

## Avoiding the credit freeze

THE RECESSION must be biting hard. The British Antarctic Survey's website buckled under the weight of interest in its new recruitment campaign for chefs, electricians and plumbers on the planet's coldest continent.

Tony McLaughlan, an electrician already working at the survey's Rothera base on the Antarctic Peninsula, told John Humphrys on the BBC's *Today* programme what drove him to apply: 'The challenge. This has to be one of the most extreme and toughest environments in the world.'



Chef Alan Sherwood prepares a dinner for 100 staff at the British Antarctic Survey's Rothera research base on the Antarctic Peninsula.

Reuters/Alister Doyle

## THREE NEW FACILITIES LAUNCHED

THE NATURAL Environment Research Council has launched three new facilities for nanoscience, environmental metabolomics and bioinformatics

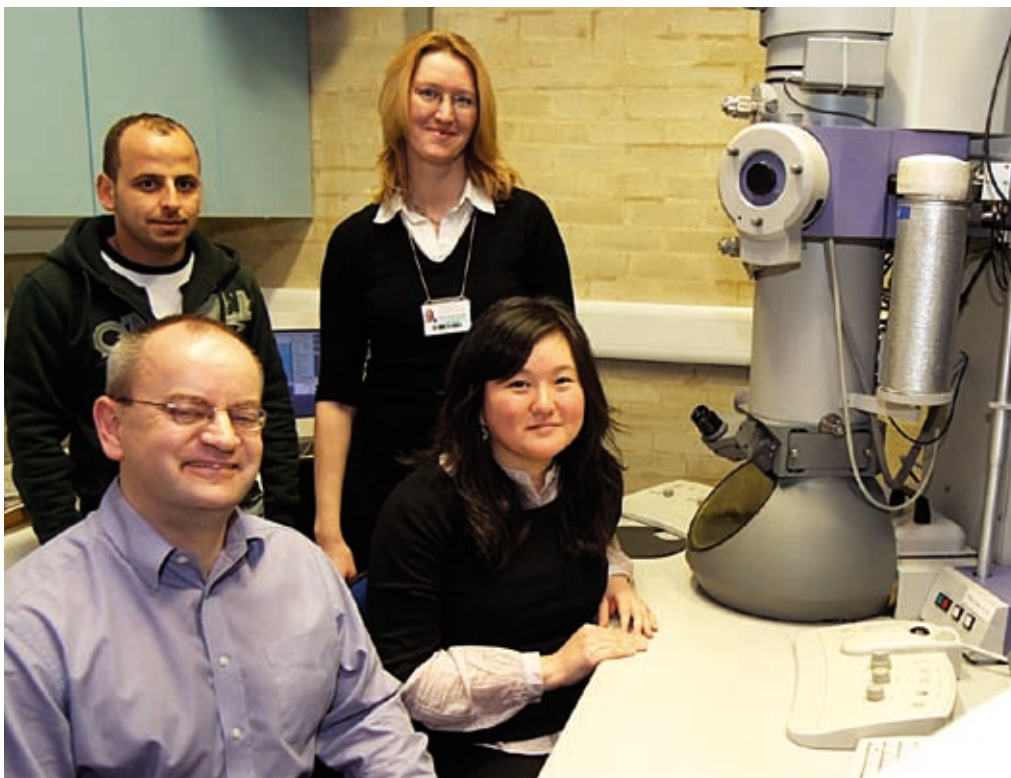
The Facility for Environmental Nanoparticle Analysis and Characterisation (FENAC) opened on 1 March. FENAC is based at the University of Birmingham

and will advise on experimental design and perform nanoparticle imaging, analysis and characterisation, and appropriate processing of data.

The existing NERC Molecular Genetics Facility (MGF), currently based at Edinburgh, Liverpool and Sheffield, is to expand, creating two new facilities: an Environmental Metabolomics node, based at the University of Birmingham, providing metabolite analyses; and a Bioinformatics node, based at the Centre for Ecology & Hydrology, Oxford, providing data generation, bioinformatics, access to the new Bio-Linux computing platform and the National Grid Service and GeneSpring software licences. Both new nodes will be launched on 1 April. To recognise these changes, MGF has adopted a new name: the NERC Biomolecular Analysis Facility (NBAF).

