



# NORSK POLARINSTITUTT



ÅRBOK 1984





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**The Annual Report  
of the Norwegian Polar  
Research Institute**

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NORSK POLARINSTITUTT

OSLO 1985

Trykt juli 1985  
ISBN 82-90307-35-7

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## Preface

Norsk Polarinstitutt's *Årbok* (Year Book) has existed since 1960 in slightly varying forms. Since 1978 the contents have been reduced as the scientific articles have gradually been transferred to *Polar Research*, another of the Institute's series. The Institute's steadily growing network of contacts outside Norway has made it imperative for us to make a decision concerning the type and availability of information of which we wish our annual report to consist. In deciding that our «årbok» in future must be an annual report in English, we are painfully aware that we run the risk of alienating some of our contacts in Norway. However we hope that they will be able to bear with us, and that the annual report in this form will be of more use to more people than we managed to reach before.

Odd Rogne  
Director

Susan Barr  
Information consultant



# Annual Report of the Norwegian Polar Research Institute

Norsk Polarinstitutt is Norway's central institute for the scientific research of Svalbard, Jan Mayen, the Norwegian dependencies in the Antarctic and the polar seas and for the mapping of the Norwegian polar land areas. Apart from its own mapping and research within the fields of geology, geophysics and biology, Norsk Polarinstitutt also acts as an advisor and coordinator for other Norwegian and foreign scientific expeditions to Svalbard.

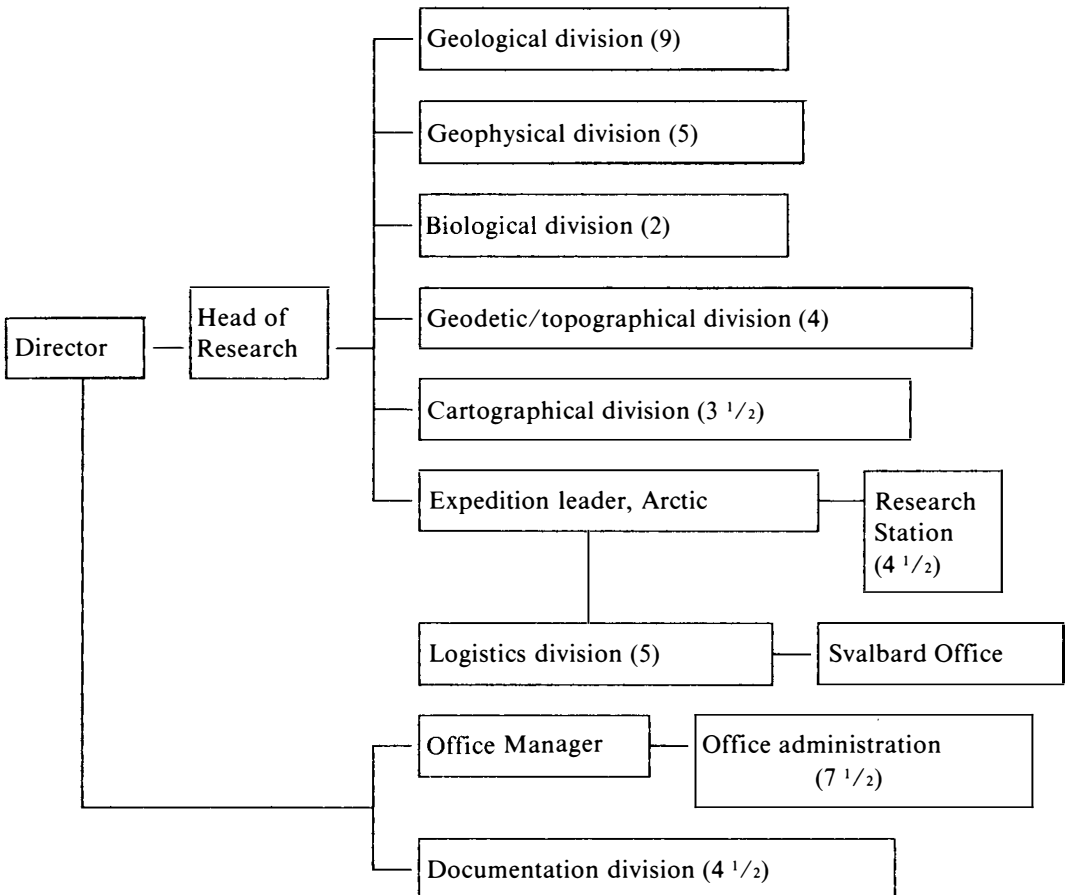
## Personnel

Director: Odd Rogne  
 Head of Research: vacant in 1984  
 No. of permanent posts: 42 1/2  
 No. of temporary posts: 4 1/2

## Address

Rolfstangveien 12  
 P.O. Box 158  
 N-1330 Oslo Lufthavn  
 Tel: 02-123650

## Organisation





## The past year

Parliamentary paper No. 26 (1982-83) concerning environmental protection, mapping and research in the polar areas had still not come up before parliament (Stortinget) at the end of 1984. However, in consultation with the Ministry of the Environment, parts of the paper have already been realised, for example, the Antarctic expedition, an increase in biological activity, and a re-orientation of certain parts of the Institute's activity towards areas indicated in the paper.

As part of the parliament's work with the above-mentioned paper, the Foreign Affairs and Constitutional Committee visited the Institute early in the year and was informed about aspects of our work. Later, during its stay in Svalbard, the Committee also visited the Research Station in Ny-Ålesund and our Svalbard Office in Longyearbyen.

Interest in Svalbard increased noticeably, especially in connection with oil exploration and foreign scientific matters. The Institute staff noticed this increase especially from the consultative angle. At the same time this has opened for cooperation with new partners.

The organisation of staff at the Research Station in Ny-Ålesund was altered from two research assistants and two engineers to one research fellow, one equipment manager and two engineers. The post of equipment manager is attached to the Institute's logistics division, which runs a duty rota between the Institute and the Station. The new organisation has been welcomed by those who use the Station. The Research Station has also increased its storage capacity appreciably.

After the decision about a suitable ship was finally reached in July, a hectic time started in order to prepare the Antarctic expedition 1984/85. The ship, coastguard vessel «Andenes», left Norway 30th November, while the expedition members flew to Ushuaia (Southern Argentina) immediately after Christmas.

The Institute supplemented its computer system with a Nord 530 at the end of the year. In addition to scientific and cartographic jobs, word processing and the development of data bases have been important areas of use.

The lack of necessary office space was somewhat alleviated when we were able to rent an extra area in the same building. The problem of acute lack of space for the logistics division remained unsolved, but alternative solutions are being considered.

The position of deputy director was changed to head of research and Dr. Jan A. Holtet was appointed at the end of the year. He was however unable to take up the appointment before 1st February 1985.

Towards the end of the year the Directorate of Organisation and Management began its study of the Institute's organisation. Their final report is expected at the end of 1985.

### *Awards and appointments*

Dr. Tore Gjelsvik, who retired as institute director last year, was appointed Commander of the Order of St. Olav by His Majesty King Olav V for his work for Norwegian polar interests. Professor in marine geophysics, Dr. Yngve Kristoffersen, left the Institute to become professor at the University of Bergen's Seismological Observatory, whilst glaciologist Olav Liestøl was appointed professor of glaciology. Marine geologist Anders Elverhøj was created Dr.philos. with a thesis entitled *Glacigenic and associated marine sediments on modern high-latitude shelves*.

### *Field work*

A total of 135 persons took part in the field programmes, of which 20 were from the Institute's staff. Of the remaining 115, 96 were collaborating scientists, engaged professional personnel and field assistants, and 19 were the crew of ships, helicopters and light aircraft. A number of scholarship holders were also at work in Svalbard during this period, partly or wholly financed by the Institute (see page 35).

## *A. Svalbard*

### *1. Scientific cruises*

Two scientific cruises with the expedition ship *m/s Lance* were carried out in and around the Svalbard area.

The first cruise — to the Barents Sea east and northeast of Svalbard — concentrated mainly on marine biology, together with oceanography, as part of the six-year «Pro Mare» project (Norwegian Research Programme for Marine Arctic Ecology). The unusual absence of ice in the area this year created a special situation. There was no drift ice in the central Barents Sea and research activities were therefore allocated to the fast ice around Kong Karls Land, to the ice edge north of Svalbard and to the Austfonna glacier front. Helicopters were used to obtain samples up to 60 n.m. from the ship. Other work included observations of polar bears and other marine mammals. More than 600 walrus were observed in different areas. Between 150 and 200 polar bears were observed on Kong Karls Land in July and August.

The second cruise — to the Fram Strait between Svalbard and Greenland — completed a four-year investigation of the magnitude and variation of the inflow of warm Atlantic water and the outflow of ice and colder water through this strait. A close cooperation on this project has been established with several groups of specialists interested in the Arctic Ocean heat budget, particularly at the University of Bergen, the University of Washington and the Alfred-Wegener-Institut, Bremerhaven. The ice conditions were especially favourable this year and it was possible to cross the East-Greenland Ice Drift Stream as far north as 80° 22' N.

In cooperation with the Hydrographic Office of Norway and the Continental Shelf Institute marine geological and marine geophysical investigations were carried out in the western Barents Sea.

