GEOLOGICAL SURVEY OF CANADA
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Vitrinite reflectance data for HB-Fina Northumberland Strait F-25

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Available from
Geological Survey of Canada
1 Challenger Drive
Dartmouth, Nova Scotia, B2Y 4A2

Avery, M.P.
2009: Vitrinite reflectance data for HB-Fina Northumberland Strait F-25; Geological Survey of Canada Open File 5886, 13p.

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Well information

G.S.C. Locality No.: D015 **Unique Well ID:** 300 F25 46100 62000 **Location:** 46.07365° N, 62.06268° W

R.T. Elevation: 31' (9.4m) **Water Depth:** 98' (29.9m) **Total Depth:** 9876' (3010.2m)

Sampled Interval: 280-9880' (85.3-3011.4m) **Interval Studied:** 2780-9080' (847.3-2767.6m)

Depth Units: Feet referenced to R.T. (Metric conversions) **Rig Release Date:** June 23, 1970

Introduction

Vitrinite reflectance has been determined on 7 rotary drill cutting samples from HB-Fina Northumberland Strait F-25, which was classified as an exploratory well, located in the Gulf of St. Lawrence. The well status is Plugged and Abandoned.

Sample preparation followed the procedures listed in Appendix I. Data acquisition and manipulation was done on 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 levels given in Table I. Specific maturity levels, as set out in this report, are based on those of Powell and Snowdon(1983) with modified terminology (Appendix II).

Table I
Inferred Hydrocarbon Thermal Maturity Levels

Depth		Vitrinite Reflectance*	Hydrocarbon generation levels**
feet	metres	%Ro	for type II or III kerogen
Upper line			
2770	844	0.50	entering 'Oil window'
3030	924	1.35	exiting 'Oil window'
Lower line			
6616[top Horton Gp]	2017	(0.42)	approaching 'Oil window'
7530	2295	0.50	entering 'Oil window'
8247 [top Fountain Lake Fm]	2514	(0.57)	marginally mature

**( )'s indicate Ro's extrapolated from lower linear regression slope: 0.267 log Ro/km*
*** Actual hydrocarbon products depend on type of organic matter present (Appendix II).*

Remarks

Sample coverage for vitrinite reflectance analysis at Northumberland Strait F-25(Figure 1, Table II) was sparse over the studied section between 2780 and 9080' (8473-2767 m) with a significant gap between 3980 and 6880' (1213-2097m). The data were plotted on a log Ro vs. linear depth scale. Regression lines fitted through the data yielded a maturity slope of 0.987 log Ro/km in the upper section and a slope of 0.2671 log Ro/km for the lower section . There is a significant variation in the number of readings that the data points are based on (Table II), therefore the regression lines were weighted based on the 'n' value for each point . The relative size of the point symbols provides an indication of the number of readings. The 'error bars' displayed on the maturity profile indicate one standard deviation on either side of the mean and may be deceivingly small for samples with very few readings.

The histogram display (Figure 2) shows the variability in the reflectance populations, which represent the maturity of the sediments with depth. 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.

Keeping in mind the limits of the data set, these vitrinite reflectance data show that the thermal maturity of the upper section of Northumberland Strait F-25 between 2780 and 3980' (847-1213m) is mature for the generation of liquid hydrocarbons while lower section between 6880 and 9080' (2097-2767m) (T.D.) ranges from immature to mature for liquid hydrocarbons. These results only reveal the maturity of the sediments penetrated, actual production of hydrocarbons depends on source rocks of the proper organic matter type and traps being present or connected to the well.

Method

Data obtained for this report were measured on polished kerogen mounts. Kerogen concentrate preparations make more of the organic matter from the sample interval available for viewing by the operator than other methods. The lack of mineral matter makes for better polishing and because the polished surface area is much smaller, the analysis time is about a third or less of that for non-concentrated whole rock preparations.

Discussion

The samples measured for this report yielded very few values which were considered indicative of the maturity of the sediments from which they were derived (Table II). The optimal number for these analysis is around 50 but this rarely achieved on polished organic preparations derived from rotary drill well cuttings. Low numbers of vitrinite reflectance data values are also typical of the lithology in this well, most of which is 'red' or oxic with high potential for reworking, oxidation and recycling.

