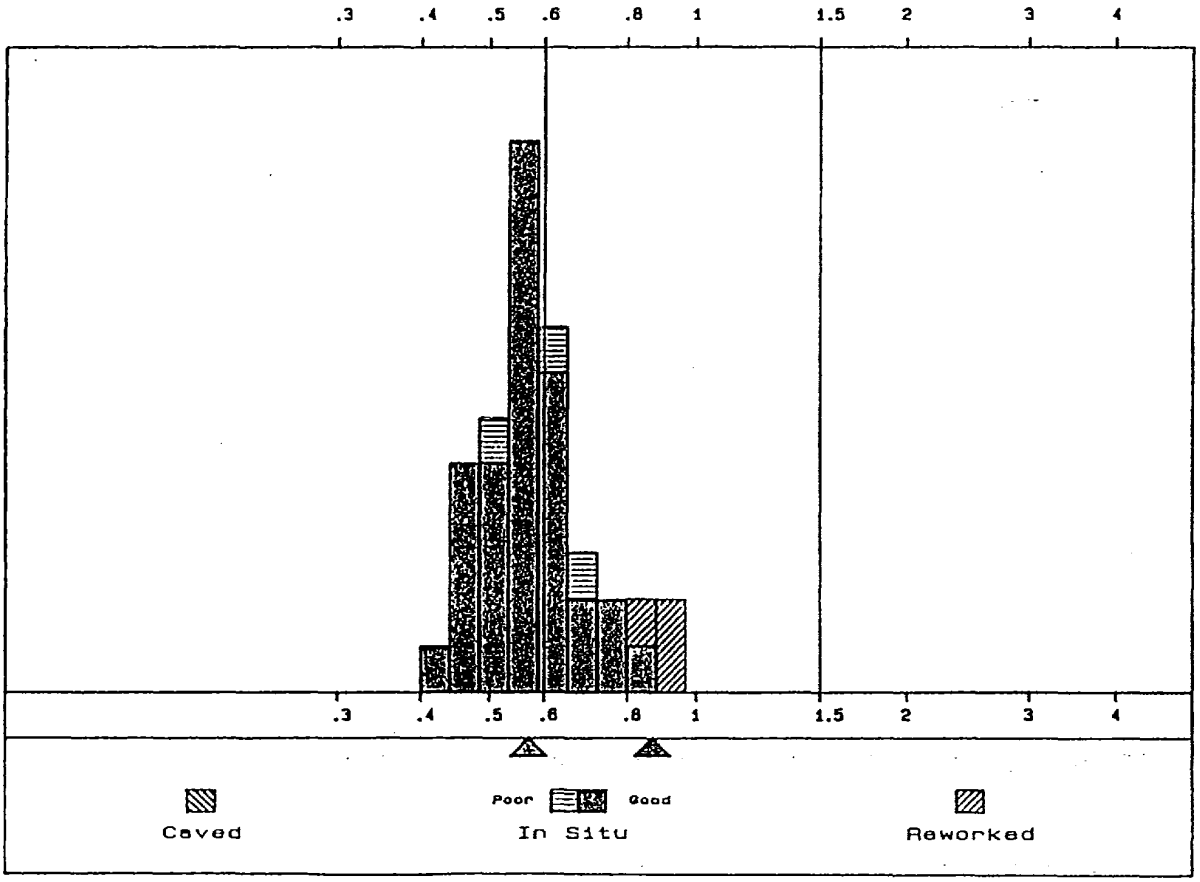


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 3810f

Population	Mean	Standard Deviation
In Situ	0.57	0.09
Caved	-	-
Reworked	0.85	0.02
Total	0.59	0.11

