Vitrinite reflectance data and analysis of the 1,070 - 7,870 foot interval of the Phillips Kerr McGee Sullivan No. 1 well

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VITRINITE REFLECTANCE ANALYSIS OF THE INTERVAL 1070-7870 FT

SULLIVAN #1 WELL, ALASKA

Introduction

This report describes the vitrinite reflectance analysis of 11 cuttings samples from the Sullivan #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

Maturity Zones Based on Ro

1,070-7,930ft Onset of Maturation

Onset of Maturation Zone: 1070-7930ft

This zone commences at 1,070ft (Ro=0.588%). This sample contains 50 readings, many of which are excellent. At 2,170ft an excellent histogram distribution shows an Ro=0.542%. The Ro is slightly depressed until 6,550ft (Ro=0.5%). It then begins to increase down to 7,030ft (Ro=0.53%). The only unreliable sample is at 6,030ft where little sample was present and most readings were poor.

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 MESUREMENTS AND HISTORGRAMS

Client: M.M.S.
Well: SULLIVAN #1
Area: ALASKA

Scientist: DUMCIUS
Date: JULY 1988
Samples are: F

VITRINITE DATA:
==========

Sample Depth : 1070.0

0.460	E	0.470		0.470		0.480		0.500		0.510		0.510	E
0.520		0.530		0.540		0.540		0.550		0.550		0.550	
0.560		0.560		0.570		0.570		0.580		0.580		0.580	
0.580		0.590		0.590		0.590		0.590		0.620		0.620	
0.630		0.630		0.630		0.630		0.640	E	0.640		0.650	
0.650		0.660		0.660		0.670		0.680		0.680		0.680	E
0.690		0.690		0.730	R	0.750	R	0.760	R	0.760	R	0.870	R
0.920	R												

Actual Mean = 0.613 Actual Standard Deviation = 0.095

Edited Mean = 0.588 Edited Standard Deviation = 0.065

Comment : Occasional pyrite; fair amount fine particles present.

Sample Depth : 2170.0

0.450		0.460		0.460		0.480		0.480		0.490		0.500	
0.500		0.510		0.510		0.510		0.510		0.510		0.510	
0.520		0.520		0.530		0.530		0.530		0.530		0.540	
0.540		0.540		0.540		0.540		0.540		0.550		0.550	
0.550		0.550		0.560		0.570		0.570		0.570		0.580	
0.580		0.580		0.580		0.590		0.590		0.590		0.610	
0.610		0.620		0.630		0.640		0.650	R	0.700	R	0.720	R
0.720	R												

Actual Mean = 0.555 Actual Standard Deviation = 0.061

Edited Mean = 0.542 Edited Standard Deviation = 0.045

Comment : Occasional pyrite; fair amount fine particles present.

Sample Depth : 2670.0

0.380	C	0.410		0.440		0.450		0.450		0.460		0.460	
0.460		0.460		0.480		0.480		0.480		0.490		0.490	
0.490		0.490		0.490		0.500		0.510		0.510		0.530	
0.530		0.530		0.530		0.530		0.540		0.540		0.540	
0.540		0.540		0.550		0.550		0.570		0.570		0.570	
0.570		0.570		0.580		0.580		0.600		0.630		0.640	
0.660	R	0.660	R	0.670	R	0.680	R	0.690	R	0.760	R	0.780	R
0.800	R												

Actual Mean = 0.548 Actual Standard Deviation = 0.091

Edited Mean = 0.520 Edited Standard Deviation = 0.052

Comment : Occasional pyrite; abundant fine particles present.

Sample Depth : 3190.0

0.410		0.420		0.430		0.440		0.450		0.450		0.460	
0.460		0.470		0.480		0.480		0.490		0.500		0.500	
0.510		0.520		0.520		0.520		0.520		0.530		0.530	
0.540		0.560		0.580		0.580		0.580		0.580		0.580	
0.580		0.600		0.600		0.610		0.610		0.620		0.630	
0.630		0.650	R	0.650	R	0.650	R	0.660	R	0.670	R	0.670	R
0.680	R	0.680	R	0.680	R	0.690	R	0.690	R	0.720	R	0.730	R
0.750	R												

Actual Mean = 0.571 Actual Standard Deviation = 0.091

Edited Mean = 0.527 Edited Standard Deviation = 0.065

Comment : Occasional pyrite; fair amount vitrinite present.

Sample Depth : 4210.0

0.450		0.450		0.460		0.460		0.460		0.460		0.470	
0.470		0.470		0.480		0.480		0.480		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		0.520		0.520		0.520	
0.520		0.520		0.530		0.530		0.530		0.540		0.540	
0.540		0.540		0.540		0.540		0.550		0.550		0.550	
0.560		0.560		0.560		0.580		0.590		0.600		0.620	
0.680	R												

Actual Mean = 0.518 Actual Standard Deviation = 0.046

Edited Mean = 0.515 Edited Standard Deviation = 0.040

Comment : Occasional pyrite; abundant vitrinite present.

Sample Depth : 4900.0

0.380	C	0.410		0.420		0.420		0.420		0.450		0.450	
0.460		0.460		0.460		0.460		0.470		0.480		0.480	
0.480		0.490		0.490		0.500		0.500		0.500		0.500	
0.510		0.510		0.510		0.510		0.520		0.520		0.520	
0.530		0.530		0.530		0.540		0.540		0.540		0.550	
0.550		0.560		0.560		0.580		0.590		0.590		0.590	
0.620		0.630		0.640		0.650	R	0.650	R	0.660	R	0.720	R
0.730	R	0.810	R										

Actual Mean = 0.533 Actual Standard Deviation = 0.086

Edited Mean = 0.513 Edited Standard Deviation = 0.056

Comment : Occasional pyrite; fair amount vitrinite present.

