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Vitrinite reflectance (Ro)
of dispersed organics
from
Shell
Alma F-67

Report No. EPGs-DOM.3-90MPA

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Vitrinite reflectance (Ro) of dispersed organics from Shell Alma F-67.

G.S.C. Locality No.: D239

Location: 43°36'18.49"N, 60°39'56.49"W

R.T. Elevation: 24m

Water Depth: 68m

Total Depth: 5054m

Sampled Interval: 814 - 5054m

Interval Studied: 870 - 5050m

Depth Units: Metres referenced to R.T.

Vitrinite reflectance has been determined on 32 rotary cuttings samples (Table II) from Shell Alma F-67 which was classified as a wildcat well and is located on the Scotian Shelf approximately 260 km east southeast of Halifax, Nova Scotia. The well was designated a gas discovery and was plugged and abandoned.

Sample preparation followed the procedures listed in Appendix I. Data acquisition and manipulation for this report utilized the Zeiss Photometer III system with a custom interface to a microcomputer which provides reliable data acquisition and fast statistical summaries.

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

Table I
Inferred Thermal Maturation Levels*

1170m (sea floor)	0.18	% Ro	immature
1844m	0.4	% Ro	immature approaching maturity
2367m	0.5	% Ro	marginally mature
2795m	0.6	% Ro	onset of significant oil generation
3469m	0.8	% Ro	peak of oil generation
3992m	1.0	% Ro	onset of significant wet gas generation
4419m	1.2	% Ro	onset of significant dry gas generation
4695m	1.35	% Ro	oil floor
5616m	(2.0)	% Ro	wet gas preservation limit
6566m	(3.0)	% Ro	dry gas preservation limit
5054m (T.D.)	1.57	% Ro	maturity at total depth

Note: () indicate Ro extrapolated at 0.185 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 for vitrinite reflectance analysis (Figure 1, Table II) was very good over the section penetrated by Alma F-67. The data are plotted on a log Ro vs. linear depth scale and a linear regression line was calculated by the least squares method (Figure 1). The 'error bars' plotted on the maturation 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 maturation line is 0.185 log Ro/km.

Selection of the reflectance population which represented the true maturation of the sediments was aided by the histogram display plot (Figure 2). This interpretation tool helps to reveal linear trends (populations) in the Ro 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 Basin Analysis Subdivision's LITHFILE database which extracts data from digitized CANSTRAT logs.

The vitrinite reflectance data provides evidence that the thermal regime at Alma F-67 (between 2367 and 5054m) is 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

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Table II

Summary of kerogen - based vitrinite reflectance

Seq. #	Sample #	Depths in metres	Mean Ro (SD) non-rotated	Number of Readings	
				Total	Edited
1	PH1688	870-875	0.29(±.04)	8	7
2	PH1689	1100-1105	0.27(±.02)	10	6
3	PH1690	1240-1245	0.35(±.05)	5	4
4	PH1691	1395-1400	0.33(±.06)	16	13
5	PH1692	1540-1545	0.34(±.06)	8	7
6	PH1693	1725-1730	0.38(±.04)	15	8
7	PH1694	1855-1860	0.37(±.06)	12	8
8	PH1695	2000-2005	0.36(±.02)	11	2
9	PH1696	2160-2165	0.43(±.04)	28	12
10	PH1697	2335-2340	0.50(±.05)	30	27
11	PH1698	2565-2570	0.57(±.06)	11	7
12	PH1699	2755-2760	0.67(±.04)	12	6
13	PH1700	2835-2840	0.71(±.05)	22	16
14	PH1701	3005-3010	0.74(±.08)	28	24
15	PH1702	3145-3150	0.67(±.07)	24	18
16	PH1703	3295-3300	0.74(±.05)	8	7
17	PH1704	3445-3450	0.79(±.04)	4	3
18	PH1705	3630-3635	0.79(±.06)	5	4
19	PH1706	3820-3825	0.96(±.06)	7	4
20	PH1707	3945-3950	0.85(±.06)	4	4
21	PH1708	4100-4105	0.98(±.05)	7	4
22	PH1709	4255-4260	0.99(±.00)	1	1
23	K0769A	4495-4500	1.29(±.06)	17	7
24	K0769B	4555-4560	1.18(±.01)	8	2
25	K0769C	4620-4625	1.21(±.00)	8	1
26	PH1711	4655-4660	1.38(±.02)	2	2
27	K0770B	4780-4785	1.39(±.08)	9	4
28	K0770C	4820-4825	1.42(±.11)	6	5
29	K0771A	4880-4885	1.40(±.13)	2	2
30	PH1713	4950-4955	1.67(±.00)	5	1
31	K0771C	5035-5040	1.73(±.03)	11	6
32	PH1714	5045-5050	1.72(±.05)	8	3

Note: Samples with 'K' prefix are kerogen concentrate preparations.
 Samples with 'PH' prefix are whole rocks preparations.

Table III

Formation Tops (Wade, pers. comm.)

Formation	Depth
Banquereau	in casing
Wyandot	1313m
Dawson Canyon	1325m
Petrel Mbr	1430-1432m
Logan Canyon	1555m
Marmora Mbr	1555m
Sable Mbr	1722m
Cree Mbr	1879m
Naskapi Mbr	2544m
Missisauga	2844m
Verrill Canyon	3112m
Top OP approx.	3650m
T.D.	5054m

