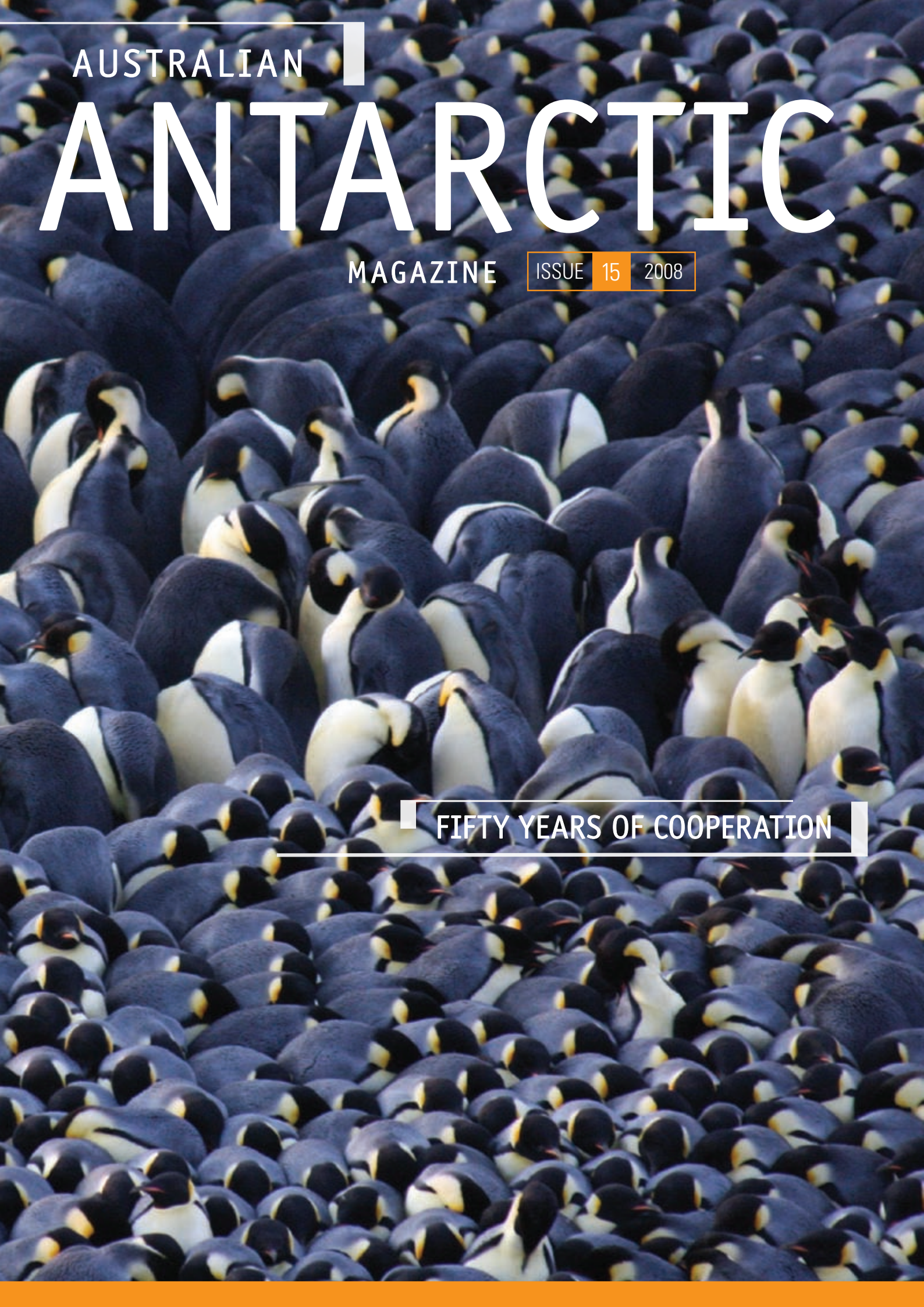


AUSTRALIAN ANTARCTIC MAGAZINE

ISSUE 15 2008

FIFTY YEARS OF COOPERATION

AUSTRALIAN
ANTARCTIC
MAGAZINE

ISSUE 15 2008

CONTENTS

The Australian Antarctic Division, a Division of the Department of the Environment, Water, Heritage and the Arts, leads Australia's Antarctic program and seeks to advance Australia's Antarctic interests in pursuit of its vision of having 'Antarctica valued, protected and understood'. It does this by managing Australian government activity in Antarctica, providing transport and logistic support to Australia's Antarctic research program, maintaining four permanent Australian research stations, and conducting scientific research programs both on land and in the Southern Ocean.

Australia's four Antarctic goals are:

- To maintain the Antarctic Treaty System and enhance Australia's influence in it;
- To protect the Antarctic environment;
- To understand the role of Antarctica in the global climate system; and
- To undertake scientific work of practical, economic and national significance.

Australian Antarctic Magazine seeks to inform the Australian and international Antarctic community about the activities of the Australian Antarctic program. Opinions expressed in *Australian Antarctic Magazine* do not necessarily represent the position of the Australian Government.

The Editor
Australian Antarctic Magazine
Australian Antarctic Division
203 Channel Highway
Kingston, 7050
Tasmania, Australia.

Australian Antarctic Division
Telephone: (03) 6232 3209
(International 61 3 6232 3209)
email: magazine@aad.gov.au
Facsimile: (03) 6232 3288
(International 61 3 6232 3288)

Editor: Wendy Pyper

Editorial Advisory Committee: Sally Chambers, Andrew Jackson, Professor Michael Stoddart
Production: Jonothan Davis, Jessica Fitzpatrick, Glenn Jacobson, Chris Clarke

Graphic Design: Red Jelly

ISSN 1445-1735 (print version)

Australian Antarctic Magazine can be viewed online: <http://www.antarctica.gov.au/magazine>.

Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division

FRONT COVER: ROBYN MUNDY
Male emperor penguins at Taylor Rookery, 100 km west of Mawson, were photographed incubating their eggs in an 'emperor huddle' in June this year. The huddle is a remarkable system of maintaining body warmth in extreme conditions and offers a fantastic sight, particularly when viewed from above.

50 YEARS OF COOPERATION

The United States Antarctic Program's LC-130 Hercules was a welcome sight on the Davis sea ice runway in October. The runway was specially constructed in a week by Davis station personnel so that an injured expeditioner could be evacuated. Fortunately, international cooperation is an inherent part of operating in Antarctica, thanks largely to the negotiation of the Antarctic Treaty 50 years ago.

As this issue of the *Australian Antarctic Magazine* goes to press, the Australian Antarctic Division is reconstructing its Antarctic science season after a rocky start.

Many of you may have heard about the quad bike accident involving an Australian expeditioner on a field trip near Davis in October. Fortunately, expeditioners and head office staff are well trained and equipped for these uncommon events. Within hours the injured expeditioner was receiving medical care back on station, while experts at head office were galvanising resources in Australia and Antarctica for further medical support and an eventual evacuation. After some delays due to bad weather the expeditioner was successfully returned to Australia on a United States Antarctic Program LC-130 Hercules and is now receiving specialist medical care.

The incident highlights the small but ever-present risks of working in such remote locations. It highlights also the importance of trained personnel who can cooperate well under pressure. Throughout the incident Australia worked closely with international colleagues to explore all evacuation options.

This international cooperation is an inherent part of operating in Antarctica, thanks largely to the precedent set during the 1958 International Geophysical Year and the subsequent negotiation of the Antarctic Treaty. It is timely, therefore, that this issue of the magazine looks back on 50 years of peace and cooperation in Antarctica and the preparations for the 50th anniversary in 2009 of the signing of the Antarctic Treaty.

Cooperation and collaboration are also cornerstones of many of our Antarctic science projects this season. While some of the projects planned for 2008–09 may not proceed as scheduled, due to the changes wrought on the schedule by the evacuation, a number of international projects will go ahead. Australia is participating in two large projects outlined on pages 15–16. This participation includes significant logistical support, by the Australian Antarctic Division, to a project investigating Antarctica's enigmatic Gamburtsev Mountains. These relatively unchartered mountains, buried under hundreds of metres of ice, may hold clues to the origin and evolution of Antarctica and, by extension, the Earth's current climate.

This issue of the magazine also focuses on the critical subject of ocean acidification. The Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) hosted a workshop this year, attracting national and international scientists working on this problem in tropical, temperate and Antarctic waters. While the effects of ocean acidification will appear first in the cold, Southern Ocean waters, research elsewhere will provide clues to possible biological responses in the less accessible Southern Ocean. As the article on pages 8–9 discusses, a range of other stressors can interact with ocean acidification to affect marine ecosystems. By extension, if we are to fully understand such a widespread and complex phenomenon as ocean acidification, our research cannot be conducted in isolation.

Finally, it is with a mixture of sadness and anticipation that I announce my departure from the Australian Antarctic Division to take up the position of Chief Executive Officer at the ACE CRC in early 2009. I am looking forward to the challenge of leading this remarkable institution and preparing to build a new collaboration when the program funding for the ACE CRC ceases in 2010. I am pleased that through the CRC I can maintain close links with many in the Antarctic community in Australia and overseas.

I would like to express my deep gratitude for the friendships and support provided by my professional colleagues at the Australian Antarctic Division, and elsewhere around the world, over the last 10 years. Your support for me is as good an example as I can imagine of the spirit of cooperation that unites the Antarctic community and underpins the work we do in one of the world's amazing places. From the big picture global concerns of climate change, to the stresses of organising a medical evacuation, we have been united by a common concern for Antarctica. What a privilege it has been to work with you.

AJ PRESS
Director, AAD

OCEAN ACIDIFICATION: AUSTRALIAN IMPACTS IN THE GLOBAL CONTEXT

Ocean acidification, caused by increased levels of atmospheric carbon dioxide (CO_2) dissolving in the ocean, is likely to have serious consequences for marine ecosystems and biodiversity in Australian waters and the Southern Ocean over this century.

At a meeting convened by the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) in June this year, scientists from national and international research and government institutions summarised the current state of knowledge about ocean acidification and its effects on ocean chemistry and the marine biota of Australian waters.

Discussions at the meeting focused on issues such as: the effects of ocean acidification on marine organisms; using the fossil record to look at the response of marine organisms to changes in ocean chemistry; and integrating ocean acidification research with the policy and management of Australian and Antarctic ecosystems.

At the end of the meeting the group released a short public communiqué outlining current scientific knowledge, gaps in the knowledge and the way forward – http://staff.acecrc.org.au/ace-notes/OAcommunique.pdf

The following articles are based on research presented at the meeting. While some of the research has an Australian focus, many of the changes described will be detected first in the Southern Ocean, where the colder water increases the solubility of CO_2. The Southern Ocean has a high inventory of anthropogenic (human-made) CO_2 and is already closer to carbonate mineral saturation thresholds than other Southern Hemisphere waters. However, research carried out on marine organisms in Australian waters will provide clues to possible biological responses in the less accessible Antarctic and Southern Ocean waters – such as the responses of deep-water corals only recently discovered close to the Antarctic continent by Census of Antarctic Marine Life surveys (*Australian Antarctic Magazine* 14: 4–6, 2008).

DEVELOPING OCEAN ACIDIFICATION POLICY

In the few years since ocean acidification came under the public spotlight, it has become an increasingly important issue that is challenging scientists, policy-makers and governments.

Ocean acidification differs from global warming in that its impact derives from the chemistry of carbon dioxide (CO_2) in seawater, rather than from its physical action as a greenhouse gas in the atmosphere. This means that even if the climate does not warm, increasing atmospheric CO_2 will inevitably increase ocean acidity.

The surface ocean absorbs as much as 30% of anthropogenic (human-made) CO_2 emissions, and the gas dissolves through a well understood chemical process, forming a weak acid that raises the acidity of the oceans. Atmospheric CO_2 is absorbed by the ocean faster than natural processes can neutralise the increased acidity it causes. The Southern Ocean is particularly vulnerable to the phenomenon, due to the higher solubility of CO_2 in cold water. As a result, the current trajectory of carbon emissions will cause a change in ocean acidity during this century that is greater in extent than anything likely to have occurred for millions of years.

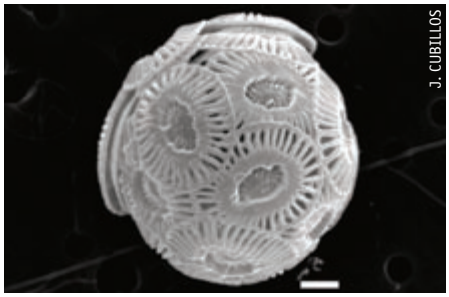
The oceanic response to enhanced CO_2 levels is likely to have serious consequences for marine ecosystems that are the backbone of important economic and social activities, such as fisheries, aquaculture, and tourism.

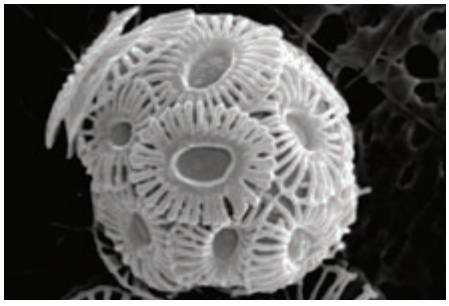
Evidence is already emerging of changes in the growth and structure of marine organisms in response to ocean acidification (*Australian Antarctic Magazine* 10: 26–27, 2006). Recent studies by the Antarctic Climate and Ecosystems Cooperative Research Centre have shown that the shells of some microscopic marine organisms in the Southern Ocean are getting thinner. The evidence is a warning that ocean acidification will have potentially serious impacts within the 21st century for the sustainability and management of many marine ecosystems and the human communities that depend on them.

Unlike 'geo-engineering' proposals to mitigate global warming, there are currently no practical technological or engineering solutions for reducing the acidity of oceans or for mitigating its impacts, short of reducing CO_2 emissions. Given the possibility that emissions will continue over the coming decades, the scientific response to ocean acidification must therefore focus on anticipating impacts and assisting policy-makers to develop informed responses. Government decision-makers and communities could then prepare adaptation strategies and action plans to address the projected effects of ocean acidification on ecosystems, economies and communities.

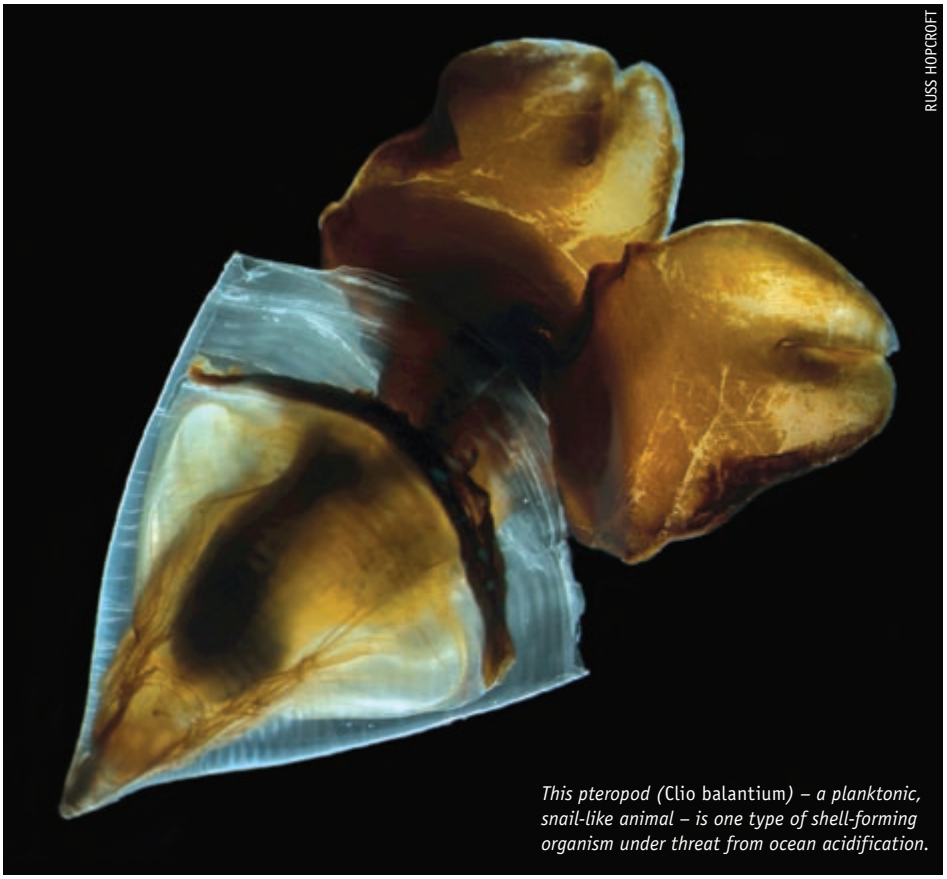
Scientific knowledge about ocean acidification and its effects is increasing, but there are still significant uncertainties that make developing ocean acidification-related policy a challenge. The biggest gaps are in understanding:

- The underlying variability of ocean chemistry and ecosystems in Australian seas. This is required to provide references against which future change can be identified.