Sample Depth : 5560.0

0.340	C	0.380	C	0.410		0.410		0.420		0.430		0.430	
0.440		0.450		0.460		0.460		0.460		0.470		0.470	
0.470		0.470		0.480		0.480		0.490		0.490		0.490	
0.490		0.500		0.500		0.520		0.520		0.520		0.520	
0.520		0.530		0.530		0.540		0.540		0.540		0.550	
0.560		0.610		0.640		0.650	R	0.650	R	0.650	R	0.680	R
0.680	R	0.700	R	0.720	R	0.720	R	0.730	R	0.730	R	0.750	R
0.800	R												

Actual Mean = 0.540 Actual Standard Deviation = 0.109

Edited Mean = 0.495 Edited Standard Deviation = 0.052

Comment : Occasional pyrite; fair amount fine particles and vitrinite present.

Sample Depth : 6030.0

0.420	P	0.430	P	0.440	P	0.440	P	0.450	P	0.480	P	0.510	P
0.600	P	0.650	P	0.850	R								

Actual Mean = 0.527 Actual Standard Deviation = 0.137

Edited Mean = 0.491 Edited Standard Deviation = 0.082

Comment : Very little sample present.

Sample Depth : 6550.0

0.400	0.430	0.430	0.430	0.430	0.430	0.440
0.440	0.450	0.450	0.460	0.460	0.460	0.460
0.470	0.470	0.470	0.470	0.490	0.490	0.490
0.490	0.490	0.490	0.490	0.490	0.500	0.500
0.500	0.500	0.500	0.510	0.510	0.510	0.510
0.520	0.530	0.530	0.540	0.550	0.550	0.560
0.560	0.570	0.580	0.580	0.590	0.590	0.620
0.690						

Actual Mean = 0.501 Actual Standard Deviation = 0.057

Edited Mean = 0.501 Edited Standard Deviation = 0.057

Comment : Occasional pyrite, many fine particles; fair amount vitrinite present.

Sample Depth : 7030.0

0.390	C	0.410	0.410	0.420	0.430	0.450	0.450
0.460		0.460	0.470	0.470	0.480	0.480	0.480
0.480		0.490	0.490	0.500	0.500	0.510	0.520
0.520		0.520	0.520	0.520	0.530	0.530	0.530
0.530		0.530	0.530	0.540	0.540	0.540	0.550
0.560		0.560	0.570	0.580	0.600	0.610	0.610
0.610		0.620	0.620	0.620	0.630	0.640	0.660
0.680							

Actual Mean = 0.527 Actual Standard Deviation = 0.069

Edited Mean = 0.530 Edited Standard Deviation = 0.067

Comment : Occasional pyrite; fair amount fine kerogen particles present.

Sample Depth : 7870.0

0.340	C	0.390	C	0.420	0.430	0.440	0.450	0.470
0.470		0.470		0.470	0.480	0.480	0.480	0.480
0.490		0.490		0.490	0.500	0.500	0.500	0.500
0.510		0.510		0.510	0.520	0.520	0.520	0.520
0.530		0.530		0.530	0.530	0.530	0.540	0.540
0.540		0.550		0.550	0.560	0.560	0.570	0.570
0.580		0.580		0.600	0.610	0.620	0.620	0.640
0.880	R							

Actual Mean = 0.522 Actual Standard Deviation = 0.078

Edited Mean = 0.521 Edited Standard Deviation = 0.051

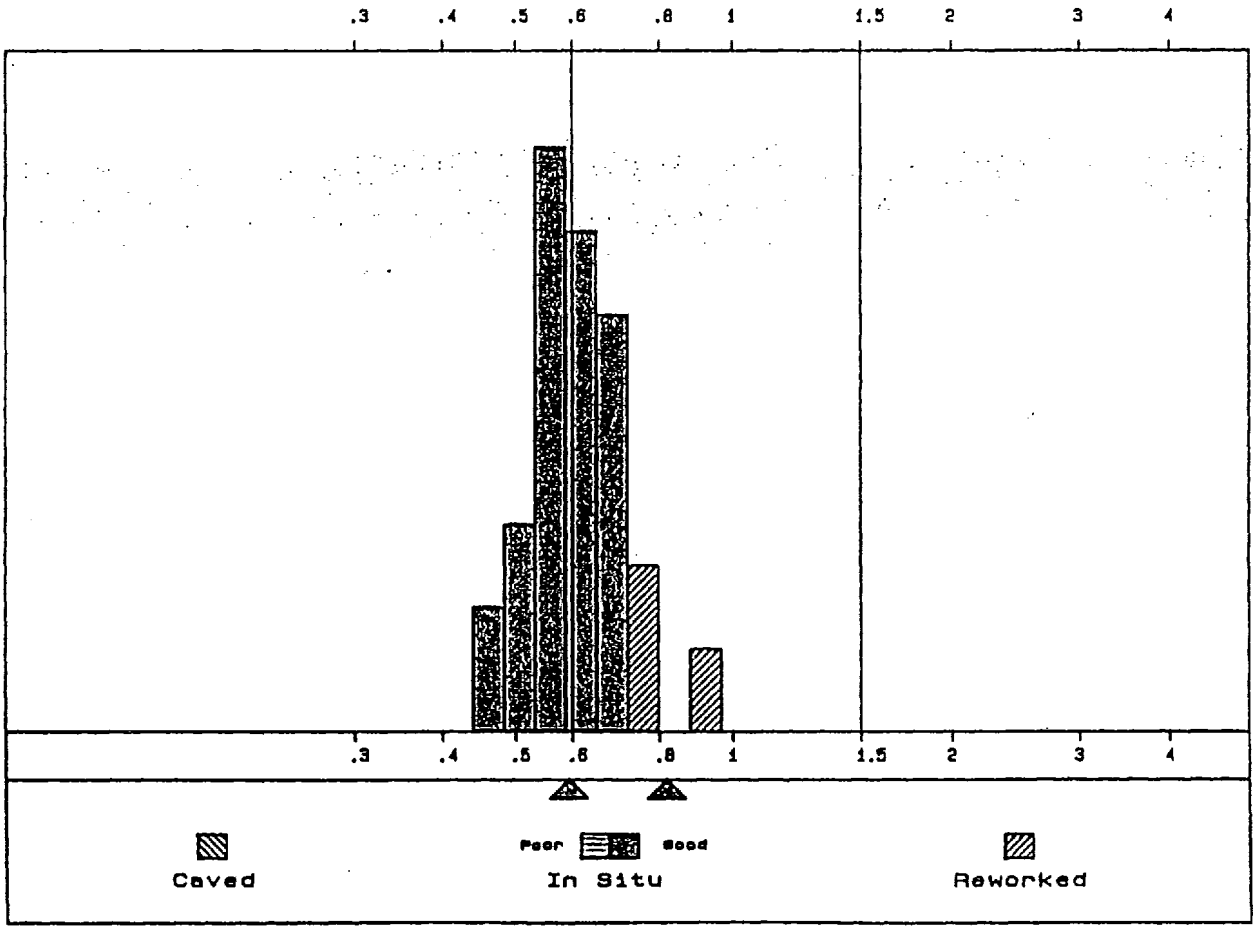
Comment : Occasional pyrite; fair amount fine kerogen present.

BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 1070f

Population	Mean	Standard Deviation
In Situ	0.59	0.06
Caved	-	-
Reworked	0.80	0.08
Total	0.61	0.10

Total measurements this sample : 50

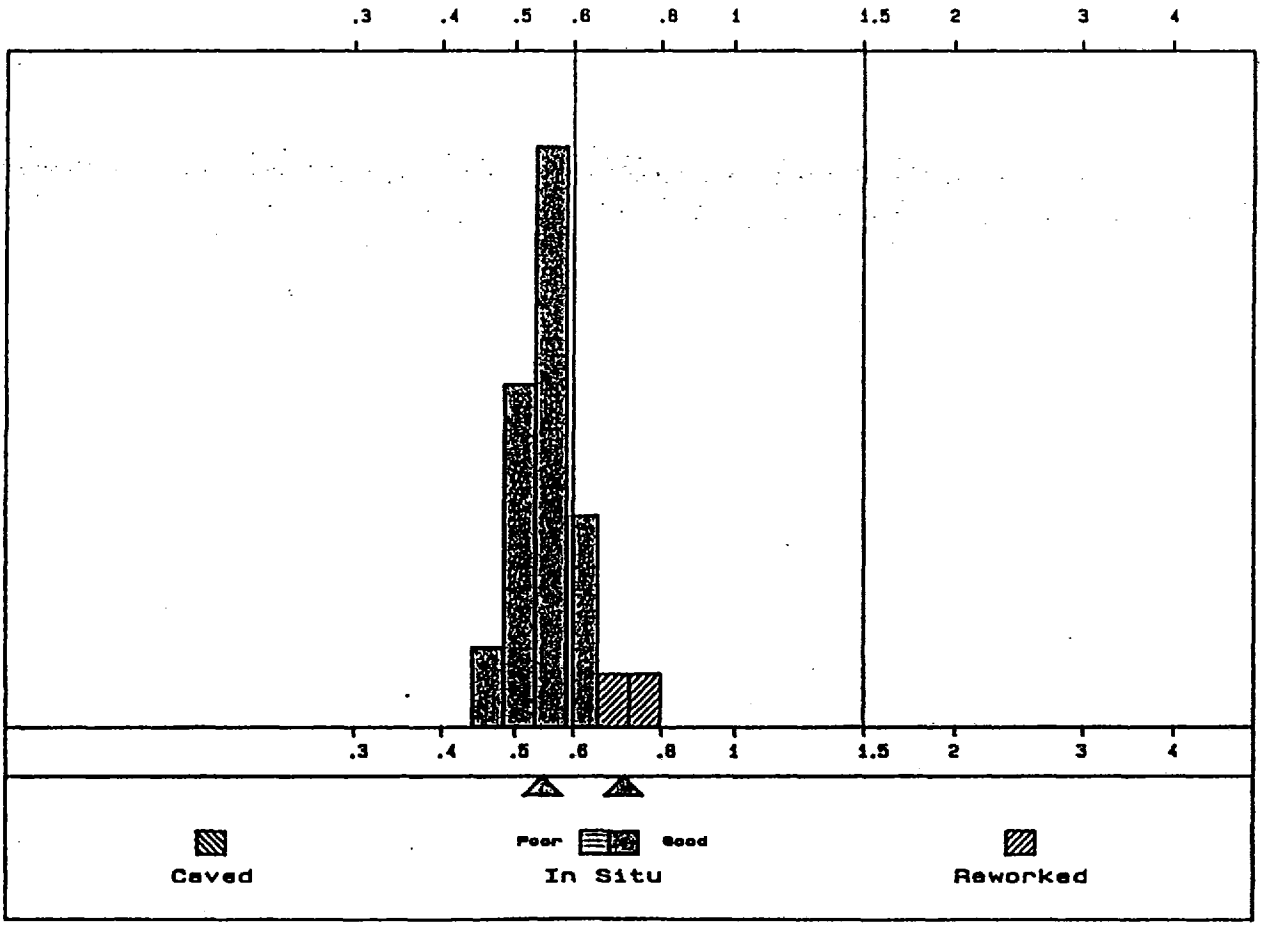


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 2170f

Population	Mean	Standard Deviation
In Situ	0.54	0.05
Caved	-	-
Reworked	0.70	0.03
Total	0.55	0.06

