IceSked

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Newsletter of the Antarctic Research Centre
Victoria University of Wellington

The year got off to a busy start with the port calls of two research vessels in January, in particular we highlight the expedition of the IODP Wilkes Land cruise. This issue also introduces two new staff, Dr's Dan Zwartz and Huw Horgan, who have recently joined our team, and we report on the research of three Masters students just completing their theses.

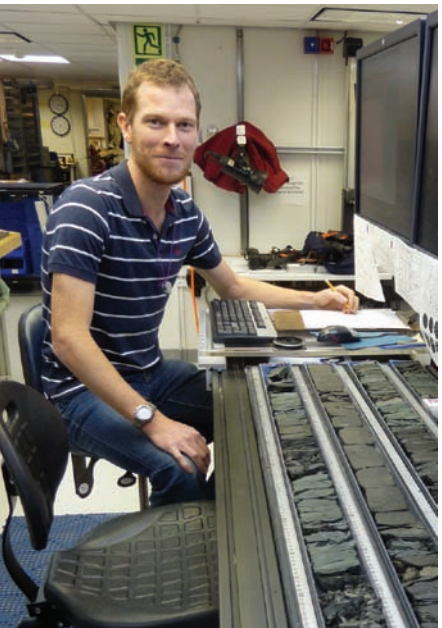
A Word From the Director

As this latest IceSked reaches you, the end of the International Polar Year (IPY) period will be marked by a major conference in Oslo, Norway where results from the many IPY science projects will be presented. Fifty years ago the previous IPY (and International Geophysical Year) led to a series of major advances in our understanding of Antarctica and its place in the global system. During this IPY many are asking, "will we see the same leap in our knowledge of the polar regions?" The answer must be undoubtedly yes, and the significance of this IPY is made even more poignant by the impact global warming is having, and will continue to have, on the polar regions. New satellite mass balance data, airborne geophysics, ice core and geological drilling records, combined with computer ice sheet and climate models are presently transforming our understanding of the behaviour and sensitivity of the Antarctic ice sheets. So as we reach the end of this IPY we face an exciting new era of scientific discovery in Antarctica. The Antarctic Research Centre staff and students feel privileged to have actively participated in, and led, a number of these international research initiatives with our collaborators, and will continue to promote the importance of these research efforts.

Tim Naish

Sailing the Southern Ocean

Rob McKay, ARC Post-Doctoral Fellow, recently returned from a nine week long cruise aboard the *JOIDES Resolution* as part of the Integrated Ocean Drilling Program (IODP) scientific research expedition to drill sediment cores offshore from the Wilkes Land coastline, East Antarctica. The *Resolution* departed from Wellington, and during its port call ARC staff were involved in numerous outreach activities, including public science presentations, ship tours, and assisting with a summer school run by GNS Science for 12-15 year old students. Here's Rob's account of the trip.



Rob McKay at work describing the cores

My primary duty on the *JOIDES Resolution* was working with the sediment core description team during one of the 12-hour per day shifts. This team provided a description of the properties of the sediments and used this information to determine the environment in which the sediment was deposited, helping scientists decipher the past behaviour and stability of the East Antarctic Ice Sheet, and its intimate relationship with global climatic and oceanographic change. For two months, scientists and crew negotiated gale-force winds, snow, significant pack ice, and numerous icebergs. Despite these challenging conditions, the international team drilled 3,200 metres of seafloor sedimentary core at seven drill sites in water depths ranging between ~500 and 4000 metres. Samples collected during this research effort date back nearly 54 million years and document dramatic changes in Earth's climate. This period is significant because it marks a transition from a "Greenhouse Earth" to an "Icehouse Earth". More recent geological time periods were also recovered, including the late Neogene and Quaternary (i.e. the past 13 million years), as well as an unprecedented, ultra high-resolution Holocene record (10,000 years ago to present) of climate variability. It is hoped that such archives of past climates at the Antarctic Margin will provide important geological analogues for future anthropogenic warming scenarios. A professional shipboard videographer accompanied the scientists during the cruise and weekly videos were uploaded during the cruise, and are still freely available, on the Ocean Leadership YouTube channel (www.youtube.com/user/OceanLeadership). In addition to documenting specific activities related to Wilkes Land drilling, the videos provide an excellent glimpse into the scientific drilling process and day-to-day life on the ship.

