



# MARGINS 2009 Review

## 5. Education and Outreach



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## 5.1 MARGINS Education and Outreach (E&O) Summary

The MARGINS education and outreach effort has been primarily focused at the college level: on undergraduate students, graduate students, and early-career post-doctoral researchers. This emphasis was chosen because the teaching duties of many MARGINS investigators provide direct access to undergraduate students and courses, and to their graduate student advisees; content and materials suitable for undergraduates are scalable to community college and K-12 audiences as well as to graduate-level courses; and, it facilitates partnerships with other groups that tend to focus at the K-12 level and on informal science such as ODP, EarthScope, IRIS, and museums.

Prior to the mid-term review of the MARGINS program, successful E&O activities established by individual investigators and their home institutions included:

- Seagoing studies of Neil Driscoll and others in spring 2004 in the Source-to-Sink Gulf of Papua focus site (<http://sio.ucsd.edu/png/>). Subsequently held a three-day short course at the university in PNG on data analysis-interpretation, and donated computers and software for continued research;
- Web page activities by David Hilton for event response field programs to Central America in 2001 (<http://sio.ucsd.edu/volcano/>) and the IBM focus site in 2004 (<http://sio.ucsd.edu/marianas/>);
- Web page development for a multi-scale seismic imaging program of the Mariana Subduction Factory in 2002-2003 (<http://www.geo.ua.edu/MARIANA/>);
- Spanish-language public outreach to under-represented groups by Joann Stock (RCL) in the Los Angeles area with interview segments in print, TV, radio media;
- Individual principal investigators incorporating undergraduates in their research programs.

The MARGINS Office contributed to educational activities through more formal efforts:

- Coordinates the NSF-funded MARGINS Post-Doctoral Fellow program established in 2003 (see Appendix);
- Establishes a “Best Student Paper” competition at the 2003 Fall AGU. It was expanded to become the broader MARGINS Student prize, judged by past and current members of the MARGINS Steering Committee and award for the best talk and best poster at each Fall AGU. Recipients recognized each spring in the MARGINS newsletter;
- Compile and publish a six-monthly widely-distributed MARGINS Newsletter (<http://www.nsf-margins.org/Publications/Newsletters/Newsletter.html>);
- Features education and outreach featured as a separate article in each issue of the MARGINS newsletter since Fall 2004;
- Organizes a MARGINS Student Reception and Community Forum at Fall AGU for graduate students to mingle with investigators;
- Makes available on the MARGINS web pages downloadable PowerPoint files for presentation given at MARGINS-sponsored workshops and theoretical institutes.

The mid-term review of MARGINS in 2004 identified the need to elevate education and outreach

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activities into a coordinated programmatic effort. In response to recommendations from that review, the Steering Committee established the MARGINS Education Advisory Committee (MEAC), with membership described in the previous chapter. This committee instigated a multi-directional, coordinated approach to education and outreach activities:

- Continuing MARGINS Office efforts listed above;
- MARGINS Distinguished Lectureship Program, in 2005, described in section 5.4.
- “Collaborative Research: Using MARGINS Research Data Resources in the Classroom: Developing and Testing Multidisciplinary Mini-Lessons” proposal funded by the NSF Course Curriculum, and Laboratory Improvement (CCLI) program (See section 5.2);
- Associated with the CCLI award, faculty workshops focused on the development of Mini-Lessons were held in Arlington, VA (2007) and Orlando, FL (2008);
- Education-focused sessions held at MARGINS-sponsored workshops (IBM 2007, SEIZE 2008);
- Education-focused workshops on data resources held at the 2007 GSA Annual and Fall AGU meetings;
- Special Session at Fall AGU 2007 on the MARGINS CCLI project results;
- Five-day short course on reflection seismology held at Universidad de Costa Rica by Steve Holbrook;
- Incorporation of MARGINS database resources in MARGINS education effort:
  - Data portal (<http://www.marine-geo.org/portals/margins/>)
  - GeoMapApp (<http://www.geomapp.org/>)
  - Virtual Ocean (<http://www.virtualocean.org/>)
  - Geochemistry databases (<http://www.geoinfogeochem.org/>);
- Annual NSF Post-Doctoral Fellowship competition. See following Section.



