Geophysical Research Abstracts
Vol. 13, EGU2011-904-1, 2011
EGU General Assembly 2011

Measuring event- and century-scale changes in sediment sources to the upper Mississippi River

Patrick Belmont (1), Jane Willenbring (2), and Julia Marquard (3)

(1) Utah State University, Logan, Utah, 84332, United States (patrick.belmont@usu.edu), (2) University of Pennsylvania, 240 S. 33rd Street - Hayden, Philadelphia, PA 19104, United States and Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences Section 3.4, Earth Surface Geochemistry , (3) Earth Surface Geochemistry Section 3.4, GeoForschungZentrum, Potsdam Germany

We document changes in sources contributing sediment to the upper Mississippi River over individual storm event and century timescales using meteoric ^{10}Be concentrations in suspended sediment and in the sedimentary record of Lake Pepin, a naturally dammed lake on the Mississippi River south of St. Paul, Minnesota, USA. Sedimentation rates in Lake Pepin have increased ten-fold since Euro-American settlement and widespread agriculture began in 1830. The Minnesota River Basin (MRB) comprises only 38% of the Lake Pepin watershed, but throughout the Holocene and modern record has consistently contributed 75-90% of the sediment deposited in the lake. This disproportionate sediment yield of the MRB is primarily attributed to the fact that the mainstem Minnesota River incised as much as 70 meters as a result of catastrophic drainage of Lake Agassiz 13,400 years ago. This incision was experienced as a nearly instantaneous drop in base level for the Minnesota River tributaries, which have been aggressively incising since that time. We use ^{10}Be concentrations in suspended sediment to document changes in sediment sources (field versus non-field) over the course of individual storm hydrographs in the Le Sueur River, a tributary to the Minnesota River. The ^{10}Be concentrations indicate systematic differences in the dominant sediment sources above and below the rapidly incising portion of the channel network as well as transitions between field and non-field sources within the storm hydrographs. In the Lake Pepin sedimentary record low ^{10}Be concentrations prior to 1830 indicate minimal upland sediment sources prior to Euro-American settlement. Between 1830 and 1940, steadily increasing ^{10}Be concentrations document an increase in the proportion of upland sediment that coincides with increasing intensity of agriculture and poor land management practices. Interestingly, ^{10}Be concentrations in modern deposits document a dramatic decrease in field sediment and significant increase in non-field sources. The decrease in field sediment indicates that conservation practices have been somewhat successful in reducing agricultural erosion. However, the increase in non-field sediment indicates that changes in hydrology from a combination of climate change, systematic changes in cropping patterns, and enhanced tile and ditch drainage systems are amplifying erosion of near-channel sediment sources. This finding calls for a paradigm shift in conservation efforts in the MRB to focus on management of the hydrologic regime and specifically those natural and human-induced factors that are amplifying erosion of near-channel sediment sources.