

Fall AGU 2008 – MARGINS-Relevant Sessions

1) Sessions with a strong MARGINS focus

U: Fluids at Convergent Margins: Synthesis of Observations, Experiments and Models, Convener: P. van Keken, A. Shaw, D. Saffer, K. Hoernle

Water and other fluids play defining roles in subduction zone processes over a wide range of depths and scales. At shallow levels these processes include diagenesis and alteration, fault zone stability and seismogenesis, and coupling of deformation between subducting and overriding plate. Fluids likely play an important role in controlling shallow seismic events at the plate interface. Deeper in the subduction zone fluids control dehydration and metamorphic reactions, magma formation and migration, rheology and dynamics of the mantle wedge, and generation of intermediate-depth seismicity. Characterizing the role of fluids and volatiles has been a key component of international and collaborative subduction zone research projects, that include the Seismogenic Zone Experiment (SEIZE) and Subduction Factory (Subfac) initiatives of the NSF MARGINS program, the Japanese IFREE program, the German SFB574 collaborative research center and the Russian-German KALMAR collaborative project, with focus sites at Nankai, Central America, Central Chile, Kamchatka, and Izu-Bonin-Marianas. These efforts have led to unprecedented advances in our understanding of the role of fluids in the formation and maintenance of the seismogenic zone and the connection between the inputs and outputs of the subduction factory. In-situ observations of fluids in subduction zones remains difficult, but the additional use of indirect observations coupled with integrated experimental and theoretical work has allowed for significant progress. This session will further the synthesis of observational, theoretical and experimental research on the role of fluids in subduction zones. This session is intended to bring together researchers from various fields with interests that cut across traditional discipline boundaries. We invite contributions from a wide range of disciplines including geodesy, ocean drilling, hydrology, volcanology, seismology, petrology, geodynamics, and geochemistry.

U: Integrated Geohazards Along Continental Margins and Plate Boundary Zones, Conveners: J. K. Morgan, B. Dugan, E. Silver, C. Ebinger, S. Bilek

An ancillary but significant product of investigations along continental margins and plate boundary zones (e.g., through the NSF MARGINS Program, ODP/IODP, and related programs) has been a broader, highly integrated understanding of the scientific causes and resulting impacts of geohazards. Examples include, but are not limited to, (1) rheologic and structural controls on plate boundary seismogenesis and tsunamigenesis; (2) stratigraphic, chemical, and geomechanical factors that promote weakening and failure; (3) climatic, tectonic, and anthropogenic influences on rates of sediment erosion, transport and deposition, and impacts on our coastlines, and (4) explosive volcanism, and the role of magma composition and volatile flux in eruptive behavior. Although geologic settings may differ, they share many common processes and conditions that contribute to hazardous phenomena; therefore a broad, cross-disciplinary discussion could benefit many scientific communities. To foster these discussions, we solicit contributions that address the wide range of margin-related geologic hazards, their causes, and their consequences. Field, laboratory, and numerical studies are welcome.

T: Seismic Fault Zone Rocks, Conveners: G. Di Toro, Y. Ben-Zion, K. Mair, C. Marone, S. Nielsen

Exhumed faults provide important opportunities for extracting information on earthquake and fault mechanics (e.g., rupture geometries, operating stress field, earthquake energy budgets, etc.) by means of field studies, complementary to drilling projects of active faults, rock deformation experiments and seismology. Not all exhumed faults were necessarily seismic during their activity, and at present only tectonic pseudotachylytes (solidified friction-induced melts produced during seismic slip) are unambiguously recognized as the signature of ancient earthquakes in exhumed faults. However, the occurrence of pseudotachylytes is not as widespread as seismic activity in the Earth crust is. It follows that the interpretation of most fault zone assemblages (cataclasites, fault gouges, pulverized rocks, etc.) remains enigmatic. Which fault zone rocks other than pseudotachylytes have been produced during earthquakes? We welcome field, theoretical and experimental contributions focused on two broad problems: (i) discriminating fault zone rocks produced during earthquakes. What are the microstructural, chemical, physical, and mineralogical features that can help discriminate rocks produced during seismic vs. aseismic slip? (ii) The problem of learning about earthquake mechanics from seismic fault zone rocks. For example, how do rocks record the stress and heat pulses typical of earthquakes?

