912

coal

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Petrography Of Pine Pass Coals

DAVID E. PEARSON & ASSOCIATES LTD.

OXIDIZED STANDARD

Petrography Of
Pine Pass Coals

March 1982

Prepared for

Crows Nest Resources Ltd.

David E. Pearson & Associates Ltd.

Consulting Coal Geologists & Petrographers

804 Leota Place

Victoria

British Columbia

V8Y 1H2

David E. Pearson & Associates Ltd.
Consulting Coal Geologists & Petrographers

804 Leota Place, Victoria, B.C. V8Y 1H2 (604) 658-5963

March 28, 1982.

Mr. Tom Cole,
Quality Control Supervisor,
Crows Nest Resources Ltd.,
525-3rd Avenue S.W.,
Calgary,
Alberta,
T2P 2M7.

SUBJECT: Petrography Of Pine Pass Coals.

Dear Tom,

We are pleased to provide you with our report on the petrography of the above-described coals, following completion of our studies. We trust that you will find this information to be satisfactory.
Once again, thank you for the opportunity to be of assistance to you.

Yours truly,

David E. Pearson, Ph.D., P.Eng.

649047
564162

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
DAVID E. PEARSON

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INTRODUCTION

Four coal samples were received at the Coal Laboratory on February 27, 1982. The samples were identified as follows:-

		FSI	VOLS
RDH-PN-~~12-4-81~~ 23-11-81	81-3348	8 ✓	24.02 ✓
RDH-PN-12-4-81	81-3338	8.5 ✓	29.96 ✓
RDH-PN-12-4-81	81-3339	3.0 (5.5)	22.22 ✓
RDH-PN-6-3-81	81-3350	6.5 (9.0)	24.13 ✓

Both samples were over 50% Acetrous

SAMPLE PREPARATION

The coal samples were coned and quartered and reduced to provide sufficient material for two pellets. This coal was then placed in pre-greased, reuseable METSERV 25 mm plastic moulds. Cold-set epoxy resin, to which had been added a portion of hardener, was then mixed with the coal and allowed to set. This is the preferred method of sample preparation for all ranks of coal, as it does not affect the reflectance of vitrinites nor the fluorescence of exinites. The pellets were subsequently ground and polished on Beuhler equipment.

PETROGRAPHIC EXAMINATION

The polished samples were examined using a Leitz Orthoplan Compact-model microscope-photometer, the control panel of which is interfaced to a Hewlett-Packard 85 microcomputer, an Epson MX-80 printer and a Hewlett-Packard 7225A plotter, for electronic computation, tabulation and draughting of results.

One hundred individual vitrinite 'A' grains were measured on each of two pellets for reflectance in the rank analysis. Standardization of photometer-readout was performed before the analysis and after every twenty-five readings. Maximum reflectance values were retained by the computer.

Five hundred grains per pellet were counted during the maceral analysis, at a traverse interval of 0.5 mm. The maceral, semifusinite, deserves special mention because of its peculiar thermorheological behavior. In this report, two approaches were used to identify reactive semifusinite.

The first approach, is that used by the CANMET Laboratories

in Ottawa, and was developed by them (Carr & Jorgensen 1975). For coals that have a large proportion of total semifusinite (30%+), it was found that by assigning 50% of that total to the reactive category, a better correlation was obtained for predicted coke strength, versus measured coke strength. Although the method is entirely empirical, it gives satisfactory results. In the Appendix, this method of assigning reactive semifusinite is described as that of CANMET.

The second method used to deal with semifusinite is based on some recent research work done at RHURKOHLE, Essen, West Germany, on coking coals from Elco and Saxon properties in British Columbia (Koensler,1980). The results of this research showed that semifusinite, with a maximum reflectance 0.2% above the mean maximum reflectance of the associated vitrinite 'A', did not melt during carbonization. In contrast, semifusinites with reflectances up to vitrinite 'A' Romax + 0.2%, did melt.

The reflectance was measured of each semifusinite maceral encountered during the maceral analysis, and depending upon the result, was assigned to the inert or reactive category. In the Appendix, this method of assigning rective semifusinite is described as that of KOENSLER.

Experience in this Laboratory shows that the CANMET method predicts a more reactive coal than the KOENSLER method. Both approaches are used in this report so that you may choose which technique is preferable for Pine Pass coals.

At the end of one hundred readings, maceral data were input to the computer; at the end of one thousand readings, the mean, standard deviation, variance and a correction for the mineral-matter content were electronically computed and printed.

RESULTS

The results of all analyses are contained in table form in Appendix A. The individual readings made in the reflectance analysis are listed together with the basic statistics and computer-generated histograms of the reflectance data in Appendix B. Maceral data and basic ststistics are contained in Appendix C, together with pie-diagrams, showing the maceral distribution of the samples using both the CANMET

and the KOENSLER methods.

STATISTICAL ANALYSIS

A) Reflectance Data -

The standard error of the mean of the Romax readings is given for each sample in the Basic Statistics in Appendix B, and is tabulated below.

Standard error of the mean	0.00%	0.01%	0.02%	0.03%
Number of samples (2 per sample)	4	4		

It is worth noting that a standard error of the mean of 0.02% is reported as acceptable by M.T.Mackowsky in Stach's "Textbook of Coal Petrology".

Similarly, the spread of the readings is given by the standard deviation, which is a measure of frequency of readings about the mean. One standard deviation contains 68% of all the readings. For the data presented in this report, the following apply:-

One standard deviation	0.03%	0.04%	0.05%	0.06%	0.07%
Number of samples (2 per sample)		1	4	2	1

Stach's "Textbook of Coal Petrology", and the "Handbook of the International Committee for Coal Petrology", both show histograms with Romax standard deviations of 0.06%.

B) Maceral Data -

Standard deviations of the various macerals are:-

Vitrinite		3.60	5.89
Exinite		0.70	1.71
Reactive S-F	(C)	1.49	3.06
	(K)	1.66	3.69
Total Reactives	(C)	2.29	3.06
	(K)	2.75	6.60

....4

Macrinite		0.42	0.70
Inert S-F	(C)	1.49	3.06
	(K)	2.42	6.19
Fusinite		0.53	1.16
Inertodetrinite		0.95	2.25
Total Inerts	(C)	2.29	3.06
	(K)	3.06	6.60

No published data are available on the variation in maceral data from other laboratories.

DISCUSSION

The vitrinite reflectance data indicate that the rank of the coal is medium volatile bituminous, with Sample 81-3338 close to high volatile bituminous rank.

Although three of the coals appear to be rich in vitrinite, and therefore would be expected to behave like reactive-rich coals, we believe that some of the vitrinite could be inert. Each of the coals has a small proportion of fluted, or slit-eyed vitrinite, which is reminiscent of "Pseudovitrinite", a variety of vitrinite that behaves like an inert maceral. Pseudovitrinite was described first in coals from the Appalachian area (Benedict,1968), but it is not very common in western Canadian Rocky Mountain coals.

There are two problems with pseudovitrinite:-

1. First, the correct identification of pseudovitrinite is difficult because it is based on two imprecise criteria; the occurence of slit-like openings, and a reflectance 0.025% higher than the associated normal vitrinite.

2. Second, correctly identified pseudovitrinite may be either reactive or inert, and its assignment to the inert category should be confirmed by study of chars.

In the Results of Petrographic Analysis in the Appendix, we have included pseudo vitrinite with the normal vitrinite, because at this stage we do not know its thermorheological nature. It is possible however, that all of the pseudovitrinite is inert. The following are the percentages of vitrinite recorded:-

Sample #	Normal Vitrinite	Pseudovitrinite	Total Vitrinite
81-3338	67.64	10.11	77.75
81-3339	36.99	7.57	44.56
81-3348	61.37	9.99	71.36
81-3350	56.94	10.84	67.78

The predicted FSI's and volatile matter yield are shown in Figures 1 and 2, based on the data shown in the Appendix. Should these values be widely divergent from the actual values obtained, then it may be that the pseudovitrinite is inert.

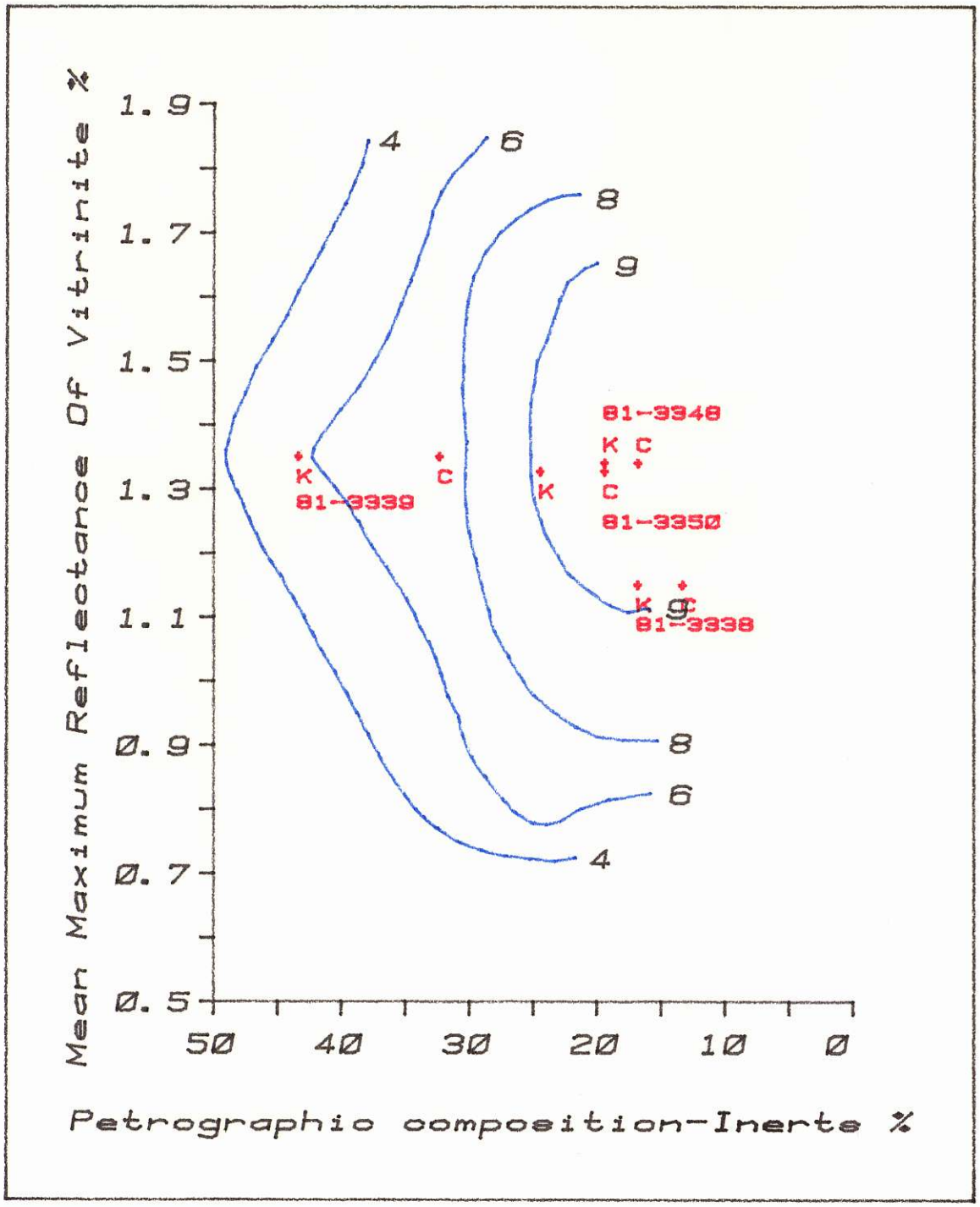


FIGURE 1. Predicted FSI Values.