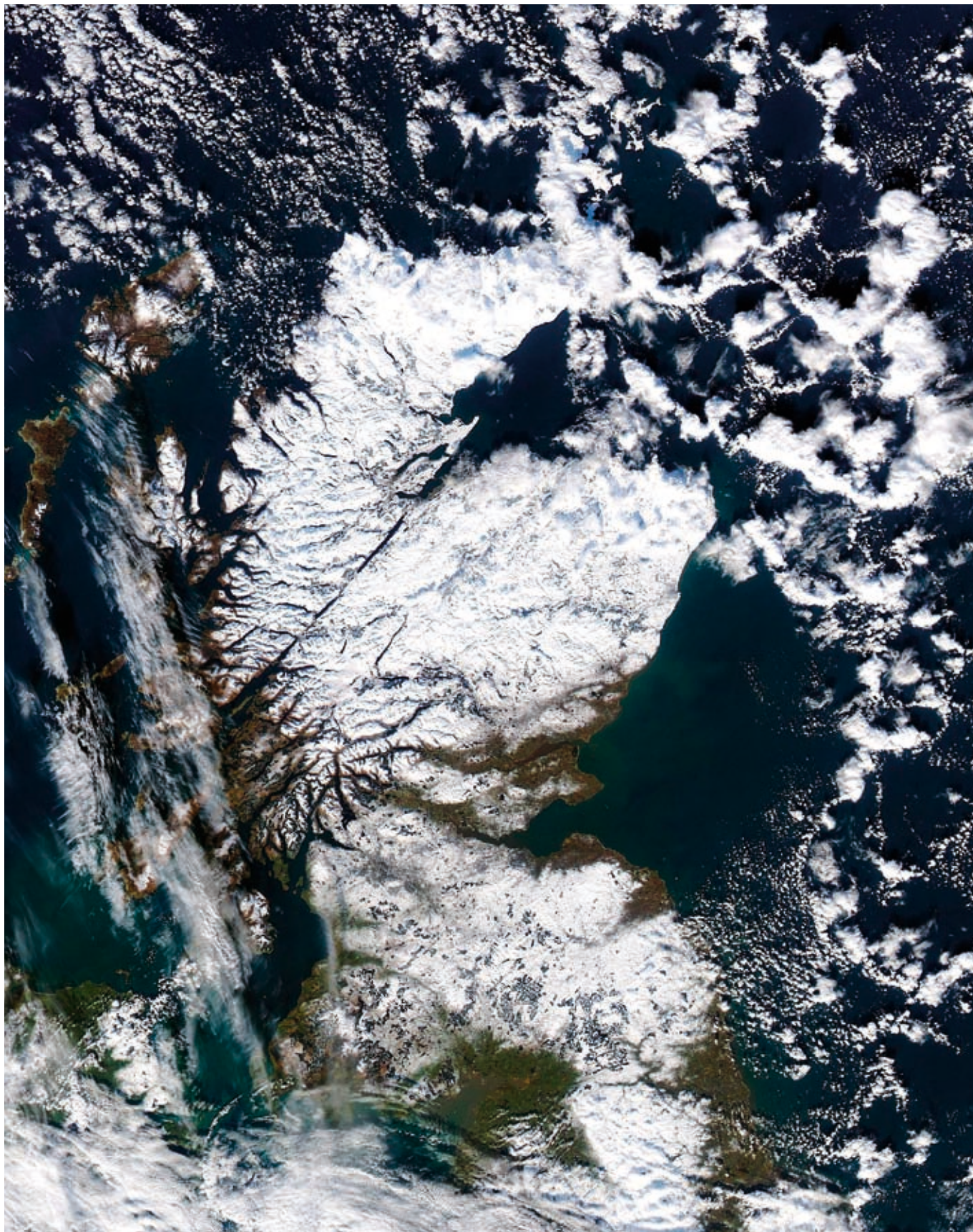
Applications for NBAF received before 17 April will be reviewed in May. Applications for FENAC received before 6 May will be reviewed in June.

[www.nbaf.nerc.ac.uk](http://www.nbaf.nerc.ac.uk)  
[www.gees.bham.ac.uk/research/fenac/index.shtml](http://www.gees.bham.ac.uk/research/fenac/index.shtml)



Front row: Nanoscience facility director Dr Jamie Lead, Dr Yon Ju-Nam. Back row: Dr Mohammed Baalousha, Dr Gillian Spicer.

## UK hit by coldest winter in 20 years



A blanket of snow covers Scotland, 11 February 2009. Satellite image processed by NERC's Dundee Satellite Receiving Station.

## Cosmic ray detector reveals sudden atmospheric warming



Two scientists work on the near detector of the MINOS neutrino experiment.

Peter Ginter

SCIENTISTS have found an unexpected use for data from particle physics experiments half a mile down a disused US mineshaft – detecting abrupt warming in the upper atmosphere.

The experiments were part of a multi-million dollar project called MINOS, which aimed to investigate subatomic particles called neutrinos. But as it turns out, the information they provide

on cosmic rays can be equally useful for atmospheric scientists, and may eventually help improve weather prediction and climate models.

Researchers from the UK's National Centre for Atmospheric Science and the Science and Technology Facilities Council discovered that background noise in the MINOS experiment can be mined for information about a phenomenon called

sudden stratospheric warming, which causes temperatures more than 30 kilometres up in the atmosphere to rocket, sometimes by as much as 40°C.

These episodes of sudden warming happen on average every other year. They are notoriously hard to predict, though scientists know they almost always occur in the northern hemisphere during winter. They are known to

affect weather conditions in the troposphere far below, but sensing them has always been difficult.

The work appeared in the journal *Geophysical Research Letters*.

For more information and to watch a movie of this research: [www.planetearth.nerc.ac.uk](http://www.planetearth.nerc.ac.uk) search: *cosmic*.



