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Vitrinite reflectance data
for
ESSO-H.B. Gjoa G-37

M. P. Avery

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GEOLOGICAL SURVEY OF CANADA

OPEN FILE 4843

**Vitrinite reflectance data
for
ESSO-H.B. Gjoa G-37**

**M. P. Avery
Marine Resources Geoscience Subdivision
Geological Survey of Canada (Atlantic), Dartmouth**

2005

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Avery, M.P.

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Well information

G.S.C. Locality No.: D209 Unique Well ID: 300 G37 63000 59000 Location: 62.9411°N, 59.10853°W

R.T. Elevation: 24 Water Depth: 1000 Total Depth: 3998

Sampled Interval: 1450 - 3998 Interval Studied: 1460-3900

Depth Units: Meters referenced to R.T. Rig Release Date: September 27, 1979

Introduction

Vitrinite reflectance has been determined on 19 rotary cutting samples from ESSO-H.B. Gjoa G-37, which was classified as an exploratory well 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 levels 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
1000[sea floor]	(0.07)	immature	upper
1620	0.3	immature	mid
2270	0.4	immature approaching maturity	mid
2710	0.5	marginally mature	mid
3520	0.6	onset of significant oil generation	lower
3998 [T.D.]	(0.64)	onset of significant oil generation	lower

**()'s indicate Ro's or depths extrapolated from linear regression
slopes: upper: 1.014, mid: 0.222, and lower: 0.052 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 reasonably complete over the section penetrated below 1460 m at Gjoa G-37. 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 1.014, 0.222, and 0.052 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 Gjoa G-37 is suitable to generate and preserve hydrocarbons within the drilled section, between 2710 and 3998 m (T.D.), provided potential source rocks of the proper organic matter type and traps are present.

Methodology

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).

Discussion

A plot of the nearby well Hekja O-71 has been included for comparison (Figure 3; Avery 2005). The lower maturity slopes in both wells are quite similar. The middle slope section appears to be compressed in the Gjoa well. In Gjoa the middle slope crosses into the 'oil window' at about 2710 m and in Hekja it crosses at 3070 m. This 'compression' may be because Gjoa has a 1700 m sediment column above the unnamed Basalts while Hekja has a 3200 m sediment column above the Basalts. The inflection point between the mid and lower slopes in both wells seems to coincide with the top of the these Basalts. The difference in the upper slopes is not readily explainable. The inflection between the upper and mid slopes is at approximately the same level as the top of the Mokami Fm. But in Gjoa this top is much closer to the sediment surface, as Gjoa has a water depth of 1000 m versus 350 m in Hekja.

References

Avery, M.P.

2005: Vitrinite reflectance data for Acquitaine et al Hekja O-71; Geological Survey of Canada, Open File 4842, 15p.

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
C024-04	1460-1470	0.21 (± 0.03)	18	17
C025-04	1520-1530	0.25 (± 0.04)	19	19
C026-04	1540-1550	0.26 (± 0.05)	13	13
C027-04	1600-1610	0.29 (± 0.04)	14	12
C028-04	1640-1650	0.29 (± 0.03)	8	8
C029-04	1660-1670	0.29 (± 0.04)	16	16
C030-04	1820-1830	0.31 (± 0.04)	13	13
C031-04	1960-1970	0.30 (± 0.03)	9	7
C032-04	1980-1990	0.38 (± 0.04)	15	15
C033-04	2120-2130	0.35 (± 0.04)	3	3
C034-04	2380-2390	0.44 (± 0.04)	11	11
C035-04	2480-2490	0.40 (± 0.03)	4	2
C036-04	2670-2680	0.46 (± 0.04)	2	2
C037-04	2700-2710	0.50 (± 0.04)	10	8
K0170A	3210-3220	0.60 (± 0.04)	15	15
C038-04	3420-3430	0.58 (± 0.05)	9	8
C039-04	3550-3560	0.55 (± 0.03)	10	10
C040-04	3810-3820	0.66 (± 0.01)	10	7
C041-04	3890-3900	0.64 (± 0.03)	9	8

*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 ?	1026
Mokami	1455
Kenamu	1646
Leif Mb	1650-1728
Cartwright	2013
(unnamed Basalts)	2701
Markland	3794
Total Depth	3998

