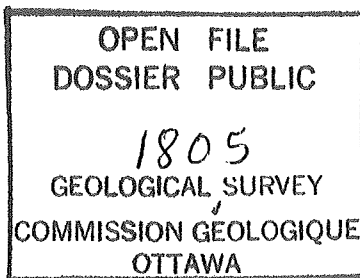


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Report No. EPGs-DOM.7-87MPA

Vitrinite reflectance (Ro)
of dispersed organics
from
Petro-Canada
Terra Nova K-08



Eastern Petroleum Geology Subdivision
Atlantic Geoscience Centre, G.S.C., Dartmouth
October 13, 1987

Vitrinite reflectance (Ro) of dispersed organics from Petro-Canada
Terra Nova K-08.

G.S.C. Locality No.: D236 Location: 46°27'31.6"N, 48°30'59.6"W

R.T. Elevation: 24.2m Water Depth: 94.5m Total Depth: 4500m

Sample Interval: 695 - 4500m Interval Studied: 845 - 4320m

Depth Units: Meters referenced to R.T.

Vitrinite reflectance has been determined on 18 rotary cuttings samples (Table II) from Petro Canada Terra Nova K-08 which was classified as a wildcat (oil discovery) well and is located on the Grand Banks approximately 340 km east-southeast of St. John's, Newfoundland.

Data acquisition and manipulation for this report utilized the Zeiss Photo-multiplier III Zonax system interfaced with a IBM-PC AT clone microcomputer to provide improved speed and reliability of data acquisition.

Sample preparation followed the procedures listed in Appendix I. The analysis of the well revealed the thermal maturation intervals given in Table I. The specific maturation levels, as set out in this report, were based on those of Dow (1977) with modified terminology (Appendix II).

Table I
Inferred Thermal Maturation Levels*

(Seafloor)-2057m	0.21 - 0.4	% Ro	immature
2057-2750m	0.4 - 0.5	% Ro	immature approaching maturity
2750-3315m	0.5 - 0.6	% Ro	marginally mature
3315m	0.6	% Ro	onset of significant oil generation
4208m	0.8	% Ro	peak of oil generation
4500m T.D.	0.88	% Ro	peak of oil generation
(4900m)	1.0	% Ro	onset of significant wet gas generation
(5466m)	1.2	% Ro	onset of significant dry gas generation
(5831m)	1.35	% Ro	oil floor
(6751m)	2.0	% Ro	wet gas preservation limit

Note: () indicate depth extrapolated at 0.140 log Ro/km

* Maturation levels are provided for all types of organic matter. Actual hydrocarbon products depend on type of organic matter present.

Remarks

Sample coverage of vitrinite reflectance data (Figure I, Table II) was good over most of the section penetrated by Terra Nova K-08. The data are plotted on a log R_o vs. linear depth scale and a linear regression line was calculated by the least squares method. The 'error bars' plotted on the maturation profile (Figure 1) 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 maturation line is 0.140 log/km.

Selection of the reflectance population which represented the true maturation of the sediments was significantly aided by the recently developed histogram display plot (Figure 2). This interpretation tool helps to reveal linear trends (populations) in the R_o data. It also demonstrates the effects of cavings, geology, casing points and other factors on the vitrinite reflectance populations.

The lithology strip plot (Figure 1) was produced directly from the E.P.G. LITHFILE database which extracts data from digitized CANSTRAT logs.

The vitrinite reflectance data provides evidence that the thermal regime at Terra Nova K-08 was suitable for the generation and preservation of hydrocarbons within the drilled section assuming potential source rocks and traps were present.

References

- Dow, W.G., 1977. Kerogen studies and geological interpretations. Journal of Geochemical Exploration, no. 7, p. 77-99
- Petro Canada, 1984. Well history report Petro Canada Terra Nova K-08. Open File report, Department of Energy, Mines and Resources, Ottawa.

October 13, 1987



M.P. Avery
Eastern Petroleum Geology

MPA

- | | |
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| Central Technical Files, Ottawa | D.F. Sherwin, CNOBP, St. John's |

Table II

Summary of kerogen - based vitrinite reflectance

Seq. #	Sample #	Depths in meters	Mean Ro (SD) non-rotated	Number of Readings	
				Total	Edited
1	K0624A	845-855	.28(±.05)	31	20
2	K0624B	1000-1010	.28(±.04)	23	20
3	K0624C	1120-1130	.27(±.04)	18	18
4	K0625A	1290-1300	.30(±.06)	33	10
5	K0625B	1470-1480	.42(±.04)	33	16
6	K0625C	1770-1780	.34(±.05)	19	13
7	K0626A	1950-2110	.43(±.04)	41	19
8	K0626B	2220-2350	.43(±.05)	34	19
9	K0626C	2490-2590	.42(±.03)	29	23
10	K0627A	2840-2850	.51(±.04)	32	14
11	K0627B	2870-2880	.53(±.06)	41	35
12	K0627C	3200-3210	.56(±.05)	39	28
13	K0628A	3350-3360	.61(±.07)	70	43
14	K0628B	3500-3510	.67(±.04)	32	5
15	K0628C	3650-3660	.69(±.00)	15	1
16	K0629A	3770-3780	.71(±.04)	9	3
17	K0629B	3920-3930	.74(±.05)	27	9
18	K0630A	4310-4320	.81(±.08)	44	33

