

2007 GSA Denver Annual Meeting (28–31 October 2007)

Paper No. 53–4

Presentation Time: 1:30 PM–5:30 PM

LITTLE INFLUENCE OF GRAIN SIZE ON COSMOGENIC 10–BE CONCENTRATION IN RIVER SEDIMENT

BIERMAN, Paul R., Geology Dept, University of Vermont, 180 Colchester Ave, Burlington, VT 05405, pbierman@uvm.edu, NICHOLS, Kyle K., Geology Dept, Skidmore College, Saratoga Springs, NY 12866, SULLIVAN, Colleen, Geology Department, University of Vermont, 180 Colchester Ave, Delahanty Hall, Burlington, VT 05405, DUXBURY, Jane, Department of Geology, University of Vermont, Delahanty Hall, 180 Colchester Avenue, Burlington, VT 05405, and MATMON, Ari, Institute of Earth Sciences, Hebrew University, Givat Ram, Jerusalem, 91904, Israel

Although the concentration of cosmogenic 10–Be in quartz purified from alluvial sediment is now routinely used to estimate rates of erosion at the basin scale, for years people have worried and speculated about the effect of sediment grain size on the resulting erosion rate estimates. Such worries are reasonable because the application of isotopic measurements in this fashion assumes that nuclide concentrations do not vary systematically between grain sizes.

Here, we test the assumption that grain size matters by doing a meta-analysis of all available grain-size specific 10–Be concentration data including 63 samples (a total of 197 grain-size splits and 3 replicates) from 16 study areas in different tectonic and climatic zones. Considering the dataset as a whole, there is no systematic grain size bias in measured 10–Be concentration. Disaggregating the data, we find that there are significant inverse relationships between sediment grain size and 10–Be concentration in only 3 of 16 study areas ($p < 0.1$). All 3 study areas (Panama, the Great Smoky Mountains, and Puerto Rico) are steep and humid. Of the 63 samples split and analyzed for grain size, 52% have at least one split for which 10–Be concentration differs from the others by > 2 sigma analytic uncertainty, suggesting that concentration variability is the result of natural, not analytic factors. Of the 63 samples, only 8 have monotonic inverse relationships between grain size and 10–Be concentration that are significant ($p < 0.1$). In 3 other samples, 10–Be concentration is positively and significantly correlated with grain size ($p < 0.1$).

In principal, the process of sediment exposure and delivery to the stream network dictates the presence or absence of a grain size effect; however, interpreting geomorphic process rates and distribution from measured ^{10}Be concentration in grain size splits is neither straightforward nor generalizable; site specific study is necessary and appears most important in steep, humid drainage basins. Since, none of the studies in arid regions have shown an effect of grain size on ^{10}Be concentration, further investigation of grain size effects in this climate zone are of less importance.

The bottom line is grain size usually doesn't matter.

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General Information for this Meeting
Session No. 53--Booth# 14
Geomorphology (Posters)
Colorado Convention Center: Exhibit Hall E/F
1:30 PM–5:30 PM, Sunday, 28 October 2007

Geological Society of America Abstracts with Programs, Vol. 39, No. 6, p. 137