## SPONGE FOSSILS PUSH BACK DAWN OF ANIMAL LIFE

SCIENTISTS have found the oldest evidence for animals in the fossil record, pushing back the date of the earliest-known animal life by at least 100 million years, perhaps to as much as 750 million years ago.

The researchers analysed ancient rocks in the South Oman Salt Basin, off the south-eastern edge of the Arabian peninsula. They found chemical traces of early life,

or 'biomarkers', showing the presence of demosponges, a class of sponge that accounts for around 90 per cent of sponges living today.

This is the first proof that multicellular animals evolved before the end of one of the greatest ice ages ever to affect the Earth, known as the Marinoan period of glaciation. The research appeared in the journal *Nature*.

## Scientists rank climate cooling schemes

Victor Heuback Visions/Science Photo Library

GIANT sun shades in space, painting roofs white and fertilising the oceans with iron have all been proposed as ways to slow or even stop global warming.

But which ideas are worth further investigation and which are pure fiction?

Scientists from the University of East Anglia have published the first assessment of the climate cooling potential of various geoengineering schemes.

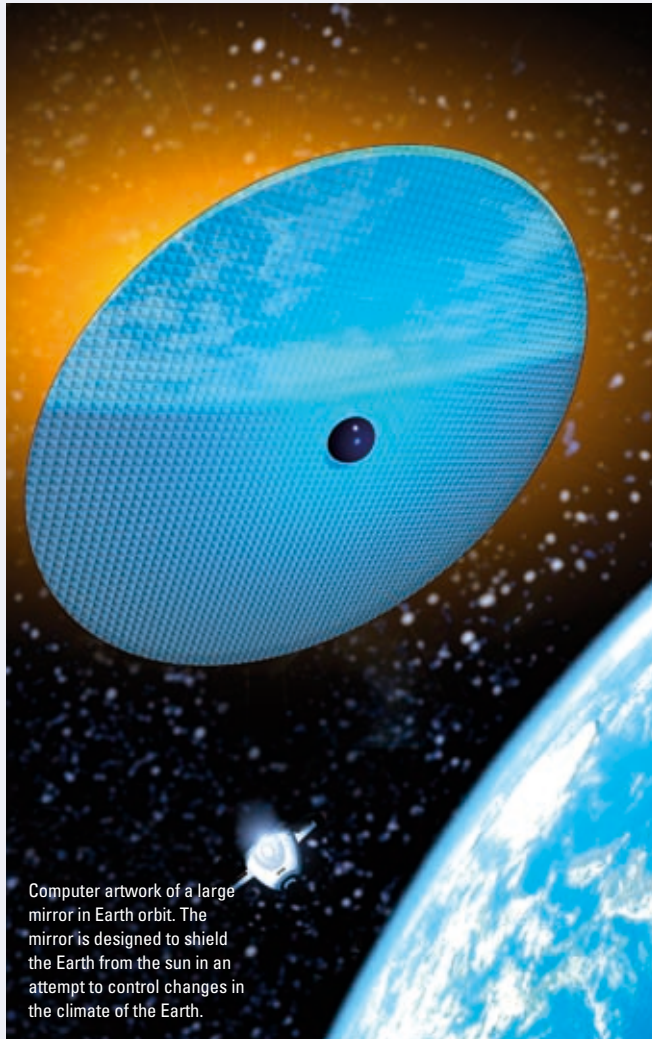
The research, partly funded by the Natural Environment Research Council, examined several ideas including: erecting sunshades in space; injecting tiny sulfate particles (aerosols) high into the atmosphere; covering deserts, roofs and roads in reflective material; growing shinier crops to reflect more sunlight; planting more trees; seeding clouds; and ramping up biochar production – turning plants into a type of charcoal in soil where it boosts crop productivity.

The paper, published in the journal *Atmospheric Chemistry and Physics Discussions*, states, 'On the face of it some encouraging results emerge from our analysis, but they come with very large caveats.'

Lead author Professor Tim Lenton says, 'We found geoengineering options could usefully complement mitigation, and together they could cool the climate, but geoengineering alone cannot solve the climate problem.'

The research, based on simple calculations of the effects of each solution, ranked the options in order of effectiveness by 2050, 2100 and then much longer time scales.

The biggest and most immediate cooling effect



Computer artwork of a large mirror in Earth orbit. The mirror is designed to shield the Earth from the sun in an attempt to control changes in the climate of the Earth.

comes from putting sunshades in space or injecting stratospheric aerosols. But these solutions also carry the greatest risks. Failure to replenish aerosols continually, for example, could lead to 'extremely rapid warming'.

An order of magnitude below that come chemical and biological methods of removing carbon dioxide from the air and shiny deserts, followed by planting more trees, biochar and changing the albedo, or reflectance, of cropland. Ocean fertilisation by iron, phosphorous or nitrogen has some merits, while other suggestions, on paper at least, look like a poor bet.

Lenton says the most surprising

result is that inadvertently adding phosphorous to the oceans, which societies already do on a large scale, may remove more carbon dioxide in the long term than the much-touted iron fertilisation.

The paper says, 'If our estimates are even remotely accurate, recent interest in ocean carbon cycle engineering is misplaced because even the more promising options are only worth considering on a millennial time scale.'

