

## The Return of Magnesium in the Lesser Antilles Arc

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Arc volcanism witnesses the elemental cycling between the slab and subarc mantle during subduction. Of particular interest is the mechanism by which the subducted material is incorporated in the arc lava. Except for the rare case where arc lava is the direct partial melting product of a subducted slab, most common scenarios suggest that mantle wedge is the major magma source that melts after being modified by fluids or melts derived from the subducted basalt and sediment. In addition, crustal processes such as polybaric crystallization and crustal assimilation can also modify the composition of arc magmas on their way to the surface. These different processes have different implications on subduction dynamics and elemental cycling, but in many cases, they are difficult to distinguish.

Here we report the first Mg isotopic data for a set of well-characterized arc samples to examine the origin of the input. The Mg isotopic composition of Martinique Island lavas from the Lesser Antilles vary from -0.23 to -0.09, in contrast to the constant value that characterizes MORBs of -0.25. These heavy Mg isotopic compositions suggest the incorporation of isotopically heavy Mg from the subducted slab. The large contrast in MgO content between peridotite and basalt or sediment rules out either direct mixing between peridotite and sediment or sediment assimilation within the arc crust as the main mechanism of producing the heavy Mg isotopes of arc lavas. Instead, the heavy Mg isotopic signature of these arc lavas requires that the overall composition of the mantle wedge is buffered and has been modified by addition of heavy Mg coming from the altered subducted slab. This in turn suggests the transfer of large amount of fluid mobile elements from subducted slab to mantle wedge and makes Mg isotopes an excellent tracer of deep fluid transfers.

Our studies show that a better picture of the processes occurring during arc genesis can be obtained by combining Mg isotopes with radiogenic isotopes such as Sr, Nd or Pb: while trace elements track down the presence of enriched sedimentary material, a major element such as Mg can demonstrate the role of subducted magmatic products in the overall composition of arc magmas.