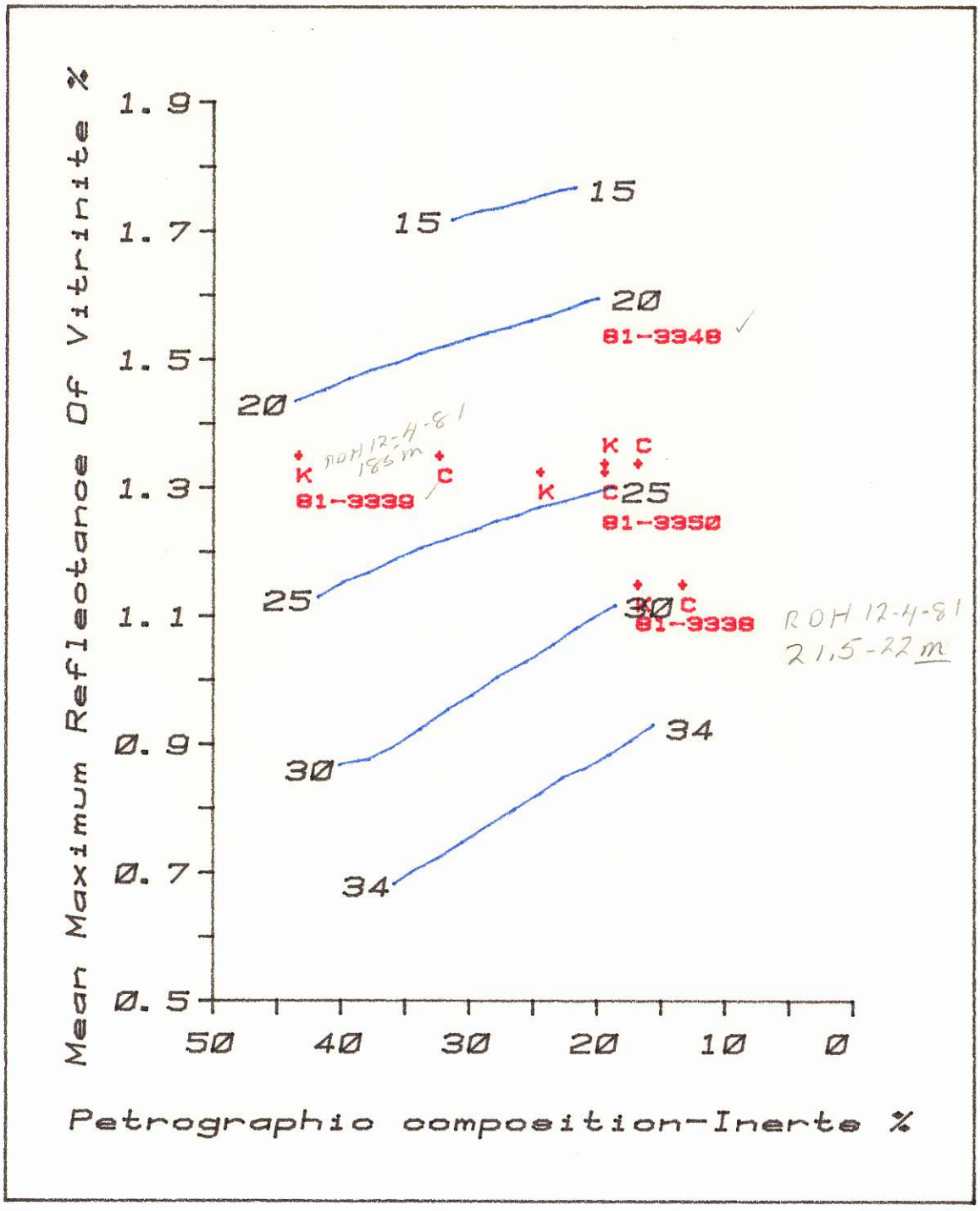


FIGURE 2. Predicted Volatile-Matter Yields.

APPENDIX A.

RESULTS OF PETROGRAPHIC ANALYSIS

IDENTIFICATION				
Description.....	81-3338		81-3339	
Pellet.....	1	2	1	2
DISTRIBUTION OF VITRINITE TYPES				
V-6.....%				
V-7.....%				
V-8.....%				
V-9.....%				
V-10.....%	32	30		
V-11.....%	63	61	4	3
V-12.....%	5	9	34	47
V-13.....%			50	46
V-14.....%			12	4
V-15.....%				
V-16.....%				
V-17.....%				
REACTIVE COMPONENTS				
(K) Koensler (C) Canmet	K	C	K	C
Total Vitrinite.....%	77.75		44.56	
Reactive Semifusinite.....%	3.19	6.96	11.91	23.43
Exinite.....%	2.51		0.38	
Total Reactives.....%	83.45	87.22	566.86	68.38
INERT COMPONENTS				
Inert Semifusinite.....%	10.73	6.96	34.96	23.43
Macrinite.....%	0.39		0.86	
Fusinite.....%	0.48		1.25	
Inertodetrinite.....%	1.64		2.11	
Mineral-Matter.....%	3.30		3.966	
Total Inerts.....%	16.55	12.78	43.14	31.96
PETROGRAPHIC INDICES				
Mean Reflectance.....%	1.12	1.13	1.31	1.30
Balance Index.....	0.52	0.39	2.81	1.65
Strength Index.....	4.21	4.14	5.17	5.26
Stability Index.....	54	50	48	59

RESULTS OF PETROGRAPHIC ANALYSIS

IDENTIFICATION				
Description.....	81-3348		81-3350	
Pellet.....	1	2	1	2
DISTRIBUTION OF VITRINITE TYPES				
V-6.....%				
V-7.....%				
V-8.....%				
V-9.....%				
V-10.....%				
V-11.....%				4
V-12.....%	27	16	35	23
V-13.....%	65	75	64	60
V-14.....%	8	9	1	13
V-15.....%				
V-16.....%				
V-17.....%				
REACTIVE COMPONENTS				
(K) Koensler (C) Canmet	K	C	K	C
Total Vitrinite.....%	71.36		67.78	
Reactive Semifusinite.....%	9.05	11.83	6.59	11.89
Exinite.....%	0.39		1.62	
Total Reactives.....%	80.80	83.57	75.99	81.29
INERT COMPONENTS				
Inert Semifusinite.....%	14.60	11.83	17.18	11.89
Macrinite.....%	0.68		0.19	
Fusinite.....%	0.58		0.19	
Inertodetrinite.....%	0.68		1.91	
Mineral-Matter.....%	2.65		4.53	
Total Inerts.....%	19.20	16.43	24.01	18.71
PETROGRAPHIC INDICES				
Mean Reflectance.....%	1.33	1.34	1.31	1.33
Balance Index.....	0.91	0.77	1.16	0.89
Strength Index.....	5.69	5.82	5.52	5.73
Stability Index.....	65+	65+	65+	65+

APPENDIX B.

VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3338
Pellet #1

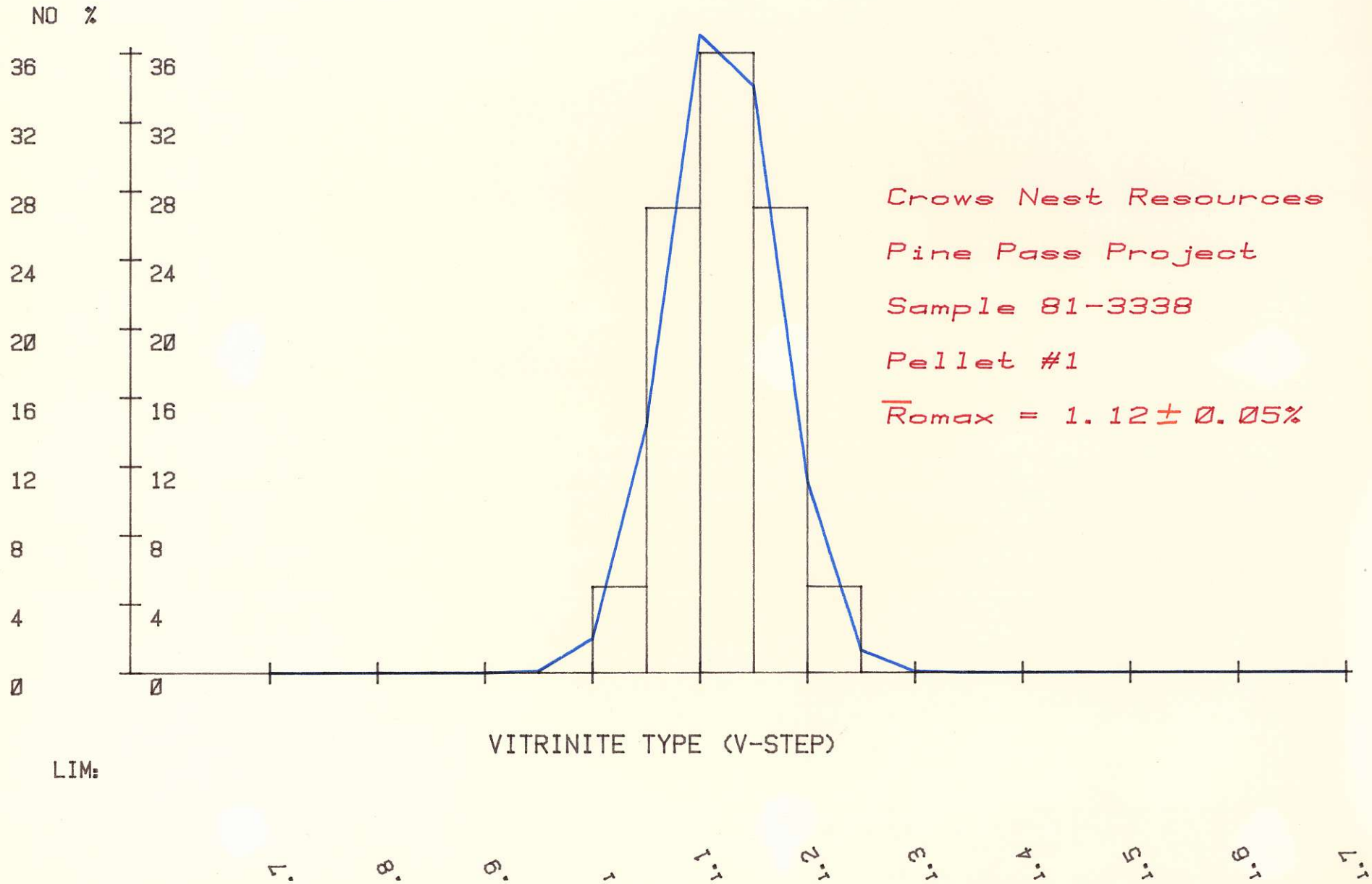
I	X(I)	X(I+1)
1	1.1200	1.1300
3	1.0800	1.1400
5	1.1000	1.1900
7	1.0800	1.1500
9	1.1200	1.0100
11	1.1900	1.0500
13	1.0400	1.1100
15	1.0900	1.0800
17	1.0900	1.1500
19	1.1400	1.0900
21	1.0800	1.1100
23	1.0900	1.0900
25	1.1300	1.1100
27	1.1600	1.1200
29	1.0700	1.2400
31	1.1500	1.1600
33	1.1100	1.1200
35	1.0300	1.0900
37	1.0500	1.2100
39	1.1500	1.0800
41	1.1000	1.1300
43	1.0800	1.1600
45	1.1200	1.0100
47	1.1100	1.2400
49	1.1400	1.0600
51	1.1900	1.1300
53	1.1900	1.0800
55	1.0500	1.1500
57	1.0600	1.1600
59	1.2300	1.1600
61	1.1200	1.1700
63	1.0800	1.1100
65	1.1100	1.1200
67	1.1400	1.1700
69	1.1700	1.1200
71	1.2300	1.0500
73	1.1500	1.0700
75	1.1400	1.1400
77	1.0600	1.1000
79	1.1200	1.0600
81	1.1500	1.1400
83	1.1600	1.1600
85	1.1900	1.0800
87	1.1500	1.1600
89	1.0700	1.1000
91	1.1000	1.1900
93	1.1900	1.0900
95	1.1700	1.1400
97	1.1200	1.0400
99	1.1200	1.1000

CROWS NEST RESOURCES LTD.
Pine Pass 81-3338
Pellet #1

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .00
MEAN = 1.1210
COEF OF VARIATION = 4.39%
VARIANCE = .0024
STANDARD DEVIATION = .0492
SKEWNESS = .1691
KURTOSIS = 2.8322

95.00% C.I. FOR MEAN:
(1.1112, 1.1308)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



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VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3338
Pellet #2