*A significant scientific uncertainty relating to ocean acidification is how key marine species, such as this coccolithophorid (*Emiliania huxleyi*), will respond to increasing acidity, and how these responses will alter marine food webs and biodiversity. Coccolithophorids are an important component of marine phytoplankton and secrete shells off calcite – a form of calcium carbonate that will become harder to produce as ocean acidity increases. The second photo (bottom) shows incomplete growth of the shell plates in sea water containing higher CO_2 concentrations.*



*This pteropod (*Clio balantium*) – a planktonic, snail-like animal – is one type of shell-forming organism under threat from ocean acidification.*

- How key species in their various life stages will respond to ocean acidification and how those responses will alter marine food webs and affect biodiversity.
- How the combined effects of climate-related changes (increased ocean temperature, nutrient availability and circulation) and commercial activities, such as fishing, tourism and aquaculture, are likely to interact with ocean acidification. For example, ocean acidification may have more severe effects on ecosystems already affected by pollution, warming or overfishing, than on less stressed systems (see story page 8).
- How the vulnerability of low-lying islands to sea-level rise may be exacerbated by ocean acidification. If the growth of reef-forming and reef-stabilising organisms such as corals and coralline algae is compromised, reefs and onshore coastal communities will be more vulnerable to the physical impacts of storm-driven erosion.
- How rapidly change will occur and whether there are thresholds that, once breached, will lead to major, persistent changes in marine ecosystems.

A further policy challenge arises because the only mitigation option available is a reduction in carbon dioxide emissions. Ocean acidification needs to be considered by decision-makers when setting stabilisation targets for atmospheric CO_2 and the timeframes in which the targets need to be reached. There is a natural time lag involved in the marine carbon cycle, both in the uptake of CO_2 by the ocean as well as in the centuries needed to reverse the acidification already under way. This places a penalty on delaying limits on carbon emissions and a premium on early action.

Another challenge is understanding the connection between ocean acidification and proposed climate mitigation proposals, such as ocean fertilisation. This involves adding nutrients such as iron to the ocean to boost carbon consumption by marine plants. The uptake of CO_2 in iron-fertilised systems would be accelerated by dissolving carbonate shells, but at the expense of these organisms and their roles in the ecosystem. On the other hand, if ocean fertilisation can enhance the transfer of carbon from the atmosphere directly to the deep ocean, it would tend to reduce the uptake of CO_2 in near-surface waters, where most shell-forming organisms dwell. The impact would be transferred to deeper waters, where organisms such as deep-water corals are important players in the ecosystem. Trade-offs like these have not yet been examined.

As ocean acidification is related to, but is not strictly 'climate change', it was not addressed in detail in the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change. However, growing recognition of the significance of acidification for the world's oceans has already prompted some countries to initiate research programs to further explore the scientific uncertainties.

Research programs are now underway in the European Union (http://www.epoca-project.eu) and there is a Bill before the US Congress that would establish an ocean acidification research and monitoring program to carry out ongoing long-term measurements of ocean chemistry and vulnerable ecosystems.

So how can Australia improve its scientific, policy and management response to this growing threat? Scientists attending an ocean acidification workshop in Hobart earlier this year recommended:

- A coordinated national assessment of the Australian Marine Jurisdiction to provide benchmark data on which to build sustained observation programs for identified high-risk regions. Future impacts can then be detected and responses to the problem assessed quickly and effectively.
- A range of modelling, experimental, and field studies that will enable clear identification of the risk and cost of ocean acidification to marine ecosystems and society.

The global scale of ocean acidification means that the Australian research community cannot fill the knowledge gaps by itself, and must build upon its already strong involvement in international research networks. The policy challenge is similarly global. As the impacts affect many low-lying island nations in our region, options for addressing these impacts need to be incorporated into Australia's international aid and foreign policy strategies and programs.

Nationally, some of Australia's iconic natural marine assets, such as the Great Barrier Reef, are at risk. Ocean acidification is thus a challenge to Australian governments at all levels.

WILL HOWARD and ROSEMARY SANDFORD
ACE CRC

KRILL BUSINESS UNUSUAL UNDER 'BUSINESS AS USUAL'

Ocean acidification could have a devastating impact on Antarctic krill according to a pilot study conducted by the Australian Antarctic Division.

RUSS HOPCROFT

Larval development in Antarctic krill, Euphausia superba, *will be affected by higher CO_2 concentrations.*

The study, led by krill biologist Dr So Kawaguchi, in collaboration with Dr Haruko Kurihara and Professor Atsushi Ishimatsu of Nagasaki University, Japan, involved incubating krill eggs in sea water under three different carbon dioxide (CO_2) concentrations: current CO_2 levels – 'control', CO_2 levels expected in 100 years time under a business as usual emissions scenario – 'medium', and CO_2 levels expected in 300 years time under a business as usual emissions scenario – 'high'.

'As this was a pilot study, we wanted to determine the range of CO_2 concentrations, if any, where we would see an effect,' Dr Kawaguchi said.

The study looked at the first four developmental stages of krill larvae after hatching.

In the control tank the eggs hatched and each larval stage developed and behaved normally. In the medium CO_2 tank the eggs hatched, but development through the larval stages was limited – as the larvae progressed through each stage they became more inactive and were unable to swim to the surface of the tank. (In the wild, krill larvae ascend from 1000 m to the surface of the ocean – a developmental step necessary for the larvae to become juvenile krill.) In the high CO_2 tank, none of the eggs hatched.

Dr Kawaguchi and his team will now refine the research to look at different ranges of CO_2 concentrations, the effects of elevated CO_2 concentrations on other krill developmental stages, and the effects of changing temperature and food availability.

WENDY PYPER
Corporate Communications, AAD

The ocean in a high CO_2 world

Australian Antarctic science was well represented at an international conference on ocean acidification in Monaco recently. The second international symposium on *The Ocean in a High CO_2 World*, from 6–9 October, was an interdisciplinary forum to assess what is known about ocean acidification and to identify priorities for future research and for social and economic policy.

WARWICK BARNES

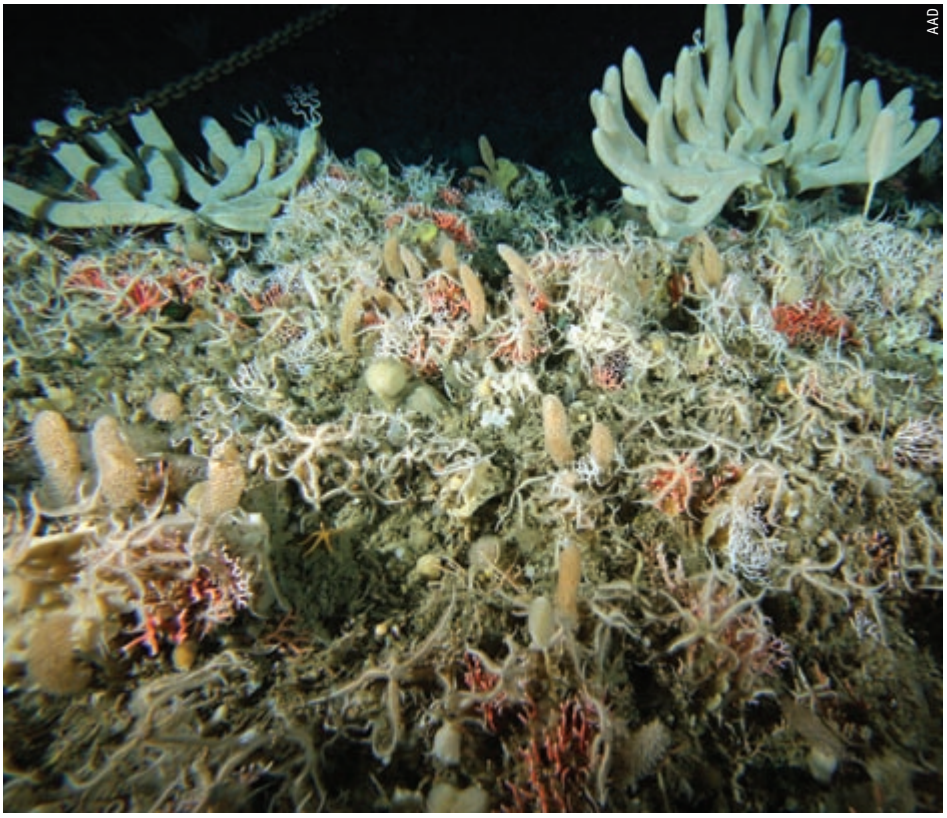
Donna Roberts and Will Howard from the Antarctic Climate and Ecosystems Cooperative Research Centre reported on the reduction of shell weight in planktonic molluscs (pteropods) and foraminifera (single-celled organisms found in plankton). Tom Trull of CSIRO reported on the distribution of pelagic (open ocean) biogenic carbonate in a transect between Australia and Antarctica, and Martin Riddle, of the Australian Antarctic Division, discussed the discovery of a diverse cold water coral community on the continental slope off East Antarctica that could be under threat from rising CO_2 (see story page 5).

The meeting, attended by 250 marine scientists from 32 countries, was organised by UNESCO's Intergovernmental Oceanographic Commission, the Scientific Committee on Oceanic Research, the International Atomic Energy Agency and the International Geosphere Biosphere Programme, with the support of the Prince Albert II of Monaco Foundation and several other partners.

Scientists attending the conference agreed that more research is needed to understand the implications and impact of the acidification occurring today. They also insisted that reducing carbon emissions would be the only effective way of stabilising or reversing the acidification process, and argued that despite the reticence of many governments, this was both achievable and affordable – potentially less than 1.5% of global gross domestic product. A full report of the proceedings will be published shortly. For more information see: www.ocean-acidification.net

CARBON DIOXIDE RAISES THE DEAD ZONE

Marine organisms that build shells or skeletons from aragonite – a form of calcium carbonate – could disappear from parts of the Southern Ocean within 50 years if carbon dioxide (CO_2) emissions continue to increase and cause ocean waters to become more acidic.


AAD

This reef of cold water corals, gorgonians and sponges was discovered at 800 m depth on the edge of the Antarctic continental slope by Australian Antarctic Division scientists earlier this year. The corals in this community are comprised of aragonite and will be amongst the first organisms to disappear if ocean acidification increases.

Carbon dioxide reacts with water (H_2O) to form carbonic acid (H_2CO_3). This weak acid makes it easier for aragonite to dissolve and therefore more difficult for organisms to form aragonite-based shells or hard skeletons. Cooler water, and deeper water, also increases the tendency for aragonite to dissolve.

Among the organisms affected will be corals and important components of ocean plankton, such as coccolithophorids (a common alga) and pteropods (snail-like molluscs), which are food for many other animals (*Australian Antarctic Magazine* 12: 24, 2007).

Changes to these organisms and other components of the ecosystem may in turn alter the capacity for the ocean to continue to absorb CO_2 from the atmosphere, and so set up a feedback that could exacerbate the rate and impacts of global greenhouse processes.

During the recent Collaborative East Antarctic Marine Census (CEAMARC) in the Southern Ocean, marine scientists observed, for the first time, coral reefs at depths of 700–800 m. These reefs exist only 200–300 m above the aragonite saturation horizon – the depth where aragonite starts to dissolve. At depths of around 1200 m the scientists observed a range of creatures with skeletons made of silicon and protein (such as sponges), and calcite – a form of calcium carbonate that does not dissolve as readily as aragonite.

'We didn't see any corals at 1200 m, although there were brittle stars, which are made of calcite, and plenty of sponges,' CEAMARC Voyage Leader, Dr Martin Riddle, said.

Dr Riddle and other scientists fear that if CO_2 concentrations continue to increase, the aragonite saturation horizon will rise towards the surface of the ocean and aragonite will begin dissolving at increasingly shallower depths, leading to the loss of cold water corals initially, and eventually coral reefs in warmer regions.

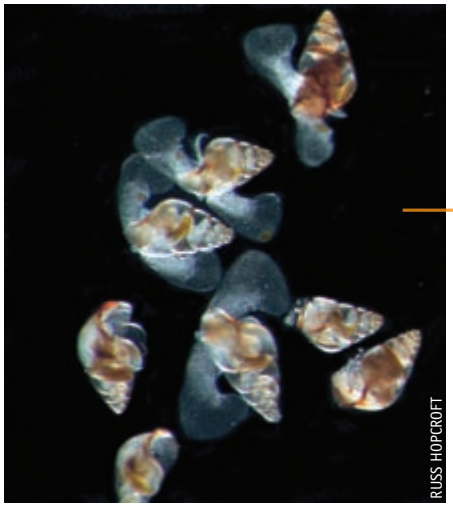
'Models predict that with the current rate of CO_2 production, the aragonite saturation horizon will be at the surface in some parts of the Southern Ocean within 50 years,' Dr Riddle said.

Southern Ocean reefs will be affected first, especially in areas such as the Mertz Polyna, where cold Antarctic Bottom Water forms. This cold, dense, saline water forms near the ocean surface when sea ice is created, and then sinks into the Mertz basin, carrying atmospheric CO_2 into the deep ocean.

The ocean acidification threat raises an urgent need to acquire a baseline of Antarctic and Southern Ocean biodiversity information, against which future changes can be compared.

Dr Riddle is now developing an ambitious three year project, beginning in 2011, to map biodiversity around the Australian Antarctic Territory. The project will use trawls fitted with underwater cameras and deployed from ships and workboats, to sample creatures on the Antarctic continental shelf and shallow ocean regions, while terrestrial biologists will sample ice-free areas on the continent.

WENDY PYPER
Corporate Communications, AAD


RUSS HOPCROFT

*These pteropods (*Limacina bulimoides*) captured in the Gulf of Alaska, build their shells from aragonite. The loss of these and other shell-forming planktonic organisms (including algal species) from the food chain, may threaten the survival of higher organisms, such as krill, penguins and seals. Planktonic organisms are also important in the flux of calcium carbonate to the deep ocean, where the carbon is stored for geological time scales – a significant mechanism for removing CO_2 from the atmosphere in the long term.*

CORAL REEF HISTORY BOOKS

Massive corals, growing several metres in size, contain an archive of information on environmental change, providing valuable reference material for monitoring the progression of ocean acidification and its effects on marine life.

Tropical coral reefs are the most charismatic of marine ecosystems and uniquely defined by both their diverse biological components and the immense physical structures they create. At their heart is a special relationship between coral animals and single-celled algae (zooxanthellae). This mutual dependence allows the corals to build their calcium carbonate skeletons (calcify) at a rate that exceeds the natural forces of erosion, creating a coral reef. These calcium carbonate structures, cemented together by coralline algae, provide complex habitats that support a vast array of flora and fauna. The backbone of Australia's Great Barrier Reef, for example, consists of more than 360 species of hard (calcifying) corals. The reef is home to over 1500 species of fish, 4000 species of molluscs, 800 species of starfish and sea urchins, 400 species of sponges…the list goes on. It is also the breeding ground for humpback whales from Antarctica.