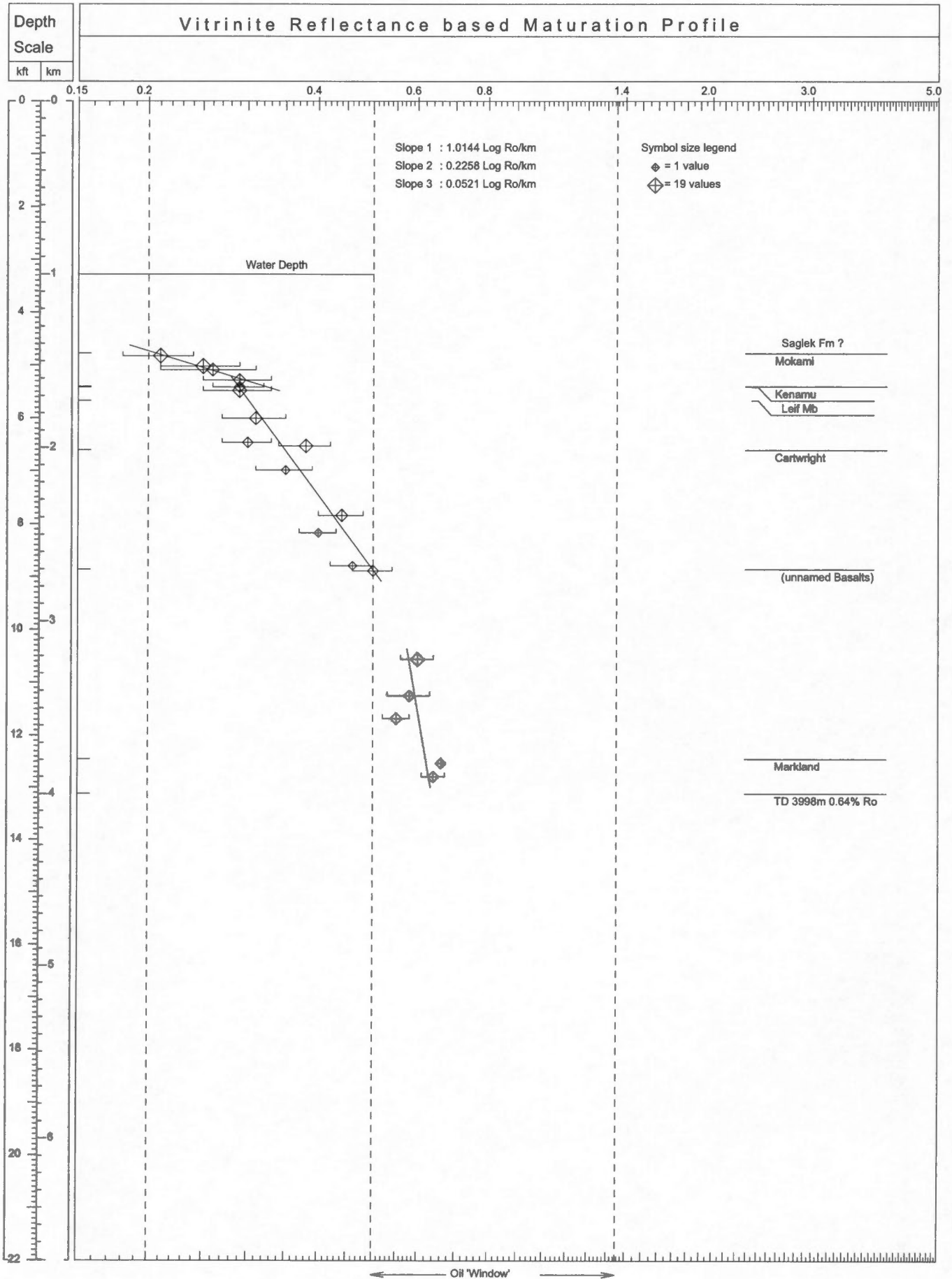


Figure 1. VR/depth plot for Gjoa G-37

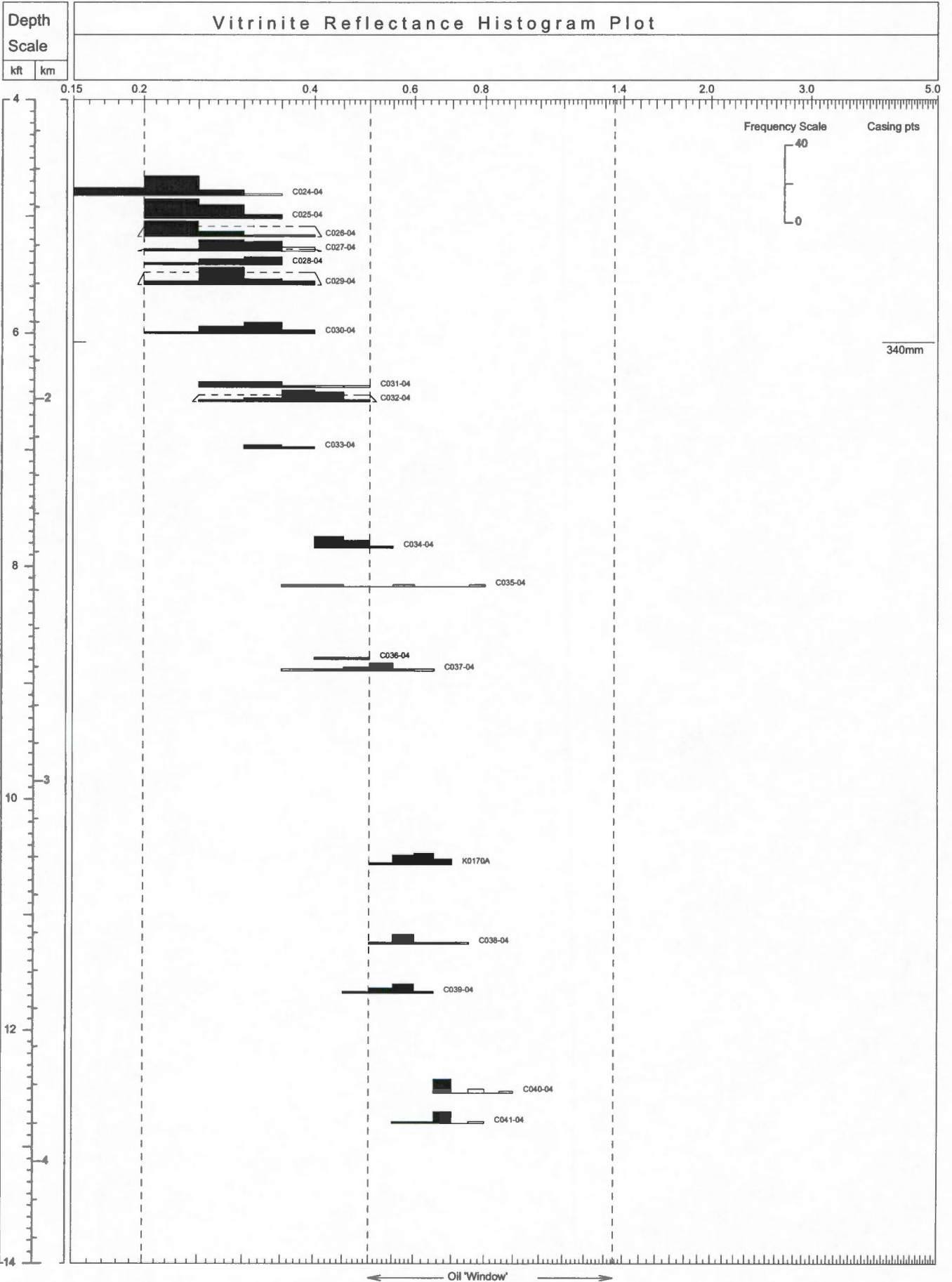


Figure 2. VR Histograms/depth plot for Gjoa G-37

