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Geological Survey of Canada Open File # 4626

Vitrinite reflectance (R_o) of dispersed organic matter
from
Amoco-Imperial Cormorant N-83

M. P. Avery

2004

GEOLOGICAL SURVEY OF CANADA

OPEN FILE 4626

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from
Amoco-Imperial Cormorant N-83

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Geological Survey of Canada (Atlantic), Dartmouth

2004

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Well information

G.S.C. Locality No.: D083 **Unique Well ID:** 300 N83 46100 48450

Location: 46.04595°N, 48.96724°W

R.T. Elevation: 98' **Water Depth:** 216'

Total Depth: 10369'

Sampled Interval: 900 - 10370'

Interval Studied: 1320-9690'

Depth Units: Feet referenced to R.T.

Rig Release Date: November 21, 1972

Introduction

Vitrinite reflectance has been determined on 22 rotary cutting samples from Amoco-Imperial Cormorant N-83, which was classified as an exploratory well and is located on the southern end of the Jeanne d'Arc Basin, Grand Banks, approximately 330 km southeast of St. John's, Newfoundland and Labrador. 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**
216 [Sea floor]	(0.20)	immature
3250	0.3	immature
5450	0.4	immature approaching maturity
7160	0.5	marginally mature
10369 [T.D.]	(0.76)	mature

*()'s indicate Ro's or depths extrapolated from linear regression
slope: 0.186 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 Cormorant N-83. 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 0.186 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 Cormorant N-83 is suitable to generate and preserve liquid hydrocarbons within the drilled section, between 7160 and 10369' (T.D.), provided potential source rocks and traps are present.

Discussion

The density of data points over the section from about 4000' to 8400' is quite high and therefore lends confidence to the maturity profile over this section. The two samples below 8400' yielded very few reliable measurements and therefore much less confidence in this lower section of the profile. This lower section of the well is dominated by Argo salt and basalts which typically yield poor organic material for vitrinite reflectance determinations.

References

- Dow, W. G.
1977: Kerogen studies and geological interpretations. Journal of Geochemical Exploration, no. 7, p.77-99.
- McAlpine, K.D.
1990: Lithostratigraphy of fifty-nine wells, Jeanne d'Arc Basin. Geological Survey of Canada, Open File 2201, 97 p.
- | | |
|--|---|
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H. Wielens, MResG, Dartmouth
A. E. Jackson, MResG, Dartmouth
MResG Files, Dartmouth | P. Dennis, Director's Office, GSC(Atlantic)
K. Osadetz, GSC (Calgary)
N. DeSilva, CNOPB, St. John's (3 copies)
C. Beaumont, Dalhousie Univ., Halifax |
|--|---|

Table II
Summary of kerogen - based vitrinite reflectance

Sample Labels	Depth in feet	Mean Ro (SD) non-rotated	Number of Readings	
			Total	Edited
K0939A	1320-1380	0.22 (± 0.03)	9	8
K0939B	1500-1530	0.24 (± 0.06)	2	2
K0939D	2220-2310	0.25 (± 0.02)	5	5
K0940A	4050-4170	0.34 (± 0.04)	7	7
K0940B	4320-4440	0.40 (± 0.05)	10	8
K0940C	4500-4620	0.32 (± 0.03)	6	6
K0940D	4950-4980	0.40 (± 0.05)	13	13
K0941A	5190-5220	0.41 (± 0.05)	10	10
K0941B	5370-5400	0.42 (± 0.04)	9	9
K0941C	5640-5670	0.41 (± 0.04)	11	11
K0941D	6000-6030	0.44 (± 0.04)	11	11
K0942B	6480-6510	0.46 (± 0.05)	15	15
K0942D	7080-7110	0.54 (± 0.06)	6	6
K0943A	7320-7350	0.51 (± 0.06)	12	12
K0943B	7500-7530	0.50 (± 0.06)	10	10
K0943C	7680-7710	0.55 (± 0.06)	12	12
K0943D	7860-7890	0.54 (± 0.07)	16	16
K0944A	8040-8070	0.52 (± 0.05)	14	14
K0944B	8220-8250	0.56 (± 0.06)	15	15
K0944C	8400-8420	0.63 (± 0.05)	14	13
K0944D	9390-9420	0.58 (± 0.03)	10	7
K0945A	9660-9690	0.74 (± 0.04)	11	3

Table III
Formation Tops (McAlpine, 1990)

