Introduction

Great earthquakes, CO₂ and H₂O cycling, and their connections across the subduction zone, have been the focus of intense international efforts in Central America for over a decade. This international program has involved geological and geophysical studies both on land and off-shore. This intense effort is paying off in new discoveries about the driving factors for earthquakes in this environment and the cycling of water and CO₂ from the oceanic plate through to the explosive volcanism of the Central American volcanic chain. The Costa Rica-Nicaragua subduction zone is a focus area of the MARGINS themes investigating the Subduction Factory (SubFac) and the Seismogenic Zone (SEIZE).

Workshop in Costa Rica

In order to display and discuss the large amount of research that has occurred in this region a workshop was held June 18-22, 2007, at the Hotel La Condesa in Heredia, Costa Rica. It was attended by about 140 participants from Costa Rica, the US, Germany, Spain, Italy, Mexico, Norway, Russia, and the Czech Republic (Figure 1). Workshop conveners were Eli Silver, Terry Plank, Kaj Hoernle, Marino Protti, Guillermo Alvarado, and Victor Gonzales. Financial support was provided by the National Science Foundation MARGINS Program, and the SFB 574 program of the German Science Foundation. The MARGINS office of Geoff Abers, Cary Kandel, and Pamela Lezaeta provided invaluable support at all levels for the workshop.

The goals of the workshop were to synthesize the data collection efforts, discuss their interpretation and modeling efforts, and provide new research directions. There was a strong focus on the geology and tectonics with ample opportunity for hands-on experience. Prior to the meeting, Don Fisher and Tom Gardner led a three day field trip to study the tectonics of the fore-arc in southern Costa Rica, adjacent to the subducting Cocos Ridge. Guillermo Alvarado and Mike Carr led a four day post-meeting...
field trip to examine the northern Costa Rican volcanoes of Arenal and the Guanacaste volcanoes.

The workshop was organized into four broad themes: the seismogenic zone, system structure and evolution, volatile fluxes, and hazards. Poster sessions were interspersed with oral presentations, and sufficient space was available to allow all posters to be viewed for the full meeting. The meeting was opened officially by Dr. Olman Segura, the Chancellor of Universidad Nacional, Dr. Roberto Dobles, the minister of Environment and Energy and Dr. Gabriel Macaya, president of the Costa Rica Academy of Sciences. They were followed by several keynote talks given by Guillermo Alvarado, Marino Protti, Kaj Hoernle, and Geoff Abers. Following each theme, an extended open session allowed a wide range of discussion of these topics, and the final afternoon was a wrap-up discussion, giving all participants opportunity to state their views and raise issues. A full program and list of participants is available at http://www.nsf-margins.org/CostaRica2007. A significant number of research papers will be part of a special Theme on the Central American Subduction System of Geochemistry, Geophysics and Geosystems (G-Cubed). Below we summarize some of the key observations, hypotheses and problems discussed within each of the themes.

Seismogenic Zone

Earthquakes in Nicaragua and Costa Rica closely follow the variations in bathymetry and structure of the incoming Cocos and Nazca plates. Nicaragua has had earthquakes with variable size and source duration, from small, rapid (or normal earthquakes) to large ($M=7.7$) “slow” or “tsunami” earthquakes, such as the 1992 event that generated a damaging tsunami much larger than would be predicted from the size of the earthquake. The incoming plate has scattered small seamounts and large offsets of the lower plate as it flexes and descends beneath the continental slope. Northern Costa Rica, offshore of the Nicoya Peninsula, has large ($M=7.7$) fast earthquakes every ~50 years or so, and at present is quiet but showing significant elastic strain buildup for the next event. Central Costa Rica is affected by a number of large seamounts and has frequent fast earthquakes up to $M=6.5$. In southern Costa Rica the Cocos Ridge subducts, which drives $M>7$ events every 40 years or so. Understanding the nature of the mechanical coupling between these features in the seismogenic zone is the subject of much observational and laboratory effort, and plans are well underway to drill into this zone as part of the Integrated Ocean Drilling Program. A very new discovery is the presence of slow slip events that propagate from deep to shallow levels of the seismogenic zone and are synchronous with onland strain transients (Figure 2). Such sequences may ultimately prove to be important factors in understanding the events leading to major earthquakes.

Temperature appears to provide one main control on the up-dip limit of the seismogenic zone. While there was agreement that the previously proposed smectite-to-illite transition fails as an explanation, new hypotheses include other diagenetic reactions, silica mobilization and fluid pressure effects to explain onset temperatures in the range of 125° to 200°C. An interesting test of this concept was observed along the Nicoya peninsula, just inboard of a
in measured heat flow on the incoming oceanic plate. Here the depth to the shallowest part of the earthquake generation zone is deeper to the northwest, where the heat flow is abnormally low. The change occurs abruptly across the contact between subducting crust generated at the East Pacific Rise (to the NW) and that generated at the Galapagos Spreading Center.

**System Structure and Evolution**

The seismogenic zone is just the shallowest part of the subduction factory, where incoming rocks and fluids are carried to great depth, strongly affecting the mechanics of convergence, and ultimately the recycling of materials back to the surface through volcanic activity. Central America has long been considered an ideal laboratory for studying this process because of the exciting findings 20 years ago that volcanoes in Nicaragua contained the highest values of $^{10}$Be measured from any volcano, and that these values decrease in each direction, with Costa Rica showing very low values. $^{10}$Be forms in the atmosphere and has a half-life of 1.5 Myr, meaning that very high values in the arc require rapid sedimentation to the trench and most of the incoming material must be carried to the zone of magma generation beneath the volcanic chain. One might suppose that Costa Rica, having no $^{10}$Be, rids itself of this material by scraping off the incoming sediments prior to reaching the zone of melting, but seismic studies and drilling have documented that all incoming material bypasses the lowermost slope, and in fact the continental slope has subsided significantly over the past 6 Myr, implying a high value of subduction erosion of the upper plate. Thus not only is much of the incoming material brought down to great depths but also material that formed the edge of the Costa Rican mainland has been removed by as much as 50 km during this period.

A key question for the Subduction Factory is how continental crust is generated. In Central America, silicic ignimbrites are voluminous and their formation may be a key process in the differentiation of the continental crust. The ignimbrites share a genetic relationship with the mafic volcanoes, owing to their similar trace element and isotopic ratios, and partial melting is favored over fractional crystallization for their origin. Other geochemical features of the volcanoes are segmented along strike (Figure 3), correlating with the total path length from the volcano to the subducting slab. A large seismic refraction experiment is underway to ascertain the volumetric significance of ignimbrites, and the crustal architecture that affects how magma makes its way to the surface.

**Volatiles**

Another possibility for explaining the changes in geochemistry is differences in amount of water carried to depth, allowing these fluids to flux through the down-going material, scavenging elements such as $^{10}$Be and bringing them to the surface in the erupting magmas. The water contents of Nicaragua magmas are among the highest in the world. These magmas have unusually low $^{18}$O and high Ba/La and low $\text{H}_2\text{O}/\text{Cl}$, pointing to an unusual flux from the subducting plate. New seismic tomographic studies show striking differences in seismic velocity of the down-going upper mantle rocks beneath Central America. Beneath

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*Figure 4. Seismic tomography comparison in Central Nicaragua for Vp/Vs (Syracuse et al., 2006) and attenuation 1000/Qs (Rychert et al., 2006) from the TUCAN seismic deployment. The region below the volcanic front shows high Vp/Vs and 1000/Qs suggesting the presence of fluids that rise from the slab interface at ~100 km depth.*
Nicaragua, seismic velocities are reduced in these mantle rocks by about 5%, which could correspond to as much as 12-17% serpentinization of these mantle rocks, whereas no such change is noted beneath northern Costa Rica. The serpentinized plate may thus provide a major source for transporting volatiles and driving mantle melting beneath the arc. Seismic tomography shows a low $S$-velocity region vertically beneath the Nicaraguan volcanoes that may indicate a rising mass of wet melts (Figure 4). These studies have involved passive seismic deployments that use arrays of seismometers with natural earthquakes as seismic sources. Further studies are planned to carry out active source experiments to test and refine these results.

An important aspect of the incoming materials on the Cocos Plate is the presence of over 200 m of carbonate rocks that continually subduct beneath the margin. This process removes carbon from the earth’s surface and transports it to the Earth’s deep interior. Decarbonation reactions in the slab may reverse the downward flux of carbon and allow some portion to recycle back to the surface in magmas and gases. New geochronological studies of lavas and tephras throughout Central America have improved estimates for the volume flux of erupted material. These flux data, combined with volatile data from melt inclusions, fumarolic measurements and remote sensing, demonstrate that $H_2O$ may be balanced across the margin to within 80%, but that $CO_2$ is not, with as little as 10-30% of the input accounted for in volcanic fluxes. Such inefficient recycling is consistent with the low solubility of $CO_2$ in slab fluids and the high temperature required for the melting of carbonated material. The implications for the carbon cycle and long-term climate change on the planet may be profound.

**Hazards**

Many of these studies have direct implications for geological hazard assessment for Central America. Earthquake and tsunami studies have clear implications, as does the understanding of volcanic explosivity and eruption frequency. Studies of tephra and tephrochronology have added significantly to our understanding of large eruptions that have occurred near modern population centers and continued volcanic, geodetic and satellite monitoring are essential to any efforts at hazard mitigation. There is much infrastructure in place and long-term time-series observations are well underway. As a result of the intensive studies over the past decade in Central America, many students have received extensive training and some have now moved into positions of authority. Education and training may well have been a most significant result of these programs.

**Ongoing and Future Work**

In summary, geophysical, petrologic, and geochemical studies in and offshore Central America have produced significant breakthroughs in understanding the nature of the seismic zone, the cycling of water and $CO_2$ through the subduction system, the tectonic development of the Central American subduction system, and the creation of continental crust.

Programs yet remaining to be accomplished include:

1) Offshore geodesy to constrain the location of the locked portion of the seismic zone;
2) Scientific ocean drilling, to discover the processes involved in generation of earthquakes in a subduction zone undergoing tectonic erosion, to better understand the fluid flow pathways in such a margin, and to ground-truth the enormous amount of geophysical data that now exists;
3) Sea floor and on-land observatories to develop continuous and integrated records of strain, fluid flow and volcanic emissions;
4) Magnetotelluric imaging for melt and fluid distribution;
5) Critical laboratory and field measurements of devolatilization reactions between the downdip extent of the seismic zone and the onset of melting in the downgoing plate (200-750°C).