Vitrinite Reflectance

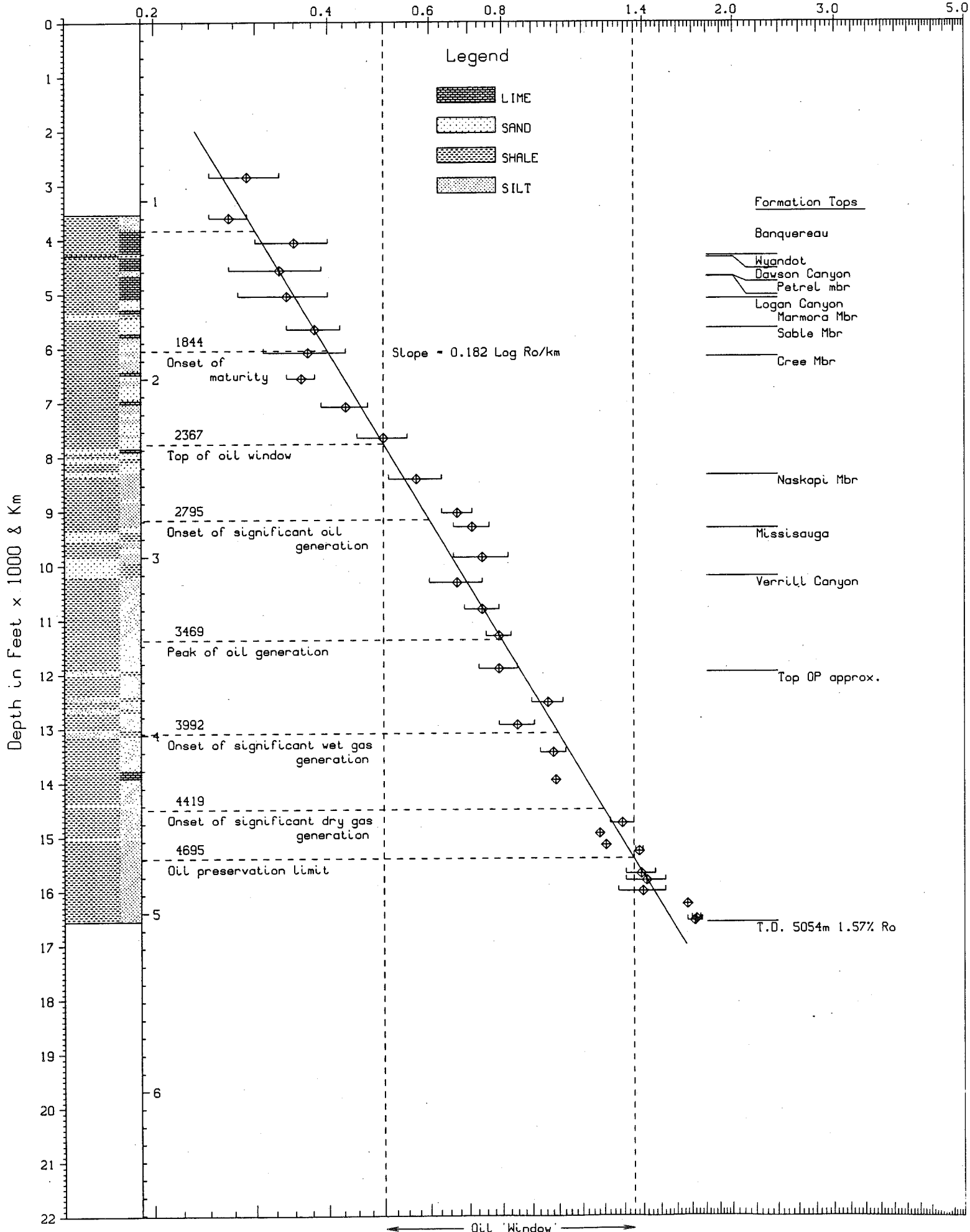


Fig. 1 Alma F-67 < Maturation Profile >

Vitrinite Reflectance

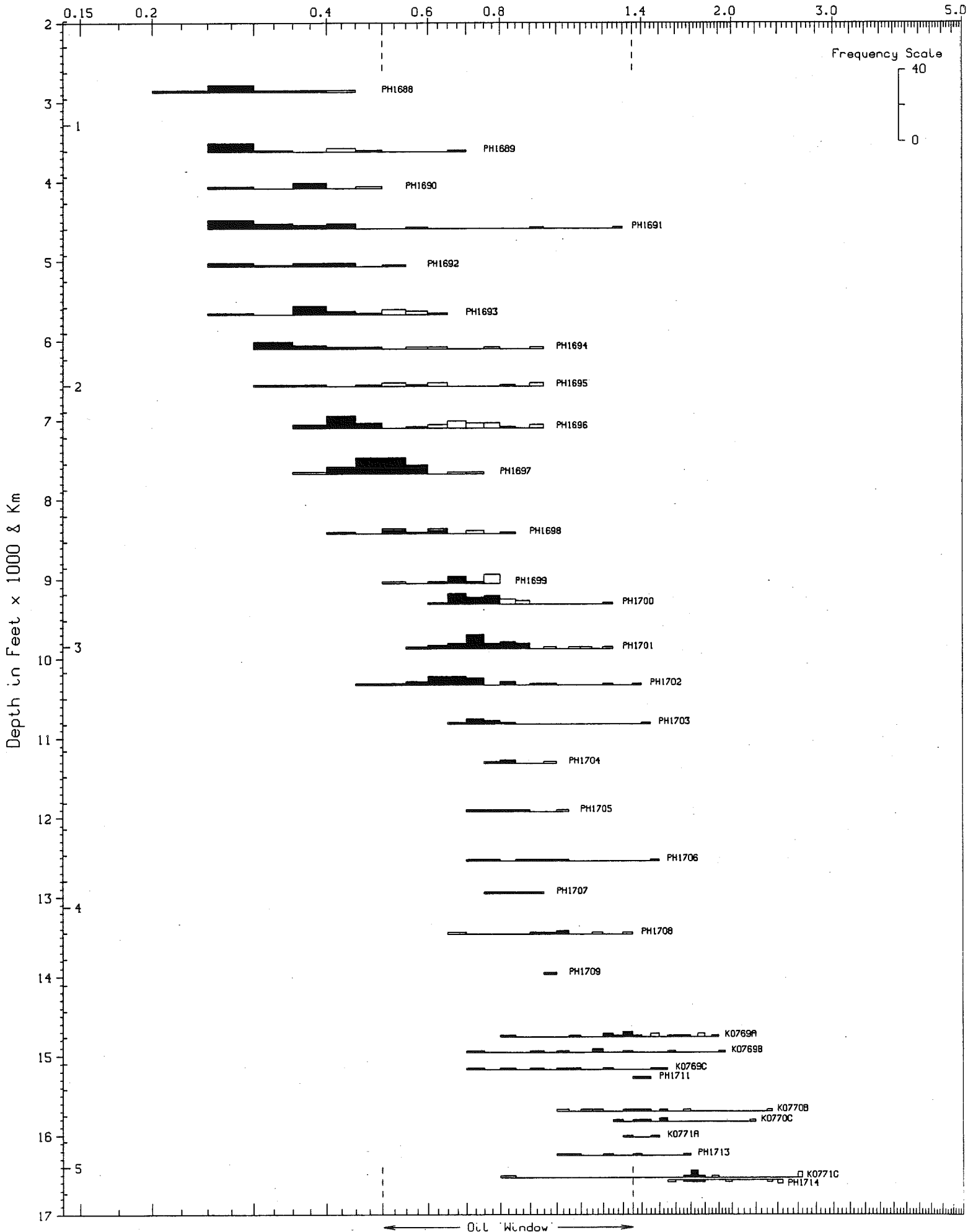


Fig. 2 Alma F-67

Histograms >

APPENDIX I

Sample Preparation Method

Kerogen Concentrate

COGLA Lab preparation

Preliminary wash

Dry samples in oven

Split: a. all of coarse to Petrology Lab

b. ½ 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

Place 20-30 grams 250 ml plastic beaker.

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

Wash (rinsed) 3 times.

Conc. HF overnight (removes silicates).

Wash (rinsed) 3 times.

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

Wash 3 times.

Transfer to 15 ml test tube with 4-5 ml 4% Alconox.

Differential centrifuge at 1500 rpm for 90 sec.

Decant.

Wash 3 times with centrifuging.

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

Centrifuge 1000 rpm, 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

Pipette off excess water.

Freeze dry.

Mount using epoxy resin (Struer's EPOFIX) in predrilled plastic tubes.

Polish to obtain low relief, scratch free surface.

Examine under oil lens, incident light at approximately 800x mag'n.

Whole Rock (VR lab prep only)

Preliminary wash & Air dry.