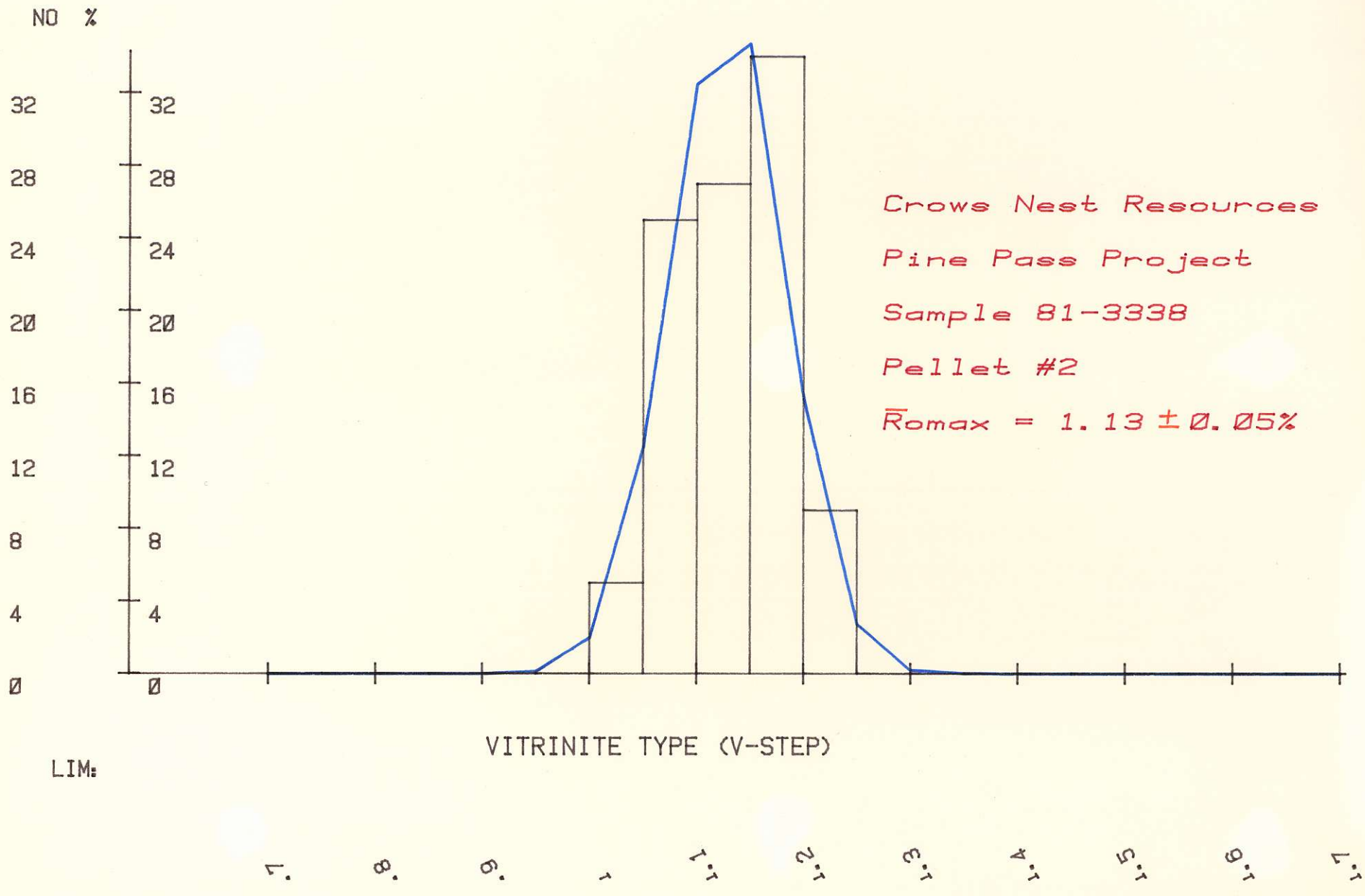
I	X(I)	X(I+1)
1	1.1000	1.2400
3	1.1500	1.0700
5	1.1200	1.1600
7	1.1500	1.0700
9	1.1800	1.1600
11	1.1400	1.1500
13	1.1000	1.1500
15	1.1400	1.0900
17	1.1400	1.1000
19	1.1200	1.0400
21	1.1800	1.1700
23	1.1400	1.0800
25	1.2300	1.1800
27	1.0900	1.1400
29	1.1800	1.1500
31	1.0900	1.1500
33	1.1500	1.0800
35	1.1300	1.0600
37	1.1100	1.0700
39	1.1800	1.1300
41	1.0900	1.0200
43	1.1100	1.1400
45	1.0500	1.1100
47	1.1800	1.1800
49	1.2200	1.2000
51	1.1400	1.0600
53	1.0700	1.1700
55	1.1200	1.2400
57	1.1100	1.1500
59	1.1100	1.2400
61	1.1800	1.0900
63	1.1500	1.0600
65	1.0600	1.1600
67	1.1500	1.0600
69	1.0800	1.0200
71	1.1100	1.0500
73	1.1800	1.2000
75	1.1600	1.1800
77	1.2100	1.0400
79	1.2200	1.1900
81	1.1300	1.1100
83	1.1100	1.0600
85	1.1500	1.1600
87	1.0900	1.1900
89	1.0700	1.0700
91	1.0200	1.1600
93	1.1600	1.0900
95	1.0700	1.1900
97	1.1000	1.1000
99	1.1400	1.1800

CROWS NEST RESOURCES LTD.
Pine Pass 81-3338
Pellet #2

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .01
MEAN = 1.1287
COEF OF VARIATION = 4.70%
VARIANCE = .0028
STANDARD DEVIATION = .0530
SKEWNESS = .0068
KURTOSIS = 2.3354

95.00% C.I. FOR MEAN:
(1.1182, 1.1392)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



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VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3339
Pellet #1

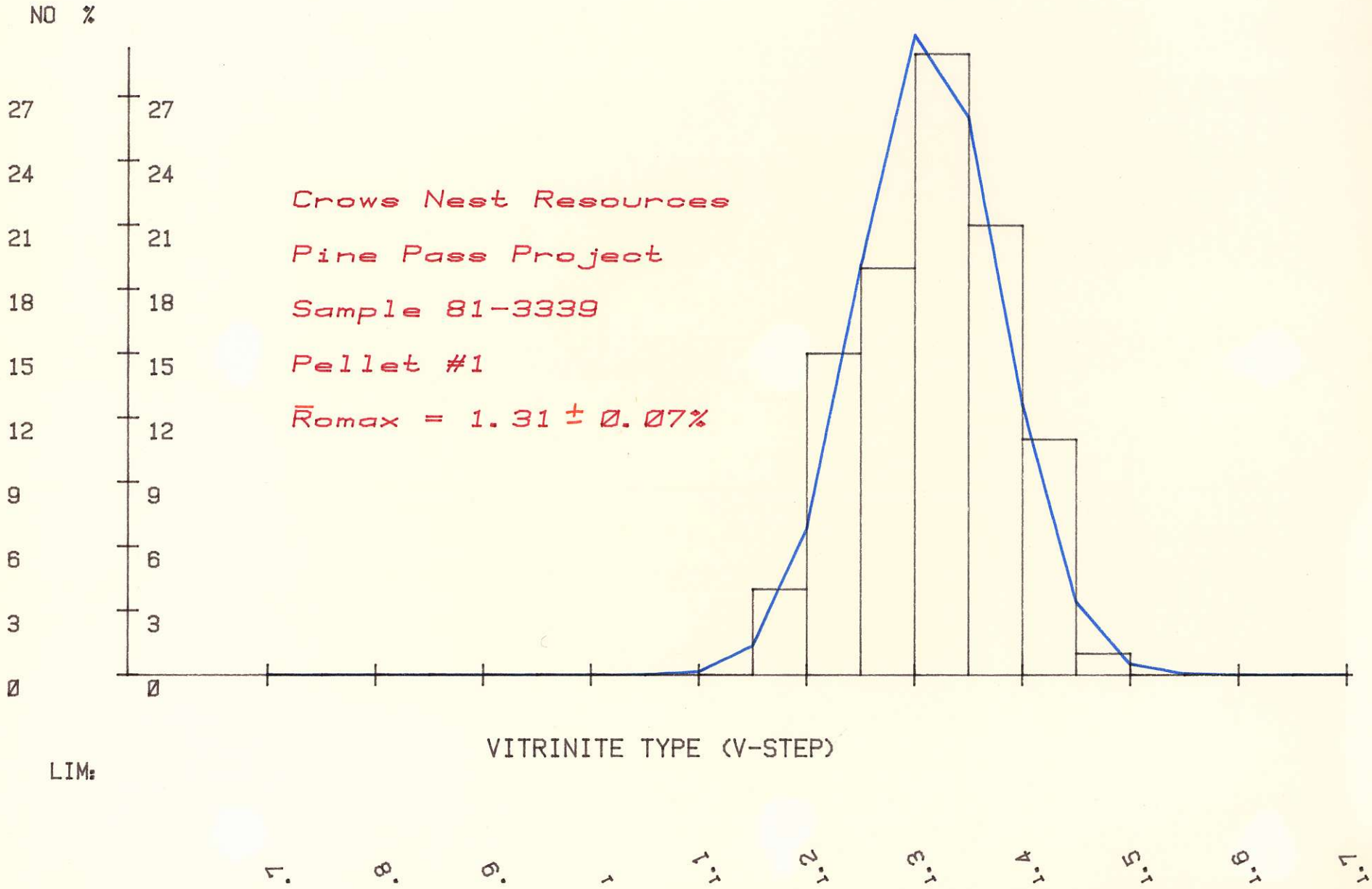
I	X(I)	X(I+1)
1	1.3500	1.3400
3	1.3900	1.2200
5	1.3100	1.3200
7	1.2800	1.3000
9	1.3500	1.2800
11	1.2900	1.3100
13	1.3900	1.3500
15	1.3700	1.3400
17	1.3800	1.3600
19	1.2700	1.3100
21	1.3700	1.4300
23	1.3200	1.3800
25	1.3200	1.3200
27	1.2300	1.2600
29	1.3100	1.4600
31	1.3700	1.2400
33	1.3100	1.2700
35	1.4100	1.2700
37	1.3400	1.2300
39	1.3900	1.3400
41	1.3000	1.3300
43	1.3000	1.3300
45	1.4200	1.2600
47	1.3500	1.3000
49	1.2700	1.4400
51	1.3300	1.3700
53	1.4000	1.3300
55	1.1900	1.3500
57	1.3300	1.3600
59	1.2400	1.4000
61	1.4100	1.2500
63	1.3200	1.2700
65	1.2500	1.3700
67	1.2300	1.2900
69	1.2400	1.2600
71	1.3700	1.2300
73	1.2400	1.2600
75	1.3400	1.2200
77	1.4000	1.3400
79	1.3800	1.1700
81	1.3800	1.2500
83	1.3400	1.2700
85	1.3400	1.3000
87	1.1900	1.4000
89	1.2200	1.2300
91	1.3400	1.3500
93	1.2300	1.2400
95	1.2700	1.4000
97	1.2300	1.1600
99	1.4100	1.2600

CROWS NEST RESOURCES LTD.
Pine Pass 81-3339
Pellet #1

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .01
MEAN = 1.3133
COEF OF VARIATION = 4.98%
VARIANCE = .0043
STANDARD DEVIATION = .0654
SKEWNESS = -.0962
KURTOSIS = 2.2982

95.00% C.I. FOR MEAN:
(1.3003, 1.3263)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



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VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3339
Pellet #2

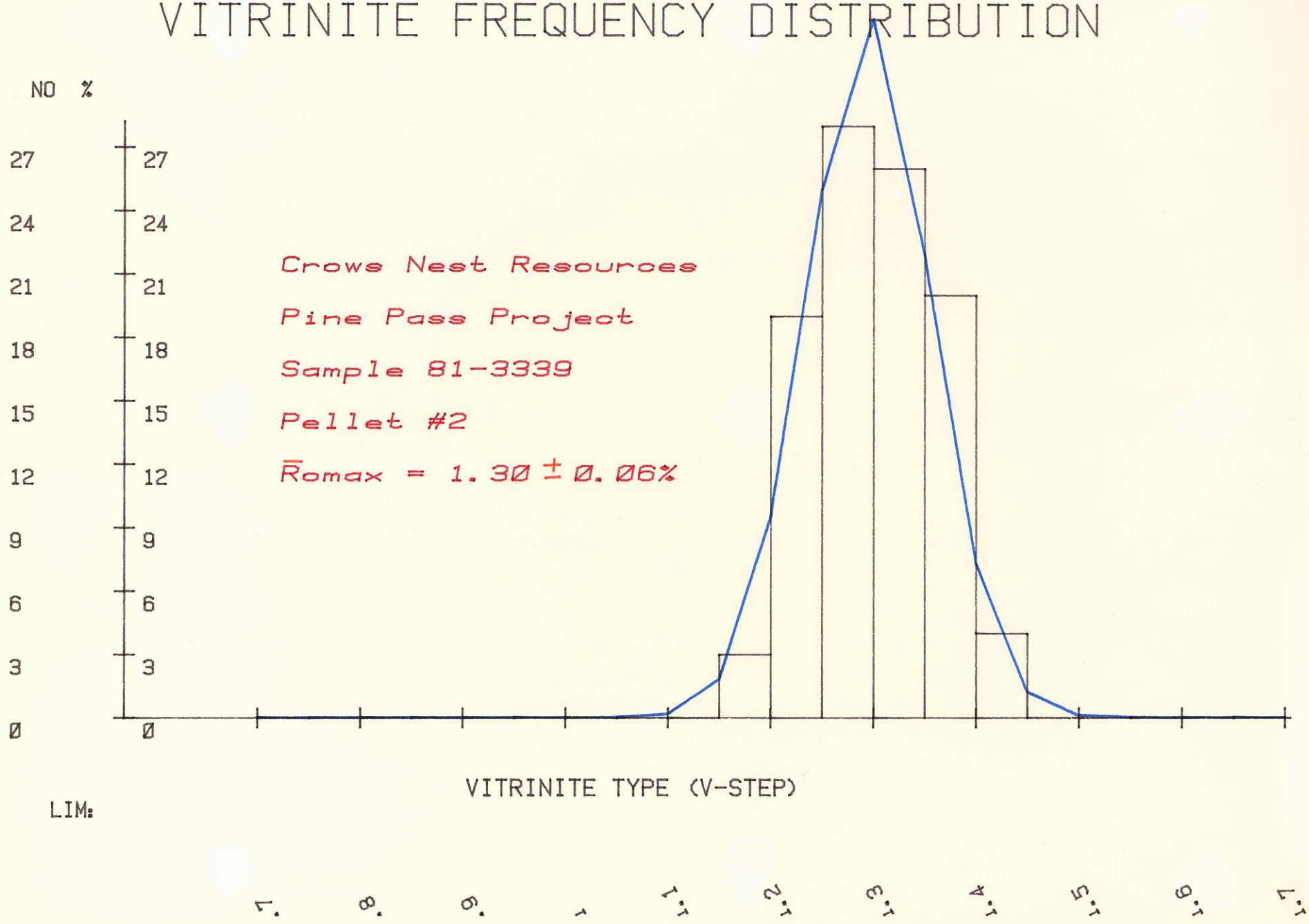
I	X(I)	X(I+1)
1	1.3200	1.3000
3	1.2200	1.3700
5	1.3200	1.3000
7	1.2000	1.3100
9	1.2600	1.3600
11	1.2400	1.2700
13	1.3800	1.4100
15	1.2500	1.3300
17	1.3600	1.3200
19	1.2900	1.2200
21	1.3700	1.1600
23	1.3600	1.2800
25	1.2300	1.2800
27	1.3500	1.2600
29	1.2100	1.2800
31	1.2400	1.2200
33	1.2500	1.2000
35	1.2900	1.3200
37	1.2800	1.3900
39	1.2000	1.2800
41	1.2500	1.2700
43	1.3500	1.2300
45	1.3200	1.2500
47	1.3000	1.3300
49	1.3300	1.3700
51	1.4200	1.2500
53	1.3000	1.2600
55	1.3200	1.3000
57	1.2500	1.3100
59	1.2600	1.2500
61	1.3300	1.3200
63	1.3600	1.2600
65	1.2100	1.3800
67	1.3300	1.3700
69	1.3700	1.3400
71	1.3600	1.2500
73	1.2400	1.4100
75	1.2400	1.3400
77	1.2600	1.4300
79	1.1600	1.2400
81	1.2900	1.2800
83	1.3000	1.3100
85	1.3400	1.1900
87	1.3800	1.2300
89	1.3500	1.3500
91	1.2300	1.2900
93	1.3800	1.2300
95	1.2900	1.2100
97	1.3500	1.2800
99	1.3100	1.3400