## 5.2 MARGINS Mini-Lesson Program

Meetings of the MARGINS Education Advisory Committee culminated in a proposal submitted to the NSF Course Curriculum, and Laboratory Improvement (CCLI) program in Spring 2006, to bring MARGINS Science to the classroom, entitled Collaborative Research: Using MARGINS Research Data Resources in the Classroom: Developing and Testing Multidisciplinary Mini-Lessons

The MARGINS Mini-Lesson project has two objectives: 1) the development and classroom testing of MARGINS teaching modules, including some assessment of the most effective formats and classroom delivery methods for MARGINS content; and 2) the engagement of MARGINS researchers/faculty and geoscience educators in the construction and testing of the modules, toward seeding a “community of practice” in the paired educational and research uses of the results of MARGINS projects.

Principal Investigators on the award are Geoff Abers (MARGINS Chairman), Don Reed (San Jose State University), and Cathy Manduca (SERC – Science Education Resource Center at Carleton College), with a Co-PI sub-award to Jeff Ryan at the University of South Florida.

The project was awarded December 2006, and the first workshop to develop these undergraduate web-

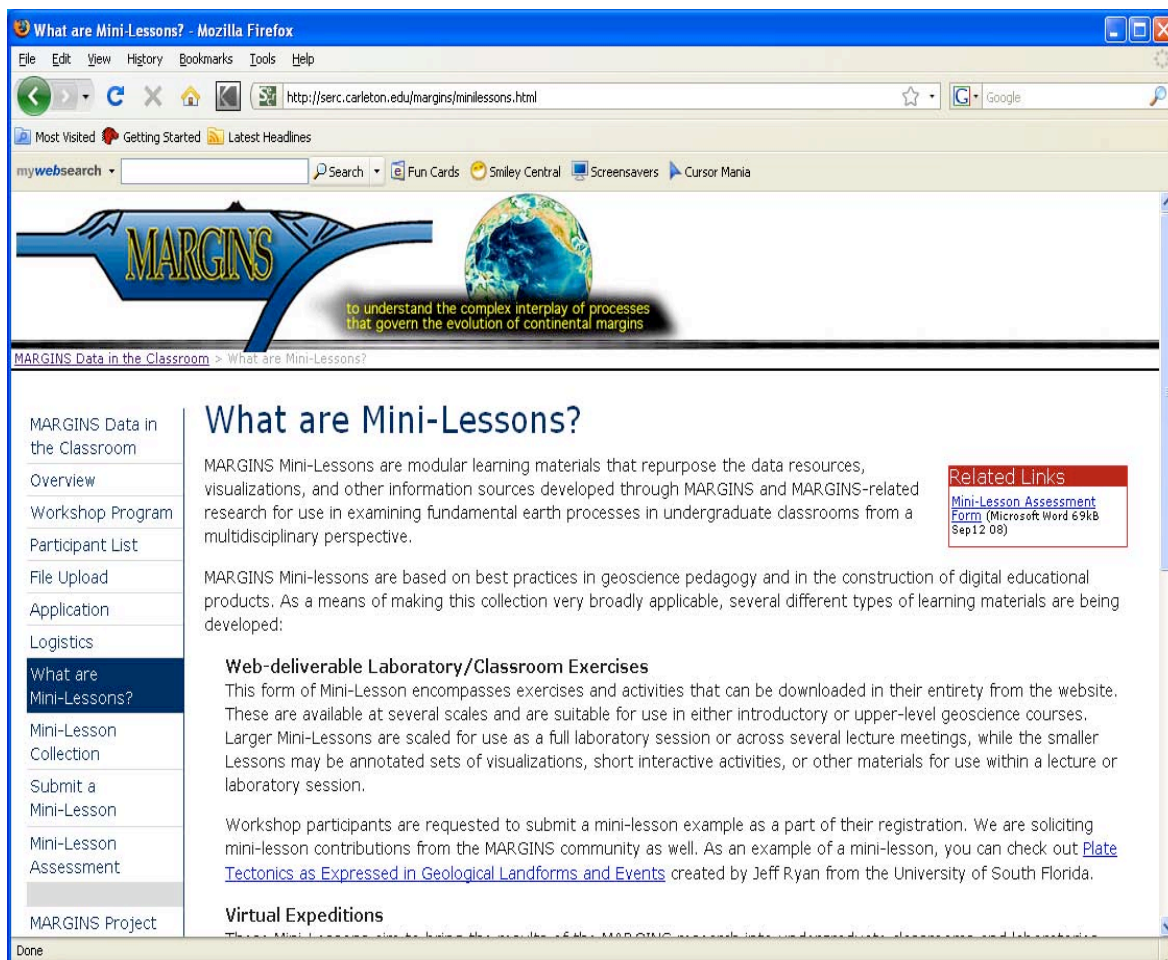


Figure: View of MARGINS mini-lessons web page

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based learning modules – called MARGINS “Mini-Lessons” – was held in April 2007. The twenty-seven participants included MARGINS investigators and steering committee members, geoscience educators and curriculum developers, and database representatives. A subsequent short workshop targeting researchers in the Source-to-Sink initiative was held at the AGU-ASLO Ocean Sciences meeting in March, 2008, with eighteen participants. Project PI Reed and Co-PI Ryan served as co-conveners of the 2008 SEIZE workshop and the 2007 MARGINS/IFREE IBM workshop, respectively, specifically to bring education- and Mini-Lesson project-related activities onto the agendas of these events as a way to engage a broader portion of the MARGINS research community.

