



299-E33-18 (A4844)

Log Data Report

Borehole Information:

| | | | | | |
|-------------------------------------|--------------------------|---------------------------------------|--|--------------------------------|---------------------------|
| Borehole: 299-E33-18 (A4844) | | Site: 216-B-7A Crib and B Crib | | | |
| Coordinates (WA State Plane) | | GWL (ft): 252.87 | | GWL Date: 03/00 | |
| North 137386.06 | East 573779.16 | Drill Date 02/50 | TOC² Elevation 643.62 | Total Depth (ft) 278 | Type 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 | 8.0 | 0.3125 | 0 | 265 |

Borehole Notes:

The casing depth information provided above is derived from *Hanford Wells* (Chamness and Merz 1993) and from *Summaries of Well Construction Data and Field Observations for Existing 200-East Aggregate Operable Unit Resource Protection Wells* (Ledgerwood 1992). The casing size information for the 8-in. steel casing is confirmed from tape and caliper measurements collected in the field by MACTEC-ERS personnel. The borehole casing is reported to have been perforated from 240 to 260 ft.

Groundwater level is derived from *Hanford Site Groundwater Monitoring for FY 2000* (PNNL 2001). Groundwater levels of 255 and 240.2 ft determined in 1950 and 1992, respectively, are reported in Ledgerwood (1992).

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 Repeat (113.0-141.0) | 4 | 5 |
|-------------------|------------------|----------|-------------------------------|----------|----------|
| Date | 11/20/01 | 11/26/01 | 11/27/01 | 11/29/01 | 11/30/01 |
| Logging Engineer | Musial | Musial | Musial | Musial | Musial |
| Start Depth | 3.0 | 57.5 | 113.0 | 274.0 | 199.0 |
| Finish Depth | 58.5 | 141.0 | 200.5 | 253.0 | 237.0 |
| Count Time (sec) | 100 | 100 | 100 | 100 | 100 |
| Live/Real | R | R | R | R | R |
| Shield (Y/N) | N | N | N | N | N |
| MSA Interval (ft) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ft/min | n/a ³ | n/a | n/a | n/a | n/a |
| Pre-Verification | A0041CAB | A0043CAB | A0044CAB | A0046CAB | A0047CAB |
| Start File | A0042000 | A0043000 | A0044000 | A0046000 | A0047000 |
| Finish File | A0042111 | A0043167 | A0044175 | A0046042 | A0047076 |

| | | | | | |
|-------------------|----------|----------|-----------------------------------|----------|----------|
| Log Run | 1 | 2 | 3 Repeat (113.0-141.0) | 4 | 5 |
| Post-Verification | A0042CAA | A0043CAA | A0044CAA | A0046CAA | A0047CAA |

| | | | | | |
|-------------------|---------------------------------|--|--|--|--|
| Log Run | 6 Repeat 253.5-272.5 | | | | |
| Date | 12/03/01 | | | | |
| Logging Engineer | Musial | | | | |
| Start Depth | 236.0 | | | | |
| Finish Depth | 272.5 | | | | |
| Count Time (sec) | 100 | | | | |
| Live/Real | R | | | | |
| Shield (Y/N) | N | | | | |
| MSA Interval (ft) | 0.5 | | | | |
| ft/min | n/a | | | | |
| Pre-Verification | A0048CAB | | | | |
| Start File | A0048000 | | | | |
| Finish File | A0048073 | | | | |
| Post-Verification | A0049CAA | | | | |

Logging Operation Notes:

Spectral gamma logging was performed in this borehole during November and December 2001 on seven separate days. Data acquired on November 28 from 199 to 254 ft were not used because of a depth return error; this depth interval was re-logged. Data repeat sections were collected between 113.0 and 141.0 ft and between 253.5 and 272.5 ft to measure logging system performance.

Analysis Notes:

| | | | | | |
|-----------------|---------|--------------|----------|-------------------|-----------------------|
| Analyst: | Henwood | Date: | 12/17/01 | 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. Post-run verifications were used for the energy and resolution calibration necessary to process the data except for the final log run where the pre-run verification was used.

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. No casing correction is applied below 265 ft in depth. A water correction is applied to data from 254 ft to the total depth of the borehole.

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. No dead times exceeding 40 % were encountered in the borehole. The ²¹⁴Bi peak at 1764 keV was used to determine the naturally occurring ²³⁸U concentrations rather than the ²¹⁴Bi 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 dual casings in this borehole.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs , ^{60}Co , and processed uranium [^{235}U and ^{238}U]) 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), and two repeat section plots. 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 man-made radionuclides detected in this borehole were ^{137}Cs , processed uranium (^{235}U and ^{238}U), and ^{60}Co . ^{137}Cs is detected between 5 and 10 ft at a concentration of less than 2 pCi/g. The processed uranium and ^{60}Co are both detected below about 234 ft in depth. The maximum concentrations for ^{60}Co , ^{235}U , and ^{238}U are about 2, 50, and 650 pCi/g, respectively. It appears the contamination coincides with the historical water levels in the area, which range from about 238 to 255 ft in depth.

