NORSK POLARINSTITUTT

ÅRBOK 1988

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The Annual Report of the Norwegian Polar Research Institute

NORSK POLARINSTITUTT
OSLO 1989

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Annual report of the Norwegian Polar Research Institute

Norsk Polarinstitutt has roots back to 1906 with regular polar activity from 1909. It was officially established by Parliament in 1928 and is today an independent institution under the Ministry of the Environment. As Norway's central institute for the scientific research of Svalbard, Jan Mayen, the polar seas, and the dependencies in the Antarctic, it is also responsible for the mapping of the Norwegian polar land areas. Research concerning fishing and other marine-biological resources and petroleum exploration on the continental shelf are taken care of by other institutions.

Norsk Polarinstitutt has three main assignments:

1. It has consultative functions for and with the Norwegian authorities in polar matters. By its research and mapping, the Institute is part of the Government's execution of its sovereignty responsibilities, the management and observation of Norwegian interests in the Arctic and in Antarctica.

2. It shall contribute to the definition of research tasks and needs for new basic knowledge about the polar areas. The Institute's own research is part of this together with the effort to stimulate other institutions to increase their activities in the polar areas.

3. The Institute should be a national centre for scientific activities in Norwegian polar areas with specific responsibility for tasks requiring continuity.

The following is a short description of some of the Institute's activities:

Biological research: Because marine and terrestrial ecosystems in the polar regions are particularly vulnerable to human activities, the Institute's biological research has been directed towards problems within wildlife management and nature conservation in Svalbard and adjacent ice-covered waters. Marine birds, botany, and marine and terrestrial mammals have been main topics of study.

Geophysical research: The geophysical work of the Institute is primarily directed towards ice and climate. Glaciers, sea ice, and the interaction between the surface of the earth, ice, and the atmosphere are major topics of study. Oceanographic investigations of the ice-covered sea regions are incorporated in the research programme.

Geological research: Geological mapping of the Norwegian polar areas is the most important aim and responsibility of the Institute's geological department. Research, which is the basis for maps and map descriptions, is carried out concurrently with the mapping activities. The Institute is responsible for the structural investigations and the charting of the sea floor in the polar sea regions.

Topographic mapping: Norsk Polarinstitutt is responsible for the terrestrial mapping of Norwegian polar regions. Priority has been given to the task of completing the main topographical map series for Svalbard in the scale of 1:100,000.

Aerial view of the Kongsfjorden area towards the south. Ny-Ålesund in the background. Photo: J. L. Sollid

THEMATIC MAPPING: Thematic maps published by the Institute include geological maps of land masses, loose deposits and upper layers of the sea floor in the polar regions, geophysical charts of sea ice distribution, ocean currents and gravity measurements, and maps of biological resources and abundancies.

RESEARCH STATION IN NY-ÅLESUND, SVALBARD: Norsk Polarinstitutt's Research Station is one of the most northerly scientific land stations in the world, located at 78°55'N, 11°56'E. It is open to all Norwegian scientists with government-funded projects and to foreigners cooperating with Norwegian institutions.

ADMINISTRATION OF JOINT SCIENTIFIC EXPEDITIONS: Norsk Polarinstitutt is responsible for the administration and implementation of Norwegian Antarctic research expeditions. The annual expedition to Svalbard also includes participants from other research institutions. In its function as central governmental body, the Institute also coordinates scientific studies in the polar regions, particularly in management-oriented investigations.

SERVICE: The Institute runs a service office in Longyearbyen in the summer season, providing practical advice and assistance for expeditions and field parties. Norsk Polarinstitutt is also building up an equipment pool where specialized polar equipment may be borrowed against a charge for normal wear and tear.

INFORMATION: The information service handles general enquiries from Norwegian and foreign institutions and individuals about the Institute's activities in Norwegian polar areas. Several scientific publications and news bulletins are published on a regular basis and the Library has one of Europe's best collections of polar literature.

CONTRACTUAL ACTIVITIES: As far as its capacity allows, the Institute accepts contract work on a non-profit basis within its fields of competence.

OTHER ACTIVITIES: The Institute has been responsible, since 1933, for the establishment and maintenance of a network of navigation lights and beacons for ships and air traffic on Spitsbergen.

THE PAST YEAR

There is an increasing political awareness in the world today of the significance of the polar areas as industrial and environmental resource areas. After having rested quietly at the ends of the world for many years, without few alterations taking place, the area is now experiencing a rapid change into an active and busy arena for different types of research and industry.

The United Nations World Commission on the Environment and Development has called attention to the importance of Antarctica for global environmental relations. National operators have enforced new environmental standards for activity in the Antarctic and various international organizations are duely interested.

A mineral convention is under ratification, a fact that in itself attracts attention to Antarctica. Another aspect is the elapse of the first thirty-year period of the Antarctic Treaty in 1991. During the last few years the number of countries with activities in Antarctica has more than doubled, and new countries are joining with increasing speed.

A similar development has taken place in the Arctic. This area was on the agenda at the summit meetings between the United States and the Soviet Union in 1988. Several countries are discussing their Arctic policy, and new national commissions or similar bodies are being appointed. The progress in the development of an International Arctic Science Committee has been especially promising and may lead to a fundamental change in Arctic scientific cooperation.

Different kinds of industrial activities are moving north while some traditional polar industries are faced with problems. Newcomers entering the scene do not always have proper knowledge about how to operate in these regions, but they are bringing new ideas into the area challenging traditional ways of thinking.

In Norway, an official committee nearly finished its report on polar research in Norway in 1988. When published in 1989, it will size up the present situation in Norwegian polar research, and will analyse the needs and recommend future action. Headed by the Research Director of Norsk Polarinstitutt, the committee was also provided secretarial assistance by the Institute.

The Norwegian Polar Research Institute is an active partner in several polar research fields. In addition to taking care of its central institutional scientific functions, it provides basic data for mapping and science and is a consultative agency for the authorities and industry. The Institute finds it of importance to be able to respond to new challenges and adapt to new functions within its field of responsibility.

This annual report will show that the Institute has already started to adapt to the new situation. Its new long-term plan, published at the end of 1988, reveals similar trends. Although 1988 was a year filled with changes and planning, the basic activities produced solid results, as seen in the section reports.

The establishment of a new atmospheric sta-

Transport of a topographic field party to Helvetiafjellet. Photo: B. Lytskjold

tion in Ny-Ålesund should be mentioned as a special event in 1988. When finished in 1989 it will offer a unique possibility for doing air research in an Arctic area which is practically without local pollution. This station, or rather observatory, will be a part of the all-year research station in Ny- Ålesund.

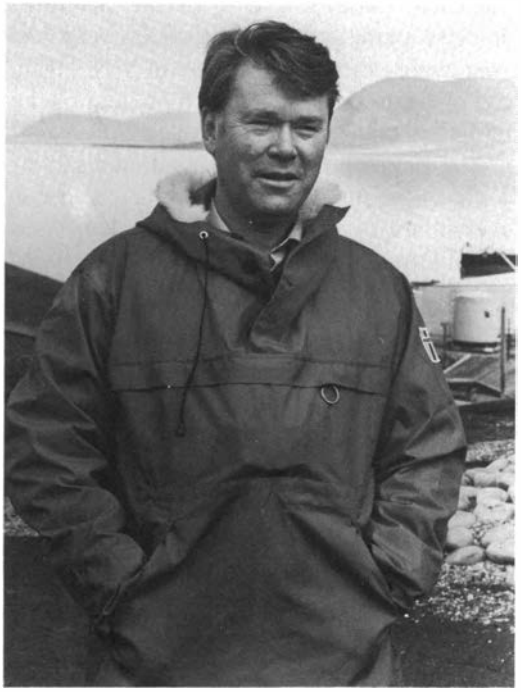
After several years' experiments, the sea ice group of the Institute managed to obtain the first ice data series ever recorded from an upward looking sonar. This data series gives a continuous registration of ice thickness and registers the direction of the ice drift.

FIELD ACTIVITIES IN 1987

The Institute's 1988 season in the Arctic was the 75th expedition sent out by the Norwegian Government to do systematic mapping and investigations of northern polar areas of interest to Norway. The 1988 season was Norsk Polarinstitutt's 61st field season as central Norwegian institution for polar research.

The main field work in 1988 took place in Svalbard and nearby waters. Four disciplines were included in the expedition programme, biology, geology, geophysics and geodesy. The main activity took place within biology. In addition, a total of fifty radio beacons and radar lights for marine and air navigation were inspected by Institute personnel in 1988 and prepared for operation throughout the winter.

A total of 135 persons took part in Norsk Polarinstitutt's field work in Svalbard, in addition to the crews of the expedition ship and helicopters. 81 were financed by the Institute,



Thor Siggerud is the leader of Norsk Polarinstitutt's Arctic expeditions, organizing and coordinating the Institute's field activitites in Svalbard and surrounding waters. He knows the area better than most, having spent almost every summer field season in Svalbard since he started working at the Institute thirty years ago. He is a geologist by profession.

34 were cooperative partners from other institutions, and 20 were financed by research scholarships.

The field work started i March/April with polar bear investigations in the Hornsund area. The main activities were spread over large parts of Svalbard, and were dependent upon use of an expedition vessel. M/S Lance left Bodø for Svalbard on 8 July and was back on the mainland, in Bergen, on 5 October.

The emblem of the Institute's Svalbard expedition 1988.

SECTION REPORTS

Biology

Norsk Polarinstitutt is responsible for management-oriented biological research in the Norwegian polar areas. The Biological Division incorporates ecological mapping and population biology studies within such disciplines as marine biology (excluding the Directorate of Fisheries' area of responsibility), ornithology, land mammals, and botany.

The increasing industrial and other economic activities in Norwegian polar areas may cause considerable impact on the natural environment. Our present knowledge of the polar ecosystems and their reaction to human interference is limited. The polar areas represent the limits for life on earth and the life systems in these areas are extremely vulnerable to environmental changes. The primary purpose of the division's work is to provide the authorities with the necessary ecological information in order to secure proper management of the ecosystems in the Norwegian polar areas.

The division has two tenured scientists: one ornithologist and one mammalogist. One marine zoologist was contracted in 1988 (for four

Fridtjof Mehlum, head of the Biological Division in 1988, has been with the Institute since 1980. His ornithological work has brought him both to Svalbard and other northern polar areas every summer. He has also worked in Antarctica.

years) to conduct studies on polar bears and marine mammals. Two contracted ornithologists continued their work under the PRO MARE and AKUP programmes (PRO MARE: Programme for Marine Arctic Ecology; AKUP: Arbeidsgruppen for konsekvensutredninger av petroleumsvirksomhet). One research fellow continued his work studying the behaviour of the arctic fox, spending about half the year at the Research Station in Ny-Ålesund. Another started a botanic project on vegetation damage caused by reindeer grazing and human activities in Svalbard. Several other biologists were contracted on short term bases for field and desk work.

Field work

The field work in 1987 focused on seabirds, arctic fox, polar bears, reindeer, and vegetation.

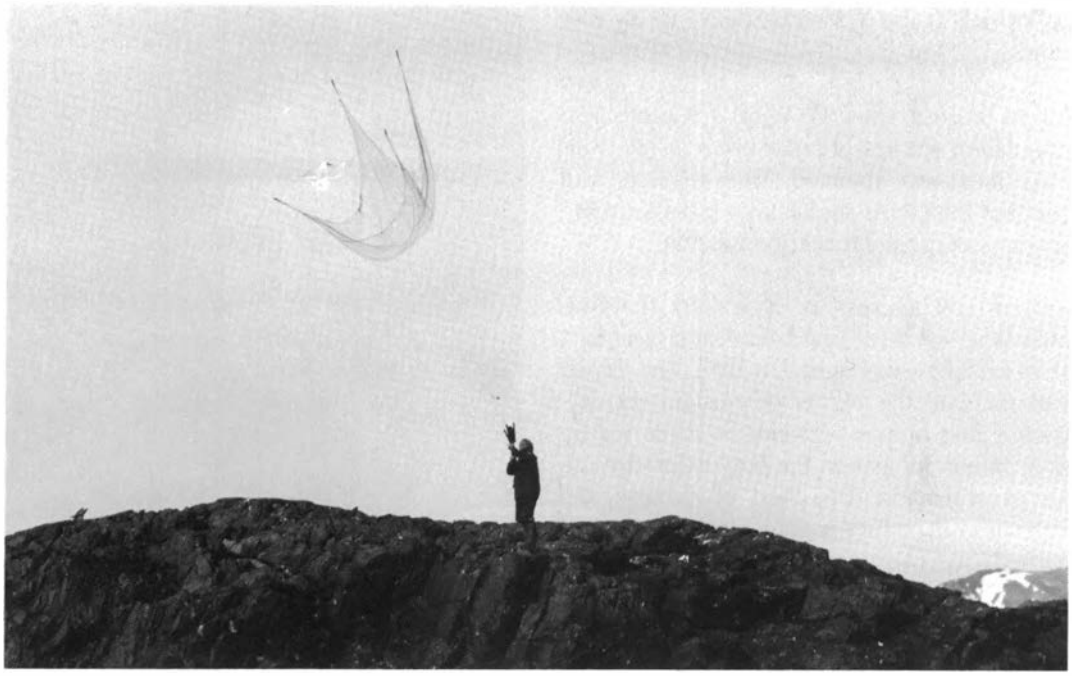
SCIENTIFIC CRUISES – One of the Institute's biologists participated in a cruise on board the coast guard vessel *K/V Andenes* in May, organized by the Norwegian research programme for marine arctic ecology (PRO MARE). Censuses of seabird distribution in ice-filled waters in the Northern Barents Sea were conducted in collaboration with Professor G. L. Hunt, University of California, Irvine. The censuses included both ship-based and helicopter transects.

