# 299-E33-68 (A6876)

## Log Data Report

### Borehole Information:

| Borehole: 299-E33-68 (A6876) | | Site: 216-B-8 Crib | | | |
|---|---|---|---|---|---|
| Coordinates (WA State Plane) | | GWL[1] (ft): 280 ft | | GWL Date: n/a[2] | |
| North | East | Drill Date | TOC[3] Elevation | Total Depth (ft) | Type |
| 137469 | 573782 | 12/47 | 636.88 | 150 | Cable tool |

### Casing Information:

| Casing Type | Stickup (ft) | Outer Diameter (in.) | Inside Diameter (in.) | Thickness (in.) | Top (ft) | Bottom (ft) |
|---|---|---|---|---|---|---|
| Steel (welded) | 2.5 | 8.625 | 7.875 | 0.375 | 0 | 150 |

### Borehole Notes:

The casing depth information provided above is derived from *Hanford Wells* (Chamness and Merz 1993). The approximate casing size information for 8-in. steel casing is confirmed from tape and caliper measurements collected in the field by MACTEC-ERS personnel.

Logging measurements are referenced to the top of the 8-in. casing.

### Logging Equipment Information:

| Logging System: Gamma 1D | | Type: SGLS (35%) |
|---|---|---|
| Calibration Date: 07/01 | Calibration Reference: | GJO-2001-243-TAR |
| | Logging Procedure: | MAC-HGLP 1.6.5 |

### Spectral Gamma Logging System (SGLS) Log Run Information:

| Log Run | 1 | 2 | 3 | 4 Repeat | |
|---|---|---|---|---|---|
| Date | 11/16/01 | 11/19/01 | 11/20/01 | 11/20/01 | |
| Logging Engineer | Spatz | Spatz | Spatz | Spatz | |
| Start Depth | 3.0 | 150.0 | 48.5 | 60.5 | |
| Finish Depth | 49.5 | 59.0 | 60.0 | 75.0 | |
| Count Time (sec) | 100 | 100 | 100 | 100 | |
| Live/Real | R | R | R | R | |
| Shield (Y/N) | N | N | N | N | |
| MSA Interval (ft) | 0.5 | 0.5 | 0.5 | 0.5 | |
| ft/min | n/a | n/a | n/a | n/a | |
| Pre-Verification | A0039CAB | A0040CAB | A0041CAB | A0041CAB | |
| Start File | A0039000 | A0040000 | A0041000 | A0041024 | |
| Finish File | A0039093 | A0040182 | A0041023 | A0041053 | |
| Post-Verification | A0039CAA | A0040CAA | A0042CAA | A0042CAA | |

## Logging Operation Notes:

Spectral gamma logging was performed in this borehole during November 2001 on three separate days. A repeat section was collected between 60.5 and 75 ft to measure logging system performance. Log run 2 was conducted with the ground surface as the zero reference point rather than the TOC used for log runs 1, 3, and 4. The depths were adjusted downward 2.5 ft to assure all log runs had a consistent reference point at the top of casing. Thus, the depths of 147.5 to 56.5 ft (log run 2) were adjusted to 150.0 to 59 ft.

## Analysis Notes:

| **Analyst:** | Henwood | **Date:** | 12/10/01 | **Reference:** | MAC-VZCP 1.7.9 Rev. 2 |
|---|---|---|---|---|---|

Pre-run and post-run verifications of the logging system were performed for each day's log event. The efficiency (peak counts per second) of the logging system was consistently lower each day in the post-run verification as compared to the pre-run verification. The cause of this discrepancy is being investigated. Evaluation of the spectra indicates the detector is functioning normally and the log data are provisionally accepted, subject to further review and analysis.

A casing correction for 0.322-in.-thick casing is applied for the 8-in. steel casing. This value is within the error of the field measurement collected to confirm casing size and represents the published thickness for ASTM schedule-40 steel pipe, a common borehole casing at Hanford.

Each spectrum collected during a log run was processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL using an efficiency function and corrections for casing and dead time as appropriate. In zones of high dead time (> 40%), maximum gross count rates and radionuclide concentrations are not considered reliable, and may be higher than reported values. Where dead time is greater than about 40 percent, pulse pileup and peak spreading effects tend to result in underestimation of peak count rates. The $^{214}$Bi peak at 1764 keV was used to determine the naturally occurring $^{238}$U concentrations rather than the $^{214}$Bi peak at 609 keV. The higher energy 1764-keV energy peak exhibits slightly better count rates than the 609-keV peak because of less gamma attenuation caused by the casing in this borehole.