Total measurements this sample : 41

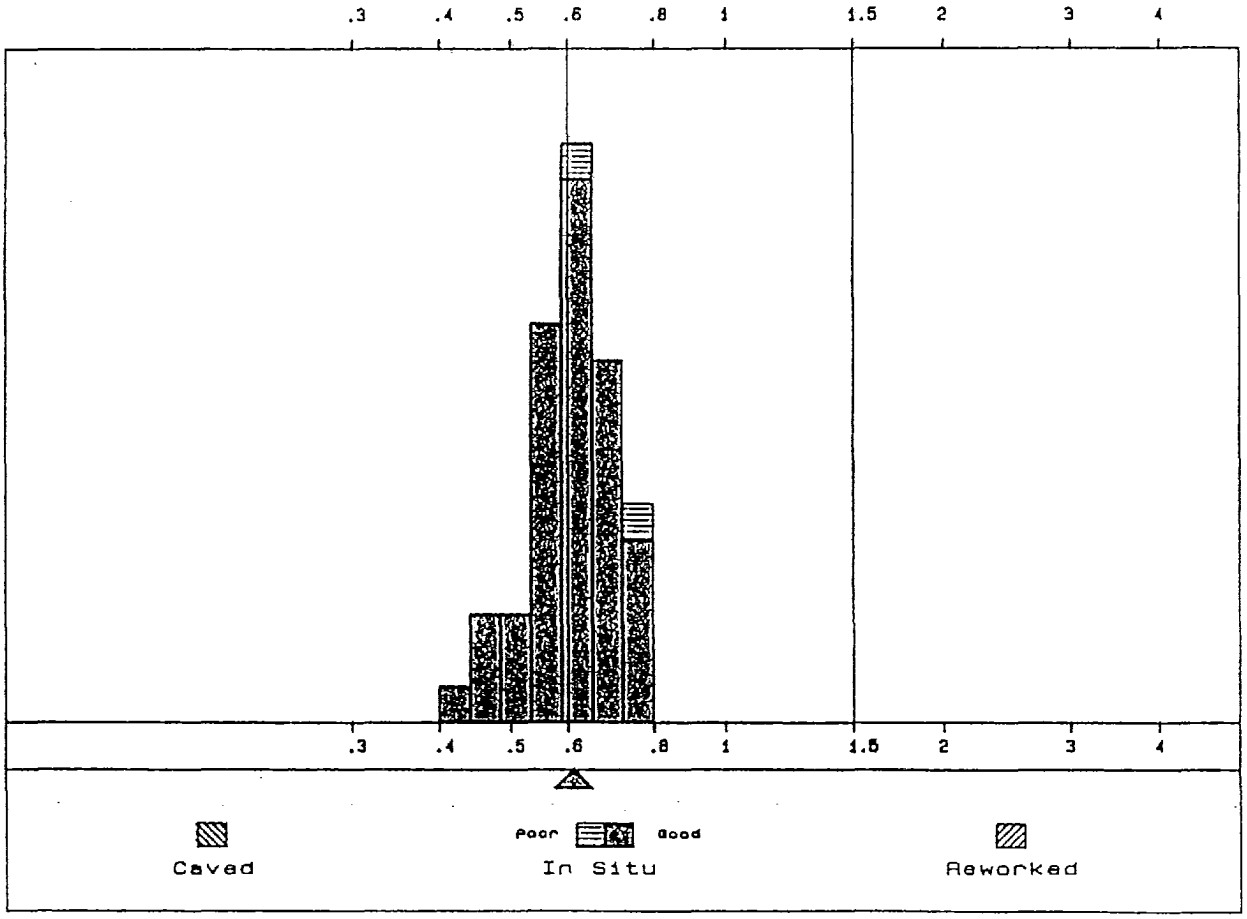


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 5070f

Population	Mean	Standard Deviation
In Situ	0.61	0.08
Caved	-	-
Reworked	-	-
Total	0.61	0.08

Total measurements this sample : 50

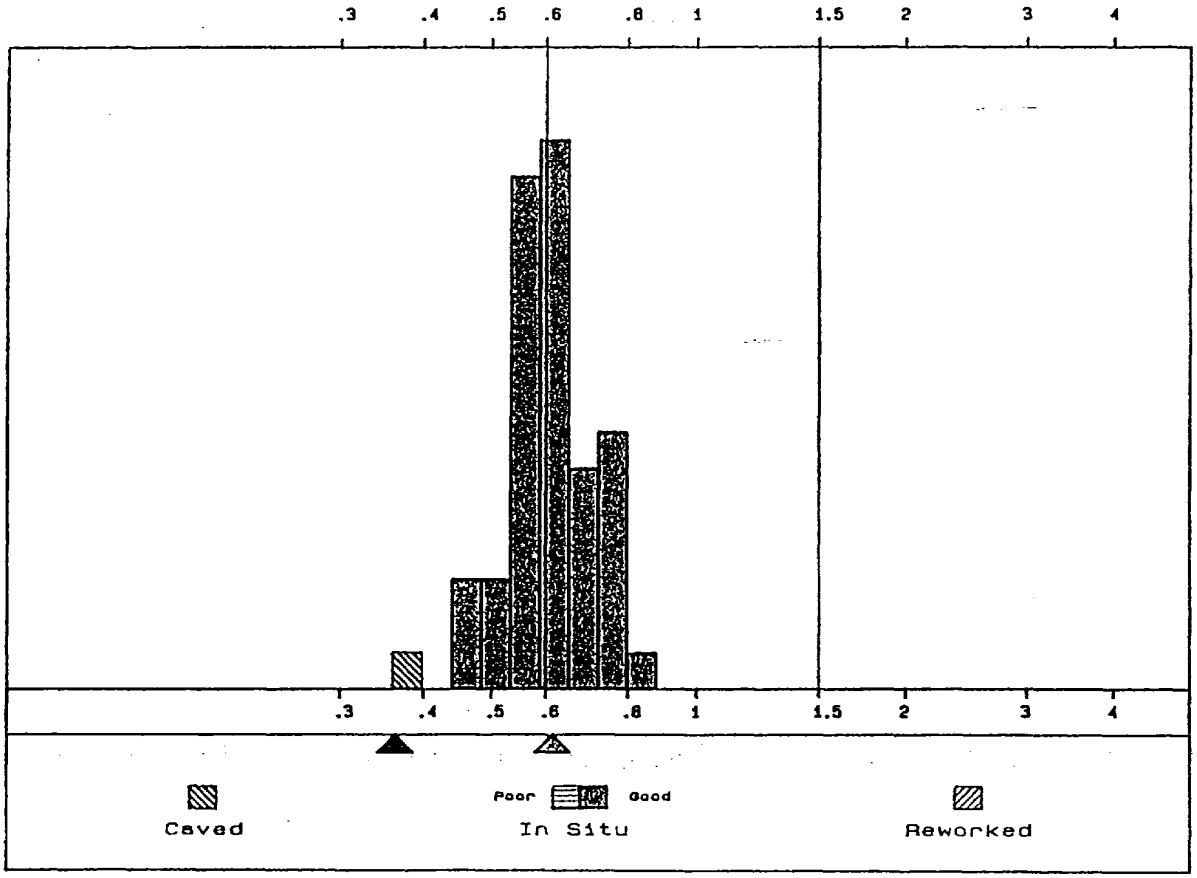


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 5590f

Population	Mean	Standard Deviation
In Situ	0.61	0.08
Caved	0.36	-
Reworked	-	-
Total	0.60	0.09