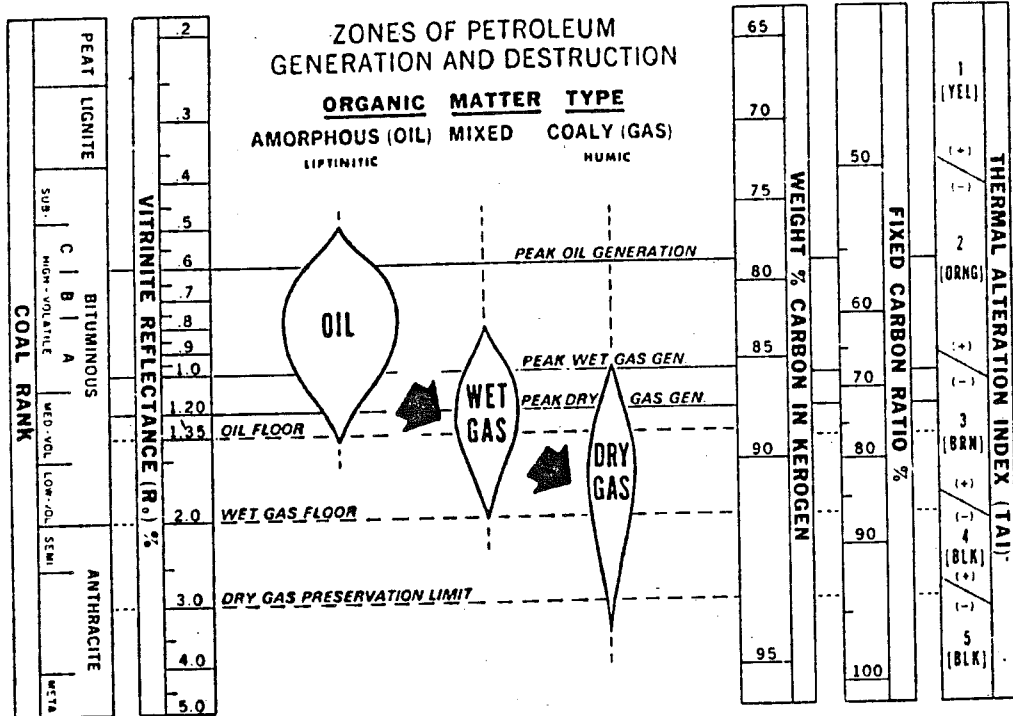
Crush to 1mm.

Mold into 1" stub with epoxy resin (EPOFIX).

Polish to obtain low relief, scratch free surface.

Examine under oil lens, incident light at approximately 800x mag'n.

Appendix II (Dow, 1977)



Note: In this report, 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 here used as the 'peak of oil generation' (Table I, Figure 1).

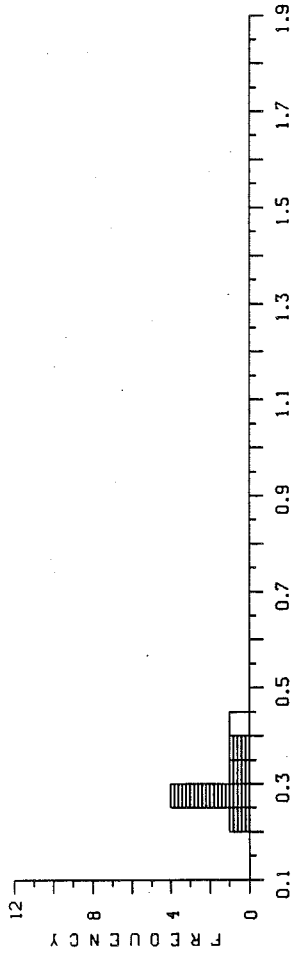
Appendix III
Reflectance Histograms

PH1688, 870-875M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.24<	.26<	.27<	.27<	.29<	.34<	.35<	.40		

MEAN	.30	.05	.24	.24	.40	2.42	SUM
STAND DEV	.29	.04	.07	.07	.35	2.02	
PTS	8	7	7	7	7	7	
MIN	.24	.24	.24	.24	.24	.24	
MAX	.40	.40	.40	.40	.40	.40	
TOTAL							3.60
EDIT<							1.64

REFLECTANCE HISTOGRAM

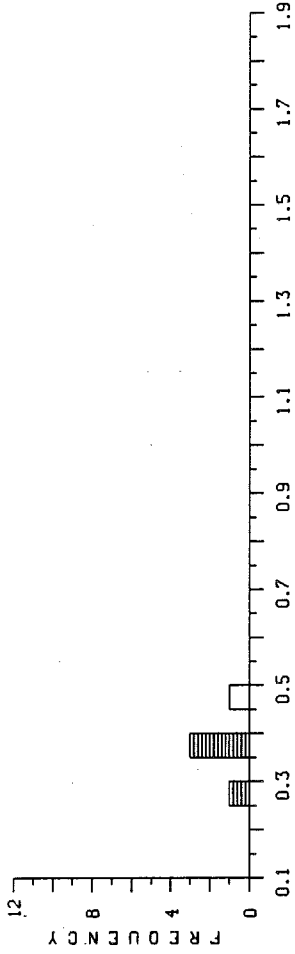


PH1690, 1240-1245M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.28<	.35<	.38<	.39<	.49					

MEAN	.38	.08	.28	.28	.49	1.88	SUM
STAND DEV	.35	.05	.4	.4	.39	1.40	
PTS	5	4	4	4	4	4	
MIN	.28	.28	.28	.28	.28	.28	
MAX	.49	.49	.49	.49	.49	.49	
TOTAL							7.13
EDIT<							4.34

REFLECTANCE HISTOGRAM

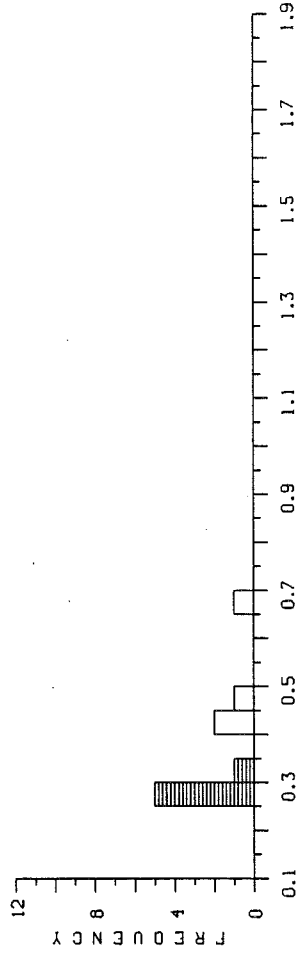


PH1689, 1100-1105M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.25<	.26<	.27<	.27<	.28<	.31<	.41	.46	.68	

MEAN	.36	.14	.25	.25	.68	3.60	SUM
STAND DEV	.27	.02	.06	.06	.31	1.64	
PTS	10	6	6	6	6	6	
MIN	.25	.25	.25	.25	.25	.25	
MAX	.68	.68	.68	.68	.68	.68	
TOTAL							1.64
EDIT<							1.64

