

ARCTIC STATION

FACULTY OF SCIENCE
UNIVERSITY OF COPENHAGEN



Annual Report 2011

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Cover photo by Rasmus Stenbak Larsen



Photo by Mikkel René Andersen

About the report

The Board of the Arctic Station is pleased to inform the public and the many users of the station about the status and activities of the station. The report is compiled by the Board based on contributions from researchers, guests, and the staff at the station.

The "Annual Report of the Arctic Station" contains brief descriptions of research projects, field courses and other educational activities, international meetings, and official visits. It also contains a summary of the research activities carried out at or in collaboration with the station, plus a list of publications resulting from these activities.

The report is published as a pdf file, which can be downloaded directly from the website (arktiskstation.ku.dk), where it is also possible to find additional information about the activities of the Arctic Station.



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Photo by Stine Kjær Petersen

The Chairman's report

The members of the Board are: Professor Reinhardt Møbjerg Kristensen, (chairman, zoology), Professor Bo Elberling (geography), Professor Kirsten Seestern Christoffersen (freshwater biology), Associate Professor Gunver Krarup Pedersen (logistics, geology) and Associate Professor Poul Møller Pedersen (vice chairman, marine botany). The external member of the Board, Professor Kirsten Hastrup, Institute of Anthropology, who has been a member since 2007, resigned from the Board in September 2011 when she was elected President of The Royal Danish Academy of Sciences and Letters.

In 2011 the station was visited by 124 guests who spent a total of 1270 nights at the station. Furthermore, the research vessel R/V Porsild was used by these groups for 90 days in the ice-free period. 2011 was a special year as regards the bowhead whale research. No fewer than five projects were conducted at the Arctic Station concerning these large mammals. Several scientists from the Greenland Institute of Natural Resources, Nuuk, were involved, and footage for the movie "The Giant of the Arctic" was recorded just outside Qeqertarsuaq.

Outi Maria Tervo (scientific leader since 1 March 2007) completed her PhD study on 30 June

2011 and defended her PhD project "Bowhead whale (*Balaena mysticetus*) acoustic behavior in Davis Strait" at The Natural History Museum of Denmark on 18 August 2011. The new scientific leader of Arctic Station, Ole Stecher, commenced work on 1 July 2011. He is a well-known geologist from Roskilde University Center and has worked for several years in France and Canada. Frantz Nielsen has been the chief of logistics since 1 May 2009. All Greenlandic staff members, including Captain Frederik Grønvold of R/V Porsild, have been involved in the bowhead research projects in the winter of 2011, and they have taken good care of the scientists and film producers. Antoinette Mølgaard has handled the cleaning of the station, and has furthermore been a fantastic cook for several courses and workshops.

It is quite unusual that books with popular appeal are published by the Arctic Station; however, in 2011 no fewer than three were published (see list of publications on page 18).

Gitte Henriksen, the Board member appointed by the Faculty, has performed very well in 2011. She is the station's secretary, and all bookings of courses and specific research programmes pass through her hands. In addition she is responsible for the station's budget and all financial matters.



Reinhardt Møbjerg Kristensen

Research projects

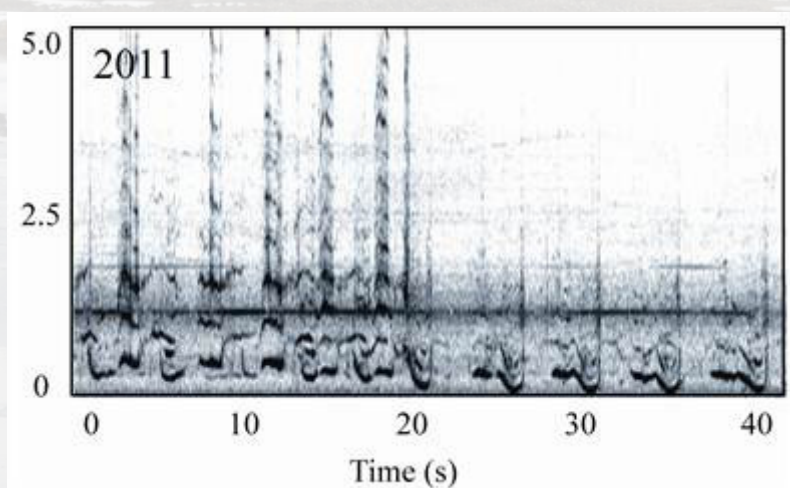
ACOUSTIC BEHAVIOUR OF BOWHEAD WHALES (*BALAENA MYSTICETUS*) IN DISKO BAY, WESTERN GREENLAND

