

Northeastern Section (39th Annual) and Southeastern Section (53rd Annual) Joint Meeting (March 25–27, 2004)

Paper No. 35-6

Presentation Time: 10:20 AM-10:40 AM

CLIMATE-DRIVEN BEDROCK CHANNEL INCISION OF THE SUSQUEHANNA RIVER, HOLTWOOD GORGE, PENNSYLVANIA: REGIONAL SIMILARITIES

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Little is known about the rate at which either glaciated or non-glaciated rivers incise through bedrock on passive margins, and how this incision relates to climate and land-level fluctuations. ¹⁰Be analysis of 78 samples reveals that bedrock strath-terraces preserved within Holtwood Gorge along the lower Susquehanna River are Late Pleistocene features; this passive margin river has incised >20 m since 100 ky and ~10 m since 30 ky. Incision significantly accelerated beginning at the onset of the last glacial period (30 to 35 ky).

A vertical transect of 4 samples, each on one prominent terrace (21 m elevation range) suggests that from >100 to ~32 ky, the Susquehanna incised through competent schist at <0.2 m/ky. From ~32 to ~19 ky, the rate of incision doubled to 0.4 m/ky. This increase correlates with the transition between the last interglacial and glacial periods. Between ~19 and ~15.5 ky, just after the LGM (glacial ice filled the northern half of the Susquehanna Basin), the rate of downcutting again doubled to 0.8 m/ky. These same data allow calculation of an integrated incision rate (32 to 15.5 ky) of 0.5 m/ky. During this time, sea level was >150 m below present and river discharge and sediment load were presumably elevated by glacial meltwater.

Furthermore, 14 samples collected in a cross section at the upper end of the gorge yield an incision rate of 0.6 m/ky ($R^2=0.94$) commencing ~31 ky. Similarly, mean ages from numerous samples collected longitudinally along each of the terrace levels suggest incision rates between 0.6 and 0.7 m/ky beginning ~30 ky and ending ~14 ky. Alternatively, amalgamating the results of 24 samples collected in vertical transects down the fronts of 3 mid-channel islands suggest incision at 0.1 m/ky from ~46 to ~24 ky, increasing to 1.0 m/ky between ~21 and ~14 ky.

The timing and rate of incision along both the glaciated Susquehanna and unglaciated Potomac Rivers (100 km south) are remarkably similar (0.8 m/ky from 37 to 13 ky) suggesting that large rivers draining the Atlantic Passive margin are responding to regional forcings likely including climate induced changes in flood frequency, sediment load, and isostasy. Passive margin incision rates we measured are less than, but approach incision rates on the Indus River (1 to 12 m/ky) in the tectonically active Himalayas ([Burbank et.al, 1996](#); [Leland et.al, 1998](#)).

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Session No. 35

[Geomorphic Process Rates on the Passive Margin](#)

Hilton McLean Tysons Corner: Sully A

8:00 AM-12:00 PM, Friday, March 26, 2004

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