Formation	Depth in feet
Banquereau (unconformity)	in casing 1250
South Mara Unit (unconformity)	1250 1499
Dawson Canyon fm	1499
Petrel Mb	2559
Eider (unconformity)	2631 2697
Downing	2697
Whale Mb	3619-4974
Iroquois	7090
Argo (unconformity) (basalt)	8497 9646 9646
(unconformity)	9760
Eurydice (tongue)	9760
Total Depth	10369

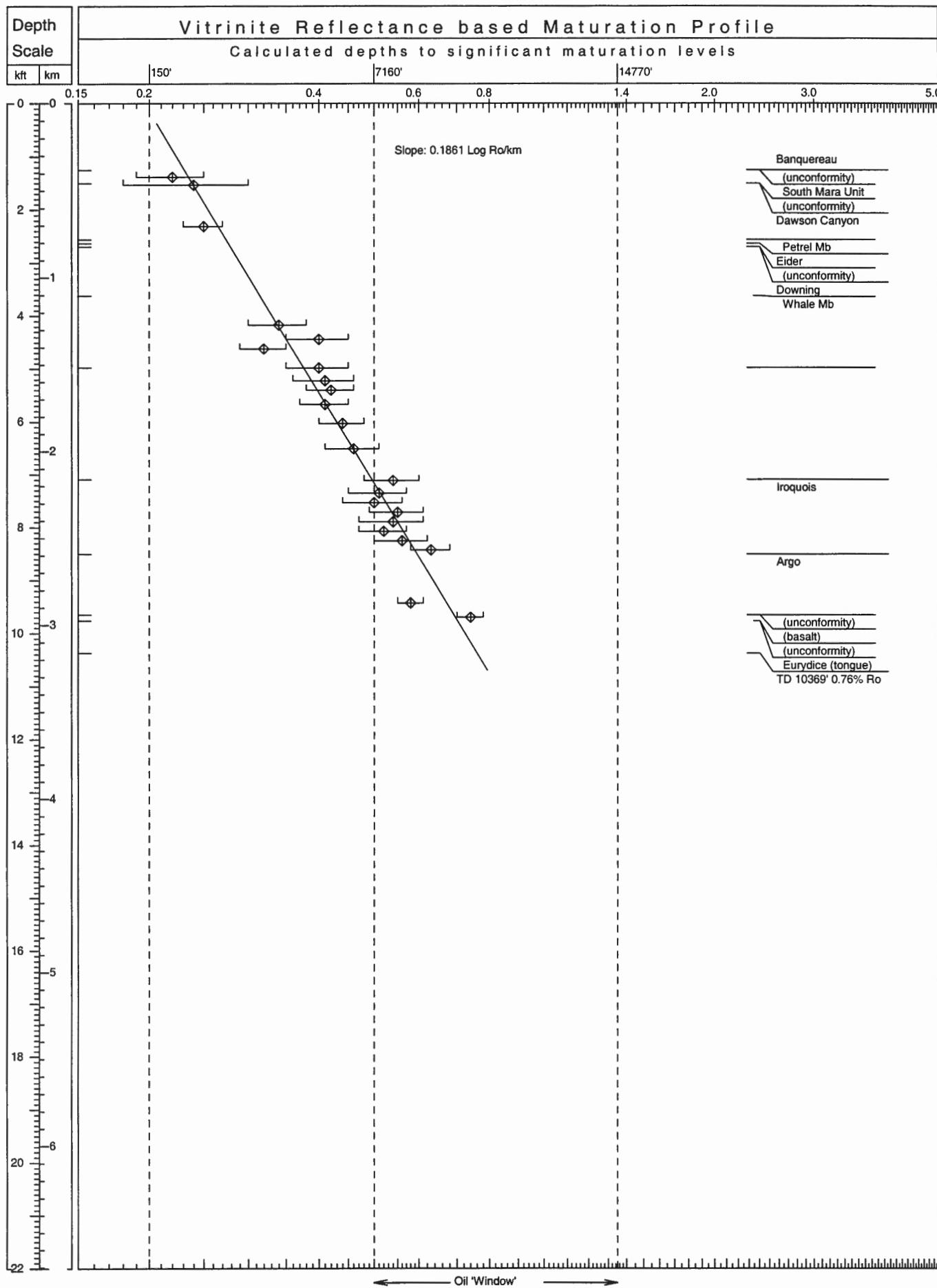


Fig. 1 Cormorant N-83

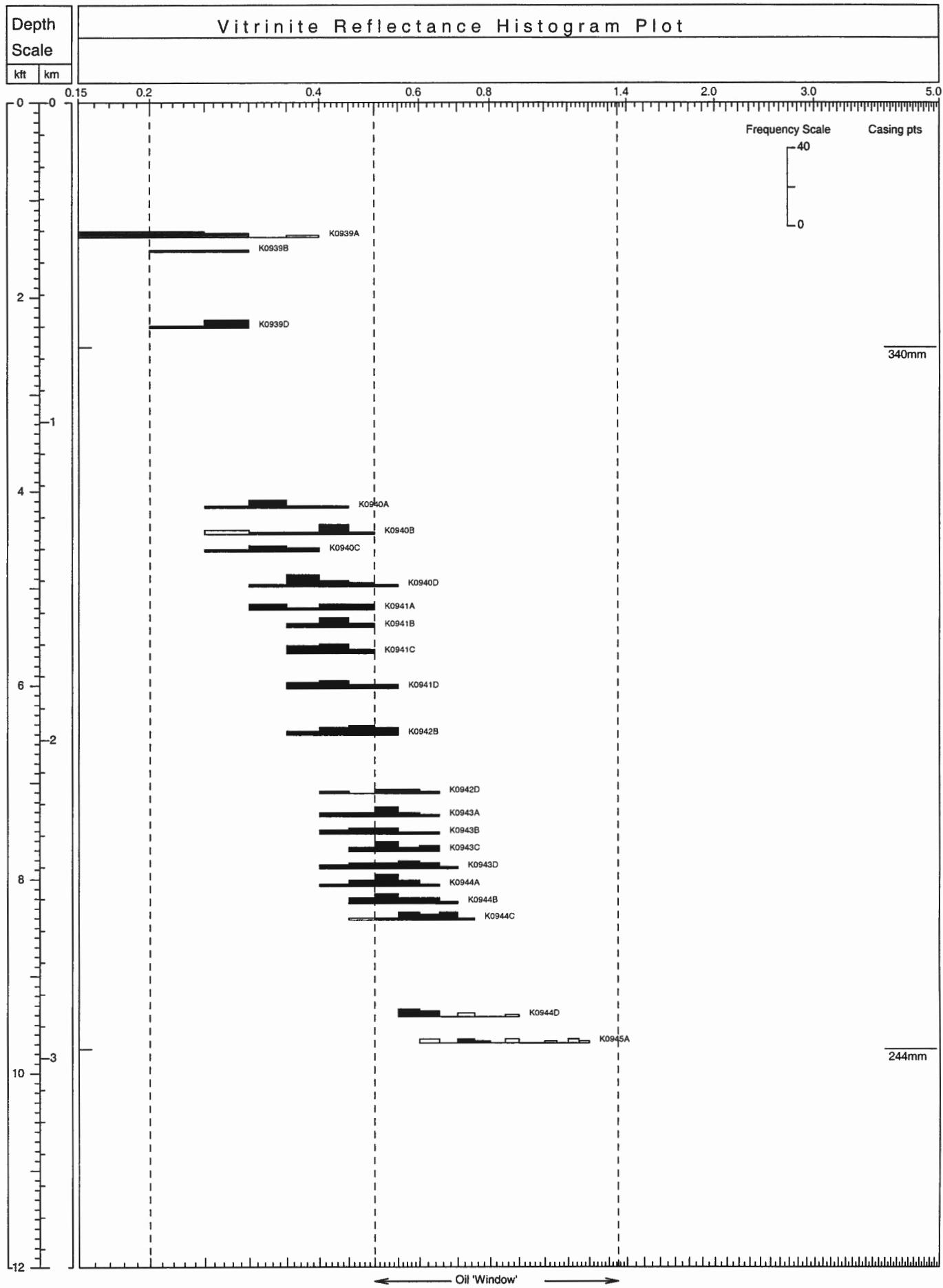


Fig. 2 Cormorant N-83 <Histograms>

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% HC1 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 HC1 (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

