

## Sessions relevant to MARGINS Science at AGU Fall Meeting 2009

The extensive list of sessions in AGU's Fall Meeting program can be daunting, so each year the MARGINS Office assembles a list of sessions that we think may be of special interest to the MARGINS community. Other relevant sessions were captured from the AGU website (<http://www.agu.org/fm09>) or listed by request of the corresponding session's convenors.

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

### *Education and Human Resources*

#### **ED: Using Digital Information Resources and Findings from Major Research Initiatives to Transform Undergraduate Instruction**

Convenors: Jeffrey Ryan, Don Reed, Andrew Goodwillie, Cathy Manduca

The development of geo-information databases with global reach and spanning multiple disciplines, and digital visualization/interpretive tools to manipulate these large datasets has dramatically facilitated the creative repurposing of results from major geoscience research programs for use in geoscience courses and curricula at the college level, and to facilitate undergraduate research. This session seeks to highlight exemplary classroom applications of the fruits of major research efforts (ex.: the NSF-MARGINS Program, IODP, EarthScope, Ridge 2000, GEON, AMS/NOAA initiatives, NASA exploration programs, etc.) toward identifying the best educational practices for the use of these new tools. ED13D, ED24A.

### *Study of Earth's Deep Interior*

#### **DI: Linking Earth's Deep Interior to the Surface Environment**

Convenors: Peter Clift, Clinton Conrad, Husson Laurent, Alison Shaw

Plate tectonics provides an interface across which Earth's deep interior communicates with its outer shells: atmosphere, hydrosphere, sediments and crust. Earth's interior dynamics may exert controls on the climatological, biological, cryospheric, hydrologic, and tectonic systems acting at the surface by affecting continental motions, surface deformation, and volcanism. Conversely, surface processes may affect deep interior dynamics by changing the spatial

and temporal distribution of heat flow, temperature, hydrology, geochemistry, and rheology of the lithospheric interface. Likewise, volatile exchange between the mantle and its exospheric reservoirs, particularly at subduction zones, affects rates and styles of mantle flow, volcanism, and tectonics by influencing mantle composition, melting, and rheology. This interdisciplinary session explores links between the Earth's surface and interior dynamics by incorporating observations and modeling studies looking either upwards or downwards within the whole-Earth system. Studies examining deep interior links between sea level, climate, sediments, geochemistry, petrology, tectonics, and other variables are welcome. DI32A, DI33B, DI41A.

#### **DI: Seismic Anisotropy and Geodynamics**

Convenors: Eduoard Kaminski, Greg Hirth, Karen Fischer

Seismic anisotropy has become a major tool to infer deformation and related convective flow in the solid Earth. A growing body of laboratory experiments, naturally deformed rock samples, seismological observations and geodynamical models are now available to solve old geodynamical problems and to allow new ones to emerge. However, these studies have also revealed rich complexity in lattice preferred orientation (LPO) development and in seismic wave interactions with anisotropic media. Multidisciplinary efforts are therefore required to understand anisotropy itself, and to fully realize its potential for constraining mantle dynamics. This session will emphasize (1) cutting-edge disciplinary findings including new seismological approaches to measuring anisotropy, experiments on LPO in Earth-like conditions (e.g. volatiles, melt, stress and pressure effects), and theo-

retical modeling of LPO development and of anisotropic rheology; and (2) multidisciplinary studies that link geodynamics and seismic anisotropy, from the lower crust to the core. DI41B, DI51A, DI52A.

#### **DI: Subducting Slabs: Integrating Seismic Properties from Laboratory Data and Field Observations**

Convenors: Peter Ulmer, Luigi Burlini, Jay Bass, Carmen Sanchez-Valle

The current generation of seismic results and high-resolution images of subducting slabs suggest several characteristic features, including low velocity anomalies and high degrees of velocity anisotropy. Interpreting these features in terms of changing slab petrology at depth, associated to deformation, is a challenge that requires interdisciplinary approaches. The aim of this session is to bring together experimentalists, computational mineral physicists, petrologists, seismologists, and geochemists to present and discuss recent results and future research directions regarding the structure, mineralogy, and ultimate fate of subducted slabs, including implications for mantle dynamics and geochemical recycling in the Earth. Topics include theoretical and laboratory constraints on seismic velocities, anisotropy; deformation and rheology of subducted rocks, the role and recycling of volatiles, advances in the theory and modeling of anelasticity, as well as inverse modeling that provides constraints on the thermal structure and mineralogy of subducted slabs. DI14A, DI21A.