Rob McKay

Introducing Our New Research Fellows

I'm grateful to the Morgan Family Charitable Foundation for the opportunity to resume research science with the ARC. Having previously studied Antarctic ice sheets and sea-level change at the Australian National University and during a Post-Doctorate at Utrecht University, Netherlands, I have had several years away from academia, working as a guide communicating science on sailing ships in the Arctic and Antarctic, and conducting remote field work on climate and geodesy projects in Antarctica, Greenland, Indonesia, Papua New Guinea and the Seychelles.

In my new position, I'll be studying the recent evolution of the East Antarctic ice sheet margin, and also reviewing New Zealand records of sea-level change in light of global and regional processes.

I have a long, if intermittent, association with the ARC, having completed my BSc (Hons) thesis here in 1990, worked for the Centre for a few months in 2004, and joined two VUWAE expeditions, in 1989-90 and 2004. I'm delighted to be back among this diverse and motivated group. *Dan Zwartz*

I have joined the ARC after completing my Doctoral Dissertation at Pennsylvania State University, where I have resided since 2004. While with the ARC I will be continuing to work on ice dynamics in West Antarctica as part of the National Science Foundation funded WISSARD program (www.wissard.org). This exciting project aims to access a subglacial lake beneath West Antarctica, and study the location at which ice leaves the West Antarctic and enters the Ross Ice Shelf. My role will be geophysical imaging of the ice sheet and underlying geology with a view to studying the role that subglacial water and sediments play in ice sheet dynamics. I would like to acknowledge the Alan Eggers Fund for funding this position. *Huw Horgan*

Huw Horgan and Dan Zwartz

New Zealand Antarctic Paleoclimate Programme Funded

We are pleased that the New Zealand Foundation for Research Science and Technology has approved eight years of funding for New Zealand's participation in a new ANDRILL Programme. The successful proposal was led by Dr Richard Levy (GNS Science) and represents a collaboration between Victoria University, GNS Science, University of Otago, NIWA and University of Canterbury, as well as our international partners. Over the next three years the programme will support survey activities and preparatory science at the site of the proposed Coulman High drilling project on the seaward edge of the Ross Ice Shelf, Antarctica. It will also support continued analysis of the existing ANDRILL cores and an ambitious glacier modelling project of the Transantarctic Mountain outlet glaciers, that will link geological evidence for past ice sheet variability from drill cores with ice sheet dynamics. During the 2010-2011 field season New Zealand and US teams will work together to make hot-water access holes through the ice shelf to measure oceanic conditions and currents, as well as take sediment samples from the sea-floor near the proposed drill site. The new ANDRILL Programme will also fund New Zealand's participation in the Coulman High Project, tentatively scheduled for 2013-2014. This deep drilling project intends to recover a record of Antarctic Ice Sheet behaviour back beyond 25 million years ago when atmospheric carbon dioxide levels were significantly higher than present day. *Tim Naish*

2010 S.T. Lee Lecture in Antarctic Studies

This year's S.T. Lee Lecture entitled "*Waking Giants: Ice Sheets in a Warming World*" was presented by Dr Robert Bindschadler, NASA Emeritus Scientist, USA on 19 May. The lecture focused on the reduction of the great ice sheets of Greenland and Antarctica which are shrinking faster and faster, due to increased meltwater and warmer ocean circulation thinning and melting the ice sheets and increasing the rate of sea level rise. Dr Bindschadler's career includes more than 30 years at NASA, before retiring in 2010. He maintains an active interest in glaciers and ice sheets and has led 15 Antarctic field expeditions to study dynamics of the West Antarctic Ice Sheet and is often quoted commenting on glaciological impacts of climate on the world's ice sheets and glaciers. The ARC gratefully acknowledges not only the support of Dr Lee but also the New Zealand American Association for helping to sponsor this year's event. Dr Bindshadler's talk can be viewed at www.victoria.ac.nz/antarctic/about/Endowments_Donations/lee lecture/lecture2010.aspx