Note: All samples are kerogen concentrate type

Table III

Formation Tops (McAlpine, pers. comm.)*

Formation	Depth
Banquereau	in casing
Paleocene U/C	1135m
S. Mara Unit	1135m
Base Tertiary U/C	1289m
Dawson Canyon	1289m
Petrel Mbr	1393-1441m
Eider	1504m
Albian U/C	1582m
Ben Nevis	1582m
Aptian U/C	1685m
Avalon	1685m
Barremian U/C	1774m
Eastern Shoals	1774-1895m
Catalina	2264m
'B' mkr	2385-2483m
Hibernia	2483m
Hebron Well Mbr	2483-2717m
Fortune Bay	2974
Jeanne d'Arc	3188m
Kimmeridgian U/C	3548m
Rankin	3548m
Egret Mbr	3650-3817m
Voyager	4286m
T.D.	4500m

* Preliminary stratigraphic picks.

Vitrinite Reflectance

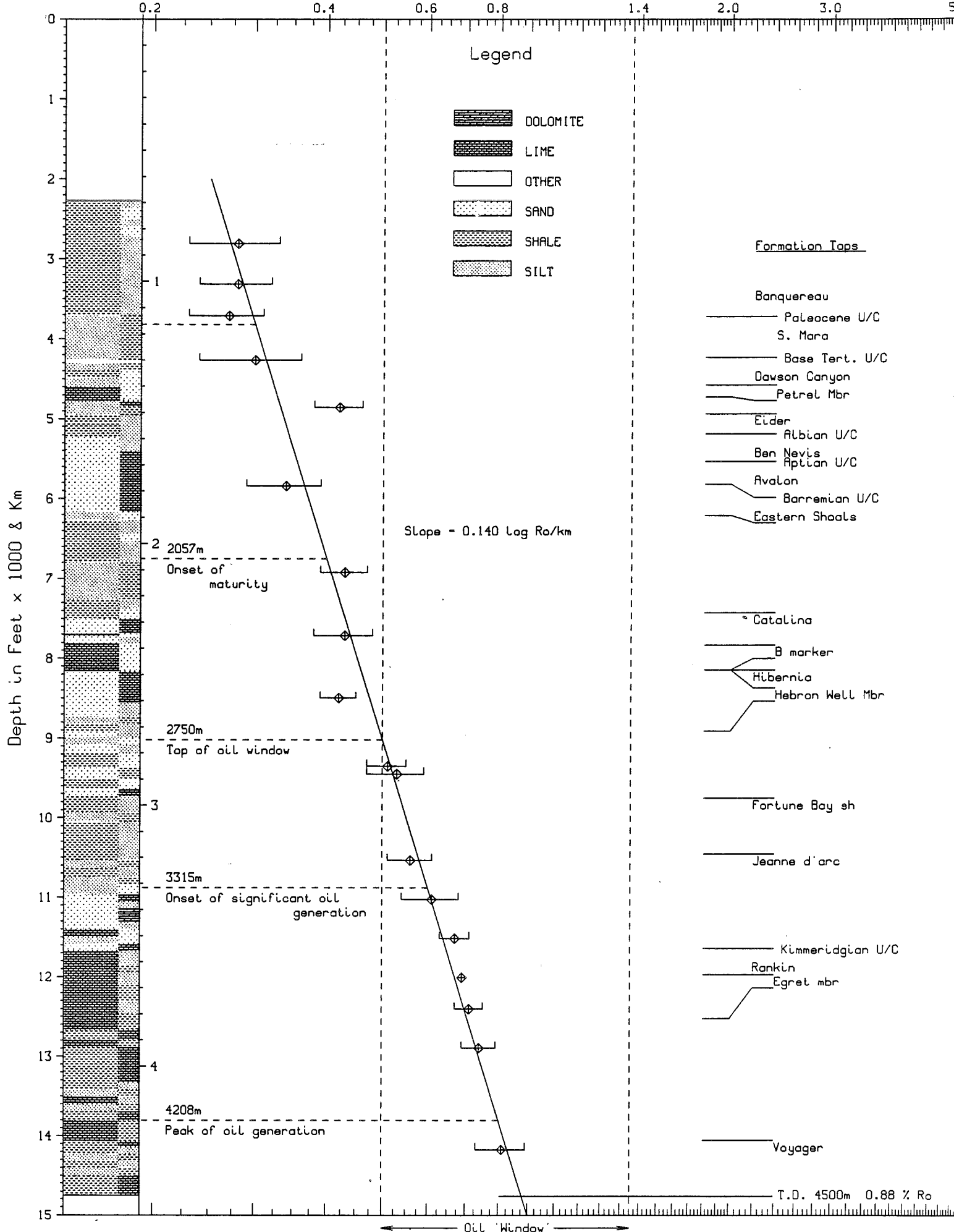


Fig. 1 Terra Nova K-08

<Maturation Profile>

Vitrinite Reflectance

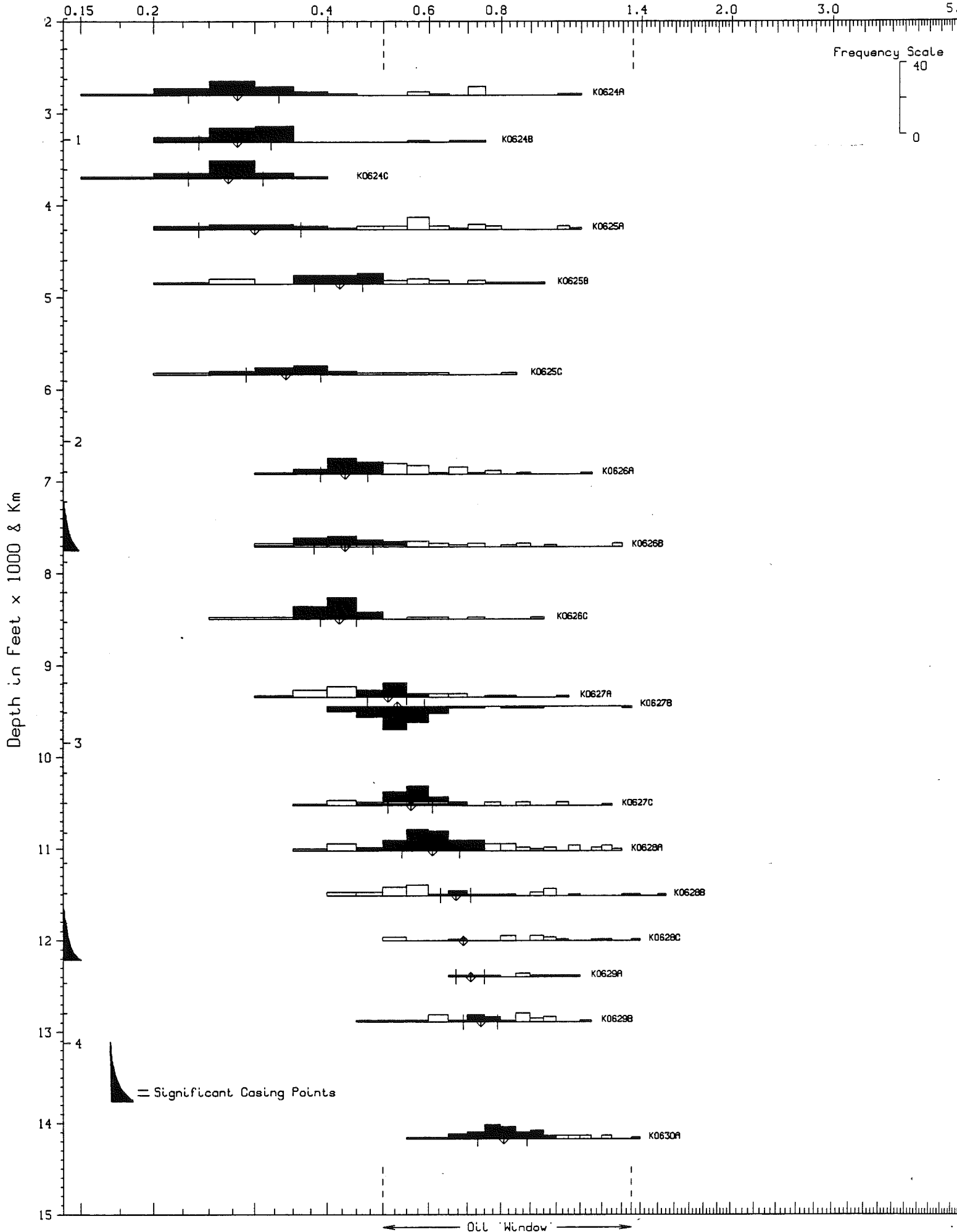


Fig. 2 Terra nova K-08 <histograms>

APPENDIX I

Sample Preparation Method

COGLA Lab preparation

Preliminary Wash

Samples dried in oven

Split: a. all of coarse to Petrology Lab

b. $\frac{1}{2}$ medium to Palynology Lab

c. rest of medium and all of fine combined for Micropaleo Lab

Split "b" is delivered to Palynology Lab and treated as follows:

PALYNOLOGY Lab preparation

20-30 grams placed in 250ml plastic beaker.

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

Washed (rinsed) 3 times.

Conc. HF overnight (removes silicates).

Washed (rinsed) 3 times.

Heated (60-65°C) conc. HCl (remove fluorides caused by HF).

Washed 3 times.

Then put into 15ml test tube with 4-5ml 4% Alconox.

Differential centrifuge at 1500rpm for 90 sec.

Decant.

Wash 3 times with centrifuging.

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

Centrifuge 1000rpm, 8 min.

Float fraction into second test tube.

Wash 3 times with centrifuging.

Kerogen smear slide made.

Remaining kerogen material delivered to Vitrinite Reflectance Lab.

VITRINITE REFLECTANCE Lab preparation

Excess water pipetted off.

