

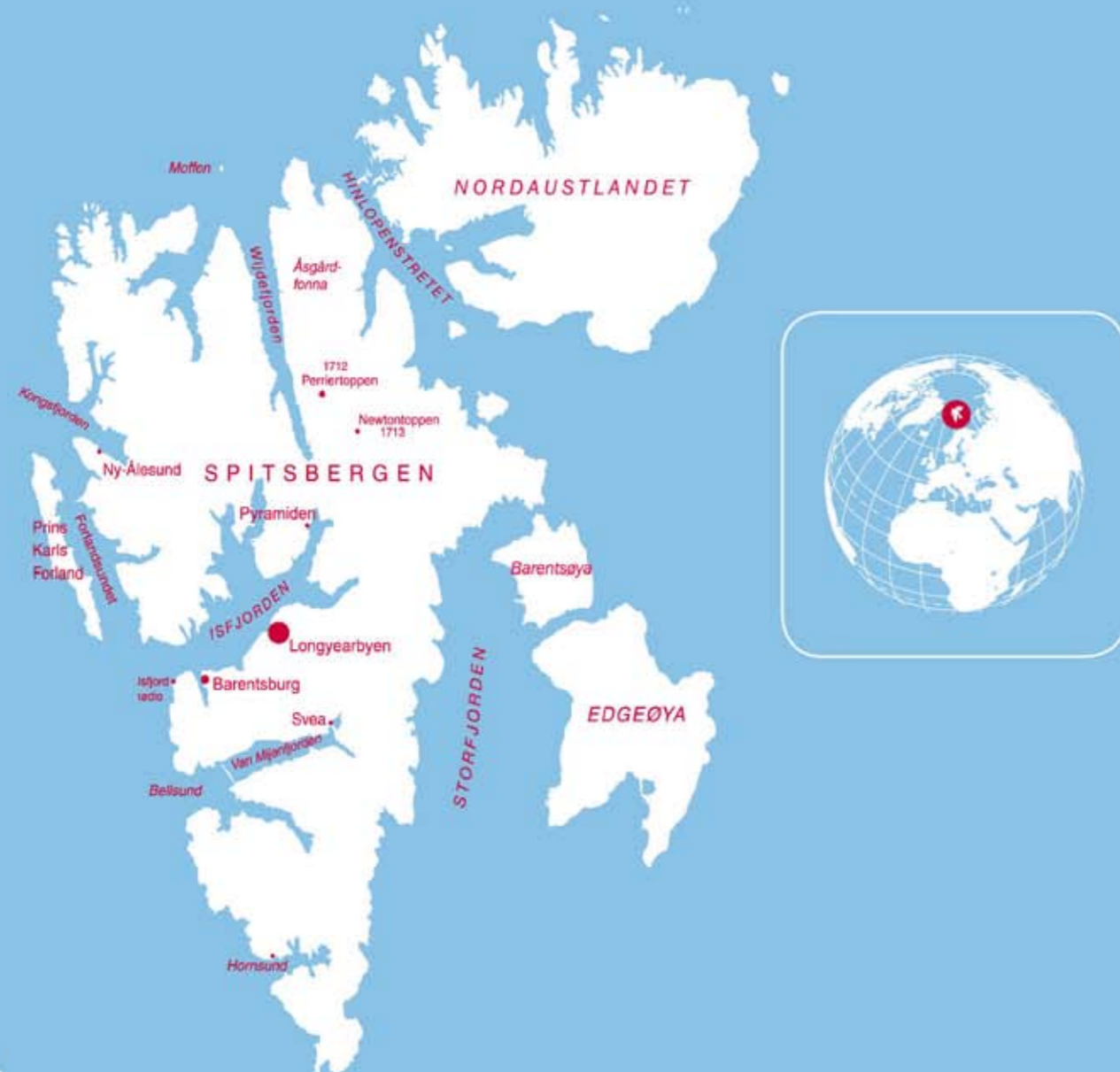
# UNIS annual report 2007



**UNIS**

The University Centre in Svalbard

# map over svalbard



Front cover: Domes on the roof of the new Kjell Henriksen Observatory bathed in blue morning light in October 2007.

Photo: Olli Jokiaho

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## from the director

The Norwegian minister of research and higher education, Tora Aasland, arrived in Longyearbyen on the 18th of February 2008 to officially open the Kjell Henriksen Observatory. The observatory is located on top of the Mine Seven Mountain, close to the glacier Foxfonna, and with a beautiful view towards the Advent Valley. It is not because of the scenery, however, that the observatory has been built at this site.

The new UNIS observatory is located in Longyearbyen because of its position beneath the polar magnetic cusp region. From Longyearbyen the conditions are favorable for studying solar winds as well as its stamp on the earth's atmosphere, the Aurora Borealis. The dayside aurora is of particular interest to the scientists working in Longyearbyen.

Atmospheric studies of the kind that can be carried out at the observatory are fascinating on two levels: First, they will enable mankind to get a better understanding of these phenomena in themselves. Secondly, the knowledge can be used to get a better picture of the energy budget of the atmosphere. We know that the sun has a major impact on the earth's climate, but we do not quite know how and to what extent.

The Kjell Henriksen Observatory, together with the EISCAT radars and the SPEAR facility, enables us to address these issues. We are entering into a strategic partnership with the EISCAT Association as well as the Norwegian universities of Tromsø and Oslo to build strength and capacity around our research efforts. Others will be welcome to join in.

As an institution for higher education, we have already opened our new observatory to the students. We hope that facilities like these will help attract young people to studying physics. In fact, if your interest is to explore the unanswered research fields of the atmosphere, we see no better laboratory anywhere.

Longyearbyen May 2008



Gunnar Sand  
Director of UNIS

## report of the board of directors 2007

*The year 2007 was a good one for the University Centre in Svalbard (UNIS). The Kjell Henriksen Observatory for studying the Northern Lights was completed, UNIS entered into co-operation agreements with a host of exciting research organisations, student numbers increased strongly following a decline the previous year and UNIS more than doubled its portfolio of externally-financed research projects.*

The University Centre in Svalbard AS (UNIS) was established as a state-owned limited corporation on November 29, 2002, replacing the original institution established in 1994 by the Norwegian University of Science and Technology and the Universities of Oslo, Bergen and Tromsø.

The institution's objective is to provide tuition and engage in research based on Svalbard's geographic location in the High Arctic and the special advantages this offers. The tuition shall act as a supplement to the tuition offered at the universities in mainland Norway and culminate with examinations at Bachelor, Master or PhD level. Studies at UNIS shall have an international profile, and all tuition is given in English.

### Education

In 2007, UNIS offered four fields of study: Arctic Biology, Arctic Geology, Arctic Geophysics and Arctic Technology. A total of 45 courses were offered, of which 27 were at Master's or PhD level. A total of 357 students from 26 different countries took courses or worked on their Master or PhD theses. This equates to 145 student years.

The female component of students in 2007 was 52 percent, while the proportion of Norwegian students was 51 percent. Of the international students, 32 percent came from other Nordic countries, while 19 percent were from Germany. Grants from the Ministry of Foreign Affairs (UD) and the

Norwegian Centre for International Co-operation in Higher Education (SIU) have enabled better scholarship programmes for Russian students and has contributed to the number of Russian students at UNIS increasing to 11 in 2007.

The total student numbers represent an increase of 32 student years compared to 2006. This can be attributed to better recognition of the educational provisions at UNIS in the universities' programme descriptions and improved marketing. The Board of Directors is satisfied that the previous year's downward trend has been reversed into new growth in student numbers.

### Research

The Kjell Henriksen Observatory for studying the Northern Lights was completed for the 2007-08 season and represents an excellent addition to UNIS. A total of 13 other institutions have moved in with their instruments. The observatory was officially opened by the Minister of Research and Higher Education Tora Aasland in February 2008 and is an essential step in the development of Arctic geophysics. Atmospheric studies has today emerged as one of the most exciting areas for instruction and research at UNIS.

The group for terrestrial biology was strengthened during 2007. This group has formed alliances with researchers in several countries and is in the process of coming into force increasingly more internationally. The biologists scored highly in publication rates and in 2007 were visible in publications including Science.

In 2007, a consortium headed by UNIS commenced trial drilling in bedrock near Longyearbyen to find the best CO<sub>2</sub> depositional sediments. The consortium partners are NGU, SINTEF, the University of Bergen, Store Norske, ConocoPhillips and Gassnova.

A strong increase in this activity is anticipated in 2008 providing the geology meets expectations.

The strategic plan for 2007-2012 places considerable emphasis on the building of alliances and partnerships. In 2007, UNIS entered into co-operation agreements with the Alfred Wegener Institute, the Geological Survey of Norway (NGU), Eiscat and three departments at the Lomonosov University in Moscow.

International Polar Year (IPY) projects are developing according to plan and are emerging as a beacon for UNIS with major international focus. Combined with other major projects, IPY has contributed to the externally funded research portfolio growing from NOK 8.8 million in 2006 to NOK 21,4 million in 2007. From 2008, UNIS has gained an independent status at the Research Council of Norway (NFR) and will now have the same annual meeting as the universities in mainland Norway.

In 2007, researchers at UNIS published 57 articles in international refereed journals, of which 15 were at the highest level. In addition, one book was published. Corresponding figures for 2006 were 38 and 10.

### Dissemination

Our website was redesigned in 2007 and now provides a far more modern impression of the institution. This shows that we have developed good routines for a high production of news articles, and the UNIS website has now become a good profiling and marketing channel.

The Svalbard Seminars, the Norwegian Science Week, the opening of IPY and the Arctic Gateway concept contributed to UNIS being highly visible in Longyearbyen over the past year. We received a host of prominent delegations wanting to learn more about UNIS and gained a wide variety of media coverage worldwide. The CO<sub>2</sub> project alone was the subject of tens of TV reports both domestically and abroad.

### Staff

As of December 31, 2007, the scientific staff at UNIS comprised five professors, 11 associate professors, four post docs, 17 research fellows and 22 with professor/adjunct associate professor attachments. There was a technical staff of 11 and an administrative

staff of 14. UNIS had several vacant academic positions, which will be filled in 2008. Women accounted for 33 percent of staff numbers and 52 percent of student numbers. Four of the seven members of the Board of Directors were women.

