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Vitrinite reflectance (Ro) of dispersed organics from Amoco Imperial **Kittiwake P-11**

Report No. EPGS-DOM.1-89MPA

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Atlantic Geoscience Centre, G.S.C., Dartmouth
January 4, 1989

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G.S.C. Locality No.: D079 **Location:** 44°40'49.43"N, 53°31'45.65"W

R.T. Elevation: 85' **Water Depth:** 314' **Total Depth:** 11647'

Sample Interval: 970 - 11647' **Interval Studied:** 2490 - 11590'

Depth Units: Feet referenced to R.T.

Vitrinite reflectance has been determined on 19 rotary cuttings samples (Table II) from Amoco Imperial Kittiwake P-11 which was classified as a wildcat well and is located on the southern Grand Banks approximately 325 km south southwest of St.John's, Newfoundland. The well was plugged and abandoned with an oil and gas show.

Data acquisition and manipulation for this report utilized the Zeiss Photo-multiplier III Zonax system interfaced with a PC AT microcomputer which provides reliable data acquisition and fast statistical summaries.

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)-4325'	0.24 - 0.4	% Ro	immature
4325-6333'	0.4 - 0.5	% Ro	immature approaching maturity
6333-7975'	0.5 - 0.6	% Ro	marginally mature
7975'	0.6	% Ro	onset of significant oil generation
10564'	0.8	% Ro	peak of oil generation
11647' T.D.	0.90	% Ro	within oil window
12573'	(1.0)	% Ro	onset of significant wet gas generation
14214'	(1.2)	% Ro	onset of significant dry gas generation
15274'	(1.35)	% Ro	oil floor

Note: ( ) indicate Ro extrapolated at 0.158 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 analysis (Figure 1, Table II) was good over the section penetrated by Kittiwake P-11. 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 deceivingly small for samples with very few readings. The slope of the maturation line is 0.158 log Ro/km.

Selection of the reflectance population which represented the true maturation of the sediments was aided significantly 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 E.P.G. LITHFILE database which extracts data from digitized CANSTRAT logs.

The vitrinite reflectance data provides evidence that the thermal regime at Kittiwake P-11 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

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Table II

Summary of kerogen - based vitrinite reflectance

Seq. #	Sample #	Depths in feet	Mean Ro (SD) non-rotated	Number of Readings Total	Edited
1	K0398C	2490-2520	0.39(±.06)	41	13
2	K0594A	2620-2650	0.34(±.06)	27	16
3	K0399A	3010-3130	0.29(±.05)	15	11
4	K0399B	3580-3700	0.39(±.03)	21	9
5	K0399C	4120-4150	0.43(±.06)	23	20
6	K0594B	4720-4750	0.43(±.08)	45	39
7	K0400A	5200-5230	0.43(±.12)	6	3
8	K0594C	5980-6010	0.44(±.04)	23	16
9	K0595A	6480-6510	0.50(±.04)	20	10
10	K0595B	6970-7000	0.49(±.08)	38	32
11	K0595C	7310-7340	0.54(±.06)	31	16
12	K0596A	7650-7680	0.60(±.05)	26	7
13	K0596B	8010-8040	0.60(±.06)	35	5
14	K0596C	8470-8500	0.59(±.05)	32	14
15	K0597A	8470-9000	0.70(±.06)	45	33
16	K0597B	9470-9500	0.75(±.05)	33	24
17	K0597C	9970-10000	0.74(±.07)	38	28
18	K0598A	10510-10540	0.73(±.07)	29	26
19	K0598B	11560-11590	1.05(±.04)	20	5

Note: All samples are kerogen concentrate type.

Table III

Formation Tops (Wade, pers. comm.)

Formation	Depth
Pleistocene	in casing
Banquereau	1246'
E. Eocene Chalk	5500-5560'
UNCONFORMITY	5560'
Dawson Canyon	5560'
Petrel Mbr	6763-7100'
Logan Canyon	7310'
Eider Mbr	7310'
UNCONFORMITY	7728'
Missisauga	7728'
Verrill Canyon	8610'
Caprock	10322'
Argo	10433'
T.D.	11647'