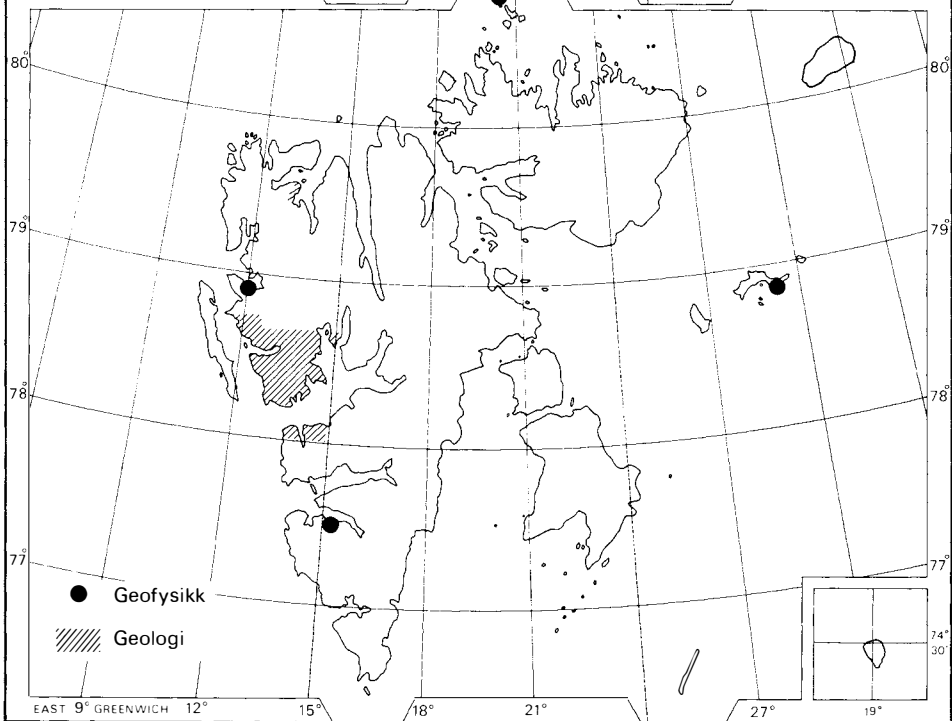
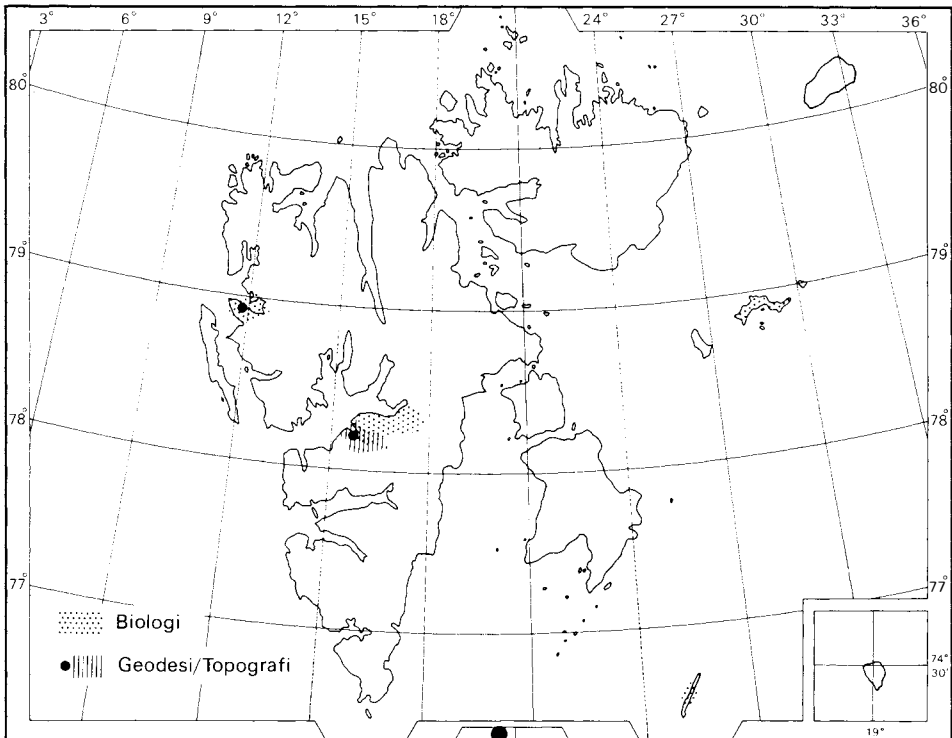
### *2. Field work on land*

*Geology* — Six of the Institute's eight geologists carried out field work in Svalbard, in the area

north of Isfjorden with Paleozoic and Mesozoic rocks and in the older folded and metamorphosed rocks of Oscar II Land. In cooperation with the University of Bergen Quaternary geology was studied in the outer Isfjorden area. Priority has been given to the geological map series Svalbard 1:100,000, and field work is mostly concentrated on collecting data for this series. Basic geological studies are carried out parallel with the mapping. In cooperation with the University of Oslo an extensive cataloging of the geological environment along the coast of Spitsbergen was continued.

*Biology* — The past few years' ornithological programme in the Ny-Ålesund area was continued. This involves in particular detailed studies of eider duck colonies. Various studies of kittiwakes at a bird cliff on Hopen were carried out later in the season. Studies of the polar bear population 'marooned' on Kong Karls Land by the absence of sea ice were continued in the late summer and in September. Field work in connection with the MAB (Man and the Biosphere) project came to an end in 1983. In order to maintain continuity of the management-orientated reindeer studies from this project, some of this work was continued as a part of NP's field work. Also included this year were studies in connection with the limited reindeer shooting which started in 1983 for the first time since the Svalbard reindeer were totally protected in 1925.

*Geophysics* — The long-term mass balance measurements of the glaciers Brøggerbreen and Lovénbreen were continued and both showed negative balances. The automatic meteorological station on Phippsøya was checked in August, and it sent observations 20 times daily throughout the year. A similar station on Kongsøya was badly damaged by polar bears in February and repair work in July was not entirely successful. In Ny-Ålesund the various components of short-wave and long-wave radiation were recorded continuously as part of a long-term programme.



EKSP 1984

*Geodesy/Topography* — Triangulation, together with building and repair of cairns on trigonometric points, was carried out in the area from Hotellneset to and around Adventdalen. The tide gauges at Ny-Ålesund and Longyearbyen were checked. One topographer participated in Statoil's expedition in Svalbard.

### *B. Mainland Norway*

*Glaciology* — Mass balance measurements of the glaciers Storbreen and Hardangerjøkulen were continued and showed that accumulation and ablation more or less balanced. Length fluctuation measurements of eight glaciers showed that seven had retreated whilst Engabreen had advanced four metres.

### *C. Antarctica*

The Norwegian Antarctic Research Expedition 1984/85 left Norway at the end of the year. The background for the expedition is described in more detail on page 16.

## Section reports

### *Biology*

Norsk Polarinstitutt is responsible for management-orientated biological studies in the Norwegian polar areas. The biological division's work includes ecological mapping and population biology studies within the categories marine biology (excluding the Directorate of Fisheries' area of responsibility), ornithology, botany and land mammals. The division has two permanent biologists. In addition in 1984 the biologist in charge of the MAB-project reindeer studies was more closely affiliated to the Institute, and an ornithologist was engaged in connection with the Pro Mare marine ecology programme. All four biologists carried out field work in Svalbard, and one ornithologist joined the Norwegian Antarctic expedition in December.

A compilation of results of many years' polar bear studies was prepared for publication. A new simulation model for the prognosis of polar bear populations was developed in cooperation with the University of Oslo.



Meeting between polar bear and walrus, seen from the expedition ship. Photo: Thor Larsen.

The year's fauna observations were entered in the Institute's data base and distribution maps for various species can now be produced for the period 1980-84. Results from the ornithological investigations in the Ny-Ålesund area 1981-84 were published.

Work was done on data and specimens collected during the regulated shooting of Svalbard reindeer.

### Geology

In addition to basic geological research, work is concentrated towards the production of geological maps of Svalbard to various scales. The geology division consists of eight geologists — six working with terrestrial geology and two with studies in the Barents Sea — and a technician. The following research fields are represented: older metamorphic and folded rocks (2), younger sedimentary sequences (2), coal petrography, quaternary geology and marine geology (2). Six geologists took part in the field work in Svalbard whilst two joined the Norwegian Antarctic expedition in December.

The last in a series of four geological maps of Svalbard to the scale of 1:500,000 was published with comments (*Skrifter 154 A, B, C, D*), whilst four map sheets of central Spitsbergen in the 1:100,000 series were under compilation. A geological map of Svalbard and Jan Mayen to the scale of 1:1,000,000 is being prepared for publication in the *National Atlas for Norway* (to be published by the Geographical Survey of Norway — NGO). A map to the scale of 1:1,500,000 of the thickness of the unconsolidated sediments in the Barents Sea was published in the series *The Physical Environment, Western Barents Sea (Skrifter 179 B)*.

### Geophysics

The main activity of the geophysical division is long-term studies of different aspects of the climatic conditions, with special emphasis on ice research. The Institute's five geophysicists

are specialised in the areas meteorology, sea ice research, glaciology (2) and oceanography. One of the glaciologists is responsible for planning and organising the Institute's Antarctic research and was during the latter half of the year occupied as leader of the Norwegian Antarctic Research Expedition 1984/85. The other four geophysicists worked in and around Svalbard during the field season.

Preparation for publication was completed of the extensive material collected during the Austfonna project 1983 — ice-thickness measurements of glaciers in Svalbard — in cooperation with the Scott Polar Research Institute.

In cooperation with the Norwegian Meteorological Institute (DNMI) and the Polar Science Center, Seattle, investigations of the interaction of ice drift, wind and ocean currents in the Fram Strait area were continued and two ice-drift stations were deployed near to the North Pole.

Sea-ice investigations based on satellite imagery, automatic buoys, measurements conducted from ships and a long-term measurement series from the weather station on Hopen were continued. Data concerning distribution and frequency of fast ice together with frequency and size of winter-open areas near land in the Svalbard archipelago for the last eight years are now being digitized in the form of maps.

Oceanographical data from the two summer cruises were prepared for publication.

### Geodesy/Topography

Norsk Polarinstitutt is responsible for land mapping of the Norwegian polar areas and for producing map series of these areas to various scales. Three topographers and a geodesist are employed in this work. Three of them participated in field work in Svalbard this season (one engaged by Statoil) and two joined the Norwegian Antarctic expedition in December.

In addition to the published maps (see under *Publications*) work was done on two other maps in the Svalbard 1:100,000 series: C7 Dicksonfjorden and B8 St. Jonsfjorden.

## *Cartography*

The cartographical division's main activity is the technical preparation and production of all the Institute's topographical, geological and glacier maps, and the administration of the final preparation and printing work which is done outside the Institute. Three cartographers and an illustrator are occupied with this work as well as with extensive illustrating for the Institute's publications.

Apart from the maps listed under *Publications*, the division has this year been concerned with the preparation or revision of twelve topographic maps of Svalbard — of which B11 Van Keulenfjorden and C13 Sørkapp are in the main 1:100,000 series - and four geological maps of Svalbard and the western Barents Sea — of which B10G Van Mijenfjorden is in the main series. The division is also engaged in preparations for transferring the place-name card file to a computer data base.

## *The Place-name Committee*

The Committee works with place names in the Norwegian polar areas and has in 1984 mostly been occupied with the main map series for Svalbard to the scale of 1:100,000. Ninety-three new names have been approved.

The Committee is also working with the transfer of the place-name card file to a computer data base, and in this connection has contact with the Institute for Name Research at the University of Oslo.