As of December 31, 2007, the following positions at UNIS were externally funded: 1 professorship (Store Norske), 4 post docs (3 NFR, 1 ConocoPhillips), 4 research fellows (Store Norske, NTNU/NFR, Total E&P, Statoil), 3 professor/adjunct associate professorships (ARS/NAROM, NERSC, NGU) and 3 partially funded professor/adjunct associate professorships (Norwegian Polar Institute). The Board of Directors would like to thank these institutions for their contribution to UNIS.

#### Health, Safety and Environment

Absence due to sickness at UNIS in 2007 was 2.2 percent. The institution has an agreement with Longyearbyen Hospital concerning occupational health services and is certified as an IA enterprise. There were no injuries or reports of serious occupational accidents or calamities resulting in serious material damage or personal injury. UNIS is unaware of contamination of the wider environment to any significant degree as a result of the institution's operations.

Fieldwork in the Arctic can endanger the health and lives of the participants, as well as posing threats to the environment. UNIS has therefore established a comprehensive set of regulations to ensure that fieldwork is

implemented in a safe manner. All students and staff must complete the mandatory Arctic Survival and Safety Course. Field and laboratory work is quality assured through risk analysis and is covered by strict reporting routines, including for any undesired incidents.

Safety instructions and control routines at UNIS cover the objectives of the Svalbard Environment Act, which states that in any conflict between activity and the environment priority must be given to environmental considerations. When carrying out its activities, UNIS aims for the least possible negative impact on the natural environment.

The Board of Directors has adopted ethical guidelines and warning guidelines equivalent to those prevailing for State employees.

#### Economic development

Funds for operation and investment at UNIS are appropriated over the budget of the Ministry of Education and Research. In the period from 2001 to 2006, UNIS has had an average annual increase in operational appropriations of 10 percent. This figure dropped to 4.5 percent in 2007.

In 2007, appropriations to UNIS totalled NOK 75,474,000, of which NOK 74,025,888 was spent on operations and NOK 1,448,112 on equipment and fixtures. Over and above the appropriations from the Ministry of Education and Research, UNIS received external research funding of NOK 21.4 million and income from consultancy services and

apartment rentals of NOK 4.9 million. UNIS has experienced an increase in external funding for research from 8 percent of its gross income in 2001 to 21 percent in 2007.

Forty-one percent of goods and services were purchased locally in Longyearbyen, according to the annual accounts for 2007.

The annual accounts show an operational surplus of NOK 242,225. After financial costs, the annual accounts show a deficit of NOK 345,522.

The institution's total assets at year-end 2007 were NOK 57,570,566, comprising NOK 28,431,300 of institutional buildings and NOK 11,509,641 of share-holder capital and other equity.

In 2007, a salary of NOK 791,920 was paid to the Managing Director, while the Chairman of the Board of Directors received a fee of NOK 35,000 and board members each received a fee of NOK 20,000.

The institution's accounts were audited by PriceWaterhouse Coopers A/S.

#### Infrastructure and housing

In 2007, UNIS took ownership of seven new apartments and at year-end 2007 owned a total of 42 apartments. In addition, UNIS rents 20 studio apartments to PhD students and a further 20 to guest lecturers. The Student Welfare Organisation in Tromsø offers a total of 144 studio apartments to students. It is decisive for UNIS that the students

have satisfactory living conditions, and the Board of Directors emphasises pursuing the good co-operation with the Student Welfare Organisation in Tromsø.

As a result of increased staff numbers (including externally-funded positions), UNIS has signed a contract with Barlindhaug Utbygging for the purchase of 10 apartments in October/November 2008. The apartments will cost NOK 22 million, which will be funded by a loan. At year-end 2008, UNIS' total housing loan will total nearly NOK 40 million. Interest, loan repayments and furniture and fittings for the 10 new apartments must be funded from the operation budget.

A major challenge for UNIS in the coming years will be to secure economic resources over and above the ordinary appropriations from the Ministry of Education and Research in order to meet loan repayments and realise our growth ambitions. Liquidity must be strengthened through (1) increasing income from external projects, (2) selling safety and logistics-related consultancy services, (3) budgeting with a surplus and/or (4) expanding share-holder capital.

#### The path forward

In 2007, UNIS implemented considerable work to adapt the course portfolio to better suit the programme descriptions at the universities on the Norwegian mainland. This reaped benefits as UNIS is now far more visible than it was one year ago. Much remains to be done before we can say we have achieved our objectives, and this work

will have priority for many years to come.

The increase in externally-funded research projects shows that UNIS has become an institution with the ability to compete for research funding. At the same time, the institution's vulnerability is being exposed. In the coming years, UNIS must strengthen its competence in project management and funding possibilities, including EU research programmes.

The main challenge in UNIS's ongoing development is the institution's size. UNIS is too small to be able to deliver research and tuition of stable quality over time. The Ministry has been advised that the number of professors/Associate professors at UNIS must be increased to 10 per department as a minimal critical mass. The Board of Directors is addressing this objective.

Increased staff numbers brings with it increased infrastructural costs relating to logistics and housing. We need to find better solutions for the funding of new staff accommodation than we have today. The Board of Directors will address this further in 2008.

In concluding, the Board of Directors would like to thank all staff at UNIS for the good contribution they have made in 2007!

Longyearbyen 4. April 2008

*Kjell A. Sælen*  
Kjell A. Sælen  
leder

*Viva Mørk Kvello*  
Viva Mørk Kvello

*Else Nøst Hegseth*  
Else Nøst Hegseth

*Steinar Nordal*  
Steinar Nordal

*Hanne Christiansen*  
Hanne Christiansen

*Ragnhild Lundmark Daae*  
Ragnhild Lundmark Daae

*Annik M. Myhre*  
Annik Myhre  
nestleder

*Gunnar Sand*  
Gunnar Sand  
director



The UNIS board of directors gathered in Tromsø. From left: Else Nøst Hegseth, Viva Mørk Kvello, Silje Eriksen Holmen (student deputy representative), Annik Myhre, Ragnhild Lundmark Daae (student representative), Hanne H. Christiansen (staff representative), and director Gunnar Sand. In the back: Berit Jakobsen (staff deputy representative), Chairman Kjell A. Sælen, and Steinar Nordal.

# UNIS leader group 01.01.08

# the brown bag lunch seminar

# statistics

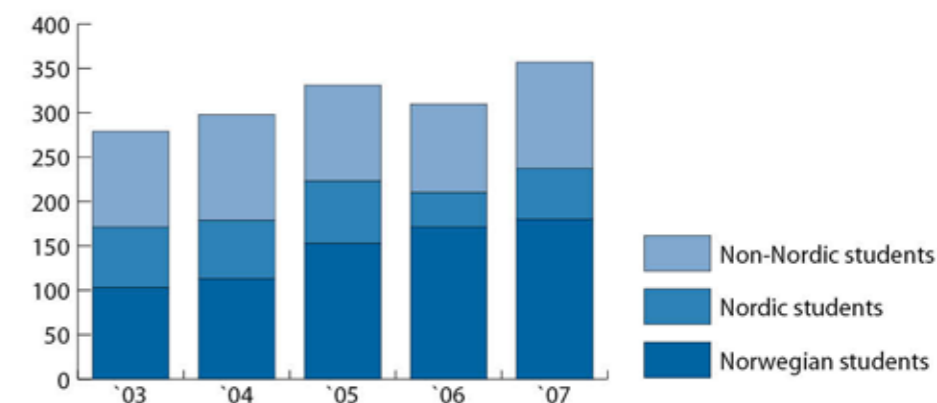
- Gunnar Sand, Director
- Helen Flå, Assistant Director
- Alvar Braathen, Department leader, Arctic Geology
- Steve Coulson, Department leader, Arctic Biology,
- Roland Kallenborn, Department leader, Arctic Technology
- Dag Lorentzen, Department leader, Arctic Geophysics
- Karin Daniels Amby, Student Council leader
- Fred Skancke Hansen, Head of Logistics and Safety
- Eystein Markusson, Head of Academic and Research Affairs

Every Wednesday at noon UNIS becomes the interdisciplinary learning platform of the Svalbard Science Centre. The Lunch Seminar provides short (15-20 min.) presentations about scientific research that goes on at UNIS and other research organizations, while the audience can enjoy their brown bag lunch. In 2007, the Brown Bag Lunch Seminar offered 38 seminars with more than 850 people attending in total, and got the special appearance of James Lovelock, author of the GAIA theory. The UNIS web portal offers detailed information about the seminars and speakers and the possibility to download some of the given presentations: [www.unis.no/lunchseminar](http://www.unis.no/lunchseminar)

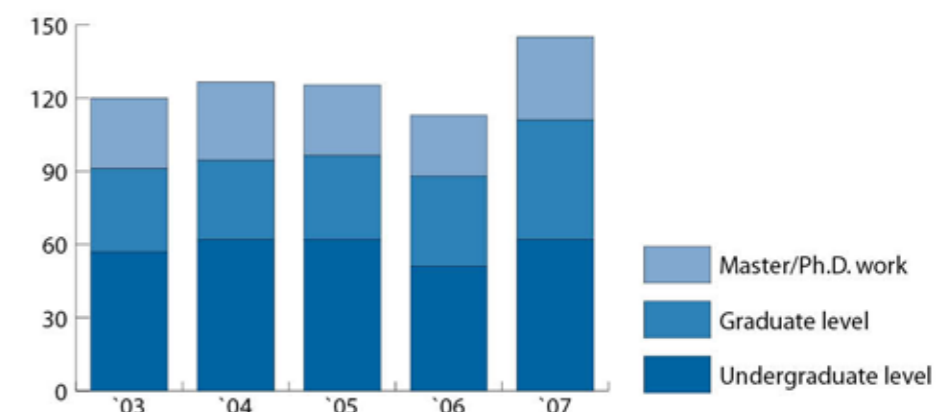


Dr. James Lovelock and his wife Sandy visited UNIS in October 2007 for a very special Brown bag lunch seminar. Photo: Eva Therese Jenssen