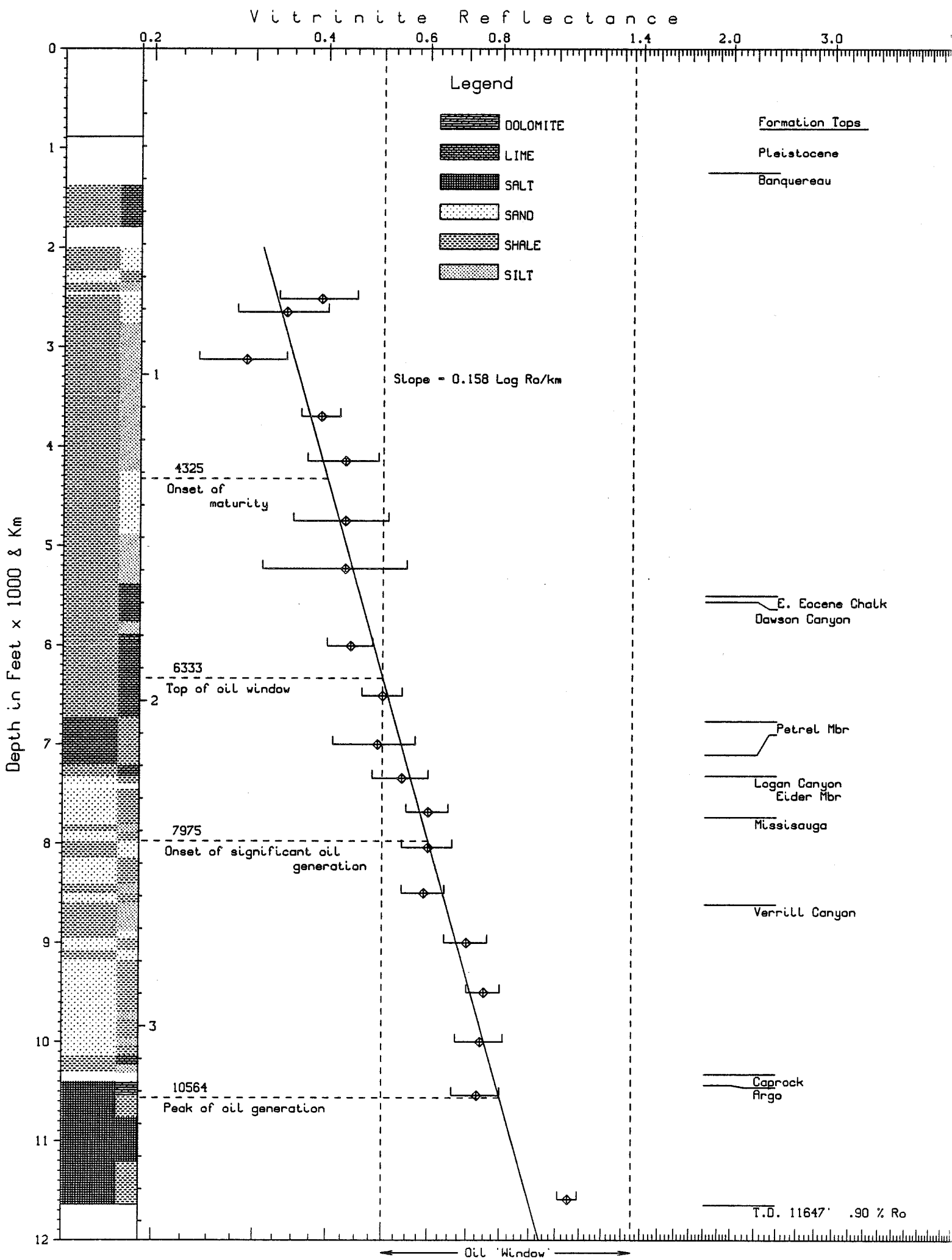


Fig. 1 Kittiwake P-11 < Maturation Profile >

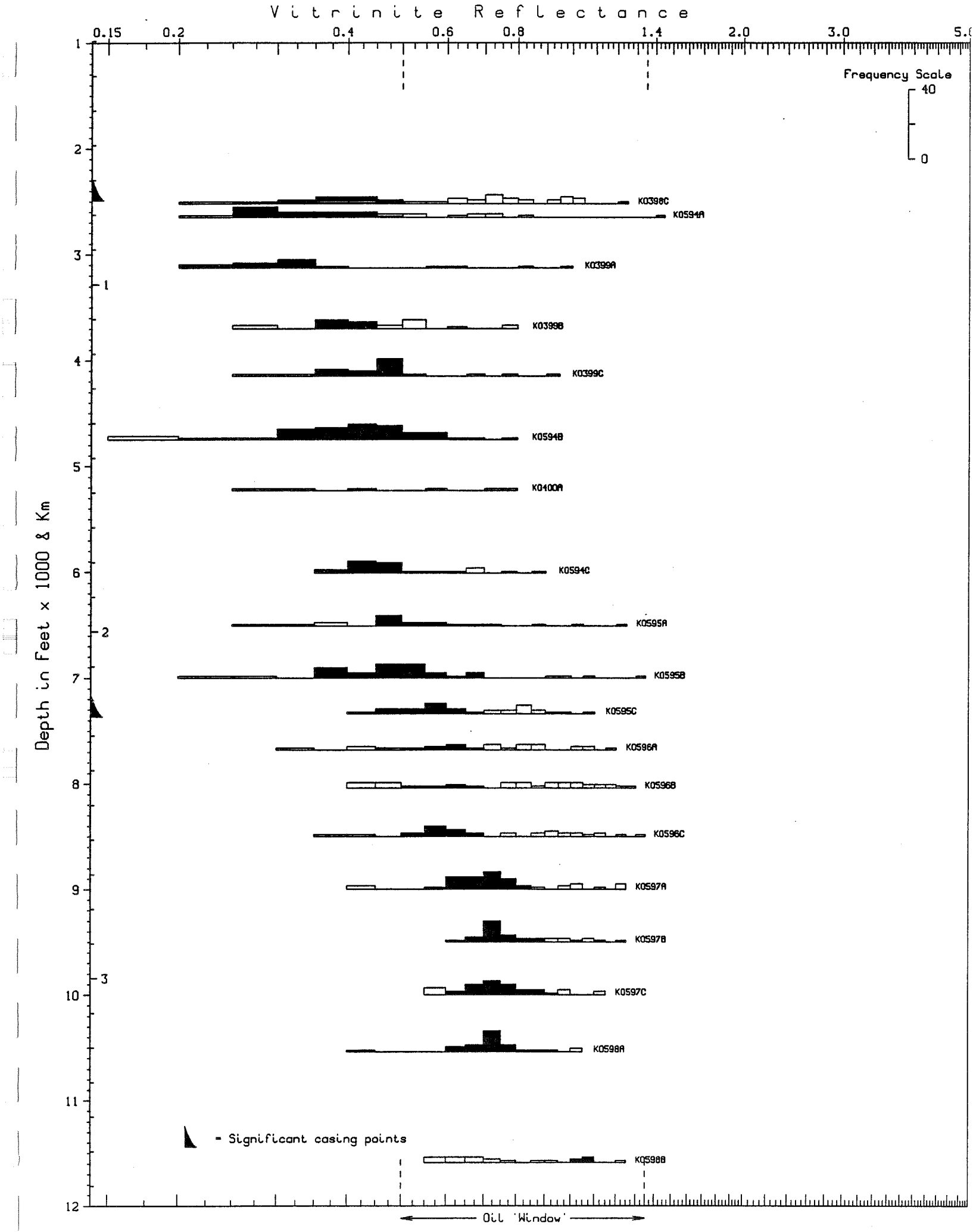


Fig. 2 Kittiwake P-11 < Histograms >

APPENDIX I

Sample Preparation Method

COGLA Lab preparation

Preliminary Wash
Samples dried 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:

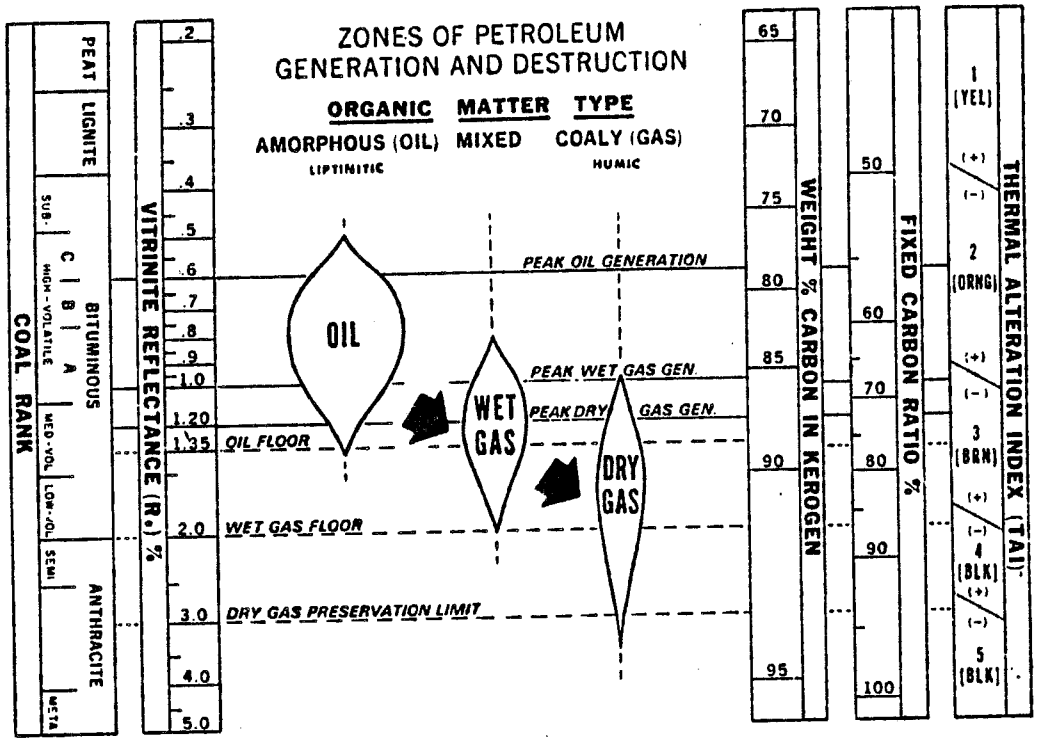
PALYNOLOGY Lab preparation

20-30 grams placed in 250 ml plastic beaker.
Add 10% HC1 till reaction ceases (removes carbonates).
Washed (rinsed) 3 times.
Conc. HF overnight (removes silicates).
Washed (rinsed) 3 times.
Heated (60-65°C) conc. HC1 (remove fluorides caused by HF).
Washed 3 times.
Then put into 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

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: 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 Ro is here used as the 'peak of oil generation' (Table I, Figure 1).

