
**GEOLOGICAL SURVEY OF CANADA**
**OPEN FILE 6052**

# Vitrinite reflectance data for Total EastCan *et al* Roberval K-92

**M.P. Avery**

**2009**

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Available from
Geological Survey of Canada
1Challenger Drive
Dartmouth, Nova Scotia, B2Y 4A2

**Avery, M.P.**
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**Well information**

**G.S.C. Locality No.:** D176 **Unique Well ID:** 300 K92 55000 55300 **Location:** 54.85987° N, 55.74327° W

**R.T. Elevation:** 13m **Water Depth:** 268.5m **Total Depth:** 3874m

**Sampled Interval:** 640-3870m **Interval Studied:** 2440-3870m

**Depth Units:** Metres referenced to R.T. **Rig Release Date:** October 27, 1978

**Introduction**

Vitrinite reflectance has been determined on 8 rotary drill cutting samples from Total Eastcan *et al* Roberval K-92, which was classified as an exploratory well, located in the Labrador Shelf. The well status is Plugged and Abandoned.

Sample preparation followed the procedures listed in Appendix I. Data acquisition and manipulation was done on a Zeiss Photometer III system with a custom interface to a computer for data storage and statistical summaries.

Analysis of the well reveals thermal maturity levels given in Table I. Specific maturity levels, as set out in this report, are based on those of Powell and Snowdon(1983) with modified terminology (Appendix II).

Table I
**Inferred Hydrocarbon Thermal Maturity Levels**

| Depth in metres | Vitrinite Reflectance* %Ro | Hydrocarbon generation levels** for type II or III kerogen |
|---|---|---|
| upper maturity slope | | |
| 269 [sea floor] | 0.16 | immature |
| 2570 | 0.50 | entering 'oil window' |
| 2970 | 0.60 | marginally maturity |
| lower maturity slope | | |
| 3770 | 1.20 | onset of dry gas phase |
| 3874 [T.D.] | 1.26 | approaching end of 'oil window' |

**upper linear regression slope= 0.197 log Ro/km; lower slope= 0.202 log Ro/km*
*** Actual hydrocarbon products depend on type of organic matter present (Appendix II).*

**Remarks**

Sample coverage for vitrinite reflectance analysis at Roberval K-92 (Figure 1, Table II) was adequate over the studied section between 2440 and 3870m with a notable gap between 2590 and 3190m. This section is mostly comprised of the Markland Fm and although samples from this interval were processed for palynology no kerogen was available. The data were plotted on a log Ro vs. linear depth scale. Regression lines fitted through the data yielded a maturity slope of 0.197 log Ro/km in the upper section and a slope of 0.202 log Ro/km for the lower section . There is a significant variation in the number of readings that the data points are based on (Table II) therefore the regression lines were weighted based on the 'n' value for each point . The relative size of the point symbols provide an indication of the number of readings. The 'error bars' displayed on the maturity profile indicate one standard deviation on either side of the mean and may be deceivingly small for samples with very few readings.

The histogram display (Figure 2) shows the variability in the reflectance populations, which represent the maturity of the sediments with depth. Plotting reflectance histograms on a log scale may help reveal any trends present in the Ro data. It also can help to demonstrate the effects of cavings, geology, casing points and other influences on the vitrinite reflectance populations.

Keeping in mind the limits of the data set, these vitrinite reflectance data show that the thermal maturity of the upper section of Roberval K-92 between 2570 and 3550m ranges from marginally mature to mature for the generation of liquid hydrocarbons while the lower section between 3550 and 3874m (T.D.)is in the upper maturity range for liquid hydrocarbons. These results only reveal the maturity of the sediments penetrated, actual production of hydrocarbons depends on source rocks of the proper organic matter type and traps being present or connected to the well**.**

## Method

Data obtained for this report were measured on polished kerogen mounts. Kerogen concentrate preparations make more of the organic matter from the sample interval available for viewing by the operator than other methods. The lack of mineral matter makes for better polishing and since the polished surface area is much smaller the analysis time is about a third or less of that for non-concentrated whole rock preparations.

## Discussion

The samples measured for this report in the upper section yielded very few values representative of the maturity of the sediments penetrated (Table II). The samples from the lower section yielded more data. The optimal number for these analysis is around 50 but this rarely achieved on polished organic preparations derived from rotary drill well cuttings.