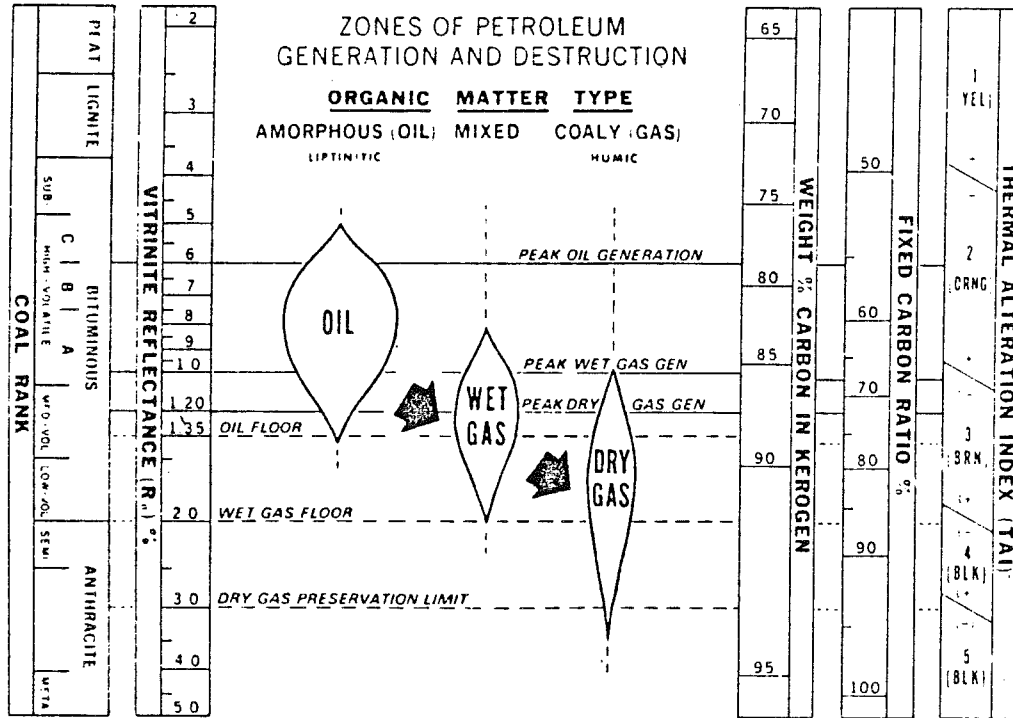
Freeze dried.

Mounted using epoxy resin (EPO-TEK 301) in predrilled plastic stubs.

Polished using modified coal petrology polishing methods.

Examined under oil lens at approximately 800x mag'n.

Appendix II (Dow,1977)



Note: For these reports, the terminology used to describe the various maturation levels has been modified. The 'peak' designation, as used in this figure, has been changed to 'onset of significant' and 0.8 R_o is now used as the 'peak of oil generation' (Table I, Figure 1).

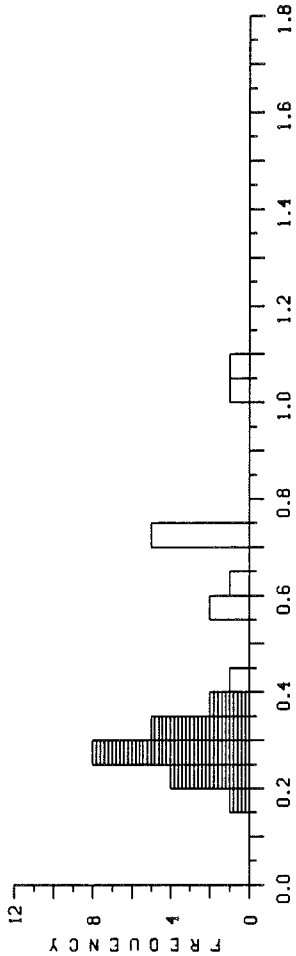
Appendix III
Sample Reports

K0624B, 845-855M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.19<	.20<	.20<	.22<	.23<	.26<	.26<	.27<	.28<	.28<
1	.28<	.29<	.29<	.31<	.31<	.32<	.32<	.34<	.35<	.37<
2	.44	.56	.59	.64	.70	.70	.71	.73	.74	1.01
3	1.05									

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.43	.24	31	.19	1.05	13.44
EDIT<	.28	.05	20	.19	.37	5.57

REFLECTANCE HISTOGRAM

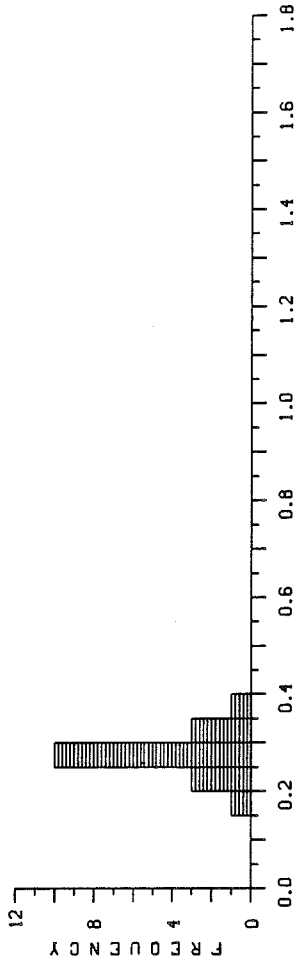


K0624C, 1120-1130M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.19<	.22<	.23<	.24<	.25<	.25<	.26<	.26<	.26<	.27<
1	.27<	.28<	.28<	.29<	.31<	.32<	.32<	.36<	.36<	

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.27	.04	18	.19	.36	4.86
EDIT<	.27	.04	18	.19	.36	4.86