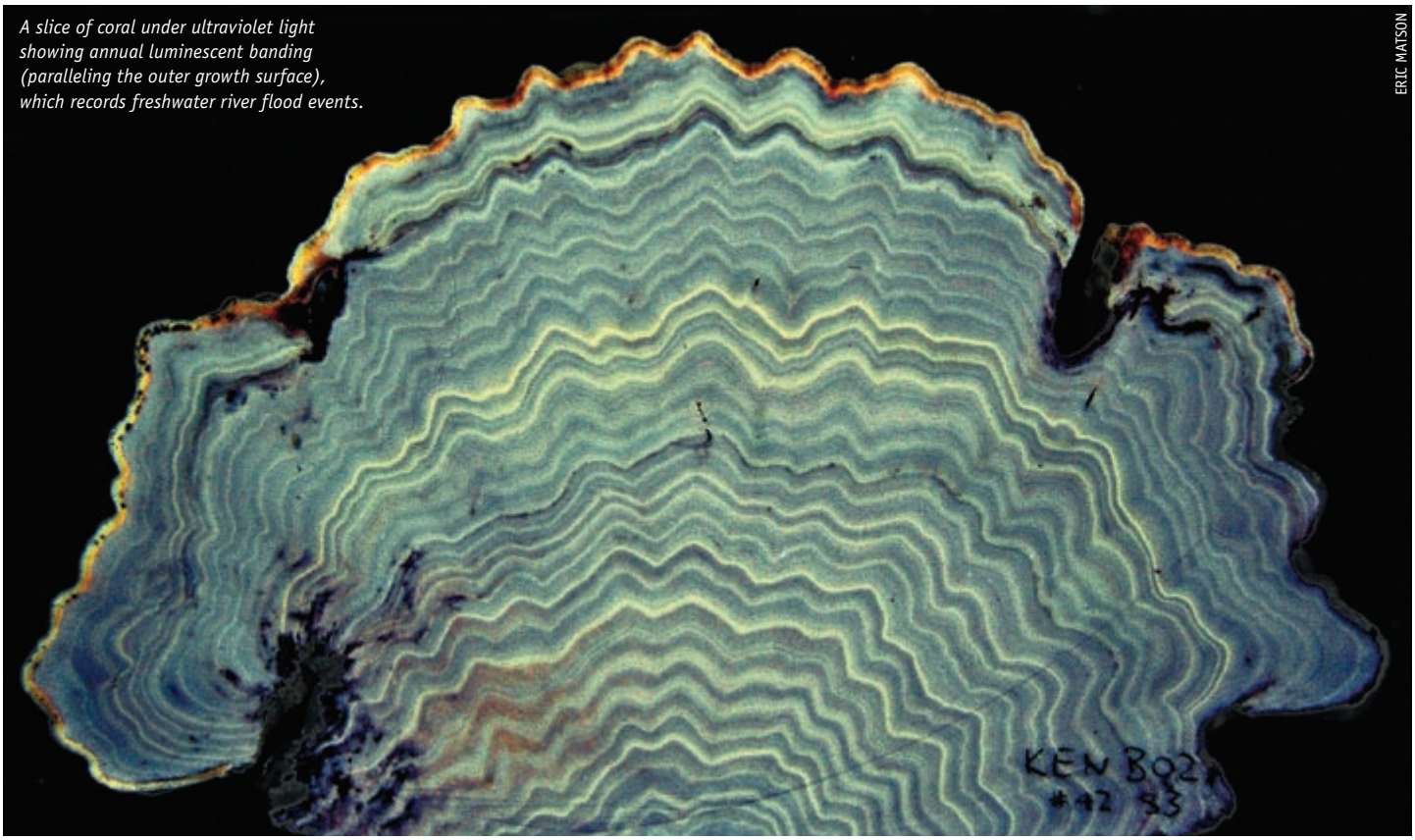
Alarm bells have been ringing about the health of the world's coral reefs for several decades. Many reefs in Southeast Asia and the Caribbean are now seriously degraded due to local over-exploitation and pollution. Coral reefs, including even the least disturbed and best-protected Great Barrier Reef, are now facing a troubled future as a result of rising ocean temperatures and progressive ocean acidification – both due to human activity.

Coral bleaching, due to the loss of the coral's zooxanthellae in unusually warmer water, can result in death of the coral and thus compromise the whole array of organisms that rely on a healthy reef. The frequency of bleaching events affecting large areas of reef (including the Great Barrier Reef in 1998, 2002 and 2006) has increased in recent decades and is clearly linked to global warming.

Ocean acidification is a more insidious threat that strikes at the structural heart of coral reefs. Calcifying marine organisms extract calcium and carbonate ions from seawater to make their skeletons and shells. As the oceans absorb our extra carbon dioxide, the pH decreases and there are fewer carbonate ions available. This increasingly compromises the ability of corals, and the important reef 'cements' (coralline algae) to produce calcium carbonate. This 'osteoporosis' will make reef structures weaker and more susceptible to the natural forces of erosion and more intense tropical cyclones (another projected consequence of global warming).

However, detecting changes requires observations. Early European descriptions of the Great Barrier Reef date to the late 18th century (Sir Joseph Banks, 1770), with more detailed scientific observations in the late 19th century (William Saville Kent *The Great Barrier Reef*, 1893) and early 20th century (The Great Barrier Reef Expedition, 1928–29). However, it was not until the invention of the aqua-lung in the 1940s that more systematic scientific observations of these tropical wonderlands could be made. New species are still being found today (www.coml.org)!

Fortunately, coral reefs contain their own history books. Some massive coral species grow to be several metres high (right) and contain annual bands similar to tree rings. Growing at



A slice of coral under ultraviolet light showing annual luminescent banding (paralleling the outer growth surface), which records freshwater river flood events.

ERIC MATSON

Massive Porites *coral, such as this specimen in the northern Great Barrier Reef, are an important archive of environmental information.*

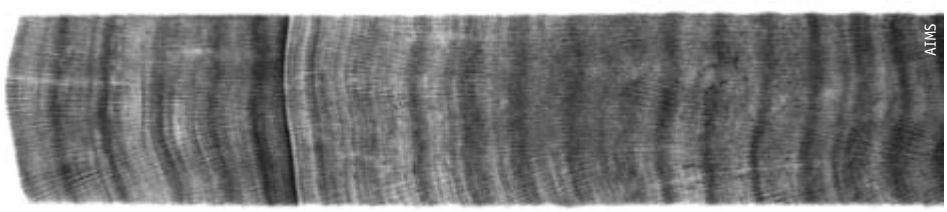
ERIC MATSON

1–2 cm per year, such corals can record several hundred years of growth and the changes that have occurred in their environment.

To 'read' these changes, cores are removed from the centre of the colony (the plugged hole is rapidly overgrown by the surrounding coral tissue). X-ray analysis of slices of the core (below) reveals the annual banding in the density of the calcium carbonate skeleton and each year can be dated from the outer edge – the year the coral was collected. The coral skeleton also records various geochemical tracers of the water (such as $\delta^{18}O$ – the stable oxygen isotope which records water temperature and salinity) and, from nearshore corals of the Great Barrier Reef, records of river flood events (left), when sea water was diluted by fresh.

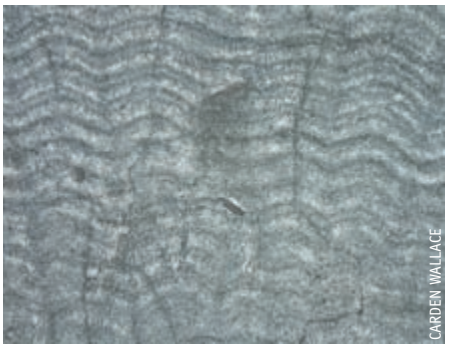
The world's largest collection of long coral cores at the Australian Institute of Marine Science provides a longer historical context to assess current changes in the reef environment. They have already told us that water temperatures are at their warmest for at least the past several centuries; that European settlement and land clearing in Australia in the late 19th century increased the amount of sediment entering the reef lagoon; and that although the average amount of freshwater entering reef waters has not changed, the wet years are becoming wetter and the dry years becoming drier.

The signatures of coral bleaching events (such as 1998 shown below) are extremely rare in past centuries. Measurements of the amount of calcium carbonate laid down each year by the coral (using gamma densitometry) show that up to the 1980s, calcification rates increased in line with warming water temperatures. However, disturbing evidence is emerging that coral calcification rates now seem to be declining, despite continued warming waters. Is ocean acidification the culprit? We cannot be one hundred per cent certain yet (partly due to lack of long-term observations of ocean chemistry) but something is happening and, combined with the other effects of a changing climate, the future for the Great Barrier Reef is at risk. This well-protected reef will not disappear, but the mix of corals and associated organisms that make up this unique and diverse marine ecosystem will change.



AIMS

A positive print of an X-ray of a coral slice showing the annual density banding pattern. The thin dark band, about six years in from the left, marks when this coral stopped growing during the 1998 coral bleaching event.



CARDEN WALLACE

Many reefs are a shadow of their former selves due to pollution and over-exploitation. Here Porites *coral has been used as paving in the Maldives.*

JANICE LOUGH
Australian Institute of Marine Science

ANDY DAVIS

THE ACID TEST: RESPONSES OF BENTHIC INVERTEBRATES TO CLIMATE CHANGE

Ocean acidification is just one of many stressors marine creatures face in the future. Understanding how the different stressors interact to impact on marine systems is critical to predicting and managing future change.

Global warming and resulting climate changes have received considerable scientific, political and media attention in recent years. There is now a clear scientific consensus that increasing atmospheric carbon dioxide (CO_2), due to human activities, is causing the oceans to warm and become more acidic.

Eastern Australia is a climate change hot spot where, due to a disproportionate increase in sea surface temperature, marine life in the region is predicted to be particularly vulnerable to the impacts of climate change and other stressors. In this region sea temperatures have been warming for decades, as a result of changes in circulation and the influence of the East Australian Current, with a 2.3°C sea temperature rise since the 1940s. The CSIRO model predicts a further 2 to 3°C rise as early as 2070 and disproportionate warming in winter. This may prove problematic for marine organisms that spawn in winter, given the potential exposure of vulnerable developmental (larval) stages to temperatures beyond their thermal tolerance threshold.

As well as changes due to global warming, marine organisms are faced with a plethora of other stressors including pollution, fishing pressure, and increased UV exposure due to ozone depletion. These stressors have interactive effects that are difficult to predict, presenting a considerable challenge as we try to foresee changes to marine ecosystems and develop adaptive management strategies in the face of climate change.

Through a series of experiments we are investigating the response of marine biota, whose distributions coincide with the Eastern

This mollusc, Dolabrifera brazieri, *is commonly known as a 'sea hare' due to the sensory organs (rhinophores) on its head, which resemble rabbit ears. Its pink egg masses are visible on the rock. This species is found in New South Wales and the north island of New Zealand.*

Australian hotspot, to multiple stressors. These experiments, described below, are in keeping with near-future climate change scenarios.

Climate change and UV-induced stress on mollusc egg masses

For intertidal molluscs that lay their eggs on hard surfaces along the shore, we looked at the influence of temperature, salinity and UV on embryonic development and the hatching success of larvae.

A comparison of the rates of mortality and development for common rocky shore molluscs, following exposure of their egg masses to three environmental stressors, revealed striking synergistic effects. Uniformly low levels of mortality (less than 10%) were observed for three species on simultaneous exposure to various temperature (18, 21 and 26°C) and salinity (25, 35 and 45 parts per thousand) treatments. However, mortality jumped 5 to 12 times on exposure to full spectrum UV radiation. With added UV exposure, the same temperature and salinity treatments significantly slowed development, extending the exposure of the mollusc embryos to potentially hazardous conditions. These dramatic impacts could not have been predicted from experiments with single stressors and warn that we may well be underestimating the effects of climate change.

Heat stress in sea urchins

To investigate the response of sea urchins to heat stress in winter and summer (in light of predicted temperature change in these seasons), we looked at changes in the animals' heat shock proteins – a group of proteins which increase when cells are exposed to elevated temperatures or other stress. This in-built protective response is common to all animals.

Two sea urchin species common in temperate Australia – *Heliocidaris erythrogramma* and *H. tuberculata* – were used. In summer both species exhibited similar levels of heat shock proteins across all experimental treatments (+2 to 6°C above ambient*) indicating that their protective response to heat stress is adapted to a warming ocean in this season. In winter the heat shock protein response to heat stress (+2 to 6°C above ambient) in *H. erythrogramma* was induced, but within a smaller temperature range, and the response of *H. tuberculata* was limited. This indicates that heat stress in winter may not be tolerated by these urchins.

*Ambient is approximately 20°C, although it varies over summer between 19 and 24°C.

Influence of temperature and pH on sea urchin fertilisation and early development

For marine organisms that release their eggs and sperm into the water column, where the larvae subsequently develop as planktonic organisms, both the main climate change stressors – ocean acidification and increased water temperature – are of concern.

We investigated the interactive effects of these stressors on fertilisation and development of *H. erythrogramma* in experimental treatments (20 to 26°C, pH 7.8 to 8.2). The degree of fertilisation did not differ across treatments and there was no difference in the level of normal development in any pH treatment. The embryos were also tolerant to decreased pH (more acidic) and increased temperature, except to the most extreme temperature treatments; 24 and 26°C (+4°C and +6°C above ambient). At these elevated temperatures the success of early development was reduced by 20% and 40%, respectively. Within 24 hours most of the embryos reared in the high temperature treatments were dead. Thus at 26°C – a temperature that is predicted to occur in local NSW waters – these urchins may have difficulty reproducing, unless they can adapt to the expected change in thermal regime.

This first study of the interactive effects of temperature and pH on sea urchin development shows that there are negative effects on fertilisation and embryo development at the upper limits of predicted ocean warming.

Our findings emphasise the need for experiments that examine multiple stressors concurrently and indicate that, in the short term, ocean warming is of particular concern. This is certainly true for the marine biota of eastern Australia. Temperature is the most important environmental factor controlling the biogeography, physiology, phenology (timing) and fundamental life history processes in marine populations. Several recent studies show that ocean warming can affect the extension or contraction of an organism's range, and the timing of biological processes. Although recent climate change research has focussed on ocean acidification and biocalcification, embryos may not be able to develop to the stage during which they make their shell or skeleton in a warming ocean.

MARIA BYRNE[1] and ANDY DAVIS[2]

1 Anatomy and Histology, Bosch Institute, F13, University of Sydney

2 Institute for Conservation Biology, University of Wollongong

HONG DAO NGUYEN

Experiments on this sea urchin, Heliocidaris erythrogramma, *which is common in temperate Australian waters, found that warmer waters could impact on its reproduction and survival.*


KIMBERLY CATTON

*Small tracer particles of titanium dioxide (less than 5 µm in size) were mixed into seawater in tanks containing Antarctic krill (*Euphausia superba*) at the Australian Antarctic Division. A laser was then used to illuminate the particles and observe the movement of water around the krill.*

Krill mix up the ocean

Turbulence in the ocean, caused by the wind, tides and currents, plays an important role in regulating the global ocean circulation and the movement of gases and nutrients between the surface and deeper waters. Now new research suggests that organisms as small as krill, can contribute to this turbulence.

According to *Science* magazine, scientists have hypothesised that schools of krill, which migrate up through the water column at night to feed, generate large turbulence patches, potentially increasing the nutrient exchange across the stratified (layered – with warmer water at the surface) ocean. This means that krill could be fertilising the surface waters, boosting the production of phytoplankton.

It's not hard to imagine that large organisms, such as whales or big fish, could produce such 'biologically generated turbulence' or 'biomixing' at a local scale. Indeed, scientists speculate that the removal of whales and stocks of big fish over the past 200 years could have removed enough biomixing to affect climate (through, for example, a change in the exchange of carbon dioxide between the atmosphere and the ocean). But the idea that krill could generate enough turbulence to efficiently mix ocean waters is controversial.

Research by the Australian Antarctic Division's krill biologist, Dr So Kawaguchi, and his collaborators at the Georgia Institute of Technology in the United States, is lending weight to the hypothesis that biomixing by krill does occur.

The team filmed krill in the Australian Antarctic Division's aquarium. High resolution analyses of the flow fields generated by the krill showed that when a small group of krill (less than five individuals) were moving in a coordinated way – similar to schooling – the energy generated to displace the water was of the same magnitude as that of turbulence observed at sea. Thus, in stratified conditions, a large enough school of krill could transport less dense water deeper into the water column, leading to increased mixing.

'This work shows that the group effect is significant and suggests that the hypothesis for biomixing by krill is valid,' Dr Kawaguchi says.

WENDY PYPER
Corporate Communications, AAD

Next step for CAML

The Census of Antarctic Marine Life (CAML) recently completed the fieldwork for the biggest ever biodiversity survey in Antarctica, coordinating projects on 18 major research voyages during the International Polar Year (www.caml.aq).

After analysis of the samples in museums and universities around the world, the data are being shared through the Marine Biodiversity Information Network of the Scientific Committee on Antarctic Research (SCAR-MarBIN; www.scarmarbin.be). This will leave a significant legacy for the International Polar Year, providing access to the data needed to improve our overall understanding of marine biodiversity and its role in the Southern Ocean ecosystem.

The census is now in the data integration and synthesis phase. In October, a workshop at Duke University, North Carolina, used case studies to explore the mapping and visualisation potential of the data (https://comlmaps.org). Comparisons between Antarctic and Arctic ecosystems were the subject of an associated workshop entitled 'Polar Synthesis Macroscope'. This refers to using a 'zoom' function to examine biodiversity data at different spatial scales.

A lot of work still remains to be completed and much of the data analysis will extend well beyond the end of CAML in 2010.

VICTORIA WADLEY
CAML Project Manager, AAD

YOUNG EMPEROR PENGUINS: WHERE DO THEY GO?

Unlike ducks and swans, which take their young to the water and show them how to forage, penguin parents simply abandon their chicks when they are about five months old. The fledglings become very hungry and eventually leave the colony to find open water. When they do, they have to learn quickly what and how to hunt.

For many years researchers have wondered where juvenile emperor penguins go once they reach the ocean. Do they stay near the colonies, or do they find a good foraging area and stay there? Now that instruments, such as satellite trackers, are small enough to be deployed on young penguins, we can follow them on their first trip to sea and find answers to these questions.