Appendix III

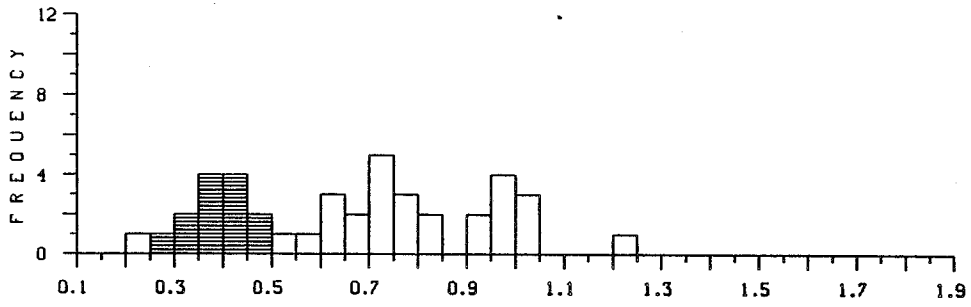
Sample Reports

K0398C,2490-2520',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.21	.29<	.31<	.31<	.36<	.37<	.38<	.39<	.42<	.43<
1	.43<	.44<	.45<	.45<	.51	.56	.60	.63	.64	.65
2	.68	.70	.72	.72	.72	.74	.75	.78	.79	.82
3	.84	.91	.92	.95	.96	.96	.98	1.01	1.03	1.04
4	1.24									

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.66	.25	41	.21	1.24	27.09
EDIT<	.39	.06	13	.29	.45	5.03

REFLECTANCE HISTOGRAM

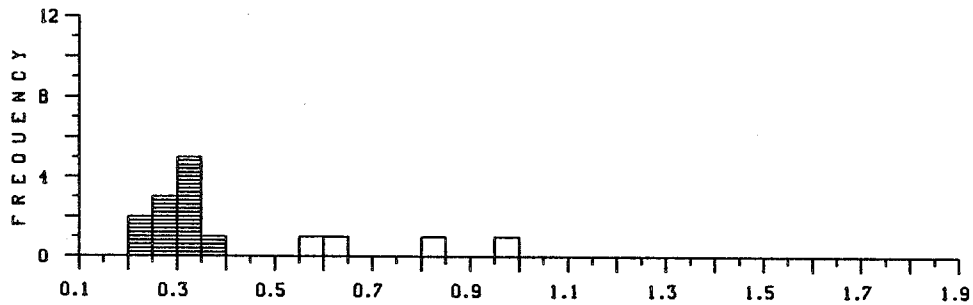


K0399A,3010-3130',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.23<	.23<	.25<	.25<	.29<	.30<	.30<	.31<	.31<	.31<
1	.39<	.59	.64	.80	.96					

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.41	.23	15	.23	.96	6.16
EDIT<	.29	.05	11	.23	.39	3.17

REFLECTANCE HISTOGRAM

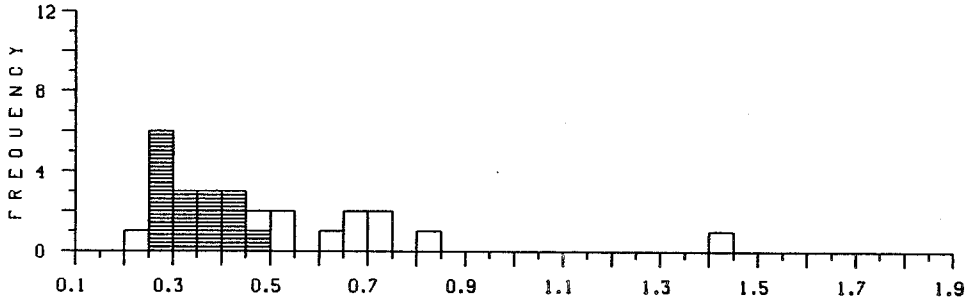


K0594A,2620-2650',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.20	.26<	.27<	.29<	.29<	.29<	.29<	.30<	.32<	.34<
1	.35<	.36<	.36<	.40<	.43<	.44<	.45<	.49	.50	.52
2	.64	.66	.66	.72	.72	.83	1.40			

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.47	.25	27	.20	1.40	12.78
EDIT<	.34	.06	16	.26	.45	5.44

REFLECTANCE HISTOGRAM

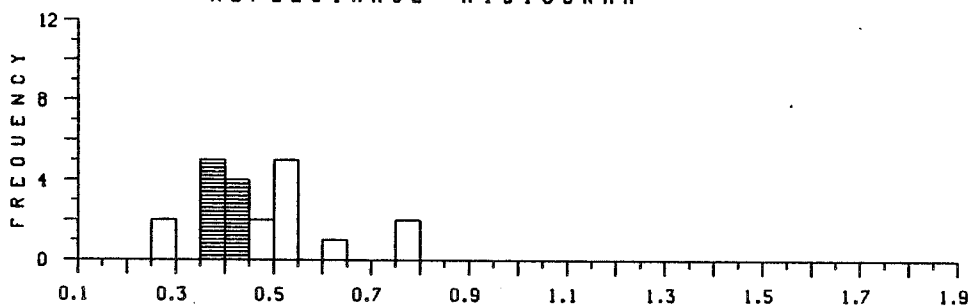


K0399B,3580-3700',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.25	.28	.36<	.37<	.38<	.38<	.38<	.42<	.42<	.42<
1	.42<	.48	.49	.50	.50	.51	.51	.53	.60	.77
2	.79									

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.46	.13	21	.25	.79	9.76
EDIT<	.39	.03	9	.36	.42	3.55

