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Vitrinite reflectance data
for
Aquitaine et al Hekja O-71

M. P. Avery

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Aquitaine et al Hekja O-71

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Figure 1 - Hekja O-71

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Appendix I - Sample Preparation Method

Appendix II - Zones of petroleum generation and destruction

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Well information

G.S.C. Locality No.: D208 **Unique Well ID:** 300 O71 62200 62450 **Location:** 62.18105°N, 62.97966°W

R.T. Elevation: 12.5 **Water Depth:** 350.8 **Total Depth:** 4566

Sampled Interval: 740 - 4566 **Interval Studied:** 750-4360

Depth Units: Meters referenced to R.T. **Rig Release Date:** October 13, 1980

Introduction

Vitrinite reflectance has been determined on 24 rotary cutting samples from Aquitaine *et al* Hekja O-71, which was classified as an exploratory well with gas and condensate discovery and is located on the Southeast Baffin Shelf in the northern Labrador Sea. 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 Snowdon and Powell (1984) with modified terminology (Appendix II).

Table I
Inferred Hydrocarbon Thermal Maturity Levels

Depth in meters	Vitrinite Reflectance* %Ro	Hydrocarbon generation levels** for type II or III kerogen	Maturity slope used to calc. depths
351[sea floor]	(0.25)	immature	upper
1900	0.3	immature	mid
2560	0.4	immature approaching maturity	mid
3070	0.5	marginally mature	mid
3490	0.6	onset of significant oil generation	mid
4566 [T.D.]	(0.73)	close to peak oil generation	lower

**()'s indicate Ro's or depths extrapolated from linear regression
slopes: upper: 0.020, mid: 0.190, and lower: 0.050 log Ro/km*

*** Actual hydrocarbon products depend on type of organic matter present (Snowdon and Powell, 1984).*

Remarks

Sample coverage for vitrinite reflectance analysis (Figure 1, Table II) was very complete over the section penetrated below 750 m at Hekja O-71. The data were plotted on a log Ro vs. linear depth scale. An initial plot of the data indicated that the maturity profile would be best represented by three distinct slopes. Regression lines for these slopes were calculated and plotted (Figure 1). The slopes of the maturity lines are 0.020, 0.190, and 0.050 log Ro/km.

Since there is a great variation in the number of readings for any given sample point (Table II, Figure 1) regression lines with weighting based on the n value for each point were fitted through the data. The relative size of the point symbol provides a graphical 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 deceptively small for samples with very few readings.

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 maturity of the lower section of Hekja O-71 is suitable to generate and preserve liquid hydrocarbons within the drilled section, between 3070 and 4566 m (T.D.), provided potential source rocks of the proper organic matter type and traps are present.

Discussion

The maturity profile based on the data presented in this report is consistent with insitu generation of gas and condensate as detected during a drill stem test (DST#01, 3212-3251 m, Figure 1) in this well that flowed gas and condensates from the Gudrid tongue of the Cartwright formation.

Most of the vitrinite reflectance data obtained for this report were measured on polished whole rock mounts which preserve, for the most part, the association of the organic matter with the mineral matrix. Two of the data points were measured on kerogen isolate mounts. Kerogen mounts use a concentration of organic matter with most of the mineral matrix removed. This provides the petrographer with a polished surface with a concentration of the organic matter obtained from the sample. A discussion of the merits of both methods is beyond the scope of this report although it is interesting to note that in this case, measurements taken on samples prepared by the different methods are quite comparable (Table II, Figure 1).

References

Powell, T. G. and Snowdon, L. R.

1983. A composite hydrocarbon generation model. Erdöl und Kohle, Erdgas, Petrochemie, v. 36, p. 163-170.

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MResG Files, Dartmouth C. Beaumont, Dalhousie Univ., Halifax

Table II

Summary of whole rock and kerogen - based vitrinite reflectance

Sample* Labels	Depth in meters	Mean Ro (SD) non-rotated	Number of Readings	
			Total	Edited
C782-03	750-760	0.22 (± 0.00)	17	1
C783-03	940-950	0.26 (± 0.04)	14	14
C784-03	1000-1010	0.25 (± 0.02)	8	5
C785-03	1350-1360	0.23 (± 0.02)	8	3
C786-03	1510-1520	0.29 (± 0.01)	3	2
C787-03	1650-1660	0.25 (± 0.02)	12	6
C788-03	1840-1850	0.28 (± 0.02)	8	3
C789-03	2050-2060	0.31 (± 0.04)	9	9
C793-03	2170-2180	0.39 (± 0.06)	17	17
C798-03	2290-2300	0.33 (± 0.04)	14	14
C799-03	2510-2520	0.41 (± 0.02)	12	12
C801-03	2630-2640	0.44 (± 0.03)	15	14
C802-03	2850-2860	0.36 (± 0.02)	11	11
C806-03	2950-2960	0.44 (± 0.05)	17	17
C808-03	3050-3060	0.50 (± 0.06)	17	17
K0171C	3120-3130	0.55 (± 0.03)	21	21
C959-03	3180-3190	0.56 (± 0.03)	18	18
C961-03	3450-3460	0.58 (± 0.06)	16	16
K0172C	3610-3620	0.67 (± 0.06)	23	23
C962-03	3630-3640	0.64 (± 0.03)	15	15
C963-03	3810-3820	0.65 (± 0.06)	12	12
C964-03	3950-3960	0.67 (± 0.06)	18	18
C965-03	4130-4140	0.67 (± 0.03)	16	12
C966-03	4350-4360	0.73 (± 0.05)	14	14

*Samples starting with the letter C are whole rock stubs prepared at GSC - Calgary and those starting with the letter K are kerogen stubs prepared at GSC - Atlantic

Table III

Formation Tops (Moir, pers. comm.)

