

PHOENIX

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CRUISE PROSPECTUS  
R/V MELVILLE  
JULY 1992 - SEPTEMBER 1992

*Robert A. Knox*

Robert A. Knox, Associate Director, SIO

## PHOENIX EXPEDITION

### R/V *Melville*

#### Leg 01

C. de Moustier, Scripps Institution  
of Oceanography  
Sea Beam 2000 Calibration Cruise  
San Diego - Acapulco  
7-16 July 1992

Calibration of Sea Beam 2000  
including water gun profiling  
along the west coast of Mexico

#### Leg 02

R. Batiza University of Hawaii at Manoa  
H. P. Johnson University of Washington  
Petrologic Temporal Variation Tests  
Rockdrill Tests  
Acapulco - Manzanillo  
20 July - 16 August 1992

Dredging, magnetics, Sea Beam 2000  
and Rockdrill tests at the  
East Pacific Rise 9°30' - 13°21'N.

#### Leg 03

P. Lonsdale Scripps Institution of Oceanography  
Guadalupe Island Cruise  
Manzanillo - San Diego  
18 August - 2 September 1992

Sea Beam 2000, magnetics, and  
Single-channel seismic refraction  
west of Guadalupe Island.

## Underway Geophysical Data Collection

R/V MELVILLE (1992):

I.D.	Dates	Days	Chief Scientist(s)	Ports
Leg 1:	7 Jul -16 Jul	10	de Moustier	San Diego - Acapulco Sea Beam (w/SB Proc); Gravity (transit mode) Magnetometer (yes); Seismic profiler (yes)
Leg 2:	18 Jul - 14 Aug	31	Batiza UH/Johnson/UW	Acapulco - Manzanillo Sea Beam (transit mode); Gravity (transit mode) Magnetometer (yes); Seismic profiler (no)
Leg 3:	18 Aug-2 Sep	17	Lonsdale	Manzanillo - San Diego Sea Beam (w/SB Proc); Gravity (transit mode) Magnetometer (yes); Seismic profiler (yes)

## Contact:

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**R. Batiza, University of Hawaii at Manoa  
Petrologic Temporal Variation Tests  
Acapulco to Manzanillo  
18 July - 14 August 1992  
Leg 02**

In order to understand the dynamic, time-varying aspects of magmatic processes below mid-ocean ridges, off-axis sampling is needed. Morphologic and theoretical lines of evidence indicate that magma supply to medium and slow spreading ridges is episodic. This episodicity is thought to occur on time scales of  $\geq 100$  Ka and to have a petrologic signature. We proposed a field and laboratory study of off-axis flow line sampling to test for such petrologic temporal variability. In order to avoid the petrologic complications that exist near the large East Pacific Rise EPR offset, we have chosen to conduct the study at the EPR at  $9^{\circ}30' - 13^{\circ}21'N$ . Our current plan is to depart Acapulco and proceed to the EPR at  $9^{\circ}30'N$ , then proceed northward to the EPR at  $13^{\circ}21'N$  and then proceed to Manzanillo.

To distinguish the petrologic effects of small offsets (devals) from the effects of temporal variability we plan to do transects (East-West) at three latitudes, probably  $9^{\circ}30'$ ,  $10^{\circ}10'$ , and  $13^{\circ}21'$  on both sides of the EPR. Each transect will be  $\sim 100$  km long and will involve Sea Beam, magnetics and sampling (dredging mainly). In total we are planning to do 160 dredges. Based on previous experience on several cruises (2-3 hours per dredge), this is quite feasible in a 23 day cruise devoted to sampling. With a sample spacing of 1-2 km, it should be possible to easily detect temporal petrologic variability occurring on time scales of  $\geq 100$  Ka. A study such as this one is essential to resolve apparently contradictory evidence for the existence of temporal variability in the petrology of oceanic crust less than 1 Ma in age. Determining whether the composition of ocean crust varies episodically, quasi-periodically or not at all is of fundamental importance to understanding the processes by which the crust is created. This study will answer this question and provide important evidence for the causes of the observed behavior.

**H.P. Johnson, University of Washington  
Rockdrill Tests  
Acapulco to Manzanillo  
18 July - 14 August 1992  
Leg 02**

The following describes two components: (A) use of the UW Rock Drill (to supplement the Batiza geochemical sampling effort) and (b) a detailed magnetic study of the EPR - using surface-towed magnetics (obtained during the Batiza pre-sampling survey) and rock magnetic studies on the Batiza/geochemical samples.

