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GEOLOGICAL SURVEY OF CANADA

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Vitrinite reflectance (Ro) of dispersed organic matter
from
Pan Am-Imperial Grand Falls H-09

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2004

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Figure 1 - Grand Falls H-09

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Well information

G.S.C. Locality No.: D026 Unique Well ID: 300 H09 45300 52000 Location: 45.47194°N, 52.00083°W

R.T. Elevation: 31' Water Depth: 256' Total Depth: 5250'

Sampled Interval: 750 - 5190' Interval Studied: 900-5190'

Depth Units: Feet referenced to R.T. Rig Release Date: October 22, 1966

Introduction

Vitrinite reflectance has been determined on 14 rotary cutting samples from Pan Am-Imperial Grand Falls H-09, which was classified as an exploratory well and is located on the Southern Basin, Grand Banks, approximately 240 km south-southeast of St. John's, Newfoundland. Well status is Plugged and Abandoned.

Sample preparation followed the procedures listed in Appendix I. Data acquisition and manipulation was done with a Zeiss Photometer III system with a custom interface to a computer for data storage and statistical summaries.

Analysis of the well reveals thermal maturity intervals given in Table I. Specific maturity levels, as set out in this report, are based on those of Dow (1977) with modified terminology (Appendix II).

Table I
Inferred Hydrocarbon Thermal Maturity Levels

Depth in feet	Vitrinite Reflectance* %Ro	Hydrocarbon generation levels**
256 [Sea floor]	(0.24)	immature
1600	0.3	immature
3230	0.4	immature approaching maturity
4500	0.5	marginally mature
5250 [T.D.]	(0.57)	marginally mature

*()'s indicate Ro's or depths extrapolated from linear regression
slope: 0.252 log Ro/km

**Actual hydrocarbon products depend on type of organic matter present (Dow, 1977).

Remarks

Sample coverage for vitrinite reflectance analysis (Figure 1, Table II) was very complete over the section penetrated below 900' at Grand Falls H-09. The data were plotted on a log Ro vs. linear depth scale and regression lines were calculated and plotted (Figure 1). The 'error bars' displayed on the maturity profile indicate one standard deviation on either side of the mean and may be deceptively small for samples with very few readings. The slope of the maturity line is 0.252 log Ro/km.

The histogram display shows the variability in the reflectance populations, which represent the maturity of the sediments with depth (Figure 2). Plotting reflectance histograms on a log scale may help reveal any trends present in the Ro data. It also can help to demonstrate the effects of cavings, geology, casing points and other influences on the vitrinite reflectance populations.

These vitrinite reflectance data show that the thermal regime of the lower section of Grand Falls H-09 is suitable to generate and preserve liquid hydrocarbons within the drilled section, between 4500 and 5250' (T.D.), provided potential source rocks and traps are present.

Discussion

The section at Grand Falls is compressed stratigraphically compared to other wells in the area. The slope is in the group of higher slopes reported by Wielens, J.B.W., and Avery M.P., 2004.

For many of the samples in the well it was difficult to determine the unoxidized autochthonous vitrinite population and therefore measure and establish the maturation profile. The small number of readings recorded for most of the samples is indicative of this difficulty (Table II). The high slope value of the maturity profile and the lack of unoxidized organics is possibly due to hydrothermal fluid flows within the sediments in this area (Wielens, J.B.W., and Avery M.P., 2004).

References

Dow, W. G.

1977: Kerogen studies and geological interpretations. *Journal of Geochemical Exploration*, no. 7, p.77-99.

Wielens, J.B.W., and Avery M.P.

2004: Maturity trends from vitrinite data on the northern Grand Banks; Geological Survey of Canada, Open File 4488.