For more information on geoengineering see: [www.planetearth.nerc.ac.uk](http://www.planetearth.nerc.ac.uk) search: *geoengineering*.

## Effectiveness of iron fertilisation to cool planet questioned

A REGION of the Southern Ocean naturally rich in iron locks away up to three times more carbon than a similar area lacking in iron, according to research in the journal *Nature*.

This is the first time scientists have measured the amount of carbon falling to the deep ocean in a natural iron fertilisation system anywhere in the world. But the amount of carbon stored falls far short of estimates for artificially seeding the oceans with iron calculated by some geoengineers.

An international team of researchers led by Professor Raymond Pollard of the National Oceanography Centre, Southampton (NOCS) made the discovery around the volcanic Crozet Islands in the Southern Ocean. The sea on the north side of the island is iron rich due to the volcanic activity. The south side is relatively iron-free, making the region ideal as a natural laboratory.

For more information see: [www.planetearth.nerc.ac.uk](http://www.planetearth.nerc.ac.uk) search: *geoengineering*.



R T Pollard

A drifting sediment trap collects samples of sinking material.

## Drought turned Amazon from carbon sink to source

THE UNUSUAL and severe Amazon drought in 2005 led to the region emitting an extra five billion tonnes of carbon dioxide to the atmosphere. This exceeds the annual industrial emissions of Europe and Japan combined, according to research published in the journal *Science*.

The finding, part of a 30-year study, provides the first solid evidence that drought causes massive carbon loss in tropical forests, mainly through killing trees. This concerns scientists because some climate models predict that parts of the Amazon will dry out this century.

'For years the Amazon forest has been helping to slow down climate change. But relying on this subsidy from nature is extremely dangerous', said Professor Oliver Phillips from the University of Leeds and lead author of the research.

'If the Earth's carbon sinks slow or go into reverse, as our results show is possible, carbon dioxide levels will rise even faster. Deeper cuts in emissions will be required to stabilise climate,' he added.

The research was funded by the Natural Environment Research Council and the Gordon and Betty Moore Foundation.

A boat attempts to navigate a dried up section of the Amazon River near Uricurituba, in northern Brazil (4 October 2005).



Eufrasio Queiroz/AP/PA Photos

## Expedition to explore subglacial lake given go-ahead

Glaciologists using explosives as part of the survey of Lake Ellsworth, which lies deep beneath the Antarctic ice.



A UK-led international team of scientists is set to explore one of the planet's last great frontiers – an ancient lake hidden deep beneath Antarctica's ice sheet.

Buried under three kilometres of ice, Lake Ellsworth – the size of Lake Windermere – may have been isolated for hundreds of thousands of years and could contain unique forms of life. The team hopes the exploration will yield vital clues about life

on Earth, climate change and future sea-level rise.

In the next five years the researchers from nine UK universities, the British Antarctic Survey and the National Oceanography Centre plan to build specially-designed drills, a 'cryobot' and a 'hydrobot'. The team hopes to finally break through to the lake during the 2012-2013 Antarctic winter season.

## Freezing assets

The UK and Canadian governments have signed an agreement to share polar bases, icebreaking research ships, ski-equipped aircraft and other polar research infrastructure.

In March, scientists from each country met in Ottawa to work out how to pool scientific expertise and share knowledge, facilities and resources.

event in London in March. The centre brings together the UK's space experts to focus on the planet's biggest environmental challenges.

The launch is the start of a busy year for UK space science. Britain is the fourth largest investor in the European Space Agency. In 2009, the agency plans to launch three Earth observation satellites: GOCE, or Gravity and steady-state Ocean Circulation Explorer, the Soil Moisture and Ocean salinity mission, or SMOS, mission and CryoSat-2, which will monitor variations in the thickness of the continental ice-sheets and marine ice cover.

NCEO director Professor Alan O'Neill said, 'This is the beginning of a very exciting journey.'

## Science Minister launches Earth observation centre

Science Minister Lord Drayson launched the National Centre for Earth Observation (NCEO) at an



The GOCE satellite.

## Greenhouse gases shrouded Snowball Earth

THE SNOWBALL Earth theory – that ice sheets covered almost the entire planet during certain periods in Earth's history – has had one of its predictions confirmed.

New evidence from ancient Arctic rocks suggests that high levels of carbon dioxide in the atmosphere – normally associated with a warm climate – coexisted with the vast ice sheets.

Scientists have speculated for some time that an ice-bound Earth would lead to high atmospheric CO<sub>2</sub> levels, but the theory lacked independent

evidence. Now they have it in the form of rocks from Svalbard – a collection of islands between Norway and Greenland – that date from around 630 million years ago. At this time researchers believe the world was coming to the end of a so-called Snowball Earth period.

The paper, published in the American journal *Science*, states that 'the atmosphere (630 million years ago) had either an exceptionally high atmospheric CO<sub>2</sub> level or an utterly unfamiliar oxygen cycle.' Both possibilities fit with an Earth largely covered in ice and snow.

