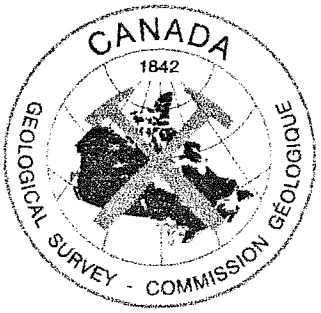



Geological Survey of Canada open file # 3855

---

# Vitrinite reflectance (Ro) of dispersed organics from Shell et al **Shubenacadie H-100**

---

M.P. Avery
Marine Resources Geoscience Subdivision
Geological Survey of Canada (Atlantic), Dartmouth
December 8, 1999

Natural Resources Canada | Ressources naturelles Canada

Canada

**Vitrinite reflectance (Ro) of dispersed organics from Shell et al Shubenacadie H-100**

**G.S.C. Locality No.**: D219 **Location:** 42.82456°N, 61.47856°W

**R.T. Elevation:** 24m **Water Depth:** 1476.5m **Total Depth:** 4200m

**Sampled Interval:** 2140 - 4200m **Interval Studied:** 2140 - 4070m

**Depth Units:** Meters referenced to R.T. **Rig Release Date:** February 11, 1983

Vitrinite reflectance has been determined on 10 rotary cuttings samples from Shell et al Shubenacadie H-100 which was classified as a new field wildcat well and is located on the Scotian Slope approximately 260 km southwest of Halifax, Nova Scotia. Well status is 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 data storage and statistical summaries.

Analysis of the well reveals thermal maturation intervals given in Table I. 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***

| Depth in meters | Vitrinite Reflectance (%Ro)** | Maturity for oil generation* |
|---|---|---|
| 1477(Sea floor) | (0.21) | immature |
| 3350 | 0.4 | immature approaching maturity |
| 3980 | 0.5 | marginally mature |
| 4490 | (0.6) | onset of significant oil generation |
| 5310 | (0.8) | peak of oil generation |
| 4200(T.D.) | 0.55 | within oil window |

** Actual hydrocarbon products depend on type of organic matter present.*
*** ( )'s indicate Ro has been extrapolated at 0.153 log Ro/km.*

Remarks

Sample coverage for vitrinite reflectance analysis (Figure 1, Table II) was adequate over the section penetrated at Shubenacadie H-100. The data were plotted on a log Ro vs. linear depth scale and a linear regression line was calculated and plotted through the data points (Figure 1). The 'error bars' displayed 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 0.153 log Ro/km.

Selection of the reflectance population which represents the maturation of the sediments was aided by the histogram display plot (Figure 2). Plotting the histograms on a log reflectance scale helps reveal any linear trends in the Ro data. It also can help to demonstrate the effects of cavings, geology, casing points and other factors on the vitrinite reflectance populations.

These vitrinite reflectance data provide evidence that the thermal regime of the lower section of Shubenacadie H-100 is suitable for the generation and preservation of hydrocarbons within the drilled section, between 3978 and 4200m (T.D.), assuming potential source rocks and traps are present.

Discussion

The results of these Ro maturation data from this deep-water slope well compare favourably with Gabriel C-60, a deep-water well located in the Flemish Pass (Avery, 1985a). With a water depth of 1476.5m and a total depth of 4200m a shorter section was penetrated at Shubenacadie H-100 compared to 1108.5m and 5171m at Gabriel (Fig. 3). The Gabriel well has a slope of 0.159 logRo/km based on 15 measurement points while Shubenacadie has a slope of 0.153 based on 10 points. Both maturation slopes project to 0.2% at approximately 1500m and to about 0.55% at 4200m (T.D. in Shubenacadie).

Another deep-water slope well is Blue H-28 which is located on the slope of the northern Grand Banks (Avery, 1985b). In the report Avery interpreted the Ro data in this well as having a 'primary' and 'alternate' population trend (Fig.4). Results of maturation data for the Shubenacadie and Gabriel (Avery 1985a & b) support the 'alternate' interpretation. The 'alternate' slope (0.160 logRo/km) for Blue has a value similar to Shubenacadie and Gabriel reaching 0.2% at about 2000m and only 0.45% at 4200m. The 'primary' slope (0.140 logRo/km) at Blue projects to about 0.35% at the seafloor (1501m) and about 0.85% at 4200m. This steeper, higher maturity slope could not be explained by the geology or current temperature regime by Avery (1985b).

References

Avery, M.P., 1985a. Vitrinite Reflectance (Ro) of dispersed organics from Esso Voyager Gabriel C-60. Geological Survey of Canada Open File Report 1206.

Avery, M.P., 1985b. Vitrinite Reflectance (Ro) of dispersed organics from Texaco Shell et al Blue H-28. Geological Survey of Canada Open File Report 1345.

Dow, W.G., 1977. Kerogen studies and geological interpretations. Journal of Geochemical Exploration, no. 7, p. 77-99

MacLean, B.C. and Wade, J.A., 1993. East coast basin atlas series: seismic markers and stratigraphic picks in Scotian Basin wells. Atlantic Geoscience Centre, Geological Survey of Canada, 276 p.

