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Diffusion in multicomponent silicate systems: preliminary results from experiments with natural melts.

C. De Campos (1), D.B.Dingwell (1), J. Martí (2) and **F. Teixidó** (1,2)

(1) Department of Earth and Environmental Sciences, University of Munich, Munich, Germany, (2) Institute of Earth Sciences Jaume Almera, CSIC, Barcelona, Spain (fteixido@ija.csic.es / Fax: +49 89 2180 4176 / Phone: +49 89 2180 4271)

Mixing results from the complex interplay between convection and diffusion processes. Let us consider the case of a felsic magma chamber being replenished by fresh mafic magma. Diffusion of heat and chemical species takes place at different rates and, under the appropriate dynamic conditions, this may lead to the onset of double-diffusive convection. Experimental and theoretical studies on these processes can be found in the literature although they are mostly restrained to analogical materials.

In order to better understand the separate role of diffusion and its efficiency to enhance mixing, we performed in this work time series experiments with contrasting alkaline melts obtained from natural volcanic products. The starting materials are the two end-member compositions and rheologies in the volcanic Province of Tenerife (Canary Islands, Spain). They correspond to an alkali basalt (43% SiO_2; μ= 4,412 Pa·s) and a phonolite (59% SiO_2; μ=10^3 Pa·s).

The samples were loaded in a platinum capsule and arranged in a buoyantly stable geometry, where the denser material is placed at the bottom (alkali basalt, ρ=2,73 gr/cm^3) and the lighter material at the top (phonolite, ρ=2,36 gr/cm^3). The temperature has been kept constant at 1350ºC during the whole experimental runs and with an irrelevant thermal gradient ($< 2^oC$). This temperature, well above the *liquidus* for the system, avoids crystallization. No forced convection was applied, so that the diffusion process takes over and the compositional gradient becomes the only parameter enhancing or not the mixing process.

Microprobe and laser ablation analysis were performed to track major, minor and trace elements. Diffusion profiles along a longitudinal section of the resulting products showed that mixing was possible. The results suggest diffusion enhanced multicomponent convection (and hence mixing) in spite of a significant thermal gradient.