

11 January 2006
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Scientific Committee on Antarctic Research
Scott Polar Research Institute
Lensfield Road
Cambridge
CB2 1ER
United Kingdom

attn.: SCAR Executive Director Colin P Summerhayes

Submission of application for Associate membership of SCAR

On behalf of the Danish Polar Center, I have the pleasure to submit the official application for an associate membership of SCAR.

I trust that the outcome of the hereby initiated process will lead to a membership with mutual benefits for the parties involved.

On behalf of the Danish polar research community, we shall be looking forward to participate as an active member in the international cooperation of Antarctic science.

Thank you very much in advance.

Yours sincerely,



Hanne K. Petersen
Director



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**Application for Associate Membership of the
Scientific Committee on Antarctic Research (SCAR)**

Submitted to SCAR
by
Danish Polar Center

in agreement with
the Royal Danish Academy of Sciences and Letters

11 January 2006

Introduction

Denmark includes in its realm Greenland and has for centuries been involved in polar research. Traditionally, Danish polar research has been concentrated on the Arctic, especially Greenland.

During the second half of the 20th century, Danish polar research has become increasingly international in perspective and in scientific relations, as the global and bipolar aspects of polar research have grown in importance, addressing subjects such as climate change and long distance transportation of contaminants.

The International Polar Year (IPY) has stressed the importance and need for bipolar cooperation and it is obvious that the Danish scientific society will benefit from gaining official access to a stimulating and vital forum like SCAR.

This application is submitted to SCAR by the Danish Polar Center (DPC). DPC is an agency under the Danish Ministry for Science, Technology and Innovation, and is also the secretariat for the Danish National IPY Committee. DPC is a knowledge and service centre to researchers and institutions dealing with polar research and arctic matters, to Danish authorities, and to the Danish public in general. DPC represents the official Danish polar research interests in international fora and partakes in international polar research cooperation, e.g. through International Arctic Science Committee (IASC) and European Polar Board (EPB).

Polar research in Denmark takes place in a number of universities and governmental research institutes. Most funds for research must be applied for in competition with non-polar projects. The Danish National IPY Committee is coordinating the planned IPY activities of Denmark and Greenland and disseminates the results.

Denmark is non-consultative member to the Antarctic Treaty since 1965. In June 2005, DPC submitted a note to the SCAR Executive Committee about the intention of applying for a Danish associate membership of SCAR to be announced by the Executive Committee at the meeting in Sofia (July 11-13, 2005).

Submitted by the Danish Polar Center

What Denmark hopes to contribute to and gain from SCAR

Denmark has a long tradition of scientific research in the Arctic and will hopefully contribute to the Antarctic scientific community with new knowledge, experience and data from this research.

A membership of SCAR would mean greater opportunities for using this experience and skills. The 2004-2010 research programmes of SCAR are all relevant for Danish researchers.

A membership of SCAR would highlight in Denmark both the Arctic and Antarctic research as natural scientific fields, especially among young researchers.

A membership would also facilitate participation in networks and getting news about upcoming Antarctic projects.

Denmark is a member of IASC and will be able to support the process of developing stronger linkages between SCAR and IASC. By its participation in SCAR, Denmark could further contribute to influencing action under the Antarctic Treaty, which SCAR advises.

A few Danish scientists have already participated in Antarctic projects as part of international cooperation. As examples, Danish researchers participated in designing and building pulsed radar systems to measure the thickness of the ice sheet from the air, have participated in ANSMET (Antarctic Search for Meteorites), and were a leading part of the European Project for Ice Coring in Antarctica (EPICA) with deep drilling at Dome C and Dronning Maud Land.

Future plans

Galathea 3 Expedition

The Galathea 3 voyage will set out in August 2006 and continue until April 2007. The goal is to stimulate general interest in research and natural sciences in the Danish public, especially the younger generations. The voyage will be a circumnavigation with a Danish naval inspection vessel, and the route around the world includes Antarctic seas. The vessel will be refitted with suitable winches, cranes, container-laboratories, etc. to carry through scientific work along the route. A number of scientific projects, including Antarctic projects, will be implemented onboard or deployed on land areas adjacent to the sea route. The planned Antarctic projects are listed in Annex 1.