CROWS NEST RESOURCES LTD.
Pine Pass 81-3339
Pellet #2

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .01
MEAN = 1.2953
COEF OF VARIATION = 4.64%
VARIANCE = .0036
STANDARD DEVIATION = .0601
SKEWNESS = .0214
KURTOSIS = 2.3359

95.00% C.I. FOR MEAN:
(1.2834, 1.3072)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



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VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD
Pine Pass 81-3348
Pellet #1

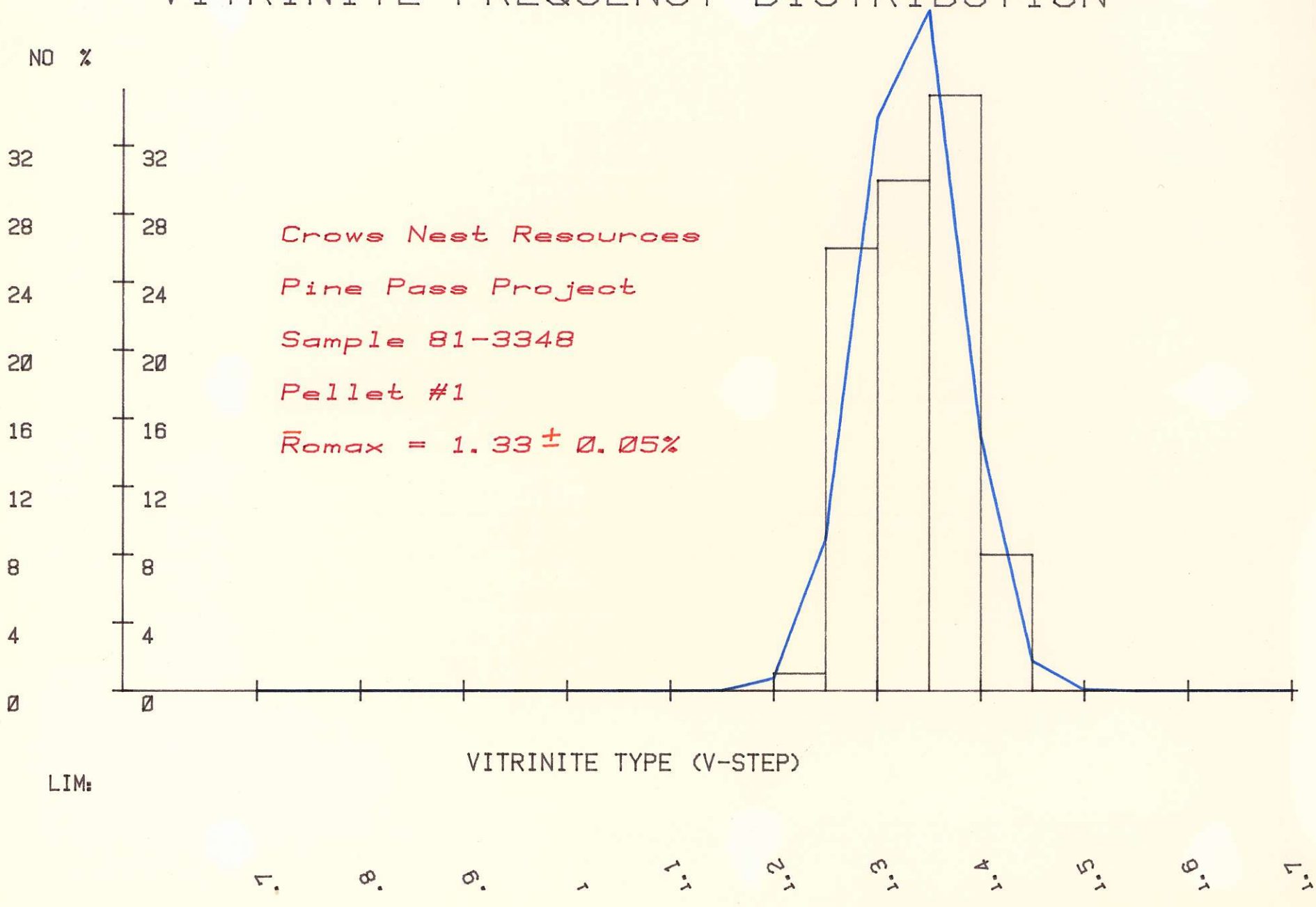
I	X(I)	X(I+1)
1	1.3500	1.3600
3	1.3600	1.3800
5	1.3700	1.3200
7	1.2900	1.4100
9	1.3400	1.3400
11	1.4200	1.4200
13	1.3600	1.3500
15	1.3500	1.4000
17	1.3600	1.3900
19	1.3300	1.3500
21	1.3500	1.3700
23	1.3200	1.3800
25	1.3400	1.3900
27	1.3600	1.3000
29	1.3900	1.3100
31	1.4000	1.4100
33	1.3600	1.3000
35	1.3300	1.3400
37	1.3200	1.3400
39	1.3300	1.3900
41	1.3600	1.3400
43	1.3400	1.4100
45	1.3700	1.3200
47	1.3900	1.3900
49	1.2900	1.3300
51	1.3800	1.3900
53	1.2600	1.2700
55	1.2700	1.3700
57	1.2900	1.3300
59	1.3700	1.3400
61	1.3800	1.3000
63	1.3700	1.2700
65	1.3600	1.3300
67	1.3500	1.3900
69	1.3100	1.2400
71	1.2600	1.4100
73	1.3600	1.2900
75	1.2600	1.2800
77	1.3600	1.2700
79	1.2500	1.3100
81	1.2600	1.3200
83	1.2600	1.2900
85	1.2900	1.3200
87	1.2600	1.2600
89	1.2800	1.2900
91	1.3000	1.2900
93	1.2700	1.3000
95	1.3500	1.3300
97	1.2900	1.3100
99	1.2700	1.2600

CROWS NEST RESOURCES LTD.
Pine Pass 81-3348
Pellet #1

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .00
MEAN = 1.3324
COEF OF VARIATION = 3.48%
VARIANCE = .0022
STANDARD DEVIATION = .0464
SKEWNESS = -.0690
KURTOSIS = 2.0028

95.00% C.I. FOR MEAN:
(1.3232, 1.3416)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



David E. Pearson & Associates Ltd.

VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3348
Pellet #2

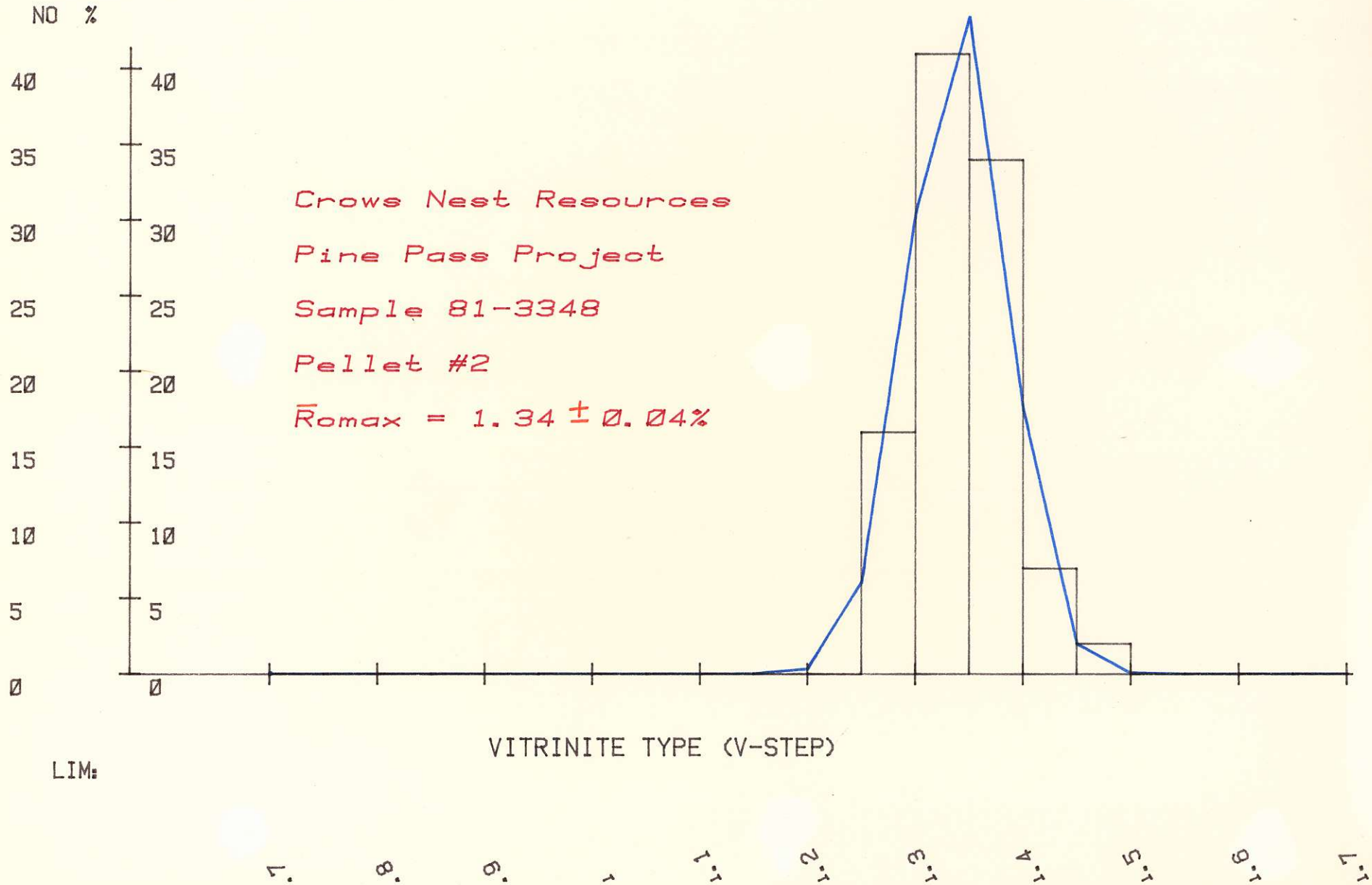
I	X(I)	X(I+1)
1	1.3600	1.3000
3	1.3100	1.3700
5	1.4300	1.3200
7	1.3600	1.2700
9	1.3300	1.3200
11	1.3400	1.2600
13	1.3100	1.3500
15	1.3900	1.3400
17	1.3600	1.3200
19	1.3100	1.3000
21	1.3600	1.4000
23	1.4100	1.3100
25	1.3000	1.3300
27	1.3100	1.2800
29	1.3400	1.4500
31	1.3500	1.3800
33	1.3300	1.3500
35	1.3400	1.3700
37	1.2900	1.3400
39	1.3300	1.4200
41	1.3500	1.3600
43	1.3400	1.4400
45	1.3900	1.3400
47	1.3500	1.4000
49	1.3700	1.2700
51	1.2800	1.3000
53	1.3200	1.3900
55	1.3800	1.3200
57	1.3000	1.3800
59	1.3000	1.3200
61	1.2900	1.3600
63	1.3800	1.3800
65	1.3400	1.2700
67	1.2900	1.3300
69	1.3300	1.3400
71	1.4600	1.2600
73	1.3000	1.3700
75	1.3200	1.3300
77	1.3800	1.3200
79	1.3600	1.3200
81	1.3900	1.2600
83	1.3600	1.3700
85	1.3300	1.3800
87	1.3500	1.3700
89	1.4100	1.3100
91	1.2700	1.3400
93	1.2800	1.2700
95	1.2500	1.2700
97	1.3700	1.3300
99	1.3600	1.3600

CROWS NEST RESOURCES LTD.
Pine Pass 81-3348
Pellet #2

```
BASIC STATISTICS
*******************************
N =  100
STD ERROR OF THE MEAN=        .00
MEAN =        1.3390
COEF OF VARIATION =        3.32%
VARIANCE =         .0020
STANDARD DEVIATION =        .0445
SKEWNESS =         .2525
KURTOSIS =        2.8777

    95.00% C.I. FOR MEAN:
(       1.3302,       1.3478)
ONE-TAIL t( 99 , .025 )= 1.98466175739
```