We are still at an early stage in translating scientific observations to the assessment of hazards associated with large population centers located within this dynamic province, and the next decade should focus on these topics.

**References**


MARGINS Chair Report Fall 2007

Geoffrey Abers
Boston University

As this Newsletter shows, the last several months have been packed full of MARGINS-related meetings. Their diversity reflects the broad spectrum of activities now under the MARGINS umbrella. All have had an excellent turnout; all have had busy programs and more applicants than anticipated. This trend reflects a healthy program, but also a heavy workload placed on the Office staff, and I am thankful that Cary and Pamela stepped up admirably.

Another sign of program success has been the rapidly growing number of publications either supported by MARGINS or engendered by MARGINS activities. The list of large publications (p. 20) includes several monographs such as the SEIZE volume just published (p. 13), and a series of Special Issues or Themes at major journals. Every Initiative is represented. Another metric is the rapidly-growing number of regular articles in top journals, including Nature and Science, featuring MARGINS research. We are starting a master reference list to be available soon on the web page, so please if you publish something that is in some way a MARGINS product and want it included, let the Office know.

Several major field programs are making progress. September 2007 marked the beginning of Chikyu scientific drilling at Nankai under the NanTroSeize program. Planning for this effort began over a decade ago and a large fraction of the SEIZE community is involved, so it is a major milestone. Also, final preparations of the R/V Marcus Langseth are underway this fall, and we hope to see critical cruises in coming months such as the Costa Rica active source experiment. To highlight these and other advances, we plan to continue a series of Initiative Summaries in the next Newsletter.

I would like to highlight two of the many workshops. The Costa Rica workshop (p. 1-4) and a parallel IBM workshop held Nov. 6-10, 2007 in Honolulu represent some of the first MARGINS synthesis workshops. Both result from international partnership, cosponsored by major programs in Germany and Japan respectively, so that 35-45% of participants were from outside the U.S. One healthy development at the Costa Rica workshop was a broad scientific dialog between U.S., German and other researchers, leading to several new collaborations. For several years the German SFB 574 program has been developing data sets on volatiles, geochemistry, and marine geophysics that nicely complement the U.S. efforts, and it is great to see integration taking place. Another constructive dialog took place between the SEIZE and SubFac communities. It is becoming clear that deep connections exist between these two Initiatives; for example, volatile transport drives volcanism, may cause tremor, and probably regulates slip episodes.

The Mini-Lesson workshop described on p. 14-16 represents a new direction for MARGINS. Thanks to separate funding from NSF’s Division of Undergraduate Education and collaboration with the SERC infrastructure, we are able to organize web-based teaching modules that highlight MARGINS research for the undergraduate classroom. Their development is completely community driven, and I encourage anyone who is interested to consider contributing a Mini-Lesson; see p. 15-16 for examples and instructions. One interesting development is the convergence with the Data Management system; many tools developed to access data, such as GeoMapApp, turn out to be excellent educational resources.

The Future

As discussed here in the Spring 2007 Newsletter, MARGINS will soon face some fundamental changes. The original program was conceived as a decadal venture ending in 2009. Although some final work may persist past that date there will be a thorough NSF review then, and any successor program would have to emerge from that process. A successor program is by no means guaranteed and will require some vision. Over the coming months we expect to work with NSF to elucidate the review process, but many preparatory activities are now underway. The first is to document success and identify critical research needs, and the two subduction workshops this year started that process. They also provided a forum for broaching the subject of the future, and helped set parts of the community in motion – a final session at both workshops was dedicated to the long-term future of MARGINS. As one result, a major SEIZE Integrative Workshop is being organized for September 2008 (stay tuned to the web page for details!). A RCL Future Mini-Workshop will take place the day before AGU (see p. 7). I encourage those interested in leading other critical planning and synthesis efforts to step forward and contact me with ideas.

One major topic of conversation is the future of the Focus Site model. Concentrating resources at one site makes interdisciplinary problem-solving possible on a big scale, leading to progress in understanding these complex systems. The success of this model is demonstrated by the recent high level and quality of scientific output, much of it truly interdisciplinary in nature. However, many feel that the time may have come to move to a more thematic program structure, and perhaps Focus Sites have served their purpose. One approach may be to take what has been learned within Focus Sites to frame key questions, and develop program Themes around them. This change in approach will be open to much debate; one counter-argument is that certain critical long-term data sets
require continuity and some projects have long lead times (e.g., drilling), favoring continued work at some current sites.

At the same time, there is benefit to having some program focus that utilizes the major new facilities provided by EarthScope and the Ocean Observatory Initiative, both concentrated in the U.S. These facilities provide unparalleled new tools for studying continental margin evolution, and NSF is deeply invested in their success. MARGINS could provide one scientific framework to address some major questions using these facilities. EarthScope has just opened its first National Office, and we are fortunate that it is under the leadership of MARGINS Steering Committee member Anne Trehu, so we anticipate excellent working relations there (unfortunately, because of this commitment Anne is leaving the MSC early).

Changes

I am pleased to welcome several new members to the MARGINS steering Committee this fall. John Swenson provides ties to the Source-to-Sink modeling community and an important bridge to the new Community Surface Dynamics Modeling System initiative. Cindy Ebiner is one of the leading geophysicists working on active rifting and East Africa. Nathan Bangs has long worked with MARGINS analyzing the multichannel seismic imaging needed to unravel thrust zone structures. Demian Saffer crosses the bridge between laboratory friction measurements, modeling and in situ sampling of forearcs. Together these four form a key component of the leadership that will take MARGINS through the Decadal Review. At the same time, it is sad to say goodbye to several members who are rotating off or stepping down, Juli Morgan, Liz Screaton, Roger Buck and Anne Trehu. They all have been dedicated contributors and have provided effective leadership, and I thank them for their efforts.

Lastly, the Office is undergoing an unexpected move. After eight productive and enjoyable years at Boston University, I am moving to a position at Lamont-Doherty Earth Observatory of Columbia University effective January 2008. This has been a very difficult decision, there are many wonderful things about being at BU and I will miss many of my colleagues. I will continue as MARGINS Chair so the Office will move to Lamont at the same time, back after a 4 year absence. Unfortunately, neither MARGINS Office staff member can move; Pamela Lezaeta has already taken another position in the private sector, and Cary Kandel is heading to graduate school. So sadly I say goodbye to Pamela and Cary, they have been hugely helpful in getting the BU Office off the ground and successfully running several major events. Thanks! My first duty at the new Office is to hire new staff – please refer the ad in this issue to anybody you think may be interested.

MARGINS OFFICE POSITION

The MARGINS Office seeks new management staff starting January 2008. The position will be at the Lamont-Doherty Earth Observatory of Columbia University, in Palisades, New York, where the Office is moving through Oct. 2009. The Office fosters and facilitates activities of the NSF-MARGINS program, and provides a focal point for the planning, organization, communication and interaction with the Earth Science community. This staff member will manage the day-to-day operation of the Office, and serves as scientific assistant to the Chair. Duties include scientific interaction with researchers around the world; writing content for, editing and distributing newsletters, reports, and meeting minutes; developing materials and managing content for the MARGINS web site; providing some technical assistance for web site; overseeing meeting logistics including on-site support and budget monitoring; coordinating and participating in Steering Committee working groups; and researching and drafting science policy documents. The staffer also serves as primary liaison with the Data Management system, and coordinates some education and outreach efforts. A PhD or MS in Earth Sciences or related discipline preferred. Well-developed organizational and communication skills are necessary. Must be able to travel to national and international meetings. Helpful qualifications include expertise in web design and management; experience with administration including supervision of at least one person; experience with science education and outreach projects.

Inquiries should be directed to Dr. Geoffrey Abers, MARGINS Chair, aberns@nsf-margins.org. Interested candidates should submit a letter of interest, CV and names and contact information for three references.
**“The Future of the NSF-MARGINS Initiative Rifting Continental Lithosphere (RCL)”**

A pre-AGU activity: Sunday, December 9, 2007, 9:00 am - 5:00 pm
Metropolitan 3 Ballroom, The Westin San Francisco Market Street (50 Third St.)

Co-convenors: Paul Umhoefer¹ and Roger Buck²
¹Northern Arizona University, paul.umhoefer@nau.edu; ²Lamont-Doherty Earth Observatory, Columbia University, ldeo.columbia.edu

Recent advances in understanding the rifting process have come from studies in the MARGINS-RCL focus site in the Gulf of California as well as through research in many rifts. This workshop will bring together geoscientists that work on the processes and sites of rifting continental lithosphere to discuss the status of RCL research and ideas for possible future directions of RCL within a potential successor program to MARGINS. The program will include a review of advances in research in the Gulf of California focus site, the status of research in selected rifts, and RCL-related modeling. We will consider if the focus site paradigm is the best for the future, and how best to get broader community input into the RCL planning process.

For more information, see the web page [http://www.nsf-margins.org/AGU2007](http://www.nsf-margins.org/AGU2007). Please confirm your attendance by e-mailing the conveners at the addresses above.

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**“Data Resources for the Geosciences”**

A pre-AGU activity: Sunday, December 9, 2007, 2:00 - 5:00 pm
City Room, The Westin San Francisco Market Street (50 Third St.)

Conveners: Andrew Goodwillie¹ and Kerstin Lehnert²
¹Marine Geoscience Data System and ²Geoinformatics for Geochemistry; Lamont-Doherty Earth Observatory, Columbia U.

Join us for an informal introduction to cool, free data resources: GeoMapApp (a data visualization and exploration tool) and the on-line geochemistry database systems EarthChem, PetDB, and SedDB. Demonstrations of these systems will be given, followed by hands-on exercises. Bring your laptop! This workshop is **free**! Refreshments provided. To see these data tools, visit [www.geomappapp.org](http://www.geomappapp.org), [www.marine-geo.org](http://www.marine-geo.org) and [www.geoinfogeochem.org](http://www.geoinfogeochem.org). Workshop places allocated on a first-come, first-serve basis with limited places reserved for students.