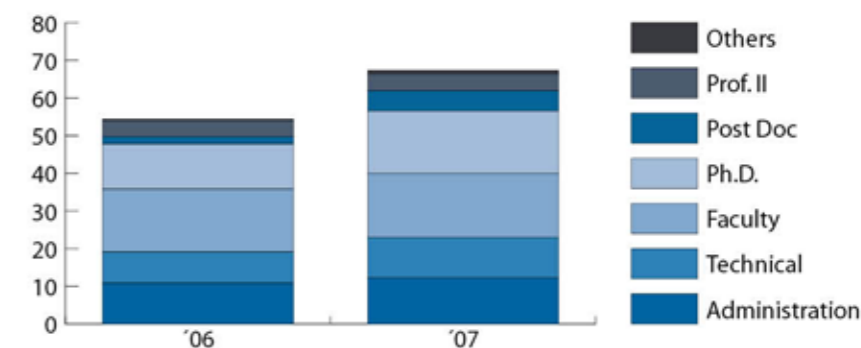
Number of students 2003-2007



Production in student-labour years (1 year = 60 ECTS credits)



Work force in man-labour years according to category at UNIS 2006 - 2007



# resultatregnskap pr. 31.12.2007

## RESULTATREGNSKAP:

	2007	2006
Driftstilskudd fra KD	74 025 888	67 290 097
Eksterne prosjektinntekter	21 420 379	8 852 183
Øvrige inntekter	4 873 065	3 194 890
Brutto driftsinntekter	<u>100 319 332</u>	<u>79 337 170</u>
Direkte prosjektkostnader	20 183 640	8 295 637
Netto driftsinntekter	<u>80 135 691</u>	<u>71 041 533</u>
Lønn og sosiale kostnader	34 598 941	29 868 338
Felt-og toktkostnader	7 132 534	6 083 173
Kostnader lokaler	20 126 919	17 642 405
Øvrige driftskostnader	18 035 072	12 782 869
Sum driftskostnader	<u>79 893 467</u>	<u>66 376 785</u>
Driftsoverskudd	<u>242 225</u>	<u>4 664 748</u>
Finansinntekter og finanskostnader		
Finansinntekter	626 098	531 589
Finanskostnader	1 213 844	517 321
Netto finansinntekter	<u>-587 747</u>	<u>14 268</u>
Resultat før ekstraord.poster	<u>-345 522</u>	<u>4 679 016</u>
Disponeringer:		
Fra annen egenkapital	345 522	

# balanse pr. 31.12.2007

## BALANSE:

	2007	2006
<b>EIENDELER</b>		
Anleggsmidler:		
Bygninger	28 431 300	20 181 649
Andeler Svalbardhallen	1	1
Sum anleggsmidler	<u>28 431 301</u>	<u>20 181 650</u>
Omløpsmidler:		
Varebeholdning	1 599 217	1 134 437
Debitorer	5 857 230	4 455 695
Andre kortsiktige fordringer	8 394 706	7 906 207
Betalingsmidler	13 288 113	24 328 436
Sum omløpsmidler	<u>29 139 265</u>	<u>37 824 775</u>
<b>SUM EIENDELER</b>	<u>57 570 566</u>	<u>58 006 425</u>
<b>GJELD OG EGENKAPITAL</b>		
Innskutt egenkapital	2 054 025	2 054 025
Opptjent egenkapital	9 455 616	9 801 138
Sum egenkapital	<u>11 509 641</u>	<u>11 855 163</u>
Avsetninger for forpliktelse		
Ubenyttet invester.tilsk.utstyr SFP	0	9 777 916
Utsatt innt.føring tilskudd Nordlysstasjonen	229 227	2 500 000
Sum avsetn for forpliktelser	<u>229 227</u>	<u>12 277 916</u>
Langsiktig gjeld:		
Boliglån SparebankEN	19 137 052	14 727 963
Sum langsiktig gjeld	<u>19 137 052</u>	<u>14 727 963</u>
Kortsiktig gjeld:		
Leverandørgjeld	10 567 326	11 243 067
Skyldige off.trekk og avgifter	3 953 209	3 059 326
Annen kortsiktig gjeld	12 174 112	4 842 987
Sum kortsiktig gjeld	<u>26 694 647</u>	<u>19 145 380</u>
<b>SUM GJELD OG EGENKAPITAL</b>	<u>57 570 566</u>	<u>58 006 422</u>

# arctic biology

By Steve Coulson

The department conducts research in arctic biology and ecology and also provides a full one-year curriculum of undergraduate studies and eight Ph.D./Master's level courses. The strategic plan of the department is to develop two research groups, one in marine arctic ecology and one in terrestrial arctic ecology. This is per the UNIS Strategic Plan 2007 – 2012 which aims to create centres of excellence in arctic science at UNIS. At the end of 2007 the department consisted of five associate professors, 5, 25 adjunct professors, two postdoctoral research fellows and four Ph.D. students.

Overall, 2007 was a period of considerable change for the department with the departure of Drs. Elisabeth Cooper, Ketil Eiane and Claudia Halsband-Lenk and the completion and defence of the Ph.D. projects of Christiaane Hübner and Vejbjørn Veiberg. However, several new researchers joined the Department, two postdoctoral research fellows, Dr. Janne E. Søreide and Dr. Øystein Varpe and Ph.D. students María Luisa Ávila Jiménez, Eike Müller and Henrik Nygård. In addition Dr. Pernille Bronken Eidesen was engaged on a one year contract for 2008 to temporarily replace Dr. Cooper and the marine group also saw the appointment of Dr. Tove Gabrielsen as the third marine ecologist. Both Dr. Gabrielsen and Eidesen had starts date in early 2008. Moreover, Prof. Bo Elberling was engaged as an adjunct professor with the departments of Biology, Technology and Geology while Adjunct Professor in microbiology, Prof. Rolf Arnt Olsen, retired after 10 years in the position.

## Terrestrial Ecology Research Group

By the end of the year, the terrestrial group consisted of two associate professors and two Ph.D. students. However, there had been some staff turnover with Dr. Elisabeth Cooper leaving from UNIS and both terrestrial Ph.D. students, Christiaane Hübner and Vejbjørn Veiberg, successfully defending their theses. Beginning their Ph.D. studies, María Luisa Ávila Jiménez and Eike Müller were engaged in August 2007 on projects investigating the dispersal to and colonisation of Svalbard by the flora and terrestrial invertebrate fauna; Ávila Jiménez on the project "High Arctic invertebrate biogeography: dispersal, establishment and survival" and Müller on "Plant dispersal and establishment in the Arctic". Research specialities of the group have been gradually focussed to concentrate on the biogeography of the flora and invertebrate fauna but also include plant ecology, population dynamics and ecophysiology. Of great significance to the terrestrial group is the new DNA laboratory which will be of key importance to the development of research in the department as a whole. This laboratory became operational during 2007 and will be built up during 2008. The DNA laboratory will enable the genetic differences between individuals and populations to be identified. Such differences will enable conclusions such as population source and individual mobility to be drawn. The facility will provide a strong connection between the marine and terrestrial research groups.

In March, Christiaane Hübner defended her thesis entitled "Spring stop-over in the



August 2007: AB-201 students help scientist Martin Loonen catch and mark geese in Kongsfjorden at 2 A.M. in the morning.  
Photo: Steve Coulson



Arctic: Implications for migrating geese and their food plants". Results indicate that moss is the most important food plant for geese during early Arctic spring and the intensive consumption may have a large impact on the vegetation. Clipping experiments showed that intensive grazing has a potential to reduce subsequent productivity of the moss shoots. However, natural grazing had little effect on the following moss growth compared to ungrazed moss. These results demonstrate that biomass removal in moss is compensated for by growth facilitation due to other aspects of goose grazing, such as mechanical break-up of the dense moss mat. The importance of Vårsolbukta as both a stopover site for geese and as a waiting area to fine-tune the arrival at the nesting sites without sacrificing body reserves was highlighted. These observations at Vårsolbukta indicate that stopover sites in Svalbard have multiple functions and they emphasize the need to identify more of these important sites for spring migrating geese in order to implement effective management actions.

Vebjørn Veiberg also defended his thesis, "Patterns, causes and consequences of tooth wear in cervids", in 2007. This thesis presents rare evidence on the consequences of tooth wear on animal performance in wild populations of cervids (deer), evaluating the importance of current ecological and prior evolutionary factors as predictors for spatial patterns in tooth wear and investment. Material from four species of northern cervids was used to investigate the effects of tooth wear. Increasing age was found to coincide with reduced chewing efficiency. In addition, heavy younger animals were found to have more worn teeth than lighter ones, indicating that increased growth had a cost in terms of tooth wear. Increased age and degree of tooth wear resulted in decreased digestion efficiency. Evidence of age related differences in stomach and stomach content proportions was also observed. The consequences of evolutionary versus environmental effects on tooth dimensions and tooth wear rates were also investigated using data from French roe deer populations and Norwegian red deer and moose populations. As predicted from evolutionary hypotheses, expected life span and dietary preferences were found to be of greater importance to tooth dimensions and wear patterns than present environmental conditions.

The new 300-level course, AB-329 "Arctic Winter Terrestrial Ecology" which commenced in November 2006 was completed in March 2007. This is the first time UNIS has run a course split between two semesters. The students attended UNIS for three weeks in November and returned for the final two weeks at the end of February/early March. During the first visit the students attended lectures on Arctic winter ecology, had field trips and lab work and established experiments designed to measure the over

winter survival and activity of the flora, invertebrate fauna and microbiology. The results were determined and analysed when the students returned for the final two weeks of the course in February 2007. This course has proved highly successful and the participating students were pleased to have an opportunity to investigate winter ecological processes in a cross-disciplinary way. This course will be run again during winter 2008-09.

#### Marine Ecology Research Group

In 2007 two associate professors, three post doctoral research fellows and three Ph.D. students pursued research in Arctic Marine Biology. Two new post doctoral research fellows arrived at UNIS due to the start of two large externally funded projects. Dr. Janne E. Søreide, began on the International Polar Year (IPY) project "Climate effects on planktonic food quality and trophic transfer in the Arctic Marginal Ice zones" (CLEOPATRA), while Dr. Øystein Varpe was engaged on the project "The Arctic sea in wintertime: ecosystem structuring due to environmental variability during the polar night" (ArcWin). In addition, Henrik Nygård began his Ph.D. project within the Statoil "Ice Edge" programme with his project entitled "Ecological and ecotoxicological studies on ice associated amphipods". This programme is focusing on the food web in the marginal ice zone and Nygård will study key ecological processes of the sea ice fauna and couplings to the benthic habitat. In brief, most studies of the marine group concentrated on various aspects of the ecology of pelagic (free living in the water column) and benthic invertebrates, particularly copepods and amphipods, and their life history traits, as well as their interactions with the physical environment and within the Arctic food web. The marine group also appointed a new associate professor, Dr. Tove Gabrielsen. Dr. Gabrielsen has considerable experience of DNA methodology applied to both marine and terrestrial systems and will bring together the marine and terrestrial groups.

