

Cruise Summary

1. Cruise information

- Cruise Number: NT09-07
- Ship name: Natsushima
- Title of cruise: Deep Alkaline Serpentine Aquifer Exploration of South Chamorro Seamount by ROV Hyper Dophin
- Chief Scientist & Representative of Science Party: Ken Takai (SUGAR project, Japan agency for marine-earth science and technology (JAMSTEC))
- Title of proposal: Is truly an active seafloor microbial community in deep serpentinite mud of the South Chamorro Seamount? —Geochemical, Biogeochemical and Microbiological Investigation for the Mystery in Deep Formation Fluid by CORK—
- Science Party: Junichi Miyazaki, Hisako Hirayama (SUGAR project, JAMSTEC), Yuki Morono (Kochi Institute for Core Sample Research, JAMSTEC), Shinsuke Kawaguchi (Precambrian Ecosystem Laboratory, JAMSTEC), Kengo Kubota (Tohoku University), Ryuichi Aoyagi (Safety and Environmental Management Office, JAMSTEC), Geoff Wheat (Univ. of Alaska, Fairbanks), Craig Moyer (Western Washington Univ.), Satoshi Okada (Nippon Marine Enterprises)
- Cruise period: 21 May, 2009 ~ 03 June, 2009
- Port call: JAMSTEC (21 May, 2009) ~ Guam (27 May, 2009 – 28 May, 2009) ~ Guam (03 June, 2009)
- Research Area: South Chamorro Seamount in Mariana forearc

2. Overview of observation

- Purposes: The primary scientific objective of this research project is to clarify whether a true active seafloor microbial ecosystem is present and functioning in the seafloor environment of the Mariana Forearc South Chamorro Seamount or not.
- Backgrounds: In 2001, Ocean Drilling Program (ODP) expedition Leg#195 was conducted to obtain the samples of serpentinization-derived fluids, rocks and mud in the South Chamorro Seamount located in the Mariana Forearc, approx. 140 km east-northeast from the Guam Island. The geochemistry characterization of the pore-water samples demonstrated that the seafloor environment of the South Chamorro Seamount is an extreme environment of which pH reaches to pH12.5, the strongest hyperalkaline in this planet. Meanwhile, the microbiological exploration suggested interesting but somewhat contradicting image of the seafloor biosphere. Based on the

culture-independent surveys, there were detected hot spots of microbial populations at several depths while the culture-dependent surveys indicated the occurrence of active microbial communities in the very shallow subsurface. The seafloor environment under pH12.5 is marginal for the microbial habitability (the highest pH limit for microbial growth is known as pH12.4). If the active microbial communities are present in the habitats, the communities might be sustained from oxidation of methane which was originally produced by the serpentinization of peridotite and the subsequent Fisher-Tropsch-Type reaction. To clarify these questions, this research project will focus on the seepage fluid from the seafloor environment. At NT09-01 cruise, we deployed seafloor *in situ* colonization system. In this cruise, NT09-07, we will recover it, and will re-challenge seafloor water sampling.

- Methods, Instruments: WHATS (Water and Hydrothermal-fluid Atsuryoku Tight Sampler), Bag Sampler, Succession sampler, Deep sampler (Pressure-tight *in situ* Fluid Sampler), Bio Sampler (Seafloor *in situ* colonization system), Vacuumed tight water sampler
- Research results: We were succeeded to recovering the *in situ* colonization system which was deployed at NT09-01 cruise. We will try to cultivate and analyze microorganisms which were captured to it and clarify the ecosystem of deep seafloor of hyperalkaline seafloor ecosystem of South Chamorro SeaMt. And we also tried to sample seafloor water using both Deep Sampler which was improved after NT09-01 cruise and new rolling system. We found that these system worked well. We will analyze the data and samples obtained in both NT09-01 and this NT09-07 cruise and clarify the ecosystem of deep hyperalkaline seafloor of South Chamorro SeaMt.