

SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR) – NATIONAL REPORT 2010-2011
MEMBER COUNTRY: UNITED KINGDOM

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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS

Underwater Antarctic Volcanoes Discovered in the Southern Ocean

During recent research cruises onboard the RRS James Clark Ross, UK scientists from BAS discovered previously unknown volcanoes in the ocean waters around the remote South Sandwich Islands. The programme of sea-floor mapping revealed 12 volcanoes beneath the sea surface — some up to 3km high. They found 5km diameter craters left by collapsing volcanoes and 7 active volcanoes visible above the sea as a chain of islands. This research is important for understanding what happens when volcanoes erupt or collapse underwater and their potential for creating serious hazards such as tsunamis. Also this sub-sea landscape, with its waters warmed by volcanic activity creates a rich habitat for many species of wildlife and adds valuable new insight about life on earth.

SPACECAST: A Major EU-funded Space Weather Initiative

Prof. Richard Horne (BAS) is leading the SPACECAST initiative, comprising an international group of space experts that is to be managed in the UK. The programme will develop forecasting models to help predict intense space radiation which causes damage to satellites used for positioning (GPS), communications, remote sensing and other applications. SPACECASE will have a warning system in place by March 2012 to respond to magnetic storms and provide forecasts and issue warnings of disruptive space weather events.

Census of Marine Life: a decade of discovery

UK scientists have played a key role in the Census of Antarctic Marine Life, a major international investigation to map the distribution and abundance of Antarctica's marine biodiversity. The IPY marks the end of this 5 year programme, a key component of the 10 year Census of Marine Life. The marine life in Antarctica is naturally vulnerable to the effects of warming sea surface temperatures, rising ocean acidification and decreasing winter sea ice. Understanding what lives in the Southern Ocean has helped to identify a benchmark against which scientists can measure the effects of climate change.

First results from Antarctica's Gamburtsev Province (AGAP) project

The AGAP team, lead by BAS and US scientists, discovered numerous large ice structures within Antarctica's Dome A region, which provide new understanding about ice sheet growth and movement that is essential for predicting how the ice sheet may change as the Earth's climate warms. Typically ice sheets grow when layers of snow are deposited on the surface, but the researchers found startling new evidence of growth at the base. Widespread re-freezing of large volumes of water to the underside of the ice sheet modifies its structure. In some places this process can account for up to half the ice sheet's thickness, and the growth caused by refreezing may be comparable to that occurring at the surface.

25th Anniversary of the Ozone Hole

In 2010, the 25th Anniversary of the discovery of the Ozone Hole was celebrated. In May 1985, reporting in Nature, Joe Farman, Brian Gardiner and Jonathan Shanklin (BAS) described their observations of large losses of ozone over Antarctica. The discovery of the ozone hole alerted the world to the dramatic and major environmental threat. The accumulation of chlorofluorocarbons (CFCs) used in refrigeration and air conditioning systems, and industrial solvents were found to deplete the protective layer of ozone that surrounds the Earth. Action by governments around the world led to the 1987 Montreal Protocol and its amendments.

Arctic Terns have the longest animal migration path in the world

Scientists from British Antarctic Survey (BAS), Greenland, Denmark, the United States and Iceland, successfully mapped the migratory movements using a tiny tracking instrument known as a geolocator. They confirmed that the Arctic tern flies more than 70,000 km on its annual migration trip from pole to pole. This represents the longest annual migration in the world, as the terns travel from Greenland to the Weddell Sea on the shores of Antarctica, and back again to their breeding grounds.

Integrated Ocean Drilling Program (IODP) Expedition 318

The UK provides a strong contribution to the IODP programme and the recent Expedition 318 was a success. Cores recovered from the Wilkes Land margin represent ~53 m.y. of Antarctic history from "greenhouse" to "icehouse" conditions across Antarctica. They record the onset and erosional consequences of the first glaciation and the subsequent dynamics of the waxing and waning ice sheets, all the way to thick, unprecedented "tree-ring style" records with seasonal resolution of the last deglaciation that began ~10,000 y ago.

ICECAP

This UK-US-AUS programme completed its third season of airborne geophysics of the Aurora and Wilkes basins in East Antarctica. The data has shed new insights into former ice sheet dynamics and size. In addition, the UK completed the first airborne survey of the Institute and Moller ice streams in West Antarctica that help us understand modern flow processes and how these have changed in the past.

