The double effect of Mg on the long-term alteration rate of a nuclear waste glass

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During their aqueous alteration, AVM French nuclear glasses exhibit a large range of behaviour, in spite of a small range of composition. AVM glasses alteration rates are controlled by two phenomena: (i) precipitation of secondary phases, mostly aluminous hectorites [1], and (ii) diffusion of water across a more or less protective gel layer. Magnesium contained in these glasses enhances the precipitation of these secondary phases, leading to a partial or total dissolution of the gel layer. This dissolution increases the glass alteration rates. On the other hand, Mg also incorporates in the gel, increasing his passivation properties [2]. The predominance of one of these two phenomena depends on the initial composition of the glass and on the initial composition of the solution (Fig. 1).

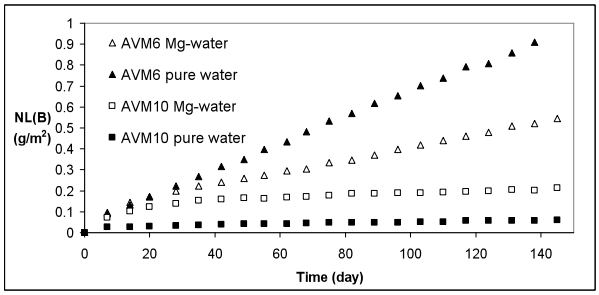

Figure 1: Quantities of altered glass for 2 different AVM glasses, AVM 6 and AVM 10, leached in pure water and in Mg-water.

[1] Thien *et al*. (2010) *Appl. Clay Sci.* ***49***, 134–141. [2] Thien (2010) *PhD Thesis*, University of Montpellier.

Magma sources at Eyjafjöll and adjacent South Iceland central volcanoes

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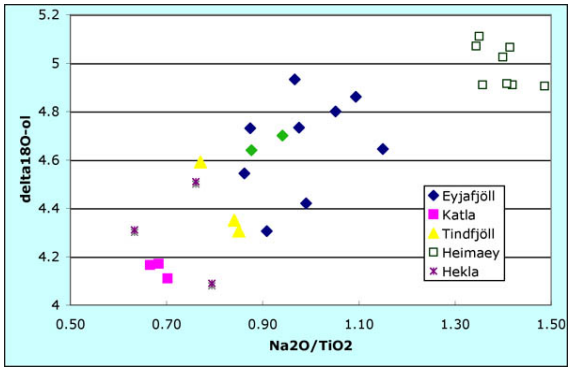
We present Pb-Sr-Nd-Hf-O isotopic data for Quaternary transitional basaltic rocks of the six central volcanoes of the South Iceland flank zone. These are amongst the deepest melts in Iceland based on high Dy/Yb and low Na_2O/TiO_2. Each volcano shows limited ranges in isotopic composition, but Eyjafjöll Sr-Nd-Hf-O data lie systematically between Heimaey at more depleted isotopic compositions to the SW, and Katla and Tindfjöll at more enriched compositions to the E and N respectively. A tight $^{143}Nd/^{144}Nd$ – $\delta^{18}Ool$ correlation at Eyjafjöll extends from the mantle-like $\delta^{18}O$ of Heimaey to +4.2‰ values in Katla and Hekla olivines. Detail provided by double-spike Pb data shows however that Katla eruptives are not a possible enriched mixing end-member as they have relatively elevated ^{208}Pb, and indeed 3 or more mixing components would be required to explain the Pb isoopic compositions of Eyjafjöll and Tindfjöll eruptives.

The Nd-O isotopic correlation at Eyjafjöll is present in samples from several interglacial stages and could only result from crustal contamination if Eyjafjöll was underlain by an early Quaternary basement of hydrothermally-altered Katla-like volcanics. Given that the bulk of Katla has developed more recently than Eyjafjöll, this seems implausible. The +4.2‰ olivine $\delta^{18}O$ observed at Katla, Hekla, and in some Tindfjöll and Eyjafjöll lavas, is consistent with the value proposed in Icelandic low-$\delta^{18}O$ mantle [1]. It is associated also with low K/Nb and low Na_2O/TiO_2 suggesting that it is co-hosted with recycled oceanic crust that in the flank zone is most effectively tapped by deep melts.



[1] Thirlwall *et al*. (2006) *Geochim. Cosmochim. Acta* **70**, 993.