TERRESTRIAL FIELD WORK – Seabird studies at Bjørnøya initiated under the AKUP programme were continued. A seabird colony monitoring programme was initiated and several colonies located in different parts of Svalbard were visited. Logistic support was given by the Governor of Svalbard. Seabird energetic studies were performed in collaboration with the University of California, Irvine, and the field work was carried out at Pribilof Islands, Alaska.

Reindeer population surveys, including tagging and tracking telemetry, were conducted on Reinsdyrflya, Nordenskiöld Land, and Brøggerhalvøya. The experimental harvesting programme was abandoned due to poor precision in the collected data. Cooperation with the University of Tromsø regarding reindeer ecology was established. Different aspects of the biology of the arctic fox were studied in the Kongsfjorden and Isfjorden areas. Foxes were held in captivity at the Institute's Research Station in Ny-Ålesund. As a part of the MUPS programme (Miljøundersøkelser på Svalbard), radiotelemtry and migration studies of polar bears were performed during the spring season in the Hornsund area.

A research group from the Institute of Oceanology, Polish Academy of Sciences, was contracted to conduct a survey of biological and physical parameters in the intertidal zone in the South Spitsbergen National Park. The results were included in a computer data base as a baseline for the assessment of possible human impact on the coastal environment.

Botanical field work was done in Nordenskiöld Land to evaluate the effect of erosion and reindeer grazing on the vegetation.



Glaucous gull caught by net for metabolic measurements. Photo: B. Brekke

Projects

FAUNA DATA BASE (F. Mehlum) - Single observations and time series of abundance of birds and mammals are recorded in a map related data base (GEOPLOT). The data base was updated with new information. Most records reflect single observations and not realistic distributions. Data on seabird colony sizes and pelagic distribution are separated in additional data bases.

SEABIRD STUDIES IN THE SVALBARD AREA (F. Mehlum and G. Gabrielsen) - The project concerns population and feeding ecology as well as physiological energetics of seabirds. It is a part of the PRO MARE programme. Field work in 1988 was carried out at Pribilof Islands, Alaska, for comparing seabird energetics in the Bering and Barents Seas.

SEABIRD STUDIES IN THE BARENTS SEA (V. Bakken) – Because of the dramatic decline in the population of Brünnich's Guillemots at Bjørnøya in recent years, a project was set up to monitor the population development of this and other seabird species at the island. Breeding biology and feeding ecology studies are included in the project.

REINDEER STUDIES IN SVALBARD (N. A. Øritsland) – The project concerns primarily population monitoring and feeding ecology. Field work was carried out at Reinsdyrflya, Nordenskiöld Land and Brøggerhalvøya.

RABIES AND POPULATION DYNAMICS OF THE ARCTIC FOX IN SVALBARD (P. Prestrud) – Tagging, tracking telemetry observations, pup production, and body growth and composition were carried out on the arctic fox in the Adventdalen and Sassendalen areas. Field work was completed in 1988.

BEHAVIOUR AND SOCIAL BIOLOGY OF THE ARCTIC FOX IN SVALBARD (K. Frafjord) - Tagging, tracking telemetry, and ethological observations of the arctic fox were carried out in the Kongsfjorden area. Further ethological observations and experimental feeding of captive foxes were

performed at the Research Station in Ny-Ålesund.

POLAR BEAR STUDIES (Ø. Wiig) – A project on population studies of polar bears in the Svalbard area was initiated. The Institute will conduct long term studies as a basis for management of the polar bear population.

VEGETATION STUDIES IN SVALBARD (L. Gulbrandsen) – A three-year botanical project for a research fellow was started in 1988. The project will evaluate the effects of erosion, reindeer grazing and human activities on arctic vegetation, with emphasis on the population dynamics of vegetation. Detection of damage and vegetation dynamics in damaged areas will be carried out by means of field investigation combined with remote sensing techniques.

ENVIRONMENTAL IMPACT STUDIES IN SVALBARD (MUPS) (N.A. Øritsland and P. Prestrud) – The following contract projects in connection with petroleum activities were carried out: Observations and satellite telemetry tracking studies of polar bears migrating through the Hornsund area, production of an environmental atlas for Adventdalen and Sassendalen (in cooperation with SINTEF), and arctic fox studies. Version 2 of the MUPS analysis system for environmental impact assessment was completed.

COMPUTER ASSISTED IMPACT ASSESSMENT OF INDUSTRIAL ACTIVITIES (DAKON) (N. A. Øritsland) – In this three-year project (1988-90) a computerized version of the MUPS analysis system will be developed. Deterministic and stochastic population models will be included and the utility of expert system shells explored.

Geology

The main objective of the geological division is to obtain data from polar areas which can contribute to the knowledge about the geological environment and the understanding of former and present geological processes. An important part of this work is the production of

Audun Hjelle was leader of the Geological division in 1988. He has been with the Norwegian Polar Research Institute since 1963 and has been doing field work in the Svalbard area almost every summer since then. He has also worked in Antarctica.

geological maps, publications and reports which can be used in research and environmental planning. In Svalbard a main series of terrestrial geological maps are published to the scale of 1:100,000, while the Barents Sea maps are to the scale of 1:1,500,000 or 1:500,000. Coastal thematic maps are published to the scale of 1:200,000.

The division has nine permanent posts, including one technical. Five persons are occupied with terrestrial bedrock geology, one with terrestrial Quaternary geology and two with marine geology/geophysics. Only two geologists did field work in Svalbard in 1988, and one took part in the Ocean Drilling Program in the Indian Ocean and East Antarctic waters. Thirteen Geological Polar Colloquia were held at the Institute in 1988, dealing with a variety of problems.

A symposium on the Tertiary tectonics of Svalbard was held 26-27 April in cooperation with the Institute of Geology at the University of Oslo.

In December the terrestrial geology group moved to a new building close to the main institute building. The new premises include rooms for 2-3 guest scientists.

Field work

TERRESTRIAL GEOLOGY – Two groups worked in southwest Spitsbergen, in the Sørkapp Land, Torellbreen, and Van Keulenfjorden map sheet areas. The field work for the 1:100,000 Van Keulenfjorden map sheet was finished during the summer.

MARINE GEOLOGY – Drill cores were obtained from the southern part of the Indian Ocean and from East Antarctic waters during A. Solheim's participation in the Ocean Drilling Program (ODP) Leg 119.

Y. Ohta did field work in Ellesmere Land in cooperation with the Geological Survey of Canada, mainly in areas with metamorphic rocks.

Projects

TERTIARY TECTONICS OF SVALBARD (W.K. Dallmann and Y.Ohta) – The objective of this 4- to 5-year project which was started in 1987, is to investigate the structure of the Tertiary fold-and-thrust belt of Spitsbergen and to establish models for its orogenic development. In 1988, field investigations were done in the area between south Nordenskiöld Land and Hornsund. In cooperation with the Institute of Geology at the University of Oslo, the compilation of a structural map, to the scale of 1:200,000, of the fold belt was initiated.

During his one-year postdoctorate fellowship stay at NP, H.D. Maher from the University of Nebraska, USA, also took part in this work. C. Lepvrier from the University of Paris worked at NP on the same project for three months as a Senior Scientist Fellow. A first symposium on the topic was held i April with international participation.

GLACIATION AND DEGLACIATION OF SVALBARD (O. Salvigsen) – The results of about 20 radiocarbon dates from western Wedel Jarlsberg Land were received. They give minimum ages for the deglaciation of the area and the first detailed shoreline displacement curve for this part of Svalbard. The project will continue in 1989 with comparative studies along the coast to south of Hornsund.

SVALBARD COASTAL MAPPING (A. Elverhøi and O. Salvigsen) - Thematic map No. 9, B4 Bellsund, to the scale of 1:200,000, was printed in 1988, and B5 Sørkapp was made ready for print. The project will continue in 1989 with map sheets C4 Edgeøya and B3 (inner Isfjorden - Agardhbukta). Kirsti Høgvard is engaged on the project, and the Geographical Institute of the University of Oslo is cooperative partner.

SEDIMENT MAPPING (SEDIMENT THICKNESS, SURFACE SEDIMENT COMPOSITION, SHALLOW BEDROCK), NORTHERN AND CENTRAL BARENTS SEA (A. Elverhøi and A. Solheim) – In this long-term mapping program, the regional series of maps to the scale of 1:1,500,000 is completed. Larger scale maps are now being prepared in connection with two Cand. scient. papers, for two areas of the northern and central Barents Sea, the southeastern flank of Spitsbergenbanken, and northern part of Bjørnøyrenna/ Storbanken

QUATERNARY GLACIATIONS IN THE NORTHERN AND CENTRAL BARENTS SEA, TIMING AND MECHANISMS (A. Elverhøi and A. Solheim) – This long-term project studies the extent, chronology and mechanisms of deglaciation of the late Quaternary (or older) glaciations. The project involves three Cand. scient. theses. Special emphasis is given to studies of the processes and mechanisms of deglaciation.

SEDIMENTATION AND SEDIMENTARY PROCESSES IN MODERN GLACIOMARINE ENVIRONMENTS (A. Solheim and A. Elverhøi) – Various aspects of glaciomarine deposition and processes are studied off Svalbard and in the Weddell Sea ice shelves in Antarctica. In 1988, data from several years of work outside the surging tidewater glaciers of Nordaustlandet, Svalbard, were synthesized and finalized.

UPPER BEDROCK (SUBCROP) GEOLOGY OF THE NORTHERN AND CENTRAL BARENTS SEA (A. Elverhøi and A. Solheim) – Based on shallow seismic data, Quaternary samples and a few in situ rock samples, the lithology, stratigraphy and shallow structure of the upper bedrock (0-500 m) are studied and mapped. The work concentrated on relatively high resolution information from the Olga Basin. S. B. Flood and H. P. Antonsen were employed on the project, and cooperative institutions were the Norwegian Petroleum Directorate and The University of Oslo.

LATE CENOZOIC GLASIGENIC SEDIMENTATION AND SEDIMENTARY PROCESSES ON THE CONTINENTAL MARGIN OFF THE WEST COAST OF SPITSBERGEN (A. Solheim) – This project uses multichannel seismic data in studies of the submarine fan off Bellsund, Spitsbergen. Emphasis is given to the onset of glacially influenced sedimentation and change in processes from pre-glacial to glacial times. Mobil Exploration Inc. provided shiptime and data aquisition facilities in 1987. The University of Bergen is cooperative institution.

SUBMARINE PERMAFROST AND GAS HYDRATES IN THE BARENTS SEA AND SVALBARD WATERS (A. Elverhøi and A. Solheim) – Based on current knowledge of the present climate and paleoclimate, and on literature from other high latitude regions, the possibilities for and distribution of submarine permafrost and gas hydrates in the region are discussed. The project also involves interpretation of high resolution seismic data from the central Barents Sea. V. Løvø and H. P. Antonsen have been employed on the project, and cooperative institutions are the Norwegian Petroleum Directorate, the Geotechnical Institute, and Veritec A/S.

PHYSICAL PROPERTIES OF GLACIGENIC SEDIMENTS IN THE ANTARCTIC CONTINENTAL SHELF, IMPLICATIONS FOR THE GLACIAL HISTORY OF EAST ANTARCTICA (A. Solheim) – This is a part of ODP Leg 119, and involves geotechnical analyses of samples from five drill holes on the shelf and upper slope of Prydz Bay in the Indian Ocean sector of Antarctica. A. Stadheim is employed on the project, and The Norwegian Geotechnical Institute is cooperative institution.

ICEBERG SCOURING IN THE NORTHERN BARENTS SEA AND ON THE ANTARCTIC CONTINENTAL SHELF (A. Solheim and A. Elverhøi) - Distribution, dimensions and mechanisms of iceberg scouring are studied in these two quite different settings. The distribution and types of iceberg scours are assessed in terms of their implications for the late glacial history of the two regions and their impact on sediment properties.

