EP23E-03: A Quaternary record of periglacial surface processes preserved in a headwater valley in central Pennsylvania

Tuesday, 12 December 2017
14:10 - 14:25
New Orleans Ernest N. Morial Convention Center - 352

Quaternary climate fluctuations altered the style and pace of erosion and sedimentation in glaciated landscapes, although the impact of such climate shifts on periglacial landscapes, common throughout the mid-latitudes during glacials, is poorly constrained. In order to understand the timescale, mechanisms and extent of climate-modulated erosion, we examine rates and dates of hillslope processes preserved in periglacial debris stored in a sandstone headwater valley in central Pennsylvania. We pair geomorphic mapping with in situ cosmogenic ^{10}Be and ^{26}Al measurements of surface and buried material to estimate residence time and deposition history of colluvium at Garner Run, a study catchment in the Susquehanna Shale Hills Critical Zone Observatory. ^{10}Be concentrations of stream sediment and hillslope regolith indicate slow erosion rates (6.3 m ± 0.5 m m.y.$^{-1}$) since ~100 kya and ^{26}Al/^{10}Be burial dating of valley-bottom deposits indicate episodes of pulsed erosion since 350 ± 110 ka. Together, we interpret these datasets as implying rapid erosion during cold periods and limited removal of valley bottom deposits during interglacials. The age of valley-bottom deposits is consistent with independent calculations of valley-fill volume, hillslope contributing area, and catchment-average erosion rate over multiple climate cycles. This record spans at least three glacial terminations, consistent with other recent dating work showing long residence times of periglacial features in central Appalachia. The preservation of valley deposits in the headwater catchment is likely due to a combination of sandstone bedrock that produces boulder-rich colluvium and the location of Garner Run upstream of a knickpoint, which insulates the catchment from regional base level change. These conditions are not unique to Garner Run; the lateral extent of folded sandstone units throughout central Appalachia presents opportunities to study climate-modulated hillslope processes within headwater valleys bearing long-lived colluvial records.

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