

SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR) – NATIONAL REPORTS 2007 – 2008
MEMBER COUNTRY: UNITED KINGDOM

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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS

Rock studies help crack questions of glacier thinning in West Antarctica

The first evidence of a volcanic eruption from beneath Antarctica's most rapidly changing ice sheet was reported in the January 2008 issue of *Nature Geosciences*. The volcano on the West Antarctic Ice Sheet erupted 2000 years ago (325BC) and remains active.

Krill discovered living in the Antarctic abyss

Reporting in the February 2008 issue of *Current Biology*, scientists from BAS and National Oceanography Centre Southampton describe their discovery that Antarctic krill live and feed down to depths of 3000m in the waters around the Antarctic Peninsula.

Rock studies help crack questions of glacier thinning in West Antarctica

Boulders the size of footballs could help scientists predict the West Antarctic Ice Sheet's contribution to sea-level rise according to scientists from BAS, Durham University and Germany's Alfred Wegener Institute for Polar and Marine Research. The latest findings from the Amundsen Sea glaciers were published in February 2008 issue of *Geology*.

Hibernation-like behaviour in Antarctic fish – on ice for winter

Scientists from BAS and the University of Birmingham revealed in the March 2008 issue of the journal *PLoS ONE*, that the Antarctic 'cod', *Notothenia coriiceps*, effectively 'puts itself on ice' to survive the long Antarctic winter.

Unmanned aerial vehicles mark robotic first for British Antarctic Survey

Scientists at BAS in collaboration with the Technical University of Braunschweig, Germany completed the first ever series of flights by autonomous unmanned aerial vehicles (UAVs) in Antarctica. The flights open up a major new technique for gathering scientific data in Antarctica's harsh and remote environment.

Antarctic ice shelf 'hangs by a thread'

In March 2008 BAS and the US National Snow and Ice Data Centre released dramatic satellite and video images of the Wilkins Ice Shelf that looks set to be the latest identifiable impact of climate change on the Antarctic environment. A large part of ice shelf is now supported only by a thin strip of ice hanging between two islands. The footage was broadcast on almost every TV station in the world.

Prestigious Descartes science prize awarded for 800,000 year old ice core

Ice core scientists from BAS are joint winners of a major European science prize. The European Project for Ice Coring in Antarctica (EPICA) - that revealed how Earth's climate behaved over the last 800,000 years - is one of three projects to be awarded the 2007 Descartes Prize for excellence in collaborative research.

Antarctica and the Global Climate System – J. Turner (BAS)

The UK is heavily involved with the SCAR Antarctica and the Global Climate System (AGCS) Scientific Research Programme. Dr John Turner (BAS) is Chair of the AGCS Steering Committee and Dr Alberto Naveira Garabato (NOC) and Dr Mike Meredith (BAS) are members of the committee. Dr Meredith also leads Theme 4 of AGCS on 'The export of Antarctic climate signals, to examine the means by which climate changes in the Antarctic can influence conditions at more northerly latitudes' and Dr Turner leads Theme 3 on 'Natural and anthropogenic forcing on the Antarctic climate system, including the production of regional-scale estimates of expected climate change over Antarctica during the next 100 years'. Dr Meredith also edits the AGCS newsletter *Notos*. UK scientists have contributed to several aspects of the scientific work of AGCS that have been identified as highlights, including:

- 1) The paper in *Nature* on 'Short-circuiting of the overturning circulation in the Antarctic Circumpolar Current' by Naveira Garabato et al.
2. The paper on 'Circumpolar response of Southern Ocean eddy activity to a change in the Southern Annular Mode' by Meredith et al that was published in *Geophysical Research Letters*.
3. The paper on improved predicts of Antarctic climate change over the Twenty First Century by Bracegirdle et al that has been submitted to the *Journal of Geophysical Research*.

In addition, Dr Meredith led the preparation of a major paper on the 'State of the Antarctic and Southern Ocean Climate System (SASOCS), which has been submitted to *Reviews of Geophysics*.

Antarctica's Gamburtsev Province (International Collaboration) – F. Ferraccioli (BAS)

Exploring the history of the East Antarctic ice sheet and lithospheric structure of the Gamburtsev Subglacial Mountains are primary goals of the International Polar Year (IPY). Scientists from several nations are working together to launch a flagship program to explore a major mountain range buried by a large continental ice sheet and bounded by numerous subglacial lakes. The combined projects under the AGAP partnership are multi-national and multi-disciplinary and include aerogeophysics, traverse programs, passive seismic experiments and ice core and bedrock drilling. The surveys are targeted at understanding the tectonic origin of these enigmatic mountains to provide crucial new inputs into ice sheet and climate models and provide key site survey support for the ice and bedrock drilling efforts. AGAP will address four fundamental questions:

- 1) What role does topography play in the nucleation of continental ice sheets?
- 2) How are major elevated continental massifs formed within intraplate settings but without a straightforward plate tectonic mechanism?
- 3) How do tectonic processes control the formation, distribution, and stability of subglacial lakes?
- 4) Where is the oldest climate record in the Antarctic ice sheet?