Formation	Depth in meters
Saglek	363
Mokami	1730
Leif Mb	2175
Kenamu	2175
Cartwright	3104
Gudrid Tongue	3212-3364
(unnamed Basalts)	3545
Total Depth	4566

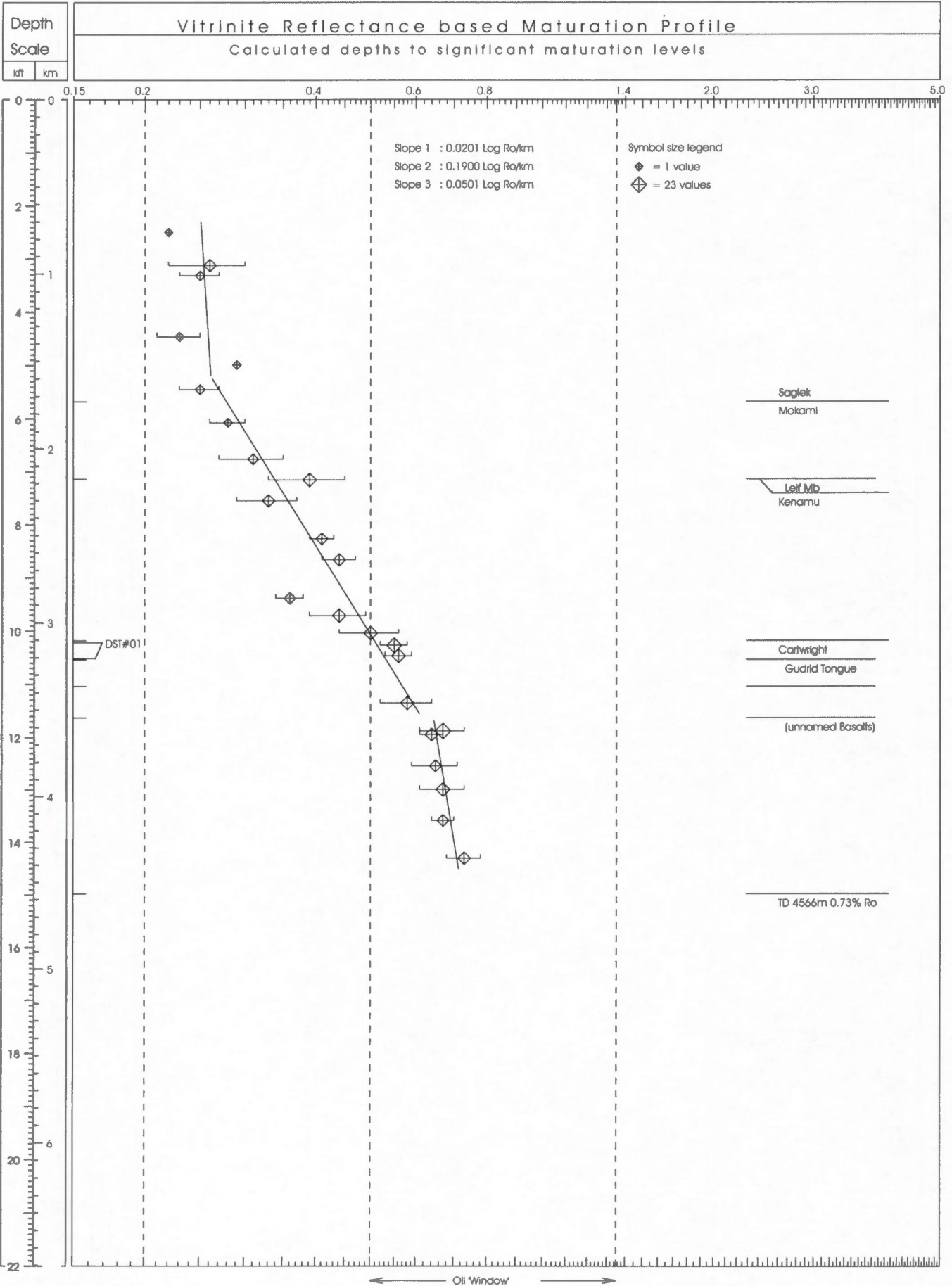


Fig. 1 Hekja O-71

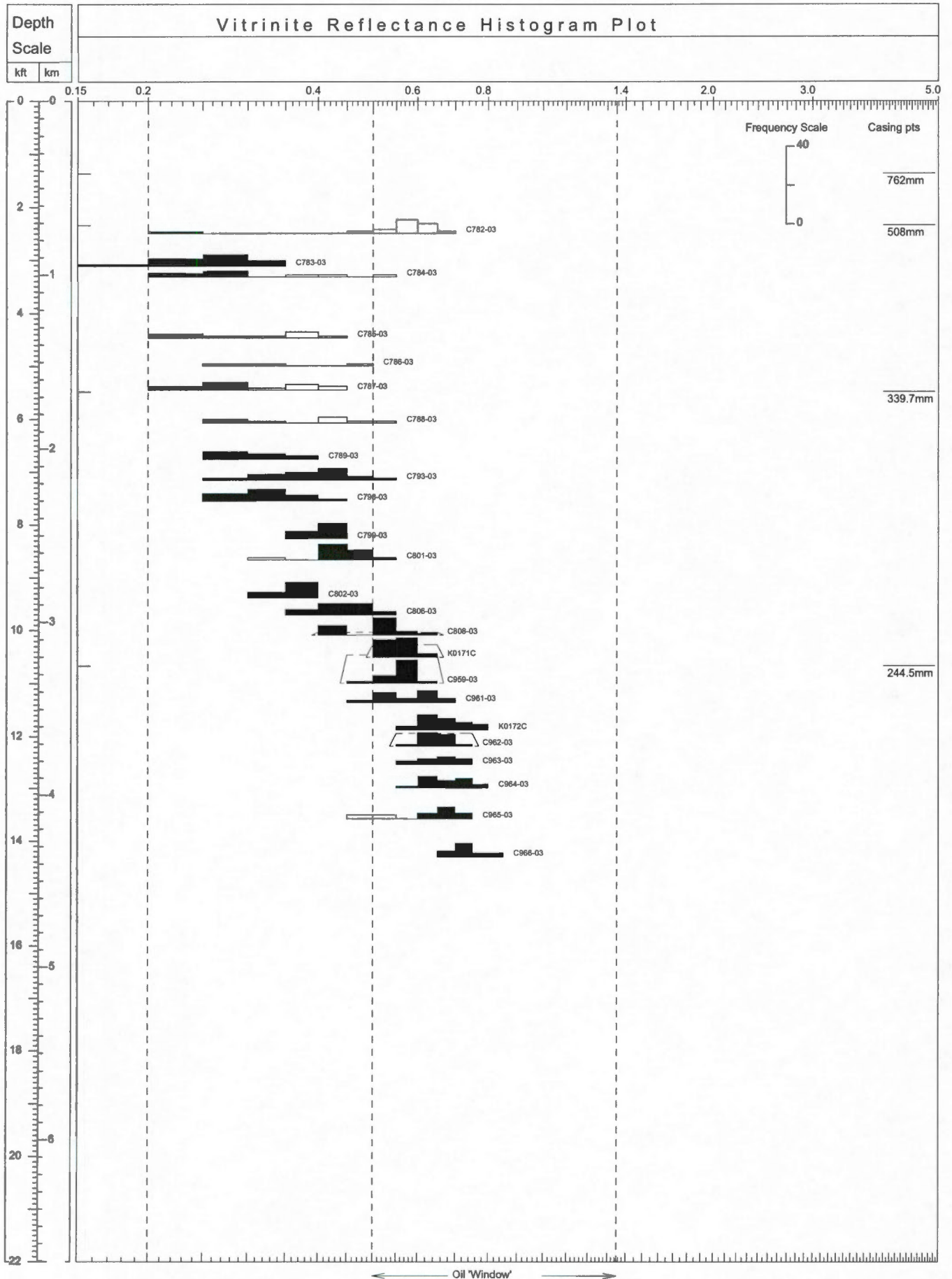


Fig. 2 Hekja O-71 <Histograms>

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.

