IceSked

Newsletter of the Antarctic Research Centre
Victoria University of Wellington

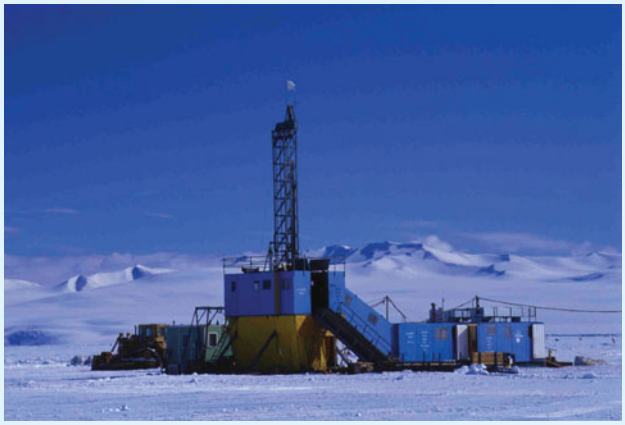
December 2003

Greetings

On December 30, 1957, almost 46 years ago, two third-year geology students stepped off the H.M.N.Z.S. Endeavour equipped with Professor Bob Clark's WWII field gear to keep them warm, and hitched a helicopter ride with biologist Ron Balham to the unexplored McMurdo Dry Valleys. Their fine mapping and reporting from that season formed the basis for the annual Victoria University Antarctic Expeditions (VUWAE) that continue to this day.

Since then VUWAE expeditions have taken over 250 staff and students to the ice, to share the excitement and satisfaction of discovering and understanding this remarkable part of the planet. The nature of exploration has changed as the region has become increasingly well known, but the style and spirit remain - a small group of innovative thinkers tackling some aspect of a big problem.

These days much of the exploration involves sampling otherwise inaccessible records by coring, on ice, on land and offshore. Our success in these endeavours has been largely through the work of Alex Pyne, who first went to the ice as an Honours student in 1978. He has since combined his geological and engineering skills for a wide range of Antarctic field activities. Over the last two decades Alex has worked as Science Support Manager on deep drilling ventures with the CIROS (1984-86) and Cape Roberts projects (1997-2000), and he continues this work with a key role in developing a system for drilling into the sea floor beneath the Ross Ice Shelf for the ANDRILL (Antarctic Drilling) Project.



Drilling rig on sea ice 15 km off Cape Roberts at CRP-3 - Nov 1999

In the last few years our research has focused on Antarctic climate history and ice sheet behaviour from sediments over the last 30 million years and more recently from permafrost and coastal ice cores. We are also integrating our geological knowledge with models of glacier, ocean and climate behaviour, seeking to improve our understanding of the global climate system, and continue the spirit of discovery that has been the hallmark of VUWAE for almost 50 years.

Despite some difficult times we have survived well and are planning to both consolidate and grow over the next few years.

We hope you enjoy our first newsletter, and would be pleased to hear any comments. You will hear more about our research and other activities in future newsletters - look out for the next one in April next year.

Peter Barrett - Director

ON THE ICE

Nancy Bertler - Post-doctoral Fellow

International polar ice coring programmes (such as GISP, Vostok, and more recently EPICA) have provided powerful new insights into Earth's climate back about 900,000 years and more from the diverse inventory of atmospheric information stored both within the ice and trapped air bubbles.

The focus of ice core research in Antarctica is moving to the acquisition of "local" ice cores that overlap with and extend the instrumental records of the last 40 years back over the last several thousand years. This will help us understand and predict the local response to anthropogenically induced global warming seen in the "global" ice cores. This has been a key motivation behind the US-led International Trans Antarctic Scientific Expedition (ITASE) of which New Zealand is a member.

In the next few years the Antarctic Research Centre's ice core climatology group will continue work on recovering a

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series of ice cores from glaciers along a 14 degree latitudinal transect of the climatically sensitive Victoria Land coastline. During the 2003/04 season the team will survey two proposed drilling locations at Evans Piedmont Glacier and Mt. Erebus Saddle. The team will use ground-penetrating radar and differential GPS for a 3D inventory of ice mass thickness, flow structures, glacier-bedrock interface, and mass balance changes.

