

Expedition to Spitsbergen (June 1978 — July 1979)

A research expedition to Spitsbergen was organized by Institute of Geophysics, Polish Academy of Sciences. The members of the expedition had to modernize the Polar Station of Institute of Geophysics in the Hornsund Fiord, prepare it to a work all the year round and carry through systematic meteorologic, seismic and magnetic observations as well as a full year series of periglacial studies. The expedition was prepared under a substantial control of the Committee of Polar Research with a cooperation of Institute of Ecology, Polish Academy of Sciences and of the Group for Realization of Polar Expeditions at the Organization-Legal Office, Polish Academy of Sciences.

The expedition that set off in June 1978 to Spitsbergen had to modernize first of all the Polar Station in the Hornsund Fiord (Figs. 1, 2- and 3). The station was built in 1957 during a polar summer. It was exploited by Polish Academy of Sciences during the IIIrd International Geophysical Year since 1957 until September 1960. After a long period of its unexploitation the Geographical Institutè, Wrocław University adapted it as a summer base for research groups working at Spitsbergen from 1970 to 1974. Basing on the main building of the station the scientists of Institute of Geophysics, Polish Academy of Sciences worked in the Hornsund area as well (in 1962—1975).

The scientific expeditions that worked in 1957—1975 basing on the Polish Polar Station at Spitsbergen, included about 140 members (not taking into account the ship crews that transported the expeditions and among them 90 scientists of various disciplines. Polish scientists took part in detailed exploration of southern Spitsbergen. Until 1957 this area had been badly scientifically penetrated, mainly due to unfavourable weather and ice conditions. Nowadays, in result of work of Polish scientists it is one of the best known polar regions not only of Spitsbergen but also in the whole Arctic. The lands of Wedel-Jarlsberg and Torell have been investigated in detail. In the station by the Hornsund Fiord ten scientists worked during a polar winter of 1957/58 under a leadership of an experienced polar explorer Professor Stanisław Siedlecki.



Fig. 1. Localization of the Polar Station of PAS at Spitsbergen

Prepared many years plan of polar scientific works provided that during the polar winter of 1978/79 a ten-person scientific-technical team would remain at Spitsbergen. The leaders of the expedition had an uneasy task. The expedition was prepared during five months only, from February to June 1978. A realization of that was possible due to enormous goodwill of many institutions and factories.

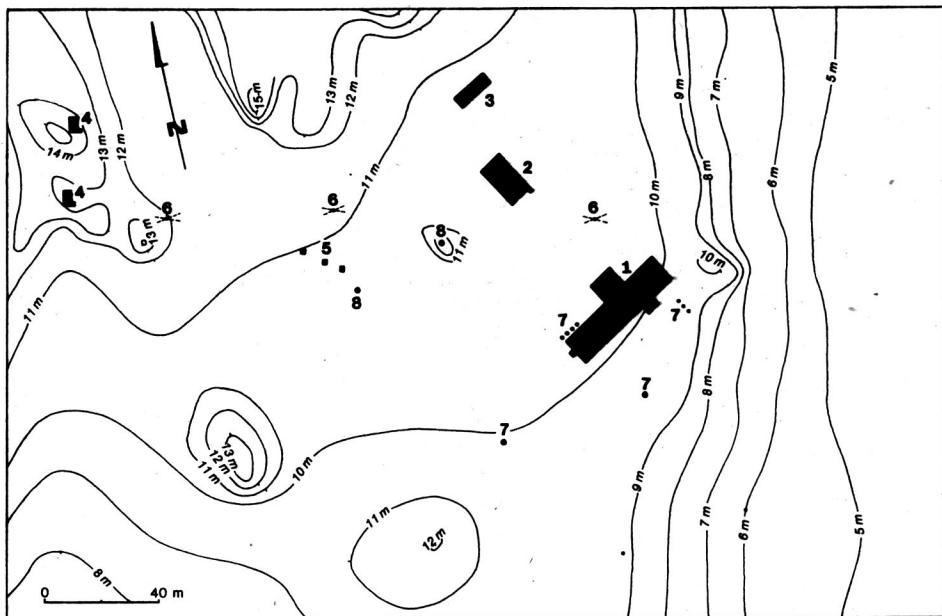


Fig. 2. Polar Station at the Hornsund Fiord

1 — main building of the station — scientific laboratories and living rooms, 2 — aggregate building (power station), 3 — old aggregate building constructed in 1957, 4 — magnetic pavilions, 5 — meteorologic cages, 6 — lamps, 7 — radio station and flag masts, 8 — meteorologic masts

