# IceSked

Issue 22: June 2014

Newsletter of the Antarctic Research Centre
Victoria University of Wellington

## A Word From the Director

Mid-year is always a busy mix of writing up research results and preparing for another busy Antarctic field season. In this newsletter we plan for the future, prepare to celebrate the past, as well as share some science in action! *Tim Naish*

## Scanning the horizons of Antarctic research

In April, 2014 in Queenstown, New Zealand, seventy-four Antarctic scientists and policy makers from twenty-two countries came together for the 1st Scientific Committee on Antarctic Research (SCAR) Antarctic and Southern Ocean Science HorizonScan. The task was to identify the most compelling scientific questions that Antarctic researchers should address in two decades time. In preparation for the meeting, the global Antarctic community was widely engaged and consulted. The HorizonScan winnowed more than 1000 questions down to the highest priority scientific questions. These questions span the breadth and depth of modern Antarctic science, and were grouped into the following Themes: (i) The Global Reach of Antarctica and the Southern Ocean. (ii) The Ice Sheet and Sea Level. (iii) The Dynamic Earth beneath Antarctic Ice. (iv) Evolution and Undiscovered Life. (v) Near-Earth Space and the Universe Beyond.

Tim Naish, Peter Barrett and Nancy Bertler (also GNS) were amongst the New Zealand contingent, which also included Craig Cary (Waikato), Gary Wilson (Otago), Bryan Storey (Canterbury) and representatives from Antarctica New Zealand and Ministry of Foreign Affairs and Trade. All of us found the process quite challenging given the tight time frame of three days to wrestle with such a large and diverse array of questions to find the key issues that will define the priorities for funders, research providers and stakeholders for the next two decades. We were asked to think outside the box, not to be constrained by resources, and while some issues were of immediate importance, to also anticipate emerging issues. The criteria were broad, ranging from critical fundamental knowledge gaps, exciting blue-sky discoveries, and issues of immediate societal relevance, technological challenges and the need for resources. So although we were in Arrowtown in autumn with pinot noir on the vines and in the bottles, we stayed on task and succeeded in defining 80 key questions.

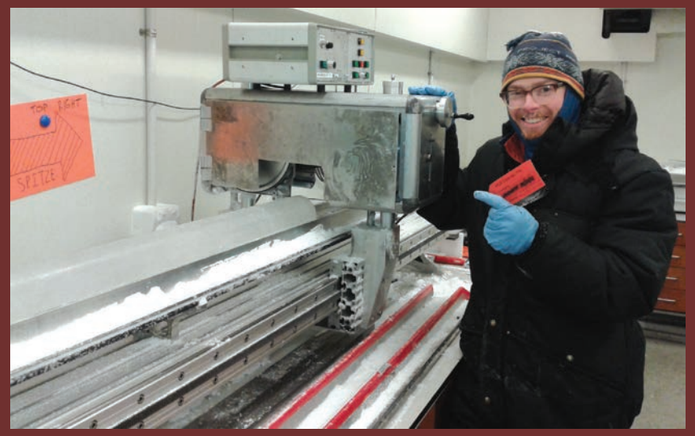
The outcome of the HorizonScan and the questions will be published in an article in *Nature* (this July) and a longer article in *Antarctic Science* later in the year. A highlight of the meeting was a half-day symposium in which a panel composed of past and present Martha Muse Prize Fellows painted a picture of Antarctica and its influence on our planet by 2045.

The HorizonScan was the brainchild of ex-SCAR President, Chuck Kennickutt, who with financial support from the Tinker Foundation and Antarctic New Zealand, worked tirelessly to pull off what we all agree was a highly successful process. So what did we find? Well that's embargoed for the *Nature* article coming out soon!

*Photo of "Ice sheets and Sea-Level" break-out group (in from two rows from left, Tim Naish, David Vaughan, Ian Allison, Carlota Escutia, Rob DeConto, Ted Scambos. Nancy Bertler is down the back)*

## Keeping its Cool – Antarctic Ice relaxing at -18°C

During 2013, the Roosevelt Island Climate Evolution (RICE) team was determined to complete the processing of the 764m deep ice core over the two and a half months of the international campaign. The core was recovered just the year before from Roosevelt Island, a little ice rise with an independent ice cap located at the northern edge of the Ross Ice Shelf. The data are expected to hold important clues on the stability of the West Antarctic Ice Sheet in a warming world, including constraints on the rate and magnitude of global sea level rise for the coming 50-200 years. The team representing nine nations ploughed away in twelve-hour shifts, highly motivated by the exciting data, produced in real-time as the ice was melted and analysed by New Zealand, Danish, US, and Australian instruments packed into the ultra-clean laboratory while also filling over 50,000 vials for discrete analyses.



*Peter Neff cutting the last full meter of the RICE core - 763m depth*

However, the team could not finish. Nancy Bertler, Chief Scientist of the RICE programme, had to cut short the processing campaign just three weeks before its completion. The reason was misbehaving ice. Ice sheets contain a zone a few hundred metres thick that is called the 'brittle ice zone'. Here, the pressure in the bubbles of the ice lattice and structure of the crystals create ideal conditions for highly stressed ice that fractures easily and explosively. Below this zone, the pressure is so high, that the gas bubbles are absorbed into ice as clathrates, creating once again manageable ice.

