The rifting apart of a continent: Part II

Martyn Unsworth is on an expedition to learn more about the unusual Mount Erebus volcano in Antarctica. This continuously active volcano is not on a plate boundary, but is actively rifting apart the continent. He will be sharing a series of his journals from his first expedition to Antarctica.

By Martyn Unsworth on January 16, 2015 | Monday, November 24 2014

We've now been on Ross Island for a month, and have finally begun to make progress with our research after a number of slow weeks. The week that we arrived from New Zealand was spent on orientation and learning how things work at Scott Base. This includes everything from signing out field equipment and pitching tents, to the protocol for using radios, and operating the coffee machine! On our second day we took the Antarctic Field Training course which includes an overnight camping at a site on the Ross Ice Shelf a few kilometers from Scott Base. We travelled out in a tracked vehicle called a Hagglunds, which is made in Sweden and extremely rugged - and noisy! On field training we were fortunate that the weather was relatively mild with very little wind and a temperature of only -15° C. As in Alberta, it is the wind speed that makes all the difference when working outside. Our campsite had an excellent view of Mount Erebus with smoke rising from the crater. A key part of the trip was to make sure that we all knew how to use the equipment provided in the survival bags. Whenever you travel away from base, you must take a survival bag and this includes a tent, stove and food for several days.

Scott Base is relatively small with a maximum capacity of 90 staff and scientists. This is small enough that you get to know most people, and in the dining room there is always a chance to talk to new arrivals, or long-term residents about their research and recent adventures. The food is excellent and there are stories of people gaining a kilo per week, so I already paying attention to that! Another great thing about Scott Base is the weekly excursions on Sundays to visit some of the amazing places on Ross Island. These are open to all staff and scientists and are another way to get to know people. On my first week we travelled across the sea ice to Cape Evans in a Hagglunds. These vehicles are designed for sea-ice travel, and in the unlikely event that they fall through, there are emergency hatches in the roof to escape. I have never got a direct answer to the question of how long they will float! At Cape Evans we visited the Terra Nova Hut that was built by Captain Scott's expedition in 1911. After spending the austral winter in the hut, Scott and his men set out for South Pole, never to return. Travelling and working in Antarctica still takes a lot of effort, and the more I learn about the early explorers, the more I realize what was involved in their journeys into the unknown continent with no means of communication, no vehicles and no aircraft.

Our second week was spent on testing some the instruments that we are using in the geophysical survey of Mount Erebus. Unfortunately, owing to bad weather and the resulting flight delays, some of the equipment spent the week in Christchurch. Ships can only reach Ross Island late in the summer, so all other supplies are brought in on flights that carry both passengers and cargo. The instruments finally arrived some ten days after our arrival. We also spent a lot of time in the second week on additional training, which included helicopter safety and glacier travel. Virtually all the locations where we will deploy instruments are on glaciers and many of the crevasses are covered with snow bridges which are often too weak to take the weight of a person walking across. Thus if there is any doubt about what is below the snow, you have to be tied to someone else, or a large metal stake hammered into the snow. After several indoor sessions working with ropes, knots and pulleys, we progressed outdoors to the 'crevasse simulator', which is a 10 m deep hole dug into the Ross Ice Shelf. We practiced "falling" over the edge of crevasse, and then waiting for the team member on the other end of the rope to set up a pulley system and rescue us. After this training, we made several modifications to the way the instruments are deployed, in order in minimize the risk of someone falling into a crevasse for real.

At the end of the second week we travelled out to Cape Royds and visited the hut built by Shackleton during his 1907-1909 expedition. This expedition got with 100 miles of the South Pole, but they turned around when they realized that they were critically low on food for the return journey, and the weather was becoming unstable. The hut is much brighter than Scott's Terra Nova hut, is surrounded by volcanic rocks, and has a great view of the plume coming from the summit of Mount Erebus.

The hut is also located just next to an Adelie penguin rookery, so most of us were excited to get our first view of penguins in the wild, who were building nests from stones and preparing to lay eggs.