Total measurements this sample : 50

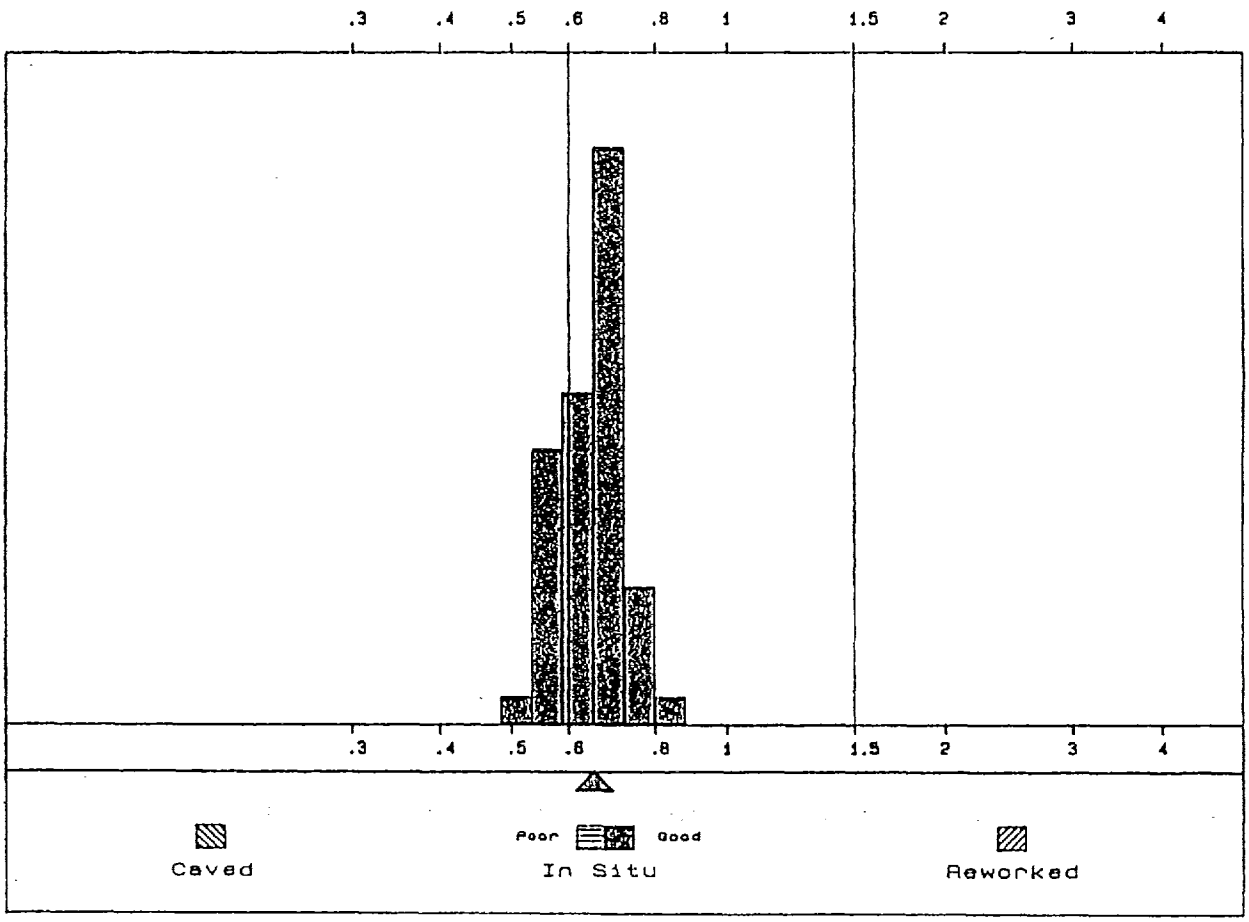


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 5930f

Population	Mean	Standard Deviation
In Situ	0.64	0.06
Caved	-	-
Reworked	-	-
Total	0.64	0.06