The NZ ice core drilling system, which was based on the Danish Hans Tausen Drill, features some modifications developed by ARC engineers Darcy Mandeno and Alex Pyne, which allowed the RICE team to obtain exceptionally high quality ice even through the brittle ice zone. At Roosevelt Island this zone occurs at a depth of 450-760m depth. Instead of highly broken and fractured ice, the drillers recovered almost exclusively single, 2m long cores. Yet, as the cold laboratory team at the National Ice Core Facility at GNS Science in New Zealand reached the ice at 500m, the ice started to fracture on the bandsaw despite all efforts of the experienced team. Fractures diminish the quality of the core with the potential to compromise the quality of RICE data, in particular for continuous flow analyses of greenhouse gases and chemical tracers. So the difficult decision was made to stop the core processing campaign until the ice can be cut again. Thus, tired, excited and a little disappointed the team packed up and students, staff and instruments returned to their home institutions. But how to relax stressed ice?

The ice core community is a small, highly collaborative family and so the ether went hot, as emails, phone calls, and Skype sessions bounced around the world to discuss the best option. We concluded the best chance for success was to store the ice at warm temperatures – perhaps as warm as -18C. This is a frightening prospect. At the National Ice Core Research Facility we keep ice at -35C, conditions suitable for long term storage of Antarctic ice. In addition, such cold temperatures also give a little buffer to accommodate rare failures, such as power outages after earthquakes. Storing ice at -18C leaves no buffer for technical issues, or we could risk losing precious ice. With some level of heightened anxiety, we discussed with our engineers the necessary steps to warm up the freezer and over four weeks we slowly increased the temperature. This also provided a good opportunity to review our emergency response protocol, to set up additional monitoring devices, to conduct additional maintenance on our back- up generator, and to develop a schedule that ensures that ice core staff were available at all times to deal with potential issues. Over the next ten months, the ice calmly rested in its sauna like conditions, carefully looked after, and unaware of the heightened activity outside.

Yet - it worked! During April to May, a team of four, Peter Neff, Rebecca Pyne, Arran Whiteford, and Nancy Bertler, put the precious ice through the Danish and New Zealand saws to cut the various sections. Ice, which just months earlier catastrophically exploded, now behaved extremely well, cutting beautifully causing only very minor damage. This was excellent news for the RICE team, and the final core processing campaign could be scheduled and commenced in June 2014. For the next two months the international RICE team convenes again at the National Ice Core Facility to complete last year's effort. Students and staff from New Zealand, USA, Australia, Denmark, Germany, India, Russia, and China will work round the clock in Twelve-hour shifts. We are so excited to complete this task as it will allow us to unravel past behaviour of West Antarctica and the Southern Ocean during climate transitions with the aim to provide urgently needed projections for future change.

## RICE fieldwork – Mission accomplished!

This year, the final RICE field season, the task was predominantly an airlift logistics effort to extract 30 tonnes of equipment accumulated from three years of ice core drilling operations at Roosevelt Island.

With such an intensive extraction effort required over a planned four to six weeks, an experienced team of seven was assembled with staff from Antarctica New Zealand, Royal New Zealand Air Force and Victoria University of Wellington supported by the team at Scott Base and USAP Mac-ops. Additionally from USAP a three party science team completed bore-hole temperature, optical tele-viewer, GPR, mass balance and accumulation measurements.

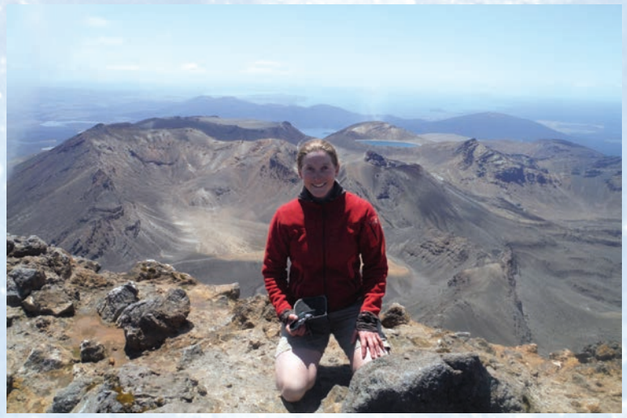
*RICE team 2013 Left to Right: Twit, Richard, Hedley, Jody (front), David, Otis (front), Hoff, Mike, Jeff (front), and Darcy. (Photo: Jeff Rawson)*

Despite aircraft, weather and even U.S. Government shutdown delays, the season was completed successfully with all equipment extracted. The U.S. Government shut down actually presenting a silver lining with more aircraft available as a result of the unfortunate scaling back of some USAP programmes allowing field operations to be completed in two and a half weeks and requiring three less aircraft movements than the originally planned thirteen. All achieved through the hard work of the NYANG 109th, Kenn Borek Air and ground support at both ends of the Ross Ice Shelf from both programmes.

