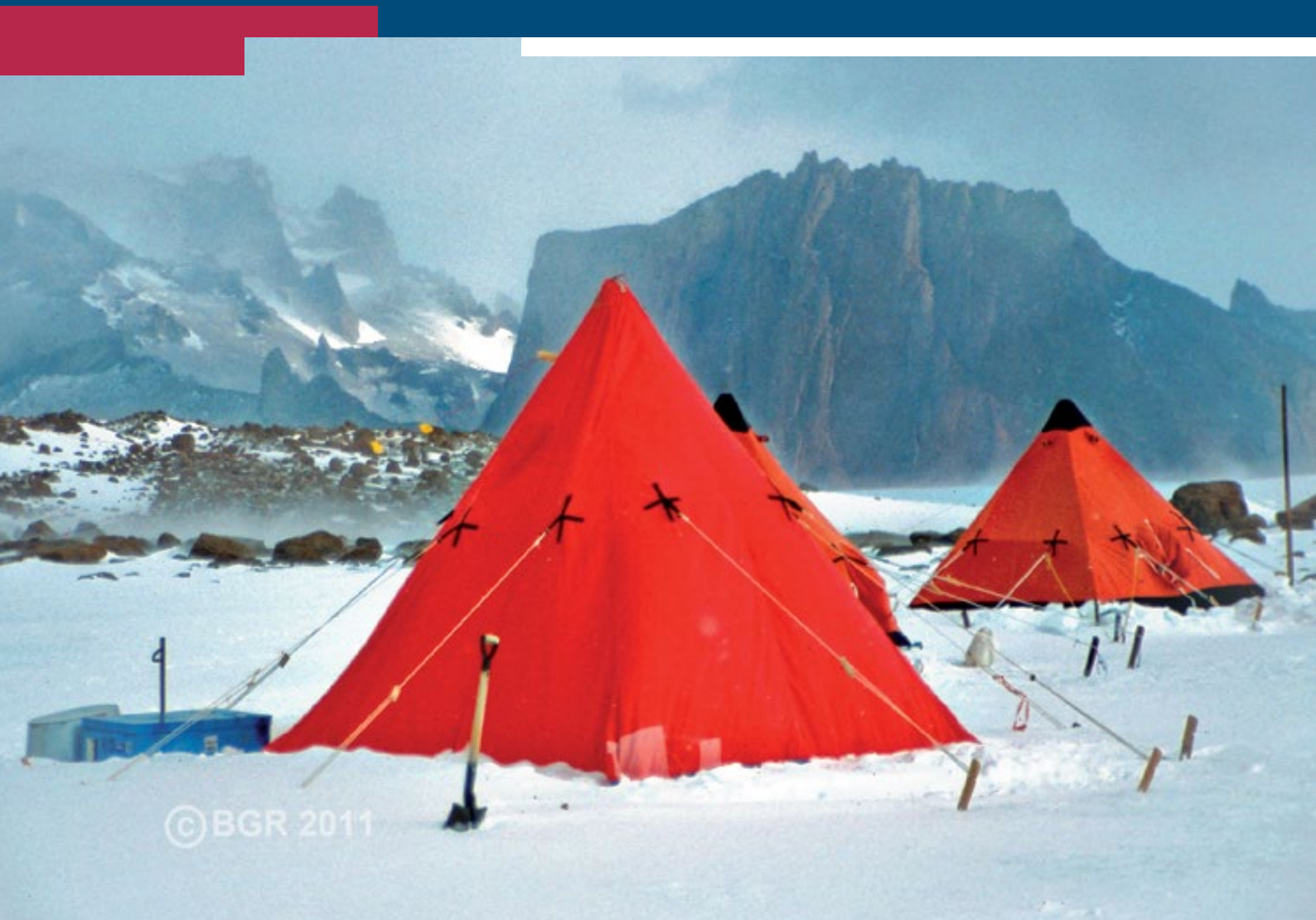


# Thirty Years of Terrestrial Polar Research

by the Federal Institute for Geosciences and Natural Resources

## – a Retrospective





# **Thirty Years of Terrestrial Polar Research by the BGR**

**– a Retrospective**

Solveig Estrada, Detlef Damaske, Andreas Läufer  
& Karsten Piepjohn



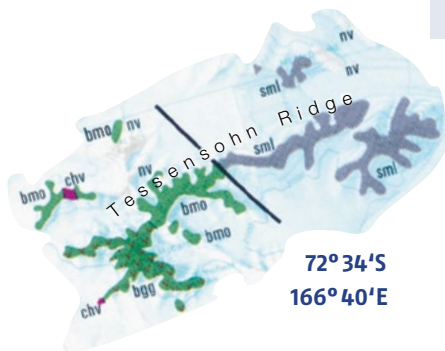




**30** years  
of terrestrial  
polar research  
by the **BGR**



Dedicated to Dr. Franz Tessensohn,  
who established polar research at the BGR.





# Introductory Remarks



**30** years  
of terrestrial  
polar research  
by the **BGR**

The polar regions of the Earth are key areas for researching and understanding the Earth as a system. Today, Antarctica is an isolated continent in the middle of an oceanic realm, the circum-Antarctic Southern Ocean. In contrast, the Arctic consists of a central ocean area, the Arctic Ocean, and is bordered by the continents of Eurasia and North America (including Greenland).

Due to glaciation and the climatic conditions, access to the polar regions is difficult. Thus large parts of the Antarctic and the Arctic constitute white spots on the geological map. The exploration of the polar regions is important, though, for obtaining an overall picture of the development of the geological structure of the Earth's crust, including its service capacity, as well as for an overall understanding of the interrelations of land, oceans, glaciation, atmosphere, orbital fluctuations and the biosphere. Special geoscientific methods and special logistics are required to meet the needs of the difficult research conditions in the polar regions.

The Federal Institute for Geosciences and Natural Resources (BGR) has been conducting terrestrial polar research since 1979. In the adjoining marine areas, they interlinked with the marine activities of the BGR, which have also been conducted in the polar regions since 1973.

Based on its polar research, the BGR supports the German Federal Government in the pursuit of political goals, such as upholding of the consultative status of the Federal Republic of Germany within the Antarctic Treaty System, and strengthening the influence of the Federal Republic of Germany in economic, environmental and research political decisions involving Arctic areas.

Because of the national division of resources, the BGR has been cooperating reliably and continuously with the Alfred Wegener Institute for Polar and Marine Research (AWI) and German universities.

By planning, organizing and executing geoscientific expeditions which are conducted on a wide scientific basis and in cooperation with domestic and foreign institutions, the BGR makes an important contribution to the mainly purely research-oriented geoscientific polar research, to which the Federal Republic of Germany is committed in the light of its general responsibility towards the global environment.

The BGR has initiated several research and cooperation programs in the Antarctic which gained international recognition.

By integrating the geoscientific projects of the German Research Foundation (DFG) into the polar programs of the BGR, interdisciplinary research has been established over the years, which has produced internationally recognized results.

The concept of this brochure, which mainly explains the development of the BGR's terrestrial polar research (including aerogeophysics), was conceived by Franz Tessensohn and Norbert W. Roland. Their approach has been taken up by the authors, the text drafts have been developed further, and the knowledge base has been updated.





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## Chapter 1



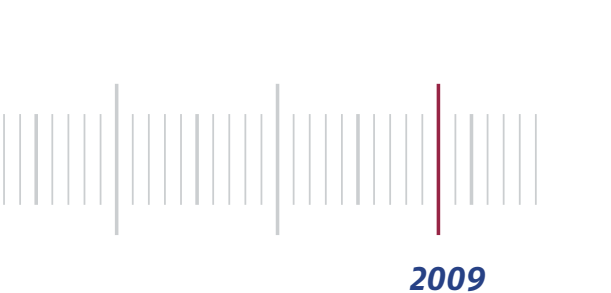
## Development of the BGR's Polar Research Activities

1979



### History

- 1973** The BGR starts polar research based on the program "Geoscientific Investigations in the North Atlantic" promoted by the Ministry of Economics (BMW) (1973–1977).
- 1974 to 1977** Execution of large-scale geophysical research by BGR's Marine Geophysics section in the western Barents Sea, at the continental margins of East Greenland and Spitsbergen, as well as in the Labrador Sea, as part of the program promoted by the BMW (see above). Research aimed at the exploration of the hydrocarbon potential of the continental margins. Industrial exploration is based on their results, e.g. in the Barents Sea.
- 1976** The BGR starts geoscientific research in the Antarctic — initially by the participation of a few researchers in US expeditions.
- 1978** For the first time after World War II, BGR's Marine Geophysics section conducts a German geophysical expedition in Antarctic waters.
- 1979** February 5, 1979: Accession of the Federal Republic of Germany to the Antarctic Treaty System.
- 1979 / 1980** Execution of two major geoscientific expeditions:
  - a marine geophysical survey of the Ross Sea and
  - the **land expedition GANOVEX I** into North Victoria Land, which marks the **start of terrestrial polar research by the BGR**.
- 1980** The BGR creates the "Antarctic" section in response to the obligations associated with the accession to the Antarctic Treaty System.
- 1981** March 3, 1981: The Federal Republic of Germany joins the consultative countries – the expeditions conducted by the BGR since 1978 supported its attainment of consultative status.



**2009**

- 1989** Reorganization of the BGR in April 1989:  
The former "Antarctic" section is renamed "Polar Research" and is part of the "Geological and Geophysical Research" division. In addition to Antarctic research, it also has the task of conducting land-based Arctic research.
- 1990** After German reunification, scientists and key activities of the geoscientific Antarctic research of the former Academy of Sciences of the German Democratic Republic are taken on.
- 1992** Start of the land-based research activities in the Arctic based on the "CASE" program.
- 1995 / 1996** Up to this date, the regional focus of the terrestrial geology and geophysics in the Antarctic had been placed on the Transantarctic Mountains, specifically the Ross Sea area (North Victoria Land) and its assumed extension in the Weddell Sea area (Shackleton Range); the research activities of the BGR are now expanded to include East Antarctica (initially Dronning Maud Land).
- 1997** Further restructuring of the BGR:  
The "Polar Research" section is renamed "Polar Geology" and is now part of the subdivision "Marine and Polar Research, Deep-Sea Exploration".
- 1998** The BGR was in charge of organizing and hosting the International Conference on Arctic Margins "ICAM III" (October 12–15, 1998, in Celle), up to now the only ICAM conference in a country not neighboring the Arctic Ocean.
- 2001** First combined marine-terrestrial Arctic expedition in the Nares Strait.
- 2002 / 2003** Extension of the activities to central East Antarctica (Lambert Glacier, Gamburtsev Mountains).
- 2009** After renewed restructuring, the BGR's "Polar Geology" activities are integrated as a unit of the "Natural Resource Geology, Polar Geology" subdepartment.



Participants of the *first GANOVEX expedition* (1979/1980)



*BGR helicopter landing on the after deck of the "Schepelsturm"*



*Remains of the camp destroyed by the hurricane "Schepel Sturm"*



*Construction of the "Lillie Marleen Hut" in a rocky depression next to the Lillie Glacier*



*Participants of the  
GANOVEX IX expedition  
(2005/2006)*



*Tents at the margin  
of the Gondwana Station*



*Searching for fossils  
in sandstones of the  
Transantarctic Mountains*



The expeditions conducted by the BGR in the polar regions, or supported as a cooperation partner, are listed in chronological order below. These expeditions will be elaborated later in the text.

The participation of individual BGR members in the polar expeditions of other institutions has been compiled in the Appendix.

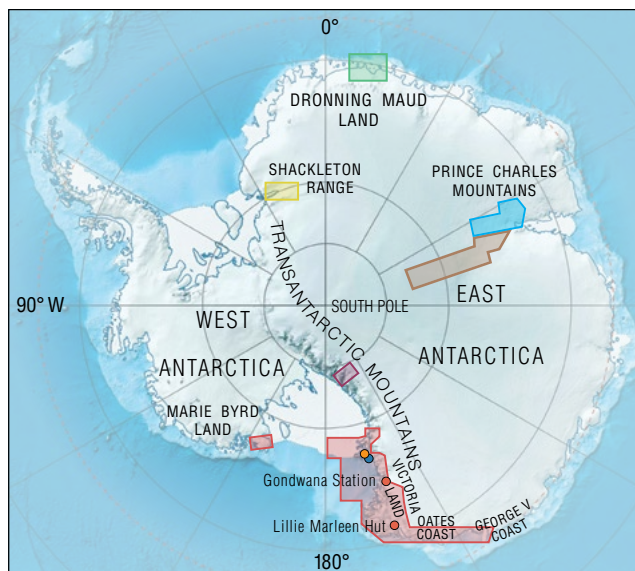


## Fields of activity and expeditions in the Antarctic

Year	Expedition	Target Area	Research / Transport Vessel	Number of Scientists **
1979/80	GANOVEX I	North Victoria Land	Schepelsturm	10
1981/82	GANOVEX II	North Victoria Land	Gotland II	14
1982/83	GANOVEX III	North Victoria Land	Polar Queen	17
1984/85	GANOVEX IV *	North Victoria Land	–	30
1987/88	GEISHA *	Coats Land, Shackleton Range	Polarstern	9
1988/89	GANOVEX V	North Victoria Land, Oates Coast	Polar Queen	41
1990/91	GANOVEX VI *	North Victoria Land	Polar Queen	29
1992/93	GANOVEX VII	North Victoria Land, Marie Byrd Land, Oates Coast	Polar Queen	35
1994/95	EUROSHACK *	Coats Land, Shackleton Range	Polarstern	9
1995/96	GEOMAUD	Central Dronning Maud Land	Polar Queen	30
1997/98	TAMARA *	South Victoria Land	–	2
1999/2000	GANOVEX VIII *	Transantarctic Mountains, Oates Coast, George V Land	Polar Duke	15
2002	ASAP *	McMurdo Sound	–	2
2002/03	PCMEGA *	Southern Prince Charles Mountains, Lambert Rift	Aurora Australis, Polar Bird	9
2003/04	REVEAL / CTAM *	Central Transantarctic Mountains	–	4
2005/06	GANOVEX IX	North Victoria Land	Astrolabe	12
2007/08	QueenMET	Dronning Maud Land	–	3
2008/09	AGAP / GIGAGAP *	Gamburtsev Mountains	–	2

