

Cretaceous High Arctic paleoenvironmental and paleoclimate change

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Project Location: Glacier Fiord and Lost Hammer Diapir, Axel Heiberg Island
Slidre Fiord, Ellesmere Island

Timeframe: Field work: July 2 to July 24, 2014 followed by at least 2 years of laboratory based work.

Project Description:

Exceptional sediments exposures of Cretaceous (144 – 66 Million years) age on the central to southern part of Axel Heiberg Island and Ellesmere Island (Slidre Fiord) provide a unique window on the Cretaceous Arctic paleoenvironment and climate history of the past.

Cretaceous temperatures ranged from relatively cool conditions of the early Cretaceous into the peak warmth about 94 Million years ago, one of the warmest periods in Earth history. These temperatures of the geological past are well understood for low latitude regions, but only few paleontological, paleobotanical and organic geochemistry data are known from the Arctic.

Purpose

The purpose of our study is: a) to develop a biostratigraphic scheme using small marine microfossils and correlate their occurrences with a framework based on chemical parameters such as carbon isotopes measured on sediments; b) to understand ancient marine passage ways that connected the Sverdrup Basin during Cretaceous time and with that revise existing paleogeographic maps, and c) try to understand phases when large amounts of CO₂ was buried in sediments and how such phases in the past affected ecosystems at that time. An improved understanding of the past will allow us to project how the present Arctic Ocean might change as the earth continues to warm.

Goals & objectives: We would like to answer the following questions:

1. How did Arctic environments react to the massive volcanic eruptions and their gas emissions that took place during the Cretaceous in the High Arctic, called the High Arctic Large Igneous Province?
2. How warm was the Arctic region during the Cretaceous and how small was the temperature gradient between low and high latitudes during that time?
3. How did the Cretaceous polar marine ecosystem react to climate changes, weathering patterns and associated runoff into the ocean? For example, how was marine plankton affected by those changes?

Method of transportation:

July 2: Flight by Twin Otter from Resolute to Sherwood Head, Axel Heiberg

Continue with helicopter from Sherwood Head to Head of Glacier Fiord (1. Field locality)

July 10: Camp move from Glacier Fiord to Lost Hammer Diapir by helicopter (2. Field locality)

July 16: Camp move from Lost Hammer Diapir to Slidre Fiord by helicopter (3. Field locality)

July 24: Pick-up at Slidre Fiord, back to Eureka by helicopter and then back to Resolute by Twin Otter

Any structures that will be erected (permanent / temporary): No permanent structures will be erected. Our camp will consist of 4 small personal tents and one cook tent, which all will be taken down at camp move.

Restoration / abandonment plans: not applicable, we will attempt to leave next to no footprint on the land.

Methodology: In the field we measure sedimentary section and record all observations such as lithological changes, macrofossil occurrences, colour changes, grain size changes, and sedimentary

structures such as ripples marks. Then every 5 to 10 m we are collecting a sediment sample, which we take with a pick-ax and put into a labelled bag. Each sample bag will be labelled with a number. Each section will have a location (Latitudes and Longitudes) for its start and end point. Samples will be shipped to laboratories at Carleton University in Ottawa and the University in Frankfurt (Germany), where material will be broken down for microfossil content and analyzed geochemically.

Community consultation: Consultations are ongoing with Resolute Bay and Grise Fiord. Resolute Bay is contacted in order to find a participant who would like to accept a summer job as a field assistant or wildlife officer. Grise Fiord is contacted because the 3. locality at Slidre Fiord is on Ellesmere Island.

Short term & long term use of data: This project is part of a multi-year approach investigating the Cretaceous Canadian Arctic as exposed in the Sverdrup Basin. I have participated in field seasons on Ellef Ringnes Island (2010), Axel Heiberg Island (2012) and Mackenzie Delta region (2012). Results are in various stages of publication and become with that available for all interested parties.

Reporting: A report on field work and preliminary findings will be submitted to the License Offices in due time. Results will also be prepared for publication in scientific journals of which copies will be made available. An follow-up article will be written for the First Air Journal Above and Beyond; I provided one for the May issue of 2012. I would also like to prepare some material to be used in schools in Arctic communities.

Note (not translated below): Due to lack of response from Resolute I have made contact with a filmmaker from Iqaluit, Keenan Lindell, who I have now hired to be our fourth team member. I have received endorsement from the Hamlet of Grise Fiord for my project.