# Magma Mixing, Not Sediment Assimilation, Explains Magmatic Evolution in Grenada, Lesser Antilles

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Previous studies identified two distinct magma series on Grenada: the Sr-rich and ankaramitic C-series and olivine-microphyric M-series. Variations in isotope ratios in the C-series had previously been interpreted as resulting from assmilation of sediment within the arc crust. New major- and trace-element and radiogenic-isotope analyses and $^{40}Ar/^{39}Ar$ ages show that eruption of these two magma series has been interwoven both in time and space over the past 6 million years during which the present volcanic edifice of Grenada has been built, indicating they share a common plumbing system and that Grenada is younger than previously believed.

Consistent with earlier studies, our data show that the two series are isotopically distinct in their most mafic examples. Trace elements and isotope ratios of both series are best modelled by addition of slab-derived components predominantly through silicate melts, indicating the slab beneath the Southern Lesser Antilles is at or above its solidus. Addition of hydrous fluids is also required, with the C-series requiring a greater fluid component that the M-series. The subducted sediment contribution is greater in the M-series (≥0.6%) than the C-series (~0.2%) and M-series magmas are generated by larger melt fractions than are the C-series.

Radiogenic isotope ratios in C-series basalts correlate significantly with MgO, but $\delta^{18}O$ does not. This and other aspects of C-series evolution, including decreasing $K_2O/Na_2O$ and Sr concentrations with decreasing MgO, cannot be explained by sediment assimilation as previously proposed. Furthermore, the C-series and M-series arrays converge at low MgO to the point where they are indistiguishable in all characteristics. These observations are readily explained by C-series magmas mixing with evolved M-series ones within the arc crust, and, perhaps, assimilation of their crystallization products. Because M series magmas constitute ¾ of Grenada igneous products and they are more heterogeneous, the effects of this magma mixing on the M-series is less obvious.