VITRINITE FREQUENCY DISTRIBUTION



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VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3350
Pellet #1

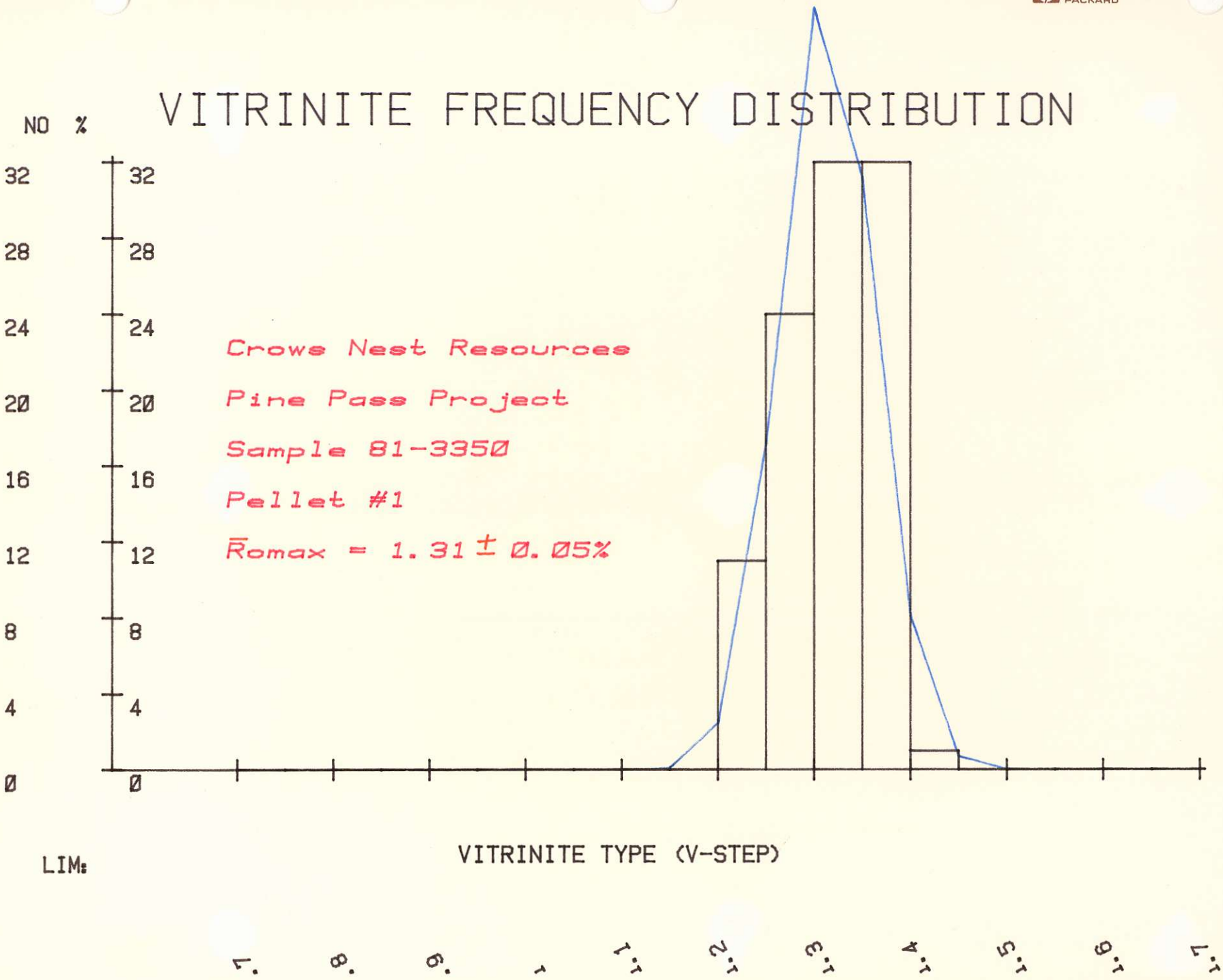
I	X(I)	X(I+1)
1	1.3700	1.3800
3	1.3700	1.2900
5	1.3000	1.2600
7	1.3700	1.2200
9	1.2800	1.2800
11	1.2500	1.3700
13	1.3100	1.3300
15	1.3000	1.3300
17	1.3800	1.3100
19	1.3000	1.2800
21	1.2900	1.2300
23	1.3400	1.2800
25	1.3300	1.3600
27	1.2700	1.3200
29	1.3200	1.3000
31	1.3500	1.2400
33	1.3400	1.3100
35	1.3700	1.3400
37	1.3700	1.2600
39	1.3900	1.3700
41	1.3200	1.3500
43	1.3700	1.3700
45	1.2300	1.3700
47	1.3600	1.3200
49	1.3700	1.2500
51	1.2600	1.2800
53	1.3200	1.2800
55	1.3300	1.3100
57	1.2400	1.2200
59	1.2600	1.2700
61	1.3900	1.3100
63	1.3400	1.2700
65	1.3100	1.4000
67	1.3000	1.3500
69	1.3000	1.3600
71	1.3300	1.2700
73	1.2600	1.3100
75	1.2800	1.2300
77	1.3400	1.3000
79	1.3700	1.2700
81	1.3500	1.2400
83	1.2800	1.3500
85	1.3300	1.3600
87	1.3700	1.2900
89	1.3500	1.3600
91	1.3500	1.2200
93	1.2800	1.3500
95	1.3700	1.2300
97	1.3700	1.2300
99	1.3200	1.3300

CROWS NEST RESOURCES LTD.
Pine Pass 81-3350
Pellet #1

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .00
MEAN = 1.3136
COEF OF VARIATION = 3.63%
VARIANCE = .0023
STANDARD DEVIATION = .0477
SKEWNESS = -.2667
KURTOSIS = 2.0132

95.00% C.I. FOR MEAN:
(1.3041, 1.3231)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



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VITRINITE REFLECTANCE DATA FOR
CROWS NEST RESOURCES LTD.
Pine Pass 81-3350
Pellet #2

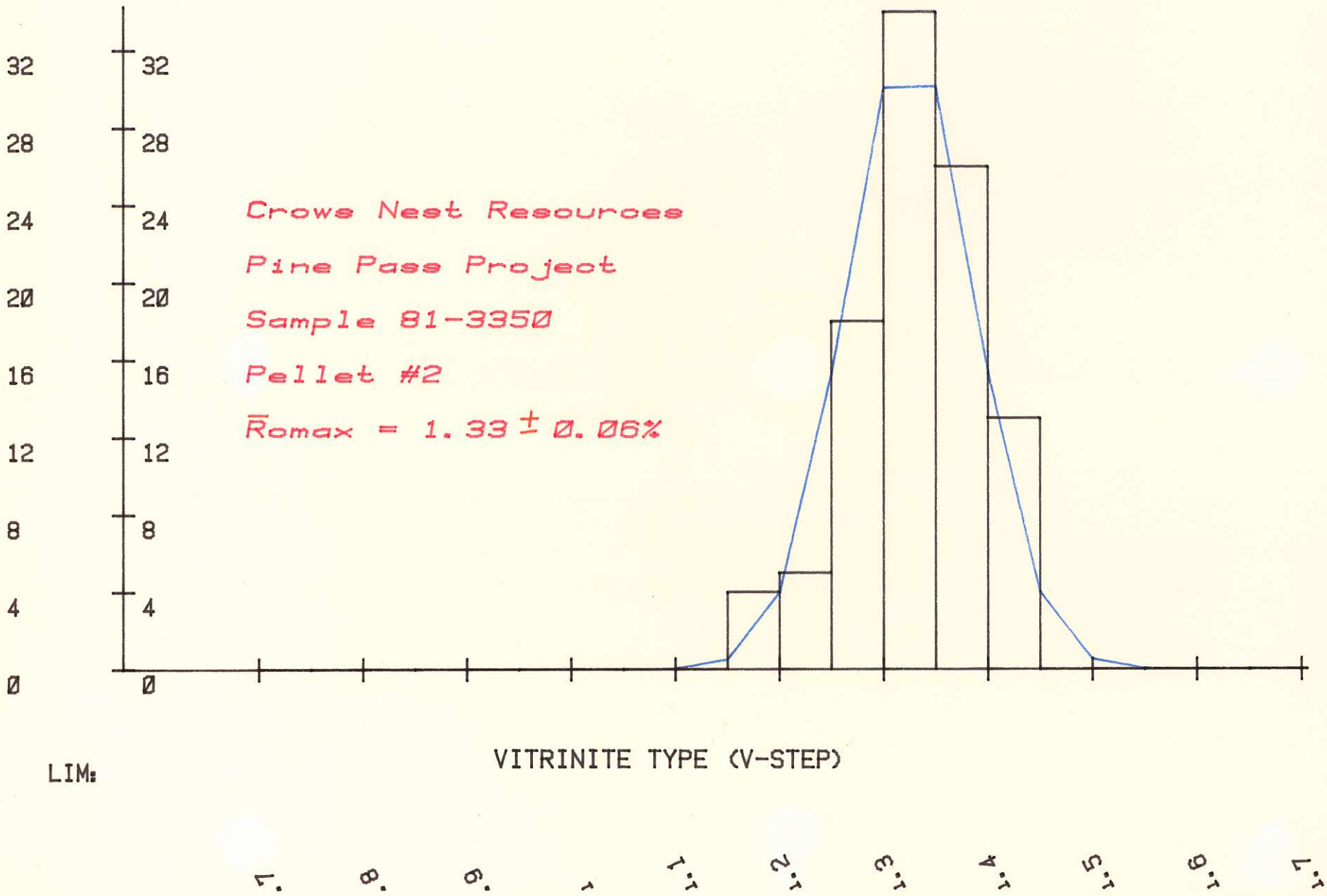
I	X(I)	X(I+1)
1	1.4200	1.3300
3	1.3700	1.3700
5	1.3600	1.3700
7	1.3300	1.3800
9	1.3900	1.4100
11	1.3000	1.3700
13	1.2500	1.3100
15	1.3800	1.3900
17	1.2600	1.3600
19	1.3400	1.3100
21	1.4100	1.3300
23	1.3400	1.4200
25	1.3700	1.3300
27	1.3500	1.3300
29	1.3000	1.3000
31	1.3100	1.2900
33	1.3300	1.3100
35	1.3200	1.2300
37	1.3400	1.3900
39	1.4200	1.3200
41	1.3600	1.3600
43	1.3700	1.2500
45	1.3400	1.2600
47	1.2700	1.2600
49	1.4100	1.3400
51	1.3200	1.3800
53	1.3100	1.3900
55	1.1700	1.2600
57	1.3000	1.2600
59	1.2900	1.2800
61	1.3500	1.2900
63	1.3200	1.4100
65	1.4000	1.2500
67	1.1900	1.3200
69	1.3300	1.3500
71	1.3200	1.3300
73	1.2400	1.4200
75	1.3700	1.3600
77	1.4000	1.3000
79	1.3700	1.2700
81	1.2200	1.3100
83	1.2200	1.3500
85	1.1900	1.4200
87	1.3200	1.2600
89	1.1700	1.2900
91	1.3000	1.2500
93	1.3400	1.4200
95	1.2100	1.3600
97	1.4200	1.2500
99	1.3400	1.3700

CROWS NEST RESOURCES LTD.
Pine Pass 81-3350
Pellet #2

BASIC STATISTICS
****
N = 100
STD ERROR OF THE MEAN= .01
MEAN = 1.3252
COEF OF VARIATION = 4.59%
VARIANCE = .0037
STANDARD DEVIATION = .0609
SKEWNESS = -.4635
KURTOSIS = 2.7217

95.00% C.I. FOR MEAN:
(1.3131, 1.3373)
ONE-TAIL t(99 , .025)= 1.98466175739

VITRINITE FREQUENCY DISTRIBUTION



David E. Pearson & Associates Ltd.

