

IceSked

Issue 35: December 2020

Newsletter of Te Puna Pātiotio — Antarctic Research Centre
Te Herenga Waka — Victoria University of Wellington

A word from our Director

Although this year's Antarctic field season has been postponed, our researchers are still making it to the polar regions, with Ruzica Dadic becoming New Zealand's sole participant on the largest polar expedition ever! The MOSAiC project involved experts from 20 countries spending a combined year in the Arctic on the R/V *Polarstern*. This project aims to understand the role the Arctic system plays in global climate. We also celebrated the legacy of Emeritus Professor Peter Barrett at a special function in November, formally opened a new climate modelling centre, and celebrate recent awards of staff and students.

Rob McKay

Diary from the Arctic: Ruzica Dadic joins the MOSAiC project

The *Polarstern* returned from the last leg of the MOSAiC expedition on 12 October 2020 with Ruzica Dadic on board, below, she regales us with her tale.

Wellington, 15 July 2020, 4.30 am:

For me, the MOSAiC expedition starts today. Panicking that I have forgotten to pack something important, I wake early. In a few hours' time, I'll have to say goodbye to my three children for three-and-a-half months, and my stomach is turning somersaults at the thought.

Fast forward to 12 August:

After a 36-hour flight, two weeks of quarantine in Bremerhaven and two weeks on board the Russian icebreaker *Akademik Tryoshnikov*, we finally catch sight of the *Polarstern*. After another three days spent to-ing and fro-ing between the two ships, we finally head to our new ice floe.

Fast forward to 20 August:

Following a short detour to the North Pole, we wake up one morning to find ourselves on a new floe. My job is to measure the surface snow on the sea ice, but there's no snow to be seen! There is some white stuff that looks like snow and feels like snow but is in fact known as the "surface scattering layer", consisting of melted sea ice from which the brine has already drained. Not letting this put us off, we start getting ready, but there's another small problem:

How do we pack our mountain of snow instruments onto one sledge?



Ruzica Dadic taking measurements of the snow surface (Photo: Mario Hoppmann)

Because there is not always two people doing the snow measurements, taking more than one sledge is not practical. Fortunately, our colleagues lend us one of their large sledges and we're all set to go. Or at least we think we are. In fact, packing up the snow-measurement sledge for the first time requires a bit of creative thinking, but we soon found what was surely the only possible way to accommodate all the gear we needed on one sledge.

A curious visitor:

We then spent weeks measuring the physical properties of snow (or "surface scattering layer"), until one day a polar bear suddenly approached and we were all immediately summoned back to the ship. Needless to say, we didn't have time to go through the rigmarole of packing up the sledge, so we watched from the ship as the polar bear sniffed about amongst the snow instruments

with great interest. We were terrified that it would devour our high-precision measuring equipment or even the valuable data we'd been collecting. Luckily for us (though not so luckily for our colleague), an automatic weather station soon piqued the bear's curiosity and it wandered off to play with the funny-looking devices. Eventually, after thoroughly inspecting every single instrument, it got bored and moved on.

We were to receive several more visits from polar bears in the weeks to come and had to suspend our measurements on several occasions. But in the end, we managed to collect a plethora of data, and have some exciting adventures along the way. Our measurements are important pieces of the jigsaw that will enable us to better understand the role of snow on sea ice and will give us improved insight into the climate of the polar regions. And that's good news not just for us, but also for the polar bears.



The polar bear also had its hands full (Photo: Polarstern Chief Engineer)

The Peter Barrett Symposium: Celebrating his legacy



On the 16-17 November, Te Puna Pātioio – Antarctic Research Centre hosted The Peter Barrett Symposium. Day one was a fieldtrip to the Wairarapa looking at a series of fossiliferous limestones and mudstones that contain evidence of past changes in sea level and ocean temperatures that related to expansion and retreat of the ice sheets in Antarctica.

The following morning, we celebrated the career of Emeritus Professor Peter Barrett through a “This is Your Life” style timeline from his early years as a PhD student to filmmaker and climate “alarmist”. Guests joined the event in person and from around the world via zoom – sharing their stories of Peter over the years. In the afternoon, the focus shifted to the “legacy” of Peter and the ARC highlighting the present research and future direction of the Antarctic Research Centre and the impact Peter had on the Centre.

Peter Barrett grew up on a Waikato dairy farm and in his teens took up caving in the Te Kuiti district. He went on to study

the Te Kuiti Limestone for his Master’s thesis at Auckland University, and by chance in 1962 joined a University of Minnesota expedition to the Ellsworth Mountains, Antarctica. This led to a PhD at Ohio State University on the Gondwana strata of the Central Transantarctic Mountains, where he discovered the first tetrapod fossil in Antarctica, leading to the confirmation of the theory of plate tectonics. In 1970, Peter returned to New Zealand to take up a postdoctoral fellowship at Victoria University of Wellington, to continue their annual Antarctic expeditions. The following year he was appointed Senior Lecturer in Geology and the inaugural director of the Antarctic Research Centre, serving in this role from 1972 until 2007.

