

IODP Exp. 351 Izu-Bonin-Mariana Arc Origins

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Understanding how subduction zones are initiated and continental crust forms in intraoceanic arcs requires knowledge of the inception and evolution of a representative intraoceanic arc, such as the Izu-Bonin-Mariana (IBM) arc system. 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. IODP Exp.351 targeted, in particular, evidence for the earliest evolution of the IBM system following inception.

The Exp. 351 drill site (U1438) is located in Amami Sankaku Basin (ASB), west of the Kyushu-Palau Ridge (KPR), i.e., paleo-IBM arc. Seismic reflection profiles suggest that sediment thickness of the Basin is about 1.3 km thick, and igneous crust, presumed to be oceanic, is about 5.5 km thick. This igneous crust seemed likely to be the basement of the IBM arc.

Primary objectives of this Expedition were: 1) determine the nature of the crust and mantle preexisting the IBM arc; 2) identify and model the process of subduction initiation and initial arc crust formation; 3) determine the compositional evolution during the Paleogene of the IBM arc; 4) establish geophysical properties of the ASB.

Exp. 351 lasted 2 months from May 30, 2014 aboard the JOIDES Resolution. Site U1438 (in 4700m water depth) consisted of 4 cored holes with overlapping recoveries; igneous basement was reached after coring the entire sediment section. The cored interval comprises 5 units: uppermost Unit I is hemipelagic sediment with intercalated ash layers, presumably recording explosive volcanism mainly from the Ryukyu and Kyushu arcs; Units II and III host a series of volcanoclastic gravity-flow deposits, likely recording the magmatic history of the IBM Arc from arc initiation until 25 Ma; Siliceous pelagic sediment (Unit IV) underlies these deposits with minimal coarse-grained sediment input, and could pre-date arc initiation. Sediment-basement contact occurs at 1461 mbsf. A basalt to dolerite section dominantly composed of plagioclase and clinopyroxene with rare chilled margins continues to the bottom of the Hole at 1611 mbsf. Preliminary assessment of the results suggests that basaltic basement is early-middle Eocene (or older) and geochemically similar to forearc basalts from IBM forearc.

Exp.351 is regarded as successful because :1)Sedimentary record preserving subduction initiation, arc maturation to shutdown was recovered: 2)Igneous basement of Amami Sankaku Basin, i.e., basement of IBM arc was recovered. The outcome of this expedition permits hypothesis testing for subduction initiation and subsequent Arc evolution.

Keywords: Izu-Bonin-Mariana arc, IODP, Exp.351, subduction initiation, oceanic island arc