However, 2007 also saw the departures of Dr. Ketil Eiane and post doctoral research fellow Dr. Claudia Halsband-Lenk. Nonetheless, both maintain tight links with UNIS with Dr. Halsband-Lenk returning for three months in the spring season 2008 and Dr. Eiane through the ArcWin project for which he is the PI. In addition Prof. Jørgen Berge began his sabbatical year at the Scottish Association for Marine Sciences in Oban, Scotland.

The CLEOPATRA-project is funded by the Norwegian Research Council (Norklima program) and is an IPY accredited project. This project will run over three years (2007-2009) and aims to investigate how increased light intensities, due to reduced ice concentrations and ice extent, affect timing, quantity and quality of primary and secondary production in the Arctic marginal ice zone (MIZ).

The MIZ is the key productive area of Arctic shelf seas. The ongoing warming of Arctic regions will lead to a northward retreat of the MIZ and to an earlier opening of huge areas in spring. This may result in a temporal mismatch between the phytoplankton spring bloom and zooplankton reproduction. Less ice will also reduce the ice algae production that may be an important food source for spawning zooplankton prior to the spring phytoplankton bloom. Quantity and quality of primary production in seasonally ice-covered seas is primarily regulated by light and nutrients. Excess light, however, is potentially detrimental for algae and can reduce algal food quality. A decrease in the relative amount of essential polyunsaturated fatty acids (PUFAs) in algae due to excess light may affect the reproductive success and growth of zooplankton, and thereby the transport of energy to higher trophic levels, such as fish, birds, and mammals.

In 2007, the CLEOPATRA-project, together with the IceAmph-project, successfully completed an extensive field campaign based in the high Arctic fjord Rijpfjorden (Nordaustlandet, Svalbard). The first field work started 1st March; the start-day of the IPY, and all together Rijpfjorden was visited eight times during the period March-October 2007. In Rijpfjorden, the CLEOPATRA-project followed the development in biomass and food quality of ice algae, phytoplankton and secondary production before, under and after ice break up. The copepod *Calanus glacialis*, the key herbivore in Arctic shelf seas, was used as target species for secondary production.

Another major research theme is the ArcWin project on which Dr. Varpe has been engaged. Three main activities have taken place within this project during 2007: 1) modelling of energy storage and reproductive strategies in copepods, 2) statistical analyses of seasonal migrations and population dynamics of zooplankton in Isfjorden, and 3) the design of future winter studies where samples will be obtained using the new UNIS boat. In addition, links with Russian collaborators (Ph.D. student I. Berchenko and post doctoral research fellow S. Slobodov) have been established.

Post doctoral research fellow Dr. Claudia Halsband-Lenk departed UNIS to join the Plymouth Marine laboratory, UK. Dr. Halsband-Lenks project, which will be concluded in 2008, aimed to determine if variability in quantitative life history traits of zooplankton, such as body size and development time, are important for understanding population dynamics on ecological time scales. The experimental results show high individual variability in these traits within populations. Variance of body size decreased when environmental variability was removed by breeding individuals under constant laboratory conditions over multiple generations, indicating

a strong impact of environmental factors on variability patterns. On the other hand, a genetic component was also apparent from trends in populations that were subjected to artificial selection towards larger and smaller body sizes, although these changes were not significant on the scale of less than 10 generations.

To what degree the pelagic ecosystem and the resident food chains react to these variations is of major importance for our understanding of climatic effects on the ecosystems in the Arctic. This aspect is studied by Ph.D. student Daniel Vogedes, who is working on the same organisms, but with a focus on food web dynamics in Isfjorden: foraging strategies of the Little Auk may give insight into the variability in *Calanus* species composition and distribution and their impact on the arctic marine food web.

Ph.D. student Malin Daase delivered her thesis with title "Mesozooplankton distribution in Svalbard waters: *Calanus* spp. and its relationship to hydrographic variability" in October 2007 and successfully defended this work in February 2008. Daase's study was on zooplankton distribution in relation

to hydrographic variability in the border area between the Arctic and Atlantic. Zooplankton data obtained from extensive sampling in the last years, accompanied by measurements of physical properties of the water column, indicate that variability in water masses has measurable effects on zooplankton distribution and species composition in the study area. Three copepod species of the genus *Calanus* co-occur in the waters around Svalbard and together dominate the zooplankton biomass in Arctic and Atlantic waters. Analysis of the relationship between *Calanus* spp. abundance and the physical environment demonstrate the existence of simple relationships between zooplankton composition and variability in ocean climate. This suggests that the effects of climatic variability on *Calanus* spp. in this region are mediated primarily through transport and mixing of water masses.

#### GRADUATES 2007: Ph.D. degree:

Christiaane Hübner: Spring stop-over in the Arctic: Implications for migrating geese and their food plants

Vebjørn Veiberg: Patterns, causes and consequences of tooth wear in cervids

#### Master degree:

Johanna Hovinen: Growth of polar cod (*Boreogadus saida*) related to water temperature and diet composition in Svalbard waters

Erlend Kjeldsberg Hovland: Tracing Coccithophorid blooms in the Barents Sea using MODIS Level-3 imagery

María Luisa Ávila Jiménez: High Arctic Soil Invertebrate Fauna and its Response to Some Environmental Factors

Leif Sindre Johannessen: Feeding and growth of polar cod in fjords of Svalbard

Mona Kleiven: Pigmentation in *Halocynthia pyriformis* from Isfjorden, Spitsbergen

Ragnhild Pettersen: Phytoplankton systematics and pigmentation in the Arctic

Eike Stübner: Biogeographical distribution of temperate vs. Arctic benthic species around Svalbard



April 2007: The CLEOPATRA team taking a break from fieldwork in Rijpfjorden. From left: Jozef Wictor, Jørgen Berge, Mikko Vihtakari, Henrik Nygård (front), Eva Leu and Janne Søreide.  
Photo: Janne Søreide





Summer 2007: The camera placed on Colletthøgda monitors the calving of the Kronebreen glacier in Kongsfjorden. The data collected is part of Monica Sund's Ph.D. project "Dynamics of Calving and Surging Glaciers".

Photo: Monica Sund

# arctic geology

By Alvar Braathen

In 2007 the Geology Department performed research within six subjects in Earth Science; marine geology, Quaternary geology, permafrost and periglacial geomorphology, glaciology, sedimentology, and structural geology. The research vision of the department focuses on Svalbard, its fjords and adjacent shelf that together offer an excellent opportunity to study a wide range of landforms, processes, sediments and structures related to the development of the Barents Shelf and infill of sedimentary basins. As an area of terrestrial outcrop on the Barents Shelf, Svalbard provides excellent access to a vast range of basin settings, from the low-latitude infill of the Devonian basins, to the present glacial and periglacial erosion and infill of valleys and fjords.

By the end of 2007, the staff consisted of four full-time faculty, professors Benn and Braathen, and associate professors Christensen and Hormes, and four adjunct professors; Helland-Hansen, Humlum, Ingólfsson, and Thiede. In addition, there were one Post Doc; Juliussen, five UNIS based Ph.D. students; Bælum, Gjermundsen, Kristensen, Luthje, and Sund, four external Ph.D. students, and one Research Assistant, Ellehaug.

In 2007, the department invested significant time in recruiting. Firstly, the aim was to fill vacant positions in Marine Geology and Sedimentology. We are pleased to announce that Riko Noormets and Maria Jensen will join the department in 2008. Further, we are presently in the process of recruiting a Petroleum Geologist. Secondly, several adjunct professor positions were replaced. Ole Humlum and Olafur Ingólfsson accepted

another 3 years with UNIS, Jørn Thiede was recruited to work with marine geology, and William Helland-Hansen took over for Wojtek Nemeč in sedimentology. Helland-Hansen also came to UNIS for a sabbatical year by the summer of 2007.

The Geology Department had a very productive year in 2007. One Ph.D. student and four Master students finished their work. The department also performed a time-high record in Master and Bachelor ECTS production, totalling 2045 ECTS, up from 1540 ECTS in 2006. The department also offered two new courses in 2007 (AG-330 and AG-331), which were well attended. Further, five new courses have been planned for 2008, by that adding to the department's course portfolio, which totals 190 ECTS.

Ph.D. student Lotta Luthje finalized her Ph.D. thesis on "Paleocene coal depositional environment". This work is an investigation of the coal-bearing Firkanten Formation of Paleocene is based on detailed investigation of new cores from SNSK and field observations from Svea, Longyearbyen, and Ny-Ålesund. Of special interest to the sponsor, SNSK, is the fact that the new models open for possible coal reserves further SSW than previous models predicted. Luthje's PhD defence is planned for the spring of 2008.

Ph.D. student Lene Kristensen completed her fieldwork in the Paulabreen surge area in inner Van Mijenfjorden. The Ph.D. project looks into the permafrost/glacier interactions in the surge environment studying landforms and modern processes. The project is due to be completed by the end of 2008.

Ph.D. student Monica Sund works on her project entitled "Dynamics of Calving and surging glaciers". The work is a part of the IPY-project GLACIODYN (The Dynamic Response of Arctic Glaciers to global warming), where the focus is on the effect of glaciers on sea level change and on the fresh water input into fjords and embayment. GLACIODYN aims to increase the understanding of the mechanisms behind rapid changes in glacier dynamics. Calving glaciers constitute a substantial part in the fresh water supply to the world oceans. A new time-dependent model, which predicts changing ice front positions and calving fluxes for tidewater glaciers will be tested and developed using data from Kronebreen. Additionally, the dynamics of surging glaciers will be included in the Ph.D. work. Recent work includes establishing 12 stakes for velocity measurements on Kroppbreen, a valley glacier in Kjellströmdalen. Ground Penetrating Radar (GPR) acquisition has also been conducted. Detailed air photo studies have been carried out and a Digital Terrain Models (DTM's) are generated for several glaciers in different stages of a surge in southern Svalbard. The data are promising for getting more detailed information about early stages during surge activity.

