IceSked

Issue 17: December 2011

Newsletter of the Antarctic Research Centre
Victoria University of Wellington

A Word From the Director

This IceSked celebrates the recent successes of our staff and students and begins a new regular feature, "A Science Story", in which we profile a recent ARC research discovery. We also farewell Senior Research Fellow, Melissa Bowen. On an even more sober note, the global financial situation of the last three years has put considerable pressure on research funding, and doesn't look like improving. It's important that we continue to communicate the value of our research, and remind our funders of the importance of environmental research to a healthy society and a productive economy. I wish you all a happy and productive 2012. *Tim Naish*

Prestigious Title Awarded to Peter Barrett

Peter Barrett, Professor of Geology and founding Director of the ARC has been appointed an Honorary Fellow of The Geological Society of London.

Honorary Fellowships have been an important part of the Geological Society ever since it was founded in 1807. Honorary members brought the Society prestige, and as the Society began to extend its reach further, 'foreign members' began to be appointed. Today, the 71 Honorary Fellows fulfil this role and are recognised for their achievements, not only in science, but in acting as ambassadors for geological science and promoting its aims to the wider public.

"The Fellowship is a truly significant honour. I am particularly pleased to be associated with the society for its recent statement on climate change. I certainly share their view that it is...a defining issue of our time, whose full understanding needs geology's long perspective," says Peter.

Jim Kennett, a friend of the ARC and VUW alumni, and a Fellow of the US Academies of Science, was visiting when Peter's latest honour was announced. "The list of honorary fellows is short and very distinguished, and it is befitting that Peter be recognised this way for his enormous contribution" Jim said.

Peter has had a long and distinguished career in unravelling Antarctic geological history. A paper, published in Science in 1968 and reported in Time magazine, recorded his discovery of the first tetrapod remains in Antarctica, supporting the theory of continental drift. In 1972 Peter joined the first DSDP leg to the Antarctic, coring the Antarctic continental shelf for its geological history and went on to led over 20 expeditions to Antarctica. With this new Fellowship he is now one of only two New Zealanders to have received such a distinguished title.

Nancy Bertler Awarded Rutherford Discovery Fellowship

Nancy Bertler, who is jointly appointed by the ARC and GNS Science, was awarded a Rutherford Discovery Fellowship. Administered by the Royal Society of New Zealand, the Fellowships support New Zealand's most talented early-to mid-career researchers providing financial support of up to $200,000 per year over a five-year period to investigate a particular research topic, and help them further their career in New Zealand.

"It is a huge privilege and I'm excited about the research the Rutherford Discovery Fellowship will support," Nancy said.

Victoria University Vice-Chancellor Professor Pat Walsh says the Fellowship awards were a significant achievement. "These awards, set up by the Government last year, will allow some of our best and brightest researchers achieve their potential to make an enormous contribution to New Zealand. We are pleased and proud that three of the ten Fellowships were awarded to Victoria University researchers. I am delighted to see those who have dedicated their career to discovery and world-leading research being supported and recognised in this way."

Nancy arrived in New Zealand from Germany in 1999 completing her PhD at Victoria University in 2004. She developed ice core research as a new discipline in New Zealand and now leads the National Ice Core programme. Nancy also manages the New Zealand Ice Core Research Laboratory and has led 11 expeditions to Antarctica to investigate the climate history of the Ross Sea region, including this season where as Chief Scientist of the international Roosevelt Island Climate Evolution (RICE) project she leads the team currently undertaking fieldwork in Antarctica.

A Science Story

In 1978 John Mercer argued in *Nature* that the West Antarctic Ice Sheet might collapse through rising CO2 emissions in 50-100 years. Few believed John at the time, but now satellites tell us that ice loss from Antarctica and Greenland is under way and accelerating. These ice sheets already contribute around half of the present global sea-level rise and are likely to dominate in the future. We need to know how and why in order to see what can be done both to mitigate ice loss and address inevitable consequences.

