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# MARGINS/ GeoPRISMS

Newsletter # 25, Fall 2010

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# MARGINS Chair Report Fall 2010

*Geoffrey Abers, Outgoing Chair, MARGINS Steering Committee*
*Lamont-Doherty Earth Observatory of Columbia University*

At the beginning of this October the MARGINS Program segues into GeoPRISMS, and after four years I step down as Chair of the MARGINS Steering Committee. It has been a very busy, productive time, seeing major research results emerge from across the program, novel synthesis activities, the Decadal Review, and also the successful writing of a Draft Science Plan for GeoPRISMS. And, many meetings- over 700 distinct people have shown up at MARGINS-sponsored workshops during this time. All this would have not been possible without herculean efforts by the staff of the MARGINS Office, first at Boston University (Cary Kandel and Pamela Lezaeta) and then at Lamont after a rapid move (Niva Ranjeet, Andrew Goodwillie, Karen Benedetto and Kristen Woodford). It has been a pleasure to work with them, and I am tremendously appreciative of their efforts. Also, the success of the program, its scientific accomplishments, and the strong case made for a successor would not have been possible without tremendous support from the MARGINS community, and the efforts of the many meeting organizers and writers, and the continued sage advice from the staff of the National Science Foundation. Thanks to all of you for making this a highly rewarding and successful four years.

I would like to give a special thanks to the numerous members of the MARGINS Steering Committee who served over the last several years. This group has, voluntarily and often with considerable commitment of time, put tremendous effort into many tasks. These range from regular assessment of progress in each of the MARGINS Initiatives, to recruiting and helping conveners run critical workshops, to judging Student Prize competitions, to orchestrating and contributing an enormous amount of writing that generated both the Decadal Review and subsequent Draft Science Plan. Personally, I have enjoyed our meetings; the group has also been a pleasure to work with, both in the meeting room and after hours, maintaining an environment of healthy collegiality that made my job easier. Members rotate every three years, so I would be remiss if I did not thank two members who are completing their terms with me, Cynthia Ebinger and Nathan Bangs – both have been instrumental in seeing MARGINS evolve into GeoPRISMS. Several new members join the others, as the MARGINS Steering Committee has transformed into the GeoPRISMS Steering and Oversight Committee (full membership is listed

## PROGRAM TRANSITION

### From MARGINS to GeoPRISMS

On October 1st, 2010, the MARGINS program moved to Rice University in Houston, Texas and has transitioned to GeoPRISMS. The MARGINS website will remain active and a new GeoPRISMS website is also available: www.geoprisms.org

*Contact the Office at:*
*The GeoPRISMS Office*
*Rice University, MS 121*
*P.O. Box 1892*
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Chair: Julia Morgan (Contact information on page 19) on p. 19 of this Newsletter, as of Oct. 2010). This excellent group should steer GeoPRISMS well.

I would like to give special thanks and wish well Julia Morgan, who is now Chair of the inaugural GeoPRISMS Steering and Oversight Committee, and is managing the first GeoPRISMS Office at Rice. The transition is well underway as of this writing, already the listserv and webpage has migrated to Rice (*www.geoprisms.org*), with a long-awaited complete redesign. The Lamont staff continues through Fall 2010 to support MARGINS/GeoPRISMS activities, ramping down gradually as Rice staff start, including the publication of this Newsletter, managing the RIE Implementation Workshop in November, and several other ongoing activities. We expect by the end of calendar year 2010 the Rice Office will be fully staffed and we can completely transfer responsibilities away from Lamont. Best of luck to those leading GeoPRISMS now; the program is in great shape.

Finally, looking forward, it is important to recognize the challenges that GeoPRISMS faces. Federal budgets likely will be tight for the foreseeable future, and a focused program such as GeoPRISMS has to compete with a wide variety of new and continuing activities across Geosciences at NSF. It must establish and maintain a clear program identity, and articulate its purpose clearly; what makes GeoPRISMS distinct from core funding and what will it accomplish that is unattainable through core NSF programs? It will be critical to stay focused on large scientific problems but also ones well-positioned for major advances in the next several years, where focused application of resources will bring clear benefit. These opportunities will need to be elucidated and also continually re-evaluated, to make sure that the program continues to be relevant and stays healthy. Part of this challenge is to continually look for ways to productively grow the community, seek new ideas, and aim for inclusiveness where possible. The other part is to ask the right questions and clearly articulate approaches to addressing them. There is tremendous potential within the Draft Science Plan written earlier this year, the challenge is to take full advantage of that potential.

# From the Program Manager: Thanks MARGINS!

*Bilal U. Haq*

*For the GeoPRISMS Program - National Science Foundation/GEO/OCE*

As of September 30th 2010 the MARGINS Program concluded after twelve years of very productive tenure. It leaves behind a significant body of work and the entire MARGINS community is to be congratulated for this proud scientific legacy. The MARGINS Program worked because of the deep and continuous interest of the community in its planning and well being, remarkable stewardship by the Steering Committees and exceptional leadership and attention to details provided by the Committee chairs. Continuous infusion of new blood into the program kept it vigorous to the very end and it passes on an inter-disciplinary, vital and, in large part, a youthful research community to the successor program, GeoPRISMS. It is fitting that these valuable MARGINS traditions continue and be strengthened within the new program. The out-going MARGINS Steering Committee chair, Geoff Abers and the entire MARGINS Office staff (Niva Ranjeet, Andrew Goodwillie, Karen Benedetto and Kristen Woodford) worked tirelessly, especially over the last two years of a very busy period of reappraisals and brain-storming for the new program. Our thanks to them for a job very well done!

The baton is now passed on to the new program, with the office at Rice University and Julia Morgan at the helm of the reconstituted GeoPRISMS Steering and Oversight Committee. NSF welcomes the new office and chair to the demanding challenges ahead. Clearly there will be an even busier period of intellectual gestation in the upcoming months, while the community ponders the details of two initiatives, Rift Initiation and Evolution (RIE) and Subduction Cycles and Deformation (SCD), at the upcoming "implementation workshops". NSF expects that these meetings will allow the broader Geoscience community to participate and impact future science plans of RIE and SCD, while devoting equal attention to implementation strategies. The latter have to be practical and doable, within the existing fiscal, technical and logistical realities. NSF would especially like to see a prioritization of the science questions within the timing and funding constraints, and the implementation plan to include a choice of primary sites, where the best science can be accomplished and commence without delay.

The GeoPRISMS Program remains amphibious in approach with both on-land and offshore components and will thus continue to be supported by both the Divisions of Earth and Ocean Sciences at NSF. For the last two review cycles MARGINS funding has largely focused on synthesis and integrative studies and on future planning activities. It is hoped that with the availability of detailed science plans for the two initiatives in FY2011, future funding will revert back to field programs and individual research projects as envisaged in the new GeoPRISMS science documents. Thus, it is imperative that the implementation workshops are broadly attended and contributed to by all stake-holders so that the resultant science plans (like those for the MARGINS Program) are beneficial to all of the Earth Science community for a further decade of compelling margins-related research.

# MARGINS Steering Committee Highlights

*29-30th April 2010, NSF Headquarters, Arlington, VA*

*Compiled by Andrew Goodwillie*

The bulk of the last MARGINS Steering Committee (MSC) meeting was devoted to in-depth discussion of the many aspects of transition from MARGINS to a new NSF-funded GeoPRISMS program.

## 1) Committee/Office Activities

Chairman Geoff Abers was formally thanked by MSC members and NSF program managers for his long and invaluable service to MARGINS. Abers, in turn, thanked committee members for their efforts on the GeoPRISMS Draft Science Plan, and briefly summarised activities of the MARGINS Office. Since the last meeting, Office staff helped organise the 2009-2010 Distinguished Lecture series and the Feb 2010 MARGINS Successor Planning Workshop (MSPW) – the largest meeting yet coordinated by the Office (see Newsletter #24). The MARGINS AGU Student Prize was again successful and the joint reception/townhall event attracted a big turn out. Staff also took part in the forward-looking education planning meeting, and in the compilation of the GeoPRISMS Draft Science Plan, MARGINS Newsletter, and on-line bibliography.

## 2) NSF Program Manager Report

National Science Foundation Officers Bilal Haq, Ian Ridley, Rodey Batiza and Bob Detrick updated the committee on NSF matters.

- NSF Director Arden Bement is leaving. A search for his replacement is ongoing. David Conover takes over from Julie Morris as OCE Division director, with Phil Taylor as interim division director.
- NSF program officers had received positive feedback from many MSPW attendees, and were impressed by the diversity of participants, particularly graduate students, young PIs, and the number of early-career speakers.
- For Fiscal Year 2010, NSF saw a 10% budget increase over the previous year, with MARGINS receiving about $4M in funding.
- In the transition year from MARGINS to GeoPRISMS, transition year FY11 awards will be aimed mainly at synthesis activities. Post-transition GeoPRISMS funding will begin in FY12 with a new proposal solicitation.
- Program manager Ian Ridley outlined the new FESD: Frontiers in Earth System Dynamics program, and outlined opportunities for GeoPRISMS.
- EAR Division chief Bob Detrick highlighted aspects of EAR operations including the new electronic EAR newsletter, a promising budget outlook, and a new program aimed at training the next generation of petroleum industry earth scientists through an agreement with the AAPG Foundation.
- Rodey Batiza described the status of ocean drilling efforts. JOIDES Resolution should be operational for about 75% of the year, with Ocean Leadership pursuing additional funding options. With a new, streamlined drilling program expected to be in place in 2013, a National Academy panel has been charged with assessment of the 40-year-old drilling program. Specifically, will future drilling fulfill the promise of delivering exciting new science?
- Community Experiments: The Cascadia Facility is coming on-line with new GPS and seismometer instruments already installed, and OBS deployments expected in May 2011. All data will be freely available with some live streaming of data.
- NSF and the US Navy are discussing data access for the Pacific Northwest sea floor monitoring facilities.
- Rapid Response: NSF-funded field projects were part of an international response effort following the 2010 Haitian and Chilean earthquakes.