REFLECTANCE HISTOGRAM

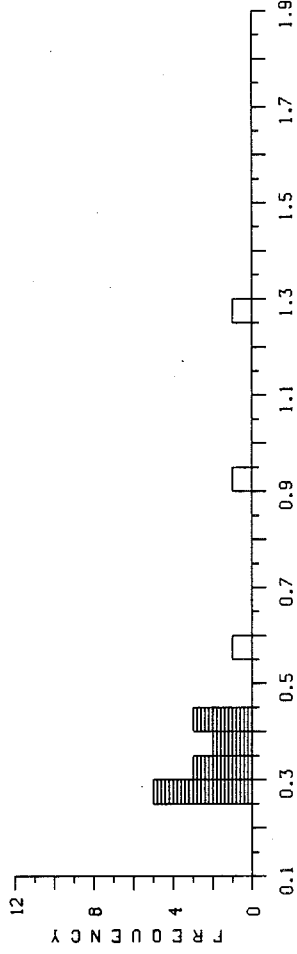


PH1691, 1395-1400M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.26<	.27<	.27<	.28<	.28<	.31<	.34<	.38<	.58<	

MEAN	.45	.28	.16	.26	1.28	7.13	SUM
STAND DEV	.33	.06	.13	.26	.42	4.34	
PTS	16	13	13	13	13	13	
MIN	.26	.26	.26	.26	.26	.26	
MAX	.42	.42	.42	.42	.42	.42	
TOTAL							4.34
EDIT<							4.34

REFLECTANCE HISTOGRAM

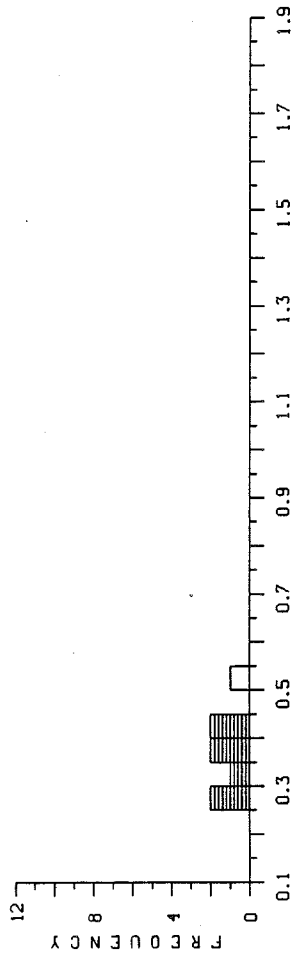


PH1692,1540-1545M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.27<	.28<	.33<	.35<	.36<	.40<	.42<	.50		

MEAN	STAND DEV	PTS	MIN	MAX	SUM
.36	.08	8	.27	.50	2.91
EDIT<	.06	7	.27	.42	2.41

REFLECTANCE HISTOGRAM

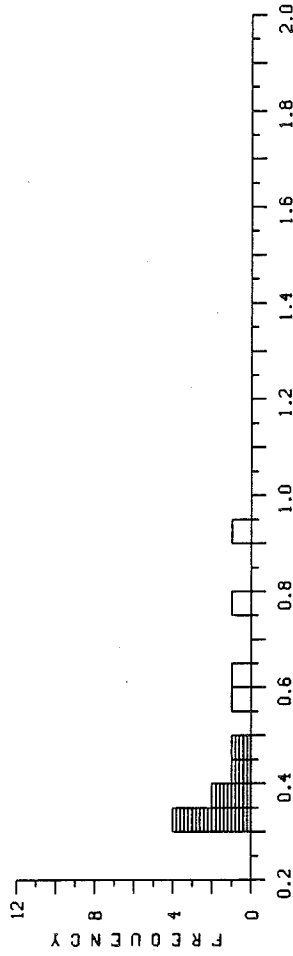


PH1694,1855-1860M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.77	.93	.31<	.34<	.36<	.39<	.44<	.45<	.59	.62

MEAN	STAND DEV	PTS	MIN	MAX	SUM
.49	.20	12	.30	.93	5.84
EDIT<	.37	8	.30	.45	2.93

REFLECTANCE HISTOGRAM

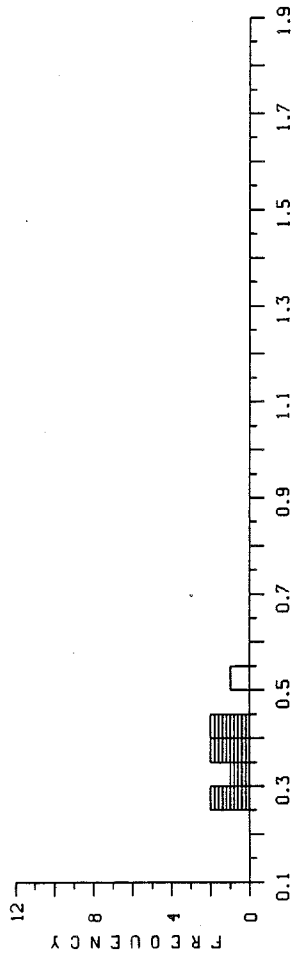


PH1693,1725-1730M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.29<	.36<	.36<	.37<	.38<	.39<	.41<	.44<	.49	.50

MEAN	STAND DEV	PTS	MIN	MAX	SUM
.45	.09	15	.29	.60	6.77
EDIT<	.38	8	.29	.44	3.00

REFLECTANCE HISTOGRAM

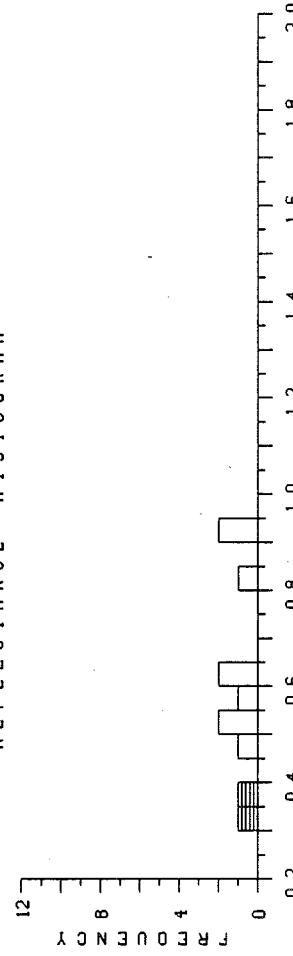


PH1695,2000-2005M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROH	.34<	.37<	.46	.50	.53	.57	.62	.64	.82	.93

MEAN	STAND DEV	PTS	MIN	MAX	SUM
.61	.21	11	.34	.93	6.71
EDIT<	.36	2	.34	.37	.71

REFLECTANCE HISTOGRAM

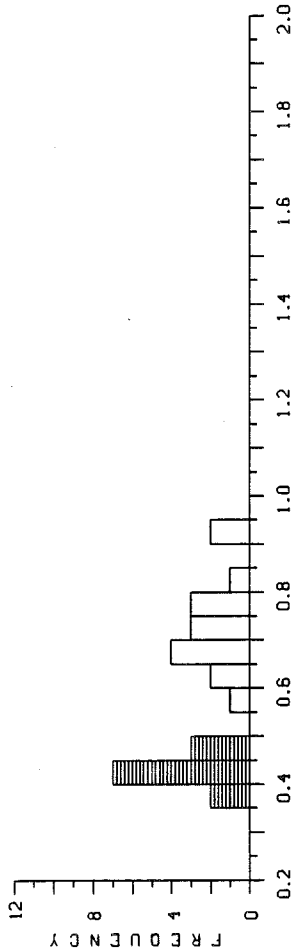


PH1696, 2160-2165M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.35<	.37<	.41<	.42<	.42<	.42<	.44<	.44<	.44<	.46<
1	.47<	.47<	.59	.60	.63	.65	.69	.69	.69	.70
2	.72	.73	.75	.75	.76	.83	.91	.92		