Total measurements this sample : 50

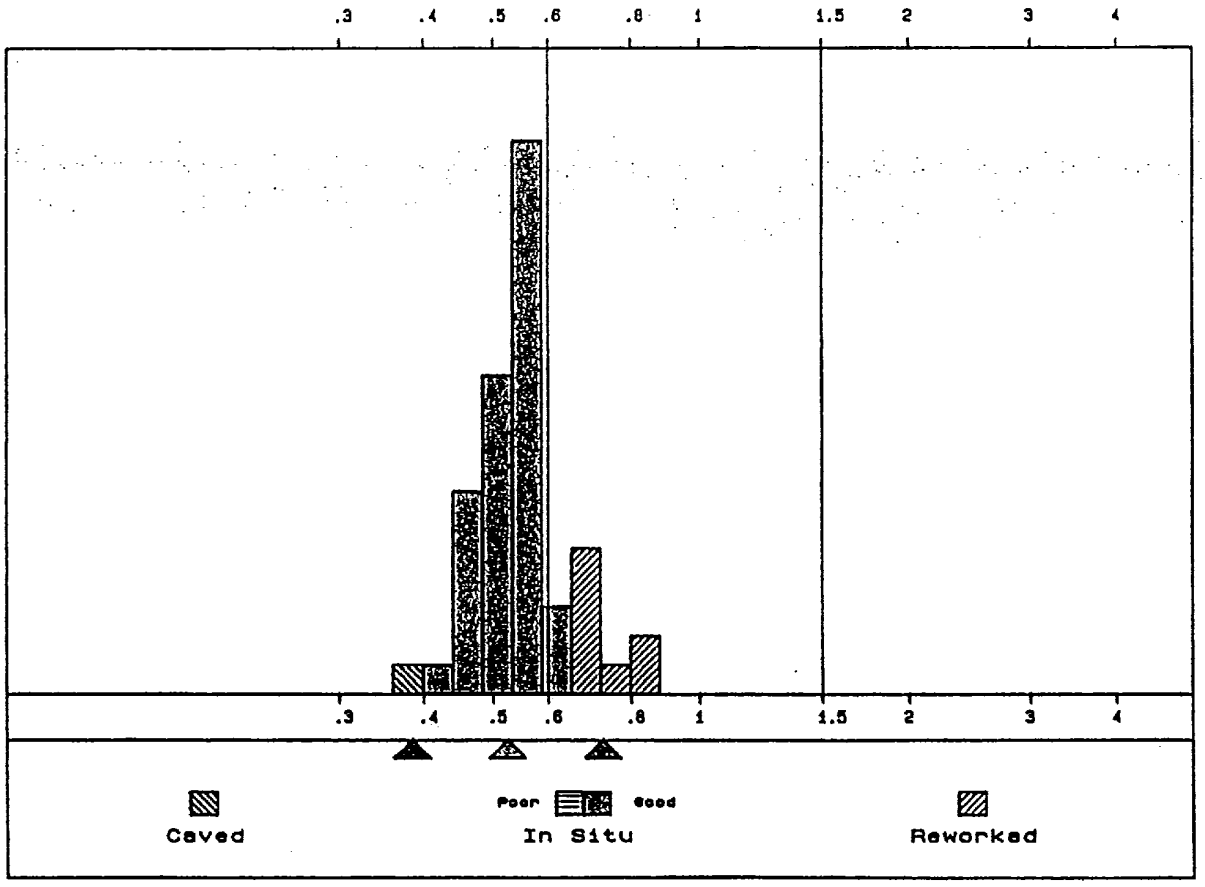


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 2670f

Population	Mean	Standard Deviation
In Situ	0.52	0.05
Caved	0.38	-
Reworked	0.71	0.06
Total	0.55	0.09

Total measurements this sample : 50

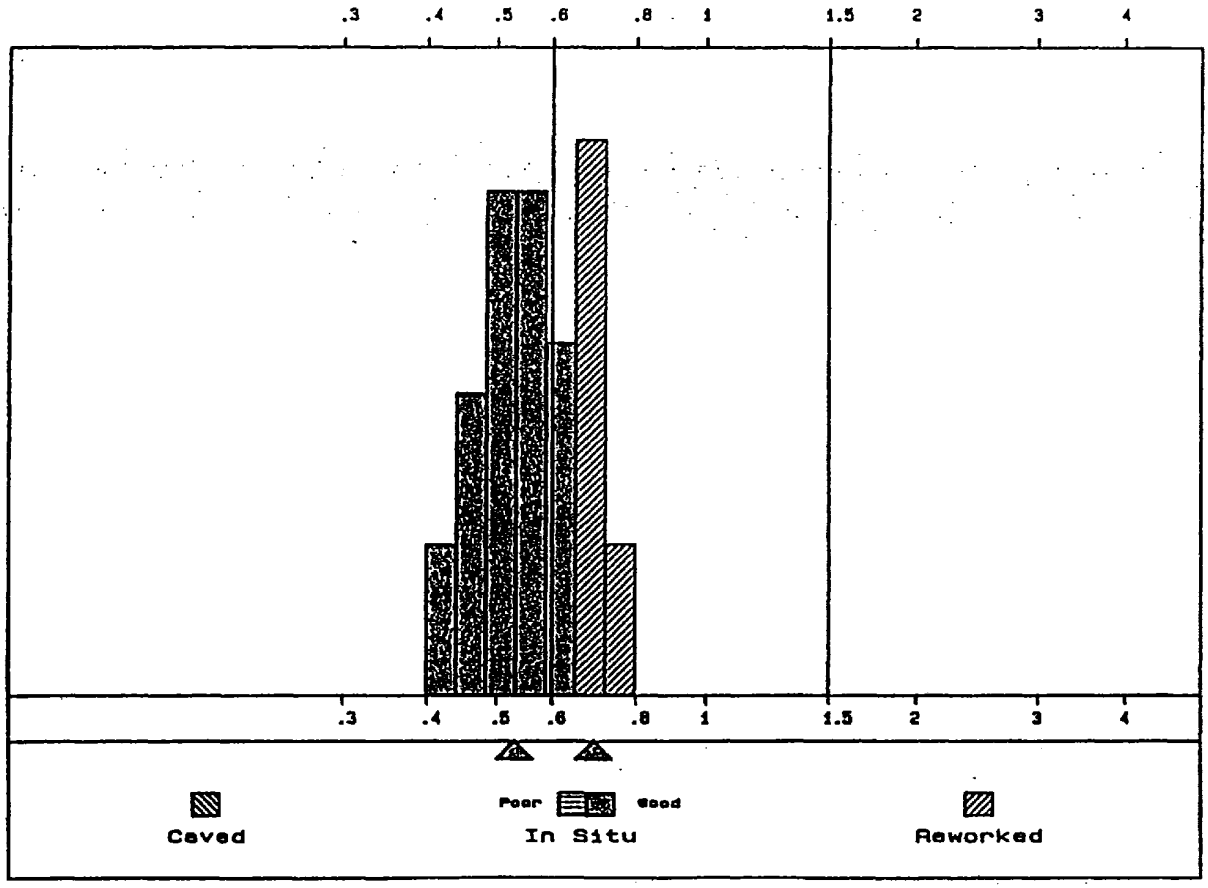


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 3190f

Population	Mean	Standard Deviation
In Situ	0.53	0.06
Caved	-	-
Reworked	0.68	0.03
Total	0.57	0.09

