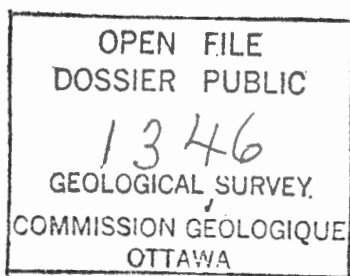Report No. EPGS-DOM.2-86MPA

Vitrinite reflectance (Ro)
of dispersed organics
from
Mobil et al.
BONANZA M-71.

Vitrinite Reflectance (Ro) of dispersed organics from Mobil et al.
Bonanza M-71.

"Quotation in full or in part from this report must be with the prior approval of the Eastern Petroleum Geology Subdivision of the Atlantic Geoscience Centre, Dartmouth, Nova Scotia".

G.S.C. Locality No: D211   Location: 47°30'47.54"N, 48°11'55.34"W

R.T. Elevation: 26.8m   Water Depth: 193.5m   Total Depth: 5295m

Sample Interval: 1220 - 5295m   Interval Studied: 1560 - 5250m

Release Date: February 4,1985   Depth Units: Meters referenced to R.T.

Vitrinite Reflectance has been determined on 20 samples (Table II) from Mobil et al. Bonanza M-71, which was classified as a wildcat well and is located on the Grand Banks, approximately 340km (211mi) due east of St.John's, Newfoundland (Mobil, 1983).

Data acquisition and manipulation for this report utilized the Zeiss Photomultiplier III Zonax microcomputer system with improvements in software to provide a dynamic histogram display as readings are acquired. Sample preparation followed the procedures listed in Appendix I. The analysis of the well revealed the thermal maturation intervals given in Table I. Specific maturation levels as set out in this report were based on those of Dow with modified terminology (1977,Appendix II).

Table I
Inferred Thermal Maturation Levels

Projected
Seaflr-1651m	0.26 - 0.4	% Ro	immature
1651 - 2457m	0.4 - 0.5	% Ro	immature approaching maturity

Determined
2457 - 3116m	0.5 - 0.6	% Ro	marginally mature
3116m	0.6	% Ro	onset of significant oil generation
4155m	0.8	% Ro	peak of oil generation
4517m (4961m)	1.0	% Ro	onset of significant wet gas generation
4670m (5620m)	1.2	% Ro	onset of significant dry gas generation
4770m (6045m)	1.35	% Ro	oil floor
5101m (7465m)	2.0	% Ro	wet gas floor

Projected
5443m (8929m)	3.0	% Ro	dry gas floor

Note: Ro = R_o or reflectance of the vitrinite observed under oil (546nm).

Bracketed () values are expolated depths from upper trend (see discussion).

Remarks

The sample coverage of vitrinite reflectance data (Figure 1,Table II) was adequate over most of the well. The lines through the data points represent the best fit established by the least squares method.

Two distinct trends are present in this well. The upper trend (1560-4396m) has a slope of 0.12 log Ro/km. This level of increase in maturation with depth is similar to the nearby Dominion O-23 well which has a slope of 0.15 log Ro/km (Avery, 1985a). After the inflection point in the curve at 4396m the rate of increase of maturation with depth is significantly greater. The slope of this lower trend is 0.52 log Ro/km.

These maturation data provide evidence that the thermal regime at Bonanza M-71 was suitable for the generation and preservation of oil within the drilled section.

Discussion

The upper maturation profile for the well exhibits the gradient expected for wells in this area. The slope of the lower trend is however more than four times as great. If real, such an increase would have to be explained by a much higher geothermal gradient. The presence of an adjacent igneous intrusion could explain this situation, but it would have to be a body of significant size. It is more probable that the geothermal gradient was higher at some time in the past. This could have occured during the early rifting stages of seafloor spreading in this area. The presence of quartz, dolomite and calcite vein material and chloritic shales from 5265m+ to T.D. (McAlpine, 1985) is additional evidence for an abnormally high-temperature event which affected the lowest section of the well.

Although formation pressure is not considered to directly alter the reflectance of vitrinite particles, it is noted that the inflection point on this curve occurs at approximately the top of the overpressure zone in this well. However, overpressure zones usually contain undercompacted shales which have relatively high fluid filled porosity that results in an insulating effect. The temperature profile (Figure 2) shows an increase in the temperature gradient in the lower section of the well which is higher than other wells in the area (Warren, 1984).

A further observation is that the samples below 4490m were increasingly dominated by natural coke particles. They are produced only through contact with an exceptionally high local heat source such as an igneous intrusion or through frictional heating of fault plane surfaces. Alternatively these particles may be reworked and record a heating event which occurred before their latest burial. The presence of highly altered organics has been reported in many of the wells recently run in the northeastern Grand Banks

area (Avery, 1984; Avery, 1985b; Avery, 1985c). Measureable vitrinite was not found in the deepest sample at Bonanza M-71 and the Ro value given was derived from measurments on particles interpreted as natural coke. Such values cannot be substituted for Ro on vitrinite. However, the resultant value fits the lower trend in the well.

If the lower trend is real, it has the effect of raising the oil floor in the area around Bonanza M-71. Alternatively, if these reflectances are interpreted in terms of reworked populations, oil floor inferences should be based on extrapolating the upper trend in the maturation profile (see Table I for comparison depths). Such an interpretation would be compatible with the TAI values reported by Bujak (1985) and included here as Table V.

Observation

Most of the kerogen samples used in this analysis contained varying amounts of distinct organic particles considered to be mud additives. Reflectance readings on these contaminants were not recorded or included in the histograms. Such particles were also described by Bujak (1985) as 'a Paleocene mud additive (North Dakota lignite)'.

References

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Avery, M.P., 1985b. Vitrinite reflectance (Ro) of dispersed organics from Esso Voyageur Gabriel C-60. GSC Open file report no. 1206.

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Bujak, J.P., 1985. Palynological analyses of Mobil et al. Bonanza M-71: Bujak Research Ltd., Calgary, Alta. Unpublished contractor's report.

Dow, W.G., 1977. Kerogen studies and geological interpretations. Journal of Geochemical Exploration, no. 7, p. 79-99.

Ervine, W.B., 1985. A synthesis of hydrocarbon maturation data for East Newfoundland Basin. GSC Open file report no. 1178.

McAlpine, K.D., 1985. Lithostratigraphic report. Unpublished internal Report no. EPGS-LITH.1-85KDM.

Mobil Oil Canada, Ltd., 1983. Well history report Mobil et al. Bonanza M-71. Open file report, Department of Energy, Mines and Resources, Otttawa.

February 28, 1986.

M.P. Avery
Eastern Petroleum Geology

MPA/mpa

c.c. J.S. Bell, E.P.G.S., Dartmouth
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     Don Sherwin, COGLA, Ottawa
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     D. Skibo, I.S.P.G., Calgary

Table II

Summary of vitrinite reflectance

Seq. #	Sample #	Depth in meters	Mean Ro (SD) non-rotated	Number of readings Total	Edited
1	K0566A	1560–1610	.35(+.04)	39	32
2	K0566B	1760–1810	.38(+.06)	28	24
3	K0566C	1920–1970	.46(+.06)	42	30
4	K0567A	2090–2140	.47(+.05)	28	21
5	K0567B	2250–2300	.49(+.06)	72	59
6	K0567C	2410–2460	.51(+.04)	57	41
7	K0568A	2570–2620	.57(+.05)	81	62
8	K0568B	2715–2725	.58(+.05)	57	36
9	K0568C	2845–2855	.59(+.06)	47	31
10	K0569A	3005–3015	.59(+.08)	23	9
11	K0569B	3205–3315	.62(+.06)	27	20
12	K0569C	3325–3375	.63(+.06)	45	35
13	K0570A	3640–3690	.69(+.07)	50	35
14	K0570B	3840–3890	.7 (+.03)	30	12
15	K0570C	4240–4330	.83(+.06)	66	25
16	K0571A	4440–4490	.86(+.06)	52	23
17	K0571B	4560–4610	1.22(+.06)	79	29
18	K0571C	4720–4770	1.39(+.15)	45	23
19	K0572A	5000–5090	1.83(+.12)	28	14
20	K0572B	5160–5250	2.49(+.1)	63	23

Note : All values are based on isolated kerogen mounts.

Table III
Formation Tops (McAlpine,1985)

Depth	Formation
in casing	Banquereau
3407m	Unconformity (base Tertiary)
3407m	Dawson Canyon
3522m	Unconformity
3522m	Missisauga/Verrill Canyon
4300m	Verrill Canyon (Jurassic?)
4461m	Jeanne d'Arc Sandstone
4568m	Mic Mac
5296m	T.D.

Table IV
Palynology Tops (Bujak,1985)

Depth	Top of
1210m	Oligocene
1560m	Eocene
3245m	Paleocene
3445m	Cenomanian
3455m	Hauterivian
3600m	Berriasian – Valangian
3840m	Portlandian
4840m	Kimmeridgian
4370m	No age assignment
5215m	Oxfordian – Kimmeridgian

TABLE V

TAI & KEROGEN TYPE - BONANZA M-71

SAMPLE	K E R O G E N T Y P E*					TAI
	A	H	W	C	R	
1560-1570m	70	30				2-
1800-1810m	70	30				2-
1960-1970m	80	20				2-
2130-2140m	80	20				2-
2290-2300m	70	30				2-
2450-2460m	80	20				2-
2610-2620m	70	30				2-
2755-2765m	90	10				2-
2925-2935m	90	10				2-
3125-3135m	90	10				2-
3285-3295m	90	10				2-
3445-3455m	80	20				2-
3600-3610m		50	30	20		2-
3800-3810m		60	30	10		2
3960-3970m		60	20	20		2
4120-4130m		70	20	10		2
4280-4290m		80	20			2+
4440-4450m		80	20			2+ to 3-
4600-4610m		70	20	10		2+ to 3-
4760-4770m		70	20	10		2+ to 3-
4920-4930m		70	20	10		3-
5258.5m CORE		80	20			3-

*Kerogen type shown as percent:

A = amorphous (amorphogen); H = herbaceous (phyrogen); W = woody (hylogen); C = coaly (melanogen); R = resinous.
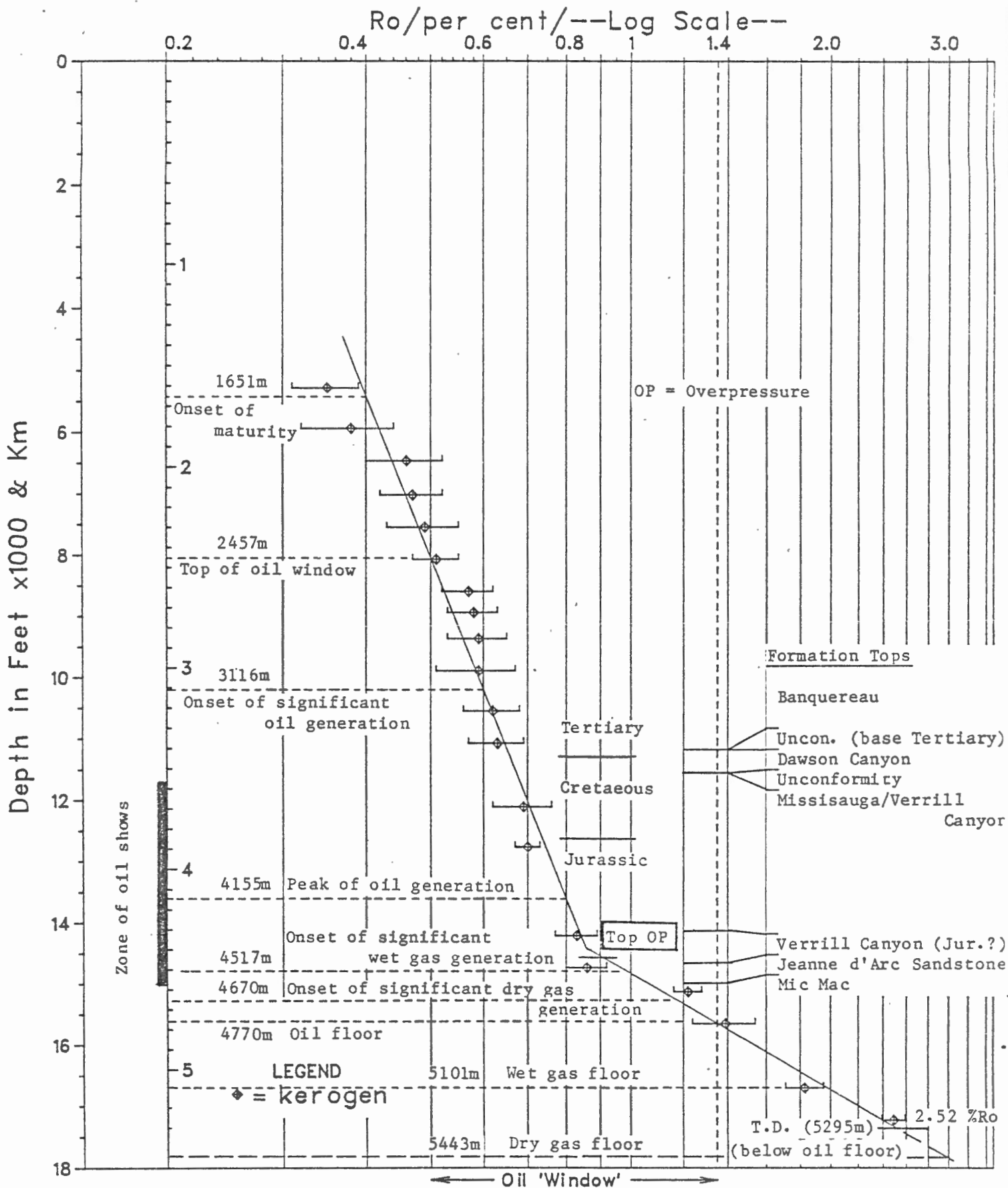
Fig. Bonanza M—71