## 3) GeoPRISMS

For the majority of the meeting, Geoff Abers and Juli Morgan led wide-ranging in-depth discussions related to the inception of the GeoPRISMS program.

- Immediate GeoPRISMS priorities were identified: the GeoPRISMS initiative workshops, closure at MARGINS Focus Sites, and the Cascadia Facility. New opportunities were recognised at existing MARGINS sites such as CRISP drilling in Costa Rica and potential IBM drilling.
- Planning for the GeoPRISMS initiative Implementation Workshops was discussed at length. NSF requires an implementation plan for each GeoPRISMS initiative before the proposal solicitation can be created. The plan should include identification of primary sites and scientific priorities, and should be submitted to NSF by January 2011 to ensure a new solicitation in time for FY2012 funds. Timelines were carefully considered.
- There was also much discussion on how GeoPRISMS can best leverage existing and upcoming community experiments and resources, such as the Cascadia Facility, with knowledge that the sequestered GeoPRISMS funding will exist in parallel to other programs including EarthScope and the new NSF FESD program.
- Regarding funding structure, the MARGINS approach had encouraged any researcher – early-career or well-established – to equally apply for funding. The new program could involve a two-tiered system of large community-driven experiments with some smaller PI-driven projects, or some other structure.

- The charge and composition of a GeoPRISMS Steering and Oversight Committee (GSOC) was weighed.

### 4) Initiative Review

SEIZE: Sue Bilek and Nathan Bangs provided an overview of recent activity. Marshall and Spotila are conducting fieldwork on Costa Rica's Nicoya Peninsula to study neotectonics and paleoseismicity. Their award includes support for a student workshop, field school and for an REU program. Schwartz, Dixon and LaFemina continue their seismometer/GPS projects in tandem with DeShon's seismicity data compilation, and Brodsky has two post-docs working on aspects of SEIZE science. An ARRA-funded 3-D Multichannel Seismic (MCS) project (CRISP) is planned in this area for 2011. Joann Tudge, a new MARGINS postdoctoral fellow, will work with Harold Tobin on borehole logging data from Nankai. Also for that focus site, analysis of the 3-D seismic reflection data is ongoing, and GeoPRISMS opportunities may come from the planned substantial period of Nankai drilling.

RCL: Cindy Ebinger and Mike Oskin outlined the recent award to Dorsey, Oskin and Umhoefer to create a digital synthesis of Gulf of California plate reconstructions. Axel Schmitt received funding to study the origin of magmas and nature of the crust under the Salton Trough. And, the Stock/Hole large active-passive seismic source experiment is ongoing.

### 5) Related Programs, Facilities, Potential Partners

- Extended Continental Shelf surveys: Debbie Hutchinson (USGS) summarised the US efforts in submitting a claim to the United Nations for extension of the continental shelf. Bathymetric surveys along with seismic profiling, sediment coring and rock dredging work is taking place in regions of interest to the US including the Arctic, Atlantic, Bering Sea, and Marianas. Data collection will continue over a five-year period, with all data being made openly available. In Arctic areas, two-ship seismic operations conducted with Canada will see some delay in release of the data. The extended continental shelf surveys cover a wide range of geological settings and processes. MARGINS and GeoPRISMS PI's are encouraged to consider submission to NSF of proposals for piggy-back surveys as well as for projects to analyse the data already collected.
- USGS Volcano Hazards Program (VHP): John Eichelberger reported that hazard mitigation is a prominent aspect of VHP work and requires collaboration with many other agencies and groups. USGS has determined a volcano threat level, with higher-ranked volcanoes being instrumented. The Aleutian arc is of prime interest to USGS as well as being of bilateral interest with Russia. Potential relationships between USGS and GeoPRISMS include helping to characterise the arc and, the planning and coordination of an academic response to volcanic eruptions with the USGS. Expressions of community interest in USGS data sets such as seismicity and GPS data strengthen the case for open access to USGS files. MSC members encouraged a broad, interdisciplinary science workshop on Cascadia.
- R/V Marcus Langseth: Juli Morgan reported on the March 2010 workshop called Challenges and Opportunities in Academic Marine Seismology, convened by Steve Holbrook and Graham Kent to address the main issues with operating the US academic seismic research vessel. Despite many successes with the past MCS cruises, an accumulation of operational and budgetary challenges has become severe, requiring NSF and community solutions. Recommendations include an emphasis on community projects, a specific Langseth program with a pre-proposal option; a separate proposal review panel; a region-based planning process; commercial initial processing of 3-D data with swift public access to data; and, implementation of training cruises.
- Ocean Leadership: Bill Ball highlighted Ocean Leadership involvement with ocean observatories and with the new instrumentation for Cascadia for which deployments may wind down about the same time that regional cabled observatories come on-line in the Juan de Fuca area.

### 6) Education and Outreach (E&O)

Rosemary Hickey-Vargas summarised an E&O vision included in the GeoPRISMS Draft Science Plan that had stemmed from a well-attended planning meeting in Oct 2009. Recommendations were to continue and improve upon existing programs: the Distinguished Lecture series, AGU annual student prizes, MARGINS mini-lessons, and the under-subscribed post-doctoral fellowship program. New approaches for GeoPRISMS could include an REU program for undergraduates; pre-meeting symposia for grad students and post-docs; partnerships with related groups; event-based activities; and, centralised support for PIs to strengthen the broader impacts of their work. International E&O partnerships and summer bridging programs had also been considered. These wider-ranging efforts would likely require a full-time E&O coordinator. For the year of transition from MARGINS to GeoPRISMS, the committee agreed with continuation of the highly successful DLP speaker tour.

### 7) Data compliance

Following a report on the MARGINS database, NSF program manager Barbara Ransom highlighted Congress-mandated steps that would require NSF to ensure data compliance and rapid data accessibility. NSF will create a new agency-wide policy, expected for Fall 2010, which will emphasise data sets that underlie publications. It was felt that existing MARGINS data policies were more than sufficient to meet likely new requirements.

# Continental Margins and the U.S. Extended Continental Shelf Project

Deborah Hutchinson and Ginger Barth
*US Geological Survey, Woods Hole, MA and Menlo Park, CA*

## Introduction

"Margins are where the action is." With these auspicious words, the opening article of the first MARGINS newsletter began in spring, 1998. Now, a dozen years later, as the GeoPRISMS follow-on program begins, the same words resonate for studies related to the Law of the Sea Convention (LOS). The LOS is an international treaty which sets forth a comprehensive framework governing uses of the oceans. The Convention has been in effect since 1994, and there are now 157 parties to the Convention. LOS addresses many maritime issues. Just one article (Article 76) deals with the use of geological and geophysical data.

Continental margins are the areas where coastal nations, using criteria established in LOS, are defining the outer limits of the region where they can exercise their exclusive rights to explore, develop, conserve, and manage the living and non-living resources of the seafloor and sub-seafloor. Forty-three coastal nations have proposed their outer limits since 2001 (*www.un.org/Depts/los/clcs_new/commission_submissions.htm*), and another 28 have formally expressed their intention to do so (*www.un.org/Depts/los/clcs_new/commission_preliminary.htm*), generating much action and interest in renewed mapping of continental margins around the globe.

The process of defining these outer limits provides marine geoscientists excellent opportunities for collecting geological, geophysical, and hydrographic data on continental margins. The purpose of this article is to give background information on defining the outer limits, to describe the U.S. data collection effort for the last seven years, to outline what the United States plans during the next 5 years, to discuss potential synergy with the newly defined GeoPRISMS program, and finally to summarize some of the U.S. Extended Continental Shelf Project data policies.

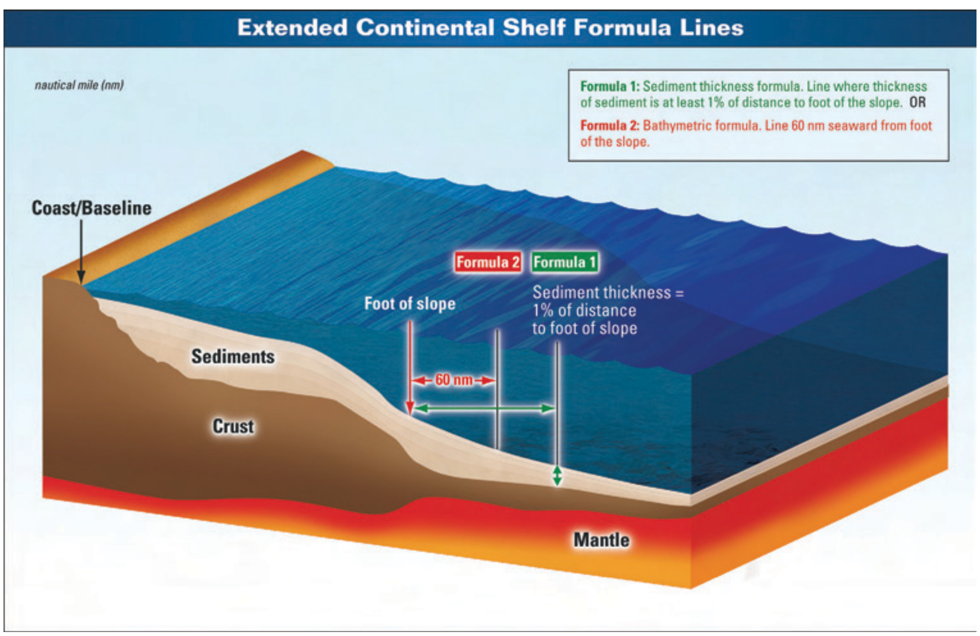


*Figure 1. Formula lines. LOS Article 76 defines two formulas for calculating the extent of the continental shelf, one based on bathymetry and the other on sediment thickness. The position of the foot of the slope is the starting point for both formulas. The bathymetric formula defines extended continental shelf to 60 nautical miles seaward of the foot of the slope. The sediment thickness formula defines extended shelf to a point where sediment thickness equals 1% of the distance from the foot of the slope. A coastal nation may use either or a combination of both of these formulas to define the ECS area extending beyond 200 nmi from the coastal baseline. (from http://continentalshelf.gov/glossary.html ).*

