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# Submersible magnetic observations at a back-arc spreading center of the Mariana Trough at 17 °N
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We surveyed the Mariana Trough in the western Pacific to understand detailed volcanic and crustal formation processes of the back-arc basin. Three dives of the Japanese submersible Shinkai 6500 were made in the axial valley situated in the spreading center of the 17 °N segment [Fujiwara et al., InterRidge News, 2008]. The 17 °N segment is suggested to have ever been in vigorous magmatic stage, because sheet lava flows, suggesting a high rate of eruption, occupy the seafloor even the slow spreading with a full-rate of ~3 cm/yr [Deschamps et al., G3, 2005; Asada et al., G3, 2007]. The sheet lavas and pillow lava mounds suggesting a low effusion rate coexist in the axial valley. Near-seafloor magnetic observations provide high-resolution magnetic anomaly that is valuable for studies of detailed magnetization structure. The magnetization intensities relate to relative age differences of the lavas, therefore the magnetic data provide a geophysical evidence for discussion whether the segment is in the magmatic waxing or waning stage at present. The deep-sea magnetometer installed on the submersible was designed to measure three components of the geomagnetic field. Because the trough is situated at low magnetic latitudes, vector components have advantages over using only total field anomaly. The measured magnetic field was affected by motion and magnetization of the submersible. The effects were determined and necessary corrections were applied by using the formulation of Isezaki [Geophys, 1986]. After the calibration, the ~4000 nT effect of the submersible was reduced to a residual less than 500 nT. Two dives traversed the western and eastern flanks of the valley in the segment center, and the other dive was on the western flank slightly in the segment end. Magnetic anomalies with large-amplitude and short-wavelength (several tens of meters) were observed near-seafloor. Particularly high amplitude anomalies (up to 5000 nT) were observed in the western flank near the middle portion of the axial valley in the segment center where sheet lavas were dominant. High magnetization intensity (up to 50 A/m) was estimated over the flank, therefore the sheet lava flows are likely young in age and recently emplaced. It suggests the segment is still magmatically vigorous at present. On the other hand, low amplitude anomalies suggesting old lava flows were observed in the eastern flank of the valley. The amplitudes in the western flank to the segment end are moderate and fall somewhere in between. The sheet lavas there seem to be slightly old. It may suggest infrequent magma effusion compared to the segment center. These magnetic age estimations are consistent with observations of sediment deposition from visual inspections and measurements of a sub-bottom profiler attached on the submersible, and also sampled rock magnetization and geochemical measurements. The across-axis magnetic structure along the dive path (a distance of ~2 km) shows the magnetization intensity decreased toward the off-axis, suggesting the seafloor age increases toward the off-axis. However the detailed variation of the magnetization distribution does not show simple seafloor age increment in proportion to distance from the spreading center because there is no clear correlation between the across-axis distribution of magnetization intensity and a compiled dataset of paleointensity variation [e.g. Sint-800: Guyodo and Valet, Nature, 1999]. It implies the complexity of the crustal formation process. A possible explanation is that lava eruption at the segment was not focused on the fixed and stationary volcanic axis, but was dispersed rather broad volcanic zone because of the enhanced magmatic activity. Otherwise ridge jumps at small distances occurred. And/or new sheet lava flows traveled a long distance and overlapped old lava flows, and the lavas overprinted the seafloor magnetization. As the result, the sequential paleointensity variation was not recorded.

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