### *Tectonophysics*

#### **T: The Many Faces of Slow Slip, Tremor, and Earthquakes**

Convenors: Joan Gomberg, Roland Burgmann, Paul Bodin

Great interest has recently focused on observations and implications of deformational processes that give rise to slow fault slip, tremor and earthquakes in plate boundary settings. This session posits that revealing the key processes and conditions that control the generation of these coupled phenomena requires investigating them in widely diverse environments and with a diversity of interdisciplinary approaches. In this session we will examine this diversity, with presentations of studies of the coupled phenomena of slow slip, tremor, and earthquakes not only in plate-boundary environments, but also in the laboratory, computer models, landslides, glaciers, and other natural systems. The session solicits abstracts that address these topics using a variety of approaches within specific environments or that compare and contrast the phenomena observed in different settings. T11C, T13D, T21F, T22B, T23E.

### **T: Earthquakes at the Edge: Observing and Understanding Transitions of Seismogenic Properties and Processes Along Subduction Zones**

Convenors: Elizabeth Sreaton, Saneatsu Saito, Andrew Newman, Robert Harris.

The world's largest earthquakes occur in subduction zones; with the ultimate magnitude controlled by the updip, downdip and lateral extent of rupture. Additionally, the updip and lateral extent contribute greatly to tsunami generation. Barriers to rupture propagation may be controlled by prior seismic and aseismic slip, material behavior, subducted topography, fluid pressure, temperature and overburden that affect interface effective stress, strength, and friction. However, precise determinations of the defining parameters remain elusive. Because transitions mark critical changes in environmental parameters that result in earthquake rupture propagation or cessation, multidisciplinary studies that explore these transitions can greatly improve our understanding of earthquake and tsunami occurrence and potential. We invite contributions that address present challenges or offer new insights or synthesis studies aimed at understanding the nature and extent of seismogenic updip, downdip, and lateral transitions along the subduction interface. Studies may focus on short and/or long-term character of the

seismogenic system. T11D, T12A, T13E, T14A, T21C, T23B.

### **T: Arc Systems, Ophiolites, and Continental Crust Formation**

Convenors: Yoshiyuki Tatsumi, Terry Plank, Douglas Wiens, Shuichi Kodaira, Robert Stern, Jonathan Snow, Yasuhiko Ohara

Continental crust is unique to the Earth in our solar system, and understanding its genesis and recycling requires collaboration between geophysicists, geologists, petrologists, and geochemists. The balance of crustal growth and loss at subduction zones is not well understood, nor are the tectonic drivers that set rates. Magmas in subduction zones build continental crust from dynamic melting processes in the mantle wedge, but also may assimilate earlier arc crust, remobilize crustal protoliths, and founder back into the mantle. This session will highlight disciplinary and multi-disciplinary studies of the rates and processes of generating and recycling continental crust at subduction zones, and especially hypotheses that can be tested by ocean drilling, or MARGINS and EarthScope data. Recent studies of forearc and backarc crust suggest dramatic differences between the two. Forearcs are built on highly depleted mantle with high-Mg andesitic lavas, and backarcs show more affinity to MORB both in the chemical composition of the lavas and the lower degree of depletion of the mantle section. At the same time, many or most ophiolites are thought to originate in a broadly "Supra Subduction Zone" setting. Given the new observations, it ought to be possible to make the distinction between forearc and backarc ophiolite setting more precisely. This session invites contributions from those studying present-day forearc and backarc regions, as well as those studying ophiolites, to bring a multidisciplinary approach to understanding the genesis of SSZ crust in the ocean basins. T21A, T23A, T31D, T32A, T33D.