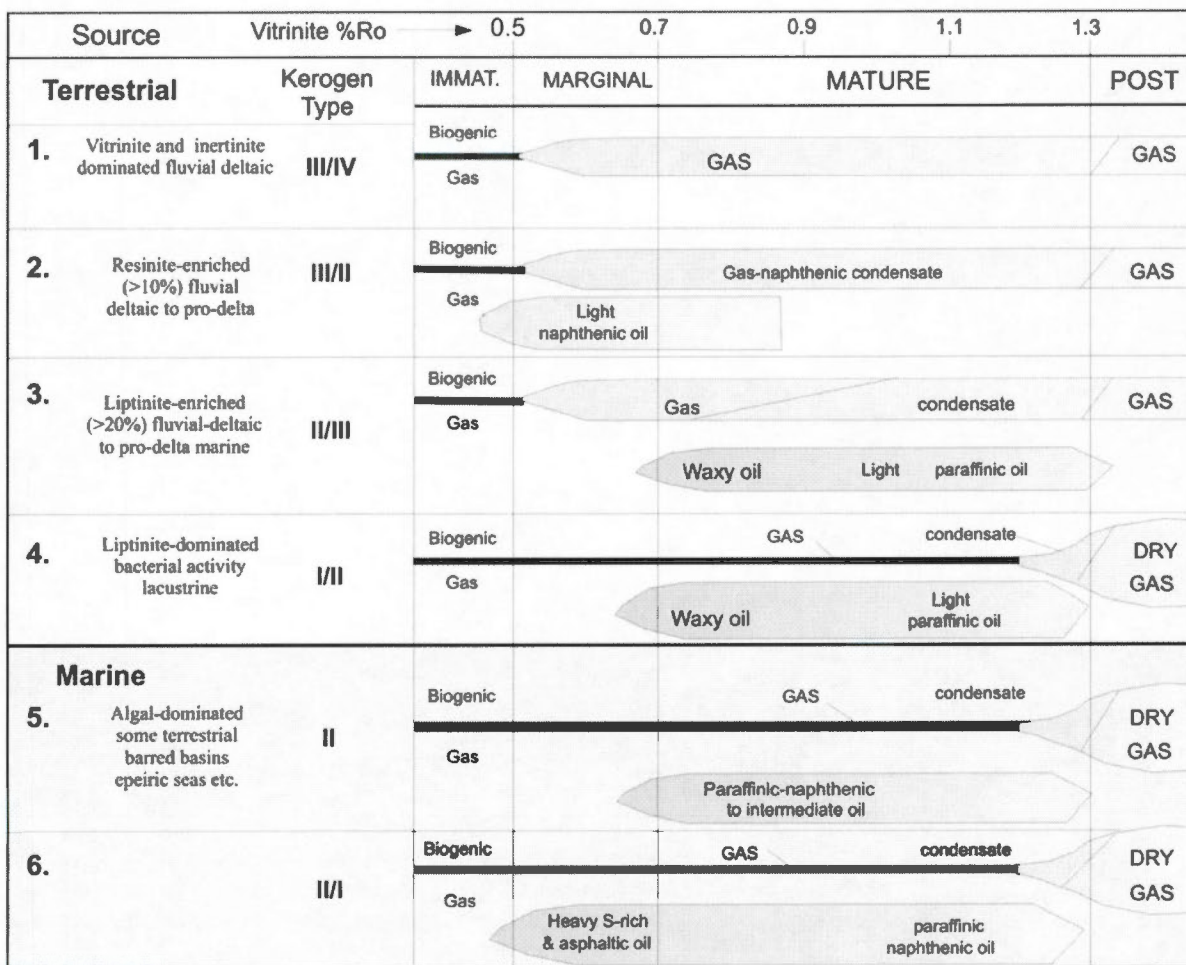
Whole rock sample preparation

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 (Snowdon and Powell 1984)



Hydrocarbon generation model compiled from Snowdon and Powell (1984) illustrating the different thresholds of hydrocarbon generation and products as related to thermal maturity, kerogen type and paleodepositional environment.

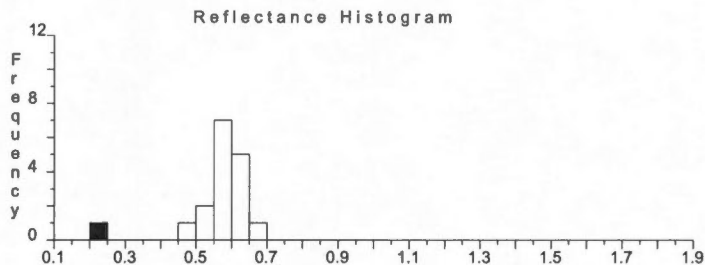
Appendix III

Data listings and basic statistics

Data listings and basic statistics for: Hekja O-71

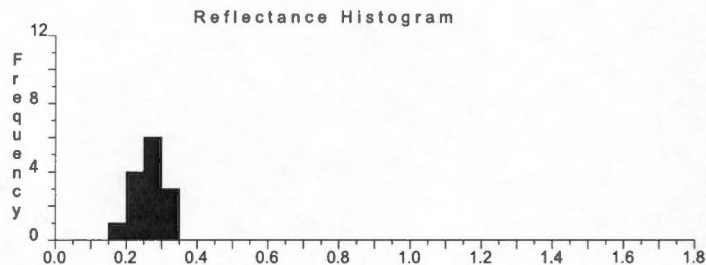
C782-03, 750-760m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	0.65	0.59	(0.22)	0.61	0.64	0.59	0.56	0.58	0.47	0.54
	0.58	0.60	0.58	0.63	0.59	0.50	0.62			
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.22	0.00	1	0.22	0.22	0.22				



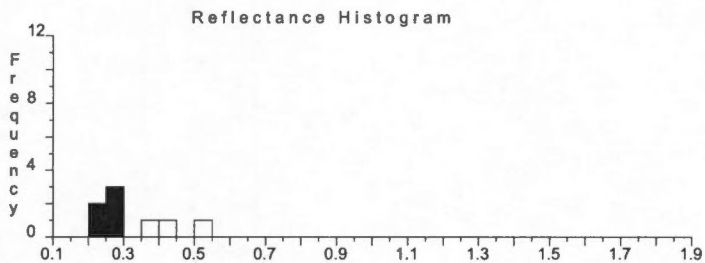
C783-03, 940-950m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.20)	(0.26)	(0.28)	(0.28)	(0.26)	(0.30)	(0.22)	(0.19)	(0.30)	(0.27)
	(0.29)	(0.23)	(0.30)	(0.23)						
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.26	0.04	14	0.19	0.30	3.61				



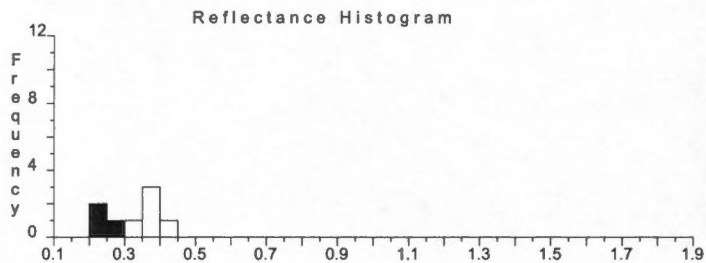
C784-03, 1000-1010m

Col >	1	2	3	4	5	6	7	8
Row	(0.25)	(0.27)	0.35	(0.26)	(0.22)	(0.23)	0.50	0.41
Total	Mean	Stand Dev	Pts	Min	Max	Sum		
(Edit)	0.31	0.10	8	0.22	0.50	2.49		
	0.25	0.02	5	0.22	0.27	1.23		