The leadership of the expedition was held by: a leader of the expedition — Professor Jan Szupryczyński, an assistant of a leader for technical matters — Janusz Jeleński, Eng., as assistant of a leader for marine matters — Marian Fabisz, Eng.

Members of the expedition:

I. Winter group 1978/79:

1. Prof. Jan Szupryczyński
2. Doc. Stefan Cieśliński
3. Dr. Mieczysław Banach
4. Ireneusz Dobruchowski, Eng.
5. Edward Jarmuszewski, M.Sc.
6. Bogdan Ołędzki, Eng.
7. Tomasz Petelski, M.Sc.
8. Tadeusz Pieńkowski
9. Bogdan Rudzki, M.D.
10. Jerzy Sacewicz

II. Scientific group:

1. Dr. Marek Grześ
2. Zbigniew Jabłoński, M.Sc.
3. Dr. Piotr Kłysz
4. Dr. Józef Liebersbach
5. Zbigniew Mechliński, M.Sc. Eng.
6. Dr. Janusz Niewiadomski
7. Jerzy Pereyma, M.Sc.

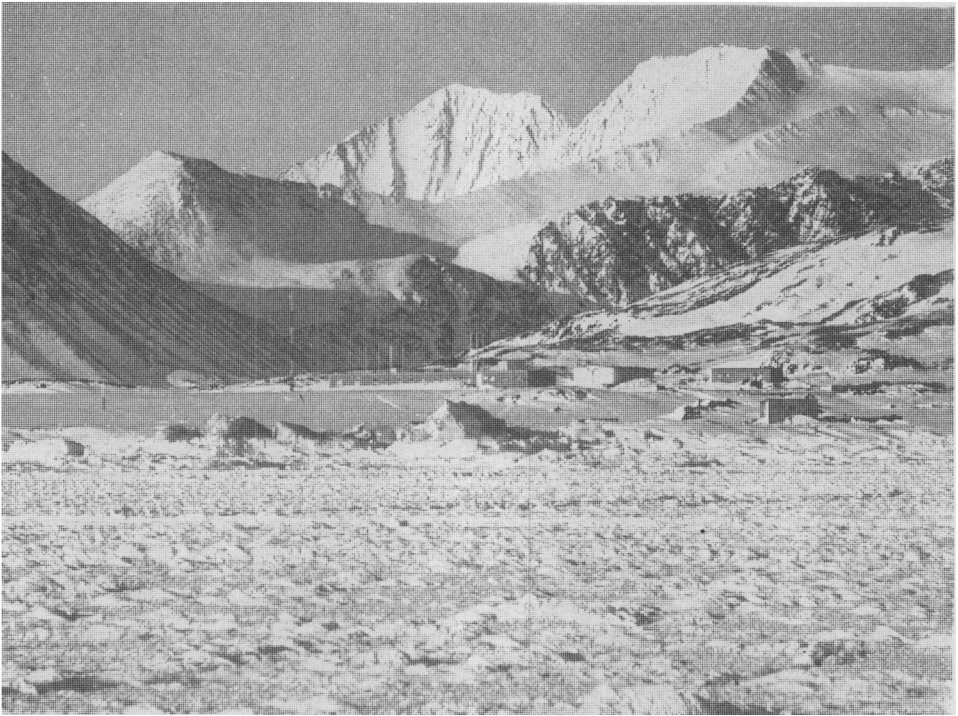


Fig. 3. Polar Station in winter; February 1979

Photo J. Szupryczyński

III. Scientific group of Silesian University:

1. Dr. Jacek Jania
2. Dr. Andrzej Kamiński
3. Andrzej Kozik, M.Sc.
4. Jan Leszkiewicz, M.Sc.

There was also a technical group (23 persons) and a operator group of Polish Television (3 persons).