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Table II

Summary of kerogen - based vitrinite reflectance

Sample Labels	Depth in feet	Mean Ro (SD) non-rotated	Number of Readings	
			Total	Edited
K0935A	900-930	0.28 (± 0.02)	8	5
K0935B	1170-1200	0.26 (± 0.03)	6	6
K0935C	1530-1560	0.33 (± 0.04)	7	7
K0935D	1950-1980	0.28 (± 0.00)	1	1
K0936A	2490-2520	0.32 (± 0.03)	5	5
K0936B	2760-2790	0.42 (± 0.05)	13	13
K0936C	3060-3090	0.41 (± 0.04)	17	17
K0936D	3270-3300	0.41 (± 0.02)	11	11
K0937A	3780-3810	0.43 (± 0.05)	10	10
K0937B	4050-4080	0.48 (± 0.03)	10	10
K0937C	4410-4440	0.49 (± 0.04)	14	14
K0937D	4770-4800	0.50 (± 0.02)	5	5
K0938A	5010-5040	0.53 (± 0.04)	11	11
K0938B	5160-5190	0.60 (± 0.02)	9	4

Table III

Formation Tops (Moir, pers. comm.)

Formation	Depth in feet
Banquereau	in casing
Dawson Canyon fm	1046
Petrel Mb	2844-2881
Eider	2942
(unconformity)	3261
Hibernia Fm (equiv)	3261
Fortune Bay Shale (equiv)	3386
(unconformity)	3711
Jeanne D'arc Fm (equiv)	3711
Rankin	4091
Voyager	4750
Total Depth	5250