\* international cooperation project

\*\* from BGR including invited scientists



- GANOVEX I – IX, ASAP, GITARA, TAMARA
- GEISHA, EUROSHACK
- GEOMAUD / QueenMET
- PCMEGA
- REVEAL / CTAM
- AGAP / GIGAGAP

- ANDRILL
- Cape Roberts project

Fields of activity in the Antarctic

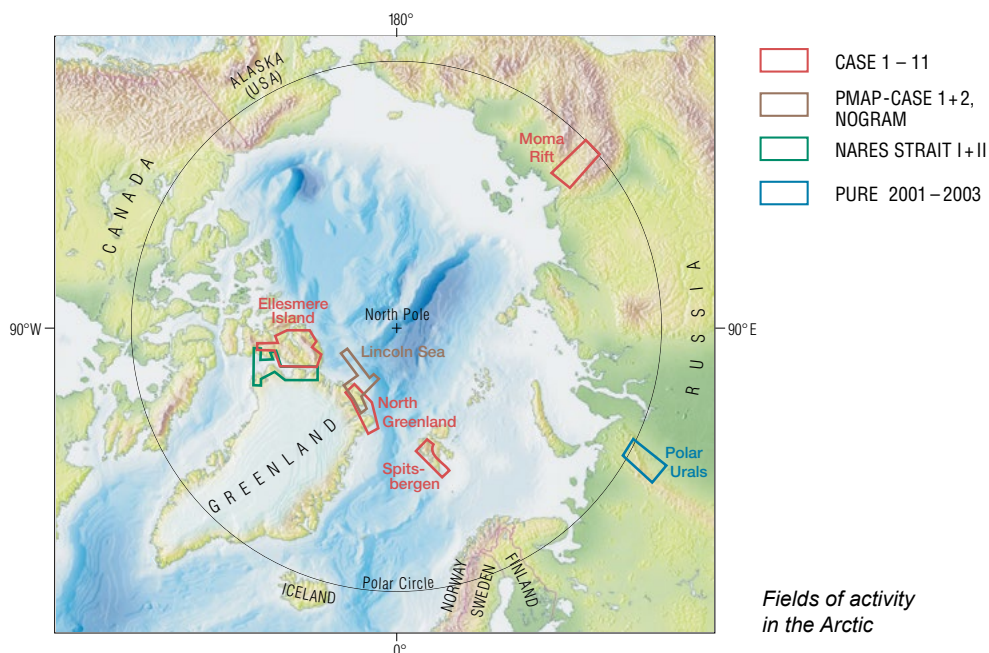
## Fields of activity and expeditions in the Arctic



Year	Expedition	Target Area	Number of Scientist **
1992	CASE 1	Spitsbergen	10
1994	CASE 2 *	North Greenland	13
1997	PMAP-CASE 1 *	Lincoln Sea	6
1998	PMAP-CASE 2 *	Lincoln Sea	6
1998	NOGRAM	Arctic Ocean / North Greenland	5
1998	CASE 3 *	Moma Rift (Jakutia)	7
1998	CASE 4 *	Ellesmere Island (Canada)	2
1999	CASE 5 *	Ellesmere Island (Canada)	7
2000	CASE 6 *	Ellesmere Island (Canada)	4
2001	CASE 7 *	Ellesmere Island (Canada)	5
2001	NARES STRAIT I *	Ellesmere Island / Nares Strait	8
2001	PURE 2001 *	Polar Ural (Russia)	5
2002	PURE 2002 *	Polar Ural (Russia)	6
2003	PURE 2003 *	Polar Ural (Russia)	7
2003	NARES STRAIT II *	Ellesmere Island / Kane Basin	3
2004	CASE 8	Ellesmere Island (Canada)	4
2006	CASE 9 *	Spitsbergen	1
2007	CASE 10	Spitsbergen	9
2008	CASE 11 – Pearya	Ellesmere Island (Canada)	20

\* international cooperation project

\*\* from BGR including invited scientists





## Chapter 2

# Political / Strategic Objectives and Priorities of the BGR's Terrestrial Polar Research

The BGR conducts polar research

- for investigating global environmental changes in the past and present;
- for assessing the natural resource potential in "frontier areas" in the forefront of industrial natural resource exploitation (Arctic).

The BGR initiates international and national research programs and participates in the programs of other research institutions. It provides logistics services required to support the terrestrial polar research activities of the Federal Republic of Germany.

## Political objectives

- Upholding the consultative status of the Federal Republic of Germany within the Antarctic Treaty System.
- Strengthening the influence of the Federal Republic of Germany with respect to economic, environmental, and research policy decisions in the Arctic.
- Safeguarding the supply of natural resources to the Federal Republic of Germany.

## Strategic objectives

### Antarctic

- Research projects for upholding Germany's consultative status.

### Arctic

- Exploration and evaluation of the natural resources potential in the forefront of industrial exploitation.



### Key activities of the BGR's terrestrial polar research

- Advisory services to various government departments.
- Participation in the "polar research" program of the German Federal Government, as well as in national and international committees and associations (e.g. SCAR, IASC, ATCM).
- **Antarctic:** Investigation of the lithosphere of the continent and the continental margins.
- **Arctic:** Frontier exploration of sedimentary basins and the marginal areas of the Arctic Ocean.
- Development and adaptation of geophysical surveying systems for polar research.
- Setting up a National Polar Sample Repository (NAPA).



## **Upholding the consultative status of the Federal Republic of Germany within the Antarctic Treaty System**

The Federal Republic of Germany signed the Antarctic Treaty in 1979 and has belonged to the group of consultative members since 1981. This status, which is characterized in particular by voting rights with respect to the development of the Antarctic Treaty System, is only maintained when the contractual party demonstrates its particular interest in the Antarctic by carrying out significant scientific research activities. The first BGR expeditions (GANOVEX I and Ross Sea Seismics) in 1979, the year of accession, contributed already to the German geoscientific research activities. Two years later, these activities played a considerable part in helping the Federal Republic of Germany attain consultative status.

The BGR has been making important contributions to the "polar research" program of the German Federal Government ever since – in close coordination with, and in addition to, the Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven. There is task sharing between AWI and BGR, with the BGR responsible in particular for the terrestrial geoscientific component of Antarctic research.

Numerous geoscientific programs by university groups, which have been funded by the "Antarctic research" priority program SPP 1158 "Antarctic Research and Comparative Investigations in Arctic Ice Areas" of the German Research Foundation (DFG), were only made possible by using BGR logistics. Due to this integration, the geoscientific spectrum of the BGR expeditions has been expanded very successfully, and this division of labor has also made it very cost effective. The universities value the BGR as a reliable, long-term partner.

## **Strengthening the influence of the Federal Republic of Germany in the Arctic**

Unlike the Antarctic, the Arctic is not a completely freely accessible region for research, but largely national sovereign territory. Germany has been a member of the 1920 "Spitsbergen Treaty" since 1925.

The "International Arctic Science Committee (IASC)" for coordinating research activities was founded in August 1990 by the eight countries neighboring the Arctic Ocean. IASC members are national research organizations – the Federal Republic of Germany is represented here by the German Research Foundation (DFG).

Countries not neighboring the Arctic Ocean can thus influence environmental and research policy decisions in the Arctic by presentation of appropriate scientific work in these committees. The German Federal Government stipulated in its 1996 "polar research" program that Arctic research is to be intensified in future to a level equivalent to the Antarctic research.

The intensification of the German research activities in the Arctic coincided with the restructuring of the political systems in Eastern Europe and the opening of the Russian institutions to the west. In addition to basic Arctic Ocean basin research, other important scientific work is on the geological structure and evolution of the circum-Arctic continents and their margins – also regarding the still unclarified natural resource potential.

## Advisory services for the German Federal Government and international committees

The BGR is obliged to provide advice to German Federal ministries on geoscientific and natural resource economic matters. The knowledge and experience gained by the BGR through its activities and research in bilateral and international polar research collaboration projects, are put to good use in the advice it provides to government departments and international committees (e.g. ATCM, IASC, SCAR).

### ■ Advisory services concerning the Antarctic Treaty System

The BGR provides geoscientific advisory services to the German delegation at the annual "Antarctic Treaty Consultative Meetings" (ATCM).

It provides expert opinions and statements primarily for the BMWi, the German Foreign Office, and the BMBF in the negotiations of the Antarctic Treaty signatories on

- the Convention on the Regulation of Antarctic Mineral Resource Activities, CRAMRA (1982 – 1988);
- the Protocol on Environmental Protection to the Antarctic Treaty (1989 – 1991), and the subsequent discussions during the implementation of the protocol into national law in the *Act Implementing the Protocol on Environmental Protection* (until 1994) and for the *Liability Annex to the Protocol on Environmental Protection*.

The Protocol on Environmental Protection to the Antarctic Treaty was signed in October 1991 by the member states of the Antarctic Treaty; it was adopted on September 22, 1994 as the *Act Implementing the Protocol on Environmental Protection to the Antarctic Treaty* by the German Parliament, and has been in force since January 14, 1998. It prohibits in [Section 32 \(1\)](#) for initially 50 years "*Prospecting for, exploration, development or extraction of mineral resources in the Antarctic*". [Section 32 \(2\)](#) also expressly stresses, however, that this does not apply to scientific research activities in the resources sector. In other words: The assessment of the potential of resources in the Antarctic can definitely be pursued by the BGR without violating the Protocol on Environmental Protection.

Act Implementing the Protocol on Environmental Protection to the Antarctic Treaty of October 4, 1991  
(Act Implementing the Environmental Protection Protocol)  
of September 22, 1994

#### Article 32: Prohibition on Mining

- (1) Prospecting for, exploration, development or extraction of mineral resources in the Antarctic is prohibited.
- (2) Paragraph (1) shall not apply to scientific research activities.

### ■ Natural resource policy advisory services

The determination of the geological history and the processes affecting polar continental margins is essential for the assessment of the resource potential. Thus, these activities assist the German Federal Government in its decision-making activities concerning long-term proactive natural resource policies.

There is considerable research need for the exploitation of new resource potential, e.g. gas hydrates and their environmentally friendly extraction from onshore and especially offshore permafrost zones. A relevance to climate of these gas hydrates is poorly understood to date. Close cooperation with Russian institutions is intended for these research activities.



## Scientific and Technical Implementation of the Research Objectives

### Geoscientific research programs in the polar regions

#### Antarctic

The regional emphasis of the Antarctic research of the BGR in the past 30 years was on the Transantarctic Mountains, in particular in North Victoria Land, and in the adjoining Ross Sea.

Up to 2009, nine expeditions were conducted within the scope of GANOVEX (German Antarctic North Victoria Land Expedition). In cooperation with PNRA (National Antarctic Research Program of Italy), the BGR actively participated in four GITARA Programs (German-Italian Aeromagnetic Research in Antarctica) (see map p. 20). In addition, the BGR was involved in the international program ACRUP (Antarctic Crustal Profile).

Other cooperation projects in the Transantarctic Mountains were TAMARA (Transantarctic Mountains Aerogeophysical Research Activities) and REVEAL / CTAM (Remote Views and Exploration of Antarctic Lithosphere / Central Transantarctic Mountains) with the USA.

The BGR participated in two international research drilling projects in the Ross Sea – the Cape Roberts Project and the ANDRILL Program (ANTarctic DRILLing Program). The BGR had already attained member status of the research steering committee when the Cape Roberts boreholes were drilled. The geophysical parameters were measured in the borehole with the know-how and instruments of the Leibniz Institute for Applied Geophysics (LIAG) of the Geozentrum Hannover. To select the ANDRILL drilling location, the BGR conducted an aeromagnetic aerial survey (ASAP) in cooperation with New Zealand.

Activities in the Shackleton Range at the southwestern margin of the Weddell Sea were conducted based on the geological expeditions GEISHA (Geological Expedition in the Shackleton Range) and EUROSHACK (European Shackleton Range Expedition). EUROSHACK was conceived during a GEISHA Workshop in the BGR, and prepared and executed jointly by the BGR and the BAS (British Antarctic Survey).

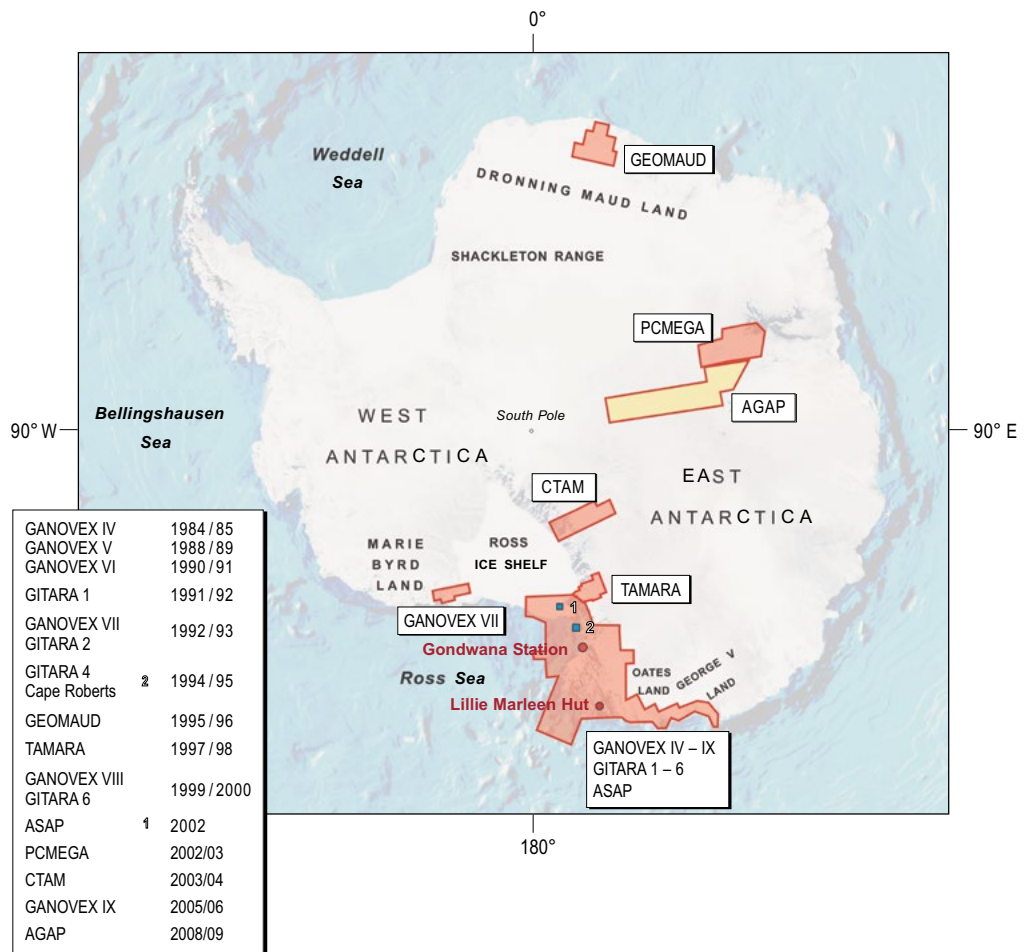
GEOMAUD (Geoscientific Expedition to Dronning Maud Land) expanded research activities to the East Antarctic Shield area. These were continued with the German-Australian joint venture PCMEGA (Prince Charles Mountains Expedition of Germany & Australia) initiated by the BGR in the core area of the East Antarctic Shield. This project was planned and conducted in very close cooperation with the AAD (Australian Antarctic Division).



