

399-1-23 (C5000) Log Data Report

Borehole Information:

Borehole: 399-1-23 (C5000)		Site: South from 316-5 Process Trenches			
Coordinates (WA St Plane)		GWL¹ (ft): 34.5 (approximate)		GWL Date: 04/13/06	
North (m) not available	East (m) not available	Drill Date 04/12/06	TOC Elevation (ft) not available	Total Depth (ft) 115	Type Sonic

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Carbon Steel	3.65	9 3/4	8 5/8	9/16	3.65	115

Borehole Notes:

The logging engineer measured the 8-in. casing and stickup using a steel tape. Measurements were rounded to the nearest 1/16 in. The onsite geologist reported the depth to bottom and depth to groundwater. Depth to water, inside the casing, was measured by the logging engineer at 39.1, 37.75, and 35.6 ft on 04/13, 04/14, and 04/17, respectively. The geologist stated the water inside the casing had not yet equilibrated with the groundwater outside the casing. The true static level of groundwater is 34.5 ft.

Logging Equipment Information:

Logging System: Gamma 4N	Type: SGLS (60%) SN: 45TP22010A
Calibration Date: 04/06/06	Calibration Reference: DOE-EM/GJ1177-2006
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Logging System: Gamma 1N	Type: SGLS (60%) SN: 45TP22010A
Calibration Date: 04/05/06	Calibration Reference: DOE-EM/GJ1183-2006
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Logging System: Gamma 4F	Type: NMLS SN: H380932510
Calibration Date: 02/27/06	Calibration Reference: DOE-EM/GJ1141-2006
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat	7 Repeat
Date	04/12/06	04/13/06	04/14/06	04/14/06	04/18/06
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	19.0	96.5	20.0	19.0
Finish Depth (ft)	20.0	97.5	112.5	50.0	22.0
Count Time (sec)	200	200	200	400	1000
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 ²	N/A	N/A	N/A	N/A
Pre-Verification	DN271CAB	DN281CAB	DN291CAB	DN291CAB	AN012CAB
Start File	DN271000	DN281000	DN291000	DN291033	AN012000
Finish File	DN271040	DN281157	DN291032	DN291093	AN012006
Post-Verification	DN271CAA	DN281CAA	DN291CAA	DN291CAA	AN012CAA
Depth Return Error (in.)	0	0	N/A	0	0
Comments	Fine gain adjustment after file-1030.	No fine gain adjustment			

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	5	6 Repeat			
Date	04/17/06	04/17/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0.0	30.0			
Finish Depth (ft)	35.5	35.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DF172CAB	DF172CAB			
Start File	DF172000	DF172143			
Finish File	DF172142	DF172163			
Post-Verification	DF172CAA	DF172CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

Logging was conducted with a centralizer on the sondes. Logging data acquisition is referenced to ground level. The maximum logging depth achieved was 112.9 ft. Repeat sections were collected in this borehole to evaluate each system's performance and to acquire more detailed information at selected depths. The SGLS repeat sections were acquired at 400 seconds (20 to 50 ft) and 1000 seconds (19 to 22 ft) relative to the main log at a 200 second counting time.

Analysis Notes:

Analyst:	Henwood	Date:	05/01/06	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the SGLS (G4N) were acquired in the Amersham verifier, serial number 115 which is enhanced in the naturally occurring radionuclides ^{40}K , ^{238}U , and ^{232}Th (KUT). The resolution (FWHM) for the 609 and 1461 keV energy peaks fell slightly below the lower control limits for pre-run verification data acquired on 04/13/06; the HASQUARD criteria were met. The control limits were not exceeded for the other five verification spectra. Therefore, the data are accepted.

Pre-run and post-run verifications for the SGLS (G1N) were acquired in the Amersham verifier, serial number 118. The criteria were met.

A casing correction for 9/16-in.-thick casing was applied to the SGLS log data.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G4NApr06.xls and G1NApr06.xls for logging systems G4N and G1N, respectively, using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 8 and 10 percent for G4N and G1N, respectively. No correction for dead time was necessary. A correction for water was applied to data acquired on 04/13 below 39.1 ft in depth. For repeat data acquired 04/14, the water correction was applied to data below 37.5 ft.

The NMLS data are presented as counts per second. A calibration for casing inside diameters greater than 8-in. is not available.