Therefore, the expedition included 48 members, among them only 15 scientists. The scientific group of Silesian University was not included into the main expedition and worked separately in Gåshamna area, to the south of the Hornsund Fiord. The group of the Polish Television stayed at Spitsbergen from 28th June to 13th July 1978, only during an anchorage of the ship "Kapitan Ledóchowski". The scientists of the main expedition represented the following research institutes: Institute of Geography and Spatial Organization Polish Academy of Sciences — 4 persons, Institute of Geophysics, Polish Academy of Sciences — 1 person, Institute of Geography, Wrocław University — 2 persons, Institute of Geography, Poznań University — 1 person, Institute of Geography, Silesian University — 4 persons, Geological Institute, Warsaw — 1 person, Institute of Meteorology and Water Management — 2 persons, Regional Geodesic-Ordnance Survey, Szczecin — 1 person.

1. Transport

The expedition set off from Gdynia harbour embarked at "Kapitan Ledóchowski" on 23rd June 1978 at 2.40 a.m. under a command of a captain Antoni Tatarski. In a cruise to Spitsbergen 157 persons took part all together — among them 48 expedition members, 47 persons of regular crew and 62 students of the Naval College at Szczecin. A freighted equipment of the expedition weighed 788.4 tons. On 26th June at 5.00 a.m. the ship passed a polar circle. The ship entered the Hornsund on 28th June at 7.00 a.m. (Fig. 4) and at 8.30 a.m. it was anchored in Isbjörnhamna. The route from Gdynia to Hornsund of 1854 NM the ship travelled 5 days 5 hours and 50 minutes so, with a mean speed of 14.73 knots. A debarkation began on 30th June at 10.25 p.m. with a use of a ferry composing of 16 connected pontoons. The ferry was set up on a fiord water after a debarkation of pontoons and cutters from holds the deck (Figs. 5 and 6). Firstly a bulldozer-loader and a cross-country car were debarked, then a tractor and four trailers, afterwards the expedition equipment included in containers of various sizes. The debarkation was carried on in shifts during days and nights and finished on 12th July at 6 p.m. Embarkation of the ferry as well as of scrap metal and rubbish from the station were



Fig. 4. Ship "Kapitan Ledóchowski" in the Hornsund Fiord at Spitsbergen

Photo J. Szupryczyński



Fig. 5. Debarkation of the expedition equipment on a ferry — July 1978

Photo J. Szupryczyński

ended on 13th July at 4.30 a.m. 766.8 tons were debarked of 788.4 tons embarked. The ferry as well as rubbish came back to the country. "Kapitan Ledóchowski" weighed an anchor on 13th July at 11.50 p.m. Weather and ice condition were favourable for debarkation during the ship anchoring in Isbjörnhamna. Since the ship arrival to Hornsund the weather was typical for this area and for that season. There was an eastern wind of 6 degree, in gusts of 7—8 degree. The waves were low and short, moving along the fiord. In Isbjörnhamna, protected from the west by Wilczek — odden, it was more safely but there were quite big breakers at the shore. The next day the wind decreased to 3—4 degree and remained at it almost for the whole anchorage period with changes of its direction only into west-southward, westward and north-westward ones but still the eastward direction predominated. A mean air temperature was about 3 C. Visibility was very good at first, then it got worse — it became foggy and there were occasional rainfalls. The Hornsund Fiord was only slightly icecovered — the ice came entirely from the calving Hans Glacier (ending with an ice cliff in Isbjörnhamna) and from other glaciers in the inner part of the fiord. During the whole ship anchorage the glacial ice made it difficult for a day only to land at the shore. A marine drift ice flowing from the eastern Spitsbergen shore and then, carried northwards along the western sides, several times closed the entrance to the Hornsund Fiord in 50% but it did not enter the fiord itself.

