Fe atom exchange between aqueous Fe^{2+} and hematite

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Recent work has revealed that Fe oxides are dynamic phases that will undergo significant Fe cycling in the presence of aqueous Fe(II) [1]. Complete exchange of Fe atoms between aqueous Fe(II) and goethite has been shown [2] and extensive exchange has also been observed for ferrihydrite and lepidocrocite [3]. Bulk electrical conduction linking oxidative adsorption of Fe(II) and reductive dissolution of the Fe(III) oxide at spatially separated sites has been suggested as a potential mechanism to explain the extensive exchange observed in the presence of Fe(II) [2; 4]. Interestingly, bulk electrical conduction linked to growth and dissolution has only been directly demonstrated in hematite, yet, ^{55}Fe isotope data indicate little exchange occurred between aqueous Fe(II) and hematite [3].

Here we are investigating atom exchange between aqueous isotope specific ^{57}Fe(II) and isotopically normal hematite to determine if exchange occurs between aqueous Fe(II) and hematite. Our working hypothesis is that the reaction of aqueous Fe(II) with hematite will result in significant Fe atom exchange and recyrstallization of hematite particles and that the rate of exchange will be influenced by particle size.

[1] Gorski and Scherer (2011) *Aquatic Redox Chemistry* **1071**, 315-343. [2] Handler *et al.* (2009) *Environ. Sci. Technol.* **43**, 1102-1107. [3] Pedersen *et al.* (2004)) *GCA* **43**, 3967-3977. [4] Yanina and Rosso (2008) *Science* **320**, 218-222. [5] Williams and Scherer (2004) *Environ. Sci. Technol.* **38**, 4782-4790.

Unravelling the crustal architecture of Cape Verde; the xenolith record

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The Cape Verde submarine plateau was extensively sampled during the Meteor M80/3 research cruise in January 2010. The suite of sampled lavas are found to host a range of xenoliths. These xenoliths provide a spectrum of lithologies available to interact with magmas during transport through the lithospheric mantle and crust. Exploring the depths of origin of such xenoliths will complement the information we derive from the host lavas and thus the 3-D geochemical framework of magma-crust interaction in the Cape Verde magmatic plumbing systems. This will allow the development of a model for the crustal architecture beneath the Cape Verde oceanic plateau.

The host lavas are nephelinites containing clinopyroxene, nosean, nepheline, ± apatite, ± sanidine phenocrysts. The crustal xenoliths are mostly mafic plutonic assemblages with one sedimentary xenolith occurring. The mafic plutonic xenoliths are holocrystalline, and fine to medium grained. They contain plagioclase, clinopyroxene, olivine and/or amphibole. The sedimentary xenolith contains rounded grains of quartz, together with minor clay minerals, biotite and alkali feldspar.

Mafic plutonic xenoliths have developed reaction zones on contact with the host magma. The reaction zones are approximatley 50 to 100 microns and are observed petrographically by crystallisation of fine grained sericite, epidote and chlorite. Element mapping highlights the increase of Na and K and decrease in Ca and Al in the reaction zone compared to plagioclase of the xenolith.

REE profiles of clinopyroxenes in the host lavas are LREE enriched whereas clinopyoxenes from the plutonic xenoliths are LREE depleted. Modelling of REE melt compositions indicates the plutonic xenoliths are derived from MORB ocean crust opposed to intrusives of the Cape Verde plateau.

Mineral chemistry of the clinopyroxenes in the host lavas and xenoliths have been used to determine crystallization pressures. Thermobarometry indicates that clinopyroxenes in the host lavas formed at depths of 17 to 46 km[1], whereas those in the xenoliths formed at 5 to 15 km. This places the depth of origin of the plutonic xenoliths above the Cape Verde Moho and in the oceanic crust.

The xenoliths thus trace magma-crust interaction to the MORB oceanic crust and overlying sediments located beneath the Cape Verde submarine plateau. The spatial distribution and vertical representation provided by crustal xenoliths will help to develop a better idea of the 3-D architecture of the oceanic crust beneath the Cape Verde plateau.

[1] Barker et al., (2011) *Contrib. Mineral. Petrol.* doi: 10.1007/s00410-011-0708-2.