Annual Report for 2012-2013 for "The ultra-warm Arctic 90 million years ago"

Scientific License #02 032 12N-A (John Tarduno, University of Rochester)

The 90 million-year-old Arctic region contains a geologic history that records extreme climatic warmth that might provide insight into modern conditions and the potential for future climate change. We are studying fossils (including turtles) from Axel Heiberg Island that indicate high past temperatures (a lack of ice), and volcanic rocks from Axel Heiberg and Ellesmere Island whose eruptions might have contributed carbon dioxide to the ancient atmosphere. We wish to better determine ancient Arctic temperatures and to test if volcanic activity caused the ancient warm conditions.

Our field-work in 2012 involved a small camp with 3 undergraduate students, and 2 graduate students. We collected sedimentary rocks from Axel Heiberg Island near Expedition Fiord, and some volcanic rocks near Bunde Fiord. Weather prevented us from any sampling on Ellesmere Island. In addition to learning about the fossils, students on the expedition also were trained in methods of field geological mapping and geophysical data collection. While in the field, the group stayed in small, mountaineering tents with minimal impact on the surrounding area. Logistic support (Twin Otter and helicopter) was provided by the Canadian Continental Polar Shelf Project.

The fossils are found encased in hard sedimentary rocks that are currently eroding at a rapid rate from a mountain side. These rocks are removed by hand from the rock outcropping in the field. We have been collecting rocks that appear to have well-preserved fossils (generally partly exposed), and bringing them to the University of Rochester where a fossil preparer removes the rock matrix using a series of specialized tools. This preparation generally takes more than one year and ***is essential so that the fossils are not damaged in the process of removing the rock matrix.*** We are fortunate because an expert in fossil preparation at the University of Rochester is involved in this careful process. Because of the need to remove the surrounding hard rock matrix, we do not know exactly how many identifiable fossils are present until the preparation process has advanced toward completion (note that the final preparation often takes several years). We are only now in a position to conduct a preliminary accounting of the fossils and to communicate these findings to the Museum of Nature, which will house the fossils at the conclusion of our scientific work. We have contacted the Museum and are in the process of sending them our preliminary fossil catalog. This catalog will be refined during the final preparation process, in coordination with the Museum.

Our work on collected volcanic rocks centers on magnetic analyses using specialized magnetometers in laboratories at the University of Rochester. Ultimately, it is hoped these analyses will help tell us more about when the volcanic eruptions that formed volcanic rocks that make up parts of Axel Heiberg and Ellesmere Island occurred. But obtaining this information takes more than one year of analysis and will require additional samples—especially those from Ellesmere Island, an area we could not

reach because poor weather prevented Twin Otter and helicopter operations at the conclusion of the field season. Our students are engaged in all aspects of our study, and will be incorporating results into their degree work at the University (at the undergraduate and graduate level).