December 8, 1999

M.P. Avery
Basin Analysis

c.c. K.D. McAlpine, MResG, Dartmouth
A.E. Jackson, MResG, Dartmouth
MResG Files, Dartmouth
Central Technical Files, Ottawa
K. Osadetz, ISPG, Calgary
S. Bigelow, CNSOPB, Halifax (3 copies)
C. Beaumont, Dalhousie Univ., Halifax

Table II

**Summary of kerogen - based vitrinite reflectance**

| Sample Labels | Depths in meters | Mean Ro (SD) non-rotated | Number of Readings Total | Edited |
|---|---|---|---|---|
| K0677A | 2140-2150 | 0.31 (±0.04) | 16 | 10 |
| K0677B | 2260-2310 | 0.30 (±0.05) | 7 | 7 |
| K0677C | 2420-2470 | 0.26 (±0.05) | 19 | 19 |
| K0678A | 2580-2630 | 0.31 (±0.05) | 7 | 7 |
| K0678B | 2860-2910 | 0.33 (±0.06) | 15 | 13 |
| K0679A | 3100-3150 | 0.32 (±0.02) | 9 | 8 |
| K0679B | 3380-3430 | 0.36 (±0.00) | 1 | 1 |
| K0679C | 3535-3670 | 0.45 (±0.06) | 2 | 2 |
| K0680A | 3900-3950 | 0.53 (±0.06) | 11 | 11 |
| K0680B | 4020-4070 | 0.59 (±0.06) | 11 | 11 |

Table III

**Formation Tops (MacLean and Wade, 1993)**

| Formation | Depth |
|---|---|
| Banquereau | in casing |
| (Miocene-Eocene unconformity) | 3059m |
| (turbidite fan) | 3436m |
| Dawson Canyon | 3784m |
| Shortland Shale | 3996m |
| Total Depth | 4200m |