REFLECTANCE HISTOGRAM

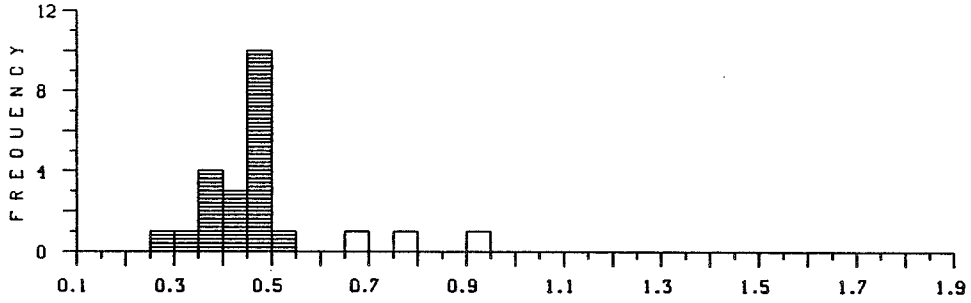


K0399C,4120-4150',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.29<	.32<	.36<	.37<	.39<	.39<	.42<	.42<	.42<	.45<
1	.45<	.45<	.45<	.46<	.47<	.47<	.48<	.49<	.49<	.53<
2	.68	.79	.92							

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.48	.14	23	.29	.92	10.96
EDIT<	.43	.06	20	.29	.53	8.57

REFLECTANCE HISTOGRAM

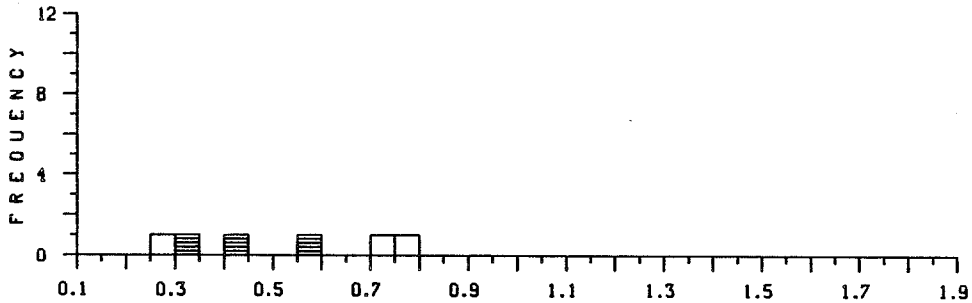


K0400A,5200-5230',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.27	.32<	.43<	.55<	.73	.76				

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.51	.21	6	.27	.76	3.06
EDIT<	.43	.12	3	.32	.55	1.30

REFLECTANCE HISTOGRAM

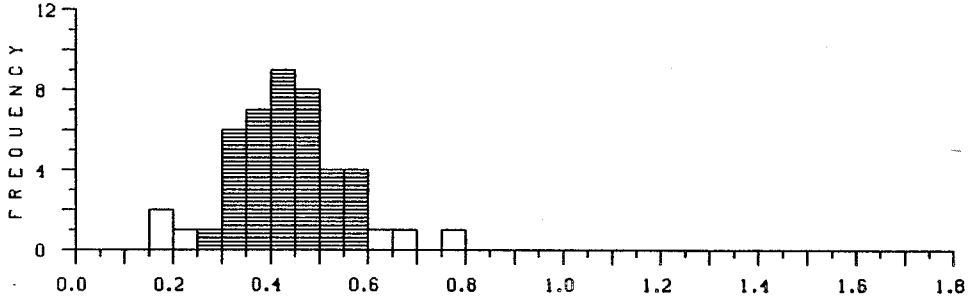


K0594B,4720-4750',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.19	.19	.24	.29<	.30<	.31<	.32<	.32<	.33<	.34<
1	.35<	.35<	.35<	.38<	.38<	.39<	.39<	.41<	.41<	.42<
2	.44<	.44<	.44<	.44<	.44<	.44<	.45<	.47<	.47<	.47<
3	.47<	.48<	.49<	.49<	.52<	.52<	.52<	.54<	.55<	.57<
4	.57<	.59<	.64	.69	.77					

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.43	.12	45	.19	.77	19.57
EDIT<	.43	.08	39	.29	.59	16.85

REFLECTANCE HISTOGRAM

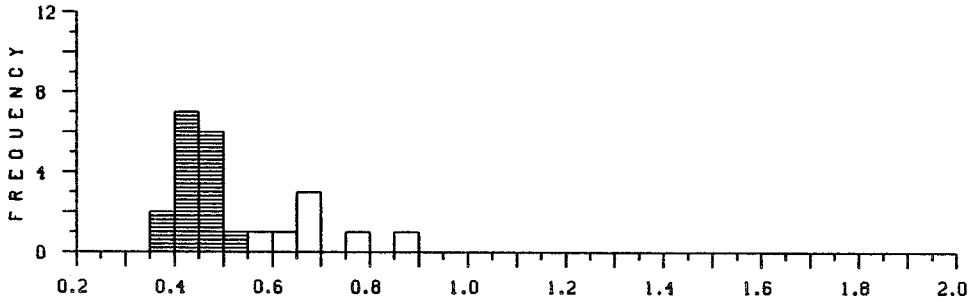


K0594C,5980-6010',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.37<	.38<	.40<	.40<	.41<	.42<	.43<	.44<	.44<	.45<
1	.45<	.47<	.48<	.49<	.49<	.51<	.56	.63	.65	.67
2	.67	.77	.86							

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.51	.13	23	.37	.86	11.84
EDIT<	.44	.04	16	.37	.51	7.03