The ^{40}K concentrations from 3 to 21 ft are low relative to normal background levels observed at Hanford. It is likely a surface casing and/or a grout seal exists in this depth interval that is not reported in Ledgerwood (1992) or Chamness and Merz (1993). Thus, the ^{137}Cs concentrations identified in this interval may be underestimated. On the basis of an increase in ^{40}K concentrations, a transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2 appears to occur at about 40 ft in depth.

Other minor changes in lithology occur at 125 and 222 ft. ^{232}Th concentration increases suggest thin beds of clayey material. Another thin bed of enhanced ^{232}Th and ^{40}K concentrations exists from 238 to 246 ft. This bed lies just below the interval of the contamination zone measured between 234 and 238 ft. The bottom of the 8-in. casing is reflected at 265 ft where the total gamma increases. A decrease in ^{40}K concentrations occurs at this depth, suggesting basalt was encountered. The driller's log (Ledgerwood 1992) identifies "lava rock" at this depth, which could mean basalt.

Naturally occurring ^{238}U measurements acquired in the first log run from 3 to 58.5 ft show enhanced count rates that are attributed to radon (^{222}Rn). The existence of ^{222}Rn causes the estimate of naturally occurring formation ^{238}U to be about 0.5 pCi/g too high during log run 1.

Repeat log sections show good repeatability for depth and radionuclide concentrations, suggesting the logging system was operating properly.

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.

Ledgerwood, R.K., 1992. *Summaries of Well Construction Data and Field Observations for Existing 200-East Aggregate Area Operable Unit Resource Protection Wells*, Draft WHC-SD-ER-T12EAA, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Pacific Northwest National Laboratory (PNNL), 2001. *Hanford Site Groundwater Monitoring for FY 2000* PNNL-13404, Pacific Northwest National Laboratory, Richland, Washington.