Fig. 2
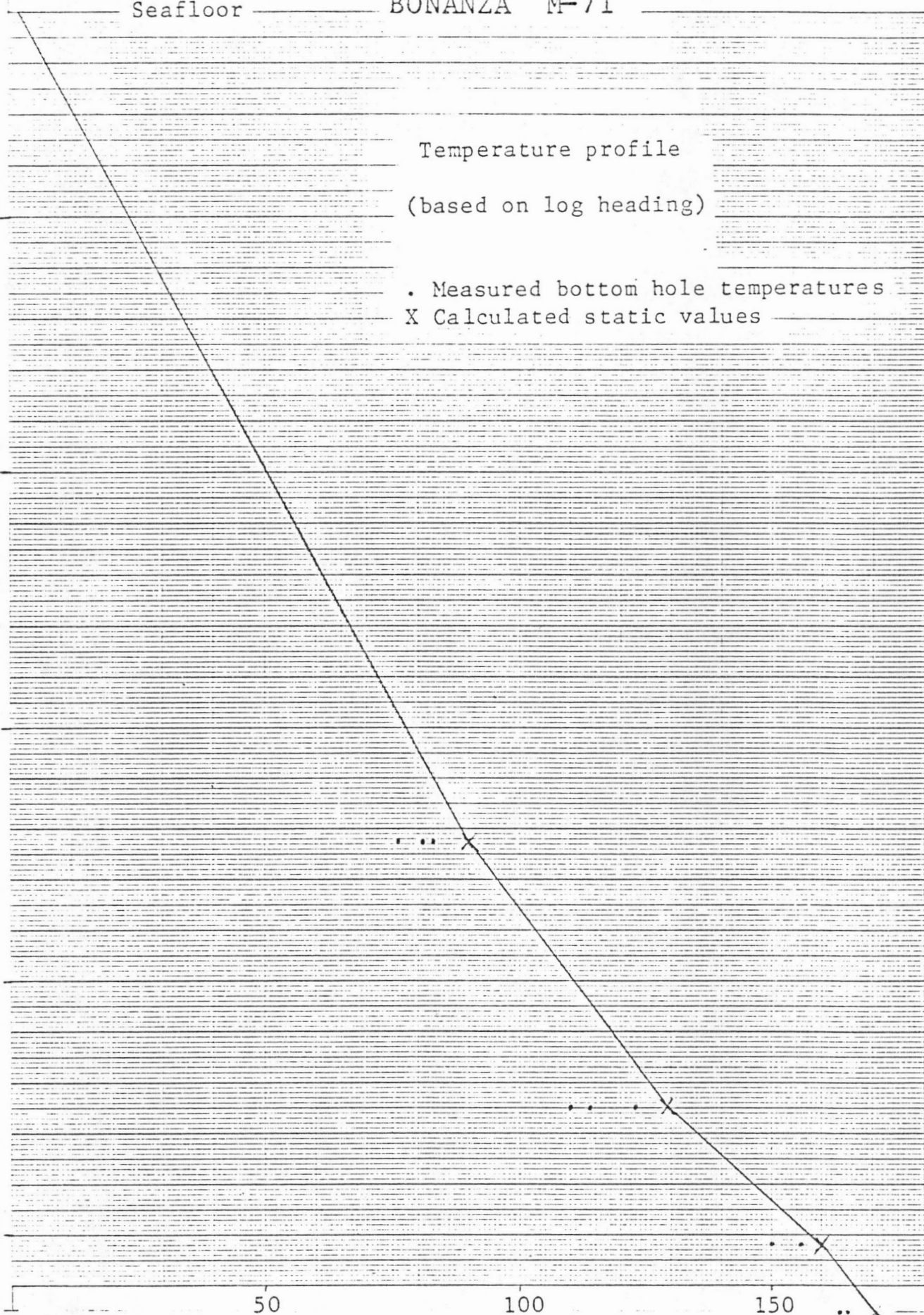
Sample Preparation Method

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 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.

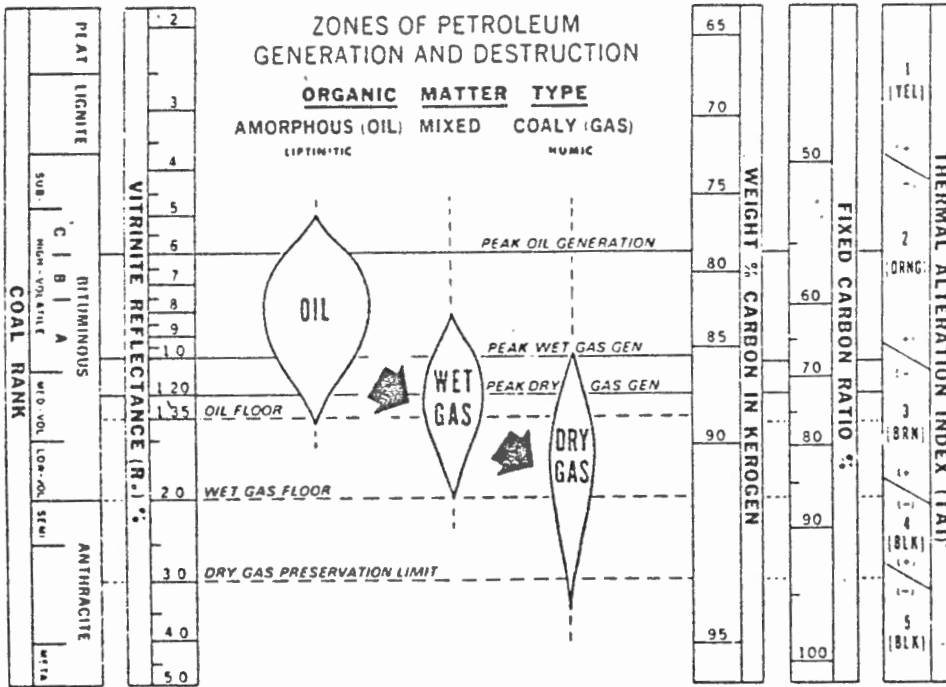### VITRINITE REFLECTANCE Lab preparation

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.

ZONES OF PETROLEUM
GENERATION AND DESTRUCTION

ORGANIC MATTER TYPE

AMORPHOUS (OIL)   MIXED   COALY (GAS)

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 Ro
is now used as the 'peak of oil generation' (Table I, Figure 1).
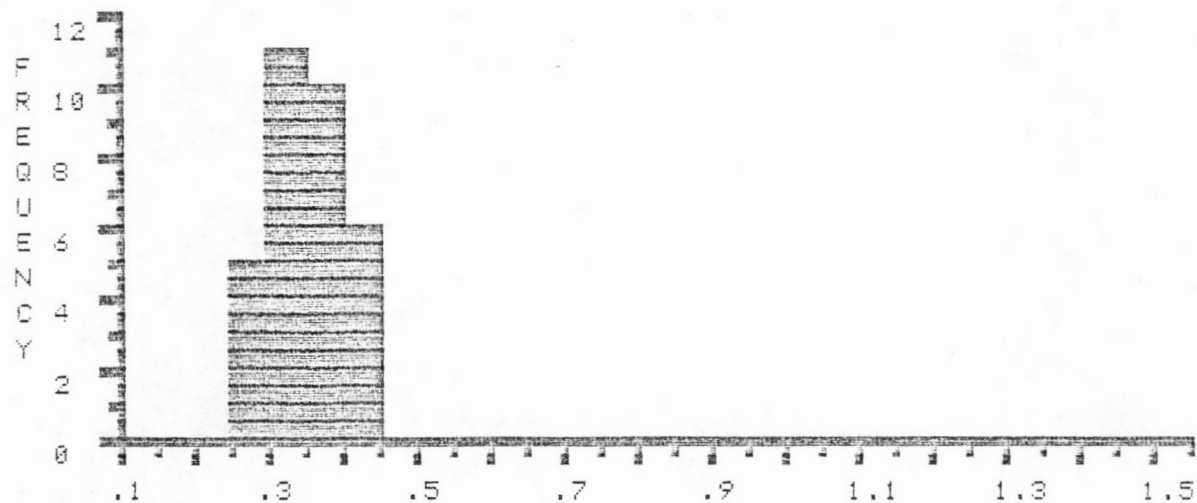
Vitrinite Reflectance Histograms

COL>	0	1	2	3	4	5	6	7	8	9
ROW		*.26	*.27	*.28	*.28	*.29	*.3	*.32	*.33	*.33
1	*.33	*.34	*.34	*.34	*.34	*.34	*.34	*.35	*.35	*.35
2	*.36	*.37	*.37	*.37	*.37	*.38	*.39	*.4	*.4	*.41
3	*.41	*.43	*.43	.48	.53	.54	.55	.73	.76	.83

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	15.59	39	.26	.83	.4	.13
*EDIT >	11.17	32	.26	.43	.35	.04

% REFLECTANCE
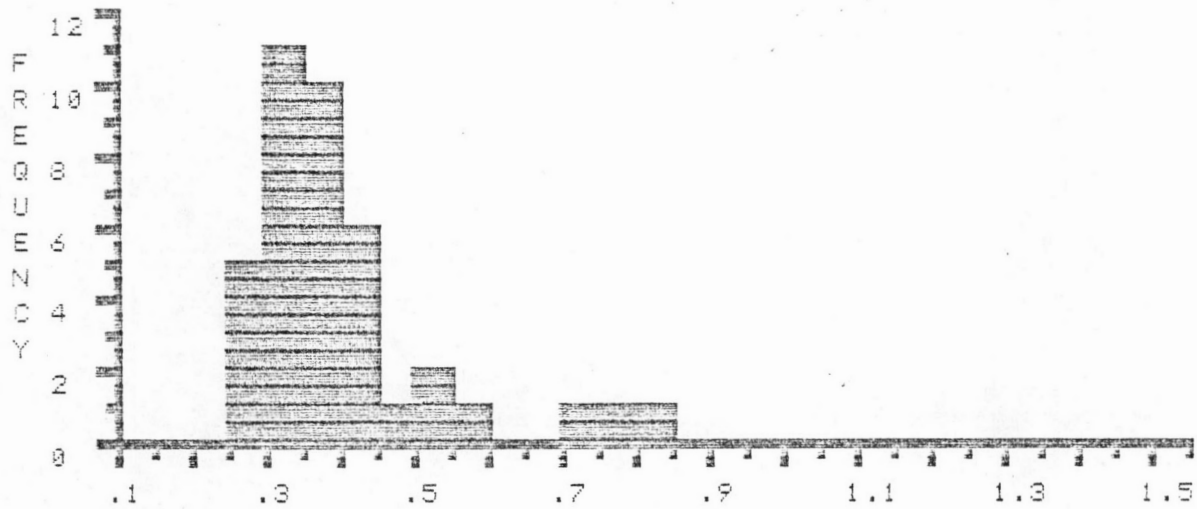
% REFLECTANCE * * EDITED * *

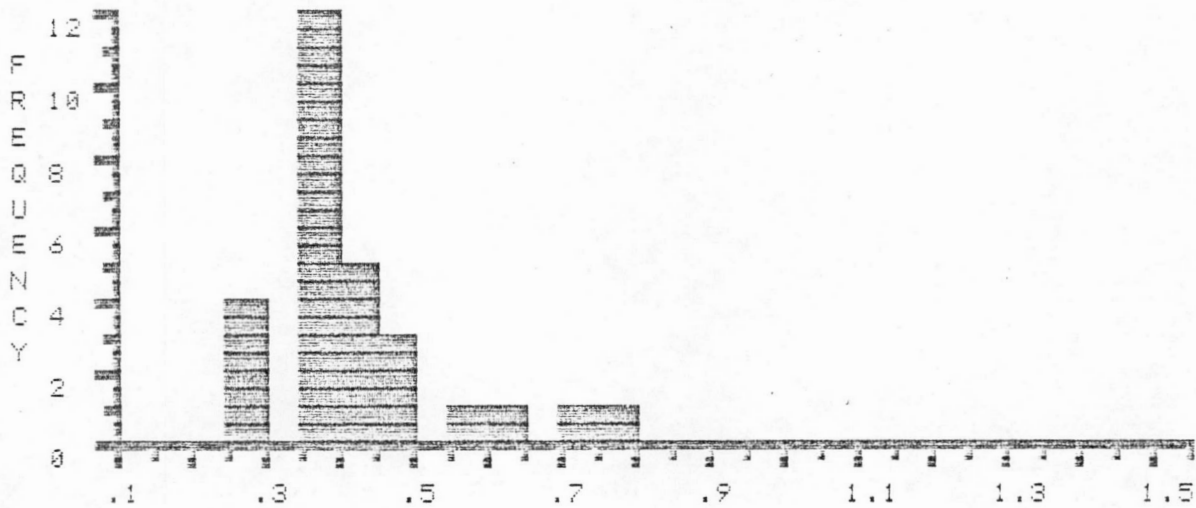FILE >> K0566B   DESCRIPTION FOLLOWS :
DEPTH 1760-1810M, BONANZA M-71, MIKE AVERY, DEC-7-85

