Does Tanzawa plutonic complex represent the IBM middle crust? New age constraint from SHRIMP zircon U-Pb geochronology

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The Tanzawa plutonic complex (TPC) is located in the Izu-Tanzawa collision zone, where the northern extent of the Izu-Bonin-Mariana (IBM) arc is colliding with the Honshu arc. The TPC ranges from tonalite to gabbro, and has been regarded as an exposed mid-crustal section of the IBM arc. Such exposures are extremely scarce in active intra-oceanic arcs.

Inspite of this importance, emplacement and crystallization ages are not well constrained for the TPC. K-Ar hb/bt ages vary widely (11 - 4 Ma, e.g. Saito *et al*. 1991), and have led to the suggestion that the formation of the TPC predates the collision of the Tanzawa block with the Honshu arc at ~6 Ma. However, more recent Ar-Ar age study suggests that older K-Ar ages are due to excess argon.

SHRIMP zircon U-Pb ages are newly obtained for tonalite and gabbro samples from the six major plutonic bodies of the TPC. Zircon crystallization ages of 4-5 Ma show that the main pulse of TPC emplacement post-dates the collision of the Tanzawa block.

TPC lithologies are characterized by strong depletion of incompatible elements such as K_2O, LILEs, and REEs (Kawate and Arima, 1998), which has been considered to be the general characteristic of IBM arc crust. However, in light of the new post-collisional ages, the association of TPC geochemistry with juvenile IBM crust needs to be carefully assessed, through a comprehensive study of the geochemistry and geochronology of silicic plutonic rocks previously collected in the IBM arc. SHRIMP zircon crystallization ages range from 49 Ma to <1Ma, representing almost the entire magmatic history of the IBM arc, and compositionally range from tonalite to granite. Most do not show strong depletion of incompatible elements as observed in the TPC. Moreover, the rocks of the TPC have significantly higher Th/Nb (<8) than other silicic plutonic rocks of the IBM arc (<2). Elevated Th/Nb ratios are a good indicator of sediment input from mature crust, and in the TPC may represent incorporation of sediments from the Honshu arc during the collision.

New zircon crystallization ages and geochemical data suggest that the TPC may not be the geochemical representative of the IBM middle crust.

References

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Determination of magnesium isotopic variation and fractionation in carbonate minerals

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Calcium carbonate is one of the most important biominerals in aqueous environments. Ca, Mg, and other elements are incorporated through various mechanisms into the lattice. Although extensive studies of C and O isotopes and elemental abundances in these $CaCO_3$ minerals are carried out to understand the mechanisms, little attention has been paid to isotope ratios of heavy elements.

In recent years, inductively coupled plasma mass spectrometry (ICP-MS) with multiple collectors (MC) has been introduced for the precise isotope analysis of heavy elements. The time-independent characteristic of the mass spectrometry against the mass discrimination allowed the precise analysis of Mg isotope ratios. Here, Mg isotope analysis technique was independently developed. The technique was applied to seawater and Mg rich $CaCO_3$, and Mg isotope ratios were determined with the reproducibility of 0.02 % for $^{25}Mg/^{24}Mg$ and 0.05 % for $^{26}Mg/^{24}Mg$ ratios. The reason of the isotopic variation and degree of fractionation from seawater will be discussed.

The overall natural Mg isotopic variation and related change in Mg atomic weight are compiled to estimate the uncertainty of Mg atomic weight. Present availability of Mg isotopic reference material is also reported.