Results and Interpretations:

A plot of manmade radionuclides is included for ^{137}Cs and processed uranium (^{235}U and ^{238}U). The plot indicates all detections based on the routine processing software. All of the detections were at or near the respective MDLs. Inspection of each spectrum where detection was indicated revealed no full energy peaks. Therefore, the detections are considered to be statistical fluctuations and are not considered valid. No other manmade radionuclides were indicated.

There is a strong indication of radon in the groundwater. Comparison of the 1764 keV and 609 keV ^{214}Bi gamma rays show differing concentrations after corrections for water and casing. The casing and water correction factors decrease with increasing energy. Gamma rays originating inside the casing are not attenuated by the steel casing, and the net effect of applying the correction factors is to amplify results from low-energy gamma rays. The fact that the 609 keV gamma ray results in a higher apparent concentration than the 1764 keV gamma line suggests that radon is present in the groundwater. Typical formation concentrations of naturally occurring ^{238}U are between approximately 0.5 and 1.5 pCi/g. The concentrations above the groundwater level are consistent with these values for the assays of both the 609 and 1764 keV peaks. Note that enhanced radon is not related to the existence of manmade uranium.

The neutron moisture results are reported in counts per second because no valid calibration is available for borehole inside diameters greater than 8 inches. Some variation is noted in the moisture profile.

The repeat sections generally indicate good agreement of the naturally occurring KUT. The repeat data were acquired at 400 (20 to 50 ft) and 1000 second (19 to 22 ft) counting times relative to the 200 second counting time for the main log data. The log data, especially for ^{40}K do not repeat between 36 and 39 ft. The water level in the borehole before logging this interval on 04/13 was 39.1 ft. When the repeat data were acquired on 04/14, the depth to water was measured before logging at 37.5 ft. Corrections used for water in the borehole are applied accordingly. The static water level (i.e., formation water is at the same level as water inside the borehole) was not realized until after the SGLS logging was complete. The lack of

repeatability in this log interval is apparently due to incorrect water corrections because of changing depth to water that occurred during logging and between the separate log events.

Log Plots:

Manmade Radionuclides

Natural Gamma Logs

Combination Plot

Total Gamma & Moisture

Total Gamma & Dead Time

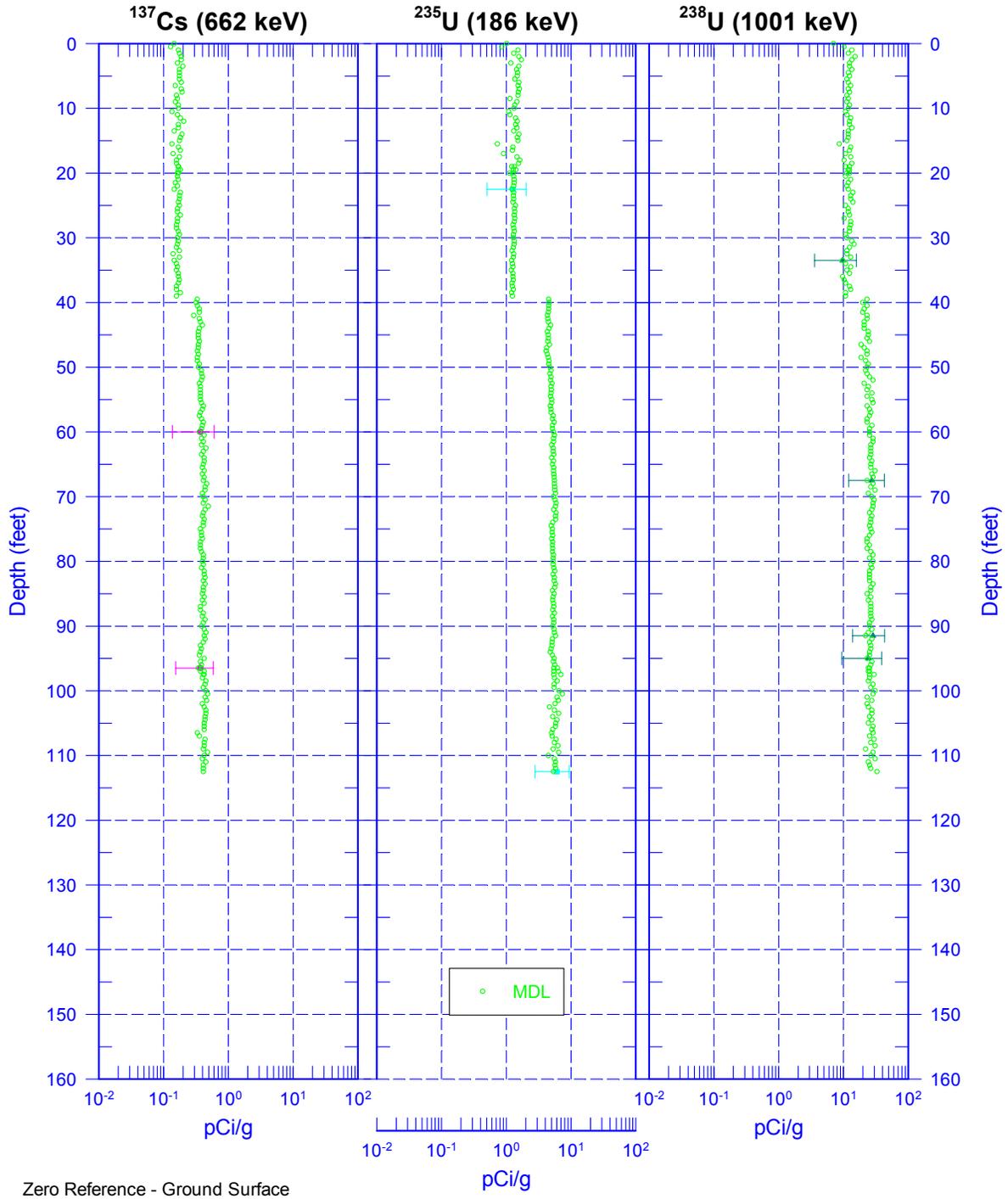
Repeat Section of Natural Gamma Logs (20 to 50 ft)