T: Evolution of Magma-Starved Rifts in Oceans, Continents and Backarcs, Conveners: J. Snow, G. Manatschal, L. Montesi

Magma-starved rifting is a significant process in Earth history as an end member in the early formation of continental rifts and ocean basins, as well as playing a significant role in the evolution of some backarcs. The geodynamic causes for magma starvation probably include both the composition and the thermal structure of the mantle, as well as pre-existing structures such as continental shear zones or pre-existing arcs that trap and localize the nascent divergent plate boundary. We invite contributions to a session that will allow exchange of views between workers in the different tectonic settings mentioned in the title, as well as across disciplines, especially field geophysical and structural observations, petrology/geochemistry, and numerical modeling. Of particular importance will be the evolution of rift magmas, structures within rifted zones, and the geometry and dynamics of mantle upwelling. Topics we hope to address include: What is the role of rift obliquity? What governs the initial magmatic and tectonic segmentation of the rift? How do the separation of ancient lithospheric mantle and the upwelling of asthenosphere occur? Can/do fragments of ancient lithosphere become “trapped” in the asthenosphere beneath the spreading rift? What are the role and mechanisms of strain localization in these relatively dry systems?

T: Magma-Rich Extensional Environments: Evolution of Continental Basins and Rifted Continent Margins, Conveners: R. Meyer, A. Breivik, J. van Wijk, C. Tegner

Observations suggest that continental rifting and the rift to drift transition are frequently associated with significant melt production, as well as with the emplacement of Large Igneous Provinces. The processes responsible for the formation and evolution of magma-rich continental rifts and the breakup of continents have been debated for almost a century. They range from bottom-up processes driven by large-scale mantle upwellings to top-down processes controlled by extension of the lithosphere. This magma-rich session includes a range of topics that can be related to magmatic extensional settings, such as

asthenospheric processes (the role of mantle plumes, thermal and compositional variations in the mantle, mantle-lithosphere interactions, etc.), lithospheric processes (stress field, melting, deformation mechanisms, etc.), crustal-scale processes (magma intrusions, fault structures, lower crustal flow, the continent-ocean boundary, etc.) and basin infill (vertical motions, eroded sedimentation record, source fill relationships, etc.). We invite scientists from the different fields of observations and modeling to discuss their results in a broad scientific community. This session is complementary to session “T07: Evolution of magma-starved rifts in oceans, continents and backarcs”.

T: Deformation in the Shallow Part of Subduction Zones Based on Field Studies, Numerical Simulations, and Analogue Experiments, Convener: N. Kukowski, K. Wang, G. Abers, A. Schultz, Y. Hu, J. Muffler, Y. Yamada

T: Plate Boundary Processes in the Nankai Trough Subduction Zone, Conveners: H. Tobin, M. Kinoshita, J. Ashi, S. Lallemand

The Nankai Trough has become an iconic subduction zone for the investigation of forearc tectonic processes and great subduction earthquakes. It is perhaps the most intensively-studied convergent plate boundary in the world. Recent work here ranges from the discovery of deep, non-volcanic tremor and VLF earthquakes, through detailed seismic tomography of subducting plate and forearc wedge structure, high resolution 3D seismic reflection surveys and, most recently, direct sampling through scientific drilling. This multi-disciplinary session will highlight the results of the just-completed first stage of IODP drilling in the NanTroSEIZE project, as well as recent 3D seismic reflection imaging, novel seismological observations, and geodetic studies. Contributions are welcomed on any topic related to the Nankai forearc and plate boundary processes, including accretionary wedge architecture, state of stress, fault zone structure, fluid-fault interaction, megathrust earthquakes, tsunamigenesis, and tremor and VLF seismic events.

