

Earliest record of Izu-Bonin arc volcanism recovered from submarine part of Bonin Ridge

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Forearcs with thin sediment cover are particularly valuable for understanding how subduction zones begin. The Bonin Ridge is an unusually prominent forearc massif in the Izu-Bonin arc that exposes early arc volcanic rocks on islands of Chichijima, Hahajima, and smaller islands (e.g., Kuroda et al., 1975; Taylor et al., 1994; Umino, 1985; Umino and Nakano, 2007). Submarine parts of the ridge, which could complement the record of volcanism preserved on the islands, have not been extensively investigated. In May 2004, we carried out the first manned submersible (SHINKAI 6500) diving survey of the western escarpment of the Bonin Ridge (Ishizuka et al., 2006). This effort along with new $^{40}\text{Ar}/^{39}\text{Ar}$ ages for Bonin island samples provided new information about the duration of infant arc volcanism and how this progressively reorganized into a typical magmatic arc by Early Oligocene time. However this survey failed to discover records of volcanism prior to the boninitic volcanism exposed on the Bonin Islands. In 2007 we conducted dredge sampling along the entire length of the Bonin Ridge in the area between Bonin Islands and Izu-Bonin Trench. Major objectives of the cruise are: 1) To establish temporal and spatial variation of volcanism along the Bonin Ridge in the earliest stage of Izu-Bonin arc. 2) To discover evidences of pre-boninite volcanism in the earliest history of the Izu-Bonin arc and test our hypothesis for the initiation of the oceanic island arc. 3) To recover constituents of arc crust possibly produced in the earliest stage of the arc.

We accomplished dredge sampling at 19 stations. The depth of the dredge stations ranges from 711 to 6420m. Major dredge targets include; 1) a chain of small bathymetric high 40-50 km east of Bonin islands, 2) landward slope of Izu-Bonin Trench, 3) northernmost part of the Bonin Ridge bounded by NW-SE and NE-SW trending fault scarps.

Small bathymetric highs east of the Bonin Islands generally have 200-400m height from the surrounding seafloor. They are generally part of E-W trending broad ridges, some of which extend from Bonin Islands. Dredge sampling mainly recovered aphyric or ol-cpx basalt lava, and boninite was recovered from only one station. This result implies that these forearc small highs are remnant volcanic edifices. This is the first recognition of basaltic volcanism in the forearc side of the Bonin Ridge. These basalts show only weak slab signatures if any. This volcanism might represent initial arc volcanism prior to boninitic volcanism and was located even closer to the trench relative to boninite volcanoes.

Dredge stations on the deeper part of the landward slope of the Izu-Bonin Trench recovered pillow basalts as well as gabbroic rocks and peridotite. This is the first recovery of these types of rocks (i.e., probably upper mantle and lower crust) from the Izu-Bonin forearc other than serpentine seamounts. Pillow lavas could be either of similar origin to the basalts from forearc highs or oceanic basement where Izu-Bonin arc was built. Preliminary data imply that these basalts are MORB-like (i.e., with no slab signature) and Pb isotopic data show Indian-MORB-like character.

Five dredge stations were made along fault scarps in the northern tip of the Bonin Ridge. These stations returned more fractionated lavas relative to the south. Pyroxene-plagioclase phyric andesite breccia and lava blocks were recovered from eastern scarp. These andesites are high-Mg andesite and show U-shaped REE pattern, which implies that they may be correlated to the transitional volcanism (Ishizuka et al., 2006) after boninitic activity which is represented by Mikazukiyama andesite from Chichijima and Ototojima Islands. Western escarpment seems to be composed of more acidic volcanic rocks. Dacite to rhyolite lava and pumice deposits were recovered. Dredging results imply that this part of the Bonin Ridge has distinct volcanotectonic history from other part of the ridge.