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Modelling Mt. Etna mantle sources

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The mantle source beneath Mt. Etna is matter of a longstanding and controversial debate, due to the absence of mantle xenoliths, the evolved nature of the erupted magmas and their geochemical variations.
This study is focused on the modelling of the petrogenetic processes responsible for the production of Mt. Etna magmas and their variation through time, by means of a comparison with the Hyblean lavas (Southern Sicily), their evolution and mantle source(s). Samples from all Mt. Etna eruptive events, from the tholeiites to the nowadays K-rich eruptions, were used to a backward reconstruction of the primitive magma compositions, taking into account the fO_2 of the magmatic system and its effect on mineral-melt Fe partitioning. The eutectic melting proportions and the modal composition of the Mt. Etna mantle source, obtained by a mass balance melting model, allowed to: i) compare the etnean inferred primary magmas with the Ol-hosted melt inclusions (MI) composition and with the Hyblean real primary magmas; ii) define some petrologic and geodynamic constraints on the Hyblean-Mt. Etna area taking also in account the compositions of the Hyblean xenoliths.
A 2% to 17% addition of dunitic to wehrlitic assemblages (Ol + Cpx in progressive equilibrium) to Mt. Etna less evolved lavas allowed to equilibrate the Mt. Etna primitive magmas (mg# = 68) compositions for Timpe, AAV, Ellittico, Mongibello and Post-1971 stages to mantle conditions; Ol with Fo=88).
The calculated Lh source is constituted by Ol + Opx + Cpx + Cr-Sp, with addition of small amounts (4.3%) of Amph and Phlog. Decreasing partial melting degrees (from 19% to 13-10%) and a change in Amph and Phlog eutectic melting proportions can explain the entire Mt. Etna compositional range, from the tholeiitic event to the Post-1971 LILE-enriched episodes, leading to the production of primary magmas characterized by a 0.6 to 1.2 wt% H_2O content. Some speculation between geodynamic and magmatic evolution of the articulated and complex area of Southeastern Sicily are also put forward.