## *Computer Section*

The Institute acquired the word-processing system NOTIS at the turn of the year 1983/84 and at the same time installed additional terminals and a printer for letter quality. A considerable latent need for this service was thereby uncovered and use of the service increased dramatically during the year. This resulted in a far larger work load for the system than previously expected and therefore periodical response problems. At the end of the year the Institute had 19 terminals.

In the course of the year three micro computers were acquired: an APRICOT PC with printer was purchased for use at the Research Station in Ny-Ålesund. Similar equipment was bought for expedition use and was installed on the expedition vessel 'Lance' for the summer field season. A third micro computer (DEC Rainbow) with software for map construction was connected to the Institute's stereo plotter.

## *Information/Documentation*

An information consultant, a publications editor, a librarian, a translator and a part-time assistant try to cover the multitude of tasks in this field which result from the Institute's position and responsibility concerning scientific research of the Norwegian polar areas. Especially noticeable this year has been the extra interest in Antarctica connected both with the Norwegian expedition and with the increased international debate on the future of Antarctica.

The translator is mainly occupied with the translation from Russian to English of scientific literature of interest for the Institute's staff.

Several refereed series are published by the Institute, describing results of scientific and other activities in polar regions. Manuscripts are received from Norwegian and foreign scientists, as well as from the Institute's own staff. Publications in 1984 are listed on page 25. NP exchanges its publications with those of other scientific institutions and libraries in 26 countries spread over five continents.

The library has a good selection of old and new material on polar subjects and is open to the public in office hours. In the course of the year 271 new titles were registered.

The Institute receives a great many requests for general information concerning the polar areas. The staff contribute with scientific and popular lectures, articles and interviews for newspapers and magazines and contributions to radio and television programmes. A new information brochure about the Institute was produced this year as well as a small exhibition to mark the 75th anniversary of the start of regular state-supported expeditions to Svalbard.

## *Logistics*

The logistics division was strengthened by the addition of a new man in June; there were 97 applicants for this position. The division now has five permanent posts and occasional part-time help. The extra work involved with preparations for the Norwegian Antarctic expedition was especially noticeable towards the end of the year. One man joined the expedition in December. The division's main problem is still the lack of satisfactory storage and work space for the steadily increasing amount of expedition equipment.

The implementation of a new organisational structure for the Institute's research station in Ny-Ålesund entails a rota system of duty whereby the division always has an on-the-spot representative in charge of the station equipment.

## *Responsibility for navigation beacons*

Norsk Polarinstitutt has since 1933 had the practical responsibility for establishing and maintaining a network of navigation lights and beacons (including 42 signalling beacons) on Spitsbergen for ships and aircraft. Personnel from the logistics division inspect and service these annually.

Five beacons were repaired and painted and a new one was built on Sarstangen. Passive radar reflectors were set up at three places. A new radio beacon was set up at Kapp Martin with assistance from Isfjord Radio. Four new navigation lights for aircraft were set up on Nordenskiöld Land with assistance from Svalbard Airport authorities and the Sysselmann (Governor). The VHF repeaters on Skolten and Scheteligfjellet were serviced.

## *Norsk Polarinstitutt's Svalbard Office, Longyearbyen*

Since 1977 the Institute has had a base for its Svalbard expeditions in Longyearbyen, and the

logistics division is responsible for this office's service function both for the Institute's own people and for other visiting scientists. The office is manned during the entire field season which this year stretched from the end of May to the beginning of October.

## *Norsk Polarinstitutt's Research Station, Ny-Ålesund*

This was established in 1968 and is one of the most northerly land stations in the world. It serves both as an observatory, a laboratory and a field base available all year round for Norwegian scientists and for others working with arctic problems in cooperation with Norwegian scientific institutions.

The station's function of observatory provides the most important part of the activity there, with a considerable recording mainly of geophysical data. Winter use of the station as geophysical laboratory for visiting scientists increased somewhat this year. In addition a small cold laboratory for physiological studies was taken into use.

Of great importance for the station have been the regular helicopter flights between Longyearbyen and Ny-Ålesund once a fortnight throughout the year. During the summer the service is doubled to weekly flights. Visiting scientists with approved projects can apply for free transport as far as seats and baggage capacity allow. Further the telephone connection has been improved and there is now direct dialling to Ny-Ålesund, although the capacity is limited.

A number of scientific projects are at present carried out from the Research Station, and the following phenomena are recorded continually or observed during longer periods of the year. Necessary service for the recording instruments is provided by the station staff:

The components of the radiation energy budget  
 Daylight and the atmospheric vapour content  
 Tides and mean sea level  
 Mass balance of glaciers  
 Atmospheric pollution  
 Meteorological conditions  
 Seismic disturbances  
 The Earth's magnetic field  
 Ionospheric activity, including aurora

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 - Norsk Polarinstitutt  
 - NILU  
 - DNMI  
 - University of Bergen  
 - Univ. of Tromsø and Oslo  
 - Univ. of Tromsø and Oslo

The organisation of staff at the Research Station was altered in the course of the year as described on page 32. Concluding the old system, the one research assistant completed his biological programme at the end of the summer, while the other continued her geophysical (meteorological) studies until October.

Visiting scientists used the station as labora-

tory or field base to a greater extent than in the previous year, when there was a noticeable reduction. In the course of the year forty-two scientists and assistants stayed at the station for a total of 923 visitor days. Of this total, 281 days concerned geophysical programmes, 500 days biological programmes and 142 days concerned other sciences such as air pollution and Quarternary geology.

## Scientific Projects in 1984

### *Biology*

Ecological polar bear studies  
 Fauna data base  
 Sea bird studies in the Svalbard area (including the «Pro Mare» project: Sea bird ecology in the Arctic)  
 Studies of population and breeding biology of eider duck in Svalbard  
 Reindeer studies in Svalbard

Thor Larsen  
 Fridtjof Mehlum  
  
 Fridtjof Mehlum  
  
 Fridtjof Mehlum  
 Nils A. Øritsland

### *Geology*

Regional geological investigations in Svalbard  
  
 Correlation of the older complexes in Svalbard  
 Study of the younger sequences (Carboniferous to Tertiary) in Svalbard  
 The glaciation and deglaciation of Svalbard  
 Sea floor investigations in the Barents Sea

Tore Gjelsvik  
 Audun Hjelle  
 Ørnulf Lauritzen  
 Yoshihide Ohta  
 Otto Salvigsen  
 Thore Winsnes  
 Audun Hjelle  
 Yoshihide Ohta  
 Ørnulf Lauritzen  
 Thore Winsnes  
 Otto Salvigsen  
 Anders Elverhøi  
 Anders Solheim



### *Geophysics*

Mass balance studies of the glaciers Storbreen and Hardangerjøkulen

Mass balance studies of glaciers in Svalbard

Length measurements of glaciers in Norway

Climatological description of the Svalbard area

Radiation measurements in Ny-Ålesund

Arctic Ocean Buoy Programme

Sea ice studies in areas around Svalbard

Automatic meteorological station on Bouvetøya

Oceanography of sea areas around Svalbard

Studies of tabular icebergs in Antarctica

Olav Liestøl

Olav Liestøl

Olav Liestøl

Vidar Hisdal

Vidar Hisdal

Torgny Vinje

Torgny Vinje

Torgny Vinje

Torgny Vinje

Bert Rudels

Olav Orheim

## Topicalities

### *Sea-floor studies*

Norsk Polarinstitutt is responsible for sea-floor studies in the Norwegian polar areas. Research work is mainly concerned with the production of maps and is concentrated on investigation of the composition, thickness and distribution of surface sediments and of the bedrock in the area where this is covered by only a thin layer of sediment.

The Institute has two marine geologists working within this field and in addition engages others for shorter periods (data collection and certain tasks within data preparation). Some work is also done by university degree students.

Shallow geophysical and geological investigations have been carried out in the Barents Sea since 1971, but the main effort has occurred since 1977. The Institute feels it is important to try to obtain a best-possible coordination of activities and we have an extensive cooperation in this area with The Hydrographic Office of Norway (NSKV), The Norwegian Petroleum Directorate (OD), The Continental Shelf Institute (IKU) and undergraduate research projects at the Universities of Bergen and Oslo. From 1985 there will also be a more formalised cooperation with Tromsø University.

So far more than 40 publications, theses and reports have been produced. During the past two years an important place has been given to

the compilation of all available material in a thematic map series: The Physical Environment, Western Barents Sea. The scale is 1:1,500,000 and the themes are surface sediment distribution, glacial history and sediment distribution, bathymetry, gravity and sea-ice distribution. Bedrock geology and ocean currents are proposed published in 1986.

### *The Norwegian Antarctic Research Expedition (NARE) 1984/85*

The last Norwegian Antarctic expedition took place in 1978/79. The question of Norwegian scientific activity in Antarctica was raised in a special chapter of the Ministry of the Environment's parliamentary paper No. 26 (1982-83) on polar research and management. The conclusion was as follows:

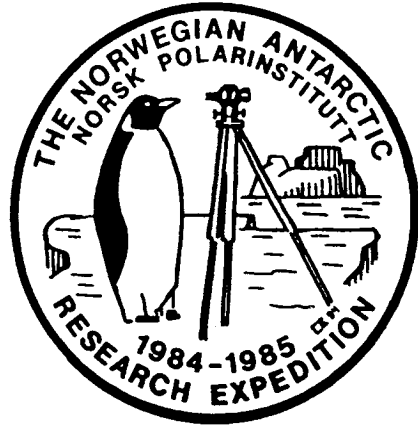
«The Government has further decided that Norwegian scientific activity in Antarctica should be continued with expeditions sent by Norsk Polarinstitutt at regular intervals.»

The Government's proposal was summer expeditions at three-year intervals. Funds were allocated for the first expedition 1984/85.

Norsk Polarinstitutt and The Norwegian Research Council for Science and the Humani-

ties (NAVF) jointly appointed a scientific committee to assess applications for research projects. In July 1984 the Coastguard ship «Andenes» was selected as expedition vessel and two helicopters with crew were engaged. Place was available for 28 scientists and engineers from a total of 15 research institutions.

The expedition consisted of two entities, a marine research cruise and two land parties. Camp Norway 5 was the base for ten scientists concerned with biological studies, geology and topographical surveying. The five in Camp Norway 6 were mainly occupied with geological studies. The remaining scientists worked from the ship in the southern part of the Weddell Sea, in particular with seismic investigations of the sea floor and underlying sediments and with deployment of a large number of oceanographical instruments.



