Geophysical Research Abstracts, Vol. 7, 04947, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04947

Island arc basalt genesis by multi-stage mixing process: application to Merapi volcano, Indonesia

V. Debaille (1), R. Doucelance (1), D. Weis (2), P. Schiano (1)

(1) Laboratoire Magmas et Volcans, OPGC-Université Blaise Pascal-CNRS, Clermont-Ferrand, France, (2) Pacific Centre for Isotopic and Geochemical research, Department of Earth and Ocean Sciences, University of British Columbia, Vancouver, Canada. (v.debaille@opgc.univ-bpclermont.fr / phone: +33 4 73 34 67 23)

Basalts sampling subduction zone volcanism (IAB) often show binary mixing relationship in classical Sr-Nd, Pb-Pb, Sr-Pb isotopic diagrams on the scale of a simple island or volcano. This is generally interpreted as reflecting the involvement of two components in their source. However, several authors have highlighted the presence of minimum three components in such a geodynamical context: mantle wedge, subducted and altered oceanic crust and subducted sediments. The overlying continental crust can also contribute by contamination and assimilation in magma chambers and/or during magma ascent.

Here we present a multi-stage model to obtain a two end-member mixing from three components (mantle wedge, altered oceanic crust and sediments), already known in other environments as pseudo-binary mixing. The first stage of the model considers the metasomatism of the mantle wedge by fluids and/or melts released by subducted materials (altered oceanic crust and associated sediments), considering mobility and partition coefficient of trace elements in hydrated fluids and silicate melts. This results in the generation of two distinct end-members, reducing the number of components (mantle wedge, oceanic crust, sediments) from three to two. The second stage of the model concerns the binary mixing of the two end-members thus defined: mantle wedge metasomatized by slab-derived fluids and mantle wedge metasomatized by sediment-derived fluids.

This model has been applied on a new isotopic data set (Sr, Nd and Pb, analyzed by TIMS and MC-ICP-MS) of Merapi volcano (Java island, Indonesia), combining step-

by-step calculations with a Monte-Carlo approach. Previous studies have suggested three distinct components in the source of indonesian lavas: mantle wedge, subducted sediments and altered oceanic crust. Moreover, it has been shown that crustal contamination does not significantly affect isotopic ratios of lavas.

The multi-stage model proposed here is able to reproduce the binary mixing observed in lavas of Merapi in the analytical error of measured data. Moreover, we show that direct and simple mixing between components can not generate such alignments. Analogies between numerical and experimental values of bulk partition coefficient and mobility coefficient are also discussed.