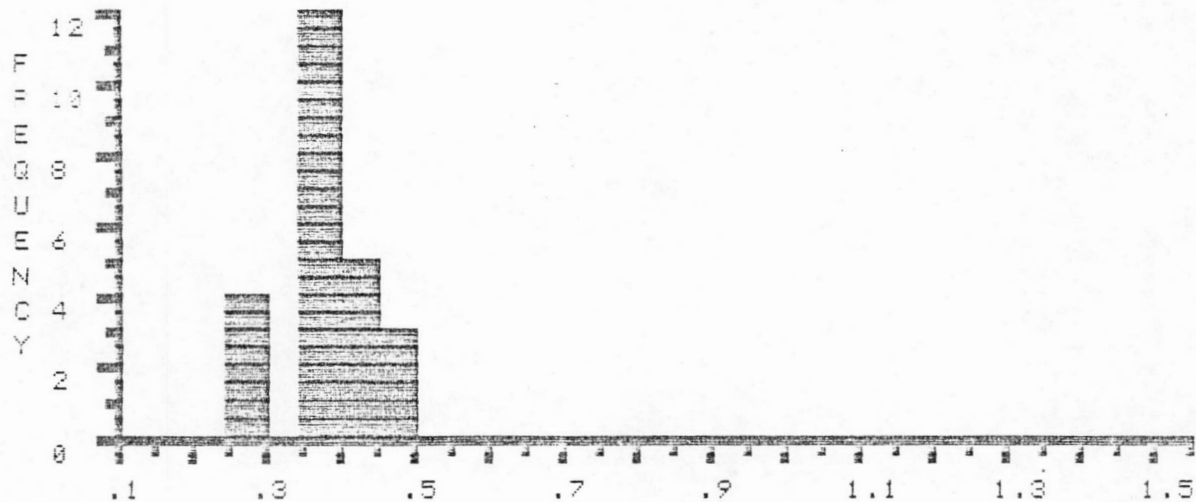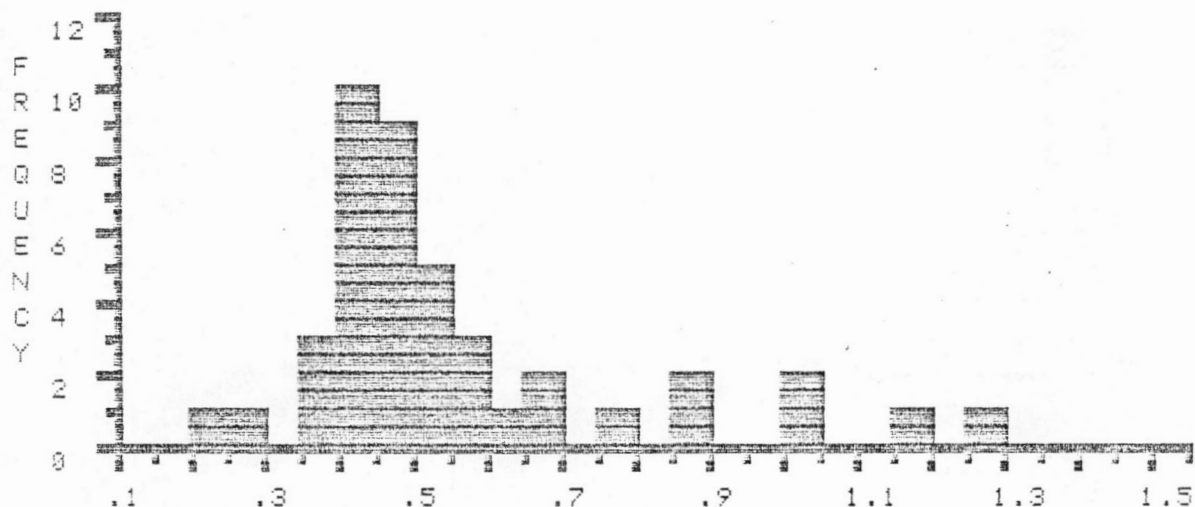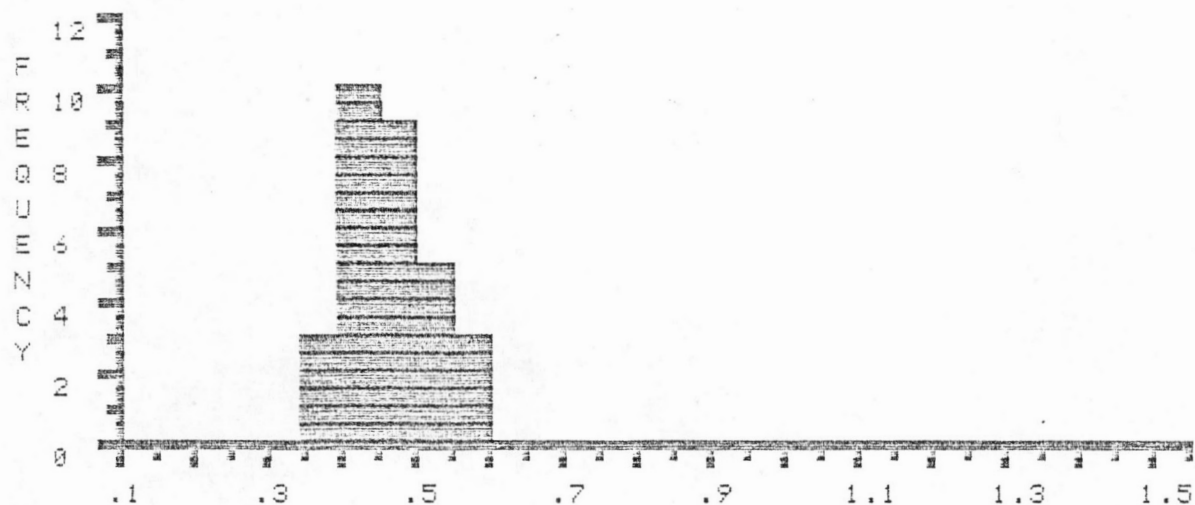COL>   0   1   2   3   4   5   6   7   8   9

ROW   *.25 *.28 *.29 *.29 *.35 *.36 *.36 *.36 *.36
 1   *.36 *.37 *.37 *.37 *.38 *.39 *.39 *.4   *.41 *.42
 2   *.43 *.44 *.46 *.47 *.49   .57   .63   .71   .75

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	11.71	28	.25	.75	.42	.12
*EDIT >	9.05	24	.25	.49	.38	.06

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

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

ROW										
		.21	.28	*.37	*.37	*.39	*.41	*.41	*.41	*.41
1	*.41	*.42	*.43	*.43	*.43	*.44	*.45	*.45	*.45	*.46
2	*.47	*.48	*.48	*.48	*.49	*.51	*.51	*.52	*.53	*.54
3	*.55	*.56	*.57	.62	.65	.67	.77	.85	.89	1.02
4	1.04	1.18	1.25							

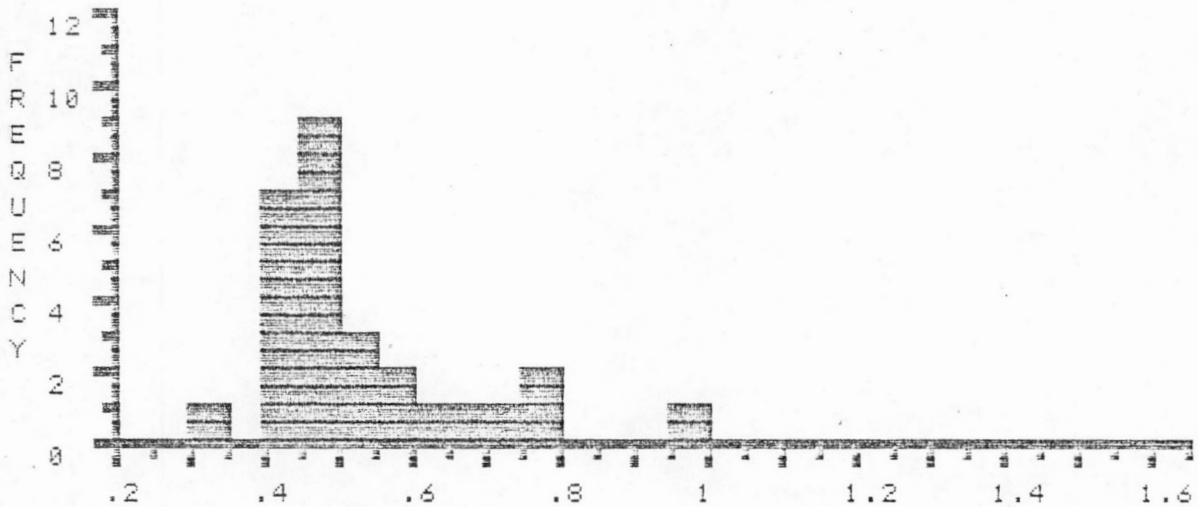|	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	23.26	42	.21	1.25	.55	.23
*EDIT >	13.83	30	.37	.57	.46	.06

% REFLECTANCE

% REFLECTANCE * * EDITED * *

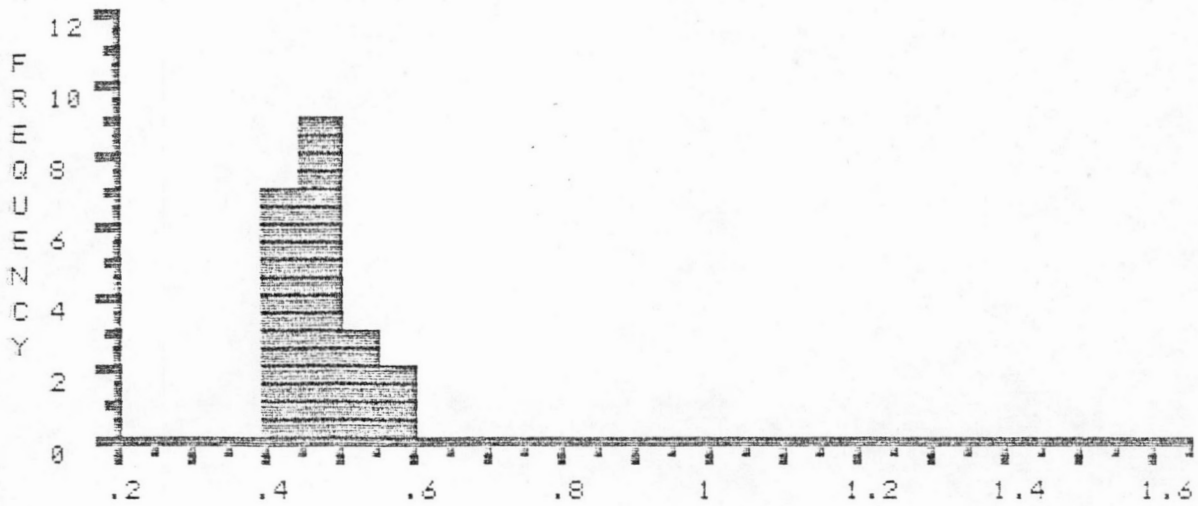FILE >> K0567A   DESCRIPTION FOLLOWS :
DEPTH 2090-2140M, SONANZA M-71, MIKE AVERY, DEC-7-85

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

ROW   .34   *.41   *.41   *.42   *.42   *.43   *.43   *.44   *.45
 1   *.45   *.45   *.45   *.46   *.47   *.48   *.49   *.49   *.5   *.52
 2   *.52   *.56   *.58   .61   .66   .74   .75   .76   .99