The emblem of the Norwegian Antarctic Research Expedition 1984/85.

# Detection of High Ground Temperatures in a Karst-featured Area, Vardeborgsletta, Near Isfjord Radio, Svalbard

## Introduction

The entire area of Svalbard has been considered to lie well inside the zone of continuous permafrost, and the observed thickness of permafrost shows variations between 75 m and 450 m. The maximum depth of the active layer which melts in summer is usually between 0.5 m and 1.5 m, mainly dependent on the texture of the ground. The climate can be classified as true tundra climate; the mean annual temperature for the period 1934-1975 at Isfjord Radio was  $-4.6^{\circ}\text{C}$ . Permafrost is, however, absent below glaciers and lakes of some magnitude and below fjord bottoms. In several places, mainly in western Svalbard, running and freezing water appears in winter time and shows the occurrence of 'weak' zones in the permafrost. Pingos and icings are often characteristic, morphological features in these areas. As a matter of curiosity the warm springs in Bockfjorden, northern Spitsbergen, should also be mentioned. A total of eight such springs are located near the quaternary Sverrefjellet volcano, and the highest temperature is about  $25^{\circ}\text{C}$ . Because of their volcanic origin they are unique occurrences in Svalbard.

The word karst is a comprehensive term applied to limestone or dolomite areas that possess a topography peculiar to and dependent upon underground solution and the diversion of surface waters to underground routes. In some areas karst has also developed in gypsiferous beds. Continuous deep permafrost inhibits sub-surface drainage and underground karst is not developed on any extensive scale. Only a few reports exist of karst features in Svalbard. The term thermokarst is often used

to describe the forms resulting from melting of ground ice in permafrost, but such processes will not be dealt with here and now.

## Vardeborgsletta karst area

The Vardeborgsletta area was studied in 1984 during field work in connection with the mapping programme of Norsk Polarinstitutt. Vardeborgsletta is a raised beach area well below 50 m in altitude, and the unconsolidated sediments vary in thickness. The underlying bedrock is mainly fossil-rich limestone, but gypsum was also seen in one locality. The karst topography of Vardeborgsletta is not imposing compared with non-permafrost karst areas, but the karst features are easily recognizable, and especially the subsurface drainage is notable.

The most significant features form an almost 2 km long, trough-shaped valley which receives most of its water from melting snow. The water disappears in a sinkhole or swallowhole in the middle of the valley, and a rough calculation showed that about 100 l/s were sinking into the ground in the end of July 1984. There are no springs or wells on land where karst water reappears, and it probably reaches the sea in subsurface outlets. Unfortunately, all attempts at tracing the water by colouring it were unsuccessful. The sinkhole lies about 8 m below the threshold level for surface drainage to the sea, and old water-level marks can be seen up to this level. The highest water levels have probably been reached during the snow-melting periods in late spring.

An asymmetric basin with a shallow pond is located west of the trough described above. Its water level is 17.5 m above sea level and 8 m below the level where surface drainage would take place. The volume of the basin is very roughly calculated to be in the magnitude of 500,000 cubic metres. This basin and other

depressions have probably mainly been formed subsequently when unconsolidated sediments have sunk into collapsing karst caves and tunnels in the ground. Several small collapsing features can also be seen in the area, and outcrops of fossil-rich limestone show a varying degree of dissolution on their surfaces.

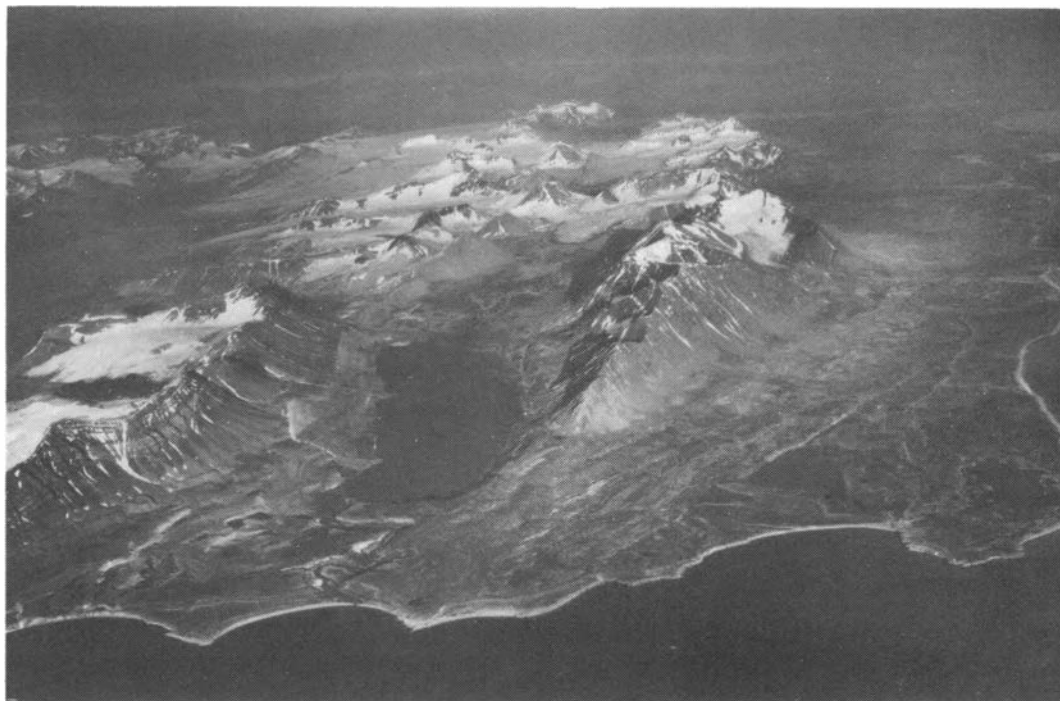


Fig 1. The Vardeborgsletta karst area lies between Linnévatnet (second largest lake in Svalbard) and the sea near the mountain slope of Vardeborg to the left of the picture. The extensive strandflat between Isfjorden and Bellsund is seen to the right with Kapp Linné and Isfjord Radio in the foreground.

### Absence of permafrost

Extensive subterranean drainage is difficult to understand and explain in an area of continuous permafrost, and ground temperatures were therefore measured near to ponds with sinking drainage. Narrow pits were dug by hand as deep as it was considered to be safe to work. In the first pit the depth of 3.3 m was reached through varying layers of sand and gravel, and the permafrost was conspicuous by its absence. The temperature was 9.5°C at a depth of 0.5 m evenly rising to 10.7 at a depth of 3.3 m. The other pit was dug about 1 km from the first pit

and showed lower ground temperatures. A minimum temperature of 4.2°C was reached at a depth of 2.5 m. A rise in the temperature to 4.4° at a depth of 2.9 m where the digging was stopped, showed that the permafrost was absent also in this area. Two pits were also dug to control the depth of permafrost in nearby areas, and the frozen ground was reached at a depth of 1.2 m. It is therefore obvious that areas without permafrost are small and only exist in connection with the depressions.

It is also remarkable that there was no water penetration from the ponds to the pits which were dug only a few metres away and reached

about 2.5 m below their water levels. There is no surrounding ground water table in connection with the ponds, and they act as perched ground water tables where gravitational water is percolating almost vertically down to the main ground water table.

## Geothermal heat

The temperatures measured in the deep pits at Vardeborgsletta are extreme compared with other ground temperatures known from Svalbard. The permafrost research station at Sveagruva has measured temperatures at a depth of 3 m varying between  $-5^{\circ}$  and  $-8^{\circ}\text{C}$  during the year. The high temperatures in the ground at Vardeborgsletta are difficult to explain. One possibility is that water has been forced down to large depths where geothermal heat has been absorbed and later brought up to a near surface level. In the uppermost layer where the deep pits were dug, there was neither water nor gas which could transport the heat, and heat transport by conduction must therefore take place.

The water must penetrate several hundred metres down in order to obtain a temperature of at least  $11^{\circ}\text{C}$ . Such water temperatures have also been measured in springs in the southern part of Spitsbergen.

## Concluding remarks

Circulating water transports geothermal heat to a near surface level at Vardeborgsletta and prevents the formation of permafrost. These conditions result in karstification in the carbonate rocks, and new collapsing features show that this process is still active.

The geothermal heat in parts of Vardeborgsletta is probably not a resource which can be exploited in the foreseeable future, but the detection of the high ground temperatures has increased our knowledge of permafrost conditions in Svalbard and indicates that they are more complex than up to now realized.

More details about the karst area at Vardeborgsletta and the high ground temperatures are prepared for publication in Polar Research.

## Do not Disturb Nesting Eiders !

Untouched nature and a rich wildlife are a unique experience. Many people are attracted to polar nature, and the stream of tourists and scientists to Svalbard increases steadily. The majority of visitors come in the animals' reproduction season, which stretches over a few summer weeks. Characteristic for the Arctic is that the season for growth and production is short. The majority of species that are to be found here, for shorter or longer periods each year, are adjusted to these conditions and manage to produce young in a short period, despite adverse weather and temperatures. As part of the nature conservation work the authorities have established national parks and bird sanctuaries which hinders traffic in many areas. However, up to the present time little has been done to investigate the direct effects of man-made disturbances on the wildlife in this northern area.

The female eider do not eat during the incubation period and must therefore rely on stored reserves in the body. It therefore seems reasonable to suggest that this species can be vulnerable to disturbance by humans. This is the background for a study that has provided interesting results which should be taken into consideration in connection with the management of birdlife in Svalbard.

When Darwin visited the Galapagos Islands at the beginning of the last century, he was struck by the fact that the animals did not seem to be especially timid when disturbed by humans. This was put down to lack of experience with humans and predators. Svalbard has sometimes been called an 'Arctic Galapagos'. Birds and mammals which live here are described as 'tame' and have of some been called 'stupid' because they do not flee when humans

appear. The archipelago's thirty bird species have few natural enemies. The most important ones are the arctic fox and the glaucous gull. Some species have developed an efficient defence against these predators. When an arctic fox threatens the nest of a barnacle goose the male will drive it away from the immediate vicinity. Ptarmigan hens in Svalbard rely on good camouflage at the same time as their nests are scattered so that predators will not be able to hunt them efficiently. Eider ducks however, usually nest in colonies on islets and islands, which hinders access for foxes. Other eiders nest in colonies together with aggressive terns, which can keep glaucous gulls and foxes away from the nesting area.

