現世の海洋性島弧・島弧衝突帯花崗岩類のジルコン酸素同位体組成

Oxygen isotopic compositions of zircons from modern intra-oceanic arc and arc collision zone granites

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The Izu-Bonin-Mariana (IBM) Arc is an active intra-oceanic arc, where silicic to intermediate granitic crust is being generated through subduction zone magmatism (e.g. Tani et al., 2015 EPSL). It has been active since ~52 Ma and for the last 15 million years has been colliding end-on with the Honshu Arc at the Izu collision zone (ICZ). As a result of this collision, voluminous syn-collisional granitic plutons are exposed in the ICZ that have attained geochemical features more akin to average continental crust through crustal modifications during the arc collision (e.g. Saito et al., 2007 J. Pet.; Tani et al. 2010, Geology). The collective understanding of silicic crust formation in modern intra-oceanic arcs and their successive modification during arc-arc collision is important, as they may be the modern analogue for continental crust formation during the early Earth history.
Since oxygen isotope ratios are sensitive to low-temperature geological processes and zircon is one of the most robust crystals to preserve initial isotopic and trace element compositions of the coexisting melt, zircon oxygen isotopic compositions are commonly used as a key tool to estimate the onset and degree of crustal recycling in the Archean crust (e.g. Valley 2003 RMG). However, it is unclear whether the zircon oxygen isotope systematics of the modern intra-oceanic arcs and arc collision zones are concordant with what is assumed for juvenile crustal formation and successive crustal modification in the Archean.
We have conducted zircon oxygen isotope analyses of representative IBM and ICZ granitic rocks using the CAMECA IMS-1280HR installed at the Kochi Institute, JAMSTEC. The analyzed IBM granitic rocks range from Eocene (~49 Ma, Torishima forearc tonalite) to modern (<1 Ma Niijima tonalite xenolith, Tani et al., 2011 EPSL) and ICZ granitic rocks range from 15 Ma (Kaikomagatake granite, Saito et al., 2012 CMP) to 4 Ma (Tanzawa tonalite, Tani et al., 2010). The average $\delta^{18}O$ values of IBM granites are generally low from 4.93 to 5.26, except for one diorite sample from Oligocene Omachi Seamount (~38 Ma) that has high $\delta^{18}O$ = 7.03. ICZ granitic rocks, on the other hand, show a wider range of $\delta^{18}O$ values from 4.77 to 6.40, which most likely reflects various degrees of incorporation of mature sediments from the Honshu Arc and/or interactions with meteoric water during the emplacement of the granitic magma at shallow levels during the arc collision. These data will provide important geochemical constraints on the crustal development processes in intra-oceanic arcs and arc collision zones and whether crustal development in intra-oceanic arcs and arc collision zones is a modern geochemical analogue of Archean crustal formation.

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