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Geochemical-microbial processes in hydrothermal sediments, Ambitle Island, Papua New Guinea

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Submarine hydrothermal systems are of inherent interest to microbial and geochemical investigations of the deep Earth. These systems are a physical link between the surface and subsurface biospheres, and have major implications for our understanding of subsurface ecology, the origins and evolution of life on Earth, and studies of Astrobiology. The inorganic geochemistry of shallow submarine hydrothermal fluids offshore Ambitle Island, Papua New Guinea has been extensively characterized [1,2]. However, investigations concerning the relationship of the system's geochemistry, including the influence of high arsenic concentrations (up to 1000ppb) [1], to the macroscopic and microscopic biological communities have escaped attention until now.

An expedition took place in November 2003 to investigate the geochemistry and thermophilic microbial communities in the hydrothermal vents offshore Ambitle Island. A location approximately 2.5m from a vent source (77.2 °C at the surface) was chosen for a 60cm vertical sediment profile. A 47cm long sediment core was retrieved and subsamples were removed from 5 differently colored sections, potentially representing a varying degree of redox potential. Preceeding the cruise, published geochemical data [2] were used to design environmentally-relevant aqueous growth media for microbial culturing. These media were inoculated with sediment, and incubated on site. Tubes of each sediment subsample were frozen for later DNA extraction. In addition, pore water was slowly extracted *in situ* at intervals of 0, 10, 20, 40 and 60cm, using a multi-port pore fluid sampler.

Pore fluids show an increase in DOC with depth, from 3.2 ppm C at the surface to 38.9 ppm C at 60cm. In addition, microbial culturing proved successful in several As-bearing media. Based on these results, two subsamples that correspond to the DOC sample depths of 10 and 40 cm were chosen for bulk DNA extraction and subsequent 16S rRNA clone library construction. Archaeal and bacterial community structures will be presented and interpreted within the context provided by DOC analyses, As concentrations, and other geochemical parameters.

References

[1] Pichler, T. *et al.* 1999. *Env.Sci. Tech.* **33**:1373-1378.
[2] Pichler, T. and Veizer, J. 1999. *Chem. Geol.* **162**:15-31.