IceSked

Issue 2: April 2004

Newsletter of the Antarctic Research Centre
Victoria University of Wellington

Our second newsletter focuses on the wide range of student activity connected with the Antarctic Research Centre. A recent highlight is the completion of two PhDs, but you will also read about everything from first-year undergrad teaching through to MSc research, and even links with primary school students.

PhD — Cliff Atkins

Cliff Atkins recently completed his PhD thesis entitled "Characteristics of striae and clast shape in glacial and non-glacial environments".

Most people think of striae as simply scratches on rocks formed beneath sliding glaciers. However, there are many non-glacial processes that produce striae, including debris flows, tectonic deformation and volcanic blasts to name just a few. The research focused on characterising striated clasts in various modern glacial and non-glacial deposits ranging from cold-based glaciers in Antarctica to the Wellington Fault in New Zealand. The overall driving question behind this was, "Are there measurable differences between striae formed in different environments?"

So what can scratches on rocks tell us? There is huge variation in striae within each environment and although some striae features appear diagnostic of a certain process, many others are common to all settings. In general, it is possible to distinguish glacial striae from non-glacial striae such as debris flows, but it can be more difficult when dealing with tectonic striae. Overall, striae need to be analysed in conjunction with the shape of the clasts on which they occur in order to make a sound judgement on their origin. This is particularly relevant when interpreting clasts from drill cores such as those from the Cape Roberts Project in Antarctica.

Cliff overturning a glacial erratic, Allan Hills, Antarctica

One highlight was the discovery of striae and related abrasion marks produced by a cold-based glacier in the Allan Hills, Antarctica. This has created some exciting new insights into the behaviour of cold-based glaciers and is helping change the view that these glaciers are incapable of erosion.

Overall, the study challenged some long and widely held beliefs and opened up possibilities for future striae research. Personally, the experience has exposed Cliff to an incredible range of places, processes, rocks and people and has reinforced the value of questioning everything, especially the established "text book" views.

PhD — Nancy Bertler

Nancy Bertler conducted her PhD with the Antarctic Research Centre and in collaboration with University of Maine. Her research uses ice cores to investigate the climate history of coastal Antarctica. Nancy has been the first to successfully analyse ice cores from coastal locations in the climactically sensitive McMurdo Sound region.

Surveying the Evans Piedmont Glacier. Nancy Bertler (front) with (L to R) Matt Wood, Louise Christie, Matt Watson (ScanTec, Auckland), Ewan Paterson (Scott Base) and Alex Pyne

As snow accumulates over thousands of years it captures detailed information about the climate, acting as a frozen weather station. At low elevation sites, this information is predominantly from the lower atmosphere, which is home to cyclones circling the Antarctic continent. For this reason those sites are especially climate sensitive.

Ice core data shows that Antarctic climate is closely linked with climate variability in the tropics. The sites demonstrate that the El Niño Southern Oscillation, a phenomenon of the tropical Pacific, is responsible for the current cooling in the Ross Sea region and also confirm that this cooling is superimposed on a longer-term, global warming trend.

Aboard the Nathaniel B Palmer

In mid January this year I headed off to spend over a month in Antarctica with two Kiwis and a pile of Americans I'd never met. A somewhat scary start for an Aussie who'd been in Wellington for three days! My purpose in Antarctica was to work with Stuart Henrys and Huw Horgan from GNS and their US colleagues (cruise leaders Terry Wilson and Larry Lawver) on an icebreaker (the *NB Palmer*) cruising the Ross Sea. I was to help collect seismic data, some of which I will be processing, interpreting and writing about for my Masters thesis.

The NB Palmer *in McMurdo Sound*

Seismic data gives information about the seafloor as well as geological features present below the seafloor. To produce the waves that reflect back from the sea floor and below, up to six air guns are trailed behind the ship and a streamer stretching 1.2 kilometres from the ship collects the returning signals. The logistics of such a set up, especially in the hazardous, iceberg-strewn conditions of Antarctica, were somewhat complex and at times it was impossible to collect seismic data. The other scientific aims of the cruise were to collect multibeam bathymetry (detailed mapping of large swaths of the seafloor) and dredge seamounts and other interesting seafloor features to obtain rock samples.

As a seismic data novice my main role on the ship was to act as a watchstander. This involved working an eight hour shift from 6pm to 2am with the main duties involving noting down the performance and values of various different machines every five minutes and watching for whales. To protect marine mammals in the survey area, a constant watch was held when seismic data was being collected and if a mammal (whale or seal) was located within the safety radius, collection was reduced or stopped completely until the animal left.