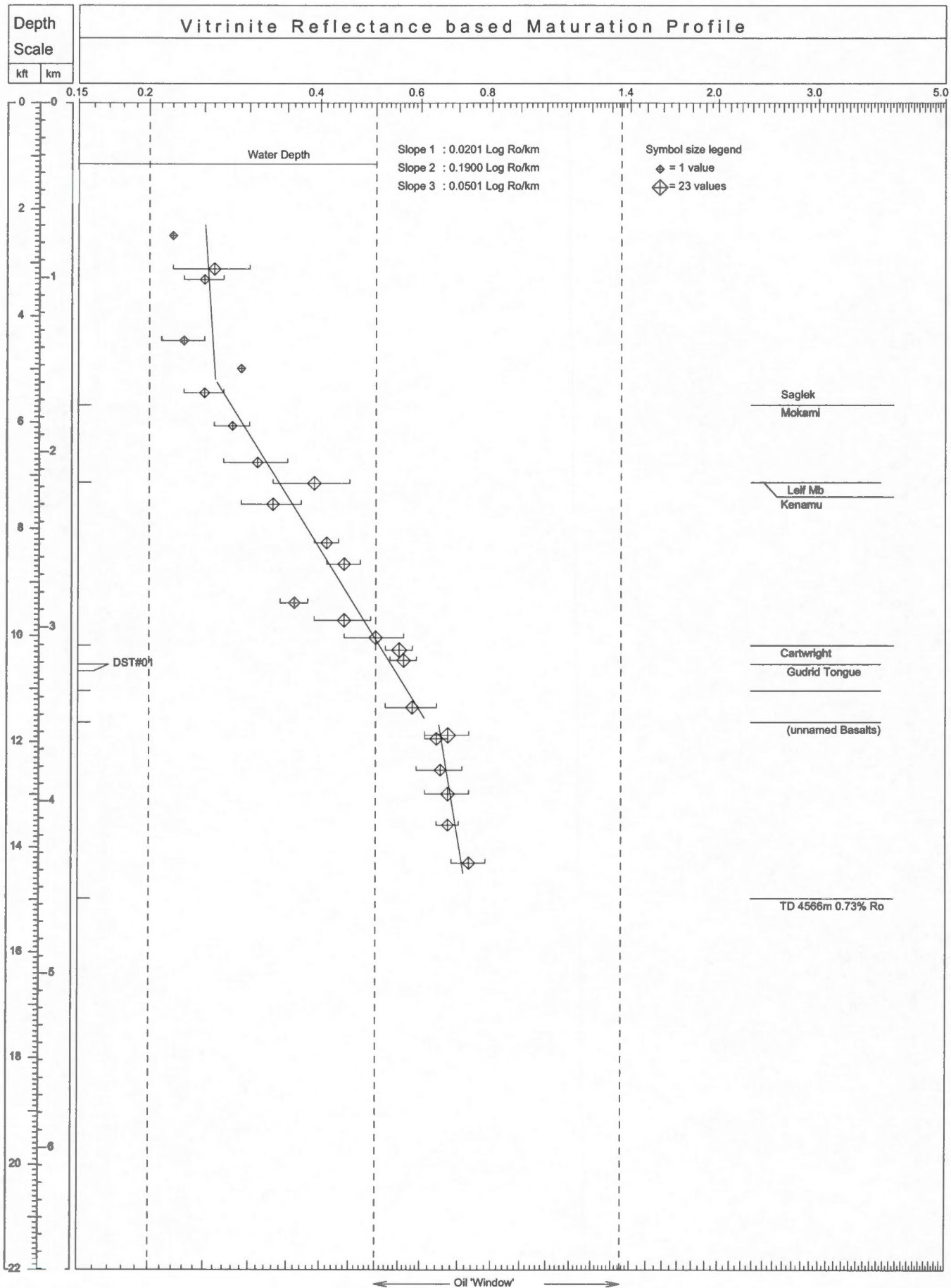


Figure 3. VR/depth plot for Hekja O-71 (for comparison)

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