            SUM   NUMBER   MIN   MAX   MEAN   STAND.DEV.
 TOTAL > 14.68   28   .34   .99   .52   .14
*EDIT > 9.83   21   .41   .58   .47   .05
```

%  R E F L E C T A N C E



%  R E F L E C T A N C E * * EDITED * *

| COL> | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|------|---|---|---|---|---|---|---|---|---|---|
| ROW | | *.35 | *.38 | *.4 | *.4 | *.42 | *.42 | *.43 | *.43 | *.43 |
| 1 | *.43 | *.44 | *.44 | *.44 | *.45 | *.45 | *.45 | *.46 | *.46 | *.46 |
| 2 | *.47 | *.47 | *.47 | *.48 | *.48 | *.48 | *.48 | *.48 | *.48 | *.48 |
| 3 | *.48 | *.49 | *.49 | *.49 | *.5 | *.5 | *.5 | *.5 | *.5 | *.51 |
| 4 | *.51 | *.51 | *.51 | *.51 | *.51 | *.53 | *.53 | *.53 | *.54 | *.55 |
| 5 | *.56 | *.56 | *.57 | *.57 | *.57 | *.57 | *.59 | *.59 | *.59 | *.6 |
| 6 | .64 | .66 | .67 | .68 | .72 | .73 | .75 | .76 | .78 | .89 |
| 7 | .89 | .92 | .95 | | | | | | | |

|        | SUM   | NUMBER | MIN | MAX | MEAN | STAND.DEV. |
|--------|-------|--------|-----|-----|------|------------|
| TOTAL > | 38.91 | 72 | .35 | .95 | .54 | .13 |
| *EDIT > | 28.87 | 59 | .35 | .6 | .49 | .06 |

% R E F L E C T A N C E



% R E F L E C T A N C E * * EDITED * *

FILE >> K35670    DESCRIPTION FOLLOWS :
DEPTH 2410-2460M, BONANZA M-71, MIKE AVERY, FEB-3-36

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

ROW           .34  .35  .37  *.42 *.44 *.45 *.46 *.46 *.47
1     *.47 *.47 *.48 *.48 *.49 *.49 *.49 *.49 *.5  *.5
2     *.5  *.5  *.5  *.51 *.51 *.51 *.52 *.52 *.53 *.53
3     *.53 *.53 *.53 *.54 *.54 *.54 *.55  -   -.55 *.56
4     *.56 *.57 *.57 *.58 *.59  .62  .63  .66  .66  .67
5      .67  .69  .73  .75  .75  .77  .9  1.12

|        | SUM   | NUMBER | MIN | MAX  | MEAN | STAND.DEV. |
|--------|-------|--------|-----|------|------|------------|
| TOTAL > | 31.66 | 57     | .34 | 1.12 | .56  | .13        |
| *EDIT > | 20.98 | 41     | .42 | .59  | .51  | .04        |

% R E F L E C T A N C E



% R E F L E C T A N C E * * EDITED * *

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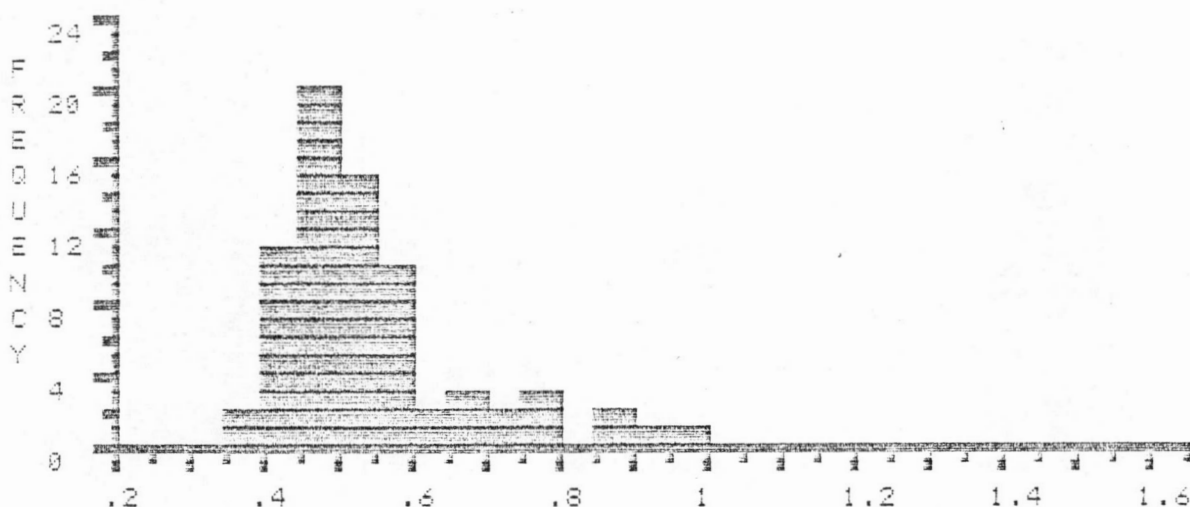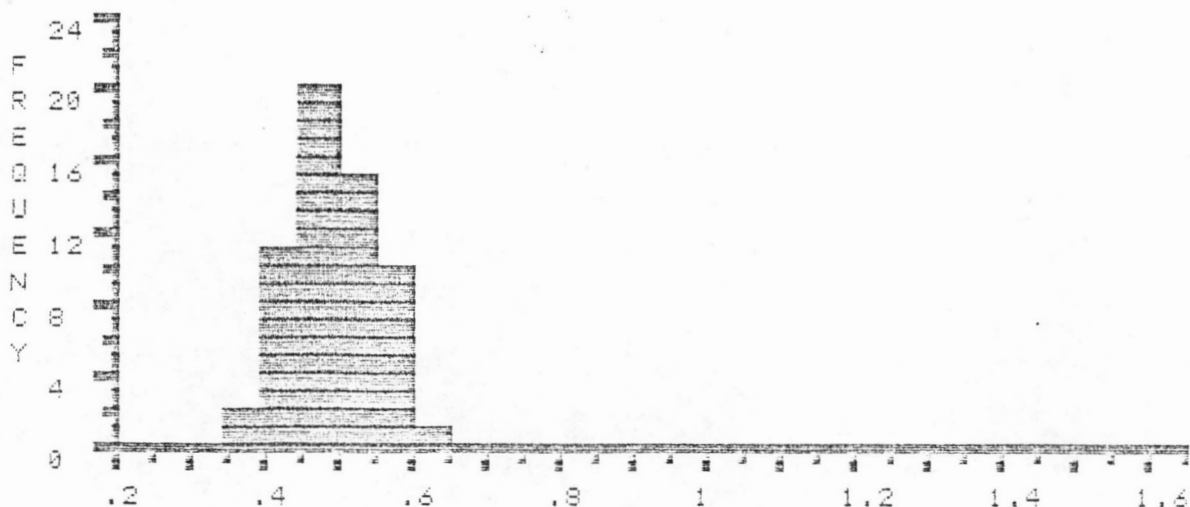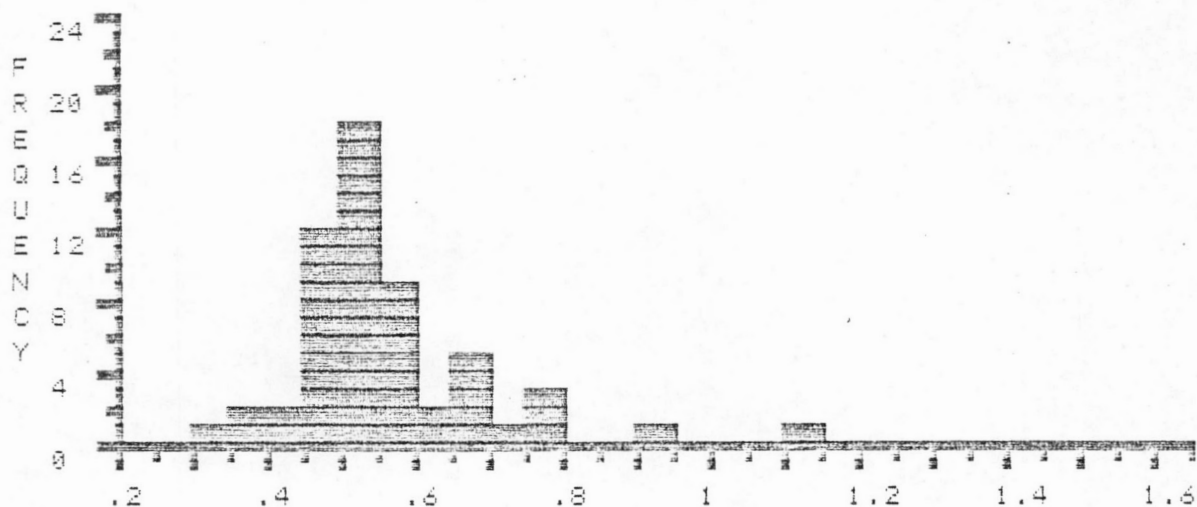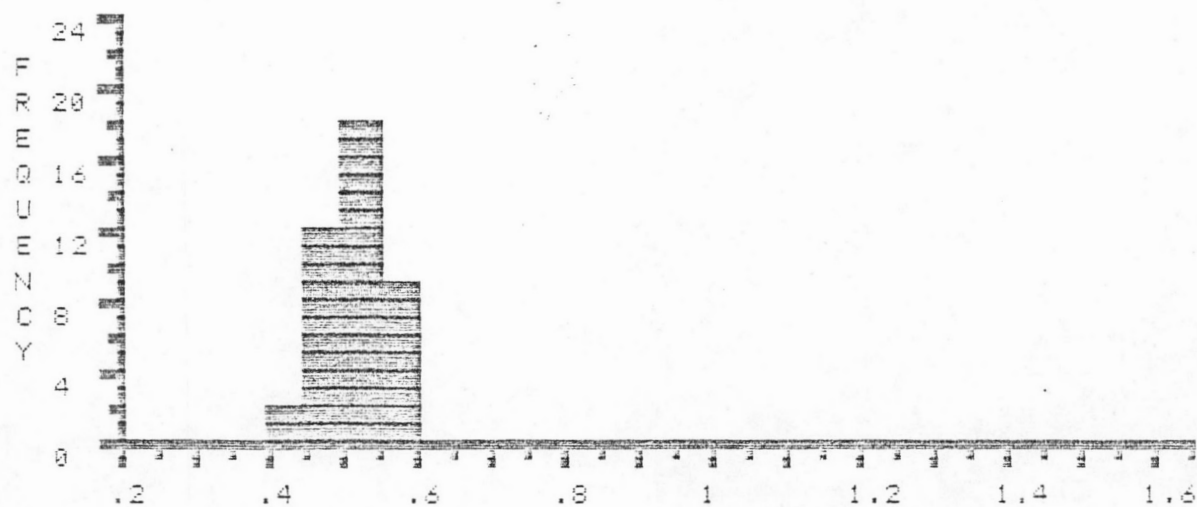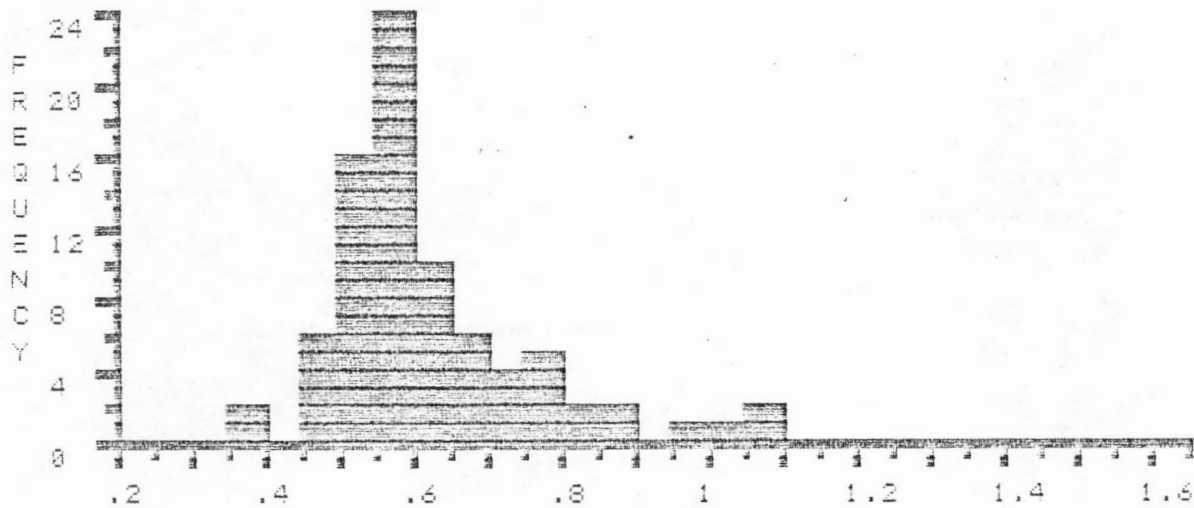FILE >> K0568A      DESCRIPTION FOLLOWS :
DEPTH 2570-2620M, BONANZA M-71, MIKE AVERY, FEB-6-86

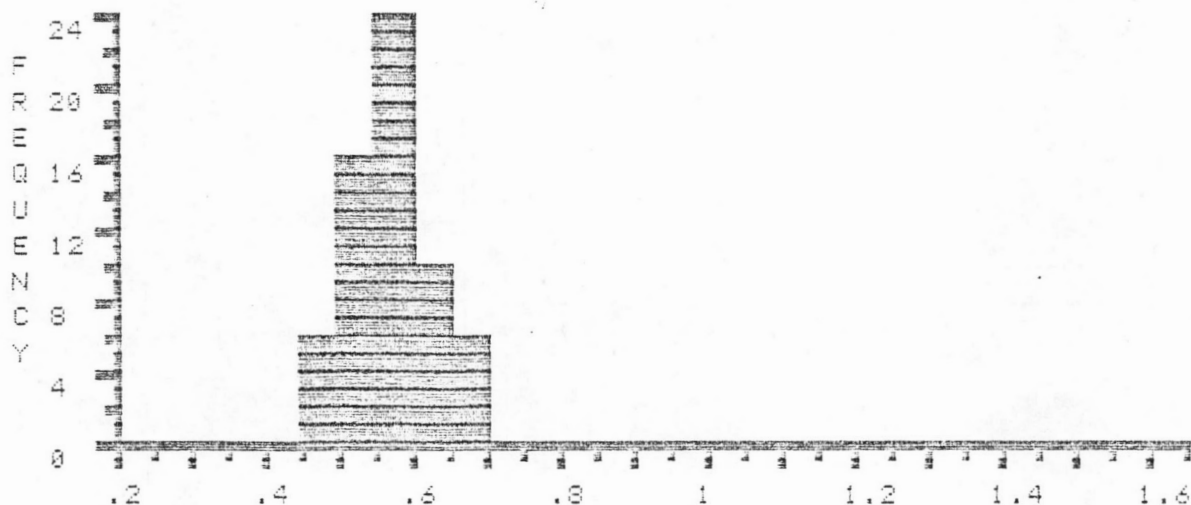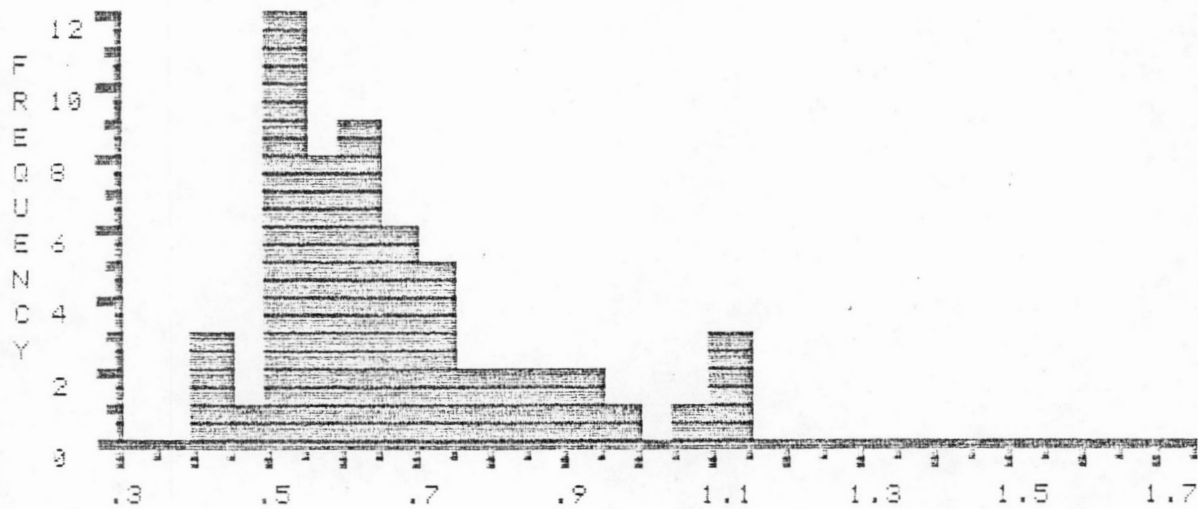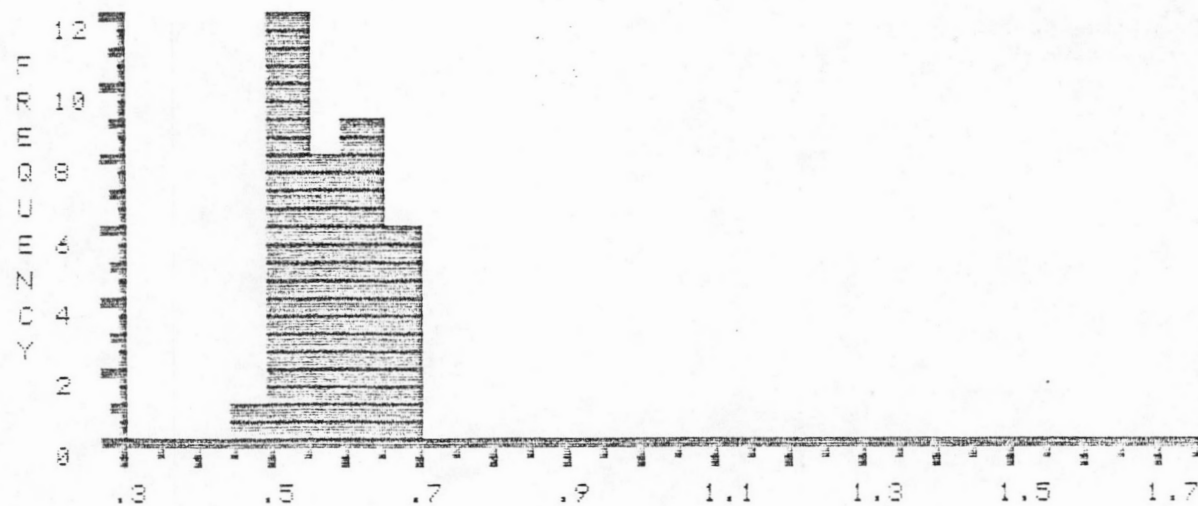COL>      0      1      2      3      4      5      6      7      8      9

ROW           .35    .39   *.46   *.48   *.48   *.49   *.49   *.49   *.51
 1     *.51   *.51   *.51   *.52   *.52   *.52   *.52   *.52   *.53   *.53
 2     *.53   *.53   *.54   *.54   *.54   *.55   *.55   *.55   *.55   *.55
 3     *.56   *.56   *.56   *.56   *.57   *.57   *.57   *.57   *.57   *.57
 4     *.58   *.58   *.58   *.58   *.58   *.58   *.59   *.59   *.59   *.6
 5     *.6    *.61   *.61   *.61   *.61   *.63   *.63   *.63   *.64   *.66
 6     *.67   *.68   *.68   *.69   *.69    .71    .72    .73    .74    .75
 7      .75    .76    .77    .78    .82    .83    .86    .86    .99   1
 8     1.06   1.06

           SUM       NUMBER      MIN       MAX      MEAN    STAND.DEV.
 TOTAL >  50.1         81        .35      1.06       .62       .14
*EDIT  >  35.17        62        .46       .69       .57       .05
```

