Hydrothermal systems in Iceland: systematic trends and experimental observations of fluid-rock interactions

Dana Thomas

Jackson School of Geosciences, The University of Texas at Austin

10100 Burnet Road, Bldg 196, Austin, Texas, 78758

dthomas@jsg.utexas.edu

Dr. Dana Thomas is a geochemist with interests in fluid-rock interactions of hydrothermal systems, energy systems and ore deposits. She received her PhD from Stanford University in 2018, focusing on field and experimental observations of reactions between CO_2-rich fluids and basalts, with a lens towards understanding the effects of hydrothermal alteration on CO_2 sequestration in basaltic rocks. She has expertise in fieldwork and lab work related to aqueous geochemistry, as well as extensive experience with experimental techniques, including batch and flow-through style experiments, and imaging techniques such as micro-X-ray computed tomography. She is currently a Program Coordinator with GeoFORCE, an experiential geoscience education outreach program within the Jackson School of Geosciences and works to enhance the diversity of the geosciences by supporting students in their academic and professional pursuits..

Abstract: Hydrothermal systems in Iceland are among the most well studied on Earth. They provide opportunities to explore mid-ocean ridge rifting subaerially and offer insight into fluid-rock interactions potentially representative of early Earth environments. Detailed field investigations have identified geochemical and mineralogical trends consistent among active and fossil basalt-hosted systems. This talk will review the general characteristics of Icelandic hydrothermal systems as reflected in the rock record and by fluid chemistries. Particular focus will be on the forms and consequences of fluid-rock interactions during hydrothermal alteration as evidenced by temperature-dependent mineralogical zones that progress with depth, the water and gas compositions in meteoric and seawater systems and the evolution of porosity and permeability within basaltic lava piles. I will present compilations of geochemical parameters such as pH, total dissolved solids content and major and trace element concentrations of fluids from low-temperature, high-temperature and CO_2-rich areas to illustrate the combined effects of temperature and ionic strength on element cycling. Field systematics provide context for comparison to observations during basalt core flow-through experiments. These experiments utilized multiple scales of imaging to identify the connections between porosity, permeability, surface area and mineral accessibility during CO_2-rich fluid flow. Observed cation release rates relative to predicted rates showed the importance of hydrothermal minerals as sources of divalent cations through cation exchange with a saline (0.1 M NaCl) fluid. The talk will conclude by presenting outstanding research questions related to the lifecycles of magmatic-hydrothermal systems and their relevance to Martian geochronology.