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.60	28	.35	.92	16.72
EDIT<	.43	12	.35	.47	5.11

REFLECTANCE HISTOGRAM

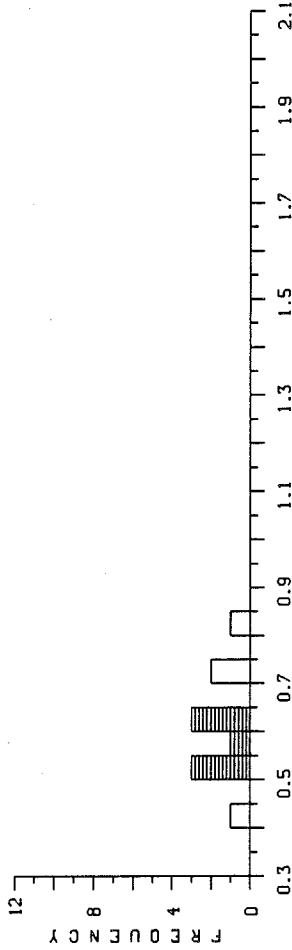


PH1698, 2565-2570M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.44	.50<	.51<	.53<	.56<	.60<	.63<	.64<	.70	.72
1	.80									

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.60	11	.44	.80	6.63
EDIT<	.57	7	.50	.64	3.97

REFLECTANCE HISTOGRAM

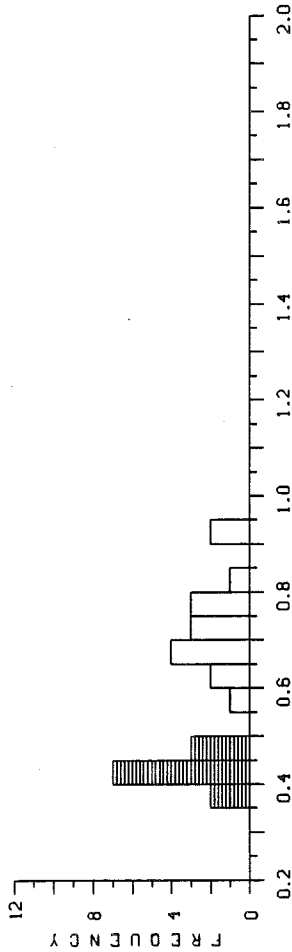


PH1697, 2335-2340M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.39	.41<	.43<	.44<	.44<	.45<	.46<	.46<	.47<	.47<
1	.47<	.48<	.49<	.49<	.50<	.50<	.50<	.50<	.51<	.51<
2	.51<	.53<	.53<	.55<	.56<	.58<	.58<	.59<	.67	.74

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.51	30	.39	.74	15.18
EDIT<	.50	27	.41	.59	13.38

REFLECTANCE HISTOGRAM

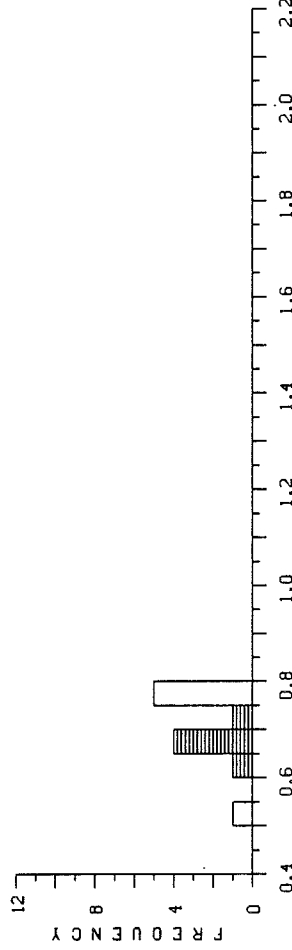


PH1699, 2755-2760M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.51	.61<	.66<	.67<	.69<	.69<	.72<	.75	.76	.76
1	.78	.78								

MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.70	12	.51	.78	8.38
EDIT<	.67	6	.61	.72	4.04

REFLECTANCE HISTOGRAM

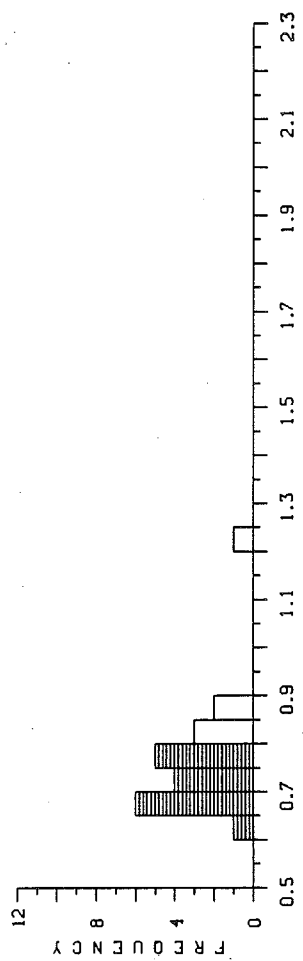


PH1700, 2835-2840M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.62<	.65<	.66<	.66<	.68<	.69<	.69<	.71<	.71<	.72<
1	.73<	.75<	.75<	.78<	.78<	.79<	.82	.82	.84	.86
2	.87	1.20								

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.76	.12	22	.62	1.20	16.78
EDIT<	.71	.05	16	.62	.79	11.57

REFLECTANCE HISTOGRAM

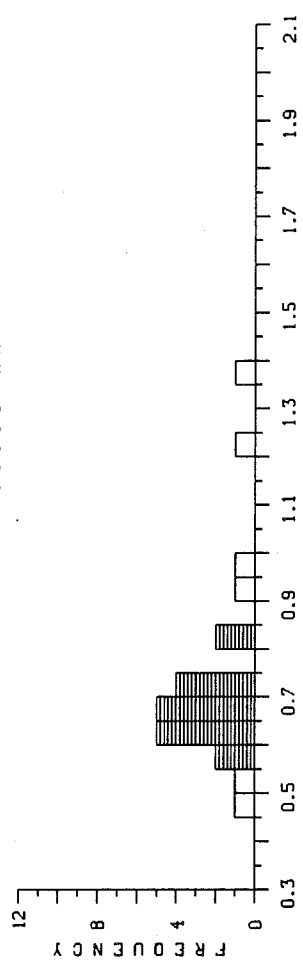


PH1702, 3145-3150M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.49	.51	.57<	.58<	.60<	.61<	.62<	.62<	.63<	.65<
1	.65<	.67<	.67<	.67<	.70<	.73<	.74<	.74<	.80<	.81<
2	.93	.96	1.22	1.39						

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.73	.21	24	.49	1.39	17.56
EDIT<	.67	.07	18	.57	.81	12.06