Total measurements this sample : 50

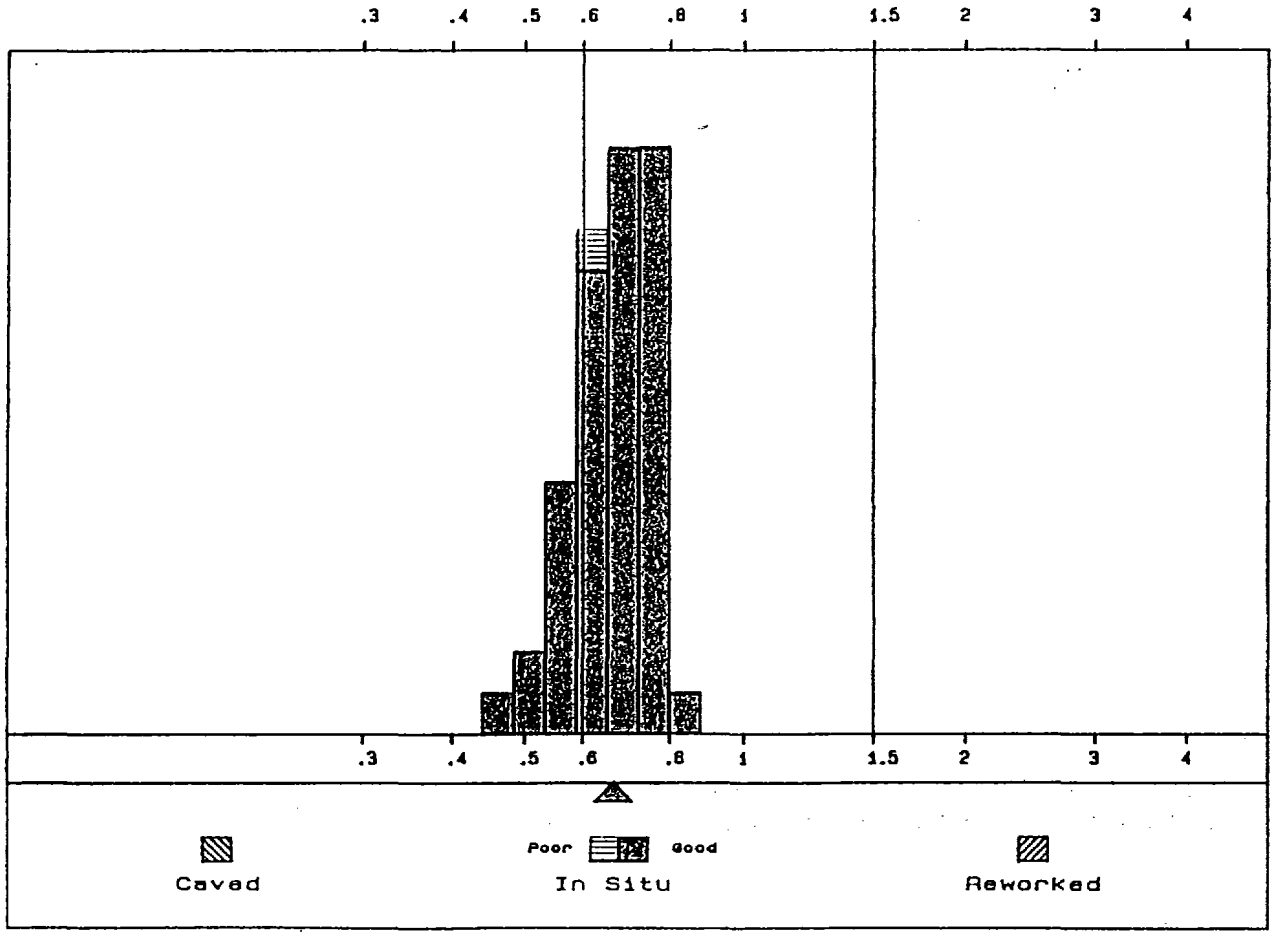


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 6510f

Population	Mean	Standard Deviation
In Situ	0.66	0.07
Caved	-	-
Reworked	-	-
Total	0.66	0.07

Total measurements this sample : 50

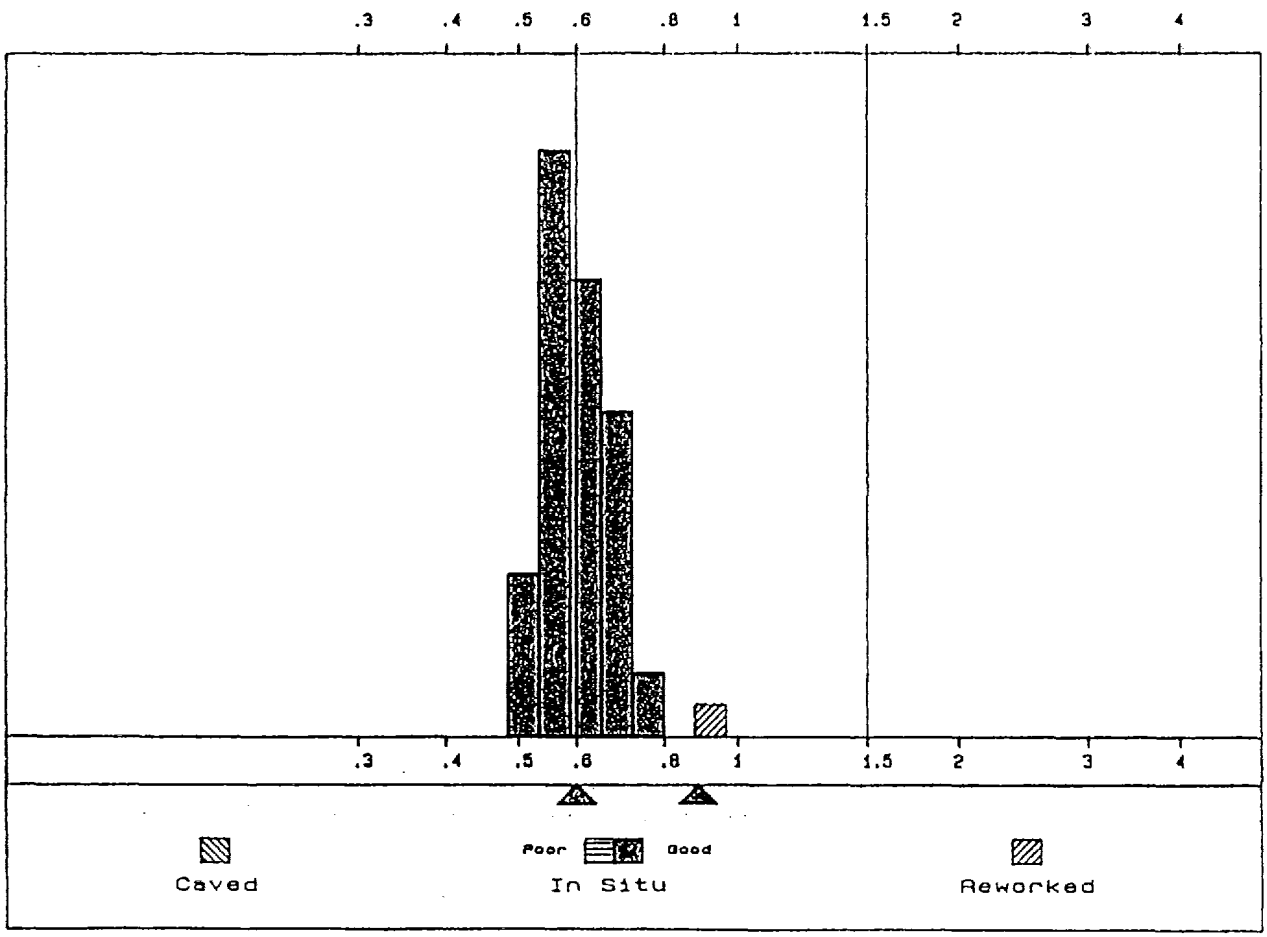


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 7000f

Population	Mean	Standard Deviation
In Situ	0.59	0.06
Caved	-	-
Reworked	0.87	-
Total	0.60	0.07