In the International Polar Year (IPY), the BGR played a leading role in the international project AGAP (Antarctica's GAmurtsev Province) as part of the main topic "Venture into Unknown Regions" with its program GIGAGAP (Geoscientific Insights of Greater Antarctica in the area from Gamburtsev Mountains, Amery Ice Shelf to Prydz Bay). AGAP was jointly conducted by the USA, Great Britain, Australia, China and Germany.

Also in East Antarctica (in Dronning Maud Land), at the margin of the polar plateau, meteorite falls on blue ice fields were investigated in the course of the QueenMET expedition. Their verification allows conclusions to be drawn on the stability of the ice in East Antarctica over long periods and thus also about climate variations in the past.

*Aeromagnetic data acquisition in the Antarctic*



## Arctic

After extensive marine geophysical work in Arctic Ocean areas, the BGR also started terrestrial expeditions in the Arctic in the summer of 1992. The Arctic projects of the BGR are generally less extensive and easier to carry out from a logistics point of view than expeditions to the Antarctic. As the research there is conducted in sovereign territories of the neighboring countries, direct cooperation with institutions of the corresponding countries is mandatory.

The CASE program (initially acronym for "Correlation of Alpine Structural Events", but from CASE 3 the acronym for "Circum-Arctic Structural Events") investigated tectonic structures and volcanic activities connected with the opening of the Arctic Ocean in the circum-Arctic area (up to now in Spitsbergen, North Greenland, Yakutia, and the Canadian Arctic).

Aeromagnetic surveys, which were conducted together with Canada in the past as part of PMAP–CASE (Polar Margins Aeromagnetic Program) and NARES STRAIT I and II, or which are planned as part of NOGRAM (Northern Greenland Gravity and Aeromagnetics) in cooperation with the AWI, are also thematically linked to the CASE program.

In the Polar Urals natural-resources-related research was conducted within PURE (Polar Urals Expedition) together with cooperation partners from geological institutes affiliated with the Russian Academy of Sciences in Moscow and Syktyvkar.



CASE 11: Camp on the northern shore of Ellesmere Island



## Development of special surveying systems for geoscientific polar research

The geoscientific exploration of the largely ice-covered polar regions requires the use of special high-tech surveying methods, whose development also always requires testing under extreme polar conditions.

The BGR is substantially involved in the development of these systems.

Examples are:

### ■ Airborne radar measurement of ice thickness

Measurements of ice thickness not only provide valuable information for glacial geology, they are also indispensable for correcting gravimetric survey data on ice. For this reason, a mobile surveying unit was developed which can be integrated in a helicopter, and which continuously measures and digitally records the ice thickness during the survey flights.

The development was based on an existing ground radar system from the State Authority for Mining, Energy and Geology (LBEG). The radar was successfully used for prospecting ore in the permafrost of the Canadian Arctic.

The helicopter-based ice thickness radar has in the meantime also been used for investigating glaciers in Chile.

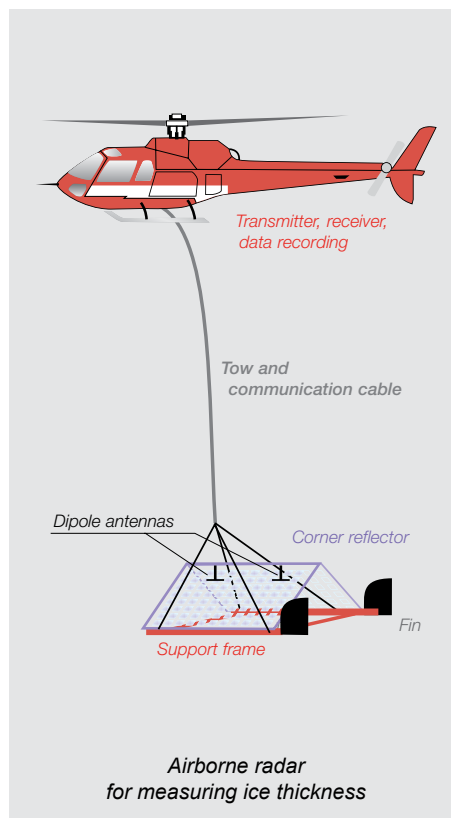
The radar system was further developed for use in fixed-wing aircrafts (Twin Otter) for the PCMEGA expedition.

### ■ Helicopter-based aeromagnetics

The use of helicopters in contrast to fixed-wing aircraft frequently requires significantly less logistical effort and is better suited for detailed measurements.

### ■ Ice drill

A special, environmentally friendly melting technique is used to drill boreholes down to approximately 100 m depth, which can, for instance, be used for measurements of heat flow density as well as for seismic studies.



## Logistics and infrastructure

The task of the BGR's "Polar Geology" unit is to prepare and conduct geoscientific research expeditions in the Antarctic and the Arctic – taking into consideration national and international priority programs and involving domestic and foreign scientists with the relevant geoscientific competence.

The BGR charters the required vessels, helicopters or fixed-wing aircrafts (e.g. Twin Otter, Hercules) and provides the polar terrain equipment, including snowmobiles (Skidoos), Nansen sleds, Scott tents, kitchen tents and work tents as well as radio equipment. Surveying systems for aerogeophysics are also provided, as well as a number of other useful small devices.

As a rule, polar expeditions are conducted using ship and helicopter support. This concept has proved itself time and again, as it allows maximum flexibility. The expedition vessel can be used as a floating base, the helicopter permits a correspondingly wide operating radius, and is faster (and thus more effective) as well as safer than sled traverses.

*BGR helicopter "S 68"  
in the final approach to the  
expedition vessel "Schepelsturm",  
a modified offshore supply ship  
in the Ross Sea  
(GANOEX I)*



*Expedition vessel "Polar Queen"  
in Terra Nova Bay  
(GANOEX VI)*



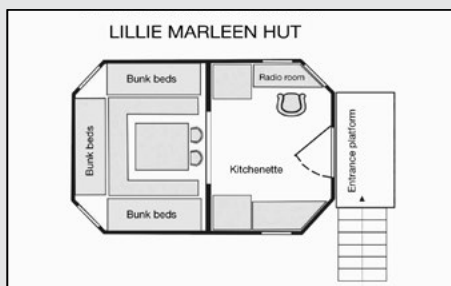
For land-based activities, a bivouac hut, the "Lillie Marleen Hut", was built at the Lillie Glacier during GANOVEX I. This hut and the nearby memorial stone commemorating the sinking of the expedition vessel "Gotland II" in December 1981 were recognized as the first German "Antarctic Historic Site and Monument" during the *XXVIII Antarctic Treaty Consultative Meeting (ATCM)* (Stockholm 2005).

The "Gondwana Station", installed at Terra Nova Bay during the course of GANOVEX III (1983), was initially a bivouac hut identical to the Lillie Marleen Hut, but was reconstructed as a summer station during GANOVEX V (1988/1989). The main building is constructed from containers based on a concept developed by the BGR, and comprises repair rooms, recreation rooms and workrooms, a kitchen, sanitary installations, a generator station and a seawater treatment plant. The station also contains a biological wastewater treatment system.

### Lillie Marleen Hut

Construction/Installation: January 1980

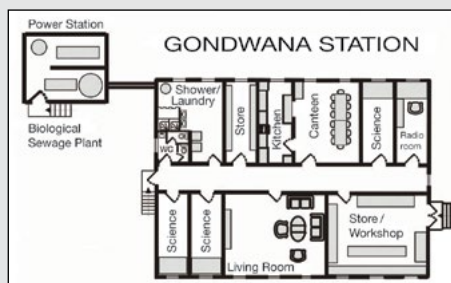
Position: 71° 12'S, 164° 31'E; Mt. Dockery, Everett Range, North Victoria Land



### Gondwana Station

Construction/Installation: January 1983 (reconstructed in 1988/1989)

Position: 74° 38'S, 164° 13'E; Gerlache Inlet, Terra Nova Bay (Ross Sea), North Victoria Land





## Scientific Cooperation



### National and international cooperation

Polar research is a large-scale scientific endeavor. The BGR depends on the scientific capacity of other research institutions because of the high cost and the numerous experts required. There has been very beneficial cooperation with many domestic and foreign institutions since the BGR became involved in polar research.

In the Arctic, investigations are conducted in national sovereign territories. Efficient scientific cooperation with the corresponding institutions of the neighboring states is thus a prerequisite for the BGR to successfully carry out its research activities.

The scientists invited to expeditions run by the BGR have experience in polar research and/or provide important contributions in their special subjects. As a rule they are recognized experts. In addition, DFG-financed final-year "diplom" (Master's degree equivalent) students and doctoral students have been integrated in the expedition programs.

The BGR cooperates with German universities and the Alfred Wegener Institute for Polar and Marine Research (AWI) in the Antarctic as well as in the Arctic. The regular meetings of the "Geology and Geophysics of the Polar Regions" working group of the German Society for Polar Research (DGP) have been successfully used for many years as an informal planning and information forum to coordinate these research activities.

Foreign cooperation partners in the **Antarctic** are mainly the Australian, American, British, Italian and New Zealand Geological Surveys and/or Antarctic research institutions and/or universities. Cooperation in the **Arctic** is mainly conducted with Canadian, Danish, Norwegian and Russian partners. A detailed list of the domestic and foreign institutions with which the BGR has cooperated in the Antarctic and Arctic and/or in the analysis and data evaluation of the sample material or the interpretation of geophysical data is included in the Appendix.

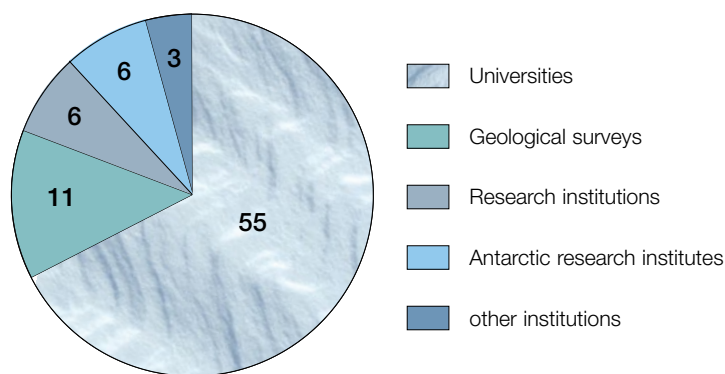
### Cooperation countries and their participants

	<b>Germany</b>	<b>40</b>
<b>other countries (cumulative)</b>		<b>41</b>
<i>breakdown according to country</i>		
	Italy	11
	USA	9
	Australia	8
	New Zealand	5
	Russia	2
	Netherlands	2
	Switzerland	2
	United Kingdom	1
	Norway	1

*BGR polar research cooperation partners in the Antarctic*



### Cooperation partners according to institutions



The DFG funds polar research by a corresponding priority program ("Division Infrastructure – Antarctic Research with Comparative Investigations in Arctic Ice Areas"). Many of the land-based geology projects and plans conducted in this context rely on BGR logistics. This emphasizes the role of the BGR in the polar research funded by the DFG. On the other hand, this cooperation also expands the BGR's knowledge base.

Some projects in the Arctic have been funded by the BMBF as part of scientific and technological cooperation (WTZ) with Canada and Russia, which in turn allowed the involvement of university scientists.

The BGR initiates cooperation programs for bundling geoscientific research efforts, e.g. as part of LIRA (Lithospheric Investigation in the Ross Sea Area) with the other countries active in the Ross Sea sector (USA, Italy and New Zealand). The objectives of this cooperation are joint research planning and coordination as well as information exchange. To this end, workshops and other meetings have been held – see Appendix for details.





Northern Ellesmere Island  
(CASE 11)



## Cooperation within the Geozentrum Hannover

An interdisciplinary approach is essential for successful polar research. Geology, geophysics and geochemistry and onshore/offshore activities have long been combined within multidisciplinary projects, and in doing so have used the scientific and technological potential of the Geozentrum Hannover, which comprises the BGR, the State Authority for Mining, Energy and Geology (LBEG) and the Leibniz Institute for Applied Geophysics (LIAG).