.

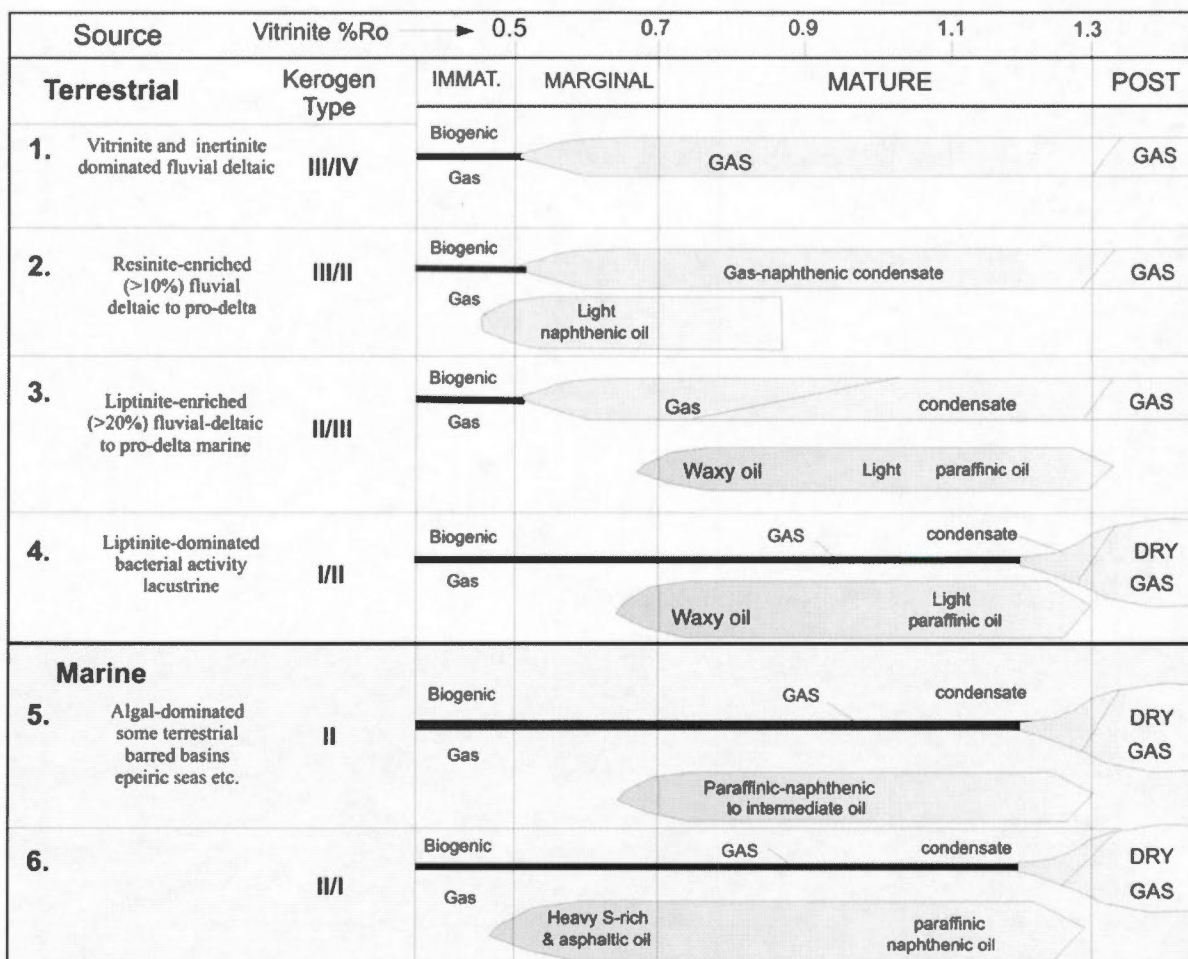
Whole rock sample preparation

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.