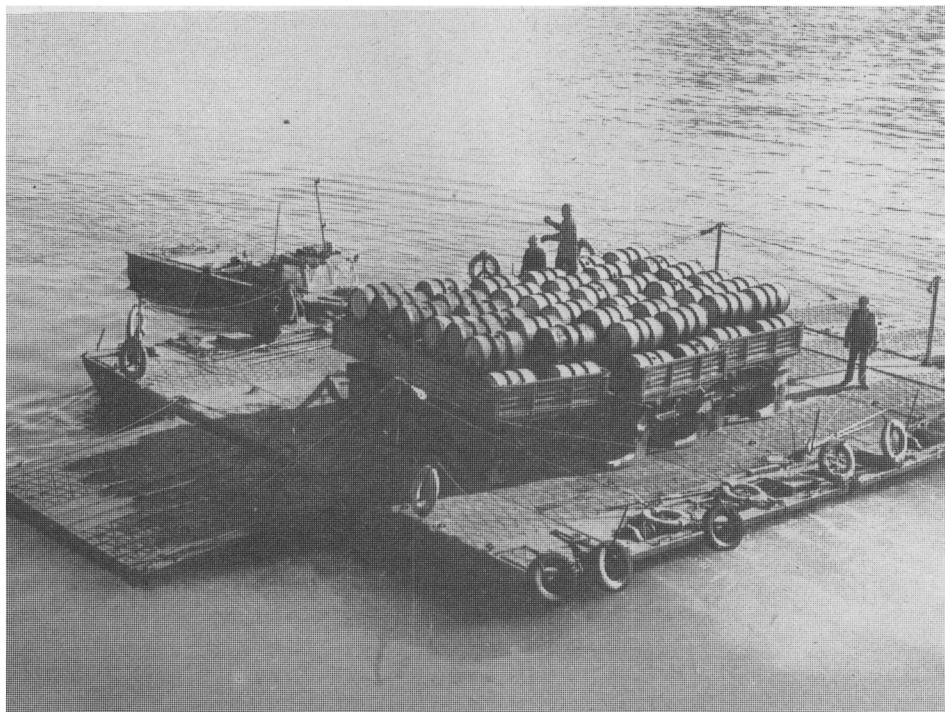


Fig. 6. Transport of fuel from the ship to a shore — July 1978

Photo J. Szupryczyński

2. Technical works

From 15th June to 15th September a renovation of the main building of the Polish Polar Station was done and also a partial development of its hinterland was finished (Fig. 7). The technical works included: overhauling of the main building of about 300 square metres area, constructing of a new building for technical purposes of about 100 square metres (aggregate room, fuel store, workshop and garage with a store of spare parts), constructing of a radio station and foundation of permanent stations — meteorologic, magnetic and seismic ones. For magnetic purposes two magnetic pavilions were built. All the buildings were equipped with electric and energetic supply provided in the project. The area around the station was illuminated by constructing ten mercury-vapour lamps. Six radio masts, two meteorologic masts and three flag mast were done and installed in the station area. Considering an occurrence of permafrost the latter works were very difficult.

An efficiency of technical works was very important for a use of the station during a polar winter for realization of a longterm programme. At the end of a summer season the leaders of the expedition had to modify the programme of the scientific groups and to engage the scientists for technical works to realize entirely building and technical programme. These works were realized in very difficult conditions. During a polar