THE SEDIMENTOLOGICAL AND STRUCTURAL EVOLUTION OF THE AREA BETWEEN KJELLSTRØMDALEN AND ADVENTDALEN/SASSENDALEN, CENTRAL SPITSBERGEN (A. Elverhøi) – In a joint project between the University of Oslo, the University of Tromsø and NP, the sedimentology, stratigraphy and structural geology along the Billefjorden fault zone have been studied during the last three years. The project, which is mainly funded by British Petroleum, and lead by H. Dypvik, University of Oslo, has now been completed.

REGIONAL GEOLOGICAL INVESTIGATIONS IN SVALBARD (W. K. Dallmann, A. Hjelle, Y. Ohta, O. Salvigsen, T. S. Winsnes) – The compilation of data from western Spitsbergen continued, with special emphasis on the southern part of Oscar II Land, Wedel Jarlsberg Land, Sørkapp Land, and Torell Land. A manuscript map to the scale of 1:100 000 of Isfjorden (No. B9G) is nearly finished.

K. Birkenmajer from the University of Krakow, Poland, visited the Institute in November and presented geological material and discussed future Norwegian-Polish cooperation on the

From one of the geologists' camps in Spitsbergen in 1988. Photo: W. Dallmann

mapping of and research in SW Spitsbergen. The 1:100,000 map of Billefjorden (No. C8G) is now ready for print.

CORRELATION OF OLDER COMPLEXES (A. Hjelle, Y. Ohta and T. S. Winsnes) – In cooperation with J. J. Peucat and R. D. Dallmeyer, Y. Ohta obtained new absolute ages of Svalbard rocks collected in 1985-86. Five ages were from U/Pb analyses, 15 from Rb/Sr, and 25 from Ar40/Ar39. In cooperation with H. P. Trettin, Geological Survey of Canada, Ohta's data from Ellesmere Land will be used in correlation with the older complexes in Svalbard, north Greenland, and Ellesmere Land. Hjelle and Winsnes continued the stratigraphical correlation of late Proterozoic and early Paleozoic rocks from the Van Keulenfjorden and Sørkapp Land map sheet areas, respectively.

INVESTIGATIONS OF THE BASAL DEVONIAN FORMATIONS, NORTHERN SPITSBERGEN (T. Gjelsvik) – Descriptions of the remaining profiles and localities were prepared based upon field data and microscopical studies. Special emphasis was given to petrographical studies of the clasts of the lowermost formation, the Lilljeborgfjellet conglomerate, in order to establish its provenance and transport directions.

SEDIMENTOLOGICAL AND PALEONTOLOGICAL INVESTIGATIONS OF UPPER CARBONIFEROUS AND LOWER PERMIAN SUCCESSIONS IN CENTRAL SPITSBERGEN. (H. B. Keilen) – Based on material collected in 1987, the study continued until Keilen's leave of absence from 1 June.

GEOLOGY DATA BASE FOR SVALBARD (A. Hjelle) – Compilation of data for the test data base for the Kongsfjorden 1:100,000 map (No. A7G) continued. The data base contains field data, and references to published and unpublished material.

Data bases were established with information about: 1. geological parameters significant for the estimation of consequences of pollution, and 2. geological resources of Svalbard.

Geophysics

The main objective of the geophysical division is long-term studies of different aspects of climatic conditions, with emphasis on ice research. Eight geophysicists worked in the division on a full-time basis: one meteorologist, three glaciologists, one oceanographer, and three sea ice researchers.

The collection of meteorological observations from automatic stations in the Arctic Ocean and Svalbard, on Bouvetøya, Peter I Øy, and in Heimefrontfjella in Dronning Maud Land was continued, and so was the recording of radiation components in Ny-Ålesund.

Sea ice and iceberg investigations based on satellite imagery, automatic drifting buoys, moored ice thickness monitoring sonars, and data collected from ships at various times of the year, continued. Sea ice projects have increased in number during the last years, particularly in connection with oil exploration in the Barents Sea.

Investigations on the seasonal structure of water masses in the Barents Sea, the Fram Strait, and the Greenland Sea were conducted on several cruises.

Landsat TM and SPOT satellite imagery was used to study snow and ice features in Dronning Maud Land.

Torgny Vine (right) and Vidar Hisdal checking instruments behind the Research Station in Ny-Ålesund. Torgny Vinje, the leader of the Division, is a sea-ice researcher and has been working at the Institute since 1956. He spent three years in Antarctia from 1956 to 1960 on an expedition under the International Geophysical Year. He has long experience as expedition leader in Svalbard and adjacent waters as well as in the Antarctic. Photo: A. Brekke.

Field activities

Oceanographic data were collected in the Barents and Greenland Seas on board the R/V VALDIVIA in February and on board the R/V LANCE between 2 September and 6 October.

The latter cruise also included sea ice investigations and mooring work in the Barents Sea, including deployment of two upward looking sonars (ULS) to be used for ice thickness recordings. Mapping of icebergs and ice conditions were carried out for oil companies on Spitsbergenbanken between 18 and 28 March.

Four ice drift buoys (ICEXAIR) were dropped in the Barents Sea in January and three in the Transpolar Ice Drift Stream in November by the 333 and 335 Squadrons, respectively.

Terrestrial investigations were carried out on Storbreen, mainland- Norway, in May, and at Brøggerbreen, Lovénbreen and Kongsvegen, Svalbard, in May/June. The radiation instruments in Ny-Ålesund were calibrated and partly remounted in August-September.

Radar profiling of icebergs in the Barents Sea. IDAP 1989. Photo: B. Erlingsson

Projects

OIL DRIFT AND POOLING CAPACITY IN ICE FIELDS (AKUP) (T. Vinje and Å. S. Johnsen) – Special sea ice investigations were carried out for the Ministry for Oil and Energy for the assessment of the consequences of oil exploration in the Barents Sea. A scanning sonar for the mapping of sub-surface topography was used for the estimation of the pooling capacity of oil under ice. Four ICEXAIR were dropped along longitude 40°N in January. The drift of oil-infested ice was estimated based on all available buoy drift data collected since 1975. A total of 22 buoy tracks were studied and the relations found between wind and ice drift and their variances, will be used as a basis for a stochastic ice drift model which is being developed for the area.

ICE DISTRIBUTION STATISTICS (T. Vinje) – The digitizing of weekly ice-maps of the Barents Sea, covering the 1966-1986 period, and including sea surface temperatures from 1972 up until now, was finished under a contract with ESSO Norge on behalf of Operatørkomite Nord. Copies of the data set were delivered to DNMI and Norsk Hydro. Ice statistics for some locations were delivered to Elf Acquitaine and to Norsk Hydro. A new data set, modified and reduced to an easily manageble size (2.8 % of the original) was developed for special statistical analyses.

ARCTIC OCEAN BUOY PROGRAMME (T. Vinje) – The cooperation between the Institute and the University of Washington continued. The Norwegian part of the programme was established in 1976 to study the variability of the Trans-

polar Ice Drift Stream emerging through the Fram Strait. The collected drift data and the data on ice thickness distribution obtained from drillings, gave the first direct measurements of the export of ice from the Arctic Ocean. Three stations were parachuted on to the ice by the 335 Squadron between the North Pole and Frans Josef Land in November.

GREENLAND SEA PROJECT (T. Vinje) – This is a comprehensive long-term international project with emphasis on climatic aspects. An important task of the Institute is to estimate the long-term transport of ice from the Arctic Ocean through the Fram Strait. An upward looking sonar (ULS) was retrieved in June from R/V POLARSTERN providing the first one-year series of ice thickness measurements. Manufactured by Chr. Michelsens Institute, the ULS registers the ice thickness every four minutes. The series contains about 130,000 individual measurements. For the sake of continuity, another ULS was deployed from POLARSTERN later that month. NAVF supports this project.

ICE DATA ACQUISITION PROGRAMME (IDAP) (T. Vinje, B. Erlingsson and Å. S. Johnsen) – The IDAP project is carried out for MOBIL on behalf of Operatørkomite Nord. Icebergs in the Barents Sea are of such a size and often occur in such great numbers, that they may present a hazard to oil exploration. In a field programme carried out on Spitsbergenbanken with the R/V LANCE and helicopter, in cooperation with SINTEF/NHL between 18 and 28 March, ten ARGOS buoys were deployed on icebergs for drift analyses. 22 helicopter reconnaissances were accomplished for iceberg and sea ice mapping. Nearly 200 icebergs were spotted, the largest measuring 450 metres across.

SOVIET-NORWEGIAN OCEANOGRAPHIC PROGRAM (SNOP) (T. Vinje and B. Rudels) – A five year long oceanographic programme was established in 1988 under the agreement between NAVF and the Soviet State Committee for Science and Technology. Instruments were purchased and three joint cruises planned for 1989. The main objective of the SNOP programme is to monitor the exchange of water and ice in the passages between Frans Josef Land and Greenland. Modelling of the Barents Sea circulation will also be a part of the cooperative programme. The Institute of Marine Research, the University of Bergen, and the Meteorological Institute are also participating. The Soviet counterpart is the Arctic and Antarctic Research Institute in Leningrad and affiliates.

ICE FIELD STRUCTURE AND INTERNAL STRESS (B. Erlingsson) – A new model designed to show the relation between the internal forces and the fracture pattern and ice thickness distribution in ice fields has been developed. The results obtained by the model will be tested by small scale field investigations and large scale satellite imagery. This project will be the basis for a Dr. Scient. thesis.

SEA ICE CLIMATIC VARIABLES (T. Vinje) – This planned ICECLIMA programme on remote sensing will use microwave data from the ERS-1 satellite which will be launched in the summer of 1990. The programme is approved by ESA. The statistical evaluation of imagery processing derivatives continues. Ice drift patterns will be mapped using a cross-correlation soft ware programme applied on consecutive SAR images covering one and the same area.

CONVECTION AND DEEP WATER FORMATION IN THE GREENLAND SEA (B. Rudels) – Studies are conducted by large scale oceanic surveys and field experiments combined with theoretical modelling. The project is conducted in cooperation with the Institut für Meereskunde, Hamburg, and LODYC Paris, and is a part of the Greenland Sea Project.

MIXING PROCESSES AND WATER FORMATION IN THE BARENTS SEA (B. Rudels) – This project involves theoretical and field work in cooperation with the Department of Oceanography and the Department of Analytical and Marine Chemistry, University of Gothenburg, and Institut für Meereskunde, Hamburg.

CIRCULATION AND WATER EXCHANGE IN THE FRAM STRAIT (B. Rudels) – The field work

consists of hydrographic measurements, tracer observations and the use of SOFAR floats while theoretically inverse methods will be applied. Cooperation with the Institut für Meereskunde, Hamburg, and LODYC Paris. The work is partly financed by NAVF as a Norwegian–French cooperative programme.

CIRCULATION AND WATER FORMATION IN THE WEDDELL SEA (B. Rudels) – This work began with the Swedish Antarctic expedition and is a cooperative project with the Department of Analytical and Marine Chemistry, University of Gothenburg.

MIXING PROCESSES, WATER FORMATION AND CIRCULATION IN THE POLAR OCEAN (B. Rudels) – This work has been mainly theoretical so far, but a future participation in the Swedish Oden Expedition might be possible.

ALBEDO OF A SNOW SURFACE (V. Hisdal) – The reflection of solar radiation from the earth's surface shows a wave-length dependence characteristic of the type of surface considered. The spectral reflectance of a tundra snow cover was measured with a spectrophotometer, revealing a strong decrease of reflectance with decreasing thickness of the snow cover, as well as a clear reduction towards the ultraviolet and the infrared spectral region. The results are prepared for publication.

RADIATION DATA FOR NY-ÅLESUND (V. Hisdal and Ø. Finnekåsa) – The main radiation components are recorded continuously. The preparation of tables of these data for the last years has been seriously delayed, however, because of insufficient capacity of the computer section.

TEMPERATURE CONDITIONS IN THE SVALBARD AREA (V. Hisdal and T. Berge) – Data from automatic and manned meteorological stations in Svalbard are analysed, aiming at a description of the temperature conditions in the areas. Observation series from the automatic stations are completed by regression analysis, using pressure gradients and temperature data from manned stations as predictors.

MASS BALANCE STUDIES OF GLACIERS IN SVALBARD (J. O. Hagen) – Mass balance investigations are carried out on the Austre Brøggerbreen, Midre Lovénbreen, and Kongsvegen glaciers in the Kongsfjorden area, north-west Spitsbergen. The first two glaciers have been measured regularly since 1967 and have been steadily decreasing. Studies on the Kongsvegen glacier were started in 1987.

SURGE INVESTIGATIONS IN SVALBARD (J. O. Hagen) – 90 per cent of the glaciers in Svalbard are subpolar and most of them seem to be of a surging type (i.e. with periodic rapid advances). The surge process is complex and investigations include velocity, profile, and volume change registrations as well as measurements of the temperature regime of some selected glaciers in Svalbard.

POLAR HYDROLOGY (J. O. Hagen) – Polar hydrology, studies of hydrological processes and data collection in areas with permafrost have been given high priority by the Norwegian Hydrological Committee. A hydrological research station has been established in Bayelva, Ny- Ålesund, and two others are being planned. This is a joint project between the Norwegian Polar Research Institute, Norges Vassdrags og Energiverk (NVE), and Norges Hydrotekniske Laboratorium (NHL).