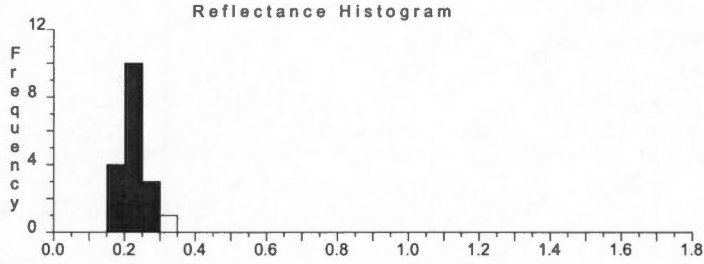
Appendix III

Data listings and basic statistics

Data listings and basic statistics for: Gjoa G-37

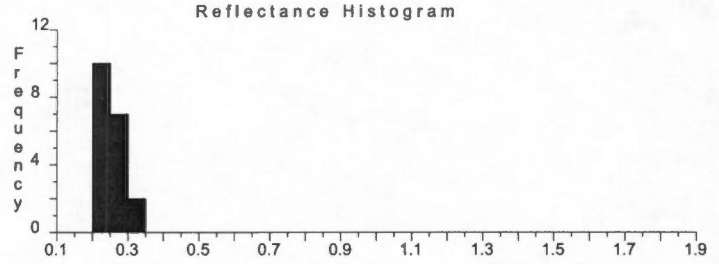
C024-04, 1460-1470m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.21)	(0.20)	(0.24)	(0.23)	0.31	(0.26)	(0.25)	(0.20)	(0.19)	(0.20)
	(0.19)	(0.24)	(0.22)	(0.27)	(0.21)	(0.16)	(0.18)	(0.20)		
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.22	0.04	18	0.16	0.31	3.96				
	0.21	0.03	17	0.16	0.27	3.65				



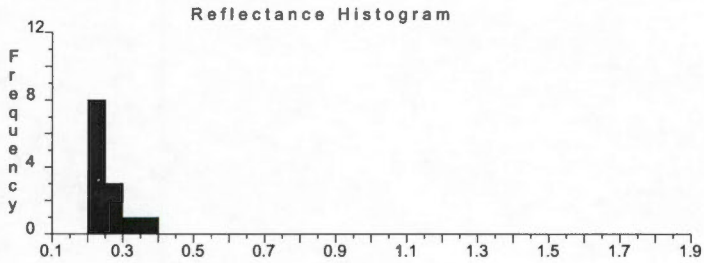
C025-04, 1520-1530m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.24)	(0.29)	(0.22)	(0.26)	(0.26)	(0.21)	(0.28)	(0.22)	(0.32)	(0.32)
	(0.22)	(0.29)	(0.22)	(0.21)	(0.22)	(0.27)	(0.22)	(0.23)	(0.25)	
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.25	0.04	19	0.21	0.32	4.75				
	0.25	0.04	19	0.21	0.32	4.75				



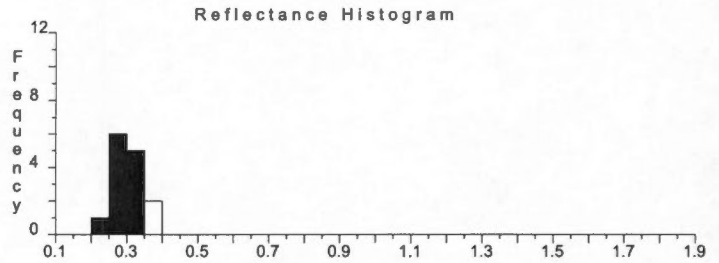
C026-04, 1540-1550m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.21)	(0.28)	(0.22)	(0.22)	(0.21)	(0.22)	(0.36)	(0.24)	(0.24)	(0.23)
	(0.33)	(0.29)	(0.27)							
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.26	0.05	13	0.21	0.36	3.32				
	0.26	0.05	13	0.21	0.36	3.32				



