A new method for measuring weathering and erosion in mafic and ultramafic rock

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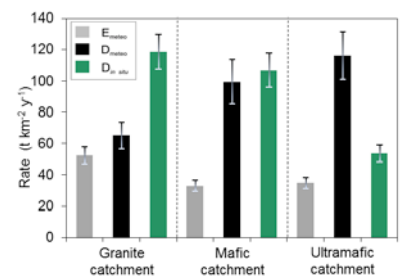
Even though the weathering of mafic rocks generates a substantial flux of Mg and Ca to the oceans the rates of denudation of these lithologies are not well-constrained. One reason is that *in situ* cosmogenic ^{10}Be, having been measured in quartz in thousands of rivers, is not applicable to e.g. basalts where no quartz is present. This gap can be closed by the combination of a) erosion rates (E) from meteoric ^{10}Be, adsorbed to fine-grained river particles after precipitation; b) denudation rates (D) from the ^{10}Be(meteoroic)/^{9}Be(stable) ratio in river sediments; c) the fraction of stable ^{9}Be released from silicate minerals that serves as a proxy for the degree of weathering [1, 2]. The challenges are: knowing the delivery flux of meteoric ^{10}Be; assessing the retentivity of meteoric ^{10}Be that depends on pH and on grain size; determining the ^{9}Be bedrock concentration at the catchment scale.

We applied this new method in three small Czech catchments underlain by granitic, mafic, and ultramafic rocks in the Slavkov Forest. The catchments are in close vicinity with each other, similar in relief, and have a identical climate and tectonic history. We experienced difficulties in obtaining representative ^{9}Be bedrock concentrations and developed an approach based on multi-element regression. We found loss of ^{10}Be in the granitoid catchment (low pH) and full retention in mafic catchments. As expected E (^{10}Be meteoric) is lower than D from (^{10}Be/^{9}Be) which agrees with D (*in situ* ^{10}Be) within a factor of 2 or better. This result presents an encouraging first step in developing means to measure denudation in mafic landscapes.



[1] von Blanckenburg *et al*. (2012) *EPSL* **351**, 295-305. [2] Wittmann *et al*. (2015) *JGR-ES* **120**, 2498-2528.