International Polar Year

The IPY represents a unique possibility to raise the awareness of polar aspects in Denmark and strengthen the polar research. In cooperation with polar researchers in Denmark and Greenland, the National IPY Committee has started the process of increasing public appreciation of the importance of polar research and of stimulating the interest for a cross-cutting political and financial support of the forthcoming national engagement in IPY. Danish and Greenland researchers are showing an overwhelming interest in participating in IPY with their own projects or

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as partners in foreign activities. Currently, c. 250 national researchers are directly involved in the planning and preparation of 58 IPY consortia. Most of these consortia deal with research topics in, around or about Greenland, but a small number is bi-polar of nature and therefore also addresses antarctic issues. Descriptions are included in Annex 1.

Nordic and International Cooperation

Denmark, Norway, Sweden, Finland and Iceland have established a Nordic Forum for Polar Research. Norway, Sweden and Finland are already cooperating on Antarctic expeditions, and Denmark will seek to obtain access to Nordic research facilities in Antarctica, as well as to other international cooperation.

Protection of the Antarctic Environment

DPC will agree to comply with the Principles of Protection of the Antarctic Environment recommended by SCAR.

The primary objective in protecting the Antarctic is to avoid or minimize disturbance by human activity. The principles, recommended by SCAR to achieve this, comprise:

- conservation of the diversity and integrity of natural phenomena and systems, both in the context of Antarctica and Planet Earth;
- preservation of the genetic diversity of indigenous biota by ensuring that adequate representative populations of animals and plants are maintained *in situ*;
- prevention of the introduction and establishment of non-indigenous species to the greatest extent possible;
- conservation of unique natural features, localities or complexes of features and sites of historical importance, which should remain undisturbed;
- protection of cultural values, such as scenic beauty and inspirational quality, wilderness status and recreational potential.

Copenhagen, Denmark

11 January 2006



Danish Polar Center

Hanne K. Petersen
Director

**ANNEX 1:
Research Projects Proposed under the Danish Antarctic Scientific Programme**

Title	The marine carbon cycle from North to South along the Galathea route
Objective	To investigate the role of the ocean in absorbing extra CO ₂ introduced to the atmosphere through human activities
Summary	Scientists from 5 different institutions in Denmark are proposing a project to be performed on the Galathea III expedition. The purpose of the studies proposed is to investigate the role of the ocean in absorbing "extra" CO ₂ introduced to the atmosphere through human activities. Measurements will be made continuously onboard the ship over the entire cruise track. In this manner, it will be possible to develop a global estimate of the role of different ocean regions in ocean-atmosphere carbon exchange. Such studies are crucial in order to improve modelling activities aimed at predicting future atmospheric concentrations of CO ₂ and in order to discern the role of the oceans in mediating global climate change. Physical and chemical measurements will be made in the atmosphere. In the ocean, measurements will be made on biological processes relating to the turnover of carbon in surface waters. In addition, physical, chemical and biogeochemical measurements will be made in surface waters. Many measurements can be made while the ship is sailing (on air and water pumped onboard). For others, the ship will either have to stop and take samples or slow down in order to be able to tow instruments after it. The proposed study is linked to a number of international research initiatives and the Galathea route gives an absolutely unique opportunity to study the ocean on the global scale
Contact	Professor, PhD Katherine Richardson Christensen
Institution	University of Aarhus, Institute of Biology
Region	60°-65°S / 150°W-70°E in the South Pacific Ocean
Timeframe	December 2006 – January 2007

Title	DNA of the Polar Seas
Objective	To investigate and describe the little known microbiological diversity of the polar marine environments through genetic fingerprinting of specific environments of microorganisms using meta-genome analysis
Summary	Less than 1% of all existing micro-organisms have been cultivated and analysed. The remaining 99% have not yet been discovered or have proved to be uncultivable in labs. For 400 years Denmark has launched expeditions to extend our cultural, economic and scientific horizons. Each expedition has brought new knowledge, that has improved and strengthened the position of Danish natural science. Galathea 3 will, like its predecessors – become a trail blazer for Danish basic research and provide new discoveries and stimulate the interest for both the classic and the innovative natural science areas. The present project will add a new dimension to the Galathea 3 expedition by penetrating into the abyss but also by entering into the smallest biological dimension. The project, demonstrating how new discoveries at the DNA