Repeat Section of Natural Gamma Logs (19 to 22 ft)

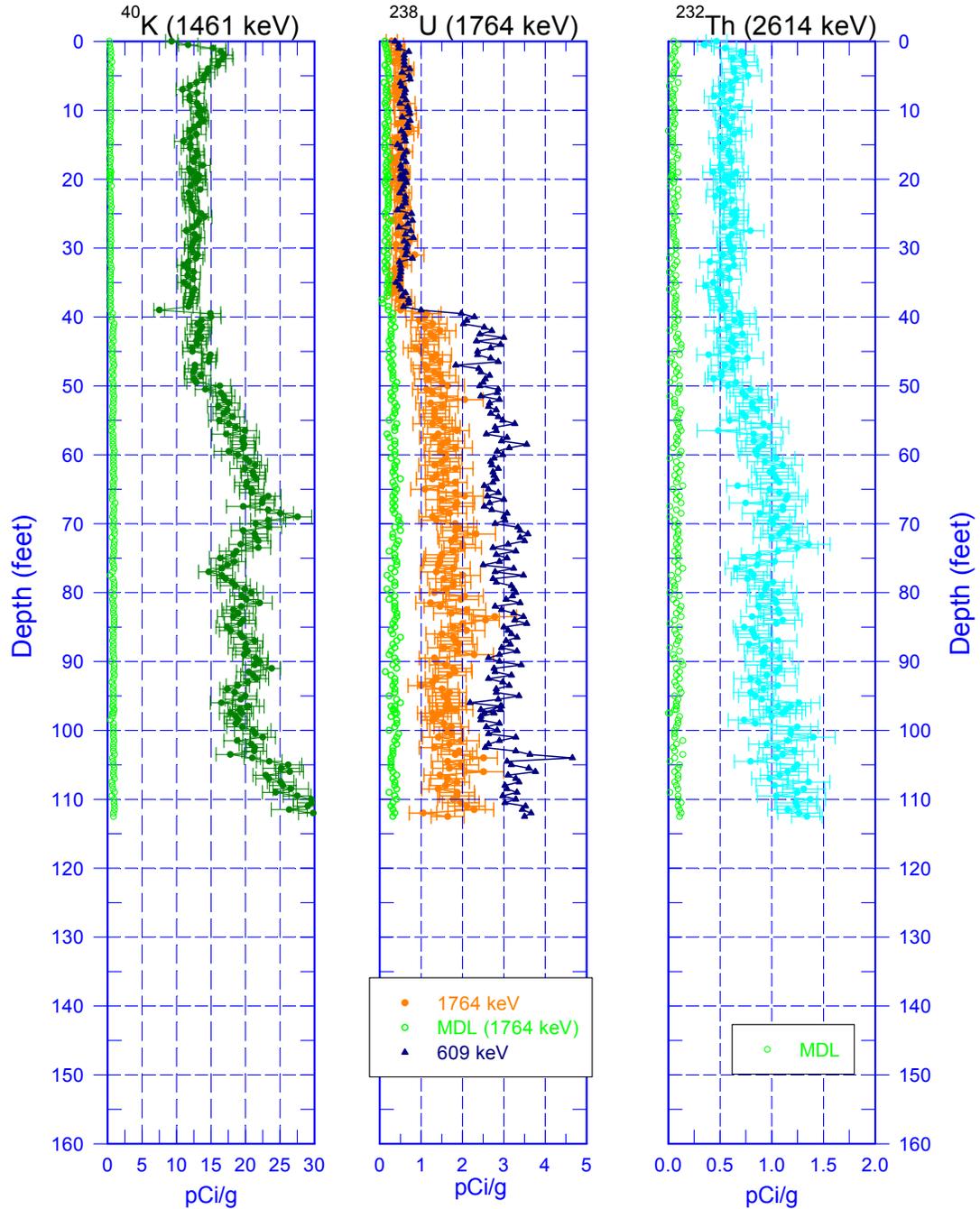
¹ GWL – groundwater level