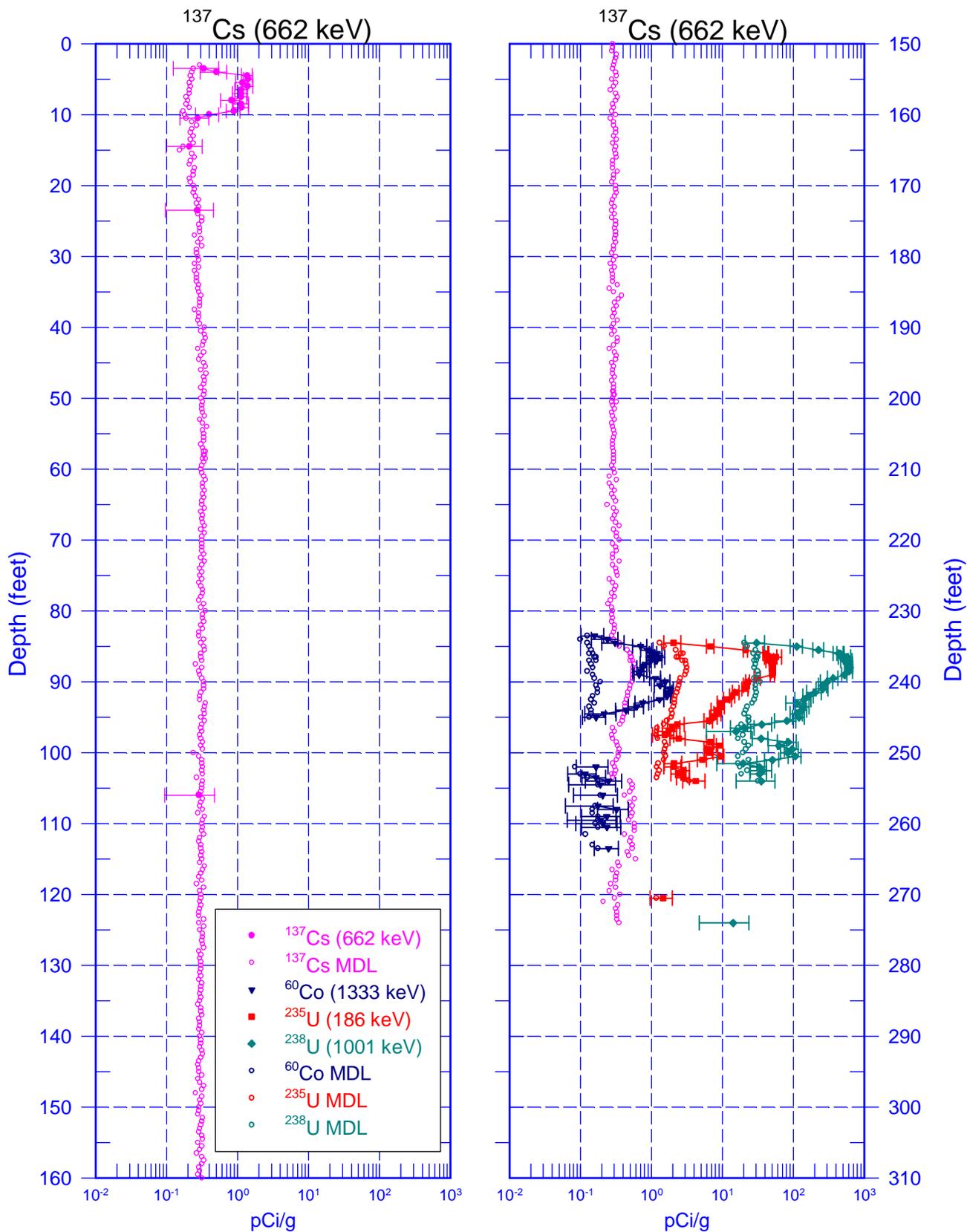
¹ GWL – groundwater level

² TOC – top of casing

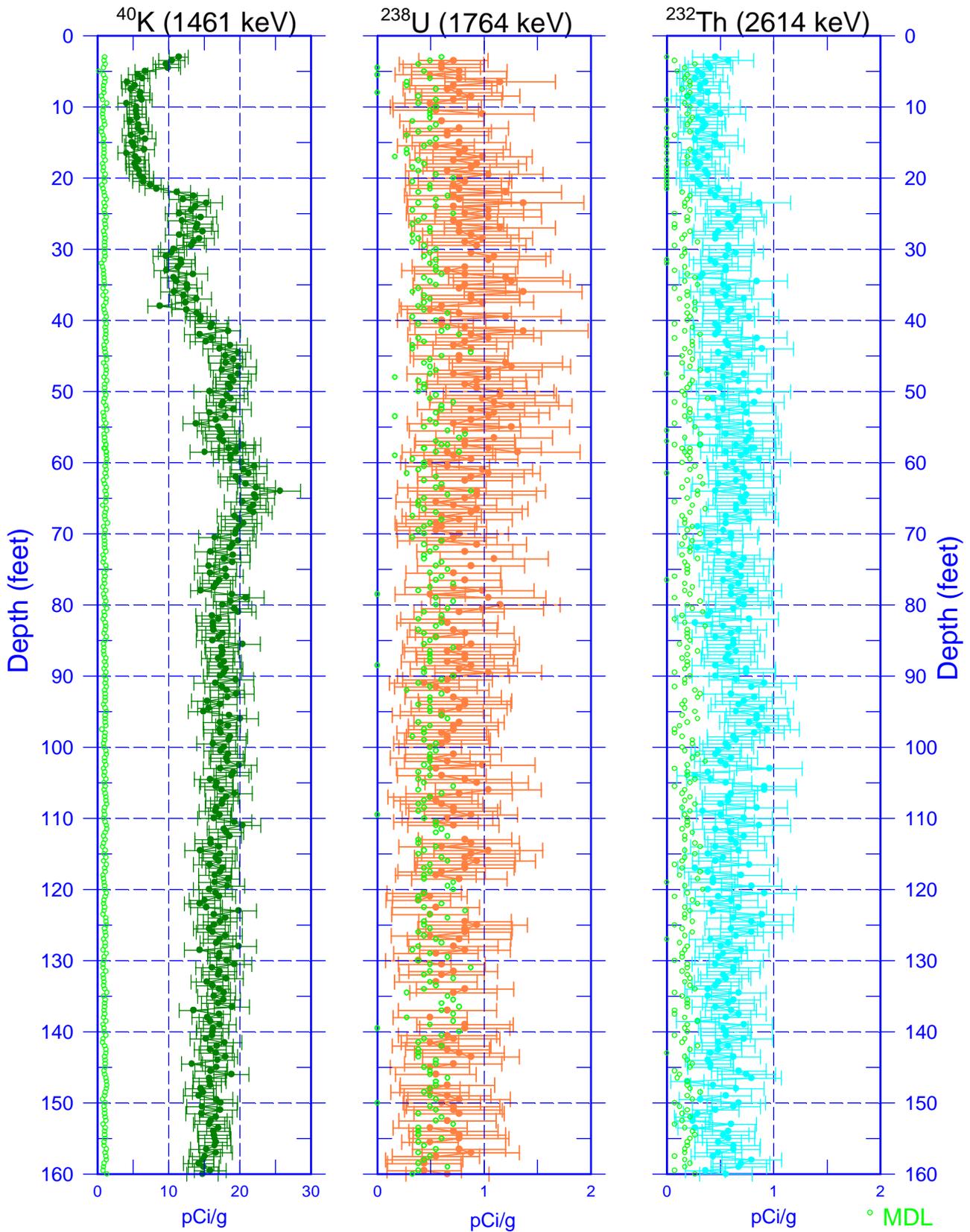
³ n/a – not applicable

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Man-Made Radionuclide Concentrations