Total measurements this sample : 50

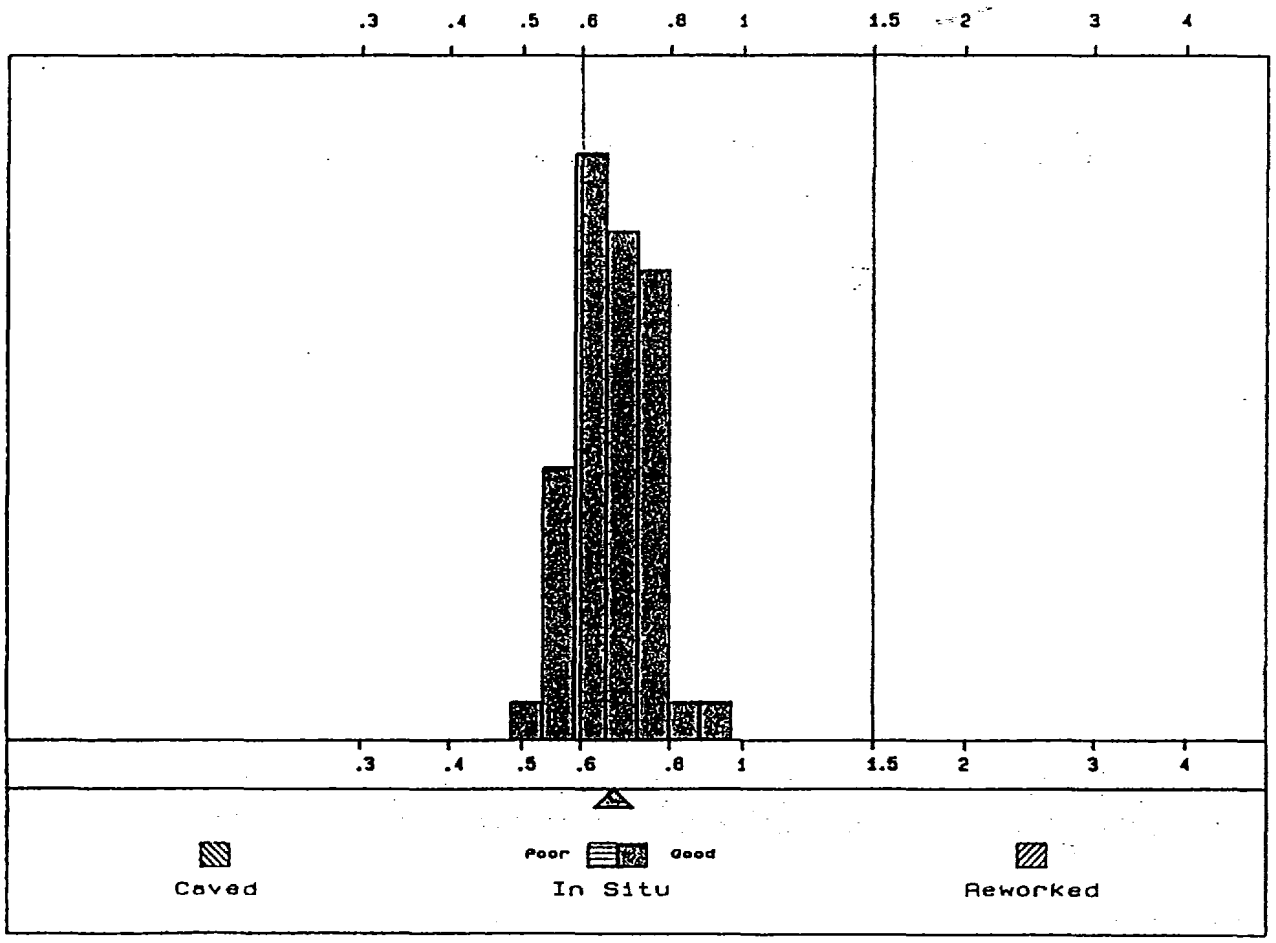


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 7500f

Population	Mean	Standard Deviation
In Situ	0.66	0.08
Caved	-	-
Reworked	-	-
Total	0.66	0.08

