

Insights into boron volatility in magmatic systems

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It is generally accepted that boron behaves as a volatile element in magmatic systems but the amount of B leaving magma (i.e. the absolute volatility) is poorly known [1]. In the aim to quantify the losses due to magmatic degassing, B concentration of recent (1977-2010) lavas from Piton de la Fournaise volcano (Réunion Island) were measured by isotope-dilution ICP-MS, using a new method avoiding sample evaporation. Twenty-three samples were selected based on three criteria: 1) samples are highly fresh and not contaminated; 2) they are cogenetic (they show tiny variations in Pb-Sr-Nd isotopes); 3) samples cover a wide range of eruption and degassing conditions, with an order of magnitude variation in magma effusion rate. Samples include massive basalts with variable amounts of cumulative olivine and naturally quenched samples (including Pélé's hairs and scoria).

B content varies from 1.15 to 3.98ppm. B behaving as a highly incompatible during magmatic processes, ratios involving B and another highly incompatible elements such as B/Nb have to be constant in our suite of cogenetic lavas [2]. However, while most samples show uniform B/Nb of 0.14, few samples show anormalous high (quenched samples) or low (first lavas of April 2007) B/Nb ratios. Because the samples are fresh and unaltered and do not include exotic minerals potentially holding B, we interpret these subtle variations as related to degassing processes. The amount of B loss in each sample has then been estimated taking the composition of a primitive olivine-hosted melt inclusion as representative of the undegassed melt composition. Boron loss varies between 10% for less-degassed samples to almost 30% for the first lavas of the April 2007 eruption. Moreover, the knowledge of eruptive history allows us to distinguish B loss during 1) continuous open-system degassing in the magma chamber (10%), 2) lava emplacement and cooling (4-10%) and 3) shallow closed-system degassing due to a vapor accumulation at the top of the magma chamber prior to the April 2007 eruption (5-8%) [3].

[1] Rubin (1997) *Geochim. Cosmochim. Acta* 61, 3525-3542.

[2] Hofmann *et al.* (1986) *Earth Planet. Sci. Lett.* 79, 33-45.

[3] Vlastelic *et al.* (2013) *J. Volcanol. Geotherm. Res.* 254 94-107.

Early diagenesis of sulfur and trace element pyritization in sediments of a tropical upwelling system: Cabo Frio, southeastern Brazil

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The early diagenesis of sulfur and the potential effects of sedimentary pyrite re-oxidative cycling on the degree of trace metals pyritization (DTMP) were assessed in short sediment cores from the continental shelf under the influence of a tropical upwelling system (Cabo Frio, Brazil). Under these depositional conditions, the degree of reactive iron pyritization was limited by both dissolved sulfide availability and pyrite oxidation events. Textural analyses of pyrite framboids provide evidence of re-oxidation processes, reflecting dynamic redox conditions in the sediments. The total sulfur, the chromium reducible sulfur (CRS), and degree of pyritization (DOP) values are relatively low, and showed an increase with depth at all stations. The isotope composition of pore-water sulfate (+18.7‰ to +23‰) remained close to the seawater value, but very light stable sulfur isotope signatures of the CRS fraction (-25.2‰ to -40.8‰) are found that reflect intense bioturbation-induced sulfur re-cycling. Relations between DTMP and stable isotope signals are found, suggesting high (Pb, As, Cd and Mn), low (Zn and Cu) or negligible (Cr and Ni) influences by iron sulfide re-oxidation. Pyrite-richer sediments provide an apparent threshold for intense pyrite re-oxidation, while CRS generally becomes more depleted in ³⁴S with increasing depth. This depletion was greatest and becomes less variable when CRS contents exceed ~0.1 wt% (with δ³⁴S values averaging -40‰ ± 1‰), after which most trace elements (Pb, As, Cd, Mn and Zn) presented more accentuated DTMP values. Before the stabilization of the pyrite re-oxidation, the release of Mn and Fe into pore water was evidenced, indicating reduction of these elements. Sulfur isotope signatures of pyrite formed under the oxic bottom water conditions at Cabo Frio are similar to those observed in euxinic sedimentary environments, as the modern Black Sea. It is also indicated, that a superimposition of sulfate reduction and intense oxidative sulfur cycling leading to pyrite re-cycling can affect benthic trace element fixation.