Izu-Bonin-Mariana Arc basement from IODP Exp. 351(Amami Sankaku Basin)

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IODP (International Ocean Discovery Program) Exp.351 targeted, in particular, evidence for the earliest evolution of the Izu-Bonin-Mariana (IBM) arc system following inception. This can be obtained by identification and exploration of regions adjacent to an arc, where unequivocally pre-arc crust (basement) overlain by undisturbed arc-derived materials exists. The drill site (U1438) is located in Amami Sankaku Basin (ASB), west of the Kyushu-Palau Ridge (KPR), i.e., paleo-IBM arc. Exp.351 successfully recovered pre-Izu-Bonin-Mariana arc basement, a volcanic and geologic record spanning pre-Arc, arc initiation to remnant arc stages. In this contribution, age and geochemical characteristics of arc basement and its tectonic significance will be discussed.
At U1438, 1611m thick section in total was cored, comprising 1461m of sediment section and 150m of igneous basement. Numerous flow contacts were identified in the basement, several chilled margins could be identified but low recovery in basement rock makes their interpretation in terms of volcanic stratigraphy difficult. Paleomagnetic measurements show consistent shallow plunges of maximum anisotropy axes, and that implies these basalts were emplaced as sheet flows rather than pillow lavas.
Basalts have diverse textures that include aphyric to subophitic/ophitic. Phenocrysts are present in approximately half of the basalts and consist of plagioclase, clinopyroxene, titanomagnetite, spinel and minor olivine.
Age interpretations based on biostratigraphy (Arculus et al., Nat Geosci, 2015) determined that the basement section is between 64 and 51 Ma, and direct age determination of basement basalt by Ar/Ar dating is under way.
Whole rock geochemical analysis of the basement basalt shows that these basalts are low K tholeiitic basalts. They mostly have high-MgO (generally >8 wt%), low-TiO_2 (0.6–1.1 wt%), Ti/V, low-Zr (mostly <50 ppm). On Ti/V plot, the U1438 basalts and forearc basalt (FAB) which is supposed to be associated with subduction initiation from IBM arc are similar to each other and clearly distinct from Philippine Sea backarc basin basalts and normal MORB by having low Ti/V.
One prominent characteristic of the basalts is their depletion of immobile highly incompatible elements compared with MORB, e.g., they are strikingly light REE (LREE) depleted. But La/Nd ratio and Th/LREE increases upcore in the uppermost part of the basement, and these trace element variations with depth is accompanied by variation of major element composition such as Si and Ti.
Hf-Nd isotopes for the basement basalts show a significant range of compositions, and relatively radiogenic Hf compared to Nd indicates an Indian Ocean-type MORB source. However, the dominant signature, with ε_{Hf} >16.5, is more radiogenic than most Indian MORB.
Preliminary data suggests that the basement basalts are relatively primitive melts and likely derived from Indian Ocean-type MORB sources that are more strongly depleted in terms of incompatible trace elements than typical MORB or backarc basin basalt in the Philippine Sea. Geochemical variation in the uppermost part of the core might imply variability of slab-derived enrichment and/or fertility of mantle at the onset of subduction.
Geochemical characteristics of arc basement from Exp.351 imply that depleted MORB-like basalt (“FAB”) appears to have formed in wider area than previously thought, i.e., including “reararc”side

of ancient IBM arc. However, critical assessment of genetic relation between FAB and basement basalt of ASB requires precise age determination to constrain tectonic setting where the ASB basalts formed.

Keywords: arc basement, Izu-Bonin-Mariana arc, geochemical characteristics, Ar/Ar age

