7. Summary and Outlook

The previous chapters document a strong GeoPRISMS science and community effort. Many significant data collection efforts are underway or have just been completed at Cascadia, the Eastern North American Margin and Alaska-Aleutians. The early scientific reports and papers based on research that started just four years ago predict a high scientific impact of GeoPRISMS-funded research.

In the SCD initiative, the primary scientific topics are being addressed through field work and thematic studies. The offshore work at Cascadia highlights the thermal structure and tectonic deformation of the fore-arc and plate boundary. Slow earthquakes here are shown to have higher seismic efficiency than previously thought. A number of interdisciplinary projects combine geophysical and geochemical work to investigate magma transport from mantle to volcano at multiple locations in Cascadia and the Aleutians. Significant geochemical and petrological work is improving our understanding of the initiation and evolution of the Aleutian arc. Laboratory experiments constrain the conditions of earthquakes and slow slip at depth. Numerical models provide new insights into the nature of outer-rise faulting and intermediate-depth seismicity. Links between surface processes, sediment production, and subduction are being investigated through numerical modeling and laboratory analyses in the three primary field areas.

In the RIE initiative, field and thematic approaches are addressing several of the key initiative questions. We have new insights into the causes of late-stage volcanism at ENAM. A significant amphibious seismic community experiment has just concluded and has provided significant training opportunities for graduate students and postdocs. An interdisciplinary project is underway to better understand the geological evolution of the U.S. east coast. New seismic hazards assessments are being completed in Malawi. Significant work funded through EAR to PIs from the GeoPRISMS community has led to better constraints on the kinematics and dynamics of rifting and the role of magma and plumes in rift initiation and evolution.

The community has grown significantly by broad outreach to and entrainment of new talent through activities organized by the Office and overseen by the GSOC. The focus on early career scientists (including students) in MARGINS and GeoPRISMS has led to a profound shift in the demographics of GeoPRISMS PIs and the broader community. We will continue to strongly engage early-career scientists with focused activities at the Fall Meeting of the AGU as well as at this Fall's SCD Theoretical and Experimental Institute (TEI) and the RIE TEI planned for 2016. These mid-term meetings will also set the stage for significant synthesis work at the primary sites and lead to progress in thematic studies.

Moving forward, there are several topics that require careful consideration as the Program enters the second half of the decade.

There are concerns about whether the science goals can be accomplished with the significant

reduction (40%) of its sequestered budget, which has been hit hard by the lack of growth in the budget of NSF GEO and the federal sequestration. In a conversation with the NSF, the GSOC has firmly supported continuing the approach laid out in the Science and Implementation Plans. It has rejected calls to find ways to explicitly reduce the scope of the program, by, e.g., eliminating one or more of the primary sites. Appendix A8 contains the full response to questions by NSF. GeoPRISMS is not just a funding opportunity but also a broad community effort and PIs are actively encouraged to obtain funding sources outside of the sequestered budget. Many GeoPRISMS PIs have been successful at this. The reduced budget will lead to fewer or smaller GeoPRISMS grants, but the GSOC recommends this budgetary pressure should be resolved by proposal competition. Ideally, the EAR and OCE divisions would work together to bring funding levels back up to pre-sequestration levels.

The Sea Change report ("Sea Change: 2015-2025 Decadal survey report of Ocean Sciences", The National Academies Press, 2015), which has subsequently been endorsed by NSF, highlights several GeoPRISMS science initiatives as key areas of inquiry for OCE to pursue in the next decade. It also recommends significant reduction in funding for OCE infrastructure to preserve the ability to conduct science. This reduction is likely to have both positive and negative impacts on GeoPRISMS science. On the one hand, the reduction in funds to IODP and the Academic Fleet will cause some delay on projects by having fewer available ships or cruises. The reduction in funds for OOI may limit the impact of future smaller projects at Cascadia. On the other hand, the increased availability of funds for PI-driven science will benefit individual PIs either through more OCE-funding or, again ideally, increased contributions from OCE to the sequestered GeoPRISMS budget.