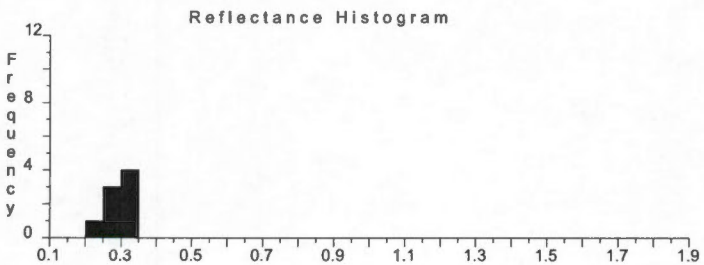
C027-04, 1600-1610m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.23)	(0.34)	0.39	(0.34)	(0.25)	(0.26)	(0.27)	(0.28)	(0.29)	(0.29)
	(0.32)	(0.30)	0.38	(0.32)						
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.30	0.05	14	0.23	0.39	4.26				
	0.29	0.04	12	0.23	0.34	3.49				



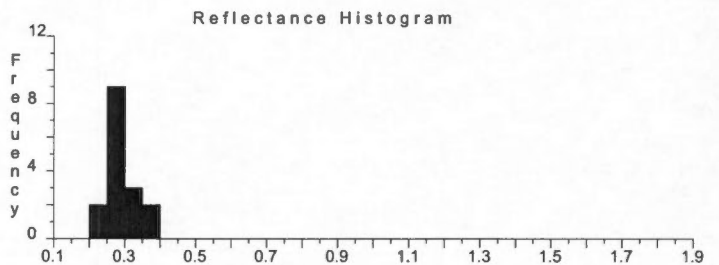
C028-04, 1640-1650m

Col >	1	2	3	4	5	6	7	8
Row 1	(0.29)	(0.22)	(0.30)	(0.32)	(0.31)	(0.32)	(0.27)	(0.27)
Total	Mean	Stand Dev	Pts	Min	Max	Sum		
(Edit)	0.29	0.03	8	0.22	0.32	2.30		
	0.29	0.03	8	0.22	0.32	2.30		



C029-04, 1660-1670m

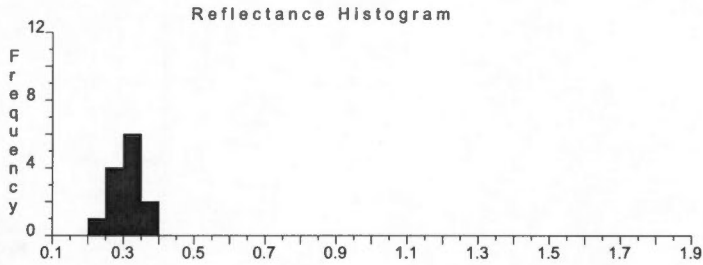
Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.27)	(0.24)	(0.28)	(0.23)	(0.26)	(0.25)	(0.28)	(0.29)	(0.35)	(0.33)
	(0.29)	(0.34)	(0.37)	(0.27)	(0.28)	(0.31)				
Total	Mean	Stand Dev	Pts	Min	Max	Sum				
(Edit)	0.29	0.04	16	0.23	0.37	4.64				
	0.29	0.04	16	0.23	0.37	4.64				



Data listings and basic statistics for: Gjoa G-37

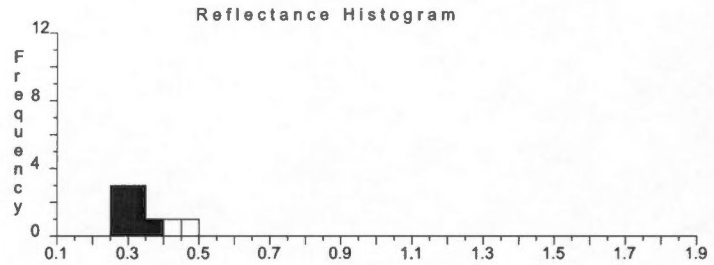
C030-04, 1820-1830m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.26)	(0.26)	(0.33)	(0.34)	(0.29)	(0.29)	(0.32)	(0.38)	(0.35)	(0.30)
Total	Mean 0.31	Stand Dev 0.04	Pts 13	Min 0.21	Max 0.38	Sum 3.97				
(Edit)	0.31	0.04	13	0.21	0.38	3.97				



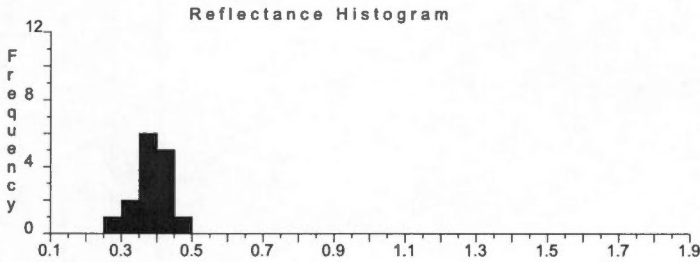
C031-04, 1960-1970m

Col >	1	2	3	4	5	6	7	8	9
Row 1	(0.29)	(0.26)	(0.35)	(0.30)	(0.33)	(0.32)	0.42	0.49	(0.28)
Total	Mean 0.34	Stand Dev 0.07	Pts 9	Min 0.26	Max 0.49	Sum 3.04			
(Edit)	0.30	0.03	7	0.26	0.35	2.13			