Adelie penguin on Franklin Island

My time in Antarctica was not all work and staring at computer screens. One of my favourite Antarctic memories comes from taking the compulsory Antarctic Field Training course where we learnt about life and survival in the field. We dug a snow trench and a snow cave and slept the night in the surprisingly warm abodes we had created. Another fabulous experience was landing on Franklin Island in zodiacs launched from the cruise ship and finding myself in an Adelie penguin colony. The antics, sights and smells of the inhabitants of this place will stay with me always, as will all the memories from the time I spent in Antarctica.

Jo Whittaker

Antarctic Field Assistants

Louise Christie and Matt Wood, as featured in Reflections, were in final year undergraduate geology when they were selected as Antarctic Field Assistants to Nancy Bertler. Along with Nancy, Alex Pyne and Matt Watson (ScanTec), they first arrived on the ice on the 7th of November after two early morning cancellations in Christchurch. After Antarctic Field Training, the work began by visiting the spectacular Lower Victoria Glacier. In 1999 Nancy had set up GPS positions at the ice divide of the glacier and close to the inland terminus. Continuing measurements will allow her to calculate the flow rates and mass balance of the glacier in recent years.

The Evans Piedmont Glacier was a new field site for Nancy. As part of the reconnaissance for next year's ice core drilling, the team had to cover a substantial area of the glacier using Ground Penetrating Radar, to map the sub-surface bedrock and internal flow structures of the glacier. They also dug a 4m deep snow pit from which snow density measurements and further chemical analyses will uncover sub-annual resolution climate variability.

Alex Pyne and Matt Wood had several days at Cape Roberts, fixing and calibrating the tide gauge there, as well as finding time to explore the impressive icebergs locked in the sea ice and visiting some local Weddell seals. The third of Nancy's planned sites; the Erebus Col on Ross Island, was cancelled due to persistent bad weather, bringing the field season to an abrupt end.

Reflections

One of the main questions I have been asked about my experience in Antarctica this summer is, "Was the work hard?" Logically the answer should be yes; one would think that working and living in such extreme climatic conditions would be physically or even emotionally draining. However, work in such an environment can't really be considered 'work' in my conventional understanding of the word, because simply having the opportunity to be there was such a blessing. Shovelling some snow or hauling a sled from time to time seems like a negligible price to pay for a once in a lifetime experience. I'm hooked.

Matt Wood

The wildlife was amazing, the scenery spectacular, and the weather extreme. However, the thing that impressed me most while down on the ice was the people. Scott Base brings together people from exceptionally diverse backgrounds,

MSc — Natalie Robinson

Natalie joined the Antarctic Research Centre prior to the 2002-2003 field season, coming into the earth sciences with a background in physics and maths. While in Antarctica in January and February 2003, she helped obtain data from the ocean beneath the McMurdo-Ross Ice Shelf with instruments suspended through holes made with a Hot Water Drilling system. The data form a unique set of measurements, this being the first time that this type of current meter data, along with temperature-salinity profiles, have been obtained from beneath any of the Antarctic ice shelves.

As well as analysing and interpreting the data directly, she is incorporating them into her own adaptation of a model previously developed for the Filchner-Ronne Ice shelf. The model uses the relationship between the ice, the water beneath and bathymetry to set up circulation in the ocean. She will also incorporate the measured tides from Scott Base and the seasonal cycle of sea ice formation into what will be a realistic reproduction of the real world.

Natalie's study will contribute to the climate change research theme of the ARC - she is interested in comparing the ocean environment of today with that of previous climates, and will be able to achieve this by varying the conditions under which the model is running. Of particular interest is the deposition of sediment at the sea floor under the various climate scenarios. This will help interpret the ANDRILL core to be recovered from the site over the next 2-3 years.

from mechanics to cooks, scientists to cleaners, drillers to military personnel, throwing them all together into its confined, bright green quarters.

With little or no opportunity for personal time and space, I expected to encounter people stretched to breaking point and ready to snap. However, it would appear that the isolation forces the 85 or so Scott Base residents to become like one big family. From the day we arrived we were made to feel welcome, and nothing was too much trouble.

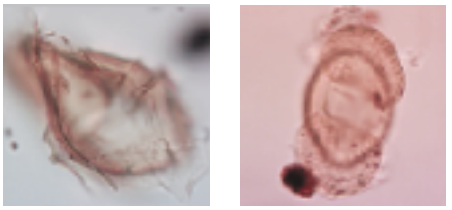
Due to the unpredictable nature of life in Antarctica, roles are often chopped and changed, with mechanics becoming bar staff, cleaners becoming firemen, and CEOs transporting field parties' toilet waste. However, to their credit, complaints and fights are almost non-existent. A Scott Base resident must be prepared to 'don whatever hat necessary', and all I encountered would do so willingly.

Louise Christie

MSc — Joe Prebble

Joe Prebble is studying climate change from pollen and dinoflagellates during the Oligocene in the Ross Sea, and is supervised by Mike Hannah, Peter Barrett (VUW) and Ian Raine (GNS).