## Log Plot Notes:

Separate log plots are provided for the man-made radionuclide ($^{137}$Cs) detected in the borehole, naturally occurring radionuclides ($^{40}$K, $^{238}$U, $^{232}$Th [KUT]), a combination of man-made, KUT, total gamma and dead time, a plot of total gamma plotted with dead time, and a repeat section plot. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. These errors are discussed in the calibration report.

## Results and Interpretations:

The only man-made radionuclide detected in this borehole is $^{137}$Cs. A zone of $^{137}$Cs is detected near the ground surface with a maximum concentration of about 200 pCi/g. A second zone of $^{137}$Cs contamination includes the depths from about 29 to 116 ft. The maximum concentrations exceed 1,000 pCi/g between 29 and 47 ft. The dead time exceeds 40 % in this zone. Where high dead times occur, values tend to be under-estimated and may be unreliable. The high rate logging system (HRLS) should be employed in this interval to obtain accurate $^{137}$Cs concentrations. $^{137}$Cs concentrations between 100 and 1,000 pCi/g occur from 47 to 98 ft in depth. From 98 to 116 ft, $^{137}$Cs concentrations decrease from 100 pCi/g to below detectable levels (about 0.2 to 0.5 pCi/g).

Above the high rate zone, apparent $^{40}K$ activities are about 12 pCi/g. Within the high rate zone $^{40}K$ concentrations increase to about 16 pCi/g, suggesting a transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2.

A repeat log section was collected between 60.5 and 75 ft in depth. The log data show good repeatability for depth and radionuclide concentration, suggesting the logging system was operating properly.

