



**PolarTREC Public Science Report**  
**Jillian Worssam**  
**Sea Floor Changes and the Antarctic**  
**Circumpolar Current**  
**NB Palmer, Antarctica 2014**



PolarTREC Expedition Page

<http://www.polartrec.com/expeditions/sea-floor-changes-and-the-antarctic-circumpolar-current>



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Janet Warburton and Sarah Bartholow  
Education Project Managers  
Arctic Research Consortium of the US (ARCUS)  
3535 College Rd. Suite 101  
Fairbanks, AK 99709  
(907) 474-1600  
info@polartrec.com  
www.polartrec.com

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## Educators on Scientific Research Expeditions

All educators interested in STEM education and bringing real world science into the classroom should have the opportunity to participate in real time scientific exploration. Teachers need to be able to excite learners about science and that excitement does not come from a book, but from hands on, interactive instruction. Through the support of a national initiative in funding STEM education experiences like PolarTREC allow educators to experience first hand what it takes to develop and then implement a research plan. The educators are able to actively engage with students through blogs and highly specialized lessons the content that they learned while on expedition, and in turn teach the students about the planets most at risk ecosystems, “The Poles.” All teachers interested in making scientific instruction relevant and highlighting the tenants of a STEM environment should look at any available opportunity to participate in field research.

## Linking Field Research to the Active Science Classroom



*Many expedition flags from across America and the world, hang in the below decks. Aboard the R/V Nathaniel B. Palmer icebreaker, transiting back to Chile.*

Educators traveling to the field during the school year have a great advantage with student participation, as the students are able to follow along on daily blogs as the science is happening, through the use of technology the students can actively participate in all facets of the expedition. Prior to the field expedition it is vital that the teacher develop strategies so that all students are required to check daily field blogs and respond accordingly while the scientific research is ongoing. All my students were required to respond at least twice a week with one question and one clarification based on the content of the blog that they were reading. The students were also required every two weeks to turn in the three-paragraph summary to the substitute teacher expressing a comprehension of

the science I was teaching them through the blog. Each summary had to show the basic principles of writing including a summary, body and conclusion with the emphasis of three facts that they learned during the two-week period. The students were also given challenges throughout the blog for graded bonus points. Each challenge was based on a different component of learning. Upon completion of the field research students will participate in a one to two week intensive unit of instruction based on the science of plate tectonics focusing on the ACC (Antarctic Circumpolar Current) and the Scotia Arc. It is important to remember that based on Next generation Science Standards ALL components of scientific instruction can fit into a model of instruction that teaches, problem solving, development of a scientific problem and real world implications of current scientific exploration. At the end of the unit teachers and students should be able to identify:

- Major earth tectonic plates
- The movement of tectonic plates over time

- The relationship between the Scotia Plate and ACC
- The importance of the ACC in global temperatures
- Why citizens should understand global/polar science and implications to climate change to the entire planet.

## Needs Assessment

Learning expectations on the part of the educator:

1. Basics of plate tectonics and plate movements
2. Relationship between the ACC and the Scotia Plate
3. Functional understanding of seismic depth recordings (MCS – MultiChannel Seismic System, Multibeam and chirp)
4. Oceanic data collection through a dredge

Through participation in the scientific research cruise I was able to learn all components of the research sampling and the reasons behind the sampling. I met all the expectations I had established prior to the cruise as well as additional information based on participation that I had not thought to ask prior to leaving on the scientific expedition. I learned all this information based on the support of the chief scientists as well as the graduate student staff present on the cruise that spent many hours painstakingly explaining to me the nuances of all aspects of the research goals. An example of post learning that was not anticipated with the relationship between the Scotia Arc and the South American Plate with possible changes over geologic time as to where South Georgia might lay.

## Improvement on Teaching Concepts Based on Needs Assessment

Based on my field experience it became obvious that the seventh grade science teachers at our school could benefit from hands on interactive instruction on plate tectonics that was relevant to current scientific data collection. It was also discussed in department meetings the importance of bringing into discussion some of the lesser known plates and their significance in global science: specifically the south American Plate and its relationship to the Scotia Arc and the ACC. There was also discussion on bringing climate change into the discussion with plate tectonics.