SIGN UP TODAY for this free workshop by emailing margins@nsf-margins.org

Workshop attendance limited to 25 people.
Introduction

Earthquakes, volcanoes, and landslides are rivaled only by the biggest and most devastating tropical storms in Asia in their destructive power in heavily populated coastal and near-coastal regions. That such events have impacts and spatial reaches at the scale of ocean basins is forcefully shown by the events following the magnitude $M_w$ 9.2 giant earthquake of 26 December 2004 off the coast of Aceh Province in northern Sumatra. This earthquake ruptured 1200 km of the Sunda (Indonesia) subduction boundary and launched a succession of tsunami waves that destroyed coastal communities over much of the northern Indian Ocean Basin. Such events threaten coastal economies near where they occur, and also regional economies at distances of many thousands of kilometers. Smaller earthquakes and landslides unrelated to subduction also have the additional potential to create hazards for local coastal communities, as well as for oil and gas production in deep water. Finally, the prehistoric record suggests that less common large-volume volcanic collapses and rare extraterrestrial meteorite and comet impacts in the ocean basins have the potential of raising tsunamis of extraordinary power that can potentially threaten huge sections of coastlines with growing populations.

These facts provide persuasive arguments for a commitment of IODP resources to scientific drilling to better understand oceanic geohazards. Such an effort will have great societal relevance, and would help obtain public and political support for increasing and sustaining IODP in the coming years. With these concerns in mind, an IODP workshop on Geohazards was held at McMenamins Edgefield, outside Portland, Oregon from August 27–30, 2007. A primary objective of the workshop was to document how scientific drilling could provide fundamental information on the frequency and magnitudes of these destructive events, and scientific insights into their spatial and temporal variability and underlying physics that govern this variability. At the workshop, 89 scientists from 18 different countries came together to review the community knowledge of earthquake, submarine landslide, volcano, and tsunami hazards. One point of consensus was the need for coordinated efforts to study geohazards in the ocean setting, integrating site surveys, observatory studies, in-situ characterization and monitoring, and coring, to better constrain the locations, magnitudes, recurrence, and duration of hazardous events. An important outcome of the meeting was a mandate to include geohazards in the updated Initial Science Plan of IODP. Presently, geohazards are included as peripheral objectives, although several IODP efforts already address critical geohazards concerns (e.g., NanTroSEIZE). A Geohazards component of IODP would also be strongly complementary to those of other research entities, including the NSF-MARGINS Program, and national hazards programs, because scientific drilling is a unique tool that provides ground truth like no other approach.

Workshop conveners were Julia Morgan and Eli Silver, and the steering committee consisted of Angelo Camberlenghi, Brandon Dugan, Steve Kirby, Craig Shipp, and Kiyoshi Suyehiro. Financial support was provided by IODP, MARGINS, InterMARGINS, and ESF.

Workshop Program

The four-day workshop consisted of three days of presentations and discussions, and a full-day field trip led by Jon Major of the US Geological Survey, Cascades Volcano Observatory, to Mount St. Helens, giving participants an excellent detailed view of the anatomy of volcano collapse and its hydrologic effects. Four broad research themes involving oceanic hazards and tsunami generation were discussed:

1) great earthquakes; 2) volcano collapse and explosive eruptions; 3) submarine landslides; and 4) geohazards in other settings, such as rifted and transform margins, and bolide impacts. A fifth theme focused on observatories and miti-
gation technologies. At the workshop, each theme was represented by several talks followed by open discussion. Posters for each theme were available throughout the meeting. Clearly, many of the topics discussed have strong linkages with the MARGINS initiatives, in particular, SEIZE, S2S, and RCL. As an example, Harold Tobin gave an excellent introduction and status review of the MARGINS-related NanTroSEIZE drilling program, which began in September 2007 and has strong geohazards applications.

The group then divided into three breakout sessions to examine broad themes common to many of the topics and settings discussed during the workshop. These were organized as: (A) sea floor deformation, (B) preconditioning, triggers, and mechanisms, and (C) reading the sedimentary record. The outcomes of the break-out sessions were discussed by the entire group in plenary session the following day, outlining some key questions and drilling objectives, summarized below.

A. Sea Floor Deformation encompassed surface and subsurface structure and deformation associated with seafloor movements, with particular emphasis on their tsunamiigenic potential.

Key questions include:
1. How does seafloor deformation relate to subsurface structures and their evolution?
2. Can we characterize the full deformation cycle in recurrent tsunamiigenic settings?
3. What is the recurrence of major deformation events (earthquakes, landslides), and how does this relate to long-term natural cycles?
4. Can we measure or predict tsunamiigenic seafloor deformation?
5. What are the appropriate inputs for dynamic models for tsunami generation?
6. Where are the most effective offshore locations to constrain competing deformation models together with onshore observations?

Potential observational strategies:
1. Integrated site-survey and drilling studies to characterize subsurface structure and stratigraphy, and to constrain pre- and post failure configurations.
2. Placement of long-term borehole observatories to monitor geodetic and

MARGINS Student and Community Reception
AGU Fall Meeting 2007

With Comments on the MARGINS Program’s status from NSF Program officers and MARGINS Chair, Geoff Abers

MARGINS will host a Reception at the AGU Fall Meeting on the evening of Monday, December 10 at 6 PM in the San Francisco, Marriott Hotel, Yerba Buena Salon 7. The Reception is an open event, welcoming participants in MARGINS-funded studies and all others with an interest in the program.

As in the previous year, students entrants of the MARGINS Student Prize for Outstanding Presentation are welcome to display their posters and discuss their research with the scientific community attending. This will be a great opportunity for them to further share their results and interact with a wide spectrum of MARGINS scientists. This year, students of poster entrants will be judged at this event for consideration in the MARGINS Student Prize Award (see announcement on page 19).

There will be ample time to mingle, with food and drink courtesy of Boston University and its MARGINS Office. Among those present will be Geoff Abers (MARGINS Chair), members of the MARGINS Steering Committee, and Program Managers for MARGINS from the National Science Foundation (NSF).

Geoff Abers and NSF Program Managers will use this event as an opportunity to welcome those present, introduce the students with poster presentations, and update the community on MARGINS funding and other issues, giving the choice to close the event with an open discussion on the future directions of the MARGINS program beyond its current 10 years of funded awards.
Introduction

The geographically focused investigations of the MARGINS program have benefited greatly from the active involvement of international partners in sharing knowledge, providing access to existing data resources, and facilitating new data acquisition within territorial boundaries. The scientifically aligned InterMARGINS program is a truly international program that aims to coordinate efforts and priorities across nations in continental margins research. At present there are no formal agreements within these programs for data sharing between foreign partners, and data exchange occurs primarily by informal agreements between scientists directly involved in specific projects. However, significant benefits to these marine-terrestrial geoscience research efforts internationally could be achieved if data collections maintained as national efforts could be better linked and if broader access were initiated. Rapid advances have occurred over the past decade in Information Technology for scientific research, providing new access to data from distributed data resources and new tools for data visualization and integration. Along with these advances in Information Technology has come the growth of digital data collections for a broad suite of data across the sciences. These advances hold great promise for the solid earth sciences, an inherently multi-national and multi-disciplinary field, which involves the collection of typically unique data sets during oceanic and terrestrial expeditions and subsequent laboratory work conducted by research institutions around the globe.

International Workshop

To explore current opportunities and challenges for international data exchange to support marine geoscience research broadly, the workshop entitled “Building a Global Data Network for Studies of Earth Processes at the World’s Plate Boundaries” was convened May 9-11, 2007, in Kiel Germany. The workshop was jointly sponsored and funded by MARGINS, InterMARGINS, InterRidge and Ridge2000. The US National Science Foundation and the German project “The Future Ocean” provided additional financial support. Seventy-one people from 14 countries attended the workshop, including scientists from the InterMARGINS and InterRidge communities, data managers, and information technologists.

The meeting agenda included presentations on science needs for data access, on existing data centers or data resources relevant for continental margins and mid-ocean ridge research, and on emerging technologies for data interoperability and sharing. Working group sessions focused on technological as well as organizational and cultural issues of global data exchange and were organized into four themes: Science User Needs & Concerns; Data Documentation and Publication; Data and Metadata Interoperability; Opportunities and Obstacles for International Data Sharing. From the working group sessions, participants reached agreement on a number of recommendations, broadly summarized here:

- Open public access to data is fundamental to verifiable scientific progress. All data that are necessary to reproduce published scientific results need to be published and archived in accepted archives. Earth scientists require access to multidisciplinary data and data integrated from both the marine and terrestrial world.
- Uniform best practices and standards need to be developed, promoted and used routinely within the international community for data acquisition, data submission to data centers, and data publication.
Best practices should include the use of globally unique identifiers for data and samples. New automated tools that support metadata acquisition at sea, in the field, and in the lab are needed to further the implementation of best practices.

- To support interoperability across distributed data resources, the community must minimize the proliferation of metadata standards and work toward a uniform approach for scientific metadata building upon the work of existing community-based projects. Data centers should work to expose their data resources via web services to enable data access through programmatic interfaces and broader range of options for data analysis and visualization.
- International programs and bodies such as GEOSS, the eGY, and ICSU should be leveraged to promote an initiative for a global data network for marine and terrestrial geoscience data. A dedicated task group is needed to advance the implementation of a global data network along with special interest groups to share experience and solutions on issues concerning metadata and interfaces.

Online publication

Further information about the meeting is available at the meeting website (http://www.nsf-margins.org/Datawkshp07/), including powerpoint presentations and one page summaries with URLs for each of the data systems/resources represented at the meeting. A workshop report is available for download from the meeting website (Fig. 2); contact margins@nsf-margins.org for a hard copy.

Call for Interdisciplinary MARGINS Mini-workshop Proposals

The MARGINS Office (MO) and Steering Committee aim to support efforts that expedite synthesis of results from MARGINS science in the various focus areas and initiatives. To this end, MO offers to help MARGINS funded investigators organize and fund mini-workshops held at national meetings for the purpose of bringing together a group of multi-disciplinary investigators to synthesize results to date. Such mini-workshops can be associated with GSA, AGU, or other national meetings at which your research area is well represented. They can be 2-4 hour workshops one evening after sessions, or half-day to day-long sessions before or after the meeting. They can bring together multiple investigators from a single Focus Site or from both Focus Sites within an Initiative, or can address a theme that transcends initiatives, according to what makes the most scientific sense and where there is the greatest need. Visit http://www.miniworkshops.html for descriptions of past mini-workshops and complete guidelines.

If you are interested in hosting a mini-workshop, coordinate with your colleagues, and then send the MARGINS Office a 1-2 page outline of your meeting plan as soon as possible (margins@nsf-margins.org). Requests should generally come not later than 3 months ahead of the meeting. The MARGINS Steering Committee (MSC) will review the submitted proposal before MO will agree to support a synthesis mini-workshop. Your write-up should include:

- Scientific rationale for the meeting and reasons for its timeliness.
- Evidence that a wide group of interdisciplinary researchers would be able to attend.
- A draft scientific program for the mini-workshop.
- The national meeting with which the mini-workshop would be associated.
- The format (evening, half-day or full day, pre- or post-meeting) desired and acceptable dates
- Size of meeting envisioned.
- Anticipated cost items (meeting space, refreshments, A/V equipment, etc.). Note that a detailed budget for these costs is not initially required, and travel or lodging costs for participants cannot not be provided.

