

## **Microbial and plant effects on rock weathering and protoil formation**

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Oliver Chadwick has dedicated his career to quantifying the influence of state factor components - embodied in Hans Jenny's theory - on soil formation. His multi-decadal efforts, in close collaboration with biogeochemist Peter Vitousek, illustrate the power of well-constrained chrono- and climo-sequences to resolve the thresholds and domains that exist within a time-climate matrix of pedogenesis. Since climate and soil fertility control the biological colonization of landscapes, it is challenging to isolate the direct effects of climate (temperature and precipitation) from those of biota on soil formation. Plants and microbes affect (in)congruent weathering of primary silicates through carbon dioxide production, depletion of dioxygen, and exudation of metal-complexing ligands or biofilms. We conducted a well-controlled mesocosm study of rock weathering with four rock types (granite, schist, rhyolite, and basalt). In two-year experiments, granular rock material of a consistent particle size distribution was subjected to water through-fluxes under consistent temperature but variable biological treatment (sterile, microbial, plant-microbial, plant-microbial-mycorrhizal) to quantify the impact of biota and discern biosignatures of weathering. We found significant impacts of both rock type and biology on the rates and patterns of chemical denudation and mineral transformation.