### **T: Gulf of California-Salton Trough Rift Margin: Recent Findings and Remaining Questions**

Convenors: Scott Bennett, Daniel Brothers, Jared Kluesner

Continental rifting and formation of

ocean basins is a fundamental component of plate tectonics. The Gulf of California-Salton Trough represents an active oblique-divergent plate boundary that provides a superb natural laboratory to study processes driving continental rifting and the spatial and temporal evolution of a young rifted margin. The Gulf of California-Salton Trough has been a focus site for the NSF-MARGINS 'Rupturing Continental Lithosphere' (RCL) initiative for nearly a decade, resulting in transformative research and discoveries from a focused community of earth scientists. Although much has been discovered about this young rift during the past decade, many fundamental questions remain in the following areas: (1) understanding early continental break-up and extension, (2) the role of magmatism and fluids, (3) 4-D distribution of lithospheric strain, (4) the interplay of sedimentation and climate and their influences on rift architecture, (5) timing of marine incursion, and (6) the nature of the continent-ocean lithospheric boundary. As Margins RCL reaches its 10th year, this session serves to highlight recent and ongoing research in the Gulf of California-Salton Trough, and to summarize remaining questions regarding processes that rupture continental lithosphere. We invite all abstracts pertaining to the physical development of this rift system. T31A, T33E.

### **T: Tectonic, Sedimentary, Magmatic, and Thermal Evolution of Lithospheric Extension Leading to Continental Breakup and Seafloor Spreading**

Convenors: E. Burov, Cynthia Ebinger, Sylvie Leroy, Paul Umhoefer, Gianreto Manatschal, Cecile Robin, Erin Beutel, Jolante van Wijk

The mechanisms controlling lithospheric thinning and rupture leading to seafloor spreading are at present not well understood. Particularly controversial is how the crust can thin to less than 10 km without showing apparent brittle faulting, how extreme crustal thinning and breakup are documented in the stratigraphic record, the role and timing of emplacement of magma and the related thermal structure during and after continental breakup. During the last 20 years a variety of models have been proposed to describe the processes

of continental extension and rifted-margin formation, however, the observational evidence to support any of the models remains equivocal and there is no consensus on the generality of these models. Therefore it is essential to compare model predictions with observations from extensional basins and rifted margins which can provide critical information on the thermal structure and composition of the crust and lithospheric mantle, timing and spatial distribution of magmatism, and the stratigraphic and subsidence history during and after rifting. This session will be a forum for discussion of mechanisms associated with lithospheric extension, ranging from little extended intracontinental rift basins to mature rifted margins where break-up occurred. In particular, we encourage the presentation of observational data and numerical models that give insights into the spatial and temporal evolution of the processes leading to continental breakup. T23F, T24D, T31C.

#### **T: Seismotectonics of the Arabian Plate and its Boundaries**

Convenors: Francisco Gomez, Robert Reilinger, Eric Sandvol

Over the past 10 – 15 years, our understanding of Arabian Plate tectonics has yielded new insight into fundamental processes of continental collision, rifting, and transform faulting, as well as a valuable opportunity to evaluate the role of driving/resisting forces involved in plate motion. This session aims to bring together, as oral and poster presentations, results of recent neotectonic, seismological, geophysical, and geodetic studies of the Arabian plate and the tectonic development of its adjacent plate boundaries, including the Bitlis-Zagros collisional belt, the Red Sea / Gulf of Aden continental rifting and mid-ocean ridge spreading, and the Dead Sea transform system. Our goal is to assemble a comprehensive view of the state-of-knowledge of the tectonic and geodynamic framework of the Arabian plate and surrounding regions. T51C, T53G, T54C.

#### *Volcanology, Geochemistry and Petrology*

#### **V: Geochemically Complex, Multicomponent Fluids and Geologic Processes**

Convenors: Jim Webster, Craig Manning. Volatile components in hydrothermal fluids exert fundamental controls on processes of metamorphism, magmatism, alteration and mineralization, and volcanic eruption. Natural hydrothermal fluids contain complex mixtures of the volatile components H<sub>2</sub>O, CO<sub>2</sub>/CH<sub>4</sub>, H<sub>2</sub>S/SO<sub>2</sub>, Cl, F, ± B. Our understanding of complex multicomponent fluids is currently limited, however, because experimental research typically involves only two, or more rarely, three of these volatile components. Furthermore, the limited nature of the experimental database has constrained the development of geologically accurate thermodynamic models that demonstrate how such fluids control processes of metamorphism, magmatism, alteration and mineralization, and volcanic eruption. We invite contributions from all avenues of study on geochemically complex fluids: thermodynamic, experimental, fluid/melt-inclusion, and hydrous-mineral geochemical studies. In particular, we encourage submission of contributions that focus on the interactions and interface between metamorphic/hydrothermal fluids and magmatic fluids. V43B, V51G, V52A.