There are some ground rules intended to maximize the benefit of such workshops to a larger scientific community. MO will provide the cost of a meeting room, presentation equipment and non-alcoholic refreshments, and will assist the meeting conveners in the logistical arrangements. The MO will not support travel, lodging, alcoholic refreshments, or other disallowed costs. Conveners are responsible for developing the science program and communicating with workshop participants on scientific matters. Any MO supported mini-workshop will be open to all interested parties and will be advertised via the MARGINS mailing list and website. Workshop conveners will provide a brief write-up of the major results of the meeting for dissemination via MARGINS website and newsletter.

The MARGINS Office and Steering Committee (visit http://www.nsf-margins.org/holdmeeting.html for more information)
The MARGINS database group (http://www.marine-geo.org/margins/) would like to thank the following investigators for contributing information and data since the last newsletter report for a number of MARGINS-funded field programs.

In the Gulf of California area, a full suite of digital data has been received from Lonsdale for his seismic and rock sampling cruises, DANA01RR, DANA02RR, DANA07RR, DANA08RR. OBS recovery information and cruise details have been added to the database for Gaherty’s SCOoba2N0 cruise. Gorman provided bathymetric coastal survey data files for cruise BAJA02RH.

For the Papua New Guinea Focus Site, EM3000 swath data files for Naar’s high-resolution bathymetric survey are now available. Raw CTD data for VANC13MV, and sound velocity data for cruises VANC13-16MV, VANC27-30MV were also received from Naar.

McNinch contributed details of the small-boat sediment coring operations in 2006 for Waipaoa New Zealand.

Basic database entries for the land-based IBM projects of Kent and Plank have been created. Also in this area, ship track navigation and digital gravity data files have been added for cruise MGLN08MV (Hilton).

The 2002 Costa Rica and Nicaragua land-based field rock sampling program of Carr, including field sample descriptions, can now be viewed. Basic database entries for Carr’s 2005 work, and the Eiler (2001) and Walker (2004) terrestrial rock sampling and analysis projects are available. International collaborators Barckhausen, Weinrebe and Ranero provided to the MARGINS database their gridded compilations of magnetic anomalies and multibeam bathymetry for Central America. Direct links have been created to IRIS and UNAVCO for access to seismic and geodetic data.

New Developments

Improved functionality and expanded data content continue to be added to the GeoMapApp data exploration and visualisation application. A set of multimedia audio-visual tutorials that highlight the capabilities of GeoMapApp can be viewed with any web browser. The MGDS Global Multi-Resolution Topography (GMRT) which underlies GeoMapApp has been updated with new grids and swath bathymetry, and a new Google Earth overlay was developed to allow native access to these GMRT tiles (http://www.marine-geo.org/Data4GoogleEarth.html). In collaboration with the Lamont Borehole Research Group, we incorporated into GeoMapApp a new Web Feature Service for IODP borehole logs with live links to on-line log data for more than 500 holes and over 150 expeditions from the entire history of DSDP-ODP-IODP logging. Updated rock geochemistry data from the EarthChem database for each of the Focus Sites can be accessed through GeoMapApp with the capability to plot samples in map view, to colour and scale the symbols based upon selected geochemical parameters, and graph geochemical variables. The interfaces for viewing multi-channel and single-channel seismic profiles have been enhanced. Users can import their own grids and data tables and build customised maps.

GeoMapApp, a platform-independent Java application, can be downloaded for free from http://www.geomapapp.org

We registered more than 30 MGDS rock and sample data sets in the NSF System for Earth Sample Registration (SESAR), http://www.geosamples.org and upgraded our MGDS Web Feature Service to include the SESAR International Geo Sample Number (IGSN).

Workshops

With funding from MARGINS and Ridge, a successful workshop (http://www.nsf-margins.org/Datawkshp07/) with attendees from numerous countries was organised in Kiel in May 2007 to promote the international exchange of data (see page 10). In April 2007, we took part in the highly-productive MARGINS Education Mini-Lessons workshop (see page 14). We will be holding data resources workshops at the Fall meetings of GSA (October 2007) and AGU (see ad on page 7).

We welcome new contributions of data from your MARGINS-funded work. A packet of standardised metadata forms to capture information for the database on the land-based field programs and cruises is available for download from http://www.marine-geo.org/metadata_forms.html.

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For upcoming field programs, we ask PIs to identify one person who will be responsible for liaising with the MARGINS database group for the field program. Contact us (http://www.marine-geo.org/contact.html) prior to your upcoming field expedition and we will help identify what metadata forms are needed to document your field program. We are actively seeking contributions from land programs and for older programs, both marine and land.
The Seismogenic Zone of Subduction Thrust Faults

Edited by Timothy H. Dixon & J. Casey Moore

Nineteen papers written by experts in a variety of fields review the most current lab, field, and theoretical research on the origins and mechanics of subduction zone earthquakes and suggest further areas of exploration. They consider the composition of incoming plates, laboratory studies concerning sediment evolution during subduction and fault frictional properties, seismic and geodetic studies, and regional scale deformation. The forces behind subduction zone earthquakes are of increasing environmental and societal importance.

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MARGINS Theoretical and Experimental Earth Science Series
Introduction

MARGINS has been awarded an NSF Course, Curriculum, and Laboratory Improvement (CCLI) grant to bring MARGINS research into widespread use in undergraduate teaching in ways that showcase the integrated, multidisciplinary approach that is characteristic of modern, front-line geoscience research. In collaboration with the Science Education Resource Center (SERC) at Carleton College, the project is developing a web-based collection of teaching materials referred to as “Mini-Lessons” (http://serc.carleton.edu/margins). Mini-Lessons range in scope from something as simple as the use of MARGINS science to illustrate a lecture to multi-day lab projects that capitalize on the MARGINS Data Repository. An exciting aspect of this work is a collaboration with Don Reed at San Jose State University to create virtual expeditions for use with introductory students.

The CCLI project kicked off with a workshop held in Arlington, VA, April 5-6, 2007, to engage the MARGINS research and educational community in the generation and testing of multidisciplinary learning materials derived from MARGINS science. Twenty-seven scientists, educators and members of the MARGINS Steering Committee (MSC) met at the Holiday Inn Rosslyn to identify critical content and initiate the development of web-based MARGINS “Mini-Lessons” for use in undergraduate teaching.

Workshop participants were asked to contribute an example of their own use of MARGINS science in teaching to the Mini-Lesson Collection hosted by SERC, and to participate in creation and review of additional teaching materials. The key goals of the workshop were to (1) document ways in which MARGINS science is currently used in geoscience courses, (2) establish development teams for larger-scale (i.e., full lab or classroom session-scale) “Mini-Lessons” covering all four MARGINS research initiatives (RCL, S2S, SEIZE and SubFac), and (3) develop a plan for testing these materials in a range of classroom settings.

Workshop Program

On the evening of April 5, conveners Jeff Ryan, Cathy Manduca, and MARGINS Chair Geoff Abers opened the meeting with an overview of the MARGINS program, and outlined the outcomes expected from this meeting. The evening concluded with a poster session that included descriptions of the four MARGINS Initiatives as well as posters by participants demonstrating examples of educational activities using MARGINS and related scientific results. Among the posters presented were a K-12 outreach program by Joint Oceanographic Institution, a GoogleEarth/GeoMapApp learning class example by Jeff Ryan and Don Reed’s video lesson examples, among others. Andrew Goodwillie from the Marine Geoscience Data Center (Lamont-Doherty Earth Observatory) presented the MARGINS data repository (http://www.marine-geo.org/margins) and a demonstration of the capabilities of the Java-based map software GeoMapApp in education (http://www.marine-geo.org/geomapapp). Among the attendants present that evening was NSF-EAR official Bill Leeman.

The following morning began with an overview of results from the four MARGINS research initiatives by MARGINS Steering committee (MSC) members. Liz Scretan outlined the main results of the Seismogenic Zone Experiment (SEIZE) initiative, Mike Blum gave an overview on the Source to Sink research (S2S), Jim Gill on the Subduction Factory (SubFac) and Paul Umhoefer on Rupturing Continental Lithosphere (RCL). MSC member Julia Morgan presented a classroom example of a global earthquake study integrating ocean bathymetry and plate boundaries, using visualization tools as a teaching resource for undergraduate classrooms. Convener Don Reed closed the first set of morning presentations with examples of MARGINS research used in teaching, including the use of data obtained through the Texas Marine Seismic Data Center. The presentations were followed by 3-4 person breakout groups that brainstormed on mini-lesson ideas related to key issues in the SEIZE, S2S, RCL and/or SubFac research initiatives.

Convener Jeff Ryan finished the morning session by presenting an online investigation of the Island Volcano Anahatan as an example of MARGINS research used in teaching (www.nsf-mar-\(_\text{gins.org/SF/Anahatan/Anahatan2003.html})\), and opened the afternoon talks with a discussion of instructional strategies for creating effective mini-lessons (http://serc.carleton.edu/introgeo/instructionalmethod.html). All presentations are downloadable from the work- continued on page 16

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<tr>
<th>Title</th>
<th>Author</th>
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<tr>
<td>Plate Tectonics as Expressed in Geological Landforms and Events</td>
<td>J. Ryan</td>
<td>SF, SEIZE,</td>
<td>Introductory geology class, upper-level tectonics or petrology; homework</td>
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<td>Introductory Geology - Exercise - testing plate tectonics in</td>
<td>P. Umhoefer</td>
<td>RCL</td>
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<td>Basic sequence stratigraphy using seismic reflection lines from Gulf</td>
<td>P. Umhoefer</td>
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<td>The Woodlark Basin as a Natural Laboratory for the Study of the</td>
<td>A. Goodliffe</td>
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<td>Chemical Inputs and Outputs at Subduction Zones</td>
<td>K. Block</td>
<td>SF</td>
<td>Introductory geology; upper-level petrology course with modifications</td>
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<td>A tour of the Mariana Subduction System</td>
<td>A. Goodliffe</td>
<td>SF</td>
<td>Introductory geology lecture class</td>
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<td>What Can (and Cannot) Be Learned from Scientific Drilling Using</td>
<td>R. Hickey-Vargas</td>
<td>SEIZE, SF</td>
<td>Introductory geoscience class</td>
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<td>Examples from Margeins Initiatives</td>
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<td>Profiling Earth’s Surface using GeoMapApp</td>
<td>L. Reiser Wet-</td>
<td>General</td>
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<td>Online Investigation of an Island Arc Volcano: Anatahan, Mariana Arc</td>
<td>J. Ryan</td>
<td>SF</td>
<td>Petrology or mineralogy/petrology course</td>
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<td>Volcano Spacing in Volcanic Arc</td>
<td>M. Schmidt</td>
<td>SF</td>
<td>Undergrad tectonics, geophysics or structure class</td>
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<td>Physical and Chemical Variations Along the Central American</td>
<td>K. Ratajeski</td>
<td>SF</td>
<td>Petrology class exercise</td>
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<td>Where is California Going?</td>
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<td>Connecting Cross-Sectional Data from The Red Sea to Plate Tectonics</td>
<td>L. Guertin</td>
<td>RCL</td>
<td>Introductory geology class</td>
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<tr>
<td>Burial, compaction, and porosities in a subduction zone</td>
<td>L. Screaton</td>
<td>SEIZE</td>
<td>Intro. geosciences; groundwater course</td>
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<td>Are you in a Hotspot?</td>
<td>J. Harden</td>
<td>SF, RCL</td>
<td>Introductory geology class</td>
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*Open for more submissions, see box on next page.*
shop website at http://serc.carleton.edu/margins/program.html.