MASS BALANCE STUDIES OF THE STORBREEN AND HARDANGERJØKULEN GLACIERS (J. O. Hagen) – Mass balance measurements of the Storbreen and Hardangerjøkulen glaciers in mainland Norway were continued. This is part of a long-term project which for Storbreen involves the second longest series of investigations of its kind, started in 1948.

LENGTH MEASUREMENTS OF GLACIERS IN NORWAY (J. O. Hagen) – Glacier front fluctuations have been regularly registered in Norway since 1900. The measurements give an approximate estimate of the average mass balance over a long period of time, and may be useful in modelling glacier response to climatic changes. A total of ten glaciers are measured each year. Eight of them retreated in 1988,

while two advanced, Briksdalsbreen by as much as 43 metres.

GLACIER ATLAS OF SVALBARD AND JAN MAYEN (J. O. Hagen) – All available data about the glaciers have been stored in data-bases. The glaciers are registered by name, geographical locality, area, depth, volume and morphological data. Torild Jørgensen is part-time contracted as project assistant on this project.

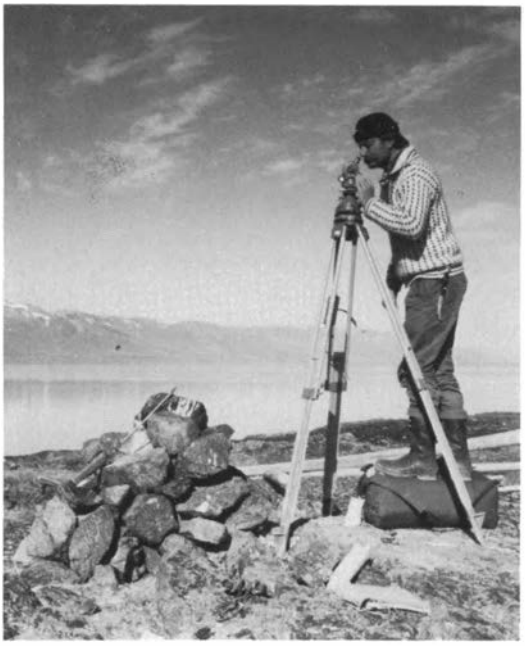
GLACIER AND CLIMATE MODELLING (O. Orheim and J. O. Hagen) – The project involves glaciologists and glacial geologists from three institutions in Norway, and from two other nations. The aim is to investigate glacier and climate variations in Norway (and possibly in polar areas) by using hard data in glaciological models. This should lead to: (1) a better insight into glacial variations and thereby a better understanding of natural climatic variations, (2) an increased Norwegian competence in glacier modelling, and (3) improvement of the models.

ANTARCTIC ICEBERGS (O. Orheim) – All nations having expedition vessels to Antarctica participate in this programme of ship observations. The data are compiled at Norsk Polarinstitutt and the data set now covers information on size and position of about 150,000 icebergs in the Southern Ocean.

ANTARCTIC SATELLITE IMAGES (O. Orheim) – LANDSAT and SPOT imagery from Dronning Maud Land are analysed for surface features, properties, and temperatures. The work is partly in cooperation with scientists from the United States.

STUDIES OF TABULAR ICEBERGS IN ANTARCTICA (O. Orheim) – The processing of iceberg data from Antarctic waters collected through an international programme led by the Institute was continued. Information has now been collected on 150,000 icebergs.

THE NORWEGIAN GLACIER CENTER (O. Orheim) – Planning is continuing for a 'museum' located near the Jostedalsbreen glacier, which is meant to be a showcase for Norwegian glacier research.



Topographer Knut Svendsen was head of the Topographical Division in 1988. He has been with the Institute since 1980, working both in Svalbard and and the Antarctic. He was the leader of the Institute's mapping expedition to Peter I Island in 1987.

Geodesy/topography

Norsk Polarinstitutt is responsible for the mapping and the production of maps of Norwegian polar land areas. Three topographers and one geodesist are employed in this work.

Triangulations made on the expedition to Svalbard in 1988 were calculated. The data from tide measurements in Ny-Ålesund in the period 1976 to 1986 were calculated. Preliminary points of the base line for the maritime boundary of Svalbard were computed. Two maps were constructed and five maps edited in the 1:100,000 series of Svalbard.

A number of topographical maps and white-prints were published in 1988 as listed under Maps and Charts on page 29.

A complete topographic data base of A4 Vasalhalvøya is now available.

Field work

Triangulation was done in Spitsbergen. The tide gauges in Longyearbyen and Ny-Ålesund received their necessary annual checks. The tide gauge station in Longyearbyen was damaged due to sediments on the inlet. An attempt was made to solve the problem in September 1988, but failed. A new station will be built in 1989.

Cartography

(leader: Bjørn Arnesen)

The cartographical division's main responsibilities are the technical preparation and production of the Institute's topographic and thematic maps, and the administration of the final preparation for the map printing work which is done outside the Institute. Three cartographers and one illustrator are occupied with this as well as with illustrating work for the Institute's publications. The division has been represented in the place-name committee.

21 topographic and two geological maps were published in 1988, as listed under Charts and Maps on page 29. Two thematic maps were published in cooperation with the Department of Geography, University of Oslo.

The division was also occupied with the preparation or revision of three topographical and two geological maps in the S100 series. One thematic map was under preparation in cooperation with the Department of Geography, University of Oslo.

Information/documentation

(leader: Annemor Brekke)

An information officer, a publications editor, a librarian, a translator and a part-time assistant cover the multitude of documentation tasks resulting from the Institute's responsibility for the scientific research in the Norwegian polar areas. The continued interest in polar matters made 1988 a very busy year for the division.

In addition to answering day-to-day questions on polar matters the Information Service seeks to give as extensive information as possible. Several press releases, news and information bulletins, in addition to the annual report of the Institute, were sent out in 1987. Two new issues of *Polarinform,* introduced at the end of 1986, were distributed to 300 subscribers, and were frequently quoted in the press. An exhibition in connection with the 100th Anniversary for Fridtjof Nansen's skiing expedition across Greenland, was made in cooperation with Aftenposten.

The publication of scientific literature is an important part of the Institute's documentation service. Two issues of the journal *Polar Research,* three *Skrifter,* one *Meddelelser,* one *Temakart* (thematic map), and seven *Reports* appeared in 1988 (see 'Published in 1988') and were exchanged and sold to scientists all over the world.

The services of the Institute also include sale of aerial photographs and topographic and thematic maps. The sale and subscription routines for Institute publications are handled by the Documentations Division.

The Institute library has one of the best collections of polar literature in Europe and is open to the public during office hours. 1988 saw another 196 titles registered, including 85 new purchases, two old titles, 6 reprints, 45 titles from exchange partners, and 58 gifts. The reprint collection totals 6600 titles. 462 loans were registered, including loans to other libraries.

The translator is mainly occupied with the translation from Russian to English of scientific literature. A list of the translations carried out this year may be obtained at the Institute.

Logistics

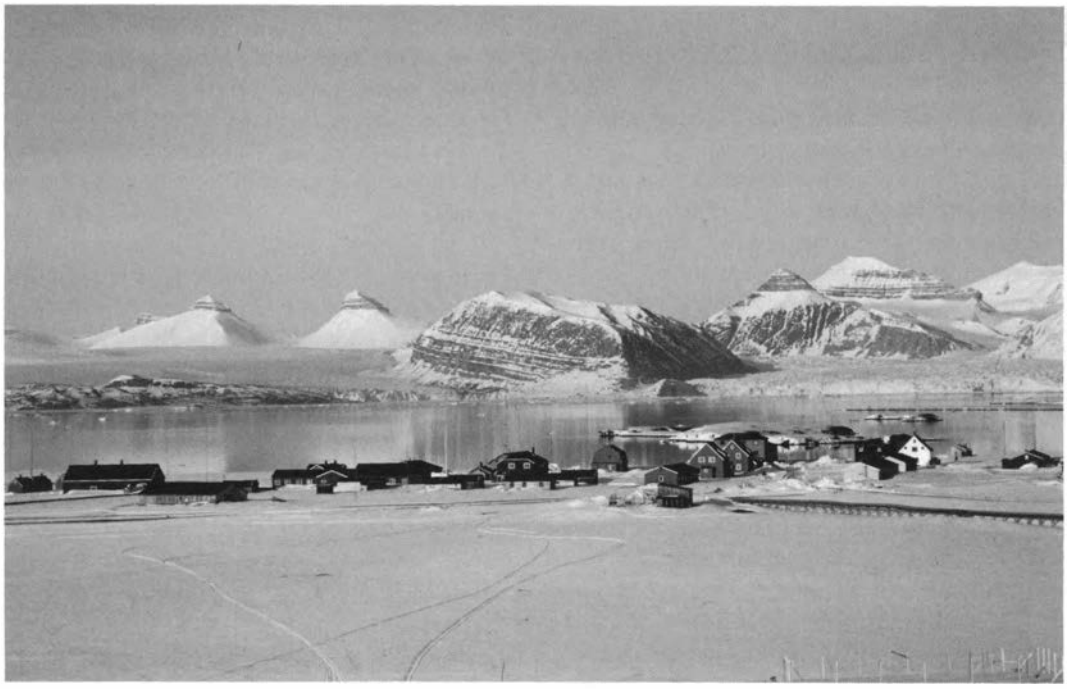
(leader: Thor Siggerud)

The division has five permanent posts and a number of part-time helpers. The personnel situation was still unstable in 1988 owing to illness and leave. A total of 238 scientists were given logistic and other support by the logistic division in 1988. Through the use of a rota system, there is always an on-the-spot representative in charge of the equipment at the research station in Ny-Ålesund.

Norsk Polarinstitutt has the practical responsibility for establishing and maintaining a network of navigation lights and beacons for ships and aircraft on Spitsbergen. Personnel from the logistics division are responsible for their annual inspection and service. In addition to general maintenance work, one strobelight was moved from Moselbukta to Gråhuken. Another two lights were erected at Poolepynten and Brandalspynten. The latter is operated by an experimental solar battery.

NORSK POLARINSTITUTT'S SVALBARD OFFICE. – The Institute has had a base for its Svalbard expeditions in Longyearbyen since 1977. The logistics division is responsible for the service function of this office, both for the Institute's own people and for other visiting scientists. The office was manned during the main field season on land, from the middle of March to the beginning of September in 1988. It functioned during the rest of the year on a part-time basis.

The Svalbard office was expanded in 1988 with two new offices and one equipment storage room, occupying 75 square metres on the mezzanine in the airport hangar. Another 200 square metres in the hangar were also added to be used as depot for special equipment.



Ny-Ålesund in the early spring. Photo: J. O. Hagen

Norsk Polarinstitutt's Research Station, Ny-Ålesund

The Research Station in Ny-Ålesund was established in 1968 and is one of the most northerly land stations in the world. It serves as an observatory, a laboratory and a field base and is available all year round for Norwegian scientists and others working with arctic problems in cooperation with Norwegian scientific institutions. The most important part of the activity takes place in connection with the station's observatory functions, which involve a considerable recording of mainly geophysical data.

The permanent scientific registration programmes of the Research Station in Ny-Ålesund were in operation throughout 1988. Some of them involve cooperation with scientists from other countries. The following phenomena are recorded continually or observed during longer periods of the year:

Components of the radiation energy budget	– Norsk Polarinstitutt
Tide measurement	– Norsk Polarinstitutt
Mass balance of glaciers	– Norsk Polarinstitutt
Atmospheric pollution	– Norsk Institutt for Luftforskning
Meteorological conditions	– Det norske meteorologiske institutt
Seismic disturbances	– University of Bergen
The Earth's magnetic field	– Universities of Tromsø and Oslo
Ionospheric activity, including aurora	– Universities of Tromsø and Oslo
Ozone measurements	– University of Oslo
Permafrost measurements	– University of Oslo/ Norsk Polarinstitutt
Hydrological investigations	– Hydrologisk komite/ Norsk Polarinstitutt
Polar fox studies	– Norsk Polarinstitutt

During the course of 1988, 55 visiting scientists stayed at the station for a total of 1100 visitor days. Not included in this number are more randomly visiting researchers, stopping over in Ny-Ålesund on their way to field work elsewhere in Svalbard. Visits are, unfortunately, not evenly spread throughout the year. More than 60 per cent of all visits to Ny-Ålesund take place in the period 15 June to 15 August. During the remaining ten months of the year, particularly in October-November and in March, there is ample room for visitors. July is the busiest month. About 50 per cent of all visits in 1988 were concerned with biological projects, 30 per cent with geophysics, and 20 per cent with geological work.

Last year's research fellow studied the behavioural ecology of the arctic fox in Svalbard, sharing his time between the Research Station and the office at Norsk Polarinstitutt.

