Microbial-soil organic matter linkages in response to climate warming

S.D. FREY

Department of Natural Resources & the Environement, University of New Hampshire, Durham, NH 03824 USA (correspondence: serita.frey@unh.edu)

Soils are the largest repository of organic carbon in the terrestrial biosphere and represent an important source of CO_2 to the atmosphere, releasing 60-75 Pg C annually through microbial decomposition of organic materials [1, 2]. Current carbon-climate models predict increased soil organic matter decomposition as global climate warms, with higher than normal soil CO_2 fluxes to the atmosphere eliciting a positive feedback to climate [3, 4]. However, results from several field studies demonstrate that while soil respiration is initially stimulated by warming, this effect often diminishes over time, with elevated soil respiration in chronically warmed soils returning to ambient levels within a few years [5, 6, 7]. Microbial decomposition of soil organic matter is responsible for as much as half or more of the CO_2 released from soils [1], and so a thorough understanding of how soil microorganisms respond to temperature is needed to accurately predict how climate warming may alter soil CO_2 fluxes [8]. This talk will synthesize data on microbial responses to climate warming, with an emphasis on microbial physiology as a driver of soil organic matter dynamics [9].

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Mass-related U isotope fractionation during alteration of oceanic crust and release of U in subduction zones – implications for deep recycling of oceanic crust

HEYE FREYMUTH[1], MORTEN ANDERSEN[2] AND TIM ELLIOTT[1]

[1]Bristol Isotope Group, University of Bristol, Queen's Road, Bristol BS8 1RJ, UK (glxhf@bristol.ac.uk)
[2]ETH Zürich, Inst. f. Geochemie und Petrologie, Clausiusstrasse 25, 8092 Zürich

The modification of material during seafloor alteration and subsequent processing within subduction zones is of primary importance for assessing the composition of deeply subducted material and it's influence on mantle heterogeneity. It has long been known that U is added to the oceanic crust during both low and high temperature alteration of the oceanic crust, whilst some of the subducted inventory of U is returned to the surface in arc lavas. The advent of techniques to measure mass-related $^{238}U/^{235}U$ isotope fractionation with sufficient precision allows us to investigate the effect of alteration and subduction zones processes on the isotopic composition of U. This is a key step in evaluating the potential of U isotope measurements to trace deep crustal recycling. Thus we have measured the U isotopic compositions of samples from the altered, mafic, oceanic crust (AOC) at ODP site 801 as well as lavas erupted at the volcanic front of the Mariana arc. The former represents a reference site for studying the time-integrated influence of seafloor alteration and the latter constitute a well characterised sample set for which the role of slab-derived 'fluid' and sediment components can be separately recognised.

The altered oceanic crust is compositionally variable with $^{238}U/^{235}U$ similar to seawater in the top ~100 m and isotopically heavier in deeper parts. These differences are likely to be caused by oxidizing conditions in the top part of the AOC and reducing conditions in deeper parts of the AOC and isotopic fractionation occurring during the alteration of the oceanic crust. The Mariana arc lavas span a range of ~100 pm in $^{238}U/^{235}U$ and vary systematically between seawater-like compositions in samples that have been previously identified as 'fluid-rich' and heavier values similar to fresh mantle basalts in the more sediment-rich samples. These systematics indicate that either the light U in the upper mafic crust is preferentially lost to the arc lavas or that during slab dehydration of the AOC, U is fractionated to generate an isotopically light fluid and heavy residue. In either scenario the deep-subducted material is left distinctively, isotopically heavy and should be an effective tracer of deep recycled material.

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