Is truely hyperalkaline subseafloor microbial ecosystem present in serpentinized-formation fluid?

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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, appox. 140 km east-northeast from the Guam Island. The geochemistry characterization of the pore-water samples demonstrated that the subseafloor 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 subseafloor 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 subseafloor environment under pH12.5 is marginal for the microbial habitability. If the active microbial communities are present in the habitats, the communities might be sustained from methane, formate and/or short hydrocarbons which was originally produced by the serpentinization of peridotite and the subsequent Fisher-Tropsch-Type reaction. Thus, the previous geomicrobiological investigations provided two important questions: (1) are the active (living) microbial populations are truly present in the hyperalkaline subseafloor environment and (2) what kinds of geofuels the ecosystem is sustained by?

To clarify these questions, we focused on the deep crustal formation fluid from the subseafloor environment. In ODP Leg#195, a CORK was deployed at one of the boreholes. Using a JAMSTEC ROV HYPER-DOLPHIN, the pristine subseafloor fluids were successfully sampled by way of the CORK (NT09-01 cruise) in January, 2009. The pH of the deep crustal formation was pH12.3 and it contained lots of methane and sulfide. Based on interdisciplinary analytical and experimental approach, we will clarify the questions described above. In this presentation, I will introduce the geochemical and microbiological backgrounds of the deep crustal fluid flow system in the South Chamorro Seamount, Mariana Forearc and will overview our recent cruise conducted in January, 2009.