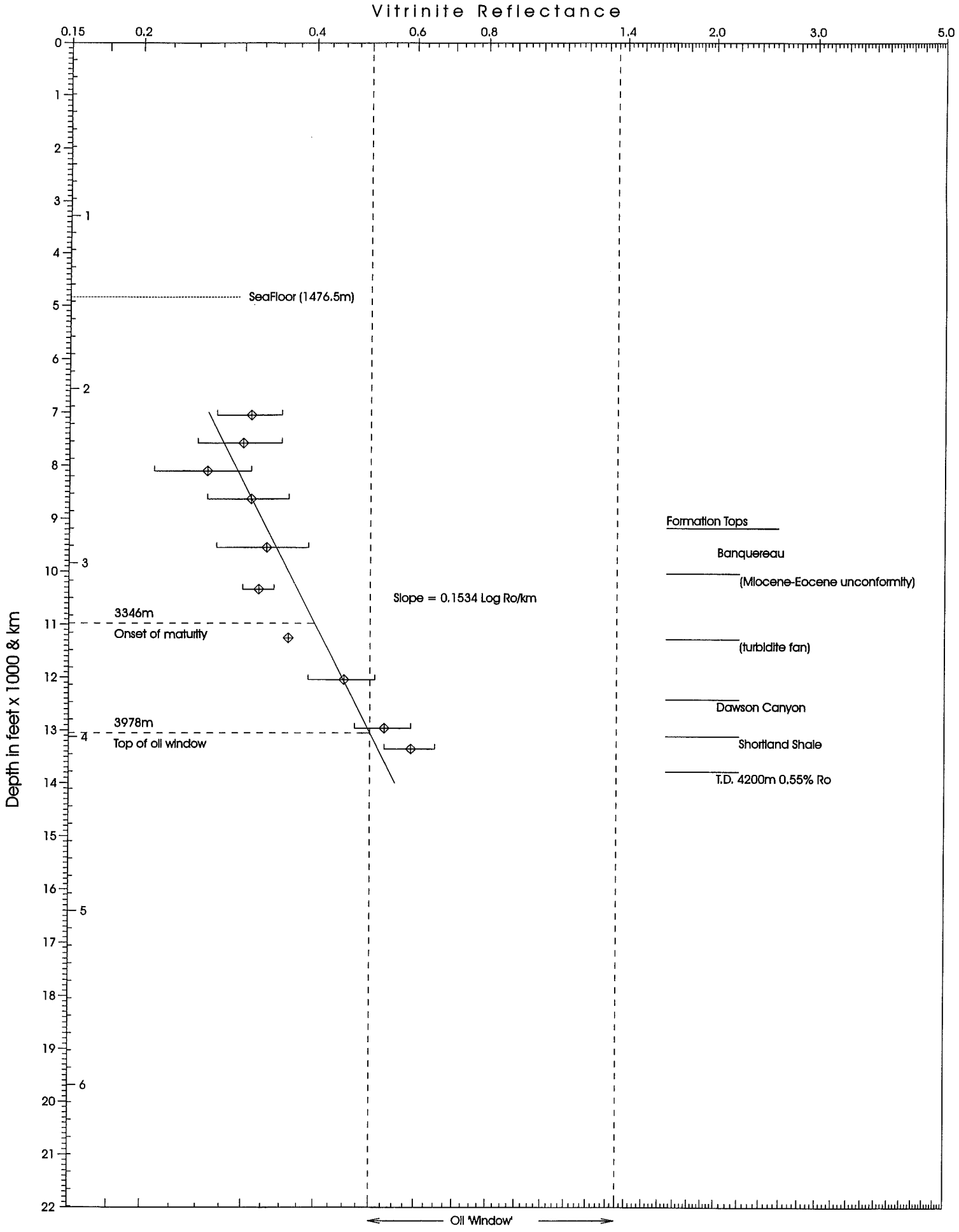



Fig. 1 SHUBENACADIE H-100

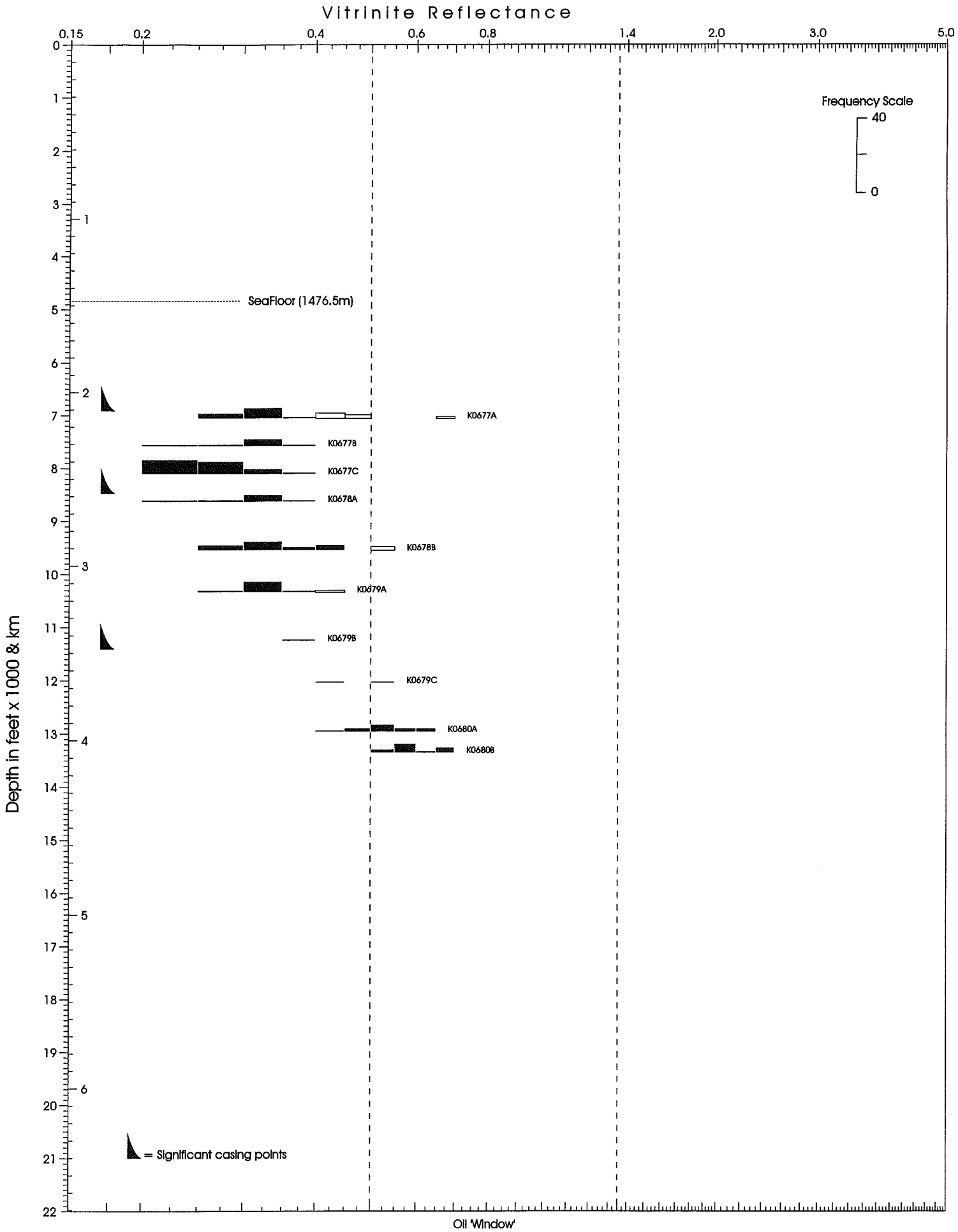



