Geophysical Research Abstracts
Vol. 18, EGU2016-8645, 2016
EGU General Assembly 2016

Scientific Drilling in the Samail Ophiolite, Sultanate of Oman

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The Samail ophiolite in Oman, a block of oceanic crust and upper mantle that was thrusted onto the Arabian continent ~100 million years ago and subsequently tilted and eroded, is an excellent field laboratory to explore rock forming processes that occurred near the surface down to 20 km depth in the Earth's interior. The exposure of these rocks to surface conditions provides a large reservoir of chemical potential energy that drives rapid reactions, heat generation, expansion and cracking.

The Oman Drilling Project will address long-standing questions regarding mantle melting, melt transport and crystallization of lavas at ocean spreading ridges to form ocean crust, determine the nature and extent of chemical interactions between the oceans and newly formed oceanic crust, improve our understanding of CO_2 and H_2O uptake via weathering to form hydrated minerals and carbonates including reaction-driven cracking mechanisms as well as explore serpentinite-hosted microbial ecosystem. With funding from the International Continental Scientific Drilling Program (ICDP), U.S. NSF, NASA, IODP, Sloan Foundation and Deutsche Forschungsgesellschaft in place, we will address these objectives via observations on core, geophysical logging, fluid and microbiological sampling, and hydrological measurements in a series of newly drilled boreholes. Preliminary surveys showed that active low-T alteration of upper mantle rocks is an ongoing process. Dissolved hydrogen and methane concentrations in fluid samples collected in existing boreholes are up to 1.3 and 8 mmol/l, respectively [1]. Regarding the physical, chemical and biological processes related to near surface alteration of mantle rocks, a multi-borehole test site will be established in the southern massif of the Samail ophiolite. This test site will facilitate in-situ studies of water-rock-microbe interactions. Technical details and potential opportunities will be discussed.