Different fields of activities of these three institutions have been included in the planning, organization, execution, and scientific data evaluation of polar expeditions over the past 30 years:

- |                              |                        |                                    |
|------------------------------|------------------------|------------------------------------|
| ■ international cooperation, | ■ seismics,            | ■ paleontology,                    |
| ■ remote exploration ,       | ■ gravimetry,          | ■ sedimentology,                   |
| ■ geological mapping,        | ■ magnetics,           | ■ petrography, sample preparation, |
| ■ glacial geology,           | ■ geothermal activity, | ■ radiocarbon dating,              |
| ■ cartography,               | ■ radar measurements,  | ■ inorganic isotope geochemistry   |
| ■ environmental geology,     | ■ borehole geophysics, | and geochronology,                 |
| ■ marine geophysics,         | ■ paleomagnetism,      | ■ spectrochemistry and             |
|                              |                        | organic petrology.                 |

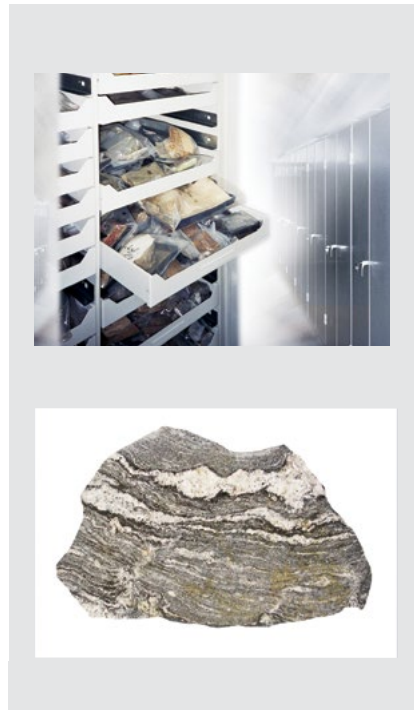


Collecting samples for geochronological studies; map preparation

## National Polar Sample Repository (NAPA)

During the course of polar expeditions, rock samples are collected for laboratory tests and for documentation purposes. Collecting this material is expensive and logistically complex, and the samples have to be conserved for further scientific application. Thus, at the request of the German National SCAR/IASC committee, the BGR established the National Polar Sample Repository (NAPA) in 2007 for the permanent storage of rock samples, which have been or are stored temporarily at various German university institutes.

The NAPA is located in the BGR branch office in Berlin-Spandau and comprises 35 collection cabinets in a storage chamber measuring 65 m<sup>2</sup>. The rock samples are recorded in a database, and in the future can be researched via the internet. This establishes a central basis for German terrestrial polar research and further scientific investigations.





## Major Results of the BGR's Terrestrial Polar Research

Certain plate tectonic and geodynamic models, for instance, can be investigated particularly well in the polar regions, including the conjugate continental margins. The Antarctic is a continent located at a pole, nearly completely surrounded by oceanic spreading centers, where the drift movement of the other circum-Antarctic continents is towards the north. On the other hand, the Arctic is occupied by an ocean surrounded by landmasses.

The polar regions are of central global importance for understanding geodynamic processes (such as the formation of fold belts and rift systems). In addition, they are key areas for the study of global climate and glaciation histories.

### The BGR pursues topics which have been incorporated in

- the "polar research" program of the German Federal Government established in 1996;
- the position paper published in 1999  
 "Geowissenschaftliche Polarforschung – mittel- bis langfristige Perspektiven  
 in der deutschen Polarforschung"  
 ["Geoscientific polar research – medium to long-term perspectives of German polar research"]  
 (compiled by the DGP working group "Geology of the Polar Areas" and the  
 FKPE working group "Geophysics of the Polar Areas");
- the DFG white paper published in 2005  
 "Deutsche Forschung in der Antarktis – Wissenschaftlicher Fortschritt und Perspektiven"  
 ["German research in the Antarctic – Scientific progress and perspectives"].



## The BGR's terrestrial polar research activities

### Antarctic

- Formation and development of the Gondwana supercontinent
- Formation of fold belts and plate tectonic processes, such as subduction and collision events
- Rift events in the Ross Sea region and in the Lambert Graben
- Aspects concerning climate evolution and the formation of the Antarctic ice sheets

### Arctic

- Deformation events and basin evolution during the opening of the Arctic Ocean
- Volcanic rocks as time-markers in the Arctic region
- Genesis and natural resource potential of ophiolite complexes in the Polar Urals



## Antarctic

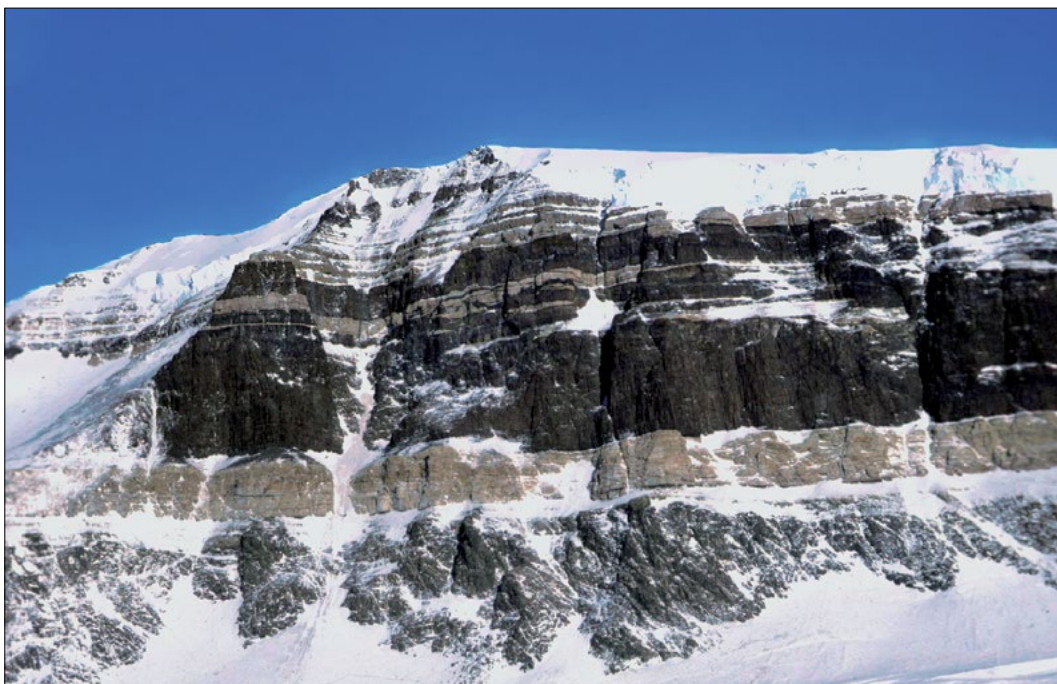
Based on its GANOVEX program, the BGR started geoscientific investigations in North Victoria Land and the Ross Sea area of the Antarctic in 1979. Special emphasis was placed on investigating the relationship of the Antarctic to other fragments of the Gondwana supercontinent, in particular Australia and New Zealand.

At the beginning of the BGR's Antarctic activities, large areas of North Victoria Land were virtually "terra incognita" on the geological world map. Plate tectonic concepts of the crustal structure at the paleo-Pacific margin of the Antarctic continent were nonexistent at the time. Only numerous individual observations in conjunction with general mapping of North Victoria Land, which was conducted at a scale of 1 : 250,000, in parallel to the detailed geological mapping, permitted the recognition of the early plate tectonic configuration.

Once the composition of the North Victoria Land terranes (crustal fragments) had been recognized, a relatively good connection to the Australian continent was found. The main research then shifted from the breakup of Gondwana to the Paleozoic active continental margin, which can be studied in an unrivaled manner in the Transantarctic Mountains. The analysis of this mountain range allows deductions to be made on the early (Paleozoic) history of the Pacific Ocean. After the start of the multi-track seismic surveys in the Ross Sea, the active Ross Sea rift system initially moved into the spotlight, and subsequently also the now inactive Lambert rift in East Antarctica.

Since 1992, the research activities have been extended to the following areas in West and East Antarctica:

- Marie Byrd Land,
- Oates Coast,
- George V Coast,
- Shackleton Range,
- Dronning Maud Land,
- the southern Prince Charles Mountains
- and the central Transantarctic Mountains.



*The geological "picture" of North Victoria Land:*

*The basement folded during the Ross orogeny was overlain 300 to 200 million years ago by Gondwana sediments (light brown) into which magmatic sills (dark) intruded parallel to the bedding around 180 million years ago*





## Formation and development of the Gondwana supercontinent

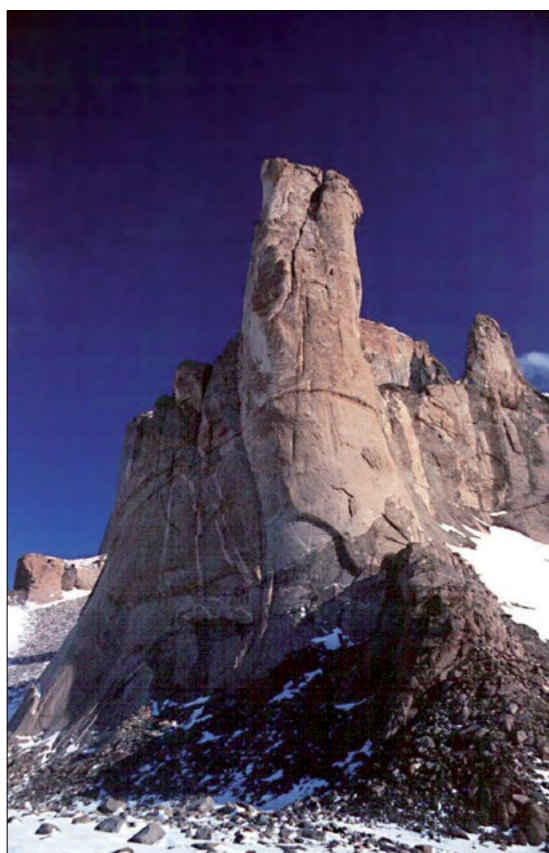
Until about 180 million years ago, the Gondwana supercontinent was a huge continuous landmass, comprising all of today's southern continents and India. The fold belts (orogens) bordering and traversing the landmass can provide the best information on the processes which result in the formation of such a supercontinent.

### The Ross orogen at the paleo-Pacific margin of Gondwana

The Ross orogenic belt of the Antarctic continues towards Australia and South America. It thus nearly matches the scale of the Andes in today's South America. The results obtained from the Transantarctic Mountains show that the Ross orogen was formed by subduction at the paleo-Pacific margin of Gondwana in the early Paleozoic. The magmatic arc of this orogen is preserved in deeper crustal levels in the form of granitoid, calc-alkaline intrusions. Sediment remnants of the former ocean occur only in a few places in the Transantarctic Mountains, amongst others in North Victoria Land, where they form two tectono-magmatic terranes. The suture with the old continent has also been found there.

### Collision zones in the interior of Gondwana

U/Pb ages of about 550 to 500 million years measured in granites are not only documented in the Transantarctic Mountains, but also for East Antarctica, which has been interpreted as a stable craton. Just like in Africa, there seems to have been a type of "Pan-African" event, of mainly thermal character, overprinting earlier crustal areas.



*Voluminous Pan-African intrusions  
in central Dronning Maud Land*

In addition, strong evidence of a mountain range of the same age with high-grade metamorphism has been found along the coast of Dronning Maud Land. The expeditions in the Shackleton Range, in Dronning Maud Land and in the southern Prince Charles Mountains have looked at these aspects. In all, these later results disprove the previous concept, according to which the East Antarctic Craton constitutes an area that has been stable for 1.1 to 1.0 billion years. Instead, it consists of several crustal fragments, which only united "Pan-African" style to form the Gondwana supercontinent in the late Proterozoic and early Paleozoic.

A Pan-African continental collision zone is assumed between the Dronning Maud Land sector of Antarctica, East Africa, Madagascar and Sri Lanka. The only rudimentarily explored Dronning Maud Land is in the central part of this postulated fold belt, and was the target area of the BGR GEOMAUD expedition.

Evidence for Pan-African crustal processes (about 580 to 500 million years ago) was found in the course of these investigations, amongst others in the form of severe deformation, metamorphic overprinting, widespread magmatic intrusions (anorthosite, diorite/granite/syenite: see Fig. left side), as well as mineral alterations indicating formation at medium crustal depths.

This work has contributed to the increased attention given to the formation of Gondwana in the period between roughly 1 billion and 500 million years ago. SCAR proposed a priority research project along these lines in 1996. A supercontinent, completely surrounded by marine areas, must have differed significantly from present conditions, also in terms of the global climate.

In the Shackleton Range, a thermal event about 500 million years ago has been demonstrated (i.e. heating of the lower crust with granite formation), as well as the discovery of Cambrian marine sediments and fossil oceanic crust. This region must have been traversed by an ocean basin which can be related to the Pan-African Mozambique Ocean of the same age. It is assumed that the two continental fragments of former West and East Gondwana that had been separate until 500 million years ago were amalgamated along this boundary.

