

Trace element and volatile signature of Etna magma source(s): A melt inclusion approach

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OIB-type alkaline magmatism at Mt Etna is related to mantle upwelling and tensional tectonics at the collision boundary of the African and European plates, promoted by differential roll-back of subducting Ionian oceanic lithosphere. During the last 4 ka Mt Etna produced rare H₂O, Ca-rich picrite magma [1] and recurrently, water-rich basalt-trachybasalts variably enriched in alkalis [2]. Trace elements, Cl H₂O and CO₂ have been analyzed in the olivine-hosted melt inclusions in order to better constrain magma genesis, the mantle source processes and the evolution of the volcano plumbing system. Both picritic and basaltic melt inclusions display closely similar Th/U, La/Th, Ce/Th, Ta/Nb ratios indicating their derivation from a bulk HIMU-type OIB mantle source. However, the Ca-rich picritic magma is distinguished by a stronger negative anomaly in Nb, high U/Nb, Cl/Ce, H₂O/Ce ratios, and moderately high Ce/Pb, Ba/Th and Sr/Nd ratios which evidence the imprint of a subduction-derived fluid component. This imprint is diluted in historic and present-day basalts that show moderate water enrichment and nearly constant H₂O/Ce and Nb/U ratios. A main feature is the decoupled behaviour of alkalis and volatiles (H₂O-Cl). Compared to historic basalts, the present-day magmas are significantly enriched in alkalis, but preserve alkalis/La ratios similar to those of the picrite. This suggests the separate involvement of an alkali-rich component during either mantle processes (melting, magma production rate) or interactions with the lower crust, as will be discussed.

References

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Probing the Organic-Mineral Interface (OMI) at the molecular level in Model Biominerals

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The process of biomineralization involves exquisite control of organic and mineral components by biological systems [1-3], which harness chemistry and physics, drawing the attention of material scientists, geochemists, physicists, and biologists [4-5]. The key to understanding biomineralization is in the interaction, at the molecular level, between the organic and mineral components [4].

In this study we employ x-ray absorption near edge (XANES) spectromicroscopy to investigate bond changes and electronic structure of both calcium carbonate mineral crystals and peptides at the OMI. We acquired XANES spectra from calcium carbonate crystals grown in the presence of three nacre-inspired peptides (AP7N, AP24N, n16N) and a sea urchin spicule matrix protein, LSM34.

All model biomineral systems examined show disruption of surface C-C bonds in calcite and the enhancement of the peak associated with C-H bond, indicating ordering of the amino acid side chains. We show that these changes do not occur when Asp and Glu are replaced in the n16N sequence with Asn and Gln, respectively, demonstrating that the Asp and Glu amino acids participate in peptide-mineral molecular associations.

References

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