In December 2006 we deployed 10 satellite trackers on fledgling emperor penguins at the colony at Auster, about 54 km east of Mawson station. The colony, which comprises around 11–12 000 breeding pairs, had split into six different 'suburbs' that were up to 1.5 km apart.

When choosing our 'volunteers' we wanted the fattest ones because they had the best chance of survival. We also needed fledglings with proper adult feathers, not down, so that the satellite trackers would remain in place once glued to their back.

Before deploying the satellite trackers we weighed each fledgling to ensure it was fat enough. On average, our volunteers weighed nearly 16 kg; the satellite trackers only weighed 92 g and were powered by two AA batteries. To conserve power the trackers were programmed to transmit data only four hours in 48.

Upon departing the colony the fledglings had to cross nearly 50 km of fast-ice and could not feed for several days until they reached open water. Ten youngsters stayed in the colony for three to eight days after we left. Most of them then started to head north towards the ice edge. One of the young birds walked towards the continent for nearly two days before it realized that it was going the wrong way. It turned around, went back to the colony and then followed the others.

BARBARA WIENECKE

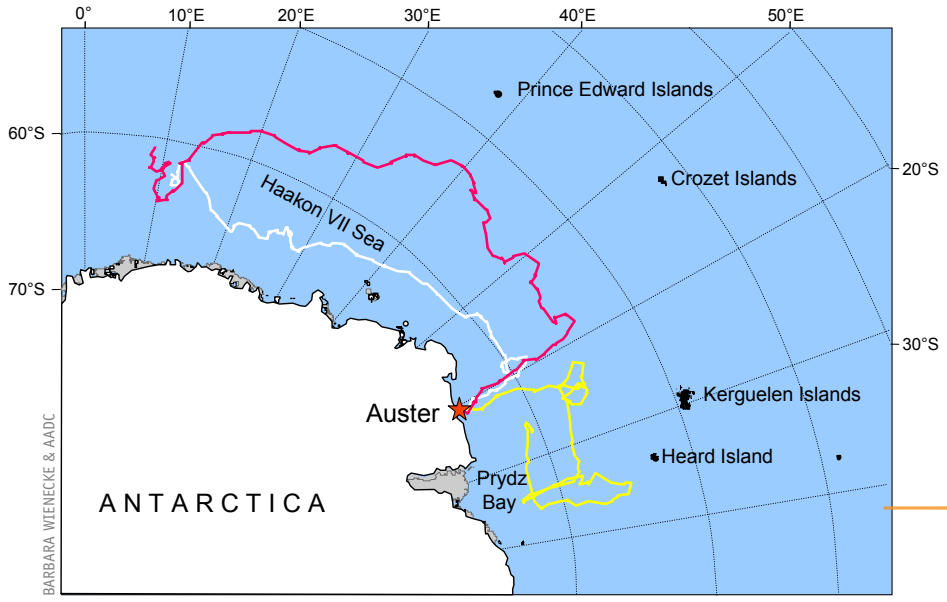
Despite appearances, this fledgling has enough adult feathers to retain the small satellite tracker.

Once they reached the edge of the fast-ice the young emperor penguins had 200–300 km of pack-ice in front of them. It was remarkable to see how they moved through it, heading directly north for the deep oceanic waters of the Southern Ocean. Some of them spent a considerable time north of 60°S. For example, Fledgling 2 was tracked for 166 days and spent 76 of those north of 60°S.

The fledglings dispersed over nearly a quarter of the Southern Ocean in their first six months at sea. The eastern-most position was at 93°E and the most westerly position reached was at 7°E – over 2300 km from their birth colony! The total distance traveled by one individual was nearly 7000 km.

But the story doesn't end here. Emperor penguins are three years of age, or older, when they first return to their colony to breed. Our research has given us a glimpse into their whereabouts for the first six months after leaving the colony. We still need to find out where they spend the other two and a half years. To do that we need to repeat the tracking studies at Auster and adjust the transmission time of the satellite trackers so that we will be able to follow the young penguins for much longer than six months. Over the coming years we also plan to go to other colonies and examine what young emperor penguins do in other parts of Antarctica.

BARBARA WIENECKE
Southern Ocean Ecosystems program, AAD



This map shows three of the longest tracks recorded of young emperor penguins on their first foraging trip, during the Auster study in 2006–07.

A VIRUS AMONGST

Despite its perceived isolation, Antarctica has been invaded by many non-native species, including pathogens. It is not surprising that wildlife in Antarctica could acquire parasites and diseases, but recent evidence of a common poultry virus in emperor penguins has captured scientific interest. Dr Gary Miller and his colleagues have been investigating the origin, spread and nature of the virus in emperor penguins at Auster Rookery.

Diseases and parasites have been detected in Antarctic wildlife populations for as long as scientists have observed and collected samples from them. However, it was not until the 1997 discovery of antibodies to Infectious Bursal Disease Virus (IBDV) in a high percentage of emperor penguin (*Aptenodytes forsteri*) chicks at Auster Rookery (through research led by Australian Antarctic Division veterinary biologist, Heather Gardner), that disease in Antarctic wildlife was connected with the presence of people in Antarctica.

Dr Gardner and her colleagues suggested that because Auster Rookery is relatively close to Mawson station, the penguins may have been exposed to this common poultry disease through contact with humans or their cargo. In support of this theory, they found no antibodies to IBDV in adult Adélie penguins from Edmonson Point – a more remote colony in the Ross Sea.

However, it is difficult to reconcile that a high percentage of emperor penguin chicks are exposed to IBDV through human contact when you look at their natural history. Emperor penguin colonies live on floating sea ice, and their eggs hatch in the middle of winter, when there is no transport of goods from outside the continent and few personnel are at Mawson station. During the summer months, when most human activity occurs, the penguins are away at sea. In many years the ice from the colony area melts completely, so there is no environment in which the virus can live.

Given these findings and a growing concern for threats to the Antarctic environment, the Australian Antarctic Division hosted a workshop in 1998 to discuss the threats to Antarctic wildlife posed by the possible introduction of diseases. Discussions at the workshop showed that there is a need to understand how diseases persist and the effects they may have on populations. My colleague, Professor Geoff Shellam, and I participated in the workshop and have since been studying the presence of various pathogens in Adélie penguins, South Polar skuas, and now, emperor penguins in Antarctica.

From our recent work we know that adult South Polar skuas in the Davis area are exposed to more diseases than the Adélie penguins there, and at higher rates. We believe that migratory birds, particularly South Polar skuas, may transmit disease to other Antarctic bird species. Because skuas travel outside the Antarctic ecosystem during the austral winter and are well known scavengers and predators, they may pick up diseases outside Antarctica. Their close association with penguins therefore creates an ideal opportunity for transmission of exotic disease to the penguins.

Our more recent testing revealed 96% of emperor penguin chicks near Edmonson Point had antibodies to IBDV. Similar high prevalences of antibodies to IBDV were found in emperor penguin chicks at Auster Rookery (93%) and Amanda Bay (100%). These results contradict the theory arising out of the 1997 research that IBDV is less prevalent in isolated colonies of emperor penguins. As research has also shown that Adélie penguins in the Vestfold Hills have no antibodies to IBDV, but South Polar skuas do (7–17% in different years), there are now more questions than answers.

ROBYN MUNDY

Securely wrapped in a jacket for its own protection, Gary brings an emperor penguin into the van for sampling. The jacket restrains the penguin but allows access to the mouth and cloaca for the swab samples, and to the right flipper to draw blood from the brachial vein.

To address this issue we designed our current project with the primary goal to determine the status and origin of diseases in emperor penguins at Auster Rookery. We have focused on IBDV, but will also test the penguins for a suite of other common poultry diseases, such as avian influenza, Newcastle disease and some common bacteria.

The plan is to capture and sample both adults and chicks at four times over winter, to isolate and describe the pathogens. Each penguin will be weighed and various samples taken – two fecal swabs (one for viruses, one for bacteria), one throat swab, and blood from a vein in the flipper – using methods approved by the Antarctic Animal Ethics Committee. Importantly, we will investigate the role that adults play in transmitting IBDV to their chicks.

As this article goes to press, we are most of the way through our sampling effort. The first samples were taken in May during the courtship and egg-laying period, when the birds were in peak condition, having just returned from several months foraging. The second samples were taken from adults in early August, when the chicks were just hatching. These two sets of samples will allow us to determine the disease status of adults before there is a chance to transmit pathogens to their chicks.

The third samples were taken from the chicks in early October, when they were old enough to be left alone at the colony. This is a particularly important sample set because it is the first one of chicks taken before skuas and giant petrels (potential disease vectors) return to the area.

The final samples will be taken from adults and chicks in the early summer. This will coincide with the sampling time from the 1997 study and will occur after skuas and giant petrels have returned to the area.

This sampling regime should allow us to determine when IBDV first appears in the colony and how the chicks become exposed to it. The expected high prevalence of IBDV indicates that we should be able to isolate the virus and discover its origin by means of RNA (ribonucleic acid) sequencing. No IBDV has been isolated from any Antarctic species, but it is known that IBDV can infect penguins in captivity. In 2002, researchers isolated an avian Birnavirus from captive African black-footed penguins (*Spheniscus demersus*) and macaroni penguins (*Eudyptes chrysolophus*). Those isolates were later identified as IBDV.

If we can isolate IBDV and sequence the RNA, we will be able to completely characterise the

THE PENGUINS

Gary catches an emperor penguin with his shepherd's crook. By hooking the penguin across the upper breast it is possible to control it enough to walk up to it as it moves forward. Once close enough, Gary hugs the penguin to restrain it until other expeditioners come to assist.

Gary (left) and a colleague wrap up a penguin for sampling.

Gary and his field assistant, Robyn Mundy, lived and worked in a small van at Auster Rookery for weeks at a time.

virus. The RNA sequence will tell us if it is the same as other known strains of IBDV, or whether the Antarctic variety is different. It is safe to say that this is an important key to the puzzle of how disease gets to Antarctica.

We will have to wait until we return to Australia in March to complete our analyses.

We will test blood serum samples for the presence of antibodies to IBDV and a number of other viruses in the virology lab at the Western Australian Department of Agriculture. We will also culture a fecal swab for a few important bacteria at the University of Western Australia and we will send fecal and throat swabs for RNA sequencing to Dr Daral Jackwood, an expert on IBDV at Ohio State University in the United States. We should have results by June 2009 – about the time the emperor penguins start the breeding cycle again.

Even if our results indicate that the IBDV in emperor penguins has been in Antarctica for some time and, therefore, is not related to human intervention, the study will provide an important, detailed description of the types of pathogens to which the penguins are being exposed. As natural and human-mediated changes to the Antarctic environment continue to occur, it is important to understand the current status and dynamics of disease in Antarctic penguins. Our project, in combination with the earlier study on IBDV, will provide a baseline that can be used to compare any disease-related changes in the future.

GARY MILLER, ROBYN MUNDY and GEOFFREY SHELLAM
University of Western Australia

WHALE RESEARCH AND CONSERVATION BECOMES COOPERATIVE

The Australian Marine Mammal Centre (formerly the Australian Centre for Applied Marine Mammal Science), based at the Australian Antarctic Division, received a $1 million funding boost for 2008–09.


JAMES SHEVLIN

New funding for the Australian Marine Mammal Centre will contribute to modernising the International Whaling Commission, and non-lethal whale research partnerships.

The new funding includes about $600 000 to supplement the existing marine mammal research fund and about $400 000 for activities in support of the Government's policies, including work towards the establishment of the first International Whaling Commission (IWC) conservation management plan, and a Southern Ocean non-lethal whale research partnership.

Federal Environment Minister, Mr Peter Garrett, said the allocation of the extra funding would advance Australia's science-based proposal to modernise the IWC.

The proposal, *Whale Conservation and Management: A Future for the IWC*, contains three main initiatives: internationally agreed, cooperative conservation plans for whales; collaborative research programs; and reforming the management of science, including an end to unilaterally granted special permits for scientific whaling.

Australia followed through with its conservation and management proposal at the 60th IWC meeting in Santiago, Chile, in June, when it signed an agreement with Chile to cooperate on whale research and other whale conservation activities. The agreement delivers on two of the key reform measures proposed by Australia – strategic research partnerships and internationally agreed conservation management plans.

The program of work that will ensue from the agreement includes regional research partnerships, a research exchange program, conservation management activities and building capacity in the area of regulatory environmental management.

Australia will also host a workshop in early 2009 to develop a research plan for the Southern Ocean research partnerships. The research exchange program will be managed by the Australian Marine Mammal Centre and will be linked to universities in both countries.

Corporate Communications, AAD

Blue genes

Research through the Australian Marine Mammal Centre has found evidence that pygmy blue whales (*Balaenoptera musculus brevicauda*) from two Australian feeding aggregations – one in the Bonney Upwelling region off South Australia and Victoria, and the other in the Perth Canyon off Western Australia – show high genetic similarity. This means that individuals from both aggregations are likely to belong to the same genetic population.

Dr Luciana Möller and her colleagues at Macquarie University say the high level of genetic similarity between Australian blue whales was particularly evident when they compared these whales with Antarctic blue whales – of the subspecies *B. m. intermedia*. As expected, the two recognised Southern Hemisphere subspecies showed low genetic similarity.

Given the severe decline in blue whale numbers due to whaling in the early 20th century, Dr Möller says the findings are good news as they mean it is more likely that Australian pygmy blue whales are able to maintain their genetic diversity over time.

Dr Möller says the research confirms the potential of genetic analysis to identify blue whale populations and to differentiate blue whale sub-species. It also provides information on the genetic structure of Australian populations, which will be incorporated into models for measuring the recovery and status of blue whales in Australian waters.

Further genetic research is now necessary to determine the identity of blue whales in Geographe Bay – another area off Western Australia where blue whales are frequently sighted. Defining populations of blue whales will be extremely important to future management and conservation efforts of these animals in Australia and elsewhere.


DAVE & FIONA HARVEY

A blue whale off Rottnest Island, Western Australia. Genetic analysis is helping scientists define blue whale populations and differentiate sub-species.

WENDY PYPER
Corporate Communications, AAD

ANTARCTIC SCIENCE SEASON AHEAD

The Australian Antarctic Division, through the Australian Antarctic program, supports or collaborates with a range of national and international researchers and research organisations. In 2008–09 the Antarctic Division will be involved in two major new international field projects (outlined on pages 15–16) and a range of station-based and marine projects (pages 17–18).

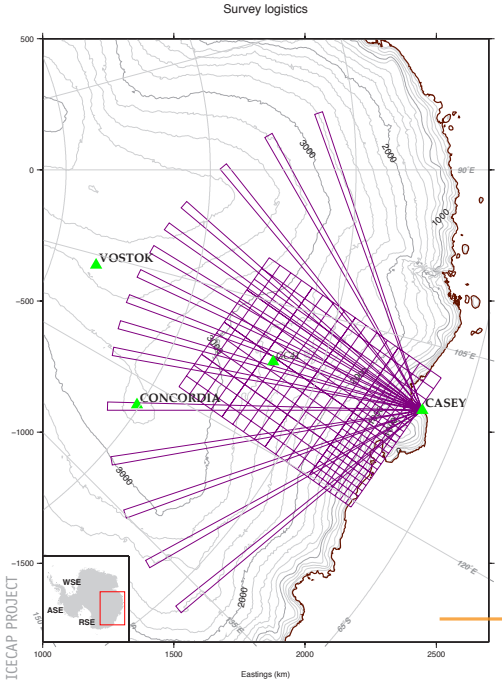
Evolution of the Antarctic cryosphere

'Investigating the Cryospheric Evolution of the Central Antarctic Plate' (ICECAP), is an ambitious International Polar Year project studying the underlying geology and the structure of the East Antarctic Ice Sheet and its subglacial processes.

A ski-equipped Basler BT-67 turboprop (an upgraded DC-3) from Kenn Borek Air Ltd, of Canada, will carry a suite of geophysical instruments to explore the glaciological and geological properties of the vast Aurora and Wilkes subglacial basins.

The project will explore the vast Aurora and Wilkes subglacial basins to uncover information critical to ice sheet modelling and an understanding of the role of the East Antarctic ice sheet in global climate and sea level rise.

From their base at Australia's Casey station, scientists from the United States, the United Kingdom and Australia will explore the Aurora Subglacial Basin over the 2008–09 and 2009–10 summer seasons. This basin, about the same area as New South Wales, is one of Antarctica's least surveyed regions, and is believed to hold the thickest ice – more than 4.5 km deep. (A second campaign, based at McMurdo, will explore the Wilkes Subglacial Basin.)



This map shows the proposed flight lines for the ICECAP project campaign based at Casey.

