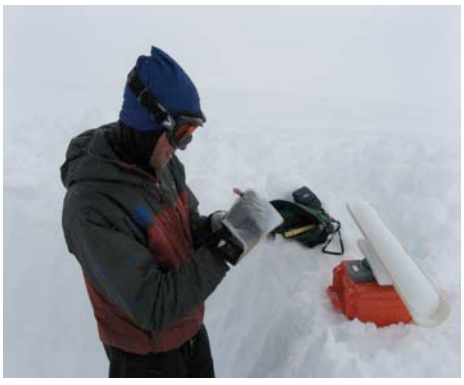
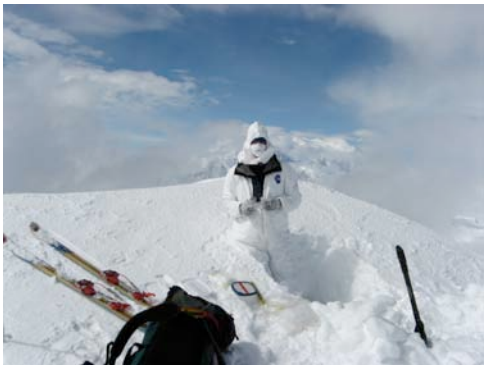
Constraining atmospheric circulation and the transport of lead aerosols in the North Pacific: *An Expedition Report*

From May 12, 2007 to June 26, 2007, I was on a research expedition, funded by the Dan and Betty Churchill Expedition Fund, in the Mount Logan region of the St. Elias Range, Yukon, Canada. The purpose of the expedition was to collect snow and firn samples from snow pits and firn/ice cores to be analyzed for chemicals and chemical ratios that are indicative of atmospheric processes. Samples were to be collected from a suite of elevations along western flank of Mount Logan in hopes of illuminating altitudinal variations within the atmosphere.

During a week long weather window, we were able to advance from base camp at Quintino-Sella (2800 m) to King Col (4017 m) with an intermediate stop at "King Trench Camp" (3100 m). We dug a snow pit of ~3 m at each camp and sampled them at 10 cm resolution for major ions, trace metals, stable water isotopes, stable lead isotopes, and density. I had never sampled a snow pit before, but quickly developed a method that was both clean and efficient. It was incredible to look up from the bottom of a 10-foot pit and realize that all that snow and more had fallen in one year.

Upon arriving at King Col our weather window abruptly closed. The hourly checks of the barometer showed a precipitous drop in atmospheric pressure. The wind picked up enough that we ate supper in our tents that night, a practice that would extend to all meals for the next 6 days. During this storm I collected a fresh snow sample for chemical analysis twice a day. My hopes are that these samples will reveal something about the evolution of this particular storm that could be calibrated to instrumental data. The storm wasn't outrageously ferocious, our tents were never in danger of collapsing, but there was enough wind and swirling snow that one didn't want to be outside for much longer than it took to dig out the tents or attend to nature's call.



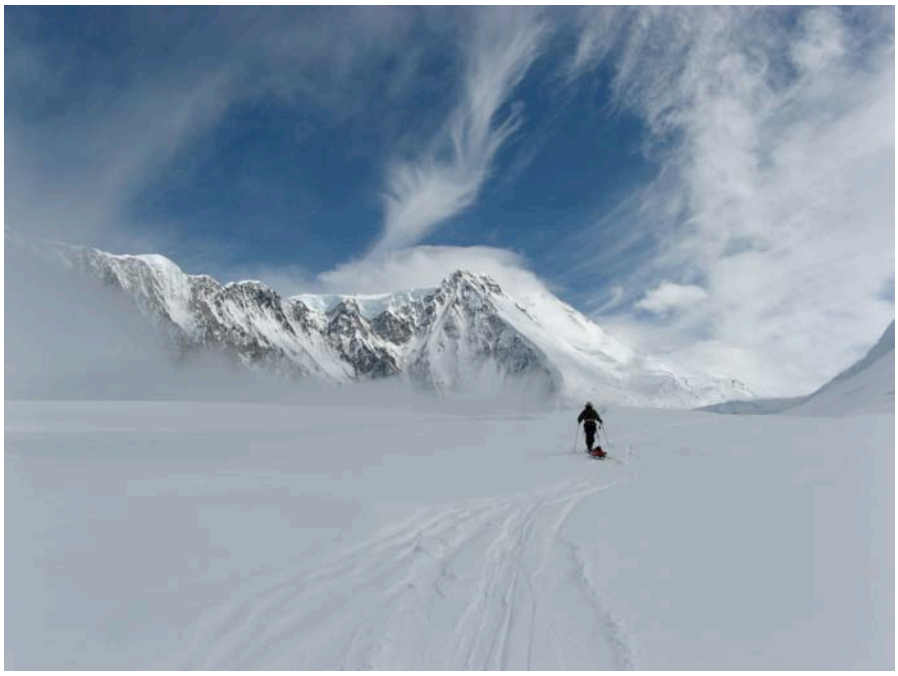


Though it never really stopped blowing or snowing during our eight days at King Col, as our food reserves ran low, we decided to try to drill a core. In lieu of less-than-perfect conditions we were able to recover 9.7 m of 4-inch core, build a snow cave for processing, and process the

core in a marathon 20-hour work day. As soon as the last core sample was processed we cooked our last 2 cups of oatmeal, broke down camp, and had a long, slow descent to Quintino-Sella in a whiteout.

We spent a week at Quintino-Sella waiting for a flyable day, so we could head back to the Arctic Institute of North America. We were back to "civilization", I learned that the was an opportunity for me to head back into the Icefields, to the Divide Site (30 km northeast of Mount Logan). While at Divide Site, I was able collect snow pit samples from three snow pits along an elevational transect of a sub peak of Mount Queen Mary.

Future work on this project will include running the samples and analyzing the data. Certainly, one of the most exciting prospects of this research is the ability to trace the source of lead pollution. Prior research indicates that lead pollution is likely coming across the pacific from Asia, but by using lead isotope ratios, we could potentially determine the country from which the lead is being emitted. Additional, atmospheric constraints on lead pollution could be determined by analyzing the seasonal and elevation variation of lead isotope ratios. By using the samples collected on this expedition in conjunction with an ~40 yr ice core record recovered by Dr. Karl Kreutz in 2002 from Eclipse Icefield (50 km northeast of Mount Logan) we will be able to examine variations in lead aerosol source through space, elevation, and time. This will be a truly 4-dimensional study that may produce significant advancements in the realm of understand North Pacific atmospheric circulation and trans-Pacific aerosol transport.



Benjamin Gross