During that time, Peter led many Antarctic field parties involving both staff and graduate students and several ambitious drilling projects. Peter was aboard the first DSDP (now the International Ocean Discovery Programme IODP) leg to Antarctica in 1972-73, which successfully collected cores in the Ross Sea, establishing the antiquity of Antarctic glaciation. From 1974 to 1999 Peter led a succession of offshore drilling projects culminating in the Cape Roberts Project recording Antarctic ice sheet dynamics and climate history from 34 to 17 million years ago. The successes and remaining questions led to the development of the ANDRILL Project.

Peter represented New Zealand as Geology delegate at meetings of the Scientific Committee on Antarctic Research (SCAR) from the early 1980s, becoming a steering committee member of the SCAR’s ANTOSTRAT project in 1989, and co-founding SCAR’s Antarctic Climate Evolution project in 2002. Peter served on the SCAR Group of Specialists on Environmental Affairs and Conservation from 1988 to 2002 and was also the first New Zealand delegate to the Antarctic Treaty System’s Committee on Environmental Protection, serving from 1998 to 2003.

After the near collapse of the ARC in 2000, Peter set his mind to building an enduring legacy. Part of that strategy involved philanthropy, enabling, in 2003, the launch of the inaugural S.T. Lecture in Antarctic Studies as well as a student exchange between University of Alaska and ARC supported by a generous donation from Singaporean philanthropist, Dr Lee Sung Tee. Peter also developed the ARC Endowed Development Fund, which was launched



VUWAE 16: Douglas Bright, Rosemary Askin, Alwyn Chinn and Peter, 1971/72

in 2004 by co-patron Barrie McKelvey. The other patron, Peter Webb, and Barrie were the sole members of the VUWAE 1 expedition that conducted some of the first geological mapping of the Dry Valleys in 1957. Peter’s burgeoning reputation and that of the ARC attracted generous donations including, the \$1 million donation from alumnus Alan Eggers in 2007. Through donations by alumni and supporters the Fund has now reached a total of \$1.38 million. This legacy continues to grow and will support post-graduate student grants and two PhD Scholarships in perpetuity.

By 2006, 25 years after his first Op-Ed on future ice sheet melt from rising CO₂ levels, Peter realised the public were not recognising the disastrous consequences, so with geologist/cine photographer Simon Lamb, he developed a collaboration between Victoria University of Wellington, the University of Oxford, and film maker David Singleton to produce *Thin Ice – The Inside Story of Climate Science*. This involved filming over 30 climate scientists in Europe, New Zealand, Antarctica and on the Southern Ocean and in the words of one review “put a human face on climate science”. It was launched in 2013 at 200 locations covering all seven continents.

Throughout his career Peter has received several accolades. In 1963-64, the New Zealand Geological Survey Antarctic Expedition named a glacier in

Antarctica after Peter. Barrett Glacier was officially recognised by the New Zealand Geographic Board in 2008. Peter was awarded a Polar Medal in 1978 and elected as a Fellow of the Royal Society of New Zealand in 1993. In 2001, Peter received the Premio Internazionale Felice Ippolito medal for Antarctic research from the Accademia Lincei (Italy), and in 2004 he received the Marsden Medal for his lifetime contributions to science in New Zealand. In 2006, he received the inaugural SCAR President’s Medal for Outstanding Achievement in Antarctic science and was named Wellingtonian of the Year. In 2008, he was invited to be Patron of the New Zealand Antarctic Society. In 2010, Peter was awarded the New Zealand Antarctic Medal for services to Antarctic science and in 2011 he was made an Honorary Fellow of the Geological Society of London, a title only held by 70 people worldwide. In 2020, Peter received the New Zealand Prime Minister’s Science Prize as a member of the Melting Ice, Rising Sea’s team.

Throughout the day as we paid tribute to Peter’s outstanding contributions to Earth science there were recurring words of a man who is, kind, patient, fun-loving, curious, optimistic and inspiring, with a relentless perseverance, unselfish dedication, intellectual honesty, and social idealism, he is a strategic thinker, leader, advocate, mentor, and friend.



Peter with his Marsden Medal, 2004

But in Peter’s own words,

“I am described as a scientist but really I have always been an explorer. And one that never really knew where he was heading. I was just interested in understanding the earth, and working with like-minded people.”

Peter Barrett, 2004

Antarctic Science Platform National Modelling Hub formally opened



Hon David Parker unveiling the National Modelling Hub plaque, at the opening event

On 17 November, Hon David Parker, Minister for the Environment, formally opened the Antarctic Science Platform National Modelling Hub at a ceremony at Te Herenga Waka — Victoria University of Wellington.

The Antarctic Science Platform (ASP) National Modelling Hub was conceived in 2019 and established in 2020, building on long standing partnerships between GNS Science, NIWA, and the ARC at Victoria University of Wellington. Four Research Fellows have been employed and are co-located in the

National Modelling Hub, hosted at the ARC. The Hub is managed by Nick Golledge and Liz Keller, Co-Chairs of the Future Projections Expert Group. The Fellows share their time between their employing institution and the Hub.