The ICECAP team will use instruments fitted to a Basler BT-67 turboprop aircraft, to measure the glaciological and geological properties of the basins. East Antarctica was previously regarded as less responsive to climatic changes than the smaller marine-based West Antarctic ice sheet, but recently numerous subglacial lakes have been discovered beneath East Antarctica, indicating that the ice sheet is potentially more mobile than if it were frozen everywhere to the bedrock. Satellites also show that the Totten Glacier, which dominates the ice drainage of the Aurora basin, is thinning near the coast.

On board the aircraft, high resolution ice-penetrating radar will image the underside of the ice sheet and layers within the ice, providing insight into bedrock conditions and past ice flow. At the same time a gravity sensor and magnetometer will measure the density and composition of the rock lying beneath the ice, exploring the geological character of this region, which was joined to Australia until the breakup of the Gondwana supercontinent. The aircraft will also carry a laser altimeter to map the ice surface, and GPS receivers to accurately locate the aircraft.

ICECAP connects with several other projects. For example, the Australian Antarctic Division is collaborating on aerial survey work around Dome A through the 'Antarctica's Gamburtsev Province' (AGAP) project (see page 16). Results from AGAP and ICECAP will be combined, and also connected to the deep ice core record from Vostok, using earlier survey data.

Data collected through ICECAP and AGAP about the ice structure and conditions at the ice-bedrock interface, will be used to improve computer models of ice flow for Antarctica. This will improve estimates of ice sheet stability, and forecasts of its reaction to climate change and impacts on global sea level.

The Australian Antarctic Division air link will be pivotal to ICECAP, enabling senior project scientists to participate by removing the barriers of time and distance. ICECAP operations from the Casey ski-way will be supported by communications and air ground support personnel, with additional support from Casey station and Antarctic Division Headquarters.

ICECAP is led by Don Blankenship from the Jackson School of Geosciences at the University of Texas at Austin, while the British and Australian contingents are being led by Martin Siegert from the School of Geosciences at the University of Edinburgh, and Tas van Ommen from the Australian Antarctic Division. The universities of Bristol, Cambridge and Melbourne are also involved.

ROLAND WARNER and JASON ROBERTS
ACE CRC and *AAD*

MYSTERIOUS MOUNTAINS UNDER SCRUTINY

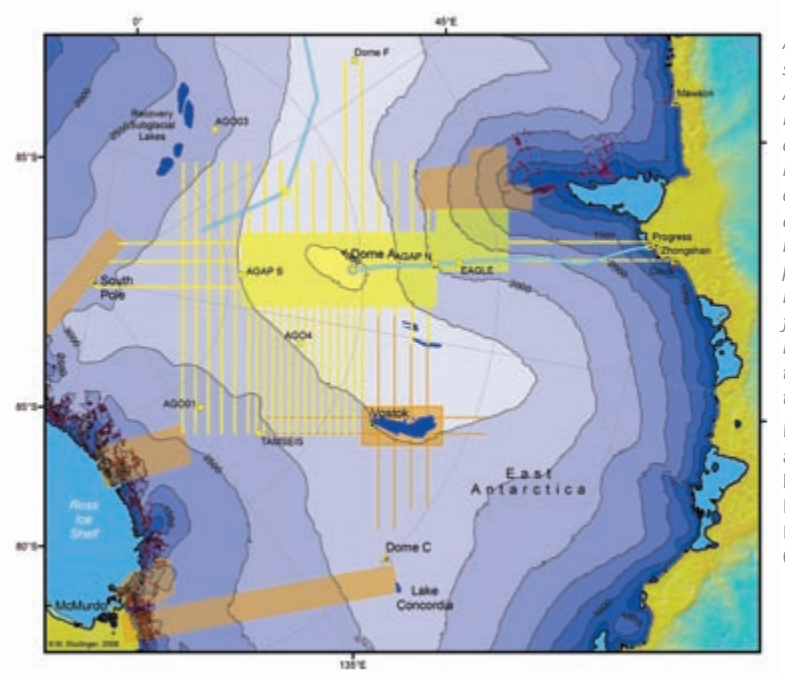
A mysterious mountain range hidden in the heart of Antarctica is the focus of a major field project, 'Antarctica's Gamburtsev Province' or 'AGAP', involving the Australian Antarctic Division in the 2008–09 season.

The Gamburtsev subglacial mountain range is 1200 km long and 3400 m high. The mountains are unusual in that they are buried under 600 m of ice and situated in the interior of the continent. They were discovered by a Soviet team during the International Geophysical Year (1957–58), on a traverse to the Pole of Inaccessibility – the point inland furthest from any coast.

The topographic nature and location of the foothills to these subglacial mountains were identified during Australia's 2002–03 Prince Charles Mountains Expedition of Germany and Australia (PCMEGA). This involved an airborne geophysical survey over the southern extension of the Lambert Glacier (*Australian Antarctic Magazine* 5: 2–6, 2003).

Scientists believe the mountains hold clues to the origin and evolution of Antarctica and, by extension, the Earth's current climate. Computer modelling suggests the mountain peaks were a nucleation point for the ice sheets that now cover the continent. However, given the difficulty in accessing the area, the mountains have been little studied.

That's all about to change as United States scientists (responsible for the overall planning coordination of AGAP) team up with scientists from Australia, the United Kingdom, Germany, China, France, Italy and Japan, to undertake airborne geophysics and seismic surveys of the subglacial Gamburtsev Mountains that will build on the results from the PCMEGA survey.



A map of the AGAP survey region. Australian Antarctic Division personnel will operate from the AGAP North camp. Yellow and orange areas mark the aerogeophysical survey regions of the AGAP project; yellow circles mark field camps or fuel caches; and the blue line from Progress to Dome A marks a traverse route.

Map adapted from an original provided by Micahel Studinger, Lamont-Doherty Earth Observatory, Columbia University.

To discover the evolutionary history of the mountains – what they are, where they come from, and how old they are – the scientists will establish two field camps (AGAP-North and AGAP-South) from which to conduct the work. A major component of the project will be an aerial geophysical survey to study the mountains' topography and take gravity and magnetic readings (see graphic). This will help explain how the mountains were formed.

Seismic stations around the province will also provide information on the structure of the mantle and crust beneath the mountains, giving insights into why the mountains are so high and how old they are.

The Australian Antarctic Division is contributing a range of resources to the project (www.aad.gov.au/default.asp?casid=35372), including personnel, food, vehicles, medical and communications equipment at the AGAP-North camp, and a C212 aircraft and helicopters to assist with the logistics of the project.

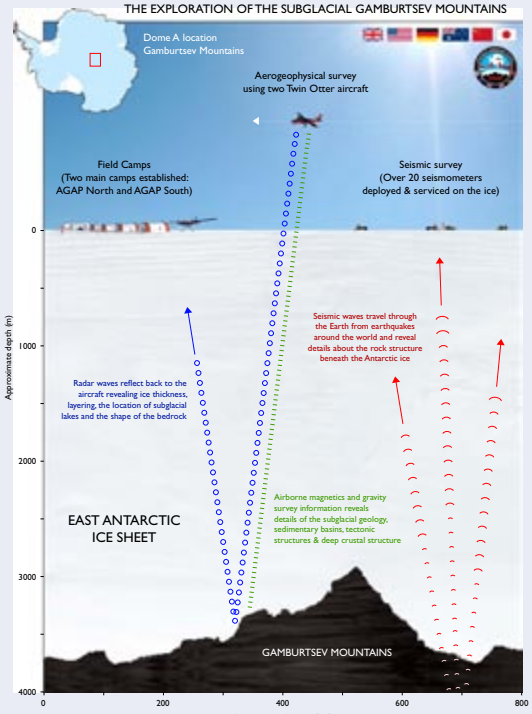
WENDY PYPER
Corporate Communications, AAD

The AGAP project will further our understanding of the origin and the influences of the subglacial Gamburtsev Mountains. The main aim is to derive a four dimensional evolutionary history of the area of East Antarctica affected by the Lambert glacier and the associated Amery Ice Shelf.

The project will survey a transect from the centre of the Antarctic continent, where the ice sheet is underlain by the Gamburtsev Mountains, northwards into Prydz Bay. To create a 3-D map of what lies beneath the ice sheet, two aircraft will complete the first aerogeophysical survey over the Gamburtsev Mountains and Dome A. Results from this aircraft mission, combined with data from a suite of seismic instruments on the ice, will unlock the secrets hidden beneath the ice.

Airborne radar measurements will also contribute to scientists' understanding of ice thickness, layering, the location of any subglacial lakes, and the shape of the bedrock in the survey region. More than 200 subglacial lakes have been located in Antarctica using airborne radar and satellite measurements. Water moves between these lakes through a complex system of under-ice rivers, streams and even swamps. Scientists believe water under the ice sheet lubricates the underside of the ice, making the ice sheet slide faster.

More details about the geophysical survey can be found at: www.ldeo.columbia.edu/res/pi/gambit/ProjectOverview.htm



GRAPHIC COURTESY OF THE BRITISH ANTARCTIC SURVEY

Australian Antarctic Science Season 2008–2009

A multitude of science projects will be conducted at or near each Antarctic station and Macquarie Island this season, while some ongoing marine science will be conducted in the Southern Ocean. Projects include:

Mawson

Cosray upgrade: This year the automated cosray (cosmic ray) data collection system, installed in the 1980s, will be replaced with modern electronics. The new system can be remotely operated, reset, or restarted and reconfigured from the Antarctic Division headquarters at Kingston. Cosmic ray research contributes to the understanding of space weather, which has impacts on satellite communication systems, high altitude air transport and space research generally.

Adélie penguin monitoring: A long-term monitoring program of Adélie penguins is conducted at Béchervaise Island each summer to provide information required by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) for the sustainable management of the krill fishery.


TODOR TOLOVSKI

Annual monitoring of Adélie penguins at Béchervaise Island provides information for krill fishery management.

Atmospheric research: A range of atmospheric research projects are conducted at Mawson each year and the results feed into climate research and models. Projects include looking at vertical mixing of the atmosphere above 100 km altitude, which could play a role in coupling the upper atmosphere to Earth's weather and climate. A new remote sensing spectrometer will be installed at Mawson to observe small-scale upper-atmospheric wind and weather systems, and monitor their response during auroral and magnetic storms.

Davis

Atmospheric studies: Projects include the long-term climate and characteristics (temperature, winds, clouds) of the Antarctic atmosphere from the ground to the edge of space, using a lidar (Light Detection and Ranging) instrument. When combined with other ground-based and satellite data sets, the measurements are used to investigate climate trends, polar ozone destruction, and to improve our understanding of the atmosphere.

Antarctic lake microorganisms: New genomic information from bacteria and Archaea collected from lakes in the Vestfold Hills will be combined with existing meteorological, geological, chemical and physical data, to generate a complete understanding of how the micro-organisms have evolved in these cold lakes, and how they have transformed and presently interact with the Antarctic environment (*Australian Antarctic Magazine* 14: 8, 2008). A second project in the Vestfold Hills lakes will look at the evolutionary pressures on dinoflagellates (a component of the phytoplankton) in different lakes.

Impact of ocean acidification on marine microbes: This project will build on work conducted on board the *Aurora Australis* in 2007 and investigate the effects of ocean acidification on phytoplankton, protozoa and bacteria in the Southern Ocean (*Australian Antarctic Magazine* 12: 25, 2007). These organisms play a vital role in the marine food web and in moderating global climate change. Microbial communities from the sea ice zone around Davis will be incubated in 'minicosms' under different carbon dioxide concentrations, to determine the effect of ocean acidification on their structure and function and the potential ramifications on the food web and carbon flux in the Southern Ocean. The impacts of global warming, sea ice retreat and enhanced ultraviolet radiation on these communities will also be investigated.


GREG STONE

The Davis lidar uses pulsed light from a powerful laser to map polar stratospheric clouds and measure atmospheric temperatures.

Casey

Aerial whale survey: This survey using the C212 aircraft will help fill gaps in our understanding of population structure, abundance, trend and distribution of the great whales, their ecological linkages and the role they play in the Southern Ocean ecosystem.

Remediation projects: These include ongoing research into the cost-effective clean up of petroleum spills in the Antarctic and other cold regions, and development and application of technologies to clean up heavy metal contaminants from abandoned waste disposal sites (*Australian Antarctic Magazine* 11: 14, 2006).

Continental movement: Geoscience Australia is measuring the movement of Antarctica using geodetic infrastructure in the Australian Antarctic Territory and, through international collaboration, by developing infrastructure across Antarctica. The infrastructure will provide information on the current motion of Antarctica for comparison with long-term geological records, with a focus on the Australia-Antarctic separation and the movement of the Macquarie Ridge and the mid-ocean ridge.

Law Dome: Scientists are studying short-lived radioactive beryllium isotopes found in ice cores to better understand the links between solar activity and global climate change. Ice cores will be returned to Australia on the air link (*Australian Antarctic Magazine* 14: 24–25, 2008).

Sea ice phytoplankton: A number of projects will look at primary production by sea ice algae, including the impact on production caused by a reduction in sea ice thickness and duration, due to climate change, and the flow-on effects to higher predators.

Atmospheric electric circuit: This project is investigating the internal (thunderstorms and electrified clouds) and external (space weather/cosmic ray) electrical influences on the atmosphere and its link to climate and weather (*Australian Antarctic Magazine* 12: 18–19, 2007).

Macquarie Island

Rabbit and rodent eradication: The start of the planned eradication of rabbits and rodents will be carried out by the Tasmanian Parks and Wildlife Service with logistic support from the Australian Antarctic Division.

Fur seals: This project is providing key information on the status and trends of recovering fur seal populations in the Southern Ocean, including information on the distribution of foraging effort, food and energy requirements and interactions with commercial fisheries.

Vegetation: Macquarie Island terrestrial environments are changing with global climate change and as alterations in the balance of feral animal populations occur. Studies include re-measuring several series of monitoring sites set up in 1980 and 1990 to study long-term changes in vegetation and soil stability.

Marine Science

Major new marine science projects for the season have had to be rescheduled, due to the Davis evacuation earlier this year (see page 1). However, a number of existing projects will go ahead, including:

- measurements of sea ice thickness using an air-borne scanning laser;
- seawater sample collection for genomic analysis of microbial communities;
- estimates of primary production in sea ice;
- mapping of plankton biodiversity with a continuous plankton recorder;
- studies of the response of zooplankton to ocean acidification; and
- collection of live krill for the Antarctic Division's research aquarium.


FREDERIQUE OLIVIER

Long-term studies on vegetation and soil stability changes on Macquarie Island will continue this summer.


CHRISTOPHER R CLARKE

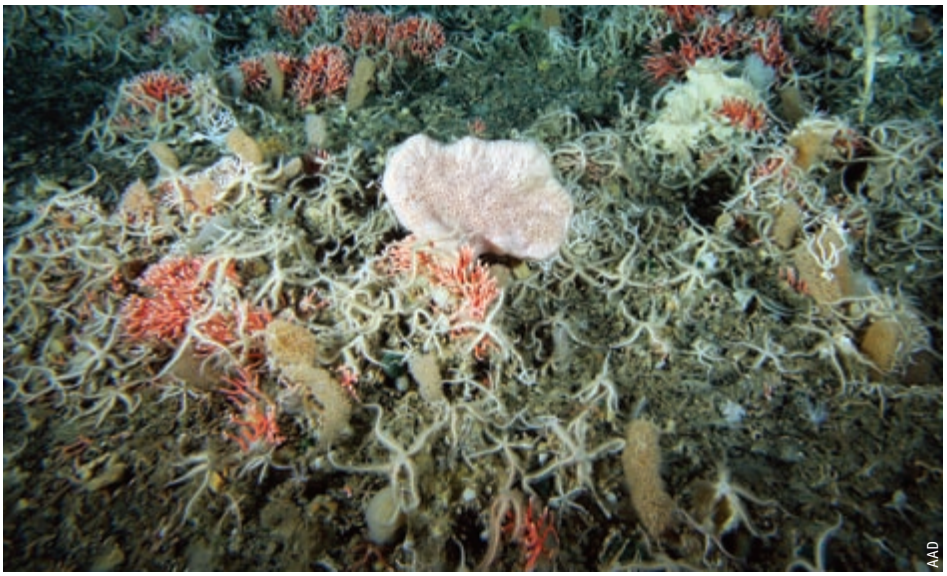
A rabbit and rodent eradication program will begin on Macquarie Island this summer.


SANDY ZICUS

In a continuous plankton recorder, plankton are trapped between two layers of very thin (270 µm) mesh silk, which wind around a spool inside a chamber filled with preserving fluid. Back in the laboratory, the silk is unwound and cut into sections for analysis. Plankton are sensitive to small changes in the marine environment, making them useful early warning indicators of changes in the health of ocean ecosystems.

