

2006 Philadelphia Annual Meeting (22–25 October 2006)

## Paper No. 112-2

**Presentation Time:** 1:30 PM-5:30 PM

# TIMING, RATES, AND VOLUMES OF BEDROCK CHANNEL INCISION MEASURED WITH 10-BE, GPS, AND LIDAR: HOLTWOOD GORGE, PA

[REUSSER, Luke](#), Geology Department and School for Natural Resources, University of Vermont, Burlington, VT 05405, [Ireusser@zoo.uvm.edu](mailto:Ireusser@zoo.uvm.edu), [BIERMAN, Paul R.](#), Geology Department and School of Natural Resources, University of Vermont, Burlington, VT 05405, [PAVICH, Milan](#), Geologic Division, U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, VA 20192, [LARSEN, Jennifer](#), Geology Department, University of Vermont, Burlington, VT 05405, and [FINDEL, Robert C.](#), Lawrence Livermore National Laboratory, Livermore, 94550

The timing, rate, and amount that rivers erode rock have important implications for the large-scale development of landscapes in both passive and tectonically active terrains. Concentrations of 10-Be measured in 78 bedrock samples reveal that strath terraces preserved within Holtwood Gorge along the lower Susquehanna River are Late Pleistocene, and that this large passive margin river incised >20 m since ~100 ka and ~10 m since ~36 ka. Mean ages for three levels of well-preserved bedrock terraces within the Gorge increase predictably with height above the modern channel floor; level 3 (highest): ~36 ka, level 2: ~20 ka, level 1 (lowest): ~14 ka. These data imply that beginning ~36 ka, in good correlation with the onset of Wisconsinan glaciation, and ending ~14 ka near the Holocene transition, rates of incision increased to between 0.45 and 0.60 m/ky, after which time most incision within the gorge ceased.

Recently acquired LiDAR coverage for Holtwood Gorge (thanks to NCALM), calibrated with GPS data gathered with a Trimble RTK 4400, provides an opportunity to quantify volumes of rock removed from the km-wide channel of the Susquehanna River during periods of incision. Rates of vertical incision can be misleading measures of erosion; if the cross-sectional area of a river channel decreases substantially during incision, the rate of incision alone does not indicate of the actual amount of bedrock eroded or the corresponding change in channel geometry. Volume calculations of Holtwood Gorge facilitated by LiDAR demonstrate that increased incision rates during the last glaciation were accompanied by increased rates of rock removal. Using paleo riverbed surfaces derived from GPS locations of each sample site, we estimate that prior to 36 ka, the maximum rate of rock removal from the gorge was ~260,000 m<sup>3</sup>/ky per river km. From ~36 to ~20 ka (levels 3 and 2), the normalized rate of removal increased dramatically to ~410,000 m<sup>3</sup>/ky/km. The lowest terrace was inundated at the time of LiDAR acquisition precluding accurate volume removal estimates between the level 1 and 2 terraces. Based on the average height difference between the level 1 and 2 paleo riverbeds, and assuming a similar channel geometry as at higher elevations in the gorge, we estimate a maximum rate of rock removal of ~480,000 m<sup>3</sup>/ky/km between ~20 and ~14 ka.

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Session No. 112--Booth# 7

[Erosion: Processes, Rates, and New Measuring Techniques \(Posters\)](#)

Pennsylvania Convention Center: Exhibit Hall C

1:30 PM-5:30 PM, Monday, 23 October 2006

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