Physical properties of Fore-arc-basalt and Boninite inthe drilled cores during the IODP Expedition 352

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The Izu-Bonin-Mariana (IBM) arc, which is located to the southeast from Japan, is a typical intra-oceanic arc system and is the type locality for subduction initiation. IBM project, which is a part of International Ocean Discovery Program (IODP) expeditions, is aimed to understand subduction initiation, arc evolution, and continental crust formation. Expedition 352 is one of the IBM projects and that has drilled four sites at the IBM fore-arc in the period from 30th of July to 29th of September, 2014. Expedition 352 has successfully recovered fore-arc basalts and boninites related to seafloor spreading during the subduction initiation as well as the earliest arc development. The fore-arc basalts were recovered from two sites (U1440 and U1441) at the deeper trench slope to the east, whereas the boninites were recovered from two sites (U1439 and U1442) at the shallower slope to the west.
In this study, we studied textures and physical properties of both the fore-arc basalt and the boninite samples recovered by IODP Expedition 352. The fore-arc basalt samples showed aphyric texture, whereas the boninites showed hyaloclastic, aphyric and porphyritic textures. For the physical properties, we measured density, porosity, P-wave velocity and anisotropy of magnetic susceptibility. P-wave velocities were measured under ordinary and confining pressure.
As a result, the densities are in a range between 2 g/cm^3 and 3 g/cm^3. The porosities are in a range between 5 % and 40 %. The P-wave velocities are in a wide range from ~3 km/s to ~5.5 km/s and have a positive correlation to the densities. The magnetic susceptibilities showed bimodal distributions so that the physical properties were classified into two groups: a high magnetic susceptibility group (>5×10^{-3}) and a low magnetic susceptibility group (<5×10^{-3}). The high magnetic susceptibility group is almost identical with the fore-arc basalt and boninite samples with the higher correlation trend between the P-wave velocities and the densities, whereas the low magnetic susceptibility group is only the boninite samples with the lower correlation trend between the P-wave velocities and the densities. It suggests that the densities could be related to the occurrence of magnetite in the samples, since the magnetic susceptibilities were remarkably correlated with the relationships between P-wave velocities and densities. In addition, these trends have also been found in the physical properties measured on board during Expedition 352.

Keywords: IODP Exp.352, Izu-Bonin forearc, volcanic rocks, density, P-wave velocity, Magnetic Susceptibility

