Experimental studies on rutile solubility in fluids and melts

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Rutile (TiO_2) is an important mineral that preferentially sequesters high field strength elements (HFSE). As such, it has been implicated in the observed depletion of HFSE in arc magmas. It has been suggested that rutile is insoluble in slab-derived fluids, and remains residual in the subducted slab. Indeed, experimental data indicates a very low solubility of rutile in pure H_2O [2], and this low solubility may result in HFSE-depleted fluids imparting a depleted signature to arc magmas. However, as yet there is scant experimental data on rutile solubility in fluids of more complex compositions [1, 3]. Our systematic experimental study into the effect of specific chemical components on rutile solubility in fluids indicates greatly enhanced TiO_2 solubility in halogen-rich brines. In H_2O m_{Ti}=0.008, whereas in F-bearing brines m_{Ti}=0.3. The relative mobility of trace elements (i.e. HFSE) in these fluids can be assessed using our run products. These results suggest that HFSE mobility in metamorphic rocks within subduction zones may be more extensive than previously thought.

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He, Ne and Ar systematics in single vesicles: Mantle isotopic ratios and origin of the air component in basaltic glasses

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An outstanding problem in understanding the origin of the gaseous phase, particularly the rare gas compositions, in magmatic rocks, is the ubiquitous atmospheric component in bulk rock samples, and whether this atmospheric component is a late stage contamination of the sample, or a recycled component though sediments or altered oceanic crust [1, 2].

Here we address this problem by analyzing single vesicles from the “popping rock 2πD43” sample from the Mid Atlantic Ridge using a UV laser ablation system. We have determined both elemental and isotopic compositions of He, Ne and Ar in single vesicles as well as Kr and Xe abundances. All vesicles analyzed have an isotopic composition identical to the referred degassed mantle value estimated from this same sample, despite analyzing vesicles from a wide size distribution [3, 4].The $^{4}He/^{3}He$ and $^{4}He/^{40}Ar$ ratios are respectively 90,000±3000 and 1.41±0.14. The Ne-Ar systematics indicate that the $^{40}Ar/^{36}Ar$ value of the degassed mantle is 27,000 ± 4000 as it was suggested by Moreira *et al.* [5] and that $^{20}Ne/^{22}Ne$ reflects more likely the B-Ne (12.5) value than the Solar wind value (13.8).

The atmospheric component, which is always detected in bulk samples by crushing, was not detected in the single vesicles. This implies that the recycling of atmospheric noble gases in the mantle cannot explain the “air-like” component of this sample. The addition of the atmospheric component must occur either during the eruption, or after sample recovery.

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