The scientists found surprisingly low levels of one particular oxygen isotope, <sup>17</sup>O. Recently, this has been linked to high levels of atmospheric carbon dioxide.

Co-author Professor Ian Fairchild, from the University of Birmingham, says, 'We found several aspects of the chemistry of the rocks that broke world records.'

For more information see: [www.planetearth.nerc.ac.uk](http://www.planetearth.nerc.ac.uk) search: *snowball*.

## Researchers raise concern about fragility of the global grain supply

A MAJOR STUDY of the vulnerability of Chinese cropland over the past 40 years has highlighted the growing fragility of the global grain supply.

The research, published in the journal *Environmental Science and Policy*, attributes drought and rapid urbanisation for this mounting exposure.

The UK team, led by Dr Elisabeth Simelton from the Sustainability Research Institute at the University of Leeds, used harvest and rainfall data to create an annual 'crop-drought vulnerability index'. An important part of this was an analysis of socio-economic factors that affect China's vulnerability to drought. As expected, the poorer landlocked regions were particularly sensitive to crop failure. What surprised the researchers was the exposure in wealthy coastal areas.

China produces 413 million tonnes of grain a year, or 18 per cent of the world total. The country, which is home to 1.33 billion people, claims it is 95 per cent self-sufficient for staple crops like rice, wheat and corn.



But rapid urbanisation, particularly in the south-east and by the coast, means less land is available to grow food, and space in some areas is saved for more profitable crops. The team report this is increasing China's vulnerability to harvest failure.

'China is a country undergoing a massive transformation, which is having a profound effect on land use,' says lead author Simelton. 'Growing grain is a low-profit exercise, and is increasingly being carried out on low-quality land with high vulnerability to drought.'

Funded by two Natural Environment Research Council programmes, the Quantifying and Understanding the Earth System programme and the

Rural Economy and Land Use programme, the team looked at China's three main grain crops: rice, wheat and corn. They compared farming areas with a resilient crop yield with areas that have suffered large crop losses with only minor droughts.

'What surprised us was that it was not just the poor regions in the west and centre where crop failure could be an issue; even the rich coastal areas and south-east are just as susceptible,' said Simelton.

'Quality land is increasingly being used for high-profit crops, such as vegetables and flowers. Let's say we have an El Niño year causing drought in the north and flooding in the south. China would be out on the world market for grain,' explained Simelton.

'If the same thing happened in India and Brazil, this would have a very big impact on food availability.'

The team plan to expand the analysis to sub-Saharan Africa.

For more information see: [www.planetearth.nerc.ac.uk](http://www.planetearth.nerc.ac.uk) search: *China*.

## PlanetEarth online

### PODCASTS



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- Ocean acidification

### OPINION

#### ■ Averting climate catastrophe

Dr Phil Williamson from the University of East Anglia discusses geoengineering and whether we should consider Plan B.

### BLOGS

- The Planet Earth blog

## Call for new members of the NERC Science and Innovation Strategy Board

NERC is calling for nominations to its key advisory board, the Science and Innovation Strategy Board (SISB).

Applications with the following backgrounds would be particularly welcome: physics, atmospheric sciences, geo- and palaeochemistry, marine biogeochemistry, geophysics, ecology, solar and terrestrial physics, or relevant business sector experience.

Members are appointed to SISB as individuals rather than as representatives of a particular organisation, and NERC aims to see that membership is balanced across public and private sectors and science areas wherever possible.

**Deadline:**  
Monday 8 June 2009.  
Appointments begin  
1 October 2009.

For further information please contact Mark Hinder [mark@nerc.ac.uk](mailto:mark@nerc.ac.uk) or tel: 01793 411537.



## Genomics computer system goes global

GENOMICS researchers worldwide now have access to a powerful new computing system, specially designed for environmental genomic scientists.

Intended users of the new system, known as NEBC Bio-Linux 5.0, range from students new to bioinformatics to teaching laboratories and genomics experts.

The system has been developed and released by the NERC Environmental Bioinformatics Centre (NEBC), based at the Centre for Ecology & Hydrology.

Researchers in North America, Europe, New Zealand, India, Iran, Africa and China have already taken advantage of Bio-Linux, and many more users are anticipated as the field of bioinformatics grows.

## Red sea anemone aids biomedical research

A NEW RED fluorescent protein could help improve imaging techniques and aid progress in biomedical research, say scientists.

Christened 'mRuby', the fluorescent protein is derived from one found in a bright red sea anemone discovered in the tropical ocean.

After it had been cloned and isolated, scientists improved the fluorescent protein through generations of random mutation and deliberate substitutions of amino acids.

Fluorescent proteins have found widespread use as markers for looking at biological systems at a molecular level. They can be fused to proteins or directed to certain compartments in a living cell. As the fluorescent proteins glow when stimulated by light of the right wavelength, they can

be used to highlight the cellular structures they are attached to.

Fluorescent proteins have already revolutionised biological imaging – so much so that the researchers who discovered the first example in a jellyfish were awarded the 2008 Nobel Prize for Chemistry.