Fig. 2 SHUBENACADIE H-100 <Histograms>

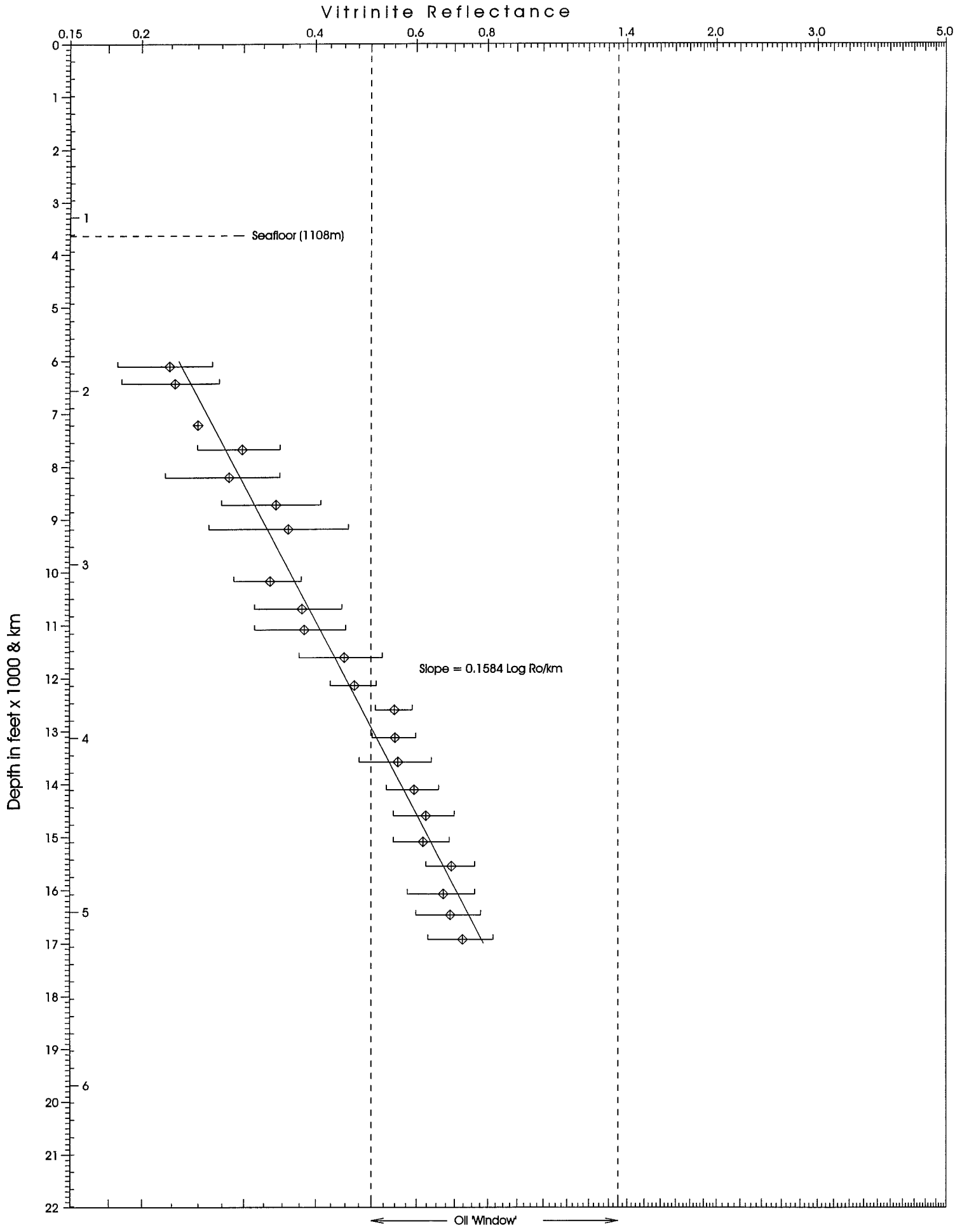



Fig. 3 GABRIEL C-60 (plot included for comparison)

