Some variations in arc magmas and their implications for magma genesis

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The northern Izu-Bonin volcanic arc, which is characterized by bimodal, basalt-rhyolite, magmatism, extends for 550 km from Izu Peninsula, Japan to near the Sofugan Tectonic line (Yuasa, 1985). The origin of rhyolite and dacite in oceanic arcs is a matter of considerable interest and debate (Tamura & Wysoczanski, 2006). The middle crust of the Izu-Bonin arc might consist of solidified calc-alkaline andesite, which is being partially melted by hot basalt to produce rhyolite (Tamura & Tatsumi, 2002). A detailed along-arc structural study of the Izu-Bonin volcanic arc revealed that the middle crust, characterized by a P-wave velocity of 6.0-6.8 km/s, varied in thickness from 3 to 13 km (Kodaira et al., 2007). Here, we show interesting chemical and petrologic variations in rhyolite magmas along the 550-km-long Izu-Bonin volcanic front from Hakone to Torishima, which variations are closely correlated to the thickness of the middle crust. Basaltic volcanoes with thick underlying middle crust have low-silica rhyolites having lower Zr/Y, but rhyolitic volcanoes with thin underlying middle crust, which appear between basaltic volcanoes, have high-silica rhyolites having higher Zr/Y. We suggest that the variations in rhyolites reflect spatial and temporal chemical variations of middle crust and the melting temperatures, which produced these rhyolites.