IceSked

Issue 8: June 2007

Newsletter of the Antarctic Research Centre
Victoria University of Wellington

The success of the ANDRILL McMurdo Ice Shelf project this past summer is the major focus of this issue of IceSked. We have reports on the technical achievements, scientific discoveries and perspectives from students working on the project. We also introduced two new students to Antarctica this year, working in the remote Whitehall Glacier and Mt Erebus regions, with Nancy Bertlers' ice coring programme.

ANDRILL: Technology Gives Scientists Plenty to Work On

On 26th December 2006, at the ANDRILL McMurdo Ice Shelf (MIS) drill site, the final section of core was retrieved from the deepest ever geological drill hole in the Antarctic (1284.87 mbsf). Importantly, drilling also reached the seismic target for the site, which was confirmed by scientific analysis at the drill site. Both the drill team and the science team were delighted to have broken the record (previously held by the 999.1 m Ocean Drilling Program core from Prydz Bay), but they were also pleased that the depth did not come at the cost of core quality or recovery (which was better than 98%).

While the components of the ANDRILL system had been tested before this summer, this was the first time that the entire system had been assembled and used for coring in Antarctica. In particular, it was the first time anyone had cored from an ice shelf platform - at MIS this meant lowering the sea riser through a hole melted through 86 m of ice shelf and a water column of 860 m before even reaching the sea floor. While the ice shelf provides a strong and stable platform, the drilling system had to be designed to cope with two kinds of ice shelf movement - continuous lateral movement of about 30 cm a day, and vertical tidal movement of up to 1.5 m over a 24 hour period.

Looking up the drilling mast

Alex Pyne, the Drill Site Manager, credits the success of the operation to having a team of highly skilled people working for the Project Operator, Antarctica New Zealand. The drill team lived at Scott Base, and the science team at McMurdo, 'commuting' out to the drill site by Hagglunds every day for 12-hour shifts. The science team working at the drill site provided continuous on-site analysis, important for both science activities and drilling decision-making. The German physical properties team, for instance, was able to confirm that the seismic target had been reached through work on the cores at the drill site.

ANDRILL was one of the largest projects ever supported by Antarctica New Zealand, and got plenty of attention. Over 300 people visited the drill site, with many people from Scott Base and McMurdo who were working to support the operation in one way or another. Visitors also included media crews from New Zealand, Italy, Germany and the USA, and distinguished visitors such as the New Zealand Minister of Science, Steve Maharey, the Board of the US National Science Foundation, and a New Zealand party including ARC Director, Peter Barrett and GNS Science Chief Executive, Alex Malahoff. ARC people working at the drill site included Alex Pyne, Tamsin Falconer, Cliff Atkins and Dene Carroll.

The ANDRILL drill site team

ANDRILL: Sedimentation History

Julian Thompson and Rob McKay raise the ANDRILL flag on Observation Hill

I spent three months as an on-ice scientist working at the Crary Lab in McMurdo Station. Working with the sedimentology team, I helped to describe and interpret the 1200 m of sediment core recovered by the ANDRILL project. This work aided in the understanding of the large-scale changes in sedimentary processes throughout the core and identified sections of core that had been subjected to significant erosion. Identifying erosion surfaces in the cores was a vital step in the development of the chronostratigraphy and for understanding changes in the styles of Antarctic glaciations over time.

My PhD is primarily focussed on the history of ice cover in the Ross Embayment over the past million years, a time period well represented in the core. Sedimentation in this section of the core is dominated by glacial diamict, with only a few thin sub-shelf muddy intervals. This is in stark contrast to older underlying sediments which display periods of cyclic fluctuations between open water conditions and glacial advances. Work continues off-ice with grain size analysis, microscopic petrology and computer modelling to better constrain the causes for this major shift in the extent and behaviour of this part of the Antarctic ice sheet.

Rob McKay

ANDRILL: Seismic Reflections

Seismic surveys across the ice since 1993 have played a key role in planning the drilling and interpreting the core of the ANDRILL MIS project. Two further seismic reflection surveys were conducted this season to provide data that can be used to link the AND-1 cored stratigraphy to older seismic reflection lines, as well as the database of marine seismic data in the Victoria Land Basin and Ross Sea.