REFLECTANCE HISTOGRAM

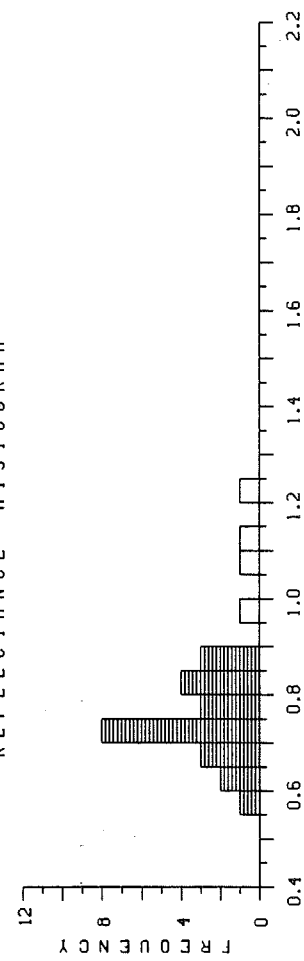


PH1701, 3005-3010M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.59<	.61<	.64<	.68<	.68<	.70<	.70<	.71<	.71<	.72<
1	.72<	.72<	.73<	.74<	.75<	.76<	.76<	.80<	.81<	.83<
2	.84<	.85<	.86<	.89<	.96	1.09	1.14	1.24		

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.79	.15	28	.59	1.24	22.20
EDIT<	.74	.08	24	.59	.89	17.77

REFLECTANCE HISTOGRAM

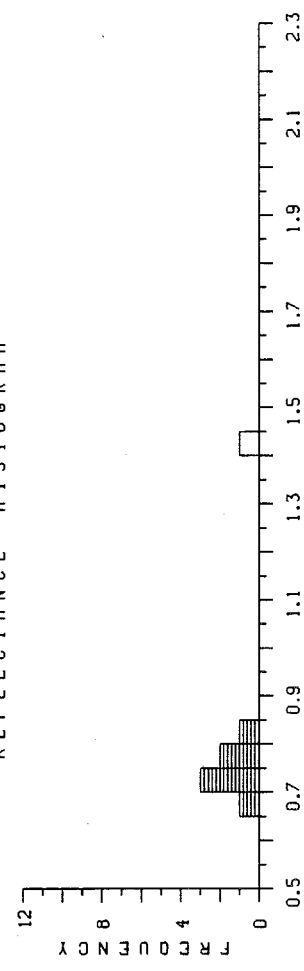


PH1703, 3295-3300M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.68<	.71<	.71<	.74<	.76<	.78<	.81<	.81<	1.43	

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.83	.25	8	.68	1.43	6.62
EDIT<	.74	.05	7	.68	.81	5.19