VULNERABLE MARINE ECOSYSTEMS IN ANTARCTICA

At its annual meeting in October, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) adopted a proposal by Australia to declare two areas of the Southern Ocean as Vulnerable Marine Ecosystems (VMEs).



This area of high biodiversity discovered in the Southern Ocean during the Collaborative East Antarctic Marine Census earlier this year, was declared a Vulnerable Marine Ecosystem at this year's CCAMLR meeting.

The areas, each comprising around 400 square kilometres, have a high diversity of marine life, in particular habitat-forming hydrocorals and sponges. They are also home to species previously unknown to science. This declaration ensures that these unique areas are not damaged by indiscriminate fishing practices.

Located in a previously unexplored region, the areas were identified in early 2008 during the Australian-led expedition of the Collaborative East Antarctic Marine Census (CEAMARC), a major International Polar Year project, and part of the Census of Antarctic Marine Life.

The Commission also adopted a new conservation measure for the protection of VMEs should they be encountered during fishing operations. The new measure requires fishing vessels to cease fishing operations if evidence of a VME is discovered. No further fishing in the risk area will be permitted until appropriate management actions are determined by the CCAMLR Scientific Committee. This interim protection will ensure the protection of VMEs until longer-term conservation strategies are developed and implemented.

The declaration of the two VMEs and the adoption of the new conservation measure highlight the importance of Australia's Antarctic scientific research in supporting policy to protect Antarctic ecosystems for future generations.

During the two week meeting the Commission also adopted measures including:

- prohibiting fishing in waters shallower than 550 m for all CCAMLR waters, to protect sensitive benthic habitat;
- making funds available for capacity training in developing states to combat illegal, unregulated and unreported fishing for toothfish;
- improving the CCAMLR Scheme of International Scientific Observation; and,
- refining the research guidelines to allow a greater proportion of research proposals to be reviewed by the CCAMLR Scientific Committee.

This year's meeting also marked the final CCAMLR meeting for Dr Tony Press, who has made a significant contribution to CCAMLR as head of the Australian Delegation at the past 11 meetings. Dr Press has been appointed the new Chief Executive Officer of the Antarctic Climate and Ecosystems Cooperative Research Centre, and will take up his post in early 2009.

MEGAN LLOYD
Antarctic Territories, Environment and Policy, AAD

Scientific meeting focuses on the International Polar Year

The Scientific Committee on Antarctic Research (SCAR) held its third Open Science Conference jointly with the International Arctic Science Committee in St Petersburg in July. This year's theme was 'Arctic and Antarctic Perspectives in the International Polar Year'.

The conference was well supported with 1300 participants and 29 sessions covering major topics including: status and change of the polar regions, polar/global linkages, a sense of discovery, the poles as vantage points for observations, and people and resources at the poles.

The latest data emerging from International Polar Year programs was presented. Of particular interest was the genetic evidence that the Antarctic Circumpolar Current acts as an engine to drive speciation of marine organisms, by providing a 'thermohaline' highway of north-bound currents.

There was also much talk about observations suggesting that the rate of polar change is right at the upper limit, or even above, the most recent Intergovernmental Panel on Climate Change (IPCC) predictions.

Immediately after the conference, SCAR delegates held a business meeting, at which SCAR became a registered charity in the United Kingdom. This satisfies the requirements of the International Council for Science that all affiliated organisations become registered as charities. Dr Chuck Kennicutt (USA) was elected President and Drs Ad Huiskes (Netherlands) and Rasik Ravindra (India) were elected Vice-Presidents. The next science conference will be held in Buenos Aires in August 2010.

MICHAEL STODDART
Chief Scientist, AAD

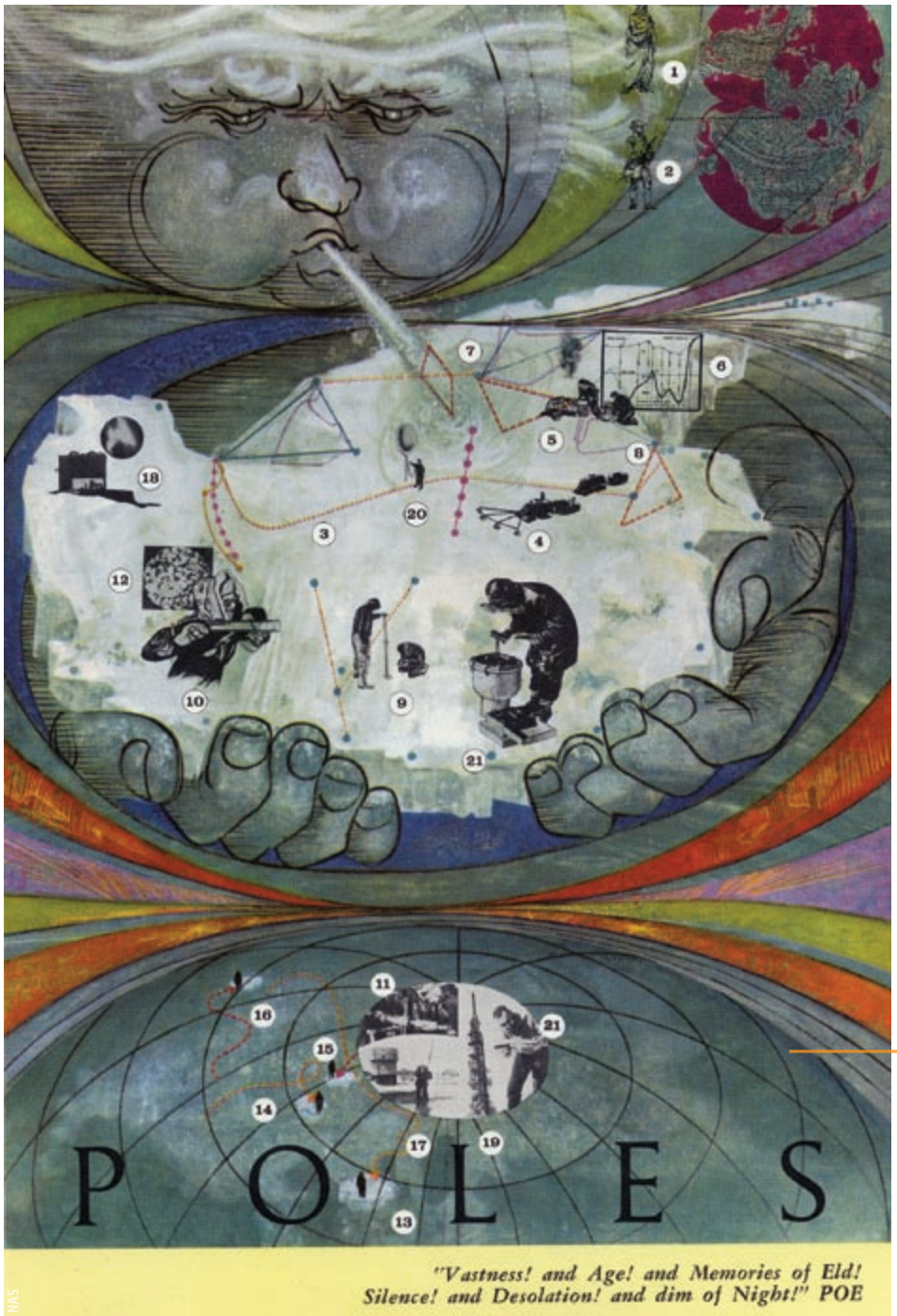
PHIL TUCAK

CELEBRATING 50 YEARS OF CO

Fifty years ago public attention on the Antarctic was focused on research being undertaken as part of the International Geophysical Year which, in late 1958, was drawing to a close.

Twelve nations were active in Antarctica at unprecedented levels, putting a shape to the continent and establishing toe-holds in a region which, to that point, was barely understood beyond tales of heroism and discovery.

But this work was proceeding in the political environment of the Cold War, where economies were strengthening and expansion of national interests was the priority for many. While polar science was making headlines, behind the scenes discussions were escalating over whether nations could continue to cooperate in Antarctica at the conclusion of the 'truce' embodied in the International Geophysical Year. There was the undeniable context of seven existing territorial claims to the Antarctic continent, and stark differences of views about the validity of those claims. Proposals by the United States 10 years earlier, that the continent should be internationalised, had fallen on deaf ears.



In 1958 the 12 countries active in Antarctica participated in a conference to negotiate a Treaty for the Antarctic. These discussions resulted in the adoption of the Antarctic Treaty on 1 December 1959, with the 12 nations becoming the Treaty's original signatories. Peace had been established; cooperation had been entrenched as the norm for the region.

The Treaty entered into force in July 1961 when the Parties met in Canberra for their first consultative meeting. Negotiation of the Antarctic Treaty had been focused on the principles of peace in Antarctica, freedom of scientific research, and accommodating the differences of view over sovereignty. At the first meeting, however, the focus of the Parties was no longer on the issues that had once separated them, but on practical ways of getting things done in Antarctica. For example, the meeting adopted recommendations relating to exchanging information, scientific personnel and research data between the Parties; conservation of flora and fauna; protecting historic sites; assistance in emergencies; and telecommunications and postal services. Any geopolitical tensions that might have existed in Antarctic affairs had been replaced by practical cooperation. This pattern continues in meetings today.

From the principles embodied in the Treaty, the Parties developed a sophisticated regime to manage the Antarctic region. To the Treaty were added associated legal instruments, such as the Convention on the Conservation of Antarctic Marine Living Resources, and the Protocol on Environmental Protection to the Antarctic Treaty. These were complemented by numerous Recommendations, Measures, Decisions and Resolutions addressing a wide range of practical issues. Together these instruments (and the institutions that support them) form what is now known as the Antarctic Treaty system.

Significant attention was given in the content of these instruments to refining the agreed approaches to activities in Antarctica. In the last two decades there has been a substantial focus on updating and strengthening the range of measures relating to environmental protection.

The spirit of peace and cooperation between nations active in Antarctica during the International Geophysical Year (IGY) formed the cornerstone of the Antarctic Treaty subsequently negotiated by the active Parties in 1959. This poster, produced by the National Academy of Sciences IGY committee in 1958, illustrates various projects, expeditions, infrastructure and equipment in the Arctic and Antarctic during the IGY (http://www7.nationalacademies.org/archives/IGYPlanetEarthPosters.html).

OPERATION

As the Treaty system has matured, it has also enjoyed expanded membership. From the 12 original signatories the number of Parties has grown to 47, and the number of Consultative Parties (the states that participate in decision-making in the Treaty meetings because they have active scientific programs) has grown to 28.

But what of the future? The vitality of the Treaty is not just measured by the number of Parties. It is also measured by the adherence of Parties to the Treaty's basic principles and the obligations they have adopted, and by the responsiveness of the Treaty system to the challenges of managing Antarctic activities. If the current trends continue, we can expect the Treaty Parties to develop an even broader view of their responsibilities.

The Antarctic Treaty can be seen as an enduring legacy of the International Geophysical Year. In the same way, the International Polar Year (2007–09) will leave a legacy of enhanced cooperation within the Antarctic Treaty and stronger collaboration between national Antarctic programs that address globally significant science and environmental issues. This is evidenced by recognition of Antarctica's role in the global environment and the commitment shown to expanding the quantity and quality of research that has worldwide value; for example, research on climate change and ocean acidification.

It is also likely that we will see further development of the Treaty system's measures to manage tourism, shipping and biological prospecting, and the institutions that support the system. We will see further adaptation of the Treaty to changes in the external legal and geopolitical environment; and we will see growing membership of the Treaty, most notably from developing states. But at the heart of it will be continued adherence to the Treaty's principles of peaceful cooperation, and looking after Antarctica for the benefit of the world.

The 32nd Antarctic Treaty Consultative Meeting in April 2009, in Baltimore, United States, will be as much an opportunity to look forward, as it is to look back and celebrate how far we have come.

As hosts of the meeting, the United States will convene a high-level event in Washington to lend diplomatic support for continued active polar scientific collaboration following the conclusion of the International Polar Year. This session will include representatives from all 28 Consultative Parties to the Antarctic Treaty and, in recognition of the bi-polar character of the International Polar Year, eight members of the Arctic Council.

It is fitting that in 2009 the Parties will be able to gather for a celebration of the Treaty in the country, and the city, where the Treaty was signed 50 years before.

ANDREW JACKSON
General Manager Policy, AAD

Treaty Parties meet in Ukraine

On the occasion of the 31st meeting of the Antarctic Treaty Consultative Meeting (ATCM), over 300 delegates from Antarctic nations around the world met in Kyiv, Ukraine, in June, to discuss a broad range of Antarctic legal, policy and environmental protection matters.

Just two days before the meeting, Monaco acceded to the Treaty – the 47th accession since its inception in 1961.

As well as the environmental outcomes of the meeting – see accompanying story on the Committee for Environmental Protection (CEP; page 22) – the management of tourism in Antarctica continued to be a priority issue for the ATCM. Among the highlights were a Resolution that implemented new visitor site guidelines for four additional priority locations which are subject to high number of visitors, and a Resolution calling on operators of tourist vessels to report regularly on their vessel positions while south of 60°S. These reports will go to the relevant maritime Rescue Coordination Centre. New Zealand also announced that it will convene an Antarctic Treaty Meeting of Experts on the management of ship-based tourism in the Antarctic in late 2009.

Biological prospecting received further attention, including a request by the ATCM that the Scientific Committee on Antarctic Research conduct a review of published research on Antarctic biological prospecting, undertake a survey of current biological prospecting activity, and report back to the next meeting.

In the lead up to the next ATCM a number of issues will be progressed in inter-sessional discussions: the United Kingdom will coordinate inter-sessional work on developing a tourism strategy for Antarctica; Norway will convene further work by the Inter-sessional Working Group on Passenger Vessel Safety; The Netherlands will convene an informal meeting on Antarctic biological prospecting; and Argentina will lead an inter-sessional group to review arrangements for the conduct of Antarctic Treaty inspections.

In science, Australia reported on the progress of the Census of Antarctic Marine Life and cooperation among Antarctic Treaty Parties, which led to 18 research vessels collaborating in data collection across the Southern Ocean. The census has gathered much new information on the marine biodiversity of the region (see page 10).

Australia participates actively in all meetings of the ATCM, consistent with the government's objective of maintaining the Antarctic Treaty system and enhancing Australia's influence in it. The annual meetings are the primary international forums for discussion of issues relating to governance in the Antarctic region. Decisions at ATCM and CEP meetings are taken by consensus. The next meeting will be held in Baltimore, United States, from 6 to 17 April 2009.

ANDREW JACKSON
General Manager, Policy, AAD

The ATCM delegation, L-R: Andrew Jackson (AAD); Emily Luck (DFAT); Penny Richards (Head of Delegation, DFAT); Tony Press (AAD); Phil Tracey (AAD); Michael Stoddart (AAD); Ben Galbraith (Tasmanian Government); Ewan McIvor (AAD).

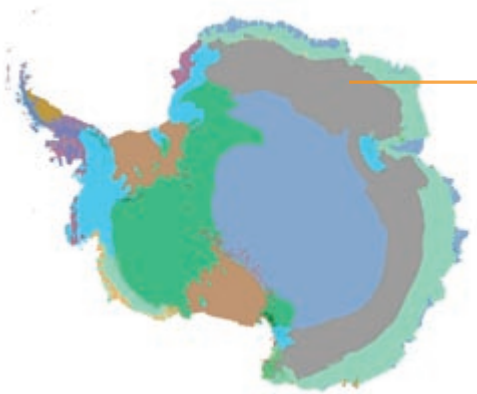
PLANNING FOR PROTECTION

A classification system for different regions within the Antarctic continent, based on the physical environment, was endorsed by the Committee for Environmental Protection (CEP) at its annual meeting in June this year.

The 'Environmental Domains Analysis', developed by New Zealand scientists, will help policy-makers identify and prioritise areas of Antarctica that may be in need of protection (see figure).

Among the other tasks of the CEP meeting – which is run in conjunction with the Antarctic Treaty Consultative Meeting (ATCM – page 21) – was consideration of 21 new and revised management plans, including endorsement of a new Antarctic Specially Protected Area jointly proposed by Australia and China to protect the emperor penguin colony at Amanda Bay, near the Larsemann Hills.

The Committee also considered the environmental aspects of China's draft plans to establish a new Antarctic research station. Constructing and operating the station at Dome Argus (Dome A), some 1200 km inland at the highest (4000 m) and possibly coldest location on the Antarctic ice sheet, will be challenging. However, China has identified the site as an important location for a range of scientific research, including deep ice core drilling to contribute to the long-term climate record, as well as geological studies and astronomical observation. China has now circulated its final plans, taking into account comments raised by ATCM Parties and the CEP, and will begin construction during summer 2008–09.