The resultant Mini-Lessons span a range of MARGINS science and use MARGINS research data, as well as GeoMapApp – the data visualization tool freely available through MGDS. The Mini-Lessons can be used as teaching aids within a lecture or class session, or as the basis for an entire teaching module. Complete Mini-Lessons are openly available at the host web site (<http://serc.carleton.edu/margins/minilessons.html>) and a number are under construction. Current Mini-Lessons include:

- Introductory Geology - Testing plate tectonics in the Gulf of California
- Basic sequence stratigraphy using seismic reflection lines from Gulf of California MARGINS projects
- The Woodlark Basin as a Natural Laboratory for the Study of the Geological Sciences  
*This activity guides the students through a set of geological problems related to the Woodlark Basin, Papua New Guinea.*
- Chemical Inputs and Outputs at Subduction Zones  
*Students use data from geochemistry databases to analyze inputs and outputs associated with arc volcanism.*
- A tour of the Mariana Subduction System  
*This lesson presents a brief tour of the Mariana subduction system, an active continental margin in the west Pacific.*
- What Can (and Cannot) Be Learned from Scientific Drilling Using Examples from Margins Initiatives
- Profiling Earth’s Surface using GeoMapApp  
*Students relate large-scale features on Earth’s surface to lithospheric plates, the underlying asthenosphere, earthquakes, and volcanoes.*
- Volcano Spacing in Volcanic Arcs
- Physical and Chemical Variations Along the Central American Volcanic Arc  
*The Central American volcanic arc displays large arc-parallel variations in chemical composition that yield important clues concerning the complex origin of magmas in subduction zones.*
- Where is California Going?
- Connecting Cross-Sectional Data from the Red Sea to Plate Tectonics  
*Students will use map views and cross-sectional profiles across the Red Sea to determine plate tectonic processes in the region.*
- Burial, compaction, and porosities in a subduction zone  
*Students look at how sediments compact as they are buried in a subduction zone and explore how rapid burial can lead to increased water pressure.*