Total measurements this sample : 50

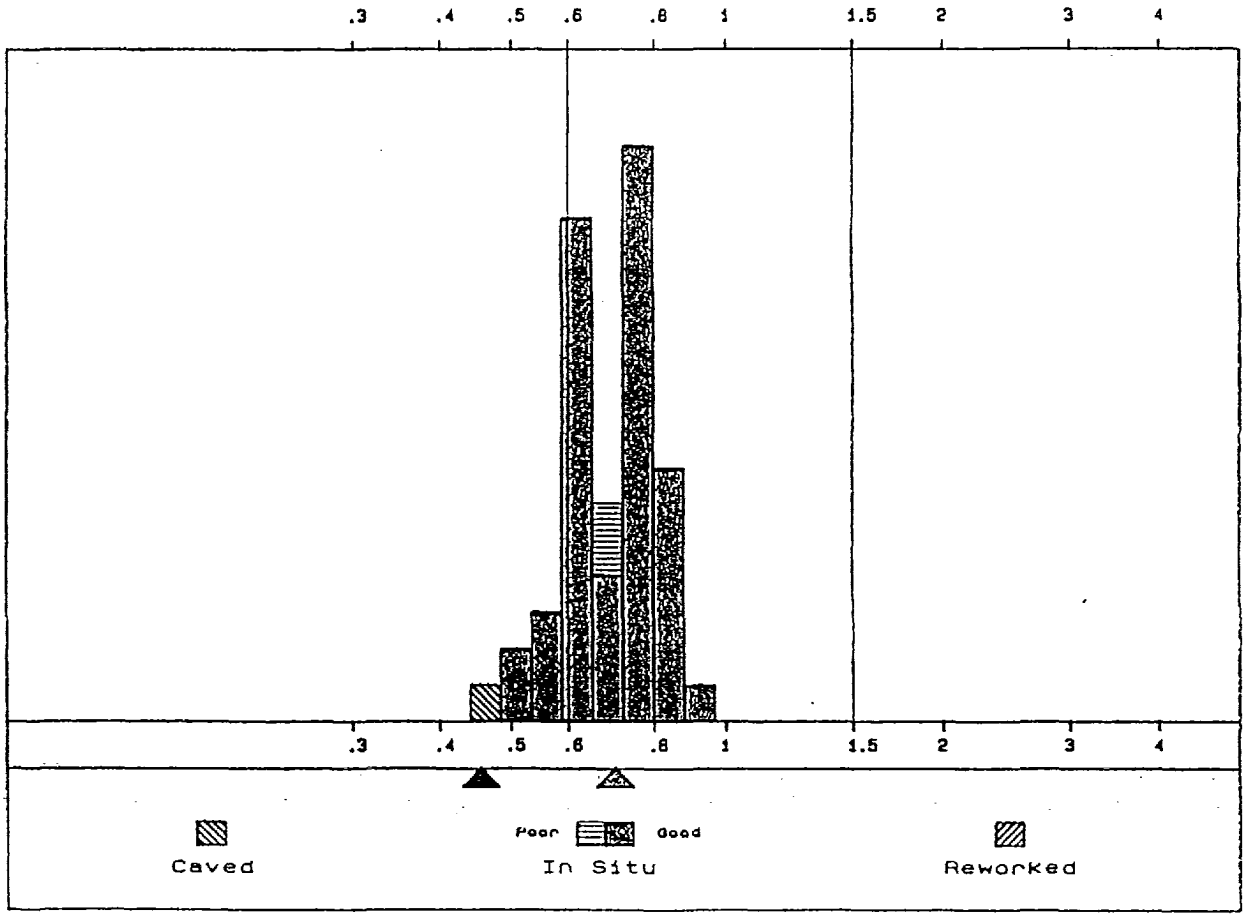


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 8020f

Population	Mean	Standard Deviation
In Situ	0.69	0.09
Caved	0.45	-
Reworked	-	-
Total	0.69	0.09

Total measurements this sample : 50

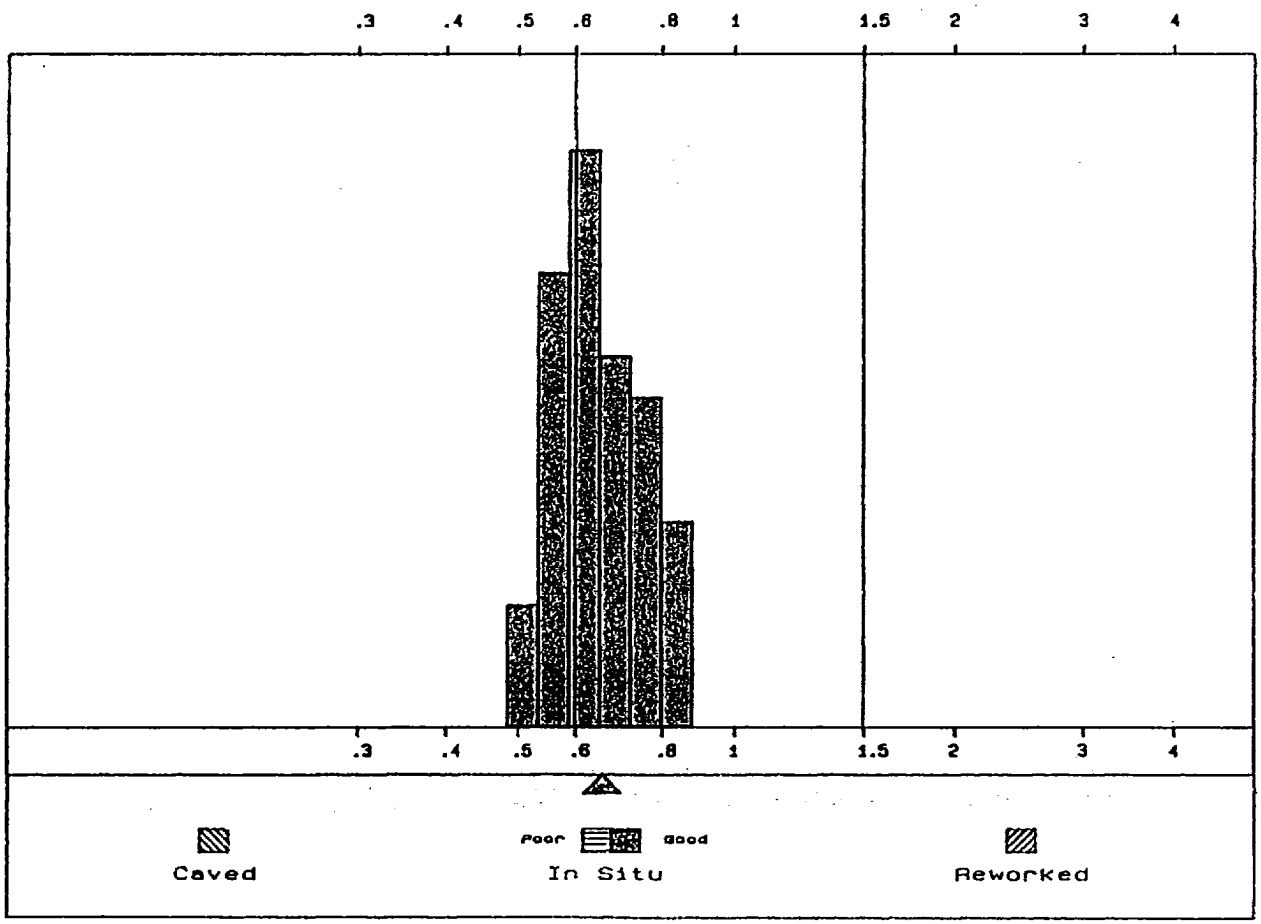


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 8520f

Population	Mean	Standard Deviation
In Situ	0.65	0.09
Caved	-	-
Reworked	-	-
Total	0.65	0.09