% REFLECTANCE

% REFLECTANCE * * EDITED * *

COL>	0	1	2	3	4	5	6	7	8	9
ROW		.4	.42	.44	*.49	*.5	*.51	*.51	*.52	*.53
1	*.53	*.54	*.54	*.54	*.54	*.54	*.54	*.56	*.56	*.57
2	*.57	*.57	*.58	*.58	*.59	*.6	*.6	*.6	*.61	*.61
3	*.61	*.62	*.62	*.64	*.65	*.65	*.66	*.66	*.67	*.67
4	.71	.71	.71	.71	.74	.76	.78	.82	.84	.85
5	.86	.93	.94	.97	1.08	1.1	1.11	1.11		

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	37.87	57	.4	1.11	.66	.17
*EDIT >	20.88	36	.49	.67	.58	.05

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

FILE >> K0568C   DESCRIPTION FOLLOWS :
DEPTH 2845-2855M, BONANZA M-71, MIKE AVERY, FEB-6-86

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

ROW   .44   *.48   *.48   *.49   *.5   *.52   *.53   *.53   *.54
1   *.54   *.57   *.58   *.58   *.59   *.59   *.59   *.59   *.6   *.6
2   *.6   *.6   *.62   *.62   *.62   *.62   *.63   *.64   *.64   *.68
3   *.68   *.69   *.7   .74   .76   .78   .78   .8   .9   .91
4   .93   .99   1.09   1.11   1.13   1.16   1.17   1.23

          SUM   NUMBER   MIN   MAX   MEAN   STAND.DEV.
  TOTAL > 33.15   47   .44   1.23   .71   .21
  EDIT > 18.24   31   .48   .7   .59   .06

% REFLECTANCE

% REFLECTANCE * * EDITED * *

FILE >> K0569A   DESCRIPTION FOLLOWS :
DEPTH 3005-3015M, BONANZA M-71, MIKE AVERY, FEB-6-84

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

ROW   .26   .4   .44   *.49   *.5   *.52   *.54   *.56   *.58
 1   *.67   *.69   *.7   .82   .85   .87   .9   .93   .95   .99
 2   1.02   1.02   1.06   1.06

              SUM   NUMBER   MIN   MAX   MEAN   STAND.DEV.
 TOTAL >   16.84   23   .26   1.06   .73   .24
*EDIT >   5.27   9   .49   .7   .59   .08

% REFLECTANCE

% REFLECTANCE * * EDITED * *

FILE >> K656FE   DESCRIPTION FOLLOWS :
DEPTH 3205-3215M. BONANZA M-71, MIKE AVERY, FEB-6-86

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

ROW   *.53 *.53 *.53 *.56 *.58 *.6   *.61 *.61 *.61
 1   *.61 *.62 *.62 *.62 *.64 *.65 *.65 *.68 *.7   *.73
 2   *.74   .79   .87 1.03 1.13 1.21 1.23 1.29

          SUM   NUMBER   MIN   MAX   MEAN   STAND.DEV.
 TOTAL > 19.97   27   .53   1.29   .74   .23
*EDIT > 12.42   20   .53   .74   .62   .06

              % R E F L E C T A N C E

              % R E F L E C T A N C E * * EDITED * *

COL>	0	1	2	3	4	5	6	7	8	9
ROW		.38	.4	.48	*.52	*.54	*.55	*.55	*.56	*.56
1	*.58	*.59	*.6	*.61	*.61	*.61	*.61	*.61	*.62	*.62
2	*.62	*.63	*.63	*.63	*.63	*.64	*.65	*.65	*.65	*.66
3	*.66	*.67	*.68	*.69	*.7	*.71	*.73	*.75	*.75	.79
4	.8	.8	.81	1	1	1.11				

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	29.63	45	.38	1.11	.66	.14
*EDIT >	22.06	35	.52	.75	.63	.06

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

COL>	0	1	2	3	4	5	6	7	8	9
ROW		.43	.54	*.59	*.59	*.61	*.61	*.62	*.63	*.63
1	*.63	*.63	*.64	*.67	*.67	*.67	*.68	*.68	*.69	*.68
2	*.69	*.69	*.69	*.69	*.69	*.7	*.7	*.7	*.71	*.73
3	*.75	*.77	*.78	*.79	*.81	*.81	*.83	*.83	.93	.94
4	.94	1.05	1.06	1.08	1.11	1.23	1.29	1.29	1.33	1.36
5	1.38									

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	40.23	50	.43	1.38	.8	.24
*EDIT >	24.27	35	.59	.83	.69	.07