#### **V: Submarine Volcanic Eruptions: Studies of Geological, Chemical, and Biological Processes**

Convenors: William Chadwick, Joseph Resing, Julie Huber, Timothy Shank

In the last several years, submarine volcanic eruptions have been remotely detected or directly observed in a number of diverse tectonic settings – from volcanic arcs to mid-ocean ridges, from near surface to the deep ocean, from violently explosive to mildly effusive. This range of activity has attracted multidisciplinary study, including the geochemistry and petrology of erupted lavas, the chemistry and evolution of associated hydrothermal emissions on the seafloor and in the water column, the formation mechanisms and dispersal of tephra underwater, the seismic and acoustic characterization of eruptive activity, and the speed and mode of micro- and macrobiological colonization of eruption sites. We invite contributions across the broad spectrum of disciplines that relate to understanding submarine volcanic eruptions,

past and present, with an emphasis on how recent direct observations of eruptive activity shed new light on active geological, chemical, and biological processes. V43I, V44B, V51D.

#### *Other Sessions of interest*

#### **U: The EarthScope Initiative: From North America Geodynamics to New Frontiers in Science**

Convenors: Kristine Larson, Michael Hedlin, Christine Puskas, Lucy Flesch  
U51D, U52A, U53A, U53B.

#### **EP: Dynamics and Processes of Deltas, Fans, and their Distributary Channels**

Convenors: Doug Edmonds, Doug Jerolmack, Ben Sheets, David Mohrig  
EP41A, EP43F

#### **G: Volcano Geodesy: Monitoring and Modeling**

Convenors: Tim Masterlark, Andrew Newman, Maurizio Battaglia, Mike Lisowski  
G41A, G43C, G44A

#### **G: The Earthquake Cycle in the Middle East**

Convenors: Sigurjon Jonsson, Andrea Walpersdorf  
G33D

#### **MR: Rock Deformation from Grain Boundaries to Plate Boundaries**

Convenors: Phil Skeme, Daniel King  
MR24A, MR41A, MR44A

#### **NH: Drilling and Monitoring for Earthquake Disaster Mitigation**

Convenors: Reiji Kobayashi, Casey Moore, Yuzuru Yamamoto  
NH31A, NH34A

#### **PP: Changing Terrestrial Fluxes to the Oceans: Investigating Controls on Weathering and Sediment Fluxes Through Time Using Geochemical Proxies**

Convenors: Julie Pett-Ridge, Chris Siebert, Kevin Burton  
PP21C, PP23A

#### **DI: Structure and Dynamics of the Earth's Upper Mantle and Transition Zone: The Role of Water**

Convenors: Steven Jacobsen, Shun-ichiro Karato, Adrian Lenardic; Teh-Ru Alex Song  
DI41C, DI43A

**T: Fault Processes in Nature and Lab: From Micro Scale to 3-D Regional Observations and Models**

Convenors: Charlotte Krawczyk, Peter Eichhubl, Stephen Martel  
T12B, T13F, T14B, T21D, T23C

**T: Lithosphere-Asthenosphere Interaction: Top-Down or Bottom-Up?**

Convenors: Romain Meyer, Sebastien

Pilet, Jolante van Wijk, Saskia Goes  
T11E, T13B

**V: Volcanism in the East African Rift System (EARS)**

Convenors: Tobias Fischer, Tanya Furman, David Hilton  
V11G, V13E

**V: The Role of CO<sub>2</sub> in Magma Evolution and Degassing Processes**

Convenors: Nicole Metrich, Hiroshi Shinohara, Emily R Johnson  
V21D, V23H

**V: Major Geochemical Cycles on Earth.**

Convenors: Catherine Chauvel, Steven Goldstein, Robert Cliff, William White  
V23G, V24A, V31D