The Fellows are: Alexandra Gossart, regional climate modeller (Antarctic Research Centre); Alena Malyarenko, process-scale ice shelf cavity modeller (NIWA); Angela Bahamondes-Dominguez, biogeochemical modeller (NIWA); and Mario Krapp, data scientist (GNS Science). Together the Fellows are

focussing on future projections and will work together, and with researchers across the country and around the globe using computer simulations and equations to replicate different parts of the earth system, from the climate, the ocean and snow patterns to predict what could happen in the future.

ASP Director, Nancy Bertler says the Antarctic science community feels a strong sense of urgency to meet the challenges of climate change.

“Understanding how the Antarctic ice sheets, ocean and atmosphere interact, how ecosystems will respond and in turn impact global carbon dioxide budgets, and to forecast and quantify impacts for humanity requires international and interdisciplinary cooperation. The Modelling Hub is a new approach to bring together some of the brightest minds and leading experts in diverse fields to accelerate progress,” she says.



(L-R) Alexandra Gossart, Mario Krapp, Alena Malyarenko; (insert) Angela Bahamondes-Dominguez

Asahiko Taira Scientific Ocean Drilling Research Prize

Rob McKay has been awarded the Asahiko Taira Scientific Ocean Drilling Research Prize in recognition of outstanding, transdisciplinary research accomplishment in ocean drilling. The Taira Prize is generously funded through the International Ocean Discovery Program (IODP) and is given in partnership between the American Geophysical Union (AGU) and the Japan Geoscience Union (JpGU). The Prize comes with an unrestricted award of USD \$18,000. The prize reflects his work in stratigraphy, sedimentology, paleoceanography and paleoclimatology during the 12 years since finishing his doctorate at the University.

Rob has been involved in three large, multinational scientific drilling expeditions on the margin of Antarctica

over the last 15 years, having participated in the ANDRILL McMurdo Ice Shelf project, IODP expedition 318 to Wilkes Land, and most recently as co-chief scientist for IODP expedition 374 to the Ross Sea. He has held leadership positions in the Australia-New Zealand IODP Consortium and co-ordinated future drilling workshops. Rob's research findings from the ANDRILL IODP drilling expeditions, have been published in leading journals, such as *Nature*, *Nature Geoscience*, and *PNAS*; and include showing for the first time that large parts of the giant East Antarctic Ice Sheet are vulnerable to collapse if planetary temperature stays 2°C above pre-industrial. This has major implications for global sea-level rise projections, as it is not just the West Antarctic Ice Sheet we now have to worry about.



Rob McKay on board the *Joides Resolution*

Rob also received the Prime Minister's Emerging Scientist Award in 2012, and a Royal Society of New Zealand Rutherford Discovery Fellowship in 2013. He was also part of the team of scientists who won the 2019 Prime Minister's Science Prize, announced this year, for their research on the impact of Antarctic ice-sheet melt on climate change.

Former student wins Hatherton Award

Georgia Grant (GNS Science) has received the Hatherton Award from the Royal Society Te Apārangi for the best scientific paper by a PhD student studying physical sciences, earth sciences or mathematical and information sciences at any New Zealand University. Georgia's paper reveals the scale and implications for sea-level rise in New Zealand from Antarctic ice sheet retreat occurring under 2°C warming.

Georgia is a recent PhD graduate from the ARC, supervised by Tim Naish and Gavin Dunbar. Her research paper 'The amplitude and origin of sea-level variability during the Pliocene epoch', was published in the leading science journal *Nature*. She used a new method of analysing marine geological sediments to construct a global sea-level record for warm climates in the geological past that are similar to those we are projecting for coming centuries.

The research shows approximately one third of Antarctica's ice sheets melted during the Pliocene epoch around three million years ago, causing sea levels to rise as much as 25 metres above present levels. Levels of carbon dioxide in the

Earth's atmosphere were similar to today's levels of ~400 parts per million, and in response, temperature was two to three degrees Celsius warmer.

Georgia developed the new method of determining the magnitude of sea-level change as part of her PhD, through analysing the size of particles moved by waves and assemblages of fossilised microscopic shells that lived on the ancient seafloor. The method was applied to the geological archive from the Whanganui Basin on the west coast of New Zealand's North Island, which contains some of the best evidence anywhere in the world for global sea-level changes. The results were compared to model experiments to determine how changes in sea level at this site related to loss of ice in Antarctica.

Georgia's work was a fundamental breakthrough, as it used a globally unique drill-core record from the Whanganui backcountry that recorded past changes in water depth from marine sediments, now uplifted onto land by tectonic activity. To achieve her results, she developed a method of using changes in sediment grain size (smaller

grain size equals deeper water as this setting is less influenced by high energy wave activity), incorporation of microfossil data (ecology of these micro-organisms are dependent on water depth), and numerical modelling methods (mapping how grain size may vary with water depth and different wave climates).

These new sea-level estimates provide a target for testing the results from computer models and improving their ability to make accurate projections of the Antarctic contribution to global sea-level rise, in particular, the rates at which the ice sheets can melt in the future.



Georgia Grant at the award ceremony