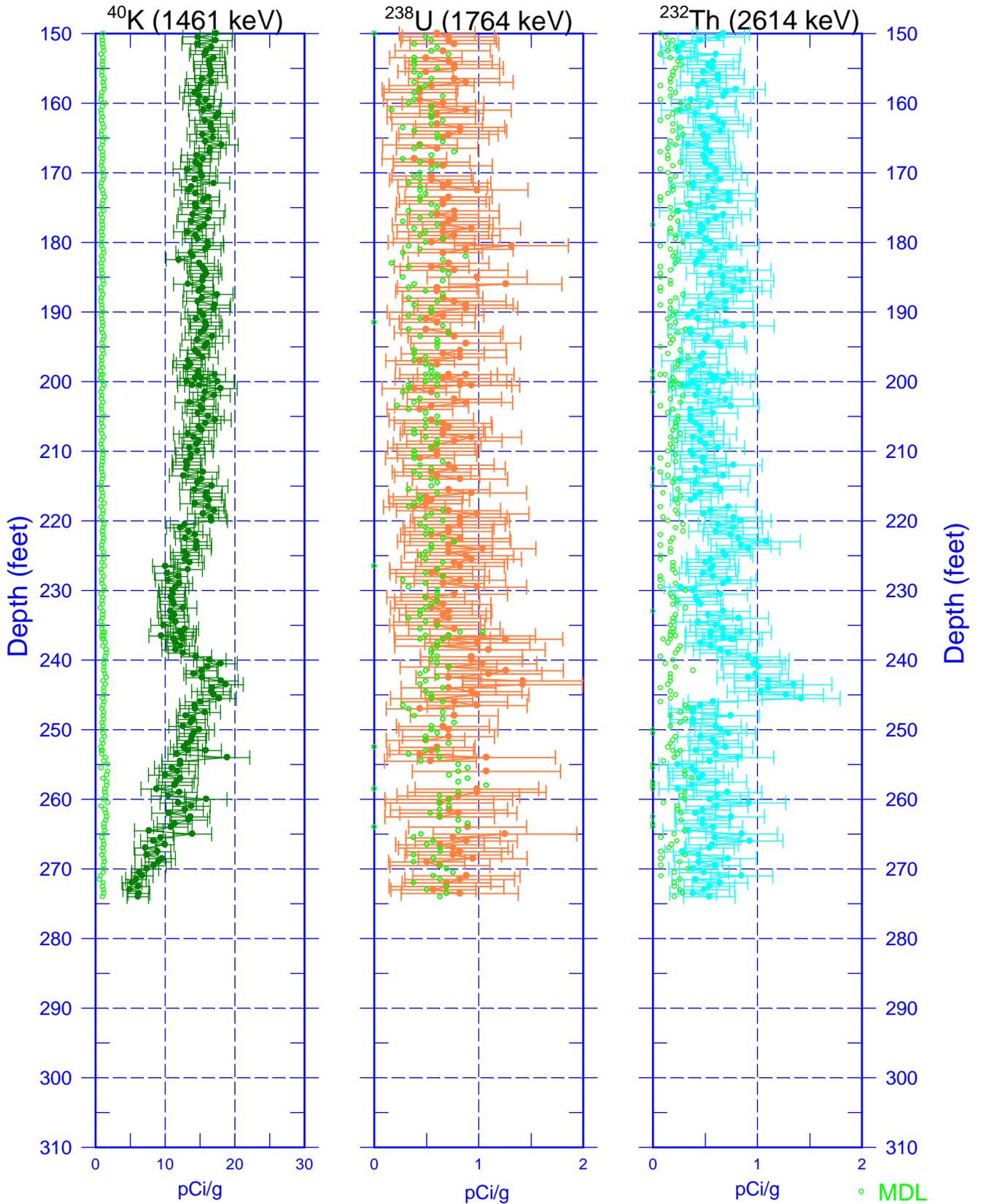


299-E33-18 (A4844) Natural Gamma Logs