Outi Maria Tervo, Mads Fage Christoffersen, Aningaaq Dahl, Arctic Station, University of Copenhagen, Denmark

Camilla Ilmoni, Arctic Whale Tours, Stø, Norway
Louise Normann Jensen, Andrew Foote, Reinhardt Møbjerg Kristensen, Natural History Museum of Denmark, University of Copenhagen, Denmark

This project was initiated in 2007 and the collection of data was planned to continue until 2011. The aim for the 2011 field season was to localise, record and biopsy singing bowhead whales. Passive acoustic monitoring was used to (1) determine the arrival and departure of bowhead whales in Disko Bay, (2) describe the song repertoire of bowhead whales, (3) determine daily changes in the singing activity in late spring, and (4) collect additional data for description of the movements of bowhead whales during singing.

Recording, localizing and biopsy collection of a singing whale was planned to take place from three boats: biopsy collected from one boat by means of a crossbow armed with a hollow arrow and localising from two boats by handheld stereo hydrophone set. The open time window for this operation is linked to the time when bowheads sing. Approximately one month before migrating out of Disko Bay the whales become silent. Unfortunately the permit for biopsy collection was issued late in the spring, which prevented us from sampling any singing individuals. Passive acoustic monitoring is a non-invasive method for studying the presence, absence, behaviour etc. of marine mammals based on the acoustic signals they produce. The acoustic signals of bowhead whales were collected using two different setups: (1) one or two hydrophones, recordings being made from a boat or from the cliffs of Qaqqaliaq, and (2) a fixed array of two hydrophones at Qaqqaliaq which collected data automatically 24 hours a day.



Sound recording of whale song. Illustration by Outi Maria Tervo.



Bowhead whale tail fin with scars from Orca attacks. The scars appear as parallel white lines. Additionally, the tips of both sides of the fin are missing, presumably they have been bitten off. Photo by Louise Normann Jensen.

BOAT-BASED PHOTO-IDENTIFICATION OF BOWHEAD WHALES (*BALAENA MYSTICETUS*) IN DISKO BAY

Louise Normann Jensen, Andrew Foote, Reinhardt Møbjerg Kristensen, Natural History Museum of Denmark, University of Copenhagen, Denmark

Camilla Ilmoni, Arctic Whale Tours, Stø, Norway
Outi Maria Tervo, Mads Fage Christoffersen, Arctic Station, University of Copenhagen, Denmark

The bowhead whale identification (ID) photograph project was started in 2010 and continued in 2011. The aim of this study was to investigate how individual bowhead whales can be identified from ID photos taken from boats. If the identification obtained by this method is reliable, the identification of individuals can provide information on the intra-year movements and residence time of bowhead whales during their spring aggregation in Disko Bay as well as on the inter-annual migration pattern. In 2011 the photo identification was conducted in the vicinity of Qeqertarsuaq from a small open boat with an outboard engine, and supplemented by one day of fieldwork from R/V Porsild. The ID photos did not focus on a specific region of the whales. Altogether 4700 ID photos were taken in 2011

and added to the 3600 photos taken in 2010. All photographs were divided into encounters of single whales, and the encounters were examined for identification markings and recaptured individuals. The results show that at least some individuals stay in the Disko Bay area in spring for at least 56 days. The analysis of photos has shown that individual bowhead whales can be recognised either by characteristic individual white scars or by patterns of several scars with similar locations, shapes and sizes. It is, however, doubtful whether smaller single scars, nicks, pigmentation, and wounds alone are reliable for identification over longer periods of time. Three individuals were photographically captured in both 2010 and 2011, which demonstrates that at least some of the bowhead whales appear in Disko Bay in successive years. These results show that boat-based photo-identification is a usable method for non-invasive capture-recapture investigations of bowhead whales and demonstrates the applicability of ID photos taken from a boat as regards recording residence time and inter-annual site fidelity of bowhead whales.