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	level have practical applications, will be composed of a scientific bioinformatic part as well as a outreach and applicability part.
Contact	Associate Professor, PhD Nikolaj Blom
Institution	Technical University of Denmark, Centre for Biosequence Analysis
Region	60°-65°S / 150°W-70°E in the South Pacific Ocean
Timeframe	December 2006 – January 2007

Title	Antifreeze protein systems in Antarctic fish
Objective	To investigate the antifreeze proteins in the Antarctic Silver Fish <i>Pleurogramma antarcticum</i> , their strategies, prevalence and evolution.
Summary	Fish in polar and temperate seas are – year round or seasonally- subjected to ice crystals in water colder than –1.9°C. These fishes often have ice crystals in the blood because they need to drink sea water holding tiny crystals or because the crystal penetrate the gill membranes. The freezing point of fish blood is c. –1°C. Therefore, the fish are super-cooled by 0.9°C when the surrounding sea water reaches – 1.9°C. Without a freeze guard the body fluids of the fish will instantly become solid when they get in contact with an ice crystal. The core of the guard system are the so-called antifreeze proteins, a group of proteins that recognizes the ice crystal surface, adheres to it and prohibits the growth of the crystal. In an evolutionary perspective antifreeze proteins are fascinating and the project involves comparison between strategies and convergent evolution in Arctic and Antarctic antifreeze proteins.
Contact	Associate Professor, PhD Hans Ramløv Mortensen
Institution	University of Roskilde, Dept. of Life Sciences and Chemistry
Region	60°-65°S / 150°W-70°E in the South Pacific Ocean
Timeframe	December 2006 – January 2007

Title	Ice, ocean topography and ocean level in Antarctic waters
Objective	By airborne laser altimeter, GPS and inertia entity to measure selected profiles along sea ice, shelf ice and ice sheet.
Summary	Gravity measurements provide improved description and characterization of both geoid and ocean currents as well as the core structure of the Earth. Antarctic bases with absolute gravimetric stations will be visited. While in Antarctic waters geodetic GPS equipment will be applied to also collect data from Ross' lceshelf and Pine Island Glacier.
Contact	Senior Geodesist Rene Forsberg

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Institution	Danish National Space Centre
Region	60°-65°S / 150°W-70°E in the South Pacific Ocean
Timeframe	December 2006 – January 2007

Title	The earliest multi-cell organisms from Antarctica
Objective	To search for new evidence of the earliest multi-cellular life in Antarctica in order to elucidate the ancient sedimentation scenario and the early geological history of the continent
Summary	540 million years ago life proliferated rapidly in the primeval ocean. The niche of the uni-cellular organisms was supplemented and taken over by multi-cellular animals with complex structures and organs. This event is called the Cambrian Explosion, richly documented in the northern hemisphere but very scarcely so in the southern hemisphere. This presents a problem as the identification of fossils with a limited geographical distribution has been fundamental in assisting the reconstruction of the continental drift through geological periods. Because Antarctica, during the past 500 million years, has played a central role in relation to other continents, a joint team of researchers from University of Copenhagen and the Geological Survey of Denmark and Greenland will look for new evidence of the earliest multi-cellular life forms in Antarctica. The remote and inhospitable mountain ranges in the northeast Antarctica will provide the field settings of this project. The outcome of the project is expected to be an increased knowledge about the earliest multi-cellular organisms in Antarctica, the primeval sedimentation scenario as well as the geological history of the continent.
Contact	Professor, PhD David A. T. Harper
Institution	University of Copenhagen, Geological Museum
Region	60°-65°S / 150°W-70°E in the South Pacific Ocean
Timeframe	December 2006 – January 2007

Title	Deep sea fishes – The evolution of Polar fishes
Objective	To sample specimens of fishes from 500-4000 m depth in Antarctic and sub-Antarctic waters
Summary	The fish species sampled in Ross Sea, Amundsen Sea and Bellingshausen Sea around Antarctica will provide material for taxonomic and phylogenetic analyses of the evolution of Polar fishes, especially the diverse families of Liparidae and Zoarcidae. The evolutionary history of these families is almost unknown and any relation between Arctic and Antarctic taxa remains an open question. Combining fish material from Greenland and Antarctica in morphologic and molecular kinship analyses will allow for the testing of theories on how Polar organisms may

