High-precision isotopic compositions of basalts from the last phase of the Hawai'i Scientific Drilling Project

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With a total depth of 3464 metres and more than 95% recovery, the Hawai'i Scientific Drilling Project represents the longest sampled stratigraphic sequence of lavas emitted by an oceanic island volcano. In this study, we present Pb, Sr and Nd isotopic compositions of 18 basalts recovered over the final drilling phase (2B) in February 2007. The samples correspond to the last 170 metres of core, with ages > 600 kyr in the stratigraphic record of Mauna Kea.

Isotopically, these samples show the largest range of $^{206}Pb/^{204}Pb$ (18.3038–18.6932) and $^{208}Pb/^{204}Pb$ (37.9233–38.2703) compared to the rest of the core, especially the samples just above them (3111 to 3326 metres, phase 2B), which showed very restricted isotopic variation. In contrast to the younger basalts that form a broad compositional field in $^{207}Pb/^{204}Pb$ - $^{206}Pb/^{204}Pb$ space, the older samples analyzed here form a linear array generally characterized by lower $^{207}Pb/^{204}Pb$ values for a given $^{206}Pb/^{204}Pb$ than the younger lavas. These older lavas extend $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ isotopic compositions of Mauna Kea to significantly more radiogenic values, similar to the isotopic compositions shown by "ancestral" Kilauea lavas. In $^{208}Pb/^{204}Pb$ - $^{206}Pb/^{204}Pb$ space these same samples form two arrays. One Pb array falls within the main Pb isotopic compositional field for Mauna Kea, whereas the other array, composed of samples belonging to the low-SiO_2 group, falls within the "Kea-hi8" trend [1]. This means that a component characterized by high $^{208}Pb*/^{206}Pb*$ that produced low-SiO_2 contents, was already being sampled early in Mauna Kea's history.

Similar to Mauna Loa, the earlier stages (older lavas) of Mauna Kea volcanism are isotopically more variable than subsequent stages. Overall, the isotopic heterogeneity in Mauna Kea shield lavas can be explained by variable proportions of mixing between three isotopically distinct components intrinsic to the Hawaiian mantle plume during partial melting and formation of the basaltic magmas. These components are: the more radiogenic "Kea" or "Hilina" component [2], a high $^{208}Pb*/^{206}Pb*$ (producing low-SiO_2 basalts) component, and a component with less radiogenic Pb isotopic compositions.

[1] Eisele *et al.* (2003) *G3* **4**, 1-32. [2] Kimura *et al.* (2006) *JVGR* **151,** 51-72.

Simulation of the nucleation and growth of solid solutions in aqueous solutions

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Nucleation and growth of solid-solutions in aqueous media (SS/AS) are related to a number of societal questions such as contamination of soils and ground-waters, global element cycles, hydrothermal ore-forming processes, etc. However, their full simulation, including kinetic effects in the first steps of their formation, still remains a challenge.

This is the purpose of the present work, which extends our previous studies of minerals of fixed composition [1-4]. Here, we model precipitation processes for ideal SS of the $A_{1-x}B_xC$ type, with variable composition x. The model is based on the classical nucleation theory, on a size-dependent (algebraic) growth law allowing growth, resorption and ripening of particles simultaneously, and on conservation laws akin to a thermodynamically closed system. The composition dependence of critical nuclei and growing particles has been assumed to follow laws similar to those of binary droplet condensates, precipitates in metallic alloys and segregation at alloy surfaces.

The model has been embedded in the geochemical code Nanokin that we have elaborated. We will present results for the precipitation of solid-solutions whose end-members have either similar or very different solubilities, thus allowing distinct ion partitionings and composition profiles.

[1] C. Noguera, B. Fritz, A. Clément & A. Baronnet, (2006*) J. Cryst. Growth* **297**, 180-186. [2] C. Noguera, B. Fritz, A. Clément & A. Baronnet (2006*) J. Cryst. Growth* **297**, 187-198. [3] B. Fritz, A. Clément, Y. Amal & C. Noguera, (2007) "NANOKIN, a geochemical computer model for dissolution, nucleation & growth in aqueous solutions" (in preparation) [4] B. Fritz, A. Clément, Y. Amal & C. Noguera, this volume.