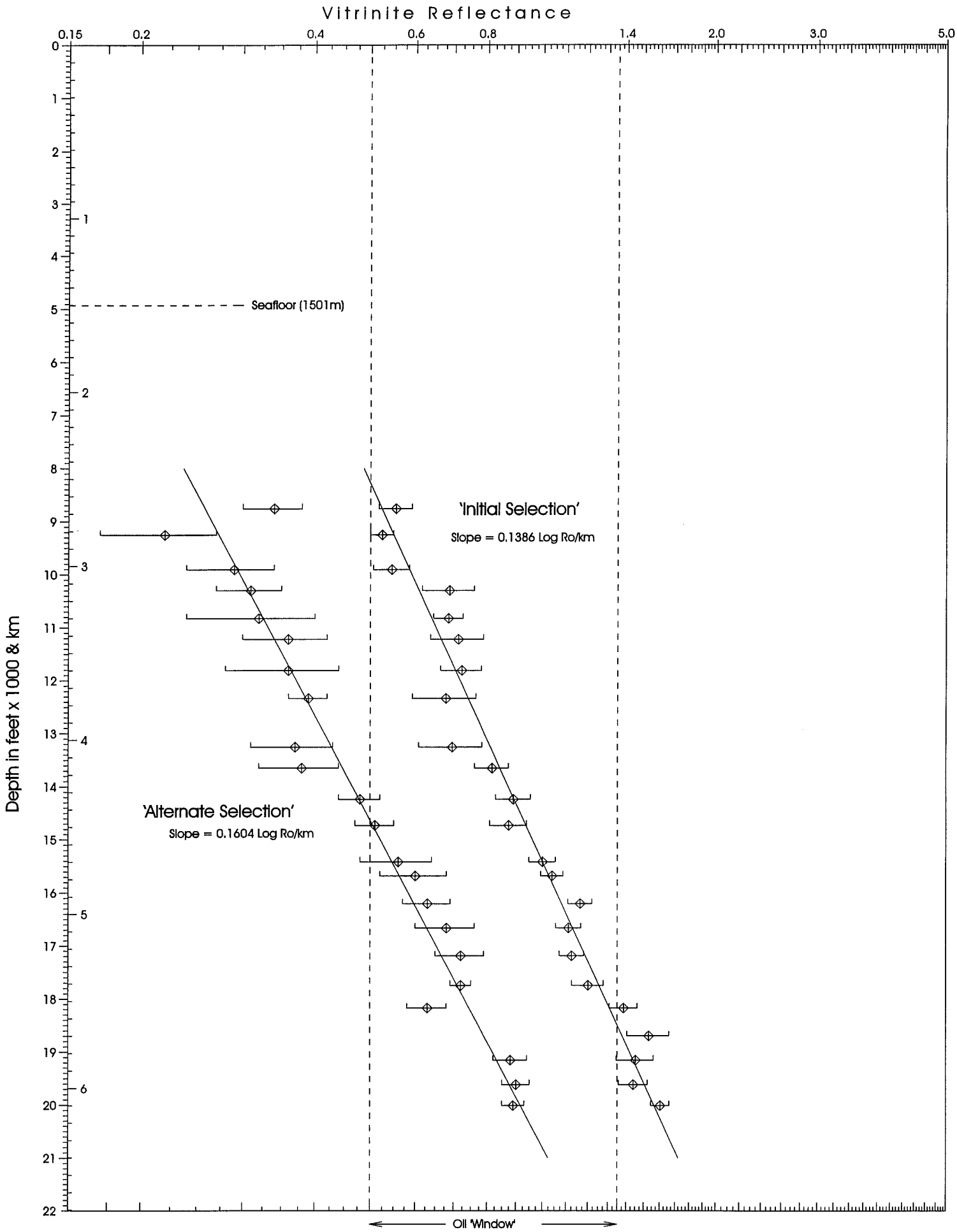



Fig. 4 BLUE H-28 (plot included for comparison)

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.
Trannsfer 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.

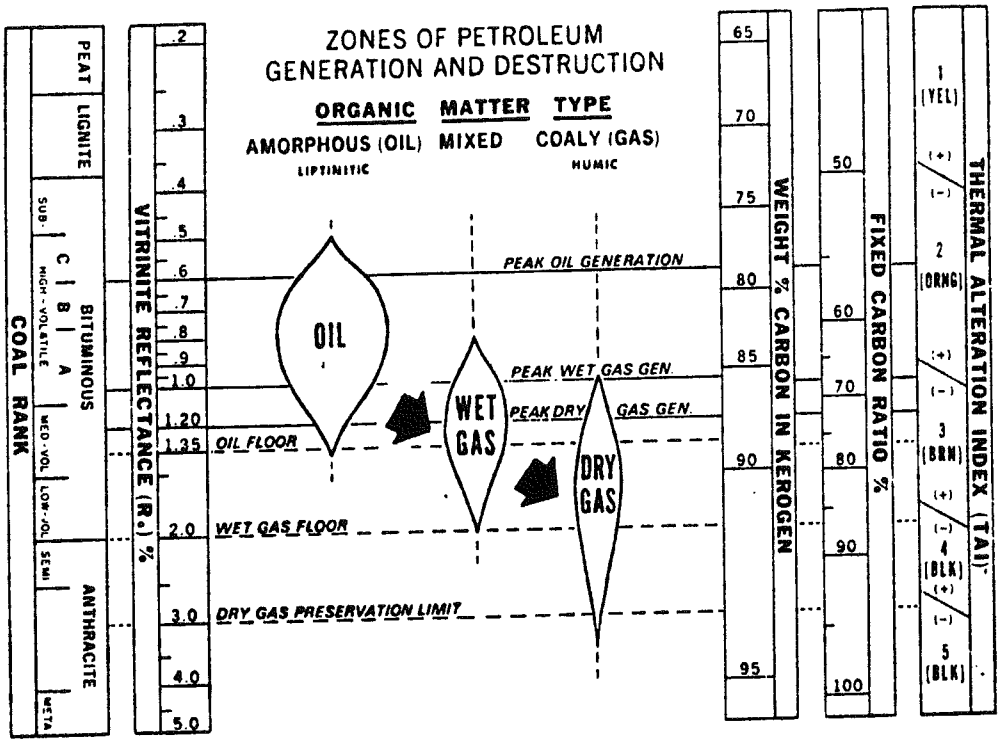
#### VITRINITE REFLECTANCE Lab preparation

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 Ro is here used as the 'peak of oil generation'

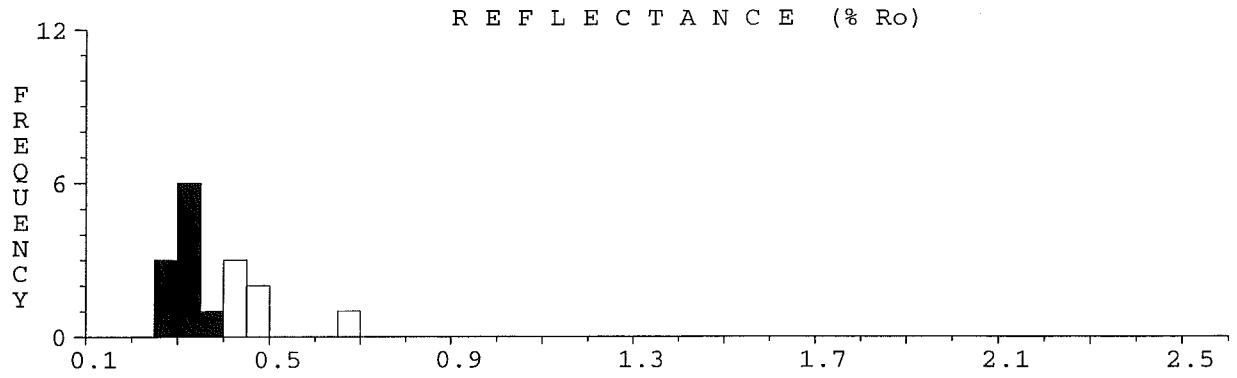
# Appendix III

## Reflectance Histograms

File: K0677A

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.25) | (0.25) | (0.28) | (0.31) | (0.31) | (0.31) | (0.31) | (0.33) | (0.34) | (0.37) |
| 1 | 0.40 | 0.40 | 0.43 | 0.46 | 0.49 | 0.68 | | | | |