REFLECTANCE HISTOGRAM

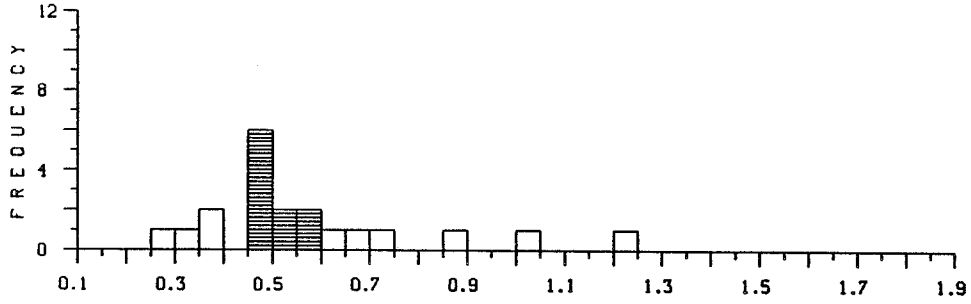


K0595A,6480-6510',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.27	.34	.38	.39	.46<	.47<	.47<	.48<	.48<	.48<
1	.50<	.52<	.55<	.58<	.64	.68	.72	.89	1.04	1.20

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.58	.23	20	.27	1.20	11.54
EDIT<	.50	.04	10	.46	.58	4.99

REFLECTANCE HISTOGRAM

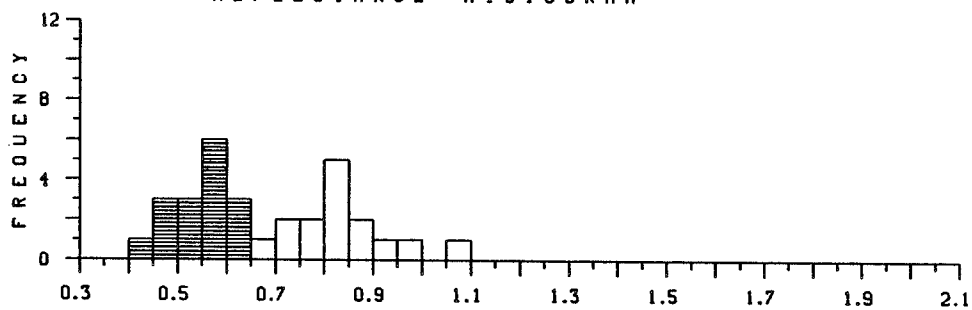


K0595C,7310-7340',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.44<	.45<	.46<	.47<	.51<	.52<	.53<	.55<	.56<	.57<
1	.57<	.57<	.58<	.60<	.61<	.62<	.69	.72	.73	.75
2	.75	.80	.80	.80	.81	.83	.85	.89	.93	.96
3	1.05									

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.68	.17	31	.44	1.05	20.97
EDIT<	.54	.06	16	.44	.62	8.61

REFLECTANCE HISTOGRAM

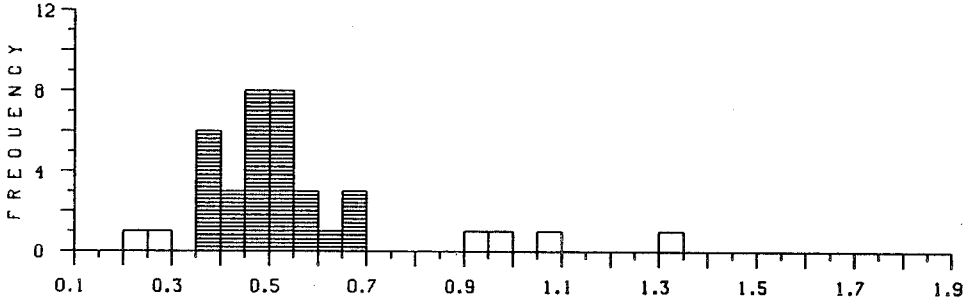


K0595B,6970-7000',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.24	.27	.36<	.37<	.38<	.38<	.38<	.39<	.40<	.42<
1	.44<	.45<	.45<	.46<	.46<	.46<	.46<	.48<	.49<	.50<
2	.50<	.50<	.52<	.52<	.53<	.53<	.54<	.56<	.58<	.59<
3	.60<	.65<	.65<	.66<	.94	.98	1.07	1.32		

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.54	.22	38	.24	1.32	20.48
EDIT<	.49	.08	32	.36	.66	15.66

REFLECTANCE HISTOGRAM

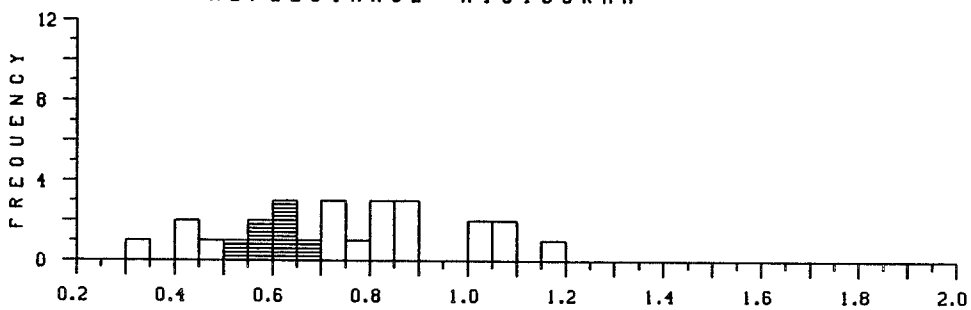


K0596A,7650-7680',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.34	.41	.43	.48	.53<	.56<	.56<	.62<	.63<	.64<
1	.65<	.72	.72	.73	.77	.80	.81	.84	.85	.86
2	.86	1.00	1.04	1.05	1.08	1.15				