² N/A – not applicable

399-1-23 (C5000) Manmade Radionuclides

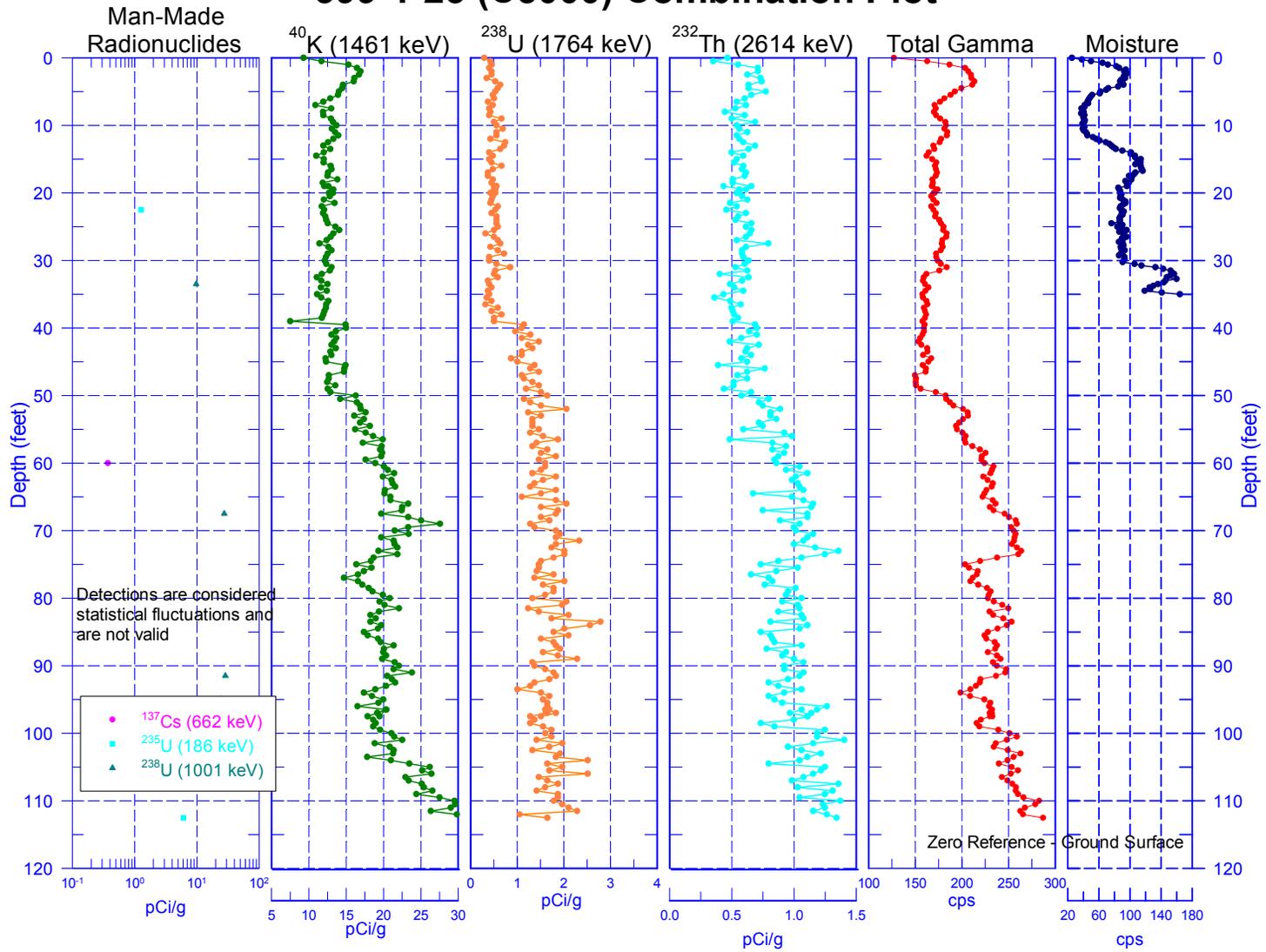


