OBSIP Experiment Archive

Year:	2016
Experiment Name:	Hydrothermal Dynamics of Yellowstone Lake (2016) Response of Continental Hydrothermal Systems to Tectonic, Magmatic, and Climatic Forcing
Principal Investigator(s):	Robert Sohn (WHOI)

Experiment Summary: (Taken from the NSF Abstract Award #1516361): Continental hydrothermal systems have immense scientific and practical significance and are critically important to the Earth?s thermal budget and geochemical cycles. Continental hydrothermal systems are a primary source of economically important metal deposits, provide geothermal resources, support exotic ecosystems that are just beginning to be explored, and in some settings pose a significant geologic hazard via hydrothermal explosions. The subsurface conditions and processes that control these systems are poorly understood because they entail the flow of multi-phase and multi-component fluids through rocks with heterogeneous permeability fields that are perturbed by a multitude of geological and environmental processes. Carefully designed multidisciplinary field experiments and modeling efforts are required to understand the coupled processes that drive these dynamic systems and control their response to geological and environmental forcing. This project is focused on quantifying the response of continental hydrothermal systems to tectonic, magmatic, and climatic processes operating on time-scales from seconds to thousands of years. The PIs address important and timely scientific questions, such as:

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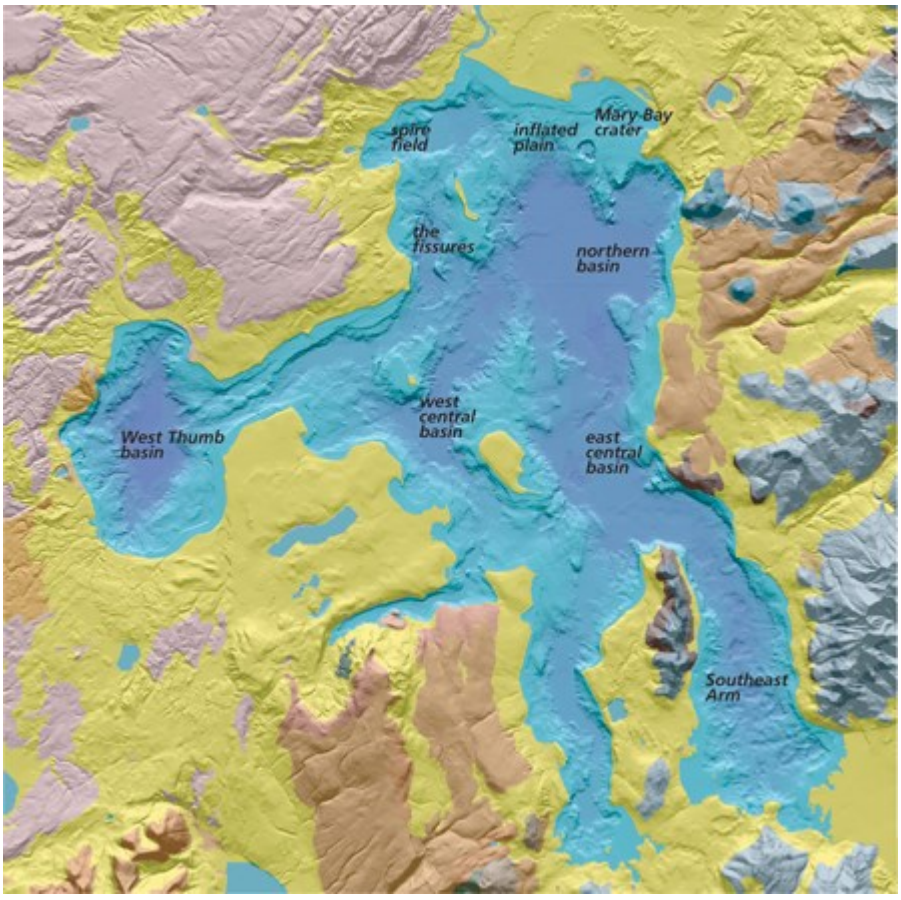

Lakebed geology of Yellowstone Lake (Lisa Morgan/USGS).

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Cruises:
7/8/2016 - 7/11/2016:
One WHOI instrument was deployed via R/V Annie and recovered to test the recovery system that was modified for freshwater use.
7/13/2016:
Two WHOI instruments were deployed via R/V Annie.
8/21/2016:
Two WHOI instruments were recovered via R/V Annie.
8/17/2017:
Ten WHOI instruments were deployed via R/V Annie.
8/11/2018 - 8/13/2018:
Ten WHOI instruments were recovered via R/V Annie.

Data:
Data from all OBSIP instruments deployed will be archived under temporary network code YL at the IRIS DMC.

Downloads/Links:

HD-YLAKE Website

"Bubblephone" Test

Eos Article

Yellowstone Lake Geology

Experiment Summary: ... How do multi-phase fluids and dissolved constituents flux through hydrothermal systems? How do these systems redistribute elements to produce mineral deposits and microbial habitats? How do earthquakes and magmatic activity perturb hydrothermal systems? What triggers hydrothermal explosions? How do environmental processes and climate affect continental hydrothermal systems?

The study will involve a combination of fieldwork, data analysis, and modeling. The field program uses a combination of innovative instrument networks and sediment coring activities that will be integrated through modeling activities to study the response of the Yellowstone Lake hydrothermal system to tectonic, magmatic, and climatic forcing. Yellowstone Lake is an ideal site for this research because it hosts an active hydrothermal system located in a region with high levels of tectonic and magmatic activity that has been influenced by a broad range of climate conditions in postglacial times. Research activities will include components of geochemistry, seismology, geology, geodesy, heat flow, micropaleontology, limnology, paleoclimatology, statistics, analytical modeling, and numerical modeling, all of which are essential for unraveling the coupled processes that drive system behavior. Working on a lake-floor system provides an exceptional opportunity to study forcing-response relationships on an expanded range of time-scales spanning more than 11 orders of magnitude.