## The Continental Shelf and Defining its Outer Limits

Under LOS, the term continental shelf describes a maritime zone (*www.state.gov/g/oes/continentalshelf/index.htm*). It is the region of the continental margin that extends to 200 nmi (~360 km) from a coastal baseline or to a common maritime boundary. This LOS continental shelf is not to be confused with the morphological definition more familiar to most geoscientists. Because some continental margins extend beyond 200 nmi, LOS allows an extension of the "continental shelf" maritime zone beyond 200 nmi if the coastal nation can demonstrate that the criteria described in Article 76 of LOS apply. This seafloor beyond 200 nmi is informally called the extended continental shelf (ECS). The submerged land areas associated with the 200-nmi continental shelf are huge, about 60 million km$^2$ or around 20 % of the global ocean; an additional 15 million km$^2$ are estimated to be part of the extended continental shelf (Cook and Carleton, 2000).

Although LOS is an international treaty, science plays a key role within this legal framework because of the criteria for defining the outer limits of the ECS in Article 76. The continental shelf must first be a "natural prolongation of its land territory" (Article 76, paragraph 1, *www.un.org/Depts/los/convention_agreements/texts/unclos/part6.htm* ). Two formulas are provided for calculating the extent of the continental shelf. Both of the formula lines depend on identifying a foot-of-the-slope as a starting point. One of the formula lines depends upon knowing sediment thickness; the other is based on a fixed distance from the foot of the slope (Figure 1). Two constraint lines are defined, which limit the maximum extent of the ECS. One of these two constraint lines depends upon accurate mapping of the 2500-m isobath; the other is a fixed distance from the coastal baselines (Figure 2). Mapping these various points and lines determines where the outer limits of the ECS are located. While these formulas seem simple, the official technical guidelines point out that there are significant ambiguities in finding foot of the slope (in a LOS context), defining natural prolongation, distinguishing submarine ridges from submarine elevations, and determining when the 2500-m contour needs to be continuous, to cite just a few examples (CLCS, 1999).

The commission that reviews the outer limit points, the Commission on the Limits of the Continental Shelf (CLCS), recommends both multibeam bathymetry and multichannel seismic data as most appropriate for determining the foot of the slope and the formula lines, but allows for inclusion of other relevant data, such as potential field, single-beam echosounding, refraction, and sampling data. The scope of the studies used to define the outer limits of the ECS can therefore be multidisciplinary.

## U.S. ECS Data Collection Efforts 2003-2010

In 2002, the U.S. Congress solicited a report on the availability of data for defining the outer limits of the ECS. The ensuing report to Congress identified 8 major regions where the United States might have an extended continental shelf and described the resources required to define these outer limits (Mayer et al., 2002). A follow-up report expanded the description of coverage of existing seismic data (Hutchinson et al., 2004).

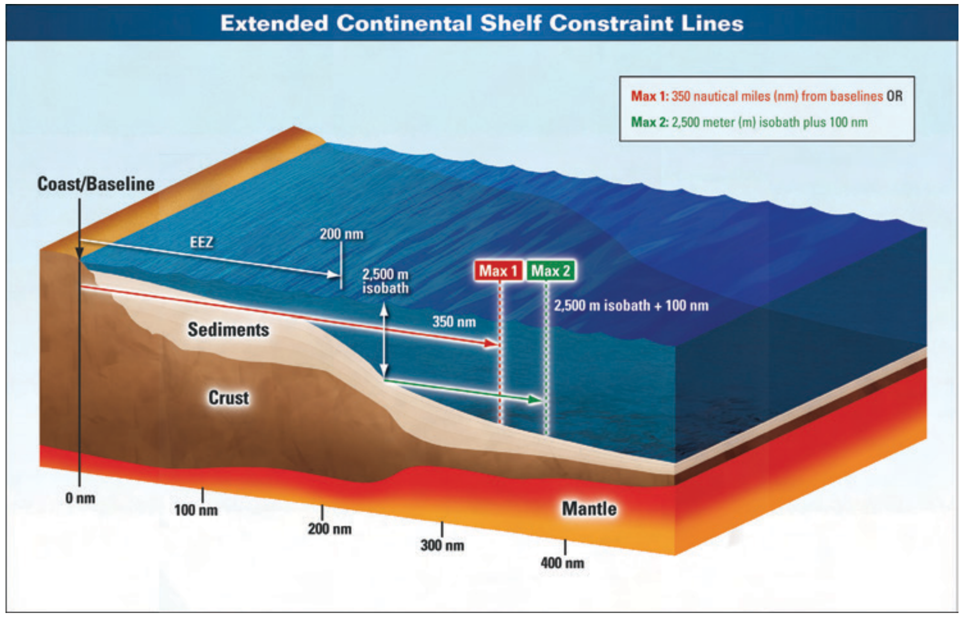


*Figure 2. Constraint lines. LOS Article 76 defines two constraint lines, which limit the maximum extent of ECS. These are applied as cutoff-lines in areas where the formula lines define ECS beyond 200 nmi. One constraint line is 100 nmi seaward of the 2500-m isobath; the other is 350 nmi from the coastal baselines (Figure 2). In cases where both constraints are applicable, a nation may use the more seaward of these constraints. Mapping formula lines and then trimming them at the constraint lines determines where the outer limits of the ECS are located. (from http://continentalshelf.gov/glossary.html)*

Congress funded an ambitious program of multibeam data collection beginning in 2003 through NOAA and the University of New Hampshire (Gardner et al., 2006). Through 2009, 14 expeditions have mapped more than one million square kilometers in the Arctic Ocean, Atlantic Ocean, Gulf of Alaska, Bering Sea, Gulf of Mexico, California margin (Mendocino Ridge), Northern Marianas and Guam region, and Hawaii (Figure 3). Bathymetric mapping programs underway in 2010 include the Line Islands near Kingman Reef and Palmyra Atoll (Gardner and Calder, 2010), Guam and N Marianas region, and the Arctic.

In 2007, an Interagency Task Force on the Extended Continental Shelf was brought together under the chairmanship of the U.S. Department of State. In an effort to systematically approach the U.S. extended continental shelf effort, this group has developed a number of documents (e.g., a strategic plan, *www.flipseekllc.com/mmsextendshelf.html*) and initiated an ongoing process of scientific and policy planning. Two significant outcomes from this more formal organization are (1) recognition that there may actually be 15 areas of potential extended continental shelf (Figure 4) that required new data along the margins of the U.S. and its Pacific islands and (2) a commitment to collect multichannel and refraction seismic data to address continuity, prolongation, and structure issues, especially for those areas where the sediment thickness formula could be applied.

To date, acquisition of U.S. ECS seismic data has taken place in the Arctic Ocean north of Alaska, collaborative with the Geological Survey of Canada which initiated a major multichannel mapping effort as part of Canada's ECS program in 2006. The U.S.-Canada collaboration began in 2008 (Hutchinson et al., 2009), with two-icebreakers working in tandem to collect coincident multibeam and multichannel seismic data. *U.S. Coast Guard Cutter (USCGC) Healy* led *Canadian Coast Guard Ship (CCGS) Louis S. St-Laurent (Louis)* and made a path through the ice for *Louis* to collect high-quality seismic data without interrupting operations to break ice, and, when the ice was too heavy for seismic operations, *Louis* led *Healy* so that high-quality multibeam data could be acquired for mapping the foot of the slope and the 2500-m isobath. During all seismic operations, sonobuoys were deployed about every 8 hours to collect wide-angle reflection and refraction data so that the travel times in the reflection data can be converted to depths for mapping sediment thickness. A second cooperative two-icebreaker seismic program was carried out for six weeks in 2009 (Mosher et al., 2009) and a third has just been completed in August-September, 2010.

The previous lack of even reconnaissance data for some of the regions of U.S. ECS interest means that the data acquired for mapping the outer limits of the ECS have huge potential for advancing scientific understanding of these generally remote regions. The Arctic is a region where lack of data, primarily due to its remote and ice-covered location, has resulted in conflicting models of how the ocean basin formed and whether oceanic crust exists (e.g., Grantz et al., 1998; Lane, 1997; Lawver and Scotese, 1990). The seismic data acquired provide regional transects across the basin and across key geophysical anomalies, including an enigmatic curvilinear gravity low that extends from the Mackenzie River to the southern extent of Alpha Ridge (Figure 5).