In the afternoon, the meeting returned to breakout groups to outline larger-scale Mini-Lesson concepts. Each of five breakout teams outlined possible large-scale Mini-Lessons and submitted their respective proposals to the Carleton College SERC project website (http://serc.carleton.edu/margins/). Each group presented their plan to the other groups after a 1.5 hour planning session. Among the larger Mini-Lessons proposed were:

1) Passive versus active margins: for 1st year undergraduates without previous knowledge of geology or geophysics;
2) a thematic set of smaller Mini-Lessons focused on discoveries in the Izu-Bonin-Mariana subduction system, targeting primarily students in upper-level geoscience courses;
3) “Where is California going?”, conceived as a laboratory exercise for use in introductory geology or oceanography courses.

Outcomes

Workshop participants have created an initial set of 15 mini-lessons based on MARGINS science for use in undergraduate teaching (http://serc.carleton.edu/margins/collection.html); Table 1 shows the collection at present. The next step is to build on the ideas generated at the workshop to create a set of multi-day lessons that allow students to learn geoscience concepts by exploring MARGINS data. The Mini-Lessons project will be advertised in EOS, and integrated into the IBM workshop in November, with plans for a future workshop at the AGU Ocean Sciences Meeting in March of 2008. Mini-Lessons submissions are being solicited from all MARGINS-interested researchers and educators, and can be contributed to the MARGINS Science in the Classroom site at http://serc.carleton.edu/margins/submit-minilesson.html.

Submit a MARGINS Mini-Lesson
http://serc.carleton.edu/margins/minilessons.html

Submission of a Mini-Lesson is open to any interested educator and/or researcher who would like to contribute an example from his/her own teaching using MARGINS data or research for web-based classes.

- MARGINS has been awarded a NSF Curriculum, and Laboratory Improvement (CCLI) Phase I grant to develop web-based undergraduate classroom teaching modules, in cooperation with the Science Education Resource Center of Carleton College.
- MARGINS Mini-Lessons are modular learning materials that repurpose the data resources, visualizations, and other information sources developed through MARGINS and MARGINS-related research for use in examining fundamental earth processes in undergraduate classrooms from a multidisciplinary perspective.
- MARGINS Mini-Lessons are based on best practices in geoscience pedagogy and in the construction of digital educational products. As a means of making this collection very broadly applicable, Virtual Expeditions and Web-deliverable Laboratory/Classroom Exercises are being developed (http://serc.carleton.edu/margins/collection.html).

We welcome contributions from any interested educator and/or researcher involved in earth sciences. To submit a Mini-Lesson go to: http://serc.carleton.edu/margins/submit-minilesson.html

Contact: Cathy Manduca (cmanduca@carleton.edu), Jeff Ryan (ryan@shell.cas.usf.edu), Don Reed (dreed@geosun.sjsu.edu) or the MARGINS Office (margins@nsf-margins.org)
MARGINS Postdoctoral Program: Biographies

Since 2003, the MARGINS program has funded a number of postdoctoral fellows, both within the special MARGINS Post-doctoral Fellowship and within the regular NSF-MARGINS programs. This article profiles the current postdoctoral fellows, Benjamin Holtzman and Jeremy Boyce, with research projects started in 2007 and 2006, respectively, and 2005 fellow Jennifer Garrison.

Benjamin Holtzman

*NSF Award 0646696*
*Columbia University*

**Deciphering the Role of Melt Segregation and Strain Partitioning in Rifting Continents**

My current research, including that funded by the MARGINS postdoctoral fellowship, lies somewhere between rock mechanics, seismology and geodynamics. I want to understand how to interpret seismic anisotropy measured at plate boundaries in terms of both rock fabrics and melt distribution, creeping towards a more detailed image of the structure of rheological properties of plate boundaries. While still involved with experimental rock deformation studies, I am also working with models of anisotropic elastic and viscous properties of partially molten rocks developed by Yasuko Takei at the University of Tokyo. At Lamont, I am collaborating with Jim Gaherty’s group on the measurement, inversion and interpretation of surface wave anisotropy from the East African Rift in Ethiopia and the Gulf of California (the MARGINS site). But more generally, or in more detail (I’m not sure which), my research focuses on the interactions of melt migration and deformation, or how melt influences rheological properties of rocks at high temperature.

As research often proceeds as a series of accidents, I have migrated from field geology to geophysics. My education in Earth Science began at Brown University. I did a field-based structural geology project on the nearest ophiolite (in Maine), mapping the structure and constraining emplacement with U/Pb dating of zircons. Then I went to the University of Minnesota to work with Christian Teyssier to study ophiolites as tectonic markers in the Himalayas, but I broke my knee playing soccer, so he concocted a modelling project (in Montpellier, France, where he was on sabbatical at the time) to study the phenomenon of fracturing pebbles in soft sediment (asking whether it was caused by seismic waves or by slow deformation of the matrix). My two month visit grew to seven months. The lab next door, headed by Adolphe Nicolas, focused on the Oman Ophiolite. He saw an analogy in my pebble problem to chromite grains that fracture while olivine creeps around them, as observed in Oman. So I had the great fortune of working with their group for three field seasons. I wrote my master’s thesis on these analogical problems. In studying the “chromite pods”, it seemed that the chromite was reducing the permeability of the rock, and modifying the flow of melt as they deformed. After a cheap sabbatical in Boston, I went back to Minnesota and joined David Kohlstedt’s lab, to do experiments on the deformation of partially molten olivine rocks. I added a little chromite to reduce the permeability and the melt segregated dramatically into networks of melt-rich shear zones. This phenomenon became the subject of my Ph.D thesis. In applying to Lamont, I proposed to study the seismic expression and rheological consequences of these melt-rich networks, to explore their geodynamical role in the Earth. After several years, these ideas are taking a practical form. I am very grateful to the MARGINS program for granting me this support to pursue them further.

Jeremy Boyce

*NSF Award 0549082*
*Arizona State University*

**Exploring the Record of Magmatic Volatiles in a Volcanic Arc via H, C, F, S, and Cl in Apatite**

When I approached Rick Hervig with the idea for our MARGINS proposal I had never met him, I had zero secondary ion mass spectrometer (SIMS) experience, and I had not worked on igneous processes in more than 5 years. Yet here I am, a MARGINS Postdoctoral Fellow in the School of Earth and Space Exploration at Arizona State University, using the SIMS to study volatiles in magmatic systems.

As an undergraduate at UCLA, I was fortunate to be surrounded by energetic faculty and graduate students who challenged me, broadened my horizons, and introduced me to geology in the field at exotic locations all over the world. I stayed at UCLA for an M.S. degree with Mary Reid and Marty Grove, evaluating the hypothesis that \(^{40}\text{Ar}/^{39}\text{Ar}\) ages from melt-inclusion bearing quartz crystals represent magma residence time. For my Ph.D, I knew I wanted to work on the (U-Th)/He system, and Mary suggested that I apply to her alma mater (MIT) to work with Kip Hodges. My visit with the faculty and graduate students there quickly convinced me that MIT was the place I wanted to continue my education. After we built the (U-Th)/He lab at MIT, we tackled a variety of problems related to (U-Th)/He, including a critical evaluation of the Durango apatite (U-Th)/He standard, determination of He diffusion rates in monazite, and most importantly, the development and application of laser
microprobe (U-Th)/He geochronology.

I stumbled upon the idea of using apatite to constrain H2O and CO2 in magmas during my first year at MIT. At the time, one of my committee members suggested (as it did not fit into my thesis plan) that I keep the idea to myself until I had a chance to write a proposal. Years later, as I wrapped up my Ph.D., I recognized the need to diversify my research portfolio beyond noble gas geochronology. The long-dormant apatite project seemed like a perfect change of pace, and I decided to try to make it happen. I wrote to Rick, introducing myself and the idea I wanted to pursue, and the rest (as they say) is history.

Since my arrival in Tempe last Spring, my collaboration with Rick and interaction with other ASU researchers and visitors has opened up to me many new frontiers in the geosciences, stimulating a tremendous number of ideas for future projects. Our MARGINS study, along with the work of colleagues, collaborators, and competitors worldwide, is helping to develop apatite as a powerful indicator of volatile processes. Perhaps even more exciting is our recent discovery that apatite crystals may not only yield information about pre-eruptive magmatic water content, but also about the timescales of volatile processes in magmas.

Every year Ph.D programs produce far more graduates who want faculty positions than can be placed in them. For those who want or need more time to develop their skills before starting the tenure clock, postdoctoral research experience is essential. Yet few NSF programs set aside money for post-docs. I know how lucky I am that the MARGINS program has the vision to promote postdoctoral research, and I hope other NSF programs follow this example.

Jennifer Garrison
NSF Award 0405262
University of Iowa

Time-scales and mechanisms of differentiation of mafic parents to rhyodacite in Central America

In August of 2004, I packed my belongings and headed out to the Midwest to begin two years of research for my MARGINS post-doc at the University of Iowa with Mark Reagan. This was the beginning of a series of challenging opportunities that will benefit me the rest of my career.