The large data gap between 3980 and 6880' (1213-2097m) is in the lower Windsor Fm, which here is mostly composed of evaporite deposits. Such a significant body of salt may be the reason for the unusual maturity trends in the well. Typically, the maturity trend for 'normal' undisturbed sedimentary sections progress in a linear fashion, using a log Ro axis, from approximately 0.2% Ro near the surface to the maturity found at TD. For this well, the upper trend is much higher in maturity than the lower trend. Such a situation can most probably be explained by a significant heat transfer by the large, highly conductive salt pillow that flowed into the section and thereby conducted heat from lower in the section over a significant amount of time. The heat rises and cooks the sediments above the salt while it sucked away from the sediments below it.

References

Powell, T. G. and Snowdon, L. R.,1983. A composite hydrocarbon generation model. Erdöl und Kohle, Erdgas, Petrochemie, v. 36, p. 163-170.

Giles, P., Utting, J., 1999. Maritime Basin Stratigraphy, Prince Edward Island and adjacent Gulf of St. Lawrence. GSC Open File Report 3732.

Table II

Summary of kerogen - based vitrinite reflectance

Sample Labels	Depth		Mean Ro (SD) non-rotated	Number of Readings	
	feet	metres		Total	Edited
K0949A	2780	847	0.52 (±0.00)	17	1
K0949B	3580	1091	0.87 (±0.06)	25	9
K0949C	3980	1213	1.23 (±0.00)	3	1
K0949D	6880	2097	0.44 (±0.06)	9	8
K0950A	7880	2402	0.82 (±0.00)	1	1
K0950B	8280	2524	0.52 (±0.05)	5	5
K0950C	9080	2768	0.76 (±0.00)	2	1

Table III

Formation Tops (Giles and Utting 1999)

Formation	Top	
	feet	metres
(Post-Permian Unconf)	98	30
Brian Island Fm	98	20
(Namur/Westph Event)	641	195
Mabou Gp	641	195
Windsor	2771	845
Horton	6616	2017
Fountain Lake Fm	8247	2514
(Basement)	9140	2786

