Volcanic activity of the slow spreading ridge in central Mariana Trough indicated from the high resolution sidescan sonar imagery

Miho Asada[1]; Anne Deschamps[2]; Toshiya Fujiwara[3]; Fujiwara Toshiya KR03-12 onboard team[4]

[1] O.R.I.,University of Tokyo; [2] WHOI; [3] Deep-Sea Res. Dept., JAMSTEC; [4] -

The Central Mariana Trough is one of active backarc basins with 5-6 cm/yr of spreading rate. Generally, slow-spreading ridges in Mid Oceanic Ridge (MOR) are characterized by well developed axial valleys and focused volcanism within the valley. Studies that addresses how relevant between these geological features and conditions under the spreading ridge such as mantle thermal structure and mantle flow etc. in these years. Slow spreading ridges in backarc basins, however, the recognitions are not necessarily effect because backarc basin are under the influence of subducting plates. We conduct a high resolution seafloor topographical survey during Oct.- Nov. 2003 using a 'WADATSUMI' system to clarify uncertain activities on slow-spreading ridge in the central Mariana Trough.

WADATSUMI was towed on two chosen distinct spreading segments' axial valley floor in the along-axis direction. Total 4 and 10 survey lines covered about 5 km and 12 km width for two segments. One segment located at ~18 deg. N ('Seg-18') is characterized by a wide rift valley and an axial volcanic ridge (AVR). The other segment, 'Seg-17', located at ~17 deg. N, is characterized by dome-shaped morphology, an hourglass shape of the valley, and no AVR.

About 5 km width image on Seg-18 shows hummocky terrain that are dominant over the AVR of the segment. Faults are few on the hummocky area, however some large faults that trend almost perpendicular to the plate motion surround the hummocky area on both sides of the AVR corresponding with the steep slopes. Then, active volcanism and faulting like MOR are found on Seg-18 area.

On the other hand, two phases of lava flow such as hummocky terrain and sheet flow dominant area with zone boundaries were observed on Seg-17. Sheet flows are dominant in the segment center and are changed the condition to hummocky terrain toward the segment end. When we switch observation from along axis to across axis, sheet flows population is minimum in the central part of axial valley and increases to valley wall. If the sheet flow and hummock were formed by a single lava flow, viscosity change of the lava flow due to cooling or of the advection current speed due to topographical condition are possible reasons. And if eruption occurs near the center of the axial valley, percentage change of sheet flow toward across axis may indicate that the eruption rate would change through the time-line. If the eruption didn't occur limited area but occur whole of the axial valley floor, percentage change of sheet flow may mean that different character of the physical property of lava flows erupt apart within the single axial valley. On the sheet flow and the hummocky terrain, lots of faults are developed. These faults are roughly divided into two groups, one group trends almost perpendicular to the plate motion and widely distributed, and the other group trends oblique that are observed near the center of axial valley floor. The estimated trend of faults is perpendicular to the direction of plate motion. Then, obliquely trending faults may reflect stress field that didn't suite for the plate motion.

Estimated volcanism on Seg-18 is relatively constant spreading, meanwhile volcanism in Seg-17 that is more active than Seg-18 (Sheet flow dominant) shows variable spreading style rather than normal spreading ridge. Because eruption rate is possible to be changed through the time-line (between sheet flow and hummock), and the local stress field that is not suited for the regional stress field expected from the global plate motion (oblique trending of faults is dominant near the center of axial valley) influence the segment. Why the percentage of sheet flow are changed toward valley wall and why faults change its trend? However no information is provided for time scale of oblique trending fault and of lava flow condition change at present. We pursue probable causes of these problems in future.