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

FILE >> K8570B   DESCRIPTION FOLLOWS :
DEPTH 3840-3890M, BONANZA M-71, MIKE AVERY, FEB-11-86

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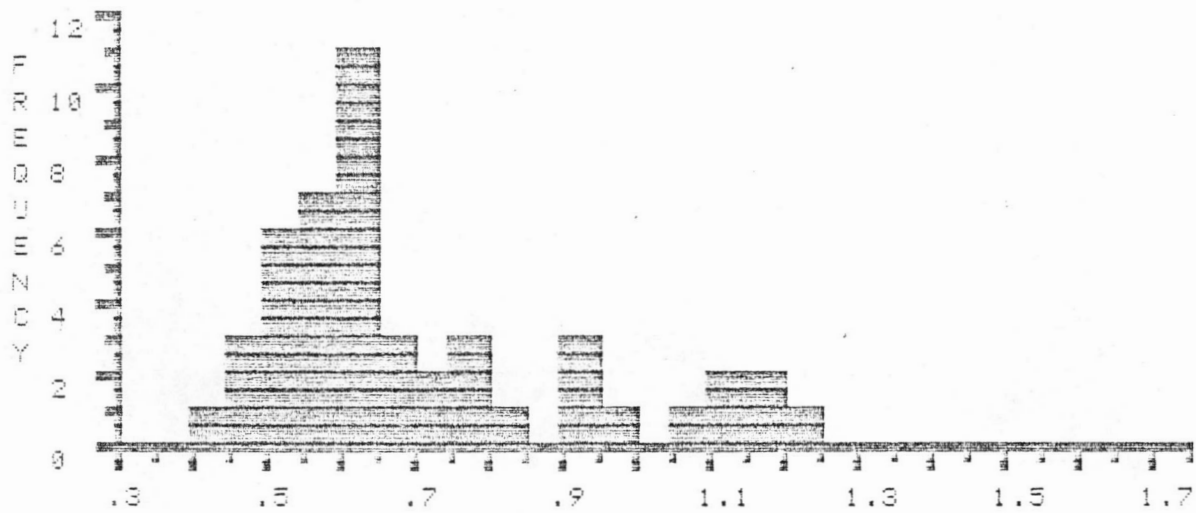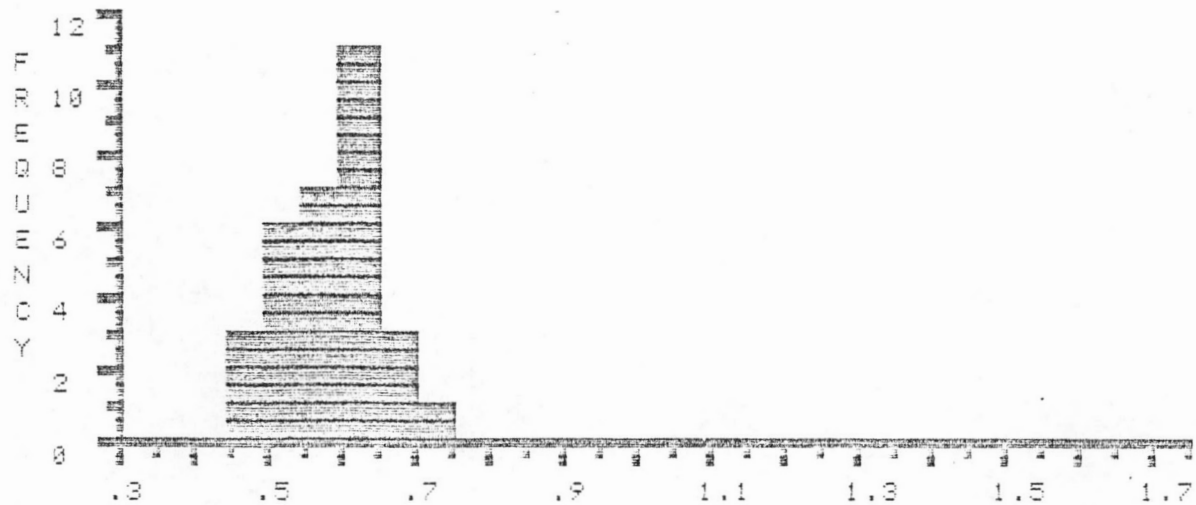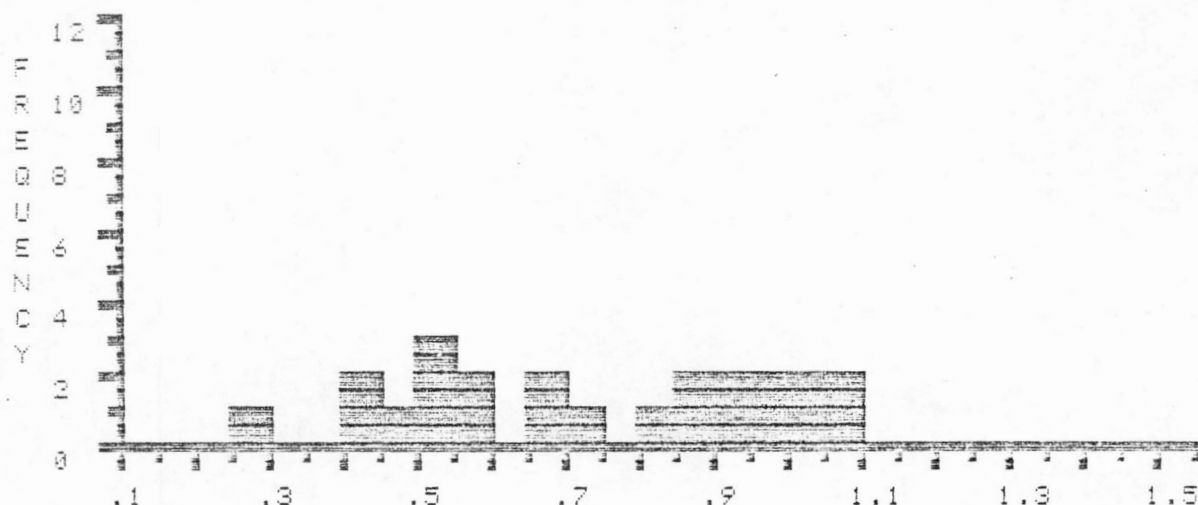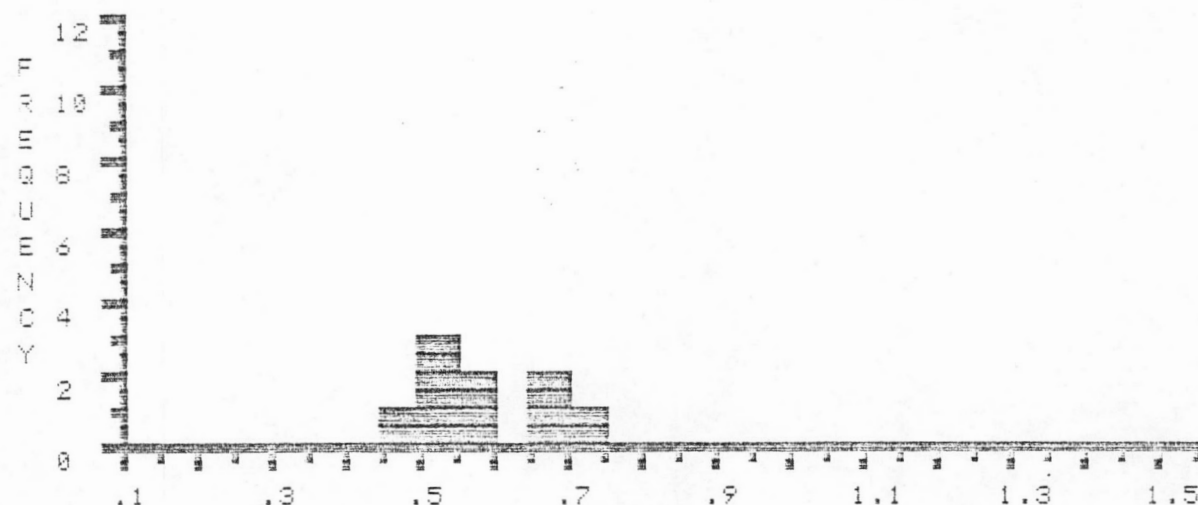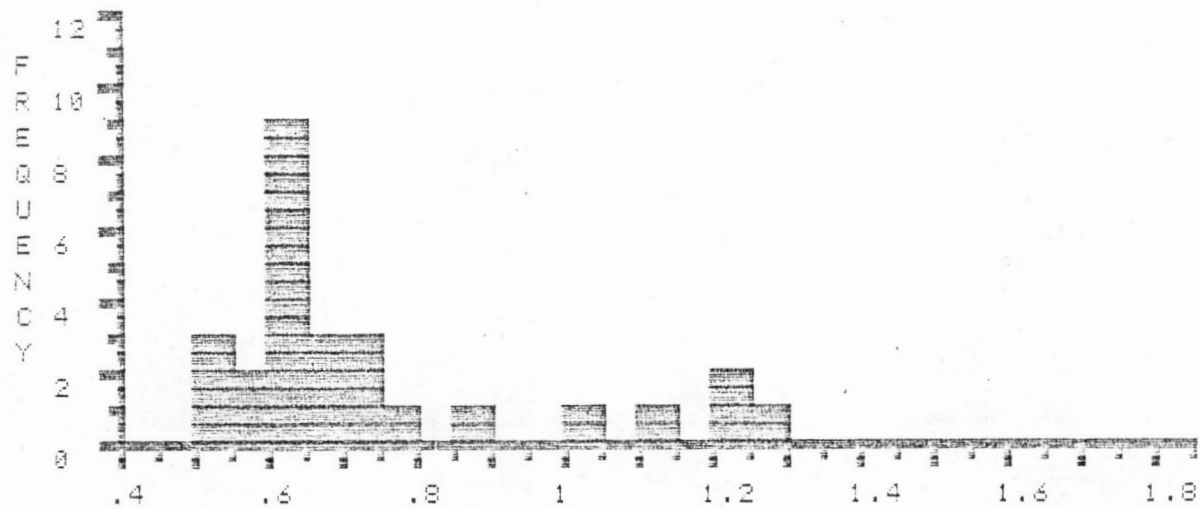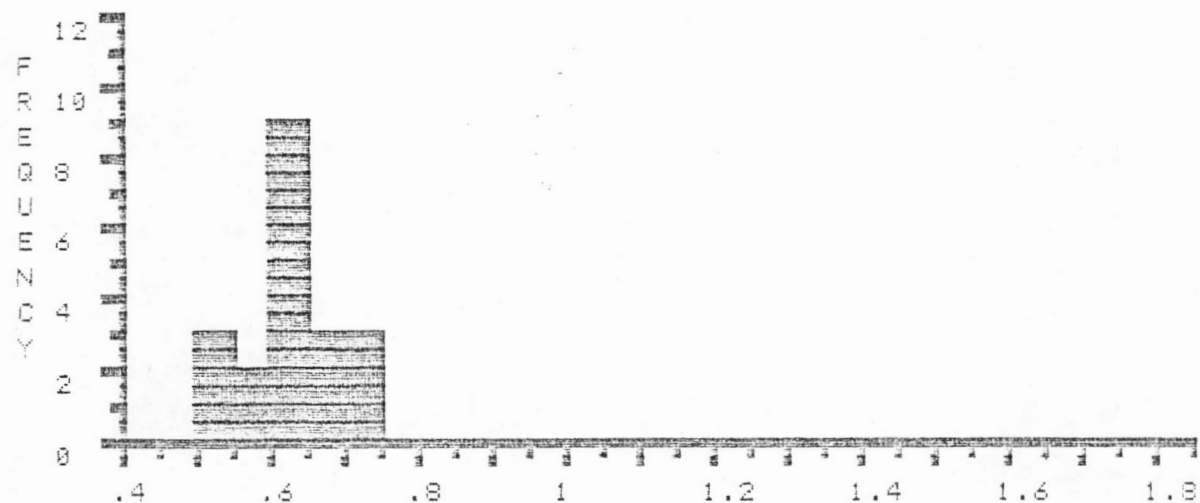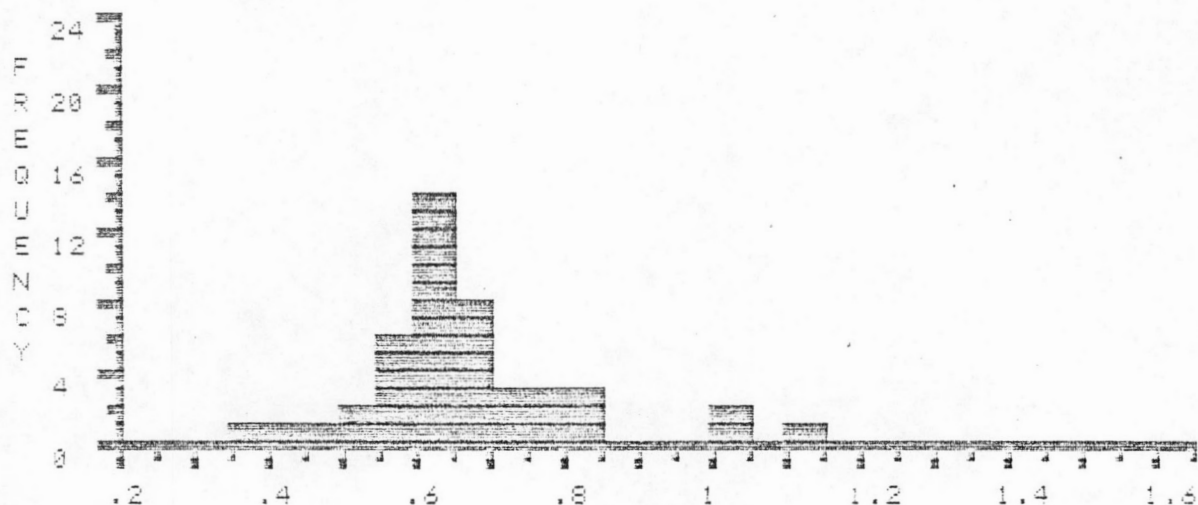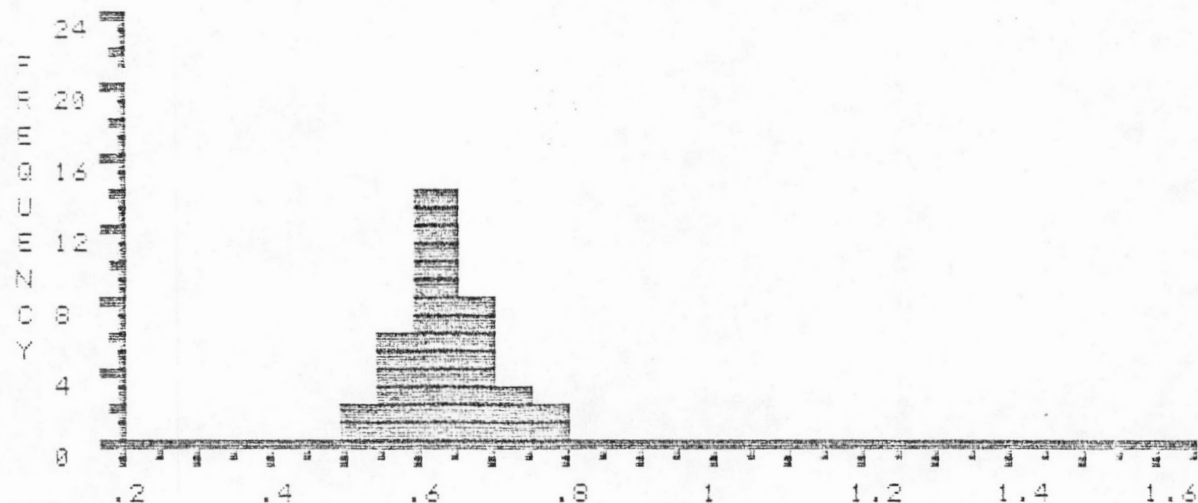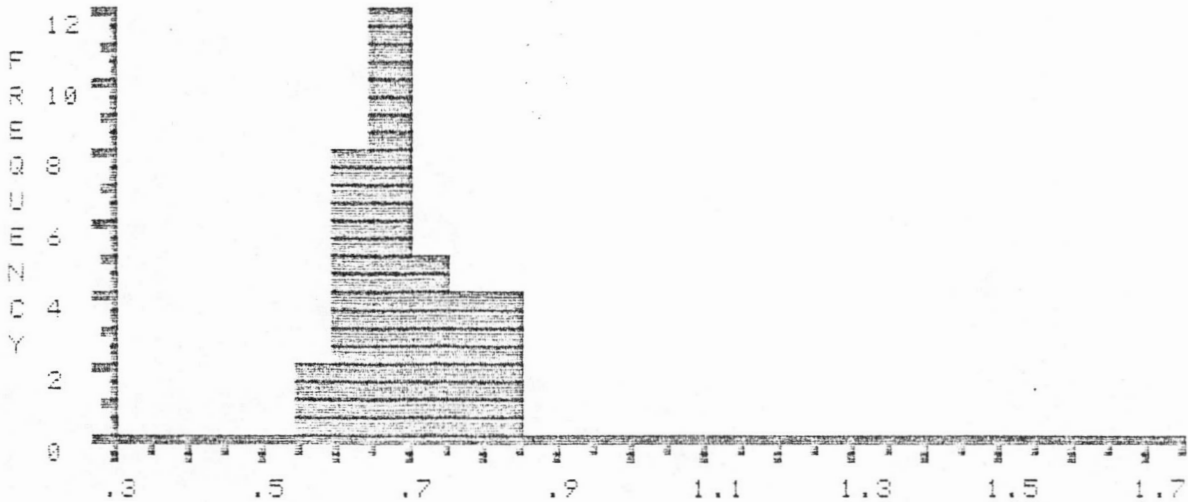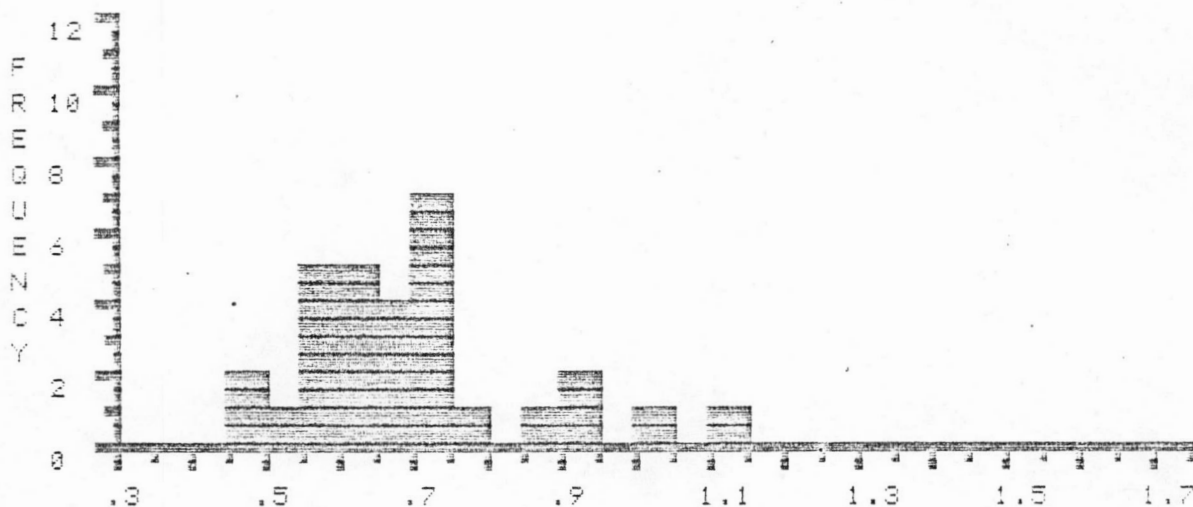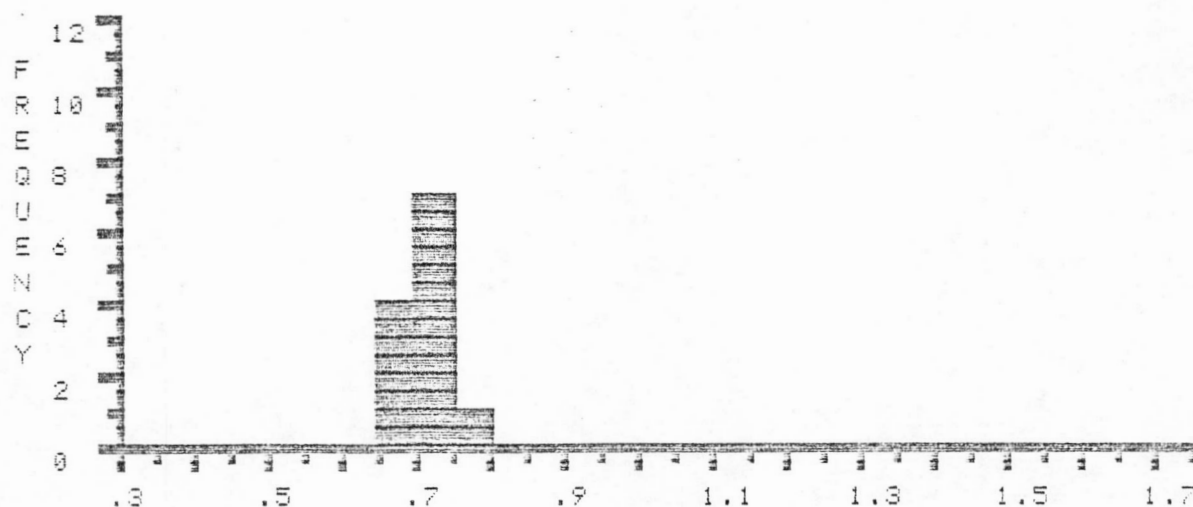COL>      0      1      2      3      4      5      6      7      8      9
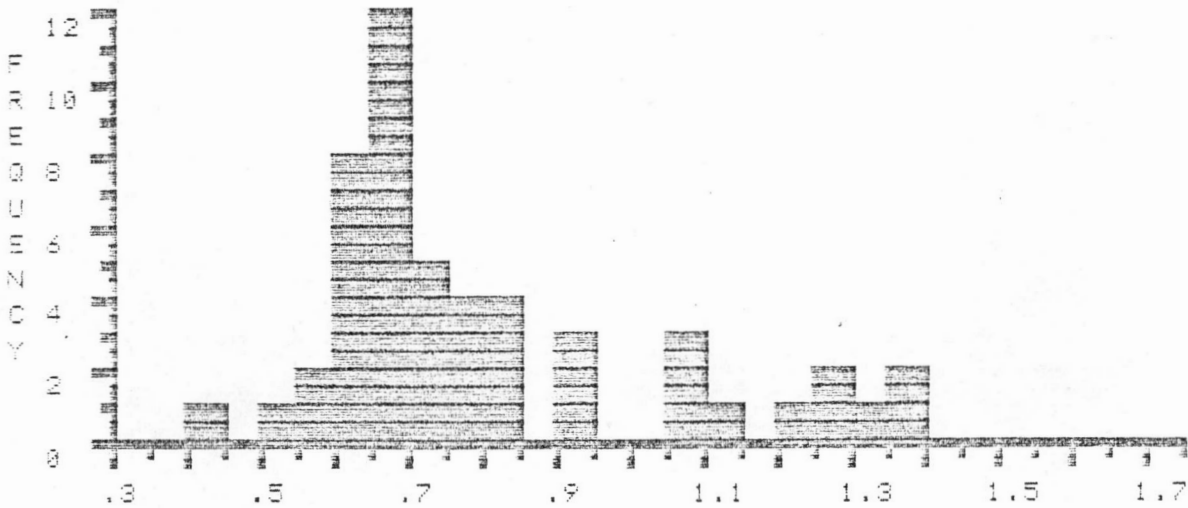
ROW           .47    .49    .53    .56    .58    .58    .59    .59    .6
  1    .62    .62    .62    .63   *.65   *.65   *.68   *.69   *.7    *.7
  2   *.71   *.72   *.72   *.73   *.73   *.75    .87    .9     .94   1.03
  3    1.13