## World's largest research effort finishes

Christian Mørch



THE WORLD'S largest internationally coordinated research effort, International Polar Year (IPY), ended in February with the launch of a report *The State of Polar Research* at an event in Geneva, Switzerland.

More than 60,000 scientists and support staff from 60 nations were involved in the two-year programme that attracted funding estimated at around \$1.2 billion.

IPY's international programme office was funded by the Natural Environment Research Council and based at the British Antarctic Survey's headquarters in the UK.

'International Polar Year came at a crossroads for the planet's future,' said Michel Jarraud, Secretary General of the World Meteorological Organization that, along with the International Council for Science, sponsored IPY.

'The new evidence resulting from polar research will strengthen the scientific basis on which we build future actions,' he added.

**More information:**  
[www.planetearth.nerc.ac.uk](http://www.planetearth.nerc.ac.uk)  
search: polar

## IN BRIEF

### Valuing Earth's life-support system

THE LINK between the health of the environment and the health of the economy is becoming clear. But how do we value the services, such as clean water and air, the natural world provides for free? NERC is sponsoring a three-day symposium (29 April – 1 May) in London organised by the Natural Capital Initiative to discuss the challenges.

### Environmental risk centre announced

ONE of the first centres to be accredited by the £1 billion Living With Environmental Change (LWEC) programme has been announced.

Cranfield University will host the collaborative centre of excellence in Understanding and Managing Natural and Environmental Risk.

Defra's Chief Scientific Adviser Professor Robert Watson said, 'This new centre will be at the forefront of finding ways to assess the risks of issues like flooding and animal and plant diseases.'

'The centre will ensure that state-of-the-art risk knowledge is incorporated in decision-making,' he added.

### British Geological Survey launches strategy

The British Geological Survey launched its new strategy, *Applied geoscience for our changing Earth 2009-2014*, at the Royal Society, London on 4 March. More information [www.bgs.ac.uk](http://www.bgs.ac.uk)



## Butterfly's 'impressions' fool ants

RORY BREMNER is famous for his impressions, but would they be good enough to infiltrate a royal household? Probably not, which makes the social-climbing antics of the Rebel's large blue butterfly all the more amazing.

According to research in the American journal *Science*, the endangered butterfly's pupae and caterpillars mimic the sound of queen ants to trick worker ants into cleaning and feeding them in preference to their own offspring.

Like our own towns and cities, ant colonies are complex hierarchical societies with highly developed communications systems. And, again like our own, these societies' success attracts unwanted attention from other species.

While ants fiercely defend their nests, about 10,000 species have evolved adaptations to infiltrate ant societies and feed on their rich resources.

The main ways ants communicate seem to be chemical signalling and touch.

But the international team of researchers found that queen ants make distinctive sounds. These sounds seem to confer a higher social status, with ants preferentially feeding the caller in times of shortage and protecting them from danger.

Using recordings made with a specially manufactured microphone, the research team played back the calls of Rebel's large blue caterpillars to nests of its host ant workers. The results demonstrate that once an intruding caterpillar has been admitted and accepted as a member of the host ant society, the mimicking of adult ant acoustics, particularly of queens, allow it to advance its seniority towards the highest attainable position in the colony's hierarchy.

Dr Karsten Schönrogge from the Centre for Ecology & Hydrology, an author on the paper, said, 'Our experiments showed that in response to the caterpillar's sounds, the worker ants protected them in a similar way to how they protect their own queens.'

## Scientists show African forests are major carbon sinks

TREES in African tropical forests are getting larger and this means they are net absorbers of carbon dioxide, according to new research.

The findings, published in the journal *Nature*, confirm that Africa's forests are second only to those of South America, which cover a bigger area, in locking away carbon dioxide that would otherwise stay in the atmosphere and disrupt the climate.

Based on long-term monitoring of around 70,000 trees in 79 one-hectare plots across ten African countries, these are the first direct observations on biomass change and carbon absorption in African forests that are of comparable rigour to previous Amazonian studies.

The researchers analysed the African results in combination with existing data on South American and Asian forests. The results, based on monitoring over time of some 250,000 trees, show that tropical forests remove about 4.8 billion tonnes of carbon dioxide from the atmosphere every year. African forests account for 1.2 billion of these.

This cushions the effect of human emissions on the climate. But it won't do so for ever. 'We are receiving a free subsidy from nature,' says lead author Dr Simon Lewis from the University of Leeds. 'Tropical forest trees are absorbing about 18 per cent of the carbon dioxide added to the atmosphere from burning fossil fuels, substantially buffering the rate of climate change.'

So far this capacity even seems to be increasing – it's not certain why, but researchers think the extra carbon dioxide in the atmosphere could be acting like a fertiliser and letting plants grow more quickly.