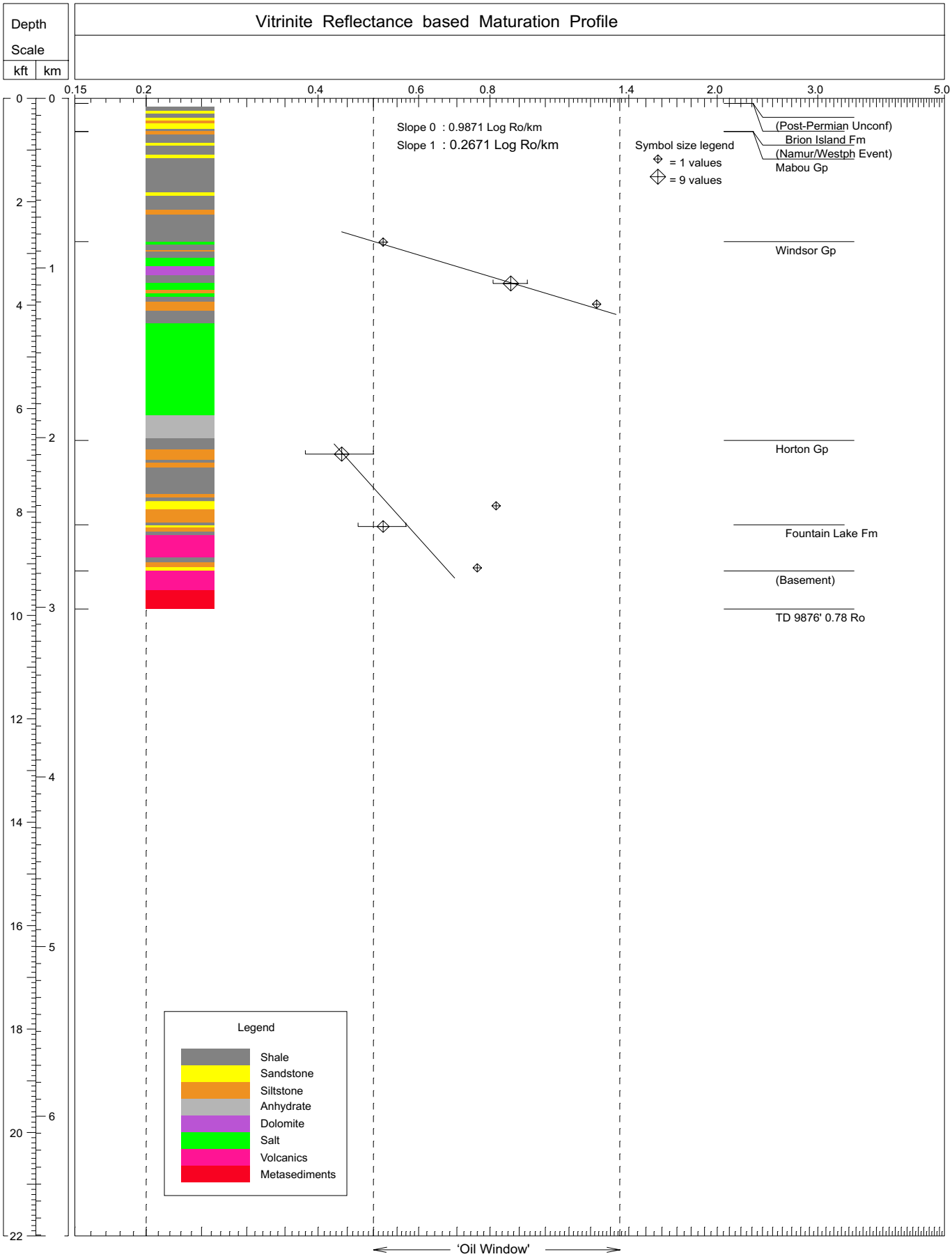


Figure1. VR/depth plot for Northumberland Strait F-25

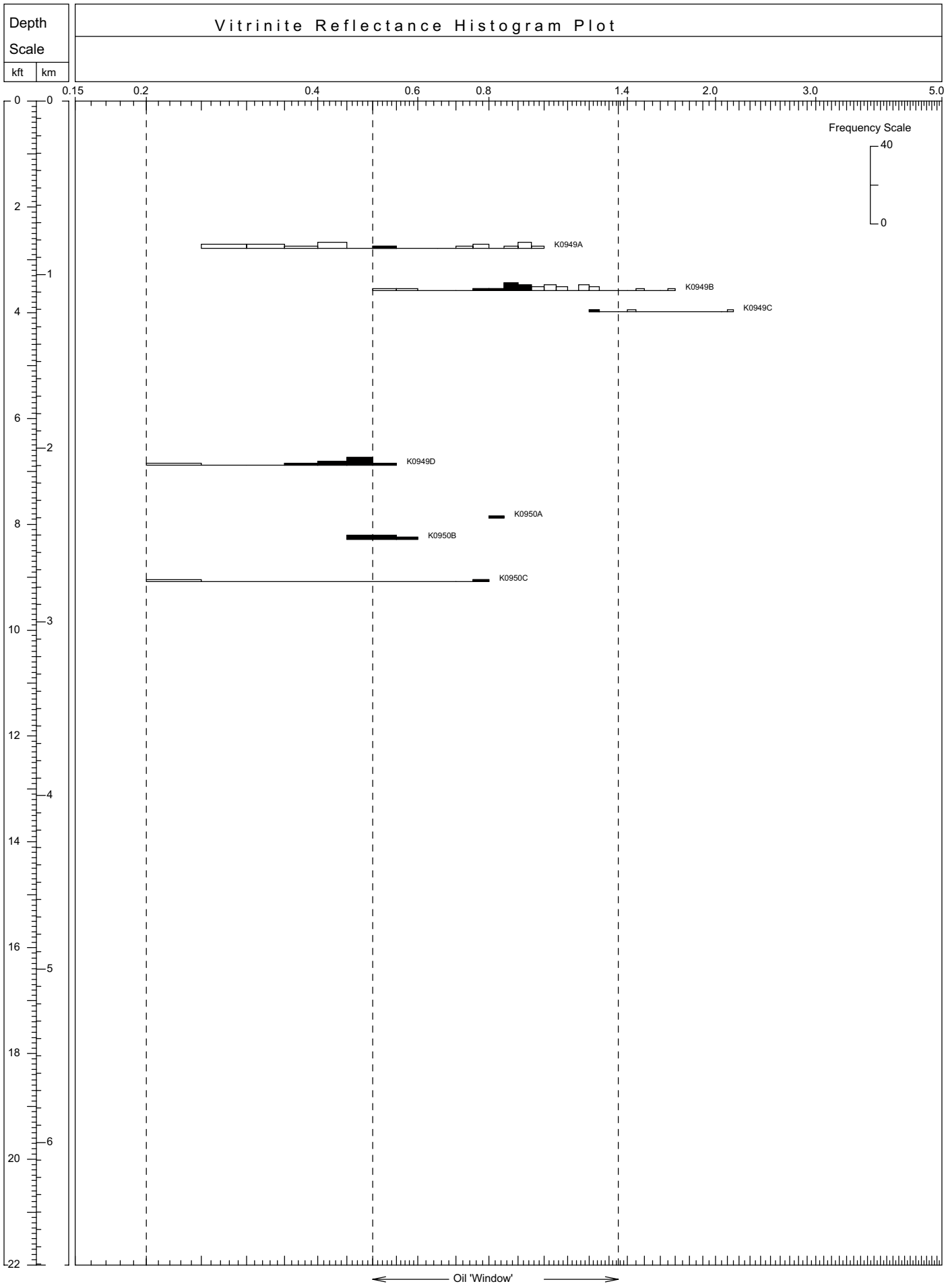


Figure 1. VR/depth plot for Northumberland Strait F-25

Appendix I

Sample Preparation Method

Kerogen concentrate sample preparation

Preliminary wash (preparation for drill 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.