Ph.D. student Karoline Bælum develops her project on geophysical imaging of sub-surface reservoirs of Svalbard. Her work focuses on the Billefjorden Palaeokarst project, including georadar, seismics, and outcrop analysis. She is also responsible for the seismic interpretation in the CO2 project.

Ph.D. student Endre Før Gjermundsen started his project in November, entitled "Reconstruction of the Weichselian Ice sheet in NW and Central Spitsbergen". His work is a part of the IPY-project RISE/Icebound (see below). The objective is to create a detailed three-dimensional model of the ice sheet geometry in field areas, which can be extrapolated to Svalbard using remote sensing techniques based on satellite imagery.

The group working with permafrost and periglacial geomorphology, consisting of Hanne H. Christiansen, Ole Humlum, Håvard Juliusen, Lene Kristensen, Jonas Ellehaug, Angélique Prick and Herman Farbrot, focused in 2007 on starting two new research projects, both funded by the Research Council of Norway. One was the IPY project "Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost" (TSP Norway), which focuses on obtaining a snapshot of the permafrost temperature and activity of different landforms in Svalbard and northern Norway, by establishing the Svalbard Nordenskiöldland Permafrost Observatory and the North Scandinavia Permafrost Observatory, and by establishing the first Norwegian permafrost database, NORPERM at the Geological Survey of Norway, to ensure the data legacy. Christiansen is the TSP Norway

project coordinator, and one of two international TSP leaders. The IPA Secretariat, run in 2007 by Prick until September and then by Farbrot, is important for the TSP coordination. TSP Norway has participating scientists from UiO, NGU, met.no, NTNU, ICG and Instanes Svalbard. Juliussen started at UNIS as a 3-year TSP Post.Doc. in May 2007. More information is on [www.tspnorway.com](http://www.tspnorway.com).

The other project is called "Climate change effects on high arctic mountain slope processes and their impact on traffic in Svalbard" (CRYOSLOPE Svalbard), and is part of the NORKLIMA program. CRYOSLOPE Svalbard studies in particular avalanches along the 70 km most used snow mobile routes around Longyearbyen, and establishes a database of these slope events and their meteorological conditions. The data are made publicly available on the project webpage [www.skred-svalbard.no](http://www.skred-svalbard.no), which also received data from others this way. The operational work was carried out by Jonas Ellehaug until December 2007, when Ulrich Neumann took over as project field and database manager. Also former slope activity is included by establishing geomorphological maps and dating slope landforms. The project shall use the different types of data obtained to establish future scenarios for slope activity in the Svalbard landscape in a changed climate. Scientists from both the Geology and Geophysics departments at UNIS, from UiO and NGU are participating. The project is coordinated by Christiansen.

Doug Benn continued to develop glaciological research in Svalbard, focusing on (1) the dynamics of calving glaciers; and (2) speleological investigation of glacial drainage systems (ice caving). A new theoretical model of calving processes and the dynamics of calving glaciers was published in two papers (Benn et al. 2007a, b). To develop and test this model, a program of glacier monitoring was begun on Kronebreen, NW Spitsbergen, with UNIS Ph.D. student Monica Sund, as part of the IPY Project GLACIODYN (Dynamic Response of Arctic Glaciers to Climate Change). A pair of automatic cameras was installed above the glacier, and the resulting set of images is being used to obtain high resolution records of glacier velocity and calving events.

Ice cave research was conducted in several glaciers by Doug Benn and University of Florida - UNIS Ph.D. student Jason Gully, with the aim of developing a new comprehensive model of glacial drainage systems. Subsurface surveys were conducted in tandem with ice-penetrating radar studies conducted by Tavi Murray, University of Swansea, providing a detailed three-dimensional view of the drainage systems and their glaciological context. Previously explored systems in Hansbreen were remapped in collaboration with the Polish Research Station at Hornsund, and new subglacial caves were discovered and explored in the surging glacier Paulabreen. In addition, ice caves in Longyearbreen, Scott Turnerbreen

and Rieperbreen were studied by Masters students Sanna Kallio, Maria Temminghof and Katleen Van Hoof.

On the teaching side, a new course, AG-331 "Glacial Processes and Landsystems", was launched in summer 2007. AG-325 "Glaciology" continues to be popular, attracting 25 students in spring 2008. Doug Benn and Lene Kristensen contributed to the popular NRK science program "Schrödingers Katt", on the recent surge of Paulabreen. In addition, Benn took part in a shoot in the French Alps for the BBC documentary series "Earth - The Biography".

Alvar Braathen has further developed three projects in 2007; Palaeokarst in Billefjorden, Mediumfjellet fold-thrust stack, and the Longyearbyen CO2 pilot study. The main aim of the "Palaeokarst in Billefjorden" project is to create 3D reservoir-analogue models from superbly-exposed kilometer-scale stratiform and cross-cutting collapse-breccias. The work is conducted within a large network of collaborating institutions and researchers, with the Centre for Integrated Petroleum Research (CIPR) at the University of Bergen in the leading role and UNIS handling the logistics. In 2007, more than 20 researchers and students performed outcrop and geophysical studies in the inner Billefjorden area. One major activity was the helicopter-based laser scanning of the area, which was performed in August 2007. These data are compiled into a high-resolution digital elevation model (DEM).

The "Mediumfjellet fold-thrust stack" project study the different structural styles and the processes responsible for uplift of Svalbard in the Early Cenozoic. The project is testing structural timing, kinematics and processes of fold-thrust belt development as a basis for analogue modeling and high-resolution strain modeling. Two master students (Tine Larsen and Pierre Mauries) of the University of Tromsø (UiT) and UNIS performed their outcrop studies in the area, together with a Ph.D. student Nancy Schmidt of Royal Holloway University and UNIS, and Alvar Braathen (UNIS) and Steffen Bergh (UiT). A key dataset for the study is the DEM based on helicopter-based laser scanning of the area, which was performed in collaboration with CIPR in August 2007.

The "CO2 free Svalbard 2025" project started in June 2007, with the first activity aimed on identifying potential reservoirs around Longyearbyen. If successful, the longer perspective is to develop one or more of the reservoir(s) into a CO2 injection laboratory, with the ultimate aim to utilize it as a permanent CO2 storage site that meets the requirements of sufficient retention of c. 10.000 years. In the autumn of 2007, the first two wells were drilled to 500 m and 860 m, respectively. Drill cores and outcrop data have been compiled, and the cores have been carefully examined with respect to

petrophysical properties. Although promising results have been encountered, the drill holes did not penetrate the main reservoir at c. 900 m depth. Hence, the third drilling in August 2008 will be critical for the final assessment of a CO2 storage site.

Anne Hormes started in an associate professor position of Quaternary geology in February 2007. Her research is focused on progress in geochronology of the last glaciation and the Holocene using radiocarbon and cosmogenic nuclide dating (CN). She took a short sediment core from the lake Trauvatnet south of Ny-Ålesund in May. The sediments are investigated in terms of glacier variability and organic pollutants in collaboration with Ph.D. student Monika Trümper, Arctic Technology, UNIS. In July Anne Hormes initiated a fieldwork campaign on Nordaustlandet in order to map glacial drift of the last glaciation and to sample for cosmogenic nuclide dating. This work is part of the IPY-project RISE (recently renamed "Icebound" with a dedicated website [www.icebound.no](http://www.icebound.no)). The aim of this project is to gather data towards a more comprehensive understanding of the last glaciation ice sheet geometry and its collapse. The former ice sheet geometry with a constrained age based on CN will benefit Earth system models that test freshwater spill events and feedbacks to the climate system. Another area of application might be uplift modeling used for basin reservoir studies for the petroleum industry. A new cooperation project has been initiated by Maria Jensen, Norwegian Geological Survey - NGU, with Lena Håkansson, Lund University, and Anne Hormes upon the stratigraphic key section Kapp Ekholm in Billefjorden. Field work on the glacial sediments was accomplished in August and a poster presentation compiled for workshops.

William Helland-Hansen, adjunct professor in geology and currently on sabbatical leave (from the University of Bergen) at UNIS conducts his research in sedimentology of the Paleogene Battfjellet Formation. These studies are carried out in collaboration with master students Andreas Olsen (UiB) and Stig Atle Stenen Kvine (UNIS/UiB) who did their project work at Blixodden, south side of Van Mijenfjorden, the summer of 2007. More students will be involved in this project summer 2008, with main focus on depositional evolution on the north side of Van Mijenfjorden. The Battfjellet Formation is an extremely well exposed sandstone unit. Understanding the geometry, lithological distribution and controlling mechanisms for this formation is of great value for the understanding of offshore equivalents on the Norwegian Shelf. Helland-Hansen also addresses the concepts related to sequence stratigraphy. A new method trajectory analysis is developed as an alternative approach to traditional sequence stratigraphic analysis. Trajectory analysis focuses on the lateral and vertical

migration of geomorphological features and associated sedimentary environments, with emphasis on the paths and directions of migration. In particular, shorelines and shelf-edges, being expressed by a pronounced break-in-slope, are suitable for mapping lateral and vertical shifts of depositional systems. The accompanying trajectories give insight into the sedimentary systems response to the combined effect of relative sea-level change and sediment supply. Helland-Hansen's third activity relates to the origin of shelves. The understanding of the geometry and topography of ancient and modern shelf often lacks a common platform. A model for shelf genesis with emphasis on the relative impact of underlying structure as compared to sedimentation, and a consistent use of shelf, platform, slope and ramp terminology is erected. In the lack of a clear apprehension in the literature on geometric and genetic criteria that encompasses both modern and ancient shelf systems, a few guidelines for discrimination of past shelf systems that also can be applied to modern systems is developed.

#### GRADUATES 2007: Ph.D. degree:

Håvard Juliussen: Near-surface ground thermal regime in permafrost areas of Norway and Svalbard: Processes and geomorphic implications

#### Master degree:

Peter Hülse: Late Palaeozoic sedimentology and stratigraphy of Svalbard

Markus Meyer: Meteorological and Geomorphological Impacts on Snow Avalanche Activity in Larsbreen Valley, Spitsbergen, against the Background of Maritime Influenced Arctic Climate

Daniel Muller: Channels in Longyearbreen, Svalbard

Jonathan Teuchert: Mapping moraines and glaciers using multispectral imagery and ancillary elevation

Helle Vittinghus: Modern and Holocene ice-wedge dynamics in the arctic environment in Adventdalen, Svalbard



April 2007: AG-330 students and staff visit the pingo in Reindalen.  
Photo: Hanne H. Christiansen



# arctic geophysics

By Dag A. Lorentzen

The department received two new positions in 2007. There was one new full time faculty position in Radar Applications and one new full time faculty position as head of the Kjell Henriksen Observatory (KHO) giving a total of 7 full time faculty positions. The department – with already established research within oceanography, meteorology, middle and upper polar atmosphere – also consisted of six Adjunct Professors, as well as one post-doc (oceanography) and four Ph.D. research fellows (upper polar atmosphere, middle polar atmosphere, oceanography and meteorology).