REFLECTANCE HISTOGRAM

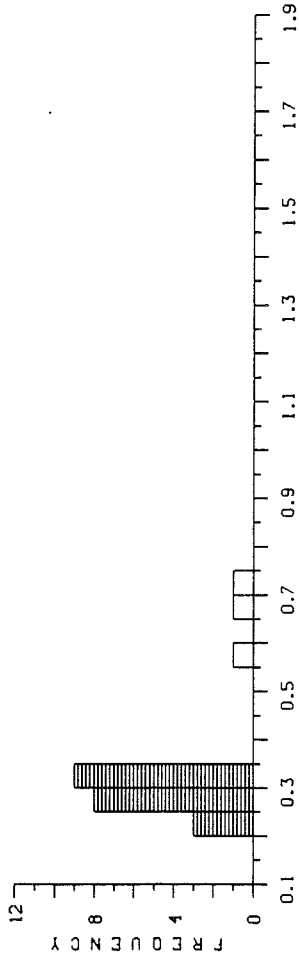


K0624B, 1000-1010M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.21<	.22<	.23<	.26<	.26<	.26<	.27<	.27<	.27<	.27<
1	.29<	.30<	.30<	.30<	.30<	.31<	.32<	.32<	.33<	.34<
2	.57	.68	.72							

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.33	.14	23	.21	.72	7.60
EDIT<	.28	.04	20	.21	.34	5.63

REFLECTANCE HISTOGRAM

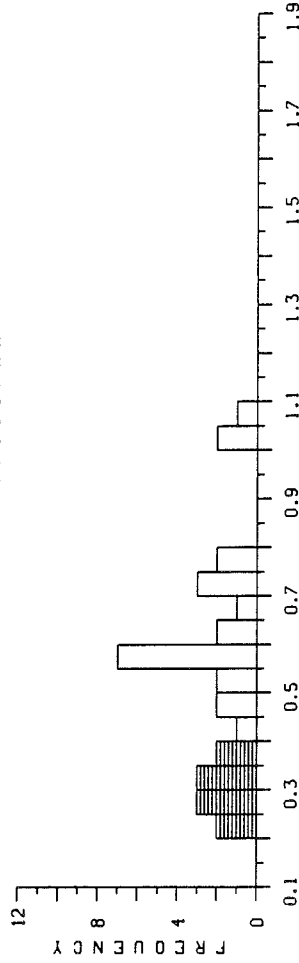


K0625A, 1290-1300M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.20<	.24<	.27<	.27<	.28<	.33<	.33<	.34<	.37<	.37<
1	.40	.46	.47	.52	.53	.55	.56	.56	.57	.58
2	.59	.59	.60	.62	.67	.72	.74	.74	.75	.76
3	1.02	1.04	1.05							

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.55	.22	33	.20	1.05	18.09
EDIT<	.30	.06	10	.20	.37	3.00

REFLECTANCE HISTOGRAM

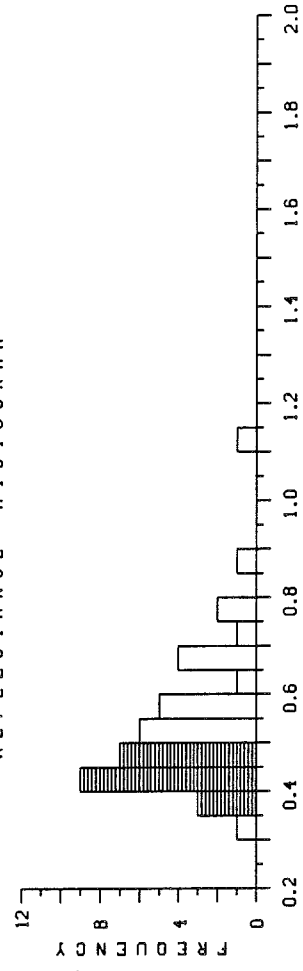


K0626A, 1950-2110M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.30	.35<	.38<	.39<	.40<	.40<	.40<	.41<	.42<	.42<
1	.43<	.43<	.43<	.45<	.47<	.47<	.48<	.48<	.49<	.49<
2	.52	.53	.53	.53	.54	.54	.55	.57	.57	.59
3	.59	.60	.65	.66	.68	.68	.73	.75	.76	.87
4	1.10									

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.54	41	.30	1.10	22.03
EDIT<	.43	19	.35	.49	8.19

REFLECTANCE HISTOGRAM

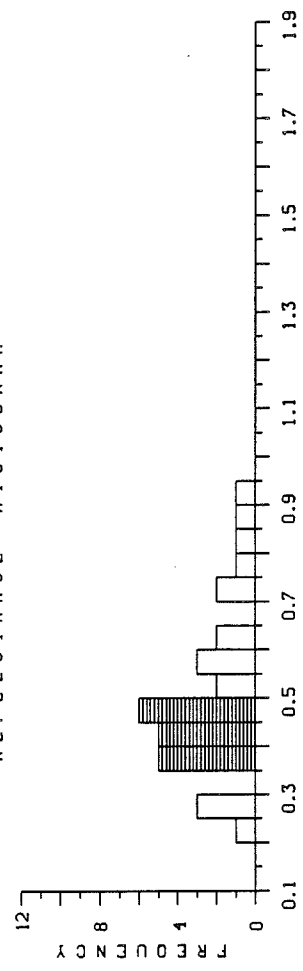


K0625B, 1470-1480M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.23	.25	.26	.28	.35<	.35<	.36<	.38<	.39<	.41<
1	.42<	.42<	.44<	.44<	.45<	.46<	.46<	.47<	.47<	.48<
2	.53	.53	.57	.58	.58	.61	.63	.74	.74	.78
3	.80	.86	.92							