- Online Investigation of an Island Arc Volcano: Anatahan, Mariana Arc  
*This activity is a web investigation and petrologic examination starting with the 2003-present Anatahan volcanic eruptions in the Mariana arc, and concluding with a petrologic examination of published ...*
- Plate Tectonics as Expressed in Geological Landforms and Events  
*Students analyze global data sets on earthquake and volcano distributions seeking to identifying major plate boundary types in different regions on the Earth.*

Current efforts are aimed at completing all planned mini-lessons, and the initiation of field-testing of the materials by MARGINS-interested teaching faculty in 2009.

The mini-lessons workshops served to strengthen links between MARGINS Education and Outreach efforts and those of several of the data management facilities that handle MARGINS data: the MARGINS data portal group which is developing GeoMapApp (<http://www.marine-geo.org/portals/margins/>, <http://www.geomapapp.org/>) and the EarthChem initiative (<http://www.geoinfogeochem.org/>).

### 5.3 Distinguished Lectureship Program

The MARGINS Distinguished Lectureship Program (DLP) was established in 2005 as an education and outreach initiative to broaden access to and interest in MARGINS science by enabling leading MARGINS investigators to visit a diverse range of schools. In its first two years, the Steering Committee chose one speaker per Initiative per year, with each speaker visiting 3-4 schools and offering both a public lecture and technical talk. To reach a broad community, smaller schools and those not normally associated with MARGINS research have been specifically targeted. Due to overwhelming demand from potential host institutions, the number of DLP speakers was almost doubled beginning in 2007 with speakers from the preceding series agreeing to stay on for a second round.

Year	# applicant institutions	# schools visited	# DLP speakers
2005	93	11	4
2006	62	12	4
2007	72	28	7
2008	43	24 (scheduled)	6

For the completed 2005-2007 series, 15 speakers visited a total of 51 institutions. Examples of comments on feedback forms for 2007-2008 DLP speakers:

**Karen Fischer:**

- Outstanding talk, which was very well received. Dr. Fischer also spent considerable time with the students.
- I thought this was a good experience for all. Dr. Fischer and I continue to communicate regarding some of her research related to the FLED project and the potential for Earthscope projects in the future.

**Peter Kelemen:**

- Dr. Kelemen gave an outstanding lecture at our general audience (undergrad sciences student dominated) series. The Geology undergrads were captivated by his capacity to weave interesting science with “tales of adventure” from the field.

**Casey Moore:**

- Thank you so much for running this program. It’s a great opportunity to promote interdisciplinary science to our students as well as bring a scientist with expertise outside our small department to campus!

**Chuck Nittrouer:**

- I think the MARGINS Distinguished Lecture Program is an excellent program that allows small departments like ours to bring in renowned speakers at the top of their fields. This helps not only students in the department, but also the faculty.

**Pat Wiberg:**

- MARGINS has organized an excellent seminar series. It helps in a great way to a small department like us. We appreciated it a lot.

The MARGINS Office coordinates applications, travel schedules, the collection of feedback, and pays for airfare and other transit expenses. Schools cover local costs associated with the visit.



