Geophysical Research Abstracts
Vol. 20, EGU2018-10620-1, 2018
EGU General Assembly 2018

Amphibole thermobarometry of trachyte/syenite bodies in the Dunedin Volcano: implications for the plumbing system evolution

Alessio Pontesilli (1), Marco Brenna (1), Mike Palin (1), Silvio Mollo (2), and Matteo Masotta (3)

(1) University of Otago, Department of Geology, New Zealand (alessio.pontesilli@gmail.com), (2) Dipartimento di Scienze della Terra, Sapienza-Università di Roma, Rome, Italy, (3) Dipartimento di Scienze della Terra, Università degli Studi di Pisa, Pisa, Italy

Magma mixing and mingling processes in volcanic systems are crucial both for their role in the evolution and differentiation of magmas and for their potential as eruption triggers. In this context, we present compelling evidences for the occurrence of magma mixing in a small trachytic body belonging to the Dunedin Volcanic Complex (Otago region, southern New Zealand), which hosts decimeter-to-meter scale inclusions of more evolved syenitic enclaves. Textural evidences of the commingled hybrid magmas include resorption and overgrowth of the phenocrysts (feldspar, clinopyroxene, amphibole), especially at the transition zone between the two magmatic bodies, and corresponding to systematic variations in their mineral chemical compositions. More specifically, Mg# of both amphibole and clinopyroxene, along with anorthite content of plagioclase from the trachytic host rock decrease consistently through their overgrowth rims. Intriguingly, while clinopyroxene crystals from both magmas exhibit a clear negative Eu anomaly, only amphiboles from the syenitic enclaves share this signature, while the absence of any Eu anomaly in amphiboles from the trachyte indicate early appearance before plagioclase. Thermobarometric estimates for the distinctive amphibole populations from the trachytic host rocks and in the syenitic inclusions support the mixing process. It is concluded that the slightly older syenitic intrusion stalled at more superficial levels in the crust and it was already partially solidified at the time of injection of the hotter and less evolved trachytic magma. After thermal equilibration of the two magmas, the complete hybridization was probably hampered by the viscosity contrast due to different initial crystal contents. Density contrasts were likely not as relevant as to prevent eruption of the incoming trachytic magma, even if potential convecting processes in a small crystal mush cannot be excluded. Therefore, magma supply leading to magma mingling and mixing processes played a key role in the magmatic evolution at the Dunedin Volcano, classically interpreted as prevalently related to crystal fractionation. The polybaric history for these magmas is also documented for small magma bodies, testifying to the development of a complex plumbing system.