Core Logging Operations of Oman Drilling Project aboard the D/V Chikyu

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Serpentinization is the metamorphic alteration of ultramafic lithology via hydration and oxidation. This process produces free energy in the form of molecular hydrogen and, in the presence of carbon (largely DIC), short chain hydrocarbons including methane[1,2]. On earth, serpentinizing systems are thought to support microbial ecosystems in diverse settings including submarine hydrothermal systems, ophiolites, and continental mélange terrains[3–8]. Serpentinites have also been detected on the surface of Mars, may exist below the icy crusts of Europa and Enceladus, and are likely to exist throughout the cosmos at large[9–13]. Thus, serpentinizing systems represent a promising astrobiological system and are of high relevance to any assessment of extraterrestrial habitability.

As a member of the NAI-funded Rock Powered Life (RPL) team, I have used spectroscopy to study serpentinites and their interactions with organic material as an on-going part of my masters alongside Dr. Dawn Cardace at the University of Rhode Island. Traveling to Oman and acting as part of the Oman Drilling project, I have assisted RPL in acquiring valuable samples of serpentinizing peridotite from the Samail ophiolite in Oman. However, most of the material extracted during the several years of OmanDP work (including thin sections taken adjacent to RPL samples) were analyzed in only a few short summer months aboard the D/V Chikyu in Shimizu Japan.

Participation in Logging activity aboard the Chikyu granted early access to data collected during the logging despite a standard two-and-a-half-year moratorium applied to all non-participants. This data continues to be of high value to RPL-team members in on-going efforts to understand the extent and context of the terrestrial deep biosphere associated with serpentinizing systems and applying findings to extraterrestrial habitability. Core material from the Oman Drilling project represents the most pristine samples of terrestrial serpentinites ever collected and will serve astrobiologists as analogs for potentially habitable terrestrial environments for years to come. I will personally characterize core material via spectroscopy (FTIR and Raman) to investigate organo-mineral interactions to inform our understanding of how biosignatures may form and degrade in the context of serpentinization. This research is targeted at informing future robotic exploration including the SHERLOC instrument aboard the Mars 2020 rover.

In addition to lending valuable manpower and expertise to a project of incredible importance, my personal understanding of the geochemical and structural context of serpentinites was sizably augmented from exposure to daily data reports from the team at large, personal use of instrumentation, and constant discourse with experts in the field of serpentinization. I was also given the opportunity to forge new and strengthen existing bonds with colleagues from parallel fields of study based at institutions from around the globe. Initiatives like are the glue that enable collaborations across disciplines and borders.

The D/V Chikyu run by JAMSTEC, is a floating geological exploration drill rig, and state of the art core description laboratory.

Core description team works with core boxes to aid interpretation of the Samail ophiolite structure. Left to right: Margerite Goadard, Joseph Aslin, and Manuel Menzel.

Geochem team and portions of the vein, and administration team dressed in safety gear to tour the drilling sections of the ship. Left to Right: Alexander Sousa, Wenlu Zhu, Ryoko Senda, Lotta Ternietin, Kanchana Kularalne, Aida Farough, Gabriel Valera, Claire Aupart, Jon Zaloumis, Mahmood Al-Sarmi, Uli Harms, Saeybul Choi.

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