



**PolarTREC Public Science Report
Dominique Richardson
Antarctic Ice Stream Dynamics
Research Vessel NB Palmer 2015**





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Ice Stream Dynamics 2015

During graduate school I attended a lecture for fun—because that's what graduate students do—given by someone who had just started his PhD. His lecture wasn't on his current research or the research he did for his Master's degree. Instead, he talked about what he did in his two years off in between: he worked as a naturalist educating tourists in Antarctica. Before his lecture all I knew about Antarctica was that it was a cold and remote frozen desert. After his lecture I was determined to learn more about and go to this amazing, vibrant haven of science at the end of the earth.

While my own career carried me into science education and eventually to mentoring students on their independent research projects in Cabrillo Marine Aquarium's research lab, I still remembered the lecture I had heard years earlier and figured someday I would work in Antarctica. It was that lasting impact that inspired me to apply to PolarTREC (Teachers and Researchers Exploring and Collaborating), an organization that furthers science education by engaging educators in field research.



PolarTREC teacher Dominique Richardson aboard the R/V Nathaniel B. Palmer in East Antarctica. Photo by Alex Fraser.

The Importance of Teachers on Science Expeditions

As part of a polar science expedition, teachers can provide outreach and an interpretation of the groundbreaking research happening in critical areas of the planet, acting as a liaison between scientists and students. Teachers can embody an important human interest aspect to science. As someone “new” to the research expedition, students and the public can easily connect with teachers as they explore the expedition together. This connection helps draw students and the public into the research, inciting interest in the science by framing facts and data in an intriguing and easily accessible story. Participating in hands-on research as an integral part of the science team can also help teachers cultivate a deeper passion for the research they're doing—a passion that they pass on to their students, fellow teachers and the public they work with through their outreach.

The benefit of having teachers participate in science expeditions goes beyond outreach for the science team and communicating the research completed during the expedition. Teachers and educators are life-long learners: participating in research expeditions not only allows teachers to learn more about new fields of study, but it also helps them develop the skills to better interpret important scientific concepts to students and peers. By engaging in field research teachers further strengthen their importance as role models—showing their students new possibilities—and increase their credibility when teaching science. Opportunities like PolarTREC also allow teachers to make

connections with researchers and other educators across the world, which can be integral in the development of new lessons and teaching techniques and provide a support system and community of like-minded colleagues working to advance science education.

Participating in PolarTREC and engaging in hands-on research in Antarctica with researchers from around the world provided me with the experience, knowledge and opportunity to grow as an educator and share the same motivation and passion that was instilled in me during a lecture in graduate school.

Ice Stream Dynamics 2015 Expedition Activities

As a 2014-2015 PolarTREC teacher, I was paired with researcher Dr. Frank Nitsche of Lamont-Doherty Earth Observatory-Columbia University who studies marine geology and ice stream dynamics—new fields to me and an excellent way to broaden my base of knowledge. After PolarTREC's Orientation—which provided an amazing support system and opportunity to network with like-minded teachers from a variety of backgrounds—in March-May of 2015, I joined Dr. Nitsche and his international team of scientists aboard the Research Vessel Nathaniel B. Palmer in East Antarctica to study ice sheets vulnerable to climate change.



Researcher Dr. Frank Nitsche aboard the R/V Nathaniel B. Palmer in East Antarctica.

Recent studies have shown that the ice sheets in East Antarctica are melting faster than previously thought, losing billions of tons of ice per year. However, the majority of this ice loss is not at the surface. Other studies suggest that the ice sheet may be melting from below, possibly due to warmer ocean water brought in through ridges in front of major ice streams. On this expedition, we tested that hypothesis by mapping the bottom of the ocean near multiple ice streams along the East Antarctic coast. We looked for areas where warm water could intrude under the glaciers and we also collected water temperature data around the ice streams to see if warm water was present, melting the large ice sheets from underneath. This work helps scientists determine how ice stream dynamics are contributing to ice sheet loss and helps scientists with future climate change predictions.