## U.S. ECS Data Acquisition Plans 2010-2015

Article 76 of LOS specifies that a coastal nation has 10 years following ratification during which it may submit its outer limit points. Hence, defining the outer limits of the ECS is expected to take a long time. For the U.S., data collection essentially began in July 2003 with the first multibeam cruise in the Bering Sea (Gardner, 2003). The U.S. ECS Interagency Task Force has set a goal of completing new data acquisition by about 2015. This will mean (1) the total U.S. data acquisition program will

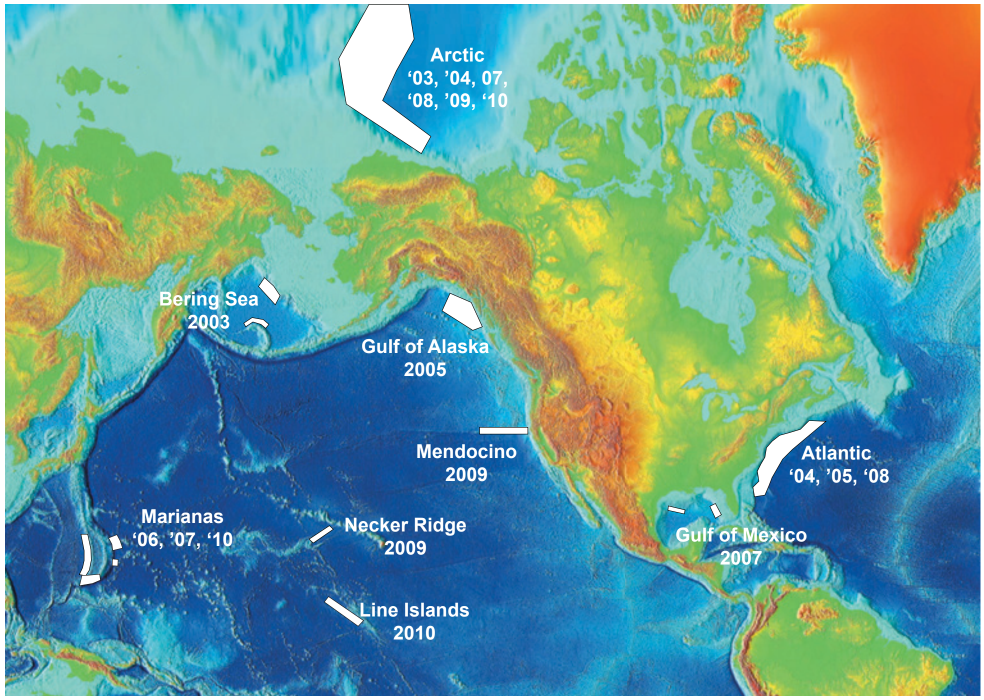


*Figure 3. Bathymetric Data collected 2003-2010. This map highlights areas where multibeam bathymetry and acoustic backscatter data have been collected 2003-2010 in support of the U.S. ECS. (modified from www.ccom-jhc.unh.edu/index.php?p=52|57&page=law_of_the_sea.php, basemap from www.ngdc.noaa.gov/mgg/image/images/g01929-pos-a0001small.pdf)*

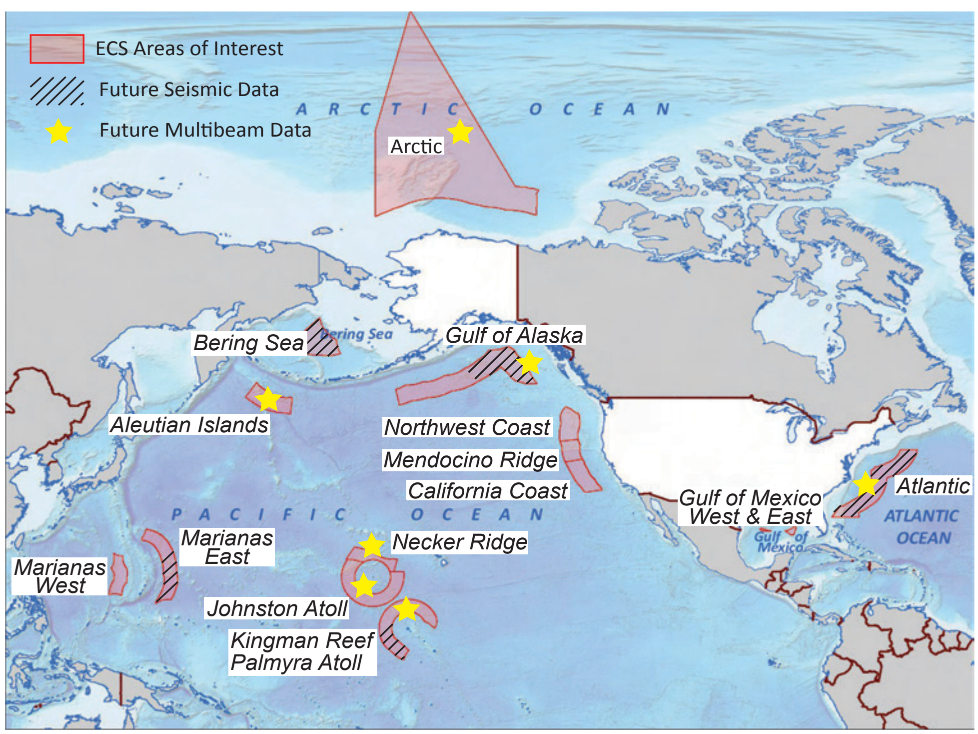


*Figure 4. ECS areas of interest and data acquisition plans, 2011-2015. Fifteen areas of interest for the U.S. ECS Project are highlighted in red. Symbols identify the general areas for expected post-2010 data acquisition for multibeam bathymetry (yellow stars) and seismic reflection/refraction data (hatched). (Figure modified from http://continentalshelf.gov/gallery.html)*

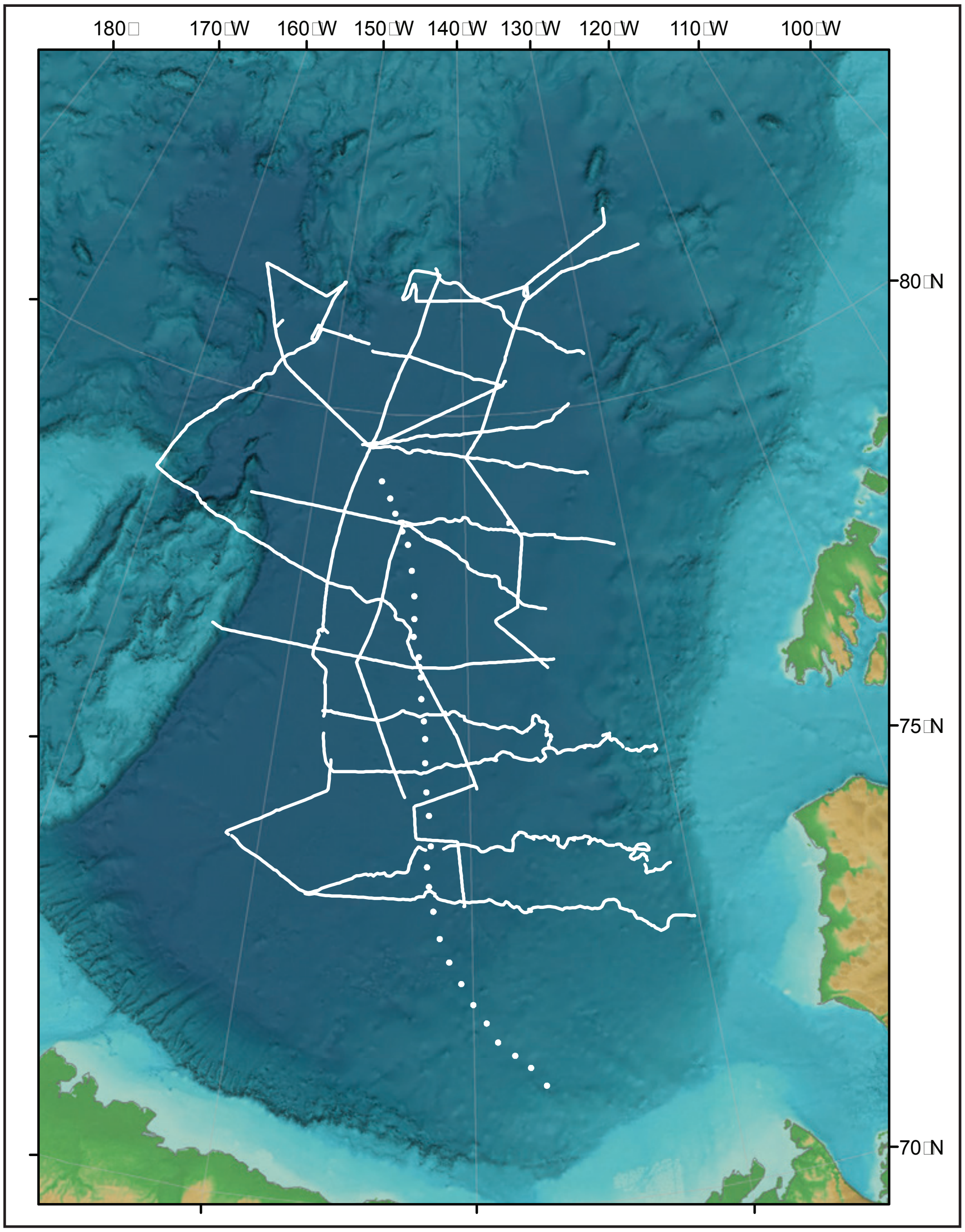


*Figure 5. ECS Arctic seismic data tracks (white) and location of the axis of a prominent linear gravity anomaly (red dotted line). This grid of seismic data collected from 2007-2009 has added ~10,000 km of reflection data in an ice-covered region where almost no data existed previously. With additional lines collected in 2010, this data set is being used to understand the enigmatic and sometimes controversial tectonic evolution of the Canada basin.*

span about a dozen years, and (2) the next five years will be especially busy with multibeam and seismic programs to finish identifying the ECS limits. The U.S. has not ratified LOS, so the 10-year window for defining the outer limits has not yet officially started.

Of the fifteen continental margin areas for possible ECS, all have need for some multibeam bathymetric data to map the 2500-m isobaths or to identify the foot of the slope. Future multibeam data acquisition is planned for the Arctic, Gulf of Alaska, western Aleutians (Stalemate Ridge); Hawaii (Necker Ridge), Atlantic margin, and Line Islands (Kingman Reef, Palmyra Atoll and Johnson Atoll) (Figure 4). Dates of many of these cruises are uncertain pending ship availability and scheduling, although the Arctic and Atlantic are the highest priorities for bathymetric data in 2011 and 2012.

