## GeoPRISMS Early Career engagement: Supporting and training the next generation of Geoscientists

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ne of the strongest and unique aspects of GeoPRISMS has been its constant support of Early Career Researchers and their professional development through networking and leadership opportunities, as well as a wide range of experiential and educational activities. Early Career Scientists - here defined as undergraduates, graduates, postdocs, assistant researchers, and pre-tenure faculty members - hold a central place within the program, and have been heavily involved in the planning process and engaged in research projects. Activities coordinated by the GeoPRISMS Office and centered around Early Career Researchers - with an emphasis on students and postdocs - have been key in enhancing their engagement within the program, and expanded the reach of the program and strengthened its community base.

Meetings and workshops have been crucial in keeping the community engaged and informed. In 10 years, these meetings have gathered thousands of individuals from across the globe and a wide range of career levels and science perspectives, to discuss the progress made on the science objectives and to disseminate emerging results. Building on the effort initiated by GeoPRISMS predecessor program MARGINS, Early Careers have been strongly encouraged to attend the program events, from small scale mini-workshops at AGU Fall Meetings to large community events such as the implementation workshops for primary sites and Theoretical & Experimental Institutes (TEIs). Since 2010, approximately 300 students and postdocs have received participative support covering their airfare and local expenses to attend these meetings. GeoPRISMS has made sure their voices were heard: Early Career Investigators have been invited to lead breakout groups, to convene mini-workshops, and to give keynote lectures. They have participated in the development of the implementation plans for each primary site. Dedicated symposia organized prior to primary site implementation meetings and TEIs provided Early Careers a chance to learn about the program, the objectives of the meeting, and develop their network. For half a day, Early Career Symposium participants received background knowledge from more established researchers. Poster sessions and popup presentations allowed them to mingle with peers, present their work, and meet with NSF representatives, all in a friendly, less intimidating environment. On top of providing a sense of belonging, the symposia have allowed the students and postdocs to come fully prepared to subsequent meetings and engage in discussions with

more confidence. Overall, the experience has been scientifically stimulating and rewarding, as revealed by the positive feedback received from Early Careers who attended GeoPRISMS meetings. For some, their participation has led to new collaborations and scientific directions. Others have received mentorship and job opportunities. For many, they went back home with a feeling their opinion matters.

Student oral and poster competitions were organized each year at the AGU Fall Meeting by the GeoPRISMS Office to highlight the important role of student research in accomplishing GeoPRISMSrelated science goals and encourage cross-disciplinary input. The contest was open to all students working on topics closely related to GeoPRISMS or MARGINS science objectives. A dedicated poster session was hosted at the GeoPRISMS AGU Townhall Meeting to provide the entrants an additional chance to meet with the judges, network with their peers, and receive feedback on their work. Since 2010, over 200 students have entered the competition - among them, 20 have been awarded with a \$500 cash prize for best oral or best poster presentation, and 40 have received honorable mentions.



2010-2019 WINNERS AND HONORABLE MENTIONS OF THE GEOPRISMS BEST ORAL AND POSTER STUDENT PRESENTATION COMPETITION

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Since the beginning of the program, GeoPRISMS has sponsored 14 postdoctoral researchers in conducting up to two years of multidisciplinary research at US institutions. The GeoPRISMS Postdoctoral scholarship, typically awarded to individuals within five years of graduation, encourages them to solidify their skills, diversify their expertise, and establish peer relationships. All who completed their postdoc appointments have since moved into faculty or research positions (read testimonials p. 86).

Terrestrial field campaigns and marine cruises associated with GeoPRISMS-funded projects have provided additional opportunities for hands-on training. With help from the GeoPRISMS Office, collaborative research projects - involving large teams of investigators and long term data acquisition - have opened participation to the science community and educators via competitive Apply-to-Sail programs, calls for field participation, and invitations to attend thematic short courses (see report from Principal Investigators Aubreya Adams and Maureen Long p.92). Calls to participate in he GeoPRISMS-funded Cascadia Initiative, the ENAM, and the Alaska & Aleutians Community Seismic Experiments have been extremely popular and led to a high number of applications for a very limited number of positions. For example, in June 2019, seven undergraduate students, selected from a national pool of 54 applicants, participated in a short course in Kodiak, AK. Led by PI Aubreya Adams (Colgate U), this week-long experience immersed participants in an intensive