(L-R): Pro-Vice Chancellor, Dean of Science Prof. David Bibby, Chairman Admiral Richard Byrd Scholarship Trust, Hon Rob Talbot, Dr Robert Bindschadler, Prof. Peter Barrett and Prof. Tim Naish

New Zealand-USA Joint Commission Meeting

A workshop which brought together Antarctic researchers from around New Zealand with funders and stakeholders and American counterparts was hosted by the ARC at Victoria University on 25 January. The workshop was part of a larger Joint Commission Meeting held on 26 January focusing on science and technology organised by the New Zealand Ministry of Research Science and Technology (MoRST) and the US Department of State to promote closer collaboration between US and New Zealand research organisations. The Antarctic workshop was chaired by Prof. Tim Naish (ARC) and Dr Ed Butler (Antarctica New Zealand). US visitors included Dr Frank Rack (ANDRILL Science Management Office, University of Nebraska-Lincoln), and Dr Jerry Mullen (US Geological Survey). US Ambassador, HE David Huebner joined us for the morning session. The workshop outcomes were to: continue working towards future collaborations (e.g. ANDRILL, ITASE); and work towards a collaborative marine ecosystems project using the highly successful approach of the Long-term Ecological Response Program.

Evie van de Ven on a hike on Mount Taranaki

Sedimentology and Zircon Geochemistry

My research project is an interesting mix of Antarctic paleoclimatology and geochemistry and my supervisors are Prof. Tim Naish (ARC) and Prof. Joel Baker (SGEES). Together with Tim and Joel I am trying to constrain factors that governed the deposition of glacial and marine deposits in the CIROS-1 drill core from western Ross Sea. To do this, I will identify the origin of the sediments and any changes in their source through time. This will help in our understanding of both glacial and tectonic processes that have operated in the region over the last 40 million years. I have extracted highly resistant zircon minerals from 19 sediment samples in the core. These have been analysed for Uranium-Lead ages of crystalisation and their trace-element composition using the laser ablation mass spectrometer at VUW. I have also been revising the stratigraphy and age of the core with the assistance of Prof. Chris Fielding (University of Nebraska-Lincoln). Through identifying the pattern of changing source regions of the zircons through time in the core, I hope to be able to trace changes in glacial dynamics, the uplift and erosion history of the Transantarctic Mountains, and make inferences about older geological terranes that make up the Antarctic continent hidden under the ice sheet. *Evie van de Ven*

Rebecca O'Donnell enjoying time in genuine, as opposed to modelled, snow and ice

Glacier Modelling: Playing with Ice, Without Getting Cold

The aim of my MSc research is to improve our understanding of Quaternary glaciations in Tasmania and in particular to understand why Southern Hemisphere 'Ice Ages' occur. I used an ice sheet model to understand the climate changes that caused these glaciers to grow and shrink. My supervisors for this research are Dr's Andrew Mackintosh and Nick Golledge (ARC) and Dr Alun Hubbard (University of Wales, Aberystwyth).

The first part of my project involved travelling to The University of Wales so Alun could help me set-up the ice sheet model. Once back in Wellington, I carried out numerous experiments and I compared the modelled output to the geological evidence.

Ultimately, the model produced a good match with the field evidence and allowed me to draw some conclusions about past climate. I discovered that mean annual temperatures during glacial phases were around 8°C colder than present. One possible reason for this large temperature change in the Southern Hemisphere, is that global CO_2 variations during Ice Ages were more important than previously thought. Another possibility is that local changes in the Southern Ocean or Antarctica actually drove the temperature changes. I will leave Andrew, Nick and others to think more about that one! *Rebecca O'Donnell*

Playing with Snow AND Getting Cold

Seasonal snow is Earth's most rapidly varying large scale surface feature, exerting a key role on the global radiation balance to govern climate and hydrological systems and is therefore of high social and economic importance. However, there is limited knowledge of snow distribution at high elevations in mountainous environments because of high accumulation rates and difficult access. My work provides the first physical, trans-alpine, high altitude seasonal precipitation assessment in the Southern Alps. In doing so, this work provides benchmark data for glacier mass balance and precipitation distribution modelling studies to be verified. Sites for this study are located in the renowned ski touring catchments of Ka roimata o hine hukatere/Waiho and Pukaki at the Davis Snowfield, Annette Plateau and the Jollie River valley.