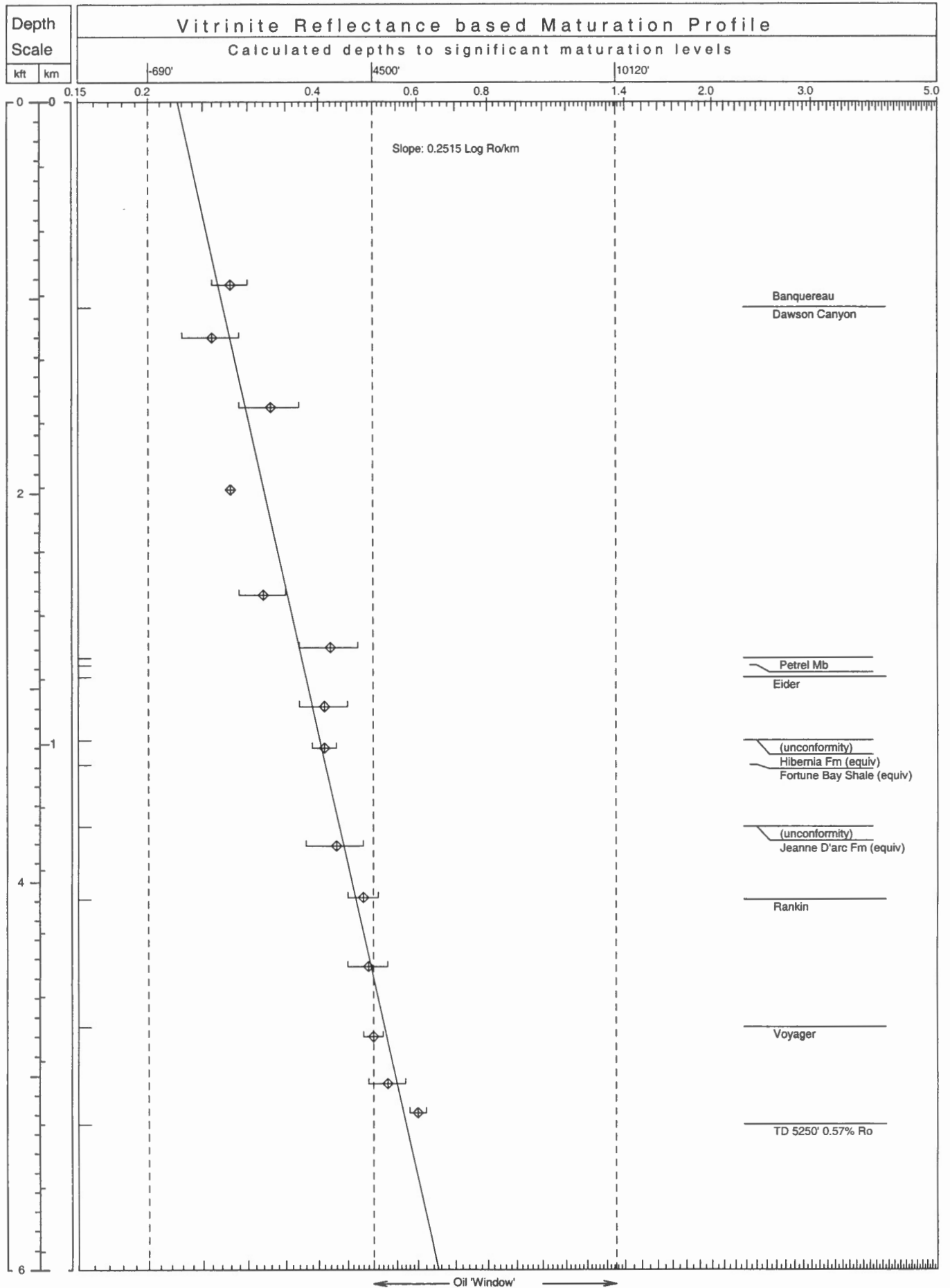


Fig. 1 Grand Falls H-09

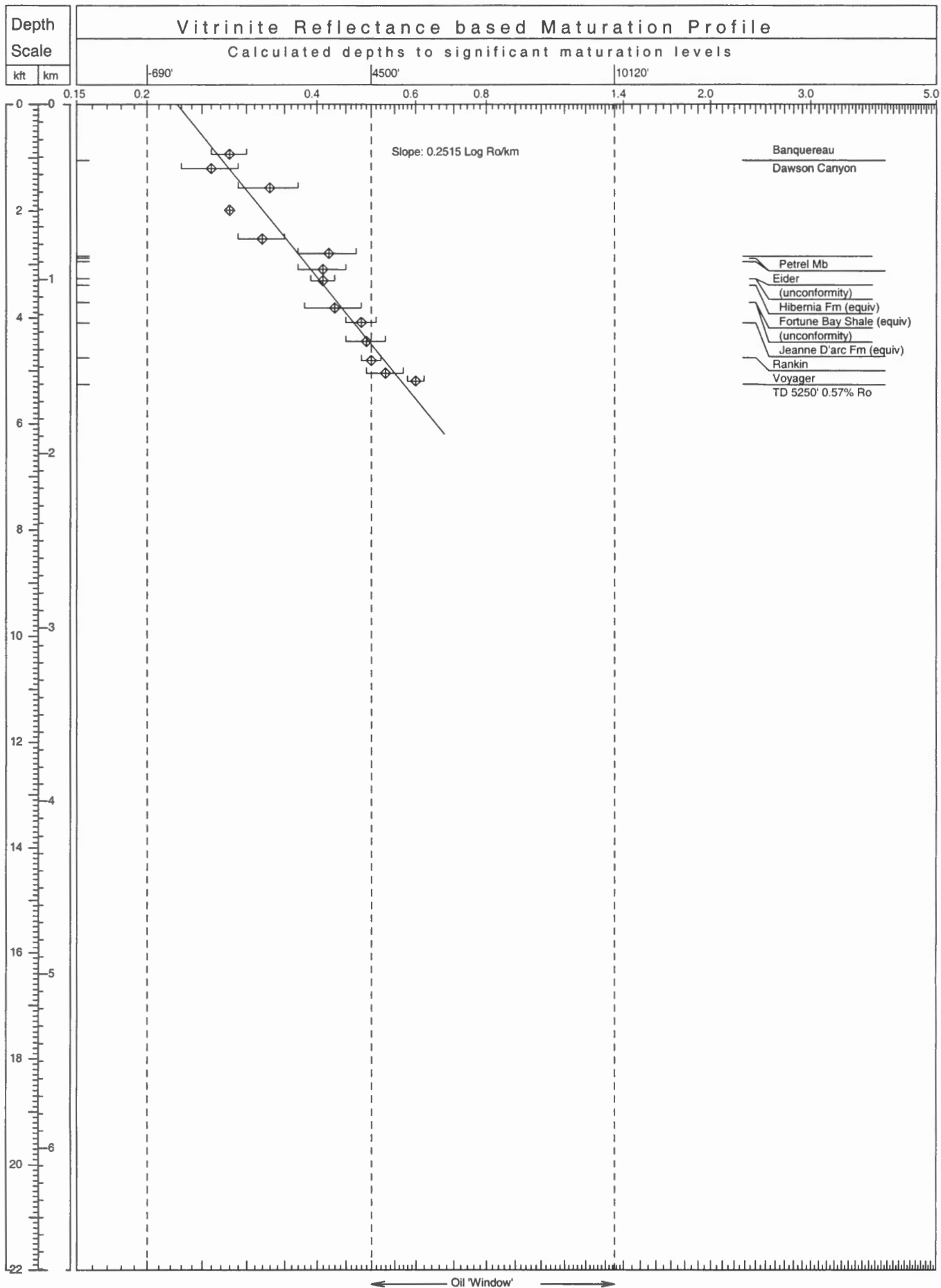


Fig. 2 Grand Falls H-09 (plotted at depth scale used for most other wells in Avery reports)