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	disperse from one Polar region to the other through the abyssal waters in the Tropical region. The project will use a 15m shrimp trawl or a Agassiz trawl through two selected transects in each of the three Antarctic seas. Trawling will take place from the continental shelf slope and downwards into the abyssal zone.
Contact	Assistant Professor, PhD Peter Rask Møller
Institution	University of Copenhagen, Zoological Museum
Region	Ross Sea, Amundsen Sea and Bellinghausen Sea
Timeframe	December 2006 – January 2007

Title	Ice crystals – a comparison between ice cores from Greenland and Antarctica
Objective	Gael Durand will be a post doc in the Ice and Climate Group in 2005-2007 to collaborate on ice crystal studies.
Summary	<p>Studying ice cores is of great interest as it is an extraordinary tool to investigate past climatic variations, i.e surface temperature, greenhouse gases and atmospheric circulation. Owing to snow accumulation, snow and firn densification to ice formation and slow ice sheet flow, a journey down to the deep layers of the ice sheet is a journey back to several hundred of thousands of years into the past.</p> <p>A crucial step of palaeoclimatic studies from ice cores is dating. Absolute dating of ice samples is impossible at the Antarctic low accumulation sites, and when large accumulation rates allow the counting of annual layers at Greenland sites, it is still a time consuming and ambiguous method. Thus, flow models are also used to reconstruct the movement and thinning of annual ice layers thereby establishing a depth-age relation. Climatic interpretations are dependent on our understanding of the deformation of the ice and consequently the ability of the flow model to correctly describe the path of an ice layer with time.</p> <p>Besides the studies of the evolution of climatic parameters (isotopes, gases, impurities), studying the ice itself is of great interest. Indeed, ice is a polycrystalline material, and the evolution of its microstructure (the grain boundary network), as well as its fabric (C axes orientations), are key features to improve our understanding of the past deformation experienced by the ice thereby enabling a realistic flow model and a true depth-age relation.</p> <p>The research groups in Copenhagen and in Grenoble are leading groups in research related to the deformation of ice. While Gael Durand has focused on the studies related to the Antarctic Dome C ice core, the Copenhagen group has studied the Greenland NGRIP ice cores. Both groups have developed methods and achieved results on the bipolar ice cores and. Gael Durand will fill a post doc position in Copenhagen in 2005-2007.</p>
Contact	Professor, PhD Dorthe Dahl-Jensen
Institution	University of Copenhagen, Niels Bohr Institute

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Region	Greenland and Antarctica
Timeframe	2006-2007

Title	Ice cores – Climate archives of the past. An outreach project
Objective	To develop a web-site about global climate in the late Quaternary based on ice core research. The user target group will mainly be high school students.
Summary	The objective of the project is to develop a website which will serve to communicate research on global climate based on results from Greenland and Antarctic ice cores. Ice cores and climate research are subjects which are well-suited for educational and outreach purposes, because ice core drilling is carried out in a spectacular environment, results are interpreted in a multi-disciplinary context, and Danish researchers have been involved in most deep ice core drilling projects. The homepage will mainly be directed towards high school students, but also lay people will be addressed. Results will be communicated through text, illustrations and interactive elements, where the user can communicate with researchers in the field, work with simulations and get re-directed to more detailed information.
Contact	Associated Professor, PhD Jørgen Peder Steffensen
Institution	University of Copenhagen, Niels Bohr Institute
Region	Greenland and Antarctica
Timeframe	2005-2008

Title	European Project for Ice Coring in Antarctica (EPICA and EPICA-MIS)
Objective	To obtain two deep ice core records from East Antarctica and to perform palaeoclimatic reconstructions based on these records and existing marine sediment records.
Summary	The EPICA project consists of two ice core drillings: At Dome C (East Antarctic plateau - Indian Ocean sector) and at Kohnen Station in Dronning Maud Land (East Antarctic plateau - Atlantic Ocean sector). The project was initiated in 1995. The more than 10 year project has been funded by national funding agencies in France, Italy, Germany, Switzerland, the Netherlands, Belgium, Denmark, Norway, Sweden and the U.K. There has been significant contribution from the E.U. (Grand Challenge, 4th and 5th framework programmes). The drilling at Dome C was successfully completed in 2005 at 3271 m depth, yielding the oldest ice core record in the world. The drilling at Kohnen station is close to completion at approx. 2800 m at time of writing. The Danish contribution has been ice core drilling know-how, field participation by Danish scientists, and extensive use of Danish drilling and bore hole logging equipment. Presently, the project EPICA-MIS is running with support from the E.U. (6th framework programme). The objective of EPICA -MIS is to com-