The maturity offset or increase between the upper and lower slope coincides with an unconformity at approximately 3544m between Cretaceous and Carboniferous (?) sediments.

## References

Powell, T. G. and Snowdon, L. R.,1983. A composite hydrocarbon generation model. Erdöl und Kohle, Erdgas, Petrochemie, v. 36, p. 163-170.

Table II

**Summary of kerogen - based vitrinite reflectance**

| Sample Labels | Depth metres | Mean Ro (SD) non-rotated | Number of Readings | |
|---|---|---|---|---|
| | | | Total | Edited |
| K0951A | 2440 | 0.48 (±0.05) | 15 | 11 |
| K0951B | 2590 | 0.49 (±0.04) | 17 | 11 |
| K0951C | 3190 | 0.67 (±0.04) | 17 | 13 |
| K0951D | 3345 | 0.74 (±0.05) | 17 | 4 |
| K0952A | 3490 | 0.74 (±0.05) | 17 | 9 |
| K0952B | 3645 | 1.14 (±0.13) | 35 | 29 |
| K0952C | 3790 | 1.18 (±0.09) | 41 | 28 |
| K0952D | 3870 | 1.27 (±0.15) | 47 | 38 |

Table III

**Formation Tops** (Moir 1989)

| Formation | Top metres |
|---|---|
| Saglek Fm | 340 |
| Mokami Fm | 726 |
| Kenamu Fm | 1815 |
| Gudrid Fm (upper) | 2356 |
| Markland Fm | 2679 |
| Bjarni Fm | 3080 |
| Snorri Mb | 3080 |
| Alexis Fm | 3197 |
| (unnamed Paleozoic) | 3544 |