There are seven identified areas of ECS interest where multichannel and wide-angle seismic reflection and refraction studies are needed. In the three areas of highest-priority (Arctic, Atlantic, and Bering Sea), sediment thickness is known to be a beneficial formula line. Three other areas may be able to use sediment thickness data and will also benefit from understanding of structural and stratigraphic relationships in the identification of natural prolongation and the foot of the slope (Gulf of Alaska, Northern Marianas, and the Line Islands). One area already has the seismic data needed to document sediment thickness (eastern Gulf of Mexico). The objectives vary with geographic region but are generally focused in the region between 200 and 350-nmi (370 – 650 km) from the coast. A notable exception is the Arctic, where mapping within the 200-nmi limit is required to show sediment continuity and where data beyond 650 km north of Alaska is warranted to define the ECS. ECS seismic data acquisition in the Arctic is due to end in 2011, with a shift to the Bering Sea and Gulf of Alaska (2011), the Atlantic (2012), and the western and central Pacific regions subsequently. Where practical, coincident gravity data acquisition is planned with all seismic data acquisition.

A minor component of the ECS program is collecting rock and sediment samples during multibeam operations when appropriate equipment is available aboard the vessel. So far, this has enabled dredge and core samples to be acquired from remote areas of the Arctic. The recovered metamorphic and volcanic rocks are being used to develop basic understanding of these poorly sampled regions (Mayer et al., 2008) and are also relevant for understanding natural prolongation.

## Synergy with GeoPRISMS

Although the ECS project has an ultimate objective of defining a national boundary, i.e., the outer limits of the U.S. ECS, the data collected have additional scientific impact that is well aligned with the two topical objectives of the GeoPRISMS Program (GeoPRISMS Draft

**Table 1: ECS Data Release Timelines, Responsible Agency, and Archive Location**

| Data Type | Time[1] | Agency | Database[2] |
|---|---|---|---|
| Seismic reflection | | | |
| - Raw data | 6 mos | USGS | InfoBank |
| - Preliminary stacks | 1 year | USGS | InfoBank |
| - Final processing | 2 years | USGS | NAMSS |
| Multibeam Bathymetry | 6 mos | NOAA-NGDC<br>UNH | MG&G<br>UNH |
| Samples[3] | | | |
| - Descriptions/Photos | 2 mos | NOAA-NGDC | MG&G |
| - Oversight period[4] | 2 years | USGS | InfoBank |
| Other Geophysical Data (navigation, gravity, etc.) | Immediate[5] | NOAA-NGDC | MG&G |

[1]*Recommended timeline for release of data pending final ECS Project approval; all times are from the end of the relevant ECS cruise.*
[2]*InfoBank: http://walrus.wr.usgs.gov/infobank/ Infobank is an inventory of USGS holdings and will redirect the user to sources of the seismic data.*
*NAMSS (National Archive of Marine Seismic Surveys): http://walrus.wr.usgs.gov/NAMSS/*
*MG&G (Marine Geology and Geophysics): www.ngdc.noaa.gov/mgg/mggd.html*
*UNH: www.ccom-jhc.unh.edu/index.php?p=52|57&page=law_of_the_sea.php*
[3]*Samples collected as part of ECS cruises.*
[4]*Requires approval of the Samples Allocation Group.*
[5]*After quality control and metadata generation.*

Science Plan, 2010, *www.nsf-margins.org/Planning_and_review/DSP_final.html* ): Subduction Cycles and Deformation (SCD) and Rift Initiation and Evolution (RIE). ECS data are being acquired on both rifted (Atlantic, Arctic) and subduction margins (Aleutians, Cascadia, Northern Marianas) of the U.S. ECS multibeam and seismic data will contribute basic information towards understanding Plate Boundary Deformation and Geodynamics, one of the overarching scientific themes of GeoPRISMS. The ECS data may contribute to the understanding of general subduction and rifting processes and help tackle specific key questions about margins (e.g., how deformation varies in space and time, and why). The ECS data may contribute to the choice of any of the U.S. ECS areas as potential geographic focus areas for GeoPRISMS. We expect that data acquired for ECS purposes, with minor exception, will be fully available to complement critical areas for GeoPRISMS studies.

The regions of ECS interest also build upon the previous MARGINS Program, which aimed at understanding "the complex interplay of processes that govern the evolution of continental margins" (Margins Mission Statement, *www.nsf-margins.org/*). The new multibeam data and potential seismic acquisition program in the Northern Marianas will contribute to understanding the deformation morphology and structure along the southern extension of the Izu-Bonin-Mariana region. Although not in a MARGINS focus area, the Arctic program will contribute to understanding mass transfer of sediments along the Alaskan and Canadian Arctic margins (e.g., Mosher et al., 2010).

The U.S. ECS project has an overlapping common interest with the USArray focus area along the East Coast, where the transportable array of instruments will be deployed in 2013-2015. The potential GeoPRISMS interest in the Atlantic margin together with the arrival of USArray in 2013, and the ECS interest in the region beyond 200 nmi may provide an opportunity for extending the Earthscope tomographic imaging from primarily continental observations to studies spanning the ocean-continent boundary.

The U.S. ECS project also encourages science of opportunity during the ECS cruises on a non-interfering basis. Examples from previous ECS Arctic missions include National Ice Center ice studies, recovery and re-deployment of long-term acoustic recording buoys, physical oceanographic studies from CTDs, and ocean acidification studies. The ECS project does not provide funding for either the staff or instrumentation for these studies, and sometimes unavoidable or extenuating circumstances prevent add-on science from occurring. The ECS Task Force, however, recognizes the importance of opportunities for collecting unique data in the remote areas where the ECS studies occur.

## U.S. ECS Project Data Availability and Additional Information

In general, all data collected as part of the U.S. ECS project will be publically available soon after data acquisition. Exceptions to this policy exist for data collected with partnership agreements that restrict distribution. Multibeam data are generally released within six months. Future seismic reflection data acquired as part of the U.S. ECS project will be released through the U.S. Geological Survey, with raw data on a timeframe of six months, preliminary processed data on a timeframe of one year, and final processed data on a timeframe of two years. Raw refraction data will be released no later than two years following the end of the cruise in which it was collected. Descriptions and photographs of rock and sediment samples are made publically available sixty days following the end of the cruise in which the samples were collected through NOAA/NGDC. Rock and sediment samples are archived at the U.S. Geological Survey and distributed through a proposal process designated by the Task Force. Note that these proposals are for sample access, not for research funding. NGDC maintains the data and information management system for the overall U.S. ECS project, although agency and UNH databases will also serve specific data to the public. Table 1 summarizes data-release timelines, responsible agencies, and relevant databases where data are archived.

Another contribution of the ECS

**Table 2: Sources of Additional Information**

| Area of Inquiry | Agency | Title | POC | Contact Information |
|---|---|---|---|---|
| General ECS Inquiries | DOS | ECS Working Group Executive Director | Brian Van Pay | **VanPayBJ@state.gov** |
| General Geology and Geophysics | USGS | Senior Agency Rep | Deborah Hutchinson | **Dhutchinson@usgs.gov** |
| General Bathymetry and Data Management | NOAA | Senior Agency Rep | Margot Bohan | **Margot.Bohan@noaa.gov** |
| Seismic Cruise Planning | USGS | Seismics Team Lead | Jonathan Childs | **JChilds@usgs.gov** |
| Multibeam Cruise Planning | NOAA | Multibeam Team Lead | Andy Armstrong | **Andy.Armstrong@noaa.gov** |
| ECS Data Management | NOAA | Data Management Team Lead | Susan Mclean | **Susan.McLean@noaa.gov** |
| Samples | USGS | Samples Curator | Brian Buczkowski | **BBuczkowski@usgs.gov** |
| Regional Expertise | DOS | Integrated Regional Teams Lead | Barbara Moore | **MooreBS@state.gov** |

project to the general academic community is the updating and improvement of marine geology and geophysics metadata standards, including new, xml-compliant metadata guidelines. A new standard for 2D and 3D multichannel seismic reflection data has been developed and is in beta testing (*www.ngdc.noaa.gov/mgg/ecs/metadata/seismic/*). New standards are also being developed for multibeam bathymetry data and for physical samples. All samples acquired through the ECS project are numbered using SESAR (System for Earth Sample Registration, *www.geosamples.org/*).

The U.S. Department of State, USGS, and NOAA are the primary partners in planning and funding the ECS expeditions. The U.S. Department of State is the lead agency for international treaties and oversees diplomatic, legal, and bilateral maritime boundary issues for ECS studies. USGS is the lead agency for seismic reflection/refraction and geophysical data that contribute to mapping sediment thickness, understanding natural prolongation, and developing geological context. NOAA is the lead agency for the acquisition of multibeam bathymetric data in support of identifying the foot of the slope and mapping the 2500-m isobath. NOAA works in partnership with the University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center. Because the ECS effort is inherently governmental, the identified leaders are government agency representatives. Table 2 gives primary contacts and responsibilities for additional information.

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## GeoPRISMS (& MARGINS) Prizes for Outstanding Student Presentations at AGU Fall Meeting 2010

The new GeoPRISMS program, sucessor to MARGINS, is offering two $500 prizes for outstanding student presentations on GeoPRISMS- or MARGINS-related science at the AGU Fall Meeting.

The two prizes, one each for a poster and an oral presentation, will be awarded to highlight the important role of student research in accomplishing MARGINS- and GeoPRISMS-related science goals, and to encourage cross disciplinary input.

Winners are highlighted in the GeoPRISMS newsletter and website.