              SUM       NUMBER       MIN      MAX      MEAN    STAND.DEV.
  TOTAL >   20.78        30          .47     1.13      .69       .15
 *EDIT >     8.43        12          .65      .75      .7        .03
```

% REFLECTANCE

% REFLECTANCE * * EDITED * *

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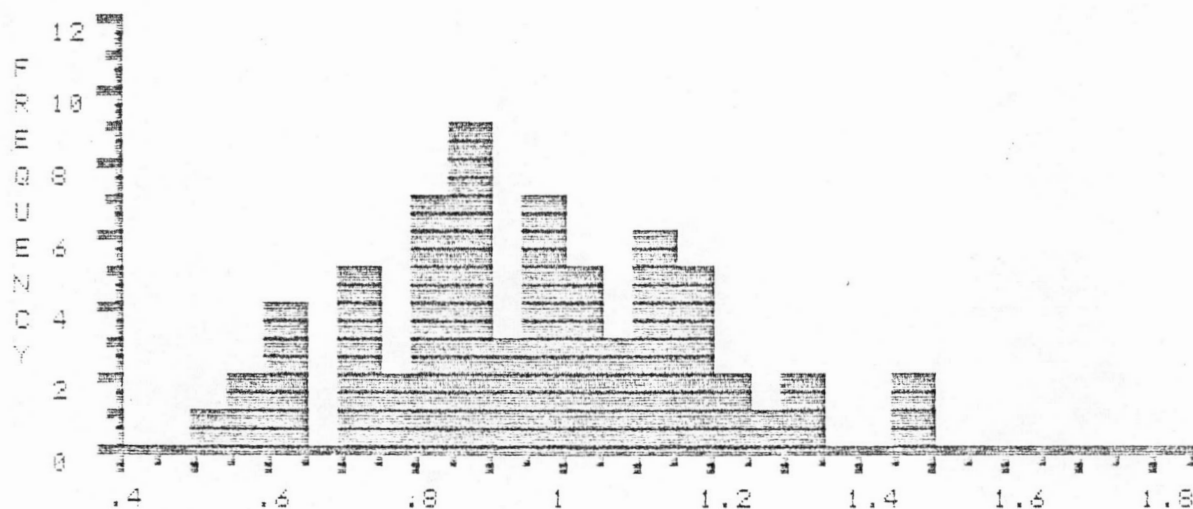FILE >> K0570C      DESCRIPTION FOLLOWS ;
DEPTH 4240-4330M, BONANZA M-71, MIKE AVERY, FEB-11-86

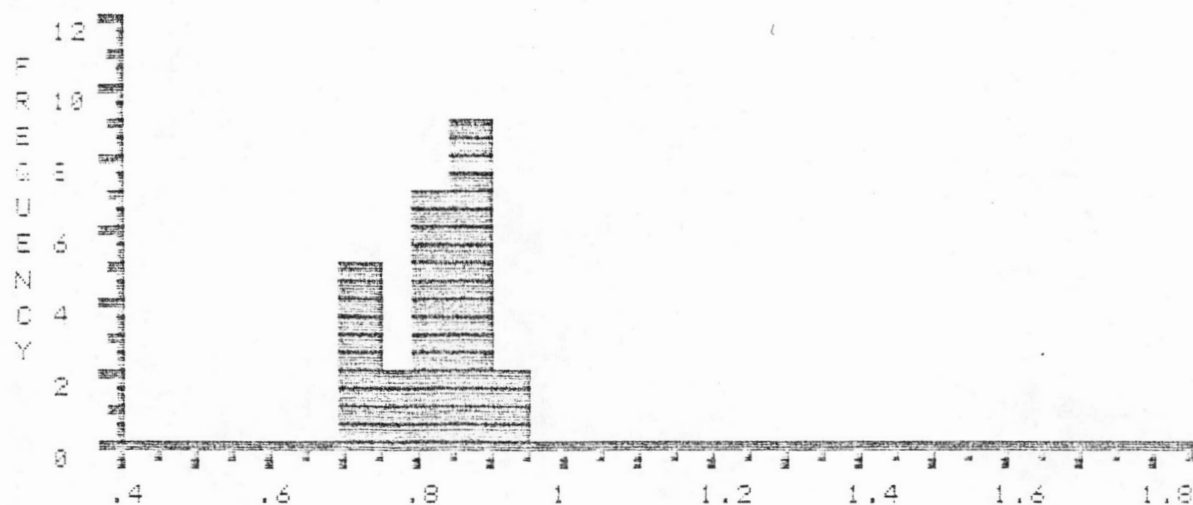COL>     0     1     2     3     4     5     6     7     8     9

ROW           .53   .58   .59   .6    .61   .63   .63   *.7   *.72
 1     *.73  *.74  *.74  *.75  *.78  *.8   *.82  *.84  *.84  *.84
 2     *.84  *.84  *.86  *.86  *.86  *.87  *.88  *.89  *.89  *.89
 3     *.89  *.9   *.9    .93   .95   .95   .96   .97   .98   .99
 4      .99  1     1.02  1.03  1.03  1.03  1.07  1.08  1.09  1.1
 5     1.11  1.11  1.12  1.14  1.14  1.15  1.15  1.17  1.18  1.19
 6     1.2   1.23  1.26  1.3   1.33  1.45  1.45
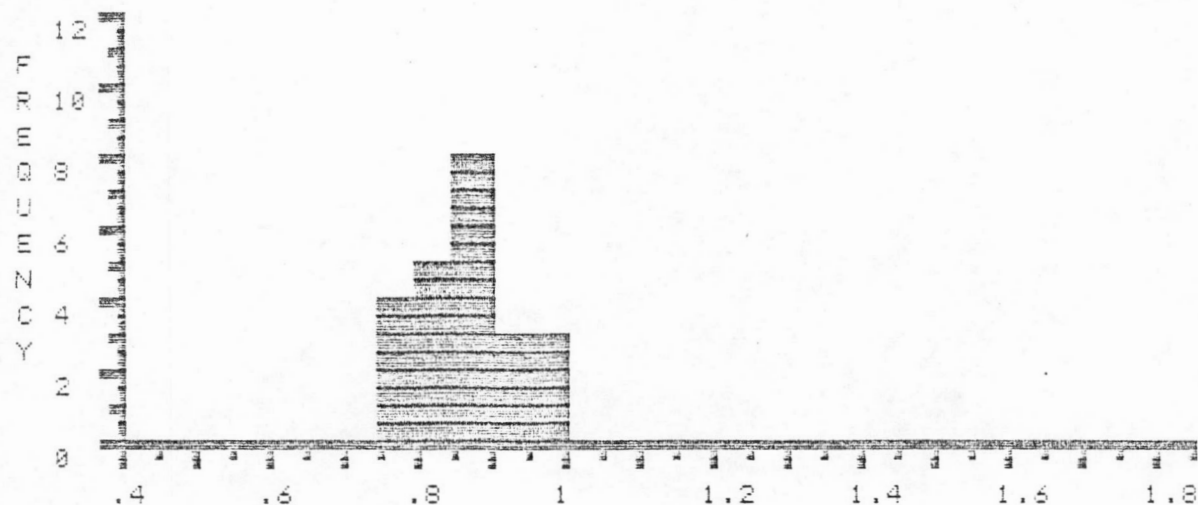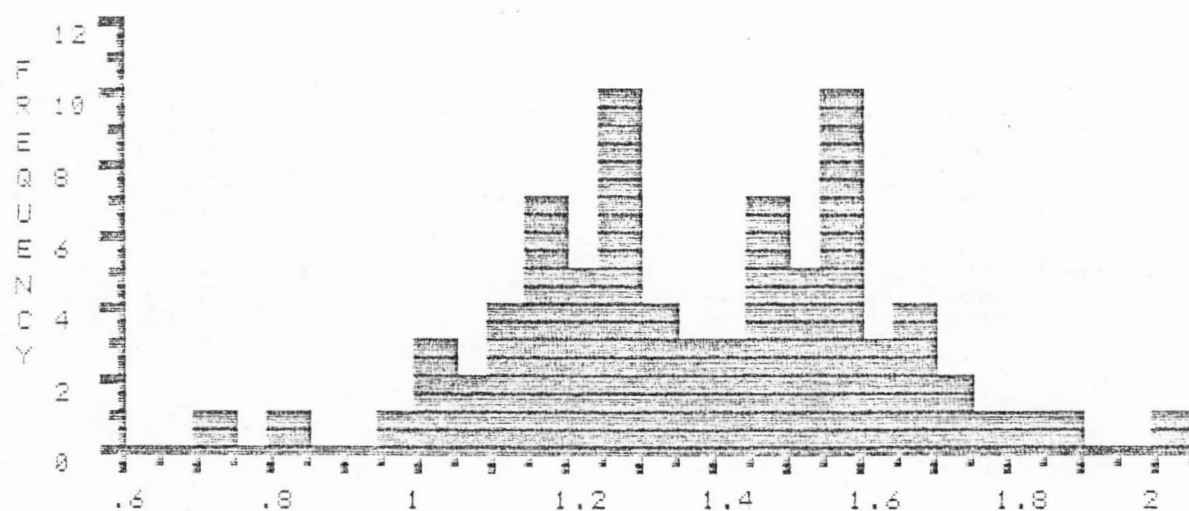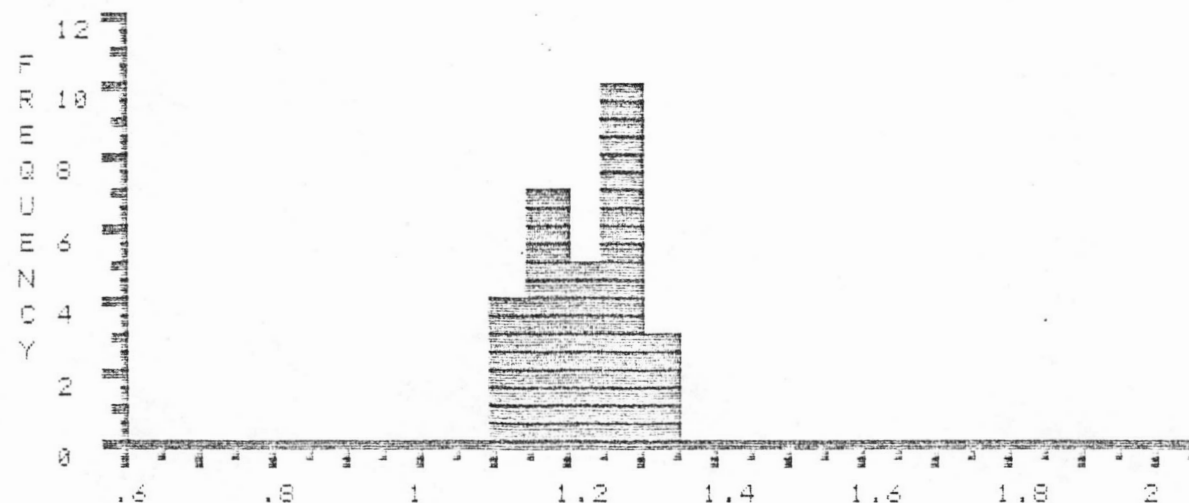
          SUM       NUMBER      MIN       MAX      MEAN     STAND.DEV.
 TOTAL > 62.69       66        .53       1.45      .95        .21
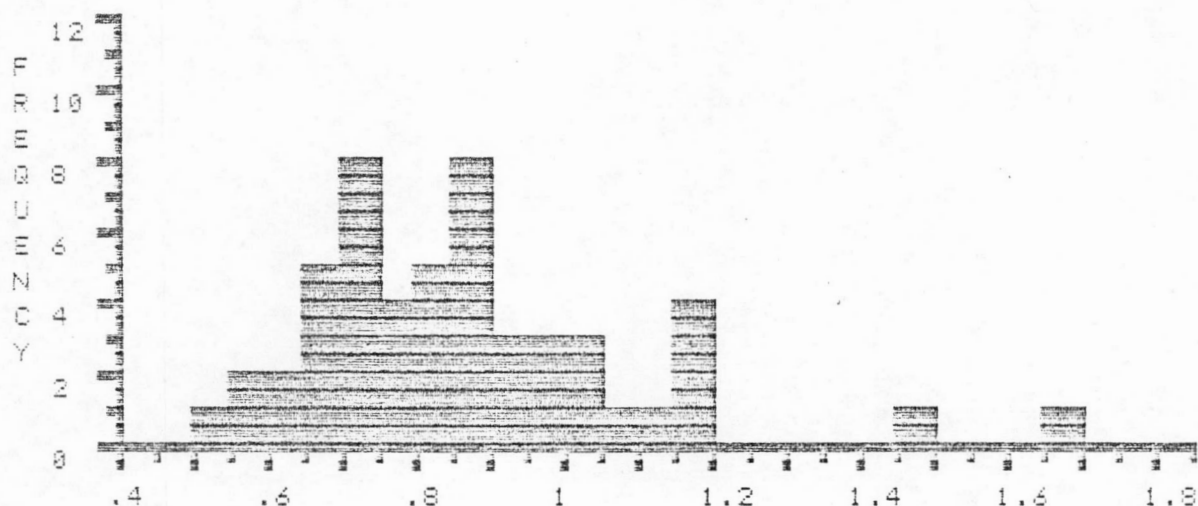*EDIT  > 20.67       25        .7        .9        .83        .06
```