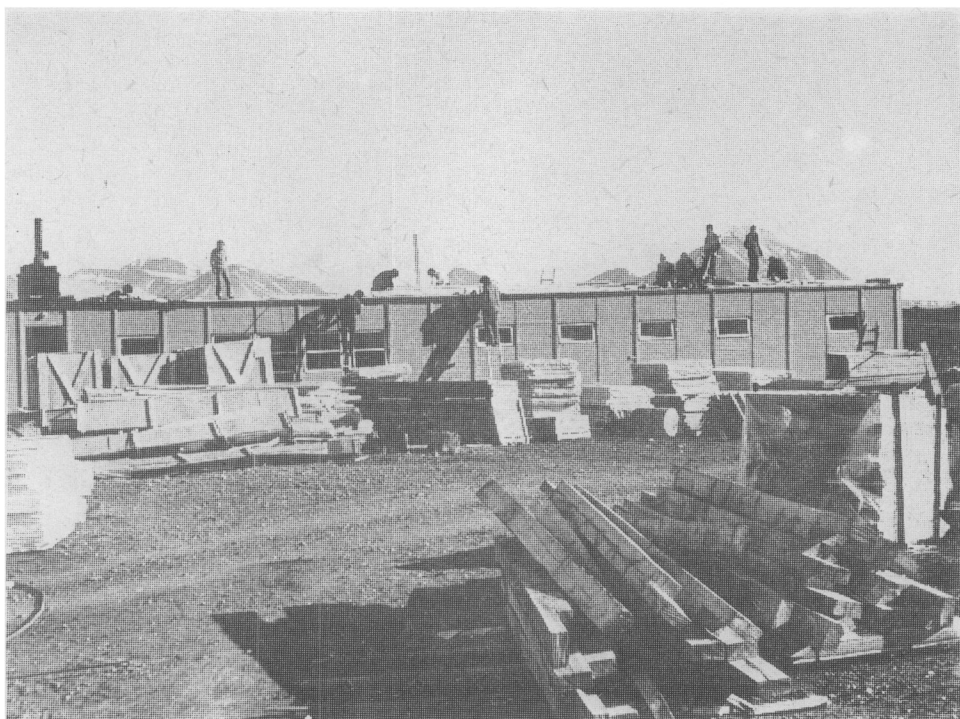


Fig. 7. Renovation works at the Polar Station at Spitsbergen — July 1978

Photo J. Szupryczyński

summer of 1978 the members of the expedition lived in tents. In July there were favourable conditions for realization of constructing works whereas in August the conditions were unfavourable neither for building — technical works nor for field research works. There were as many as 23 days with rainfalls. A mean total of precipitation equalled 83 mm i.e. one fifth of noted mean annual precipitation in Spitsbergen. September was also the unfavourable month. Already on 15th September tundra and mountaineous massifs were covered with snow; a polar winter began rapidly.

On 20th September 1978 there was a solemn opening of the Polish Polar Station at the Isbjörnhamna bank. The Polar Station of Polish Academy of Sciences is localized at the northern seaside of the Hornsund Fiord. Its position is defined by the following geographical coordinates: 77°N and 15°33'E. A distance from the Polar Station to the northern pole equals about 1450 kilometres whereas to Gdynia a sea route is about 3435 kilometres (1854 NM).

3. Research works

3.1. Meteorologic observations and studies

They were started on 1st July 1978. A meteorological station was equipped similarly as the Polish meteorological stations and adapted to play a role of a so-called "synoptic station". The observations included all the

principal data: air temperature, air humidity, atmospheric pressure, wind direction and velocity, cloudiness, atmospheric precipitation and visual observations. Besides, observations of ground temperatures at depths of 10, 20 and 50 cm were done as well as insolation and cooling, measurements of a water equivalent of snow.

Since 1st July until 31st October 1978 the observations were done four times a day at 0.00, 6.00, 12.00 and 18.00 GMT, from 1st November 1978 until 30th June 1979 full observations were done at 6.00, 12.00 and 18.00 GMT and partial ones — at 0.00, 3.00, 9.00, 15.00 and 21.00 GMT. The observations included the data of: air temperatures, atmospheric pressure, direction and speed of wind, ground temperatures and fragmentarily, the visual observations of general cloudiness, atmospheric precipitation, snowstorms, etc. For the most of the year from 1st December 1978 until 15th June 1979 the meteorologic observations absorbed highly the other members of the winter group. It was caused by a necessity of protecting the observer from polar bears.

Since 18th November 1978 three times a day a wire "SYNOP" was sent with the data of 6.00, 12.00 and 18.00 GMT to the Forecast Office of Norwegian Meteorologic Survey by the Norwegian radio stations Svalbard-Radio or Hopen-Radio. During the whole period of the Station work 657 synoptic wires were transmitted.

Mean monthly air temperatures at the Station Isfjord Radio (78°04'N, 13°38'E) of a period 1951—1960) were compared with temperatures noted at the Hornsund Station from July 1978 until June 1979 (Table I).

During twelve months of our stay at Spitsbergen there were ten months with mean temperatures below 0°C. A polar winter of 1978/79 was one of the coolest at Spitsbergen during the last twenty years. Absolute minimum temperatures in every winter month are presented in the Table II.