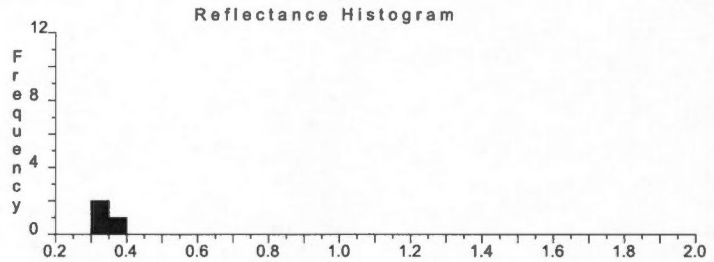
C032-04, 1980-1990m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.36)	(0.36)	(0.38)	(0.40)	(0.39)	(0.29)	(0.43)	(0.40)	(0.39)	(0.31)
Total	Mean 0.38	Stand Dev 0.04	Pts 15	Min 0.29	Max 0.46	Sum 5.71				
(Edit)	0.38	0.04	15	0.29	0.46	5.71				



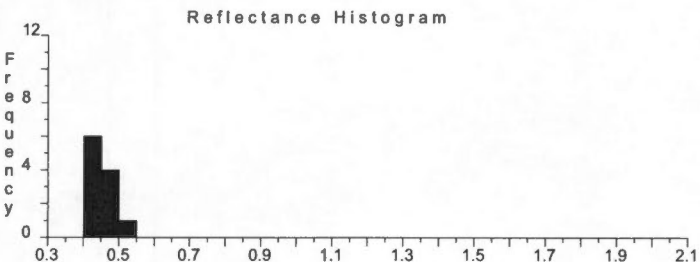
C033-04, 2120-2130m

Col >	1	2	3			
Row 1	(0.32)	(0.39)	(0.33)			
Total	Mean 0.35	Stand Dev 0.04	Pts 3	Min 0.32	Max 0.39	Sum 1.04
(Edit)	0.35	0.04	3	0.32	0.39	1.04



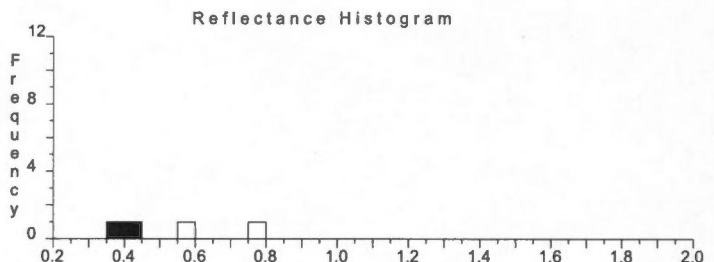
C034-04, 2380-2390m

Col >	1	2	3	4	5	6	7	8	9	0
Row 1	(0.40)	(0.46)	(0.43)	(0.41)	(0.47)	(0.49)	(0.46)	(0.42)	(0.40)	(0.43)
Total	Mean 0.44	Stand Dev 0.04	Pts 11	Min 0.40	Max 0.51	Sum 4.88				
(Edit)	0.44	0.04	11	0.40	0.51	4.88				



C035-04, 2480-2490m

Col >	1	2	3	4		
Row 1	(0.38)	0.78	0.55	(0.42)		
Total	Mean 0.53	Stand Dev 0.18	Pts 4	Min 0.38	Max 0.78	Sum 2.13
(Edit)	0.40	0.03	2	0.38	0.42	0.80

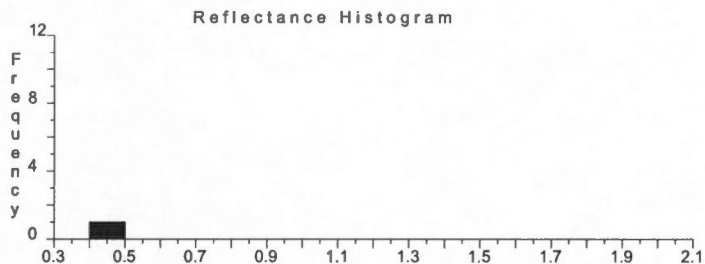


Data listings and basic statistics for: Gjoa G-37

C036-04, 2670-2680m

Col >	1	2
Row	(0.49)	(0.44)

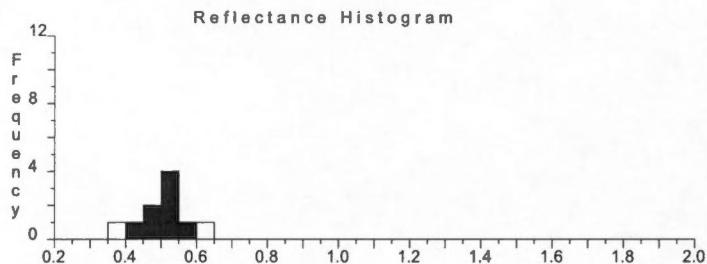
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.46	0.04	2	0.44	0.49	0.93
(Edit)	0.46	0.04	2	0.44	0.49	0.93