We normally distinguish between two types of physiological and behavioural reactions in animals when threatened: active defence, ie. flight or fight, and passive defence, ie. freezing or playing dead. Active defence is connected with preparations for increased physical activity and is characterized by deeper and faster breathing, increased heart rate and the liberation of adrenalin. The animal's muscular and circulation systems are in this way prepared for the extra effort which may come. In contrast to the active defence reaction, passive defence is characterized by the animal attempting to avoid the danger. This reaction is followed by lowered breathing and heart rate.

Our knowledge of behaviour in wild animals has until recently been gathered by observation using binoculars and telescope. In later years the development within electronics has made it possible to build miniature transmitters which can give us information about the body functions from a distance. In our investigations we have relayed radio signals of the birds' heart

activity (electro-cardiogram ECG) and used these as indicators of the birds' physiological reactions when disturbed.

The eider is the most common duck in Svalbard. The largest colonies are found on islands along the west coast. Our studies were made in the Kongsfjorden area, where birds breed in close colonies on the islets in the fjord. Near the built-up area of Ny-Ålesund the nests are more scattered. The ducks were caught on the nests and fitted with an ECG-telemetry transmitter fastened to a special back-pack. The transmitter had a range of 200 to 500 metres and the signals were stored on cassettes for later processing by a micro-computer. It took 15-20 minutes to fit the transmitter, and the birds were back on the nest 20-30 minutes after capture.

Nesting and undisturbed eider ducks had a heart rate of between 90 and 110 beats per minute, and breathed 14-16 times a minute. This changed when the birds were subjected to sight and sound stimuli. Sight of and calls from people always resulted in immediate cessation of all body activity. The duck lay quite still with raised head and open eyes. This is known as an orientation or 'what is it?' response and was always followed by double or triple increase in heart rate for 5-15 seconds. The orientation

response was triggered by movements and sounds in the duck's surroundings. We observed different behavioural responses in birds on the islet (Mietheholmen) and those nesting near Ny-Ålesund, when one or several persons walked towards the duck's nest. When provoked, the ducks nesting near Ny-Ålesund showed freezing behaviour with the head against the body and eyes open. They had a short critical distance which resulted in flight, or they left the nest when the person was 0.1 metre away. Some birds had to be pushed from the nest. They walked around until we moved out of the area. Freezing behaviour was followed by a very small change in heart rate, but there was a slight decrease when the person moved directly towards the nest. The escape response with high constant heart rate before leaving the nest was not registered in these birds.

The eider ducks nesting in colonies on Mietheholmen, reacted quite differently from their sisters at Ny-Ålesund. When people in an open boat were 100-200 metres from the islet a doubling of heart rate was registered. At the same time the birds showed restless behaviour, with raised head and open eyes. The same symptoms were also registered when people went ashore on the islet. When they were 15-30

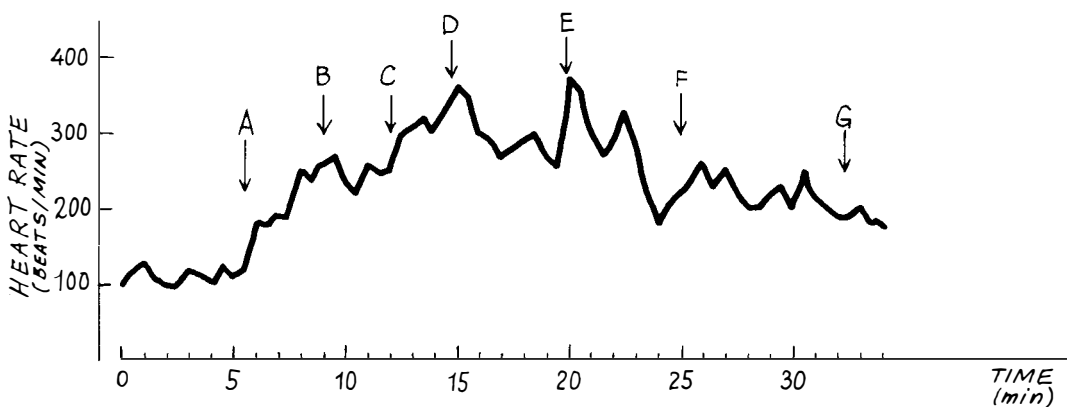


Fig. 1. Heart rate responses in incubating eider duck (Mietheholmen) when approached by humans. A. The eider duck can see the boat, with humans, at a distance of 100-150 metres away from the islet. B. The boat is hidden by the islet. C. The eider duck can see the approaching person. D. The eider duck leaves the nest when the approaching person is 15 metres away. She moves back to the nest when he leaves the area. E. The eider duck leaves the nest again when the approaching person is 20 metres away. F. The eider duck can see the boat leaving the islet. G. The boat is 100 metres away from the islet.

metres away, the birds left the nest. The behavioural response was followed by high heart rate (Fig. 1) as long as there were people on the islet.

On two different occasions we were able to study the effect of helicopter flying near Ny-Ålesund. The eider ducks then lay with head against the body, and we could register a slight lowering of the heart rate when a helicopter flew at a height of 50-100 metres over the nesting area. On one occasion a car was driven towards the nesting area just after the helicopter had passed. We then registered a heart rate increase, followed by an additional increase, as three people got out of the car. The duck raised its head momentarily before sinking it against the body as two people moved towards the nest. A very low heart rate was registered during this provocation. This was probably because the eggs were near hatching time.

The 'what is it?' response is an activating response in connection with the bird's efforts to locate the source of disturbance. Earlier studies of nesting birds have shown the response to be followed by a short period with lowered

heart and breathing rates. It does not increase in the way we have registered in the eider ducks we have studied in Svalbard. Similar to the Svalbard ptarmigan hens, the eider ducks soon get accustomed to sounds, indicating that they are not afraid. This is probably because they have not learned that such disturbances are a threat.

Defence behaviour in birds and mammals must be perceived as a result of pressure from a predator population on a prey population. The object is to protect the individual or species against attack by predators. Freezing behaviour with lowered heart and breathing rates is interpreted as an anti-predator response, which is especially well developed in nesting birds. Freezing decreases the chance of being caught or of the nest being discovered. The bird's immobility reduces the possibility of being seen, and reduced respiration probably decreases the secretion of odours so that for example a fox does not discover the nesting bird. The eider duck has good camouflage colours, but unlike its sisters in mainland Norway, it can

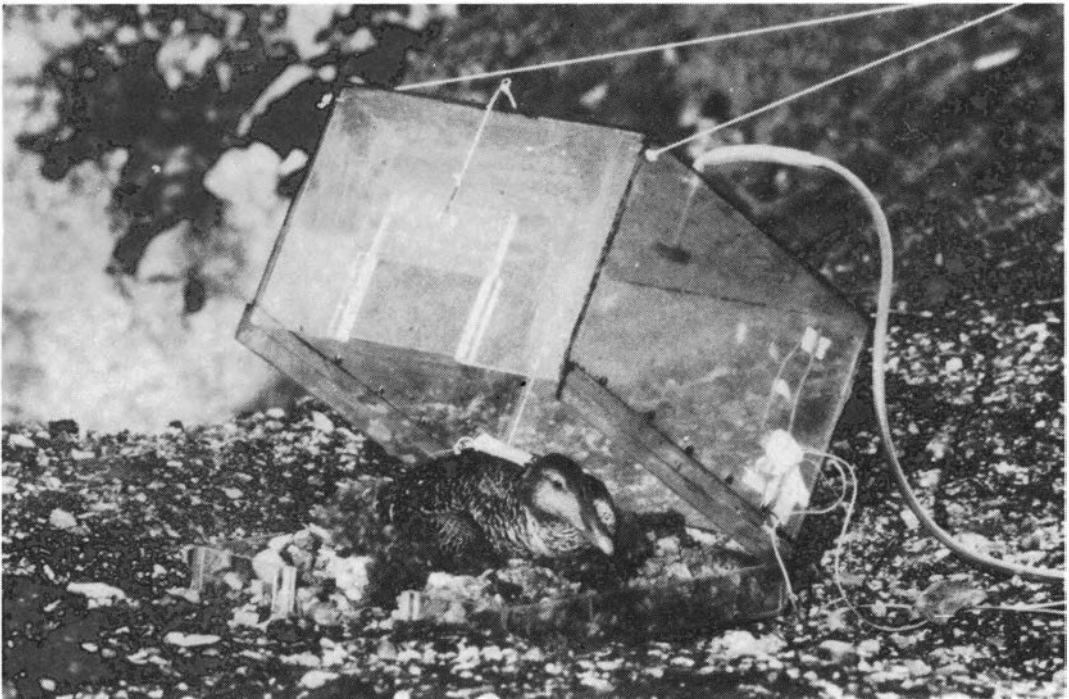


Fig. 2. A wild eider duck with an ECG transmitter incubating in a respiration chamber.



find little natural cover. The camouflage colours and the fact that the birds usually nest in colonies, mean that the flight response is the most efficient for them. Eider ducks and willow ptarmigan hens on the mainland exhibit a strong freezing response, followed by lowered heart and breathing rate when disturbed. Nesting Svalbard ptarmigan hens and eider ducks on Svalbard exhibit both defence responses, but the behavioural and physiological response is less than what is found on the mainland.

During our field work in Ny-Ålesund we were able to measure oxygen consumption and carbon dioxide production in nesting eider ducks. The eider duck on the picture above was placed in an open respiration chamber which allowed us to measure the bird's respiration gasses. The eider duck's incubation metabolism is the same as its resting metabolism. Despite the fact that these birds have a fasting period of 25-30 days, they do not show a metabolic depression, as was thought earlier. The birds must maintain a constant heating of the eggs. They use their body's reserves and lose 40% of body weight, mainly fat and protein. By seldom leaving the nest, and by using as little energy as possible on activity, the eider duck loses only ca. 25 gram of body weight per day. Disturbances and provocations by humans and predators, and repeated heating of the eggs on return to the nest, entails extra investments. This means further loss of energy which these birds dearly need in order to raise their young. An increase in activity level of ca.10% per day will result in an extra weight loss of 4-5 gram of body weight per day. In time this will result in a weight loss which can lead to the bird breaking off brooding in order to save itself.