Dhiresh Hansaraj drilling shot hole

During drilling of AND-1, my supervisor Stuart Henrys (GNS Science) and I tested instruments, surveyed, and loaded shot holes in preparation for the logging period that took place once the drilling had concluded. Two vertical seismic profile (VSP) experiments will provide an accurate time-depth curve, and a high resolution near-well seismic image. I am currently processing and interpreting the data towards my Marsden-funded MSc degree.

Dhiresh Hansaraj

ANDRILL: A Bounty of Scientific Discoveries

After six years of planning, Tim Naish the co-chief scientist of ANDRILL's McMurdo Ice Shelf (MIS) Project, is justifiably pleased with the bounty of scientific discoveries that the cores are beginning to yield. The cores provide a unique record of the history of the Ross Ice Shelf/Ice Sheet spanning the last 13 million years, comprising more than 60 cycles of ice advance and retreat under a range of climate conditions, some of which may represent extended periods when the climate was a few degrees warmer than present; much like that predicted for the next century or two. It is believed that the 1200 m of core will become a benchmark for the testing of climate and ice sheet models, and for constraining predictions of future climate behaviour, for many years to come.

More than 35 of the 50-strong science team from New Zealand, Germany, Italy and the USA participated on-ice for 12 weeks, where they worked in the world-class Crary Laboratory, McMurdo Station, doing the initial characterisation and description of the cores. ARC on-ice researchers included Lionel Carter, Gavin Dunbar, Mike Hannah, Rob McKay, and Dhiresh Hansaraj.

By studying the cores, the ARC team will help understand when the ice was grounded and sitting directly on the seabed, when the Ross Ice Shelf was fully over the site and floating in the water, and when there was open water and the glaciers had retreated onland. The team was surprised and intrigued by abrupt transitions from glacial to ocean conditions, which they have interpreted as times of rapid ice sheet retreat or even ice shelf collapse. A key aspect of the work will be using biological and geochemical proxies

Co-chief scientists Dr Tim Naish (L) and Dr Ross Powell (R) and Project Staff Scientist Dr Richard Levy (Middle)

The ANDRILL drill site with Mt Erebus behind

to reconstruct the climatic conditions under which major changes were occurring in the Antarctic ice sheets. Gavin will be working with international collaborators, and Joel Baker's mass spectrometry facility at VUW, to reconstruct sea surface temperatures using geochemical techniques.

The entire science team met in the first week of May, at the Antarctic Core Facility at Florida State University, for their post-drilling workshop where the initial report was finalized and plans set in place for more detailed analyses. The first scientific results are planned for publication later in the year.

ANDRILL (www.andrill.org) is a multinational collaboration involving Germany, Italy, New Zealand and the United States. Funding support for ANDRILL comes from the U.S. National Science Foundation, New Zealand Foundation of Research, Science & Technology, Royal Society of New Zealand Marsden Fund, Antarctica New Zealand, the Italian National Program for Research in Antarctica - PNRA, The German Science Foundation and the Alfred Wegener Institute for Polar and Marine Research Science (AWI).

Julia Bull in front of Observation Hill

Snow Sample Chemistry - Whitehall Glacier

This past Antarctic field season, I was chosen to accompany the K049 team - led by Nancy Bertler, and including, Dr Sepp Kipfstuhl (AWI), Matt Watson (ScanTech) Glen Kingan (Webster Drilling), and Davie Robinson (VUW) - to Whitehall Glacier. The aim was to recover a high resolution ice core as a part of the NZ International Trans Antarctic Scientific Expedition (ITASE) programme, and collect snow samples from four pits which will provide the basis of my MSc degree in Geology.

Whitehall Glacier is a small, independent ice mass just 12 km off the coast. Its coastal location, low elevation and proximity to the Antarctic low pressure belt make it an ideal site to study influences and feedbacks between the El Nino Southern Oscillation and the Southern Annular Mode. This location made for interesting working conditions – having to dig the drilling pit twice and establish a makeshift drilling 'tent'– however, 105 m of core was recovered making the trip a great success.

Snow pit samples will be analysed for oxygen and hydrogen isotopes, which combine to provide a useful temperature proxy once calibrated with our direct meteorological measurements. Major and trace element geochemistry will be used to provide information about aerosol depositional controls and how they relate to climate. Overall the trip was an amazing and very valuable experience, with memories of lots of good music, a very unique 21st celebration and a great group of people.