REFLECTANCE HISTOGRAM

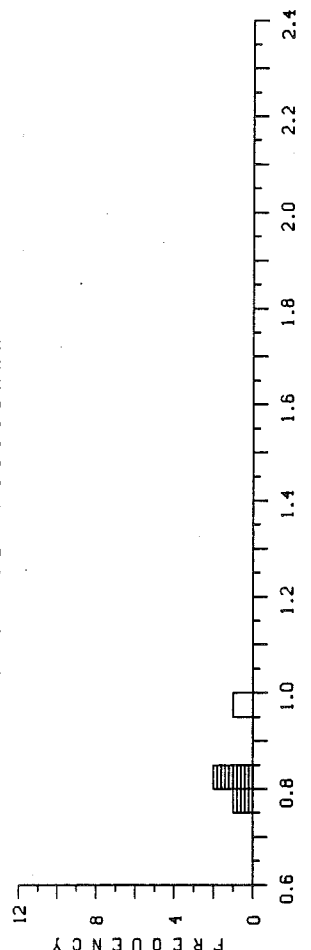


PH1704,3445-3450M,ALMA F-67

COL > 1 2 3 4 5 6 7 8 9 0
 ROW .75< .80< .83< .98

MEAN STAND DEV PTS MIN MAX SUM
 TOTAL .84 .10 4 .75 .98 3.36
 EDIT< .79 .04 3 .75 .83 2.38

REFLECTANCE HISTOGRAM

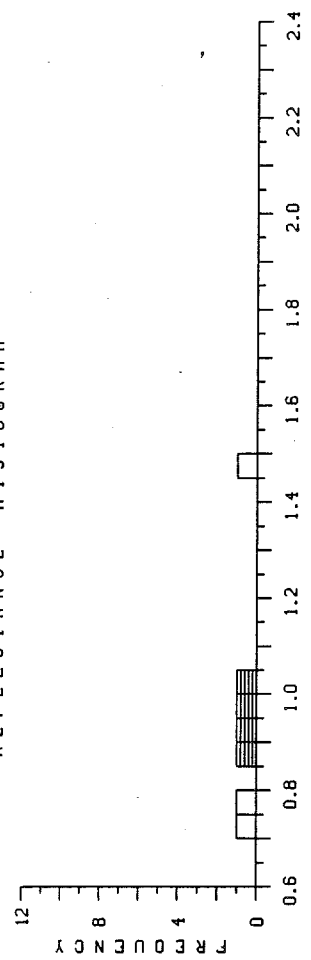


PH1706,3820-3825M,ALMA F-67

COL > 1 2 3 4 5 6 7 8 9 0
 ROW .72 .79 .89< .93< .99< 1.03< 1.45

MEAN STAND DEV PTS MIN MAX SUM
 TOTAL .97 .24 7 .72 1.45 6.80
 EDIT< .96 .06 4 .89 1.03 3.84

REFLECTANCE HISTOGRAM

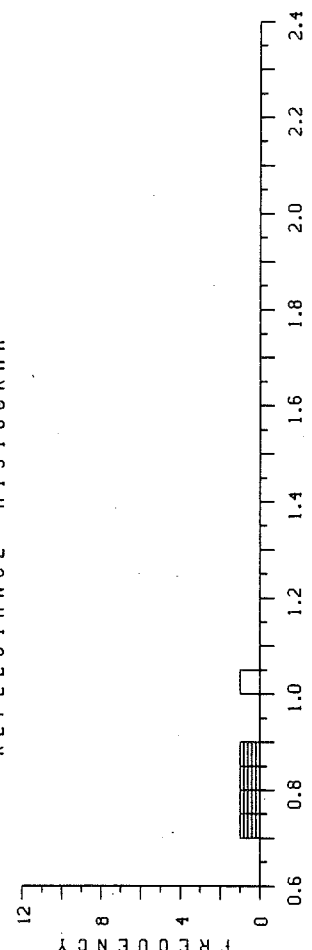


PH1705,3630-3635M,ALMA F-67

COL > 1 2 3 4 5 6 7 8 9 0
 ROW .74< .75< .80< .87< 1.01

MEAN STAND DEV PTS MIN MAX SUM
 TOTAL .63 .11 5 .74 1.01 4.17
 EDIT< .79 .06 4 .74 .87 3.16

REFLECTANCE HISTOGRAM

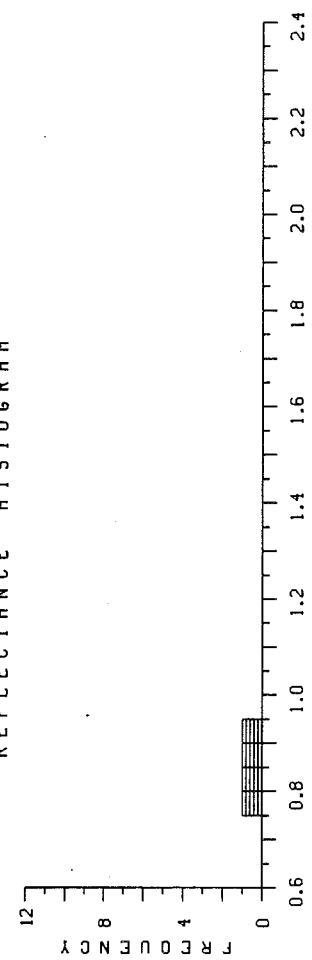


PH1707,3945-3950M,ALMA F-67

COL > 1 2 3 4 5 6 7 8 9 0
 ROW .77< .83< .88< .91<

MEAN STAND DEV PTS MIN MAX SUM
 TOTAL .85 .06 4 .77 .91 3.39
 EDIT< .85 .06 4 .77 .91 3.39

REFLECTANCE HISTOGRAM

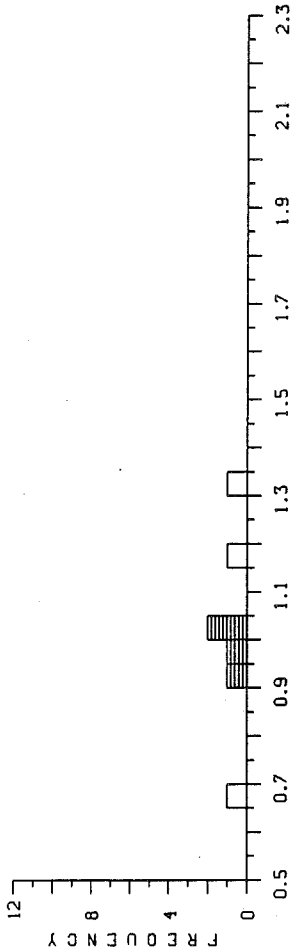


PH1708, 4100-4105M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.67	.92<	.97<	1.01<	1.02<	1.16	1.31			

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.01	.20	7	.67	1.31	7.06
EDIT<	.98	.05	4	.92	1.02	3.92

REFLECTANCE HISTOGRAM

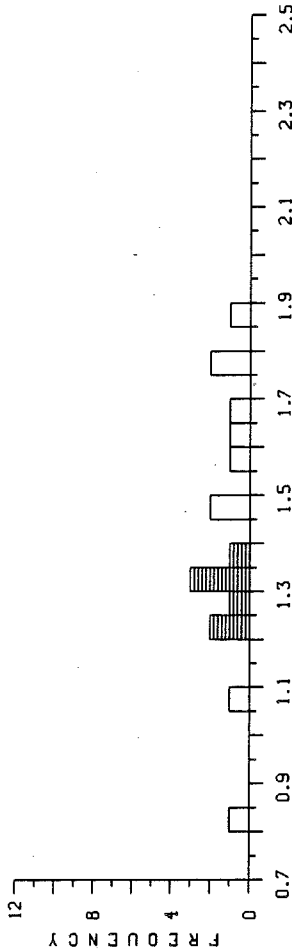


K0769A, 4495-4500M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.83	1.07	1.20<	1.23<	1.26<	1.31<	1.32<	1.34<	1.35<	1.47

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.42	.28	17	.83	1.88	24.16
EDIT<	1.29	.06	7	1.20	1.35	9.01

REFLECTANCE HISTOGRAM

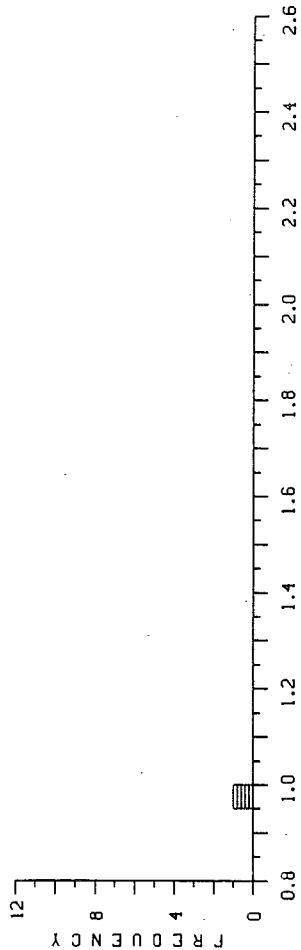


PH1709, 4255-4260M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.99<									

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.99	.00	1	.99	.99	.99
EDIT<	.99	.00	1	.99	.99	.99

REFLECTANCE HISTOGRAM

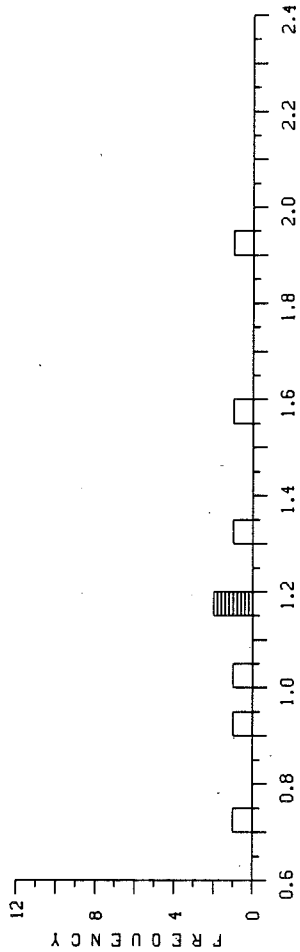


K0769B, 4555-4560M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.73	.90	1.04	1.17<	1.19<	1.31	1.56	1.90		

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.23	.37	8	.73	1.90	9.80
EDIT<	1.18	.01	2	1.17	1.19	2.36

REFLECTANCE HISTOGRAM

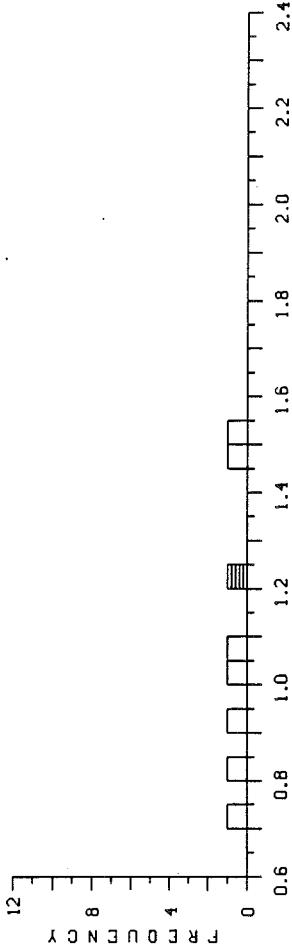


K0769C,4620-4625M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.71	.82	.94	1.00	1.09	1.21<	1.47	1.50		

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.09	.29	8	.71	1.50	8.74
EDIT<	1.21	.00	1	1.21	1.21	1.21

