Nb in basalts from Turrialba Volcano, Costa Rica revisited

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Basalts from Turrialba volcano have restricted REE concentrations (La/Yb=18-24) but La/Nb and Ba/La ratios that vary from those typical for an arc basalt (2.1, 20) to those typical for an ocean island basalt (1.0, 12). Reagan and Gill [1] attributed these observations to variations in the partition coefficients for Nb as the degrees of mantle melting changed with the extent of slab fluid fluxing. We have further investigated the origin of the Nb-Ta anomalies by applying modern microbeam techniques to analyze homogenized olivine-hosted glass inclusions for major-element, trace-element, and H_2O concentrations, as well as S^{6+}/S (fO_2). Like the whole rocks, the inclusions are enriched in LREE, and have variable La/Nb and Ba/La values. These incompatible trace element ratios, and the degrees of LREE enrichment however, are significantly more variable in the inclusions. The variations in most trace element concentratons in the glass inclusions including Ti can be explained by mixing between a small degree melt of OIB-like mantle source and large degree melt of a similar mantle in the presence of a LIL-element-bearing fluid from the slab. The exception is Nb, whose concentration varys by more than a factor of two above those of any other trace element, and thus cannot be successfully modeled without a siginficantly higher D_{Nb} during melting to generate the low-Nb mixing endmember. Because D_{Ti} does not need to simlarly increase, the changes in D_{Nb} do not appear to be the result of the presence or absence of a Ti-rich phase, but rather, results from changes in D_{Nb} for other residual mantle phases.

S^{6+}/S values appear to vary independently of La/Nb values for the data set as a whole, and taken at face value, these data indicate that fO_2 had little effect on D_{Nb}. However, H_2O contents of the inclusions range from 0-1.6 wt %, indicating that the host olivine crystals grew after varying levels of H_2O-CO_2 degassing. Thus, the S^{6+}/S values in these samples could have been affected by this degassing. Nevertheless, the glass inclusions with La/Nb < 1 all have near-zero S^{6+}/S values suggesting that their fO_2 values are generally below QFM. Glass inclusions with greater La/Nb values have wide ranging S^{6+}/S values and calculated fO_2 values as high as 1.1 log units above QFM, suggesting that magmas feeding into this system do indeed have variable fO_2, although the relationship of fO_2 to La/Nb remains uncertain.

[1] Reagan & Gill (1989) *JGR* **94**, 4619-4633.

Impact of the aerosols on the photolysis rates at regional scale

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Photolysis rates in the atmosphere are greatly affected by the presence of clouds and aerosols. In Chemistry Transport Model (CTM), and especially, in regional CTM, the aerosol feedbacks on photolysis rates are generally not taken into account. In this study we coupled a regional CTM (POLAIR3D) with a radiative transfer model (Fast-JX). We assessed the aerosol feedbacks on the photolysis rates and the subsequent impact on gas and aerosol species concentrations simulated over the European domain.

It was shown that some oxidant species as OH or NO are greatly affected through all the troposphere. Changes on ground O_3 concentrations and aerosols formation can also be locally important. Aerosols having the stronger impact are dust and carbonaceous aerosols. In the future climate, Biomass Burning (BB) are predicted to increase. The long-range transport of BB pollutants and their regional impact thousands of kilometres away from emissions may become a subject of importance.

For these reasons, a specific event was analysed: the long-range transport into Europe in July 2004 of Alaskan BB plumes. The indirect impact of these plumes on European air quality through the modification of photolysis rates was analysed together with their direct impact through the incorporation of BB pollutants in the boundary layer. Model results were compared with measurement taken during this period over Europe as part of the ICARTT (International Consortium for Atmospheric Research on Transport and Transformation) campaign.