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Chemical heterogeneity of Mt. Etna magmas in the last 15 ky and inferences on their mantle sources

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Primitive basaltic magmas are crucially important in the study of geochemical heterogeneity documented in Etna magmas and their inferred mantle sources. We undertook a systematic sampling of the less evolved basalts erupted at Mt. Etna over the past few millennia, focusing on lava flows and pyroclastites emplaced during deep-dyke fed (DDF) eruptions which were driven by the rapid ascent of deeply-rooted magma intrusions that bypassed the shallow plumbing system of the volcano. All the samples were analyzed by the same laboratory to avoid analytical biases and to build up a comprehensive dataset on their major and trace element compositions in order to propose a coherent framework to interpret the geochemical fingerprints of Etna present-day basalts.

Trace element modelling together with literature data for Sr isotopes gave insight into long-term magmatic processes related to different melting degrees of the heterogeneous mantle beneath Mt. Etna. DDF magma batches younger than 15 ky provide good snapshots of their mantle source heterogeneities that point to the variable involvement of clinopyroxenitic lithology, Rb-87Sr-Cl-rich fluid component(s) possibly controlled by their source mineralogy, and slab-derived fluids selectively enriched in alkalis (Rb, K). The ongoing alkali (Rb, K) enrichment of the present-day magmas, well manifest since the 1970s, is decoupled from that of Sr and Cl. This recent process is linked to mantle source composition and is concomitant with changes in both volcanological and seismotectonic patterns of the volcano. There is no evidence for any time evolution of DDF magma chemistry.