My Ph.D. research at UCLA with Jon Davidson had taken me to Ecuador, where I studied the geochemistry of lava flows and pyroclastic deposits related to Cotopaxi volcano in the Northern volcanic zone (NVZ) of South America. Cotopaxi is one of the few composite volcanoes in Ecuador that has erupted a bimodal suite of rhyolite and andesite lavas, and we used trace element and isotopic compositions of whole rocks and mineral separates to study the timescales and processes of magma differentiation operating in the NVZ. In addition to valuable research and travel opportunities, my Ph.D. project provided me with a solid background in the analytical techniques that I would soon put to use during my postdoc.

I initially met with Mark Reagan at the 2003 AGU/EGS meeting in Nice, France where we discussed possibilities and funding options for a project in Central America. In spring 2004, I was excited to receive notification that our MARGINS project had been funded, and we started working in El Salvador in February of 2005. Our MARGINS project focused on voluminous dacites erupted from three calderas in El Salvador and Nicaragua (Ilopango, Apoyo and Apoyequé) over the last 20 ka. The youngest of these was the climactic eruption from Ilopango caldera in El Salvador about 1605 years ago. We used trace element and isotope geochemistry to assess differences among these calderas. While conducting our field research in El Salvador we were fortunate to be accompanied by Dolores Ferres from the local government office that monitors volcanic activity in El Salvador (Servicio Nacional de Estudios Territoriales, or SNET). After completing field work in El Salvador, I had the opportunity to participate in a field excursion to Santa Maria volcano in Guatela, led by Dr. Bill Rose from MTU. The hike and three day stay in this very active crater was an experience I’ll never forget. After returning to Iowa City, I began the process of separating minerals and preparing rocks for analysis. Most of the sample preparation was done in the University of Iowa clean lab facility. The analysis of the U-series isotopes (U, Th, Ra), and the long-lived radiogenic isotopes (Pb, Sr, Nd) were accomplished at Woods Hole Oceanographic Institute.

I spent a total of four months at WHOI working with Ken Sims to prepare and analyze samples. On the basis of Th, Sr, Nd, and Pb isotopes, our preliminary data show that the rhyodacites in this system are produced by fractionation of local, more mafic magmas. Samples from all three systems have 238U excesses, which is significant because most of the more mafic rocks from this area have 238U excesses that result from fluid addition from the slab. Positive correlations between (238U/232Th), Ba/Th, and Ce/Pb, as well as large differences in Th isotope ratios from north to south suggest that these differences correspond to changes in the amount of subducted sediment involved in magma genesis. This is important because relating geochemical variation to petrogenetic processes and subsequently relating these processes to timescales is critical to our understanding of magma genesis and volcanic evolution. I am currently preparing these results for publication, and we presented our research at the June MARGINS workshop in Costa Rica (see pages 1-4).

As a result of my time spent at WHOI, I have initiated important contacts and have planned future collaborations, including research in Ecuador on El Reventador volcano. I am very thankful to have been afforded the opportunity for this research project.
MARGINS at the AGU Fall Meeting 2007

This section highlights the MARGINS sponsored events taking place at the 2007 AGU Fall Meeting, December 10-14. On pages 21 to 25 you will find a list of AGU sessions of relevance to MARGINS science. These sessions have been recommended by the corresponding convenors involved in MARGINS research or picked up from the AGU website (http://www.agu.org/meetings/fm07/) by the MARGINS Office. If you are planning to attend the AGU Meeting, we hope this list will be useful for you.

As last year, the MARGINS Prize for Outstanding Student Presentation will run throughout the week (see below). This year, student entrants are featured at the MARGINS Student and Community Reception on Tuesday, December 11 (see page 9). At this reception, poster entrants will have the opportunity to present their research to the MARGINS judges of the Student Prize competition and some judging will take place.

MARGINS Mini-Workshop “The Future of NSF-MARGINS Initiative Rifting Continental Lithosphere (RCL)” will take place on Sunday, December 9, prior to the start of the AGU Meeting (see page 7). We hope that anyone interested in rifting processes can participate in this meeting. The MARGINS Mini-Workshop “Data Resources for the Geosciences” is oriented to students interested in learning data visualization and exploration tools and is being convened by database specialists Andrew Goodwillie and Kerstin Lehnert. It will be on Sunday, December 9 (see page 7).

Sunday, December 9
• 9:00 AM - 5:00 PM: Mini-Workshop “The Future of NSF-MARGINS Initiative Rifting Continental Lithosphere (RCL)”, Metropolitan 3 Ballroom, The Westin San Francisco Market Street.
• 2:00 - 5:00 PM: Mini-Workshop “Data Resources for the Geosciences”, City Room, The Westin San Francisco Market Street.

Monday, December 10
• 6:00 - 9:00 PM: MARGINS Student and Community Reception, Yerba Buena Salon 7, San Francisco Marriott.

MARGINS Prize for Outstanding Student Presentation

The MARGINS Office and Steering Committee are offering $500 prizes for two Outstanding Student Presentations on MARGINS-related science at the AGU Fall Meeting, December 10-14, 2007 in San Francisco. The two prizes, one for a poster presentation and one for an oral presentation, will be awarded to highlight the important role of student research in accomplishing MARGINS science goals, and encourage cross-disciplinary input to the MARGINS program. Any student as first author presenting a poster or talk with research related to the MARGINS science initiatives is eligible to participate. Students from the U.S. and international community are encouraged to apply. Posters from students entrants can be on display throughout the MARGINS Student and Community Reception (see ad on page 9) for judging. The winner and any honorable mentions will be notified after the AGU Fall Meeting, and will be highlighted in the MARGINS newsletter and website, including notification to the hosting schools of their achievement.

Application deadline: Friday, November 23, 2007
Visit the MARGINS website for further information: http://www.nsf-margins.org/AGU2007/
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Sessions relevant to MARGINS science at AGU Fall Meeting 2007

We have selected a list of AGU sessions that may be of special interest to the MARGINS community. The sessions highlighted with * directly address MARGINS themes. All other relevant sessions were captured from the AGU website (http://www.agu.org/fm07) or listed by request of the corresponding session’s convenor.

AGU Code Key: Capital letters assigns session’s theme.

Education and Human Resources

*ED: New Directions in Undergraduate Geoscience Education: Bringing Together Research, Education and Technology in the Classroom and Field
This session will highlight efforts being made to transform undergraduate education through the repurposing of the datasets and scientific results of major research initiatives for use in classroom settings. Presentations will highlight efforts that take advantage of the fruits of major Federally-funded research initiatives, including but not limited to the NSF-MARGINS Program, Ridge 2000 and IODP, to invigorate coursework and classroom activities and facilitate focused research and research-like experiences for undergraduate students. This session is co-sponsored by NSF-MARGINS and Council on Undergraduate Research (CUR).

Ocean Sciences

OS: Mountains to Ocean Deep: Tracking Material Fluxes and Processes During Climatic Change with New and Better Proxies
Conveners: C. Siebert & B. Georg
Recent technical advances have resulted in new and improved proxies for quantifying the chemical and biological processes and fluxes that govern mass transfer from the continents to the oceans. We need to better understand how these processes respond to, and provide feedbacks and drivers for, long term climatic change. The application of proxies is rapidly expanding and this session is intended to give geochemists the chance to present and discuss their new discoveries as well as providing an overview of the latest developments in the field. We invite contributions that utilize geochemical proxies to (1) constrain key fluxes such as the macro and micro nutrients contributed by rivers, groundwater and the atmosphere, (2) elucidate the relevant controlling processes and (3) understand the link to climate change. The scope will range from micro-scale reactions in porewaters to global scale modeling of feedbacks. Constraining continental sources and fluxes is an important part of the session goals. This includes weathering processes, the relative importance of different lithologies, the roles of dust and aerosols versus rivers and versus groundwater and how together these different facets of the Earth system link to climate. Understanding transport processes including the interaction between different pathways is also an important goal of the session. Finally, we need a better understanding of the drawdown and recycling of oceanic sinks and how these might respond to global change. Although some focus of the session will be on new proxies such as non-traditional stable isotopes, contributions on other tracers, such as biomarkers, as well as multi-proxy approaches are welcome. Indeed, detailed comparisons between these approaches are seen as essential to the further development of the field.

Seismology

S: New Perspectives into the Seismotectonics of the Andaman, Sumatra, and Java Subduction Systems
Conveners: H.R. DeShon & S. Bilek
The occurrence of the 2004 and 2005 great Sumatra earthquakes and the 2006 Java tsunami earthquake highlight the significant seismic hazard associated with subduction offshore Indonesia. These three earthquakes exhibited a large degree of variability in their rupture patterns, associated tsunami, aftershock locations and mechanisms, and frequency range of associated seismic energy. This session aims to improve understanding of the seismotectonics of the Andaman, Sumatra, and Java subduction systems in order to provide further insight into the range of seismogenic zone processes affecting earthquake generation. We invite contributions from a range of disciplines including passive and active source seismology, marine geochemistry, geology, and geodesy that address seismotectonic issues in this region.

Tectonophysics

*T: Inner Workings of Centam and IBM Subduction Factories
Conveners: J. Gill and S. Holbrook
This session’s goals are to report and compare geophysical and geochemical discoveries related to subduction processes in the Central American and Izu-Bonin-Mariana arcs. The “Factory” in this session includes the incoming plate, the slab to the transition zone, the mantle wedge, and outputs to the crust and atmosphere from the forearc to rear arc. Contributions are especially welcome that draw from Workshops during 2007 about these topics, or explicitly relate geophysical and geochemical discoveries, or compare the two arcs. Syntheses of long-term projects are welcome even if some of the results have been presented before.

T: Tectonic Erosion, Sediment Accretion and Mass Recycling in Subduction Zones
Conveners: P. Vannucchi, P. Clift and J.P. Morgan

The flux of continental material into subduction zones is known to have a large effect on arc magmatic chemistry, as well as on the tectonics and vertical motions of convergent margins. Recent estimates of mass recycling place the rate of mass subduction at around 3 cubic km/year, a level that is high enough to be important in the generation and maintenance of the continental crust. Of this total only around a half comprises trench sediment, with the rest made up by eroded forearc crust. What controls the rate of mass subduction is still debated but is important in understanding subduction petrogenesis and seismogenesis. Detailed geophysical data from eroding arcs remains relatively scarce. We solicit contributions from geophysicists, geochemists and geologists working on the cycling of material through subduction zones in order to build a multidisciplinary session where the different datasets can be reconciled in a coherent model of margin evolution. Studies spanning long and shorter geological timescales are encouraged, as are those involving direct sampling or remote imaging of the subduction channel and the tectonic erosion process.