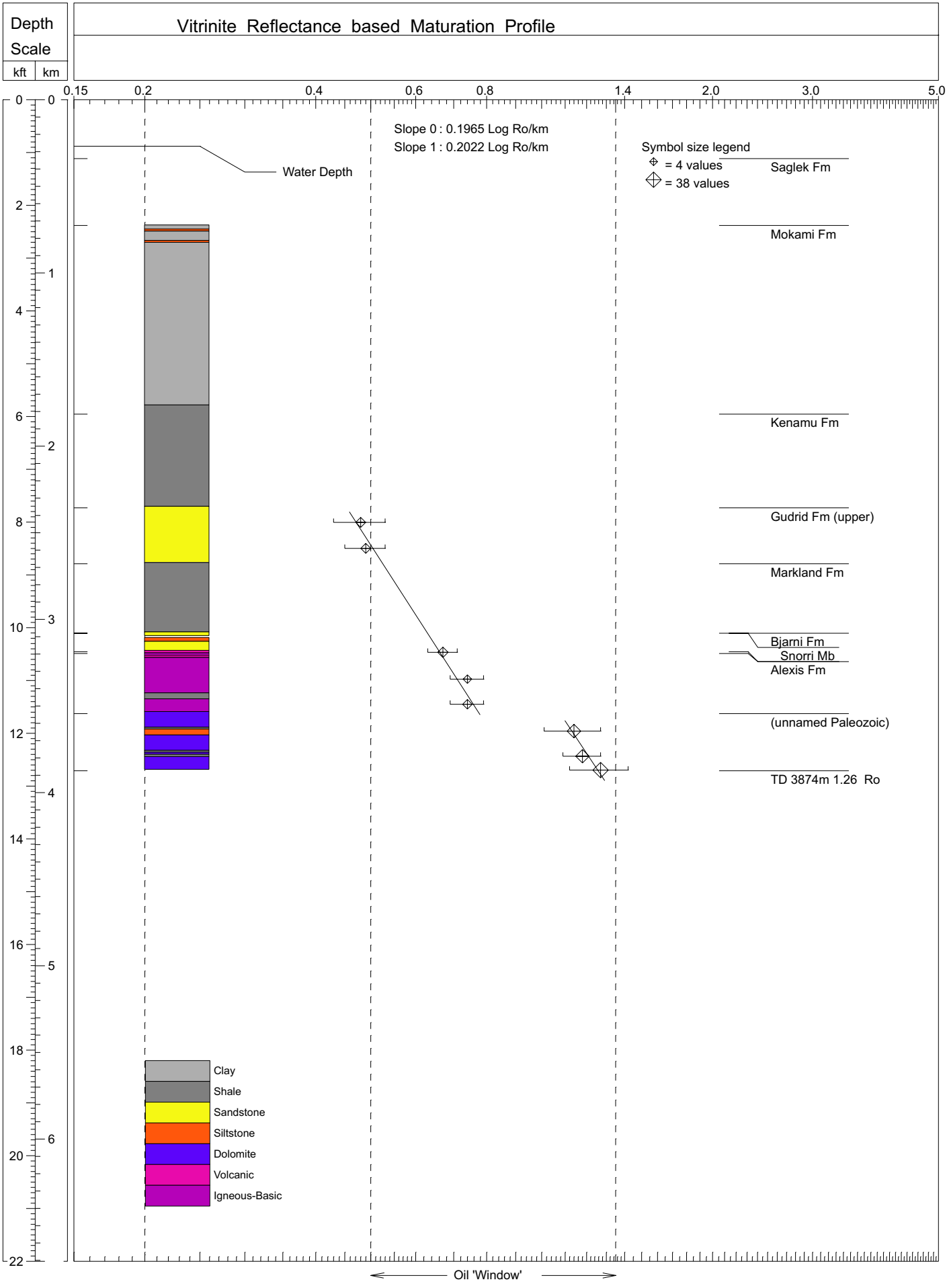



Figure 1. VR/depth plot for Roberval K-92

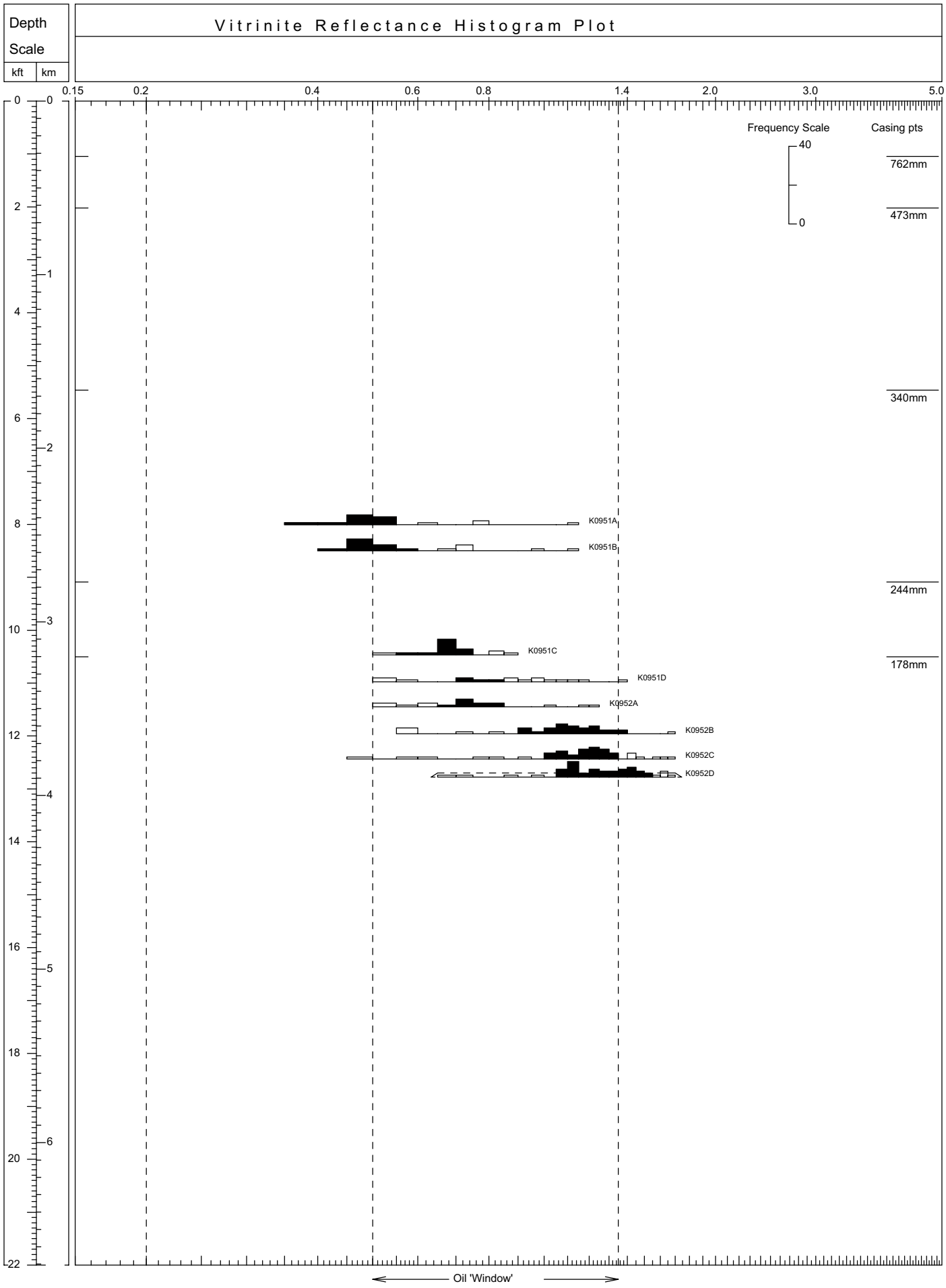



Figure 2. VR histograms/depth plot for Roberval K-92

# Appendix I

## Sample Preparation Method

### Kerogen concentrate sample preparation

Preliminary wash (preparation for drill cuttings)

Dry samples in oven (25°C)

PALYNOLOGY Lab preparation

Place 20-30 grams in 250 ml plastic beaker.
Add 10% HCl till reaction ceases (removes carbonates).
Rinse 3 times.
Immerse in hot concentrated HF overnight (removes silicates).
Rinse 3 times.
Heat (60-65°C) in concentrated HCl (removes fluorides caused by HF).
Rinse 3 times.
Transfer to 15 ml test tube with 4-5 ml 4% Alconox.
Centrifuge at 1500 rpm for 90 sec.
Decant.
Rinse and centrifuge 3 times.
Float off organic fraction using 2.0 S.G. ZnBr solution.
Centrifuge at 1000 rpm for 8 min.
Float fraction into second test tube.
Wash and centrifuge 3 times.
Make kerogen smear slide.
Remaining kerogen material is made available to Organic Petrology Lab.

