

Comparison of volcanism and deformation styles along the Mariana backarc basin with the Mid-Atlantic Ridge

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The Mariana Trough is one of active backarc basins and currently the seafloor is spreading with 2-4 cm/yr in full rate [e.g. Kato et al., 2003]. Geochemical analysis along the central Mariana Trough indicates water contents derived by subducting slab in the backarc mantle [e.g. Gribble et al., 1996]. Therefore volcanism along the backarc would be considered to be different from that along mid-ocean ridges. However, the differences between them, such as scale or distribution of volcanisms, are not clearly understood yet. In 2003, we obtained the first fine-scale sidescan imagery along the spreading segments of central Mariana Trough using a WADATSUMI (Univ. of Tokyo). This study presents results from comparison of volcanic activities inferred from fine-scale sidescan sonar imageries along the Mariana backarc basin and along Mid Atlantic Ridge (MAR) at the scale of tens of meters.

Our WADATSUMI survey obtained images along two distinct spreading segments around 17deg.N (we call Seg-17 here) and 18deg.N (Seg-18) of the trough. The bathymetry of Seg-17 is characterized by an hour-grass shaped axial valley. The heightened segment center suggests robust volcanism in the past. On the other hand, the bathymetry of Seg-18 is characterized by a deep axial valley and clear axial valley walls with an Active Volcanic Ridge (AVR). Sidescan sonar imagery along MAR was obtained by TOBI (Towed Ocean Bottom Instrument, UK) [Briais et al., 2000]. The TOBI data cover 6 spreading segments from 27deg.N to 30deg.N, where the full spreading rate is 2-3 cm/yr. Bathymetric characters in this area are variable, but generally characterized by magmatic and hour-grass shaped axial valleys [Sempere et al., 1993].

At first, our imagery along central Mariana Trough leads the following results:

- Volcanic morphologies of Seg-17 and Seg-18 show different characters. Smooth lava flow widely covers the segment center of Seg-17 and hummocky volcanoes developed toward the segment end. On the other hand, surface of AVR in Seg-18 is dominantly covered by hummocky volcanoes. It could indicate differences of eruption rate.

- Linear features (including faults and fissures) show various azimuths, not only perpendicular to the plate motion but also mainly 15-20deg. oblique to the motion was observed on both Seg-17 and Seg-18.

- In Seg-17, linear features show asymmetric distribution especially by the obliquely trending features. The oblique trending features distribute only limited area in the eastern side of the axial valley.

The TOBI imagery along 27deg.N- 30deg.N MAR leads the following results:

- Similar morphological variation to the Mariana Trough, such as smooth lava and hummocky volcanoes, was also observed. Hummocky volcanoes are the most dominant feature over the segments.

- However, widely distributed smooth flow like Seg-17 was not found along 6 different segments in MAR.

- Linear features are found on the hummock-dominant volcanoes. Azimuths of the features are almost perpendicular to the plate motion.

The differences between MAR and Mariana Trough, under the similar spreading rate, indicate the dissimilarity of volcanic and deformation environment over the two settings. The various appearances of the volcanic morphology and the variously trending linear features could suggest the unstable and influenced by subducting slab settings of the basin.