*www.geoprisms.org/studentprize10*

## GeoPRISMS Townhall Meeting and Community/Student Forum AGU Fall Meeting 2010

GeoPRISMS will host a Townhall meeting and community forum at the AGU Fall Meeting on the evening of Tuesday December 14 at 6 PM in the Westin Market Street Hotel, Metropolitan Room 3. The event is open to all with an interest in the GeoPRISMS program. The GeoPRISMS Chair and NSF Program Manager will discuss ongoing planning activities and workshops.

Student entrants of the GeoPRISMS Student Prize for Outstanding Presentations are invited to display their AGU posters and discuss their research with the scientific community. This will be a great opportunity for them to further share their results and interact with a wide spectrum of GeoPRISMS scientists. There will be time to mingle, and refreshments will be available.

*http://www.geoprisms.org/townhall10*

# Status Report on the MARGINS Data Portal

## October 2010

*Andrew Goodwillie and the MARGINS Database Team*
*Lamont-Doherty Earth Observatory, Columbia University*

### Introduction

Since 2003-2004, the MARGINS database group hosted at Lamont has worked closely with many MARGINS PIs to capture information on MARGINS-funded programs (*www.marine-geo.org/portals/margins*). With fieldwork spanning both land and marine domains, the wide range of data types reflects the breadth of MARGINS science interests. Examples include volcanic rock samples and gas measurements, GPS campaigns and passive seismometer networks, geophysical surveys of lakes, active-source 3-D seismic marine experiments, high-resolution bathymetric mapping projects, and sediment coring work. In all, the MARGINS database currently provides information and data for more than 80 field programs.

The MARGINS database group would like to thank the following investigators for contributions of MARGINS-funded and -related field program information and data since the last newsletter.

In the Central America focus site, fieldwork details have been added for the Nicoya Peninsula field program of Jeff Marshall and Jim Spotila. As part of a Research Experience for Undergraduates project, their fieldwork aimed to map the extent of palaeoseismicity indicators in Quaternary sediments. Peter Lonsdale provided single-channel seismic data files from his two late-2003 dredging and mapping cruises onboard Revelle. New information was also contributed for the 2005 TICO-CAVA on-land seismic refraction shooting operations (PIs Holbrook, van Avendonk, Lizarralde, Cheadle).

Descriptions of recent activity in the Cascadia region has been added to the database. This covers Anne Trehu's 3 OBS deployment-recovery cruises onboard R/V Wecoma during 2007-2008 (W0709A, W0807A and W0808B) and the 2010 OBS deployment cruise, W1007B, of Jeff McGuire and John Collins.

### Web Page Updates

MARGINS portal web pages (*www.marine-geo.org/portals/margins/*) include an enhanced Search For Data page. In addition to providing key word searches on scientist name, data and device type, field program ID, Focus Site, date ranges and geographical bounds, users can search for data associated with specific publications and MARGINS NSF awards. A Google Maps™ -based interactive map shows ship survey tracks, stations and samples from MARGINS-funded expeditions within each of the focus sites. Clicking on a track or station invokes a link to the associated data sets and field program information. Statistics on data file downloads are compiled annually and sent to the contributing scientists.

### Education and Outreach

Database resources, including GeoMapApp, are used in a number of undergraduate-level learning modules called MARGINS mini-lessons which range in duration from in-class segments to multi-lab units. They are available here: *http://serc.carleton.edu/margins/collection.html*.

MediaBank (http://*media.marine-geo.org*) provides access in a gallery format to MARGINS-related images which include photos from field expeditions, and images from MARGINS research nuggets and other PI publications, as well as from slide presentations given at recent MARGINS meetings. Additional image contributions are encouraged.

### GeoMapApp and Virtual Ocean

The free map-based data exploration and visualisation tool, GeoMapApp (*www.geomapapp.org*), now at version 2.6.0, has improved functionality, greater ease-of-use and the addition of new data sets. Very high-resolution USGS NED land elevation data allows stunning base maps at 10m horizontal resolution to be created with GeoMapApp for the entire US landmass, including Hawaii and Alaska, with NASA ASTER data providing elevations at 30m resolution globally. With GeoMapApp, users can also import their own data tables and grids and have access to the full suite of built-in functionality. More high-resolution grids compiled from multibeam bathymetry have been added, as well as USGS grids of depths to subducting slabs. Multimedia audio-visual tutorials are available on the GeoMapApp web page.

Virtual Ocean *(www.virtualocean.org*) offers GeoMapApp capabilities in 3-D. A wide range of built-in data sets is available. As with GeoMapApp, data tables can be imported and manipulated, and custom maps can be generated.

We welcome new contributions of data and information from your MARGINS-funded work: please contact us at *www.marine-geo.org/about/contact.php*

### MARGINS Database

- Visit **www.marine-geo.org/portals/margins**
- Search and download data for >80 MARGINS-funded field programs
- Download GeoMapApp and Virtual Ocean
- Visit the MARGINS-MGDS exhibit booth (249) at Fall AGU

# MT and the Subduction Factory

*Rob Evans*
*Woods Hole Oceanographic Institution*

## Introduction

To many geoscientists Magnetotellurics, or MT, is a mysterious technique that crops up now and again, but is rarely the focal point of any major field campaign. Yet MT has been around for a long time and has been used extensively to map continental and oceanic structures. Along with companion controlled source electromagnetic (CSEM) methods, MT is also now a mainstay of petroleum exploration at sea and minerals exploration on land.

When described in its entirety the method can sound somewhat mystical. Charged particles released from the sun in solar flares get entwined with Earth's magnetic field creating complex patterns of electrical currents in the ionosphere. Through induction, currents are created within the Earth in response to these ionospheric currents and the patterns of these internal currents are highly dependent on the Earth's electrical structure: currents flow in areas of high electrical conductivity. Just as seismic velocity is influenced by temperature, composition and the presence of fluids such as melt, so too is electrical conductivity albeit in different ways. In fact, conductivity is much more sensitive to small amounts of connected fluid such as melt than is velocity. Thus, measurements of conductivity offer a complementary view of the Earth and can provide insight into some of the more important processes in active settings such as subduction zones where fluids are plentiful and widespread melting occurs.

There has been a lot of recent activity using MT at subduction zones across the globe. A good deal of this activity has been at focus sites of the MARGINS program, as well as at Cascadia, a venue for future efforts. The aim of this short article is to showcase some of this activity, much of which will be presented at the Fall AGU meeting (below we reference AGU meeting sessions for which authors are presenting relevant work), and to show how MT is likely to play a continued role in active margins studies.

## Marianas

From 2005 to 2007 an international magnetotelluric experiment was carried out across the Marianas subduction system, with coverage spanning the incoming Pacific plate, the forearc and across the back-arc spreading center. US involvement was supported by MARGINS (P.I.s Chave and Evans (WHOI)). Japan took the lead in providing shiptime and instruments for the project and Australia also participated, providing instruments. A paper describing the first results of the data analysis are in Matsuno et al. (2010).

Highlights of the models derived from the data include an electrically conductive region of mantle that sits above the downgoing slab, starting at a depth of around 60-70 km. The feature suggests melt generation and its location is broadly consistent with the depth to the onset of melting predicted by models for the Marianas (Grove et al., 2009). Strangely, there is no evidence for melt above this depth that might be related to melt transport either towards the arc or to the slow-spreading back-arc ridge. This "null" result suggests that melt delivery to both features is highly three-dimensional and limited in both its across and along strike dimensions. While this might not be a surprise for the arc volcanoes, it was somewhat of a surprise for the back-arc system. Future work will look at constraining the limits of allowable melt column sizes through 3D forward modeling. This lack of conductive features at shallow depth contrasts with zones of high seismic attenuation (Pozgay et al., 2009), so clearly more work is needed to unravel the differing controls on these two physical properties.

## Central America

In addition to MARGINS funded programs in central America, German colleagues have carried out extensive work in Costa-Rica and Nicaragua and this has

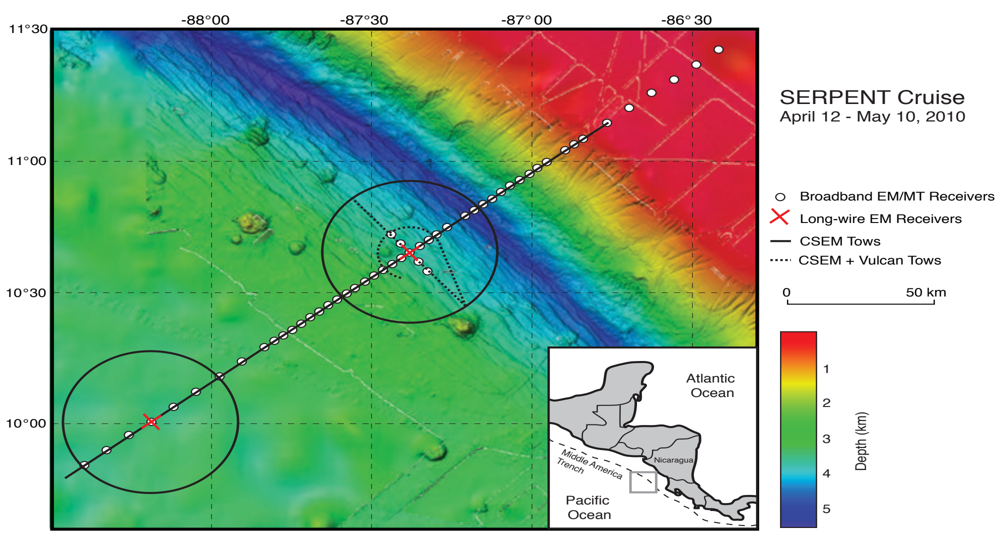


*Figure 1. Map of deployment locations of 54 seafloor MT/CSEM instruments off Nicaragua during the SERPENT experiment. Dots are instrument locations on the seafloor, the black lines are the path of CSEM transmission tow-lines designed to detect anisotropy in the lower crust and upper mantle. CSEM data were also collected along the survey profile.*