Fifty early career scientists attended the early career symposium organized ahead of the 2015 TEI for the SCD Initiative. This meeting was the first in GeoPRISMS and MARGINS history to have more than 50% students, postdocs and pre-tenure scientists attending the meeting and more than 40% female attendees. These numbers are in part due to the dedicated attention that GeoPRISMS has shown engaging early-career scientists. course introducing topics in seismology and the tectonic history of Alaska. The students then took part in a field trip that introduced the geology of accretionary prisms. They finally joined PI Lindsay Worthington (UNM) in the recovery of 398 nodes in eastern Kodiak. The experience offered by these programs are as numerous as they are varied. Selected apply-to-sailors and field participants have been engaged in all aspects of on-board and field science activities, from instrument preparation, deployment and recovery, to data acquisition and processing. Participants also communicated research efforts in real time via blogs, and contributed Reports from the Field published in the GeoPRISMS Newsletters, sharing the excitement of field work and inspiring Early Career Scientists to take part in similar experiences. These initiatives have offered invaluable insights into conducting high-quality, collaborative, and interdisciplinary science in the field.

GEOPRISMS IN NUMBERS

218 PIS AND CO-PIS

187 Research Projects

35% Female Investigators

45% Collaborative Projects

25% Interdisciplinary Projects

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Early Career Symposium participants attending a pre-meeting field trip during the 2012 GeoPRISMS implementation workshop for the EARS Primary Site.

These efforts are reflected by the current program demographics. The number of undergraduates, graduates, and postdocs attending GeoPRISMS meetings have increased over the years (fig. 1A). Since 2010, approximately 700 Early Career Researchers - representing nearly 30% of all meeting participants - have attended mini-workshops at AGU Fall Meetings, implementation workshops for primary sites, and Theoretical & Experimental Institutes. Subsequently, more Early Careers have been engaged in projects, as revealed by the increased number of early career investigators and the number of undergraduate, graduates, and postdocs supported by GeoPRISMS-funded awards (fig.1B). Additionally, almost half of GeoPRISMS Investigators are female (fig 1C.); GeoPRISMS investigators tend to be involved in projects that are collaborative and interdisciplinary.

#### **Looking forward**

As GeoPRISMS comes to completion after its run of more than 10 years, time has come to consider its legacy and look ahead at the work that still needs to be done to advance geoscience understanding and further develop a diverse community of researchers.

GeoPRISMS has successfully executed the vision of an interdisciplinary, shoreline-crossing science program and demonstrated the importance of science driven by a community of researchers. The program effectively built and educated a broadly interdisciplinary group of scientists, training the next generation of practitioners in a highly collaborative culture. As revealed by current GeoPRISMS demographics, the program fostered a research community balanced with respect to gender and career status. These numbers also reveal that there is still much work to be done within the geosciences to address long-standing inequities and the lack of representation and inclusivity. Research programs built upon GeoPRISMS's successful model should lead the way in developing best practices to attract, train, and retain BIPOC (Black, Indigenous, and People of Color) students and scholars. This is an essential shift from long-standing inequities to ensure our Geoscience Community becomes and remains truly just, inclusive, equitable, and diverse.

> Figure 1. Demographics for the GeoPRISMS and MARGINS programs. Data have been collected by the GeoPRISMS Office and the National Science Foundation. Please refer to p.73 for the list of GeoPRISMS Meetings and their full titles.

A | Attendance for GeoPRISMS large meetings



B | Students & postdocs supported by GeoPRISMS and MARGINS projects



C | Proportion of female to male investigators



#### MEET THE GEOPRISMS COMMUNITY EARLY-CAREER RESEARCHER PROFILES



Dr Sarah Jaye Oliva graduated from Tulane University in 2020. At the time of publication, Sarah is a postdoctoral research fellow at the University of British Columbia in Canada. More information about Sarah's research can be found on her personal website at https://olivasarahj.wordpress.com/

Right page: top: Sarah with peers James Muirhead, Tobias Fischer, and Amani Laizer during a field campaign in Tanzania. Photo credit: J. Muirhead. Bottom: GeoPRISMS offered the opportunity to Early Career Researchers to present their work and interact with peers at meetings. Here, Sarah is presenting her poster at the 2019 GeoPRISMS TEI Meeting.

