

*Workshop Report*  
**MARGINS-GeoSwath-EarthScope Integrated Collaborations in  
Cascadia and the Walker Lane/Salton Trough**  
*March 27, 2007, Portola Plaza, Monterey CA*

**Program Committee:** Salton Trough – Walker Lane (Paul Umhoefer, Danny Stockli, Susanne Janecke, Roger Buck); Cascadia (Anne Trehu, Tim Melbourne, Paul Wallace)  
**Coordinators:** Geoff Abers (MARGINS); Basil Tikoff (GeoSwath)

## **INTRODUCTION**

On March 27, 2007, over 70 scientists met to explore collaborative studies in active margins of the Western U.S. between NSF MARGINS and EarthScope programs. The workshop included members of the MARGINS community, EarthScope-affiliated scientists, and others with an interest in the deformation and evolution of active margins. The workshop coincides with the deployment of EarthScope's seismic and geodetic instruments on the western margin of North America; with the start of the Ocean Observatory Initiative (OOI), which includes plans for a Regional Cabled Observatory (RCO) in the Pacific Northwest; and with early planning for GeoSwath, an emerging NSF-EAR initiative for broad interdisciplinary involvement in understanding the results coming out of the EarthScope facility. These programs provide new opportunities to realize overarching MARGINS science objectives. The workshop consisted of initial and closing plenary sessions, and focus group meetings on two areas of clear common interest between MARGINS, EarthScope and GeoSwath: the Cascadia subduction zone, and the Walker Lane – Salton Trough/Gulf of California rift.

The MARGINS program provides a broad cross-disciplinary program relevant to EarthScope through its Rupturing Continental Lithosphere (RCL), Subduction Factory (SubFac) and Seismogenic Zone (SEIZE) initiatives. The Focus Site for RCL is the Gulf of California – Salton Trough, which is partly within the EarthScope footprint. The Walker Lane just to the north provides a natural point of comparison. Cascadia is an Allied Site in the SubFac Science Plan, because it is a global endmember of a hot-slab subducting plate and it features a large accretionary complex, which is absent at the two SubFac Focus sites. Cascadia also represents an endmember for SEIZE, where large interplate earthquakes are infrequent and are separated by a notable lack of earthquake activity. The importance of sedimentation in both the Walker Lane and Cascadia opens the possibility for future interaction with the Source to Sink (S2S) initiative. MARGINS provides a global framework within which to study the western margin of the EarthScope domain.

## **AN EXPANDING TRANSTENSIONAL PLATE BOUNDARY: GULF OF CALIFORNIA-SALTON TROUGH TO WALKER LANE**

Continents break apart to form new oceans in two fundamentally different settings: within continental interiors and along active plate boundaries. The MARGINS program recognizes the Gulf of California – Salton trough (GoC–ST) as the premier focus site to

study oblique rifting processes. The Workshop strongly endorsed linking study of the GoC–ST to the broadly similar Walker Lane – Eastern California shear zone because of unprecedented opportunities for integrated geological and geophysical studies of processes related to oblique continental rifting.

The 2300-km-long region from the Gulf of California to Walker Lane represents an integrated transtensional belt and provides an opportunity to directly examine the type of continental rupturing that creates continental terranes and new ocean basins. Whereas the GoC–ST has evolved into a fully ruptured plate boundary system, the Walker Lane is in an immature state and may eventually develop into a plate boundary. There is an excellent opportunity to investigate varying affects of lithospheric and crustal structure, structural and magmatic inheritance, and anisotropy influencing the structural style, strain partitioning, and vertical strength distribution of a deformation belt. A linked MARGINS and EarthScope effort has the potential to define the lithospheric structure and processes related to those histories and greatly improve our understanding of active continental margins and rifting processes.

There was consensus at the Workshop that there is a tremendous prospect for symbiosis between the EarthScope facilities and future research efforts within the Walker Lane and the MARGINS program's focus in the GoC–ST. The youthful nature of this transtensional belt allows for unambiguous reconstructions of structural relationships and summation of strain budgets, but success will be enhanced by full use of the Earthscope facility. We recommend sequential examination of the belt and ultimately the deployment of 3-4 geophysical imaging experiments in the Salton Trough, Mojave province, and southern and northern Walker Lane.

## **THE CASCADIA SUBDUCTION ZONE**

Three integrative themes emerged at the workshop.

### 1) Quantification of the spectrum of moment release along the Cascadia megathrust:

The increasing instrument density in Cascadia over the last decade has revealed the existence of megathrust moment release events – known as episodic tremor and slip (ETS) - that are different from conventional earthquakes. Many critical parameters of these events remain unknown, including the depth distribution of the tremor that accompanies slow slip, whether the slow-slip zone extends updip to the locked portion of the plate boundary, and whether ETS events affect the short-term seismic hazard. Also poorly understood is the up-dip limit of seismogenic coupling, which has a first-order impact on tsunami risks associated with an eventual Cascadia megathrust event. Seafloor seismic and geodetic instrumentation is needed to complement the Earthscope Plate Boundary Observatory.

### 2) Understanding the genesis and migration of fluids and their role in modulating moment release:

The Cascadia subduction zone represents an area where young lithosphere is being subducted beneath the western edge of the North American Plate, at the hot end of the

global spectrum. In addition, most of the sediment on the oceanic plate is offscraped into an accretionary complex and thus only a small (but poorly constrained) amount is subducted to great depth. Still, water reaches the arc, and forearc serpentinization may control mechanical behavior there. MARGINS and EarthScope can facilitate integrate of onshore and offshore geochemical data and geophysical imaging that is sensitive to fluid cycling.

3) Development of forearc microplates and their relationship to mantle processes: GPS permanent and campaign measurements over the past decade indicate that the Cascadia forearc is composed of a complex collage of microplates that extends offshore. Questions include what controls the strength of these blocks and how deep do they extend. An understanding of these microplates provide a basis for understanding the history of amalgamated terranes here and elsewhere. MARGINS can facilitate identification of auxiliary studies needed to maximize the value of the long-term observations provided by EarthScope and OOI.

## **SUMMARY**

The workshop succeeded at highlighting critical scientific questions in these two areas. All of them require a broad, interdisciplinary approach and both onshore and marine observation. Cooperation between MARGINS, EarthScope-related programs, and other new initiatives seems likely to lead to some major advances not otherwise attainable.