REFLECTANCE HISTOGRAM

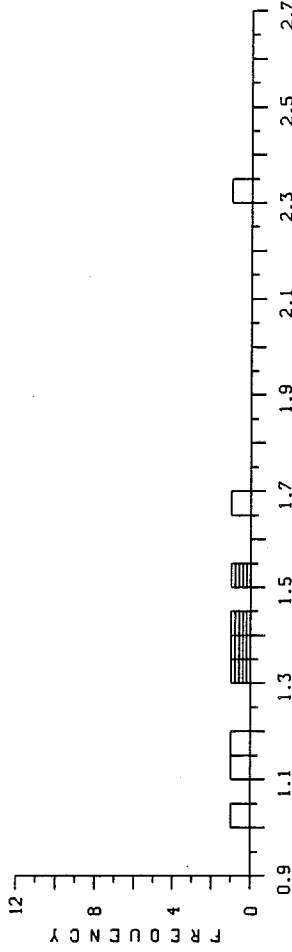


K0770B,4780-4785M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	1.03	1.14	1.15	1.31<	1.37<	1.40<	1.50<	1.66	2.32	

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.43	.39	9	1.03	2.32	12.88
EDIT<	1.40	.08	4	1.31	1.50	5.58

REFLECTANCE HISTOGRAM

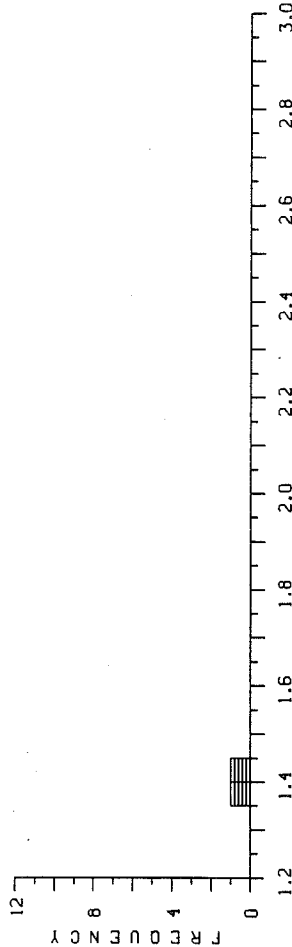


PH1711,4655-4660M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW										

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.39	.02	2	1.37	1.40	2.77
EDIT<	1.39	.02	2	1.37	1.40	2.77

REFLECTANCE HISTOGRAM

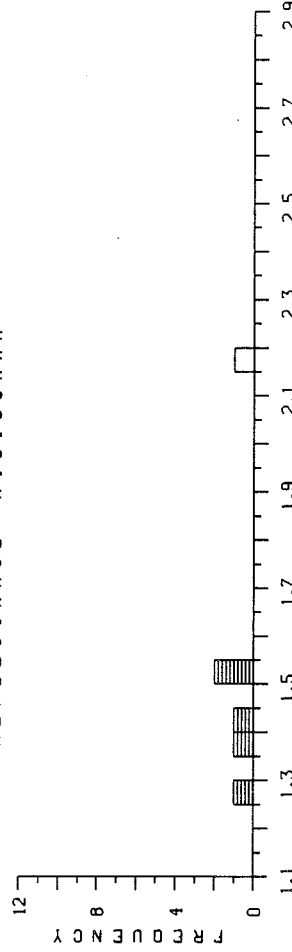


K0770C,4820-4825M,ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW										

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	1.54	.32	6	1.26	2.16	9.25
EDIT<	1.42	.11	5	1.26	1.51	7.09

REFLECTANCE HISTOGRAM

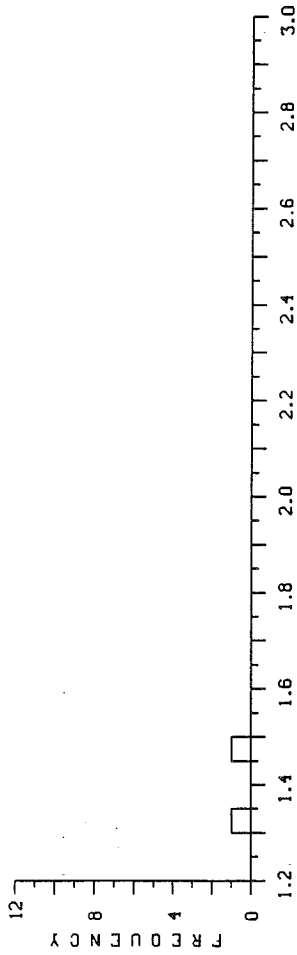


K0771A, 4880-4885M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	1.31<	1.49<								

MEAN	1.40	.13		1.31	1.49	2.80				
STAND DEV			2							
PTS										
MAX										
SUM										
TOTAL										
EDIT<										

REFLECTANCE HISTOGRAM

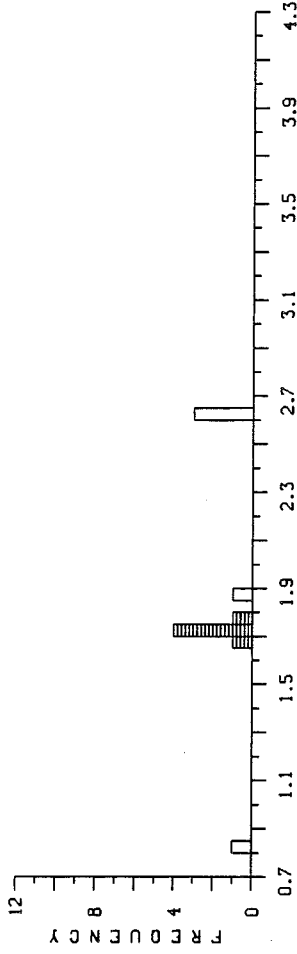


K0771C, 5035-5040M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.84	1.68<	1.72<	1.73<	1.73<	1.74<	1.77<	1.87	2.61	2.63

MEAN	1.90	.54		1.68	1.77	20.95				
STAND DEV			6							
PTS										
MAX										
SUM										
TOTAL										
EDIT<										

REFLECTANCE HISTOGRAM

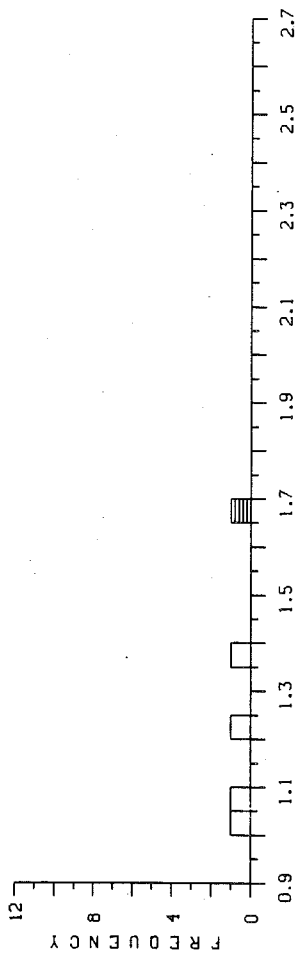


PH1713, 4950-4955M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	1.02	1.09	1.21	1.37	1.67<					

MEAN	1.27	.26		1.02	1.67	6.36				
STAND DEV			5							
PTS										
MAX										
SUM										
TOTAL										
EDIT<										

REFLECTANCE HISTOGRAM



PH1714, 5045-5050M, ALMA F-67

COL >	1	2	3	4	5	6	7	8	9	0
ROW	1.58	1.68<	1.70<	1.77<	1.95	2.33	2.42	2.44		

MEAN	1.98	.36		1.58	2.44	15.87				
STAND DEV			8							
PTS										
MAX										
SUM										
TOTAL										
EDIT<										

REFLECTANCE HISTOGRAM