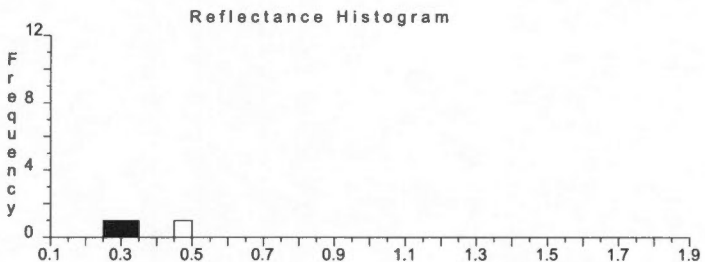
C785-03, 1350-1360m

Col >	1	2	3	4	5	6	7	8
Row	(0.23)	(0.22)	0.33	0.40	0.38	0.35	0.36	(0.25)
Total	Mean	Stand Dev	Pts	Min	Max	Sum		
(Edit)	0.32	0.07	8	0.22	0.40	2.52		
	0.23	0.02	3	0.22	0.25	0.70		



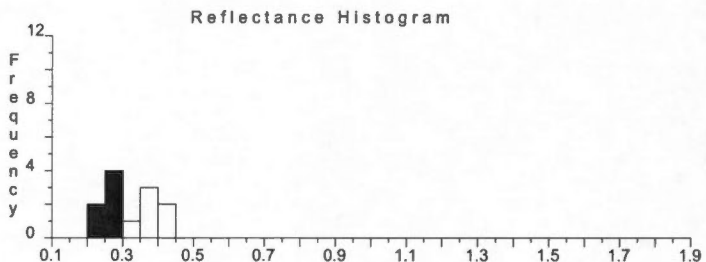
C786-03, 1510-1520m

Col >	1	2	3			
Row	0.45	(0.28)	(0.30)			
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.34	0.09	3	0.28	0.45	1.03
	0.29	0.01	2	0.28	0.30	0.58



C787-03, 1650-1660m

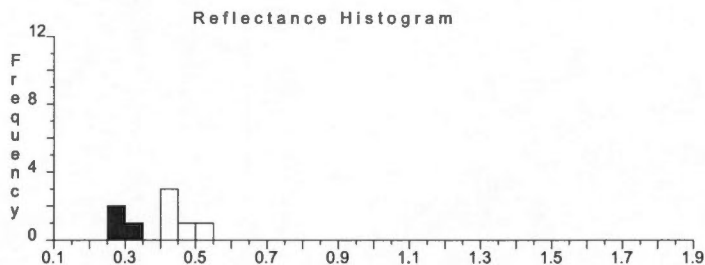
Col >	1	2	3	4	5	6	7	8	9	0
Row 1	0.36	0.33	0.39	0.40	(0.27)	0.38	0.40	(0.22)	(0.26)	(0.25)
	(0.27)	(0.24)								
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.31	0.07	12	0.22	0.40	3.77				
	0.25	0.02	6	0.22	0.27	1.51				



Data listings and basic statistics for: Hekja O-71

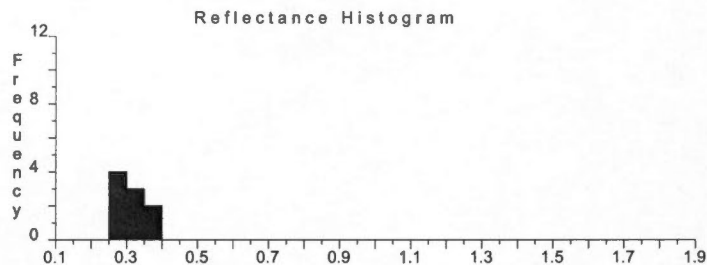
C788-03, 1840-1850m

Col >	1	2	3	4	5	6	7	8
Row	(0.30)	0.47	0.42	0.51	(0.28)	0.40	(0.26)	0.41
Total	Mean	Stand Dev	Pts	Min	Max	Sum		
(Edit)	0.38	0.09	8	0.26	0.51	3.05		
	0.28	0.02	3	0.26	0.30	0.84		



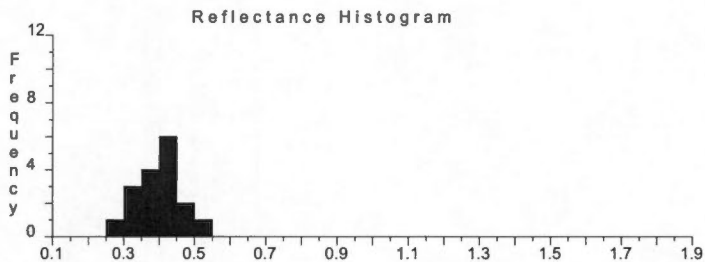
C789-03, 2050-2060m

Col >	1	2	3	4	5	6	7	8	9
Row	(0.30)	(0.28)	(0.37)	(0.27)	(0.38)	(0.27)	(0.30)	(0.30)	(0.28)
Total	Mean	Stand Dev	Pts	Min	Max	Sum			
(Edit)	0.31	0.04	9	0.27	0.38	2.75			
	0.31	0.04	9	0.27	0.38	2.75			



