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Boron isotopes in feldspar: Tracing magmatic processes on Gran Canaria

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Miocene peralkaline ignimbrite 'A' on Gran Canaria (13.63 $\pm$0.04 Ma [1]) comprises three chemically distinct end-member magma types: a comenditic trachyte ($SiO_2 \approx 65\%$) and two comenditic rhyolites ($SiO_2 \approx 70\%$) [2]. Feldspar forms the main phenocryst phase and each end-member magma type contains a characteristic feldspar composition. Chemical variations (major and trace elements, $\delta^{18}O‰$ $^{87}Sr/^{86}Sr$) in ignimbrite 'A' feldspars record a history of fractional crystallisation, magma-mixing, and crustal assimilation within a shallow-level magma chamber [2-5]. To test the feasibility of boron isotopes as a tracer for magma chamber processes in evolved ocean island magmas, we have analysed a suite of ignimbrite 'A' feldspar separates for their B concentrations and $\delta^{11}B‰$ values. We also investigated a range of potential crustal contaminants, including the igneous and sedimentary portions of the ocean crust and hydrothermally overprinted plutonic rocks from the island's core. Boron concentrations and $\delta^{11}B‰$ in feldspar from the three ignimbrite 'A' end-members ranges from 37.1 to 51.5 ppm and from –3.55 to +3.48 ‰ for trachyte to most evolved rhyolite compositions, respectively. Trends in the feldspar data suggest a combination of crystal fractionation/accumulation and progressive contamination of trachyte to rhyolite magmas by a contaminant that is best reflected by a mixture between sedimentary portions of the ocean crust and rocks of the island's intrusive core. Considering the boron data in concert with existing oxygen and strontium isotope data for the same sample suite [2, 4, 5], it appears that ignimbrite 'A' has been contaminated by variable components of the proposed crustal mixture, arguing for selective contamination from the two main contaminants. The correlation between our new boron isotope data and the published data for ignimbrite 'A' feldspars demonstrates the applicability of boron isotopes to the study of magma chamber processes in dynamic ocean island systems.

References

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