**(a) Magnetism Component - A High-Resolution Magnetic Study of the East Pacific Rise**

Recent marine geological and geophysical studies show that there is a wide range of variation in crustal magnetization present near the zone of formation at spreading centers. This variation may be caused by alteration of the magnetic minerals, rock geochemical composition, the addition of secondary magnetization, or geomagnetic field behavior. The detailed study of the variation of oceanic crustal magnetization, in the area near the axis of spreading, can tell us a great deal about both the crustal formation and evolutionary processes. Specifically, magnetic studies can tell us about the (a) spatial distribution of the crustal alteration associated with fluid flux, (b) determine crustal thickness (ie, magnetic source layer thickness), (c) map extrusive rock geochemistry (for FeTi-enriched rocks), both on the surface and below the surface veneer, and (d) provide a quantitative measure of the rate of low temperature oxidation of the upper crustal layers. We are proposing to characterize the sources of this variation with a detailed study of the magnetization of the extrusive rocks obtained from the East Pacific Rise near the region between 9° and 12°N. The magnetization of the surface rocks will be quantitatively compared with that obtained by the inversion of the sea surface magnetic anomalies.

**(b) UW Rock drill - An Extension of the Sampling Program into Older Ocean Crust**

We will be adding the sampling capability of the University of Washington Rock Drill to the Batiza/geochemical program on the East Pacific Rise. The UW Rock Drill, which is able to penetrate and sample 3-meter cores from extrusive volcanic rock, will enhance the present program by adding the capability to penetrate sediment cover and thick manganese coatings in older crust, allowing sampling to be continued from the present dredge-limit at 1 million years out to at least 2 million year old crust. In addition, the oriented cores of the rock drill will allow paleomagnetic measurements to determine (within limits) the timing of the volcanic eruptions, and constrain specific geochemical models. Further, the 3-meter penetration of the drill may allow the sampling of more than one cooling unit at a sampling site, in the proper stratigraphic sequence, an ability not available during dredging. Finally, the use of the UW drill during this cruise will allow us to test several recent major mechanical and electrical modifications, and to demonstrate the operational readiness of the sea floor rock drill.

## Scientific personnel Leg 02:

1. Dr. Rodey Batiza, University of Hawaii, Chief Scientist
2. Mr. William A. Boger, University of Hawaii, Graduate Student/RA
3. Mr. Chad Braden, University of Hawaii, U/G Student-Volunteer
4. Mr. James Charters, UCSD/SIO/STS, Computer Technician
5. Mr. Ronald Comer, UCSD/SIO/STS, Resident Technicians
6. Ms. Janet A. Cushing, University of Hawaii, Graduate Student/RA
7. Dr. Robert Duncan, Oregon State University, Professor
8. Mr. William Gallahan, Oregon State University, Graduate Student/RA
9. Dr. David Graham, Oregon State University, Scientist
10. Mr. Adam Haile, Harvard, U/G Student-Volunteer
11. Mr. Bryan Halbert, University of Washington, Engineer
12. Mr. Earl Heckman, UCSD/SIO/STS, Hardware Technician
13. Ms. Kelina Isaacs, University of Hawaii, U/G Student-Volunteer
14. Mr. Phillip Janney, UCSD/SIO, Graduate Student/RA
15. Dr. H. Paul Johnson, University of Washington, Professor
16. Dr. Jill Karsten, University of Hawaii, Professor
17. Dr. Yaoling Niu, University of Hawaii, Scientist
18. Ms. Cassi Paslick, University of Michigan, Graduate Student/RA
19. Dr. Janet Pariso, University of Washington, Post-Doc
20. Ms. Robin Peterson, University of Hawaii, U/G Student-Volunteer
21. Dr. Terri Plake, Western Washington University, Professor
22. Ms. Renee Rice, Windward Community College-Oceanic Institute, Research Technician
23. Mr. Scott Semyan, University of Washington, Technician
24. Ms. Sarah Sherman, University of Hawaii, Graduate Student/RA
25. Mr. Christopher Sinton, Oregon State University, Graduate Student/RA
26. Mr. Thomas Stein, University of Washington, Engineer
27. Ms. Robin Stephani, Evergreen State, U/G-Student Volunteer
28. Ms. Darcy Van Patten, University of Washington, U/G-Student Volunteer
29. Mr. Jeffrey Yee, University of Hawaii, U/G-Student Volunteer