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A highly diverse silicic end member of a bimodal magma suite formed in an active continental back arc, Okinawa Trough

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The Okinawa Trough (OT) is an incipient continental back-arc basin that extends from Kyushu in the north to Taiwan in the south. The Okinawa Trough can be split into three segments, the Northern (NOT), Middle (MOT), and Southern (SOT) with active back-arc volcanism restricted to volcanic centres located in en-echelon grabens the MOT and SOT. Previous studies have shown magmatism in the OT is bimodal (basaltic to rhyolitic), with at least two types of silicic melts inferred to form through pure fractional crystallisation from basalt and by fractional crystallisation along with minor crustal assimilation (Shinjo and Kato, 2000).

Here we present petrological descriptions, along with major, trace element and Sr–Nd isotopic data for 75 silicic end member samples recovered as both lava and pumice, collected during the R/V Sonne HYDROMIN1 and 2 cruises in 1988 and 1990, respectively. Samples were dredged from various seafloor knolls and ridges located in the Ito and Iheya grabens and from Izena Hole in the MOT, and from a single volcanic ridge in the Yaeyama graben and a single isolated knoll in the SOT.

Results show a chemically highly diverse silicic end member magmas, with at least four identifiable groups based on differences in the degree of enrichment of incompatible elements (LREE, K, Rb, Ba, etc.). Each group contains at least one dense lava sample suggesting the chemical diversity is a primary feature of magmatism in the Okinawa Trough rather than a result of the floating in of pumiceous material from various locations.

Using petrological descriptions and the chemistry of samples along with MELTS modelling we plan to calculate magma formation conditions and identify any evidence of magma mixing or crustal assimilation. In doing so we hope to provide a model to explain the diversity of silicic magma chemistry in the MOT and SOT.

Shinjo, R., and Kato, Y. (2000). Geochemical constraints on the origin of bimodal magmatism at the Okinawa Trough, an incipient back-arc basin. *Lithos* 54, 117–137. doi:10.1016/S0024-4937(00)00034-7.