[1] GWL – groundwater level
[2] n/a – not applicable
[3] TOC – top of casing

## References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy.

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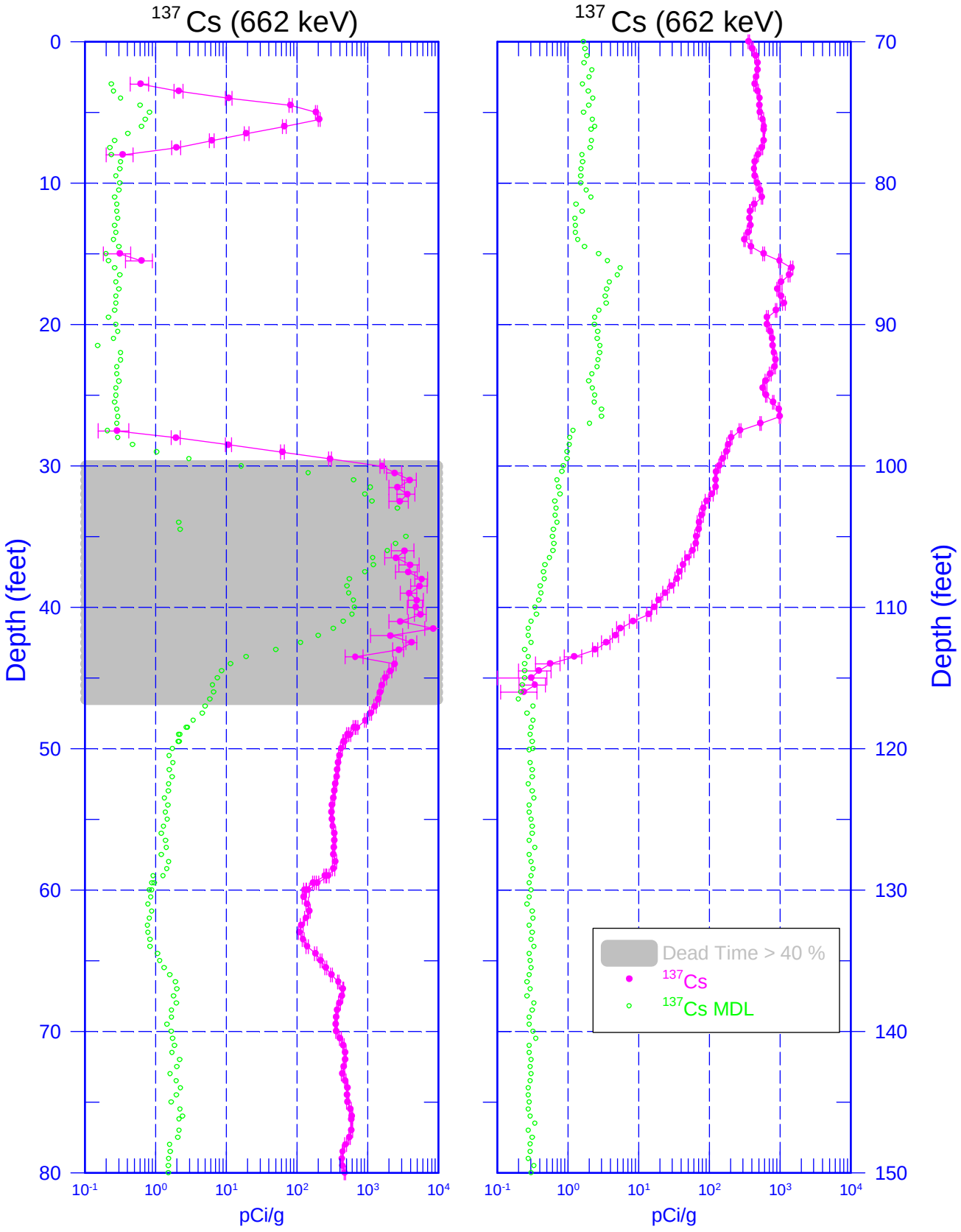
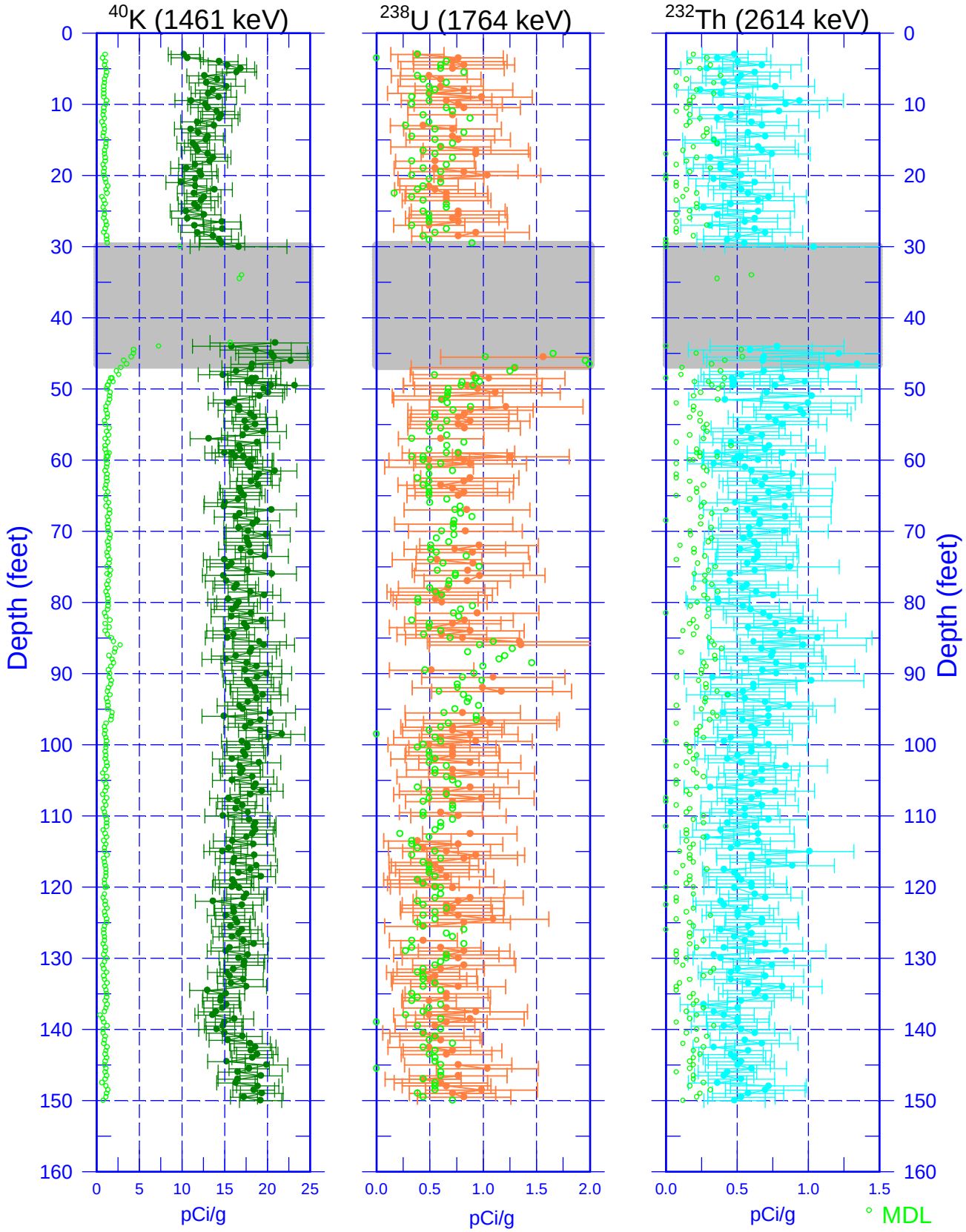
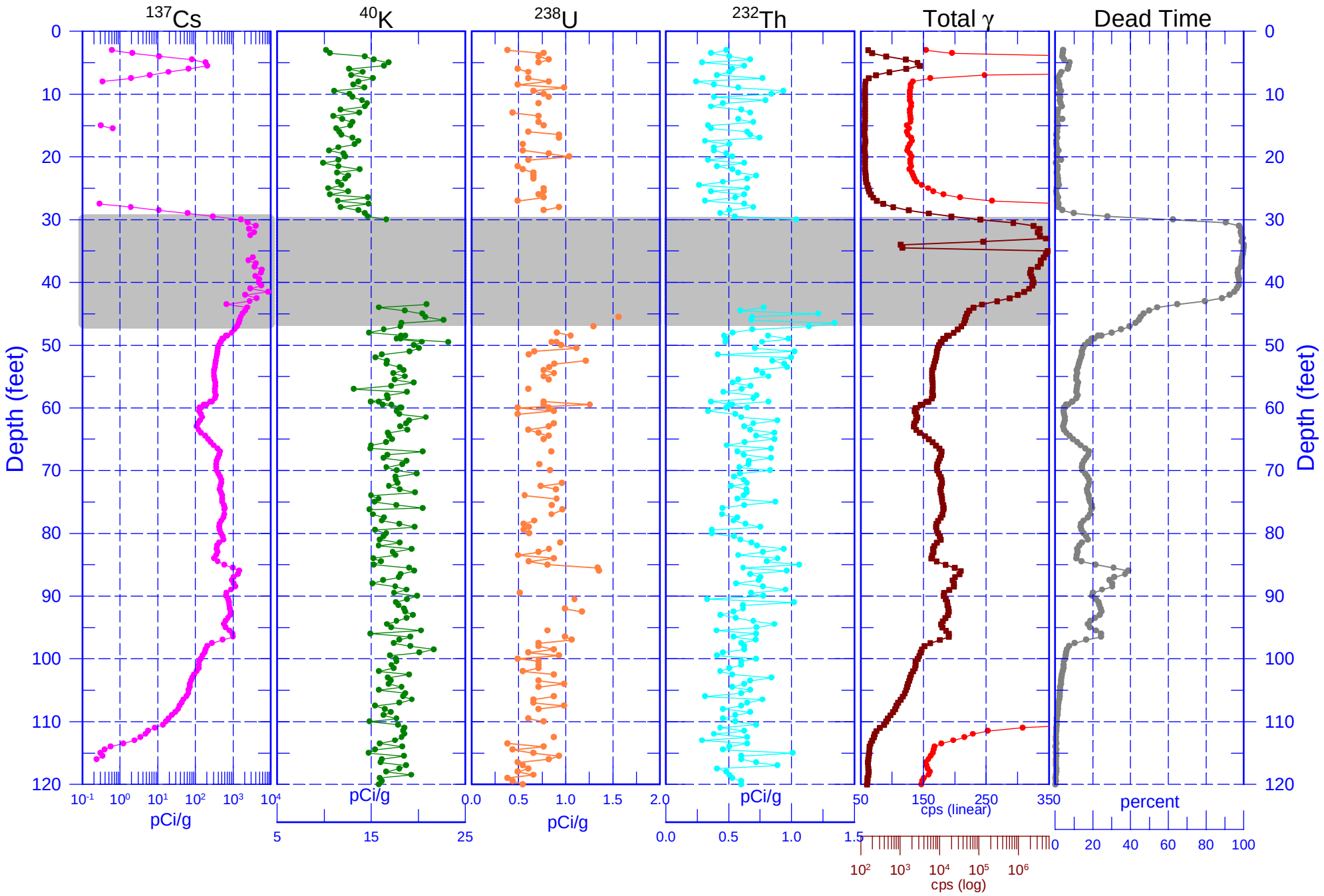
## Man-Made Radionuclide Concentrations