399-1-23 (C5000) Natural Gamma Logs

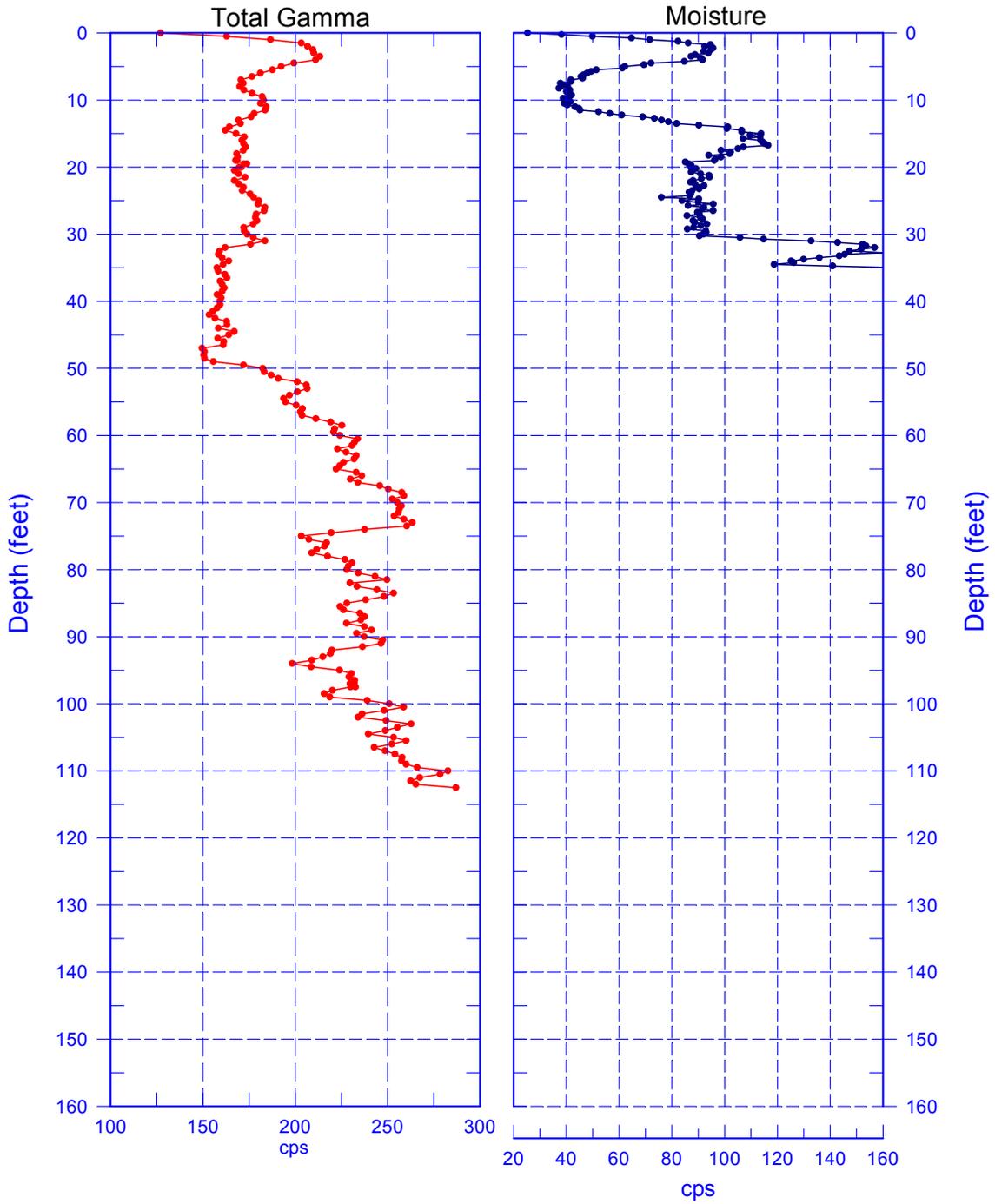


Zero Reference - Ground Surface