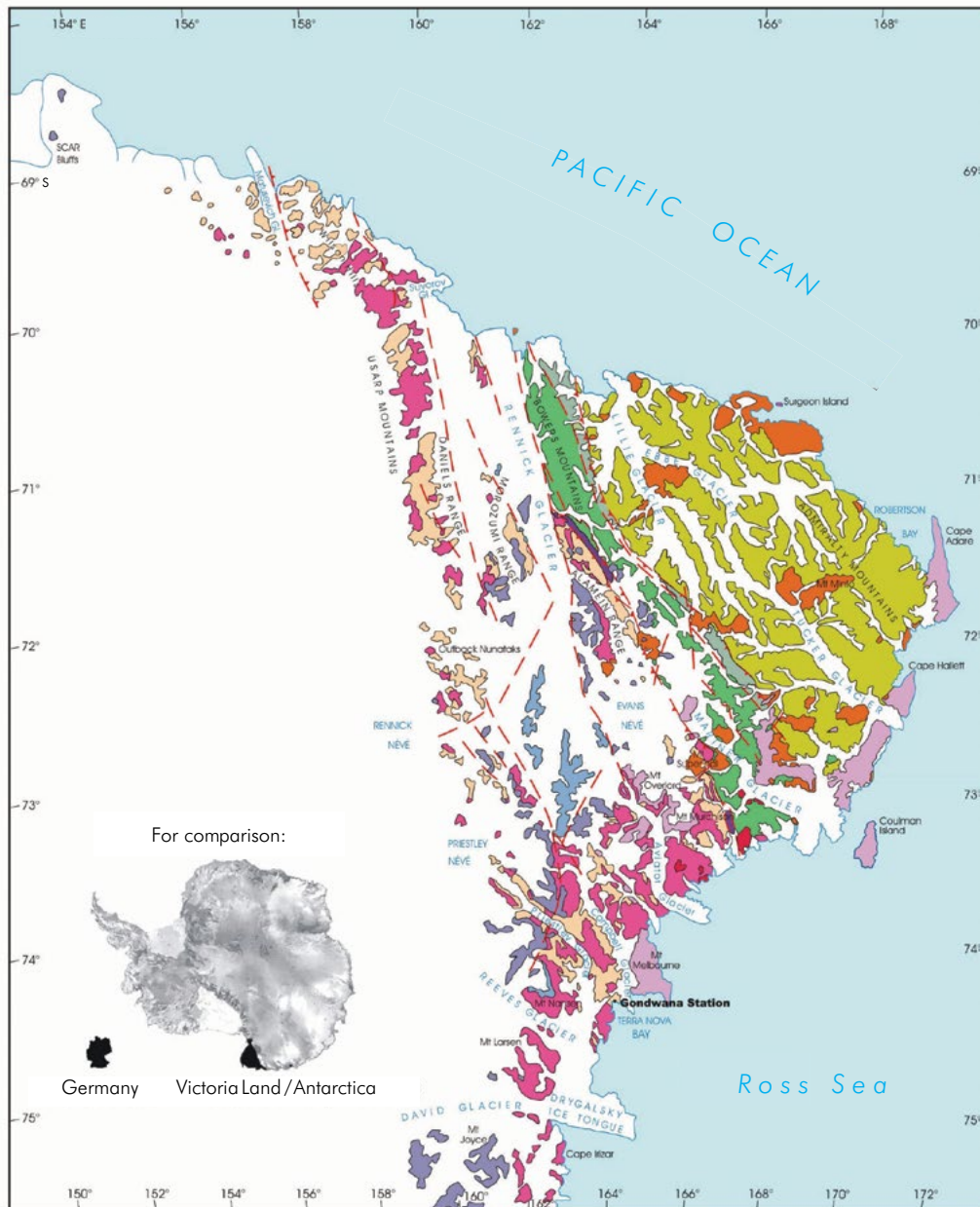


*Nunataks in the  
Shackleton Range*

More recent investigation in the southern Prince Charles Mountains located in the core region of the East Antarctic Craton during the PCMEGA campaign showed the existence of comparable intense deformation related to the Pan-African event (see Fig. below). A zone documenting a tectonic mega-event is exposed in the southern Mawson Escarpment. Mantle material has been imbricated into this about 30 km wide zone. This zone either documents collision or transpression – i.e. the oblique shearing of continental crust.



*Multiply deformed bedrock  
in the southern  
Prince Charles Mountains*



CENOZOIC MAGMATISM AT THE ROSS SEA MARGIN

- McMurdo Igneous Complex:
  - (a) Meander Granite and Syenite
  - (b) Maita, Hallett and Melbourne Volcanic Suites

POST-ROSS MAGMATISM AND SEDIMENTATION

- (a) Kirkpatrick Basalt
- (b) Ferrar Dolerite and Beacon Supergroup
- Admiralty Igneous Complex
- Thrusts
- Faults

TERRANES AND UNITS OF THE ROSS OROGEN

- Wilson Terrane
  - (a) Wilson Metamorphic Complex and
  - (b) Granite Harbour igneous Complex
- Dessert Ridge Unit in the Mountaineer Range and possible correlatives at the eastern margin of the Lanterman Range
- Bowers Terrane
- Millen Schist
- Robertson Bay Terrane



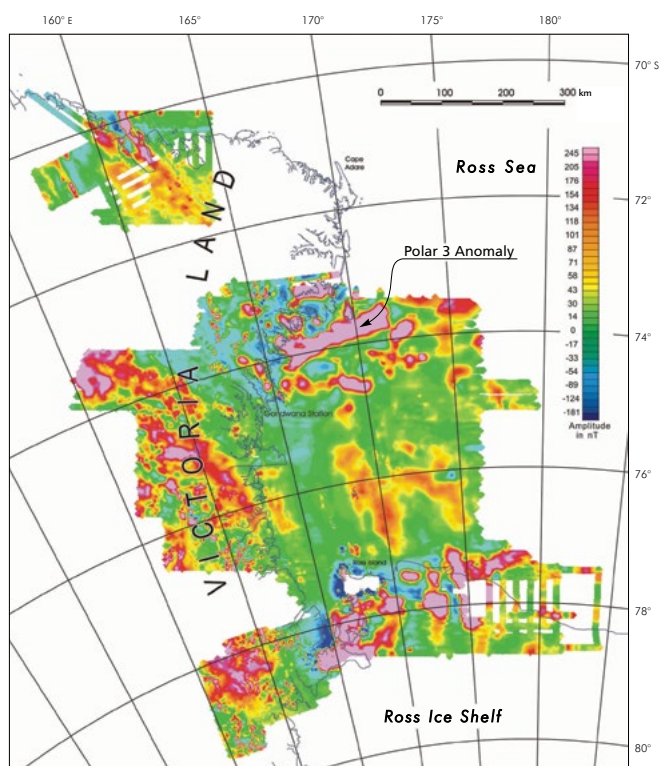
Geological-tectonic map of North Victoria Land



## Rift events in the Ross Sea region and in the Lambert Graben

The disintegration of Gondwana resulted in the formation of the present, largely passive continental margins of the Antarctic. Their investigation is the objective of marine geophysical surveys run by the BGR, especially with comparison to the corresponding margins of the neighboring continents (e.g. Australia (Tasmania) to Ross Sea; Africa to Dronning Maud Land).

The combination of the BGR's onshore and offshore work has contributed to interpreting the Ross Sea Shelf as part of the West Antarctic Rift System, which stretches perpendicular to the Antarctic continental margin, more than 2,500 km into the interior of the Antarctic. The overall tectonic structure is characterized by deep sedimentary basins (e.g. Victoria Land Basin), a thinner continental crust and bimodal volcanism of strong alkaline character. Deep plutonic bodies, the equivalents of rift volcanism, stand out as significant magnetic anomalies (e.g. Polar 3 anomaly, see map below). Some volcanoes are still active today.



*Aeromagnetic anomalies  
in North Victoria Land  
and in the adjoining Ross Sea*

These features make the West Antarctic Rift System among the largest graben structures on Earth (cf. Rhine Graben and East African Rift). However, it differs from these structures by its pronounced asymmetrical shape. The greatest subsidence is connected with the greatest onshore uplift: the offset between the two is more than 10 km. The Transantarctic Mountains constitute the elevated western rift shoulder. The uplift to form today's high mountains began approximately 50 million years ago and is still continuing. To the east, the sedimentary basins in the rift become shallower, and the eastern margin of the rift (rift flank) is poorly defined and shows only a small incline with a flat slope.

The BGR conducts research to explain the causes of this asymmetry based on a geophysical surveying program across the Transantarctic Mountains and far into the adjoining ice-covered interior of the continent. Gravimetric surveys have established a gravity minimum under the Transantarctic Mountains, which indicates the existence of a mountain root.



*Mt. Erebus,  
one of the active volcanoes  
in the Ross Sea area*

In East Antarctica, the Lambert Graben constitutes one of the largest crustal structures and contains the largest glacier on the Earth, the Lambert Glacier. This region was the target area of the PCMEGA project, which was conducted by the BGR together with the Australian Antarctic Division (AAD) in the austral summer of 2002/2003. The structure of the Lambert Graben morphologically perceivable today dates back to crustal extension taking place during the breakup of Gondwana and the separation of India from the Antarctic continent approximately 130 million years ago. The graben might, however, have developed much earlier, namely at the end of the Paleozoic.

The rift processes were the main cause for the uplift and erosion of the southern Prince Charles Mountains. This mountain range constitutes the sole area in the interior of East Antarctica where rock emerges for geoscientific investigations, and that at a distance of nearly 700 km from today's coast. The AGAP IPY project penetrated even further into the interior of the Antarctic. Detailed aerogeophysical surveys for investigating the Gamburtsev Mountains under the Antarctic ice cap were conducted here for the first time in 2008/2009. The formation of this mountain range in the interior of the continent, its development and the correlation with the flanking subglacial lakes and the Lambert rift system have not been understood up to now.

*Geological work on the  
about 3 billion year old rocks  
of the southern Mawson Escarpment  
forming the eastern edge of  
the Lambert Graben*





## Geological drilling projects: Climatic and tectonic development of Antarctica and the formation of the polar ice cap

The geodynamic history of the region has been strongly influenced by the formation of the West Antarctic Rift System together with the uplift of the Transantarctic Mountains, as it is assumed that these events triggered the Antarctic glaciation. In addition, the mountain range today acts as a barrier preventing the outflow of the East Antarctic inland ice. Drilling programs are vital to solve the controversy of whether the Antarctic has been continually ice-covered or whether there have been interglacials with melting.

### Cape Roberts Project

The climate history was one of the main objectives of three major international research boreholes on the ice of the Ross Sea between 1997 to 1999 – the "Cape Roberts Project".

Targets were

- reconstructing the development of the climate from the Cretaceous to the present as completely as possible;
- documenting the start of the Antarctic glaciation;
- looking for indicators of interglacials;
- checking correlations between tectonic events and the development of the climate:  
For instance, can the uplift of the Transantarctic Mountains be considered a condensation nucleus for the Antarctic ice cap or does glaciation coincide with the final isolation of Antarctica (opening of the Drake Passage)?

The cores from the boreholes document the climate history from 34 to 17 million years ago: 34 to 29 million years ago, a cool-temperate climate prevailed, in some cases with trailing, low shrubby vegetation. Glaciers calved icebergs into the Ross Sea. Then 24 to 17 million years ago, the climate was considerably cooler with low tundra vegetation. Glaciers merged in the Ross Sea and were seated solidly on the seafloor over large areas. By combining different dating methods it was possible for the first time to document ice advance and retreat for a period of about 100,000 years.



*Cape Roberts drilling site on the Ross Ice Shelf*

## **ANDRILL (ANTarctic Geological DRILLing)**

The multinational ANDRILL program arose from the Cape Roberts Project.

ANDRILL is also focused on investigating the role of the Antarctic in terms of global climate and environmental changes during the past 65 million years. To this end, boreholes are to be drilled in coastal and shelf sediments at several locations all around the continent to help reconstruct the climatic, volcanic and tectonic development of the Antarctic in more detail. ANDRILL is thus of great importance with respect to increasing our understanding of global environmental change.

The selection of the drilling locations planned in the Ross Sea area are based on extensive preliminary geophysical investigations with the considerable participation of the BGR. The first two boreholes were drilled in the McMurdo Ice Shelf and in the southern McMurdo Sound of the Ross Sea with the involvement of members of the Geozentrum Hannover (BGR and LIAG) in the 2006/2007 and 2007/2008 seasons.

The total length of the sediment cores cut in the two boreholes, about 2400 m, can be correlated and added to the core from the Cape Roberts borehole, giving a continuous tectonic, volcanic and climatic history of the Antarctic from approximately 34 million years ago until today. The results indicate how the Antarctic ice sheet behaved in the recent geological past and how it might change in the near future. The results have shown that small rises in the CO<sub>2</sub> concentrations in the atmosphere influence the stability of the West Antarctic ice sheet and may therefore cause a rise in global sea level.



*ANDRILL location, southern McMurdo Sound*





## Arctic

In contrast to the Antarctic, which is surrounded by oceans, the Arctic represents an ocean surrounded by landmasses. The older part of this ocean, the Canada Basin (Amerasian Basin), cannot be satisfactorily correlated with any of the other oceanic ridge systems. The younger eastern part, in the form of the Eurasian Basin, represents the continuation of the North Atlantic ridge system, which has been opening continuously since approximately 56 million years ago.

As part of the CASE program started in 1992, the BGR investigates the geodynamics of the periphery of the Arctic Ocean and reconstructs the plate tectonic situation before and during its complex opening. In addition to the structural geology and petrographic geochemical analyses of the Arctic volcanic rock provinces onshore, another key activity is the collection of aerogeophysical data of the adjacent marine areas and straits. Aerogeophysics is used to record the most inaccessible and difficult parts of the Arctic, the ice-covered shelves.

PURE projects involved mineral resource studies and structural geology activity in the Polar Urals.

## Deformation events during the separation of Eurasia from North America

An intracontinental deformation belt is known in North Greenland and the Canadian Arctic (Ellesmere Island). This belt continues to the western margin of Spitsbergen, which was connected to North Greenland before the opening of the North Atlantic and the Eurasian Basin. Paradoxically this "squeezed zone" marked by intensive compressive structures formed simultaneously with extension processes during the opening of the ocean basins.

The parts of the deformation belt in Spitsbergen, North Greenland and Canada (Ellesmere Island) were surveyed during the CASE expeditions and their relationships were studied. The focal point of the investigations was the determination of the chronological relation between transform fault events (Wegener Fault, DeGeer Fault) and compressional structures (folding, thrust faults). Such investigations are important for the interpretation of the evolution and architecture of the still largely unexplored continental margins in the Arctic, and thus for the assessment of the possible resource potential.



*Spitsbergen 1992:  
Participants in CASE 1*



Before the expeditions, it was already known that Greenland had experienced the "pincer movement" of two mid-ocean-ridge spreading systems about 60 to 40 million years ago (Baffin Bay and Labrador Sea in the west and the North Atlantic in the east). Such a plate tectonic configuration is exceptional.

From geophysical analysis (involving the BGR) of the processes in Baffin Bay and the Labrador Sea, it was known that the Greenland plate **moved in two different directions** at different times:

1. An earlier movement towards the northeast, when at first only the mid-ocean ridge in Baffin Bay and Labrador Sea between Canada and Greenland was active (see Figure on the right, Anomaly 31).
2. With the activation of the mid-ocean ridge between Greenland and Norway, the direction of movement of Greenland was diverted to the north (see Figure on the right, Anomalies 24 and 21).

The final breakup between Spitsbergen and Greenland, and thus between Eurasia and North America, only took place about 35 million years ago along the right-lateral DeGeer transform fault, when only the mid-ocean ridge between Greenland and Norway was active (see Figure on the right, Anomaly 13).



