

## IODP Expedition 351 Izu-Bonin-Mariana Arc Origins: Summary of lithostratigraphy and geophysical data

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**Introduction:** International Ocean Discovery Program (IODP) Expedition 351 (June-July 2014) cored 1611-m-long cores composed of 1461-m-long sediments and 150-m-long igneous basement rocks from Site U1438 in the Amami Sankaku Basin (ASB), west of the Kyushu-Palau ridge (KPR) which represents a remnant part of the now active Izu-Bonin-Mariana (IBM) arc. Here we provide a summary of the lithostratigraphic and geophysical data of recovered cores which provide a high-resolution record of subduction initiation and the subsequent evolution of the IBM arc.

**Lithostratigraphy of the site U1438:** Cores recovered from the site U1438 are composed of hemi-pelagic sediments, turbidites and igneous basement rocks. Based on lithostratigraphy, the recovered cores are divided into five units. The uppermost Unit I (160.3-m long) is composed of hemi-pelagic sediments with interspersed discrete ash layers probably derived from explosive volcanism from the Ryukyu and Kyushu arcs. Both Units II (139.4-m long) and III (1046.4-m long) are composed of turbidites, which record the magmatic history of the IBM arc. The estimated ages of Units II and III are Oligocene and Oligocene to Eocene, respectively, based on biostratigraphic and paleomagnetic studies. As a whole, Unit III sediments are coarser grained than those of Unit II and comprise five intervals of coarser clastic sedimentary rocks. Unit IV (99.7-m long) is composed of siliceous pelagic sediments interbedded by tuffaceous sandstones. Age of Unit IV would be early Eocene (~50 Ma). The igneous basement (Unit 1, 150.0-m long) occurs at 1461 mbsf. The radiometric age of the basement rocks has not been determined yet, but it should be equivalent to or older than ~50 Ma based on biostratigraphy. Unit 1 is composed of basaltic lava flows, the majority of which are high-MgO (mostly  $\geq 8$  wt%), low-TiO<sub>2</sub> (0.6-1.1 wt%) tholeiitic basalts. Most of the igneous rocks are aphyric, but some contain phenocrysts of Cr-spinel, olivine, plagioclase and clinopyroxene. Their groundmass textures are variable from holocrystalline to microcrystalline and glassy.

**Geophysical properties of the site U1438:** The geophysical properties of recovered cores, such as *P*-wave velocity, density, porosity, thermal conductivity and magnetic susceptibility, were measured to help characterize the lithostratigraphic units and provide the basis for linking the lithostratigraphy to seismic imaging of the subseafloor geological structure. There is an overall reduction in porosity and consequent increase in *P*-wave velocity through sedimentary Units I to IV, reflecting the compaction of sediments. There are significant jumps in sonic velocity, grain density, and magnetic susceptibility at the Unit I/II, II/III and IV/1 boundaries. Oscillations in *P*-wave velocity and magnetic susceptibility within the top portion of Unit III correspond to changes in the proportion of sands and conglomerates to muds. Higher velocities are correlated to mudstones with dense clasts, and lower velocities are found in mudstones without clasts. There is also a prominent spike in the level of natural gamma radiation within Unit IV, most likely due to elevated concentrations of U, Th and K.

Downhole temperature measurements were made at seven depths using the advanced piston corer temperature tool (APCT-3) from the seafloor to 83.2 mbsf, and these give a linear geothermal gradient without any substantial deviation from 77.6 K/km. With nearly constant values of thermal conductivity (0.952 W/mK), the geotherm is undisturbed by local processes, such as sediment compaction and fluid flow within the porous sediments. The calculated heat flow is 73.7 mW/m<sup>2</sup>, implying a thermal age for the underlying lithosphere of 40-60 Ma. This is consistent with an age constrained based on biostratigraphic and paleomagnetic studies (~50 Ma or older), as mentioned above.

Keywords: IODP, IBM arc, Kyushu-Palau ridge, Amami Sankaku Basin, evolution of island arc