Leaving Roosevelt Island as we found it, only the addition of a lonely green fiberglass bore hole casing above a 763.5m deep hole, the sole monument of the considerable effort that has gone into the last four years at a little field camp deep in the heart of the Ross Ice Shelf.

## S.T. Lee Young Researcher Travel Award

I'm honoured to have had the opportunity to visit the Antarctic Research Centre at Victoria University of Wellington through the S.T. Lee Travel Award. I arrived fresh from Antarctic fieldwork to spend about three weeks in January working with Dr. Huw Horgan. During November and December 2013, I was part of a field team that collected geophysical data focusing on the areas around the Blood Falls feature of Taylor Glacier. Our geophysical campaign included collecting GPS, ground-penetrating radar (GPR), interferometric radar, seismic, and time-lapse imagery and thermal imagery data.



*Enjoying the views from the top of Ngauruhoe*

While at ARC, I focused on the initial preparation and processing of the GPR dataset. First, I sorted through the GPR and GPS data and performed some initial data quality control. After ensuring that complete metadata were compiled from all the field notebooks, I began the process of georeferencing the GPR data using the fast static GPS points we collected separately. Under the guidance of Dr. Horgan, I developed code to georeference the GPR data. This code development helped me significantly improve my MATLAB skills. I created the workflow and data organisation that has been used by our group since January to further process the GPR transects. At the end of my visit in Wellington, the newly georeferenced GPR transects could be topographically corrected.

A highlight of my visit was a weekend trip to the Tongariro area with a group of (mostly) geology VUW graduate students. While completing the Tongariro trek, climbing Ngauruhoe, and hiking around Ruapehu, we spent a good deal of time "geologizing". I thoroughly enjoyed the weekend learning the volcanic and glacial history of the area through observation and discussion of landforms and deposits with these knowledgeable young scientists.

I look forward to welcoming the next recipient of the S.T. Lee Travel Award to Fairbanks!

*Christina Carr*

# OTHER ACTIVITIES

## The ARC Endowed Development Fund has now reached $500,000, with 54 grants having been awarded since its inception in 2004.

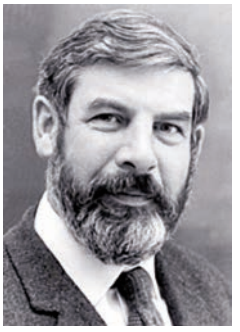
This substantial fund enables the ARC to give small grants of up to $4000 to postgraduate students with research links to Antarctica and enables some amazing opportunities to be taken up, that would not have otherwise been possible.

The 2013 recipients included PhD students Christine Bylenga and Francisca Vermeulen from the School of Biological Sciences, who presented their research at the XIth SCAR Biology Symposium held in Barcelona, Spain. The remaining recipients were all from the Antarctic Research Centre. Bella Duncan attended the Urbino Paleoclimatology Summer School in Urbino, Italy in July. Heidi Roop and Molly Patterson both attended the American Geophysical Union Meeting in San Francisco in December. Andrea Tuohy and Peter Neff headed to Curtin University, Perth to collaborate with researchers on their ice core research. Daniel Emanuelsson travelled to the University of Washington and Jane Chewings completed sample analyses which contributed to the results for a paper she submitted to Sedimentology. Finally Richard Jones used his grant to pay for cosmogenic dating of his samples from the Mackay Glacier, Antarctica.

For further information on how you can provide philanthropic support to the Antarctic Research Centre, please contact our Director, Professor Tim Naish, Email: timothy.naish@vuw.ac.nz, or Shelagh Murray, Executive Director, Victoria University Foundation Ph: 0800 VIC GIFT (0800 842 4438), Email: shelagh.murray@vuw.ac.nz. All donations are made through the Victoria University Foundation, a registered charity, and are therefore eligible for a charitable gift taxation rebate.

*Lee Seng Tee*

## Symposium for VUWAE Benefactors, Alumni and Friends including the opening of the S.T. Lee Reading Room with the Colin Bull Polar Book Collection – October 22 & 23, 2014



*Colin Bull*

VUWAE Benefactors, Alumni and friends are invited to a symposium on October 22 and 23, 2014, to appreciate the legacy of past expeditions, review current activities and get a glimpse of future research plans. A key feature of the event will be the opening of the S.T. Lee Reading Room, funded through the generosity of Dr Lee, and the Colin Bull Polar Book Collection, very kindly donated by Colin and his family.

The event will include a day of talks and posters at VUW by alumni, staff and students representing both early and recent years, followed by a half day of talks at GNS Science with a focus on Antarctic mapping, and also celebrating the close association between VUW and GNS over the last half century. The national ice core facility and other displays can be viewed after lunch and a symposium dinner will be held in the evening. A three-hour tour of significant Antarctic sites around Wellington will be arranged for the following day.

A preliminary programme will be posted in August on the ARC website www.vuw.ac.nz/antarctic/ For further information e-mail VUWAESymposium@vuw.ac.nz.

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