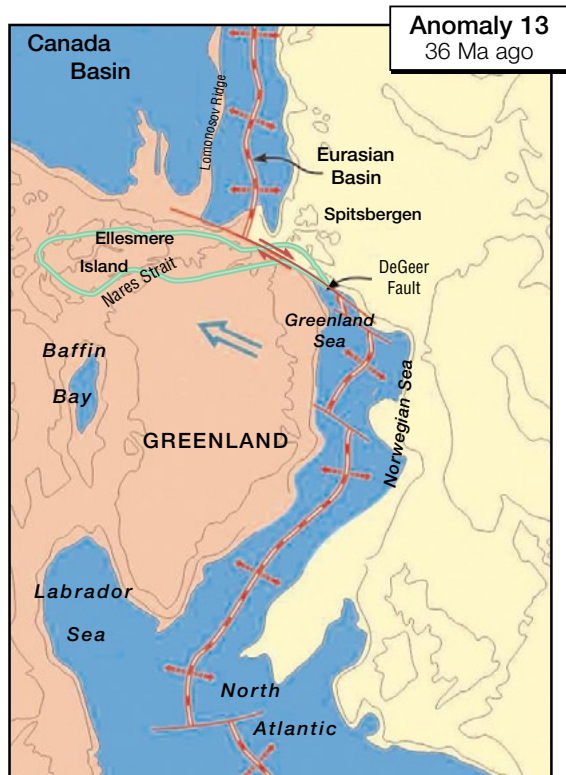
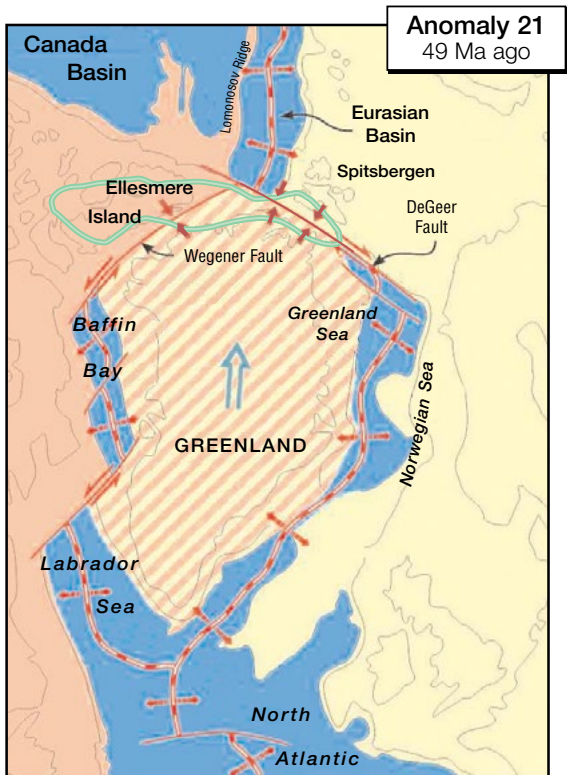
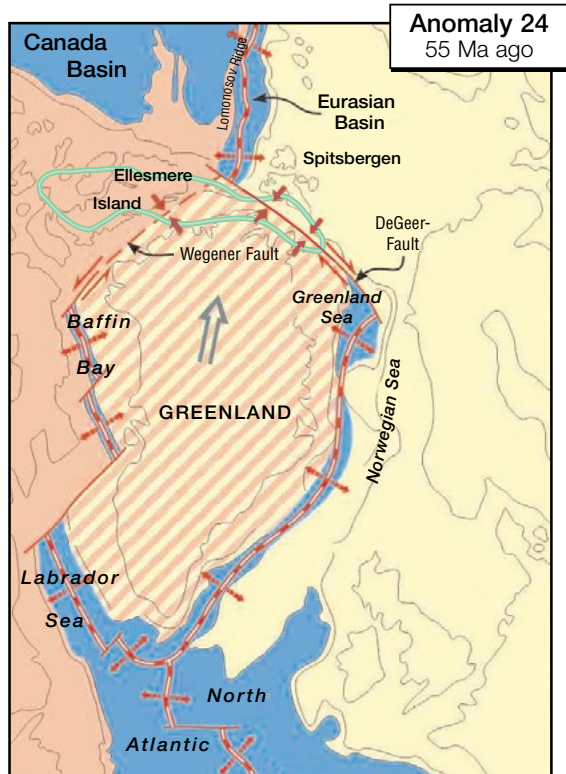
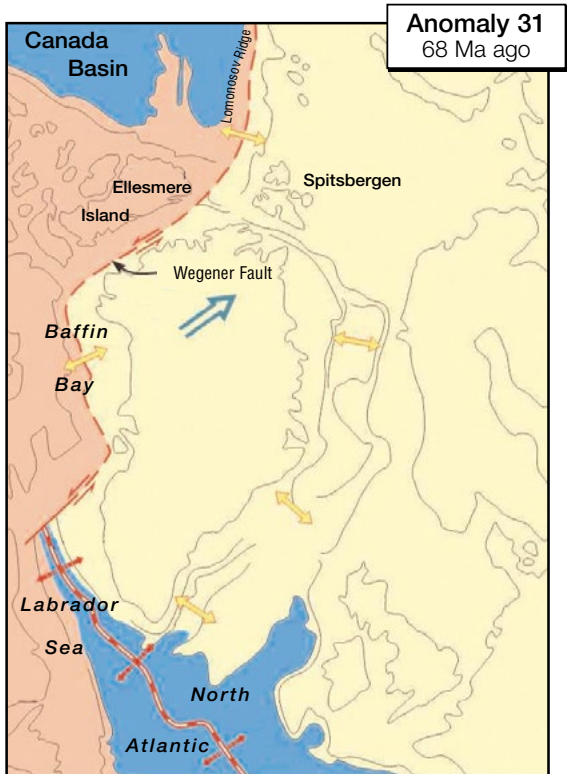


Plate tectonic development before and during the opening of the Eurasian ocean basin and the North Atlantic (according to Tessensohn & Piepjohn 2000).





The first fieldwork in western Spitsbergen and North Greenland during CASE 1 and CASE 2 demonstrated that the compressive deformation cannot be attributed to the right-lateral DeGeer transform fault, but was formed independently in both areas, possibly earlier, with a uniform tectonic transportation direction to the north.

In the area of today's Nares Strait (between Greenland and Ellesmere Island) it is likely that a left-lateral transform fault (the Wegener Fault) was activated during the first phase, which was overprinted during the second phase by compression and formation of the "squeezed zone". This situation was confirmed by structural geological investigations during joint fieldwork with the GSC.

On Ellesmere Island, transform faults with displacements of at least 20 km were found, running parallel to the northern Nares Strait. The location of the main fault between Greenland and Ellesmere Island (Wegener Fault) is presumed to follow the trend of today's Nares Strait.

The causes of both phenomena – the strong lateral displacement and the deformation belt – thus have to be sought in different periods of movement of the Greenland plate. These plate movements are in turn caused by the spreading processes at the two parallel mid-ocean ridge systems to the west and to the east of Greenland.



*Deformation structures in the mountain range on Ellesmere Island (Canadian Arctic)*



*Volcanic rock and sedimentary sequences deposited approximately 470 million years ago on the north shore of Ellesmere Island*

The structural geology work on Ellesmere Island was accompanied by ship-based marine geophysical and aeromagnetic investigations in the Nares Strait in cooperation with Canadian and Greenland-Danish institutions (NARES STRAIT I). The aim of the research was to determine the exact line of the Wegener Fault between the Greenland and North American plates, and the associated sedimentary basins: When two continental plates move past each other along a transform fault, a sedimentary basin may "open" in this fault zone, and may be of interest when prospecting for hydrocarbon deposits. Several Tertiary sedimentary basins were found within the Nares Strait, as well as fault zones running parallel to the coastlines.

Despite these investigations, it has still not been possible to prove beyond doubt the existence of the Wegener Fault in the southern part of the Nares Strait. Old basaltic dikes were traced from western Greenland across the Nares Strait up to Ellesmere Island using the aeromagnetic surveys (NARES STRAIT II), which argues against an offset in this part. Further investigations are being planned.

Another focus of the work is the Pearya Terrane at the northern margin of Ellesmere Island. The question currently being looked at is whether Pearya was originally connected to Spitsbergen and remained behind as a small part of Europe when North America and Spitsbergen finally separated when the ocean basin opened.





## Volcanic rocks as time markers in the Arctic area

Volcanic rocks formed in conjunction with the complex opening of the Arctic Ocean (which continues to this day) are widespread in the circum-Arctic onshore area (Franz Josef Land, Spitsbergen, DeLong Islands, Canadian Arctic islands, North Greenland) and offshore (Morris Jesup Rise, Yermak Plateau, Alpha Ridge, Arctic Mid-Ocean Ridge). The offshore work of the BGR discovered the volcanic continental margins in the Arctic area, e.g. south of Spitsbergen and east of Greenland.

The BGR's onshore work was mainly concentrated on the chronological and magma-genetic correlation of volcanic provinces on the Canadian Arctic islands and North Greenland, which may provide important time markers for the tectonic events described above.



*North Greenland, Cape Washington –  
collecting volcanic rock samples on the coast of the Arctic Ocean*

Narrow sedimentary basins formed on Ellesmere Island directly at the western margin of the Nares Strait in Canada. The sediments are rich in fragments of volcanic rock and in magnetic minerals, causing positive anomalies of the Earth's magnetic field. Aeromagnetism allows these basin structures to be traced offshore in the Nares Strait in the direction of the Lincoln Sea. The structure and arrangement of the basins suggest that they were formed by movement along a transform fault (the Wegener Fault).

Volcanic pebbles from the basins were analyzed petrographically and geochronologically: This indicated they originated in a volcanic center that was active about 60 million years ago. Because the volcanogenic sediments form the lowest part of the fossil-poor sequence, they are an important time marker for the "opening" of the basin and thus for the tectonic activity along the Wegener Fault. The volcanoes are either completely eroded in the meantime or they have been covered by water and ice.



## Genesis and natural resource potential of ophiolite complexes in the Polar Urals

The Urals are an elongated fold belt at the suture between Europe and Asia, which was formed approximately 300 million years ago due to collision. Large ophiolite complexes consisting of fossil oceanic crust and mantle rock are strung together in the central area of the mountain range like pearls on a string. These rocks contain chromium and platinum.

Because the chromite deposits in the southern Urals have belonged to Kazakhstan since the dissolution of the Soviet Union, the chromite occurrences in the Polar Urals are a matter of particular interest to Russia. The BGR is mainly interested in carrying out research as part of a pan-European study on the genesis of chromium ore and platinum metals. Plate tectonic as well as mineral resource aspects were looked at during the three PURE expeditions conducted together with scientists from institutes of the Russian Academy of Sciences in Moscow and Syktyvkar. The targeted area was the Voykar ophiolite complex south of Vorkuta.

The studies revealed that two parts of the ophiolite sequence are characterized by chromium ore enrichments of different textures.

The following inferences can be drawn:

- The orebodies are distributed irregularly, have highly variable form, and only extend over short distances. The ore thickness varies; coarse-grained, compact high-grade chromite ore only occurs locally.
- The orebodies are mainly located in logistically very unfavorable positions in the morphologically highest parts of the Polar Urals.
- The number of ore mineralizations, however, increases significantly from the southern Voykar complex towards the northeast to the adjoining Ray-Iz complex, where chromite ore is being mined.
- The potential for platinum group elements (and gold) has been assessed as low for the eastern part of the Polar Urals. Exceptions are two chromium ore occurrences in the central Voykar ophiolite, which are characterized by elevated platinum and palladium concentrations.



*Fieldwork during the PURE 2002 and 2003 expeditions in the Polar Urals*

*Rock sequence of chromite (black) and dunite (yellowish) from the mantle/crust transition zone of the Ray-Iz complex*





*Geologists in the mountains of the Canadian Arctic*





## Future Focus

Based on the previous research results, the BGR and other research groups intend to investigate higher-level topics, arising from the international (e.g. SCAR/IASC) and national (e.g. DFG) basic research activities. To this end, cooperation has been intensified at the national level with the AWI and German universities, as well as within the BGR, e.g. with Marine Geosciences.

The project planning of the BGR's polar research is concentrated on the following main research priorities:

### Antarctic

- Geodynamic processes in connection with the formation and breakup of supercontinents (Rodinia, Gondwana, Pangaea)
- Structure and development of the fossil active continental margins and of the recent subduction system of the Antarctic
- Comparison of the geodynamic development of Antarctica with corresponding areas in the other southern continents
- Mesozoic and Cenozoic geodynamics and neotectonics: Development of the passive continental margin and the rift systems of Antarctica as well as their correlation to structures such as subglacial lakes and mountains in the interior of the continent
- Paleoclimatic development and importance of the Antarctic in the global climate system (e.g. ANDRILL)

### Arctic

- Plate tectonic reconstruction of the opening of the Arctic Ocean
- Correlation of pan-continental systems (e.g. fold belts, rift systems, sedimentary basins) and their geodynamic development
- Evaluation and assessment of the natural resource potential of the Arctic region
- Paleoclimatic development of the Arctic region





Chapter 7

## Publications and Public Relations

The results of the scientific work in the polar regions, which are largely cooperation projects, are presented at national and international workshops and conferences (see Appendix) and published as expedition volumes, for instance in the "Geologisches Jahrbuch" of the BGR: 11 volumes have been published so far as "Polar Issues".

The results of the EUROSACK, NARES STRAIT, PCMEGA, GANOVEX VIII and CASE 4 to 6 expeditions conducted as part of international cooperation projects were published in the journals "Polarforschung" (DGP), "Terra Antarctica" (Italy), as well as in the "GSC Bulletin" (Canada).

The expedition volumes also contain numerous geological and geophysical maps. In addition, a series of geological maps of North Victoria Land at a scale of 1 : 250,000 is being published as a German-Italian coproduction. Seven maps have been prepared with the technical supervision of the BGR (see adjacent outline map).