A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS cont/d

Subglacial Lake Ellsworth and ATHENA

The UK-led programme to undertake the direct measurement and sampling of Lake Ellsworth in West Antarctica remains on track for exploration in December 2012. A comprehensive environmental evaluation of the programme has recently been submitted to the Antarctic Treaty Committee on Environmental Protection. The hot water drill is due to be completed and shipped to Antarctica in August 2011 and the timetable for completion is still on schedule.

ATHENA

A new Expert Group, ATHENA (Advancing Technological and Environmental Stewardship for Subglacial Exploration in Antarctica), has been proposed in the wake of SALE. Dr. Jemma Wadham (Bristol) is set to be co-chair of this group, with Matt Mowlem (NOC, Southampton) providing a link to the SLE team. The group aims to take subglacial aquatic research in Antarctica in new and important directions by coordinating and facilitating collaboration, specifically technologies and environmental stewardship to underpin current and future subglacial aquatic environment exploration.

Past and Future Change of the Antarctic Environment (PACE)

Proposals for a new SCAR scientific research programme, PACE, are being led by Dr. John Turner (BAS). The programme will address important questions on how the Antarctic climate system will evolve over the next century, in the light of our knowledge of past climate, as determined from in-situ data and paleoclimate record. The information gathered will work towards better predictions of global sea level rise, ecosystem response, and changes in regional, hemispheric and global climate. This will facilitate better Antarctica resource and infrastructure management and planning in the future.

Hyperspectral airborne and ground survey

An exciting new pilot study, led by Hugh Corr (BAS), collected hyperspectral airborne and ground survey data over the Antarctic Specially Protected Areas (ASPAs) near Rothera Research Station. BAS and Canadian collaborators, DRDC and ITRES, will use the survey data to develop a method of monitoring changes in vegetation extent and health of the ASPAs and other sensitive areas, which are likely to be affected by changing temperatures and visitor numbers.

Evolution and Biodiversity in Antarctica

EBA has been developing two new programmes over the last year and the UK component of this group has been strongly involved in this process through the UK co-chair Dr. Pete Convey (BAS). The first AntETR (Antarctic Ecosystems: Adaptations, Thresholds and Resilience) will look to determine the resistance, resilience and vulnerability of Antarctic biological systems to changes in their environment that may result from global climate change, invasive species, human impacts, and extreme events. The second is AntECO (State of the Antarctic Ecosystem) will examine what biodiversity is there, how it got there, why it is there, what threatens it, and also provide recommendations for its management and conservation. Biological diversity is the sum of all those organisms that dictate how ecosystems function, and underpins the life-support system of our planet. This programme has been designed to focus on patterns of biodiversity across terrestrial, limnological, glacial and marine environments within the Antarctic, sub-Antarctic and Southern Ocean regions.

Shallow Ice Cores from the Antarctic Peninsula

In a recent field season, Dr. Liz Thomas (BAS) successfully collected Antarctic Peninsula shallow ice cores to examine recent climate change. Two ice cores of around 135m each are likely to hold a record of climate over the last 200-300 years, enabling scientists to assess how far the warming, so obvious in the Peninsula, extends into West Antarctica.

West Antarctic Glacial Isostatic Adjustment

A team led by Matt King (Newcastle) and Mike Bentley (Durham), successfully retrieved data from a number of GPS stations across West Antarctica, as part of a project to obtain new crustal motion data to assess West Antarctic glacial isostatic adjustment.

PALEOPOLAR

This is a new project to investigate the impact of global disturbances on the evolution of life in the polar regions during the early Cenozoic (65 - 45 Ma), funded by NERC as part of the Long term Co-Evolution of Life and the Planet research programme. The team comprised Alistair Crame (BAS), Jane Francis (Leeds), Jon Ineson (Geus), Liz Harper (Cambridge), Dan Lunt (Bristol) and Stuart Robinson (UCL). After a successful field season on Seymour Island in 2010 laboratory work on palynology, palaeontology, geochemistry and molecular biology, as well as climate modelling are being undertaken to understand how Antarctic biotas survived several environmental disturbances in the past, ultimately resulting in the evolution of modern polar biotas.

A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS cont/d**History of the Antarctic Ice Sheet**

A team from the Universities of Leeds and Aberystwyth have undertaken a field season for their AFI funded project to investigate the size of the Antarctic ice sheet during the Last Glacial Maximum. The team collected glacial erratics in the James Ross Island region and will use cosmogenic exposure dating to establish how and when the erratics were carried to their present site, providing information about the previous size of the ice sheet and its effect on sea levels.

New Chair to UKNCAR

It is also worth noting that Prof. Martin Siegert has now stepped down as Chair to the UKNCAR, following completion of his term. Prof. Jane Francis has been elected to the position from 2011.