Measuring denudation rates with the ^{10}Be(meteoric)/^{9}Be isotope ratio in catchments with different lithologies

N. DANNHAUS[1*], F. VON BLANCKENBURG[1], H. WITTMANN[1], P. KRAM[2] AND M.CHRISTL[3]

[1] GFZ German Research Centre for Geosciences, Potsdam, Germany (*correspondance: nadine.dannhaus@gfz-potsdam.de)
[2] Czech Geological Survey, Prague, Czech Republic (pavel.kram@geology.cz)
[3] ETH, Zurich, Switzerland (mchristl@phys.ethz.ch)

Unlike *in situ*-produced cosmogenic nuclides, determining denudation rates with the new ^{10}Be(meteoric)/^{9}Be ratio does not depend on the presence of quartz. In the Critical Zone cosmogenic ^{10}Be and its stable counterpart ^{9}Be mix to a characteristic rate that is dependent on the denudation rate, the fraction of ^{9}Be released from primary minerals, and the ^{9}Be concentration of the parent bedrock [1]. This rate can be determined either on the reactive phase (adsorbed onto or precipitated in secondary minerals) of sediment or on the dissolved phase in stream water. The reactive beryllium can be separated by a sequential extraction method described in [2]. Dissolved cosmogenic ^{10}Be is concentrated from a water sample by co-precipitation with iron(III)-hydroxide.

We applied this new method to three small catchments in the Slavkov Forest, Czech Republic. Each catchment is underlain by different bedrock, namely granite, amphibolite, and serpentinite. These diverse lithologies are ideal to investigate the potential of the ^{10}Be/^{9}Be isotope system under various geochemical conditions (e.g. different acid-base chemistry of stream and soil water). Resulting ^{10}Be/^{9}Be ratios in the reactive and dissolved phase differ only within a factor of two for each catchment, indicating almost complete equilibration of the isotopes. We used these ^{10}Be/^{9}Be ratios to calculate denudation rates that turned out to be highest for the ultramafic and lowest for the granitic catchment.

One advantage of this new approach is that it can be applied to any lithology, provided that the bedrock ^{9}Be concentration is known. The second novelty of this system is that a denudation rate can be determined from a ^{10}Be/^{9}Be ratio measured in the dissolved fraction of stream water.

[1] von Blanckenburg *et al*.. (2012) *EPSL* **351-352**, 295-305.
[2] Wittmann *et al*.. (2012) *Chem. Geol*. **318-319**, 126-138.

Influence of geological setting on geochemical baselines of heavy/trace elements in soils of Medak district, Andhra Pradesh, India

SUJATHA DANTU

CSIR - National Geophysical Research Institute, Hyderabad, India – 500 007
(sujathadantu@rediffmail.com)

A collection of 878 soil samples (557-topsoil 0-25 cm depth interval, 321-subsoil 70-95 cm depth interval) were taken from 557 sites (representing a density of 1 site/17 km^2) derived from the major rock types in the Medak district of Andhra Pradesh, India. The concentration of 29 elements (major: Si, Al, Fe, Mn, Mg, Ca, Na, K, Ti, P and trace: As, Ba, Cd, Co, Cr, Cu, F, Mo, Ni, Pb, Rb, Se, Sr, Th, U, V, Y, Zn, Zr) was determined on the < 2 mm soil fraction by X-ray fluorescence spectrometry. The sampling sites were not directly influenced by any external pollution. The geochemical baseline values for each element in soils developed on different litho-units are presented. The median concentrations of Ni, Pb, Rb, Sr, Y, Zn, Zr, Si, Al, Fe, Mn, Mg, Ca, Na, Ti and P were measured to be significantly lower while the median concentrations of Ba, Cd, Co, Cr, Cu, F, Mo, Se, Th, U and K were found to be higher than the world median soil values. The distribution patterns of element concentrations are primarily influenced by the lithology. By contrast, the concentrations of Co, Cu, Fe, Mn, Ti, V and Zn are high in soils developed on basaltic terrain while the soils developed on granitic and gneissic terrain exhibited high elemental concentrations of K, Pb, Rb, Si, Th and Y. High concentration of radioactive elements in soils in certain pockets of the study area appear to characterize the igneous rocks formed over considerable periods of time and also by subsequent addition of Th derived from the erosion of the neotectonically uplifted rocks [1]. Enrichment of the elements in the soils developed on different rock variants reflected the elevated levels in the parent material and or fixation (adsorption) in soils by weathering processes. Further elemental concentrations are also related to the size of soil particles therefore, the loss or gain in clay, silt and sand size fractions of soil by wind or hydrological transport may cause differences in element enrichment at regional or local scale. It is therefore, evident that most of the differences in geochemical values of elements are controlled by the bed rock. These results indicate that regional geology is an important determinant of soil geochemical baselines for soil pollution assessment.

[1] Sujatha Dantu (2010) Environ Monit Assess, 170: 1-4, 681-701.

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