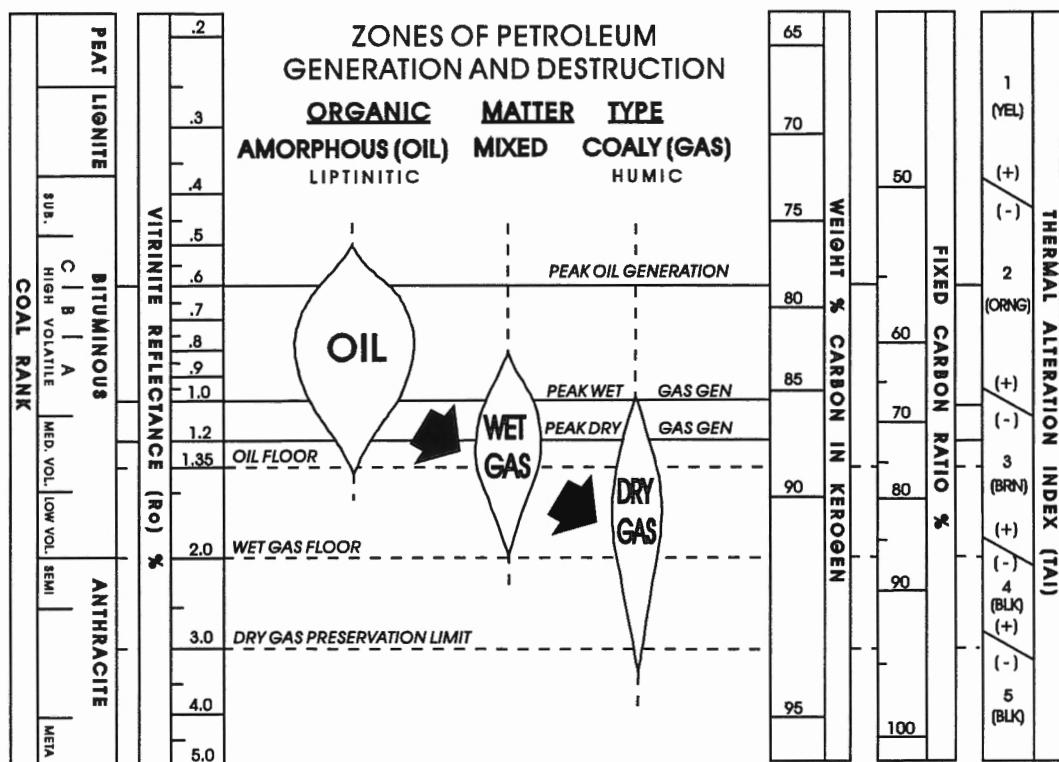
Pipette off excess water and prepare as 2.5 cm (1") diameter plastic stubs to fit polisher.

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

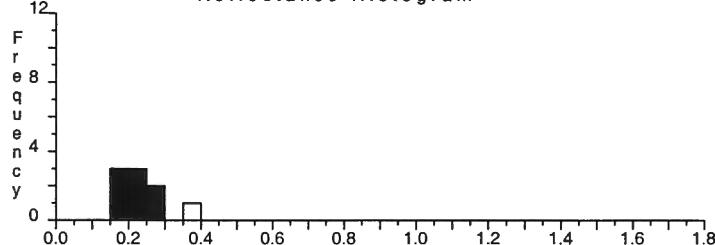
Data listings and basic statistics

Data listings and basic statistics for: Cormorant N-83

K0939A, 1320-1380'

Col >	1	2	3	4	5	6	7	8	9
Row	0.36	(0.24)	(0.25)	(0.25)	(0.18)	(0.20)	(0.18)	(0.19)	(0.24)
Total	0.23	0.06	9	0.18	0.36	2.09			
(Edit)	0.22	0.03	8	0.18	0.25	1.73			

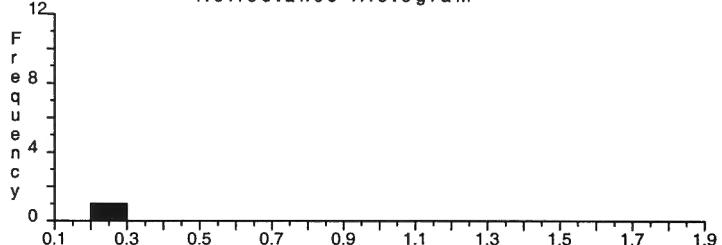
Reflectance Histogram



K0939B, 1500-1530'

Col >	1	2
Row	(0.20)	(0.28)
Total	0.24	0.06
(Edit)	0.24	0.06

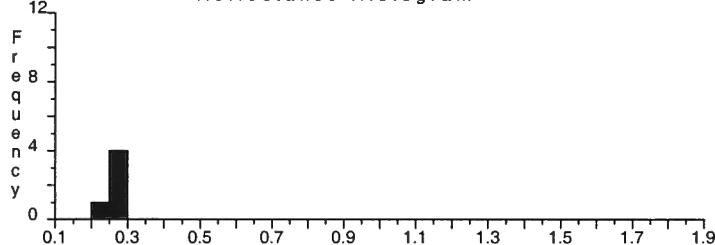
Reflectance Histogram



K0939D, 2220-2310'