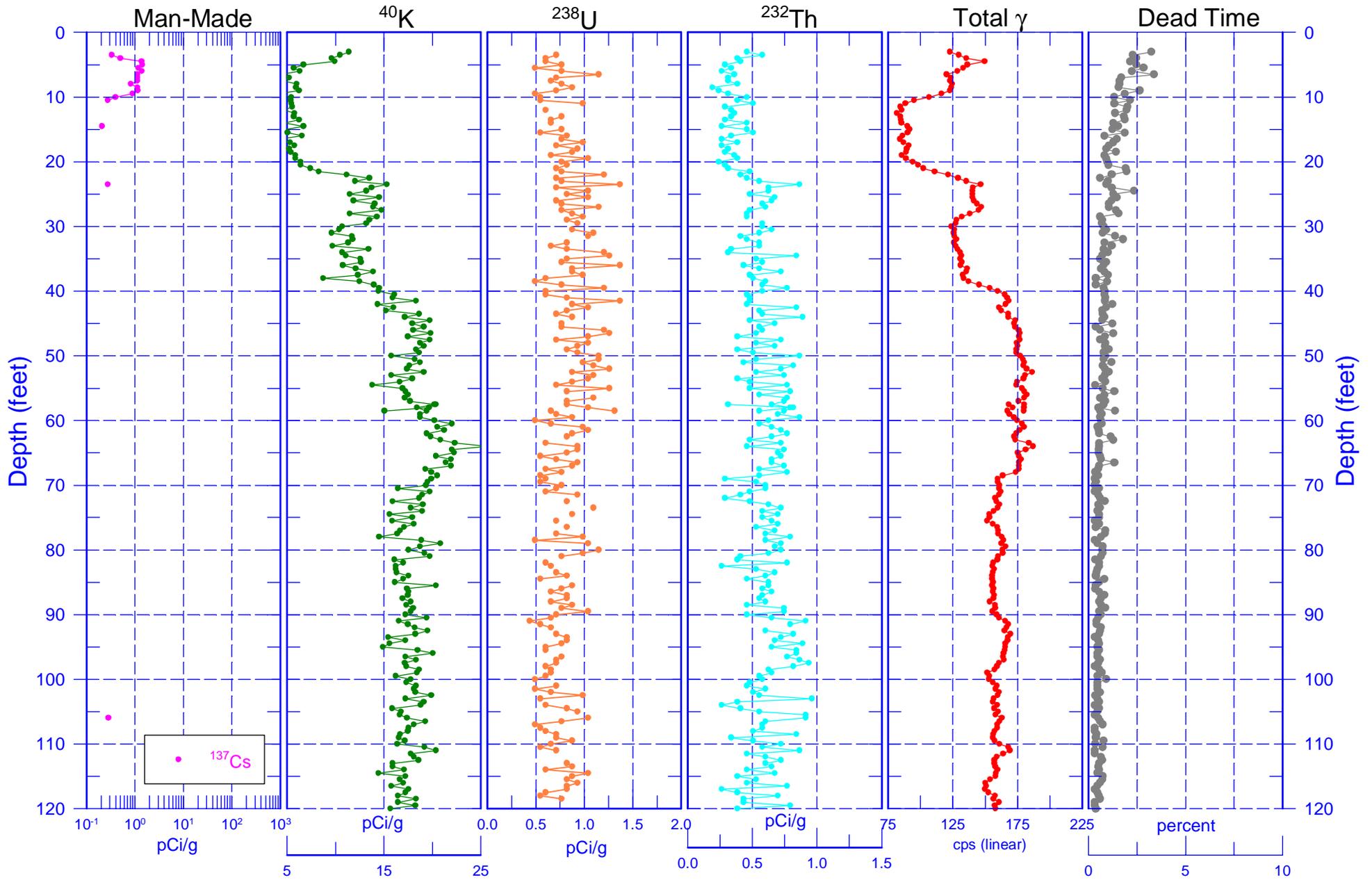


299-E33-18 (continued)