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.50	33	.23	.92	16.64
EDIT<	.42	16	.35	.48	6.75

REFLECTANCE HISTOGRAM

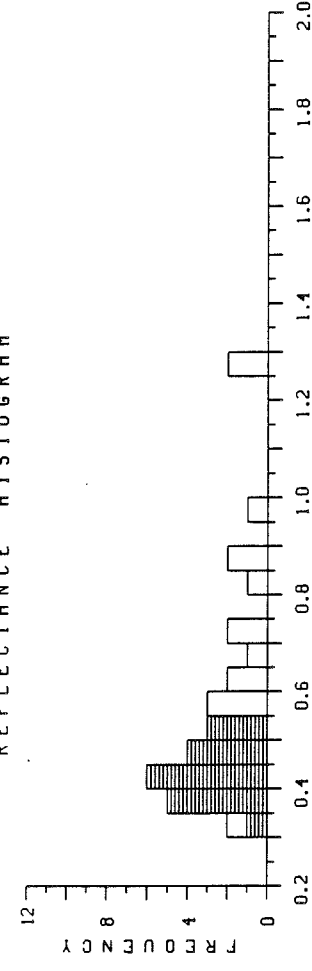


K0626B, 2220-2350M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.31	.34<	.38<	.38<	.39<	.39<	.39<	.40<	.40<	.42<
1	.43<	.43<	.44<	.45<	.45<	.47<	.48<	.51<	.52<	.52<
2	.55	.56	.59	.60	.64	.66	.71	.71	.80	.88
3	.88	.98	1.27	1.27						

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.58	34	.31	1.27	19.60
EDIT<	.43	19	.34	.52	8.19

REFLECTANCE HISTOGRAM

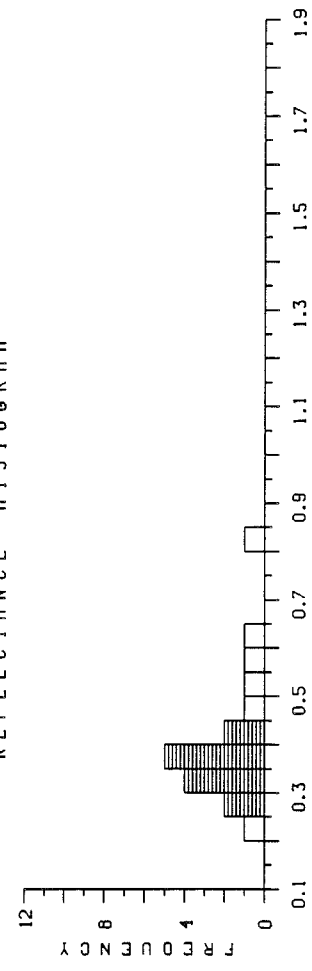


K0625C, 1770-1780M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.22	.26<	.28<	.30<	.30<	.33<	.34<	.35<	.36<	.37<
1	.37<	.39<	.40<	.41<	.45	.52	.56	.61	.84	.84

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.40	19	.22	.84	7.66
EDIT<	.34	13	.26	.41	4.46

REFLECTANCE HISTOGRAM

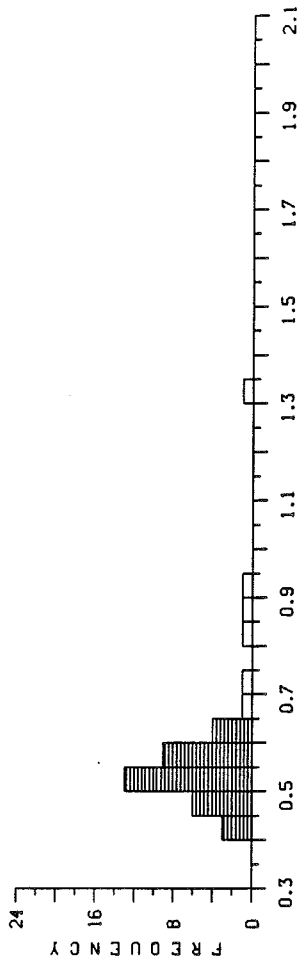


K0627B, 2870-2880M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.40<	.43<	.44<	.46<	.46<	.46<	.47<	.49<	.49<	.50<
1	.50<	.51<	.52<	.52<	.52<	.53<	.53<	.54<	.54<	.54<
2	.54<	.54<	.55<	.55<	.56<	.56<	.56<	.57<	.58<	.59<
3	.59<	.61<	.61<	.62<	.63<	.67	.74	.84	.88	.94
4	1.33									

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.58	41	.40	1.33	23.90
EDIT<	.53	35	.40	.63	18.50