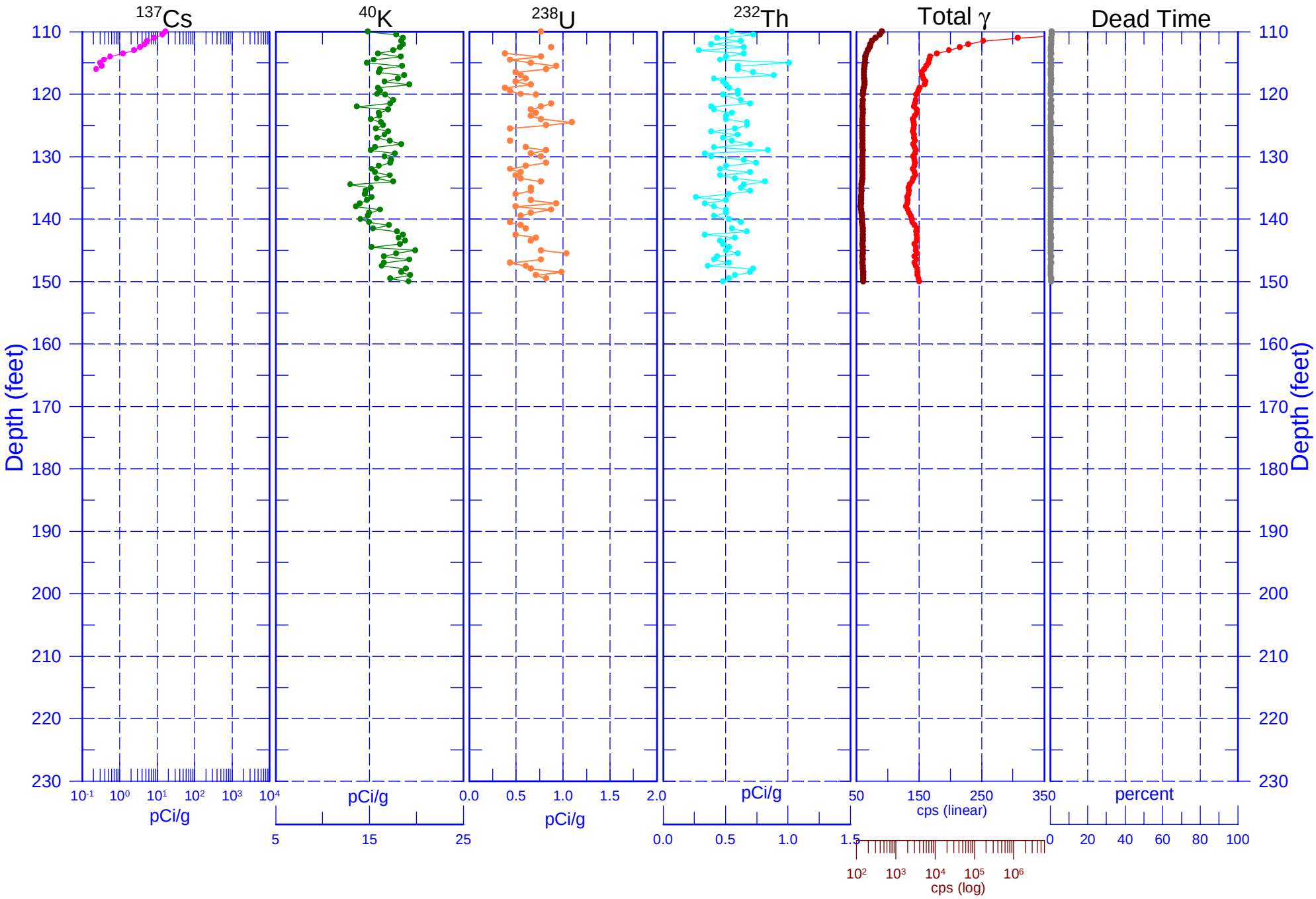
# 299-E33-68 (A6876)
## Natural Gamma Logs