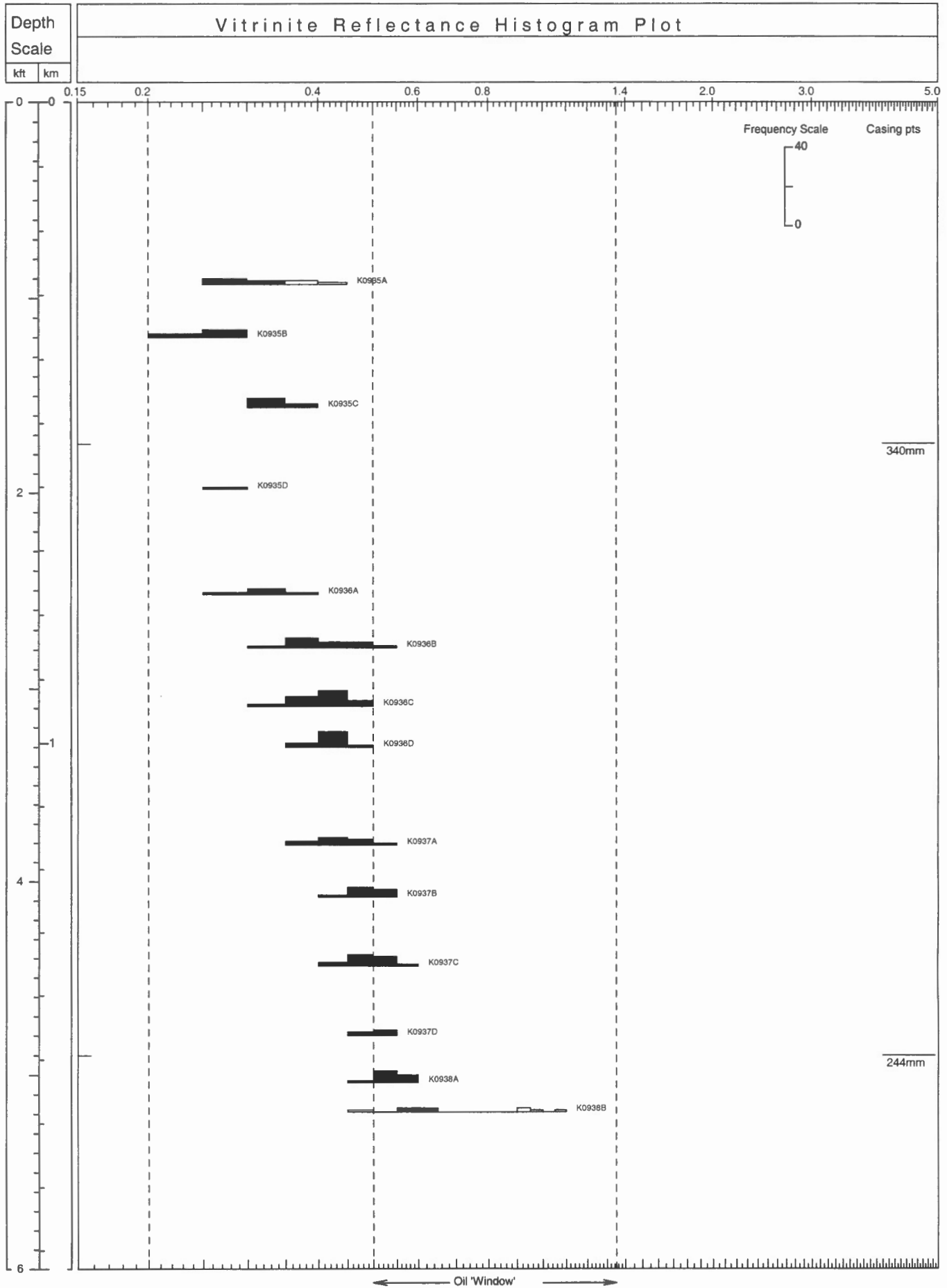


Fig. 3 Grand Falls H-09 <Histograms>

Appendix I

Sample Preparation Method

Kerogen Concentrate

Preliminary wash (preparation for cuttings)

Dry samples in oven (25°C)

PALYNOLOGY Lab preparation

Place 20-30 grams in 250 ml plastic beaker.