APPENDIX C.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3338
Semifusinite - CANMET method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	75	77	81	79	82	77	87	82	84	80
EX.	5	2	2	3	4	0	0	4	2	4
R.S.F.	8	9.5	8	8	6.5	8.5	4.5	7	5.5	6.5
TOTAL R	88	88.5	91	90	92.5	85.5	91.5	93	91.5	90.5
MAC.	0	1	0	0	1	2	0	0	0	0
I.S.F.	8	9.5	8	8	6.5	8.5	4.5	7	5.5	6.5
FUS.	1	0	0	1	0	1	1	0	1	0
INERTO	3	1	1	1	0	3	3	0	2	3
TOTAL I	12	11.5	9	10	7.5	14.5	8.5	7	8.5	9.5

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	80.40	3.60	12.93
EX.	2.60	1.71	2.93
R.S.F.	7.20	1.49	2.23
TOTAL R	90.20	2.29	5.23
MAC.	0.40	0.70	0.49
I.S.F.	7.20	1.49	2.23
FUS.	0.50	0.53	0.28
INERTO.	1.70	1.25	1.57
TOTAL I	9.80	2.29	5.23

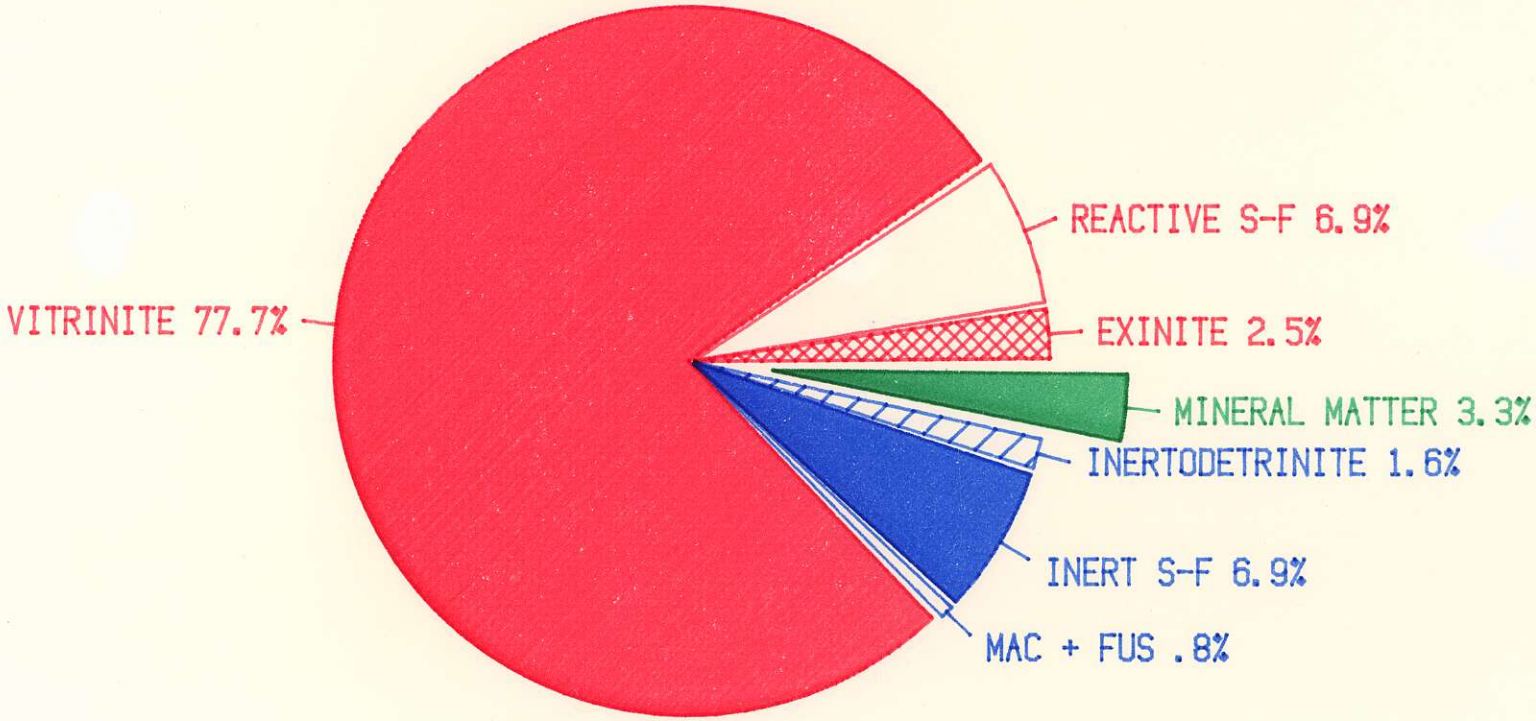
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	77.75
EX.	2.51
R.S.F.	6.96
TOTAL R	87.22
MAC.	0.39
I.S.F.	6.96
FUS.	0.48
INERTO.	1.64
MIN.MAT	3.30
TOTAL I	12.78

MACERAL DISTRIBUTION

Pine Pass Sample #81-3338

Semifusinite - CANMET method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3339
Semifusinite - CANMET method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	46	55	48	52	42	38	53	46	46	38
EX.	0	0	0	0	0	3	0	0	1	0
R.S.F.	24	21	22.5	20	26.5	27	22	26.5	25	29.5
TOTAL R	70	76	70.5	72	68.5	68	75	72.5	72	67.5
MAC.	1	0	0	1	1	1	1	1	1	2
I.S.F.	24	21	22.5	20	26.5	27	22	26.5	25	29.5
FUS.	2	1	1	1	2	4	0	0	1	1
INERTO	3	2	6	6	2	0	2	0	1	0
TOTAL I	30	24	29.5	28	31.5	32	25	27.5	28	32.5

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	46.40	5.89	34.71
EX.	0.40	0.97	0.93
R.S.F.	24.40	3.03	9.16
TOTAL R	71.20	2.86	8.18
MAC.	0.90	0.57	0.32
I.S.F.	24.40	3.03	9.16
FUS.	1.30	1.16	1.34
INERTO.	2.20	2.25	5.07
TOTAL I	28.80	2.86	8.18

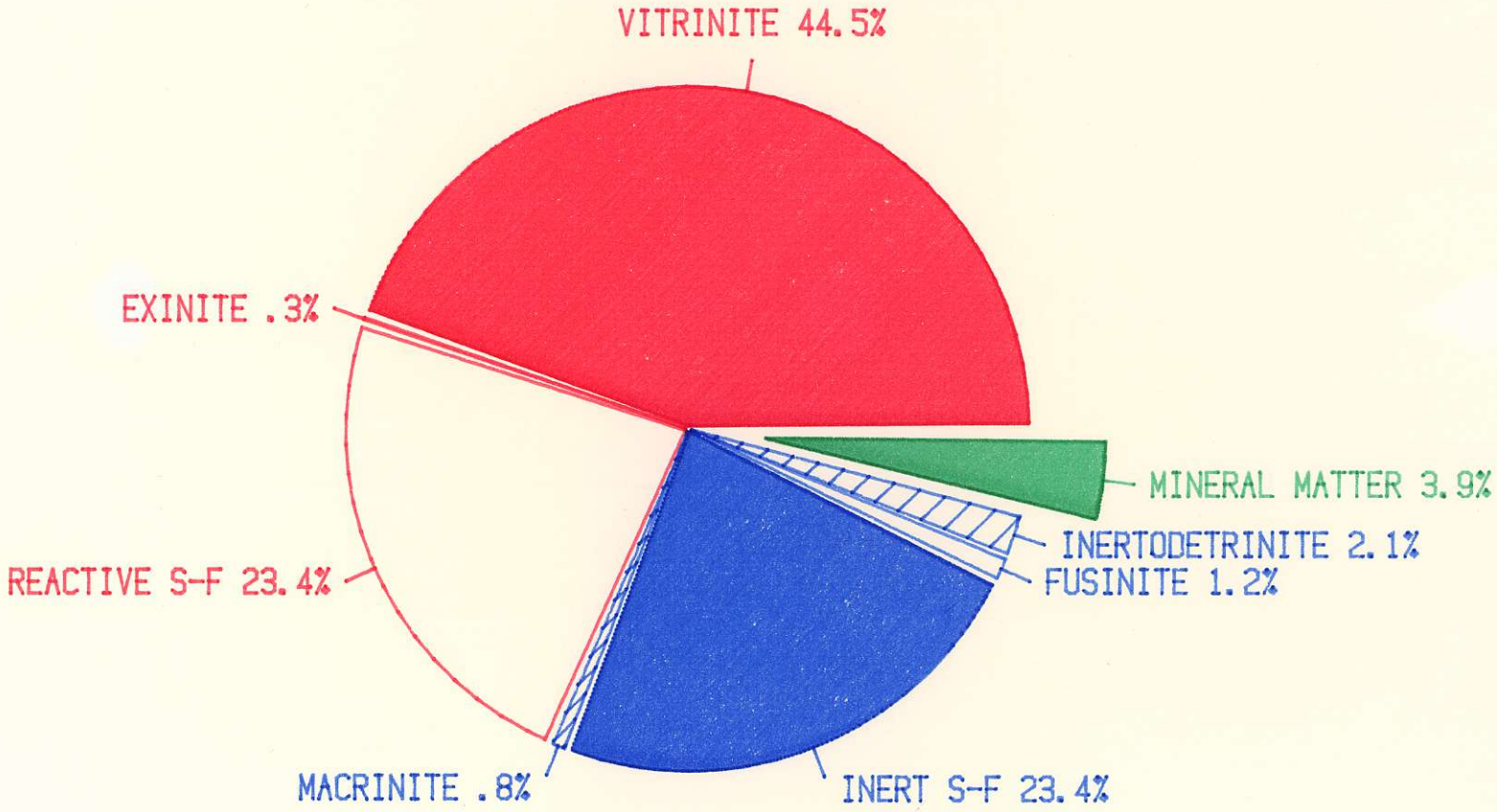
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	44.56
EX.	0.38
R.S.F.	23.43
TOTAL R	68.38
MAC.	0.86
I.S.F.	23.43
FUS.	1.25
INERTO.	2.11
MIN.MAT	3.96
TOTAL I	31.62

MACERAL DISTRIBUTION

Pine Pass Sample #81-3339

Semifusinite - CANMET method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3348
Semifusinite - CANMET method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	65	74	70	68	76	75	82	78	78	67
EX.	0	0	0	0	0	1	1	0	2	0
R.S.F.	17	11.5	13.5	15.5	9.5	11.5	8	10	9.5	15.5
TOTAL R	82	85.5	83.5	83.5	85.5	87.5	91	88	89.5	82.5
MAC.	1	1	1	1	0	0	1	1	1	0
I.S.F.	17	11.5	13.5	15.5	9.5	11.5	8	10	9.5	15.5
FUS.	0	1	1	0	2	0	0	0	0	2
INERTO	0	1	1	0	3	1	0	1	0	0
TOTAL I	18	14.5	16.5	16.5	14.5	12.5	9	12	10.5	17.5

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	73.30	5.56	30.90
EX.	0.40	0.70	0.49
R.S.F.	12.15	3.06	9.39
TOTAL R	85.85	3.06	9.39
MAC.	0.70	0.48	0.23
I.S.F.	12.15	3.06	9.39
FUS.	0.60	0.84	0.71
INERTO.	0.70	0.95	0.90
TOTAL I	14.15	3.06	9.39

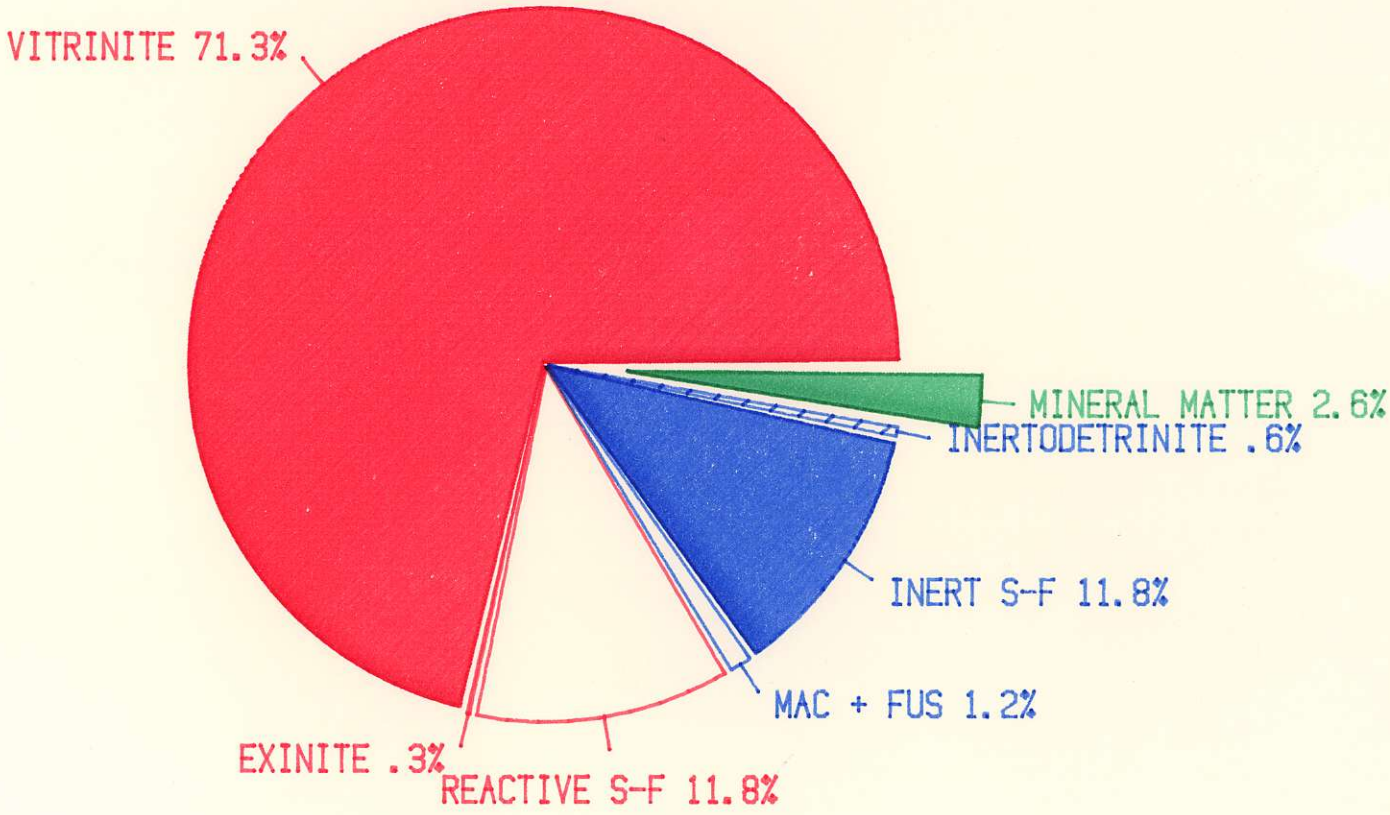
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	71.36
EX.	0.39
R.S.F.	11.83
TOTAL R	83.57
MAC.	0.68
I.S.F.	11.83
FUS.	0.58
INERTO.	0.68
MIN.MAT	2.65
TOTAL I	16.43

