

Diverse sources for Oruanui rhyolite (NZ): Evidence from feldspar and zircon

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In many arcs, the erupted products reflect the integrated effects of differentiation mechanisms, which modify primary magma(s) as they ascend from their source region(s). Radiogenic isotope systematics can aid discrimination among various differentiation processes if the different end-members have contrasting isotopic signatures. Use of crystal isotope microstratigraphy, which employs microanalysis for Sr isotopes, shows that intra-crystalline isotopic and compositional heterogeneities exist within many volcanic rocks.

The 26.5 ka Oruanui eruption (530 km³, magma) from Taupo volcano in New Zealand is the world's youngest supereruption. Oruanui rhyolite is mildly zoned (mostly 73-76% SiO₂) but was tapped non-systematically. Within some pumices, 1-5% of the plagioclase feldspars have grey cores mantled by clear rims. High resolution EMP traverses and Normarski imaging show a growth history punctuated by magmatic events that are seen as unconformities and inclusion rich zones within the crystals.

The grey cores have ⁸⁷Sr/⁸⁶Sr of 0.70540, and the clear rims are 0.70562, the latter being compatible with Oruanui rhyolite whole-pumice values. Intermediate zones sometimes have large excursions to very radiogenic ⁸⁷Sr/⁸⁶Sr values (max. ~0.7076). Accompanying these variations are changes from ~An₃₀ at the rim (in equilibrium with the host pumice) to ~An₆₅ in the core. Associated timescales of these variations in the grey-cored crystals are obtained from SIMS ²³⁸U-²³⁰Th model ages of zircons included within some of the growth zones. These ages can be compared with the age spectrum of zircons present as free crystals in the host pumice to show that incorporation of both xenocrystic and antecrystic material occurred during assembly of the Oruanui magma body.

Bacterial surfaces inhibit the oxidation of Fe(II)

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Bacteria are known to affect the fate of metals through sorption reactions. Secondary minerals, such as iron-oxides, are another important phase scavenging metals in the environment. It has often been suggested that bacterial surfaces favor the precipitation of iron-oxide phases. In this study, we demonstrate that this is not the case. We have mimicked the processes occurring at an oxic interface, which lead to the formation of iron oxides, by introducing progressively a fixed total amount of Fe²⁺ ions at a fixed pH of 6.5 in an aerobic reactor in the absence and in the presence of increasing concentrations of *Bacillus subtilis* bacterial cells. Alternatively, increasing amounts of Fe²⁺ ions were added to a fixed concentration of *Anoxybacillus flavithermus* bacterial cells. The kinetics of the reaction were monitored by measuring the rate of addition of the base needed to maintain the pH constant. In another set of experiments, we added Fe²⁺ ions at once in anaerobic conditions and oxygenated the suspension afterwards. The rate of oxidation of the Fe(II) was then measured directly using the ferrozine colorimetric method. In both types of experiments, it was clearly observed that the kinetics of oxidation of the Fe(II) are dramatically reduced by the presence of the bacterial cells. This is an important result, as the oxidation state and the speciation of the sorbed Fe impact the immobilization by the bacterial-iron composite suspensions of other metals. For instance, we have observed that a given amount of Fe reduces the Cd sorption ability of the cells, and it does this more effectively when it occurs as a sorbed Fe(II) species as when it is precipitated as adhering iron oxide nanoparticles.