Add 10% HCl till reaction ceases (removes carbonates).

Rinse 3 times.

Immerse in hot concentrated HF overnight (removes silicates).

Rinse 3 times.

Heat (60-65°C) in concentrated HCl (removes fluorides caused by HF).

Rinse 3 times.

Transfer to 15 ml test tube with 4-5 ml 4% Alconox.

Centrifuge at 1500 rpm for 90 sec.

Decant.

Rinse and centrifuge 3 times.

Float off organic fraction using 2.0 S.G. ZnBr solution.

Centrifuge at 1000 rpm for 8 min.

Float fraction into second test tube.

Wash and centrifuge 3 times.

Make kerogen smear slide.

Remaining kerogen material is made available to Organic Petrology Lab.

VITRINITE REFLECTANCE Lab preparation

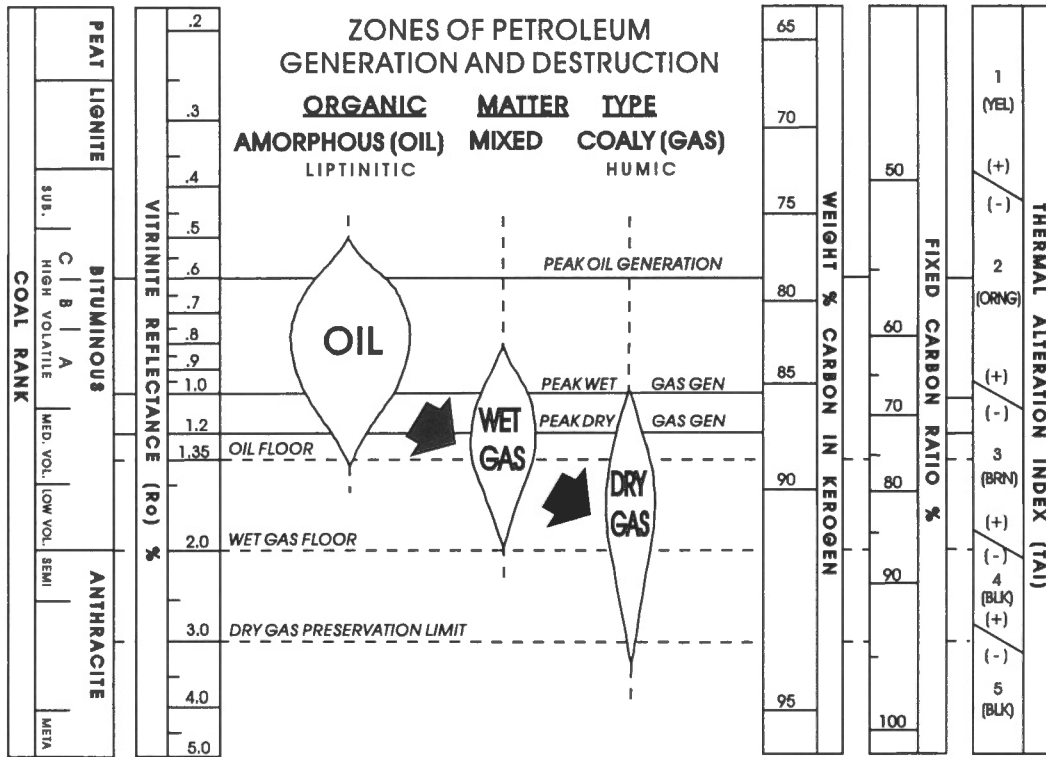
Pipette off excess water and prepare as 2.5 cm (1") diameter plastic stubs to fit polisher.

Freeze dry and fix material for polishing with epoxy resin.

Polish with diamond-based suspension to obtain low relief, scratch-free surface.