Table I.

Mean montly air temperatures (°C)

Month	Isfjord-Radio 78°04'N, 13°38'E (1951—1960)	Hornsund Station (1978/1979)
July	5.0	4.3
August	4.5	3.7
September	1.3	-1.0
October	-2.4	-3.3
November	-5.3	-8.3
December	-7.9	-9.6
January	-10.3	-15.4
February	-9.9	-16.6
March	-11.9	-13.5
April	-8.2	-14.1
May	-2.7	-7.6
June	2.1	-0.2
Mean annual temperature	-3.8	-6.8

Table II.

Minimum air temperatures (I) and minimum air temperatures at a ground surface (II) during a polar winter 1978/79 at the Hornsund Station (°C)

Date	I	II
20 November	-20.5	-28.2
28 December	-26.5	-29.5
2 January	—	-34.1
11 January	-31.1	
24 February	-33.6	
28 February	—	-39.6
1 March	-25.4	
16 March		-30.8
17 April	-25.4	
20 April		-20.8
3 May	-18.0	

Meteorologic observations were collected during the summer season of 1978 also in the forefield of the Werenskiöld Glacier (about 15 km to north-west from the Hornsund Station). A meteorologic station, localized on the end moraine of the glacier, collected the meteorologic registration from 15th July until 10th September 1978.

At the meteorologic station on the end moraine of the glacier the following meteorologic elements were registered: air temperature, air relative humidity, total sun radiation, short-wave reflected radiation, reverse radiation of atmosphere, direction and velocity of a wind, magnitude and intensity of precipitation as well as ground temperatures at different depths. On the Werenskiöld Glacier and on the surrounding mountaineous massifs seven microclimatic sites were localized, self-recording a temperature and an air humidity. In the summer season of 1978 an ablation was measured at the Werenskiöld Glacier in two transversal sections (at the front, in a middle part of the glacier) and in its firn field.

3.2. Hydrologic observations and studies

For the whole year in Isbjörnhamna the data of shore water temperatures, marine ice thickness and ice phenomena were collected. Besides, the water samples were taken from the bay and the fiord to define its chemical composition.

Seven hydrometric posts were founded (5 water gauges and 2 limnigraphs) at rivers of different feeding and at lakes of various origin. At these posts periodical measurements of water level, flow magnitude and water temperature were done. Several dozen samples of water were collected and filtered to define a suspended matter in streams with drainage basins of various physiographic conditions.

To estimate the present sedimentation rate in reservoirs of stagnant water four sedimentometers were founded in the lakes of different genetic

types. These lakes were sounded and also, the measurements of vertical distribution of temperature of water and deposits were done. Water and sediment samples were taken for analyses of physico-chemical properties. During the winter season the measurements and the observations of ice growing and its disappearance were done at streams in the Honrsund Fiord region.

3.3. Geomorphologic and geologic works

The geomorphologic works dealt with forms and sediments in the marginal zones of the glaciers: Hans, Arie, Werenskiöld, Nann, Torell and Gás. A geomorphologic mapping in the scale of 1 : 10 000 was carried through in the Fuglebergsletta area. The area of about 40 square kilometres was mapped in detail. The analyses of marine terraces by Nottinghambukta were also done; that area was mapped in the scale of 1 : 5000. From the accumulative covers of low terraces the samples were collected for sedimentologic analyses and for biostratigraphic studies.

Among the periglacial studies the observations of ground temperatures were collected at 8 sites at standard depths: 1, 5, 10, 20, 50, 70 and 100 cm. At the same time at the same sites the measurements of extreme air temperatures were carried through in the air layer close to the ground. At the measurement points of tundra temperatures the samples for analyses of physico-chemical properties were collected. The studies over polygons of Taimyr type were done at two test fields at Seterdalneset. Quantitative studies over the rate of displacement of mineral sediment at ice-morainic ridges were carried through in the forefields of some glaciers in connection with a founded (in 1975) measurement net. The observations over a formation of a snow relief by aeolian processes were also done (snow drifts, snow dunes, snow waves, deflational troughs).