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	plete the drilling operations and to perform analysis of the ice cores to obtain records that can be compared to results from marine sediments.
Contact	Associated Professor, PhD Jørgen Peder Steffensen
Institution	Ice and Climate Group, Niels Bohr Institute, University of Copenhagen
Region	Dome C, 75 S, 123 E; Kohlen Station, 75 S, 0 E. And Southern Ocean
Timeframe	EPICA: 1995-2004. EPICA-MIS: 2005-2007

Title	Sea level and tidal science in the polar oceans
Objective	To monitor sea levels in both high-latitude polar regions in order to understand more completely the spatial pattern of long-term sea level change due to ocean warming and ice melt.
Summary	The measurement of sea level along polar coastlines presents great technical challenges for the Global Sea Level Observing System (GLOSS) of the WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM). The need for measurements in these data sparse regions has been clearly made in the scientific literature. For example, in oceanography, Arctic sea level data presently available suggest a common-mode of variability that provides insights in the quasi-resonant dynamics of the Arctic Ocean. Arctic sea level data are of particular interest within water balance studies concerning the freshening of the Arctic Ocean and its relationship to the Arctic Oscillation. Antarctic sea level changes have also been found to demonstrate considerable coherence related to the Southern Annular Mode and transports in the Antarctic Circumpolar Current. The need for measurements for climate studies by the Intergovernmental Panel on Climate Change has also been clearly made. Monitoring of levels in both high-latitude regions is necessary to understand more completely the spatial pattern of long term sea level change due to ocean warming and ice melt. Climate and sea level changes also affect the stability of ice shelves and fast ice and the glaciers behind them. This project will use existing and new Arctic sea level recorders (there are no sites currently operational in Greenland, for example) and will make enhancements to the existing network of gauges in Antarctica. Past and future tide gauge data sets will be used in combination with satellite altimeter and space gravity data where possible to understand further the regional ocean dynamics and climate change (Eol 580). Differences between Arctic and Antarctic in ocean dynamics and sea level response to climate change are particularly interesting.
Contact	Associated professor PhD Per Knudsen
Institution	Danish National Space Centre
Region	Tide gauge fieldwork will take place along Arctic and Antarctic coastlines and at Arctic and Southern Ocean islands. 'Fieldwork' using space remote sensing techniques will encompass all polar seas. Ocean tide studies will take place in the central Arctic, Antarctic margins and on major Antarctic ice shelves.

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Timeframe	2006 - 2009
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Title	Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost
Objective	To obtain a standardised set of permafrost temperature profiles throughout the permafrost regions of Planet Earth (snapshot). To produce retrospective and contemporary global data sets of permafrost temperatures, active layer thickness and temperatures, and coastal erosion rates.
Summary	The main Field Campaign is planned for the 12-18 month period during 2007-08, but starting in 2006 with the inspection of potential remote boreholes. The updated GTN-P catalogue of boreholes consists of more than 600 candidate boreholes throughout the permafrost regions, 125 sites in the CALM network, and some 25 coastal (ACD) key sites. A Project Steering Committee is under development. Data will be incorporated into the GTN-P and archived at the National Snow and Ice Data Center (NSIDC), Boulder, Colorado. Education and training activities are to be coordinated and developed through the University Centre in Svalbard (UNIS). IPA/IPY activities will be incorporated into the IUGS International Year of Planet Earth.
Contact	Associated Professor PhD Bo Elberling
Institution	University of Copenhagen, Institute of Geography
Region	Southern Hemisphere - all of Antarctica, sub-Antarctic islands, Andes (South American countries), and African highland and mountains
Timeframe	2006 - 2009