Our studies showed a pattern. The presence of predators means that the potential prey develop behavioural and physiological mechanisms which aim to secure survival for the individual or species. On the mainland there are numerous enemies, and nesting birds have developed good defence responses. Those species of birds which so far have been studied in Svalbard have poor defensive reactions. This is probably due to the fact that there are few predators and sparse vegetation, with few possibilities of cover. The fact that birds in Svalbard are seldom exposed to dangers, may explain why freezing behaviour and physiological response are so poorly developed. Birds in Svalbard have little experience with humans. They have probably not learnt that humans can be dangerous, and this is most likely the reason why they exhibit little fear of people.

An increased energy consumption beyond normal brooding will be especially damaging in a species which does not eat during the incubation period. A cold climate will increase the damaging effect. Compared with eider ducks further south, the Svalbard ducks will be more vulnerable if they are disturbed in the reproduction season. If they are often disturbed, the brooding can be entirely unsuccessful. This is something that nature lovers and keen photographers should remember. It is wrong to believe that the birds are tame and trustful when they sit on the nest while we stand nearby. They are in reality extremely frightened and do not tolerate much disturbance before they give up the brooding attempt altogether.

## Published in 1984

Several series are published by the Institute. *Polar Research* contains shorter 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 following publications were made in 1984:

*Information brochure: Norsk Polarinstitut - sentralinstitut for kartlegging og forskning i norske polarområder. - Norwegian Polar Research Institute - central institute for mapping and research in Norwegian polar regions.*

The publication of this pamphlet fills a long and strongly-felt need for information on the Institute's history and activities today. Several black/white and colour photographs illustrate the information in the text which is given both in Norwegian and English.

### *Polar Research Vol.2 n.s., No.1*

This is the sixth issue in this series, which started in 1982. The series includes original scientific papers in the field of polar research, and in such disciplines as geology, biology, glaciology, oceanography, geophysics, etc:

Brown, R.G.B.: Seabirds in the Greenland, Barents and Norwegian Seas, February-April 1982.

Jepsen, P.U.: Observations of moulting Eider and breeding Common Eider *Somateria mollissima* at Nordaustlandet, Svalbard, in 1979.

Born, E.W.: Status of the Atlantic walrus *Odobenus rosmarus rosmarus* in the Svalbard area.

Myhre, A.M., Eldholm, O. & Sundvor, E.: The Jan Mayen Ridge: present status.

Köhler-Lopez, M. & Lehmann, U.: The Triassic ammonite *Aristoptychites kolymensis* (Kiparisova) from Botneheia, Spitsbergen.

Feyling-Hanssen, R.W. & Ulleberg, K.: A Tertiary-Quaternary section at Sarsbukta, Spitsbergen, Svalbard, and its foraminifera.

Salvigsen, O.: Occurrence of pumice on raised beaches and Holocene shoreline displacement in the inner Isfjorden area, Svalbard.

Salvigsen, O.: Two observations of pumice levels from the west coast of Spitsbergen (res. note).

Establishment of a Committee for Norwegian stratigraphy (res. note).

Larsen, T. & Ugland, K.I.: Modelling of polar bear populations by Leslie matrix population model (res. note).

NOK 80.-

### *Norsk Polarinstitut Skrifter No. 154D - Lauritzen, Ø. & Ohta, Y.: Geological map Svalbard 1:500,000, Sheet 4G Nordaustlandet*

This publication completes a series of four geological map sheets covering all of Svalbard. The maps are based on data found on field maps, in field diaries and other unpublished material belonging to Norsk Polarinstitut, and in literature cited at the end of the descriptive text.

NOK 80.-

*Norsk Polarinstittutt Skrifter No. 179B - Solheim, A. & Kristoffersen, Y.: The Physical environment Western Barents Sea 1:1,500,000, Sheet B, Sediments above the upper regional unconformity: thickness, seismic stratigraphy and outline of the glacial history*

When completed, this series will include seven publications on various aspects of the physical environment of the Western Barents Sea. Each issue will have a map or plate/outline, with a short description of about 15-20 pages.

NOK 100.-

*Norsk Polarinstittutt Skrifter No. 180 - Geoscientific investigations in the Barents and Greenland-Norwegian Seas.*

Several authors are responsible for the five articles contained in this issue of *Skrifter*. Two free-air gravity anomaly maps are included as supplement to one of the articles.

Elverhøi, A. & Lauritzen, Ø.: Bedrock geology of the northern Barents Sea (west of 35° E) as inferred from the overlying Quaternary deposits (:5-16).

Eldholm, O., Sundvor, E. & Crane, K.: Sonobuoy measurements during the «Ymer» Expedition (:17-23).

Kristoffersen, Y., Milliman, J.D. & Ellis, J.P.: Unconsolidated sediments and shallow structure of the northern Barents Sea (:25-39).

Myhre, A.: Compilation of seismic velocity measurements along the margins of the Norwegian-Greenland Sea (:41-61).

Faleide, J. I., Gudlaugsson, S. T., Johansen, B., Myhre, A. & Eldholm, O.: Free-air gravity anomaly maps of the Greenland Sea and the Barents Sea (:63-67 + two maps).

NOK 65.-

*Norsk Polarinstittutt Skrifter No. 181 - Current research on Arctic Geese. Proceedings of a symposium at Voksenåsen, Oslo, 24-26 October 1983.*

A number of well-known biological researchers from Great Britain, Denmark, the Federal Republic of Germany and Norway took part in a symposium arranged by Norsk Polarinstittutt in October 1983, to consolidate existing knowledge of the biology and population status of the Svalbard geese. The papers presented at the symposium are compiled in this issue of *Skrifter*, edited by Mehlum, F. & Ogilvie, M.:

Mehlum, F.: Preface.

Norderhaug, M.: The Svalbard Geese: an introductory review of research and conservation (:7-10).

Ebbinge, B. S., van der Meulen, H. T. & Smit, J. J.: Changes in winter distribution and population size of Pink-footed Geese breeding in Svalbard (:11-18).

Madsen, J.: Numbers, distribution and habitat utilization of Pink-footed Geese *Anser brachyrhynchus* in Denmark 1980-83 (:19-24).

Prokosch, P.: The wintering sites of Svalbard Pink-footed Geese *Anser brachyrhynchus* in Germany — present situation (:25-28).

Schilperoord, L. J.: The status of the Pink-footed Goose *Anser brachyrhynchus* in southwest Friesland (the Netherlands) and the movements over western Europe (:29-36).

Owen, M.: Dynamics and age structure of an increasing goose population — the Svalbard Barnacle Goose *Branta leucopsis* (:37-48).

Ogilvie, M. & Owen, M.: Some results from the ringing of Barnacle Geese *Branta leucopsis* in Svalbard and Britain (:49-56).

Gullestad, N., Owen, M. & Nugent, M. J.: Numbers and distribution of Barnacle Geese *Branta leucopsis* on Norwegian staging islands and the importance of the staging area to the Svalbard population (:57-66).

Black, J. M. & Owen, M.: Importance of the family unit to Barnacle Goose *Branta leucopsis* offspring — a progress report (:79-86).

Prop, J., van Eerden, M. R. & Drent, R. H.: Reproductive success of the Barnacle Goose *Branta leucopsis* in relation to food exploitation on the breeding grounds, western Spitsbergen (:87-118).

Madsen, J.: Status of the Svalbard population of Light-bellied Brent Geese *Branta bernicla hrota* wintering in Denmark 1980-1983 (:119-124).

Prokosch, P.: The occurrence of *Branta bernicla hrota* in Brent Goose flocks in the German Wattenmeer (:125-128).

Prestrud, P. & Børset, A.: Status of the goose populations in the bird sanctuaries in Svalbard (:129-134).

Prokosch, P.: Breeding sites and distribution of geese in the northwest Isfjord area, Svalbard, 1982 (:135-138).

Madsen, J.: Study of the possible impact of oil exploration on geese populations in Jameson Land, East Greenland. A progress report (:139-150).

Jepsen, P. U.: Protection and management of arctic goose populations in Denmark (:151-158).

Norderhaug, M.: Captive breeding and reintroduction of northern geese (:159-162)

Ogilvie, M.: Summary and conclusions at Arctic Geese Symposium in Oslo, Norway, 24-26 October 1983 (:163-166).

NOK 130.-

*Norsk Polarinstitutt Skrifter No. 182 - Dowdeswell, J. A., Drewry, D. J., Liestøl, O. & Orheim, O.: Airborne radio echo sounding of sub-polar glaciers in Spitsbergen.*

740 track kilometres of airborne radio echo sounding were flown in Spitsbergen in the spring of 1980. This paper describes some of the results obtained.

NOK 40.-

### *Norsk Polarinstitutt Årbok 1983*

This yearbook gives an outline of the activities of Norsk Polarinstitutt in 1983, and includes the following articles (these articles for 1984 will appear in NP publications later in the year):

Liestøl, Olav: Glaciological work in 1983.

Hisdal, Vidar: The weather in Svalbard in 1983.

NOK 20.-

### *Research in Svalbard 1984*

This is a yearly bulletin which gives information on the scientific work planned to take place in Svalbard each year. It is based on international data collected by Norsk Polarinstitutt, and is distributed to all contributors before the field season begins each year.

### *Norsk Polarinstitutt Report series*

The following seven papers appeared in Norsk Polarinstitutt's *Report series*, which is published only for limited distribution. Reports are not for sale, but may be obtained directly from the authors.

Nr. 15 Vinje, Torgny E.: Frequency distribution of sea ice, ridges, and water openings in the Greenland and Barents Seas. — A preliminary report on the 'Birds Eye' observations.

Nr. 16 Mehlum, F. & Giertz, I.: Feeding ecology of seabirds in the Svalbard area - a preliminary report.

Nr. 17 Elverhøi, A.: 1. Tidlig-diagenetiske prosesser i marine avsetninger. 2. Erosjon og sedimenttransport fra bredekte områder. (Prøveforelesninger holdt for den filosofiske doktorgrad 23. februar 1984.)

Nr. 17a Karlsen, Hans-Erik: Flytakseringer av ærfuglflokker langs vestkysten av Spitsbergen.

Nr. 18 Vinje, Torgny E.: Fram Strait cruise with M/S Lance 17-31 August 1984.

Nr. 19 Lydersen, Christian & Giertz, Ian: Studies of the ringed seal in its breeding habitat in Kongsfjorden, Svalbard.

Nr. 20 Larsen, Thor: Rapport fra Norsk Polarinstitutt's tokt med 'Lance' til Svalbard 17. juli - 14. august 1984 (Tokt II).