REFLECTANCE HISTOGRAM

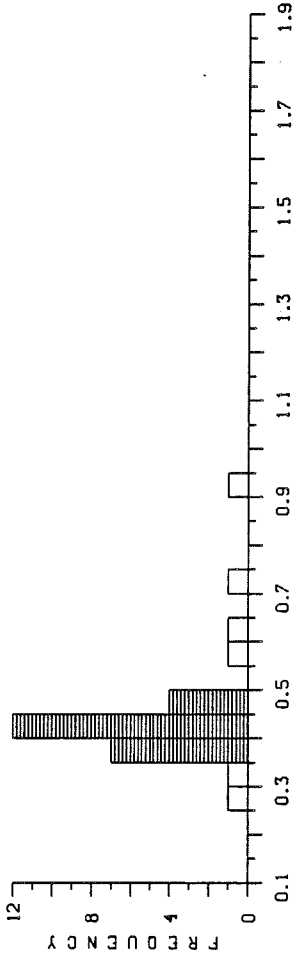


K0627C, 3200-3210M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.35	.40	.43	.44	.48<	.48<	.51<	.51<	.51<	.51<
1	.52<	.53<	.53<	.54<	.55<	.55<	.55<	.55<	.55<	.55<
2	.56<	.56<	.56<	.56<	.58<	.58<	.60<	.60<	.60<	.60<
3	.67<	.68<	.75	.78	.87	.88	1.01	1.03	1.23	

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.61	39	.35	1.23	23.82
EDIT<	.56	28	.48	.68	15.65

REFLECTANCE HISTOGRAM

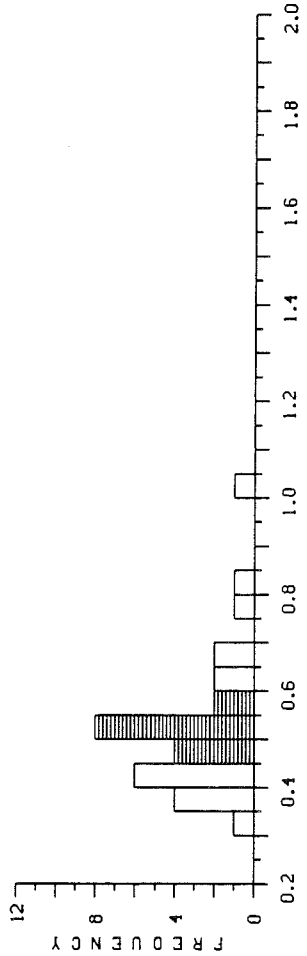


K0627A, 2840-2850M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.34	.36	.37	.39	.39	.41	.41	.43	.43	.43
1	.44	.45<	.45<	.45<	.47<	.50<	.51<	.52<	.52<	.54<
2	.54<	.54<	.54<	.55<	.57<	.61	.64	.65	.65	.79
3	.80	1.00								

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.52	32	.34	1.00	16.69
EDIT<	.51	14	.45	.57	7.15

REFLECTANCE HISTOGRAM

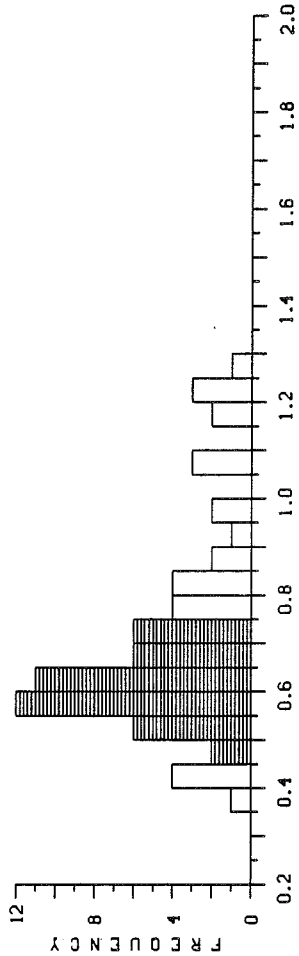


K06288,3350-3360M,TERRA NDVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.38	.41	.43	.44	.44	.48	.49	.50	.52	.52
1	.52	.53	.53	.55	.56	.56	.56	.56	.57	.58
2	.58	.58	.59	.59	.59	.60	.61	.61	.61	.61
3	.61	.61	.62	.63	.64	.64	.65	.66	.66	.67
4	.67	.69	.70	.71	.73	.74	.74	.74	.77	.77
5	.79	.79	.80	.81	.82	.84	.86	.87	.90	.96
6	.97	1.05	1.05	1.08	1.15	1.16	1.20	1.20	1.22	1.28

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.71	70	.38	1.28	49.54
EDIT<	.61	43	.48	.74	26.10

REFLECTANCE HISTOGRAM

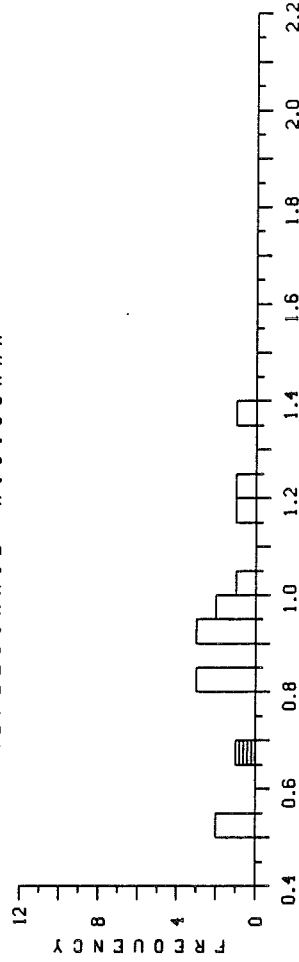


K0628C,3650-3660M,TERRA NDVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.50	.53	.69	.81	.82	.83	.90	.90	.92	.96
1	.97	1.04	1.18	1.24	1.36					