T: Recent Advances in Understanding the Gulf of California/Salton Trough Plate Boundary System: Along Strike and Through Time, Conveners: P. Umhoefer, M. Oskin, R. Dorsey, J. Stock

The Gulf of California - Salton Trough is an active oblique-divergent plate boundary. Despite similar rates of relative plate motion along strike, major differences in rifting style have been expressed along the boundary and through time since 12 Ma. Many parameters and processes along the plate boundary may have affected rifting style, including strain partitioning, localization of strain, width of rift domains, and the role of magmatism, low-angle normal faults, and sediment flux in surface to upper mantle processes. The Colorado River has produced a large sediment flux since 5 Ma that dominates the north while the south is sediment-starved. The role of varying climate and tectonics is an emerging research theme as the boundary spans from temperate to tropical zones. The total offset across the plate boundary and its temporal development is controversial. How the northern part of the system in the Salton trough ties northward into the broader Pacific - North America boundary is also incompletely understood. This session welcomes contributions from recent research or novel ideas from any relevant research, terrestrial or marine, that contributes to understanding this plate boundary over the past 12 million years.

V: Subduction Zones: Geochemical Processes and Geophysical Constraints, Conveners: C. Chauvel, B. Reynard, R. Hyndman, S. Straub, N. Petford, B. Yardley, J. Hawkins, N. Keller, K. Nicolaysen, H. Sommer

Subduction zones are one of the most geologically dynamic and scientifically exciting areas of the earth because they are the place where old crust is destroyed and new crustal material is created. They also are responsible for most of the volcanoes and produce most of the largest earthquakes and tsunamis. This session aims at evaluating the geochemical processes and budgets of subduction zones and the associated petrological processes. We welcome contributions focused on (a) the chemical and isotopic budget of the subducted material (the input sediments and crust), (b) the composition of the volcanic arcs, back-arcs and fore-arc basins and their origins, (c) the effects of the presence of volatiles on the melting conditions in the mantle wedge, (d) the seismic and other geophysical characteristics of the materials of the mantle wedge that constrain compositions and processes, and establish mass transfer estimations and (e) physical and numerical modeling of mass transfer in subduction channels and mantle wedge. Integration of these different approaches should help our community to decipher the complex processes occurring in key areas of our planet and by consequence to better understand long-term contribution of subduction processes to its evolution.

V: From Subduction Zones to Mantle Plumes: High Field Strength Elements as Geochemical Tracers of Crustal Recycling, Conveners: G. Gaetani, M. Jackson

Large quantities of oceanic and continental crust are known to enter the mantle at subduction zones, and some of this material may become entrained in mantle upwellings, or plumes, imparting a geochemical signature on hotspot lavas. However, following injection into the mantle, the composition and fate of subduction zone-processed material is little known, making the signatures associated with recycled oceanic crust difficult unambiguously identify. This owes, in large part, to the complex processes that operate in subduction zones, including phase changes and dehydration or partial melting of the subducted oceanic lithosphere. Many of the elements frequently used as geochemical tracers for subduction are volatile and/or fluid mobile and appear to be largely lost from the subducted lithosphere during dehydration and/or partial melting. High field strength elements (HFSE), such as Ti, Zr, Hf, Nb, and Ta, are thought to behave conservatively during subduction zone processing, providing a unique tools for understanding subduction zone processes and identifying recycling signatures in hotspot lavas. This session is intended to bring together a confluence of information provided by experimental, dynamical and geochemical studies that helps to unravel subduction zone processes, and ultimately detect the signatures of the recycled materials in hotspot lavas. While the session will highlight experimental and geochemical studies that utilize HFSE as tracers of subduction zone processes and whole mantle recycling, presentation of other geochemical indicators that help constrain these processes such as Ni in olivine as a proxy for eclogite melting, radiogenic isotope (Os, Sr, Nd, Pb, etc.) signatures for crustal recycling, noble gas and volatile signatures for crustal melting beneath arcs and recycling into hotspots, is very much encouraged.

