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Mantle components and characteristics of the metasomatizing agent in the Mt. Etna magma source: insights from the Hf isotope composition of lavas

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Hf isotopic data of selected historic (pre-1971 eruption) and recent (post-1971) lavas provide further constraints on the mantle source characteristics of Mt. Etna volcano recently defined. The Hf signature of Etnean lavas resembles that of the FOZO mantle component, being in the Hf-Nd space slightly below the linear array defined by MORB and OIB volcanics. This suggests that the Etnean mantle source is garnet-bearing and that it experienced an episode of low-degree melting prior to melt formation. Furthermore, distinct Lu/Hf ratios found in these volcanic products suggest variable modal proportions of garnet and metasomatic phases involved in the partial melting mechanism. The integration of geochemical and isotopic data from literature [1] evidences that FOZO is the dominant Etnean mantle component, to which $\sim$10% of an EM1-type component should be added to account for the observed isotopic variability. The coupled analysis of 176Hf/177Hf and trace element ratios also indicates that silicate melts may be the enriched, infiltrating and metasomatizing component with EM-1 signature [2]. Our evidence could imply a physical scenario where the ambient Etnean mantle derives from recycling of ancient, altered oceanic lithosphere (FOZO) later metasomatized by infiltrating melts that carry the enriched signature (EM1-type). This supports the idea that small-scale heterogeneity is responsible for changes in the geochemical signature of Etnean magmas over any possible timescale.

[1] Viccaro M., Cristofolini R. (2008), Lithos 105, 272-288, doi:10.1016/j.lithos.2008.05.001.
[2] Viccaro M., Nicotra E., Millar I.L., Cristofolini R. (2010), Chemical Geology, in press, doi:10.1016/j.chemgeo.2010.12.020.