

Petrographic analysis of major and trace element partitioning during assimilation of quartz xenoliths into the lava of the 2013–2014 New South-East Crater eruption, Mt. Etna, Sicily

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Xenoliths included in volcanic deposits are a valuable tool for deciphering the nature of the basement rocks, the ascent history of the magma and processes of magma contamination. In this study we have examined quartzite xenoliths from the siliceous metasedimentary basement below Mount Etna, Sicily. The xenoliths were erupted during the December 2013–January 2014 activity at the New South-East Crater. Our goal is to examine the petrography and mineral / glass chemistry of both the lavas and the xenoliths to decipher the patterns of element partitioning during assimilation of the xenoliths. The xenoliths range in size from a few centimetres to more than 15 cm. They comprise 0.2–0.5 mm, subrounded and embayed quartz, with vesicular interstitial glass, rare poikilitic clinopyroxene and small amounts of zircon, titanite and Fe-Ti oxides. The host lava comprises phenocrysts of complexly zoned plagioclase and clinopyroxene, as well as forsteritic olivine, and Fe-rich oxides all of which are in a glass and microlite-rich groundmass. Between the lava and the quartz-rich xenoliths there is commonly a zone of brown to clear glass that shows evidence of mechanical mixing. In some samples, this glass-rich zone contains euhedral clinopyroxene. Glass in the quartzite xenoliths is dacitic to rhyolitic whereas the groundmass of the lava is basaltic trachy-andesite to trachy-andesite. The silica-rich glasses lie close to a binary mixing line the lava groundmass and quartz for all oxides except K_2O , which is strongly enriched in the silica-rich glass. Silica-poor glasses are light REE enriched with a $Eu_N/Yb_N \sim 5$, the silica-rich glasses also show light REE enrichment, but the heavy REE all have similar normalised abundances ($Eu_N/Yb_N \sim 1$). Rb in the silica-rich glasses show a similar enrichment to potassium. Clinopyroxene in the lava is titanium-rich and light REE enriched compared to that in the xenoliths. Our preliminary interpretation of the petrographic and chemical data is that Etnaean lava infiltrated the xenoliths, dissolving quartz, and crystallizing secondary clinopyroxene. The amount of clinopyroxene crystallisation required to give the observed compositional trends is consistent with the petrographic observations. However, the extreme enrichment of K_2O and Rb in the xenolith glasses cannot be explained by this model. We propose that potassium and rubidium element enrichment in the silica rich glass occurs because they preferentially partitioned into polymerised melts over depolymerised melts. The remainder of this study will focus on sourcing the xenolith from U-Pb dates and Ti-quartz thermometry.