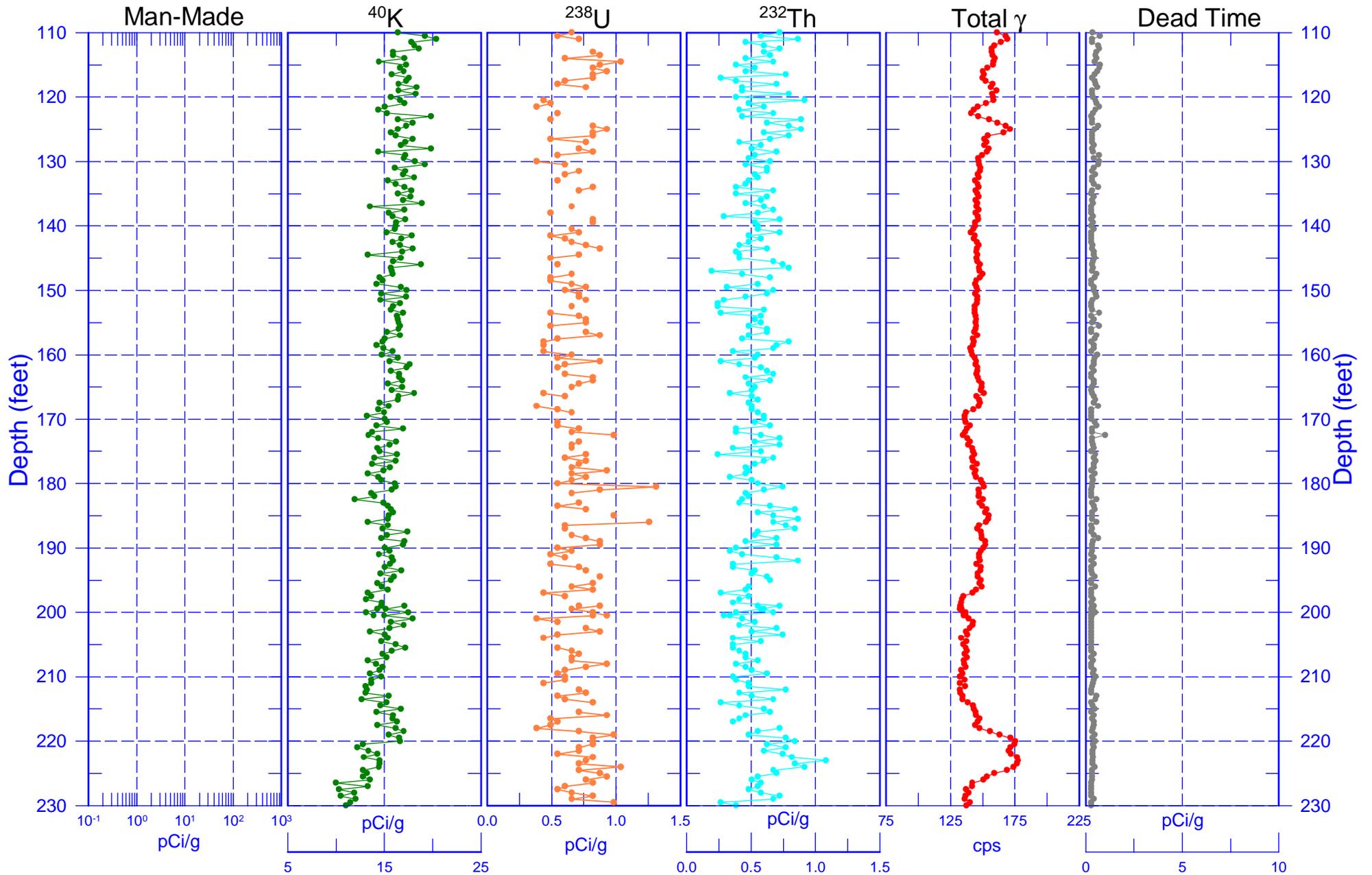
Natural Gamma Logs



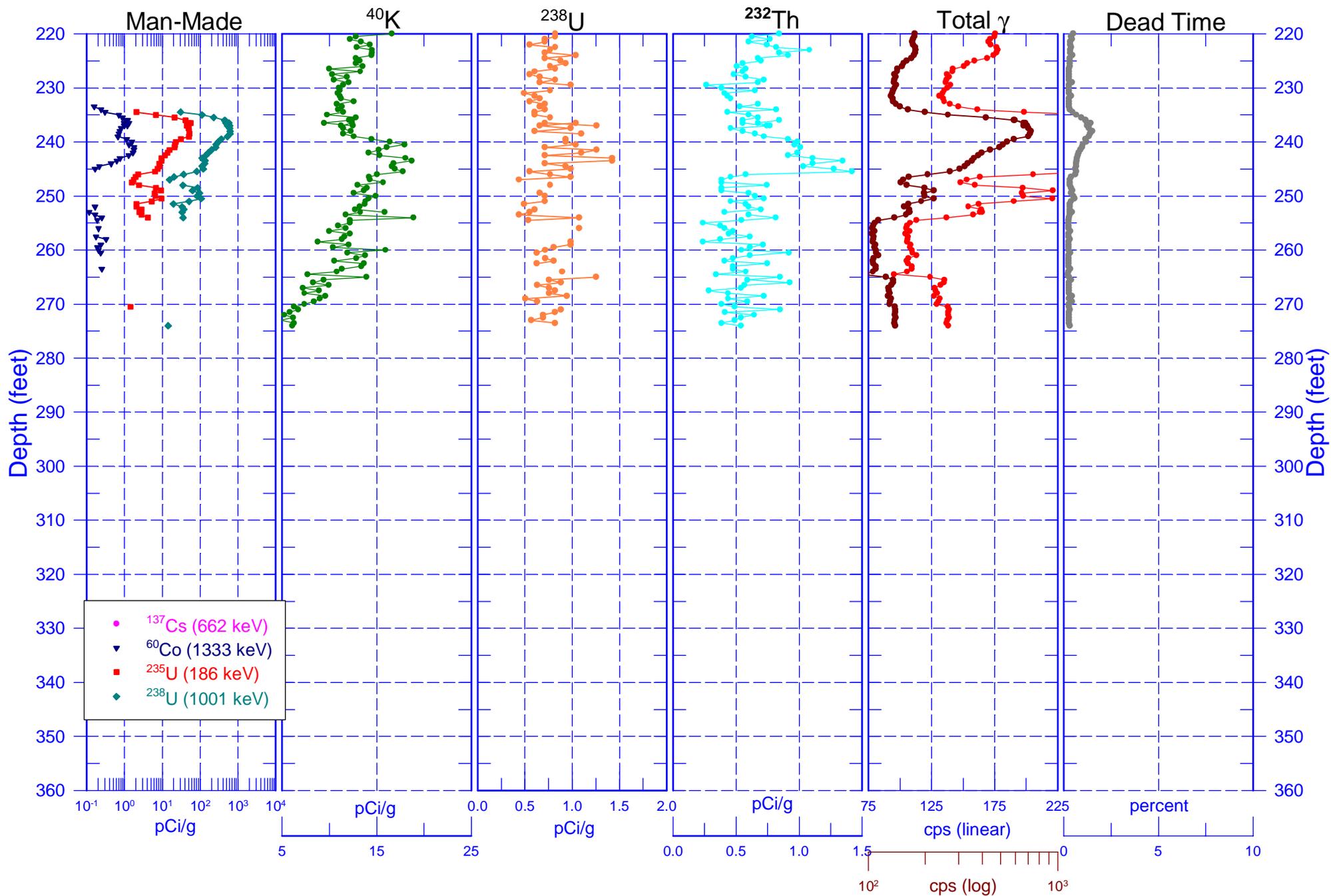