CLIMATE CHANGE AND BALEEN WHALE TROPHIC CASCADES IN WEST GREENLAND

Mads Peter Heide-Jørgensen, Greenland Institute of Natural Resources, Greenland

Kristin Laidre, Polar Science Center, Applied Physics Laboratory, Seattle, United States of America

Mikkel Villum Jensen, Mikkel Villum, Denmark

This was the last year of the project that started in 2008. The project is focused on two species linked by phenology and spatial and temporal proximity that exploit different levels of the trophic web. A spring component examines the coupling between sea-ice recession, primary and secondary production, and the foraging ecology of bowhead whales, while a summer component examines the coupling between late-ascent secondary production, forage fish, and the foraging ecology of humpback whales. We instrumented a total of eight bowhead whales with satellite-linked data recorders. The data from these instruments combined into spatial and bioenergetic models will provide insight into the dynamic predator-prey relationships in the West Greenland ecosystem, a marine area currently undergoing large shifts due to climate change. This was the last year of the project and the conclusions will be further analysed in 2012.

THE GIANT OF THE ARCTIC

Adam Schmedes, Mikkel Schmedes, Martin Oliver MacNaughton, Jesper Kikkenborg, Loke Film, Denmark

The purpose of this project was to record bowhead whale behaviour, partly by divers using high-definition cameras and hydrophones. Additional recordings were made from kayaks and from the margin of the ice. The film crew was assisted by local hunters. The film crew succeeded in obtaining high-quality underwater and surface shots of whales, as well as recordings of whale song. The main result is a film for worldwide broadcast distribution. The audiovisual material

will be made available for scientists and for use in museums and educational institutions. Raw film has been forwarded to scientists connected with the Arctic Station. The Arctic Station is the ideal base for this kind of work under extreme conditions and low temperatures. The social and scientific feedback is also important.

ABORIGINAL SUBSISTENCE WHALING AND THE INTERNATIONAL WHALING COMMISSION

Martin Mennecke, Faculty of Law, University of Copenhagen

The purpose of the stay at Arctic Station was to analyse relevant treaties, official records and documentation issued by the International Whaling Commission and to conduct qualitative interviews with relevant stakeholders. The project will continue through to the next meeting of the International Whaling Commission in June/July 2012.

THE WEST GREENLAND VOLCANIC PASSIVE MARGIN: A REVIEW OF MARGIN STRUCTURE AND TIME/SPACE DEVELOPMENT

Marco Pinheiro Machado, Juliano Magalhaes Stica, Caesar Augusto Rigoti, Adriano Roessler viana, Pedro Zalan, Petrobras, Brasil

Mansour Abdelmalak, Université du Maine, France

Laurent Geoffroy, University of Brest, France

The West Greenland margin is the only volcanic margin in the world that is exposed onshore, from the basement to an inner-sea dipping reflector (SDR). It apparently has a similar structure and evolution compared to offshore volcanic margins such as those of Vøring and Hatton in the Northeast Atlantic. The objective was to survey the West Greenland volcanic margin using R/V Porsild as a mobile research basis. A group of scientists from both the industry

and academia aimed to discuss the architecture and development of the Southeast Baffin margin from onshore observations. We especially focused on issues such as (1) basement inheritance, (2) the geometry of the pre-magmatic Cretaceous sedimentary basin, and (3) the structure and development of the Svartenhuk inner-SDR. The observations were fruitfully compared to industrial crustal-scale data incoming from other volcanic passive margins. The former observations on this margin were formalised and illustrated: (1) the pattern of extension during the Cretaceous is distinct from the one acting during final continental break-up (Paleogene), (2) the extension during the Cretaceous is polyphased and more complex than the published data indicate, (3) the general profile of the margin is similar to that of volcanic margins elsewhere.