Examine under oil lens, incident light at approximately 1000x magnification.

Appendix II (Dow, 1977)



Note: In this report, the terminology used to describe the various maturity levels has been modified. The 'peak' designation, as used in this figure, has been changed to 'onset of significant' and 0.8 %Ro is herein used as the 'peak of oil generation' (Table I, Figure 1).

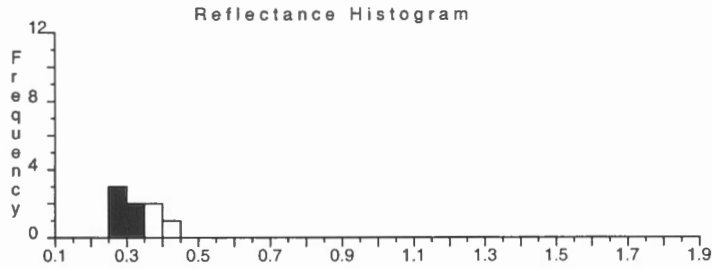
Appendix III

Data listings and basic statistics

Data listings and basic statistics for: Grand Falls H-09

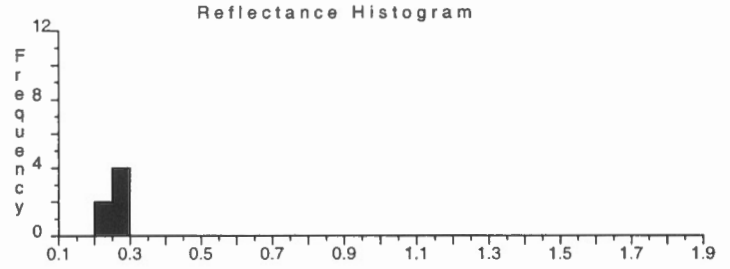
K0935A, 900-930'

Col >	1	2	3	4	5	6	7	8
Row	(0.30)	(0.26)	(0.31)	(0.26)	0.37	0.39	(0.29)	0.42
Total	Mean	Stand Dev	Pts	Min	Max	Sum		
(Edit)	0.32	0.06	8	0.26	0.42	2.60		
	0.28	0.02	5	0.26	0.31	1.42		



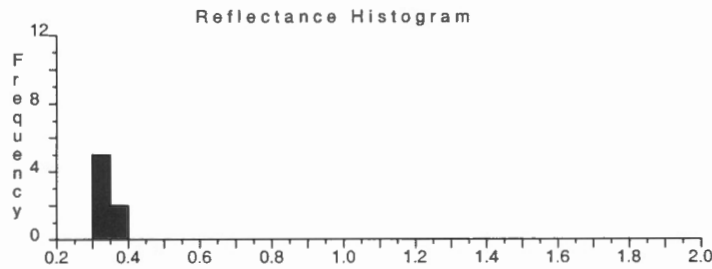
K0935B, 1170-1200'

Col >	1	2	3	4	5	6
Row	(0.20)	(0.28)	(0.27)	(0.29)	(0.24)	(0.28)
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.26	0.03	6	0.20	0.29	1.56
	0.26	0.03	6	0.20	0.29	1.56



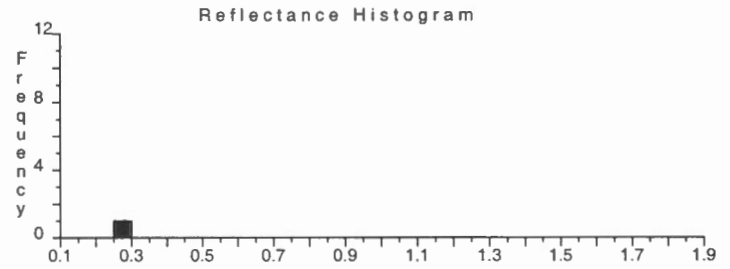
K0935C, 1530-1560'

Col >	1	2	3	4	5	6	7
Row	(0.32)	(0.31)	(0.37)	(0.30)	(0.34)	(0.39)	(0.30)
Total	Mean	Stand Dev	Pts	Min	Max	Sum	
(Edit)	0.33	0.04	7	0.30	0.39	2.33	
	0.33	0.04	7	0.30	0.39	2.33	



