

Cruise Summery

1. Cruise information

- Cruise Number: NT09-01
- 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, Tomoo Watsuji (SUGAR project, JAMSTEC), Fumio Inagaki, Yuki Morono (Kochi Institute for Core Sample Research, JAMSTEC), Katsunori Yoshida (Safety and Environmental Management Office, JAMSTEC), Geoff Wheat (Univ. of Alaska, Fairbanks), Jeff Seewald (W.H.O.I.), Bill Kirkwood (M.B.A.R.I.), Tom Pettigrew (Mohr Engineering), Craig Moyer, Sean McAllister (Western Washington Univ.), Misumi Aoki (Nippon Marine Enterprises)
- Cruise period: 8 January, 2009 ~ 28 January, 2009
- Port call: JAMSTEC (8 January, 2009) ~ Saipan (13 January, 2009 ~ 16 January, 2009) ~ Guam (28 January, 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. In ODP Leg#195, a CORK (a kind of seal cap of a drilled hole) was deployed at one of the boreholes. The CORK had a valve through which we are able to obtain the non-diluted seafloor serpentinization-derived fluids. Using a JAMSTEC ROV HYPER-DOLPHIN, the pristine seafloor fluids will be sampled by way of the CORK.

- Methods, Instruments: Valve connector, WHATS (Water and Hydrothermal-fluid Atsuryoku Tight Sampler), W.H.O.I. fluid sampler, Bag Sampler, Succession sampler, Deep sampler (Pressure-tight *in situ* Fluid Sampler), Deep Bio Sampler (Seafloor *in situ* colonization system), Vacuumed tight water sampler
- Research results: In this cruise, we succeeded in (1) pulling an old dummy logger, (2) replacing a new PVC manifold with pressure sensor socket, (3) deploying a flow meter, (4) collecting close to non-contaminated highly alkaline, deep crustal water, (5) undergoing SIP and RIP experiments and (6) deploying *in situ* colonization devices in the deep crustal fluid. The only thing not successfully carried out was collecting a deep source fluid at a depth of 150 m below seafloor by using a newly developed deep borehole fluid sampler (DEEP SAMPLER). The data obtained from the deployed tools at the seafloor and obtained from the future onshore investigation will be integrated with the ones that will be taken during the coming cruise planned in May, 2009. The combined data from the two successive cruises with R/V Natsushima and ROV HyperDolphin will provide important insights into a key question: are the functionally microbial communities truly present in the serpentinized-derived, extremely alkaline deep crustal fluid flows?