MACERAL DISTRIBUTION

Pine Pass Sample #81-3348

Semifusinite - CANMET method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3350
Semifusinite - CANMET method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	70	72	72	65	72	69	65	78	72	75
EX.	3	0	1	3	2	1	1	3	0	3
R.S.F.	12.5	12	12.5	14.5	11	14.5	15	8	13.5	11
TOTAL R	85.5	84	85.5	82.5	85	84.5	81	89	85.5	89
MAC.	0	1	0	0	0	0	0	0	1	0
I.S.F.	12.5	12	12.5	14.5	11	14.5	15	8	13.5	11
FUS.	0	0	0	0	0	0	2	0	0	0
INERTO	2	3	2	3	4	1	2	3	0	0
TOTAL I	14.5	16	14.5	17.5	15	15.5	19	11	14.5	11

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	71.00	4.03	16.22
EX.	1.70	1.25	1.57
R.S.F.	12.45	2.11	4.47
TOTAL R	85.15	2.49	6.23
MAC.	0.20	0.42	0.18
I.S.F.	12.45	2.11	4.47
FUS.	0.20	0.63	0.40
INERTO.	2.00	1.33	1.78
TOTAL I	14.85	2.49	6.23

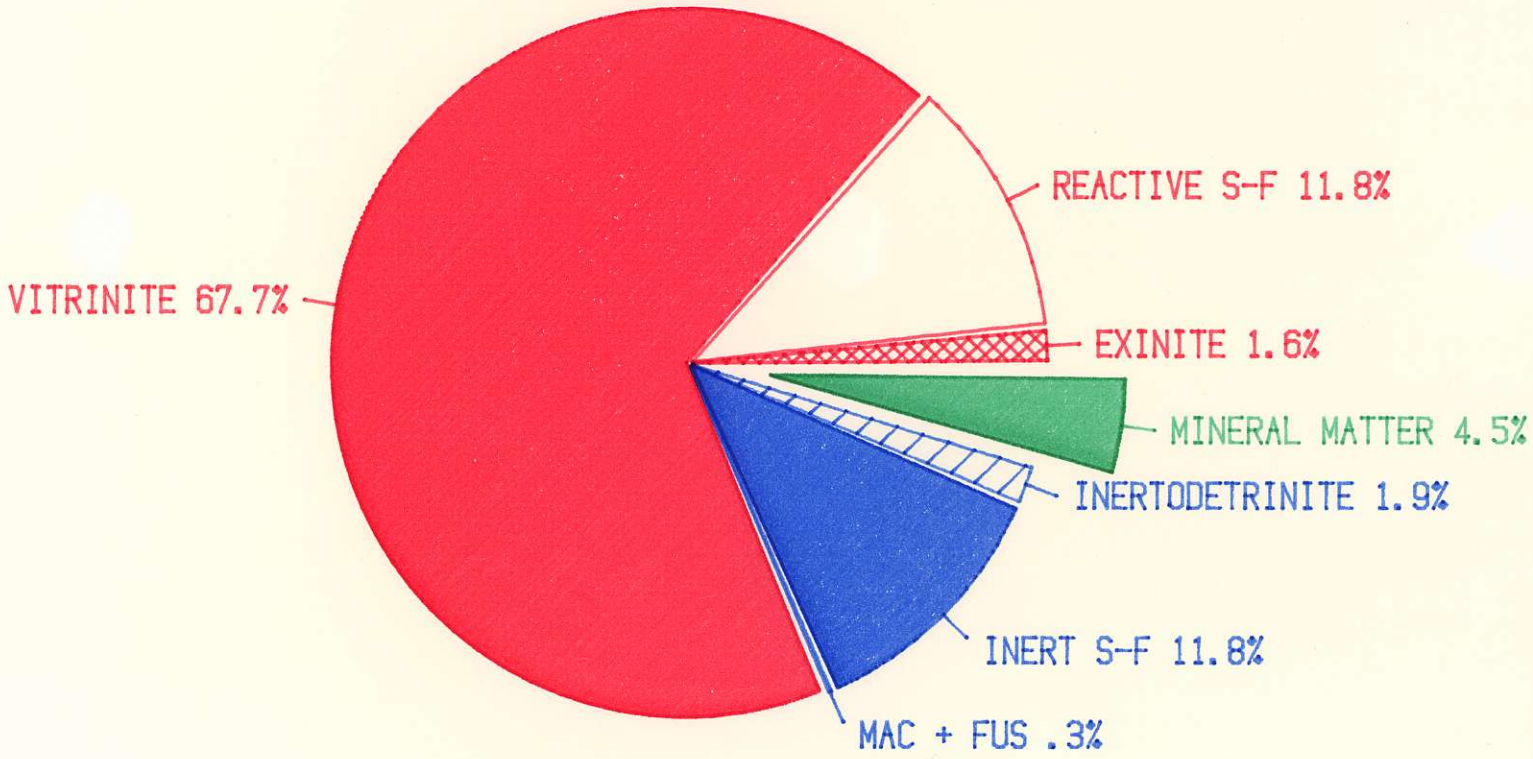
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	67.78
EX.	1.62
R.S.F.	11.89
TOTAL R	81.29
MAC.	0.19
I.S.F.	11.89
FUS.	0.19
INERTO.	1.91
MIN.MAT	4.53
TOTAL I	18.71

MACERAL DISTRIBUTION

Pine Pass Sample #81-3350

Semifusinite - CANMET method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3338
Semifusinite - KOENSLER method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	77	87	82	84	80	75	77	81	79	82
EX.	0	0	4	2	4	5	2	2	3	4
R.S.F.	3	1	3	1	3	9	5	5	3	0
TOTAL R	80	88	89	87	87	89	84	88	85	86
MAC.	2	0	0	0	0	0	1	0	0	1
I.S.F.	14	8	11	10	10	7	14	11	13	13
FUS.	1	1	0	1	0	1	0	0	1	0
INERTO	3	3	0	2	3	3	1	1	1	0
TOTAL I	20	12	11	13	13	11	16	12	15	14

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	80.40	3.60	12.93
EX.	2.60	1.71	2.93
R.S.F.	3.30	2.58	6.68
TOTAL R	86.30	2.75	7.57
MAC.	0.40	0.70	0.49
I.S.F.	11.10	2.42	5.88
FUS.	0.50	0.53	0.28
INERTO.	1.70	1.25	1.57
TOTAL I	13.70	2.75	7.57

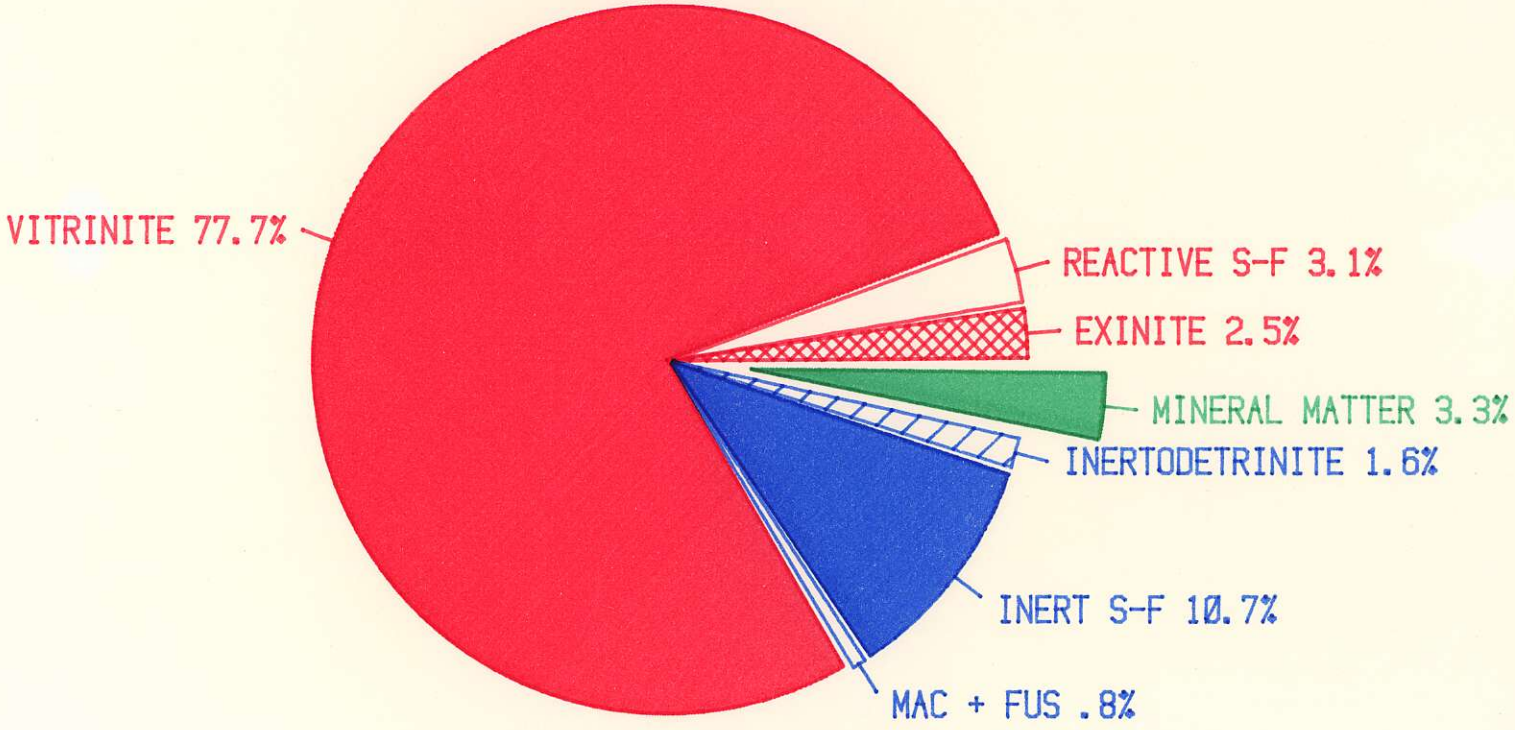
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	77.75
EX.	2.51
R.S.F.	3.19
TOTAL R	83.45
MAC.	0.39
I.S.F.	10.73
FUS.	0.48
INERTO.	1.64
MIN.MAT	3.30
TOTAL I	16.55

MACERAL DISTRIBUTION

Pine Pass Sample #81-3338

Semifusinite - KOENSLER method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3339
Semifusinite - KOENSLER method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	46	55	48	52	42	38	53	46	46	38
EX.	0	0	0	0	0	3	0	0	1	0
R.S.F.	7	12	9	9	12	15	18	18	12	12
TOTAL R	53	67	57	61	54	56	71	64	59	50
MAC.	1	0	0	1	1	1	1	1	1	2
I.S.F.	41	30	36	31	41	39	26	35	38	47
FUS.	2	1	1	1	2	4	0	0	1	1
INERTO	3	2	6	6	2	0	2	0	1	0
TOTAL I	47	33	43	39	46	44	29	36	41	50

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	46.40	5.89	34.71
EX.	0.40	0.97	0.93
R.S.F.	12.40	3.69	13.60
TOTAL R	59.20	6.60	43.51
MAC.	0.90	0.57	0.32
I.S.F.	36.40	6.19	38.27
FUS.	1.30	1.16	1.34
INERTO.	2.20	2.25	5.07
TOTAL I	40.80	6.60	43.51

