Carbonate assimilation by Sunda Arc magma at Sumbing volcano, central Java, Indonesia

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The Sunda Arc volcano Gunung Sumbing, in central Java, provides a natural experiment to explore the petrological and chemical effects of carbonate assimilation by arc magma. It has produced two volcanic suites; pyroclastic rocks that are contaminated by carbonate crust, and lavas which are not.

Incompatible trace element and isotopic ratios in the moderately porphyritic lavas show no systematic variation with differentiation. Other than ranging from basaltic andesite into andesitic compositions, the Sumbing lavas are very typical Sunda Arc volcanic products. Sumbing pyroclastic rocks contain more clinopyroxene and plagioclase than lavas, including plagiocalse with very high calcium contents. Their major and trace element, and isotopic compositions progressively diverge from the lavas towards lower silica. The pyroclastic deposits have elevated $^{87}Sr/^{86}Sr$ accompanied by elevated Sr, Pb, and Ba contents and depletion of several, nominally, immobile elements (e.g. Nb). Correlation with the petrologic differences indicates that these chemical features are due to assimilation of carbonate by magma resembling andesitic lava. It seems likely that this process contributed to the more energetic eruption of the pyroclastic rocks.

Contamination by carbonate in the arc lithosphere caused most of the compositional variation at Sumbing and neighbouring volcanoes, such as Merapi. Its effect is to increase the abundance of some elements that are considered mobile during slab devolatilisation and to decreased the contents of several elements that are considered immobile. This contamination has the potential to compromise estimates of the nature and abundance of recycled, subducted components in the Sunda Arc mantle.