Julia Bull

Mt Erebus Ice Core Drilling

Climate change science is currently unraveling one of the most complex problems humanity has faced, and ice cores are now providing us with an unparalleled account of our climates past. In December 2006 I was fortunate enough to accompany Nancy Bertler, Sepp Kipfstuhl and Glen Kingan to Mt Erebus Saddle (~1600 masl). The primary objective was to retrieve a high resolution ice core to contribute to the ITASE data set. This data provides an onshore analogue to the marine record and will extend the proxy data currently available from coastal, low elevation ice domes in the Southern Hemisphere, thus improving future regional climate model development.

Tales of extreme 90 knot winds while living in tents on the Erebus Saddle had left me feeling a little anxious about my first Antarctic experience. However brilliant weather conditions for almost the whole two and a half weeks put my worries at ease. We succeeded in obtaining 168 m of core from the target depth of 209 m. Many thanks to Nancy and all the other researchers, and support staff who lead the forefront of this very important research both in New Zealand and Antarctica.

Rod Boys

Dr Nancy Bertler, Dr Sepp Kipfstuhl, Rod Boys, and Glen Kingan

OTHER ACTIVITIES

S. T. Lee Lecture in Antarctic Studies

Professor Paul Mayewski

The highly attended 2007 S. T. Lee Lecture "The Ice Chronicles and Rapid Climate Change" was presented by Paul Mayewski, Professor and Director of the Climate Change Institute, University of Maine. The presentation offered an overview of key results from the 110,000 year long GISP2 (Greenland Ice Sheet Project) ice core that dramatically changed the way scientists view the dynamics of past and future climate, and from ITASE ice cores that provide evidence of the current state of the Antarctic climate. Paul also gave talks at GNS Science on Asian ice coring; NIWA on Northern Hemisphere ice sheets and VUW on ITASE and other research programmes suggesting that the Antarctic climate is poised for even greater change.

Ice core science celebration

Paul was also guest of honour at a special celebration of ice core science organized by GNS Science on the 23rd of March as the new Ice Core Research Laboratory approached the start of its operational life. The gathering was addressed by Alex Malahoff (GNS Science), Peter Barrett (VUW), Katja Reidel (NIWA) and Nancy Bertler (VUW/GNS). We were also delighted that inaugural S.T. Lee Lecturer Rob Dunbar, Stanford University, and 2004 S.T. Lee Lecturer Jim Kennett, University of California at Santa Barbara (and a VUW Alumnus), could join us for the occasion.

Antarctica: 50 Years on the Ice – "Just the Tip of the Iceberg"

From the 2nd-6th July 2007, at the Duxton Hotel, Wellington, Antarctica New Zealand and the Royal Society of New Zealand are holding a conference celebrating 50 years of New Zealand's involvement in the Antarctic. The conference aims to present the successes of the past (International Geophysical Year to present day) and enthuse New Zealand about its future in Antarctica.

The conference registration fee is $450 (regular) and $200 (student). Registrations and abstracts are required by June 20th 2007. All the information about the conference can be downloaded from the Antarctica New Zealand website (www.antarcticanz.govt.nz).

Reminder – VUWAE Reunion

Preceding this conference is the celebration of another 50 year anniversary – the Victoria University of Wellington Antarctic Expeditions, VUWAE Reunion, will be held over two days from the 30 June-1 July 2007. Registration costs $25 and if you would like to attend please find further information and the registration form on our ARC website.

It's Official – The New Zealand Ice Core Research Laboratory Opening

On the 12th of April the Honorable Steve Maharey opened the New Zealand Ice Core Research Laboratory, a GNS Science and Victoria University of Wellington venture through the Joint Antarctic Research Institute (JARI), and with the support from NIWA. The $1.4 million facility, located at the National Isotope Centre in Gracefield, has recently received its first ice cores; 800 m of ice collected in the Antarctic by GNS Science and VUW scientists over the past summer. Organisers of the event decided against using the more traditional 'cutting of the ribbon' to officially open the facility and instead marked the event with the 'breaking of the ice core'.

Dr Nancy Bertler (VUW/GNS) and Dr Frank Bruhn (GNS Science) help Science Minister Hon. Steve Maharey open the facility by 'breaking the ice core' (photo: Hutt News)

Antarctic Research Centre
Victoria University of Wellington, PO Box 600, Wellington, New Zealand
Phone +64-4-463 6587, Fax +64-4-463 5186,
E-mail Antarctic-Research@vuw.ac.nz
www.vuw.ac.nz/antarctic

Victoria
UNIVERSITY OF WELLINGTON
Te Whare Wānanga o te Ūpoko o te Ika a Māui