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.74	.22	26	.34	1.15	19.13
EDIT<	.60	.05	7	.53	.65	4.19

REFLECTANCE HISTOGRAM

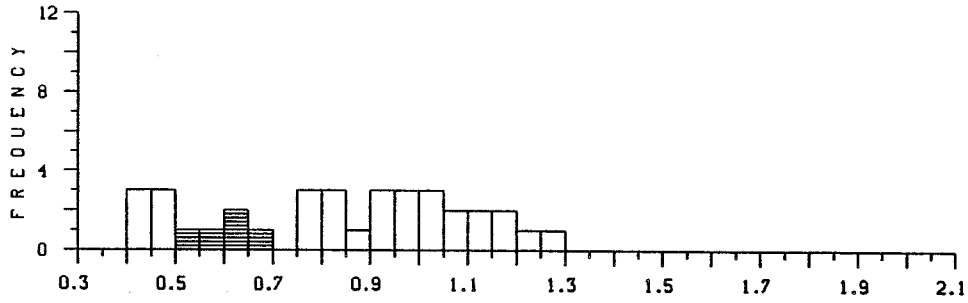


K0596B,8010-8040',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.41	.44	.44	.45	.47	.49	.52<	.57<	.60<	.62<
1	.69<	.76	.79	.79	.80	.82	.84	.85	.90	.91
2	.92	.97	.97	.99	1.01	1.02	1.03	1.08	1.08	1.11
3	1.13	1.17	1.18	1.20	1.29					

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.84	.26	35	.41	1.29	29.31
EDIT<	.60	.06	5	.52	.69	3.00

REFLECTANCE HISTOGRAM

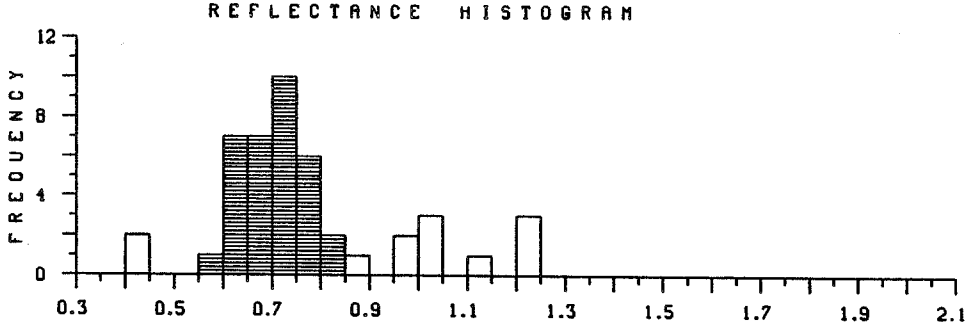


K0597A,8470-9000',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.42	.44	.58<	.60<	.60<	.60<	.61<	.63<	.63<	.64<
1	.65<	.66<	.66<	.66<	.67<	.67<	.68<	.70<	.71<	.71<
2	.72<	.72<	.72<	.73<	.73<	.74<	.74<	.76<	.77<	.77<
3	.77<	.77<	.77<	.80<	.81<	.88	.95	.96	1.01	1.02
4	1.04	1.13	1.22	1.22	1.23					

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.77	.19	45	.42	1.23	34.50
EDIT<	.70	.06	33	.58	.81	22.98

REFLECTANCE HISTOGRAM

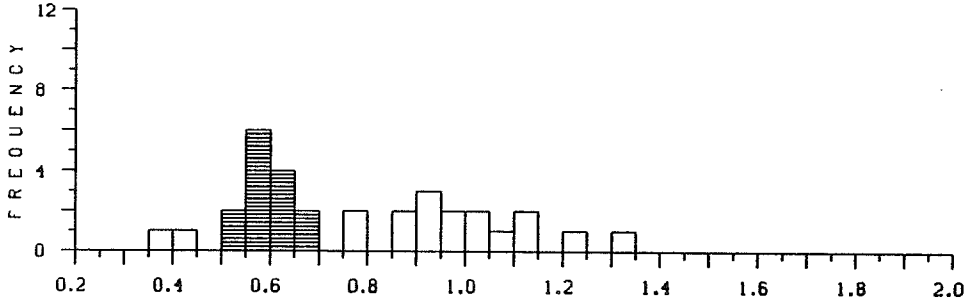


K0596C,8470-8500',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.38	.42	.50<	.54<	.55<	.55<	.56<	.56<	.58<	.58<
1	.60<	.60<	.62<	.62<	.66<	.68<	.75	.76	.86	.87
2	.91	.92	.94	.95	.96	1.00	1.03	1.07	1.11	1.13
3	1.24	1.32								

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.78	.25	32	.38	1.32	24.82
EDIT<	.59	.05	14	.50	.68	8.20