**V: Volatiles in the Earth: From Past to Present**

Convenors: Rajdeep Dasgupta, Helge M Gonnermann  
V11D, V13H, V14C

**V: Cenozoic Volcanism in Western North America: Plumes, Drips, Extension and/or Subduction?**

Convenors: Richard Carlson, Maureen D Long, Mary Reid  
V41B, V53A



## MARGINS~NSF Awards 2009

This is a continued list of the funded MARGINS Proposals for the fiscal year 2009. Because of the late budget resolution, NSF spending for FY09 was not finalized for the printing of the Spring Newsletter. If additional awards are announced, they will be listed in the next Newsletter and added to the MARGINS Awards web page <[www.nsf-margins.org/Mawards.html](http://www.nsf-margins.org/Mawards.html)>.

### NSF Awards 0841079 and 0841075

**Collaborative Research: Advanced models of magma migration at convergent MARGINS**

Marc Spiegelman<sup>1</sup>, Peter van Keken<sup>2</sup>

<sup>1</sup>Columbia University; <sup>2</sup>University of Michigan Ann Arbor

The work proposed is to develop quantitative tools to model fluid flow and magmatism at subduction zones. The focus of the work will be on the top of the downgoing slab where fluids are released by metamorphic dehydration reactions, and the mantle wedge where fluids interact with high temperature solids to form magma. The work will start with 2-D models and extend to more challenging 3-D models.

NSF Awards 0840981, 0840794, 0840574, and 0840448

**Collaborative Research: Synthesis and Integration of Magmatic Controls for Subduction Factory Focus Sites**

Robert Stern<sup>1</sup>, James Gill<sup>2</sup>, Mark Feigenson<sup>3</sup>, Michael Carr<sup>3</sup>, Peter van Keken<sup>4</sup>

<sup>1</sup>University of Texas at Dallas; <sup>2</sup>University of California-Santa Cruz; <sup>3</sup>Rutgers University New Brunswick; <sup>4</sup>University of Michigan Ann Arbor

This is a 3-year collaborative project (between 5 US and 2 Japanese scientists) to use the Earthchem database to assemble high-quality geochemical and isotopic data for fresh, young igneous rocks from Izu-Bonin-Mariana and Central America arcs into a Subduction Factory Geochemical Reference Library. These data will then be used to generate forward models (using the Arc Basalt Simulator, or ABS; Kimura et al. 2009). ABS is an Excel spreadsheet-based program that is designed to be flexible and accessible. Models will be site-specific, using appropriate plate age and convergence rates to generate thermal structure models appropriate for the each subduction zones. Best estimates for the compositions of subducted sediments and oceanic crust at each focus site will be used in tandem with thermodynamic models of prograde metamorphism to model mineral reactions and fluid/melt generation within the subduction zone. We will train users of the Library and ABS at two free workshops at national scientific meetings. We will also develop lesson plans that explore controls on subduction zone magma genesis using ABS and the Subduction Factory Geochemical Reference Library.

Kimura, J., B. R. Hacker, P. E. van Keken, H. Kawabata, T. Yoshida, and R. J. Stern. 2009. Arc Basalt Simulator version 2,

a simulation for slab dehydration and fluid-fluxed mantle melting for arc basalts: Modeling scheme and application, *Geochem. Geophys. Geosyst.*, 10, Q09004, doi:10.1029/2008GC002217.

### NSF Award 0840862

**Mariana Forearc Geology and Early Arc Volcanism**

Mark Reagan<sup>1</sup>, William McClelland<sup>1</sup>, David Peate<sup>1</sup>

<sup>1</sup>University of Iowa

We are exploring the origin of early subduction-related volcanic rocks from the Izu-Bonin-Mariana (IBM) fore-arc. The goal of the project is to develop a comprehensive understanding of the evolution of the southern portion of this arc during its infancy. Most of the samples analyzed for this study were collected during diving with the Japanese submersible Shinkai 6500 in 2006 and 2008 southeast of Guam. Other samples were collected from the fore-arc islands. We are presently analyzing whole rocks and pillow glasses for major element, trace element, volatile element, and Sr-Nd-Pb-Hf isotope compositions. Major, trace, and volatile element concentrations of olivine-hosted glass inclusions in olivine also are being determined. Eruption ages are being constrained by <sup>40</sup>Ar/<sup>39</sup>Ar and