CONSERVATION AND NATURAL HISTORY OF THE GREENLAND SHARK (*SOMNIOSUS MICROCEPHALUS*)

Richard Brill, Virginia Institute of Marine Science, United States of America

Peter G. Bushnel, Matt Williams, Indiana University South Bend, United States of America

John Fleng Steffensen, Department of Biology, University of Copenhagen, Denmark

This project focuses on the biology of the Greenland shark (*Somniosus microcephalus*), but also on its future as a central component of the polar ecosystem. Fishing pressure and ignorance of the shark's basic natural history threaten the long-term viability of this long-lived Arctic shark. In Greenland, the halibut (*Reinhardtius hippoglossoides*) longline fishery is plagued by a substantial bycatch of Greenland sharks, which has led to the establishment of a bounty on shark hearts as proof of their elimination. Given the slow growth and low replacement rate of these very large and docile animals, we are concerned that fishing pressure may be threatening the viability of the species. We are interested in documenting the Greenland shark's long- and short-term movement patterns by deploying popup satellite archival tags (PSATs). In addition we wish to amass a collection of vertebral and other hard-part samples from Greenland shark carcasses for age and growth analysis. The methods used included: (1) long lines baited with seal, narwhal and Greenland Husky, (2) Floy ID Tags mounted close to the dorsal fin on 16 sharks, (3) PSATs mounted on four sharks, and (4) age determination by Accelerated Mass Spectroscopy at Aarhus University for ^{14}C analysis. Given the relatively high failure rate inherent in the PSAT technology, we were pleased to learn that all four tags successfully detached from the sharks on August 31st and have been uploading their data. The animals travelled to a location approximately 800–1000 km north of their deployment site. Interestingly, two of the PSATs were within three km of each other when they first reported in. Analysis of the data provided by the PSATs is ongoing. None of the 14 sharks released with a Floy tag has been reported captured yet, but if/when it happens and measurements of the shark's girth and length are forwarded to us, we will be able to determine the growth rate. We have analysed two sharks in collaboration with the AMS centre at Aarhus University, and apparently the sharks (290 and 330 cm long) are more than 60 years old, maybe as old as 200 years.



Tagging of Greenland shark. Photo by John Fleng Steffensen.

HUNTERS AND RESEARCHERS IN JOINT WHALE PROJECT

Kitte Vinter-Jensen, Mads Peter Heide-Jørgensen, Greenland Institute of Natural Resources, Greenland

The purpose of this project was to collect information for articles (public outreach) about the collaboration between hunters and researchers. Since 1999, several local hunters have worked for the Greenland Institute of Natural Resources from April to October, taking samples of catches, collecting narwhal stomachs and the genitals of game, carrying equipment into the field, taking biopsy samples, and tagging minke whales, bowhead whales and humpback whales with transmitters. They also work for other scientists working in the Disko Bay. During our stay this summer, we interviewed hunters and scientists about the collaboration with a view to publishing several newspaper articles on the subject.

THE ARCTIC PHYTOPLANKTON SPRING BLOOM AND TROPHIC TRANSFER OF ALGAL TOXINS

Nina Lundholm, Anna Tammilehto, Natural History Museum of Denmark, University of Copenhagen, Denmark

Yang Li, South China Normal University, China
Sara Hardardottir, National Institute of Aquatic Resources, Technical University of Denmark

The aim of this project was to study the diversity of the marine phytoplankton spring bloom, exploring the overall diversity changes during the whole spring-bloom period and with more detailed emphasis on the diversity of the diatom genera *Fragilariopsis* and *Chaetoceros*. Sampling was carried out during a two-month period and monoclonal cultures of phytoplankton were established using light microscopes in the cold laboratory container. The samples are being used for countings on diversity changes of the spring bloom, exploring which parts are being trans-

ferred to the next trophic levels, and which are settling to the bottom. The live cultures have been brought back to Denmark and are being used for detailed electron microscopical and molecular studies. Some of the diatom cultures established from the area during 2010 were later found to produce toxins in culture experiments. Thus in 2011, we conducted grazing experiments with *Calanus* species, being the most important copepods in the area grazing on the toxic cultures. We found that the *Calanus* are indeed able to graze on the toxic diatoms and contain toxins themselves. Detailed analyses of the data are ongoing and further studies will be conducted in 2012.