The Cape Roberts drilling project cored through over 50 shallow marine sedimentary cycles from the period from 34 to 17 million years ago. These reflect repeated advance and retreat of an ice sheet located near the Trans Antarctic Mountains. Throughout this time period pollen and phytolith (siliceous plant microfossil) studies have shown a gradual deterioration of climate.



Dinoflagellate Deflandrea and Podocarp Pollen

Pollen and marine palynomorphs (dinoflagellates and microscopic marine algae) have been extracted at a high resolution from two of the glacial sedimentary cycles. The pollen study will allow documentation of changes in terrestrial vegetation within, and between two glacial cycles. The marine microfossil study will document changes in the size and taxonomy of the marine microfossils within the glacial cycles, some of which are due to changes to their paleo habitat as the glacier advanced and retreated.

The vegetation 32 million years ago was dominated by *Nothofagidites* type pollen (Southern Beech), and *Podocarpus* pollen. The climate is likely to have been a cool temperate one. By 24 million years ago, much of the diversity within the *Podocarpus* pollen had disappeared; leaving a (possibly stunted, ground hugging) *Nothofagidites*-dominated vegetation, reflecting a cooler climate.

ST Lee Lecturer for 2004 - Professor Jim Kennett

The inaugural ST Lee Lecture in Antarctic Studies, endowed by Singaporean philanthropist Dr Lee Seng Tee, was given last year by Professor Rob Dunbar of Stanford University (IceSked #1). This year's lecture will be presented by one of our most distinguished alumni, Professor James Kennett of the University of California Santa Barbara, on Thursday 12th August. Prof Kennett is well known for his pioneering work on the history of Antarctic glaciation. He has also been influential in promoting the understanding of the earth as a single though complex system and more recently for research into the influence of methane on past climate change.

More details will be available on our website closer to the date.

OTHER ACTIVITIES

Kapanui School visit — December 2003

At the end of the school year, Vanessa Thorn visited Year 4 class Te Awa 3 at Kapanui School in Waikanae to talk about what it is like living and working in Antarctica. The visit began with a 'question and answer' session about where Antarctica is, the people there and its relationship to New Zealand. The children were also interested in the Antarctic environment, its animals and the types of things scientists study on the ice.

Kapanui School year 4 student Deanna Walker dressed and ready for Antarctica

Splitting the class in two, we got to the really exciting bit. Half the group tried on the extreme cold weather clothing and had their photo taken in front of an Antarctic scenery backdrop. The rest of the group climbed in and out of the Scott tent, had races to the bottom of the three sleeping bags and back and investigated the radio and cooking box. The visit ended with a round of applause and I went home for a well-deserved sleep!

Vanessa Thorn

Antarctica: unfreezing the continent (ESCI 132)

We are starting to put together the programme for this year's version of our popular first year course on Antarctica. The School of Earth Sciences, in association with the Antarctic Research Centre, has offered this course for the past five years and every year it is different. This is because we try to introduce the students to a wide variety of topics, using "volunteer" experts to come in and talk about their area of expertise.

The course is directed at science students and non-science students alike and each year about 80 students take the course. Student feedback is always complimentary and indicates that we are being successful at producing a dynamic, varied and informative course.

The topics covered in ESCI 132 are wide indeed. We usually start with the history of exploration (you can't give an Antarctic course without mentioning Scott and Shackleton). We can then cover the history of the ice sheets and their significance in climate change, Antarctic weather, geological history, and the life that lives on the continent and in the seas that surround it. We also include lectures on the politics of the continent and its conservation from VUW lecturers Joanna Mossop and Cath Wallace. In previous years Nigel Roberts has stepped away from his role as a political scientist to round off the course with his predictions for Antarctica's future.

Course stalwarts from outside the University include Erick Brenstrum from MetService, who talks about Antarctic weather, heritage architect Chris Cochran tells us about the historic huts and their preservation, and the well-known painter Margaret Elliot outlines how her visits to Antarctica have affected her painting. Antarctica New Zealand and the Ministry of Foreign Affairs and Trade also support us by providing guest speakers.

Much of the success of the course is due to the excellent tutors. We don't hold traditional laboratory sessions but instead offer a series of tutorials designed to expand on the topics covered in the lectures. The major requirement for becoming a tutor is that the candidate must have been to Antarctica. This gives the tutors "street cred" and students know that when they talk about Antarctica they are doing so from first hand experience. The same is the case for the lecturing staff; most have made the trip down to the ice.

Each year we invite tutors who went down to the ice for the first time the previous year to give a presentation. This brings the experience vividly to life for the audience. Each year the tutors present their talk differently – we have had everything from readings from a diary of the trip to a montage of images accompanied by loud rock music!

Mike Hannah

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