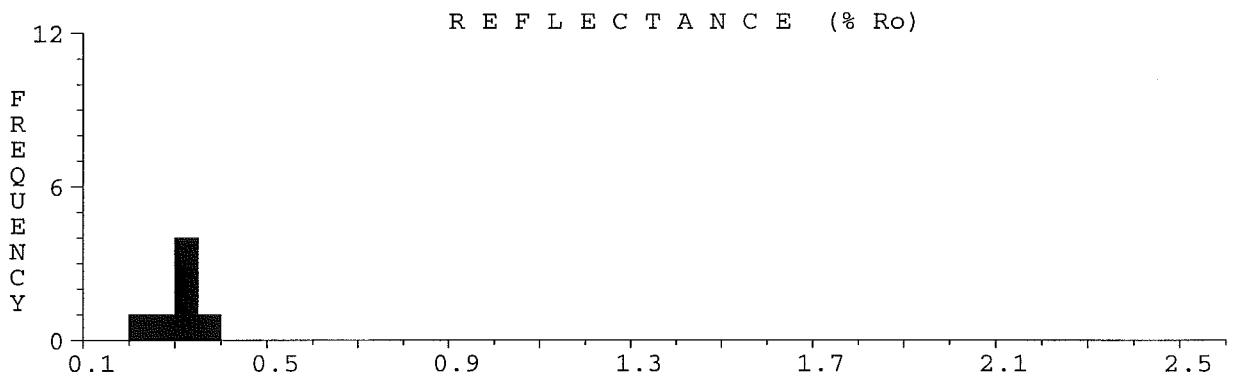
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.37 | 0.11 | 16 | 0.25 | 0.68 |
| (Edit) | 0.31 | 0.04 | 10 | 0.25 | 0.37 |




File: K0677B

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.23) | (0.25) | (0.30) | (0.31) | (0.33) | (0.34) | (0.37) | | | |

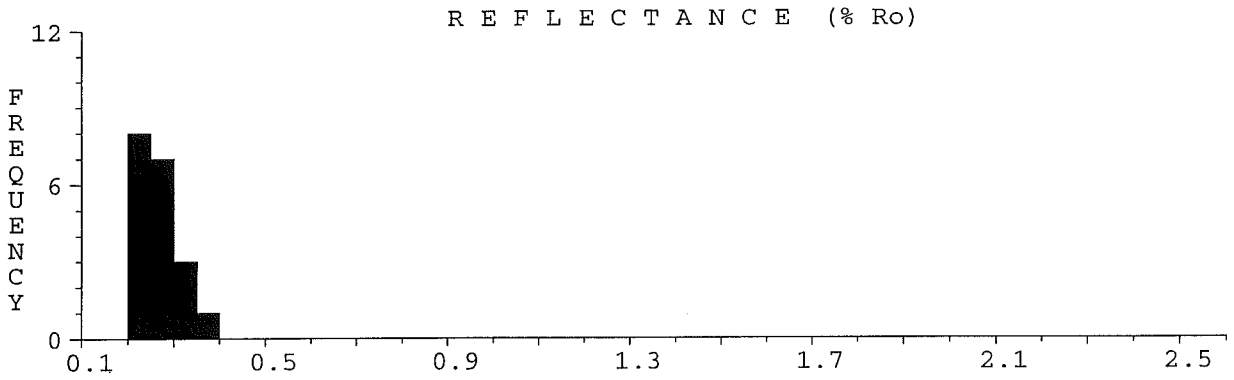
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.30 | 0.05 | 7 | 0.23 | 0.37 |
| (Edit) | 0.30 | 0.05 | 7 | 0.23 | 0.37 |



File: K0677C

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.20) | (0.20) | (0.20) | (0.21) | (0.23) | (0.23) | (0.23) | (0.23) | (0.25) | (0.25) |
| 1 | (0.25) | (0.25) | (0.27) | (0.28) | (0.28) | (0.30) | (0.31) | (0.33) | (0.36) | |

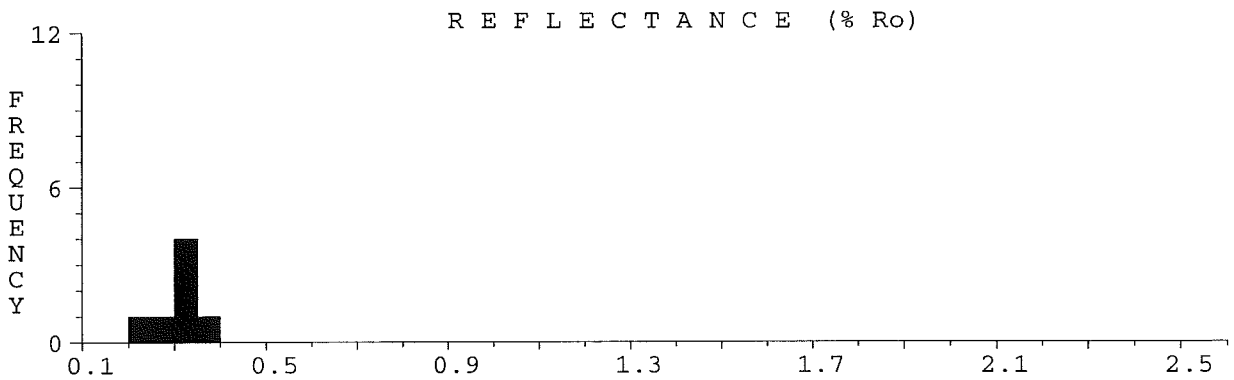
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.26 | 0.05 | 19 | 0.20 | 0.36 |
| (Edit) | 0.26 | 0.05 | 19 | 0.20 | 0.36 |