The snow scooter pool of the Research Station was expanded in 1988, and some new deep freezers, a microscope, etc. added to the laboratories.

Polar events

SYMPOSIUM ON TERTIARY TECTONICS OF SVALBARD

The academic and industrial interest in the structure of the Tertiary mountain belt of Spitsbergen and the mountain building processes, has increased significantly in the 1980ies, although few efforts have been made to bring people together and discuss the topic at an interinstitutional level. The geological division of Norsk Polarinstitutt, in cooperation with the Geological Institute at the University of Oslo, therefore, decided to arrange a symposium on this topic.

The meeting took place at the Geological Institute on 26 and 27 April. More than 60 participants from 22 institutions and companies attended. The majority were Norwegians, but scientists from Denmark, England, France, Germany and the United States were also present. 28 lectures were given.

It became clear at the meeting that the fundamental ideas on the structure and evolution of the mountain belt have changed significantly during the last years. There was a general consensus concerning many revised views, although other questions were lively discussed. Many new data and scientific models were presented, and subsequently published as extended abstracts in Norsk Polarinstitutt Report Series No. 46. A subsequent meeting is planned to take place in 1990.

PHOTOGRAPHIC MATERIAL FROM NORWEGIAN POLAR HISTORY

Norway has an extensive history in both the north and south polar areas. However, few historians in Norway have actually spent much time on this subject and original historical material from this field has not always been sufficiently appreciated. Norsk Polarinstitutt took the initiative, therefore, to establish a data base of information concerning primary historical material from the Norwegian polar areas and concerning Norwegian activities in all polar regions. The Institute itself has a considerable amount of such material, including several thousand original photographs. In cooperation with NAVF (the Norwegian Council for Science and the Humanities) Norsk Polarinstitutt decided to begin with the registration of photographic material, and NAVF provided means for a research fellow to be based at Norsk Polarinstitutt for three years.

The aim of the project is to register relevant photographs in public collections (and private as far as possible) in Norway and abroad, and to include in the data base information gathered about other original relevant historical material. Research concerning the photographic material is an important part of the project.

The project must be regarded as a good start, as neither the time span nor the personnel involved are sufficient to complete the task of identifying and recording original sources of Norwegian polar history.

The project started on 1 June 1988 and concentrated during the first period on determining and testing a computer system for registering photographic material. It was decided to use the programme Polydoc as this suited and was already in use at the Institute. In addition methods of

The Institute's collection of historical photographs includes highly unstable nitrate film, which is self-destructive over time. Rescue and identification of such film must be given priority. This photograph has recently been copied, and although analysis has not yet been completed, it is almost certainly from Fridtjof Nansen's FRAM. Theodore Claudius Jacobsen, at the wheel in 1896, as the three-year voyage was nearing its successful completion.

storing the photographic material and preserving the images were studied, and a preliminary survey of institutions with relevant material in their collections was drawn up.

UPTURNED ECHO SOUNDING INSTRUMENT MEASURES ICE THICKNESS

The ice thickness distribution is one of the most important parameters for the detection of climatic changes. Relatively frequent observations from in situ instruments are necessary to get good estimates of the distribution at a given location. Moored upward- looking sonars (ULS) have proved to be a very interesting instrument for such ice thickness measurements.

Several years ago, Torgny Vinje at Norsk Polarinstitutt, started to advocate for the use of such an instrument. Experiments were begun in 1985, but it was not until June 1988 that the first one-year series of ice thickness measurements by this method was retrieved. The ULS is attached to the top of a mooring about fifty metres below the surface. Sound waves from the ULS hit the underside of the ice passing over every four minutes, registering the keel depth and drift direction. A one-year series thus contains 130,000 single measurements, which will provide a very good basis for ice statistics.

The first ULS used for these measurements was manufactured by Chr. Michelsens Institute, Bergen, and R/V POLARSTERN helped with deployment and retrieval of the data. Another two upward looking sonars have later been deployed in the Barents Sea from R/V Lance. The project is planned to continue for several years, to give both the authorities and industrial companies important data for climatic studies.

The ULS programme has gained international interest, and Vinje has recently been invited to lead an Arctic Sea Ice Thickness Monitoring Programme under the World Climate Research Programme of WMO and ICSU.

TIDE MEASUREMENTS IN SVALBARD

The Norwegian Polar Research Institute is responsible for tidal measurements in Svalbard. Since the first mean water level was established in Hiorthamn in 1916, several stations have been in operation for shorter or longer periods of time. In 1956 the first automatic tide gauge was mounted in Longyearbyen. Another automatic tide gauge of the pneumatic type was mounted in Ny-Ålesund in 1969.

The Institute bought its first Aanderaa self-recording tide gauges in 1976. They have been in operation since then in Ny-Ålesund, Longyearbyen, and elsewhere in Svalbard. Up until now, 25 one-year series have been recorded with such gauges. Recordings have taken place continuously in Ny-Ålesund from 1976 up until now, while the station in Longyearbyen has been in operation for nine years. The location of the latter has been changed twice.

The main purpose of tide measurement recordings is to establish a mean water level reference, a zero reference for measuring heights. In addition, tide measurement analyses may result in harmonic constants which can be used for prediction of future tides.

Long-term tide measurements in one station may give evidence of land uplift, but a long series of measurements is usually required to obtain significant results.

POLAR BEAR RESEARCH COOPERATION BETWEEN NORWAY AND THE SOVIET UNION

Representatives of the five signatory countries to the agreement of 1973 on polar bear protection, were summoned to a meeting in Sochi, SSSR, on 24-29 October 1988, arranged by the IUCN. This was the first time since 1981 that a working group meeting was held with full representation.

When protected in 1973, the polar bear had been excessivley hunted for many years, and was on the verge of becoming extinct. The protection was almost total, allowing only people that

traditionally had polar bear hunting as means of living, to kill a certain amount of animals each year. A total of 850 bears are taken annually by the inuits in the Greenland/Alaska area. Exact population figures are difficult to obtain, for natural reasons, but estimates seem to indicate that the Svalbard-Greenland population of polar bears has increased to about 6000 today.

The meeting in Sochi passed a total of twelve resolutions, most of them dealing with research and management cooperation. Two resolutions which are of importance for Norway, urge for close cooperation in the Barents Sea, based on the increasing oil activity in the area, and for protection of the mutual Norwegian/Soviet polar bear population. The latter resolution anticipates that no changes in the management strategies of any country be implemented without prior consultations with the other signatory parts.

Published in 1988

Several series are published by the Institute. The journal *Polar Research* contains original scientific papers in English and appears in two-three issues per year. The *Skrifter* series is for monographs in English, French or German, while *Meddelelser* is a series for articles of a more popular character. *Polarhåndbok* has so far appeared in two issues, on the flora and geography of Svalbard. *Årbok* has been published annually since 1960. The *Temakart* series (Thematic maps) was started in 1985, one new issue appearing in 1988.

The following is a list of literature and maps published by the Norwegian Polar Research Institute in 1988. They may be ordered from bookstores or directly from the Institute.

PUBLICATIONS

Polar Research

This journal, started in 1982, has attracted many subscribers and is exchanged with the scientific literature of about 250 institutions around the world. Two issues, Vol. 6 Nos. 1 and 2, appeared in 1988.

Norsk Polarinstitutt Skrifter

No. 179D – Elverhøi, A., Antonsen, P., Flood, S.B., Solheim, A. & Vullstad, A.A.: The physical environment western Barents Sea 1:1,500,000. Shallow bedrock geology.

No. 189 – Doyle, P., Kelly, S.R.A.: The Jurassic and Cretaceous belemnites of Kong Karls Land, Svalbard.

No. 190 – Kanat, L. & Morris, A.: A working stratigraphy for central western Oscar II Land, Spitsbergen.

Norsk Polarinstitutt Meddelelser

No. 109 – Arlov, T.B.: Svalbard 1596-1650 i historiografisk lys.

Norsk Polarinstitutt Temakart

Temakart No. 3 – Winsnes, T.S.: Bedrock map of Svalbard and Jan Mayen (geological 1:1,000,000.

Norsk Polarinstitutt Årbok 1987

In addition to being the annual report of the Norwegian Polar Research Institute, this yearbook contains an article on the 1987 expedition to Peter I Øy in Antarctica.

Research in Svalbard 1988

This yearly bulletin gives information on the scientific work planned to take place in Svalbard during the coming season. Based on data collected by Norsk Polarinstitutt it is distributed to all contributors before the beginning of the field season each year.

Norsk Polarinstitutt Report Series

The following papers appeared in the Report Series in 1988 which is published for limited

distribution. Some are for sale at the Institute, while others may be obtained directly from the authors.

No. 42 Gulliksen, Bjørn: Marinbiologiske forhold i Svalbards territorialfarvann NOK 50.–

No. 43 Solheim, A., Elverhøi, A. & Finnekåsa, Ø.: Marine geophysical/geological cruise in the Northern Barents Sea NOK 50.–

No. 44 Bakken, Vidar & Mehlum, Fridtjof: AKUP – sluttrapport Sjøfuglundersøkelser nord for N74°/Bjørnøya. NOK 50.–

No. 45 Krzyszowska, Anna: Human impact on the tundra environment at Ny-Ålesund, Svalbard Out of print

No. 46 Dallmann, W. K., Ohta, Y. & Andresen, A. (eds.): Tertiary tectonics of Svalbard. Extended abstracts from Symposium held in Oslo 26 and 27 April 1988. NOK 50.–

No. 47 Solheim, Anders: Glacial geology of the Northern Barents Sea, with emphasis on the surge related, ice proximal depositional environment NOK 75.–

Polarinform

This information bulletin gives short notes on general news topics from the polar areas, and is meant to be published two to four times a year. It appeared for the first time in November 1986 and will be distributed free of charge to those interested. Two issues appeared in 1988.

MAPS AND CHARTS

Topographic maps published in 1988:

Antarctica:	1:250,000	D8 Heimefrontfjella nord
		D9 Heimefrontfjella sør
	1: 50,000	Peter I Øy
Svalbard:	1:500,000	Edgeøya
		Spitsbergen, Søre del
	1:100,000	B8 St. Jonsfjorden
		C7 Dicksonfjorden
		C9 Adventdalen
		C11 Kvalvågen

Published as whiteprints:

Antarctica:	1:250,000	P5 Einseten
		P6 Tussebreen
		Q5 Utsteinflya
		Q6 Widerøefjellet
		R5 Byrdbreen
		R6 Mefjell
		S5 Balchenfjella nord
		S6 Balchenfjella sør

Svalbard:	1:100,000	D8 Negribreen
		A4 Vasahalvøya
		A5 Magdalenefjorden
		B7 Tre Kroner

Geological maps

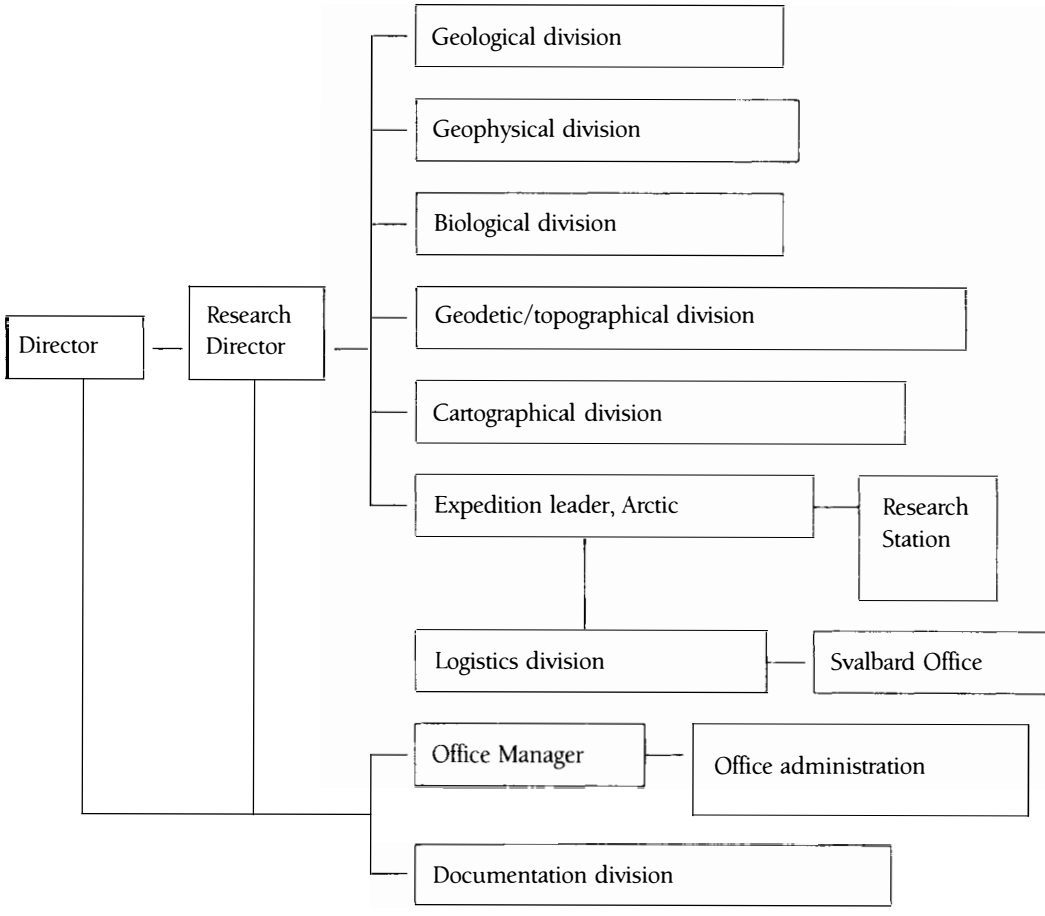
Svalbard:	1:100,000	C8G Billefjorden
	1:1,500,000	Barentshavet bedrock maps (part of Skrifter 179D)

