



New perspectives on primary magmas and related mantle sources from Mt. Etna (Sicily, Italy)

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Mt. Etna is one of the most active volcano in the world and the understanding of its eruptive dynamics is fundamental to reduce volcanic risk related to the frequent volcanic events. In this respect the complete evolution of Mt. Etna magmatism and the reconstruction of its mantle source was considered performing a detailed sampling from Tholeiitic to Recent Mongibello periods.

Backward mass balance fractionation models, starting from real and primitive analyzed magmas, allowed to reconstruct the “primary” and un-fractionated melt compositions. The Tholeiitic suite did not necessitate a backward reconstruction for the presence of real primary un-fractionated compositions. The least differentiated products for each alkaline period were identified and about 17 to 19% of a solid assemblage made up of Ol (87 to 100%) and Cpx (up to 13%) was added to re-equilibrate the basalts with mantle olivine (Fo₈₇). A further subtraction of an average 23.3% of a solid assemblage constituted by Ol (7-18%), Cpx (26-55%) and Plag (21-48%) is needed to get to the most differentiated erupted lavas. To reach the most evolved terms we hypothesized the involvement of 27% Ol, 14% Cpx, 29% Opx, 15% Plg and 15% Cr-sp for a total amount of 53.1% of Gabbroic material. On average an estimation of about 40% of material should be considered beneath the volcanic edifice taking into account the entire volume of the products emitted by the volcano. Thus if according to [1] the whole volcano edifice amounts to about 370 km³, about 150 km³ of magma should be left behind from the magma on its way from the mantle to the surface.

Although Etnean alkaline lavas appear enriched in K, Rb, Th and U and depleted in Ti, Y and Yb with respect to the Iblean magmas, their overall composition appear quite similar. Thus partial melting models were developed for each Etnean magmatic period, based on a mantle composition similar to that of the nearby Iblean lithosphere. Results indicate two different sources for Tholeiitic and Alkaline suites analogously to the modeling developed by [2]. Tholeiitic magmas can be reproduced by about 17% of an amphibole-bearing peridotite source, while Alkaline magmas can be reproduced by melting of about 7% an amphibole-phlogopite-bearing peridotite source. Our results are in agreement with those recently advanced by [3] indicating a large similarity between Mt. Etna and Mt. Iblei mantle sources.

[1] Neri and Rossi (1992) Quaderni di geofisica – Istituto nazionale di Geofisica e Vulcanologia 20. [2] Beccaluva et al. (1998) J. Petrology 39, 1547-1576. [3] Correale et al. (2014) Lithos, 243-258.