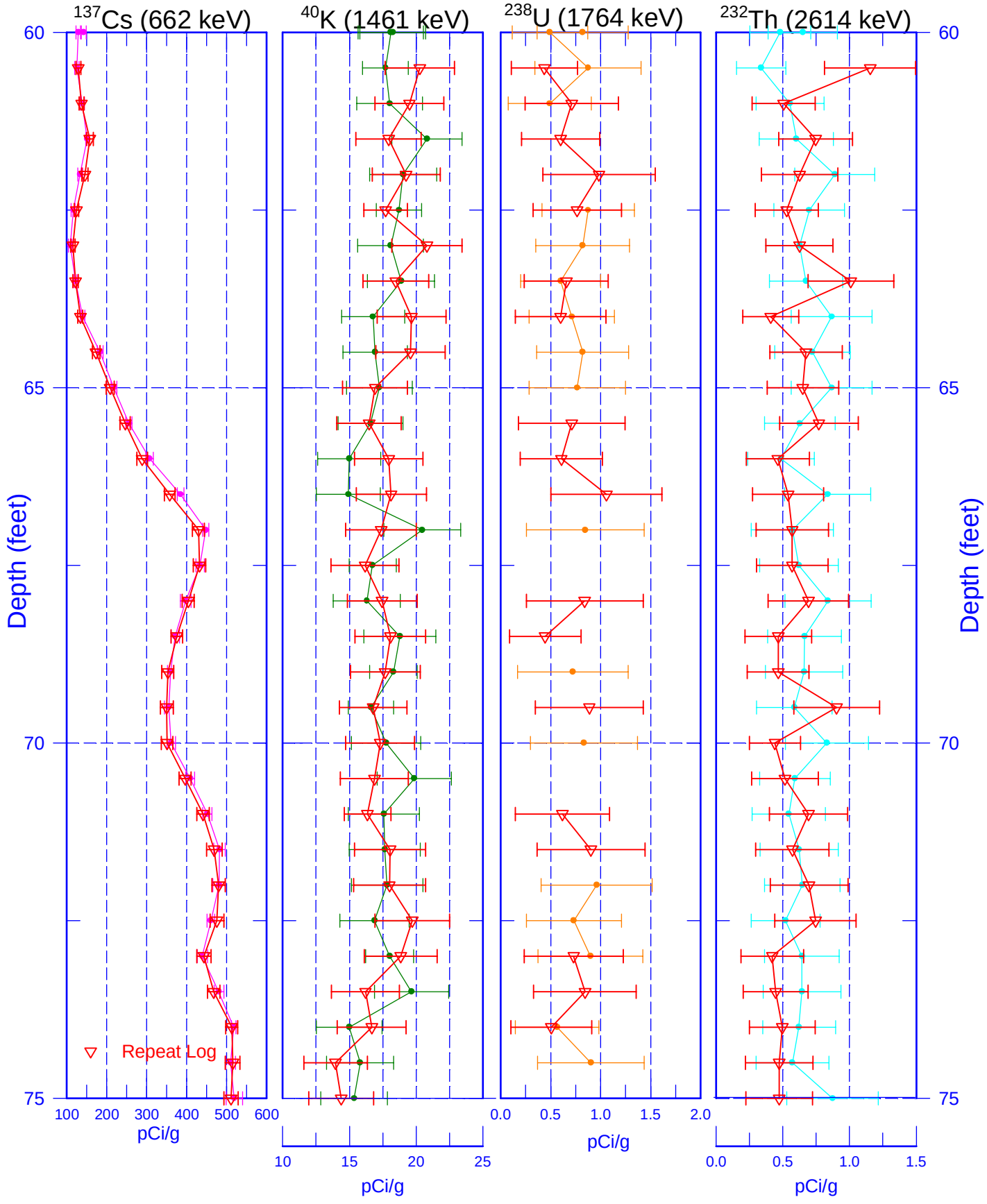
# 299-E33-68 (A6876) Combination Plot



# 299-E33-68 Combination Plot (continued)



# 299-E33-68 (A6876)
## Repeat Logs



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