File: K0678A

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.23) | (0.25) | (0.30) | (0.31) | (0.33) | (0.34) | (0.38) | | | |

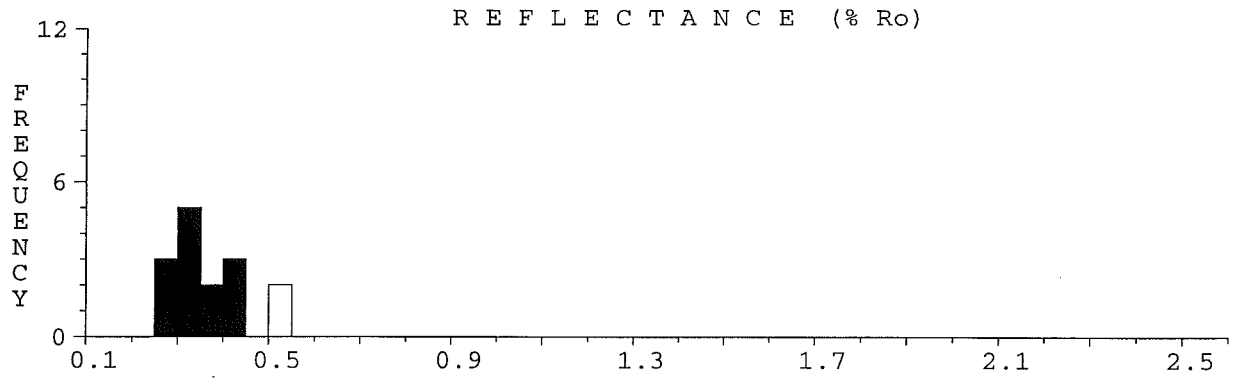
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.31 | 0.05 | 7 | 0.23 | 0.38 |
| (Edit) | 0.31 | 0.05 | 7 | 0.23 | 0.38 |



File: K0678B

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.25) | (0.25) | (0.28) | (0.30) | (0.30) | (0.31) | (0.31) | (0.33) | (0.36) | (0.37) |
| 1 | (0.40) | (0.40) | (0.43) | 0.50 | 0.54 | | | | | |

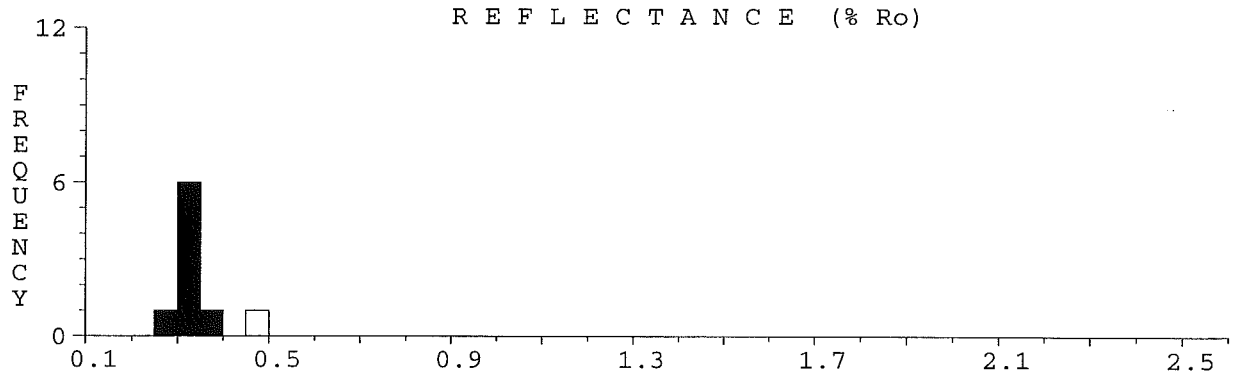
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.36 | 0.09 | 15 | 0.25 | 0.54 |
| (Edit) | 0.33 | 0.06 | 13 | 0.25 | 0.43 |




File: K0679A

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.28) | (0.30) | (0.31) | (0.33) | (0.33) | (0.33) | (0.34) | (0.36) | 0.45 | |