REFLECTANCE HISTOGRAM

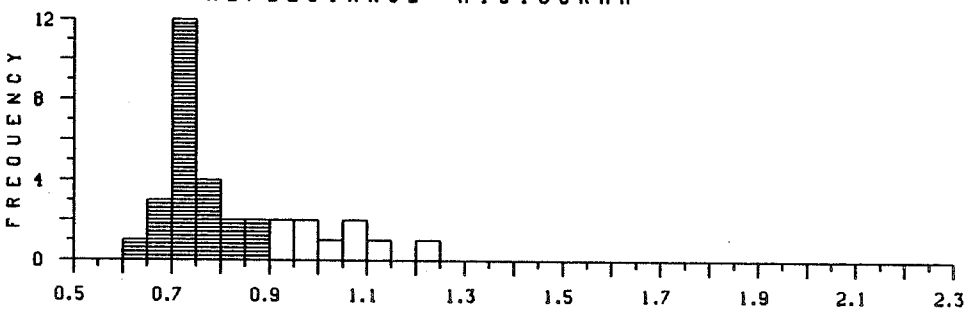


K0597B,9470-9500',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.64<	.69<	.69<	.69<	.70<	.71<	.72<	.72<	.73<	.73<
1	.73<	.74<	.74<	.74<	.74<	.74<	.77<	.77<	.77<	.78<
2	.83<	.84<	.85<	.86<	.91	.92	.97	.99	1.04	1.05
3	1.08	1.10	1.23							

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.82	.15	33	.64	1.23	27.21
EDIT<	.75	.05	24	.64	.86	17.92

REFLECTANCE HISTOGRAM

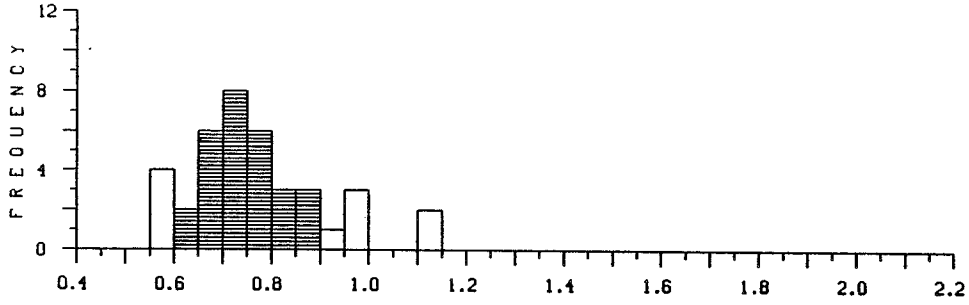


K0597C,9970-10000',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.56	.56	.57	.57	.63<	.64<	.65<	.66<	.67<	.69<
1	.69<	.69<	.71<	.72<	.73<	.73<	.74<	.74<	.74<	.74<
2	.75<	.75<	.76<	.76<	.76<	.77<	.82<	.83<	.84<	.85<
3	.86<	.89<	.94	.95	.96	.98	1.11	1.12		

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.77	.14	38	.56	1.12	29.13
EDIT<	.74	.07	28	.63	.89	20.81

REFLECTANCE HISTOGRAM

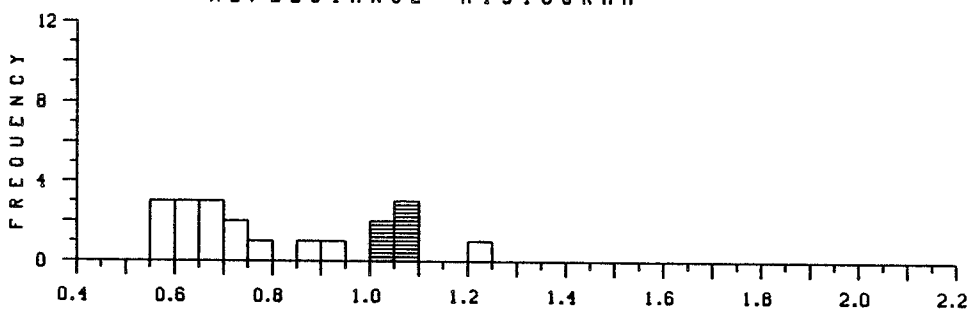


K0598B,11560-11590',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.56	.56	.56	.63	.64	.64	.66	.67	.69	.72
1	.73	.77	.86	.92	1.01<	1.02<	1.07<	1.08<	1.09<	1.24

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.81	.21	20	.56	1.24	16.12
EDIT<	1.05	.04	5	1.01	1.09	5.27

REFLECTANCE HISTOGRAM



K0598A,10510-10540',KITTIWAKE P-11

COL >	1	2	3	4	5	6	7	8	9	0
ROW	.41	.61<	.63<	.63<	.66<	.67<	.68<	.69<	.70<	.71<
1	.71<	.71<	.72<	.72<	.73<	.73<	.74<	.74<	.74<	.74<
2	.76<	.78<	.79<	.79<	.84<	.89<	.92<	1.03	1.03	

	MEAN	STAND DEV	PTS	MIN	MAX	SUM
TOTAL	.74	.12	29	.41	1.03	21.50
EDIT<	.73	.07	26	.61	.92	19.03

REFLECTANCE HISTOGRAM