Title	Atmospheric Monitoring Network for Anthropogenic Pollution in Polar Regions
Objective	The project aims at establishing a long-term Arctic-Antarctic network of monitoring stations for atmospheric monitoring of anthropogenic pollution. Based upon the long and excellent experiences with different scientific groups performing air monitoring within the Arctic Monitoring and Assessment Programme (AMAP), an expanded network will be established including all AMAP stations and all major Antarctic "year-around" research stations. The project intends to establish a long-term coordinated international Arctic-Antarctic contaminant programme, to develop and implement a joint sampling and monitoring strategy as an official guideline for all participating stations, to support bi-polar international atmospheric research with high-quality data on atmospheric long-range transport of contaminants (sources, pathways and fate), and to support future risk assessment of contaminants for Polar Regions based on effects of relevant contamination levels and polar organisms
Summary	Based upon the well-established experiences of circum-Arctic atmospheric contaminant monitoring in the Arctic under the AMAP umbrella, a bi-polar atmospheric contaminant network will be established and maintained. In conjunction with the polar network of atmospheric monitoring stations for air pollution, surface-based and satellite instrumentation will be utilised to provide the characterization of the Arctic atmospheric-water-ice cycle. Together with numerical weather prediction and

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	chemical transport model calculations, simultaneous measurements of pollutants at various locations in the Arctic and Antarctic will enhance our understanding of chemical transport and distribution as well as their long-term atmospheric trends. In addition to investigating the importance of atmospheric transport of pollutants an understanding of the transference and impact of these pollutants on both terrestrial and marine environments will be sought. A secretariat and a “scientific project board” will be established. During this initial phase of the project (2006), a guideline on priority target compounds, sampling strategies, equipment and instrumentation, analytical requirements, as well as quality assurance protocols (including laboratory intercalibration exercises) will be developed and implemented.
Contact	Senior Researcher PhD Henrik Skov
Institution	Danish National Environmental Research Institute
Region	German Antarctic Station “Neumayer”, Norwegian Antarctic Station “Troll”, British Antarctic Station “Halley”
Timeframe	2007 - 2008

Title	Plate Tectonics and Polar Gateways in Earth History
Objective	The project intends to adopt a multidisciplinary approach by addressing tectonic-magmatic, geodynamic, sedimentary and biostratigraphic processes, by utilising paleo-biological and geochemical proxies as well as past and recent oceanographic conditions in the gateways, and by using state-of-the-art geophysical techniques, sediment coring, ocean drilling and accompanying land investigations.
Summary	Geophysical and bathymetric surveying as well as geological and biological sampling is planned for critical regions of the Southern Ocean that formed since the break-up of Gondwana. A thorough revision of this break-up will be performed in parallel with new data acquisition giving special emphasis to the compilation and integration of existing data sets. Uncertainties about the early stages of development of the Drake Passage/Scotia Sea gateway will be resolved by studies of the tectonic and sedimentary evolution of the basins and the origin of bathymetric highs, the structure and history of relevant plate boundaries, and deformation of neighbouring land areas. Geophysical data will be collected in the Tasmanian Gateway to constrain the timing of shallow and deep-water opening between the Indian and Pacific Oceans as well as the motion between East and West Antarctica which is critical to the timing of the uplift of the Transantarctic Mountains. Other regions of interest include the passage between the southern Kerguelen Plateau and Antarctic continent as well as major topographically outstanding transform and fracture zone systems in the Pacific.
Contact	Senior Researcher PhD Flemming Getreuer Christiansen
Institution	Geological Survey of Denmark and Greenland
Region	Drake Passage, Scotia Sea, Antarctic Peninsula, western Weddell Sea, Tasmanian Gateway, northwestern Ross Sea, south Indian Ocean, Kerguelen Plateau - Antarctic Passage.

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Timeframe	2006 - 2009
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Title	Polar Field Stations and IPY History: Culture, Heritage, Governance (1882-Present)
Objective	To study the history and legacy of IPY through its field stations
Summary	Field stations have been one of the most salient and tangible features of IPYs since 1882-83 and through to the coming IPY 2007-08. The polar station is a modern feature, the smaller field cousin of the Laboratory, Instrument, or Observatory. It is a nexus, and a place, where a number of central features of the modern scientific enterprise – laboratory practices and methods, precision instruments, territorial claims – meet in the landscape and sometimes in close vicinity of local groups and populations. Field stations, and the scientific expeditions that created them and used them as vantage points, are inseparable from polar research. They form important parts of the infrastructure of polar research in the past two centuries. They have also served as flag carriers, and as symbols of political, diplomatic and economic ambitions of the nations to which their founders belonged.
Contact	Associated Professor PhD Kirsten Thisted
Institution	University of Copenhagen, Department of Cross-Cultural and Regional Studies
Region	Antarctic Peninsula and Dronning Maud Land
Timeframe	2006 - 2008