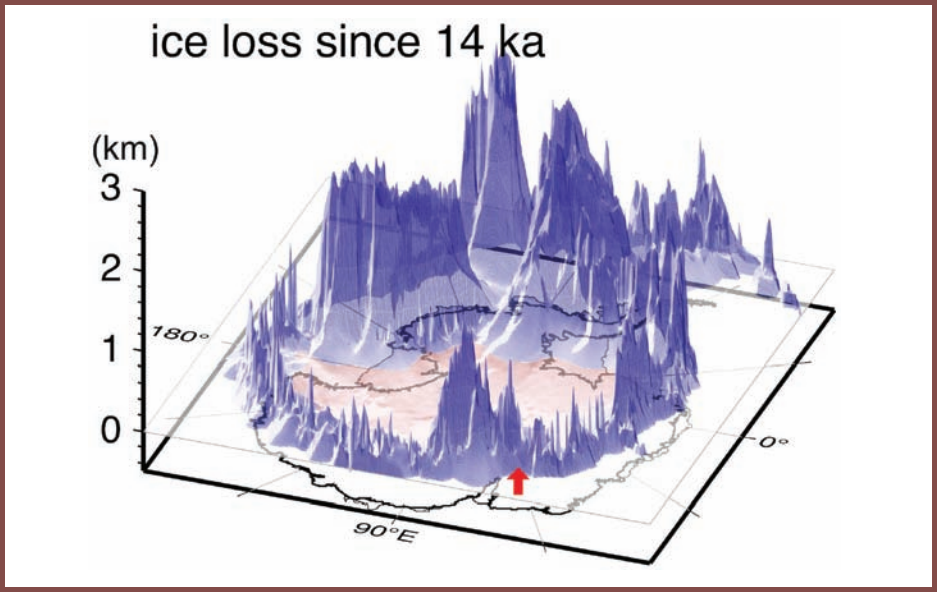
The *Nature Geoscience* paper "Retreat of the East Antarctic ice sheet during the last glacial termination" by Mackintosh *et al.* (2011) represents a major advance in both approach and new understanding of ice loss from Earth's largest ice sheet (57 m sea-level equivalent). They report on its most recent and most substantial loss of ice in the last 100,000 years – a period from around 14,000 to 7000 years ago, when it lost 15 m of ice equivalent sea-level. This is less than 10% of the total ice loss since the last Ice Age, which raised sea level by 120-130 m, for most of that ice came from the huge Northern Hemisphere ice sheets. But now the roles have been reversed, with over 90% of the world's ice in Antarctica, and now at risk from future warming.

The strength of their case comes from the integration of field observations from Antarctica and ice sheet modelling, with results not only internally consistent but tested against data on ice retreat and sea level rise from other parts of the world. The case is first built on the integration of a history of ice sheet lowering for the central sector of the East Antarctic Ice Sheet (measured by dating the period over which rock surfaces have been exposed) with a history of ice sheet retreat from the edge of the adjacent continental shelf (measured in two separate locations by carbon-dating sediments deposited after floating of grounded ice began). This history was then simulated first with a simple 2-D cross-sectional model and then with a continent-wide 3-D model.

The results are significant not only in confirming a long-held view that the retreat of the Antarctic ice sheet since the Last Glacial Maximum was a consequence of both rising sea level from melting Northern Hemisphere ice sheets and regional warming, but they explain the 6000 year lag in Antarctic response. They also show the importance of the differing shapes of the drainage basins that make up each ice sheet in determining their dynamic behaviour and specific history of ice loss.

Peter Barrett

Modelled loss of Antarctic ice sheets since 14,000 years ago. Most ice loss occurred around the ice sheet perimeter (blue) as a result of oceanic warming, whereas the interior of the ice sheet (red) has thickened since this time, due to increased snow accumulation. The red arrow points to Mac. Robertson Land, where the model was compared to field evidence



INQUA Congress

The International Union for Quaternary Research (INQUA) congress is held every four years. This year, four members of the ARC glacial modelling group attended this event between the 21 and 27 July in Bern, Switzerland. INQUA is attended by several thousand scientists, and is the premier scientific event for discussing Earth's climate record over the last 2.6 million years. In particular, it is an exciting place to present cutting-edge science in the field of climate change.

One of the aims of the glacial modelling group is to use models to help understand the paleoclimate significance of New Zealand moraine records. The group showcased our newest findings in four oral presentations delivered by Andrew Mackintosh, Nick Golledge, Alice Doughty and Karen McKinnon in the sessions 'Glacier-climate sensitivities and paleoclimate implications', 'Pleistocene Glacial Chronologies and Paleoclimate Implications', 'Glacial overdeepening: processes, forms and significance' and 'Linking Southern Hemisphere multiproxy records and past circulation patterns'. Andrew commented how pleased he was to see both the students (Alice and Karen) deliver outstanding talks in front of their international peers.