3.4. Photogrammetric works

The photogrammetric works carried through in summer 1978 at the forefield of the Werenskiöld Glacier were supposed to result in a preparation of a topographic map in the scale of 1 : 5000 as the confrontation map in relation to the map of that forefield of 1958—1959. The works covered the area of about 10 square kilometres. 13 main points were founded and 25 photopoints were installed. The photopoints were defined by a geodesic connection. Generally, 18 stereograms were done (80 plates). Additionally two photogrammetric bases were founded on a mountaineous crest of Jens Erikfjellet at an altitude of about 500 m a.s.l. From that place the stereograms were done that covered 75% of the glacier forefield.

3.5. Seismologic observations

During summer season (July — August) six seismographs were installed in the field and in the laboratory of the Station — a registration instrument of “Górník” type. On 20th September 1978 a continuous seismic registration

has begun. The instrument of the type "Górnik" was adapted to registration of earthquakes of global and regional scales; the latter included the phenomena connected with ice fissuring, the so-called seismic crackles occurring in glaciers. The seismographs were arranged in a profile 4 km long, in the field in a north-west—south-east direction. The registrations were done by an analogous way with a record on paper and magnetic tape. During a continuous annual registration 48 significant seismic registrations were obtained that have been preliminary sent by radio to Institute of Geophysics PAS, Warsaw. The collected registration data of 78 rolls of registration paper is under a detailed analysis now.

3.6. Magnetic observations

Close to the Station two magnetic pavilions were built, registration and measurement ones. The pavilions of about 10 m² each were constructed of non-magnetic elements put on concrete posts in which they were anchored by brass rods. In the registration pavilion a portable magnetic station cooperating with a system of analogous registration was installed. The changes of components of the geomagnetic field were registered i.e. vertical Z , horizontal H ones and the declination D . A continuous registration was started on 19th September 1978. Since 1st October 1978 until 30th June 1979 47 measurements for definition of the scale values and absolute magnitudes of registered components were done to find the bases for every record. 285 day magnetograms were obtained with a record of variations of three components H , D and Z . 66 tables of registered and prepared values were sent by radio to Institute of Geophysics at Warsaw.

The summer group left Spitsbergen embarked at a ship "Łużyca" on 20th September 1978. In the Polar Station ten-person scientific-technical group stayed for winter (Fig. 8) to carry through observations and research works from 20th September 1978 to 30th June 1979. The meteorological conditions during the polar winter were very unfavourable, mean monthly temperatures were extremely low taking the last twenty years into account. The low temperatures were accompanied by very strong winds. In January 1979 there were only four windless days. There were very strong winds coming from the east, blowing for over two weeks in January, February and March. Rattling hurricane blows were shaking the Station at the beginning of March. Maximum wind velocity exceeded 45 m/s i.e. over 162 km/h.

For 3.5 month there was a polar night in the area of southern Spitsbergen. The darkness was sporadically illuminated by a moon shine and by northern lights. A polar night is a burdensome period for people working in the Arctic. For the whole stay at Spitsbergen we have succeeded in a systematic realization of all the observations expected in a research programme what I suppose, to be the greatest success of the group working at the Polar Station of PAS at Spitsbergen during the twelve months of 1978/79.



Fig. 8. Winter group 1978/79 — from the left: I. Dobruchowski, M. Banach, T. Pieńkowski, B. Rudzki, J. Szupryczyński, E. Jarmuszewski, J. Sacewicz, S. Cieśliński, T. Petelski, B. Ołędzki
Photo W. Stan

A research work at Spitsbergen was also dangerous due to many polar bears. During a polar night the bears have been coming close to the station windows. The first bear was noticed by the station on 27th November 1978 and the last — on 8th June 1979. During our stay at Spitsbergen we had as many as 241 “visits” of bears by the station. We have met them also frequently during ski routes to field observatory places.

On 30th June 1979 we handed the Station over to the next group of the next scientific Spitsbergen expedition (1979—80). A debarkation of a ship that arrived with a new expedition lasted until 25th July in result of unfavourable ice conditions. We have left Spitsbergen 26th June and arrived to Gdynia on 30th July 1979, after 13 months of stay outside the country.

Jan Szupryczyński