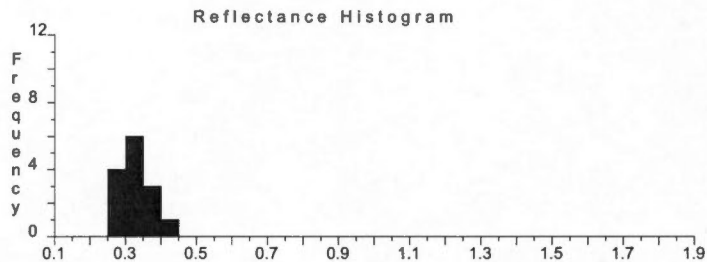
C793-03, 2170-2180m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.33)	(0.39)	(0.27)	(0.39)	(0.40)	(0.32)	(0.38)	(0.45)	(0.41)	(0.44)
1	(0.50)	(0.44)	(0.41)	(0.42)	(0.45)	(0.31)	(0.35)			
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.39	0.06	17	0.27	0.50	6.66				
	0.39	0.06	17	0.27	0.50	6.66				



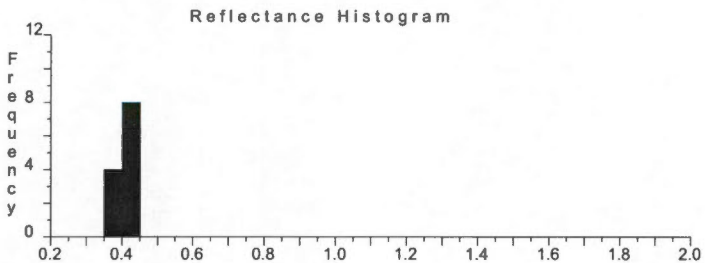
C798-03, 2290-2300m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.31)	(0.34)	(0.26)	(0.34)	(0.28)	(0.29)	(0.33)	(0.41)	(0.28)	(0.34)
1	(0.37)	(0.38)	(0.33)	(0.36)						
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.33	0.04	14	0.26	0.41	4.62				
	0.33	0.04	14	0.26	0.41	4.62				



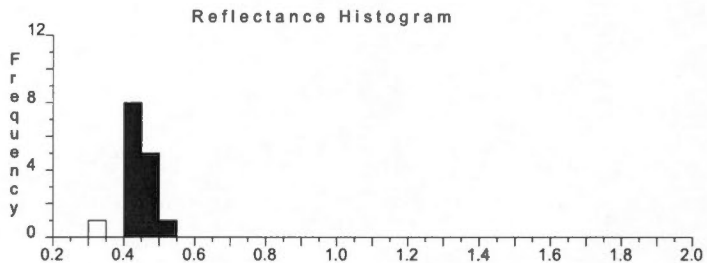
C799-03, 2510-2520m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.44)	(0.43)	(0.43)	(0.44)	(0.43)	(0.40)	(0.42)	(0.39)	(0.37)	(0.42)
1	(0.39)	(0.39)								
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.41	0.02	12	0.37	0.44	4.95				
	0.41	0.02	12	0.37	0.44	4.95				



C801-03, 2630-2640m

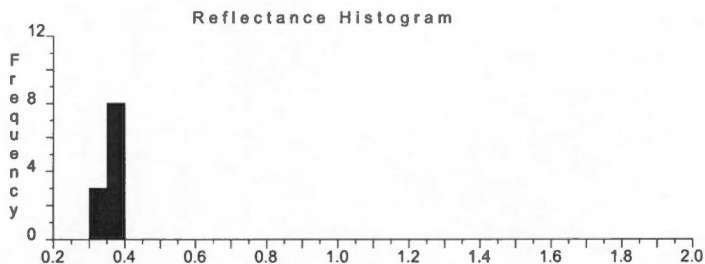
Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.47)	(0.46)	(0.44)	(0.41)	0.31	(0.40)	(0.41)	(0.40)	(0.46)	(0.40)
1	(0.43)	(0.46)	(0.46)	(0.52)	(0.43)					
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.43	0.05	15	0.31	0.52	6.46				
	0.44	0.03	14	0.40	0.52	6.15				



Data listings and basic statistics for: Hekja O-71

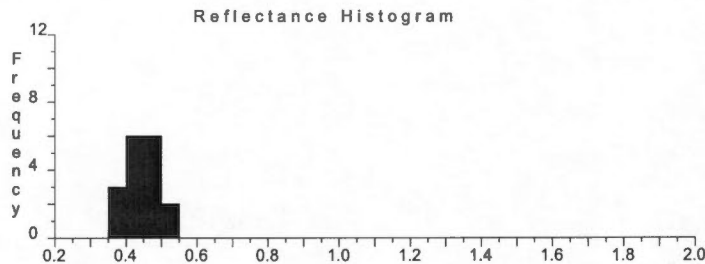
C802-03, 2850-2860m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.35)	(0.37)	(0.39)	(0.35)	(0.34)	(0.38)	(0.34)	(0.36)	(0.37)	(0.34)
Total	Mean 0.36	Stand Dev 0.02	Pts 11	Min 0.34	Max 0.39	Sum 3.96				
(Edit)	0.36	0.02	11	0.34	0.39	3.96				