Total measurements this sample : 50

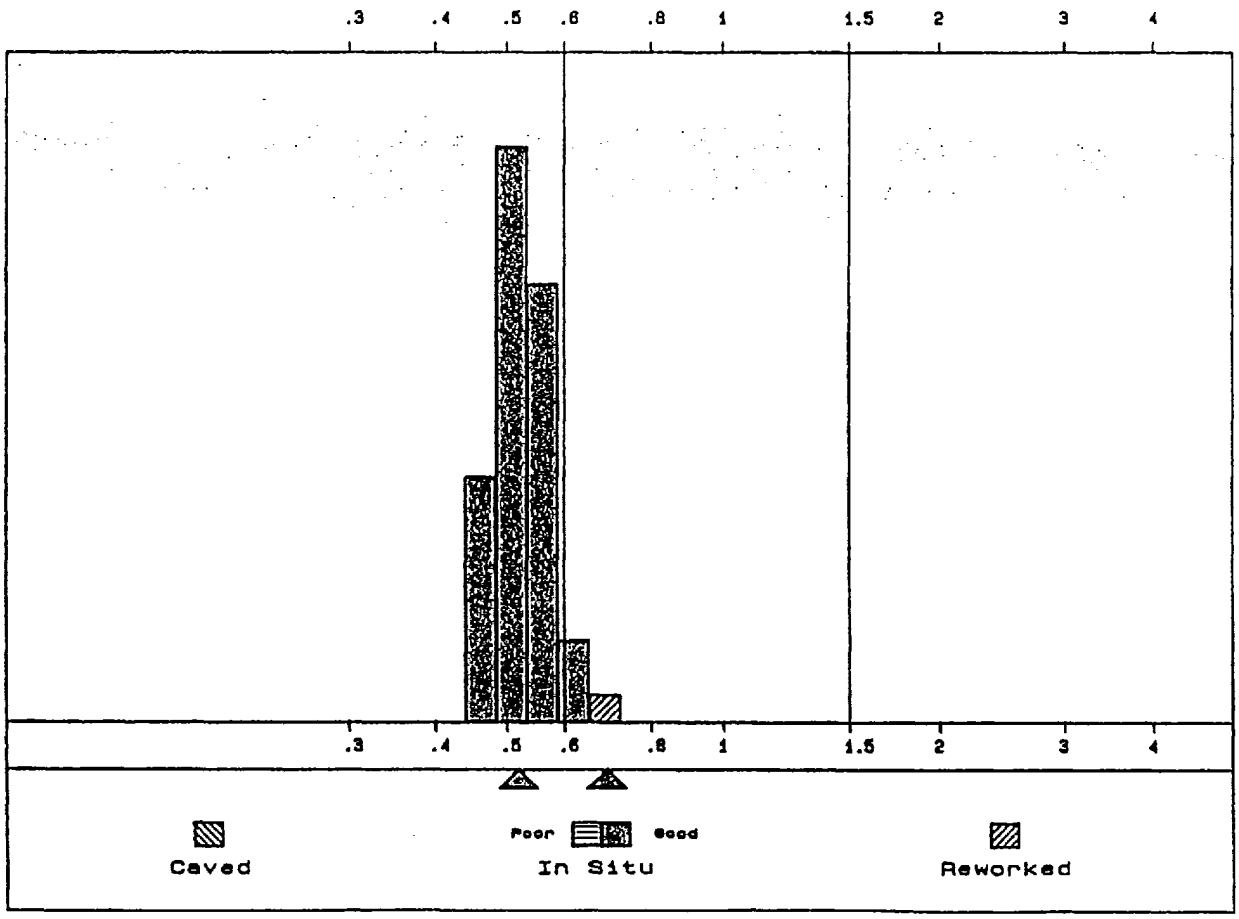


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 4210f

Population	Mean	Standard Deviation
In Situ	0.51	0.04
Caved	-	-
Reworked	0.68	-
Total	0.52	0.05