## MARGINS Distinguished Lectureship Program Summary

Year	Speaker		Lecture Titles
2008– 2009	Donna Shillington	RCL	<b>Public:</b> Recipe(s) for continental breakup. <b>Technical:</b> An abrupt along-strike transition from magma-poor to magma-rich rifting in the eastern Black Sea. <b>Schools Visited:</b> Kutztown Univ., TAMU, Univ. of Kentucky
2008-2009	Greg Hirth	SEIZE	<b>Public:</b> Understanding earthquakes processes at the microscopic scale. <b>Technical:</b> The rheology of real rocks. <b>Schools Visited:</b> Texas Tech Univ., Univ. of Texas at El Paso, Utah State Univ., Cal State Northridge, CICESE, SDSU, UCSB
2008-2009	Tim Dixon	SEIZE	<b>Public:</b> Unraveling Earth's Largest Earthquakes Using Space Techniques <b>Technical:</b> Comparing Short and Long Term Deformation as Recorded by Geodesy and Geology. <b>Schools Visited:</b> Dickinson College, PSU, Randolph College, Miami-Dade College
2008-2009	David Mohrig	S2S	<b>Public:</b> Application of Earth Science and Engineering to Maintenance of the Mississippi River Delta. <b>Technical:</b> Comparing the Evolutions of Lowland Rivers and Submarine Channels. <b>Schools Visited:</b> Indiana Univ., Indiana-Purdue Univ., Fort Wayne, Indiana-Purdue Univ., Indianapolis
2008-2009 2007-2008	Pat Wiberg	S2S	<b>Public:</b> Transport and fate of DDT on the Palos Verdes shelf, CA: a source-to-sink story. <b>Technical:</b> Formation and preservation of event-scale stratigraphy in the coastal ocean. <b>Schools Visited:</b> Idaho State Univ., Montana Tech, Willamette Univ., UMD Center for Env. Science, FIU, UNC at Wilmington, Univ. of Pittsburgh, Vanderbilt Univ.
2008-2009	Simon Klemperer	SF	<b>Public:</b> Building continental crust in the Subduction Factory. <b>Technical:</b> Crustal structure and evolution of the Mariana intra-oceanic island arc. <b>Schools Visited:</b> Colorado State Univ., Southern Methodist Univ., Univ. of Arizona
2007– 2008	John Hopper	RCL	<b>Public:</b> Massive volcanism during Earth's history from breaking continents apart. <b>Technical:</b> The Newfoundland-Iberia Rift System: Insights into crust and mantle processes of breakup and early seafloor spreading. <b>Schools Visited:</b> Case Western Reserve Univ., Colorado School of Mines, Univ. of Miami, Univ. of Tennessee
2007–2008 2006-2007	Daniel Lizarralde	RCL	<b>Public:</b> Different ways continents tear apart. <b>Technical:</b> Controls on extensional style: magma, slab windows, sediment, and geology in the Gulf of California. <b>Schools Visited:</b> Cal State Sacramento, SFSU, Univ. of Alabama, Virginia Tech, East Carolina Univ., UNC Chapel Hill, Valdosta State Univ.
2007 –2008 2006-2007	Casey Moore	SEIZE	<b>Public:</b> Subduction zone superlatives: how plate convergence causes the largest earthquakes, the largest tsunamis, and the largest mountains. <b>Technical:</b> Where have all the earthquakes gone? Finding paleoseismogenic faults in mountains of mélangé. <b>Schools Visited:</b> Colorado College, Grand Valley State Univ., Juniata College, Kansas State Univ., Univ. of Missouri-Columbia, Youngstown State Univ., TAMU, Trinity Univ., Univ. of Houston
2007–2008 2006-2007	Charles Nittrouer	S2S	<b>Public:</b> Writing Earth history with continental-margin sedimentary processes. <b>Technical:</b> The ties that bind Source to Sink: within and between New Guinea and New Zealand. <b>Schools Visited:</b> Bowling Green State Univ., Univ. of Delaware, Univ. of Florida, WVU, Boston College, The Richard Stockton College of New Jersey, Univ. of Maine
2007–2008 2006–2007	Karen Fischer	SF	<b>Public:</b> Where plates collide: The origin of volcanos and earthquakes in subduction zones. <b>Technical:</b> Mantle structure, dynamics and melting in the Central American subduction zone. <b>Schools Visited:</b> Georgia Southwestern State Univ., Univ. of Arkansas, Univ. of Georgia, Univ. of Kansas, Crossroads Academy, Dartmouth College, UC Davis, Western Washington Univ.
2007– 2008	Peter Kelemen	SF	<b>Public:</b> (a) Origin and evolution of continental crust. (b) The future of geological exploration: Why, and Show? <b>Technical:</b> (a) Arc lower crust: The Talkeetna Continental Dynamics Project. (b) A viscous shear heating mechanism for intermediate depth earthquakes. <b>Schools Visited:</b> Central Michigan, Skidmore College, SUNY-Oswego, Univ. of Colorado
2005- 2006	Neal Driscoll	S2S	<b>Public:</b> Reading Earth history from the geologic record. <b>Technical:</b> Dispersal systems in actively deforming regions: Papua New Guinea has it all! <b>Schools Visited:</b> Montana State Univ., North Dakota State Univ., Univ. of North Dakota
2005 –2006	Terry Plank	SF	<b>Public:</b> Recycling within the Subduction Factory. <b>Technical:</b> The effect of water on mantle melting at subduction zones. <b>Schools Visited:</b> Boise State Univ., Humboldt State Univ., Univ. of Alaska, Fairbanks
2005 –2006	Susan Schwartz	SEIZE	<b>Public:</b> Great Earthquakes and Tsunamis: Causes and Effects. <b>Technical:</b> Seismic, Geodetic and Fluid Flow Constraints on Seismogenic Zone Processes in Costa Rica. <b>Schools Visited:</b> Bates College, Brooklyn College, Univ. of New Hampshire
2005 –2006	Joann Stock	RCL	<b>Public:</b> Plate tectonics and how continents split apart. <b>Technical:</b> Defining the continent/ocean boundary: Insights from active rifts. <b>Schools Visited:</b> College of Charleston, UNC Charlotte