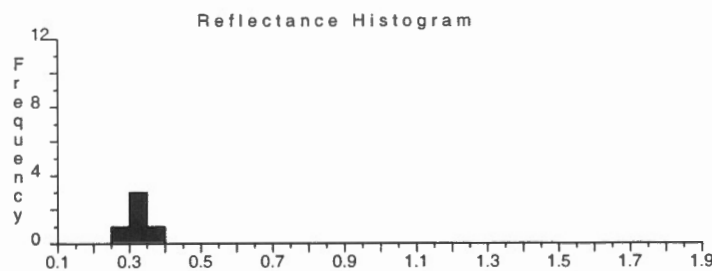
K0935D, 1950-1980'

Col >	1					
Row	(0.28)					
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.28	0.00	1	0.28	0.28	0.28
	0.28	0.00	1	0.28	0.28	0.28



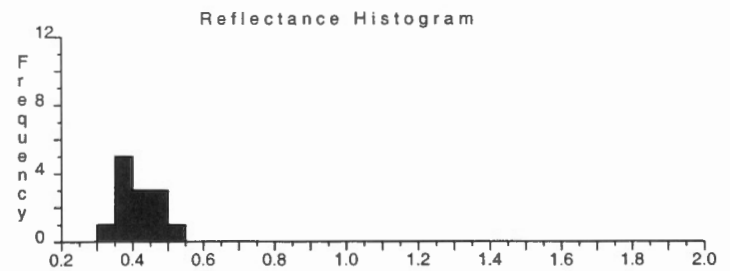
K0936A, 2490-2520'

Col >	1	2	3	4	5	
Row	(0.29)	(0.33)	(0.32)	(0.36)	(0.31)	
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.32	0.03	5	0.29	0.36	1.61
	0.32	0.03	5	0.29	0.36	1.61



K0936B, 2760-2790'

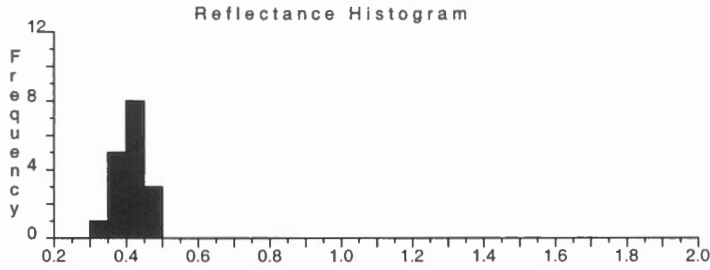
Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.34)	(0.46)	(0.44)	(0.38)	(0.39)	(0.39)	(0.38)	(0.39)	(0.45)	(0.45)
1	(0.41)	(0.41)	(0.52)							
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.42	0.05	13	0.34	0.52	5.41				
	0.42	0.05	13	0.34	0.52	5.41				



Data listings and basic statistics for: Grand Falls H-09

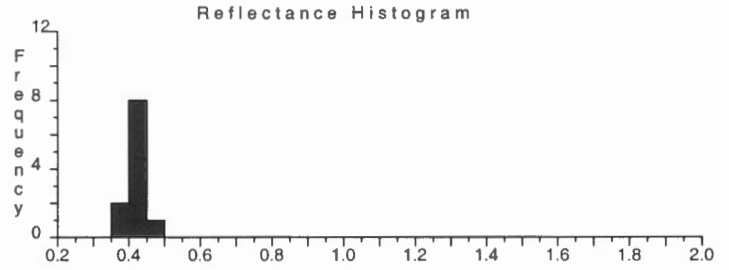
K0936C, 3060-3090'

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.38)	(0.43)	(0.44)	(0.39)	(0.45)	(0.35)	(0.47)	(0.39)	(0.33)	(0.42)
	(0.38)	(0.42)	(0.47)	(0.41)	(0.42)	(0.43)	(0.43)			
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.41	0.04	17	0.33	0.47	7.01				



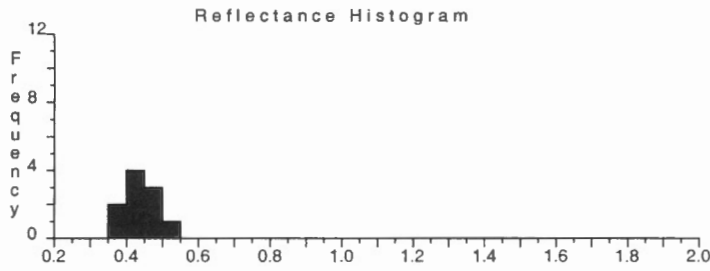
K0936D, 3270-3300'