With the arrival of all the geophysical equipment, we were able to finally deploy instruments in the third week. This used Hagglunds transport for one station close to Scott Base, and helicopter access for the rest. Our first helicopter site was located on the Erebus Glacier tongue, which is in the centre of the photo below. Placing the sensor in the snow has some challenges compared to the usual deployments that are made in soil, and the deployment generally takes about 2 hours with a group of 3 people and co-operative weather. These instruments measure natural radio waves that travel from the atmosphere down into the Earth. Observations of these waves let us determine the properties of the rocks from the surface to depths of more than 50 km. This geophysical method is called magnetotellurics (MT for short) and is especially useful on volcanoes because it can detect regions of hot water and molten rock underground. Helicopter availability was a challenge later in the week, but at least we had started deployments, and were able to use the time to make some changes to the deployment technique that will be more efficient on the heavily crevassed glaciers that cover most of Mount Erebus. In the field we are always working with a mountain guide from Scott Base and who is responsible for the safety of the group. Working with Richie, Ben and Richard has been one of the highlights so far, as their experience and training has made our work much more efficient, and we have learnt a lot of skills to make ourselves more self sufficient.

In the fourth week, which has just finished, the combination of good weather, and helicopter availability, let us make rapid progress with ten MT stations deployed by the end of the week. The instruments need to record data for 2-4 day to get good results, and they are powered by solar panels, which work well in the 24-hour sunlight of the austral summer. When there is no wind, it can be quite warm and when digging trenches in the snow, only a thin jacket is needed. However, once the wind starts blowing, multiple layers including the thick parka is needed. We have minimized the number of cables that need to be connected in the field, but there are still some connections that are tricky to make while wearing gloves. The strong winds are sometimes only found at low altitudes and as we have moved up the mountain, it gets colder and also calmer. On some days the plume from the crater rises vertically, although geologists working on summit plateau are still reporting a temperature of -25 C.

We've now collected MT data at a growing number of locations, and back at Scott Base it is possible to process the data and start to get some idea of what is beneath Mount Erebus. However, more stations are needed to get a reliable image and that will take a lot more time. In recent years I have worked on several similar studies of active volcanoes. Each study has presented a unique set of logistical challenges, including a recently study of a 6000 m volcano in the Bolivian Andes. These studies are teaching us a lot about the structure of each volcano and giving us a much better impression of what features are common to all volcanoes, and which features are unique to each one. This allows us to better understand the eruptive behaviour of each, and how volcanoes fit into the global plate tectonic cycle.

It has also been fascinating to see the rapidly changing seasons in the Antarctic. For the first two weeks, we didn't see any birds, but now some skuas have arrived. These are large brown birds which are about the size of a seagull and very aggressive in their search for food. Being 'skua-ed' is to be attacked while carrying food outdoors, and I am told it is not a pleasant experience. The location of Scott Base is spectacular, being located on Pram Point which is the southernmost point of Ross Island. In the distance is Mount Terror - a presently inactive volcano that forms the eastern end of Ross Island. In front of Scott Base is a set of pressure ridges in the sea-ice, which are formed by the forces from distant tides and currents. The ice is buckled into 5 m high ridges and a safe route is marked with flags. This is a popular evening walk that lets people explore the shaped ice formations. With the warming weather, the ice is starting to move and the safe route through the ridges is constantly changing. In the New Year there will be open water in front of the base, and good views of penguins and whales. Sadly I shall be back in the North by then and miss this experience. The pressure ridges also create cracks in the ice that allows seals to haul themselves out of the water and sleep on the ice. The number of Weddell seals has been slowly increasing and there are now a couple of pups. I have two more weeks here at Scott Base and hoping that we will be able to deploy a lot more stations now that we have the logistics worked out.

I'll be writing a final installment once back in Canada in December!

Source: Faculty of Science

URL : http://uofa.ualberta.ca/science/science-news/2015/january/fire-and-ice-part-ii