### Dr. Sarah Jaye Oliva

I learned about the GeoPRISMS program early in the first year of my PhD. Since then, I have attended numerous meetings and even contributed as breakout leader, scribe, and earlycareer symposium presenter. In most of those meetings, I received some sort of travel and/or lodging assistance which made participation very accessible in the first place.

During the AGU Fall Meeting in my second year of PhD, I presented my poster at one of the GeoPRISMS workshop. I remember explaining my poster and referencing an author's work without knowing that the said author was the person I was talking to! It was a bit embarrassing, but it also signaled the beginnings of my integration into the community as I got to know the faces to match the names I read in papers. Despite that hiccup, I was pleasantly surprised that I got awarded Honorable Mention in the GeoPRISMS Student Prize for a poster presentation. Before GeoPRISMS, as an international student in a new academic community, I felt like the scientific community was too big and unnerving, but the opportunity to discuss my work and be recognized for it within the GeoPRISMS crowd gave me the affirmation and confidence that I was part of the community.

I learned a lot from the many talks I have attended at GeoPRISMS meetings. They helped me better digest the context in which my own work existed. The interdisciplinary take on the many breakout discussions was a welcome challenge because I was stimulated to think hard about how my field - and its limitations - might fit in the framework of the big overarching science questions, how results from other fields might impact my own interpretations, and what future direction might be. GeoPRISMS provided valuable training, especially to Early-Career Researchers such as myself.



GeoPRISMS has allowed me to get to know and connect with other researchers working in rifts fellow seismologists and those working in different but complementary fields. I met peers I could communicate and bounce ideas with, and experience of pursuing graduate studies. I met mentors I could seek advice from on my research and career prospects. I met researchers with whom I would later co-convene my first AGU Fall Meeting session. It was during the 2019 GeoPRISMS TEI that I shyly approached and introduced myself to a particular researcher, explained my future plans and asked for advice on looking for postdoctoral positions. He answered my queries, suggested names I could reach out to - which I did - and now I am a postdoctoral fellow with one of those names. Networking at GeoPRISMS helped me find a job!

It was also thanks to a GeoPRISMS-funded project that I was able to travel to one of my study areas to assist in important fieldwork to measure  $CO_2$  degassing in Tanzania. I consider this one of the most amazing experiences of my career thus far, where I saw firsthand the scale of the geological features I studied, met locals who are some of the direct stakeholders to research that I write about, and collaborated with a truly multidisciplinary team. That collaboration enabled by GeoPRISMS resulted in the first Nature publication that I have coauthored!

I feel incredibly fortunate that the GeoPRISMS program existed throughout my PhD since day one. GeoPRISMS supported me as an Early-Career Researcher and provided me with the valuable opportunities to connect with like-minded researchers working in related problems, through which I have found peers and mentors that have helped me in my academic journey thus far. GeoPRISMS witnessed me progress in research expertise through the years and grow in confidence to speak more and take on more responsibility in meetings. I am a little sad that the program is nearing completion, but I am proud of all that was accomplished and glad to have had the chance to be a part of it and to meet all the wonderful people in it - special shoutout to the GSOC and the superheroes Anaïs and Jo Ann who organized all meetings so flawlessly! Even as the program ends officially, I hope the emphasis on collaboration and the effort towards training and involving Early-Career Researchers that GeoPRISMS embodied so well will continue in the community.



#### MEET THE GEOPRISMS COMMUNITY

## EARLY-CAREER RESEARCHER PROFILES

### Dr. Zachary Eilon

Dr Zachary Eilon completed his PhD at Columbia University in 2016 and then moved on to conduct postdoctoral research at Brown University. Since 2016, Zach has been an Assistant Professor at the University of California Santa Barbara. More information about Zach's research can be found on his website at http://zeilon.squarespace.com/

> Right page: Zach installing a seismic station during the 2014 iMUSH experiment; convening the ENAM GeoPRISMS Mini-Workshop at the 2017 AGU Fall Meeting

