IODP Exp.351 Izu-Bonin-Mariana Arc Origins: Refertilization of mantle inferred from melt inclusions

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In 2014, a triplet of IODP expeditions (Exp.350-352) focused on the Izu-Bonin-Mariana (IBM) arc were conducted to comprehensively understand the evolution of oceanic island arcs and ultimately, the origin of continental crust. Exp.351 drilled Site U1438 in the Amami Sankaku Basin (ASB), about a 100 km west of the Kyushu-Palau-Ridge (KPR), a remmant part of the IBM arc. While new oceanic igneous basement was formed during subduction initiation at about 52 Ma, the overlying volcaniclastic sediments record the temporal evolution of arc volcanism at the IBM arc.

In order to unveil this magmatic evolution, we analyzed major and volatile elements (S and Cl) of more than 300 melt inclusions collected from top to bottom of Unit III (30-40 Ma based on onboard biostratigraphy) using electron probe microanalyzers. Unit III is composed of accumulated turbidetes, and therefore, it is expected to record magmatic evolution of the early IBM arc over 10 Ma.

Most of the host minerals are clinopyroxene and plagioclase. Composition of melt inclusions are diverse, ranging from basalt through rhyolite, and also ranging from low-K through medium-K series. In terms of major elements, low-K series melt inclusions are consistent with the melt compositions reported from the volcanic front of the IBM arc. Major element compositions of medium-K series melt inclusions overlaps with the melt compostiions reported from the IBM rear-arc, such as volcanoes on the KPR and/or near the ASB. These observations suggest that the turbidites accumulated at Site U1438 originate not only from the IBM rear-arc, but also from the IBM frontal arc. Generally, compositions of melt inclusions shift from evolved melts (higher SiO_2 and lower FeOt/MgO) to less differentiated melts (lower SiO_2 and higher FeOt/MgO), suggesting refertilization of mantle at around 37 Ma. We will further investigate temporal evolution of arc volcanism by analyzing trace elements and isotopes in melt inclusions, which are sensitive to heterogeneity of the mantle wedge metasomatized by slab fluids.