



The rifting apart of a continent: Part III

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. This is the final entry in a series of his journals from his first expedition to Antarctica.

By Martyn Unsworth on March 10, 2015

Part 3: Edmonton, January 2015

After six amazing weeks in Antarctica, I am back in Canada and adjusting from the Southern summer to the Northern winter. The first four weeks at Scott Base saw a slow but solid start to our geophysical fieldwork, and a remarkable spell of good weather. In the fourth week all the factors needed for fieldwork combined, and we were able to deploy a number of the magnetotelluric (MT) instruments efficiently.

However, the fifth week saw the arrival of unsettled weather with very little flying possible. On the Monday we flew to collect one of the instruments, and this would have meant being left on the ground to work while the helicopter went to work elsewhere. With the obviously deteriorating weather, the mountain guide decided it wasn't worth risking a 3-day camping adventure and we returned to Scott Base empty-handed in time for coffee.

The following day we visited the one instrument location that was accessible by Hagglands, and I gained a new appreciation for the concept of flat light and low visibility. Safe routes away from Scott Base on the sea-ice and Ross ice shelf are marked by flags. In low visibility it can be difficult to even see the 30m to the next flag. Most of the fifth week was spent analysing the weather forecast, which only really proved that forecasting weather in Antarctica is very challenging based on the limited data. One afternoon I volunteered to help one of the biology projects and helped carry some time-lapse camera equipment to a site where numbers of seals in a colony were being monitored.

We finally resumed work by helicopter on the Friday afternoon. Since it was the Thanksgiving weekend, there was a two day break. The Americans at McMurdo invited everyone from Scott Base to Thanksgiving dinner on the Saturday, and with four sittings fed over a thousand people with an excellent turkey dinner.

McMurdo station and Scott Base are just 3 km apart along a gravel road, and very different in character. Scott Base has bunks for 80 people and a personal atmosphere where you quickly end up knowing who everyone is. In contrast McMurdo can house up to 1000 people in peak season and is the transport hub for all of the American operations in Antarctica. Flights arrive here several times a week from New Zealand, and wheeled aircraft land on the Pegasus Ice Runway. Onwards flights use ski-equipped planes from a separate snow covered runway and fly to the South Pole and temporary field camps. A tanker ship arrives just once a year, so McMurdo has many large tanks to store the fuel needed to power generators, aircraft, helicopters and vehicles for a year. In some ways it resembles a large mining camp, but with a significant proportion of scientists in the population.

Both bases are located in the Ross Dependency, which is New Zealand's territorial claim in Antarctica. Despite this, the larger American presence means that all traffic drives on the right side of the road, although they drive on the left in New Zealand.

The sixth week started with definitely improving weather and also a growing number of people needing to fly in the helicopter to get their work done or travel to field camps. The base managers did their best to maximize the use of limited helicopter resources, but despite these efforts, progress on the field project was really quite slow. On days when it was obvious there was no chance of being able to fly, I took the chance to walk on the routes and trails around Scott Base and McMurdo.

Between the two bases is Observation Hill, and named because it provides a clear view south across the Ross Ice Shelf towards the South Pole. The hill was used by the British Antarctic Expedition to look in vain for Captain Scott and his party on their anticipated return from the South Pole in 1912. The Scott party ran out of food, trapped in a blizzard, some 200 miles south of Ross Island and never returned. A wooden cross was erected at the summit in their memory and, like many things in Antarctica, it reinforces the incredible efforts made by the early explorers. Observation Hill also provides a great view of the green buildings at Scott Base, surrounded by the pressure ridges in the rapidly melting sea-ice.

During the sixth week, it became clear to me that with the slow progress of the fieldwork and the weather, I wasn't going to see the upper part of the volcano on this trip. We had some tantalizing views of the summit from the lower slopes where we have been working, and not visiting the summit plateau was a disappointment for me. However I have been privileged to see many amazing places during my stay on Ross Island and meet many new people over the last six weeks.

On my last afternoon we worked at a magnetotelluric station high on the west side of the volcano and enjoyed some final views of Mount Erebus and the rapidly melting sea-ice in McMurdo Sound. As on most days, there was a strong plume of steam and gas rising from the summit crater which contains one of the worlds very few active lava lakes.

We had a two hour wait for a scheduled pickup by an American helicopter and enjoyed the warm sunshine. However just before pickup time, a fog bank rolled in and the helicopter could not reach us. We didn't need to open our survival packs—but it was good to know they were there. It was also reassuring to know that there was no chance of being stranded in the dark. With the long austral summer, the next sunset on Mount Erebus will be in three months.

After a chilly couple of hours the fog lifted and a New Zealand pilot was able to pick us up. A number of people commented that I was obviously trying to delay my departure and stay longer in Antarctica!

The next morning it was time to head north and on my last morning we enjoyed a view of Mount Erebus smoking in the distance. Graham Hill, John Stodt, Phil Wannamaker and Erin Wallin will stay until January and hopefully be able to increase the rate of data collection with some better weather and reduced competition for helicopter

time. My northbound flight was with the Royal New Zealand Air Force on a C-130 Hercules. The C-130 is very loud inside, but with the webbing seats it was actually quite a comfortable, if crowded flight. As we headed north we had some amazing last views of Antarctica from the flight deck as we crossed Victoria Land. Finally after 8 hours we landed in Christchurch, and handed back the cold weather clothing to the staff at Antarctica New Zealand.

Arriving back in New Zealand was a shock in many ways. There was no snow, plants everywhere, and there were people that you did not recognize! Finally I could leave a building without carrying a handheld radio and reporting my every move to the communications operator! But the biggest shock was when it got dark! We had enjoyed 40 days of continual daylight in Antarctica, and I had grown used to the endless daylight of the austral summer.

What have we learnt from this research? Now that the first year of data collection has finished, the task of data analysis has begun. This is using computer analysis to generate a map of the rock properties beneath the volcano, in a similar way to how medical imaging is used to look inside the human body. We have used this method on a number of volcanoes and it has shown where the magma is stored and how it moves to the surface. Getting a full image of what's below Mount Erebus will require a second field season and more magnetotelluric data collection on the east side of the volcano.

One of the challenges in studying volcanoes is that their lifespan is a lot longer than that of most people. To observe certain types of eruptions we often need to study several volcanoes, or look back in time at the rocks formed in past eruptions. My group at the University of Alberta is working on several active volcanoes around the world, trying to understand how magma moves beneath a volcano prior to eruptions.

Our next field expedition will be in April 2015 to Laguna del Maule in the Southern Andes of Chile. Here the surface of the Earth is moving upwards at 30 cm per year, which is much faster than most volcanoes. This uplift has been going on for five years, which is also unusual, and has produced a total movement of 1.5 metres. The uplift is being driven by a zone of molten rock, a magma body, at about 5 km depth below the surface. The question we are investigating is whether this uplift is a sign that the volcano is moving towards a major eruption.

An important research theme in volcanology is how long it takes for a volcano to change from being dormant to a major eruption beginning. The consensus used to be that this took hundreds to thousands of years, but new studies suggest it could be a lot less. This question will be answered with observations of many volcanoes, and our results from Mount Erebus and the Chilean Andes are important steps towards finding the answer.

-Martyn Unsworth

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