The GeoPRISMS program has been an integral part of my early career. GeoPRISMS first arrived on my radar in 2012, when as a graduate student I recall being bemused by the alphabet soup of sub-fields among SCD/RIE and leftover SubFac/SEIZE/RCL/S2S options as I filled out the application for the student prize. Little did I know how important the GeoPRISMS program would be to my then and future research. Since that time, I have enjoyed attending multiple TIEs, pre-AGU mini-conferences including convening one on ENAM science directions, and mid-AGU soirées (both formal and informal!). I was fortunate enough to win a student presentation award in 2015, and have enjoyed judging many student posters and talks since then, particularly getting into the thick of the science when fuelled by canapés and beverages at the evening events. As a student, I benefited from travel funds and conference support, and received my first invitation to give a keynote presentation from this program. As an early career faculty member, I have been lucky to be funded by the GeoPRISMS program both for science and as co-convener for the 2019 synthesis conference.

My scientific perspective and network has been significantly shaped by the GeoPRISMS community. The RIE initiative, where my work on continental extension found a home, successfully balanced geographic specificity with examination of general processes. As a community, we have made substantive advances in understanding the role of fluids and volatiles, depth- and time-variation of strain localisation, and the role of magma within rifts.



These advances, and my own perspective on plate boundary science, have been shaped by GeoPRISMS's multidisciplinary outlook; GeoPRISMS conferences are the rare venues where one can always find practitioners of different sub-fields talking with, rather than past, each other.

I am no doubt biased, but I believe that the strongest aspect of the GeoPRISMS program has been its support for early career scientists. Early career symposia allowed graduate students to present cutting-edge findings to a low-pressure group of peers. Poster and oral competitions shone spotlights onto early career research through prize judging that frequently brought grizzled world experts into conversation with freshfaced students. GeoPRISMS created networks of peers at every level. Most of my current funded grants and collaborations are rooted in relationships built through these networks. Through careful planning and tending of its programs by the leadership team and the tireless Anaïs, GeoPRISMS managed to shrink down the impersonal mass of scientists and subfields, that too often overwhelms young scientists arriving at AGU, into a warm community of familiar faces.

I would also like to mention that one of the signature qualities of GeoPRISMS as an NSF program has been the evident care, involvement, and dedication of our program officers, particularly Jenn Wade and Debbie Smith. They have been a constant, candid, and cheerful presence at meetings. They are clearly passionate about the science and the community of investigators and students under the GeoPRISMS umbrella. We have been lucky to have them.

Although it feels clichéd to end on this note, a central legacy of the GeoPRISMS program for me will be the personal friendships it has helped spark. I am grateful to the GeoPRISMS Office for cultivating the mutually reinforcing qualities of good community and good science. While substantive work still needs to be done to ensure our research networks are truly inclusive and equitable, this program has conscientiously intertwined community building and empowerment of early career scientists with scientific excellence. My sincere thanks go to the leadership and administrative teams who have worked so hard for this last decade to execute the vision of this multidisciplinary program with such remarkable success.



#### MEET THE GEOPRISMS COMMUNITY

### EARLY-CAREER RESEARCHER PROFILES

Dr Maryjo Brounce completed her PhD at the University of Rhode Island and the Smithsonian Institution in 2014. From 2014 to 2016, Maryjo conducted postdoctoral research at the California Insitute of Technology. Since 2016, Maryjo has been an Assistant Professor at UC Riverside. More information about Maryjo's research can be found on her website at https://sites.google.com/prod/ucr.edu/brounce

#### Dr. Maryjo Brounce

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My name is Maryjo Brounce and I am an assistant professor in the Department of Earth and Planetary Sciences at the University of California Riverside. I am a proud product of and participant in the NSF community focused programs MARGINS and GeoPRISMS and am the third generation of female scientists supported by these efforts. Broadly speaking, without the support of MARGINS, I would not have successfully navigated graduate work at the University of Rhode Island and the Smithsonian Institution, and without the support of GeoPRISMS, I would not now be focused on developing an independent program of new and exciting research as an assistant professor. I have been directly funded by both programs, but support from them extends significantly beyond the monetary. I have attended focus site meetings hosted by the GeoPRISMS program where I met and established a support network of colleagues and fellow students, some of whom are now my collaborators and encourage new creative and careful science. I have also participated in student presentation opportunities at the AGU Fall Meeting and focus site meetings. These presentations have helped me to develop my voice as a scientist, earn recognition for my efforts, then later as a judge for these programs, my voice as a colleague and mentor. I am very grateful for these programs. The GeoPRISMS presence more broadly pervades large meetings like AGU, where one especially in early career stages - could be easily lost and overwhelmed. The GeoPRISMS community has served as an anchor for me in these settings on more than one

occasion, by ably highlighting the work most relevant to my own, as well as providing a comfortable space to meet new people and learn about their work. The townhall meetings at AGU in particular emphasized to me from the very start of my graduate studies the importance of crossing disciplines to find accurate constraints on the workings of plate tectonic processes.

