Geophysical Research Abstracts
Vol. 14, EGU2012-9291, 2012
EGU General Assembly 2012

Tracing crustal contamination along the Java segment of the Sunda Arc, Indonesia

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Arc magmas typically display chemical and petrographic characteristics indicative of crustal input. Crustal contamination can take place either in the mantle source region or as magma traverses the upper crust (e.g. [1]). While source contamination is generally considered the dominant process (e.g. [2]), late-stage crustal contamination has been recognised at volcanic arcs too (e.g. [3]). In light of this, we aim to test the extent of upper crustal versus source contamination along the Java segment of the Sunda arc, which, due its variable upper crustal structure, is an exemplary natural laboratory.

We present a detailed geochemical study of 7 volcanoes along a traverse from Anak-Krakatau in the Sunda strait through Java and Bali, to characterise the impact of the overlying crust on arc magma composition. Using rock and mineral elemental geochemistry, radiogenic (Sr, Nd and Pb) and, stable (O) isotopes, we show a correlation between upper crustal composition and the degree of upper crustal contamination. We find an increase in 87Sr/86Sr and δ18O values, and a decrease in 143Nd/144Nd values from Krakatau towards Merapi, indicating substantial crustal input from the thick continental basement present. Volcanoes to the east of Merapi and the Progo-Muria fault transition zone, where the upper crust is thinner, in turn, show considerably less crustal input in their isotopic signatures, indicating a stronger influence of the mantle source. Our new data represent a systematic and high-resolution arc-wide sampling effort that allows us to distinguish the effects of the upper crust on the compositional spectrum of individual volcanic systems along the Sunda arc.

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