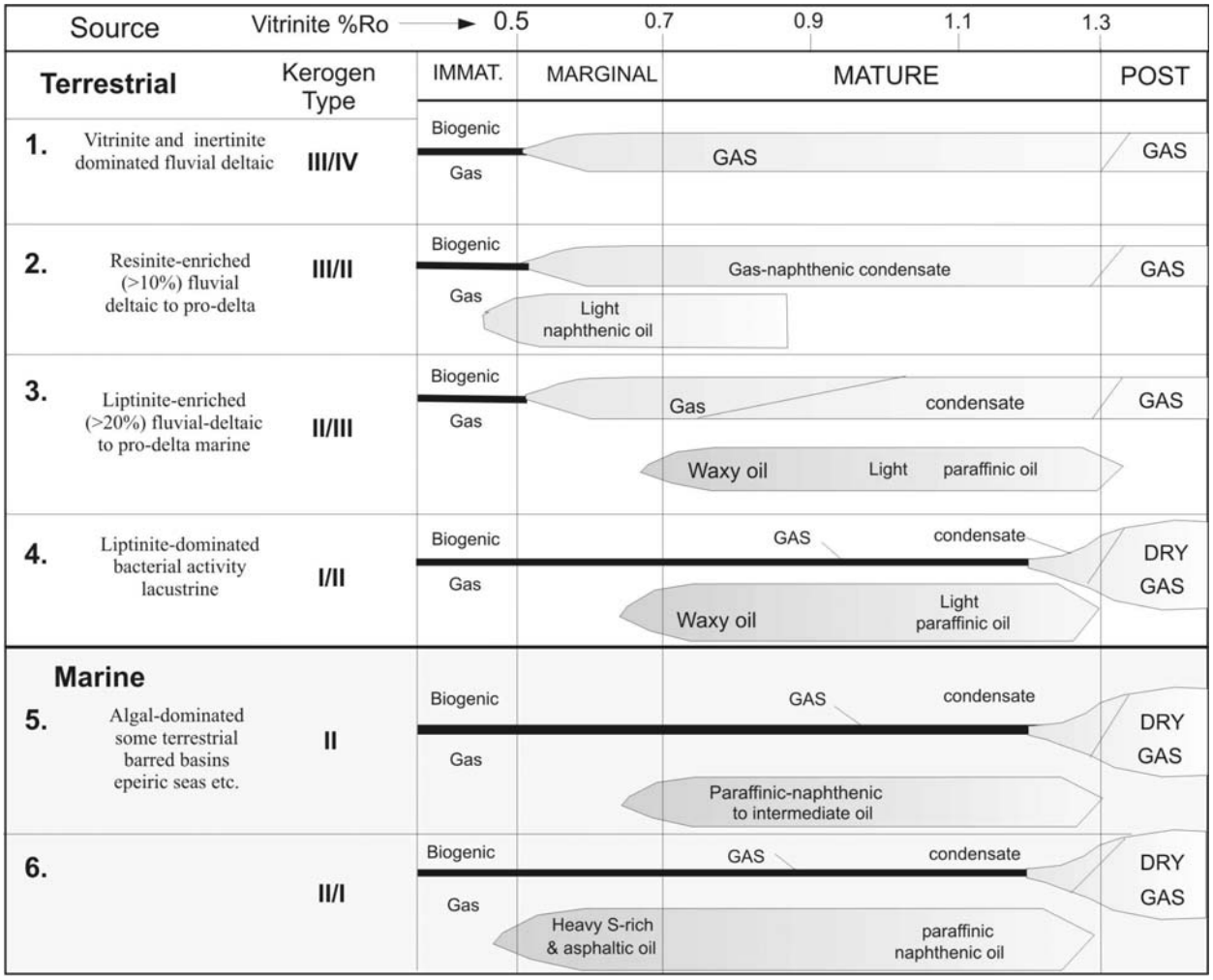
VITRINITE REFLECTANCE Lab preparation

Pipette off excess water and prepare as 2.5 cm (1") diameter plastic stubs to fit polisher.
Freeze dry and fix material for polishing with epoxy resin.
Polish with diamond-based suspension to obtain low relief, scratch-free surface.
Examine under oil lens, incident light at approximately 1000x magnification.

### Whole rock sample preparation

Set washed drill cuttings in epoxy to form 2.5 cm (1") diameter plastic stubs to fit polisher.
Grind and polish to obtain low relief, scratch-free surface.
Examine under oil lens, incident light at approximately 1000x magnification.

Appendix II (Powell and Snowdon 1983)




*Hydrocarbon generation model compiled from Powell and Snowdon (1983) illustrating the different thresholds of hydrocarbon generation and products as related to thermal maturity, kerogen type and paleodepositional environment.*

# Appendix III

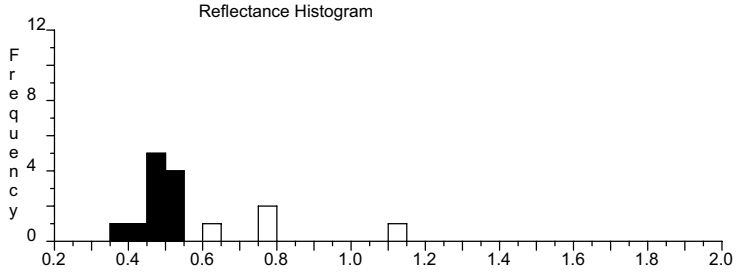
Data listings and basic statistics

# Data listings and basic statistics for: Roberval K-92

## K0951A

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | 1.12 | (0.48) | (0.40) | (0.46) | (0.51) | (0.39) | (0.53) | 0.77 | 0.62 | (0.51) |
| 1 | (0.49) | 0.79 | (0.47) | (0.45) | (0.54) | | | | | |

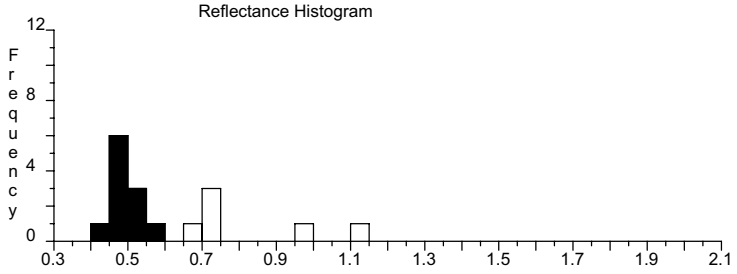
| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 0.57 | 0.19 | 15 | 0.39 | 1.12 | 8.53 |
| (Edit) | 0.48 | 0.05 | 11 | 0.39 | 0.54 | 5.23 |