Total measurements this sample : 50

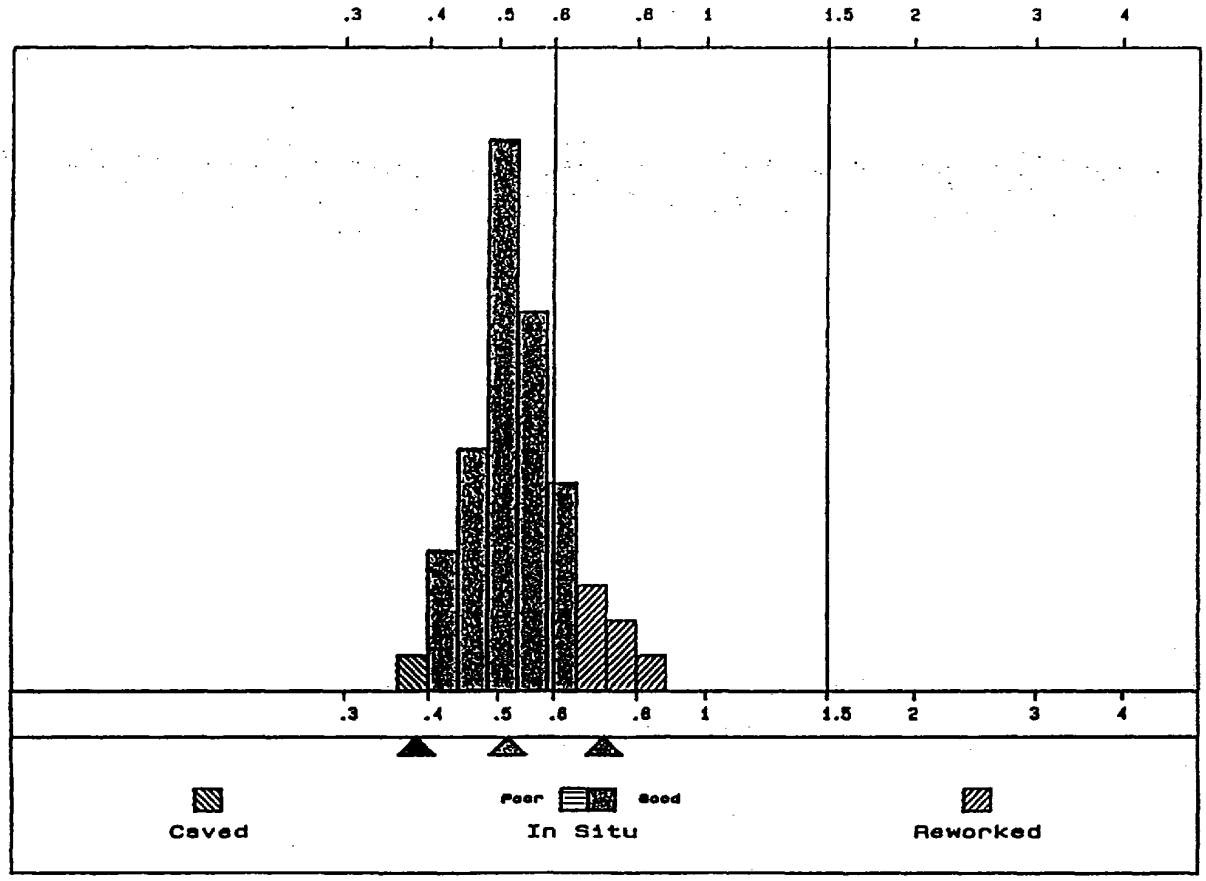


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 4900f

Population	Mean	Standard Deviation
In Situ	0.51	0.06
Caved	0.38	-
Reworked	0.70	0.06
Total	0.53	0.09

Total measurements this sample : 51

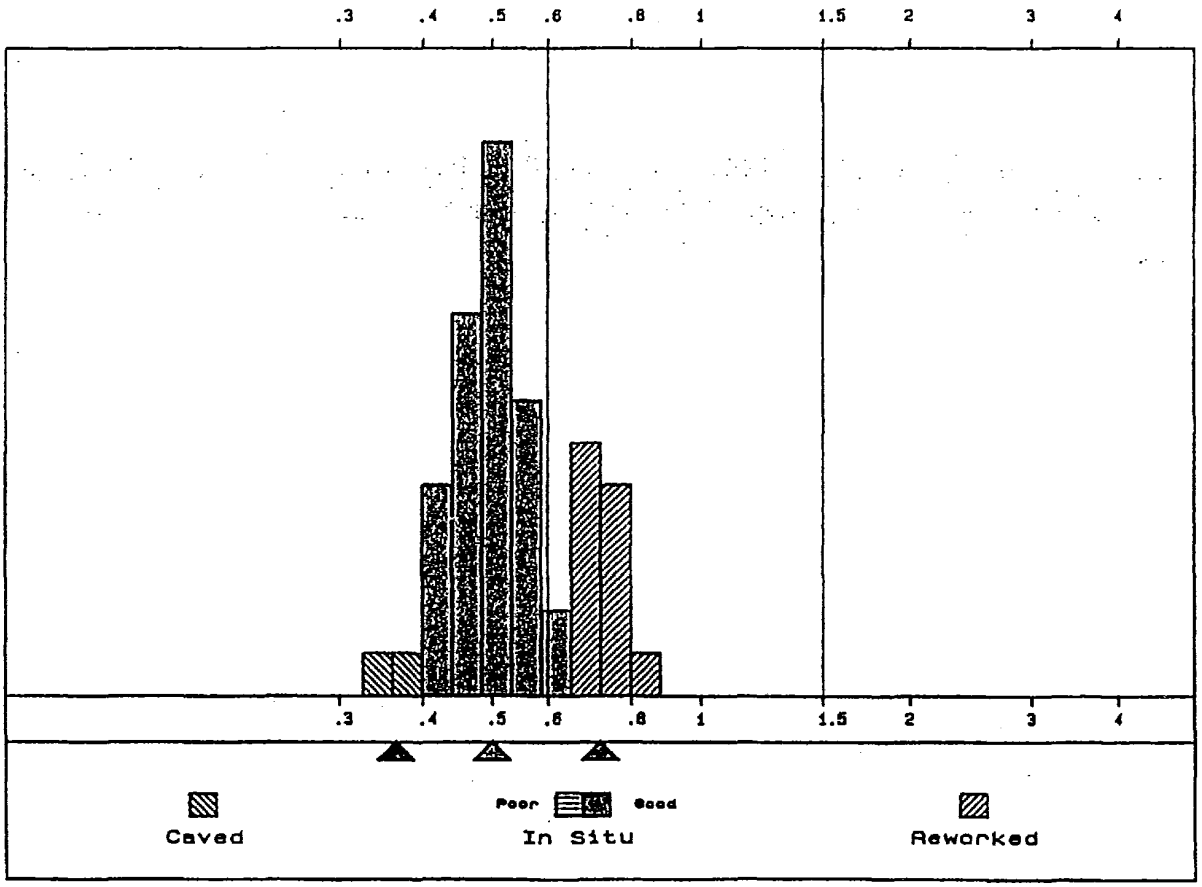


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 5560f

Population	Mean	Standard Deviation
In Situ	0.49	0.05
Caved	0.36	0.03
Reworked	0.70	0.05
Total	0.54	0.11