V: Minerals, Inclusions, and Volcanic Processes: Melt Inclusions in Phenocrysts From Mafic and Ultramafic Magmas, Conveners: L. Danyushevsky, A. Kent

The last two decades have witnessed a dramatic growth in interest in studies of melt inclusions – small portions of melt trapped by crystals growing during magma evolution. One important area of application

for melt inclusion research is the study of primitive mantle-derived magmas. These are commonly modified prior to eruption by fractionation, degassing, assimilation and other processes, with melt inclusions potentially providing ‘snapshots’ of the early crystallisation environment. Increasing interest in melt inclusions has also stimulated theoretical, petrological and experimental studies aimed at understanding the processes that lead to melt inclusion trapping and post-entrapment modification. This session, complementing the short-course for the new *Reviews in Mineralogy and Geochemistry* volume “Minerals, Inclusions and Volcanic Processes”, will focus on important and topical questions in the field of melt inclusions research: What does the melt inclusion record actually represent? How much is this record modified by post-entrapment processes? What unique information is provided by melt inclusions? How does this information tie in with broader topics in basaltic petrogenesis? We welcome contributions based on studies of natural samples and/or experimental and theoretical studies of melt inclusion formation and modification.

OS: Coastal Geomorphology and Morphodynamics, Conveners: M. Kirwan, S. Fagherazzi, P. Barnard

Coastal environments and landforms evolve in response to winds, waves, tides, currents, sediment delivery, and relative sea level fluctuations at a wide range of time and space scales. In light of climate change-induced sea level rise, coastal geomorphology has particular relevance to society because of the high density of human population near the coast. This session welcomes contributions on recent advances in coastal geomorphology and morphodynamics from a variety of geomorphic settings (including rocky coasts, barrier islands systems, open ocean coasts, sheltered/semi-enclosed bays, uniform and mixed sediment beaches) at a variety of timescales (event, seasonal, interannual through decadal, and century through Quaternary), with particular emphasis on the feedbacks between changes in morphology and forcing agents. Contributions based upon field measurements, application and development of models, or investigation of sedimentary deposits are encouraged.

ED: Promoting the Classroom Use of Cyberinfrastructure and Other Methods to Engage Undergraduates in Active Inquiry and Research: Successful Strategies, and Challenges Posters
Conveners: K. Block, K. Lehnert, J. Ryan

2) Other sessions of interest to MARGINS projects

U: Episodic Tremor and Slip, Conveners: J. Vidale, G. Beroza, H. Dragert, P. Segall

U: Geologic, Seismologic, and Geodynamic Constraints on the 4-D Evolution of North America: Where are we now and Where are we Going?, Conveners: W. Holt, M. Williams

S: Mechanics of Slow and Fast Slip in Active Faults, Conveners: C. Marone, F. Renard, C. Voisin

S: Dynamic Rupturing of Earthquakes at Various Scales, Conveners: H. Aochi, E. Fukuyama, H. Bhat, S. Hok

S: USArray: Transportable Array and Flexible Array Observations in the Western US, Conveners: A. Levander, M. Ritzwoller, K. Sigloch, M. Fouch, I. Tibuleac

T: Base of the Crustal Seismogenic Zone, Conveners: R. Sibson, R. Burgmann, E. Hauksson, N. Beeler

V: Minerals, Inclusions and Volcanic Processes 1: Thermobarometry and Implications for Magma Storage and Transport, Conveners: T. Hansteen, A. Klugel, K. Putirka

V: Subduction Zone Metamorphism: Fluid-Rock Interaction in Time and Space, Conveners: M. Feineman, G. Bebout, J. Ague, I. Savov

V: Arc Crustal Cross-Sections: Studies in the 4-D Evolution of Arcs, Conveners: R. Economos, S. Paterson, R. Miller

OS: Connecting the Seafloor and the Shoreline: Steps Toward Successfully Integrating Observation and Modeling, Conveners: J. Miselis, P. Gayes

T: The Co-evolution of River Systems and Orogens, Conveners: S. Cina, P. Zeitler

GP: Recent Progress in EM Studies of Crust and Mantle from Ground and Space, Conveners: A. Kuvshinov, A. Kelbert

ED: Integrating Data and Technology in Education: Novel Ways to Promote Earth Science Literacy, Conveners: C. Connor, A. Prakash

IN: From Data to Synthesis: Next-Generation Science Applications, Conveners: V. Ferrini, C. Chandler