In addition the Institute has compiled a bibliography of selected references to publications concerning Norwegian Antarctic research from 1956 to 1983, classified under the following subjects: General, Biological sciences, Cartography and maps, Expeditions, Geological sciences, Ice and snow, Medical Sciences, Meteorology, Oceanography, Terrestrial physics, Political geography.

## Maps and Charts

Svalbard 1:500,000: Spitsbergen, søre del (see fig. over) Satellite map published in cooperation with IBM, Oslo

NOK 27.- + mva

Svalbard 1:100,000, C8 Billefjorden (78°20'-78°40'N and 15°-17°30'E),

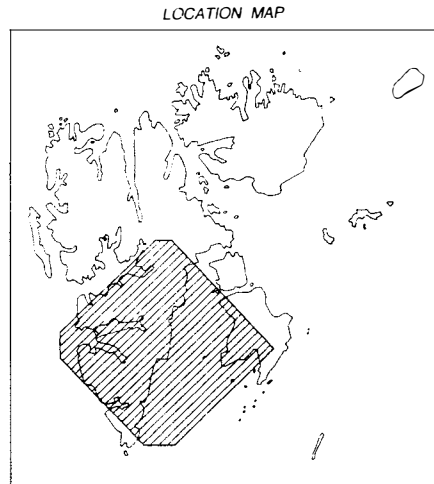
NOK 27.- + mva

Dronning Maud Land 1:250,000 (K5): Filchnerfjella Nord (71°-72°S and 6°-9°E). Satellite map published in cooperation with IBM, Oslo

NOK 18.- + mva

Chart No. 504 Svalbard - Fra Sørkapp til Bellsund. 1:200,000. New edition

NOK 40.- + mva



## Published outside the Institute

Dowdeswell, J.A., Drewry, D.J., Liestøl, O. & Orheim, O. 1984: Radio echo sounding of Spitsbergen glaciers: problems in the interpretation of layer and bottom returns. *Journal of Glaciology* 30 (104).

Elverhøi, A. 1984: Glaciogenic and associated marine sediments in the Weddell Sea, fjords of Svalbard and the Barents Sea: a review. *Mar.Geol.* 57:53-88.

Gjelsvik, T. 1984: Scientific Research and Cooperation in Antarctica: Antarctic Challenge. *Veröffentlichungen des Instituts für Internationales Recht an der Universität Kiel*, 88.

Gjelsvik, T. 1984: The Tertiary orogenic zone of Spitsbergen and its relation to plate tectonics in the northern Greenland Sea. *The 27th International Geological Congress, Moscow, August 1984*.

Haim, Nicolaisen & Øritsland, N.A. 1984: Crude oil - its impact on the rat's heat balance. *Comp.Biochem.Physiol.* 78A (2) :259-261.

Larsen, T. 1984: *Abundance, range and popula-*

- tion biology of the polar bear (Ursus maritimus) in the Svalbard area.* Dr. philos. thesis, University of Oslo. Mimeo, 286 pp.
- Liestøl, O. 1984: Glasiologiske undersøkelser i Norge 1983. Bidrag til *NVE Rapport nr.3, 1984.*
- Mangerud, J. & Salvigsen, O. 1984: The Kapp Ekholm section, Billefjorden, Spitsbergen: a discussion. *Boreas* 13 :155-158.
- Mangerud, J., Elgersma, A., Helliksen, D., Landvik, J. & Salvigsen, O. 1984: The Late Weichselian (25-10 ka BP) glacial maximum in Isfjorden and Van Mijenfjorden, Spitsbergen, Svalbard. Abstract 13, *Annual Arctic Workshop, INSTAAR, Univ. of Colorado, Boulder, USA* :67-68.
- Mangerud, J., Elgersma, A., Helliksen, D., Landvik, J. & Salvigsen, O. 1984: The Late Weichselian glaciation in Isfjorden and Van Mijenfjorden, Svalbard. Abstract from *Sediments and Climate in the Arctic Symposium*, Oslo 9-11 April 1984.
- Ohta, Y. 1984: Caledonian Fractures on Svalbard. (Eds: Gabrielsen et al.): *International Basement-tectonics Association, Publication No.4* :339-345.
- Rahn, H., Greene, D.G., Tøien, Ø., Krog, J. & Mehlum, F. 1984: Estimated laying dates and eggshell conductance of the Fulmar and Brünnich's Murre in Spitsbergen. *Ornis scand.* 15 :110-114.
- Rudels, B. 1983: Report on the meeting: The Physical and Chemical Oceanography of the Arctic Ocean. (By Eddy Carmack & Bert Rudels). *Oceanografiska Institutionen, Special Report No.1.*
- Rudels, B. 1984: The importance of the fresh water discharge and the Atlantic inflow for the maintainance of the Arctic Ice Cover. *Report of the meeting of experts on Sea Ice and Climate Modelling, World Climate Programme No.77.*
- Soglo, E. & Mehlum, F. 1984: Gulkinnd for første gang på Svalbard. *Vår Fuglefauna* 7:34.
- Vinje, T. 1983: On the present state and the future fate of the Arctic sea ice cover. *Arctic Whaling. Proceeding of the International symposium February 1983. Works of the Arctic Center No.8.* University of Groningen.
- Øritsland, N.A. & Hedlund Markussen 1984: Grønlandselens matbehov. I: Biologisk bakgrunn og utvikling av simuleringsmodellen SEAERG. II: Programlister for simuleringsmodellen SEAERG. *Rapporter utgitt fra Avd. for Generell Fysiologi.*

### Popular Science

- Barr, S. 1984: Kulturminner og kulturvern. *Svalbard. Vårt nordligste Norge* (Det Norske Svalbardselskap). Forlaget Det Beste, Oslo.
- Hisdal, V. 1984: Svalbards klima. *Svalbard. Vårt nordligste Norge* (Det Norske Svalbardselskap). Forlaget Det Beste, Oslo.
- Larsen, T. 1984: We've saved the ice bear! *International Wildlife Magazine* 14(4) :4-11.
- Larsen, T. 1984: Observing without disturbing arctic fauna. *Naturopa* 48 :25.
- Liestøl, O. 1984: Breene på Svalbard. *Svalbard. Vårt nordligste Norge* (Det Norske Svalbardselskap). Forlaget Det Beste, Oslo.
- Liestøl, O. & Ramsli, G. 1984: Snø og breer i Norge. *Norge, land og miljø.* J.W. Cappelens Forlag a/s, Oslo.
- Mehlum, F. 1984: Svalbards sjøfugler. *Ottar* 6/84 :45-52.
- Vinje, T. 1984: Sjøisen. *Svalbard. Vårt nordligste Norge* (Det Norske Svalbardselskap). Forlaget Det Beste, Oslo.

# Meetings, Courses and Teaching

Institute staff attended meetings and short courses both in Norway and in Canada, Denmark, India, Japan, Scotland, Sweden, USA and West Germany. Anders Solheim spent the period 5 April-11 August as guest researcher at Woods Hole Oceanographic Institution, Massachusetts, USA.

The following have held regular lectures and tuition at the University of Oslo:

Liestøl, Olav: Glaciology  
Øritsland, Nils Are: Biology

and at the University of Bergen:

Orheim, Olav: Glaciology.

Guest lectures at various universities:

Gjelsvik, Tore: *The work of SCAR and results of Antarctic research since 1960*. New Dehli, Bombay, Goa, Madras. Salvigsen, Otto: *Svalbards geologi*. Oslo, Lund, Uppsala. Øritsland, Nils Are: *Vegetasjonskartlegging*. Tromsø.

## Lectures and Conference Contributions

Gjelsvik, Tore: *Kartlegging og geografisk utforskning av våre Polarområder siden 1960*. Det Norske Geografiske Selskab.  
Larsen, Thor: *Population size and dynamics of the polar bear in the Svalbard area*. Viltbiologisk kongress, Kalø, Danmark 28 September.  
Lauritzen, Ørnulf: *Svalbards og Barentshavets geologi*. Svalbardkurs, Ny-Ålesund, July.  
Mehlum, Fridtjof: *Ornitologiske undersøkelser ved Norsk Polarinstitutt*. Longyearbyen, 9 February.  
Mehlum, Fridtjof: *Bestands- og hekkebiologiske studier av ærfugl (Somateria mollissima) på Svalbard*. Viltbiologisk kongress, Kalø, Danmark, 28 September.

Ohta, Yoshihide: *Timing of Caledonian high-pressure metamorphism, based on geological data*. Tectonic and structural geology meeting, Bergen, October.

Orheim, Olav: *Ressurs- og naturforhold på Sydpollandet*. Seminar for teachers in senior schools in Østfold. 14 March.

Orheim, Olav: *Iceberg discharge and the mass balance of Antarctica*. Workshop on the relationship between land ice and sea level, Seattle, 13 September and SCAR working group in glaciology, Hamburg, 26 September.

Orheim, Olav: *Iceberg observations in the oceans around Antarctica*. SCAR working group in logistics, Hamburg, 27 September.

Rogne, Odd: *Forskning på Svalbard fra et utenrikspolitisk synspunkt, og Norsk Polarinstituttts oppgaver*. Lecture for Foreign Affairs Committee, Ny-Ålesund, 31 August.

Rogne, Odd: *Forskning og utvikling i polarområdene. Hva skjer nasjonalt og internasjonalt*. Meeting of Polarforum, Oslo, November.

Rogne, Odd: *Hvorfor polarforskning ?* Stortinget, Oslo, November.

Rudels, Bert: *Betingelsen for isdekket i Polhavet*. Nordiskt havisforskmøte, Norrköping, 2-4 May.

Rudels, Bert: *On the T-S structure in the Polar Ocean and in the Greenland/Norwegian seas*. ICES Hydrography working group meeting, Oban 22-23 May.

Salvigsen, Otto: *Nedisingen av Svalbard/Barentshavet i sen Weichsel*. Nordic geological winter meeting, Stockholm 9-13 January.

Salvigsen, Otto: *Weichselian glaciation in Svalbard-Barents Sea: a review*. Symposium Sediments and Climate of the Arctic, Oslo 10 April.

Solheim, Anders: *Sedimentfordeling og glacialhistorie i det vestlige Barentshav*. Nordic geological winter meeting, Stockholm 9-13 January.

Solheim, Anders: *Sediment distribution and glacial history of the western Barents Sea* and

*Effects of recent glacier surge into open marine conditions.* Lamont Doherty Geological Observatory, New York; Bedford Institute of Oceanography, Dartmouth, Canada; Woods Hole Oceanographic Institution, Mass., Oregon State University. June/July.  
Vinje, Torgny: *Isformer og isutbredning i havet i polarområdene.* Course on Polar marin teknik, Göteborg 12-14 March.