Total measurements this sample : 50

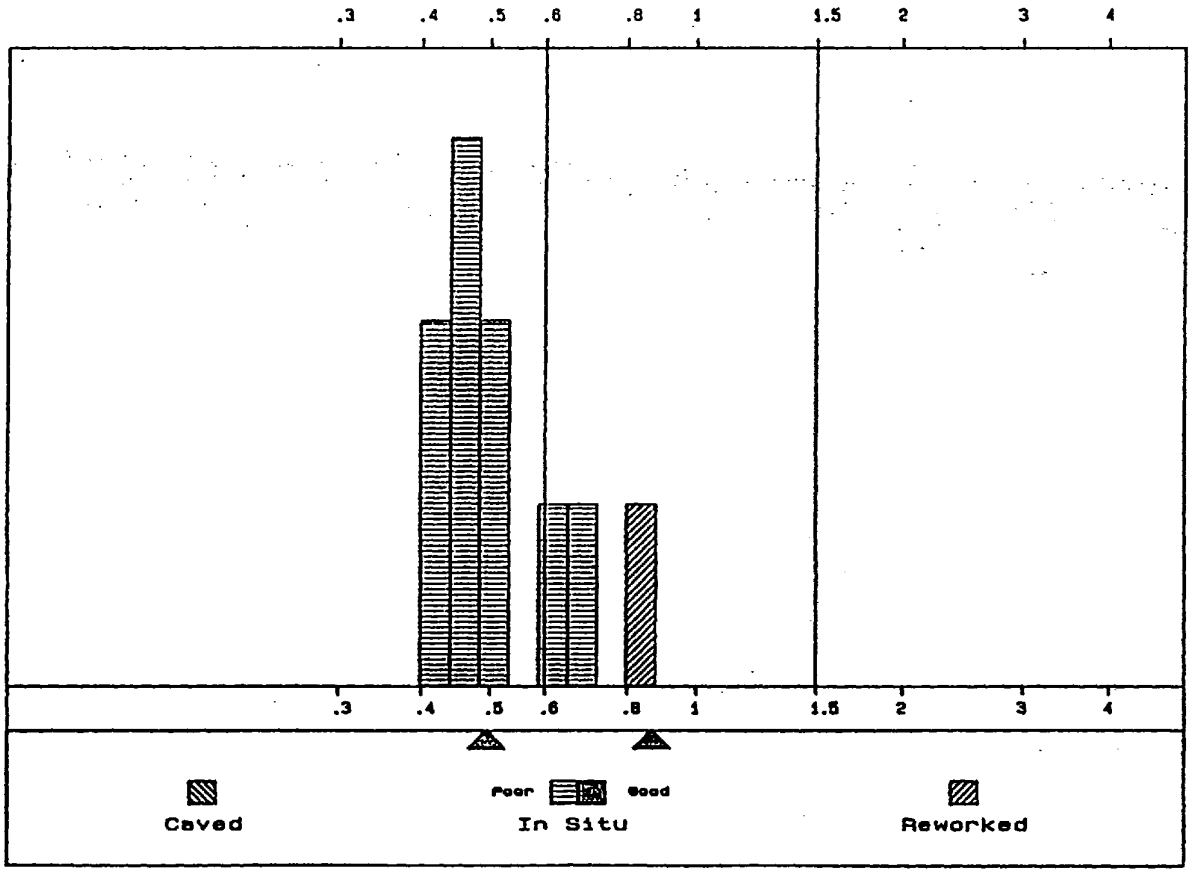


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 6030f

Population	Mean	Standard Deviation
In Situ	0.49	0.08
Caved	-	-
Reworked	0.85	-
Total	0.53	0.14