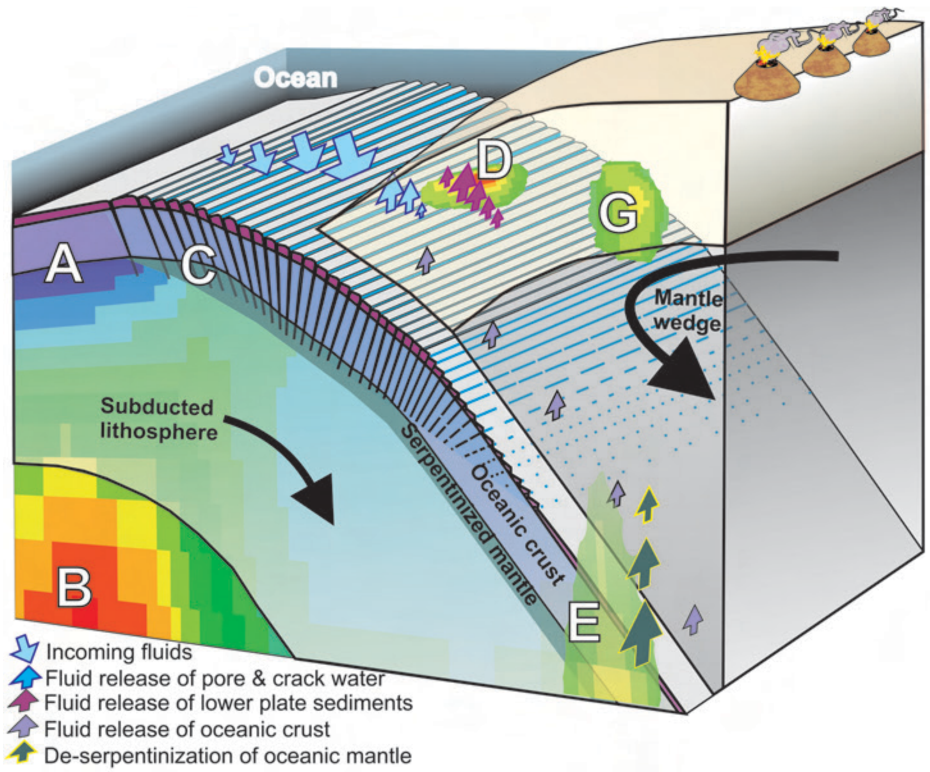


*Figure 2. Cartoon of structure beneath the Nicoya Peninsula based on MT models. Figure from Worzewski et al., (submitted).*

included both terrestrial and marine MT work. One onshore-offshore profile was carried out across the Nicoya peninsula (Worzewski et al., AGU session T20).

As with other MT transects across ocean-continent subduction systems, conductors are found both in the uppermost part of the wedge above the slab, and also around the base of the crust, but at a distance significantly trenchward of the arc. The first conductor represents the shallow release of fluids from the downgoing slab, most likely free fluids. The second conductor is more difficult to understand. It could represent an accumulation of melt trapped from rising upwards by the relatively impermeable crust. Why it is not directly beneath the arc is mysterious – perhaps the position in the wedge is determined by permeability in the wedge, which is thought to be closely related to temperature structure (Wada, AGU session T20). If this is the case, then another mechanism would be needed to move the melt both upwards and laterally though the crust to the arc volcanoes.

As a complement to the German work, MARGINS funded a marine MT/CSEM experiment further north off Nicaragua, in an area of heavily fractured and faulted seafloor. This experiment, named "SERPENT" (P.I.s K.Key and S. Constable (SIO), R. Evans and D. Lizarralde (WHOI)), aims to look at the hydration state of the incoming plate and featured 54 broadband seafloor MT stations deployed along a 300 km long profile. The seafloor instruments were also transmitted to with a deep-towed electric-dipole source injecting a much higher frequency signal than the MT source field, so that information on the entire crustal sequence is obtained. The cruise was completed in May 2010 on the R/V Melville (Figure 1). Initial analysis of the data is very encouraging with good quality MT responses and an initial indication of strong electrical anisotropy in the lower crust or upper mantle, presumably related to a preferential cracking direction (Figure 2). Work is just beginning on these data, but you can read more at *http://marineemlab.ucsd.edu/Projects/SERPENT/* and a series of presentations on the experiment at the fall AGU meeting include Naif et al. (GP02), Constable et al. (GP02) and Key et al. (T26).

Future work onshore is in the pipeline, to be carried out by German Colleagues led by Henri Brasse.

## Cascadia

As part of the USArray Earthscope program, a grid of MT stations, spaced roughly 70 km apart, has been collected across Washington State and Oregon. These data provide a regional scale picture of the landward portion of the Cascadia subduction system (Patro and Egbert, 2008; McGary et al. in prep; Meqbel et al., Session T13). In addition, a flex-array study is underway in Washington state collecting wideband and long-period data at much finer spatial resolution that should provide more detailed images of the fluid release and melting processes beneath the Cascades (P.I.s P. Wannamaker (Utah), R. Evans (WHOI)). These Earthscope profiles are complemented by existing data sets including the EMSLAB profile (Wannamaker et al., 1989) and a profile in Canada (Soyer and Unsworth, 2006). The flex-array study is coincident with the seismic CAFE experiment (Abers et al., 2009) and so offers the opportunity to jointly interpret velocity and conductivity models on a fine scale. For example, graduate student Shane McGary (MIT/WHOI joint program in Oceanography) is working on combining information from teleseismic arrivals, which he has migrated to form an image of scattering layers within the subducting system, into the modeling of MT data.

One component that is currently missing from Cascadia is a substantial marine MT dataset. Marine data have been shown to provide not only constraints on the incoming plate, but also on the connections between the downgoing slab and the conductive mantle wedge (Evans et al., 2002). New long-period seafloor MT instruments are currently under construction at WHOI funded by an MRI-2 proposal (P.I.s. R. Evans and A. Chave; WHOI), and these new instruments will complement the large broad-band fleet of instruments at Scripps, providing the US community with the capability to carry out detailed regional scale imaging of the entire system, potentially starting at the Juan de Fuca ridge.

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## GeoPRISMS Activities at AGU Fall Meeting 2010

This year's Fall AGU meeting, 13-17 December 2010, in San Francisco, features a number of GeoPRISMS (and MARGINS) -sponsored and -related events.

- Science sessions relevant to GeoPRISMS-MARGINS are listed on pages 16-17.
- Other scientific sessions of interest are on page 17-18.
- GeoPRISMS Townhall Meeting and Community/Student Forum:
  Tuesday, 14th December, 6-8pm (see information box on page 11). Held at the Westin San Francisco Market Street Hotel, room Metropolitan-3.
- GeoPRISMS Student Prizes for Outstanding Presentations – see box on page 11.
- MARGINS database exhibit – live demostrations of GeoMapApp, Virtual Ocean, and more! Visit Exhibit Hall booth 249. Free goodies!

Visit the GeoPRISMS website for further information:

***www.geoprisms.org***

# Sessions relevant to MARGINS~GeoPRISMS Science at AGU Fall Meeting 2010

The extensive list of sessions in AGU's Fall Meeting program can be daunting, so each year the MARGINS Office assembles a list of sessions that we think may be of special interest to the MARGINS-GeoPRISMS community. Other relevant sessions were captured from the AGU website (*www.agu.org/meetings/fm10*) or listed by request of the corresponding session's convenors.

*AGU Code Key: Capital letters assigns **session's theme**. First number indicates the **day of the week** (1=Monday, 2=Tuesday, etc.). Second number indicates **session time** (1X: 8:00; 2X: 10:20; 3X 13:40; 4X 16:00). E.g., **OS23A** = Ocean Sciences, Tuesday, Session 3A. Please refer to the AGU meeting program to verify session times and locations.*

*Study of Earth's Deep Interior (DI)*

**DI: Observations and Dynamics of Subducted Slabs**

Convenors: D. Stegman, E. Syracuse

Subduction zones represent a snapshot of a dynamic and evolving system, and the time-history of their evolution is expressed in the morphology of their associated slabs. Seismic observations reveal individual slabs have complex 3D shapes exhibiting strong variations of curvature and seismicity both along-trench and down-dip. Such variations are linked to the details of the system, including influences by the mineralogy, thermal structure and strength of slabs, flow of surrounding mantle, and coupling to surface plate motions. We welcome contributions that provide improved observations that help characterize the structure and evolution of subducted slabs, and those that link observations to geodynamic models or tectonic reconstructions. DI31A, DI41B, DI42A.

*Education (ED)*

**ED: New Resources, Approaches and Technologies for Teaching about Plate Margins**

Convenors: J. Ryan, M. Williams, D. Reed, V. Cronin

Students must understand the relationships among the tectonic, structural, petrologic and geochemical processes that occur at plate boundaries if they are to move from undergraduate geoscience courses into modern multidisciplinary geoscience research. This session seeks to highlight innovative resources and approaches to teaching plate boundary science, as have been produced in association with major research initiatives (MARGINS, Ridge2000, IODP, EarthScope), or as facilitated by new data and geospatial information resources (EarthChem, GeoMapApp/MGDS, Google Earth). Programs that move students from the classroom into plate margin research, at either the undergraduate or graduate level, are also of interest. ED41B, ED44A.

