Luksch, C., Them, T., "Mercury Geochemistry of a Terrestrial Transect Across the End-Permian Mass Extinction."

Corinne Luksch Research Statement:

I will describe and collect hand samples with my advisor, Dr. Theodore Them, and his colleagues in July-August at the Grotto Creek study site in the Wrangell-St. Elias National Park & Preserve. I will analyze the effects of weathering, primary productivity, and redox at the study site and compare sedimentary mercury (Hg) data with geochemical data generated from this site and other highly restricted depositional environments from around the world. I have the opportunity to experience extensive field work and also use a state-of-the-art Milestone DM-80 evo rapid mercury analyzer in the laboratory, with the goal of reconstructing the ancient Hg cycle across the Triassic-Jurassic transition. Despite much attention on these intervals, there are currently no records of open-ocean environmental change during this time interval. It is thought that these volcanic provinces controlled evolution during the Late Triassic through Early Jurassic due to climatic effects. The Grotto Creek section represents a unique opportunity to study Late Triassic to Early Jurassic environmental change. The Upper Triassic and Lower Jurassic stratigraphy (mixed carbonate-siliciclastics of the McCarthy and Lubbe Creek formations) at the study site contains high abundances of useful index fossils and several ash beds that are stratigraphically significant in regards to studying the effects of global climate change and mass extinction (Caruthers et al., in review). Because the Grotto Creek section was deposited 210-174 million years ago in the tropical Panthalassan Ocean offshore from a terrane, the McCarthy Formation found here represents a high-resolution archive of environmental change in regard to Triassic-Jurassic extinctions and recoveries (Caruthers et al., in review). Our samples will be shipped to the College of Charleston from Anchorage, and once in Charleston, I will generate mercury (Hg) concentration records to track potential changes in atmospheric Hg deposition, which may be related to volcanic emissions of mercury. I will use a mortar and pestle to powder the samples for eventual chemical analysis. The Hg contents from raw powder will be measured in the mercury analyzer at the Geochemistry of Ancient and Modern Environmental Systems (GAMES) Laboratory. Data from this site will help analyze the effects of volcanic activity and subsequent biogeochemical feedbacks to help determine what processes controlled Hg deposition on a global scale. What interests me the most about generating mercury data in the GAMES Lab is researching ancient environments pulls together all three facets: studying the geochemistry and mineralogy of marine and terrestrial sediments, researching mass extinction events and the environmental processes associated with them, and applying what we have discovered to introduce new concepts and questions regarding Earth's geology in comparison to other planets in our solar system. I would like to prioritize a future career in earth science and strengthen my research capabilities in hopes of becoming a field geologist. Piecing together earth's ancient mercury cycle has elevated my curiosity into exploring ancient and modern environments. Studying Hg concentration data on the Early Jurassic in Alaska and working in the GAMES Lab at CofC will allow me to expand my research skills and strengthen my communication skills in preparation for my future plans to enroll in a graduate program. Caruthers, AH., et al., (In review), New evidence from a Panthalassan section (Wrangell Mountains, Alaska) for long duration Rhaetian Stage and regional differences in carbon cycle perturbations at the Triassic-Jurassic transition, For: Earth and Planetary Science Letters.

My research at the College began with an independent study with Dr. John Chadwick where we investigated the temperatures at which minerals such as olivine, pyroxene, and plagioclase, crystallize. To accomplish this, we searched for and collected igneous rocks in a Mesozoic dyke in western South Carolina which we brought back to the College of Charleston to study in the lab. This past summer, Dr. Them and I both received funding from a NASA Space Grant program, the Palmetto Academy, to analyze the mercury contents of Archean sedimentary rocks from two Australian drill cores. I completed a poster project and will hopefully be able to attend a major conference in the future to share the mercury data we generated from the ancient sediments. Shortly after the project's completion, I traveled to Montana with Dr. Them and another Palmetto Scholar to collect sedimentary rocks that were deposited across the end-Cretaceous mass extinction, a project also funded through the Palmetto Academy. There, we studied the sedimentary deposits found in the Hell Creek: and Fort Union formations, and we were able to capture drone footage featuring the Cretaceous/Paleogene boundary. In the fall, I received a MAYS grant to generate Hg concentrations across the Late Devonian Frasnian-Famennian (F-F) mass extinction where I will compare these values to other geochemical measurements to help determine what caused the mass extinction event. We plan to publish multiple manuscripts on these projects in the coming years in academic journals.