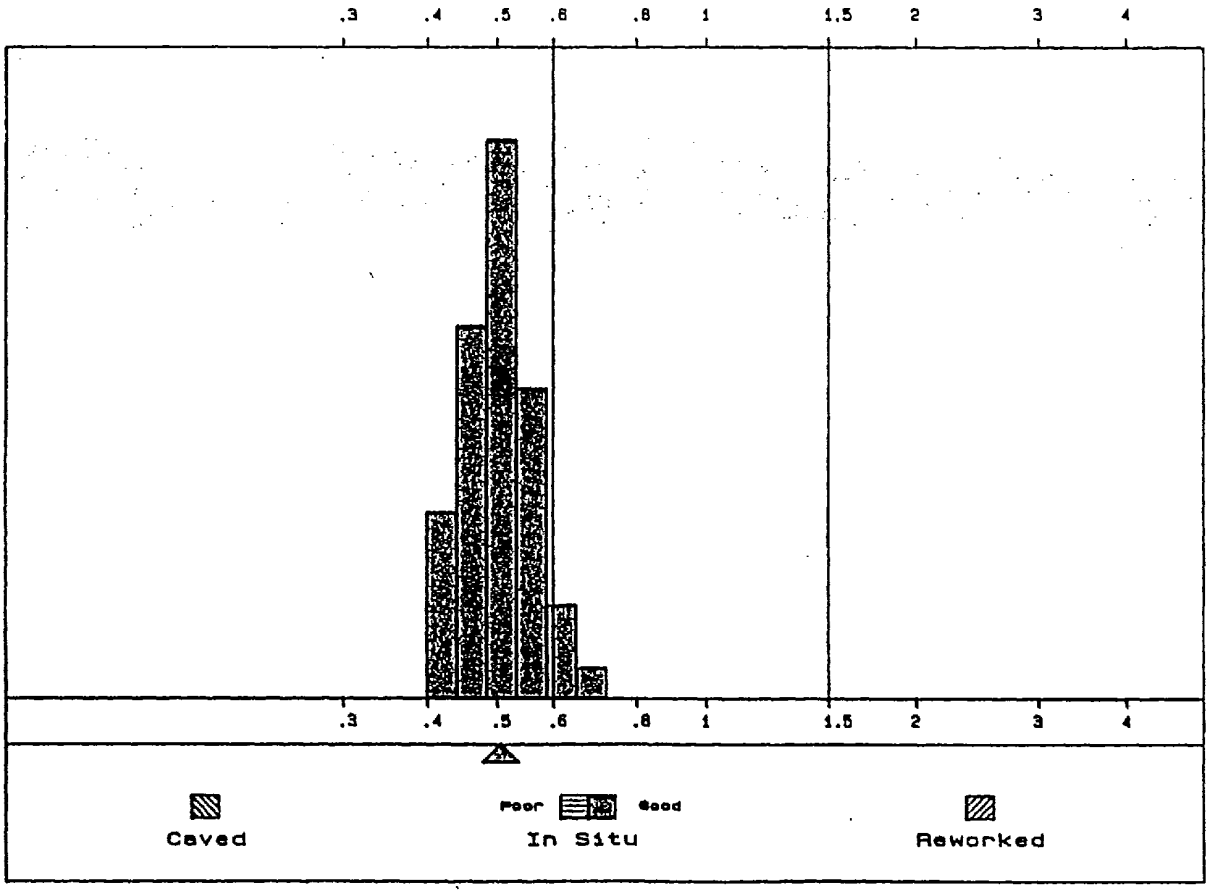
Total measurements this sample : 10



SAMPLE : 6550f

Population	Mean	Standard Deviation
In Situ	0.50	0.06
Caved	-	-
Reworked	-	-
Total	0.50	0.06

Total measurements this sample : 50

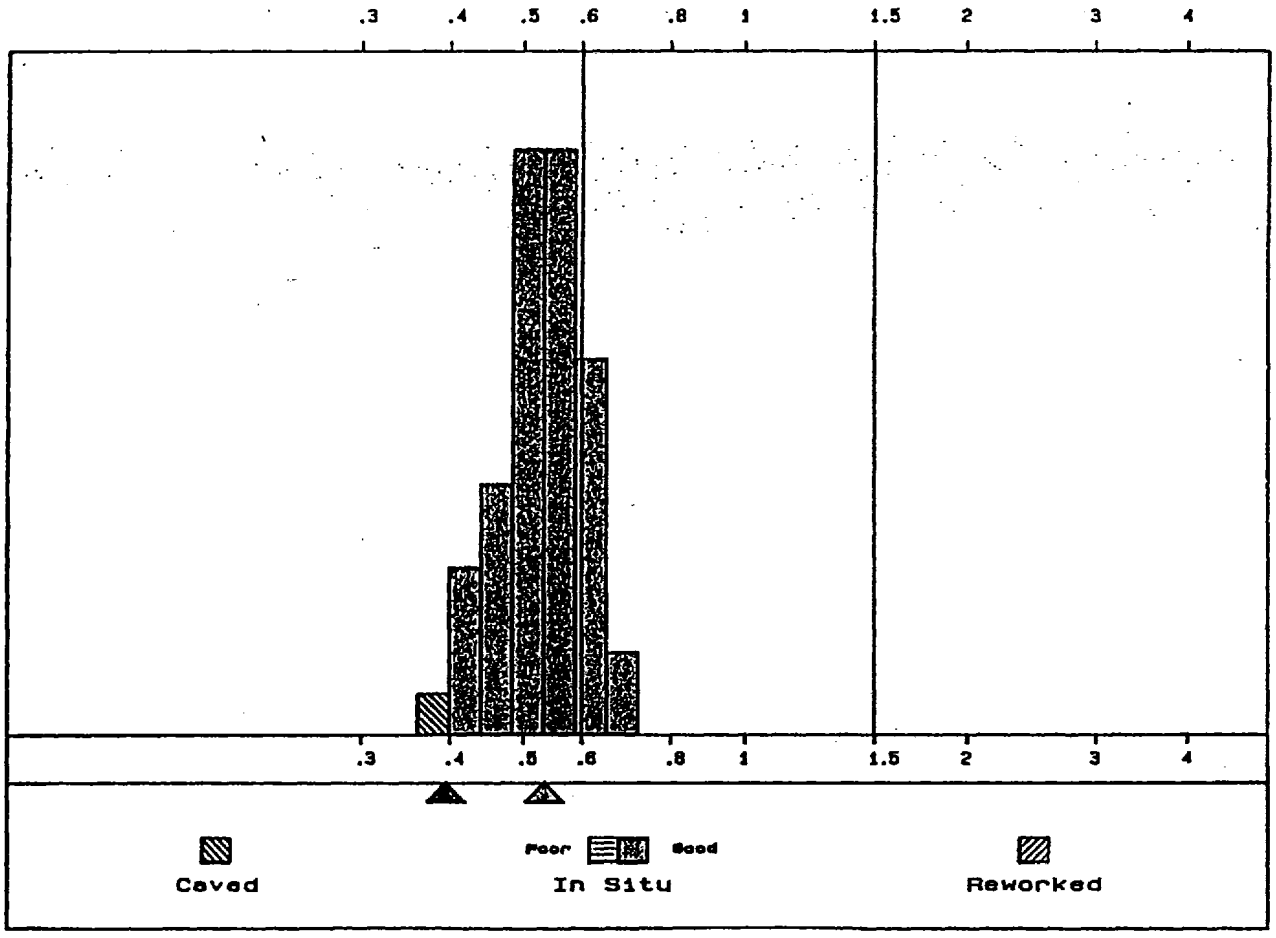


BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 7030f

Population	Mean	Standard Deviation
In Situ	0.53	0.07
Caved	0.39	-
Reworked	-	-
Total	0.53	0.07

Total measurements this sample : 50



BUJAK DAVIES GROUP : VITRINITE SULLIVAN #1

SAMPLE : 7870f

Population	Mean	Standard Deviation
In Situ	0.52	0.05
Caved	0.37	0.04
Reworked	0.88	-
Total	0.52	0.08

Total measurements this sample : 50