Title	International Partnerships in Ice Core Science
Objective	Searching for the longest possible ice core record. Initiation of coring to recover the last interglacial and older ice from Greenland. Starting a detailed spatial network of deep and intermediate-depth Antarctic ice cores. To obtain firm air records spanning more than the last 150 years, encompassing much of the period from the industrial revolution to the present day.
Summary	Ice cores have contributed substantially to understanding climate change. They provide convincing evidence of large, abrupt climate changes, demonstrate links between greenhouse gases and climate, and show how humans have altered the atmosphere. However, there is a great deal more to learn. 1. International unification of ice coring research and training of the next generation of chemists, geologists, glaciologists, atmospheric scientists, biologists, and engineers involved in ice coring. 2. Site selection for a major new project - the first Antarctic ice core record reaching > 1 million years. This includes developing a new understanding of ice dynamics in interior east Antarctica. Expected deliverables include probable drilling locations, at least one workshop report, and peer reviewed papers. 3. The first ice core record of the last interglacial period in Greenland, a possible analogue for future warming of the northern Hemisphere. Expected deliverables include the ice core and climate records from it published in peer reviewed papers, and the

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	borehole itself.4.Initiation of drilling of a major new high resolution ice core covering the last 100,000 years in West Antarctica (WAIS Divide). 5.Improved understanding of polar climate variability on time scales from latest Holocene through the last glacial period, including climate change of the last millennium, the role of greenhouse gases in climate change, evolution of the anthropogenic impact on the atmosphere, and the manifestation of abrupt climate change in Antarctica. 6.Broader understanding in the general public of polar science and the role of polar science in studying environmental change, through IPICS outreach efforts (web sites, collaboration with museums and educational institutions, etc.).
Contact	Professor PhD Dorthe Dahl-Jensen
Institution	University of Copenhagen, Niels Bohr Institute
Region	Antarctica, WAIS Divide Ice Core site. East Antarctica, Dome C-North Vostok-Dome B.
Timeframe	2007 - 2009

Title	Astronomy from the Polar Plateaus
Objective	To quantify these conditions at four sites, Summit in Greenland, Ellesmere Island in Canada, and Domes A and C on the Antarctic plateau, and then to begin the process of turning these sites into frontline observatories. Dome A is likely to be the pre-eminent location on the Earth for observational astronomy, but has only recently been visited by humans (China in 2005). Dome C is the site for a new station (France/Italy, fully operational in 2005), and already shows indications for better seeing conditions than for any existing observatory. Summit Station (Denmark/USA) and Ellesmere Island (Canada) are also extremely cold and dry. They are the best prospective observing sites in the northern polar regions and their conditions have not yet been quantified.
Summary	It has long been recognised that the polar plateaus provide the best sites on the Earth's surface for the conduct of a wide range of astronomical observations, from optical to millimetre wavelengths. This is on account of the extremely cold, dry and stable air found there. The exceptional site conditions would allow observations to be made of the cosmos, with greater sensitivity and clarity, and across a wider part of the electromagnetic spectrum, than from temperate-latitude sites. The project builds upon a decade of site testing experience, at both the South Pole and at Dome C, including the development of autonomous observatories that can gather the data over the winter. In particular, it will make use of AASTINOs (Automated Astrophysical Site Testing International Observatories) to conduct a range of experiments at each site, and to transmit the data to their operations centres via satellite phones. Measurements made will include the sky brightness (auroral in the optical, thermal emission in the infrared), the optical seeing and the transparency, precipitable water vapour content and microturbulence levels in the atmosphere, as well as the meteorological conditions. These will provide the baseline data needed to quantitatively assess what future astronomical facilities could be built in the polar regions, and the science programs they could tackle. The AASTINO's and their

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	experimental suites will need to be brought to the four sites by overland traverse or by air transportation, with the scientists taken in by air to assemble them.
Contact	Senior Researcher PhD Per Kjærgaard Rasmussen
Institution	Danish Meteorological Institute
Region	Dome A and Dome C, Antarctica
Timeframe	2007 - 2009

