Rates and mechanisms of oxygen consumption by fresh volcanic material in the marine environment

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Volcanic sediments are ubiquitous in the marine environment, to the extent that almost a quarter of the Pacific Ocean sediments are believed to be of volcanic origin. Volcanic material from explosive volcanism is fresh, fine grained and highly reactive. Although longer term alteration of volcanic material in the marine environment is relatively well studied, and has been demonstrated to make a significant contribution to the global cycling of elements, early diagenetic alteration of volcanic sediment in the marine environment is less well understood. We may, therefore, be missing an important component in our understanding of global geochemical cycles.

The ongoing eruption of Soufriere Hills, Monsterrat, West Indies, provides an excellent case study for these processes. Oxygen microelectrode profiles were measured in cores collected from around the island, 18 months after the May 2006 dome collapse event deposited approximately 115 x 10^6 m^3 of non-dense rock equivalent of material into the ocean [1]. Profiles reveal that oxygen is typically depleted to zero within 0.5 cm of the sediment water interface in volcanic deposits, compared with up to 6.5 cm in unaffected sediments. Oxidation of all available organic carbon in the volcanic sediments is only sufficient to sustain the calculated rate of oxygen consumption for c. 25 days. Hence, there must be another mechanism for oxygen consumption in these sediments. Results from laboratory flow-through experiments with the volcanic sediment indicate that consumption of the dissolved oxygen is likely driven by a coupled charged transfer reaction involving oxidation of silicate bound Fe^{II}.

[1] Trofimovs *et al*., (2011), *Bull. Volcanology,* (in press).

Intercalibration of Ar-Ar standards and samples at LDEO

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The Columbia University Spring 2011 Introduction to Geochronology and Thermochronology class is conducting an intercalibration experiment of Ar-Ar monitor standards in addition to some promising, well-behaved sanidine samples that have been analyzed multiple times in several labs. The goals are to document the intercalibration factors “R” (as defined by Renne *et al*., 1998, Chemical Geology) for the lab at Lamont-Doherty Earth Observatory and further to integrate research and education by providing a real introduction to EARTHTIME with a hands on exercise to examine the issues related to obtaining the highest quality Ar-Ar dates. This experiment will address the degree to which the Ar-Ar dates can be confidently compared between our lab and others that have reported on these samples, and will provide insights into potential sources of bias.

We have designed aluminium disks with 12 “unknown” pits, each surrounded by 4 “monitor” pits. Each unknown shares 2 of the 4 surrounding pits with an adjacent unknown. One package was irradiated for 4 hours, and another for 24 hours at the USGS TRIGA reactor in Denver, CO. Both irradiations contain several pits with Fish Canyon and Taylor Creek sanidine standards, which will result in 7 populations.