The team comprises Nancy, Alex Pyne, Matt Wood and Louise Christie from the Antarctic Research Centre, and Matt Watson from Scan-Tec.

Alex Pyne - Projects Manager

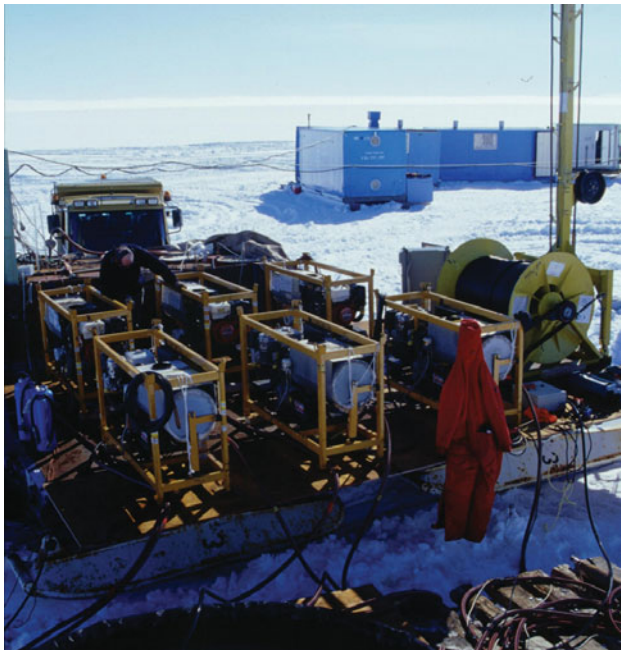
Alex will be in Antarctica for about a month from early November and will spend a short time with Nancy's event to look at the site requirements for ice coring in the following season. At Cape Roberts Alex will maintain and download data from the tide gauge refurbished and upgraded in 2002-03. While at Scott Base he will be working with Jim Cowie and Webster Drilling and Exploration personnel evaluating and inventorying drilling equipment that has been transferred from the Cape Roberts Project to incorporate into the new ANDRILL Drilling System.

OFF THE ICE

ANDRILL

ARC, along with the Institute of Geological and Nuclear Sciences and the University of Otago, has funding from the Foundation for Research Science and Technology for a significant role in the upcoming ANDRILL project. This is a multinational drilling programme to improve the understanding of ice sheet and ice shelf behaviour over the past few million years, and their influence on the New Zealand region.

Drilling of two sites has now been recommended. The first site (2005) is off New Harbour and will core strata recording the transition from a very cool to a cold climate around 15 million years ago. The second (2006) will drill through the Ross Ice Shelf in Windless Bight to get a history of advance and retreat of the Ross Ice Shelf over the last several million years.



Hot Water Drilling in McMurdo Sound

In the last two years ARC worked with GNS colleagues to conduct site surveys in Windless Bight to determine the ice thickness (140m), water depth (900m), water column properties (especially currents - up to 20cm/second) and the characteristics and geometry of the strata beneath. The aim is to recover sediment cores to a depth of 1000m below the sea floor. The gravity cores from last January (the first ever from beneath the ice shelf in this region) show that 60cm of sediment has been deposited in the last 12,000 years, and the ice shelf has not changed significantly in that time.

Peter Barrett

Coring in the Canadian High-Arctic

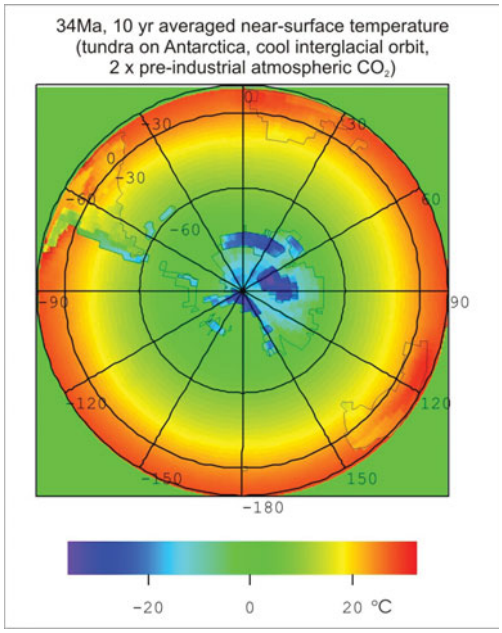
In May, a team of 14 engineers and scientists from NASA, McGill University (Canada), and New Zealand travelled to Ellesmere Island, Canada for a field workshop on coring the Arctic permafrost. Warren Dickinson and Alex Pyne from the ARC along with Bain Webster and Tony Kingan from Webster Drilling (Porirua) were demonstrating a permafrost coring system, which they have been developing over several Antarctic field seasons. Wayne Pollard and his group from McGill University have studied the site at Eureka Station, 80˚N, extensively. They will use the 35m of core, which includes permafrost and massive ground ice to a depth of 16m, for astrobiology analysis.