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.37)	(0.43)	(0.42)	(0.42)	(0.42)	(0.45)	(0.38)	(0.40)	(0.40)	(0.40)
	(0.40)									
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.41	0.02	11	0.37	0.45	4.49				



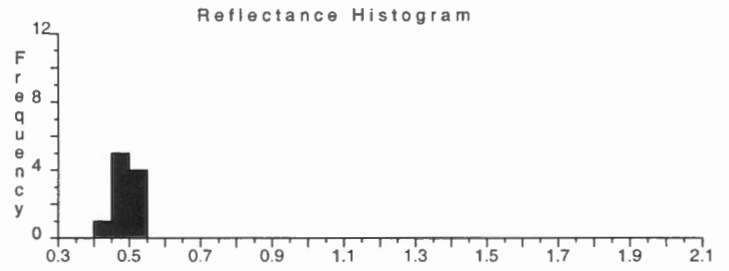
K0937A, 3780-3810'

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.38)	(0.35)	(0.41)	(0.48)	(0.42)	(0.46)	(0.40)	(0.46)	(0.43)	(0.53)
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.43	0.05	10	0.35	0.53	4.32				



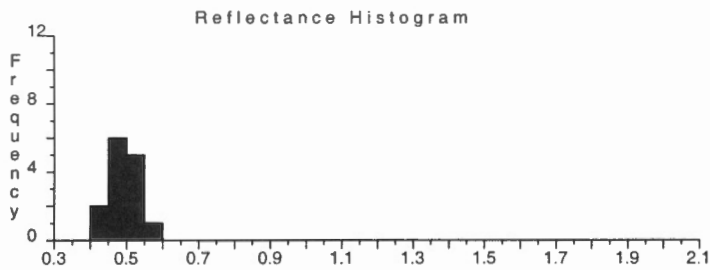
K0937B, 4050-4080'

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.45)	(0.43)	(0.45)	(0.48)	(0.51)	(0.49)	(0.51)	(0.49)	(0.51)	(0.53)
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.48	0.03	10	0.43	0.53	4.85				



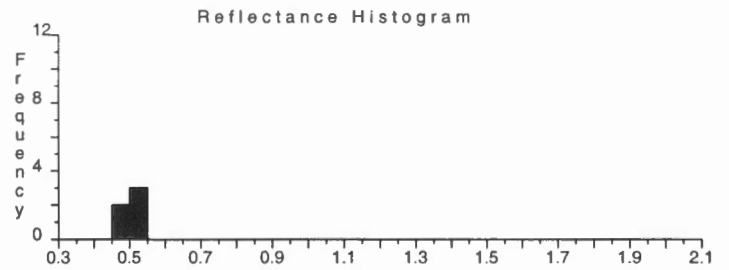
K0937C, 4410-4440'

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.45)	(0.47)	(0.42)	(0.51)	(0.49)	(0.46)	(0.54)	(0.49)	(0.48)	(0.42)
	(0.52)	(0.55)	(0.52)							
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.49	0.04	14	0.42	0.55	6.84				



K0937D, 4770-4800'

Col >	1	2	3	4	5	
Row 1	(0.48)	(0.50)	(0.53)	(0.51)	(0.48)	
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.50	0.02	5	0.48	0.53	2.50



Data listings and basic statistics for: Grand Falls H-09

K0938A, 5010-5040'

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.50)	(0.51)	(0.58)	(0.57)	(0.55)	(0.59)	(0.52)	(0.53)	(0.49)	(0.50)

	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.53	0.04	11	0.49	0.59	5.84
(Edit)	0.53	0.04	11	0.49	0.59	5.84

K0938B, 5160-5190'

Col >	1	2	3	4	5	6	7	8	9
Row	0.99	1.06	0.48	(0.60)	(0.59)	(0.59)	0.91	(0.63)	0.91

	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.75	0.21	9	0.48	1.06	6.76
(Edit)	0.60	0.02	4	0.59	0.63	2.41