Total measurements this sample : 50

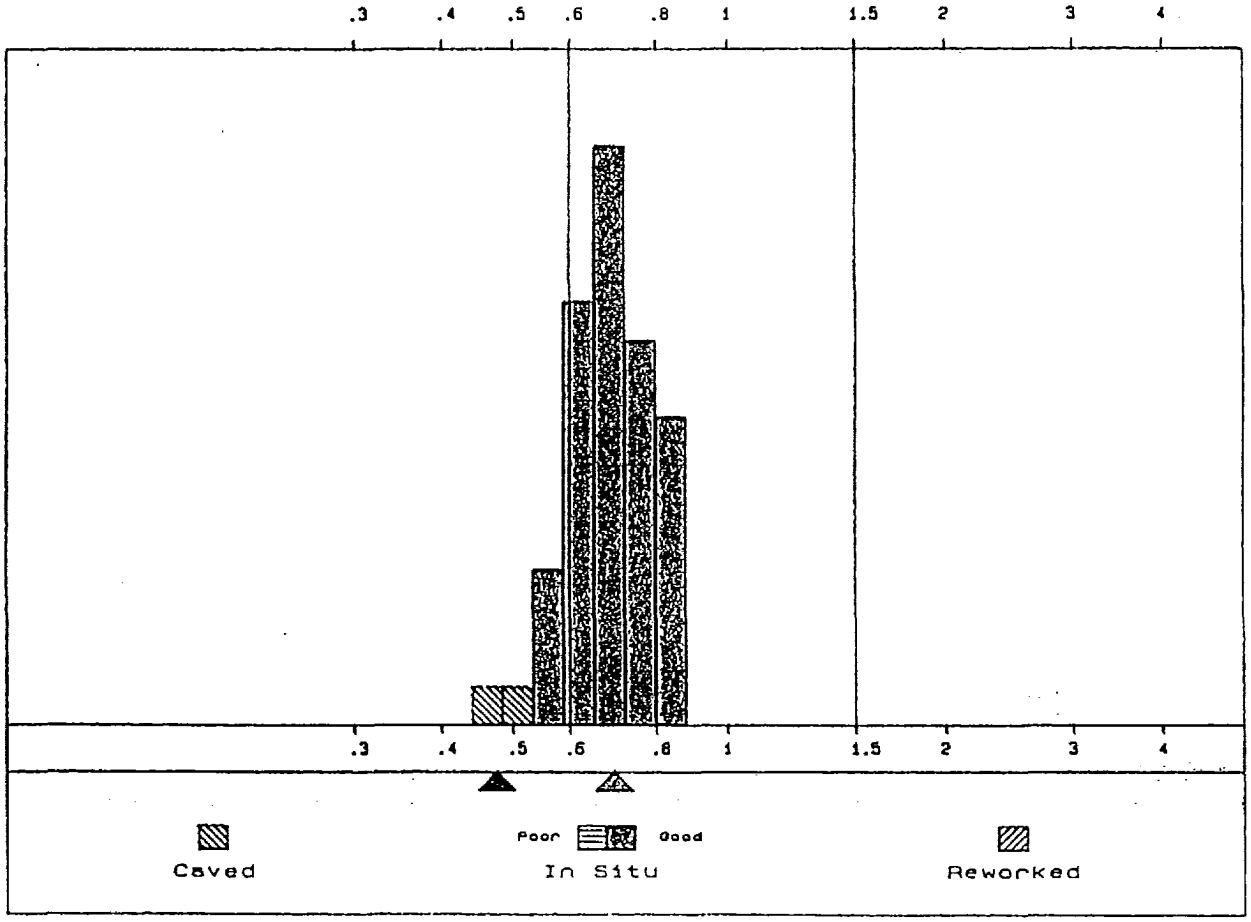


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 8740f

Population	Mean	Standard Deviation
In Situ	0.68	0.07
Caved	0.47	0.04
Reworked	-	-
Total	0.68	0.08