A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS cont/d

ICECAP (International Collaboration) – M. Siegert (Edinburgh)

The thickness of ice sheets and the topography and geology on which they flow are fundamental to appreciating their behaviour now, in the past and in the future. In central East Antarctica, such information is either absent or is based on limited data. ICECAP will undertake the first detailed airborne geophysical analysis of the Ridge B and Dome C regions of central East Antarctica, the Aurora Subglacial Basin to the north of Dome C and the Wilkes Basin to the East. Extensive radio-echo sounding (RES) will allow us to measure the ice thickness, englacial structure, subglacial topography, subglacial lakes and basal thermal conditions of these regions. Subglacial topography and ice thickness will be used as input to an ice sheet model, to determine how the flow of the ice sheet is affected by realistic topography. Internal ice-sheet layers will be used to construct ice accumulation rates both now and in the past, and to stratigraphically link the major ice divides in East Antarctica (including the Vostok and Dome C ice cores). In addition, airborne magnetic and gravity surveys will allow, for the first time, the identification of the detailed crustal structure of the central Antarctic Plate and its gross lithology. Data from the Aurora basin will be particularly important to investigations of Totten Glacier, which is undergoing surface elevation change. The results will fundamentally advance our understanding of the ice sheet and geological history of Antarctica. We will ensure that the data will be made available to the scientific community and, as with previous collaborative UK-US RES in East Antarctica, we anticipate that they will be a vital resource for many years.

Lake Ellsworth – M. Siegert (Edinburgh)

The exploration of Subglacial Lake Ellsworth in West Antarctica has two fundamental scientific aims: (1) to understand how microbial life can exist and develop in Antarctic subglacial lakes, and (2) to determine the age and history of the West Antarctic ice sheet. To meet these aims, we will undertake the direct measurement and sampling of water and sediment within Subglacial Lake Ellsworth in West Antarctica. Since Lake Vostok was shown to be a deep-water body beneath the Antarctic Ice Sheet, scientists have regarded subglacial lakes to be extreme yet viable habitats for microbial life. Additionally, sedimentary climate records are thought to exist on the floors of subglacial lakes, which would provide critical insights into the glacial history of Antarctica. Of the >150 known subglacial lakes, Lake Ellsworth stands out as an ideal candidate for exploration. Through a UK NERC-Antarctic Funding Initiative (AFI) award, glaciologists have shown the lake, beneath 3.2 km of ice, to be 10 km long, 2-3 km wide and 160 m deep, confirming it as an ideal deep-water lake for exploration. The deployment of heavy equipment has been shown to be possible at this location, based on several deep-field reconnaissance studies. This project will build, test and deploy all the equipment necessary to complete the experiment in a clean and environmentally responsible manner. Samples will be analysed and split at laboratories in the field and at Rothera Station, and then distributed to laboratories across the UK. This project, which has been in a planning stage for four years, will be a benchmark exercise in the exploration of Antarctica, will make profound scientific discoveries regarding life in extreme environments and West Antarctic ice sheet history, and will be of genuine interest to the public and media.

Antarctic Funding Initiative

The Antarctic Funding Initiative (AFI) is a non-thematic initiative of the UK Natural Environment Research Council (NERC) and is supported logistically by the British Antarctic Survey (BAS). Its objective is to promote wider participation in Antarctic research by UK universities and other academic institutions. Since 1998, 52 science projects have been funded to a total value of just under £14 million. See www.antarctica.ac.uk/afi.

International Polar Year 2007-2008

The IPY International Programme Office (IPO) is hosted by the British Antarctic Survey. The UK is involved in 96 of the 170 officially sanctioned science projects, and 15 of the 56 education and outreach projects. The four NERC-funded Arctic IPY consortium projects (ASBO, COBRA, ABACUS and HYDRATES) are well underway. See www.ipy.org. Summaries of projects involving scientists from the British Antarctic Survey can be found at www.antarctica.ac.uk/press/featured/ipy/media_summaries.php.

Polar View – Andrew Fleming (BAS)

Polar View brings together - for the first time - multiple satellite observations to provide timely data for polar monitoring. Via an international consortium funded by the European Space Agency, Polar View will deliver accurate, near-real-time information about sea ice conditions in the Arctic and Antarctic, data that other IPY projects working on ships in sea ice will be able to use to improve the efficiency of their operations.

LIMA – Andrew Fleming (BAS)

In November 2007, a team of researchers from NASA, the U.S. Geological Survey (USGS), the National Science Foundation (NSF) and British Antarctic Survey (BAS) unveiled the most geographically accurate, true-colour satellite photograph ever made of Antarctica. More than a thousand scenes captured during seven years of satellite observations have created the visually stunning Landsat Image Mosaic of Antarctica (LIMA). The virtually cloudless satellite view of Antarctica's frozen landscape provides much greater detail for the entire continent than has been available before. For the first time researchers and the public can explore Antarctica for themselves in a completely new way.