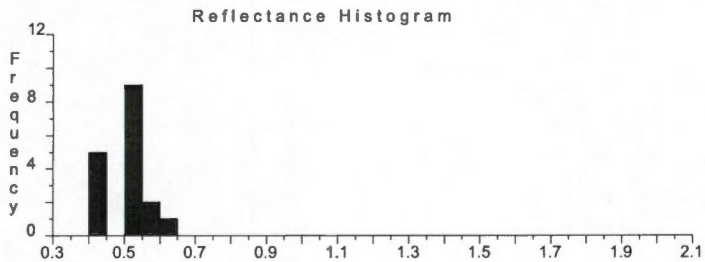
C806-03, 2950-2960m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.40)	(0.47)	(0.37)	(0.35)	(0.42)	(0.45)	(0.42)	(0.45)	(0.43)	(0.47)
Total	Mean 0.44	Stand Dev 0.05	Pts 17	Min 0.35	Max 0.54	Sum 7.45				
(Edit)	0.44	0.05	17	0.35	0.54	7.45				



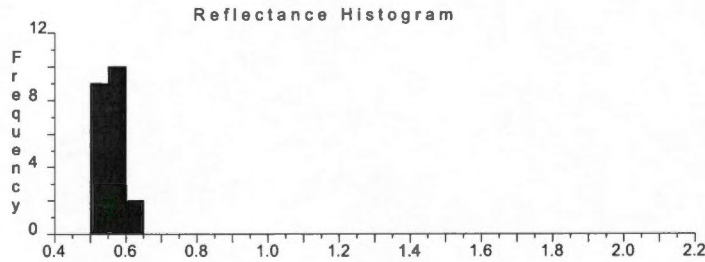
C808-03, 3050-3060m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.57)	(0.54)	(0.54)	(0.41)	(0.55)	(0.44)	(0.54)	(0.40)	(0.63)	(0.51)
Total	Mean 0.50	Stand Dev 0.06	Pts 17	Min 0.40	Max 0.63	Sum 8.55				
(Edit)	0.50	0.06	17	0.40	0.63	8.55				



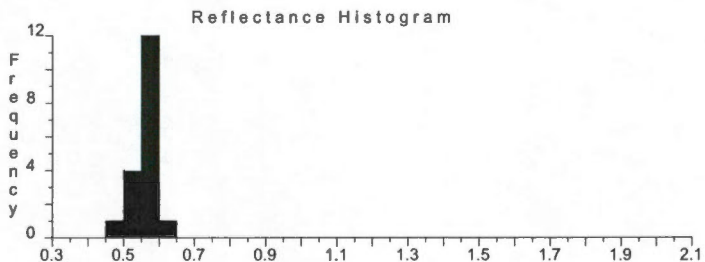
K0171C, 3120-3130m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.54)	(0.56)	(0.58)	(0.56)	(0.55)	(0.51)	(0.60)	(0.50)	(0.53)	(0.54)
Row 2	(0.58)	(0.52)	(0.51)	(0.56)	(0.61)	(0.55)	(0.53)	(0.54)	(0.59)	(0.58)
Total	Mean 0.55	Stand Dev 0.03	Pts 21	Min 0.50	Max 0.61	Sum 11.62				
(Edit)	0.55	0.03	21	0.50	0.61	11.62				



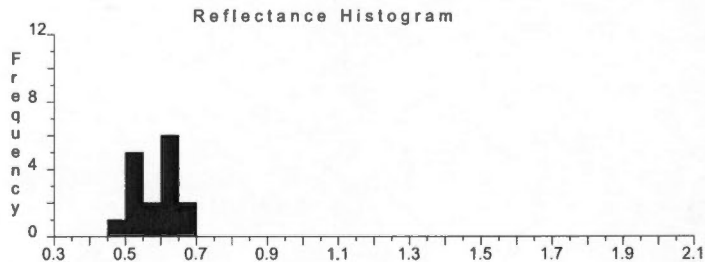
C959-03, 3180-3190m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.55)	(0.55)	(0.56)	(0.58)	(0.58)	(0.59)	(0.49)	(0.55)	(0.55)	(0.61)
Row 2	(0.58)	(0.54)	(0.51)	(0.54)	(0.56)	(0.52)	(0.57)	(0.57)		
Total	Mean 0.56	Stand Dev 0.03	Pts 18	Min 0.49	Max 0.61	Sum 10.00				
(Edit)	0.56	0.03	18	0.49	0.61	10.00				



C961-03, 3450-3460m

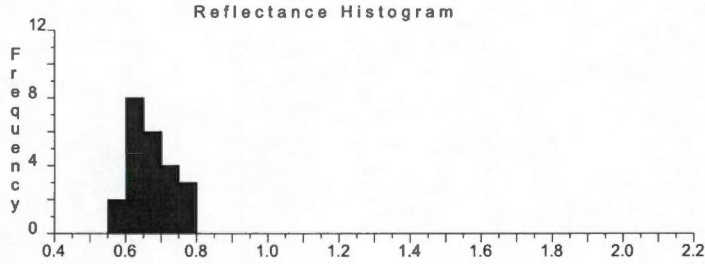
Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.52)	(0.62)	(0.63)	(0.59)	(0.67)	(0.48)	(0.56)	(0.62)	(0.54)	(0.63)
Row 2	(0.61)	(0.51)	(0.54)	(0.67)	(0.61)	(0.54)				
Total	Mean 0.58	Stand Dev 0.06	Pts 16	Min 0.48	Max 0.67	Sum 9.34				
(Edit)	0.58	0.06	16	0.48	0.67	9.34				