The following maps were published in cooperation with the Department of Geography, University of Oslo:

Kystkart Svalbard 1:200,000	B4 Bellsund
Nasjonalatlaset/Temakart Nr. 7	Dyreliv Svalbard og Jan Mayen

Institute staff

ORGANIZATION



Administration:

Director	Odd Rogne
Research Director	Jan A. Holtet

Office administration:

Office Manager	Otto Gerhard Vaagen
Economic consultant	Asbjørn Traaholt (from 1.4.)
Accounts	Bjørg Grimsrud
	Hildegunn Ardal
Telephonist/Receptionist	Nora Lisen Bugge (part time)
	Mary Caspersen (part time)

Director's Office	Marit Wiik
Secretarial	Rigmor Hiorth (part time)
	Åsta Marie Reinsli (part time, from 1.7.)
	Janne-Mai Riiser (temporary, part time, from 1.10.)
Correspondence archive	Ingeborg Christiansen
Computer services:	
Leader	Øivind Finnekåsa
	Torstein Berge
Remote sensing	Jostein Amlien
Documentation division:	
Leader, information officer	Annemor Brekke
Editorial assistant	Knut Arnesen
Russian translator	Peter Hagevold
Librarian	Reidunn Lund
Documentation assistant	Inge Marie Mølmen (part time, until 11.3.)
	Mary Aiko Wiborg (part time, from 1.4.)
Cartographical division:	
Leader	Bjørn Arnesen
	Reidar Mandt
	Arild Myhrvold
	Donald Tumasonis (part-time, until 31.3.)
	Espen Kopperud (part time, from 1.4. until 31.8.)
	Mona Bendixen (part time, from 1.9.)
Expedition Leader, Arctic, and leader of Logistics division and Research Station, Ny-Ålesund:	Thor Siggerud
Logistics division:	
	Kåre M. Bratlien (until 11.10)
	Jan Mikalsen
	Eilif Frantzen
	Georg Johnsrud
	Jarl G. Pedersen
Temporary	Knut Hovrud
"	Lars Bakke (from 14.11)
Research Station, Ny-Ålesund (temporary posts):	
Station leader, shared with KBKC	Jomar Barlaup (until 26.4.)
	Einar Ellingsen (from 27.4. until 25.10.)
	Harald Gule (from 26.10)
Research fellow	Karl Frafjord
Engineer	Bjørn Willy Fjeld (until 16.6.)
Engineer	Trond Jensen (until 30.6.)
Engineer	Kurt Karlsen (from 31.5.)
Engineer	Paul Hinsch (from 21.6.)
Logistics	One person from Logistics division on a rota system

Scientific divisions

Biology:

Leader	Fridtjof Mehlum (from 1.6.)
	Nils Are Øritsland (until 31.5.)
Contracted	Geir Wing Gabrielsen
”	Vidar Bakken
	Øistein Wiig (from 10.3.)
”	Ian Gjertz
”	Pål Prestrud (until 1.11.)
”	Per Espen Fjeld
”	Rasmus Hansson
”	Egil Soglo (technician)
Research fellow	Linn Gulbrandsen (from 16.6.)

Geophysics:

Leader, Sea ice studies	Torgny Vinje
Meteorologist	Vidar Hisdal
Antarctic, Glaciologist	Olav Orheim
Oceanographer	Bert Rudels
Glaciologist	Jon Ove Hagen
Contracted	Ånund Sigurd Johnsen
”	Geir Kjærnli (part time)
”	Bengt Larsen
”	Bjørn Erlingsson
”	Torild Jørgensen

Geology:

Leader	Audun Hjelle
	Thore S. Winsnes
	Yoshihide Ohta
	Otto Salvigsen
	Hilde B. Keilen
	Winfried K. Dallmann
Marine geology	Anders Elverhøi
	Anders Solheim
Technician	Jon Erik Møller
Temporary	Pål Haremo
”	Vigdis Løvø (from 1.4 until 31.10)
”	Hans Petter Antonsen (from 1.11. to 31.12)
”	Sten Boye Flood (part time, total two months)

Geodesy/Topography:

Leader, topographer	Knut Svendsen
Geodesist	Trond Eiken
Topographer	Bjørn Lytskjold
Topographer	Brit Åse Luktvasslimo (from 1.9.)
Research fellow NAVF, history	Susan Barr (from 1.6.)

Post retirement positions:

Geology	Tore Gjelsvik
Topography	Sigurd Helle

The following left the Institute in 1987:
Espen Kopperud
Aud Christiansen

On leave:
Inge Marie Mølmen (from 12.3.)

DISTINCTIONS AND DEGREES

Dr. philos. Tore Gjelsvik, former Director of Norsk Polarinstitutt, was awarded the Georg von Neumayer's Medal of Merit in October for his contribution to international polar research and for his assistance in the building up of German polar research.

Odd Rogne, Director of Norsk Polarinstitutt, was appointed Knight of the French State's decoration of merit for his efforts to establish cooperation within the field of Arctic research, between France and Norway.

A. Solheim was confered the Dr.scient. degree at Oslo University in December on the thesis 'Glacial geology of the northern Barents Sea, with emphasis on the surge related, ice proximal depositional environment'.

PUBLISHED BY THE INSTITUTE STAFF

Bakken, V. & Mehlum, F., 1988: AKUP sluttrapport. Sjøfuglundersøkelser nord for N74°/Bjørnøya. *Norsk Polarinstitutt Rapport Nr. 44.*

Barr, Susan, 1988: Hvilke kilder er aktuelle når det gjelder Svalbardforskning? Oversikt over hovedkilder og kildegrupper. In: Rapport fra Svalbardseminar i Tromsø 19.-20.11.1987. *Tromura, Kulturhistorie nr. 11, 66-78.* University of Tromsø.

Anker-Nilssen, T., *Bakken, V.* & Strann, K. B., 1988: Konsekvensanalyse olje/sjøfugl ved petroleumsvirksomhet i Barentshavet sør for 74°30' N. *Viltrapport 46.* Direktoratet for naturforvaltning.

Dallmann, W.K. 1988: The structure of the Berzeliustinden area: Evidence for thrust wedge tectonics in the Tertiary Spitsbergen fold belt. *Polar Research 6,* 141-154.

Dallmann, W.K., Ohta, Y. & Andresen, A. (eds.) 1988: Tertiary tectonics of Svalbard. Extended abstracts from symposium held in Oslo 26 and 27 April 1988. *Norsk Polarinstitutt Rapport Nr.46,* 110 pp.

Elverhøi, A. & Solheim, A. 1988: Late Weichselian glaciation of the Northern Barents Sea - a discussion. *Polar Research 5,* 285-287.

Erlingsson, B., 1988: Two-dimensional deformation pattern in sea ice. *J. of Glaciology 34(118).*

Fjeld, P.E., Gabrielsen, G.W. & Ørbæk, J.B., 1988: Noise from helicopters and its effect on a colony of Brünnich's Guillemots *(Uria lomvia)* on Svalbard. *Norsk Polarinstitutt Rapport 41,* 115-53.

Fjeld, P.E. & Gabrielsen G.W., 1988: Kan helikoptertrafikk ødelegge hekkingen? *Populærvitenskapelig magasin nr. 1,* 32-34.

Frafjord, K., 1988: Betraktninger omkring fjellrevbestanden i Sør-Norge i perioden 1981-1985. *Fauna 41,* 35-39.

Frafjord, K., 1988: Noen norske aviser holdning til store rovdyr. *Fauna 41,* 101-103.

Cyvin, J. & *Frafjord, K.,* 1988: Sylaneområdet - bruken og virkninger av bruken. *Rapport zoologisk serie 1988 nr. 2.* Universitetet i Trondheim, Vitenskapsmuseet.

Gabrielsen, G. W., Mehlum, F. & Karlsen, H. E., 1988: Thermoregulation in four species of arctic seabirds. *J. Comp. Physiol. (B) 157,* 703-708.

Gabrielsen, G. W., 1988: Forsvarsresponser hos ryper. *Ottar nr. 4,* 12-16.

Steen, J.B., *Gabrielsen, G.W.* & Kanwisher, J.W., 1988: Physiological aspects of freezing behaviour in Willow ptarmigan hens. *Acta Physiol. Scand. 134,* 299-304.

Steen, J.B. & *Gabrielsen, G.W.,* 1988: The development of homeothermy in Common Eider ducklings *(Somateria mollissima). Acta Physiol. Scand. 132,* 557-561.

Hagen, J. O., 1988: Glacier surge in Svalbard with examples from Usherbreen. *Nor. Geogr. Tidsskr. 42(4).*

Hagen, J.O., 1988: Brefrontvariasjoner. In: (Østrem, G.) *Atlas over breer i Sør-Skandinavia.*

Hagen, J. O., 1988: Glacier mass balance investigations in the balance year 1986-87. *Polar Research 6,* 205-209.

Hagen, J. O. & Sørbel, L., 1988: Glaciers in Svalbard. Pp. 17-19 in: (Orheim, A. & Sollid, J.L. eds.) Svalbard excursion guide. V. International conference on permafrost, *Meddelelser fra Geografisk institutt, Universitetet i Oslo, Naturgeografisk serie, Rapport 8.*

Hisdal, V., 1988: Climate and light. Flora and fauna of Svalbard. In: *Arctic Pilot.* Published by Norw. Hydr. Service and Norw. Polar Res. Inst. Stavanger 1988.

Hjelle, A. 1988: Tertiary structures in western Nordenskiöld Land. *Norsk Polarinstitutt Rapport Nr. 46,* 29-31.

Hjelle, A. 1988: Svalbard, a geological picture book. In *Arctic Pilot,* 7. 125-139. The Norwegian Hydrographic Service/The Norwegian Polar Research Institute.

Johnsen, Å. S. & Vinje, T., 1988: *Havisundersøkelser i Barentshavet.* Utkast til sluttrapport for AKUP-havis.

Mehlum, F., Gjessing, Y., Haftorn, S. & Bech, C., 1988: Census of breeding Antarctic Petrels *Thalassoica antarctica* and physical features of the breeding colony at Svarthamaren, Dronning Maud Land, with notes on breeding Snow Petrels *Pagodroma nivea* and South Polar Skuas *Catharacta maccormicki. Polar Research 6,* 1-9.

Haftorn, S., *Mehlum, F.* & Bech, C., 1988: Size variation in the Snow Petrel *Pagodroma nivea. Notornis 35,* 109-116.

Haftorn, S., *Mehlum, F.* & Bech, C., 1988: Navigation to nest site in the Snow Petrel *(Pagodroma nivea). Condor 90,* 484-486.

Ohta, Y., Peucat, J.J. & Gee, D.G. 1988: Greenvillian in Svalbard and its correlation elsewhere in the Arctic. *18 Nordiske geologiske Vintermøde, København January 1988,* 328-329. (Abstract).

Ohta, Y. 1988: Structure of Carboniferous strata at Trygghamna and along the SE margin of the Forlandsundet Graben. *Norsk Polarinstitutt Rapport Nr.46,* 25-28.

Ohta, Y. 1988: An additional presentation of the basement-platform boundary structures in NW Nordenskiöld Land. *Norsk Polarinstitutt Rapport Nr. 46,* 32-33.

Knoll, A.H. & *Ohta, Y.,* 1988: Microfossils in metasediments from Prins Karls Forland, western Svalbard. *Polar Research 6,* 59-68.

Max, M.D. & *Ohta, Y.* 1988: Did major fractures in continental crust control orientation of the Knipovich Ridge-Lena Trough segment of the plate margin? *Polar Research 6,* 85-94.

Orheim, O., 1988: Glaciology, hydrology and glacial geology around Jostedalsbreen. *Field guide to excursion 10 September – 13 September 1988 organized in conjunction with Symposium on Snow and Glacier Research related to human living conditions.* Lom, Norway.

Orheim, O., 1988: Glaciology and glacial geology of Fjærland. Pp. 36-42 in: (Orheim, O. ed.) Glaciology, hydrology and glacial geology around Jostedalsbreen. *Field guide to excursion 10 September – 13 September 1988 organized in conjunction with Symposium on Snow and glacier research related to human living conditions.* Lom, Norway.