299-E33-18 (A4844) Combination Plot



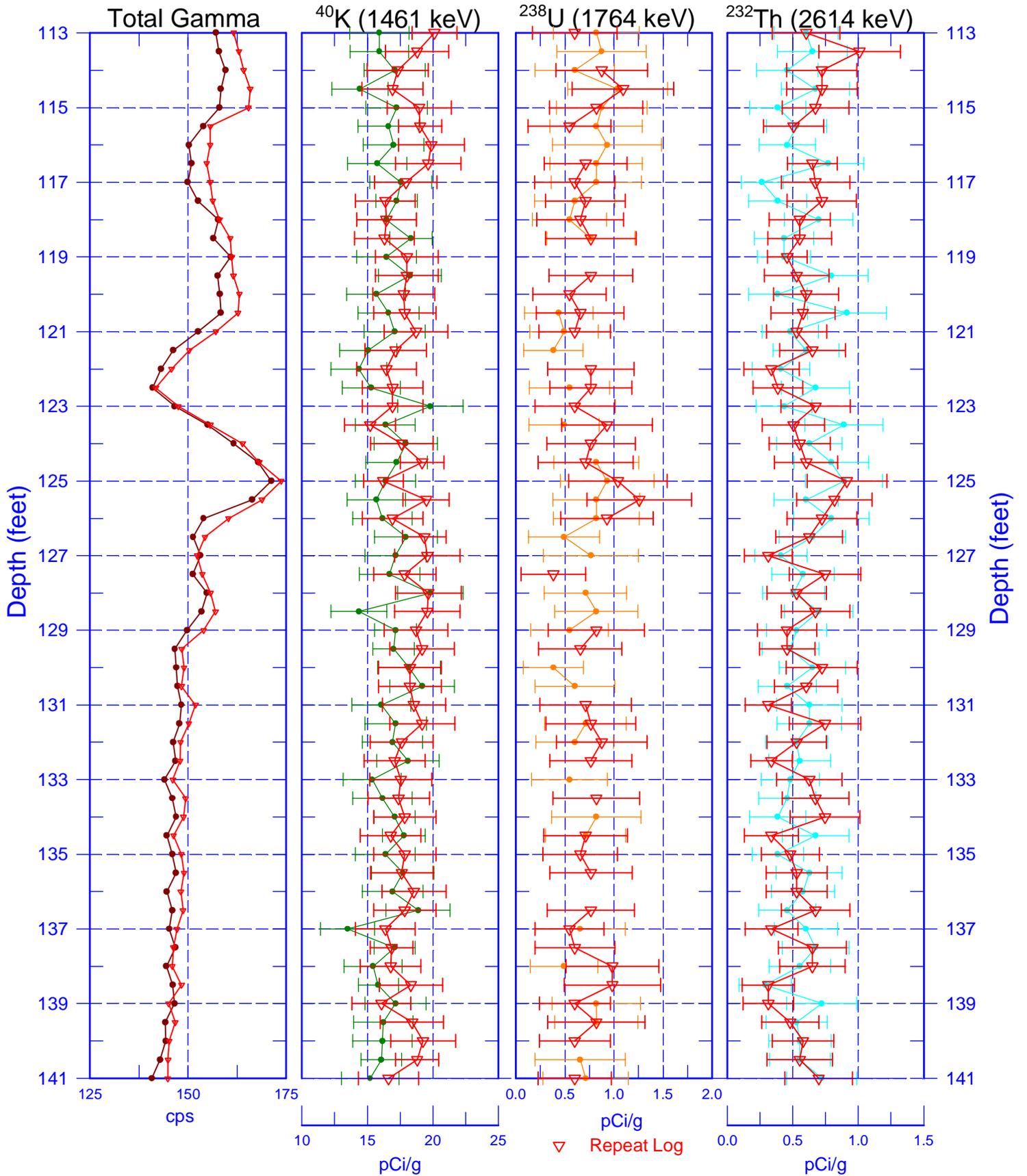
299-E33-18 Combination Plot (continued)