*Earth and Planetary Surface Processes (EP)*

**EP: Source to Sink Insights into Integrated Sedimentary System Evolution**

Convenors: J. Covault, A. Fildani

This session features integrated sedimentary systems from terrestrial source areas to depositional sinks highlighting stratigraphic forcings and developmental timing. We are soliciting contributions that employ cutting-edge technologies in the analysis of modern, i.e., earth surface/shallow subsurface, sedimentary systems, which are amenable to natural experimentation as a result of a high degree of control on external/intrinsic forcing mechanisms and timing. An integrated, inclusive approach to the study of sedimentation across continental margins can provide accurate and rigorously tested predictions of natural resource presence and quality, and inform policy decisions. EP53C, EP54A.

*Tectonophysics (T)*

**T: Interaction Between Magmatic and Tectonic Processes in Continental and Incipient Oceanic Rifts**

Convenors: D. Keir, C. Pagli, J. Biggs, E. Rivalta

A key breakthrough in the last decade is recognition of the intimate linkage between extensional deformation and magmatism during rupture of the continents. However, the nature of this relationship at all depths through the lithosphere and its evolution through time remain controversial. We invite contributions from observational and modeling studies that constrain the length, time scales and mechanisms of magma transport and emplacement in continental and incipient oceanic rifts. We also welcome contributions on interactions between magmatism and other deformation mechanisms (e.g. faulting and ductile stretching) and their response to rheological controls. T21G, T22C, T31B.

**T: Recent Submarine Volcano-Tectonic Events Along Western Pacific Island-arcs, Back-arcs, and Subduction Zones**

Convenors: R. Dziak, K. Rubin, E. Baker

Several regional-scale geologic events have occurred within the last year at the Lau back-arc basin, Tonga volcanic-arc and trench: the 18 March 2009 shallow-water eruption near Tonga, the 29 September 2009 Samoan earthquake (Mw 8.1), and the ongoing, deep-ocean eruption at West Mata volcano. Studies of such recent events provide important information on regional volcano-tectonic perturbations, responses, and timescales, and are foci of the NSF Ridge2000 and MARGINS programs. We solicit studies from marine geophysics, volcanology, petrology, marine chemistry, and physical oceanography to provide an integrated view of West Pacific upper mantle, ocean crust and water-column processes. T11E, T13B.

**T: From Sediment Inputs to Seismogenesis at Subduction Zones**

Convenors: R. Wells, S. Saito, C. Ranero, L. McNeill, T. Byrne, Y. Hashimoto, M. Strasser

Recent research projects on subduction zones have been capturing the entire picture of subduction processes from the inputs of sediment and basalt to seismogenesis. The objective of this session is to foster discussions among disciplines and among researchers working on various subduction zones, both modern and ancient. We welcome presentations showing recent results of ocean drilling, geophysical investigations, laboratory studies, and analytical or numerical modeling. T13A, T22B, T23E, T24A.

**T: Rifting to Rupture to Drift: Linking Lessons from Active Rifts to the Evolution of Passive Margins**

Convenors: M. Oskin, R. Arrowsmith, J. Collier, A. Schettino, E. Bonatti

This session explores how the diversity of processes and feedbacks that drive continental rifting towards rupture, initiation of seafloor spreading affect the transition to the low rate and more distributed deformation of the passive margin. Contributions will explore the various roles of magmatism, faulting, rift obliquity, surface processes, pre-existing lithospheric structure and deep Earth processes on the 4D architecture of active rifts and rifted margins, with emphasis on how rifting processes influence subsequent passive margin development. T32C, T33C.

*Volcanology, Geochemistry, and Petrology (V)*

**V: The Subduction Filter: Effects on the Mantle, Arcs and Continents**

Convenors: C. Chauvel, T. Plank, P. Hall, E. Chin, J. Davidson, W. White, C. Class, R. Rudnick

Subduction zones are the place where material from the surface of the Earth is sent back into the mantle after being changed by mineral-fluid/melt reactions. They act as filters separating material added to continental crust through arc volcanism, from residues that are recycled into the mantle, and whose compositions may differ markedly from the original subducted slab. This session aims at evaluating information provided by studies of volcanic arcs, mineral-fluid processes in the slab, newly formed crust, and mantle melts. The aim is to highlight the key processes that occur in subduction zones and how they influence the differentiation of the Earth and the long-term evolution of continental crust and mantle. V11F, V12B, V13G, V14A, V33B.

*Other sessions of interest*

*Union (U)*

**U: The 12 January 2010 M7.0 Haiti Earthquake (Webcast)**

Convenors: E. Calais, S. Hough, A. Lerner-Lam, R. Momplaisir
U11A, U13A.

**U: The M 8.8 Chilean Earthquake of 27 February 2010 (Webcast)**

Convenors: S. Barrientos, B. Brooks, K. Wang, D. Melnick
U21B.

**U: Frontiers in Scientific Ocean Drilling: Recent Discoveries and Future Opportunities**

Convenors: S. Humphris, P. DeMenocal, E. Solomon, R. von Huene
U42A, U43A.

*Education (ED)*

**ED: The Future of Cyber-Education in the Geosciences: New Directions and Opportunities**

Convenors: J. Ryan, S. Eriksson, L. Guertin, K. Lehnert
ED22A, ED23B.

*Geodesy (G)*

**G: The Magnitude 8.8 Chilean Earthquake of 27 February 2010**

G31B, G32A, G33A – and see U21B session.

**G: Plate Motion and Continental Deformation**

Convenors: D. Argus, J. Freymueller, R. Fernandes
G41C, G42A, G43A.

**G: Measuring and Modeling of Active Tectonic Processes in Alaska at the Beginning of the EarthScope Era**

Convenors: J. Sauber, J. Freymueller, D. Christensen
G14A, G21B.

*Seismology (S)*

**S: Toward Elucidating the Physics of Fault Tremor and Slow Slip**

Convenors: H. Houston, T. Melbourne, D. Shelly, R. Burgmann, M Brudzinski, A. Rubin, A. Wech
S11C, S12A, S13D, S23A.

*Tectonophysics (T)*

**T: Structure, Dynamics, and Evolution of the African-Arabian Rift Systems**

Convenors: D. Keir, I. Bastow, C. Tiberi, C. Doubre
T23F, T24C, T31C.

**T: What Controls Strong vs. Weak Coupling on Subduction Interface Faults?**

Convenors: L. Wallace, R. Bell, S. Schwartz, H. Sato, S. Henrys
T43E, T44B, T51D.

**T: Characterization of the April 4, 2010 El Mayor-Cucapah Earthquake and Implications for Earthquake Preparedness in Southern California and Baja California**

Convenors: J. Gonzalez-Garcia, J. Fletcher, R. Arrowsmith, E. Fielding, A. Barbour, B. Crowell
T51E, T53B.

**T: Latest Results From EarthScope's San Andreas Fault Observatory at Depth**

Convenors: S. Hickman, W. Ellsworth, M. Zoback, M. Jackson
T41A, T52B.

**T: Subduction-Zone Segmentation over Multiple Earthquake Cycles**

Convenors: C. Goldfinger, A. Meltzner, I. Shennan, R. Witter
T11D, T14B.

**T: Understanding Continental Evolution From Innovative Analysis of EarthScope Data**

Convenors: H. Gilbert, L. Astiz, B. van der Pluijm, B. Tikoff, R. Keller
T41E, T42C, T51C.

*Volcanology, Geochemistry, and Petrology (V)*

**V: Metamorphic Perspectives of Subduction Zone Evolution**

Convenors: G. Bebout, B. Hacker, H. Marschall
V31D, V32A, V33A.

**V: Volatiles in Magmas: the Breath of the Deep Earth**

Convenors: P. Ruprecht, S. Demouchy, T. Plank, T. Sisson
V23E, V24C, V33F, V34C, V53C.

## MARGINS Mini-Lessons:

## Learning activities for your classroom!

MARGINS mini-lessons are hands-on learning activities that cover a wide range of MARGINS-related science. Developed as part of the MARGINS education and outreach initiative, mini-lessons are aimed at the undergraduate level and range in length from material suitable as in-class demonstration segments all the way to multi-lab units. The modules span many different data sets and technology resources, and their creation by MARGINS PIs and members of the broader MARGINS community provides cutting-edge content.

View and download MARGINS mini-lessons here:
*http://serc.carleton.edu/margins/collection.html*

Examples of some of the many exciting mini-lessons available:

- Burial, compaction, and porosities in a subduction zone
- Serpentine Seamounts in the Mariana Forearc: Shallow Material Releases from Downgoing Plates
- Sediment production and distribution across the margins
- A Geologic Safari of the East African Rift and the Newark Basin: Why these areas are more alike than you know
- Margin Morphology: Does Form Follow Function?
- Partitioning of thrust and strike/slip faulting in oblique subduction
- Source to Sink Morphology, Sedimentation, and Anthropogenic Impact: Hudson System, New York
- Chemical Inputs and Outputs at Subduction Zones
- The Woodlark Basin as a Natural Laboratory for the Study of the Geological Sciences
- Online Investigation of an Island Arc Volcano: Anatahan, Mariana Arc
- Physical and Chemical Variations Along the Central American Volcanic Arc
- Serpentinite in Subduction Zones: How do we find it, and how common is it?
- Tracing sediment provenance from source to sink: Isotope records in the Bay of Bengal and Indonesia

After using a mini-lesson, its content, approach and pedagogical effectiveness can be quickly evaluated using an on-line feedback form, here: *http://serc.carleton.edu/margins/protocol.html*

Your mini-lessons feedback is much appreciated.

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Please refer to the MARGINS and GeoPRISMS websites for updates to this information.

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# MARGINS / GeoPRISMS

Newsletter No. 25, Fall 2010

## PROGRAM TRANSITION

On October 1st, 2010, the MARGINS program moved to Rice University in Houston, Texas and has transitioned to GeoPRISMS. The MARGINS website will remain active and a new GeoPRISMS website is available: www.geoprisms.org

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