Title	Bipolar Climate Machinery
Objective	A study of the interplay of northern and southern polar processes in driving and amplifying global climate as recorded in paleoclimate archives and their significance for the generation of realistic estimates of future climate and sea level development.
Summary	Paleoclimatic research indicates that processes and conditions in polar regions play a large role in driving and amplifying global climate variability at centennial to millennial time scales. The outstanding role of polar regions in the global climate system is currently evidenced by the distinct warming of polar regions (e.g. Arctic realm, Antarctic Peninsula) that exceed modern warming on a global scale. Polar processes and conditions include biological cycling and physical circulation in the polar oceans, the formation and distribution of sea ice, the behavior of permafrost areas, atmospheric circulation and transport of water vapor, and the volume and stability of continental ice. Polar and subpolar High-Nutrient-Low-Chlorophyll (HNLC) areas may act as CO ₂ sinks during glacial periods when the increased input of the micronutrient, iron, stimulates primary production. The extent and the seasonal variability of sea ice influences the Earth's albedo, water mass production, heat and gas exchange between the ocean and atmosphere, and biological productivity. Melt water pulses, which alter surface ocean density gradients, may induce rapid climate change. The impact of such environmental events in the Arctic Ocean, North Atlantic, and Southern Ocean may propagate globally via ocean circulation, through the operation of the "bipolar seesaw".
Contact	Professor PhD Eske Willerslev
Institution	University of Copenhagen, Niels Bohr Institute

Research Projects Proposed under the Danish Antarctic Scientific Programme

Region	Jetty Oasis lakes (Pr Charles Mtns) 70°S, 68°E and region; Lakes near Davis station (Ingr. Christensen Coast) 68°S, 78°E and region; Princess Elisabeth Land, coastal East Antarctica Sector between 70°E-80°E; Scotia Sea Latitudinal transect at ca.45°W; Drake Passage transects ca. 70°W; Antarctic Peninsula Sector between 60°-80°W; Larsen B and C ice shelf area, Mobiloil Inlet 68°S, 65°E; Pacific sector of Southern Ocean Latitudinal transects at ca. 170°W, 150°W, 120°W; Ross Sea Mooring Site A 76°42'S, 169°04'E; Ross Sea Mooring Site B 74°S, 175°05'E; Ross Sea Transects around 180°E south of 70°S; ANDRILL-site Southern McMurdo Sound (SMS) 77°43'S, 165°20'E; ANDRILL site McMurdo Ice Shelf (MIS) 77°53'S, 167°10'E; Ross Ice Shelf; Western Coast of Ross Sea, and adjacent Mountains with focus on Northern Victoria Land, including Offshore Islands (Franklin Island, etc.), Rennick Glacier; Off-shore Wilkes Land Sect. betw. 120°E-150°E;
Timeframe	2007 - 2009

Title	Health of Arctic and Antarctic bird populations
Objective	To study geographic variation in infections, parasites, immune system functioning and pollution levels in birds. To perform an effect study on individual marked birds. To model future scenarios of geographic variation and relating the findings to climate change, nature management and human health.
Summary	Healthy individuals are able to optimize resource use, survival and reproduction. Health of an individual will be under constant attack. Animals have developed immunological, physiological and behavioural strategies to battle these attacks from pathogens, parasites and/or pollution on their health. This battle for health is the main theme of the study. Individually marked birds are the subject of this study. They can be studied over their life time in the wild. Health of marked individuals can be correlated with present and future fitness. Experimental manipulations will quantify the consequences of specific attacks on health and will determine cause and effect in the correlations. Ecological immunology is a fast developing field, with beautiful examples of individual and species differences in immune response. Population size and distribution is structured by pathogens, parasites and pollution, which effect on fitness often is a complex interaction in an evolution of the struggle for survival. Spatial and temporal variation between populations and individuals is the main focus of the study. The polar regions are of special interest for this study. These areas are considered to have relatively low levels of pathogens, parasites and pollution. Migratory birds linking temperate regions with the Arctic are potential vectors of diseases as shown by the recent spread of the West Nile Virus and Avian Influenza: diseases which are threatening domestic animals and humans. With a changing arctic due to climate change and pollution, more knowledge is needed on how animals cope with attacks on their health.
Contact	Head of Research, PhD Jesper Madsen
Institution	Danish National Environmental Research Institute
Region	Circumpolar Arctic and Antarctic, the project aims to study geographical variation. Field sites will be selected in a discussion with partners.

Research Projects Proposed under the Danish Antarctic Scientific Programme

Timeframe	2007 - 2008
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