Total measurements this sample : 50

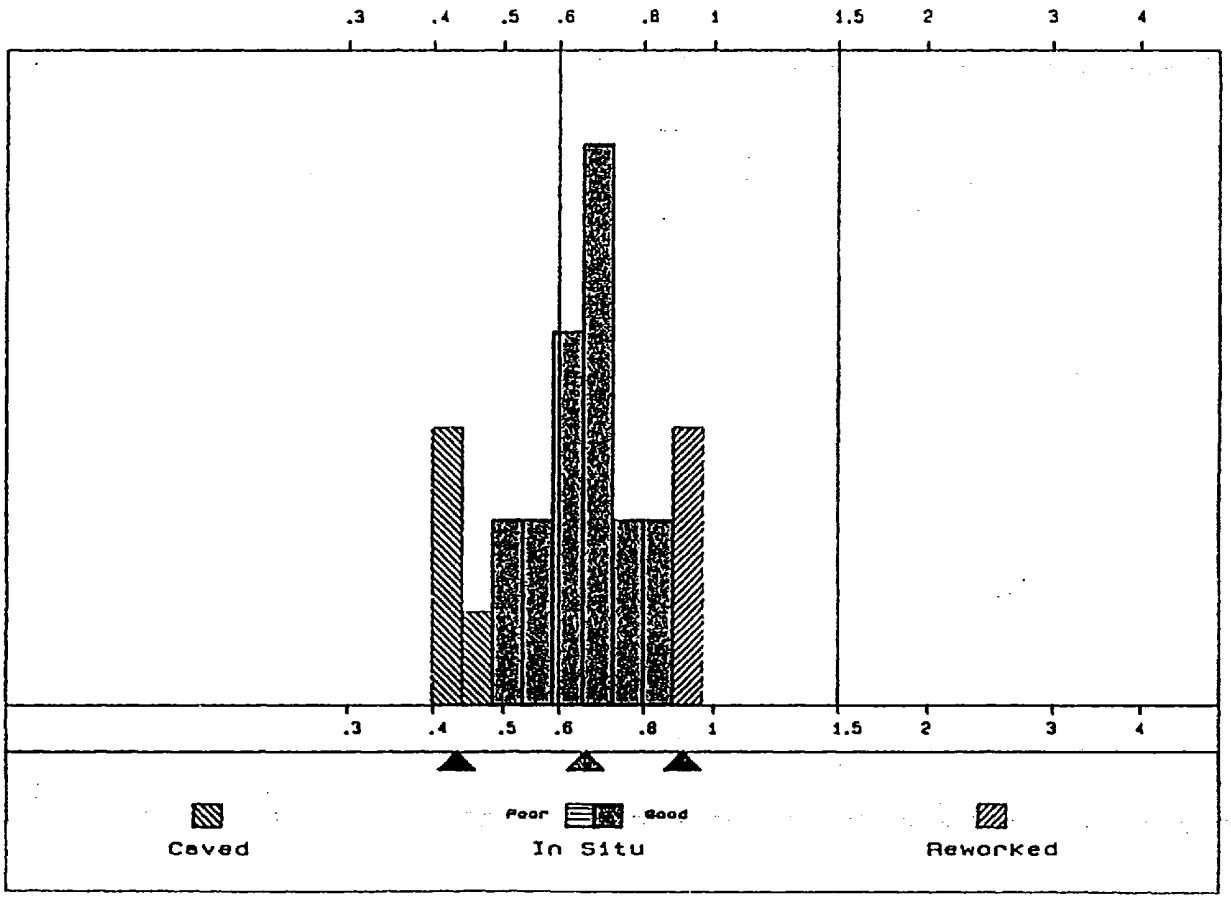


BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 8995f

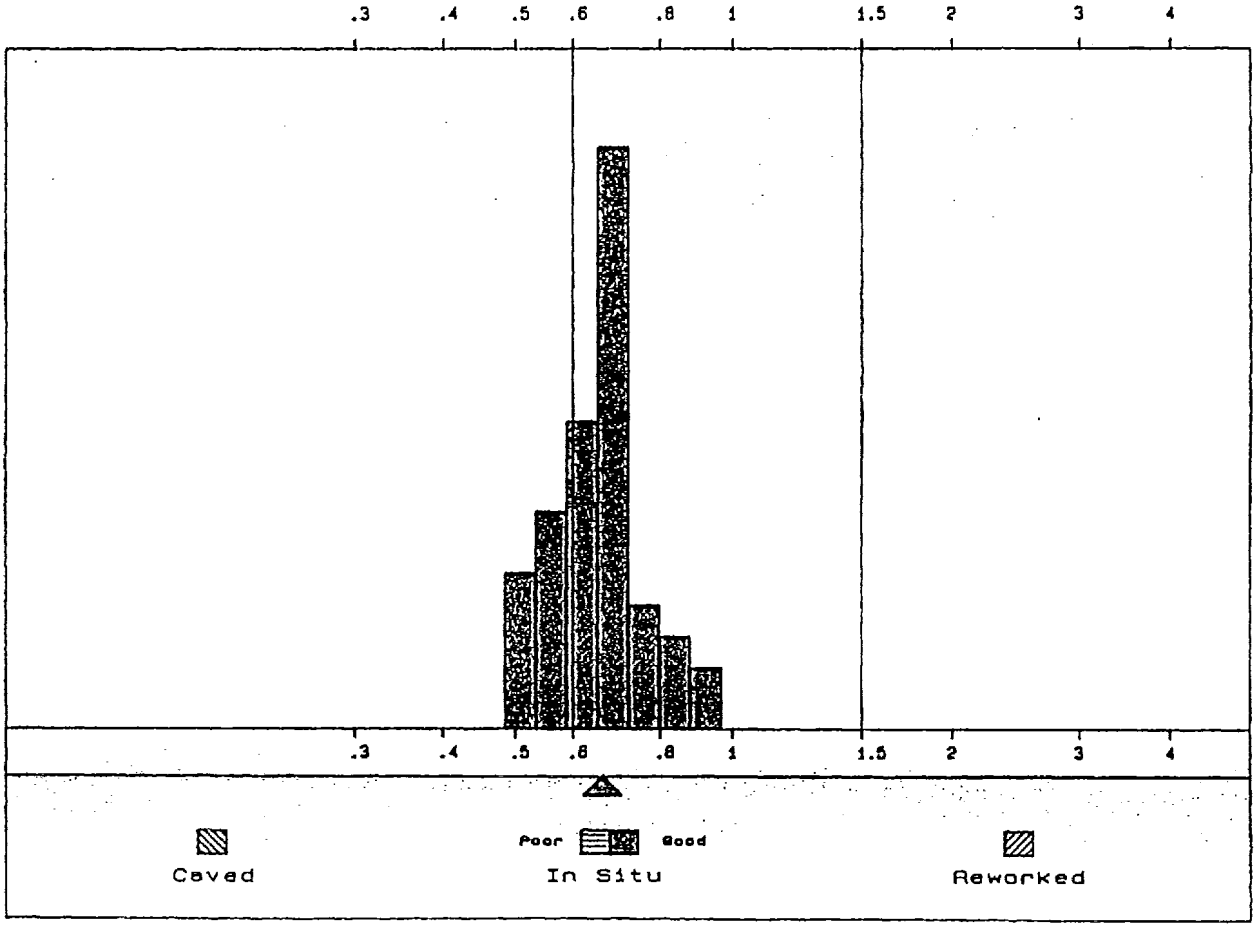
Population	Mean	Standard Deviation
In Situ	0.65	0.08
Caved	0.43	0.02
Reworked	0.89	0.04
Total	0.64	0.14

Total measurements this sample : 25



BUJAK DAVIES GROUP : VITRINITE BEAL #1

SAMPLE : 9410f

Population	Mean	Standard Deviation
In Situ	0.65	0.10
Caved	-	-
Reworked	-	-
Total	0.65	0.10

Total measurements this sample : 50