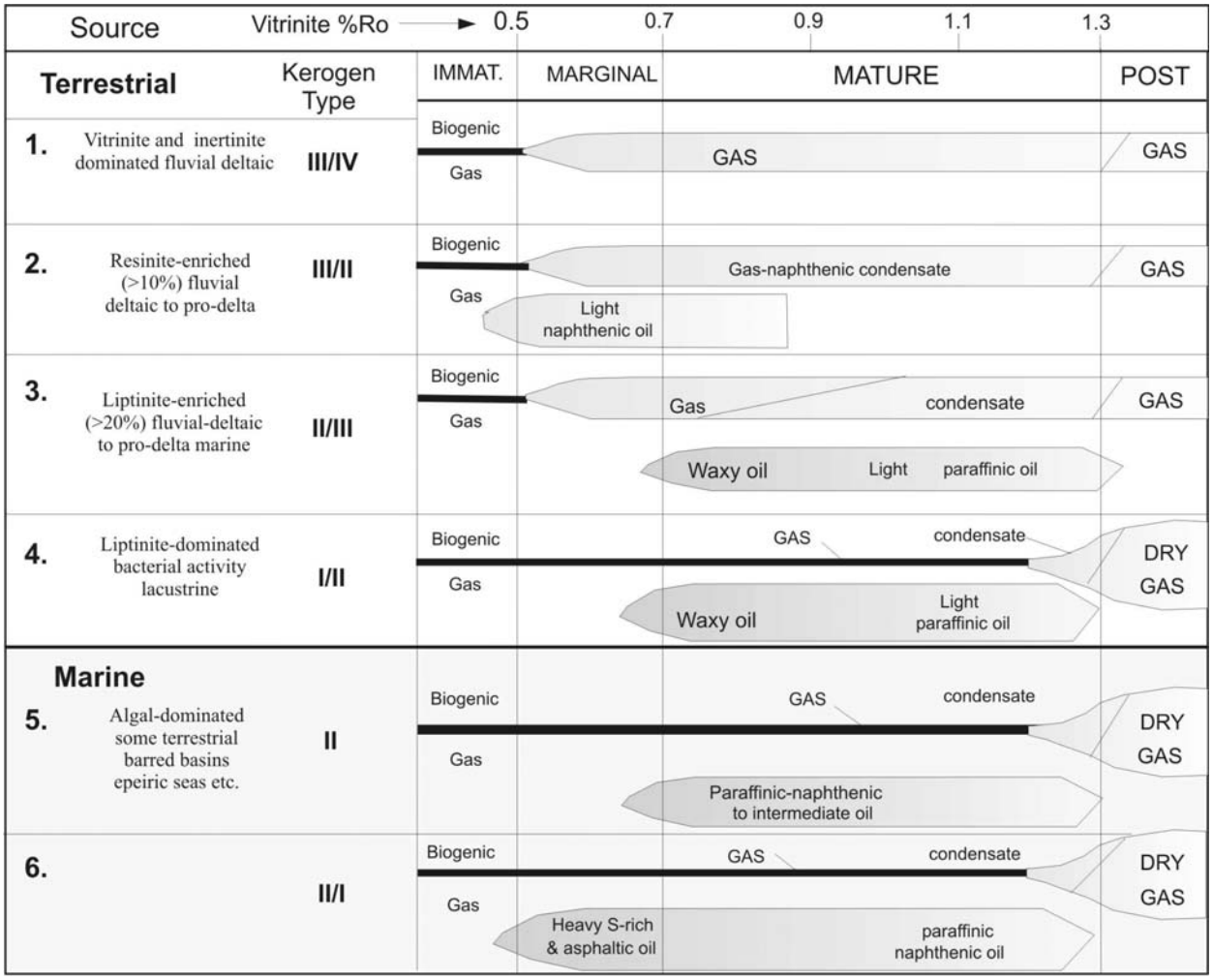
VITRINITE REFLECTANCE Lab preparation

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.

Whole rock sample preparation

Set washed drill cuttings in epoxy to form 2.5 cm (1") diameter plastic stubs to fit polisher.
Grind and polish to obtain low relief, scratch-free surface.
Examine under oil lens, incident light at approximately 1000x magnification.

Appendix II (Powell and Snowdon 1983)



Hydrocarbon generation model compiled from Powell and Snowdon (1983) illustrating the different thresholds of hydrocarbon generation and products as related to thermal maturity, kerogen type and paleodepositional environment.

Appendix III

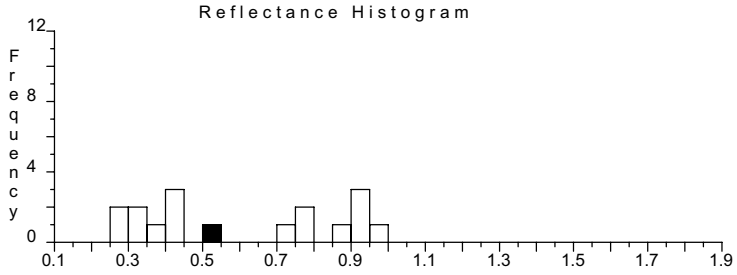
Data listings and basic statistics

Data listings and basic statistics for: Northumberland Strait F-25

K0949A

Col >	1	2	3	4	5	6	7	8	9	0
Row	0.41	0.27	0.29	0.30	0.36	0.32	0.94	(0.52)	0.40	0.94
1	0.98	0.77	0.41	0.75	0.71	0.91	0.86			

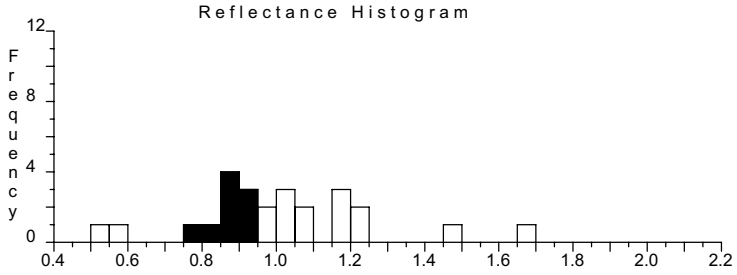
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.60	0.27	17	0.27	0.98	10.14
(Edit)	0.52	0.00	1	0.52	0.52	0.52



K0949B

Col >	1	2	3	4	5	6	7	8	9	0
Row	1.49	1.20	1.16	1.15	(0.86)	0.55	1.08	1.03	1.09	1.16
1	(0.89)	1.66	(0.92)	(0.89)	0.96	(0.91)	(0.75)	0.95	1.03	(0.82)
2	0.51	(0.92)	1.04	1.20	(0.88)					