## EVENTS

**21 & 24 April**

### **NERC community events**

For NERC grant-holders, stakeholders and staff in centres. 21st, Scottish Exhibition Conference Centre, Glasgow. 24th, Holland House Hotel, Bristol

**29 April - 1 May**

### **Valuing Our Life Support Systems**

[www.naturalcapitalinitiative.org.uk](http://www.naturalcapitalinitiative.org.uk), London

**16 June**

### **25th anniversary of the reintroduction of the large blue butterfly**

National Trust's Montacute House, Somerset

**25 June**

### **Environmental Nanoscience Initiative**

Houses of Parliament, London

**30 June - 4 July**

### **Royal Society Summer Science Exhibition**

The Centre for Ecology & Hydrology exhibition on the harlequin ladybird. The University of Bristol exhibition on using organic chemistry to understand how the Earth worked in the past. London

### **31 August - 4 September World Climate Conference**

Climate prediction and information for decision-makers.

World Meteorological Organization, Geneva

## Mountain range the size of the Alps surveyed beneath Antarctic Ice Sheet

A MASSIVE yet enigmatic mountain range as big as the Alps lying deep beneath Antarctica's ice has been surveyed in detail for the first time.

The expedition, one of the most ambitious and challenging during International Polar Year, has captured the first clear picture of the mysterious Gamburtsev subglacial mountains.

The seven-nation team of researchers set out last November on a geophysical mission to capture the first glimpse of a landscape buried under up to four kilometres (2.5 miles) of ice. They returned to the UK in February with data showing that some of the mountain peaks may be less than 500 metres below the surface of the ice.

The Gamburtsev mountain range was discovered in 1958 during International Geophysical Year by a Soviet Antarctic expedition and named after Grigoriy Gamburtsev, a Russian geophysicist. It is positioned deep

in East Antarctica, lying below the highest, and perhaps the coldest, place on the East Antarctic Ice Sheet – Dome A.

Researchers think it could be the birthplace of the vast East Antarctic Ice Sheet that covers 10 million km<sup>2</sup> of our planet – an area the size of the United States.

The mountains are unusual because they are situated in the heart of Antarctica. Ranges like the Himalayas, Andes and Rockies form when continents collide and crunching tectonic plates force peaks upwards. This explanation does not fit easily with what polar researchers know about the Gamburtsev range. Mountains can also form above volcanic hotspots like Hawaii, but so far, no volcanic activity has been found in the region.

Geologist Dr Fausto Ferraccioli from the British Antarctic Survey said, 'We really can't understand what these mountains are doing in the centre. It really is an enigma.'

Working for weeks at high



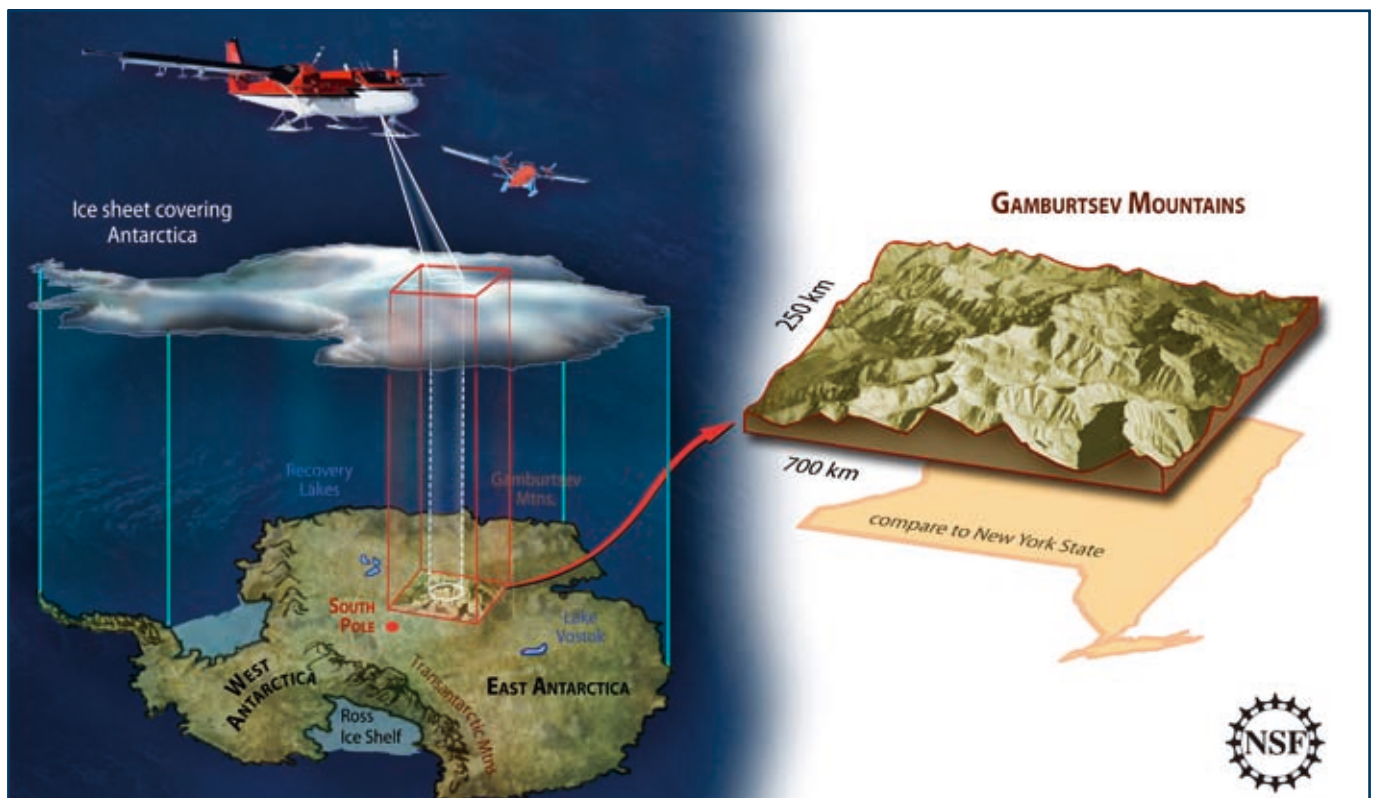
A seven-nation expedition team came together to explore the mountain range.