LAKE MONITORING IN SOUTHERN DISKO

Kirsten Seestern Christoffersen, Jesper Philip Aagaard Christensen, Department of Biology, University of Copenhagen, Denmark

The purpose of this project is to establish a limnological monitoring programme in two lakes on Disko in order to detect seasonal dynamics and inter-annual changes in lake ecology. It has been shown that Arctic lakes are very sensitive to climate change and it is therefore important to



Field work at Kangaarsuk, deploying measuring equipment. Photo by Kirsten Seestern Christoffersen.

follow such changes in different regions of the Arctic. Through this limnological programme the Arctic Station will contribute to the Greenland Ecosystem Monitoring programme (GEM). The locations are Morænesø and Kangaarsuk, which are shallow, clear-water lakes. One lake (Kangaarsuk) has a small population of arctic charr. The concept includes submerged sensors that continuously measure basic parameters (light, temperature, conductivity, pH, oxygen and chlorophyll) as well as manual sampling of water and sediment for identification of biota (phytoplankton, zooplankton and benthic invertebrates). The equipment was tested and installed in the lakes in March 2011 through holes in the ice. After seven months the equipment in Kangaarsuk was retrieved for inspection. Unfortunately, technical problems had occurred and no data had been logged. The problems were solved and the equipment re-installed in the lake. It was not possible to retrieve the equipment in Morænesø as it was situated precisely under the sledge track, which was being used daily. The equipment will instead be located and retrieved in July 2012.

VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE IN QEQTARSUAQ, WEST GREENLAND

James Ford, Christina Goldhar, McGill University, Canada

The purpose of the project was to identify and examine human vulnerability and adaptation to climate change in Qeqertarsuaq. The information was gathered from (1) 132 semi-structured interviews with community members in Qeqertarsuaq, (2) 10 key-informant interviews with policymakers in Qeqertarsuaq and Nuuk, and (3) analysis of secondary sources. The work documents significant changes in sea-ice regimes, temperatures, and wind, as reported by project participants. Vulnerabilities to these changes are primarily associated with hunting and fishing activities, with individuals/households closely linked to the subsistence economy being affected by constrained access and availability of key wild-

life resources, and enhanced danger of activities. Adaptations being employed combine both reactive and anticipatory interventions autonomously undertaken at an individual and household level, including travelling to new fishing grounds to avoid dangerous weather and ice conditions, seeking alternative sources of income when harvesting activities are not possible, preparing for the unexpected, and increased reliance on boat transport as ice conditions deteriorate. The role of women in supporting male hunters/fishermen, knowledge of environmental conditions, alternative sources of income, diversity and flexibility in harvesting, and willingness to change and alter livelihoods, are important in underpinning adaptive capacity. However, institutional constraints are a major barrier to adaptation and have reduced the flexibility which historically has enabled adaptation to changing conditions. Thus, alternative income sources are increasingly important in light of stresses imposed by climate change, but those licensed as occupational hunters have restrictions on earning money from non-harvesting activities; regulations are limiting the ability of fishermen to travel to new locations; and quotas on various species do not reflect alterations in access and availability caused by changing climatic conditions. More broadly, hunting regulations have contributed towards the erosion of the moral economy of harvesting and weakening of social networks, increasing vulnerability to projected future changes in climate.

SERIAL-SECTIONING APPLIED TO TUNDRA SHRUBS FOR DENDROCHRONOLOGICAL ANALYSES IN THE HIGH ARCTIC

Agata Buchwal, Grzegorz Rachlewicz, Adam Mickiewicz University, Poland

Holger Gärtner, Paolo Cherubini, Swiss Federal Research Institute for Forest, Snow and Landscape, Switzerland

Environmental changes can be traced in vegetation using dendrochronological techniques. The main purpose of our research is to conduct dendrochronological and wood-anatomical studies