Dr. Kjellmar Oksavik was employed in the Radar Application position, enhancing the focus on space-related research in the department. The position was important in order to increase our cooperation with other space-related institutions on Svalbard such as the EISCAT Svalbard Radar, and in order to better exploit available research infrastructure in this field. Prof. Fred Sigernes was employed in the KHO position, leaving the Middle Polar Atmosphere position vacant for new applicants. The position was announced - but not occupied during 2007.

Teaching was conducted at both the undergraduate and graduate level, with seven and

five courses respectively. An important part of all courses is the field work, which allows the students to operate research equipment in the field. The data collected are then typically used in course reports, giving the students valuable experience in analysing and presenting scientific data in a coherent manner.

After 100 days of construction, the new observatory named after Prof. dr. Kjell Henriksen (the Kjell Henriksen Observatory), was finished in time by the local contractor Svenkerud AS in August 2007 and handed over to Statsbygg Nord for inspection. The fiber connection from UNIS in Longyearbyen to the station at Breinosa was finished at this time. The users of the observatory were allowed to start moving instruments from the old station in Adventdalen, and to prepare for the upcoming auroral season. All optical instruments were moved and the station was fully operational by 1. December 2007. The observatory is one of the largest of its kind in the world.

In Upper Polar Atmosphere, a number of research projects have been pursued in 2007.

Using KHO as the main instrument platform, the PROEM project - a Norwegian Research Council project in cooperation with UiO and Laboratoire de Planetologie, Grenoble - was initiated in 2007. The main research topic is polar cap patches. Patches can be measured using the EISCAT radars and ground based optics. This data will be used as input to the TRANSCAR model developed by the French group, in order to understand more about the morphology and physics of these high density clouds of plasma following the general convection pattern.

Another project - POLARLIS - in cooperation with Laboratoire de Planetologie, Grenoble, France, UNIS and UiO - was carried out in order to investigate the polarization of aurora (especially the red auroral line at 630.0 nm) using a custom built instrument placed at KHO. Through Ph.D. student Jeff Holmes, modeling and observations of hydrogen aurora (the PROTONICS project) has also been performed during the year, using instrumentation in both Longyearbyen and Ny-Ålesund.

The EISCAT Svalbard Radar operated continuously from March 1, 2007, in support



The Kjell Henriksen Observatory, situated at the mountain Breinosa outside Longyearbyen, was finished in 2007, and is now fully operational.

Photo: Fred Sigernes



of the IPY. In addition we carried out a two-week EISCAT campaign in December 2007 in collaboration with KHO and SuperDARN. Our main research topics are to study flow transients, electron density structures and mechanisms producing HF radar irregularities in the F-region ionosphere.

In Oceanography, 2007 set the start for new research projects through Norwegian and European IPY funding. Assoc. Prof. Frank Nilsen is PI in the two largest Norwegian IPY projects, IPY iA00S-Norway and IPY BIAC. New instruments and subsurface moorings were deployed around Svalbard in order to study the dynamic of the West Spitsbergen Current and its effect on the water mass and sea ice distribution in the Arctic Ocean (iA00S), and to study ice production and deep-water formation in the Barents Sea and its effect on the thermohaline circulation (BIAC). These projects also fund a post-doc position in oceanography and co-sponsored the IPY International Sea-Ice Summer School ([www.seaice.info](http://www.seaice.info)) that was successfully completed at UNIS during 2-13 July 2007. 92 participants from 16 different nations and 23 lecturers from 12 different nations gathered for two very intense and interesting weeks of science, social events and outdoor activities. The main focus of the scientific programme was on sea ice physics, mechanics and dynamics, but it also included marine ice fauna biology, biogeochemical processes, remote sensing and paleo-oceanography. A total of 66 hours of lectures were given, with two additional poster sessions where most participants presented their work. This was the third time in history that a sea-ice summer school was organized, following similar events in Italy in 1981 and Finland in 1994. The aim was to gather world's foremost experts in the field today, to educate tomorrow's sea ice experts and to inspire and stimulate networking and cooperation within the sea-ice research community. A textbook based on the lectures given at the summer school is planned to be produced

One of the focus areas in meteorology is air-ice-sea interaction and in May, Tiina Kilpeläinen started as a Ph.D. student in meteorology. Kilpeläinen will study the physical processes that control the exchange of energy between air and sea in fjords of Svalbard and how this affects the lower part of the atmosphere; something critical in order to improve weather and climate models. Kilpeläinen's work consists of field measurements, over especially Isfjorden, and modeling studies done in cooperation with the University of Bergen.

The project "Climate change effects on high arctic mountain slope processes and their impact on traffic in Svalbard" (CRYOSLOPE Svalbard), is a three year project (2007-2009) funded by the Norwegian research council (NORKLIMA). The meteorology group's focus is on meteorological monitor-

ing and surface exchange processes with the aim to better understand the connection between avalanches and weather.

The meteorology group also works with what controls the climate on a local scale with varying topography and surfaces such as tundra, snow, ice etc. As part of this, Charlotta Petersson completed her Master thesis in which she analyzed the local weather around Longyearbyen.

In the field of snow- and ice processes research activities has concentrated on two focus areas, namely melt water refreezing in snow and ice and the effect of microparticles on melt rates of glaciers. Detailed field measurements have been carried out to analyze how and where meltwater refreezes inside a seasonal snowpacks. It was found that the layering in snow forms hydraulic discontinuities where meltwater is temporarily halted, an ice lens forms which prevents further percolation. This mechanism with formation of ice lenses in seasonal snow packs retard vertical percolation. However, the impermeable nature of such ice lenses result in water ponding, metamorphism and subsequent lateral drainage of meltwater. A result of these micro processes in the snow is that ice lenses may prevent deep percolation into glaciers. But, it promotes lateral flow and may lead to runoff instead of refreezing of the meltwater. Such processes are important in order to understand the climate sensitivity of the Svalbard glaciers since more than one third of the melt water is believed to refreeze inside glaciers.

During the spring of 2007 spectrometer analysis was carried out together with measurements of BC (black carbon from coal dust) in the vicinity of Longyearbyen. An important outcome of the studies has been the establishment of a BC-albedo relation for high concentration in seasonal snow. It was found that a non-linear relation exist between BC and the resulting albedo. And, the snow absorbs twice the solar radiation with less than 1% BC in the top layer.

#### GRADUATES 2007:

##### Master degree:

Karin Nordkvist: Ocean Colour Retrieval using DroneSpex, a Miniature Imaging Spectrometer.

Charlotta Petersson: An analysis of the local weather around Longyearbyen and an instrument comparison

Maria Wedlund: Airglow OH (8,3) rotational temperatures (780N) 2003.

Marius Årthun: Seasonal variation in cross-shelf flow on the West Spitsbergen slope



October 2007: AGF-311 students and staff raise a new weather mast on Kapp Lee, Edgeøya. Weather data from Kapp Lee can be found on the UNIS webpage.

Photos: Eva Therese Jenssen



May 2007: AT-208 and AT-321 students and staff working on the sea ice.

Photo: Aleksey Marchenko

# arctic technology

By Roland Kallenborn

The Arctic Technology Department offers state-of-the-art education and research opportunities in Arctic Engineering as well as in Arctic Environmental Technology and Chemistry. Arctic Engineering concentrates on engineering problems to be tackled when settling in the Arctic environment: living and building on frozen ground that may be subject to landslides and avalanches (Geotechnics), Arctic offshore oil and gas exploitation (Ice Mechanics, Geotechnics), and potable water supply (Hydrology). Arctic Environmental Technology and Chemistry concentrates on current and potential pollution problems, environmental impacts and feasible remediation techniques in Arctic areas.

In co-operation with the Arctic Geology department, Arctic Technology will develop a new UNIS priority research and education strategy within "Arctic Energy & Environment" within 2008.

The technological challenges deriving from increased human activity in the northern marine environments, as well as locally here on Svalbard, continue to be our main focus. This research priority is also including climate change related topics in education and science. The faculty staff continued to work on established relevant research programs at UNIS and new studies were initiated.

## Arctic Engineering

The key topics within Arctic Engineering are permafrost and ice. We perform measurements and simulations of thermo-mechanical response in relation to onshore, coastal and offshore infrastructure. The main sites of our investigations are Longyearbyen, the Van Mijenfjorden and Svea. These research aspects also include climate change related aspects. In this context, UNIS Arctic engineering scientists monitor ground temperature profiles down to 10 m depth in open country research sites, down the supporting piles at the Svalbard Science Centre,

and in various waste tips in Adventdalen.

The development of the mine as well as community related infrastructure and harbour facilities in Longyearbyen, as indeed in the Svea community, poses important scientific and engineering tests for our staff and students. The ice coverage in the Van Mijenfjorden is usually stable throughout the season, allowing us to perform seasonal studies without risk of losing essential scientific equipment.

Several unique medium- as well as large scale experiments have been performed on the ice, close to the Svea community, over the past years during a set of international co-operation projects. These experiments brought together a unique combination of real sea ice measurements and load-determinants. Ice conditions on the Van Mijenfjorden were monitored and in-situ ice stresses were investigated. The main focus within this project was to investigate how environmental variables (meteorological and oceanographic) determine ice conditions. In the Barents Sea we performed our annual measurements and experiments on first-year sea ice ridges as a part of a combined scientific and educational program were also students participate in state-of-the-science research activities as part of their project work.

Several Ph.D. research projects are related to the research of ice characterisation on Van Mijenfjorden. As an example, Fabrice Caline is studying the design of environmentally friendly shore protection structures. A full-scale test embankment is being built with local masses in Svea and will help understand the action of frost and sea ice. The project is supported by the coal mining company Store Norske (SNSG), the Research Council of Norway (RCN) and recently obtained the European Eureka innovation label. A second Ph.D. thesis is under progress

where Sébastien Barrault investigates the "Mechanical deformation of first-year land fast sea ice due to temperature variations".