The main aim of the workshop was to acquaint the NASA team, who are designing and building a Mars drill, with shallow coring techniques, which will need to be automated for robotic drilling on Mars. In addition, they tested several sensors and a data logging system that can be used to develop a database on drilling methods in permafrost. The ARC hopes that a similar data logging system can also be used on the ANDRILL rig in Antarctica. Future workshops will include coring relict ice and permafrost in the Dry Valleys with both the Webster drill and an automated Mars drill.

Eocene/Oligocene Antarctic Vegetation and Climate Modelling

During the past year, Vanessa Thorn has been developing a new collaboration with Dr Rob DeConto (University of Massachusetts), a climate modeller especially interested in modelling the palaeoclimate of the south polar region to help understand the development and fluctuations of the Antarctic ice sheets over the past ~50 million years. Dr. DeConto visited the ARC in December 2002 to present a workshop to the New Zealand earth science community on the application of General Circulation Models (GCMs) to palaeoclimate research questions. He is also involved in the ANDRILL initiative.

Vanessa's work on high latitude modern and Cenozoic phytoliths, and knowledge of Cenozoic vegetation on Antarctica is contributing to Dr. DeConto's projects through providing both realistic vegetation boundary conditions (the starting blocks for the models) and



essential 'ground-truthing' to assess the realism of the model predictions.

Looking back to times before the Antarctic ice sheet became permanent (around the Eocene/Oligocene boundary) it is possible to compare climate information interpreted directly from the geological record (including fossil plants) with what the model is predicting for that time and place. Discrepancies between the two can then be analysed and the model parameters adjusted, if necessary, to improve accuracy. The same model can then be used with greater confidence to model related scenarios, such as the effect on global climate of varying atmospheric CO_2 levels or different vegetation coverage, and further down the line to predict future climates as a result of anthropogenically enhanced global warming.

Unfreezing the Continent

This year about 70 students enrolled in Victoria's Antarctic Studies course entitled 'Unfreezing the Continent'. The course covers a broad range of topics, ranging from the early exploration of the continent, to geological history, Antarctic literature and art, and governance issues.

One of the strengths of the course is the variety of guest lecturers from outside the University. This year Chris Cochran told us about conserving the historic huts, Erick Brenstrum discussed the weather, Margaret Elliot demonstrated the impact Antarctica had on her painting and Mariska Wouters reviewed tourism and its potential impacts. We were particularly delighted to present a lecture by Trevor Hughes of the Ministry of Foreign Affairs and Trade, continuing the Ministry's association with the Antarctic Research Centre.

The course is also supported by VUW lecturing staff from other parts of the University: Bill Manhire (on literature), Joanna Mossop (law), Cath Wallace (environment) and Nigel Roberts (politics). The student review of the course has been very good, the vast majority saying that their interest in Antarctica was stimulated by the course and that the teaching was good to outstanding.

OTHER ACTIVITIES

Lee endowment enables Antarctic lecture series

Stanford University scientist Professor Robert Dunbar is well known in both Antarctic and tropical circles through his research on lake, oceanographic and climatic patterns on annual-decadal time scales from sediment cores and corals patterns. He was also the inaugural speaker for Victoria University's S.T. Lee Lecture in Antarctic Studies, speaking on the topic of "Antarctica and Climate Change in the Century Ahead - Causes, Consequences and Surprises".

Rob's presentation on August 8 was made possible by a NZ$150,000 endowment from Singaporean philanthropist Dr Lee Seng Tee, established through the Victoria University of Wellington Foundation. Dr Lee has established important lecture series at academic institutions throughout the world, including Oxford, Cambridge and Harvard, spanning topics in humanities, military history, public policy and government. The S.T. Lee Lecture in Antarctic Studies is the first Lee lecture series in the Southern Hemisphere.