Data listings and basic statistics for: Hekja O-71

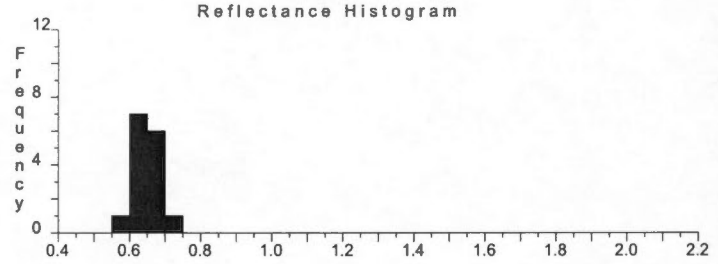
K0172C, 3610-3620m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.67)	(0.65)	(0.62)	(0.62)	(0.59)	(0.64)	(0.62)	(0.71)	(0.73)	(0.67)
1	(0.67)	(0.64)	(0.60)	(0.55)	(0.75)	(0.68)	(0.76)	(0.77)	(0.72)	(0.69)
2	(0.63)	(0.61)	(0.73)							
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.67	0.06	23	0.55	0.77	15.32				
(Edit)	0.67	0.06	23	0.55	0.77	15.32				



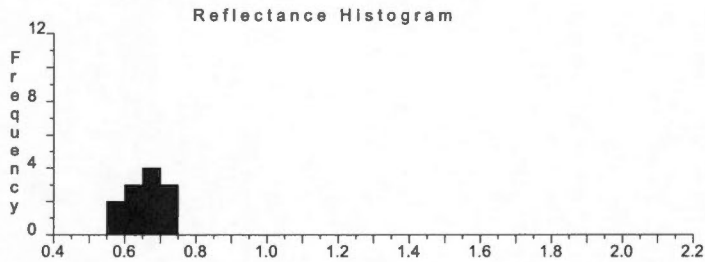
C962-03, 3630-3640m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.61)	(0.61)	(0.70)	(0.66)	(0.67)	(0.66)	(0.57)	(0.64)	(0.64)	(0.65)
1	(0.65)	(0.61)	(0.63)	(0.61)	(0.69)					
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.64	0.03	15	0.57	0.70	9.60				
(Edit)	0.64	0.03	15	0.57	0.70	9.60				



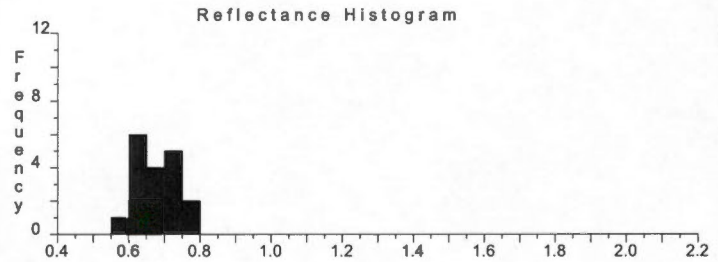
C963-03, 3810-3820m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.63)	(0.71)	(0.67)	(0.55)	(0.57)	(0.65)	(0.61)	(0.66)	(0.73)	(0.60)
1	(0.68)	(0.70)								
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.65	0.06	12	0.55	0.73	7.76				
(Edit)	0.65	0.06	12	0.55	0.73	7.76				



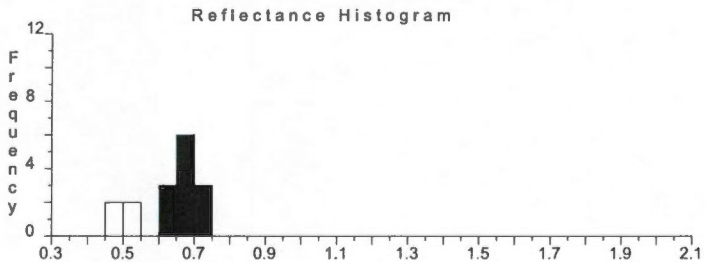
C964-03, 3950-3960m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.68)	(0.72)	(0.60)	(0.62)	(0.55)	(0.66)	(0.60)	(0.66)	(0.68)	(0.74)
1	(0.73)	(0.64)	(0.64)	(0.78)	(0.74)	(0.76)	(0.70)	(0.61)		
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.67	0.06	18	0.55	0.78	12.11				
(Edit)	0.67	0.06	18	0.55	0.78	12.11				



C965-03, 4130-4140m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.61)	(0.63)	(0.67)	0.51	0.48	(0.67)	0.53	(0.72)	(0.63)	(0.68)
1	(0.65)	0.49	(0.68)	(0.71)	(0.71)	(0.65)				
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.63	0.08	16	0.48	0.72	10.02				
(Edit)	0.67	0.03	12	0.61	0.72	8.01				



C966-03, 4350-4360m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.65)	(0.72)	(0.73)	(0.70)	(0.75)	(0.71)	(0.81)	(0.73)	(0.68)	(0.69)
1	(0.71)	(0.76)	(0.70)	(0.82)						
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.73	0.05	14	0.65	0.82	10.16				
(Edit)	0.73	0.05	14	0.65	0.82	10.16				