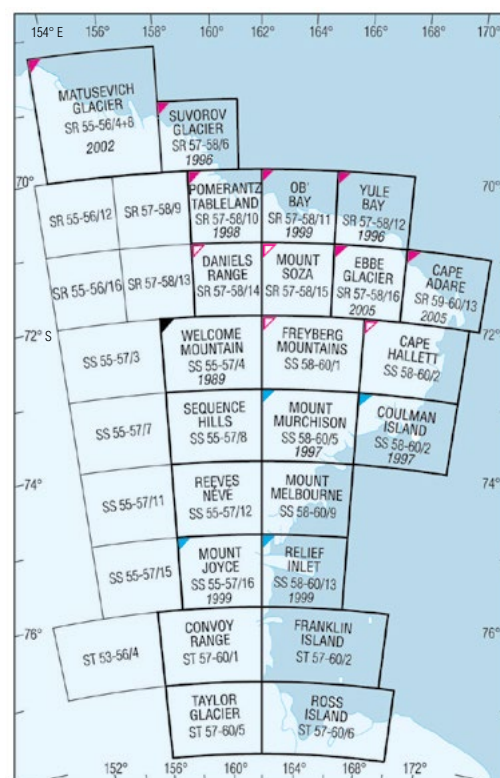
In total more than

**800 individual papers,**

based on participation in the BGR's onshore expeditions have been published.

A current list of publications can be found on our website:

<http://www.bgr.bund.de/publikationsliste-polarforschung>



BGR, 1996

planned by BGR

PNRA, 1997

USGS, 1989

## Volumes of the "Polar Issue" series published to date

Polar Issue	Expedition Year	published as "Geologisches Jahrbuch"
	No. 1 GANOVEX I 1979/80	Geol. Jb., B 41; GANOVEX (1981) 277 pp., 126 figs., 5 tables, 3 pls.
	– GANOVEX II 1981/82	<i>Shortly after the beginning of fieldwork the GANOVEX II -Expedition had to be cancelled due to the sinking of the research vessel Gotland II. Some results have been published in Polar Issue No. 2</i>
	No. 2 GANOVEX III 1982/83	Geol. Jb., B 60; N. W. ROLAND (ed.): GANOVEX III, Volume I (1984) 399 pp., 193 figs., 44 tables
	No. 3 GANOVEX III 1982/83	Geol. Jb., B 66; F. TESSENSOHN & N. W. ROLAND (eds.): GANOVEX III, Volume II (1987) 321 pp., 111 figs., 28 tables, 1 map
	No. 4 GANOVEX IV 1984/85	Geol. Jb., E 38; D. DAMASKE & H.-J. DÜRBAUM (eds.): GANOVEX IV (1989) 521 pp., 256 figs., 51 tables, 2 pl., 1 map
	No. 5 GANOVEX V 1988/89	Geol. Jb., E 47; D. DAMASKE & J. FRITSCH (eds.): GANOVEX V (1993) 436 pp., 185 figs., 39 tables, 1 pl.
	No. 6 GANOVEX V 1988/89	Geol. Jb., B 89; N. W. ROLAND (ed.): GANOVEX – From Oates Coast to Marie Byrd Land (1996) 370 pp., 131 figs., 27 tables, 6 pls.
	No. 6 GANOVEX VI 1990/91	
	No. 6 GANOVEX VII 1992/93	
	No. 7 CASE 1 1992	Geol. Jb., B 91; F. TESSENSOHN (ed.): Intra-Continental Fold Belts – CASE 1 – West Spitsbergen (2001) 773 pp., 237 figs., 28 tables, 37 pls., 1 map
	No. 8 GANOVEX VII 1992/93	Geol. Jb., B 95; S. ESTRADA (ed.): Geology and Geophysics of Marie Byrd Land, Northern Victoria Land, and Oates Coast (2003) 235 pp., 80 figs., 10 tables
	No. 9 GANOVEX V 1988/89 ITALIANTARTIDE IV, V 1989/90	Geol. Jb., B 85; F. TESSENSOHN & C. A. RICCI (eds.): Aspects of a Suture Zone – The Mariner Glacier Area, Antarctica (2003) German-Italian Collaborative Research in Antarctica 444 pp., 135 figs., 40 tables, 8 pls., 1 map
	No. 10 GEOMAUD 1995/96	Geol. Jb., B 96; H.-J. PAECH (ed.): International GeoMaud Expedition of the BGR to Central Dronning Maud Land, Volume I – Geological Results (2004) 497 pp., 134 figs., 47 tables, 27 pls., 3 maps
	No. 11 GEOMAUD 1995/96	Geol. Jb., B 97; H.-J. PAECH (ed.): International GeoMaud Expedition of the BGR to Central Dronning Maud Land, Volume II – Geophysical and other Results (2005) 410 pp., 140 figs., 26 tables, 1 pl., 4 maps



The results of the different expeditions are accessible to the general public. This is done via various means:

- **Expeditions** are accompanied by journalists and camera teams, who report their impressions in the press, on TV and in the Internet. In addition, five popular science films were made, which can be rented from BGR. A list is published in the Internet:  
<http://www.bgr.bund.de/filme-polarforschung>
- **Lectures** in schools, clubs and scientific societies
- **Exhibitions**
- **Presentations** (e.g. for the "Open House Presentations" in the Geozentrum Hannover/in the BMWi Berlin)
- **Internet**

## Highlights

- **Year of the Geosciences** (2002)
  - BGR information booth "Unter Meer und Eis – Die Grauzonen um unsere Kontinente" (Inauguration event in the "Europa Center" in Berlin, January 16–19, 2002)
  - BGR special exhibition "Gebirge im Eis" ("Erlebnisswelt steinzeichen steinbergen" in Steinbergen, March 29 to October 31, 2002)
  - Contribution to the exhibition "Universitas Antarctica, 100 Jahre deutsche Südpolar-expedition 1901–1903 unter der Leitung Erich von Drygalskis" (Joint project between DGP and Institut für Länderkunde Leipzig, touring exhibition)
- **International Polar Year** (March 2007 to March 2009)
  - Participation in the German IPY committee
  - BGR exhibition booth on the topic "Internationale Zusammenarbeit der BGR auf dem Gebiet der Arktisforschung" (33<sup>rd</sup> International Geological Congress (IGC) in Oslo, August 06–14, 2008)
  - Arctic exhibition "Spitzbergen auf Reisen – Polarforschung made in Hannover" (part of the scientific month in the New Townhall in Hannover, October 31 to November 11, 2008)
- **Touring exhibition "Expedition: Arktis – Zukunftsforschung im Hohen Norden"** of the AWI and the BGR (March/April 2009 in the Foreign Office in Berlin; May/June 2009 in the Erlebniszentrum Naturgewalten in List on Sylt)





# Appendix

BGR participation in expeditions organized by other institutions ... in the <b>Antarctic</b> and <b>Arctic</b> .....	55
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## BGR participation in expeditions organized by other institutions ... in the **Antarctic**



Year	Expedition	Target area	Lead Organization	Number of BGR-participants / department
1976/77	AIRS	South Victoria Land (Dry Valleys)	NSF, Univ. Kansas	1 / Geology for Aerogeophysics
1977/78	AIRS	South Victoria Land, Marie Byrd Land	NSF, Univ. Kansas	2 / Geology, Surveying
1978/79	AIRS	South Victoria Land (Darwin Glacier)	NSF, Univ. Kansas	2 / Geology, Surveying
1978/79		Antarctic Peninsula	Argentina	1 / Exchange of experience concerning Logistics
1978/79		McMurdo Sound	DSIR (NZ)	2 / Glacial Geology, Technology
1979/80	AIRS	Ellsworth Mountains	NSF, Univ. Kansas	2 / Geology, Technologys
1980/81	AIRS	South Victoria Land (Dry Valleys)	NSF, Univ. Kansas	2 / Geology, Technology
1980/81	ANT	Weddell Sea	AWI	1 / Building G.-v.-Neumayer-Station
1981/82	AIRS	North Victoria Land	NSF	1 / Technology
1982/83	AIRS	South Victoria Land (Szabo Bluff, Scott Glacier)	NSF, Univ. Kansas, Canada	2 / Glacial Geology, Technology
1983/84		Antarctic Peninsula and West Antarctica	BAS	1 / Aerogeophysics
1983/84	ANT	Weddell Sea	AWI/Univ. Münster	1 / Aeromagnetics, Radar
1984/85		North Victoria Land	DSIR	2 / Geology
1986/87	ITALIANTARTIDE	North Victoria Land	ENEA	1 / Logistics consulting
1986/87	ANT V/4	Shackleton Range, Halley Bay, G.-v.-Neumayer-Station	AWI	1 / Logistics, Magnetics
1990/91	USAP	South Victoria Land	NSF	1 / Meteorite Research
1991/92	GITARA I	North Victoria Land	ENEA	2 / Aeromagnetics
1994/95	ACRUP	North Victoria Land	ENEA	2 / Gravimetry, Radar
1994/95	GITARA IV	North Victoria Land	ENEA	1 / Aeromagnetics, Gravimetry
1994/95	CASERTZ	Marie Byrd Land	NSF/Univ. Texas	1 / Aerogeophysics
2006/07	ANDRILL	Ross Ice Shelf	NSF	1 / Geology
2007	ANT XXXIII / 9	Prydz Bay, Kerguelen Plateau	AWI	1 / Aeromagnetics

## ... in the **Arctic**



Year	Expedition	Target area	Lead Organization	Number of BGR-participants / department
1988	MSE 3	Spitsbergen	Univ. Münster	1 / Geology
1991	SPE '91	Spitsbergen	Univ. Stuttgart	1 / Geology
2005		Spitsbergen	NPI	1 / Geology
2007		Siberia	VSEGEI	2 / Geology
2008		Spitsbergen	UNIS	1 / Geology





## Domestic and foreign cooperation partners ... in the **Antarctic**

- AWI, Alfred-Wegener-Institut für Polar- und Meeresforschung (Bremerhaven)
- BKG, Bundesamt für Kartographie und Geodäsie (Frankfurt am Main)  
(former "Institut für Angewandte Geodäsie, IfAG"; Frankfurt)
- DGP, Deutsche Gesellschaft für Polarforschung (Bremerhaven)
- DWD, Seewetteramt Hamburg (Hamburg)
- GFZ, Helmholtz-Zentrum Potsdam – Deutsches GeoForschungsZentrum (Potsdam)
- IWF, Wissen und Medien gGmbH (Göttingen)  
(former "Institut für den Wissenschaftlichen Film, IWF"; Göttingen)
- LBGR, Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (Cottbus)  
(former "Landesamt für Geowissenschaften und Rohstoffe Brandenburg, LGRB"; Kleinmachnow)
- LBEG, Landesamt für Bergbau, Energie und Geologie (Hannover)  
(former "Niedersächsisches Landesamt für Bodenforschung, NLfB"; Hannover)
- LIAG, Leibniz-Institut für Angewandte Geophysik (Hannover)  
(former "Institut für Geowissenschaftliche Gemeinschaftsaufgaben, GGA"; Hannover)
- Max-Planck-Institut für Chemie (Otto-Hahn-Institut) (Mainz)
- ZIPE, Zentralinstitut für Physik der Erde (Potsdam)  
(external university research institute of the Academy of Sciences GDR)

### Universities

- Hochschule Bochum  
(former "FH Bochum")
- FH München, Fakultät für Geoinformation
- TU Bergakademie Freiberg, Institut für Geologie
- TU Braunschweig, Institut für Geophysik und Extraterrestrische Physik  
(former "Institut für Geophysik und Meteorologie")
- TU Darmstadt, Geologisch-Paläontologisches Institut
- TU Dresden, Institut für Planetare Geodäsie
- RWTH Aachen, Lehr- und Forschungsgebiet Geologie – Endogene Dynamik  
RWTH Aachen, Angewandte Geophysik (FB Bohrlochgeophysik)
- Ruhr-Univ. Bochum, Institut für Geologie, Mineralogie & Geophysik
- Univ. Bremen, Fachbereich Geowissenschaften (FB5)
- Univ. Erlangen-Nürnberg, GeoZentrum Nordbayern
- Univ. Frankfurt, Geologisch-Paläontologisches Institut
- Univ. Freiburg, Mineralogisch-Geochemisches Institut
- Univ. Göttingen, Geochemisches Institut der Universität  
Univ. Göttingen, Institut für Geologie und Dynamik der Lithosphäre



- Univ. Hannover, Institut für Erdmessung  
Univ. Hannover, Institut für Mineralogie
- Univ. Hamburg, Institut für Geophysik
- Univ. Jena, Institut für Geowissenschaften
- Univ. Kiel, Geologisch-Paläontologisches Institut  
Univ. Kiel, Institut für Polarökologie
- Univ. Köln, Abteilung Nuklearchemie
- Univ. Mainz, Institut für Geowissenschaften
- Univ. München, Geophysikalisches Observatorium Fürstenfeldbruck
- Univ. Münster, Forschungsstelle für Physikalische Glaziologie  
Univ. Münster, Geologisch-Paläontologisches Institut  
Univ. Münster, Institut für Geophysik
- Univ. Potsdam, Institut für Biochemie und Biologie
- Univ. Würzburg, Mineralogisches Institut

## Australia

- AAD, Australian Antarctic Division (Kingston, TAS)
- Bureau of Mineral Resources (Canberra, ACT)
- Darling Downs Institute, School of Applied Sciences (Toowoomba, QLD)
- Geological Survey of Tasmania (Hobart, TAS)
- Univ. Adelaide, Dept. of Geology & Geophysics (Adelaide, SA)
- Univ. Melbourne, School of Earth Sciences (Melbourne, VIC)
- Macquarie Univ., Dept. of Physical Geography (Sydney, NSW)
- Univ. Tasmania, Dept. of Geology (Hobart, TAS)

## Italy

- ENEA, Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (Rom)
- INGV, Istituto Nazionale di Geofisica e Vulcanologia (Rom)
- Osservatorio Geofisico Sperimentale (Triest)
- Univ. di Bologna (Bologna)
- Univ. di Genova, Dip. di Scienze della Terra, Sez. Geofisica (Genua)
- Univ. Napoli, Dip. di Geofisica e Vulcanologia (Neapel)
- Univ. Pisa, Dip. di Scienze della Terra (Pisa)
- Univ. Ravenna (Ravenna)
- Univ. Roma III, Dip. di Scienze Geologiche (Rom)
- Univ. di Siena, Dip. di Scienze della Terra (Siena)
- Univ. di Torino, Dip. di Scienze Mineralogiche e Petrologiche (Turin)