on Arctic shrubs in Southern Disko, in the vicinity of the Arctic Station. The main goal of our study is to obtain the highest confidence in the annual date assignment in order to present a reliable chronology development of tundra shrubs growing in the Arctic. This was done by sampling Arctic tundra shrubs, especially focused on willow (*Salix*) species. For additional analyses other species such as *Betula nana* and/or *Dryas integrifolia* were chosen. The serial-sectioning method was used by taking at least 10 samples per plant for further dendrochronological investigations: annual shrub-rings recognition and cross-dating of the growth patterns (1) within the single plant, (2) within the plants from one particular location, and (3) between the plants taken from different micro-sites. The standard procedure consisted of sampling entire shrub individuals within two or three chosen locations differentiated based on the geomorphic settings of the site (valley bottom, upper marine terraces, and front moraine). Within each microsite, at least 10 plants of a particular species were collected. The shrubs were also collected in areas where geomorphic disturbances can be excluded, in order to make sure that the analysis represents the undisturbed growth of every single individual. The shrub-sampling strategy followed a detailed geomorphological survey of the sampling site. For serial sectioning and first micro-slides preparation we used microtome and Arctic Station laboratory facilities. The ongoing laboratory work consists of preparation of micro-sections in order to measure the sequence of annual tree-rings in the shrub material and to conduct wood-anatomical analyses. Applying the method of detailed serial-sectioning, we will be able to obtain a high-resolution proxy – the tree-ring chronologies for chosen shrub species – which can be correlated with the existing data (i.e. climate records) and finally form a basis for reconstructing climatic-driven parameters back in time. Our first plants are aged more than 70 years; this is promising for validating and reconstructing the climatic record for Southern Disko.

ATLANTIC CROSSING OF WHEATEARS (*OENANTHE OENANTHE*) MIGRATING FROM GREENLAND TO WEST AFRICA

Jannika Boström, Christoffer Sjöholm, Alexander Berg, Mihaela Ilieva, Lund University, Sweden

The purpose of this project is to investigate the migration routes and wintering areas of Greenlandic wheatears using light loggers. This is a novel technique which has given rise to new possibilities in the field of bird migration with focus on small passerines. We use light loggers that weigh less than 1 g, and they log information on sunrise and sunset combined with a clock. This information can be used to determine the location of the birds during different phases of their migration and wintering cycle. At present, the routes and stopover sites used by Greenlandic wheatears are unknown and this project offers a unique opportunity to answer the open questions of where and how far these birds fly before they stop to rest. The birds were caught in traps and light loggers were mounted on their backs. We used only adult birds that were breeding in the vicinity of the Arctic Station in order to maximise the chances of catching the same individuals again next summer. 18 birds were caught and equipped with loggers. In order for the information to be downloaded and analysed, the birds have to be caught again next summer.



Wheatear (*Oenanthe oenanthe*). Photo by Jannike Boström.

HIDDEN DIVERSITY IN THE GENUS *SYNURA* (STRAMENOPILES) IN WEST GREENLAND

Pavel Škaloud, Magda Škaloudová, Charles University Prague, Czech Republic

The silica-scaled chrysophytes are unicellular flagellates, solitary or colonial, assigned to the class Chrysophyceae. These organisms are restricted to different freshwater biotopes. The most conspicuous genus of the class, *Synura*, is a colonial organism formed by a variable number of cells joined together at their posterior ends. Each cell is covered by imbricate silica scales. The modern taxonomy of *Synura* is based on scale ultrastructure, investigated using an electron microscope, and a wide range of more or less divergent morphotypes is known, especially in the *Synura petersenii* complex. Several forms and morphotypes within this complex are also known to occur in Greenland and investigation of the genetic and morphological pattern within the Greenlandic *Synura petersenii* complex was the main purpose of our study. In total, 50 freshwater samples have been collected in three different regions in West Greenland using a plankton net. *Synura* colonies were isolated by single-cell pipetting, and the uni-algal cultures were grown in a cold room at the Arctic Station. In addition, isolated colonies were frozen. Both living cultures and frozen samples were transferred to Prague, where morphological and molecular investigations have been conducted. Preliminary results show that only 10 of the 50 sampled water bodies contained silica-scaled chrysophytes, including members of the genus *Synura*. In total, five *Synura* species (*S. petersenii*, *S. petersenii*-like, *S. echinulata*, *S. mammosa*, *S. sphagnicola*) were observed in the samples, together with 11 other members of the silica-scaled chrysophytes. According to the concatenated Bayesian phylogeny of the genus *Synura*, section Petersenianae, the *Synura* colonies isolated in West Greenland were inferred within the three distantly related lineages. Only the isolates from the Ilulissat Dam could be assigned to previously described species, cosmopolitan *S. petersenii*. The remaining two lineages found exclusively in the vicinity of

Qeqertarsuaq represent new, so far undescribed species of the genus *Synura*.