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.91	15	.50	1.36	13.65
EDIT<	.69	1	.69	.69	.69

REFLECTANCE HISTOGRAM

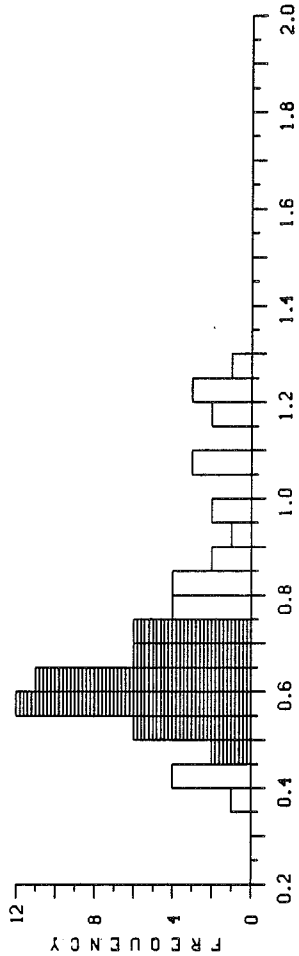


K06288,3500-3510M,TERRA NDVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.44	.44	.45	.47	.50	.53	.53	.54	.54	.55
1	.55	.55	.57	.58	.58	.64	.65	.66	.67	.74
2	.77	.83	.91	.92	.98	.98	.99	.99	1.09	1.33
3	1.38	1.51								

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.75	32	.44	1.51	23.86
EDIT<	.67	5	.64	.74	3.36

REFLECTANCE HISTOGRAM

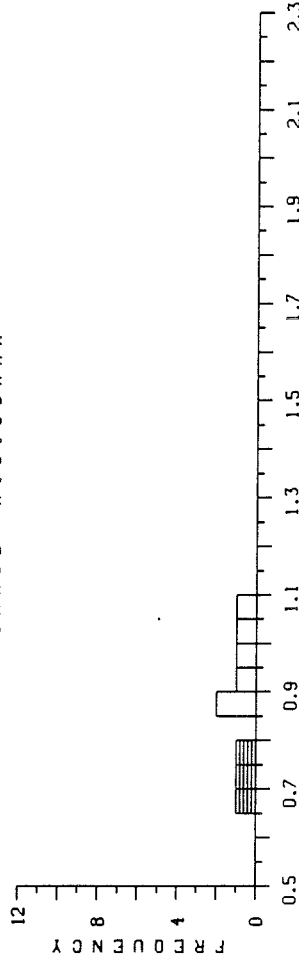


K0629A,3770-3780M,TERRA NDVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.67	.70	.75	.86	.89	.93	.96	1.02	1.09	

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.87	9	.67	1.09	7.87
EDIT<	.71	3	.67	.75	2.12

REFLECTANCE HISTOGRAM

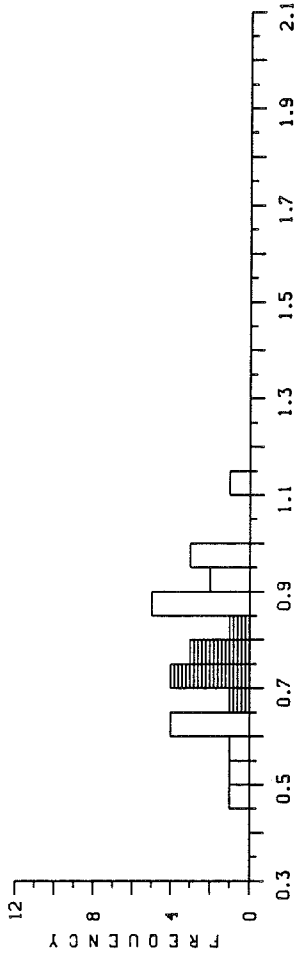


K06298, 3920-3930M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.45	.50	.56	.60	.62	.63	.64	.66	.66	.72
1	.72	.73	.75	.76	.78	.84	.85	.85	.86	.86
2	.87	.93	.93	.96	.98	.98	1.12			

TOTAL	MEAN	STAND	DEV	PTS	MIN	MAX	SUM
EDIT<	.77	.16	.05	27	.45	1.12	20.86
	.74	.05	.05	9	.66	.84	6.67

REFLECTANCE HISTOGRAM



K0630A, 4310-4320M, TERRA NOVA K-08

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.59	.63	.66	.67	.68	.71	.72	.72	.74	.76
1	.77	.77	.77	.77	.77	.78	.79	.81	.82	.83
2	.83	.83	.83	.84	.85	.86	.86	.89	.90	.90
3	.92	.93	.93	.95	.96	1.00	1.01	1.05	1.06	1.14
4	1.14	1.20	1.22	1.37						

TOTAL	MEAN	STAND	DEV	PTS	MIN	MAX	SUM
EDIT<	.87	.17	.08	44	.59	1.37	38.23
	.81	.08	.08	33	.66	.96	26.62

REFLECTANCE HISTOGRAM