Seismic studies and drilling have shown that ultramafic rocks are exposed in the transition zone between continental and oceanic crust at some rifted continental margins. However, the tectonic and magmatic processes responsible for mantle exhumation remain enigmatic. This session will bring together scientists involved in imaging, sampling and modelling the thinned continental crust, transition zone and early oceanic crust at ‘non-volcanic’ margins, both modern and ancient.

Key questions include: - Why do some ‘non-volcanic’ margins exhibit mantle exhumation whilst others do not? - What is the origin and petrological history of the exhumed mantle? Can we distinguish between subcontinental and asthenospheric mantle? Can we identify and explain fertile, depleted, refertilized and infiltrated mantle? What are the implications for mantle heterogeneity and continental break-up? - In the transition zone, what is the nature and source of magnetic anomalies, is there evidence for gabbroic bodies, and how deep and pervasive is serpentinitisation? - How do the characteristics of the transition zone at ‘non-volcanic’ margins compare with those of ultra-slow seafloor spreading? Can mantle exhumation at ‘non-volcanic’ margins be explained by melt suppression at very slow spreading rates or anomalously cool lithosphere during early seafloor spreading? - What does the sedimentary record tell us about uplift and subsidence during break-up? - How does continental break-up occur without the assistance of magma?

Contributors are invited to present seismic, petrological, sedimentological or structural observations and/or formation process models relating to magmatism and tectonics at ‘non-volcanic’ margins.

T: Faults in the Ocean Crust: Perspectives From Geology And Geophysics
Conveners: N.W. Hayman and D. Bohnenstiehl

Faults in the oceanic crust play many roles: accommodating magmatic and tectonic strains at spreading centers, facilitating fluid flow along the ridge crest and outer-rise, and allowing the relative motions of plates along transform boundaries. Different approaches to studying ocean crustal faults include bathymetric analysis, earthquake and reflection seismology, ocean drilling, and geologic studies from submersible investigations. These diverse investigative techniques yield information at a range of temporal and spatial scales, which are challenging to integrate into a comprehensive model of oceanic fault development. Consequently, many processes and interactions involving seismicity, hydrogeology, and fault evolution remain poorly understood in oceanic settings. This session is intended to bridge disciplines to focus on open problems in ocean crustal faulting.

T: From the Trench to the Arc: Subduction Along South America
Conveners: N. Kukowskin, Nathan L.B. Bangs, A. Tassara

The western rim of South America has been shaped through subduction of oceanic plates since the Paleozoic; however, the existing structures of the Andes, currently Earth’s largest subduction orogen, developed almost entirely during the Cenozoic. During the past decade, several large multinational and multidisciplinary initiatives have focused on the Andes to investigate subduction erosion and subduction accretion along the margin tip, formation of the Altiplano-Puna plateau, which is Earth’s second largest continental plateau, arc volcanism, relationships between climate variability, erosion and tectonics, seismogenic processes along the subduction interface and associated seismic and volcanic hazards. These efforts have made significant progress, but many open questions remain about the Andean margin regarding e.g., the timing of uplift, the thermal evolution of the orogen, the interaction of climate and tectonics, and more. To review our current knowledge on the subduction processes along the South American forearc and to develop an overview of the Andean margin structures and processes, we invite contributions from all fields of geophysics and geology, including both marine and terrestrial components. We especially encourage contributions about interdisciplinary studies that combine multiple aspects of Andean evolution.

T: Mantle Exhumation at Rifted Continental Margins: Magmatic and Tectonic Processes
Conveners: R. Fletcher, G. Manatschal, O. Müntener, A. Goodliffe

During the past decade, several large multinational and multidisciplinary initiatives have focused on the Andes to investigate subduction erosion and subduction accretion along the margin tip, formation of the Altiplano-Puna plateau, which is Earth’s second largest continental plateau, arc volcanism, relationships between climate variability, erosion and tectonics, seismogenic processes along the subduction interface and associated seismic and volcanic hazards. These efforts have made significant progress, but many open questions remain about the Andean margin regarding e.g., the timing of uplift, the thermal evolution of the orogen, the interaction of climate and tectonics, and more. To review our current knowledge on the subduction processes along the South American forearc and to develop an overview of the Andean margin structures and processes, we invite contributions from all fields of geophysics and geology, including both marine and terrestrial components. We especially encourage contributions about interdisciplinary studies that combine multiple aspects of Andean evolution.
T: Bringing Together Observations and Models at Rifted Margins and Extensional Basins
Conveners: J.W. Van Wijk, G Péron-Pinvidic, D. J. Shillington
Recently developed numerical models are capable of simulating a wide range of factors thought to be important in controlling the evolution of extensional terranes, including variations in stretching with depth, magmatism, prerift structural heterogeneities, and rheological layering. As these models become more sophisticated, it is essential to compare model predictions with observations. Geological, petrological and geophysical datasets from extensional basins and rifted margins provide critical information on the structure of the crust and lithospheric mantle, volume of magmatism, stratigraphic and subsidence history, petrology of magmatic and mantle rocks, etc. Clearly, a close integration of numerical and analogue modeling with rift attributes from observational data can result in a greater understanding of the factors most important in controlling the evolution of continental basins and rifted margins. Additionally, numerical and analogue models can highlight rift characteristics that are as of yet still poorly constrained by existing data and thus guide future data acquisition. We invite presentations that seek to investigate rifting and the transition to seafloor spreading with diverse observations (e.g., geophysical, petrological and geological datasets) and modeling.

T: Observations, Interpretations, and Implications of Slow Slip, Non-Volcanic Tremor, and Associated Phenomena
Conveners: J. Rubinstein, S. Ide, H. Hirose and J. Townend
Aseismic fault slip, non-volcanic tremor, and other low-frequency seismic phenomena have been observed in a variety of tectonic environments, most notably subduction zones but also within the strike-slip San Andreas Fault zone and beneath the island of Hawaii. In the Cascadia and southwest Japan subduction zones, in particular, the spatiotemporal coincidence of tremor and slow slip suggests a strong relation between these phenomena, but our understanding of the underlying physical processes is incomplete and other locations exhibit either slow slip or seismic tremor but not both. In addition to addressing the long-standing scientific goal of understanding fault mechanical processes, including the generation of megathrust earthquakes in subduction zones, recent observations have significant policy implications based on the suggestion that seismicity and seismic hazard may increase following slow slip activity.

This session seeks presentations that shed light on the mechanics of slow slip, non-volcanic tremor, and associated phenomena, as well as the hazard implications posed by these processes. In particular, we seek contributions that explore this burgeoning field of research using new techniques, new observations, and innovative modeling. We also welcome studies that address regional variations in the occurrence and characteristics of these phenomena.

*T: Progress in Subduction Modeling
Conveners: S. Buiter, S. Goes, P. Van Keken
Subduction zones display a wide range of slab morphologies, upper plate deformation regimes, plate and trench motions and mantle flow patterns. Models of varying degrees of complexity have been used to understand natural subduction regimes and their variability in space and time. Recent progress in models of subduction zone processes includes the incorporation of slab petrology and phase changes, the evaluation of effects of three-dimensionality, and an improving capability to model the evolution of the slab and trench in a dynamically self-consistent way. The aim of this session is to showcase the latest results of numerical and analogue models of subduction and initiate discussion of their current achievements and challenges. We also welcome studies that describe how observations (e.g., seismic and gravity) and laboratory measurements can be used to constrain which processes are most important in natural subduction and what parameter values, particularly for rheology, are applicable to the Earth. Topics that may be considered include, but are not restricted to: the strength of slabs, the role of pressure- and temperature-dependent rheologies (plasticity, grain-size weakening), the depth extent of slabs, the effect of phase transitions, and the role of the overriding plate.

T: Megathrust Slip and Forearc Structure
Conveners: R. Briggs, C. Goldfinger and R. Witter
Megathrusts accommodate most of the convergence between colliding plates along subduction zones. This interdisciplinary session invites studies that address the connection between seismogenic behavior of the megathrust and forearc structure. Topics of interest may include, but are not limited to, the temporal and spatial relationship between megathrust slip (co-seismic, postseismic, and aseismic) and upper plate structure; internal deformation of the overriding plate during the seismic cycle; controls on along-strike and down-dip variations in seismogenic behavior; and models that explicitly tie the earthquake cycle to evolution of the forearc. We hope to attract submissions spanning geology, marine geophysics, geodesy, seismology, and geophysical and analog modeling, and welcome discussion of how our current understanding of megathrust slip affects seismic hazard models.

Volcanology, Geochemistry and Petrology
V: Subduction volcanism at continental edges
This session has its focus on volcanism at the edge of continents, as exemplified (but not exclusively) by the Mexican volcanic belt. Mass flow in subduction environments from the mantle to the surface is influenced among others by differentiation processes, crustal contamination, degassing, magma ascent rates and eruption type. Presentations are invited on volcanic products ranging from volcanic rocks, melt inclusions in crystals, and gases to xenoliths that provide insight into the origin, evolution and transport processes of such continental arc magmas. Fundamental topics to be addressed may include ‘the role of subduction volcanism in the formation of
the continents’, ‘estimates on the amount of crustal contamination in a volcanic suite’, ‘the composition of the mantle wedge at continental margins’, ‘the volatile budget in specific subduction zones’, and ‘the application of the stratigraphic and petrologic history of a volcano to better predict future eruptions. This session invites contributions thematically linked and/or inspired by the lasting and fundamental work of James F. Luhr.

*V: From the Arc to the Back-Arc: Linking Geochemical and Geophysical Observations with Geodynamic Models of the Mantle Wedge
Conveners: P. Hall, S. Escrig
Back-arc basins (BABSs) are complex tectonic environments in which oceanic crust is created at a spreading center (Back-arc spreading center, BASC) in close proximity to a subduction zone. This juxtaposition results in strong spatial gradients in both geochemical and geophysical observables, providing a unique window on geodynamic and petrogenetic processes in the upper mantle. This session seeks to highlight progress in our understanding of mantle flow and melting in the mantle wedge by considering differences between arcs and BABSs, as well as between BABSs and normal mid-ocean ridges. Questions of interest include: What is the nature of the slab-derived component that contributes to arc and BASC magmatism (e.g., hydrous fluids, melts)? What is the distribution of this component within the wedge, and by what mechanism is it transported? What constraints do seismic attenuation and velocity studies provide regarding the presence of water, melt and fine-scale structure in the mantle wedge beneath BABSs? How does plate kinematics (e.g., subduction angle, subduction rate, arc-back-arc separation, back-arc spreading rate) affect mantle flow and melting in arcs and BABSs? Contributions from geochemistry, petrology, seismology, geophysics, geodynamics and mineral physics are encouraged, as are contributions from researchers working in relevant Ridge and MARGINS focus sites (e.g., Lau Basin, Izu-Bonin-Mariana).