## K0951B

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | 0.72 | (0.45) | (0.48) | (0.49) | (0.46) | (0.52) | (0.49) | 0.98 | 0.70 | 0.73 |
| 1 | (0.51) | 0.66 | (0.57) | (0.48) | (0.42) | (0.52) | 1.12 | | | |

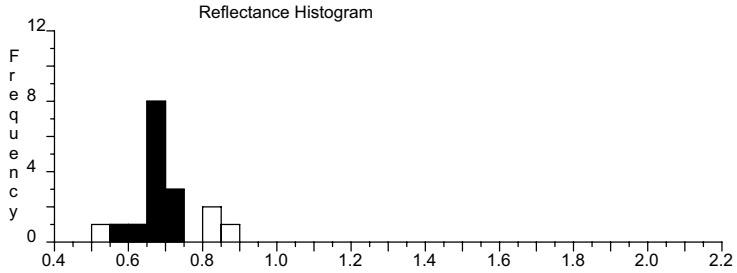
| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 0.61 | 0.20 | 17 | 0.42 | 1.12 | 10.30 |
| (Edit) | 0.49 | 0.04 | 11 | 0.42 | 0.57 | 5.39 |




## K0951C

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | 0.88 | (0.74) | 0.83 | 0.83 | (0.58) | (0.65) | (0.66) | (0.68) | (0.65) | (0.73) |
| 1 | (0.70) | (0.69) | (0.67) | (0.68) | (0.63) | 0.51 | (0.65) | | | |

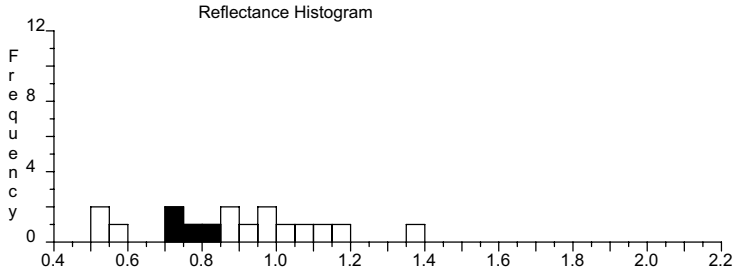
| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 0.69 | 0.09 | 17 | 0.51 | 0.88 | 11.76 |
| (Edit) | 0.67 | 0.04 | 13 | 0.58 | 0.74 | 8.71 |




## K0951D

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | (0.71) | 0.98 | 1.17 | 1.36 | 1.12 | (0.70) | 1.04 | (0.75) | 0.52 | 1.07 |
| 1 | (0.82) | 0.59 | 0.53 | 0.86 | 0.95 | 0.87 | 0.91 | | | |

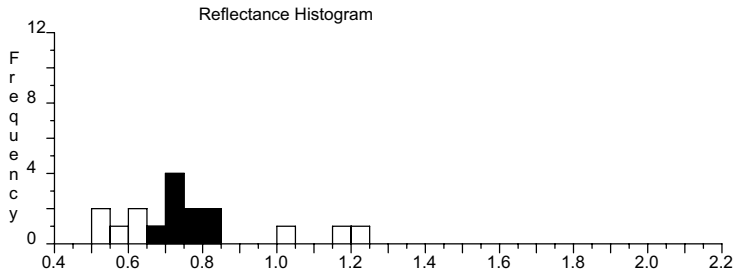
| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 0.88 | 0.23 | 17 | 0.52 | 1.36 | 14.95 |
| (Edit) | 0.74 | 0.05 | 4 | 0.70 | 0.82 | 2.98 |




## K0952A

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | (0.70) | (0.81) | 0.54 | (0.75) | 0.57 | 0.52 | (0.81) | 1.15 | (0.79) | (0.71) |
| 1 | (0.71) | 0.63 | (0.68) | 1.23 | 1.03 | (0.74) | 0.60 | | | |