## Great Britain

- BAS, British Antarctic Survey (Cambridge)

## New Zealand

- DSIR, Dept. of Scientific and Industrial Research (Lower Hutt)
- IGNS, Institute of Geological & Nuclear Sciences (Lower Hutt)
- New Zealand Geological Survey (Christchurch)
- Canterbury Univ. (Christchurch)
- Victoria Univ. Wellington, Dept. of Geophysics (Wellington)

## Netherlands

- Rijks Geologische Dienst (Haarlem)
- Univ. Amsterdam, Fysisch Geograf. en Bodenkundig Lab. (Amsterdam)

## Norway

- Univ. Bergen, Institute of Solid Earth Physics (Bergen)

## Russia

- VNIIOkeangeologia (St. Petersburg)
- VSEGEI, A. P. Karpinsky All-Russian Geological Research Institute (St. Petersburg)

## Switzerland

- ETH Zürich, Institut für Mittelenergiephysik (Zürich)  
ETH Zürich, Versuchsanstalt für Wasserbau, Hydrologie u. Glaziologie (Zürich)

## USA

- LDEO, Lamont-Doherty Earth Observatory;  
The Earth Institute at Columbia University (Palisades, NY)
- NSF, National Science Foundation;  
Office of Polar Programs (Arlington, VA)
- USGS, United States Geological Survey (Denver, CO)
- Univ. Alaska, Geophysical Institute (Fairbanks, AK)
- Univ. California, Institute for Crustal Studies (Santa Barbara, CA)
- Univ. Kansas (Lawrence, KS)
- Ohio State Univ., Dept. of Geology and Mineralogy (Columbus, OH)  
Ohio State Univ., Byrd Polar Research Center and Dept. Geol. Sci. (Columbus, OH)
- Oregon State Univ., College of Oceanography (Corvallis, OR)





## Domestic and foreign cooperation partners ... in the Arctic

- AWI, Alfred-Wegener-Institut für Polar- und Meeresforschung (Bremerhaven)
- DGP, Deutsche Gesellschaft für Polarforschung (Bremerhaven)
- Museum für Naturkunde,  
Leibniz-Institut für Evolutions- und Biodiversitätsforschung  
an der Humboldt-Universität zu Berlin (Berlin)
- Senckenberg Naturhistorische Sammlungen Dresden,  
Abteilung Museum für Mineralogie und Geologie (Dresden)  
*(former "Staatliches Museum für Mineralogie und Geologie zu Dresden")*

### Universities

- Univ. Bremen, Fachbereich Geowissenschaften (FB5)
- Univ. Erlangen-Nürnberg, GeoZentrum Nordbayern
- Univ. Halle-Wittenberg, Institut für Geowissenschaften  
(Allgemeine Geologie und Geiseltalmuseum)
- Univ. Münster, Geologisch-Paläontologisches Institut



### Denmark

- Danish Lithosphere Centre (Copenhagen)
- GEUS, Geological Survey of Denmark & Greenland (Copenhagen)  
*(former "Grønlands Geologiske Undersøkelse")*
- KMS, National Survey and Cadastre (Copenhagen)
- Univ. København, Institute of Historical Geology and Palaeontology (Copenhagen)  
Univ. København, Geophysical Institute (Copenhagen)

### France

- Univ. Paris, Depart. Géotectonique (Paris)

### Great Britain

- Univ. Greenwich, School of Earth Sciences (London)

## Canada

- GSC, Geological Survey of Canada (Atlantic),  
Bedford Institute of Oceanography (Dartmouth)
- GSC, Geological Survey of Canada (Calgary)
- GSC, Geological Survey of Canada (Ottawa)
- Polar Continental Shelf Project (Ottawa)
- Dalhousie Univ., Department of Earth Sciences (Halifax)
- Univ. Toronto, Department of Geology (Toronto)

## Netherlands

- Vrije Univ. Amsterdam (Amsterdam)

## Norway

- Norsk Polarinstitut (Tromsø)
- UNIS, The University Centre in Svalbard (Longyearbyen)

## Russia

- Russian Academy of Sciences :
  - Geological Institute (Moscow)
  - Institute of Geology and Geochemistry (Yekaterinburg)
  - Komi Science Center (Syktyvkar)
- Jakutian Academy of Sciences (Jakutsk)
- VNII Okeangeologia (St. Petersburg)
- VSEGEI, A. P. Karpinsky All-Russian Geological Research Institute (St. Petersburg)

## USA

- Univ. Idaho, Dep. of Geological Sciences (Moscow, ID)

## Conferences and Workshops

### Organization of international conferences

- **ICAM III**

*3<sup>rd</sup> International Conference on Arctic Margins*

BGR responsible for organizing and running the international **Arctic Conference** "ICAM III" (October 12–16, 1998, in Celle)

- **ISAES IX**

*9<sup>th</sup> International Symposium on Antarctic Earth Sciences*

BGR involved in organizing and running the international **Antarctic Conference** "ISAES IX" (September 8–12, 2003, in Potsdam)

### Workshops



#### **GANOVEX Workshops**

*German Antarctic North Victoria Land Expeditions*

September 1981	Workshop GANOVEX I, preparation GANOVEX II (BGR, Hannover)	
03.09. – 07.09.1984	Geoscientific Antarctic Workshop GANOVEX III (BGR, Hannover)	
04.02. – 07.02.1986	Geoscientific Antarctic Workshop GANOVEX IV (BGR, Grubenhagen)	
26.11. – 28.11.1990	Pre-Expedition Workshop GANOVEX VI (Antarctic Center, Christchurch (New Zealand))	
22.05. – 24.05.1991	Terra Nova Workshop: German-Italian Workshop (BGR, Hannover)	
24.11. – 26.11.1992	Pre-Expedition Workshop GANOVEX VII: (Antarctic Center, Christchurch (New Zealand))	
24.09. – 27.09.2001	Workshop GANOVEX VIII (BGR, Grubenhagen)	
14.10.2004	Pre-Expedition Workshop GANOVEX IX (BGR, Hannover)	

### **LIRA Workshops**

*Lithospheric Investigations in the Ross Sea Area*

- 28.09. – 02.10.1992 Uplift of the Transantarctic Mountains  
(Haarlem, Netherlands)
- 03.06. – 05.06.1993 Crustal Structure Transantarctic Mountains and Ross Sea  
(Triest, Italy)
- 20.10. – 22.10.1994 Ross Orogen: Crustal Structure and Plate Tectonic Significance  
(Dallas, TX, USA)
- 03.09. – 05.09.1996 Backside of the Transantarctic Mountains  
(Hannover, Germany)

### **GEISHA Workshop**

*Geological Expedition to the Shackleton Range*

- 23.04. – 27.04.1990 Results of the Shackleton Range Expedition  
(Hannover)



### **EUROSHACK Workshop**

*European Expedition to the Shackleton Range*

- 23.04. – 25.04.1996 Erlangen



### **GEOMAUD Workshops**

*Geoscientific Expedition to Dronning Maud Land*

- 18.10. – 20.10.1996 Grubenhagen
- 17.10. – 19.10.1997 Grubenhagen
- 27.03. – 28.03.1998 Grubenhagen



### **PCMEGA Workshops**

*Prince Charles Mountains Expedition of Germany & Australia*

- 09.08.2002 Pre-Expedition Workshop  
(Hannover)
- 20.11. – 22.11.2002 Pre-Expedition Workshop  
(AAD, Kingston, Tasmania)
- September 2003 First results,  
Workshop during "ISAES IX"  
(Potsdam)



## IPY/GIGAGAP Workshop

*Geoscientific Insights of Greater Antarctica in the Area from Gamburtsev Mountains, Amery Ice Shelf to Prydz Bay*

20.06 – 22.06.2005 International Workshop, project planning  
(Hannover)



## CASE Workshops

*Circum-Arctic Structural Events*

04.02. – 08.02.1993 Hannover  
21.08. – 24.08.1993 Hamburg  
16.03. – 18.03.1994 CASE 1, Scientific evaluation  
(Copenhagen)  
16.05. – 17.05.1995 CASE 2, First results  
(Hannover)  
  
September 1998 CASE 4  
(Münster)  
  
07.08.1999 Resolute  
01.10.1999 Münster  
17.01. – 18.01.2000 Erlangen  
08.03.2000 Frankfurt  
August 2000 Hannover  
April 2001 German-Canadian Final Workshop  
CASE 4 to 6  
(Erlangen)







# Glossary

## *Official names of the institutions involved in this report*

AAD	Australian Antarctic Division
ACRUP	Antarctic Crustal Profile
AGAP	Antarctica's Gamburtsev Province
AIRS	Antarctic International Radiometric Survey
ANDRILL	Antarctic Drilling Program
ANT	Antarctic
ASAP	Aeromagnetic Surveys for the Andrill Program
ATCM	Antarctic Treaty Consultative Meeting
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung
BAS	British Antarctic Survey
BMBF	Bundesministerium für Bildung und Forschung
BMWi	Bundesministerium für Wirtschaft und Technologie <i>(former "Bundesministerium für Wirtschaft und Arbeit")</i>
CASE	<i>Initially acronym for "Correlation of Alpine Structural Events", from CASE 3 for "Circum-Arctic Structural Events"</i>
CASERTZ	Corridor Aerogeophysics of the Southeastern Ross Transect Zone
CRAMRA	Convention on the Regulation of Antarctic Mineral Resources Activities
DFG	Deutsche Forschungsgemeinschaft
DGP	Deutsche Gesellschaft für Polarforschung e.V.
DSIR	Department of Scientific and Industrial Research (New Zealand) <i>(today "Institute of Geological and Nuclear Sciences Ltd.", GNS Science)</i>
ENEA	Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (Italy) <i>(today "Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile")</i>
EUROSHACK	European Expedition to the Shackleton Range
FKPE	Forschungskollegium Physik des Erdkörpers e.V.
GANOVEX	German Antarctic North Victoria Land Expedition
GEISHA	Geological Expedition to the Shackleton Range
GEOMAUD	Geoscientific Expedition to Dronning Maud Land
GIGAGAP	Geoscientific Insights of Greater Antarctica in the Area from Gamburtsev Mountains, Amery Ice Shelf to Prydz Bay

GIGAMAP	German-Italian Geological Antarctic Map Program
GITARA	German-Italian Aeromagnetic Research in Antarctica
GSC	Geological Survey of Canada
IASC	International Arctic Science Committee
ICAM	International Conference on Arctic Margins
IPY	International Polar Year
ISAES	International Symposium on Antarctic Earth Sciences
ITALIANTARTIDE	Spedizione Italiana in Antartide
LBEG	Landesamt für Bergbau, Energie und Geologie (Hannover) <i>(former "Niedersächsisches Landesamt für Bodenforschung", NLFb)</i>
LIAG	Leibniz-Institut für Angewandte Geophysik (Hannover) <i>(former "Geowissenschaftliche Gemeinschaftsaufgaben", GGA)</i>
LIRA	Lithospheric Investigations in the Ross Sea Area
MSE 3	Münsteraner Spitzbergen Expedition 3
NAPA	Nationales Polarprobenarchiv
NARES STRAIT	Nares Strait Expedition
NOGRAM	Northern Greenland Gravity and Aeromagnetics
NPI	Norsk Polarinstitut (Norway)
NSF	National Science Foundation (USA)
PCMEGA	Prince Charles Mountains Expedition of Germany and Australia
PMAP	Polar Margins Aeromagnetic Program
PNRA	Programma Nazionale di Ricerche in Antartide
PURE	Polar Urals Expedition
QueenMET	Queen Maud Land Meteorites Search Expedition
REVEAL/CTAM	Remote Views and Exploration of Antarctic Lithosphere / Central Transantarctic Mountains

SCAR	Scientific Committee on Antarctic Research
SPE '91	Geoscientific Spitsbergen Expedition 1991
TAMARA	Transantarctic Mountains Aerogeophysical Research Activities
UNO	United Nations Organization
UNIS	The University Centre in Svalbard
USAP	United States Antarctic Program
USGS	United States Geological Survey
VSEGEI	A. P. Karpinsky All-Russian Geological Research Institute (St. Petersburg)
WTZ	Wissenschaftlich-Technologische Zusammenarbeit







*The Gondwana Station  
of the BGR  
at the Gerlache Inlet, Terra Nova Bay (Ross Sea),  
photographed at the end of January 2006*

## Picture credits

The photos were provided by courtesy of the members of the Geozentrum Hannover and by the participants of the BGR expeditions.

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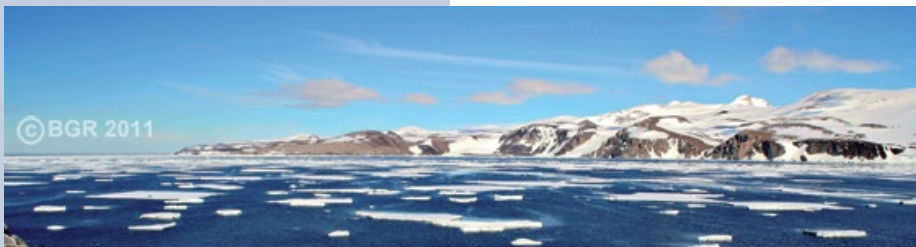
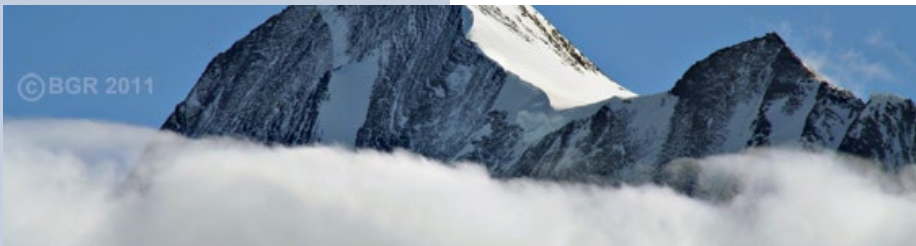
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Geowissenschaften  
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