Submersible Dive Survey to the Superfast-Spreading East Pacific Rise Between 14° S and 18° S

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The Science and Technology Agency (STA) of Japan has been coordinating a research program entitled "Ridge Flux Project" among national research institutes and universities since 1993. The main purpose of the "Ridge Flux Project" is to evaluate quantitatively the fluxes of energy and mass from solid earth to its surface environment through hydrothermal activity along the ocean ridges. Special emphasis is placed on superfast-spreading East Pacific Rise (EPR) between 13°S and 19°S where these fluxes are proved to be the highest among the world oceanic ridges(Urabe et al., 1995, Baker and Urabe, 1996).

The Ridge Flux group conducted three cruises at the EPR area during the first term (1993-1995) of the project: that is, (1) CTD-transmissometer-nephelometer"tow-yo" (yo-yoing while deep-towing nephelometer-CTD sensor package) survey on R/V Melville in 1993, (2) Deep-sea submersible Shinkai 6500/Yokosuka cruise in 1994, and (3) High-resolution side-scan-sonar [TAMU]²/Gyre cruise in 1995, in cooperation with NSF, NOAA/PMEL and Texas A&M University.

The "tow-yo" survey in 1993 identified about 20 hydrothermal plumes over the superfast-spreading segments of EPR between 13°30'S and 18°40'S (Urabe et al., 1995). DSRV Shinkai 6500 dives in 1994 discovered active vent sites of varied temperature and chemistry under the foci of five hydrothermal plumes among six sites investigated (Urabe, 1996). Those include four high-temperature sites where we observed "black smokers" and a low-temperature site where there is an extensive diffuse venting along neo-volcanic zone.

These high-temperature sites, namely, RM11 (15°00'S), RM24 (17°30'S), RM29 (18°12'S), and RM28 (18°26'S), and the low-temperature site RM23 (17°34'S) are subdivided into "volatile-rich" and "-poor" sites, according to the chemistry of the suspended particulate matter such as S/Fe ratio observed in the hydrothermal plumes over these sites.

It becomes clear that high S/Fe ratio of the site is the product of volatile-rich hydrothermal end-member fluid regardless of the temperature. Other lines of evidence such as the thickness of sediment cover indicate that the recent magmatic activity gives rise to the volatile content of the fluid. On the other hand, low S/Fe ratio is a sign that the convective system is aged and the input of volatile components from underlying magma chamber is minimal.

It is necessary to monitor for a long term the hydrothermal sites to test the hypothesis of the evolution of the magmatic-hydrothermal system.

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