Orheim, O. & Lucchitta, B.K., 1988: Numerical analysis of Landsat Thematic Mapper images of Antarctica: Surface temperatures and physical properties. *Annals of Glaciology 11,* 109-120.

Orheim, O., 1988: Antarctic icebergs – distribution and disintegration (abstract). *Annals of glaciology 11.*

Ryg, M., Smith, T.G. & *Øritsland, N.A.,* 1988: Thermal significance of the topological distribution of blubber in ringed seals *(Phoca hispida). Can. J. Fish. Aquat. Sci. 45,* 985-992.

Watts, P.D., *Øritsland, N.A.* & Hurst, R. J., 1988: Standard metabolic rate of polar bears under simulated denning conditions. *Physiol. Zool. 60,* 687-691.

Staaland, H., *Øritsland, N.A.* & White, R.G., 1988: Digestion of energy and nutrients in Svalbard reindeer. *Rangifer 8(1),* 2-10.

Prestrud, P. & Øritsland, N.A., 1988: Miljøundersøkelser i tilknytning til petroleumsvirksomhet på Svalbard 1987. *Norsk Polarinstitutt Rapport nr. 41.*

Rogne, O., 1988: Hvorfor polarforskning? Hvilke motiver ligger bak? In: Linder, Herberth (ed.) *Polarområdene. Hvite felt i politikk og vitenskap,* 73-79.

Quadfasel, D., *Rudels, B.,* and Yurz, K., 1988: Outflow of dense water from a Svalbard fjord into the Fram Strait. *Deep-Sea Research 35,* 1145-1150.

Anderson, L. G., Jones, E. P., Lindegren, R., *Rudels, B.,* and Sehlstedt, P.-I., 1988: Nutrient regeneration in cold, high salinity bottom water of the Arctic Shelves. *Continental Shelf Research 8,* 1345-1355.

Solheim, A., 1988: Glacial geology of the northern Barents Sea, with emphasis on the surge related, ice proximal depositional environment. *Norsk Polarinstitutt Rapport Nr.47,* 343 pp.

Solheim, A., Milliman, J.D. & *Elverhøi, A.,* 1988: Sediment distribution and sea-floor morphology of Storbanken: implications for the glacial history of the northern Barents Sea. *Canadian Journal of Earth Sciences, 24,* 547-556.

Solheim, A., *Elverhøi, A. & Finnekåsa, Ø.,* 1988: Marine geological/ geophysical cruise in the northern Barents Sea 1987 – Cruise report. *Norsk Polarinstitutt Rapport Nr.43,* 103 pp.

Solheim, A., as a member of ODP Leg 119 scientific party, 1988: Early glaciation of Antarctica. *Nature 333,* 303-304.

Solheim, A., as a member of ODP Leg 119 scientific party, 1988: Leg 119 studies climatic history. *Geotimes,* July 1988, 14-16.

Vinje, T. & Jensen, H., 1988: *IDAP 88 Vessel Deployment.* Cruise report 18-28 March.

Vinje, T., Løset, S., *Johnsen, Å.,* Løvås, S.M., *Erlingsson, B.* & Jensen, H., 1988: *IDAP 88 Vessel Deployment. Volume 2: Field Observations and Analysis.*

Wiig, Ø., 1988: The grey seal *Halichoerus grypus* (Fabricius) and the Common Seal *Phoca vitulina* L. in Troms, northern Norway. *Fauna norv. Ser. A9.*

Wiig, Ø., 1988: Change in the degree of infestation of parasitic nematodes in Grey Seals *Halichoedrus grypus* from Froan, Norway. *Fauna norv. ser. A9.*

Wiig, Ø., 1988: Grønlandssel og selinvasjon. Hva vet vi - hva tror vi. *Naturen 1988,* 35-41.

Wiig, Ø. & Andersen, T., 1988: Non-metrical variation in the skull of Norwegian lynx. *Acta theriol. 33,* 3-19.

Wiig, Ø. & Øien, N., 1988: Recoveries of Common Seals *Phoca vitulina* L. tagged along the Norwegian coast. *Fauna norv. Ser. A9.*

Winsnes, T.S. & *Ohta, Y.* 1988: Fold structures of Carboniferous to Triassic rocks in the inner part of St. Jonsfjorden. *Norsk Polarinstitutt Rapport Nr. 46,* 21-24.

MEETINGS, COURSES AND TEACHING

Institute staff members attended meetings and short courses in Norway, Australia, Canada, Denmark, Finland, Great Britain, Iceland, New Zealand, Poland, the Soviet Union, Sweden, United States.

The following have held regular University lectures and tuition:

Eiken, Trond: Surveying – University of Oslo
Elverhøi, Anders: Geology – University of Oslo
Hagen, Jon Ove: Glaciology – University of Oslo
Orheim, Olav: Glaciology – University of Bergen
Øritsland, Nils: Biology – University of Oslo

LECTURES AND CONFERENCE CONTRIBUTIONS

Bakken, V.: *Sjøfuglsituasjonen i Barentshavet.* Norsk Ornitologisk forening. Oslo, September.
- *Distribution and feeding ecology of Brünnich's Guillemots in the northern Barents Sea during winter and spring.* University of Tromsø Seabirds at sea workshop. Skibotn, October.
- *Sjøfuglsituasjonen på Bjørnøya og i Barentshavet.* Nordisk havfuglgruppes årsmøte. Varberg, December.

Dallmann, W.K.: *Late Ordovician/Early Silurian tectonics along the Baltoscandian margin - the Eknean unconformity.* 18 Nordiske Geologiske Vintermøde. København, 12-14 January.
- *Thrust tectonics south of Van Keulenfjorden.* Symposium on Tertiary tectonics of Svalbard. Oslo, 26-27 April.
- *The geological map sheet Van Keulenfjorden (No.B11G), discussion and progress report.* Polar Colloquia, Norsk Polarinstitutt. Oslo, 8 November.

Dallmann, W.K. & Maher, H.D.: *Thick- and thin-skinned tectonics in the SW part of the Tertiary fold-and-thrust belt, Spitsbergen.* 6.Annual TSGS-meeting. Oslo, 17-18 November.

Frafjord, K.: *Energibalanse og dominansforhold hos fjellrev på Svalbard.* University of Oslo, January.
- *Fjellrevøkologi.* Hovedfagskurs i arktisk økologi, University of Oslo. Ny-Ålesund, June.
- *Fjellrevprosjektet i Ny-Ålesund.* Orientering for skoleklasse fra Longyearbyen og Svalbardposten, September.

Gabrielsen, G.W.: *Sjøfuglenergetikk.* Muskelfysiologisk Institutt, University of Oslo, March.
- *Theremoregulation and energetics of arctic seabirds.* NATO Advanced Research Workshop, Physiology of cold adaptation in birds. Loen, June.
- *Sjøfuglers energetikk, virkning på fiskeribestander.* Norges fiskerihøgskole. University of Tromsø, November.
- *Seabirds in the Arctic.* The Fulbright Alumini Ass. of Norway. Oslo, November.
- *Behavioural energetics of arctic breeding seabirds.* London Zool. Society, December.

Gjertz, Ian: *Research on polar bears and walruses in Svalbard.* International Club, Norges Landbrukshøgskole. Ås, November.

Hagen, J.O.: *Glacier surge in Svalbard.* Uppsala University, March.
- *Glaciers in Svalbard.* Guiding on the V. International Conference on Permafrost, post conference excursion, August.
- Weekly lectures in glaciology at Geographical Institute, University of Oslo.

Hjelle, A.: *Tertiary structures in western Nordenskiöld Land.* Symposium on Tertiary tectonics of Svalbard. Oslo, 26-27 April.

Holtet, J.: *Isforskning i Barentshavet i tilknytning til petroleumsvirksomhet.* Norsk Petroleumsforening, Stavanger, January.
- *Ozon og atmosfærefenomener i polarområdene.* Svalbardkurset, Ny-Ålesund, July.
- *Norsk Polarinstitutt og forskningsvirksomhet i Ny-Ålesund.* Svalbardkurset, Ny-Ålesund, July.
- *Hva skjer med ozonlaget?* NIF/SINTEF Studietur Nord, Svalbard, August.
- *Forskning i Ny-Ålesund og Kongsfjordområdet.* NIF/SINTEF Studietur Nord, Svalbard, August.

Keilen, H.B. *Nye sedimentologiske og paleogeografiske aspekter ved Gipshukenformasjonen, Svalbard.* Polar Colloquium, Norsk Polarinstitutt 8 March.

Mehlum, F.: *Modeller – Sjøfuglpopulasjoner.* Seminar om marin kystøkologi. Trondheim, March.
- *Lectures on arctic animal ecology.* Hovedfagkurs i arktisk økologi, University of Oslo. Ny-Ålesund, June.
- *The distribution and feeding ecology of seabirds in icefilled waters around Svalbard during summer.* University of Tromsø Seabird at sea workshop. Skibotn, October.

Ohta, Y., Peucat, J.J. & Gee, D.G.: *Greenvillian in Svalbard and its correlation elsewhere in the arctic.* 18 Nordiske geologiske Vintermøde. København, 12-14 January.
- *Structure of Carboniferous strata at Trygghamna and along the SE margin of the Forlandsundet Graben.* Symposium on Tertiary tectonics of Svalbard. Oslo, 26-27 April.
- *An additional presentation of the basement-platform boundary structures in NW Nordenskiöld Land.* Symposium on Tertiary tectonics of Svalbard. Oslo, 26-27 April.

Ohta, O. & Dallmann W.K.: *Tectonic aspects of the eastern margin of the west Spitsbergen fold belt.* Norsk Geologisk Forening's møte, Oslo 17 March.

Orheim, O.: *Shallow drilling potential on the eastern Weddell Sea shelf* (Orheim, Solheim and Elverhøi). *Polar Drilling Workshop,* Columbus, USA, 5-10 November.
- *Glaciological and oceanographic studies underneath Fimbulisen. Norwegian plans for drilling through the ice shelf in the 1989-90 season.* Polar Drilling Workshop, Columbus, USA, 5-10 November.
- *Snow and glacier research related to human living conditions in Norway* (Orheim, Lied, Norem & Wold). International Glaciology Symposium, Lom, 4-14 September.

Øritsland, N.A.: *Lectures on arctic animal ecology.* Hovedfagskurs i arktisk økologi, University of Oslo. Ny-Ålesund, June.

Rogne, O.: *Samarbeid om forskning og utvikling.* Teknologidagene '88. Narvik, March.
- *International Arctic Science Committee. A short survey of the needs, goals, terms of reference and organizational structure.* Kungl. Vitenskapsakademien, Stockholm, March.
- *Italia-ekspedisjonen. En minnetale 60 år etter.* Vadsø, May.
- *Miljøutfordringer i polarområdene.* Orientering til Stortingets Miljøvernkomite. Svalbard, August.

- *Norsk polarforskning i nord og sør. Rammevilkår og utviklingstendenser.* Universitetet i Tromsø, October.
- *Polarmarkedet. Organisering av norske produsenter og leverandører av polarutstyr, -teknologi og -tjenester.* Polarforum, November.
- *Norsk polarforskning - utfordringer og muligheter.* Det norske Svalbardselskap, December.

Salvigsen, O., Elgersma, A., Landvik, J.Y., Mangerud, J. & Sandahl, T. *1987: Strandforskyvningen på Svalbards vestkyst i Sen Weichsel og Holocen.* 18 Nordiske Geologiske Vintermøde København, 12-14 January.
- Landvik, J.Y., Mangerud, J. & *Salvigsen, O.: Glacial history and permafrost in the Svalbard area. Permafrost.* V Intern. Conf. on Permafrost Trondheim 2-5 August.

Solheim, A., Elverhøi, A., Orheim, O.: *Shallow drilling potential on the eastern Weddell Sea shelf.* Polar Drilling Workshop. Ohio State University. USA, 6-9 November.

Vinje, T.: *Isfjellkartlegging i Barentshavet.* Nordiske SPOT-dager i Kiruna. Sweden, January.
- *En 20-års isdatabase for Barentshavet.* Copenhagen, February.

Wiig, Ø.: The following papers were read at the IUCN Polar Bear Specialist Group's Vth meeting in Socchi, Soviet Union:
- Wiig, Ø.: *Satellite telemetry at Svalbard 1988.*
- Wiig, Ø.. & Born, E.: *Relevance of harbour seal mass mortality to polar bears.*
- Wiig, Ø., Hansson, R. & Øritsland, N.A.: *Research on polar bears in Norway 1986-1988.*
- Wiig, Ø., Hansson, R. & Øritsland, N.A.: *Management of polar bears in Norway.*

Winsnes, T.S. & Ohta, Y.: *Fold structures of Carboniferous to Triassic rocks in the inner part of St. Jonsfjorden.* Symposium on Tertiary tectonics of Svalbard. Oslo, 26-27 April.