Vinje, Torgny: *Havisfordeling, struktur og biologiske prosesser.* PRO MARE meeting, Oslo 19-21 March.

Vinje, Torgny: *Havisundersøkelser i Barents- og Grønlandshavet.* Nordisk havisforsker møte, Norrköping 2-4 May.

Vinje, Torgny: *Possible Nordic sea-ice projects.* Polar Research — A Nordic Meeting, Drammen 12-14 November.

## Institute staff

In 1984 the Institute had 42 <sup>1</sup>/<sub>2</sub> permanent posts and 4 <sup>1</sup>/<sub>2</sub> temporary positions, a total of 47. This is one post less than in 1983. Per 31.12.1984 the positions of head of research and research fellow were vacant.

### *Administration:*

Director  
Head of Research

Odd Rogne  
vacant

### *Office administration:*

Office Manager  
Accounts  
Telephonist/Receptionist

Reidar Lund  
Bjørn Grimsrud  
Aud Christiansen (part time)  
Nora Lisen Bugge (part time)  
Elsa Knudsen (part time, resigned  
31.12.1984)  
Gro Pedersen (part time)  
Marit Wiik (part time)  
Jorunn Myklebust  
Anne Hamnes (until 14.8)  
Bodil Bye Larsen (contract from 20.8)

Director's Office

Secretarial  
Correspondence archive

### *Computer services:*

Leader

Øivind Finnekåsa  
Torstein Berge



*Documentation division:*

Leader, information cons.  
Publications editor  
Russian translator  
Librarian  
Documentation assistant

Susan Barr  
Annemor Brekke  
Peter Hagevold  
Reidunn Lund  
Inge Marie Mølmen (part time)

*Cartographical division:*

Leader

Bjørn Arnesen  
Reidar Mandt  
Arild Myhrvold  
Espen Kopperud (part time)

*Expedition Leader, Arctic, and supervisor  
of logistics division and Research Station,  
Ny-Ålesund:*

Thor Siggerud

*Logistics division:*

Leader

Kåre M. Bratlien  
Jørn E. Fortun  
Jan Mikalsen  
Odvar Lund  
Egil Soglo (from 8.6)

*Research Station, Ny-Ålesund (temporary  
posts):*

Station leader  
Engineer  
Engineer  
Engineer  
Engineer  
Research assistant  
Research assistant

Harald Gule (shared with KBKC)  
Harald Ottesen (until 7.7)  
Edgar Knudsen (until 14.9)  
Peer Aasarød (fra 8.6)  
Håvard Brekke (fra 16.8)  
Howard Parker (until 31.7)  
Inger Hanssen-Bauer (until 30.9)

*Scientific Divisions*

*Biology:*

Leader

Thor Larsen  
Fridtjof Mehlum (contract)

### *Geophysics:*

Leader, Glaciologist	Olav Liestøl
Meteorologist	Vidar Hisdal
Antarctic, Glaciologist	Olav Orheim
Oceanographer	Bert Rudels
Sea Ice	Torgny Vinje

### *Geology:*

Leader	Thore S. Winsnes Audun Hjelle Ørnulf Lauritzen Harald Major Yoshihide Ohta Otto Salvigsen
Marine geology	Yngve Kristoffersen (resigned 31.7.) Anders Elverhøi Anders Solheim
Technician	Jon Erik Møller

### *Geodesy/Topography:*

Leader, topographer	Sigurd Helle
Geodesist	Trond Eiken
Topographer	Bjørn Lytskjold
Topographer	Knut Svendsen

### *Pensionist appointments:*

Geology	Tore Gjelsvik
Pilot Description	Kaare Z. Lundquist

### *The following received permanent positions in 1984:*

Torstein, computer services, 1.1. (previously on contract)  
Elverhøi, Anders, marine geologist, 1.1. (previously on contract)  
Finnekåsa, Øivind, computer services, 1.1. (previously on contract)  
Fortun, Jørn, equipment manager, 16.5. (promotion)  
Kristoffersen, Yngve, marine geologist, 1.1. (previously on contract)  
Mikalsen, Jan, store foreman, 16.5. (promotion)  
Solheim, Anders, marine geologist, 1.10. (previously on contract)

*On leave:*

Hamnes, Anne, correspondence archives, 21.8.84-14.8.85  
Øritsland, Nils Are, biologist (until MAB-project in Svalbard is completed)

*Contracted for projects:*

Brattbakk, Ingvar, biologist, (MAB-project)  
Holst, Anne Margrethe, engineer (part time, MAB-project)  
Øritsland, Nils Are, biologist, (leader, MAB-project)  
Solheim, Anders, marine geologist, until 1.10. (environment atlas)  
Gabrielsen, Geir Wing, research assistant (financed by NAVF for the project Sea-bird ecology in the Arctic)

## Accounts for 1984

<i>Chap.1412. Debit items</i>	<i>Granted</i>	<i>Expenditure</i>
01. Salaries, wages, etc.	9,005,000.-	9,365,000.-
11. Goods and services	9,060,000.-	9,060,300.-
21. Special expences	7,020,000.-	7,389,700.-
45. Large new purchases	520,000.-	206,300.-
70. Scholarships	369,000.-	368,900.-
	<hr/>	<hr/>
	25,974,000.-	26,390,200.-
 <i>Chap.18. Beacons and radio beacons in Svalbard</i>	 977,000.-	 865,000.-
	<hr/>	<hr/>
<i>Chap.4412. Credit items</i>	<i>Budgeted</i>	<i>Received</i>
01. Sale income	150,000.-	184,000.-
03. Income from various services	5,000.-	0.-
04. Reimbursement from Svalbard budget	1,600,000.-	1,600,000.-
05. Contribution to environment atlas	0.-	376,000.-
	<hr/>	<hr/>
	1,755,000.-	2,160,000.-
 <i>Chap.5309.29 Other income</i>		
14 Other income	0.	16 400.-
	<hr/>	<hr/>

# Grants and Financial Assistance for Research Projects

- Hans Erik Foss Amundsen and Britt-Lise Skjellekvåle: Kr. 11,000.- towards field work in Svalbard in connection with theses in geology.
- Natascha Heinz: Kr. 3,000.- towards travel expenses for field assistant in connection with Paleontological Museum's expedition to Svalbard.
- Ragnar Brækkan: Kr. 8,000.- towards research project Model for heat conduction through the surface in Arctic areas.
- Jan Mangerud: Kr. 44,000.- towards Quaternary-geological studies in the Van Mijenfjorden-Isfjorden area of Svalbard.
- Bengt Bjarne Larsen: Kr. 4,600.- towards collection of material in the Fram Strait in connection with thesis in geology.
- Svein Østerhus: Kr. 5,000.- towards expenses for mapping of micro-structure of the Greenland Sea in connection with thesis in physical oceanography.
- Inger Hanssen-Bauer: Kr. 20,000.- towards expenses for studies of inversions in Ny-Ålesund.
- Ole Martin Smestad and Bjørn Erlingsson: Kr. 25,000.- towards expenses for geophysical measurements in the Fram Strait.
- Bjørn Lybekk: Kr. 10,500.- towards aurora studies in Ny-Ålesund.
- Brondz Efim: Kr. 10,500.- towards VLF-registering project in Ny-Ålesund.
- Svein Mathiesen: Kr. 10,000.- towards project Microbic digestion in Svalbard reindeer during changing nutrition and fasting.
- Arne Rognmo: Kr. 23,000.- towards project Indirect estimation of energy use in free-living Svalbard reindeer.
- Rune Sævre: Kr. 5,000.- towards expenses for radiological dating of material collected in 1983 during field work in Adventdalen and Sassendalen, Svalbard.
- Nils Gullestad: Kr. 3,000.- towards studies of migration conditions on Bjørnøya for Svalbard geese autumn 1984.
- Christian Lydersen and Ian Gjertz: Kr. 40,000.- towards expenses for studies of Ringed seal in Kongsfjorden area during pupping period.
- Karl Alfred Arnesen: Kr. 12,000.- towards studies of grey phalarope in Ny-Ålesund 1984.
- Tom Sanddal: Kr. 6,000.- towards field work in Svalbard in connection with thesis in Quaternary geology.
- Ida Lønne: Kr. 6,000.- towards field work in Svalbard in connection with thesis in Quaternary geology.
- Anne Kristine Lycke: Kr. 6,000.- towards field work in Svalbard in connection with thesis in Quaternary geology.
- Magne Balstad: Kr. 6,000.- towards field work in Svalbard in connection with thesis in Quaternary geology.
- Karl Erik Zachariassen: Kr. 11,000.- towards project in Svalbard concerning seasonal variations of cold hardiness in fish, littoral crustaceans and possibly also insects.
- John Krog: Kr. 19,900.- towards project Effect of altering light exposure on the adult Ringed seal pineal gland.
- Kjell Henriksen: Kr. 4,000.- towards implementation of optical auroral observations in Svalbard Nov/Dec. 1984.
- Rasmus Hansson: Kr. 3,527.- towards polar bear studies on Kongsøya, Svalbard in Sept/Oct. 1984.
- Karl Arne Stokkan: Kr. 34,900.- towards project Activity rhythm in Svalbard ptarmigan and Willow ptarmigan in Ny-Ålesund.
- Bjørn Kaltenborn: Kr. 5,500.- towards project Terrain damage in Svalbard due to over-use.
- Hans Petter Leinaas: Kr. 12,160.- towards pilot study of the terrestrial evertbrate fauna in the littoral zone in Svalbard.

Sigmund Unander: Kr. 7,500.- towards project  
Population dynamics of Spitsbergen ptarmigan during five-year period 1980/84.

Lars Øivind Knutsen: Kr. 3,500.- towards field  
work in Churchill, Canada concerning immobilization of polar bears with Telazol.

Monica Kristensen: Kr. 2,230.- towards studies  
of melting sea ice and plankton upwelling in Kongsfjorden, Svalbard.

Howard Parker: Kr. 6,160.- towards population and predation studies of eider ducks in the Kongsfjorden area, Svalbard.

Arne Vollan Aarset: Kr. 1,880.- towards expenses in Ny-Ålesund during project Collection of ice fauna, thermal hysteresis proteins in fish and respiratory effects of osmotic stress in *Gammarus wilkitzkii*.