The availability of ARRA funds for the acquisition of hardware for the Amphibious Array led to significant investment in the Cascadia Initiative, which is in essence a large-scale community experiment with its offshore implementation managed through the CIET. The ENAM Community Seismic Experiment was encouraged by NSF and was formulated following a community workshop. Both efforts are relatively new approaches to data-driven science within MARGINS and GeoPRISMS, where collected data is immediately made available to the academic community. It will be useful to evaluate the community science model following these two experiments and weigh the benefits (open data, community efforts toward a common goal) and disadvantages (significant work by PIs without actual funding for science, no priority access to the data). While the GSOC has not formally evaluated these community experiments, informal discussions with lead PIs has suggested that some design improvements can be made in future experiments, including careful consideration of the length of time PIs commit themselves to the initial project and of the demographics of the PI team – the CIET is principally composed of senior PIs whereas the ENAM CSE is principally conducted by early- and mid-career PIs.

The impact of the phased funding model for primary sites needs to be evaluated. While the phased funding approach has economized and focused funding for large data acquisition efforts, there is the potential for imbalance in the impact GeoPRISMS funding has on research at the five primary sites. A few examples of factors that may contribute to this imbalance are changes in available funding due to the sequestration in FY13 (which negatively affects the later primary sites), a delay on

the (otherwise very positively evaluated) shared logistical support for fieldwork in the Aleutians, and limited funding success for EARS proposals in its first year. Another contributing factor to imbalance between primary sites is that with the phased funding approach some sites (e.g., Cascadia and New Zealand) will have been open for proposals without competition from proposals for another primary site, effectively allowing PIs working at Cascadia and New Zealand to compete for a larger pool of funds. The first stage of the phased funding model will end next year when New Zealand is open for the second year. This mid-life review of GeoPRISMS therefore provides an opportunity to consider the best use of GeoPRISMS funding in the remaining years, which may include revisiting some of the primary sites.

Moving forward, the GeoPRISMS community is strongly involved in important discussions regarding the future of facilities such as SAGE and GAGE operated by UNAVCO and IRIS, which will be recompeted in the near future, as well as plans for new scientific approaches to continental margins science. One of the most prominent of these, that has substantial implications for GeoPRISMS science, is the concept of the Subduction Zone Observatory (SZO) that has been described in IRIS and UNAVO plans as a possible follow-up and extension to EarthScope. It has the ambitious scope to cover most of the subduction zones in the Pacific (and specifically those in the Northern and Eastern Pacific) and combine a multi-disciplinary facility with an active, international, shoreline-crossing and interdisciplinary community studying convergent margins and their associated hazards. Two SZO Townhall meetings at AGU have engaged a wide community. We note that the 2014 Townhall was attended by a significant number of GeoPRISMS PIs and had an attendance that was 43% female and 29% early career. We expect that the future SZO discussions will focus on integration between the EarthScope and GeoPRISMS science objectives with broad geophysical and geochemical facility support and strong interaction with the USGS and international partners. A proposal for a planning workshop for the SZO initiative is currently under development with participation from the IRIS and UNAVCO Directors, the GeoPRISMS and EarthScope Chairs, and the Chair of the IRIS Board of Directors.

In closing, we are happy to report that the GeoPRISMS community is alive and well. Many PIs are engaged in GeoPRISMS-funded projects; many more scientists and students engage in closely related research and participate in GeoPRISMS community initiatives; and the general public is exposed to new findings about the structure of continental margins. It is still too early to be able to fully synthesize or quantify the progress towards the science goals, but initial reports from funded projects demonstrate the high quality of exciting new interdisciplinary, collaborative and shoreline crossing work, and set the stage for another five years of quality GeoPRISMS research. We expect that the research productivity will accelerate in a similar fashion to that from MARGINS-funded work before it and continue to have an impact long after the final GeoPRISMS funding decisions have been made.