International Symposium on Antarctic Earth Sciences

Rob McKay and Alex Pyne checking out the local peat, Islay, Scotland

The four-yearly International Symposium on Antarctic Earth Sciences (ISAES) was held this year in Edinburgh in July. It was ably convened by Prof. Martin Siegert, and hosted at historic University of Edinburgh beneath Arthur's Seat and Salisbury Crags where geologist James Hutton developed some of his most famous theories on the formation of geological sequences. With this and a pre-conference fieldtrip by Alex Pyne, Rob McKay and Tim Naish to Islay and Arran to inspect the local peat, the scene was set for yet another very enjoyable and successful conference. There was a strong attendance by ARC staff and students with Warren Dickinson and Cliff Atkins (SGEES) convening a vibrant session on cold-based glaciation. Andrew Mackintosh received a lot of interest on his recently published research in *Nature Geoscience* (summarised on previous page), while Rob and the rest of the Wilkes Land IODP Expedition members presented their initial results. This was also an opportunity for students Molly Patterson and Georgia Grant to interact with the rest of the Wilkes Land Team and broader Antarctic community. Both presented posters and said they got tremendous value from the opportunity to participate thanks to support from the ARC Endowed Development Fund. ANDRILL Program results were in the thick of it again with Nick Golledge, Rob, Alex, Richard Levy (GNS Science) and Gary Wilson (UOtago) all presenting talks. Peter Barrett gave a fascinating historical overview of the progress in understanding the Late Neogene glacial history of Antarctica and the vexed Sirius Group debate in his Plenary, putting some old bones to rest (but not all). Peter's work and views will be published in the conference proceedings volume by the Royal Society of Edinburgh Transactions. Finally, Tim espoused the value of Antarctic paleoclimate research in the context of climate change and the IPCC in his Plenary. All in all it was a great to see Antarctic geological research addressing some of the leading questions in global change research.

Iron Biogeochemistry of Windblown Dust

Holly Winton in her "Antarctic camo"

I began my MSc camouflaged on the sea ice in Southern McMurdo Sound, SW Ross Sea wearing a white Tyvek body suit. This is one of the few areas where direct sampling of sediment accumulating on sea ice is possible. The 'Antarctic camo' is necessary for collecting surface snow samples in an ultra-clean fashion. I am primarily interested in windblown sediment trapped within snow, and how the iron (Fe) content of the sediment influences micro-nutrient availability for primary production in McMurdo Sound.

Each summer the sea ice breaks up at a time when the Ross Sea experiences vast phytoplankton blooms. Upon break up, sediment is deposited into the ocean releasing dissolved Fe from the particles surface. This project found that new dissolved Fe, supplied solely from local sediment, rises the concentration of dissolved Fe in the surface waters above the Fe-limitation threshold level required for phytoplankton growth.

During my Masters I was fortunate to visit the Glaciology Laboratory, University of Milano-Bicocca, Italy, to learn a new method (Coulter-Counter analysis) of measuring dust mass and grain size in dilute snow and ice samples and also to present the results of this project at the Goldschmidt geochemistry conference, in Prague earlier this year.

Holly Winton

Holly completed her MSc thesis "Aeolian iron variability and its contribution to primary production in McMurdo Sound, SW Ross Sea, Antarctica" in October with support from the MSI funded ANZICE programme, and supervision from Nancy Bertler and Gavin Dunbar.

Rain Events and Melting Glaciers

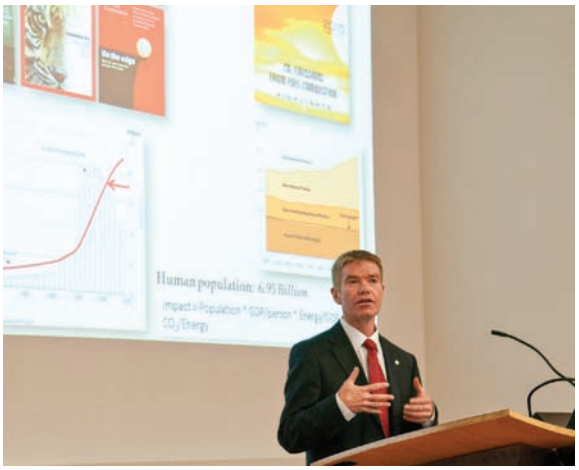
The Franz Josef Glacier, New Zealand, is subject to large water inputs throughout the year. Surface melt rates can exceed 20 m per year, and rain occurs year round on the lower glacier. In comparison, melt rates on a typical continental glacier are usually around 3-5 m per year, and rain often only occurs in the summer. Water inputs are important in understanding how a particular glacier behaves, as large water inputs can reduce friction at the glacier bed and increase glacier sliding. My MSc project looks at variations in glacier flow after large rain events and diurnal melt cycles at the Franz Josef Glacier. The project combines in-situ measurements of glacier flow recorded in March 2011 with a simple glacier model. Luckily (or unluckily?), several large rain events occurred while I was out on the glacier in March, and I now have some interesting results for further analysis. My supervisors are Andrew Mackintosh, Huw Horgan, Brian Anderson, and Ruzica Dadic, with funding from the US Fulbright Program.