## 5.4 NSF MARGINS Post-Doctoral Fellowship Program

As part of its regular MARGINS Solicitation, NSF has since 2003 included a Post-Doctoral Fellowship Program, designed to support promising early-career scientists in conducting MARGINS-related research. Post-docs identify an advisor, whose home institution submits the proposal, to provide mentoring. Several early MARGINS post-docs have gone to faculty or research positions, and some are now MARGINS PIs.

The NSF MARGINS Post-Doctoral program announcement is in the Supporting Documents section. The Appendix includes interviews with post-doctoral fellows, including project summaries and lists of publications arising from the Fellowship.

### MARGINS Post-Doctoral Fellowships since program inception:

2008

- **Heather Savage**, The effect of frictional properties in subduction zones on earthquake triggerability, University of California, Santa Cruz.  
Advisor: Emily Brodsky.

2007

- **Ben Holtzman**, Deciphering the Role of Melt Segregation and Strain Partitioning in Rifting Continents, Lamont-Doherty Earth Observatory of Columbia University.

2006

- **Jeremy Boyce**, Exploring the Record of Magmatic Volatiles in a Volcanic Arc via H, C, F, S, and Cl in Apatite, Arizona State University.  
Advisor: Richard Hervig.

2004

- **Jennifer Garrison**, Time-scales and mechanisms of differentiation of mafic parents to rhyodacite in Central America, University of Iowa.  
Advisor: Mark Reagan.  
Now: Assistant Professor at California State University, Los Angeles.

2003

- **James Conder**, A Numerical Investigation of the Relative Importance of Different Melting Mechanisms at Volcanic Arcs, Washington University, St Louis.  
Advisor: Douglas Wiens.  
Now: Senior Research Associate, Washington University, St. Louis.

2003

- **Alison Shaw**, Constraining the Volatile and Slab Flux in the Izu-Bonin-Mariana MARGIN Using Geothermal Fluids, Phenocrysts and Melt Inclusions, Carnegie Institution of Washington.  
Advisor: Erik Hauri.  
Now: Assistant Scientist, Woods Hole Oceanographic Institution.

2003

- **Glenn Spinelli**, The Role of sediment diagenesis and dewatering on fluid and heat flow, Costa Rica margin, University of Missouri-Columbia.  
Advisor: Michael Underwood.  
Now: Assistant Professor, New Mexico Tech.