Magmatic processes recorded by garnets from the AD 79 eruption of Vesuvius

D. HARRIES, A. HEUMANN, K. SIMON AND A. KRONZ

Geowissenschaftliche Zentrum Göttingen, Abt. Geochemie, Georg-August-Universität Göttingen, Germany (dennis.harries@stud.uni-goettingen.de)

Introduction

Evolved K-phonolitic tephra of Mt. Somma-Vesuvius volcano (Campania, Italy) contains Ti-rich garnets of the andradite-grossular solid solution series ('melanite') which are interpreted to be of magmatic origin in the Mercato (~8.1 ka) and Avellino (~3.7 ka) eruptive products (Scheibner *et al.*, 2007).

Here we present data on REE distribution patterns obtained by laser ablation ICP-MS profiles in garnets of similar composition from tephra of the AD 79 eruption of Vesuvius in order to potentially distinguish metasomatic and magmatic garnets. The studied garnets have melanitic compositions and show core/rim structures with higher Fe^{3+}/Al ratios in the rims and resorption features at the interfaces.

Samples and Analytical Methods

Garnet phenocrysts (~0.3-0.8 mm) were separated from crushed pumice samples taken from the basis of the chemically most evolved white tephra and from basis and top of the less evolved grey tephra at Pompeii ('Necropolis', Cioni *et al.*, 1995).

Continuous profiles through sectioned garnet crystals were obtained by ICP-MS coupled to a 193 nm ArF excimer laser. Profile width/spot size was 30 µm and resulting profile depth was ~60 µm. Detection limits ranged between 1 to 7 ppm for REE. Major element quantification was accomplished by wavelength dispersive EPMA.

Results and Discussion

LREE concentrations peak at Nd and show almost no variations through cores and rims, in contrast HREE are strongly depleted in the cores by a factor of up to 30 (2 to 10 for individual crystals) relative to the rims. Very high partition coefficients for HREE in melanitic garnets (Scheibner *et al.*, 2007) suggest crystallisation of the cores from a highly fractionated magma unlike any of the eruption products of AD 79. These findings imply a significant contribution of a residual, higly evolved magma from previous eruptive cycles to the reservoir of the AD 79 eruption as previously outlined by other works (e.g. Cioni *et al.*, 1995).

References

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Scheibner B., Wörner G., Civetta L., Stosch H.-G., Simon K. and Kronz A. (2007), *Contrib. Mineral. Petrol.* **in press**, DOI: 10.1007/s00410-006-0179-z.

Using Pb isotopic analyses of fluid and melt inclusions to trace sources of Cu-Au porphyry deposits

C.R. HARRIS[1], T. PETTKE[2], C.A. HEINRICH[1] AND T. KLEINE[1]

[1]IGMR, ETH Zurich, Clausiusstrasse 25, 8092 Zurich, Switzerland (harris@erdw.ethz.ch; heinrich@erdw.ethz.ch; kleine@erdw.ethz.ch)

[2]Institute of Geological Sciences, 3012 Bern, Switzerland (pettke@geo.unibe.ch)

We have analyzed Pb isotopic ratios of natural fluid and melt inclusions by LA-MC-ICPMS and demonstrate the ability to use Pb ratios normalized to both ^{204}Pb and ^{206}Pb in tracing ore mineralization. The case study follows extensive feasability tests (Pettke *et al*., in prep) using synthetic Pb fluid inclusions, in which we attained within run precisions (± 2SE) of as good as 200 ppm (normalized to ^{206}Pb) and 400 ppm (normalized to ^{204}Pb) and shot to shot reproducibilities (± 2SD) of 800 ppm and 7000 ppm, respectively.

Fluid inclusions in this study are from quartz veins in two different Cu-Au porphyry systems in the Apuseni Mountains, Romania. The Apuseni Mountains represent the richest concentration of metal deposits in Europe, and have been mined since pre-Roman times. Mineralization is hosted by sub-volcanic Miocene magmas intruded in a transtensional geodynamic environment. The magmatic rocks are mostly andesitic in composition, several of which contain high Sr and Pb concentrations, LILE enrichment and MORB-like Sr and Nd isotopic compositions characteristic of adakite-like magmas. Stocks hosting the porphyry deposits have adakite-like chemical signatures. Whole rock major, trace, and Pb-Sr-Nd isotopic analyses on the magmatic rocks represent the maximum range in age and composition, including endmembers of hybrid magmas recognized in the field from mingling textures. Pb isotopic ratios of whole rock solutions were measured with MC-ICPMS using Tl normalization. Fluid inclusions were measured by LA-MC-ICPMS while admixing desolvated 997-Tl standard solution. In high temperature stockwork veins, fluid inclusion ratios are indistinguishable from high temperature sulfides but less radiogenic than galena from the same deposit. Pb ratios of fluids and sulfides overlap ratios from the magmatic host rocks. Feldspar cores and several melt inclusions hosted in the feldspar cores, however, exhibit Pb isotopes more radiogenic than the magmatic rocks and fluids, consistent with observed inverse feldspar zoning. Results will be explored in consideration of the idea that ore deposition is linked to a pulse of more primitive magma into the system (e.g., Kamenov *et al*., 2005).

References

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