Col >	1	2	3	4	5
Row	(0.25)	(0.25)	(0.28)	(0.23)	(0.25)
Total	0.25	0.02	5	0.23	0.28
(Edit)	0.25	0.02	5	0.23	0.28

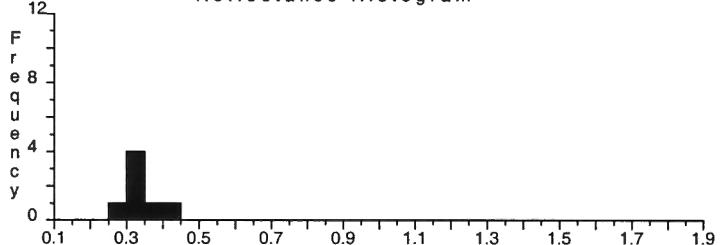
Reflectance Histogram



K0940A, 4050-4170'

Col >	1	2	3	4	5	6	7
Row	(0.29)	(0.34)	(0.37)	(0.33)	(0.34)	(0.31)	(0.41)
Total	0.34	0.04	7	0.29	0.41	2.39	
(Edit)	0.34	0.04	7	0.29	0.41	2.39	

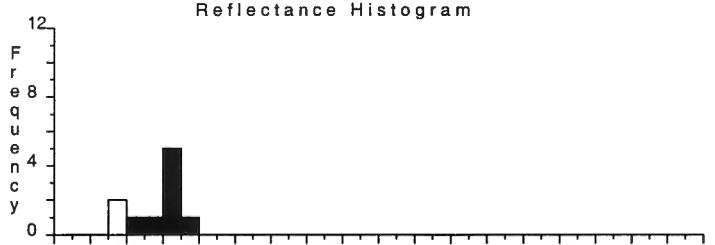
Reflectance Histogram



K0940B, 4320-4440'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.40)	0.27	0.28	(0.42)	(0.35)	(0.30)	(0.40)	(0.42)	(0.40)	(0.47)
Total	0.37	0.07	10	0.27	0.47	3.71				
(Edit)	0.40	0.05	8	0.30	0.47	3.16				

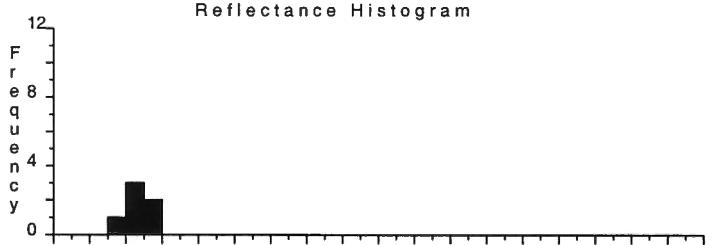
Reflectance Histogram



K0940C, 4500-4620'

Col >	1	2	3	4	5	6
Row	(0.36)	(0.30)	(0.31)	(0.28)	(0.35)	(0.32)
Total	0.32	0.03	6	0.28	0.36	1.92
(Edit)	0.32	0.03	6	0.28	0.36	1.92

Reflectance Histogram



Data listings and basic statistics for: Cormorant N-83

K0940D, 4950-4980'

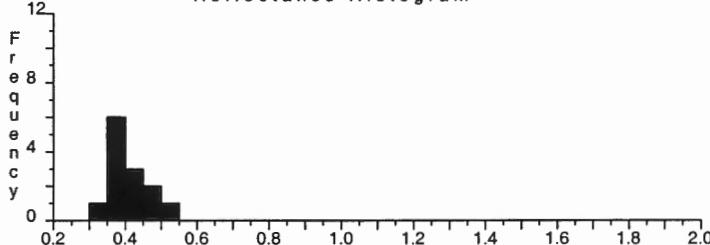
Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.38)	(0.36)	(0.41)	(0.45)	(0.46)	(0.34)	(0.37)	(0.36)	(0.40)	(0.40)
1	(0.51)	(0.38)	(0.38)							