In this context, he examines in-situ how temperature variability induces internal forces by thermal expansion into a constrained sea ice cover. The majority of the experiments are conducted in Sveabukta in the Van Mijenfjorden area. Two new Ph.D. projects started in 2007. Lucie Strub-Klein, who started her Ph.D. in August 2007 on first-year sea ice ridges, will focus mainly on physico-mechanical properties of the ice rubble during the season. Her first fieldwork consists in building and studying a small ridge in the Van Mijenfjorden in Svalbard. Louis Delmas, started his Ph.D. studies on geotechnical and climate related mechanisms leading to increased snow avalanches releases under the special Arctic conditions. A first experiment was started in 2007, recording the effect of permafrost on the temperature gradient in the snowpack.

### Environmental Technology and Chemistry

Key topics of interest within Environmental Technology include: The fate of oil spills in an Arctic environment and possible counter-measure/remediation techniques; levels and spreading of persistent organic pollutants (Polychlorinated biphenyls, current used pesticides and organochlorine pesticides in Arctic biota, sea water, ice and snow as well as lake sediment and sea weed); and spreading and effects of pollution from local mining industry. Oil spills in an Arctic environment, for instance the waters around Svalbard, can be expected to behave significantly differently than oil spills in warmer waters, like the North Sea. The differences in spreading, evaporative loss, emulsification, dispersion and other factors add up to important modifications in operational oil spill contingency planning. There is a range of potential sources of oil spills in and around Svalbard, including fishing boats and freighters, tourist vessels, and leakage or seepage from oil depots on land.

A new international research project was launched in 2007, focusing on weathering processes of oil spills under Arctic conditions as a follow up of an earlier RCN funded project. An integrated Ph.D. study will be incorporated into this research project during the summer 2008.

A new environmental chemistry laboratory has been operational since 2005 for the trace analytical quantification of organic contaminants in Arctic environmental samples. In 2007 a set of experiments have been performed on fate and distribution of persistent organic pollutants and current used pesticides (CUPs), including new emerging contaminants in Arctic environments. The laboratory consists of gas chromatographic

equipment with electron capture, mass selective as well as flame ionisation detection. In addition, a high performance liquid chromatograph with variable wavelength detection (DAD) is available for the investigation of water soluble contaminants. The laboratory is currently actively in use for post-graduate courses (AT-321 and AT-324) as well as for research purposes.

As a part of her Ph.D. project Monika Trümper performed combined laboratory and field experiments on photochemical transformation processes of persistent organic pollutants on ice and snow surfaces under Arctic conditions. In addition, the department has conducted comprehensive experimental work within two research projects financed through the RCN for the investigation of pharmaceutical residues in sewage treatment processes under different climate conditions and the environmental behaviour of perfluorinated flame retardants in off-shore fire fighting foams (AFFF), respectively.

Another topic of interest within Environmental Technology includes the environmental control of acids and metals being released (known as acid mine drainage) from mine waste rock piles (tips) and the impact of metals as these accumulate in soil, disperse within the hydrological system or taken up by plants. In 2007 a co-operation project between University of Copenhagen and UNIS terminated after three years of investigating the release and fate of metals associated with a tip in Bjørndalen: Snow and temperature control of biogeochemical oxidation processes in natural and managed High Arctic ecosystems. The project included five UNIS master students and

one Ph.D.-student (Jens Søndergaard). The project is now extended as part of a second Ph.D.-project (Jørgen Hollesen).

### Project co-operation

In 2007, the Arctic Technology department was awarded with two RCN projects supporting scientific exchange of students (Ph.D. and M.Sc. level) as well as scientific personnel between Russian and Norwegian academic institutions involved in research in the European "High North". The projects "NorthPOP" and "Safe loading and transport of hydrocarbons from the Barents sea" (see detailed information on the UNIS web-page) are currently coordinated through the UNIS Arctic Technology department.

### GRADUATES 2007:

#### Ph.D. degree:

Per Olav Moslet: In-situ Measurements of Sea-Ice Parameters that Affect the Loads on Coastal and Offshore Structures

Svetlana Shafrova: First-year sea ice features: Investigation of ice field strength heterogeneity and modelling of ice rubble behaviour

#### Master degree:

Magnus Gabrielsen: Laboratory investigation of sea ice relaxation

Marco Nanetti: Experimental study of friction between saline ice and steel

Lucie Strub-Klein: Sea Ice Rheology under time dependent loading

# student council

### By Karin Daniels Amby

As with all universities, the welfare of the students at UNIS plays a crucial role in its success. However, the unique location of UNIS brings with it a large number of welfare issues not encountered at other institutions. Tackling these issues requires a close bond between staff, students and the local community of Longyearbyen. As such, the student council at UNIS strives to promote communication between these three parties, connecting students with the relevant people or, where appropriate, acting on their behalf.

Internal links to UNIS are maintained by representatives in both the UNIS board, and in the leader group at UNIS. These representatives are the students voice in the organization and have a say in all matters that concern both students and UNIS as an institution.

Whilst no 'hard' links to the community outside of UNIS exist, the student council strive to promote student participation in community events such as "Ta Sjansen" and the local sports club "Svalbard Turn". Participation encourages students to socialise with local people and aids integration into the community.

In addition to the above, the student council gathers all students together to allocate some responsibilities of a more practical nature. The budget allocated by UNIS for

student welfare is used to provide and maintain many facilities for students' use.

These include outdoor equipment such as skis, sledges, camping gear and safety equipment, kitchen utensils and two student cabins. These facilities are used extensively by the students at UNIS, and being a helping hand for the students responsible for these things is perhaps the student council's most important role.

With such a high turnover of students at UNIS, the student council must be dynamic, constantly changing its services to meet the demands of the new students and address their needs. This is no easy task, and is perhaps the biggest challenge that faces the new student council team as it begins office every semester.

Some student representatives in 2007:

#### Spring

SC Leader	Ole-Christian Ekeberg
SC Vice leader	Tore Nordstad
Board representatives	Ragnhild Lundmark Daae Fredrik Paulsen
Treasurer	Holger Schmithüsen

#### Fall

SC Leader	Ole-Christian Ekeberg
SC Vice leader	Karin Daniels Amby
Board representatives	Ragnhild Lundmark Daae Silje Eriksen Holmen
Treasurer	Mikko Vihtakari



September 2007: AT-207 students and staff burn oil as part of a field investigation in Van Mijenfjorden.

Photo: Aleksander Kurilo



March 2007: UNIS students participate eagerly in the annual "Ta sjansen" sledge race during Sunfest week.

Photo: Eva Therese Jenssen

# scientific publications

Scientific journal articles and books published with UNIS as author address in journals accepted by the Norwegian Association of Higher Education Institutions (UHR).

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The article is also published in Russian in 2007: *Okeanologija* 47(5): 685-695.

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**Bøggild, C.E.** Simulation and parameterization of superimposed ice formation. *Hydrological Processes* 21 (12): 1561-1566 DOI: 10.1002/hyp.6718

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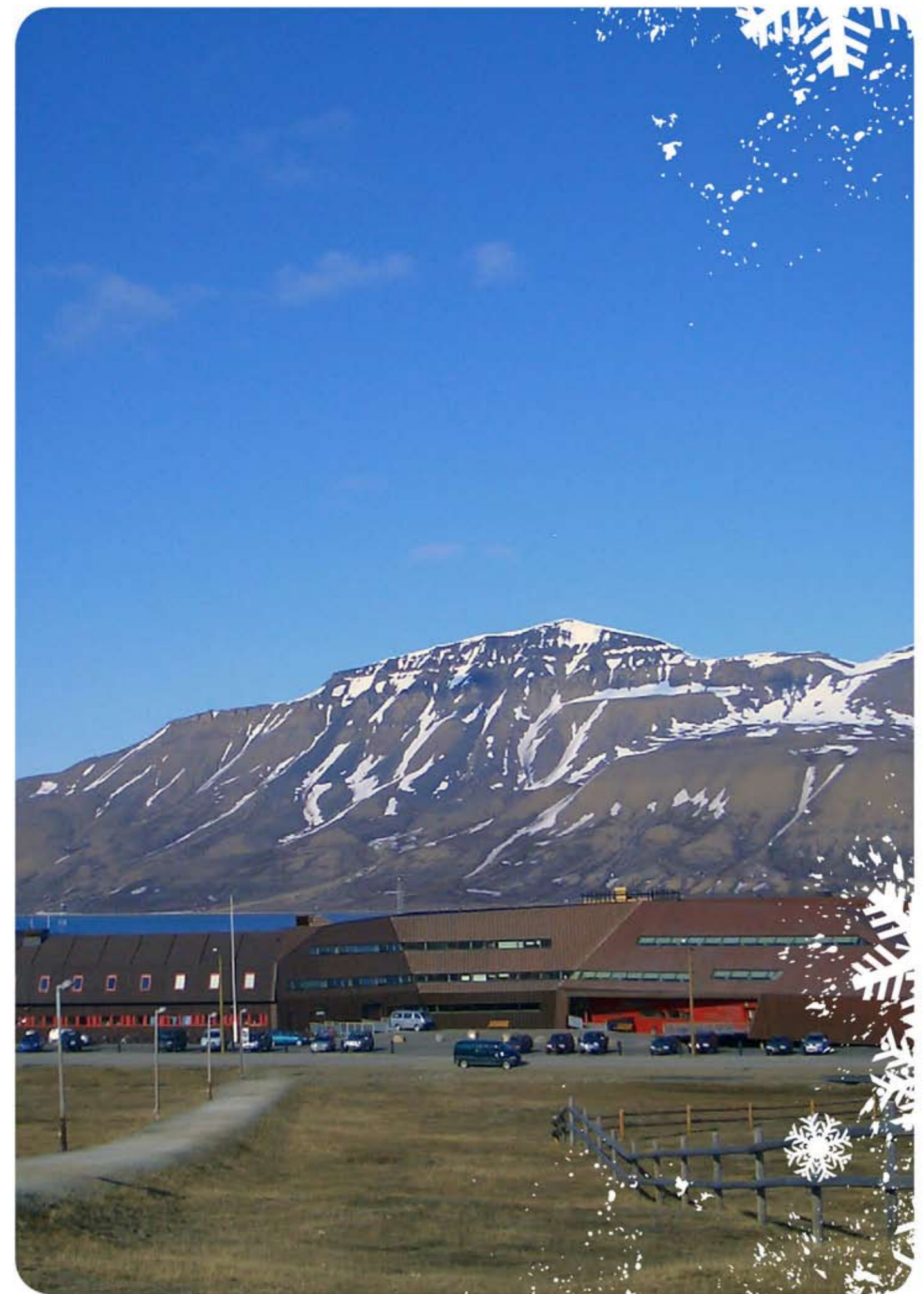
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**Books**  
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# guest lecturers 2007