399-1-23 (C5000) Combination Plot

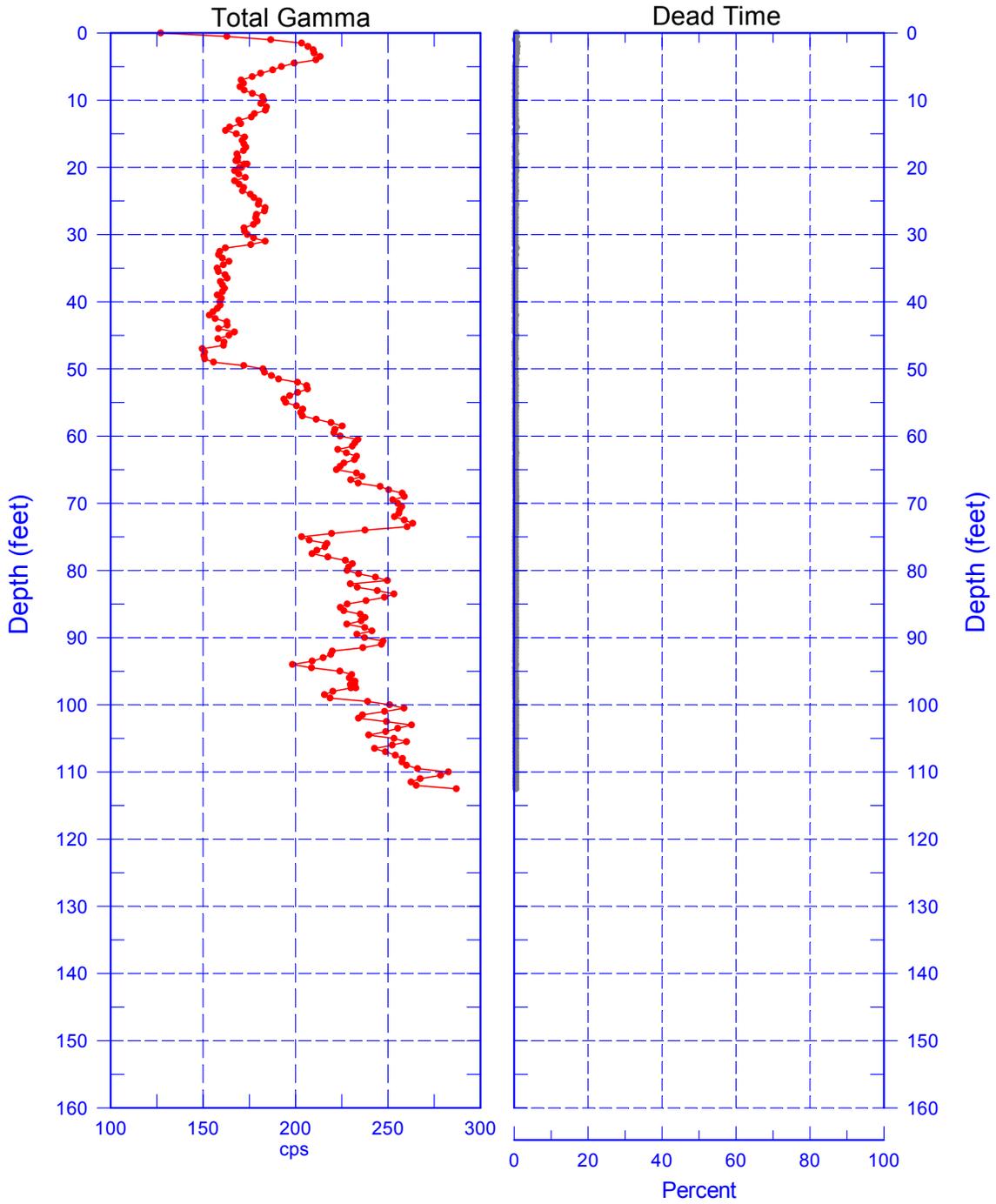


399-1-23 (C5000) Total Gamma & Moisture