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.40	0.05	13	0.34	0.51	5.20

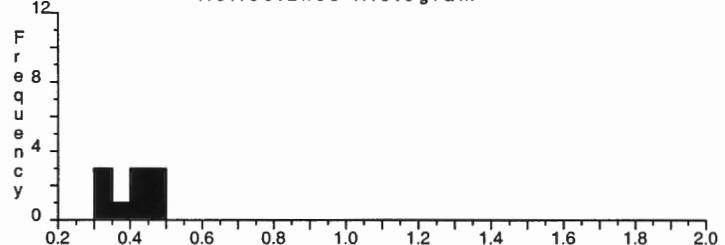
K0941A, 5190-5220'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.34)	(0.34)	(0.48)	(0.46)	(0.39)	(0.34)	(0.45)	(0.44)	(0.43)	(0.40)
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.41	0.05	10	0.34	0.48	4.07				
(Edit)	0.41	0.05	10	0.34	0.48	4.07				

Reflectance Histogram



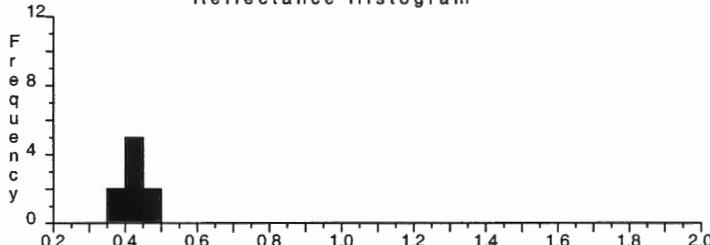
Reflectance Histogram



K0941B, 5370-5400'

Col >	1	2	3	4	5	6	7	8	9
Row	(0.44)	(0.45)	(0.43)	(0.40)	(0.40)	(0.41)	(0.47)	(0.38)	(0.36)
	Mean	Stand Dev	Pts	Min	Max	Sum			
Total	0.42	0.04	9	0.36	0.47	3.74			
(Edit)	0.42	0.04	9	0.36	0.47	3.74			

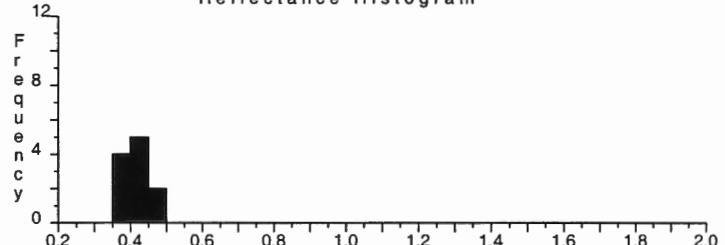
Reflectance Histogram



K0941C, 5640-5670'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.44)	(0.44)	(0.43)	(0.35)	(0.39)	(0.45)	(0.47)	(0.37)	(0.44)	(0.38)
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.41	0.04	11	0.35	0.47	4.56				
(Edit)	0.41	0.04	11	0.35	0.47	4.56				

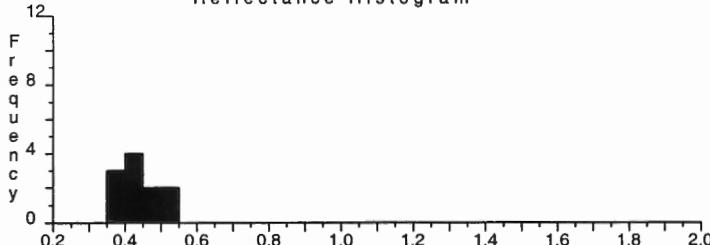
Reflectance Histogram



K0941D, 6000-6030'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.44)	(0.44)	(0.43)	(0.48)	(0.39)	(0.37)	(0.39)	(0.50)	(0.50)	(0.43)
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.44	0.04	11	0.37	0.50	4.84				
(Edit)	0.44	0.04	11	0.37	0.50	4.84				

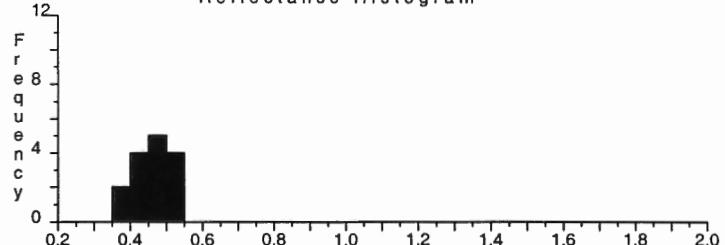
Reflectance Histogram



K0942B, 6480-6510'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.36)	(0.38)	(0.51)	(0.53)	(0.49)	(0.46)	(0.42)	(0.52)	(0.43)	(0.46)
	Mean	Stand Dev	Pts	Min	Max	Sum				
Total	0.46	0.05	15	0.36	0.53	6.84				
(Edit)	0.46	0.05	15	0.36	0.53	6.84				

