Geological structure, cold seep and methane hydrate in the outer ridge off Ashizuri

Juichiro Ashi[1]; Yurika Ujiie[2]; Noriko Nakayama[3]; Urumu Tsunogai[4]; Michio Tanahashi[5]; Keita Koda[5]

[1] ORI, Univ. Tokyo; [2] ORI, Univ. of Tokyo; [3] ORI.,Tokyo Univ; [4] Division of Earth and Planetary Sciences, Grad. School Sci., Hokkaido Univ.; [5] JOGMEC

Five forearc basins with width of 100 to 150 kilometers are distributed landward of the Nankai Trough. Each basin is divided by a seaward extending spur from the Shima Peninsula, Cape Shionomisaki, Cape Muroto, and Cape Ashizuri, respectively. These heights, which correspond to outer ridges, change trends from N-S near shore to NE-SW near prism slopes. Seafloor surveys at the Daini-tenryu and the Daini-atsumi knolls show well-developed carbonate crust exposures and large Calyptogena colonies by methane seep (Kuramoto et al., 2001; Ashi et al., 2004). Methane hydrate BSRs are widely distributed at the both areas, and hydrate dissociation and methane seep seems to be caused by fault activities and uplifts. The Ashizuri knoll has the similar tectonic background as those knolls and shows development of methane hydrate BSRs on the multichannel seismic profiles. In order to study the active methane seep in the Ashizuri knoll, the research cruise by MMAJ (now JOGMEC) R/V Hakurei-maru No.2 was conducted as a part of the METI project for deep sea survey technologies for natural resources.

The Ashizuri knoll with ENE-WSW elongation consists of NE-SW trending ridges showing right-stepping, en echelon arrangements. These structures are caused by northwestward subduction of the Philippine Sea plate. Dextral strike slip displacement is assumed at the landward dipping thrust fault south of the knoll. Large chemosynthetic biological communities and active bubbling were discovered by the deep sea camera near the summit of the knoll. More detailed seafloor investigations show developments of white bacterial mats at the northern flank of the knoll suggesting large methane flux. Bottom seawater chemistry indicates high methane contents and thermogenic origin. Calyptogena shells around the summit of the knoll show white, white-yellow and white-gray colors. Most of white colored clams are standing vertically and alive now. In contrast, white-yellow and white-gray colored clams often show dead open shells. These observations suggest intermittent activities of cold seepage. Carbonate crusts are distributed around the summit of the knoll and have a large number of preferred oriented cracks caused by extension at fold axis, en echelon cracks and shear planes. Exposures of carbonate crusts indicate active uplift of the knoll because carbonate rocks were originally formed by oxidation of seeping methane within the sediments below the seafloor.