DATECH: DATING TECHNIQUES CROSS CALIBRATION USING LICHENOMETRY, RADIOCARBON DATING, AND SURFACE-EXPOSURE DATING

Vincent Rinterknecht, University of St Andrews, United Kingdom

Vincent Jomelli, Romain Schlappy, National Centre for Scientific Research, France

Glacier margins may be dated by using multiple dating techniques: lichenometry, radiocarbon, and cosmogenic nuclides. Lichenometric data were collected directly *in situ* on blocks found on moraines. Lichen measurements are currently being analysed with the new approach based on extreme value theory, using software recently developed by Jomelli and collaborators. Organic material for radiocarbon dating was collected from sections through moraine mounds. Rock samples (top few centimetres of large boulders) were collected on top of the moraines. Samples from Disko are currently being analysed for Chlorine-36.

CALIBRATION OF THE QEQTARSUAQ GEOMAGNETIC OBSERVATORY

Jürgen Matzka, Lars William Pedersen, Stavros Kotsiaros, DTU Space, Technical University of Denmark

The researchers came to the Arctic Station to calibrate the Qeqertarsuaq Geomagnetic Observatory, which monitors geomagnetic secular variation (temporal change of the Earth's core field) and long-term trends in space weather (magnetosphere, polar ionosphere). The observatory instruments were checked and their environment and data loggers improved. The resulting changes in instrument calibration were determined. Local personnel were trained to perform regular calibration measurements. An additional study

on magnetic gradients in the observatory and its surroundings was conducted by a PhD student. The Qeqertarsuaq Geomagnetic Observatory continues to operate as high-quality station in the international geomagnetic observatory network.

RESEARCH DIRECTOR NETWORK

Niels Overgaard Andersen, Faculty of Science,
University of Copenhagen, Denmark

In June, a group of eight research directors visited the Arctic Station with the aim of analysing the possibilities and peculiarities of Danish research in the global production of knowledge, based on more than 100 years of research in Greenland. The contents of a feature newspaper article was prepared concerning the network's view of how Danish research and Danish research politics may advantageously build on traditional strong points such as polar science. The opportunities for Danish research directors to influence ethical conduct in research environments were also discussed.

THE FATE OF THE ARCTIC SPRING BLOOM

Magnus Bohr, Sara Hardardóttir, University of
Southern Denmark

Birgit Søborg, Eva Friis Møller, Morten Hjort,
Aarhus University

Karen Riisgård, Sanne Kjellerup, Torkel Gissel
Nielsen, Thomas Kiørboe, Line Ree, Technical
University of Denmark

Anna Tammilehto, Nina Lundholm, Per Juel
Hansen, University of Copenhagen

Susan Menden-Deuers, Catelyn Lawrence, Univer-
sity of Rhode Island, United States of America

The aim of this project was to follow the development and fate of the Arctic spring bloom, with special emphasis on the role of zooplankton, the impact of toxic phytoplankton species, and the potential impact of elevated pH during the bloom. The project was based on a combina-

tion of weekly field sampling from R/V Porsild (CTD, water and net samples) on the permanent monitoring station in Disko Bay, and experimental work in the laboratory, in particular the cooling container at the Arctic Station. Compared to previous years with strong ice cover, when the spring phytoplankton bloom developed very fast within two weeks, 2011 was characterised by very weak and late ice cover and a spring bloom of much longer duration. The lack of stabilising ice and consequent recurrent mixing of the surface layer caused a reintroduction of nutrients to the surface. During the project, the fate of the bloom was investigated based on estimates of zooplankton grazing and sedimentation from the upper part of the water column collected by sediment traps.