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

COL>	0	1	2	3	4	5	6	7	8	9
ROW		.54	.58	.58	.6	.62	.65	.67	.67	.69
1	.69	.7	.7	.7	.7	.72	.73	.74	.74	*.76
2	*.77	*.78	*.79	*.8	*.83	*.84	*.84	*.84	*.85	*.85
3	*.86	*.86	*.87	*.88	*.88	*.88	*.91	*.94	*.94	*.96
4	*.96	*.97	1	1.02	1.04	1.07	1.14	1.15	1.15	1.15
5	1.17	1.46	1.67							

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	44.9	52	.54	1.67	.86	.22
*EDIT >	19.66	23	.76	.97	.86	.06

% REFLECTANCE

% REFLECTANCE * * EDITED * *

FILE >> K05715   DESCRIPTION FOLLOWS :
DEPTH 4560-4610M, BONANZA M-71, MIKE AVERY, FEB-11-86

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

ROW   .73   .8   .99   1.02 1.03 1.03 1.05 1.08 *1.12
  1   *1.13 *1.13 *1.14 *1.15 *1.16 *1.16 *1.17 *1.18 *1.18 *1.19
  2   *1.2 *1.2 *1.22 *1.23 *1.23 *1.25 *1.26 *1.26 *1.26 *1.27
  3   *1.27 *1.28 *1.28 *1.28 *1.29 *1.3 *1.31 *1.31 1.34 1.37
  4   1.38 1.39 1.4   1.44 1.44 1.45 1.47 1.47 1.48 1.49
  5   1.49 1.49 1.51 1.53 1.53 1.54 1.54 1.56 1.56 1.57
  6   1.57 1.57 1.58 1.59 1.59 1.59 1.59 1.6   1.61 1.61
  7   1.65 1.66 1.67 1.68 1.71 1.74 1.78 1.82 1.87 2.01

              SUM   NUMBER   MIN   MAX   MEAN   STAND.DEV.
 TOTAL >   109.06   79   .73   2.01   1.39   .26
*EDIT >   35.41   29   1.12   1.31   1.22   .06

% REFLECTANCE

% REFLECTANCE * * EDITED * *

FILE >> K05710   DESCRIPTION FOLLOWS :
DEPTH 4720-4770M, BONANZA M-71, MIKE AVERY, FEB-11-86

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

ROW   .56   .58   .61   .62   .65   .68   .67   .69   .73
  1   .73   .75   .76   1.07 *1.15 *1.15 *1.15 *1.17 *1.22 *1.34
  2   *1.35 *1.35 *1.37 *1.37 *1.37 *1.38 *1.39 *1.39 *1.43 *1.46
  3   *1.48 *1.51 *1.51 *1.58 *1.59 *1.6 *1.62 1.7   1.75 1.75
  4   1.78 1.82 1.83 1.87 1.89 2.05

           SUM   NUMBER   MIN   MAX   MEAN   STAND.DEV.
 TOTAL > 57.49   45   .56   2.05   1.29   .43
*EDIT > 31.93   23   1.15   1.62   1.39   .15

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

COL>	0	1	2	3	4	5	6	7	8	9
ROW		.86	.86	1.07	1.12	1.49	*1.65	*1.7	*1.7	*1.73
1	*1.72	*1.78	*1.81	*1.83	*1.91	*1.92	*1.94	*1.94	*1.78	*2.01
2	2.11	2.14	2.2	2.2	2.42	2.81	3.48	3.71	3.87	

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	55.95	28	.86	3.87	2	.74
*EDIT >	25.61	14	1.65	2.01	1.83	.12

% R E F L E C T A N C E

% R E F L E C T A N C E * * EDITED * *

FILE >> K0572B   DESCRIPTION FOLLOWS :
DEPTH 5160-5250M, BONANZA M-71, MIKE AVERY, FEB-14-86

COL>	0	1	2	3	4	5	6	7	8	9
ROW		.66	1.03	1.23	1.41	1.88	2.05	2.08	2.09	2.19
1	2.21	2.21	2.23	2.24	*2.33	*2.35	*2.36	*2.37	*2.37	*2.39
2	*2.42	*2.44	*2.44	*2.45	*2.45	*2.46	*2.51	*2.53	*2.54	*2.54
3	*2.57	*2.57	*2.59	*2.6	*2.63	*2.64	*2.69	2.8	2.8	2.83
4	2.84	2.88	2.89	2.91	2.93	3.08	3.1	3.14	3.16	3.19
5	3.26	3.31	3.39	3.47	3.52	3.56	3.56	3.59	3.71	3.84
6	3.9	3.94	4.06	4.55						

	SUM	NUMBER	MIN	MAX	MEAN	STAND.DEV.
TOTAL >	170.96	63	.66	4.55	2.71	.71
*EDIT >	57.24	23	2.33	2.69	2.49	.1

% REFLECTANCE

% REFLECTANCE * * EDITED * *