Hf isotope signature of Mt. Etna magmas (Sicily, Southern Italy)

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High-precision Hf isotopic data for selected historic (pre-1971 eruption) and recent (post-1971) Etnean lavas will be discussed in light of their covariation with previously analyzed Sr-Nd-Pb isotope ratios. ^{176}Hf/^{177}Hf ranges between 0.282961 and 0.282989 in the historic lavas, and between 0.282943 and 0.282990 in the recent ones, displaying, especially among the latter, an overall time-related decrease. In Hf-Nd and, to a minor extent, Hf-Sr-Pb isotope spaces, Etnean lavas plot slightly below the linear array defined by MORB and OIB, between the enriched-end of the FOZO and HIMU fields. This may suggest that the Etnean magma source experienced a previous low-degree of melting in presence of garnet and that evolved then for enough time to produce a decoupling of the ^{176}Hf/^{177}Hf and ^{143}Nd/^{144}Nd ratios. In addition, the distinct εHf values of the historic and recent lavas may account for portions of the mantle bearing distinct Lu/Hf ratios, likely related to decreasing modal proportions of garnet participating to the partial melting process. Integration of all the available data may suggest that FOZO is the dominant component in the origin of Etnean magmas, although it is not enough to solve the observed ^{176}Hf/^{177}Hf change coupled with the Sr-Nd-Pb variation through time. Binary mixing modelling between FOZO and EM-type components gives evidence that addition of about 10% of an EM1-type component to FOZO may account for the isotopic variability of Etnean magmas, a feature more emphasized in the most recent lavas. Divergences from a dominant FOZO signature of erupted magmas at Mt. Etna may therefore be attributed to small-scale heterogeneity produced by the access into the source of enriched material with an EM1 signature.

Effects of oxidation on nanomagnetite magnetization, aggregation, and sedimentation

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Magnetite (Fe_3O_4) is a ubiquitous component of anoxic subsurface environments. Magnetite within the nanodomain (particle diameter, $d < 100$ nm) is of particular interest because of its potentially unique properties. Due to size effects, changes in its physical, chemical, and reactive properties relative to bulk (coarse) material are expected. Previous work by our group has shown that nanoscale magnetite can degrade reducable organohalides such as carbon tetrachloride (CT) under anoxic conditions at enhanced rates relative to bulk magnetite [*1*]. In that study, we observed that aggregation significantly impacts the measured reactivity of the nanoparticles. This presentation will focus on work conducted to further examine the interplay between nanomaterial aggregation and reactivity.

Magnetite nanoparticles were synthesized using an established co-precipitation method [*2*]. Both NaOH and TMAOH were used as the base. NaOH mediated precipitation produces particles with TEM determined diameter of 10.0 nm (polydispersity, P = 0.15), while precipitation in TMAOH produces particles with diameter 7.93 (P=0.085). The latter particles are stabilized in suspension due to the association of TMA^+ cations at the particle surface. Suspensions containing either of these magnetite nanoparticles were characterized with respect to their stability using dynamic light scattering (DLS) and UV-VIS-NIR spectroscopy. The effects of salt addition and oxygen induced nanoparticle oxidation on the stability of the suspensions were characterized.

This presentation will show that changes in the oxidation state of magnetite (i.e. conversion to maghemite) result in measurable changes to nanoparticle magnetization, aggregation, and sedimentation. The importance of the collected results will be presented using a DLVO-based framework.

[1] Vikesland *et al.* (2007) *Environ. Sci. Technol.* **41**, 5277–5283. [2] Vayssieres *et al.* (1998) *J. Coll. Inter. Sci.* **205**, 205–212.