In particular, as a graduate student I was provided funding from GeoPRISMS to attend a site planning meeting for the East African Rift focus site in 2012. I attended knowing very little about the problems that rocks from this area could address and knowing even fewer individuals attending the meeting. I write to you now, a handful of years later, as an assistant professor with my first funded proposal as Principal Investigator from GeoPRISMS to work on tephras from East African Rift volcanoes. This one meeting, which unfolded over the course of only a few days, provided me with the basic tools necessary to begin crafting what would become a successful proposal to the National Science Foundation. I am sure, reader, you can appreciate how this may support the moral of a new assistant professor, and if you happen to be one of the people in attendance at that meeting, I offer my gratitude.

These programs are among the top factors in shaping the path of my early career. It has been a real privilege to engage with the collegial and community-minded scientists they attract, and I look forward to seeing more of similar efforts in the future. Drs. Hiroko Kitajima and Tamara Jeppson both received GeoPRISMS Postdoctoral Fellowships. Hiroko is an Associate Professor at Texas A&M University. Tamara is now a Postdoctoral Researcher at the U.S. Geological Survey.

## Dr. Hiroko Kitajima & Dr. Tamara Jeppson

My first involvement with GeoPRISMS was back in 2008 when I attended the MARGINS Workshop on the Next Decade of the Seismogenic Zone Experiment (SEIZE). I was a graduate student, pursuing a Ph.D. at Texas A&M University at that time. MARGINS and GeoPRISMS workshops have some focuses on specific scientific themes, so their size is perfect for early-career researchers to develop networking. My research interest focuses on understanding the mechanics of earthquakes and faulting in subduction zones by characterizing deformation behaviors and mechanical/hydraulic/physical properties of the rocks through laboratory experiments. Thus, it has been aligned well with the MARGINS Seismogenic Zone Experiment (SEIZE) and the GeoPRISMS Subduction Cycles and Deformation (SCD) initiative.

The postdoctoral fellowship is another critical component of the GeoPRISMS to support the career development of early-career researchers. I was awarded the MARGINS/ GeoPRISMS Postdoctoral fellowship in 2011-2012 under the supervision of Demian Saffer and Chris Marone at the Pennsylvania State University. Demian and I had met at various meetings including MARGINS workshops, but we solidified a plan for the proposal at the NSF-MARGINS Successor Planning Workshop in San Antonio, TX. In the research, we focused on the estimation of the in-situ stress states and pore pressure in the Nankai subduction zone, by incorporating laboratory deformation experiments under simulated loading conditions and the data

from geophysical surveys (Kitajima and Saffer, 2012; Kitajima and Saffer, 2014; Kitajima et al., 2017).

Later in 2016-2018, I served as a supervisor of another GeoPRISMS Postdoctoral fellow. Tamara Jeppson. We met for the first time at Penn State in 2011 when Tamara came to learn some laboratory techniques. Tamara also became the new owner of my cat, Vivian, because I was about to move to Japan to take a new job. After I came back to Texas A&M, Tamara and I started discussing her postdoc research topic when we were at the GeoPRISMS Theoretical and Experimental Subduction Cycles and Institute on Deformation in 2015. The research focuses on defining elastic, plastic, and viscous deformation behaviors of shallow subduction zone materials by performing high-pressure and high-temperature consolidation and creep experiments on samples of incoming sediment obtained during ocean drilling projects at the Nankai, Aleutian, and Sumatra subduction zones (Jeppson and Kitajima, inprep.).

Although GeoPRISMS is sunsetting successfully, many scientific questions remain unanswered. Community efforts and also international collaborations continue to be crucial to tackling such scientific problems. I look forward to seeing the new research community that facilitates collaborative research and provides career development opportunities for early-career scientists.