Reflectance Histogram



Data listings and basic statistics for: Cormorant N-83

K0942D, 7080-7110'

Col >	1	2	3	4	5	6
Row	(0.53)	(0.52)	(0.44)	(0.62)	(0.56)	(0.55)

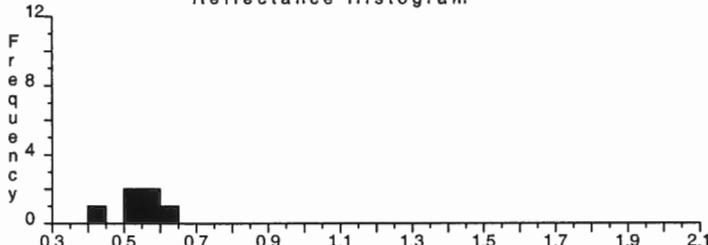
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.54	0.06	6	0.44	0.62	3.22

K0943A, 7320-7350'

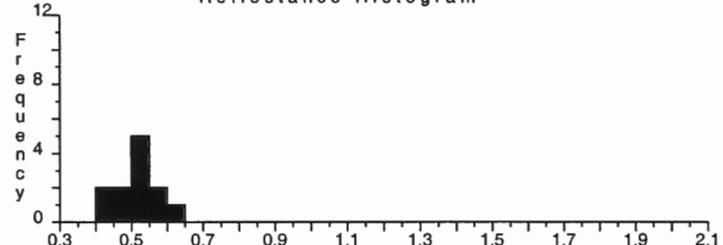
Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.53)	(0.53)	(0.62)	(0.46)	(0.46)	(0.40)	(0.42)	(0.51)	(0.55)	(0.54)

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.51	0.06	12	0.40	0.62	6.10

Reflectance Histogram



Reflectance Histogram



K0943B, 7500-7530'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.45)	(0.47)	(0.44)	(0.43)	(0.52)	(0.49)	(0.64)	(0.52)	(0.52)	(0.55)

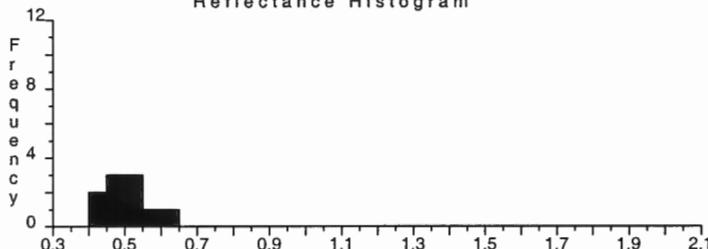
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.50	0.06	10	0.43	0.64	5.03

K0943C, 7680-7710'

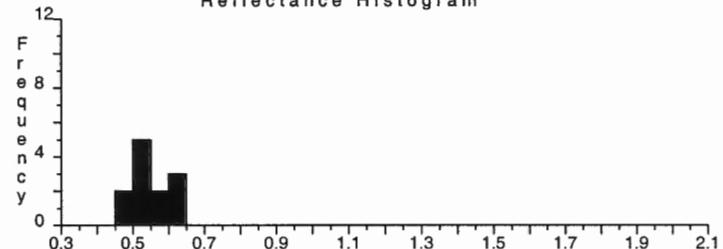
Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.59)	(0.45)	(0.64)	(0.58)	(0.52)	(0.52)	(0.47)	(0.53)	(0.51)	(0.62)

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.55	0.06	12	0.45	0.64	6.59

Reflectance Histogram



Reflectance Histogram

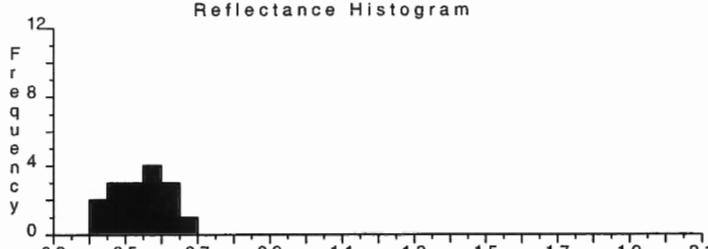


K0943D, 7860-7890'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.48)	(0.61)	(0.50)	(0.62)	(0.45)	(0.65)	(0.43)	(0.42)	(0.56)	(0.58)