Last name	First name	Institution	Last name	First name	Institution
Alaeimajolan	Behzad	University of Bergen, Norway	Larsen	Eiliv	Geological Survey of Norway
Alfredsen	Knut	Norwegian University of Science and Technology	Leppäranta	Matti	University of Helsinki, Finland
Alm	Göran	Stockholm University, Sweden	Lewkowicz	Antoni	University of Ottawa, Canada
Andresen	Steinar	University of Oslo, Norway	Li	Charlie	Norwegian University of Science and Technology
Asplin	Lars	Bjerknes Centre for Climate Research, Norway	Lockwood	Mike	Rutherford Appleton Laboratory, UK
Astakhov	Valery	St. Petersburg State University, Russia	Loe	Leif Egil	University of Oslo, Norway
Bakken	Vidar	University of Oslo, Norway	Lubbad	Raed	Norwegian University of Science and Technology
Bamber	Jonathan	University of Bristol, UK	Lund	Alf Kristian	Norwegian Geological Institute
Beldring	Stein	The Norwegian Water Resources and Energy Directorate	Lundén	Bengt	Stockholm University, Sweden
Berggren	Anne Lise	Geofrost Engineering A/S, Norway	Lüthje	Mikael	SINTEF, Norway
Birkely	Sten-Richard	Akvaplan NIVA, Norway	Løvhaug	Unni Pia	University of Tromsø, Norway
Biuw	Martin	St. Andrews University, UK	Mayer	Christoph	Bavarian Academy of Sciences, Germany
Bjørnå	Noralv	University of Tromsø, Norway	McAllister	Jonathan	University of Aberdeen, UK
Bogen	Jim	Norwegian Water Resources and Energy Administration	McPhee	Miles	McPhee Research Company, USA
Bogorodsky	Jim	Arctic and Antarctic Research Institute, Russia	Midtkandal	Ivar	University of Oslo, Norway
Brattegard	Torleif	University of Bergen, Norway	Moline	Mark	California Polytechnic State University, USA
Brevik	Knut	Norwegian Institute for Air Research	Murray	David	University of Alaska, USA
Briner	Jason	University of Buffalo, USA	Murray	Tavi	University of Wales, Swansea
Brown	Ian	University of Buffalo, USA	Myking	Steinar	University of Bergen, Norway
Cardozo	Nestor	University of Bergen, Norway	Mølmann	Truls	Barlindhaug A/S, Norway
Christoffersen	Kirsten	Freshwater Biological Laboratory, Denmark	Maatanen	Mauri	Helsinki Technical University, Finland
Cleveland	Frank	University of Bergen, Norway	Nagy	Jenő	University of Oslo, Norway
Cottier	Finlo	Scottish Association for Marine Science, UK	Nemec	Wojtek	University of Bergen, Norway
De Lange	Tor	University of Bergen, Norway	Nerland	Ørjan	Norwegian Geotechnical Institute
Elberling	Bo	University of Copenhagen, Denmark	Nielsen	Tove	GEUS, Denmark
Edvardsen	Lene	Norwegian State Housing Bank	Nilsen	Lennart	University of Tromsø, Norway
Egeland	Alv	University of Oslo, Norway	Notz	Dirk	University of Cambridge, UK
Eiken	Trond	University of Oslo, Norway	Odland	Jon Øyvind	AMAP Secretariat, Norway
Etzelmuller	Bernd	University of Oslo, Norway	Oehme	Michael	Applied Analytical Chemistry, Switzerland
Evans	David	University of Durham, UK	Olafsson	Haraldur	University of Bergen, Norway
Falck	Eva	University of Bergen, Norway	Osmundsen	Per Terje	Geological Survey of Norway
Fedak	Mike	University of St. Andrews, UK	Ottesen	Dag	Geological Survey of Norway
Fer	Ilker	University of Bergen, Norway	Pedersen	Åshild Ørnvik	University of Tromsø, Norway
Finch	Ivan	Rutherford Appleton Laboratory, UK	Piotrowski	Jan	University of Aarhus, Denmark
Finseth	Jomar	Norwegian University of Science and Technology	Pohjola	Veijo	Uppsala University, Sweden
Forman	Steven	University of Illinois at Chicago, USA	Powell	Ross	Northern Illinois University, USA
Freitas	Carla	Norwegian Polar Institute	Rasmussen	Tine	University of Tromsø, Norway
Funder	Svend	Geological Museum, Denmark	Reed	Mark	SINTEF, Norway
Førland	Eirik	Norwegian Meteorological Institute	Reiersen	Lars Otto	AMAP Secretariat, Norway
Gabrielsen	Roy	University of Oslo, Norway	Reimann	Stefan	EMP
Gjevik	Bjørn	University of Oslo, Norway	Renauld	Paul	Akvaplan NIVA, Norway
Gjosæter	Harald	Institute for Marine Research, Norway	Rutt	Ian	University of Bristol, UK
Goering	Douglas	University of Alaska, USA	Sand	Knut	Statkraft Grøner A/S, Norway
Graef	Christiane	University of Tromsø, Norway	Sander	Gunnar	European Environment Agency, Denmark
Griffiths	Colin	SAMS, UK	Sandven	Rolf	Norwegian University of Science and Technology
Grydeland	Tom	University of Tromsø, Norway	Schmidbauer	Norbert	Norwegian Institute for Air Research
Gudmestad	Ove	Statoil, Norway	Schuler	Thomas	University of Oslo, Norway
Guio	Patrick	University of Oslo, Norway	Schytte-Blix	Arnoldus	University of Tromsø, Norway
Hagen	Jon Ove	University of Oslo, Norway	Sikhinek	Carl	State Technical University of St. Petersburg, Russia
Hanssen	Inger	Norwegian Meteorological Institute	Sirevaag	Anders	Bjerknes Centre for Climate Research, Norway
Haugan	Peter	University of Bergen, Norway	Skardhamer	Jofrid	Akvaplan NIVA, Norway
Heia	Karsten	Norwegian Institute of Fisheries and Aquaculture	Skatter	Hans	Televilt, Sweden
Herstad	Bente	University of Oslo, Norway	Skogseth	Terje	Norwegian University of Science and Technology
Hjøllo	Solfrid	Institute for Marine Research, Norway	Smedsrud	Lars Henrik	University of Bergen, Norway
Hole	Lars Robert	Norwegian Institute of Air Research	Smith	Fraser	University of Dundee, UK
Holm	Elis	Lund University, Sweden	Sneli	Jon-Arne	Norwegian University of Science and Technology
Holmgren	Sofia	Göteborg University, Sweden	Solbo	Stian	NORUT Information Technology Ltd., Norway
Hop	Haakon	Norwegian Polar Institute	Solheim	Bjørn	University of Tromsø, Norway
Hovland	Erlend	Norwegian University of Science and Technology	Solheim	Jan Erik	University of Oslo, Norway
Hulton	Nick	University of Edinburgh, UK	Sorteberg	Asgeir	University of Bergen, Norway
Hyllestad	Robert	Ministry of Justice and the Police, Norway	Stordal	Frode	University of Oslo, Norway
Høgda	Kjell Arild	NORUT Information Technology Ltd., Norway	Storvold	Rune	NORUT Information Technology Ltd., Norway
Instanes	Arne	Opticonsult, Norway	Strømme	Anja	EISCAT, Norway
Jaedicke	Christian	Norwegian Geotechnical Institute	Sundet	Jan	Norwegian Institute of Fisheries and Aquaculture
Jensen	Maria	Geological Survey of Norway	Svenning	Martin	Norwegian Institute for Nature Research
Jenssen	Bjørn Munro	Norwegian University of Science and Technology	Svenning	Mette	University of Tromsø, Norway
Jessen	Simon	University of Tromsø, Norway	Svenøe	Trond	Norwegian Polar Institute
Julium	Rolf	Statsbygg, Norway	Tandberg	Anne Helene	University of Tromsø, Norway
Killingtveit	Ånund	Norwegian University of Science and Technology	Thiede	Jörn	Alfred Wegener Institute, Germany
Klanderud	Kari	Norwegian University for Life Sciences	Thisis	Thomas	Norwegian University of Life Sciences
Knutsson	Sven	Luleå Technical University, Sweden	Tverberg	Vigdis	Norwegian Polar Institute
Koyi	Hemin	Uppsala University, Sweden	Ulfstein	Geir	University of Oslo, Norway
Krapp	Rupert	University of Kiel, Germany	Vader	Wim	University of Tromsø, Norway
Kristensen	Dorthe Klitgaard	University of Bergen, Norway	Vogt	Christoph	University of Bremen, Germany
Kristiansson	Jon Egill	University of Oslo, Norway	Walløe	Lars	University of Oslo, Norway
La Hoz	Cesar	University of Tromsø, Norway	Wergeland	Sjur	Norwegian Meteorological Institute
Lacasse	Joseph	University of Oslo, Norway	Werner	Al	Mount Holyoke College, USA
Landvik	Jon	Norwegian University of Life Sciences	Widell	Karolina	University of Bergen, Norway
Langvatn	Rolf	Norwegian Institute for Nature Research	Zajaczkowski	Marek	Polish Academy of Sciences
			Zolotukhin	Anatoly	Statoil, Norway
			Øie Nilsen	Jan Even	Nansen Centre, Norway
			Ørbæk	Jon Børre	Norwegian Polar Institute
			Østerhus	Svein	University of Bergen, Norway
			Aagaard	Knut	University of Washington, USA



The Svalbard Science Centre on a summer's day.  
Photo: Steve Coulson



# UNIS annual report 2007

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**UNIS**

The University Centre in Svalbard