Rob's visit to New Zealand included a field trip to the Pleistocene Milankovitch cycles in the Wanganui Basin; discussion groups and seminars with staff and students in the School of Earth Sciences; and meetings with the Institute of Geological and Nuclear Sciences and the Ministry for the Environment's Climate Change Office. He also visited Antarctica New Zealand and Gateway Antarctica (Canterbury University) and presented the S.T. Lee Lecture in Christchurch.

Professors Peter Barrett (VUW) and Robert Dunbar (Stanford) with Vice-Chancellor Stuart McCutcheon and Minister for the Environment Marian Hobbs

Martin Siegert: visiting glaciologist

University of Bristol glaciologist Martin Siegert visited the ARC during August as part of a period of leave funded by the Philip Leverhulme Prize. Martin is well known for his ice modelling and radar studies of subglacial lakes and also his textbook Ice Sheets and Late Quaternary Environmental Change and was recently appointed a personal chair in Geography.

Martin gave two superb talks during his visit - "Utilizing the Geological Record to Reconstruct Former Ice

Sheet Configurations in Antarctica" and "Processes within Lake Vostok and their implication for life in Antarctic subglacial lakes". Martin is the co-chair of the Antarctic Climate Evolution project (along with Rob Dunbar) and he described how ice modelling could be used to test geologically derived hypotheses regarding the history of glaciation in Antarctica. Rob also introduced the phenomenon of subglacial lakes in Antarctica and the concept that subglacial lakes have sloping surfaces.

Martin also spent time with Peter Barrett and Alex Pyne talking about the logistical and technical challenge of drilling subglacial lakes. Damian Gore (from Macquarie University) and Andrew Mackintosh talked with him about developing an ice-modelling project in the South Island, and also the late Quaternary history of Antarctica.

Andrew Mackintosh

Plans for Library and Resource Centre

Plans are underway at the Antarctic Research Centre to build a library and resource centre to support research and increase public awareness of the ARC's long and distinguished history in Antarctic earth science.

Dr Lee, in addition to establishing the lecture series in Antarctic Studies, has offered $150,000 to establish a library. A keen bibliophile, he would like to support a collection of rare or significant books relating to the Antarctic. The ARC naturally welcomes this generous offer, and would like to use it as a catalyst for a wider development.

We envisage a library with not only rare Antarctic books, but also a resource centre with space and facilities for ARC researchers to use the existing collection of maps and reports, a room for meetings and presentations to small groups, displays of past and present scientific research, and photographs and memorabilia from VUWAE expeditions over the last five decades.

The offer is very timely, as with the current range of projects, staff and students the ARC has outgrown the existing space. The current plan being worked out with the School of Earth Sciences is to include the library with its space for workstations, offices and meeting room, in a 200 sq m redevelopment of the first floor of Cotton Building.

Personnel

Professor Peter Barrett, Director
Mr Alex Pyne, Projects Manager
Tamsin Falconer, Administrator (half-time)
Dr Dan Zwartz, Research Assistant (Aug-Oct 2003)
Dr Vanessa Thorn, Post-doctoral Fellow (2002-04)
Cliff Atkins, Post-doctoral Fellow (2003-04)
Nancy Bertler, Post-doctoral Fellow (2003-05)
Dr Warren Dickinson, Research Associate

Associated staff

Dr Andrew Mackintosh, Lecturer, School of Earth Sciences
Dr Mike Hannah, Senior Lecturer, School of Earth Sciences
Dr Tim Naish, Senior Scientist, Institute of Geological and Nuclear Sciences

Students

Nora Patterson (MSc in Geology)
Joe Prebble (MSc in Geology)
Natalie Robinson (MSc in Geophysics)
Nicola Wilson (BSc Hons in Geology)

ARC people: (back L-R) Natalie Robinson, Tricia Walbridge (VUW Foundation), Warren Dickinson, Peter Barrett, Vanessa Thorn, Andrew Mackintosh, Nicola Wilson, Cliff Atkins, (front) Gavin Dunbar, Nancy Bertler

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