C037-04, 2700-2710m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.43)	(0.55)	0.60	0.35	(0.50)	(0.53)	(0.48)	(0.54)	(0.50)	(0.48)

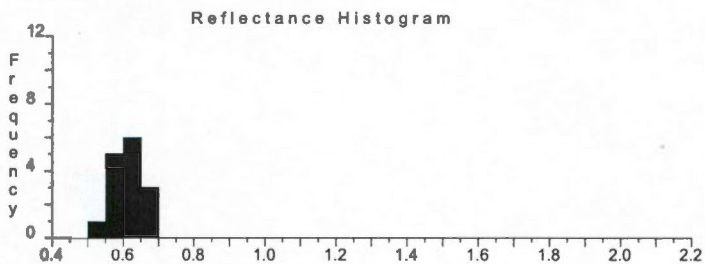
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.50	0.07	10	0.35	0.60	4.96
(Edit)	0.50	0.04	8	0.43	0.55	4.01



K0170A, 3210-3220m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.60)	(0.58)	(0.61)	(0.67)	(0.66)	(0.56)	(0.63)	(0.62)	(0.66)	(0.61)
1	(0.51)	(0.56)	(0.63)	(0.59)	(0.57)					

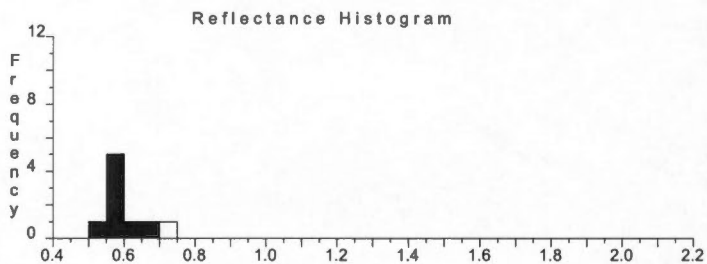
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.60	0.04	15	0.51	0.67	9.06
(Edit)	0.60	0.04	15	0.51	0.67	9.06



C038-04, 3420-3430m

Col >	1	2	3	4	5	6	7	8	9
Row	(0.59)	(0.63)	(0.56)	(0.65)	(0.50)	(0.57)	0.74	(0.59)	(0.58)

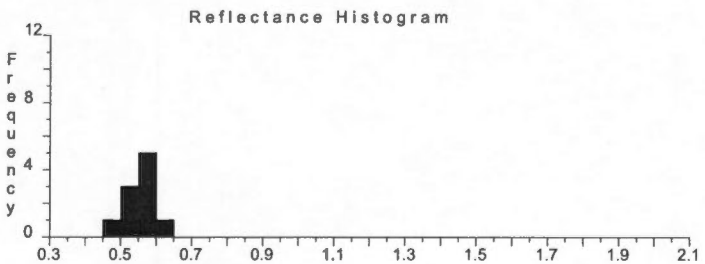
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.60	0.07	9	0.50	0.74	5.41
(Edit)	0.58	0.05	8	0.50	0.65	4.67



C039-04, 3550-3560m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.61)	(0.55)	(0.55)	(0.55)	(0.57)	(0.51)	(0.54)	(0.49)	(0.57)	(0.52)

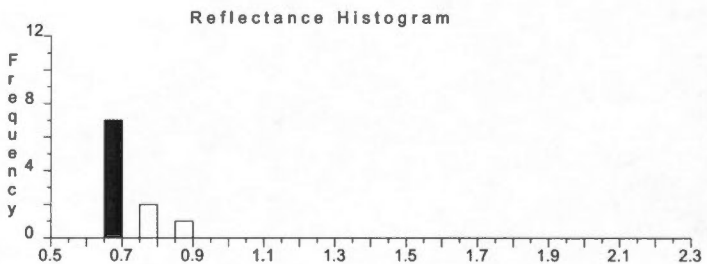
	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.55	0.03	10	0.49	0.61	5.46
(Edit)	0.55	0.03	10	0.49	0.61	5.46



C040-04, 3810-3820m

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.65)	0.85	(0.67)	(0.67)	(0.66)	0.78	(0.65)	0.77	(0.65)	(0.68)

	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.70	0.07	10	0.65	0.85	7.03
(Edit)	0.66	0.01	7	0.65	0.68	4.63



Data listings and basic statistics for: Gjoa G-37

C041-04, 3890-3900m

Col >	1	2	3	4	5	6	7	8	9
Row	(0.65)	(0.61)	(0.59)	(0.65)	(0.65)	0.75	(0.66)	(0.67)	(0.68)

	Mean	Stand Dev	Pts	Min	Max	Sum
Total	0.66	0.04	9	0.59	0.75	5.91
(Edit)	0.64	0.03	8	0.59	0.68	5.16