R/V Porsild

Courses

FIELD COURSE IN PHYSICAL GEOGRAPHY 2011

TEACHERS

Bo Elberling (course and field leader) and Birger Ulf Hansen, Department of Geography and Geology, University of Copenhagen, Denmark

STUDENTS

Nicolai N. Christensen, Toke Fogh, Anders Bjørnsen, Mette Hansen, Malene A. Hansen, Katrine M. L. Johansen, Sascha Müller, Tobias Feld, Stine H. Pedersen and Louise Berg, all from the Department of Geography and Geology, University of Copenhagen, Denmark

Will Manning, School of Marine Science and Technology, Newcastle University, United Kingdom
Alejandro Barrera, Faculty of Life Sciences, University of Copenhagen, Denmark

The aim of the course was to integrate the following three elements: (1) meteorological gradients quantified within the landscape at Flakkerhuk and active-layer thickness modelled over two thawing seasons based on soil thermal properties from local soil types, (2) active-layer and permafrost characteristics based on samples collected from pits and permafrost coring, and (3) in-situ methane fluxes between the soil surface and the atmosphere using a mobile chamber setup. The combination of these three parts can provide new insight into the current and future net methane budget within the study area, taking current and future climate trends into account. The study area is located at Flakkerhuk, eastern Disko and is a near-coastal landscape which has undergone isostatic land rise and formations of fossil beach terraces. Flakkerhuk is influenced by an Arctic climate, but an average increase in mean air temperature of 0.25 °C per year was recorded between 1991 and 2010. The snow cover is decreasing as regards both duration and thickness. The duration of snow cover and the isolating properties are important for the thawing rate of permafrost and the active-layer thickness, as it deter-

mines the energy available for thawing the ice in the soil. A spatial climate distribution with a temperature gradient that increases exponentially when going inland was found. There is a high diversity of plant species which occur in a mosaic pattern of low dwarf-shrub heath and fen. Soil properties vary with respect to drainage conditions: as expected, wet soils are found to have higher concentrations of carbon (C) and nitrate (N) than well-drained soils. Generally, concentrations of solid C and N are low and highest in the top of the profiles. Methane (CH₄) emissions were measured over two weeks in July 2011. Correlations between CH₄ fluxes and soil water content and soil temperature were expected to be found but could not be confirmed by measurements due to the short period of measurement – hence the results show a snapshot of the arctic midsummer conditions. When upscaling the flux values to Flakkerhuk, the net balance for CH₄ at the study site over two weeks surprisingly suggest a minor sink of CH₄. Applying a permafrost model, it is shown that the thermal properties of the soil type have a major effect on its melting potential during the arctic summer. It is shown that, due to permafrost thawing, it is unlikely that Flakkerhuk will change into a major source of CH₄ in the future with the current water balance.



Field work. Photo by Bo Elberling

FIELD TRIP FOR 4TH-YEAR STUDENTS OF BIOLOGY AND NATURAL SCIENCE FROM THE TEACHER'S COLLEGE IN NUUK

TEACHER

Britta Lohmann, Ilinniartissuaq, Greenland's Teacher's College, Nuuk, Greenland

STUDENTS

Regine Mølgaard, Akisooq Sandgren, Inoorak Johansen, Lea Josefsen, Nammininnguaq Jakobsen, Serminguaq Uvdloriaq, Aggalu Augustussen

The purpose of the field trip was to build up work routines for the students under optimal conditions. Before we arrived, we had prepared a plan for our short visit. The topics to be covered included: soil analyses (moisture and nutrient content), botanical investigations (considering soil type and location), zoological investigations of insects, lake investigations, and geological investigations of rocks and minerals. In addition, the scientific leader of the Arctic Station kindly allowed us to observe and participate in his work, e.g. determining the depth of the permafrost layer. Part of the work was continued after we arrived back at Ilinniartissuaq.

FIELD TRIP FOR 2ND-YEAR HIGH-SCHOOL VISUAL ARTS STUDENTS FROM AASIAAT UPPER SECONDARY SCHOOL

TEACHER

Signe Falck Diederichs, Aasiaat Upper Secondary School, Greenland

STUDENTS

Anders Broberg, Arnajaraq Petersen, Aviaq Reimer, Else-Kaalat Nielsen, Emil Olsvig, Ivalu Grønvold, Katrine Filemosen, Kristian Jensen, Kaaka Qvist, Louise Larsen, Malu Fleischer, Masauna Peary, Nukaaka Brandt, Najannguaq Jeremiassen, Paninnguaq Geisler, Paulus Samuelsen, Uiloq Kristiansen.

Students from Aasiaat Upper Secondary School visited the Arctic Station in September for a field trip which was part of a landscape theme in their visual arts course.

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Photo by Signe Brandt Larsen

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