altitude the science teams set up two remote field camps on both sides of Dome A. In some of the harshest conditions imaginable with temperatures averaging -30°C, the researchers flew two survey aircraft over the ice sheet. The aircraft covered 120,000km, the equivalent of three trips around the globe. Over 20 per cent of the East Antarctic Ice Sheet was explored with state-of-the-art radar, aeromagnetic and gravity sensors.

Ferraccioli said, 'This

is a fantastic finale to the International Polar Year. The most interesting thing about our findings is that there definitely is a huge mountain range beneath the ice. Before this expedition we only knew of its existence from quite sparse information taken during the Russian expedition.'

The expedition, named the Antarctica Gamburtsev Project or AGAP, involved researchers from the UK, the US, Germany, Australia, China and Japan.



## Horses domesticated 1000 years earlier than previously thought

THE EARLIEST known evidence of horse domestication has been unearthed in Kazakhstan in central Asia. New research suggests the Botai Culture have been riding horses and using their milk for the last 5500 years.

This is around 2000 years before horses were domesticated in Europe and 1000 years earlier than previously thought for Kazakhstan.

The findings could point to the beginnings of horse domestication and the origins of the horse breeds we know today. Archaeologists argue that it was the domestication of horses that opened the way to trade, warfare, transportation, agriculture and many other aspects of human civilisation. Horses were harnessed to chariots and carried archers into battle. They played a major role in the expansion of the Roman Empire, helped secure the 13th-century conquest of China by the Mongols and were used in the First World War to move artillery.

### Three lines of evidence

Previous research traced horse domestication back to around 4500 years ago. But the new analysis – published in the American journal *Science* – used three independent lines of evidence to show that humans and horses lived in close



Wild horses of Kazakhstan.

association earlier than this. The study, led by Dr Alan Outram from the University of Exeter and Professor Richard Evershed at the University of Bristol, found that horses were not just used for riding. They were also used for food, including milk.

Outram's team – including researchers from the University of Winchester, the Carnegie Museum of Natural History in Pittsburgh, USA, and Kokshetau University in Kazakhstan – studied material from the Eneolithic site of Botai in northern Kazakhstan.

The researchers looked for a strip of wear on horses' front teeth for evidence of 'bit damage' – caused by horses being harnessed or bridled. They also wanted to see if the lower jaw bone has changed as a result of being harnessed. Their results showed the horses had

been harnessed, which raises the possibility they were also ridden.

Using a new method of fat-residue analysis that exploits differences in carbon and hydrogen isotopes, they found traces of fat from horses' milk on Botai pottery. Mare's milk is still drunk in Kazakhstan, a country in which horse traditions run deep. The milk is usually fermented into an alcoholic drink called 'koumiss'. While it was known that koumiss has been produced for centuries, the study shows it dates back to the earliest horse herders. 'This is the first time anybody has been able to show such early horse milking,' says Outram.

### Horses selected for breeding

The team also looked at the shape of the lower leg bones in the horses found at Botai. They discovered slender bones that are similar to bones from horses living in the Bronze Age – a time when horses were widely used by people. Bones from wild horses from the same region from the Pleistocene era are much stockier. This may mean people selected wild horses for their physical attributes, which were then exaggerated through breeding.

Outram's results show clearly that people in Kazakhstan were using horses much earlier than originally thought. 'The

three different techniques all tell the same story. They really seal it,' says Outram. 'This is significant because it changes our understanding of how these early societies developed. The domestication of horses is known to have had immense social and economic significance, advancing communications, transport, food production and warfare,' he adds.

The steppe zones, east of the Ural Mountains of northern Kazakhstan, were a prime habitat for wild horses thousands of years ago. Indigenous cultures hunted wild horses for generations. They fashioned tools from horse bones and turned horse hides into thongs.

Throughout most of their history, the Kazakh people lived nomadic lives. But at some point they started settling down. The reason for this could be horse domestication.

Outram and his team's research suggests that horses were domesticated in preference to cattle, sheep and goats, which were a later addition to the prehistoric economies of the region. 'Horses can live in a wide variety of grasslands and are used to very cold winters. They can graze, whereas cattle need fodder,' he adds. 'These people didn't have other domestic animals at this time.'

Fermented horse milk is a popular alcoholic drink in Kazakhstan.