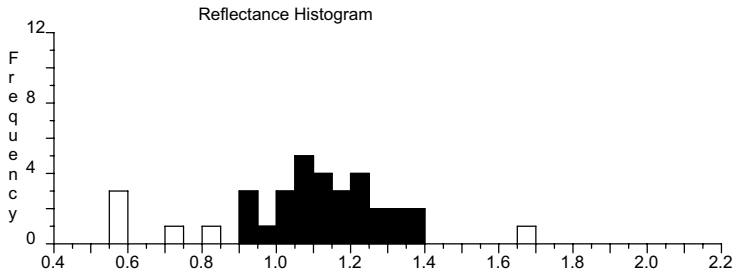
| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 0.76 | 0.20 | 17 | 0.52 | 1.23 | 12.97 |
| (Edit) | 0.74 | 0.05 | 9 | 0.68 | 0.81 | 6.70 |




## K0952B

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | 0.59 | 0.56 | (0.92) | 1.65 | (1.04) | (1.34) | 0.59 | (1.11) | (1.23) | (0.96) |
| 1 | (0.90) | (1.38) | (1.25) | (1.23) | (1.00) | (1.09) | (1.00) | 0.81 | (1.06) | (1.22) |
| 2 | (1.14) | (1.10) | (1.07) | (1.22) | (0.92) | (1.13) | (1.07) | (1.09) | (1.30) | 0.72 |
| 3 | (1.38) | (1.27) | (1.18) | (1.17) | (1.18) | | | | | |

| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 1.08 | 0.23 | 35 | 0.56 | 1.65 | 37.87 |
| (Edit) | 1.14 | 0.13 | 29 | 0.90 | 1.38 | 32.95 |

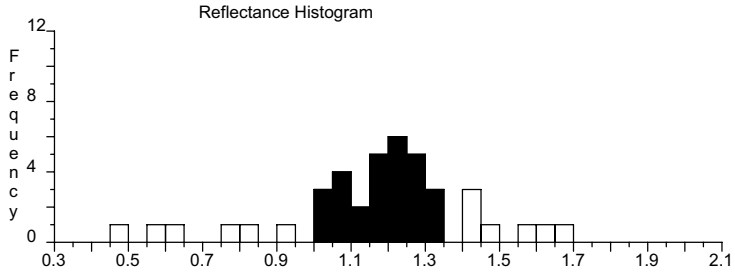


# Data listings and basic statistics for: Roberval K-92

K0952C

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | 0.55 | (1.14) | (1.06) | (1.24) | 1.63 | (1.17) | (1.24) | 1.66 | 1.44 | 1.55 |
| 1 | 0.63 | (1.27) | (1.07) | (1.12) | (1.17) | (1.18) | 0.82 | 0.47 | (1.21) | (1.23) |
| 2 | (1.25) | (1.24) | (1.29) | 0.94 | (1.25) | (1.04) | (1.07) | (1.30) | (1.17) | 1.49 |
| 3 | (1.27) | (1.23) | 1.42 | (1.30) | (1.34) | (1.00) | (1.08) | 1.40 | (1.04) | (1.18) |
| 4 | 0.77 | | | | | | | | | |

| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 1.17 | 0.26 | 41 | 0.47 | 1.66 | 47.92 |
| (Edit) | 1.18 | 0.09 | 28 | 1.00 | 1.34 | 33.15 |




K0952D

| Col > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | 1.61 | (1.28) | (1.06) | (1.16) | (1.05) | 0.70 | 1.62 | 0.87 | (1.50) | 1.57 |
| 1 | (1.24) | (1.45) | (1.22) | (1.05) | (1.24) | (1.30) | (1.10) | 1.65 | (1.10) | 1.63 |
| 2 | (1.36) | 0.65 | (1.13) | (1.12) | (1.25) | (1.10) | (1.49) | (1.44) | (1.37) | (1.34) |
| 3 | (1.36) | (1.46) | (1.41) | (1.23) | (1.06) | (1.35) | (1.43) | (1.14) | (1.40) | (1.18) |
| 4 | (1.28) | 0.99 | (1.14) | (1.30) | (1.44) | (1.51) | (1.13) | | | |

| | Mean | Stand Dev | Pts | Min | Max | Sum |
|---|---|---|---|---|---|---|
| Total | 1.27 | 0.23 | 47 | 0.65 | 1.65 | 59.46 |
| (Edit) | 1.27 | 0.15 | 38 | 1.05 | 1.51 | 48.17 |