## Outreach Documentation

### Pre-Cruise

Through a partnership with PolarTREC, Dr. Larry Lawver and Dr. Ian Dalziel requested and received an educator to document, disseminate and highlight the scientific cruise NBP 1408. The following outreach model has three major components: pre-cruise, cruise and post cruise.

Prior to departure Jillian Worssam completed a variety of outreach projects designed to



Russian Flag and "Flag Kit"

engage and elicit participation from students, children, schools, families and individuals from throughout America and abroad as well as through her own school district. The count of participants engaged prior to departure includes: 46 America states, and three international locations: Russia, England and two schools in Australia. To establish contact with such a wide base Ms. Worssam used networking and social media. Once a possible partner was identified Ms. Worssam sent out a “Flag Kit.” Each participating partner received: directions to design an expedition flag, a NBP (Nathaniel B. Palmer) bumper sticker, a NBP post card, a personal expedition business card and directions on how to return the expedition flag to Ms. Worssam.

Ms. Worssam also participated in over five community, school outreach events and state level events to encourage participation from individuals in Arizona.

Upon departure Ms. Worssam had over 150 flags from all afore mentioned locations, and 96 addressed and labeled post cards to be mailed back to the participants from Chile at Ms. Worssam’s expense.

In another component prior to the cruise departure Ms. Worssam arranged for a series of articles written by her to be published in the local Arizona Daily Sun. One article each: pre-cruise, cruise and post cruise. Ms. Worssam also scheduled a series of phone calls to different participating classrooms, as well as a public event in partnership with the Flagstaff Festival of Science.

### Cruise

During the 30 day cruise Ms. Worssam actively participated in maintaining a daily blog highlighting the science of the cruise, translating the science of exploration into terminology to be understood by the general public as well as by her 14 year old students. Part of the journal goal was also to engage, excite and explain to all readers the importance of scientific exploration and its relevance to their lives even though the research was being conducted many thousands of miles away.

Through photographic documentation Ms. Worssam also used the individual expedition flags provided by schools, students and community members from around the world to show the equipment being used to document sea floor changes in the Scotia Sea. Each component of the research was included in daily blogs at a rate of 8 -10 pictures daily: many of the pictures were actually collages of multiple pictures.

During the cruise Ms. Worssam had an hour long “teleconference” with the Flagstaff Festival of Science.” The event was scheduled prior to departure and the entire Flagstaff community invited. Approximately 200 people attended this public event, which included a slide presentation on the nature of the research science, and discussion on science in polar ecosystems. There was also a lengthy question and answer session conducted by Ms. Worssam

The daily blog entries focused predominantly on the four forms of data collection used during the research cruise: multibeam bathymetry, Knudsen echo sounder (chirp), a Multichannel Seismic system and the installation of three GPS stations.



## Post-Cruise Outreach Plan



*Presentation call to over 100 Flagstaff citizens during the Flagstaff Festival of Science 2014.*

Initially after the cruise all “Flag” participants received formal participation correspondence in the form of a participation thank you letter, returned personal expedition flags, and either a sticker or expedition patch (over 100 patches sent out). All “Flag” participants also received personalized post cards sent from Punta Arenas, Chili to arrive during the expedition to reignite interest in the cruise and data collection. Also post cruise was two classroom visits to participating local classes and a presentation to district science personnel with collected data and information as well as the invitation to have me come and speak to classes. Currently there are four classes interested in a partnership for next year in presenting a series of lessons to their students. Scheduled for September 2015 is a team presentation between chief scientist Dr. Lawver and myself to the Flagstaff community during the Flagstaff Festival of Science. Also in the works is a collaboration of designed curriculum and presentation with one of the graduate students who was aboard the Palmer who is an undergraduate graduate of Northern Arizona University.

I also plan on developing (enhancing existing curriculum) new curriculum with a year long focus on both Arctic and Antarctic ecosystem science for students for an entire academic calendar. The focus of the unit of study to emphasize key components of research in both polar regions: krill, sea floor topography and relationship to biological systems, ecology, climate, and exploration history.



*The science team and ASC support personnel – an amazing group of dedicated individuals committed to the exploration of science.*