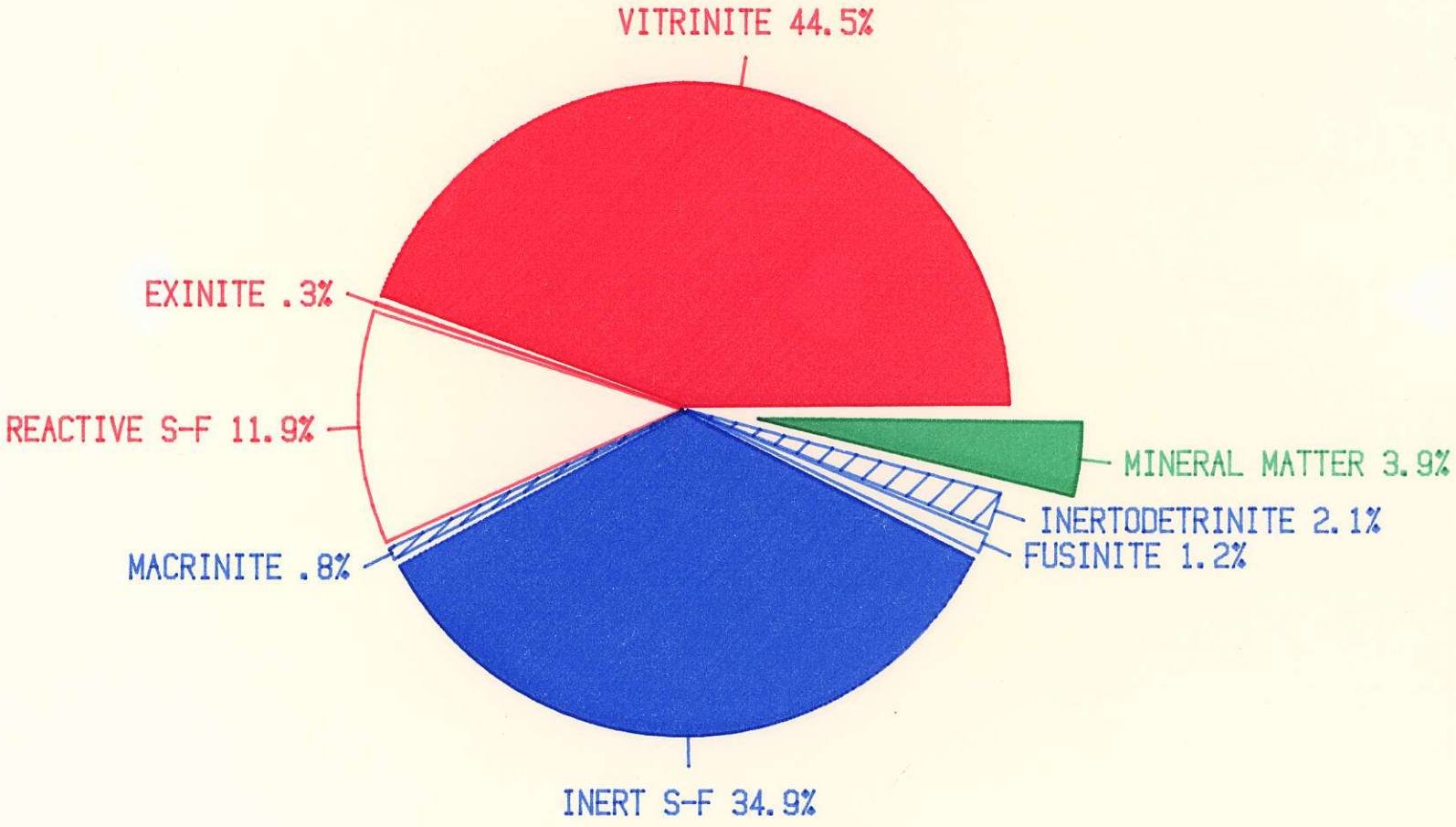
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	44.56
EX.	0.38
R.S.F.	11.91
TOTAL R	56.86
MAC.	0.86
I.S.F.	34.96
FUS.	1.25
INERTO.	2.11
MIN.MAT	3.96
TOTAL I	43.14

MACERAL DISTRIBUTION

Pine Pass Sample #81-3339

Semifusinite - KOENSLER method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3348
Semifusinite - KOENSLER method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	65	74	70	68	76	75	82	78	78	67
EX.	0	0	0	0	0	1	1	0	2	0
R.S.F.	11	10	7	10	6	15	5	9	6	14
TOTAL R	76	84	77	78	82	91	88	87	86	81
MAC.	1	1	1	1	0	0	1	1	1	0
I.S.F.	23	13	20	21	13	8	11	11	13	17
FUS.	0	1	1	0	2	0	0	0	0	2
INERTO	0	1	1	0	3	1	0	1	0	0
TOTAL I	24	16	23	22	18	9	12	13	14	19

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	73.30	5.56	30.90
EX.	0.40	0.70	0.49
R.S.F.	9.30	3.40	11.57
TOTAL R	83.00	5.06	25.56
MAC.	0.70	0.48	0.23
I.S.F.	15.00	4.97	24.67
FUS.	0.60	0.84	0.71
INERTO.	0.70	0.95	0.90
TOTAL I	17.00	5.06	25.56

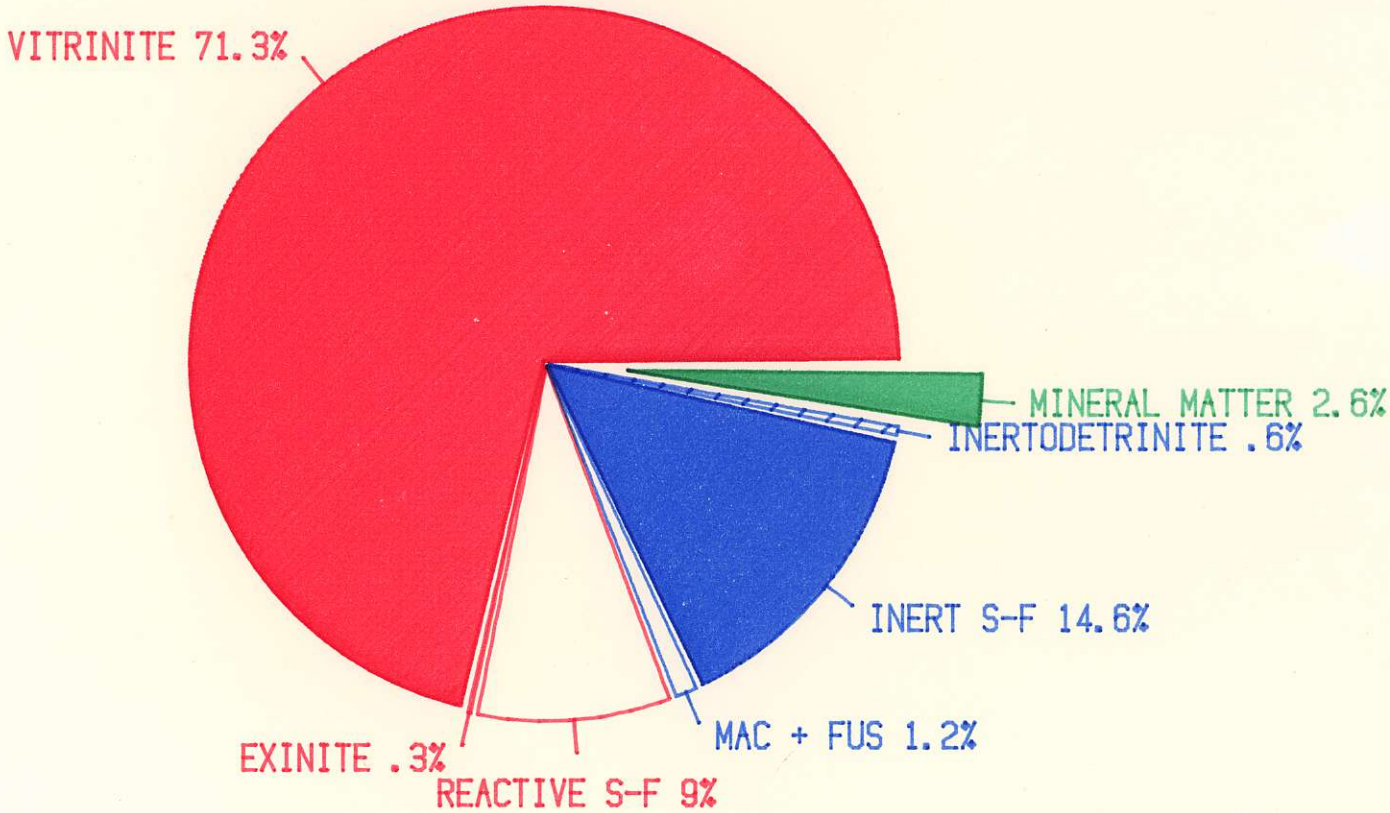
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	71.36
EX.	0.39
R.S.F.	9.05
TOTAL R	80.80
MAC.	0.68
I.S.F.	14.60
FUS.	0.58
INERTO.	0.68
MIN.MAT	2.65
TOTAL I	19.20

MACERAL DISTRIBUTION

Pine Pass Sample #81-3348

Semifusinite - KOENSLER method



David E. Pearson & Associates Ltd.

CROWS NEST RESOURCES LTD
Pine Pass Sample 81-3350
Semifusinite - KOENSLER method

COUNT	100	200	300	400	500	600	700	800	900	1000
VIT.	70	72	72	65	72	69	65	78	72	75
EX.	3	0	1	3	2	1	1	3	0	3
R.S.F.	7	9	6	9	6	8	8	4	7	5
TOTAL R	80	81	79	77	80	78	74	85	79	83
MAC.	0	1	0	0	0	0	0	0	1	0
I.S.F.	18	15	19	20	16	21	22	12	20	17
FUS.	0	0	0	0	0	0	2	0	0	0
INERTO	2	3	2	3	4	1	2	3	0	0
TOTAL I	20	19	21	23	20	22	26	15	21	17

BASIC STATISTIC

	MEAN	ST.DEV.	VARNCE.
VIT.	71.00	4.03	16.22
EX.	1.70	1.25	1.57
R.S.F.	6.90	1.66	2.77
TOTAL R	79.60	3.06	9.38
MAC.	0.20	0.42	0.18
I.S.F.	18.00	3.06	9.33
FUS.	0.20	0.63	0.40
INERTO.	2.00	1.33	1.78
TOTAL I	20.40	3.06	9.38

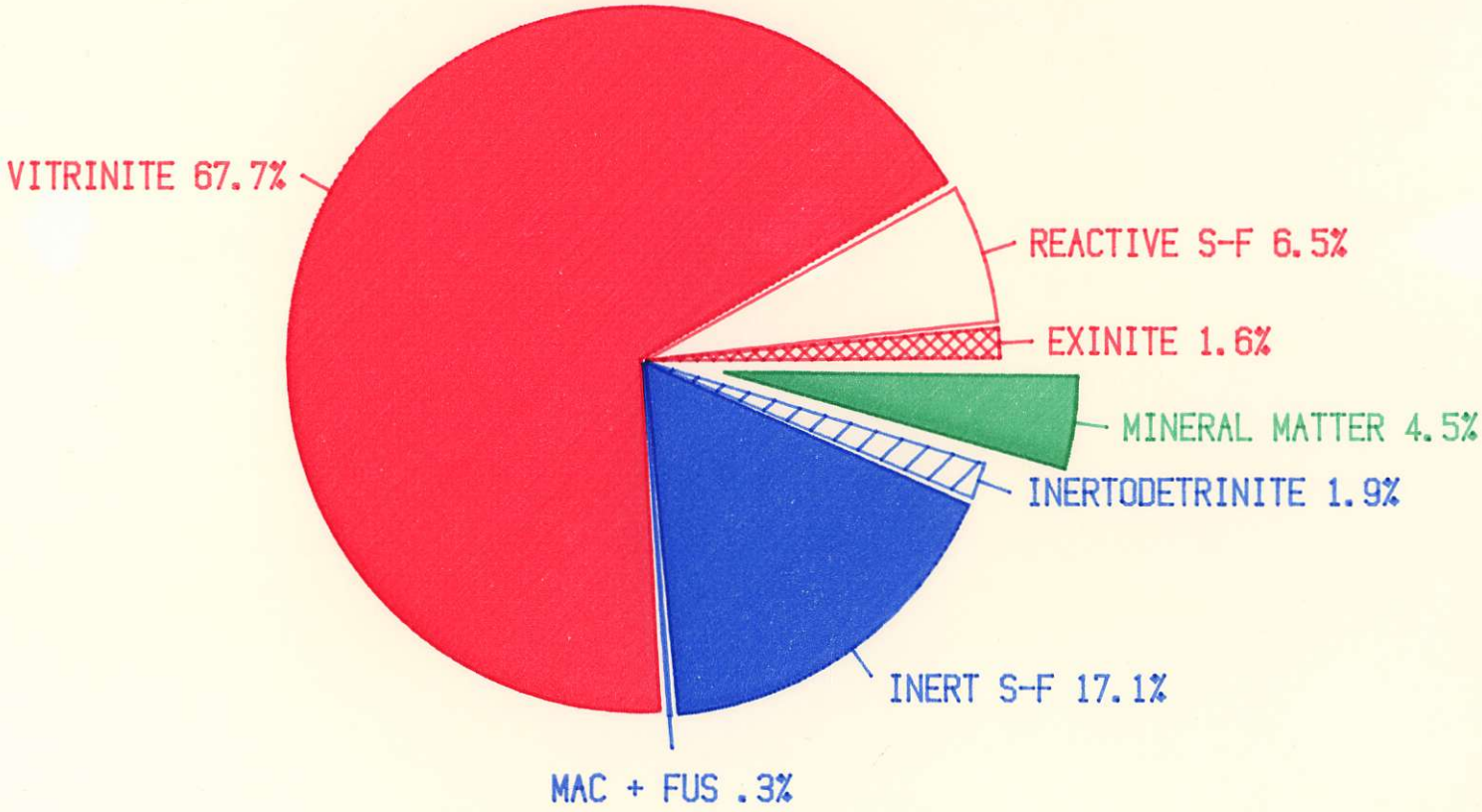
MACERAL DATA CORRECTED FOR MINERAL-MATTER

VIT.	67.78
EX.	1.62
R.S.F.	6.59
TOTAL R	75.99
MAC.	0.19
I.S.F.	17.18
FUS.	0.19
INERTO.	1.91
MIN.MAT	4.53
TOTAL I	24.01

MACERAL DISTRIBUTION

Pine Pass Sample #81-3350

Semifusinite - KOENSLER method



David E. Pearson & Associates Ltd.