Basin-wide distributions of meteoric ^{10}Be in river water, sediments and soils -- implications for understanding long-term Earth surface denudation in China's karst rock desertification areas

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Karst rocky desertification has been a very serious environmental issue in the southwestern China. Heavy metal elements entering the surface ecosystem through the dissolution of carbonates in such areas increases the pollution risk to the farmland soils. Here we present preliminary results of a new attempt of determining long-term soil erosion rate using isotope ratios of the meteoric cosmogenic nuclide ^{10}Be to the mineral-derived stable isotope ^{9}Be (^{10}Be/^{9}Be ratio). River water, river-bed sediments, suspended sediments, and soil samples were collected from the drainage of the Wujiang River (in the Yangtze River system) and Beipanjiang River (in the Pearl River system) in Guizhou Province, where rocky desertification is widely distributed. For comparison, water, sediment and soil samples from valley areas with severe soil erosion in the western Yunnan Province were also studied. Here, large amount of sediment comes from the Lancing River (renamed as the Mekong River in Southeast Asian countries) and the Nuking River (renamed as the Salween River in Myanmar), making the application of the ^{10}Be/^{9}Be ratio in deciphering the history of the long-term weathering process and stability of the soil in the limestone areas a challenging task. Along with the beryllium isotope data, major and trace elements in rocky desertification areas will be presented. This leads to the establishment of spatial distributional patterns of meteoric ^{10}Be/^{9}Be ratio and concentration levels, distributional features and potential sources of eight heavy metal elements (Cr, Ni, Cu, Cr, Cd, Pb, As, Hg). Comparisons of results for samples collected under the pristine conditions of typical rocky desertification areas and under human disturbance conditions (such as farming and building of dams) allows us to assess the effect anthropogenic activities on chemical weathering. For this purpose, soil, water and sediment samples in the upper and lower reaches of four dams in Wujiang River were collected and the results will be discussed. The dissolved ^{9}Be concentrations in the river water samples vary from <0.5 to >10 nM. Both the ^{9}Be and meteoric ^{10}Be concentrations in the sediments show wide variability, resulting in the ^{10}Be/^{9}Be ratio in a range from 2×10^{-10} to 2×10^{-8} (atoms/atoms). The results of this study will not only provide valuable information on the processes regulating Be isotopic distribution in karst areas, but also serving as a basis for the long-term soil erosion rate estimation from hillslope scale to an entire river basin scale, and its relation with heavy metal migration and transport in the rocky desertification areas.