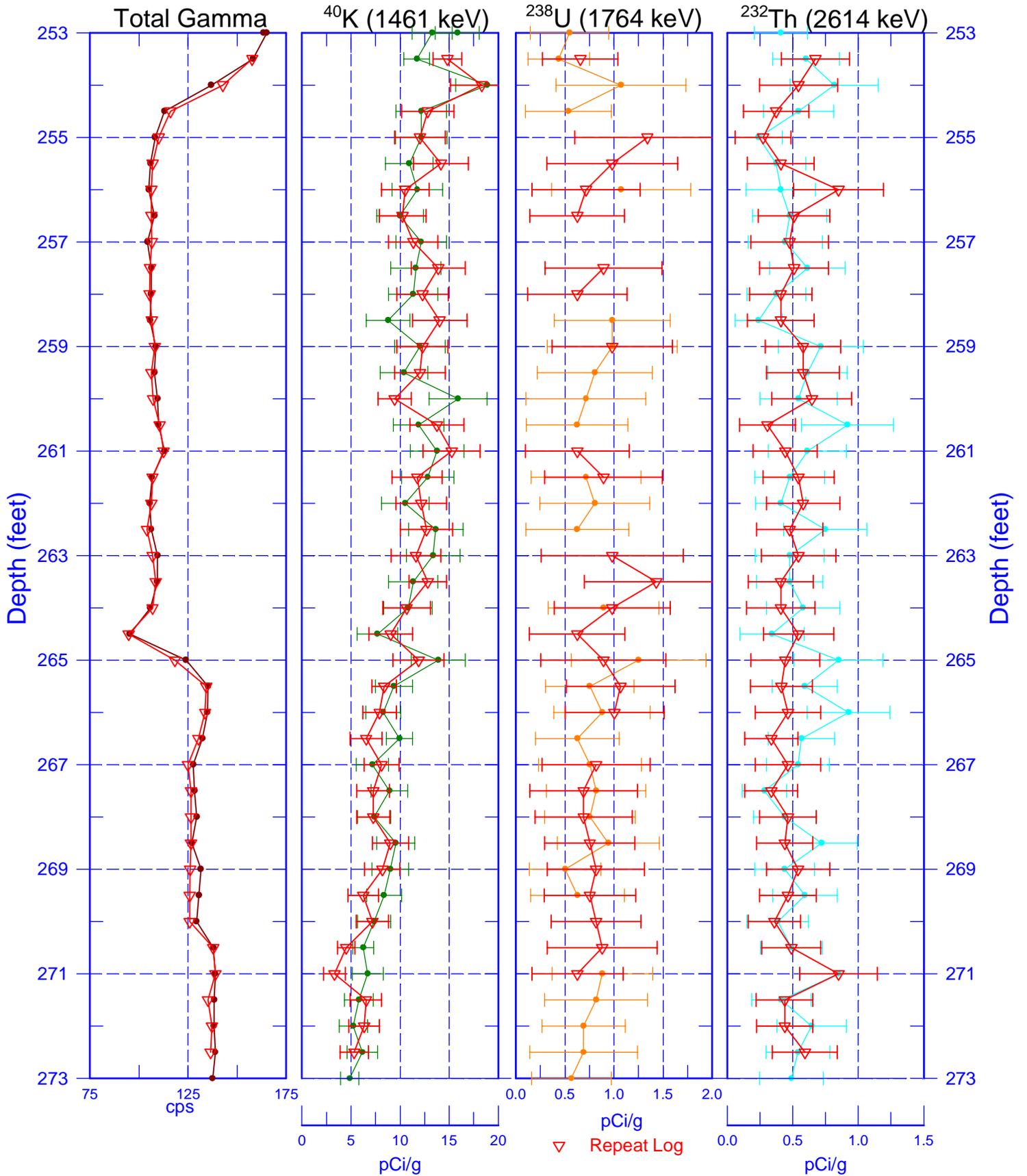
299-E33-18 Combination Plot (continued)



299-E33-18 (A4844) Repeat Logs



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Total Gamma & Dead Time