Accounts for 1988

Chap.1412. Debit items	*Budgeted*	*Expenditure*
01. Salaries, wages, etc	12,728,000.-	12,833,587.-
11. Goods and services	11,578,000.-	11,568,554.-
21. Special expenses:		
Ordinary	6,519,000.-	6,156,999.-
Contracts	4,722,000.-	3,748,474.-
45. Large new purchases	435,000.-	354,211.-
70. Scholarships	100,000.-	100,000.-
	36,082,000.-	34,779,825.-
Chap.18. Beacons and radio beacons in Svalbard	2,092,000.-	2,087,001.-
Chap.4412. Credit items	***Budgeted***	***Received***
01. Sale income	1,000,000.-	672,907.-
03. Income from various services	4,722,000.-	3,748,474.-
04. Reimbursment from Svalbard budget	2,050,000.-	2,050,000.-
	7,772,000.-	6,471,381.-

Grants and financial assistance for research projects

Norsk Polarinstitutt gives financial support to polar research at the Norwegian universities and research institutions in the form of fellowships and project grants. Fellowships are granted to individuals, mainly students, to support and stimulate new scientific projects in Svalbard. More extensive management-oriented projects will be supported under the Programme for Biological Research and Investigations in the Arctic, see project grants below.

FELLOWSHIPS IN 1987

Etzelmuller, Bernd: Genesis of fine material at Kvadehuksletta.
Haremo, Pål: Structural and sedimentological evolution of rocks between Isfjorden and Van Mijenfjorden.
Hasle, Grethe Rytter: Comparative studies of diatom floras of Svalbard and Bouvetøya.
Heimdal, Berit Riddervold: Comparative studies of diatom floras of Svalbard and Bouvetøya.
Jacobsen, Bjørn: Large-scale auroral dynamics. Theoretical modelling of the solar wind-magnetosphere interaction compared with observations.
Lindgård, Kjell: Photoperiodic control of fat-metabolism in captive Svalbard ptarmigan.
Lønstad, Paula: Thermoregulation in arctic tern chicks (Metabolic capacity and the development of muscles).
Odasz, Ann Marie: Winter metabolism in reindeer-forage vascular plants.
Siggerud, Erling Heintz: Foraminifer stratigraphy and eludiation of depositional conditions.
Sørbel, Leif: Geomorphological studies of rock glaciers.
Ødegård, Rune: Detailed geomorphological studies in the coastal zone in Spitsbergen.

PROJECT GRANTS 1988

Amlien, Jostein: Remote sensing in geological and botanical mapping of Svalbard.
Bakken, Vidar: Seabird investigations at Bjørnøya.
Elvebakk, Arve: Satellite based mapping of vegetation, reindeer grazing areas and surface temperatures in Svalbard.
Prestrud, Pål: Studies of the polar fox in Svalbard with special emphasis on factors influencing the outgrowth and dispersal of rabies.
Salvigsen, Otto, Elverhøi, A. & Sollid, J. L.: Classification and mapping of coastal zone in Svalbard.
Tyler, Nick: Reindeer studies in Adventdalen, Svalbard.
Wiig, Øystein: Sea mammal investigations in Svalbard.
Øritsland, Nils A.: Reindeer investigations in Svalbard.

Satellite tracking of Polar bears

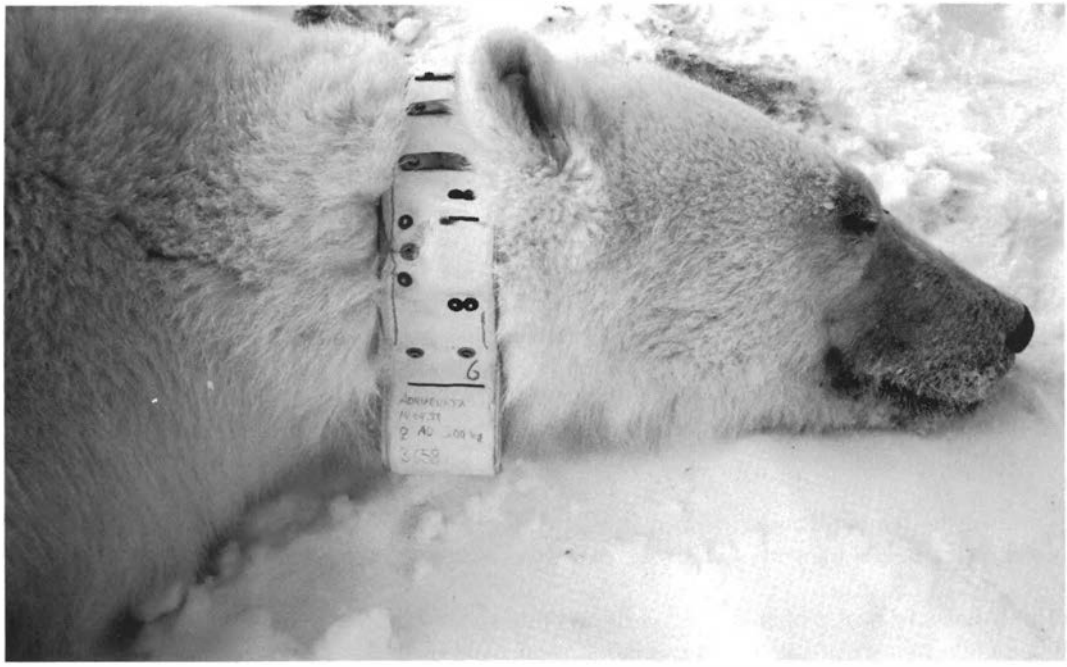
ØYSTEIN WIIG

Polar bears seem to be distributed in many relatively descrete subpopulations around the North Pole. In the Svalbard area they probably wander in the region from East Greenland to Frans Josef Land and Novaja Zemlja, but the exact range and distribution of the population are still uncertain. The use of satellite telemetry has enabled us to follow single polar bears from day to day for more than a year.

The method of fitting radio collars on polar bears has been in use for more than ten years. While the first transmitters weighed 5.6 kilograms, today's collars have been reduced to only 1.6 kilograms. The transmitters function within the world wide ARGOS satellite system, the instruments being carried on board two TIROS-N series polar orbiting satellites operated jointly by France, Great Britain and the United States. At latitudes higher than 75°N the two satellites make 28 overpasses in 24 hours. They are programmed to send information for twelve hours every third day. This makes the battery package last longer than with one continuous transmission. Our transmitters should, theoretically, last for about eighteen months.

All transmitters operate on the same frequency of 401.65 MHz. Location is determined from the Doppler shift in the frequency received in the satellite, as it moves towards and away from the transmitter. Each transmission lasts for 360-920 minutes.

Coming from the west, polar bears wander every year in the late winter/early spring through the Hornsund fjord area in the South Spitsbergen National Park. They may stay in land-connected ice



Female polar bear with satellite transmitter. Photo: Ø. Wiig

Expedition crew (left to right): Ian Gjertz, Øystein Wiig, and the leader, Jørn Thomassen.

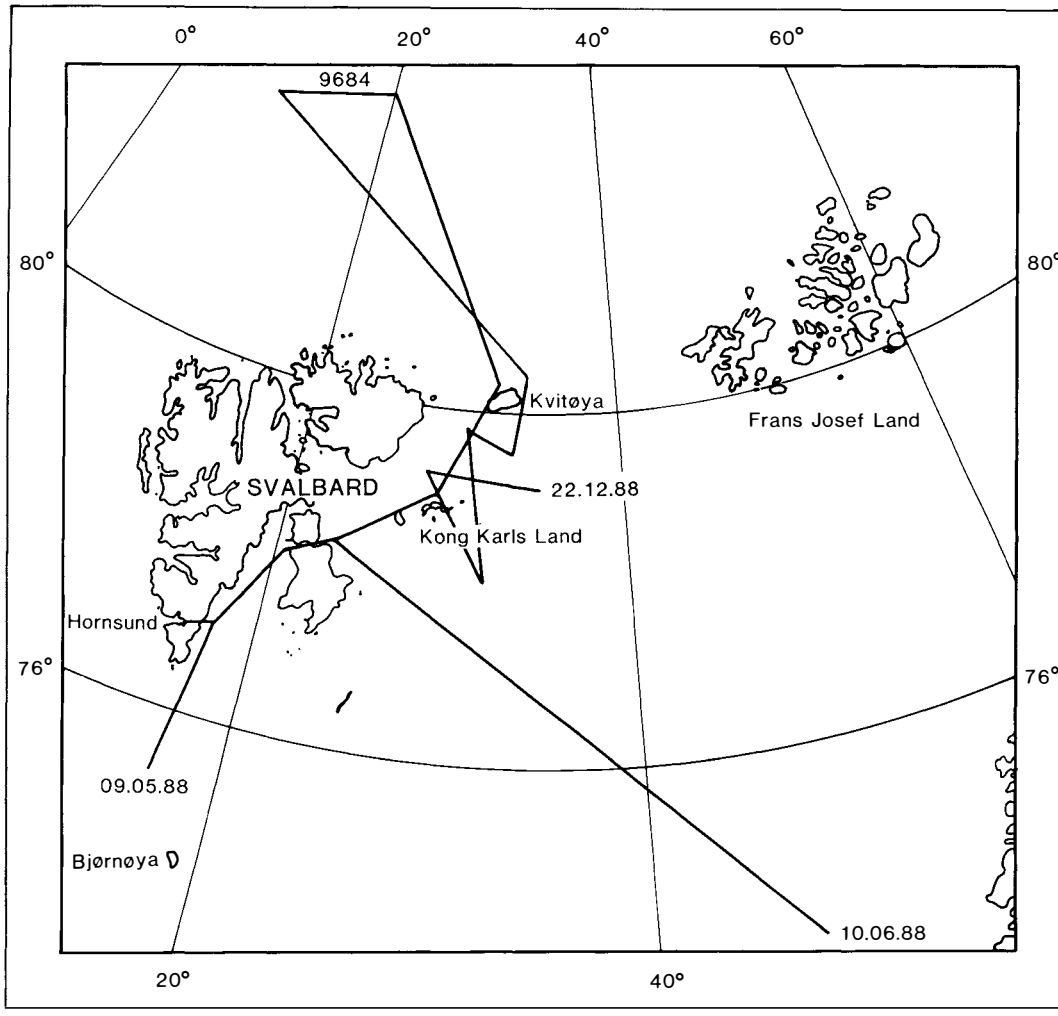
areas in the eastern part of the fjord for a few days, before moving on to Storfjorden. In the spring, this area has one of the highest concentrations of polar bears in Spitsbergen. This was also noticed by earlier hunters, who found Hornsund to be one of the best hunting fields in Svalbard. The bear has now been protected for more than fifteen years.

In March and April 1988, four female polar bears were instrumented with satellite transmitters in Hornsund. The work was financed through the MUPS programme by oil companies planning to do prospecting investigations in the area. Polar bears were tracked down on the landfast ice by researchers on skidoos. They were immobilized by shots in the shoulder or hip with anaestetics-filled darts. Approximately ten minutes after they had been hit, they would fall asleep for a couple of hours, giving the scientists enough time to do their investigations.

The bears were weighed and measured, tagged in the ear with a little white plastic tag, and tatooed in the upper lip for later recognition if caught again. The bear then got the transmitter fitted around its neck and a number painted on its hip, to be recognized and identified if seen again in the Hornsund area.

Three of the females caught were in heat and the fourth had two male yearlings. The female weighed about 200 kilograms, while the cubs were around 65 kilograms each.

The females in heat probably denned during the winter 1988/89 giving birth to their cubs. We hope to find the exact location of this denning area, although it is suspected that we are working in marginal areas for present technical possibilities. One of the transmitters worked for only two



Movements of polar bears in the Svalbard area tracked by satellite transmitters.

days after it had been fitted on the bear. Two transmitters worked satisfactorily for about two months. It was found out that one bear walked to Storfjorden, then towards Bjørnøya, before the signals disappeared. The other had nearly reached Novaja Zemlja when the transmitter ceased operating. The location, however, seems to support the common belief that we share a polar bear population with the Soviet Union. All three bears were in heat. Since we lost track of the bears before the winter started, we have no information about the denning area this winter.

The fourth bear had two cubs (yearlings) and has given a full demonstration of the possible effectivity of the satellite telemetry system. Signals from her transmitter were picked up almost every three days from the day when she was instrumented in Hornsund until mid- winter when this account was written.

During the summer she went far towards the north, into the pack ice of the polar basin. In the autumn she returned south, reaching the area around Kvitøya and Kong Karls Land where she would probably be hunting for seal.

In the spring of 1989 she will come into heat again and leave her cubs if they are still alive. We doubt that she will return to Hornsund. We will be there, however, trying to put radio transmitter collars on another six polar bears. Hopefully, they will add significant knowledge to the data we already have on the wanderings of the polar bears in the Svalbard area.