Laura Kehrl

Laura Kehrl in the field, Franz Josef Glacier

OTHER ACTIVITIES

S.T. Lee Lecture in Antarctic Studies



Prof. Steven Chown presenting his lecture at Rutherford House, Wellington

'Untroubled times are those we yearn most for'. The opening statement of the synopsis of this year's S.T. Lee Lecture presented by Prof. Steven Chown, Director of the DST-NRF Centre of Excellence for Invasion Biology and Professor of Zoology at Stellenbosch University, South Africa. Prof. Chown's highly engaging talk, "Lion Griefs in the Shade: Global Change Biology in the Antarctic" highlighted the rapid environmental changes occurring in apparently pristine biological systems, such as those of the terrestrial Antarctic. Across the region the signs of impact from the major environmental change drivers and their synergies are becoming more noticeable. Climate change is making many terrestrial areas more hospitable for indigenous organisms and for species from temperate areas. Distributions are changing rapidly, with the greening of areas that were previously free of closed vegetation making habitat change a significant consideration for the region. Warming in many areas is also benefitting non-indigenous over indigenous species. Although conservation management is feasible in many instances, the consequences thereof are frequently unanticipated. Prof. Chown's talk can be downloaded from our website at: www.victoria.ac.nz/antarctic/about/news/s-t-lee-lecture/lecture-2011.aspx

Melissa Bowen

Goodbye & Good Luck

Melissa Bowen will be leaving the ARC at the year-end to take up a position in the School of Environment, University of Auckland. This is a significant loss because Melissa has made a substantial contribution to ARC science through her physical oceanographic expertise and the generous way she helped students and staff.

A PhD graduate from the prestigious Woods Hole Oceanographic Institute, she returned to New Zealand to take up a position at NIWA where she focused on the surface circulation of the Tasman Sea that was a combination of fundamental and applied research, the latter relating to the dispersal of fish larvae. Melissa joined the ARC in September, 2009 as a Senior Research Fellow and although a part-time position, her contribution was major. She undertook supervision of MSc and PhD students, taught a 4th year ESCI course, joined a Marsden project as an investigator, conducted a course on wavelet analysis, published two papers and unfailingly provided much needed wisdom on a host of physical oceanographic matters. Such expertise is much needed considering we live on an ocean-dominated planet that is undergoing rapid environmental change. The ARC will greatly miss Melissa but we wish her every success in the new job and look forward to collaborative projects in the future.

News in Brief

- Congratulations to Brian Anderson who succeeded in winning a FastStart Marsden grant.
- In September the ARC welcomed its new Administrator, Louise Soulsby, to the team.
- Julene Marr was the winner of VUW's 'Postgraduate Research Excellence Award – Science'
- Lionel Carter was voted 'Most Popular Supervisor - Science' at the Postgraduate Student Association's 2011 Victorias Awards.
- Georgia Grant won 'Best Talk' at the Royal Society Beanland-Thornley Student Talks Competition.
- Joe Prebble and Sanne Maas won the third place award for 'Best Student Oral Presentation' and 'Student Poster Presentation' respectively, at this year's Geosciences Conference in Nelson.

VUWAE Reports now Available Online

After months of painstaking digitising by the Victoria University Library's Digital Projects team the Victoria University of Wellington Antarctic Expedition (VUWAE) Reports are now live on the New Zealand Electronic Text Centre website. These reports, highlighting the logistics and science behind the expeditions by Earth Sciences staff and students, go back to 1969. To view the reports go to: www.nzetc.org/tm/scholarly/tei-corpus-VUWAnta.html

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