

REPORT

Theoretical and Experimental Institute on the Subduction Cycles and Deformation Initiative

More photos, agenda, list of participants, and many of the presentations and posters for this TEI can be found on geoprisms.org/tei-scd-2015. This article is a summary of the meeting prepared by Sarah Penniston-Dorland, Erin Wirth, and Peter van Keken on behalf of the other organizers.

In October, nearly 130 scientists converged on Redondo Beach, CA to discuss progress on research within the GeoPRISMS Subduction Cycles and Deformation (SCD) Initiative. This Theoretical and Experimental Institute (TEI) follows the format of MARGINS meeting by integrating observational and field-based work with theoretical, computational, and experimental approaches.

The organizing committee (consisting of Jeff Freymueller, Sarah Penniston-Dorland, Donna Shillington, Kelin Wang, Erin Wirth, and Gene Yogodzinski) prepared a schedule that guided participants from the incoming plate through the forearc, the subducting plate and back up into the mantle wedge and arc crust.

The first session (with a keynote by Doug Wiens and invited talk by Magali Billen) focused on the physical and chemical state of the incoming plate. These talks and others in this session discussed in particular the role of outer rise faulting and active rehydration of the incoming plate.

The second session (with a keynote by Kerry Key and invited talk by Nathan Bangs) focused on the shallow forearc. Geophysical imaging has led to a much better understanding about the nature of the forearc, including processes in the shallow seismogenic zone, the role of fluids produced by shallow dehydration, and the nature of the accretionary prism.

The seismogenic zone, or mega-thrust, was explored in a separate session, with a keynote by Laura Wallace and invited talk by Rocco Malservisi. The discussion focused in particular on the great progress made in interpreting the full earthquake cycle and importance of episodic tremor and slow slip in many of the world's subduction zones.

The nature of the deep slab was the focus of the fourth session with a keynote by Brad Hacker and invited talk by Pierre Bouilhol. The discussion focused in particular on the thermal and physical structure and dynamics of the slab at depth and the consequences for fluid flow, deformation, and slab melting.

The subduction zone cycle was completed with a visit to the mantle wedge and arc crust with a keynote by Peter Kelemen and invited talk by Ellen Syracuse. Topics ranged from the chemical structure and evolution of the Aleutian arc, the role of primitive magmas, geophysical imaging of the roots of volcanoes and deformation experiments to help interpret seismic anisotropy.

The last session of the meeting was dedicated to international collaborations with talks by Saskia Goes (United Kingdom), Shuichi Kodaira (Japan) and Simon Turner (Australia), and a broad discussion of the [Subduction Zone Observatory](#), introduced by Terry Plank. This forward-looking discussion focused on how the GeoPRISMS community can further grow in its international partnerships and collaborative work with NSF sponsored facilities.

The oral discussions were augmented by two lively evening poster sessions, before which presenters had the opportunity to introduce their research through a one-slide, one-minute presentation in the oral sessions. As part of an impromptu 'Best Student Poster Award', attendees ranked the student poster presentations each evening. Winners Kirstie Haynie (University of Houston) and Miles Bodmer (University of Oregon) received a copy of the recent *Moho* review book that was kindly provided by two of the editors, Hans Thybo and Irina Artemieva.

Student and postdoc symposium

This meeting was the first in GeoPRISMS and MARGINS history to have more than 50% early-career scientists (defined as pre-tenure and before) and more than 40% female attendees. These demographics indicate that the GeoPRISMS community is vibrant and young, which is in part due to the dedicated attention that GeoPRISMS has given to the interests of early-career scientists.

GeoPRISMS continued its tradition of hosting a dedicated student and postdoc symposium ahead of each meeting. This TEI featured the highest symposium attendance thus far, with some 50 students and postdocs participating. Erin Wirth organized the agenda, which featured introductory talks on major concepts that would be addressed at the TEI.

The symposium culminated with a spirited discussion of the Subduction Zone Observatory led by Joan Gomberg. For many of the students and postdocs in attendance it was their first introduction to the idea of a Subduction Zone Observatory. They discussed the major scientific questions that the Subduction Zone Observatory should address, with a particular focus on the role of fluids in the subduction system and the spectrum of slip behaviors, which were later echoed by participants in the TEI. Further discussion revolved around the necessary tools and equipment (including a strong component of offshore instrumentation), and national and international partners. Participants also debated geographical targets, pondering the question: "*Should we do a few things in many subduction systems, or many things at just one?*"

Field trip to Catalina Island

Twenty participants stayed an extra day to participate in the optional field trip to view the Catalina Schist on Santa Catalina Island led by Sarah Penniston-Dorland. Catalina provides world-class exposures of subduction-related rocks. The trip focused on high-grade amphibolite-facies *mélange* and coherent rocks near the (rather fogged in) Airport in the Sky and the blueschist-facies *mélange* rocks along the beach near Two Harbors. The group observed the block-in-matrix structures that are well-exposed in both localities, with amphibolites, serpentinites, and pegmatites surrounded by 'rosette rock' and chlorite schist matrix in the amphibolite facies, and metaconglomerates, metabasalts and metagraywackes surrounded by chlorite-amphibole-rich matrix in the blueschist facies. Interesting and unusual features included migmatitic stringers and reaction 'rinds' indicative of partial melting and fluid-rock reaction respectively in the high-grade exposures, and metamorphosed pillow basalts and veins in the low-grade exposures. For many this was their first experience of the island, its impressive topography and scenery (once the clouds broke) and its unique zoology (with bison left over from a silent-movie western, a bald eagle and golden eagle at the Conservancy's rescue center, a baby rattlesnake protecting *mélange* matrix, and a healthy fox population).