Ground Penetrating Radar (GPR) was used to assess snow depth. Results confirm that helicopters and skis are both acceptable methods of transport to, from, and within the Alps, and digging snow pits is more enjoyable when watching others do it. The cross mountain investigation also provided winter precipitation values equal to previous annual estimates west of the main divide, and in agreement with seasonal estimates to the east of the divide. To compare the GPR data with local long term lower elevation precipitation measurements, temperature index modelling was used allowing direct estimation and comparison of accumulation data at annual and storm intervals. *Lawrence Kees*

Lawrence Kees using the GPR in the Jollie River valley

OTHER ACTIVITIES

(L-R): Alex Pyne, Peter Barrett, and Tim Naish with their Antarctic Medals

2010 New Years Honour Recipients

Peter Barrett, Tim Naish and Alex Pyne were honoured in April at three different investiture ceremonies at Premier House with the award of the New Zealand Antarctic Medal. Peter received it for services to Antarctic science, Tim for services to Antarctic climate science and Alex for services to Antarctic engineering. The New Zealand Antarctic Medal was formally instituted in 2006 as a replacement to the (British) Polar Medal and given to a team or individuals who have made an outstanding contribution to exploration, scientific research, conservation, environmental protection, or knowledge of the Antarctic region. It is the first time the medal has been awarded to more than one person from the same institution, and also to previous recipients of the Polar Medal, such as Peter and Alex.

ARC Administration Receive Award

Centre Manager, Tamsin Falconer and Administrator, Michelle Dow were presented a Team Award at the 2009 Victoria University Staff Excellence Awards ceremony on 30 March. The award was for providing outstanding service to the Antarctic Research Centre and for their contribution to the excellent research performance and profile of the Centre over the last two years.

(L-R): Vice Chancellor, Prof. Pat Walsh, Michelle Dow, Tamsin Falconer and Chancellor, Ian McKinnon at the awards ceremony

Frank Niessen & Polarstern visit

Over the summer months we were delighted to host Dr Frank Niessen from the Alfred-Wegener Institute (www.awi.de). Frank has a long association with the ARC having been involved in the Cape Roberts drilling project led by Peter Barrett in the 1990s. During this recent visit Frank worked with Gavin Dunbar (ARC) on reprocessing and re-interpreting physical properties measurements collected during the more recent ANDRILL project in Southern McMurdo Sound for the initial report which was published in April in *Terra Antartica*. Fortuitously, Frank's visit coincided with a Wellington port-call by the German research ice breaker *Polarstern* (Polar Star) on its way to the Ross Sea. Members of the ARC had two opportunities to visit this truly impressive vessel (www.awi.de/en/infrastructure/ships/polarstern), the first as guests of the German Embassy and ship's captain and the second for a more detailed look around, with Frank generously acting as tour guide.

The Last Trillion Tonnes

Over the past three years, the ARC, with the help of the VUW Research Office, has been supporting Simon Lamb to make a feature film on climate change as part of a VUW-Oxford University collaboration. The film runs for 80 minutes and is entitled *"The Last Trillion Tonnes"*. It features climate scientists from four countries telling of their work in understanding how the Earth's climate system works and how human activity is disturbing it. It includes sequences filmed on ice sheets in Antarctica, on a research vessel in the Southern Ocean, and in laboratories and institutions in New Zealand, UK and Germany. A screening in Wellington to an invited audience with the support of the UK High Commission on 24 March was well received. Plans are being laid for screenings at scientific meetings in Christchurch in July and the Scientific Committee on Antarctic Research in Buenos Aires during August, as well as for distribution by DVD and other networks.

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