V: Magmatic Processes in Arcs and Metallogeny
Conveners: R.F. Weinberg and A. Tomkins
This session will focus on the interaction of physical and chemical processes during magmatic evolution in island and continental arcs, and how these affect the genesis of ore deposits related to felsic magmas. The session aims to address formation of the massive metal and sulfur anomalies that characterize these deposits by taking a broad view of the magmatic system, including processes in the magma sources and the deeper part of the system. We welcome contributions from igneous petrologists, economic geologists, numerical modelers, geochemists and geophysicists describing any aspect of these magmatic systems. Studies based on field, experiments or theoretical approaches are invited.

V: Fluid-Rock Interaction in the Crust and the Upper Mantle
Conveners: T. Mueller and A. Wohlers
The presence of fluids in the crust and the upper mantle has fundamental consequences for many petrologic processes, such as the genesis of magmatic rocks, mineral reactions, rates and mechanisms of nucleation and growth of minerals, mineral solubility, isotope transport, partial melting. We invite contributions in the field of metamorphic and igneous petrology which address the questions and problems of fluid-rock interactions in different geological settings, and on different scales, in order to advance our understanding of the fundamental processes controlling fluid-rock interactions in earth’s crust and mantle. Field, experimental and theoretical studies ranging from shallow crustal regimes to subduction zones and the upper mantle are welcome.

V: Seafloor Hydrothermal Systems Related to Volcanic Arcs
Conveners: D. Butterfield and W. Bach
Hydrothermal venting at back-arc spreading centers and at submerged island-arc volcanoes display both similarities and differences when compared to systems found on mid-ocean ridges, with differences attributed to a range of factors including the composition of the substrate (basalt, andesite, rhyolite, dacite), contributions of magmatic volatiles to the hydrothermal system, and the depth and structure of the substrate. For example, recent studies in the southwest Pacific (Lau Basin, Manus Basin, Kermadec and Mariana Arcs) are providing evidence for volatile input (based on both alteration assemblages and vent fluid compositions). This session seeks contributions on any topic related to submarine volcanic arc hydrothermal systems.

Other Sessions of interest
B: Cold Seeps at Continental Margins: Past and Present
Conveners: J. Sample & H. Schwartz
DI: Volatiles and Melts in the Earth’s Interior
Conveners: R. Dasagupta, C. Aubaud, G.M. Leahy, J.E. Dixon
G: Plate Motion and how it is Taken up in Deforming Zones
Conveners: D.F. Argus, J.T. Freymueller
H: Flow and Transport in Heterogeneous Media: New Experimental and Modeling Approaches
Conveners: M. Dentz, A. Englert, T. Le Borgne
NS: Fault Imaging and Seismic Hazard Assessment
Conveners: M. Craig, S. Kruse
OS: Coastal Models and Data: Simulation, Synthesis and Integration
Conveners: C.J. Hearn, O.S. Petersen & K.K. Yates
S: Earthquake Early Warning: Design and Application Around the World
Conveners: R.M. Allen, P. Gasparini, O. Kamigaichi
S: New Insights About Seismogenesis from Dense Geophysical Observations
T: Tectonic, Magmatic and Surface Processes in Arc-Continent Collisions
Conveners: P. Clift and A. Draut
Sessions relevant to MARGINS-science at the Ocean Sciences Meeting
March 2-7, 2008, Orlando, FL

Sessions convened by scientists involved in the Source-to-Sink Initiative are announced here.

Session 134: Toward Integrating Source-to-Sink Field Studies of Sediment Dispersal Systems

Organizers: Clark Alexander (Skidaway Inst of Oceanography), Andre Droxlér (Rice University), Alan Orpin (National Inst of Water and Atmospheric Research) and John Swenson (U of Minnesota).

Scientists around the world are examining the processes within and linkages between the components of individual siliciclastic, carbonate, and mixed dispersal systems from uplands and to the sea, including erosion and transport processes in highlands, processing of material along river courses and within floodplains, discharge from land, neritic carbonate production in areas flooded within the photic zone, and redistribution and accumulation on the continental margin from the inner shelf/lagoons to adjacent basins and abyssal plain. In many cases, these studies have reached a point where field observations are sufficient to drive conceptual and/or numerical model generation for all or parts of these systems. This session will focus on results coming out of dispersal system studies and will illustrate the characteristics of modern dispersal systems with a global perspective. Contributions that explicitly integrate one or more components of an individual dispersal system are particularly encouraged.

Session 165: Advances in Coastal Morphodynamics: From Estuaries and Beaches to Deltas and Shelves

Organizers: Art Trembanis (U of Delaware), Carl Friedrichs (William and Mary/VIMS), Andrew Short (U of Sydney) and Jeff List (USGS).

Coastal morphodynamics aims to understand the complex bi-directional coupling between hydrodynamic processes and morphologic responses. The field has experienced tremendous growth and evolution of understanding over the last 25+ years thanks in part to advances in field observations and modeling capabilities. Much exciting and challenging work remains to link processes and responses at all scales, from the micromorphodynamic level (boundary layer scales), to large scale coastal behavior (decadal to century scales), to geological time scales (millennial scales). In this session we seek to bring together researchers in coastal morphodynamics pursuing observational and modeling studies in diverse settings including estuaries, beaches, deltas, and the continental shelf.

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Research Vessel - Marcus Langseth
Town Hall Meeting at AGU
Monday, Dec. 10, 2007 • 7:30 pm • Location: TBA

Come to hear about progress and plans of the United States’ new 3-D seismic research vessel, which is scheduled to begin science operations in early 2008. For more information, please go to: http://www.unols.org/meetings/2007.
“Geohazards” cont. from pg. 9

seismic activity, and pore fluid transients, throughout a deformation cycle.

B. Preconditioning, Triggers and Mechanisms explored properties and processes that contribute to seafloor deformation and tsunamigenesis, including geotechnical properties, strength, rheology, and triggering events (e.g., fluid pressurization, sea level changes, methane hydrate dissociation and/or dissolution, earthquakes, and magmatic processes).

Key questions include:

(1) What are the properties of layers prone to failure, and how do they differ from those of stable units?
(2) How does material rheology evolve with time and deformation?
(3) What controls frequency, magnitudes, and rates of seafloor deformation?
(4) What are the relative roles of in-situ preconditioning vs. triggering in specific settings?

Potential observational strategies:

(1) Complete geotechnical studies (field and laboratory) to determine physical properties and conditions that favor slope failure and seafloor mobility.
(2) In-situ measurement and long-term monitoring of stress, strain, pore pressure, and associated transient phenomena.
(3) Focus on regions with high rates of deformation and/or recurrence, and therefore high probabilities of events that could be monitored.

C. Reading the Sedimentary Record addressed the overall evolution of sedimentary basins, and specifically, the origins and sources of turbidites, the processes of deposition, chronostratigraphy, and local, regional, and global correlations of event deposits.

Key questions include:

(1) Can we reliably distinguish the different origins of turbidites in the sedimentary record (earthquake, submarine slide, sea level change, tsunamis)?
(2) Do specific sedimentary processes generate distinct geohazards?
(3) How can we improve local and global chronostratigraphy?
(4) Can we extrapolate information about physical properties from seismic profiles?

Potential observational strategies:

(1) Integrate site survey and borehole data to establish broad spatial coverage of material properties, stratigraphy, and age relationships.
(2) Establish local, regional, and global correlations of event stratigraphy, coupled to other data sets.
(3) Correlate submarine event stratigraphy with independent, and possibly historic, records, e.g., of climate change, earthquakes, eruptions, etc.

Several participants made brief, informal presentations in support of potential drilling programs to demonstrate the importance of IODP in understanding geohazards. Some of these were proposals already in the system; others were simply concepts open to discussion. The purpose of this session was not to gain consensus from the group for any specific program, but rather to introduce participants to the IODP proposal process, to encourage comments and questions, and to bring together international groups with common interests to pursue proposal development following the workshop. Topics included suggested targets and locations for drilling, proposed observatories to study active, and potentially precursory, processes, in-situ measurement techniques, and methodologies for interpreting core records. A common theme was the unique opportunity afforded by IODP drilling to study active processes relevant to geohazards, especially at known points within the deformation cycle. MARGINS related examples include offshore monitoring of geodetic and seismic activity near Costa Rica’s Nicoya Peninsula, which exhibits a ~50 yr seismic cycle, and examination of post-seismic strain and fluid responses to the Sumatra earthquake of 2004. Several examples of potential incipient slope failure were also presented.

The workshop concluded Thursday afternoon with an open discussion of the best ways to proceed toward fulfilling the objectives of the workshop – i.e., advancing the study and understanding of geohazards through ocean drilling, by defining the key research questions, identifying potential drilling targets, and guiding development of new technologies and methodologies. To facilitate this process, workshop participants self-organized into working groups charged with synthesizing knowledge of specific topics for the entire IODP community and encouraging the development of IODP proposals to address oceanic geohazards. These working groups are intended to be inclusive of all interested parties, regardless of their attendance at the workshop, with initial leadership volunteered by workshop participants. The working groups include:

- Landslides: Jacques Locat, Angelo Camerlenghi;
- Volcanic Processes: Tom Sisson, Juli Morgan, Maria-Teresa Pareschi;
- Earthquake Hazards: Steve Kirby, Chris Goldfinger;
- Impact Hazards: Sean Gulick, Henning Dypvik;
- Tsunami Studies: Simon Day, David Tappin;
- Risk Assessment: Mark Legg, Roger Urgeles;
- Coastal and Submarine Aquifers: Evgeny Kontar.

Effective January 2008:

MARGINS Office moves to Lamont-Doherty Earth Observatory

The new address will be: 61 Route 9W Palisades, NY 10964

The webpage will remain at: http://www.nsf-margins.org

Contact MARGINS Chair, Geoff Abers (abers@nsf-margins.org) with questions.
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MARGINS Mini-Workshops

Sunday, Dec. 9, 2007; pre-AGU Fall Meeting:

“The Future of NSF-MARGINS Initiative Rupturing Continental Lithosphere (RCL)” and “Data Resources for the Geosciences”

see ad on page 7