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.54	0.07	16	0.42	0.65	8.58

Reflectance Histogram

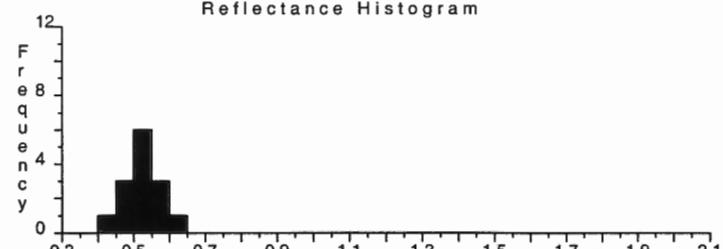


K0944A, 8040-8070'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.52)	(0.43)	(0.45)	(0.46)	(0.54)	(0.59)	(0.51)	(0.47)	(0.52)	(0.50)

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.52	0.05	14	0.43	0.61	7.21

Reflectance Histogram



Data listings and basic statistics for: Cormorant N-83

K0944B, 8220-8250'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.54)	(0.53)	(0.63)	(0.59)	(0.64)	(0.47)	(0.54)	(0.68)	(0.54)	(0.53)
	(0.47)	(0.61)	(0.49)	(0.55)	(0.55)					

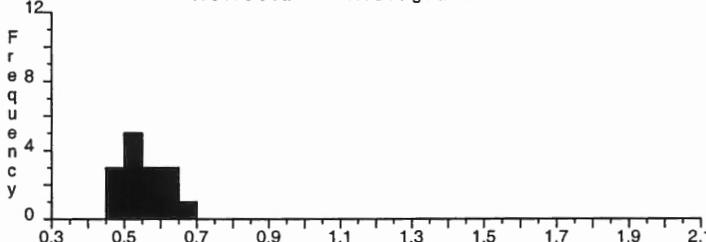
Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.56	0.06	15	0.47	0.68	8.36

K0944C, 8400-8420'

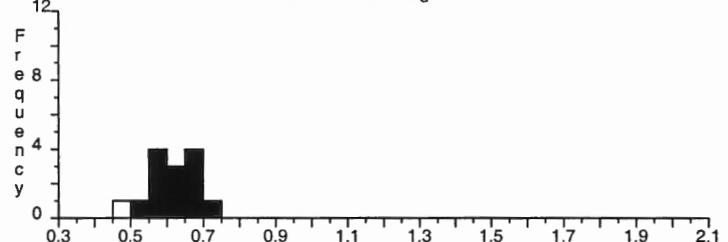
Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.71)	(0.59)	(0.58)	(0.68)	(0.60)	(0.58)	(0.69)	(0.66)	0.49	(0.66)
	(0.63)	(0.58)	(0.54)	(0.63)	(0.63)					

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.63	0.05	13	0.54	0.71	8.13

Reflectance Histogram



Reflectance Histogram

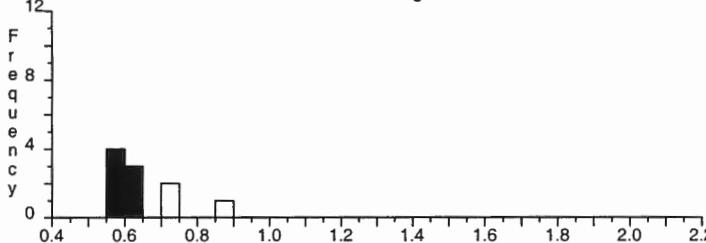


K0944D, 9390-9420'

Col >	1	2	3	4	5	6	7	8	9	0
Row	(0.55)	0.87	(0.55)	0.72	(0.63)	(0.57)	(0.60)	(0.59)	(0.60)	0.72
	(0.62)		(0.62)		(0.62)		(0.62)		(0.62)	

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.64	0.10	10	0.55	0.87	6.40
	0.58	0.03	7	0.55	0.63	4.09

Reflectance Histogram



K0945A, 9660-9690'

Col >	1	2	3	4	5	6	7	8	9	0
Row	1.13	1.14	0.89	0.87	1.17	1.02	(0.73)	(0.71)	(0.78)	0.62
	0.62		0.62		0.62		0.62		0.62	

Total	Mean	Stand Dev	Pts	Min	Max	Sum
(Edit)	0.88	0.21	11	0.62	1.17	9.68
	0.74	0.04	3	0.71	0.78	2.22

Reflectance Histogram

