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Microbathymetry of the southern Mariana hydrothermal vents area, revealed by AUV Urashima

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Three hydrothermal sites (Snail, Archean and Pika) have been known in the southern Mariana Trough. These sites are located just on the active backarc spreading axis, the eastern foot of the axial high and the top of an off-axis seamount about 5 km from the axis, respectively. Geochemical characteristics of the hydrothermal fluids and underneath volcanic rocks are different among these closely located three sites, where signature of arc magmatism is strong in the backarc spreading axis and is weak in off-axis seamount closer to the active arc. During YK09-08 cruise (R/V Yokosuka, 29 June to 17 July, 2009) we planned a multi-sensor mapping of three hydrothermal sites using AUV URASHIMA to reveal the detailed geological structure around these hydrothermal vent sites and the temporal and spatial distribution of hydrothermal plume originated from these sites in higher resolution than ever. Three-dimensional, high resolution, physical, chemical and microbiological mapping both in water column and seafloor can lead us to understand the tectonic setting that controls the type of hydrothermal activity, and to evaluate the effect of hydrothermal circulation on ocean via hydrothermal plume. Three dives (Dive #91-93) were done keeping a constant AUV altitude of 110 m for each site. The 120 kHz side-scan sonar images and 400 kHz multibeam echo soundings were collected during these dives and show the detailed surface structures and geological features with high (~1m) resolution. The Snail site is located along the axial volcanic zone of the backarc spreading center. The ridge crest shows a fast-spreading characteristics without prominent axial valley, though the spreading rate is relatively slow. The active hydrothermal area would be settled in an elongated mound-like structure, which is likely to consist of hydrothermal deposits. The area is bounded by a normal fault and fissures at its northwestern boundary. An almost inactive or relict vent, the Yamanaka site, along the ridge crest also shows a similar morphological feature. The Archean Site is located at the foot of ridge crest and is known as a very active black smoker type activity. The vent site is just above a large mound and the side-scan image shows that the hydrothermal deposits may extend to the backarc basin floor southeast of the mound. The Pika Site is the site above an off-axis seamount. The seamount has two peaks and the active site is located at the top of the western peak. The southern slope of the seamount is covered with small-scale inflated mounds. This feature is very unique, but its origin is still unknown. We recognize possible vents in each site on our detailed map, that will be carefully compared with submersible dive video data. We will try to integrate the multibeam bathymetry, sonar images, then to elucidate the difference of geological setting among three sites.

Keywords: hydrothermalism, backarc basin, morphology, AUV