

A Concept Proposal for a Buoy Observatory at 9° 50' N on the East Pacific Rise.

*Maya Tolstoy¹, Stace Beaulieu², Del Bohnenstiehl¹, Suzanne Carbotte¹, Milene Cormier¹, Dan Fornari², George Luther³, Rich Lutz⁴, Lauren Mullineaux², Mike Perfit⁵, Andreas Thurnherr¹, Meg Tivey², Tim Shank², Costantino Vetriani⁴, Karen Von Damm⁶, Felix Waldhauser¹, Spahr Webb¹, and William Wilcock⁷.

¹*Lamont-Doherty Earth Observatory of Columbia University, 61 Route 9W, Palisades, NY 10964*

²*Woods Hole Oceanographic Institution, Woods Hole, MA 02543*

³*University of Delaware, 700 Pilottown Rd., Lewes, Delaware 19958*

⁴*Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901*

⁵*University of Florida, Gainesville, Florida 32611*

⁶*University of New Hampshire, 39 College Road, Durham, NH 03824*

⁷*University of Washington, Box 357940, Seattle WA 98195-7940*

**Please note – we expect to add additional authors for the final proposal.*

Mid-Ocean Ridges (MOR) are one of the most fundamental geological features of Earth – they are where two-thirds of the surface of our planet form. They also are host to chemosynthetic biological communities that may provide insight into how life started on our planet as well as how it may exist on other planets. In this regard, the MOR system, from mantle to microbe, is of great significance, and has been the subject of extensive study through the NSF Ridge and Ridge2000 programs. Ridge2000 is a multidisciplinary program involving micro- and macro-biologists, geochemists, geologists, geophysicists and physical oceanographers. The work includes extensive interdisciplinary fieldwork, monitoring, and integration with modeling. However, despite a long history of concerted investigations, fundamental accretionary events at MORs have not been 'caught in the act' by *in situ* sensors.

The Ridge2000 program has focused efforts at three primary 'Integrated Study Sites' (ISS). The 8°-11° N East Pacific Rise (EPR) site has been a focal point of interdisciplinary ridge research since a fresh eruption was discovered in 1991 during a series of Alvin dives. With a focused 'bull's-eye' area at 9°48-9°52'N, monitoring efforts at the site currently include: time-series sampling of vent fluid temperature, chemistry, and vent fauna; monitoring of seismicity, geodetic deformation and tidal pressure; and a study of oceanographic and topographic influences on larval dispersal. In addition, crustal structure is being carefully mapped through magnetotelluric studies, 3-D multichannel seismics and compliance measurements. Modeling studies and a microbial weathering study are also underway.

The EPR-ISS therefore represents a relatively well understood MOR site, where the next leap in understanding this critical global system can best come from an associated leap in the technical capabilities of site monitoring. In particular, the ability to detect and respond to events in near-real time could lead to significant advances in our understanding of seafloor biological, chemical, geological and physical processes. In

addition the same suite of monitoring instruments will provide a valuable time series of processes and interactions.

We therefore propose to utilize a buoy capable of providing power to and communicating data in near-real time to and from a suite of seafloor instruments focused on monitoring and responding to events on in the 9°48-9°52 region and nearby areas. This instrumentation will include, but is not limited to: temperature probes, in situ chemical sensors, current meters, seismometers, geodetic sensors, time lapse photography, video plankton imaging, automated water sampling, and response AUVs.

In addition to providing the opportunity to take MOR science to the next level, a buoy observatory at 9°N on the EPR would also provide deep current information for ENSO monitoring, complementary to the TAO array data, and real-time access to the pressure gauge array which has the potential to provide a tsunami warning system. A seafloor laboratory with live web-based data has many potential educational and outreach applications that could be utilized by the well developed Ridge2000 E&O program. This proposal therefore has broader impacts that are significant for other science disciplines and for society.

PI Contact:

Maya Tolstoy (Lamont-Doherty Earth Observatory of Columbia University)

Email: tolstoy@ldeo.columbia.edu

Phone: 845-365 8791

Fax: 845-365 8179

List of Participants (may increase):

Stace Beaulieu

Del Bohnenstiehl

Suzanne Carbotte

Milene Cormier

Dan Fornari

George Luther

Rich Lutz

Lauren Mullineaux

Mike Perfit

Andreas Thurnherr

Meg Tivey

Tim Shank

Maya Tolstoy

Costantino Vetriani

Karen Von Damm

Felix Waldhauser

Spahr Webb

William Wilcock

Potential Reviewers:

Jim McClain (UC Davis)

Jim Childress (UCSB)

Stacy Kim (MLML)

Dave Chadwell (SIO)

Bob Dziak (OSU/NOAA-PMEL)