Reconstruction of late Oligocene Izu-Bonin Arc Magmas from Mineral-Melt Partitioning

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The Kyushu Palau Ridge (KPR), a remnant arc of the Izu-Bonin Mariana Arc formed by arc rifting and sea-floor spreading during the late Oligocene, is an excellent place to study early arc processes. DSDP site 296 lies on the northernmost crest of the KPR close to the recently drilled IODP Site 1438 in the Amami Sankaku basin to the west. Both sites are dominantly contemporaneous volcanoclastic sediments marking the transition from arc rifting to remnant arc stage. We studied fresh glass shards and alteration resistant detrital volcanic minerals such as pyroxenes and amphiboles to help reconstruct the magmatic history before and during rifting. The major and trace element composition of glasses, minerals, and melt inclusions were analysed, and both published and calculated mineral/melt partition coefficients (Kds) were compared and used to model melt trace element compositions. For clinopyroxenes and their mafic melt inclusions, the calculated Kd values match published values and trace element models were similar. For orthopyroxene, we calculated Kd values using melt inclusions, but few published values are available for comparison. In the absence of melt inclusions within amphibole, we used major element Kd values to deduce coexisting basaltic andesite and dacitic melts, then used SiO_2 appropriate trace element Kds to model melts. These reveal fractionation of Zr and Hf not observed in glass shards. Models for felsic melts are hindered by scarce and inconsistent published Kds. The characteristics of the trace element patterns suggest that during rifting stage fractionation of amphiboles along with pyroxenes played an important role in the differentiation of silicic magma.