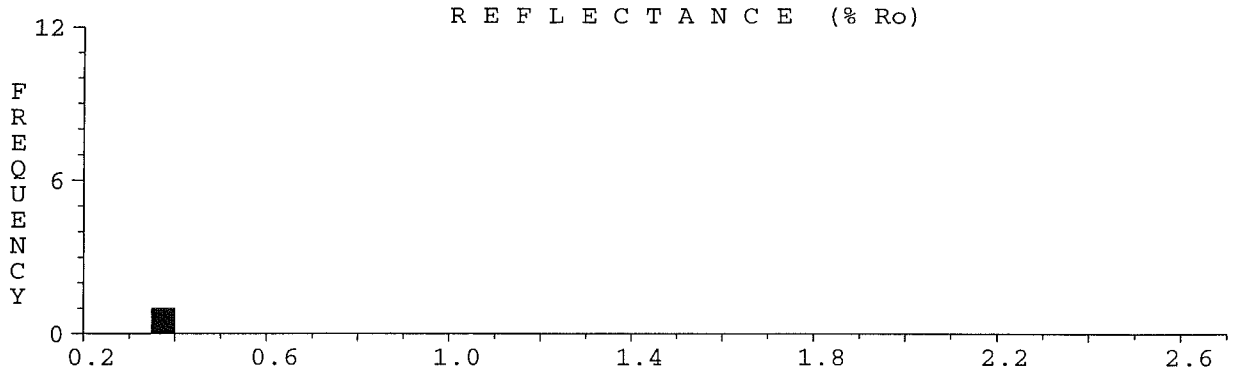
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.34 | 0.05 | 9 | 0.28 | 0.45 |
| (Edit) | 0.32 | 0.02 | 8 | 0.28 | 0.36 |



File: K0679B

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.36) | | | | | | | | | |

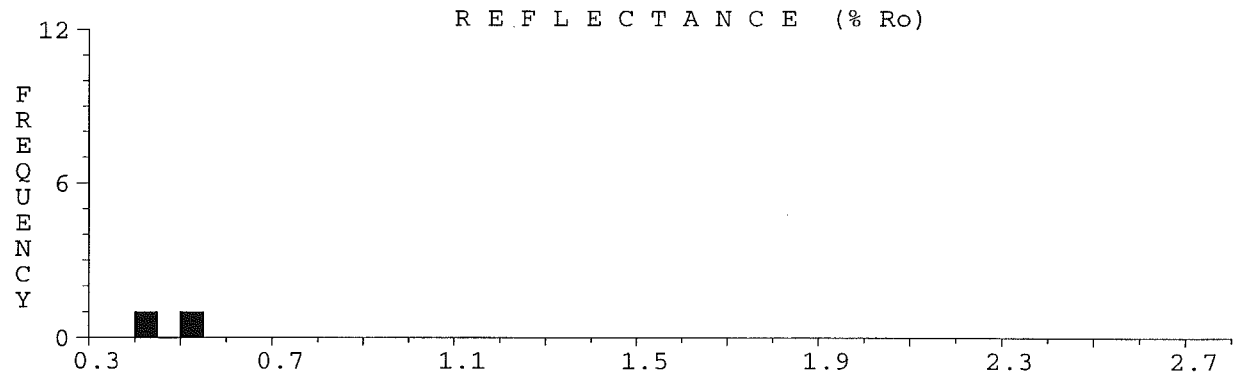
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.36 | 0.00 | 1 | 0.36 | 0.36 |
| (Edit) | 0.36 | 0.00 | 1 | 0.36 | 0.36 |




File: K0679C

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.41) | (0.50) | | | | | | | | |

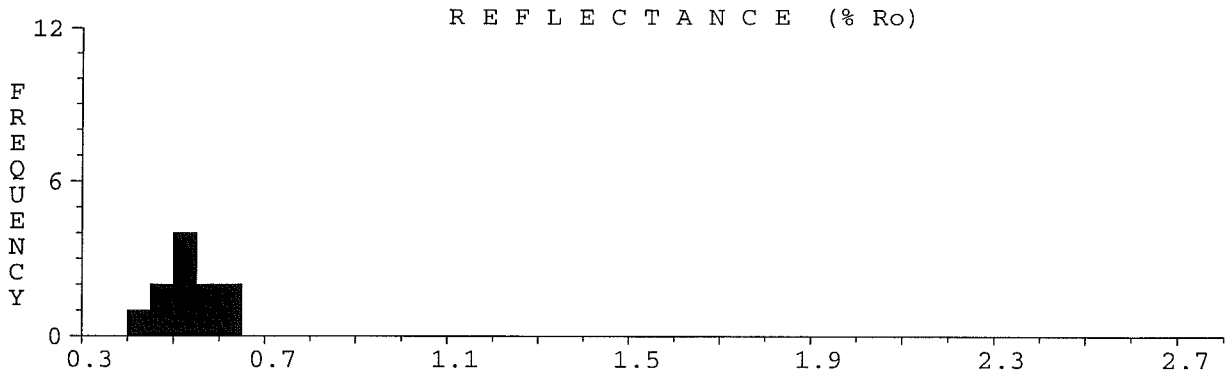
| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.45 | 0.06 | 2 | 0.41 | 0.50 |
| (Edit) | 0.45 | 0.06 | 2 | 0.41 | 0.50 |



File: K0680A

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.43) | (0.46) | (0.49) | (0.50) | (0.51) | (0.52) | (0.54) | (0.55) | (0.57) | (0.62) |
| 1 | (0.63) | | | | | | | | | |

| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.53 | 0.06 | 11 | 0.43 | 0.63 |
| (Edit) | 0.53 | 0.06 | 11 | 0.43 | 0.63 |




File: K0680B

| Col> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row 0 | (0.52) | (0.54) | (0.55) | (0.56) | (0.56) | (0.58) | (0.58) | (0.61) | (0.66) | (0.67) |
| 1 | (0.69) | | | | | | | | | |

| | Mean | Stand.Dev. | Pts | Min | Max |
|---|---|---|---|---|---|
| Total | 0.59 | 0.06 | 11 | 0.52 | 0.69 |
| (Edit) | 0.59 | 0.06 | 11 | 0.52 | 0.69 |