The Environmental Domains Analysis developed by New Zealand is a classification of the Antarctic continent into 21 distinct regions, based on physical characteristics such as climate, slope, land cover and geological data. Among other things, it will be used to help implement Parties' obligation under the Protocol on Environmental Protection to the Antarctic Treaty, to designate Antarctic Specially Protected Areas within a 'systematic environmental-geographic framework'. For more information about the domains see www.antarcticanz.govt.nz/environment/4537

ANDREW JACKSON

Part of the Australian delegation involved in the meetings of the CEP and the ATCM, held in Kyiv, Ukraine, in June 2008: Ewan McIvor (left), Penny Richards of the Department of Foreign Affairs and Trade, and Australian Antarctic Division Director, Tony Press.

The Scientific Committee on Antarctic Research reported on a workshop held in May 2008 to assess the conservation status of southern giant petrels in the Antarctic region. Available data suggest the Antarctic population is not 'threatened' in terms of the IUCN threatened species criteria, but the CEP acknowledged the sensitivity of individual birds and colonies and called for continued action to minimise human disturbance, particularly at breeding sites, and to improve the process for collecting, managing and analysing population data.

The CEP agreed to Australia's proposal for a joint meeting of the CEP and the Scientific Committee on the Conservation of Antarctic Marine Living Resources (SC-CAMLR). Both bodies provide important advice on the comprehensive protection of the Antarctic environment, and while SC-CAMLR focuses on conservation in the marine environment, there are a number of areas of mutual interest. A workshop will be held in April 2009 to discuss opportunities for future cooperation and collaboration on issues such as environmental monitoring, climate change research, protected areas and spatial management, threatened species protection and non-native species.

As the CEP workload has continued to increase each year, significant environmental issues were prioritised for consideration in a five-year work plan. The 'high priority' issues identified – including non-native species, climate change, tourism and marine protected areas – will be discussed at the next CEP meeting in Baltimore in April 2009.

On a personal note, I was very pleased to be elected as a CEP Vice-Chair, taking over from Tania Brito of Brazil. This appointment maintains Australia's active involvement in the CEP, which was chaired from 2003–2006 by the Australian Antarctic Division Director, Dr Tony Press. I look forward to working closely with the Chair, Neil Gilbert from New Zealand, the other Vice-Chair, Yves Frenot from France, and the Secretariat, to help guide and support the Committee. As part of this new role I am also leading a subsidiary body to make recommendations on ways to improve the quality of protected area management plans.

EWAN McIVOR
Antarctic Territories, Environment and Policy, AAD

More Information:

Download the full report of the 11th meeting of the CEP at www.ats.aq/e/cep_documents.htm

Pie and pees – life in Antarctic field huts

Memories are made in Antarctic field huts, as veterinarian, Phil Tucak, discovered.

Expeditioners living and working at Australia's Antarctic stations, sometimes have the opportunity to stay out in the Antarctic wilderness in one of many field huts.

The field huts vary from square-shaped, wood-panelled cabins, to the unique and enchanting domed, fibreglass 'apples' and 'melons'; each with an interesting story to tell.

The huts were constructed over the years to serve the various scientific studies conducted in the Australian Antarctic Territory, but are also used by station-based expeditioners on overnight hiking trips.

While some might argue that the aptly named Wilkes Hilton, near Casey station, is the most luxurious field hut on offer – the former transmitter room has been transformed into snug and inviting historic accommodation – there is history and comfort to be found in all of Australia's Antarctic field huts.

Brookes Hut, for example, which has been overlooking Shirokaya Bay since the early 1970s, has a painted fresco adorning the range-hood above the kitchen cooker, and framed photographs of previous expeditions on the walls. Platcha Hut, whose name is said to derive from an abbreviation of 'plateau chateau', has a rustic charm and location at the eastern end of Long Fjord that could be compared to chateaus of the Swiss Alps. It sits, seemingly forlorn, against the majestic backdrop of the Antarctic plateau, but is a welcome refuge when the temperature dips.

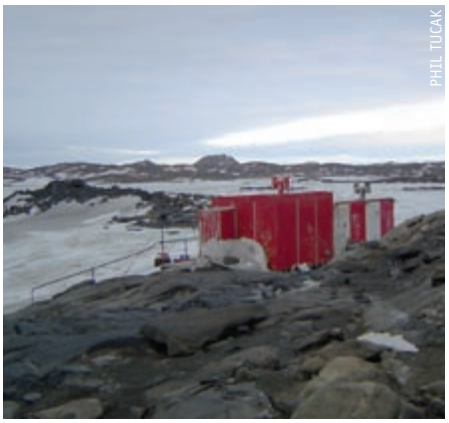
As part of the field huts' conditions of use, expeditioners are encouraged to bring their own food and drink. The huts do contain spare survival rations, which can be used if necessary, so long as items are later replaced.

One well known food item available in most survival ration kits is the Fray Bentos tinned pie. These distinctive pie puddings are renowned and either loved or hated. Some expeditioners have been known to request them for dinner on station, while others might liken their taste and appearance to an indistinguishable mix of meat and cardboard-like pastry. The picture on the tin provides a tantalising glimpse of what could be, but the reality of the cooked pie is often quite different. Interestingly, Fray Bentos tinned pies were first produced in the Uruguayan town of Fray Bentos in the late 1800s. Production later moved to Britain, and also Australia.

Vacuum packed dinners and 'cuppa soup' mixes are other common inclusions in Antarctic field hut stores. Depending on the length of an expeditioner's stay in the field – anything from one night to several weeks – the replenishment of provisions with fresh food from station is usually a much anticipated event.

If a blizzard blows up, then usually the best place to be is inside a field hut. Only the need to toilet leads expeditioners to make the precarious trip outdoors. Some Antarctic field huts have adjacent toilet cubicles, which make for relative luxury compared to utilising a bucket outside while being buffeted by very cold katabatic wind. In either case, many expeditioners are left with an everlasting aversion to talcum powder, which is used to counter toilet odours.

In some of the larger Antarctic field huts, entertainment can consist of a game of darts played in competition with expeditioners back at the station, with scores relayed via radio communications. Cards, board-games, reading and photography are also popular ways to pass the time. More unique pastimes might evolve the longer expeditioners have to live in the field – but what happens in the field, stays in the field. Often though, there is nothing more awesome than sitting snugly inside the hut with a hot cup of tea, looking out the window and savouring the incredible Antarctic landscape.



Brookes Hut overlooks spectacular Shirokaya Bay, in the Vestfold Hills near Davis.

The Wilkes Hilton has been transformed from its original purpose as a transmitter room.

PHIL TUCAK

Dr Tucak works as a vet in Perth and as a television producer with ABC TV.

After returning from a summer working as the vet for a Weddell seal project in Antarctica in 2006–07 (*Australian Antarctic Magazine* 13: 27, 2007), he promoted the work of wildlife veterinarians through his role as Murdoch University Veterinary Trust's BJ Lawrence Veterinarian in Residence (2006).

FROM WILKES TO CASEY

Construction of the original Casey station in the 1960s had its share of highs and lows, as former plumber, Rod Mackenzie, recalls.

By 1964 the original Wilkes station, established by the United States in 1957–58 and generously handed to Australia in 1959, had reached its use-by date. Whilst a very comfortable station to winter in, with all buildings connected by corridors, the siting of the station in a drift prone valley had been a mistake. By the end of winter the entire station was almost buried in drift snow, and with the summer melt, some 20 pumps were needed to prevent the station filling with water. The oil soaked floor boards and the lack of exits also made it a dangerous fire risk.

In 1964 the Australian National Antarctic Research Expeditions (ANARE) established a team comprising ANARE members, Department of Works architects and Melbourne University engineers, to design an Antarctic station that was drift free, fire proof, comfortable and safe.

The buildings would be constructed of insulated panels – metal on the outside, fibro-cement on the inside – built in a single line with a seven metre space between to prevent the spread of fire. The structure would be elevated two metres above the bedrock, with a rounded profile facing the prevailing east wind to prevent snow build-up. The rounded profile was to be an access corridor to connect all the station buildings, with the exception of the balloon building and garages.

Surveys were undertaken in 1964 and two buildings erected by the 1965 Wilkes party. The project was named 'Repstat' (replacement station).

In October 1965 I was invited to participate in a special 14-man summer construction party, to begin in earnest the building of Repstat. The team comprised carpenters, plumbers, riggers, plant operators and a Department of Works architect.

Nella Dan departed Melbourne on 29 December 1965. The party that night was quite an affair with a great deal of alcohol in a variety of forms being consumed, Dr Phil Law playing his accordion with the ship's officers, and expeditioners vying with each other as to who could sing the most ribald songs. The ship was rolling considerably, which only seemed to increase the hilarity. This climaxed with the entry at midnight of Bill Edgar playing the bagpipes. Moments later a large swell rolled the ship to 50 degrees, sending men, chairs, bottles, glasses, and other paraphernalia, crashing and sliding backwards and forwards across the floor. Fortunately we all escaped injury.

It was on this night that Dr Law announced his retirement from the Antarctic Division. This was a real bombshell to us all. Phil Law *was* the Antarctic Division. This was his 27th voyage to Antarctic regions. It was going to be hard to find a replacement.

After a very rough crossing we arrived at Wilkes on 11 January 1966. The daily program was as

A dog trip to the Vanderford Glacier was a highlight of Rod's time in Antarctica


BRIAN RIEUSSET

The completed Casey station in January 1969, showing the rounded profile of the tunnel (access corridor) which connected the buildings behind. In the late 1980s the station was replaced with the more modern buildings that stand today.

follows: rise 0530, breakfast 0600, ashore 0630, start work 0700, dinner 2000, lights out 2130.

With fine weather over the next few weeks, great progress was made. Six buildings in the main line were completed, the steel-framed vehicle workshop and power house complete with concrete floors was finished, and the first 30 m of the corridor was erected.

During the winter some work was carried out by the Wilkes 66 party and a big effort to complete the station was to be made in 1967. However, the relief ship was caught in the ice for six weeks, eventually being rescued by the US Coast Guard icebreaker *East Wind*. This meant a very quick change-over to relieve the station and no building materials were unloaded. Without materials, the 1967 winterers could do little toward the construction program.

1968 therefore became the year for the completion of Repstat. As well as a summer construction team of eight, a four-person team was chosen to winter at Repstat: Bob Nicholson – carpenter/foreman, Terry Kelly – electrician, Brian Rieusset – radio technician and myself as plumber.

The summer saw an enormous amount of work take place: 11 buildings erected, tank farm established, generators installed, radio masts erected, and the lower half of the wind corridor completed. On 10 March the summer party departed and six of us (including two from Wilkes) were left to finish the station, ready for occupation in 1969.

By the end of April the 620 m corridor was complete and work began on the installation of the central heating system, together with the fitting out of all the buildings. Water was scarce and a bucket shower once a week was the norm.

We had to visit Wilkes on odd occasions for radio scheds and supplies. Sometimes five of us would go over and while three would socialise, the other two would be raiding the food or clothing stores for needed items that the store-keeper at Wilkes was reluctant to let us have. As a result, we got the nick-name 'Repstat Raiders'.

Early in June we borrowed the dogs and the dog sled from Wilkes. When we went to return the team, the sled hit a concealed rock and the


ROD MACKENZIE

The 1968 over-wintering Repstat construction team (L-R): Bob Nicholson (carpenter), Rod Mackenzie (plumber), Terry Kelly (electrician) and Brian Rieusset (radio technician).

By the end of winter Wilkes station would be buried in snow drift and the summer melt had to be pumped out of the buildings.


PHILIP LAW

three of us on board were thrown off. However the sled righted itself and, despite our shouting, the dogs continued all the way back to Wilkes on their own.

We suffered a misfortune in July with the loss of one of the Wilkes party through carbon dioxide poisoning in a field caravan. This event weighed heavily on us all and made us very conscious of our vulnerability and remoteness.

By the end of September the central heating system at Repstat was commissioned and life became more agreeable. The coming of spring was greatly anticipated, for it meant not only sunshine but the return of the wildlife; the birds, penguins and seals, and the opportunity to use the dogs. On the first cloudless, sunny day, everyone went mad, behaving like schoolboys on the first day of summer holiday, with bob-sledding, snow fights, and stripping off winter clothing. We were filled with a *joy de vivre* we had not experienced in a long time. Morale reached an all-time high.

Shortly after, three of us participated in a dog trip to beyond the Vanderford Glacier, visiting many of the off-shore islands along the way to discover anything of biological importance, such as penguin and bird rookeries, lichen samples, and seal colonies. The trip was the highlight of my time in Antarctica.

With plenty of daylight hours, every evening after dinner, and on Sundays, I began a biology program that included numbering 41 snow petrel and 12 Wilson storm petrel nest sites and making daily observations of these sites to record egg laying dates, incubation times and so on. With the help of others I also banded over 100 skua gulls and giant petrels and over 200 Adélie penguins.

The station was ready for full occupancy by the end of December and we eagerly awaited the arrival of the relief party in February. However *Thala Dan* became fast in pack ice. Morale was low as we faced the possibility of another year in Antarctica on emergency rations. But six weeks later, to our great relief, the ship was rescued by the US Coast Guard icebreaker *South Wind*.

With the help of the Americans the proposed 10 day change-over was completed in two days. Repstat was named 'Casey' and handed over to the 1969 winterers. It was an emotional moment for me when the flag was raised for the first time and I know we all had a sense of pride in what we had achieved in our year at Repstat.

ROD MACKENZIE (O.A.M.)


BRIAN RIEUSSET

Rod bands a giant petrel as part of the biology program; October 1968.

Profile: Rod Mackenzie

Rod Mackenzie was born in Melbourne and educated at Geelong High School. He began a plumbing apprenticeship in 1949 and served his National Service with the RAAF in 1954. In 1960 he became a plumbing inspector with the Geelong Waterworks and Sewerage Trust. After returning from Antarctica and a summer at Macquarie Island, Rod opened his own plumbing consultancy in Geelong. In 1979 he was elected to Parliament as the MLC for Geelong Province. He went straight to the front bench as the Shadow Minister for Public Works and in 1982 he became the Minister for Forests, Lands and Soldier Settlement. He was elected President of the Legislative Council in 1985 and became an Independent in 1988, until he lost the seat in 1992. He returned to Antarctica in 1997, visiting the Australian stations and the Russian station, Mirny. In 1999 he was awarded the Order of Australia for his services to the Geelong Community and in Antarctica. Rod has written a book about his time in Antarctica, which he hopes to self publish in 2009.

MAWSON TOONS

During the annual shutdown of Mawson station's kitchen, for maintenance, there were often 10 people in the kitchen at any one time, busily cleaning, repairing, painting and stepping over each other. What often looked like a circus, however, was a well coordinated operation.

G. FREEMAN

Mawson carpenter, Nick Cartwright, is as adept with the coloured pencils as he is with construction materials. As official cartoonist on station, Nick has captured the mundane, the unusual and the dramatic moments of station life in humorous weekly sketches. He spoke to Wendy Pyper about the inspiration and rationale behind his work.

Why do you draw cartoons?

Cartooning for me is that opportunity to portray 'what we all know' in a humourous way. While there is an abundance of filmic record of Antarctica, the drawn image has as an advantage in its rarity and therefore, novelty. There are other defining advantages. Primarily, that it is created *after* the fact, so there is no mechanical device required to be on hand at any precise moment, and the moment is experienced and enjoyed without interruption. Then in recreating the moment on paper, there is licence to stretch the truth and represent the physically impossible, the surreal and the absurd. This is where the cartoon comes into its own. It is where, apart from representing an *actual* physical incident, it can extend to include anything from simple moments of humour to flights of pure fantasy, often from fellow expeditioners just sitting around the dinner table.

Where did you learn your craft?

I have always drawn. My mother still laughs at her early attempts at 'teaching' me, and comforts herself in the notion that by completely disregarding everything she said, I have done alright. Along the way there have been a couple of mentors that have assisted me with advice and 'challenges'. And there was the period I spent with three female art student friends taking it in turn to strip and pose for each other, which was not the most unpleasant way to get an education. I have sculpted and painted, but through it all have maintained a fascination with the drawn line. In the early days it was the likes of Beano, Captain Hurricane, the Marvel Comics, and later, Heath Robinson, architects' and designers' sketches, the nouveau lines of Aubrey Beardsley, Heavy Metal comics, Manga, and the work of Shaun Tan.

The Home of the Blizzard lived up to its name in July. Expeditioners were entertained during lunch one day when Mawson doctor, Peter Tsminadis, walked out of the hydroponics shed carrying two bundles of fresh produce. He very quickly lost two of his lettuces in the wind, which took off towards Horseshoe Harbour with Peter and an assistant in hot pursuit. One lettuce was recovered, only to be blown away a second time and lost for good.

Have you produced cartoons for other purposes?

