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METEORIC 10Be CONCENTRATIONS IN THE POTOMAC RIVER BASIN

TRODICK, Charles D. Jr[1], BIERMAN, Paul[2], PAVICH, Milan[3], REUSSER, Lucas J.[1], and ROOD, Dylan[4], (1) Department of Geology, University of Vermont, Delehanty Hall, 180 Colchester Ave, Burlington, VT 05405, ctrodick@uvm.edu, (2) Geology Department, University of Vermont, Perkins Hall, Burlington, VT 05405, (3) U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, VA 20192, (4) Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, CA 94550-9234

We measured meteoric ^{10}Be in sand collected from 3 sites on the main-stem Potomac River (basin areas of 18616, 15528, and 1411 km^2) and from 12 tributaries (16 km^2 to 2642 km^2). Ten samples came from USGS gaging station sites where suspended sediment data are available. Meteoric ^{10}Be concentration are uncorrelated with both basin area (R^2 = 0.07) and modern sediment yields (R^2 =0.08).

Our meteoric ^{10}Be concentrations range from 0.6 to 5.5*10^8 atoms/g with an average of 2.5+/-1.3*10^8 atoms/g (1s). Small basins (16 to 34 km^2), one in the Coastal Plain and 3 in the Piedmont, near Washington, DC have the lowest meteoric ^{10}Be concentrations (0.6 to 1.5*10^8 atoms/g). The highest concentration of ^{10}Be (5.5*10^8 atoms/g) is found on Conococheague Creek, (basin area 796 km^2), the northernmost tributary of the Potomac. There is a decreasing downstream trend in ^{10}Be concentrations on the Potomac (4.3*10^8, 2.6*10^8 and 2.0*10^8 atoms/g).

Brown et al. (1988) computed a ^{10}Be Erosion Index (EI), a basin-scale ratio between atmospheric ^{10}Be loading and ^{10}Be leaving the basin on sediment. We sampled a location (station 01638500, main branch Potomac) where Brown et al. 1988 calculated an EI of 0.77; today the site has an EI of 1.3. The change results from differences in ^{10}Be concentration (4.2*10^8 atoms/g (Brown), 2.6*10^8 atoms/g (this study)) and sediment yield (2.6 mg/(cm^2*yr) (Brown et al.), 4.1 mg/(cm^2*yr) (Gellis et al., 2004)). Potomac sediment samples, collected by Brown et al. (n=2), have an average ^{10}Be concentration of 6.1+/- 2.4*10^8 atoms/g, about twice the average of our measurements (n=15). Brown's EIs ranged from 0.77-3.77 (average 2.26); ours (n=10) range from 0.25 to 3.33 (average 1.75); the differences in ^{10}Be concentration and EI are not significant (p-values of 0.74 and 0.88, respectively).

Assuming steady state and a ^{10}Be delivery rate of 1.3*10^6 atoms/(cm^2*yr), we can interpret measured meteoric ^{10}Be concentrations as erosion rates. Calculated erosion rates range from 9 m/My to 77 m/My with an average of 25 m/My, similar to that reported along the Appalachian Mountains and adjacent Piedmont. However, some erosion rates are inconsistent with other estimates a difference likely reflecting violation of the steady state assumption caused by soil stripping from colonial and post colonial agriculture and development.

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General Information for this Meeting

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Geomorphology (Posters)
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