Research Vessel Nathaniel B. Palmer

During the 2 month long research expedition I lived, worked and spent my free time along the Antarctic coastline in the 350 foot long icebreaker R/V Nathaniel B. Palmer with 20 crew, 10 science support staff and 7 other scientists. We all—myself included, participating as an integral part of

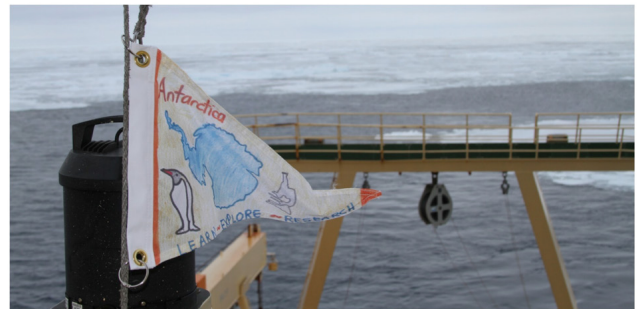


Dominique Richardson collecting data at the multi-beam bathymetry work station. Photo by Ricardo Correia

the science team—worked around the clock collecting bathymetric and oceanographic data, and monitoring equipment and the ship. In keeping with the Antarctic spirit of worldwide collaboration for science, we were truly an international team—from across the United States, Germany, Portugal, Australia, Japan, France, Argentina and the Philippines. The scientists and research staff were a treasure-trove of information, making them a vital network as I developed new lesson plans, activities and techniques for my students.

Through the course of the expedition we were able to collect an outstanding data set. We mapped previously un-mapped areas of the Antarctic continental shelf and discovered areas where warm water is reaching and melting glaciers—all to be published and presented by the scientists in the near future. We were also able to get an impressive amount of outreach done. I wrote daily PolarTREC journal/blogs and several scientists updated weekly blogs for their own institutions. We held a PolarConnect lecture and Q&A event live from the ship as well as several online and mail-in contests. We answered questions and performed outreach in schools in multiple countries and I had a strong following on Facebook, Instagram and Twitter. Everyone was willing to share their expertise and their stories with those around them as well as with students and public we reached out to during the trip.

The student and public participation, the questions from blog readers and schools, and the feedback I received upon return from the expedition highlighted the impact our science outreach and personal stories had in making our research accessible to a wide and diverse audience. My passion for science and Antarctica deepened during the expedition and was passed on to others through outreach, inciting interest and, hopefully, a lasting impact.



Continued Outreach and Implementation

As an educator, this research expedition was an unbelievable experience. I learned about things that, before this opportunity, I didn't even know existed and got to experience things I thought I'd only ever see in science documentaries. It was incredibly powerful to get to see firsthand the immediate changes happening to our planet, many of which are caused by human impact. It



An example of an art contest winner from pre-expedition outreach. Participants submitted flag designs to represent the research cruise and winners had their designs flown from the ship.

was also incredibly inspiring to experience such a harsh, beautiful and fragile ecosystem that is the climate engine for the rest of the planet. And it was wonderful to get to work with so many talented people making science happen.

I learned a great deal from this experience. I have a better understanding of physical science and oceanography data collection techniques that I can use to mentor my research students that are interested in projects beyond my life sciences background. I have been able to improve my skills in project design and management through building and running expedition-related outreach programs and I have learned better networking skills through working with my research team, other researchers on board the research vessel, and with other PolarTREC teachers. I also feel this experience has improved my skills as a teacher by allowing me to better explain climate science, science techniques and abstract scientific concepts.

Returning to work at Cabrillo Marine Aquarium after the expedition is giving me the opportunity to share this experience and everything I've learned with students, teachers, informal educators, and the public. Although I do not have a traditional classroom, I mentor more than 40 science students and our Aquarium reaches teacher networks and over 300,000 public visitors per year. Through my experience with PolarTREC I have developed a climate science exhibit and hands-on science activities for students and the public, teacher workshops, have begun to mentor students through related research projects and, of course, have given several lectures.

Although we completed outreach before, during and immediately after the expedition, there is still so much potential for future research education as I continue to work with new students and the ever changing public audience seen at my workplace. The skills and science I learned during this expedition have helped make me a better liaison between scientists, students, other teachers and the public, which is increasingly important as global climate shifts and both personal and institutional changes are required for impactful and lasting social change. And just as someone shared their experience with me years ago, I'm compelled to continue to share my experience with as many other people as I can, in hopes to inspire them in their own scientific explorations of polar regions.



Students at a school in Los Angeles try on ECW gear during expedition outreach.