Over the years there have been numerous isolated creative projects, but the only steady illustration has been reserved for technical or construction works. This recent spate of cartooning was borne out of the predicament faced by the resupply voyage to Mawson last summer. A huge iceberg blocked the entrance to the harbour and numerous ideas were put forward by the ship's crew to obviate the problem. This spawned 'The Plan' series of drawings, several of which were printed onto t-shirts to mark that voyage. (Nick has also produced cartoons for a run of t-shirts for the Antarctic Division's 'Walk Across Antarctica' challenge and the same for the Davis station 'Bar & Café'.)

How did you end up in Antarctica?

Carpentry has allowed me to pursue my great love of travel, and I have been involved in building works from Melbourne to Sydney, Alice Springs, Central and Western deserts, and immediately prior to coming to Antarctica, the Tiwi Islands north of Darwin. I came close to applying for Antarctic work some years ago, but circumstances intervened.

More recently when I was close to finishing a contract on Melville Island the opportunity came up again. The transition from the tropical north to Antarctica was easy – I find the contrasts in life are what living is all about. I do sometimes get a strong desire for lush, green grass under my bare feet, or the feel of flicking the mangroves for a 'bite'. But I relax in the knowledge that it will happen again in the future, as will a return to this continent.

Scientist, Gary Miller, has been studying infectious bursal disease antibodies in emperor penguins at Auster rookery, near Mawson (see story on page 12). Despite years of experience, catching penguins is still tricky.

The remote Wilkins Runway camp was home to Matt and a small construction crew.

TODOR IOLOVSKI

Runway ends with Antarctic Medal

After 12 years working in often remote and tropical environments for the Australian Defence Force, former diesel mechanic, Matt Filipowski, never suspected he would end up with a pivotal role in ice runway construction in Antarctica. Nor did he suspect it would lead to an Antarctic Medal.

But a path to the white continent appeared when Matt took a job in the engineering workshop of the Australian Antarctic Division in 2001. Here he gained new skills in preparing vehicles for cold environments and sealing them against snow ingress. He also prepared vehicles and equipment destined for Wilkins Runway – the landing site for Australia's new Antarctic air service.

Then in late 2003, Matt went south as the Runway Construction Supervisor, responsible for all facets of ice runway construction, the runway crew, and transport between the runway and Casey station, about 70 km away.

The three-person team (up to seven people worked at the site in subsequent years) lived in a simple camp of shipping containers converted for sleeping, eating and ablutions. Camp comforts were minimal, with a small bedroom each, a communal area and an iridium satellite phone for contact with Australia and Casey station. The footprint of the camp was designed to be small for ease of operation, to minimise environmental impact, and to reduce cleanup after a blizzard.

The crew worked 12–14 hour days, seven days a week, with the occasional trip to Casey for food and fuel and a break from the remoteness and austerity of their camp. Initially, they worked closely with the experienced United States runway crew, to learn the art and science of constructing an ice runway – a compressed snow pavement atop glacial ice.

'When we weren't working, we were sleeping or eating,' Matt says.

'It was hard work, but it was challenging and satisfying. There was a strong sense of the significance and uniqueness of what we were doing, which was a big motivator, especially in times of frustration or challenge.'

Among the frustrations were the weather, and cold-related equipment breakages.

'Sometimes it would take a whole day to dig the vehicles out of the snow after a blizzard. Other times, if a part needed replacing and we didn't have one available, we had to wait for delivery on the next ship,' Matt says.

However, Matt says one of the biggest challenges for him was managing people in the unbroken, flat, white expanse of the runway site, where there was no other visual stimulation and no physical stimulation, such as a gym or games area.

'Most people managed the remoteness and confines of the camp well, but we all needed to have a break from the site occasionally,' Matt says.

ID PHOTOGRAPHICS

Matt (left) on the receipt of his Antarctic Medal from the Governor General, Major General Michael Jeffery.

'You learn a lot about yourself in these environments. You learn where your zenith of tolerance starts and finishes, and your coping mechanisms. In Antarctica you will be tested to the maximum of what you can cope with. But you do get to know what your capabilities are and others' expectations of you.'

In early 2007, after four summers in Antarctica (and two years of his life), Matt and his team finally graded the last of the glacial blue ice on the 4000 x 100 m ice runway. Later that year Matt was amongst the first people to land on the runway in the A319 aircraft.

Matt inspects the runway after the first landing of the Airbus.

CHARLTON CLARK

'When we landed for the first time I was excited, relieved and satisfied. Until that moment we were never 100 per cent certain it was going to happen. It was a fantastic culmination to the five years of hard work for the runway crew and all those that supported us – at headquarters, at home, in Antarctica, and in other Antarctic programs.'

In June this year Matt received the Antarctic Medal, which is awarded to individuals for 'outstanding service in scientific research or exploration, or in support of such work, in the course of or in connection with an Australian Antarctic Expedition'.

'It is an honour to receive this individual award,' Matt says, 'but for me it also recognises the committed and supportive team who worked with me, both in Antarctica and Australia.'

At the announcement of the award Federal Environment Minister, Peter Garrett, said: 'Matt has developed a vast knowledge of Antarctic operations and his leadership in the field has been of the highest order. He is an exceptional example to expeditioners, and during the long, hard slog to build the runway, he maintained a positive outlook in often difficult circumstances. His efforts have helped Australia maintain its leading role in Antarctic science'.

Matt is now the Mechanical Supervisor at the Australian Antarctic Division, responsible for supervising the mechanical maintenance staff in Antarctica, and managing the fleet of Antarctic vehicles and the repair and rebuilding of machinery. However, he will continue to provide advice and support for the ongoing maintenance of the runway during air operations.

M. BENEVENTE

Matt, second from left, smashes ice from a plaque during the official opening of Wilkins Runway in January 2008.

Matt is taking a break from the white continent this summer to enjoy some of his other passions; mountain biking and fresh fruit. But he expects the lure of Antarctica will draw him back soon enough.

'I'm looking forward to the challenges this new job will bring, but the unique challenges of working in Antarctica are difficult to replicate. It's an environment I work well in, and I hope I'll return.'

WENDY PYPER
Corporate Communications, AAD

More information:

For more information about Wilkins Runway see www.aad.gov.au/default.asp?casid=33752

For more information about the Australian Antarctic Medal and its recipients see www.aad.gov.au/default.asp?casid=12389

IN BRIEF

Director joins the ACE CRC


TARA HEWITT

After 10 years as Director of the Australian Antarctic Division, Dr Tony Press is leaving to take up the Chief Executive Officer position at the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) in early 2009. Dr Press has had a long career in science, natural resource management, public administration and international policy.

The ACE CRC is a collaboration between core partners – the Australian Antarctic Division, CSIRO Marine and Atmospheric Research, the University of Tasmania and the Bureau of Meteorology – and a consortium of other partners. The Australian Antarctic Division wishes Dr Press all the best in his new role.

Antarctic Chief Scientist moving on


JESSICA FITZPATRICK

After a decade of guiding Australia's science program in Antarctica, Chief Scientist, Michael Stoddart, is also leaving the Australian Antarctic Division.

Professor Stoddart joined the Division in 1998 after an impressive academic career in Scotland and the United Kingdom, and his appointment as Professor of Zoology at the University of Tasmania in 1985, and Deputy Vice-Chancellor at the University of New England in 1993.

His arrival at the Antarctic Division coincided with a push for an air link between Hobart and Antarctica. In 2004 he played a central role in a presentation to government of Antarctic science and the importance of an air capability.

Professor Stoddart has been a driving force behind Australia's coordinating role in the Census of Antarctic Marine Life – an International Polar Year project. Professor Stoddart will continue his work with the Census of Antarctic Marine Life until 2010 and his connection with the Antarctic programs of Malaysia and France.

Station Leaders for 2008–09

Antarctic and Macquarie Island stations leaders for 2008–09 are:

CASEY – Graham Cook


GRAHAM COOK

Graham returns to Antarctica after spending 2007 as the Davis Station Leader and 2005 as the Mawson Station Leader. Prior to that he spent three years in a dual role as Operations Manager with Federal Hotels' Strahan Village Resort, and Manager of Gordon River Cruises on Tasmania's west coast. Between 1991 and 2001 he was responsible for the operation of a number of remote Aboriginal community stores and Aboriginal enterprise developments in Arnhem Land in the Northern Territory, the Kimberley in Western Australia, the Tanami and Great Sandy Desert areas, and the northern Gold Fields of Western Australia. Graham has travelled extensively throughout South East Asia. He is a keen mountaineer, skier and bushwalker.

DAVIS – Bill De Bruyn


GLENN JACOBSON

Bill is a Divisional Superintendent with Victoria Police. Since joining the Victoria Police Force in 1972, at the age of 18, he has performed duties in all facets of policing, including task forces and crime squads. He has also been in charge of country and metropolitan police stations and major events such as the Australian Motorcycle Grand Prix at Phillip Island. He has won several national and state crime prevention awards. He and his wife Christine have two adult children – his daughter is a police woman and his son an electrical linesman. Bill is actively involved in his local football club and enjoys most outdoor sports.


GLENN JACOBSON

MAWSON – Peter Hackworth

Before joining the Antarctic Division Peter was the CEO of the Phylloxera and Grape Industry Board in South Australia. His favourite wine is currently Yalumba's 'Mawson'; a blend of cabernet, shiraz and merlot. Yalumba was a sponsor of Douglas Mawson's 1911–14 expedition and this wine was named in recognition of his achievements. Peter's other link to Mawson is his grandfather, who was a young crew member on the *Aurora* during its 1912 voyage to retrieve Mawson. Peter is a keen bushwalker, canoeist and cyclist. After pedalling around Europe, he and his partner Rosie established a cycling hire and touring business which they ran for a decade from the mid-80s. Peter has also worked with disadvantaged youth in an outdoor education capacity; in regional economic development in Victoria and South Australia; and for the Australian Competition and Consumer Commission.

MACQUARIE ISLAND – Jason Ahrens


BARRY BALKIN

Jason will perform the combined role of Station Leader and Building Services Supervisor at Macquarie Island. He was previously employed at Davis as the wintering Building Services Supervisor, senior plumber and Deputy Station Leader (*Australian Antarctic Magazine* 12: 36, 2007). Jason has extensive experience in the plumbing industry and in staff and contractor management. He has been a member of the Country Fire Authority in Victoria for 13 years.

Director's Awards 2008

During mid-winter celebrations this year Australian Antarctic Division Director, Tony Press, presented Director's Awards to:

- the Casey and Wilkins summer crew of 2007–08, for exemplary service in support of the inaugural season of the Antarctic Air Link;


GLENN JACOBSON

Air Link Project Manager, Charlton Clarke (centre), and General Manager, Kim Pitt (right), accept the Director's Award on behalf of the Casey and Wilkins summer crew.

- Aaron Spur, for exceptional service, leadership, teamwork and commitment in support of the Australian Antarctic program's (AAp) marine science activities;
- Robb Clifton, for exemplary personal leadership in the planning, support and conduct of operations during the AAp's 2007–08 summer season; and
- the Corporate Services Group, for consistently providing a high standard of administrative support to the AAp.

Australia formalised as home of international Seabird Secretariat

Hobart, Tasmania, became the official home to the Secretariat for the Agreement on the Conservation of Albatrosses and Petrels (ACAP) in June.

IAN HAY

Australian Antarctic Division Director, Tony Press (left), and Executive Secretary of the ACAP Secretariat, Warren Papworth, signed the Headquarters Agreement for ACAP, which established the Secretariat in Hobart.

The historic Headquarters Agreement for the Conservation of Albatrosses and Petrels is the culmination of negotiations between the Australian Government and other Parties to ACAP, to establish the Secretariat in Hobart, which has been the interim host in recent years.

Tasmania has a strong and long-standing commitment as a host to international Secretariats and organisations with an Antarctic or Southern Ocean focus, including the Commission for the Conservation of Antarctic Marine Living Resources, the Council of Managers of National Antarctic Programs, and the French Polar Institute's southern base.

Historic map preserved in National Archives

The Australian Antarctic Division has presented the National Archives of Australia with the first Australian map of the whole Antarctic continent, published in 1939.

'We decided this map belongs with the National Archives, which has the conservation expertise to ensure its preservation for future generations of Australians,' Australian Antarctic Division Director, Dr Tony Press, said.

National Archives Director-General Ross Gibbs said the map was an important part of Australia's history in the Antarctic and would provide a valuable resource for historians, scientists and researchers. The National Archives' brief is to preserve Commonwealth Government documents and ensure the public has access to them.

The handover of the map, originally produced by the Department of the Interior with an accompanying handbook, coincided with the 75th anniversary of the transfer of the Australian Antarctic Territory from Great Britain to Australia in 1933. In 1939 the map, which charts the claim, was created using details provided by pioneering expeditions and early flights over the southern continent.

IAN HAY

Tony Press (right) presents the 1939 map to National Archives Director-General, Ross Gibbs.

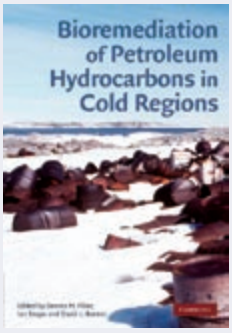
New Mawson's Huts Management Plan and web site

The *Mawson's Huts Historic Site Management Plan 2007–2012*, launched in June, sets out the direction of management of huts built and occupied by Douglas Mawson and his men during the 1911–1914 Australasian Antarctic Expedition. The site is regarded as Australia's most significant historic presence in Antarctica.

At the launch of the plan in Canberra, Environment Minister, Mr Peter Garrett, said it would ensure the proper care and conservation of the place Douglas Mawson called 'the home of the blizzard'. A number of expeditions by the Australian Antarctic Division and the Mawson's Huts Foundation have carried out a range of critical conservation work in recent years, and this work will continue. View the management plan and the new Mawson's Huts web site at:
www.mawsonshuts.aq/national-heritage/protection/managment-plans.html

Secretary's Awards

Many deserving Australian Antarctic Division staff received Departmental Secretary's Awards this year, in three categories. Atmospheric scientist, Gary Burns, was recognized for 'effective mentoring and role modeling'; the Business Support Team and analytical chemist, Greg Hince, were recognized for 'knowledge sharing within teams'; and Angela Doyle of the Polar Medicine Unit, was recognized for her 'consistent contribution to the Department's goals'.



Bioremediation in cold regions

Contaminants Geochemist, Dr Ian Snape, of the Australian Antarctic Division, has co-edited a practical guide to bioremediation in cold regions. The book, *Bioremediation of Petroleum Hydrocarbons in Cold Regions*, is targeted at environmental practitioners, industry and regulators, and was written by environmental engineers and scientists with first-hand experience of bioremediation in polar regions. The book contains in-depth discussions on regulations, identification and adaptations of cold-tolerant bacteria, contaminant transport in cold soils and permafrost, analytical methods, treatment, emerging technologies…and much more. Dr Snape and his colleagues in the Environmental Protection and Change program at the Antarctic Division have authored several chapters. The book is available from Cambridge University Press Australia for $199 – www.cambridge.org/aus/9780521869706

Magazine survey

Earlier this year a survey was conducted amongst Antarctic Division staff to find out what they like, or would like, to read in this magazine. A range of inspiring ideas were collected, some of which appear in this issue. Among these are an overview of the science season ahead (pages 17–18), and more historical articles (pages 24–26) and profiles of expeditioners and/or head office staff (pages 27–30). Interest was also expressed in international events and science programs, life on station, technology used in Antarctica, and operating aircraft in Antarctica. These and other ideas will continue to be integrated into future issues of the magazine. The Editor thanks participants for their ideas and suggestions and welcomes feedback from all readers via the email address magazine@aad.gov.au.

This photo, Snow petrel in flight*, was taken on Shirley Island, just across the frozen channel from Casey, during a walk with my Bureau of Meteorology colleague, Joel. It was early spring but already time for the Adélie penguins to start arriving. There was only one on the whole island, walking around and calling towards the open waters in the hope of finding a mate. Suddenly Joel said: 'Look there – a snow petrel!' As I had my camera already to my eye, photographing the ice cliff in the foreground, I looked straight through it and this is what I saw.*

FREEZE FRAME

Todor Iolovski has just spent his first winter in Antarctica working as a meteorology technician for the Bureau of Meteorology. Photography has been a serious hobby for Todor since he bought his first little Russian camera over 30 years ago. He says Antarctica is the most photogenic environment he has lived in and he hopes to convey its striking beauty through pictures. Todor won the $2000 *Pure Tasmania – Wayne Papps Prize* for his image *Wilkes – Forever in the Ice*, and a special commendation for *At the fringes of the Earth*, in the Antarctic Midwinter Festival Extreme Environment Photographic Competition in June this year.

ANTARCTICA valued, protected and understood

Australian Government
Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division

www.antarctica.gov.au