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Global chemical weathering and associated P-release

Jens Hartmann (1), Nils Moosdorf (1), Ronny Lauerwald (2), Matthias Hinderer (3), and A.Joshua West (4)

(1) Institute for Geology, Universität Hamburg, Hamburg, Germany (geo@hattes.de), (2) Department of Earth & Environmental Sciences, Université Libre de Bruxelles, Buxelles, Belgium, (3) Institute for Applied Geoscience, Technische Universität Darmstadt, Darmstadt, Germany, (4) Department of Earth Sciences, University of Southern California, Los Angeles, USA

Chemical weathering releases phosphorus to soils and ecosystems. To improve understanding of the spatial distribution of the global P-release characteristics, a model framework for estimating global chemical weathering rates was coupled with geochemical information.

Results suggest that the global soil shielding reduces chemical weathering fluxes by about 44%, compared to an Earth surface with no deeply weathered soils but relatively young rock surfaces (e.g. as in volcanic arc and other tectonically active areas). About 70% of the weathering fluxes globally derive from 10% of the land area, with Southeast Asia being a primary “hot spot” of chemical weathering and for P-release. In contrast, only 50% of runoff is attributed to 10% of the land area; thus the global chemical weathering rating curve is to some extent disconnected from the global runoff curve due to the spatially heterogeneous climate as well as differences in rock and soil properties.

In addition to total chemical weathering fluxes, the release of P, a nutrient that controls biological productivity at large spatial scales, is affected by the spatial correlation between runoff, lithology, temperature and soil properties. The areal abundance of deeply weathered soils in Earth’s past may have influenced weathering fluxes and P-fuelled biological productivity significantly, specifically in the case of larger climate shifts when high runoff fields shift to areas with thinner soils or areas with more weatherable rocks and relatively increased P-content. This observation may be particularly important for spatially resolved Earth system models targeting geological time scales.

The full research text can be found in:
Hartmann, J., N. Moosdorf, R. Lauerwald, M. Hinderer, A.J. West (2014) Global chemical weathering and associated P-release - the role of lithology, temperature and soil properties. Chemical Geology 363, 145-163. doi: 10.1016/j.chemgeo.2013.10.025 (open access)