Reference - Ground Surface

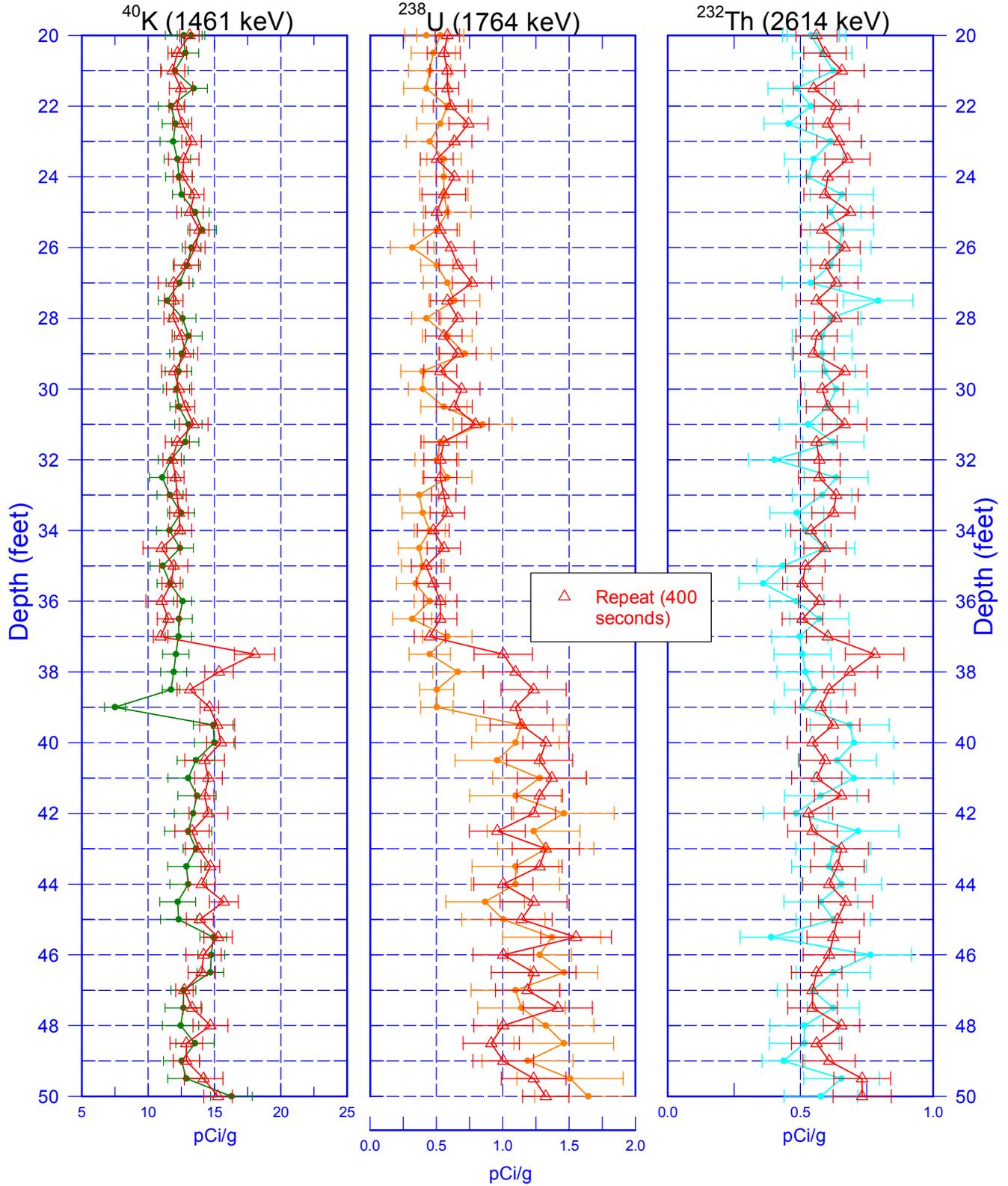
399-1-23 (C5000) Total Gamma & Dead Time