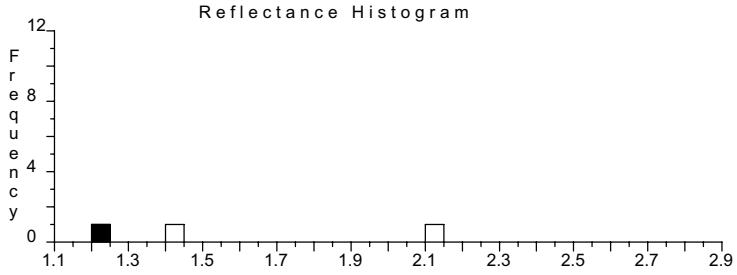
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	1.00	0.25	25	0.51	1.66	25.10
(Edit)	0.87	0.06	9	0.75	0.92	7.84



K0949C

Col >	1	2	
Row	2.11	1.42	(1.23)

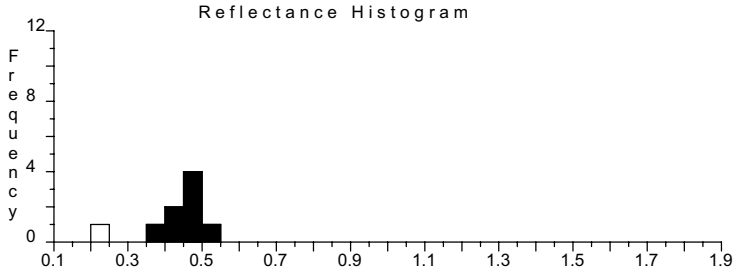
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	1.59	0.46	3	1.23	2.11	4.76
(Edit)	1.23	0.00	1	1.23	1.23	1.23



K0949D

Col >	1	2	3	4	5	6	7	8	
Row	(0.47)	(0.47)	(0.35)	(0.49)	(0.40)	(0.45)	(0.53)	(0.40)	0.20

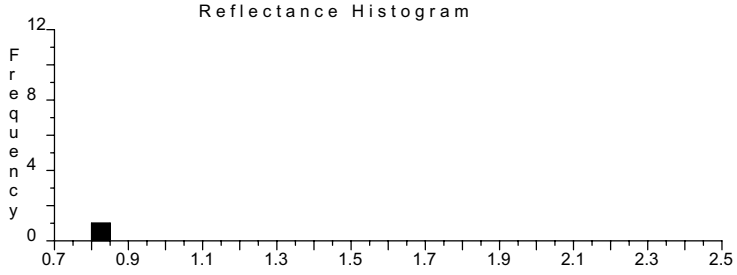
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.42	0.10	9	0.20	0.53	3.76
(Edit)	0.44	0.06	8	0.35	0.53	3.56



K0950A

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.82)									

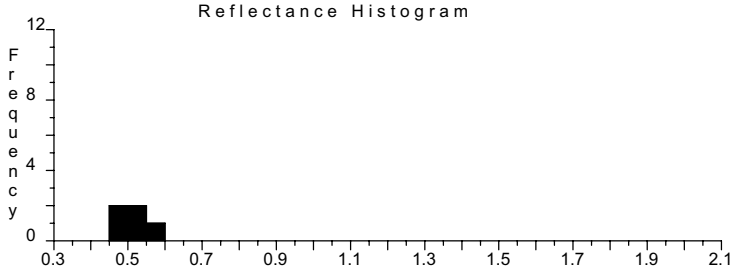
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.82	0.00	1	0.82	0.82	0.82
(Edit)	0.82	0.00	1	0.82	0.82	0.82



K0950B

Col >	1	2	3	4	
Row	(0.53)	(0.52)	(0.59)	(0.46)	(0.49)

	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.52	0.05	5	0.46	0.59	2.59
(Edit)	0.52	0.05	5	0.46	0.59	2.59



Data listings and basic statistics for: Northumberland Strait F-25

K0950C

Col > 1
Row 0.23 (0.76)

	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.50	0.37	2	0.23	0.76	0.99
(Edit)	0.76	0.00	1	0.76	0.76	0.76