Reference - Ground Surface

399-1-23 (C5000)

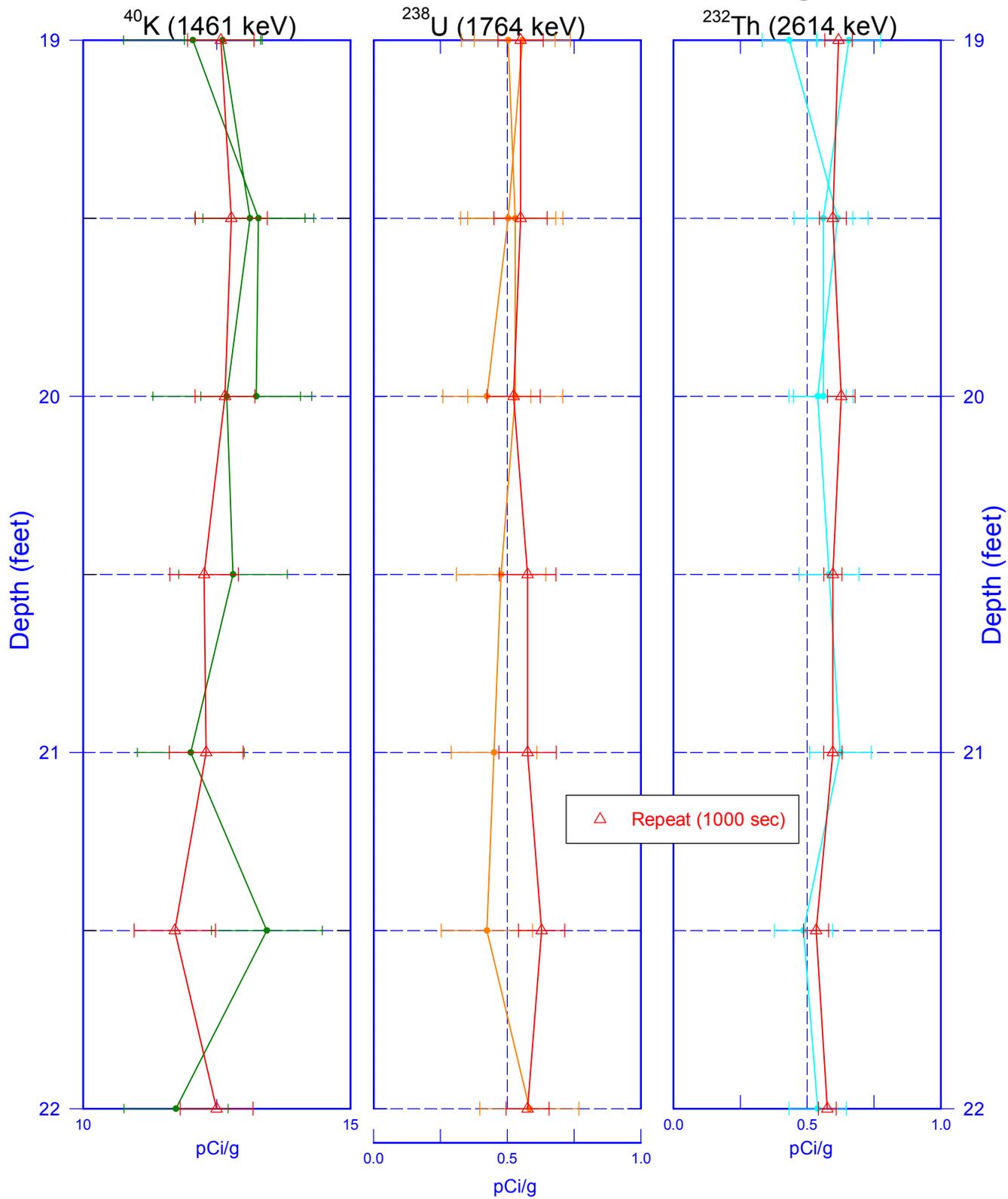
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

399-1-23 (C5000)

Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface