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Elaboration of topographic maps of the Polish A. B. Dobrowolski Station at Bunger Oasis on the Antarctic Continent

ABSTRACT: Bunger Oasis ($66^{\circ} 15'S$ $100^{\circ} 45'E$), which lies in the deep interior of the Antarctic Continent, was the destination of the Polish Polar Expedition in 1978/1979. The area of Oasis which is free of ice, with a surface area of 1000 km^2 , its own hydrographic network and diversified relief of the terrain, has over the recent years been populated by live organisms, birds (cheek-bone and snow fulmar) and Wedell seal. In valleys and depressions of the terrain, traces of soil, mosses and lichens appear. The relief of the terrain of Oasis is undergoing continuous intensive change as a result of the natural effects of the Antarctic climate.

Key words: Antarctic Continent, maps of Bunger Oasis

1. Introduction

On 17 January, 1979, a Polish Polar Expedition arrived at the A. B. Dobrowolski Station at Bunger Oasis (Fig. 1). It was organized by the Institute of Geophysics, Polish Academy of Sciences, to investigate the dynamics of continental glaciers in the marginal zone. The expedition, equipped with Mi-2 helicopters, undertook an additional task of making two, 1:500 and 1:5000, topographic maps of the area of the research station. The 1:500 map was to be an inventory plan of the closest vicinity of the research station. The 1:5000 map was to show the character of the terrain relief of Bunger Oasis.

2. Characteristic of the terrain

Oasis is a hilly area, built mainly from Precambrian metamorphic rocks, among which garnet-biotite gneisses dominate. The highest elevation of Oasis is 165 m over the sea level, the relative heights of hills and hillocks do not exceed 100 m. Depressions and valleys are filled with moraine deposits. The slopes of hillocks and their feet are covered by large amounts of rock waste. This is a result of strong rock erosion. The uncovered rocks are intensely destroyed by the processes of physical erosion. A large role in the process of rock erosion is played by the considerable amplitude of the terrain surface temperature over 24 hours and strong slope winds carrying rock and ice dust (E. Wiśniewski 1980).

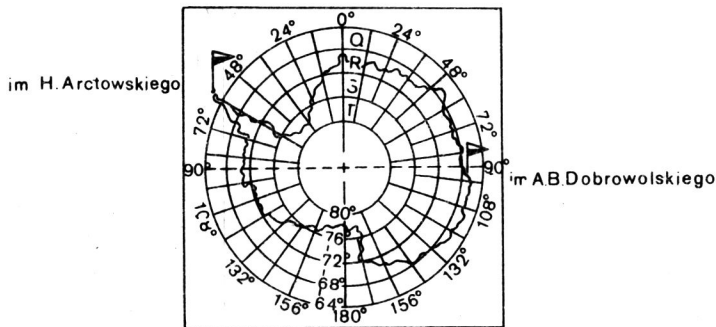


Fig. 1. Polish Antarctic Station

The climate of Oasis is typically continental, harsh, dry and windy. The mean temperature of the warmest month of the year, i.e. January, recorded in 1957, was $+1.8^{\circ}$ in the day. The coldest temperature recorded at Bunger Oasis by Soviet winter researchers in 1957 was -37.6° .

During the stay of the Polish expedition at Bunger Oasis in January 1979, with the uncloudy sky the temperature of the insolated rock surface reaching $+30^{\circ}$ was recorded, with the air humidity 1.5 m over the sea level reaching 0° . Despite the presence of numerous lakes, in the summer, the air humidity is very low at Oasis. It is characterized by a considerable number of days with strong winds, with mean velocities varying between 5 and 10 m/s. The maximum wind speed, recorded in February 1979 at Oasis, was 56 m/s, caused by hurricane lasting 3 days (G. Wójcik 1980).

The diversified terrain relief, multi-colour rocks with strange forms and shapes, numerous lakes with clear blue-green water, all create the seldom encountered phenomena of the harsh beauty of the Antarctic land.

3. Methods

A detailed image of the characteristic properties of Bunger Oasis are the large-scale maps of the Polish A. B. Dobrowolski research station, elaborated in 1979. The maps were made on the basis of geodetic measurements by the field group and of air photographs. The geodetic measurements included the determination of the astronomical point and the establishment of a network of signalled photopoints (Fig. 2). The astronomical point was determined by the Kawrajski method, by J. Cisak, and the result

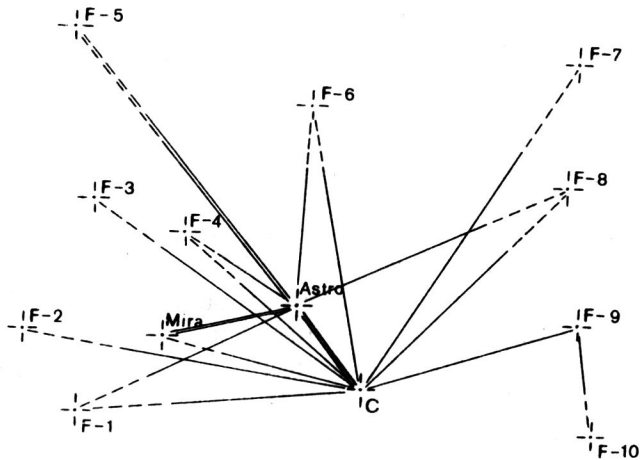


Fig. 2. Situation plan of the network of photopoints at the A. B. Dobrowolski Station. 1:20000 scale

was confirmed by the Australian researcher Vincent Moram, by using the Doppler method. The value of the ASTRO point was $\varphi = -66^{\circ}16'34''.4$ and $\lambda = -100^{\circ}45'00''.7$. The astronomical point of the ASTRO-MIRA point (Fig. 1) was determined from observations of the Sun: $A_{A-M} = 256^{\circ}24'30''.0$ (J. Cisak 1980). The height of the astronomical point was taken over from its determination in 1959 by the first Polish expedition to Bunger Oasis $H = 35.3$ m. The network of photopoints was measured by a Wild T-2 theodolite and an EOK-2000 Zeiss range-finder. The accuracy of the position of the points was $m_{xyh} = \pm 0.05$ m (S. Mroczek 1980). The signalling of the photopoints was marked by a cross symbol, pointed directly in white on the rock. The dimensions of the cross were $1\text{ m} \times 1\text{ m} \times 0.25\text{ m}$. The air photographs were taken from an Mi-2 helicopter by an air camera AFA-BAF 21s, at a height of 1150 m and 1:5500 scale. The photographs were taken on Polish Fotopan-10 film, with 27 DIN sensitivity and exposure time of $1/300$ s, and 16 lens opening, using a UV filter. Im-

mediately after the photographs had been taken, parts of the air photographs were developed to verify the good work of the camera.

Examples of the air photographs are shown in Fig. 3 and 4. The chamber elaboration of the maps, the plotting of the terrain relief and situation were carried out by means of an Odra 1325 computer and a Wild A-8 automatic plotter (Z. Battke 1980). The legends of the maps contain the value of the acceleration of gravity at Bungee Oasis, measured at the gravimetric pavilion of the research station, with reference to the Potsdam system, and determined by Z. Ząbek and J. Sledziński in 1959, $g = 982438.4 \text{ mgal} + 0.4 \text{ mgal}$ (A. Pachuta 1980).

At the ASTRO point, the magnetic declination of the 1979.5 epoch was determined: $D = -89^{\circ}28'4''$. The value of declination at Bungee Oasis for the 1958.0 epoch, as measured by Soviet polar researchers, was $D = -84^{\circ}59'6''$ (S. Mroczek).

The maps applied terminology from the existing editions: A. B. Dobrowolski Station, Lake Figurnoe, Bungee Oasis (GUGK maps, USSR 1959).

In the region closest to the research station, for the characteristic orientation points at which scientific observations were carried out, the Polish Antarctic Expedition set the following names: Bay of Polish Geodesists (Lake Figurnoe $66^{\circ}16'5'' \text{ S } 100^{\circ}45'0'' \text{ E}$), Beskid ($66^{\circ}16'5'' \text{ S } 100^{\circ}44'5'' \text{ E}$), Giewont 9.5 m ($66^{\circ}16'2'' \text{ S } 100^{\circ}45'2'' \text{ E}$), Hel ($66^{\circ}16'8'' \text{ S } 100^{\circ}43'8'' \text{ E}$). The names documenting field observations were: Seal Rock ($66^{\circ}16'6'' \text{ S } 100^{\circ}46'0'' \text{ E}$), Fulmar Nest ($66^{\circ}16'6'' \text{ S } 100^{\circ}46'3'' \text{ E}$), Cheek-bone Nest ($66^{\circ}16'9'' \text{ S } 100^{\circ}43'9'' \text{ E}$), Black Rock ($66^{\circ}16'7'' \text{ S } 100^{\circ}45'3'' \text{ E}$).

Then, there are the names in honour of known Polish scientists, members of Arctic and Antarctic expeditions:

— A. B. Dobrowolski Station ($66^{\circ}16'5'' \text{ S } 100^{\circ}45'0'' \text{ E}$)

Prof. Antoni Bolesław Dobrowolski (1872—1954), geophysicist, member of the Polish Academy of Sciences, who participated in a Belgian expedition, headed by A. Gerlache, in 1897—1899, on board the “Belgica”.

— Krzemiński Hills ($66^{\circ}16'5'' \text{ S } 100^{\circ}44'0'' \text{ E}$)

Prof. Wojciech K. E. Krzemiński (1926—1981), geodesist, head of Polish Antarctic expeditions in 1959 and 1979.

— Centkiewicz Hells ($66^{\circ}16'0'' \text{ S } 100^{\circ}44'0'' \text{ E}$)

Czesław and Alina Centkiewicz (1904 and 1907), a popular couple of Polish writers and travellers. Authors of books for the young: “The Conquerors of the North Pole”, “To Conquer the Arctic”, “Direction: The Antarctic Continent” (all in Polish)

— Manczarski Valley ($66^{\circ}16'2'' \text{ S } 100^{\circ}44'2'' \text{ E}$)

Prof. Stefan Manczarski (1899—1979), geophysicist, radioelectronic engineer, member of the Polish Academy of Sciences, Scientific Secretary of the Committee of the International Geophysical Year, of the Year of the

Peaceful Sun. Member of the Polish Antarctic Expedition to Bunger Oasis in 1959.

— Mount Różycki (66°16'7 S 100°46'0 E)

Prof. Stefan Różycki (1906), geologist, member of the Polish Academy of Sciences, researcher of the geology of Spitsbergen, member of the Antarctic expedition to Bunger Oasis in 1959.

4. Conclusion

The first Antarctic macroscale topographic elaborations of the area of Bunger Oasis can provide comparative material for the investigations of the dynamics of terrain surface changes caused by the climate conditions on the Antarctic Continent.

The area of Bunger Oasis has excellent conditions for performing research, didactic experiments in the fundamental sciences of the Earth. The terrain without deposit material allows direct access to all rock structures. The vicinity of Oasis, with practically all glacier types, permits broad glacial investigations to be carried out. Finally, the population of birds and seals at Oasis provides opportunities for biological studies on the lives of live organisms in the extreme living conditions. Particular consideration should be given to the observations made during the previous expeditions to Bunger Oasis which were not documented in scientific terms or with incomplete data. An example of such can be changes in magnetic declination, the magnitude of sea tides in the bays of Oasis or the formation of enclosing moraines. There is still today no knowledge of the climate and sea ice conditions in the areas of the Antarctic shore closest for the disembarkment of expeditions headed for Bunger Oasis.

5. Резюме

Во время Польской полярной экспедиции на станцию им. А. Б. Добровольского составлены две карты на основании проведенной тогда автором аэрофотосъемки. Одна карта составлена в масштабе 1:500 главным образом для инвентаризационных целей экспедиции, вторая топографическая карта в масштабе 1:5000 охватывает территорию 4,3 км, занятую станцией. Составленные карты, так же и помещенные на них названия, свидетельствуют о проведенных польскими полярными экспедициями исследованиях и являются постоянным достижением в рамках исследований территории Антарктиды.

6. Streszczenie

Podczas Polskiej Wyprawy Polarnej do Stacji im. A. B. Dobrowolskiego opracowano dwie mapy z wykonanych wówczas przez autora zdjęć lotniczych. Jedną mapę wykonano w skali 1:500 głównie dla celów inwentaryzacyjnych wyprawy, drugą w skali 1:5000 topograficzną, która obejmuje obszar stacji około 4,3 km. Na mapach zastosowano polskie nazwy. Wykonane mapy jak i nadane nazwy na nich świadczą o prowadzonych pracach badawczych przez polskie wyprawy polarne i weszły na trwałe do obszaru badań Antarktydy

7. References

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6. Wiśniewski E. Moraine forms and deposits of Antarctic icesheet at the contact with Bunger Hills. *Polish Polar Research*, Vol. Vol. 2, Nos. 1—1 1981.

ENCLOSURES

1. Antarctic, Polish Polar Station at Bunger Oasis — map in the scale 1:500, 1 sheet.
2. Map of the area Polish Polar Station at Bunger Oasis in the scale 1:5000, 1 sheet.

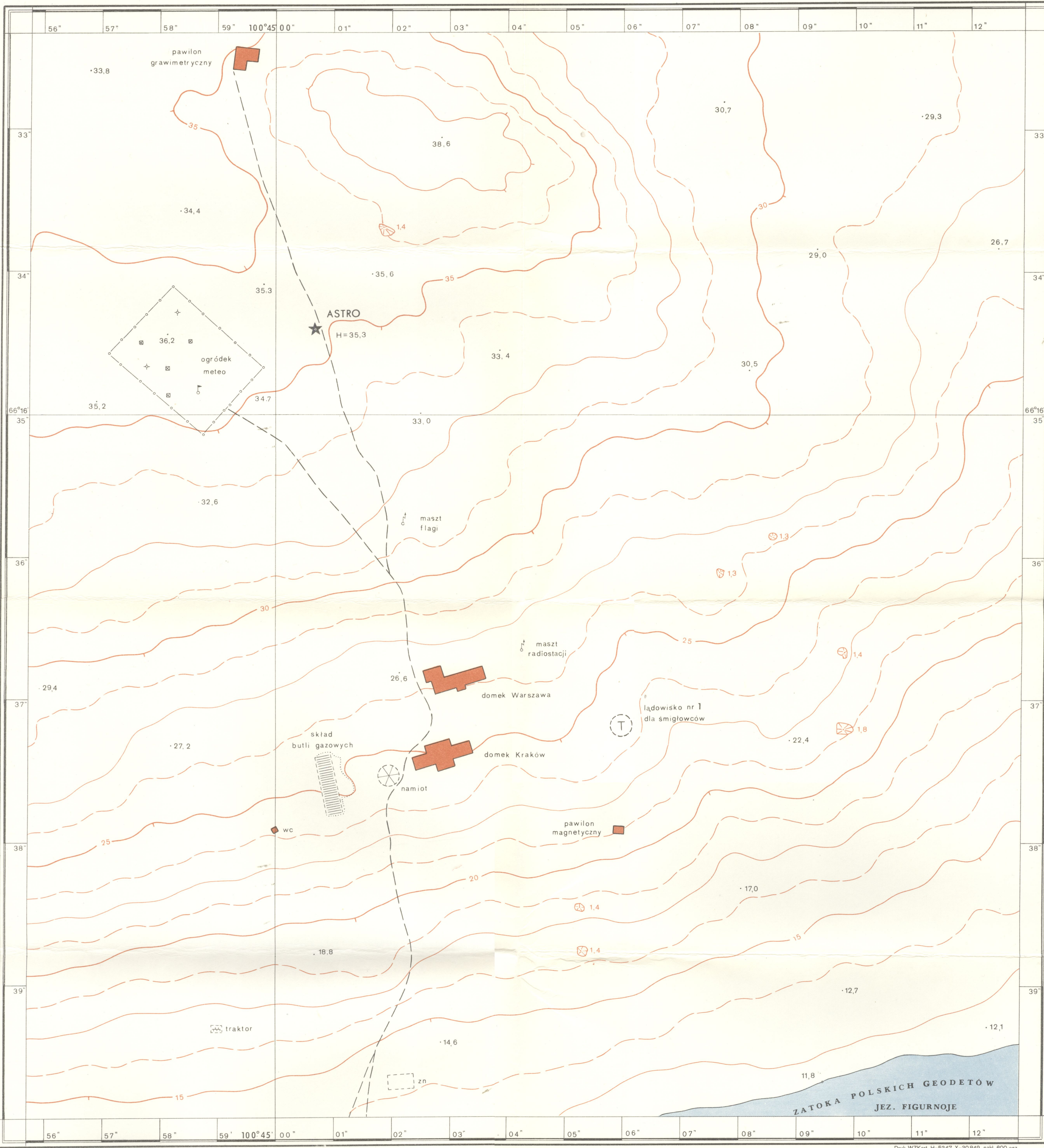
Paper received 1981. December 15

ANTARKTYCZNA STACJA im. A. B. DOBROWOLSKIEGO

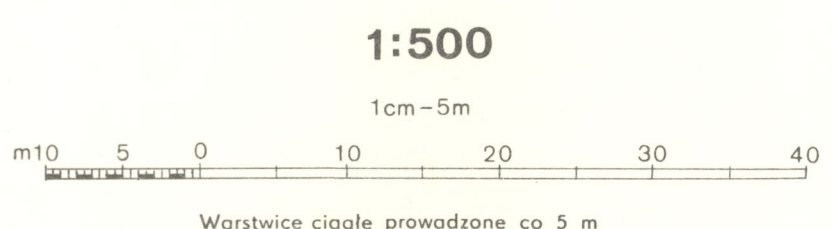
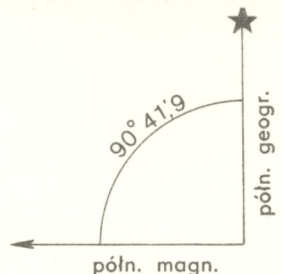
WYDAWNICTWO
INSTYTUTU GEOFIZYKI PAN

OAZA BUNGERA

$\varphi = 66^{\circ} 16' 34,4'' S$
 $\lambda = 100^{\circ} 45' 00,7'' W$
Współrzędne geograficzne STACJI



Członkowie WYPRAWY ANTARKTYCZNEJ PAN 1978—1979
Zbigniew BATTKE Jan CISAŁ Janusz GUMIŃSKI
Zbigniew KOWALEWSKI Wojciech KRZEMIŃSKI
Janusz MAZUR Seweryn MROCEK Czesław OPOKA
Andrzej PACHUTA Janusz STOCHNIAŁ Bronisław ŚWIETLIŃKI
Maciej TALAŁAŻ Edward WISNIEWSKI Gabriel WOJCIK



Punkt ASTRO
Szerokość geograficzna $\varphi = 66^{\circ} 16' 34,4''$
Długość geograficzna $\lambda = 100^{\circ} 45' 00,7''$
Wysokość punktu $H = 35,3$ m
Azymut A — MIRA $A = 256^{\circ} 24' 30,0''$
Przyspieszenie ziemskie $g = 982438,4$ młg $\pm 0,4$
Deklinacja w okresie luty 1979 r. $D = -90^{\circ} 41',9''$

Materiał podstawowy
Zdjęcia lotnicze wykonane w dn. 14.02.1979 r.
Pomiary terenowe wykonane przez
POLSKĄ WYPRAWĘ ANTARKTYCZNĄ 1978—1979
Mapę wykonał: mgr inż. Zbigniew BATTKE

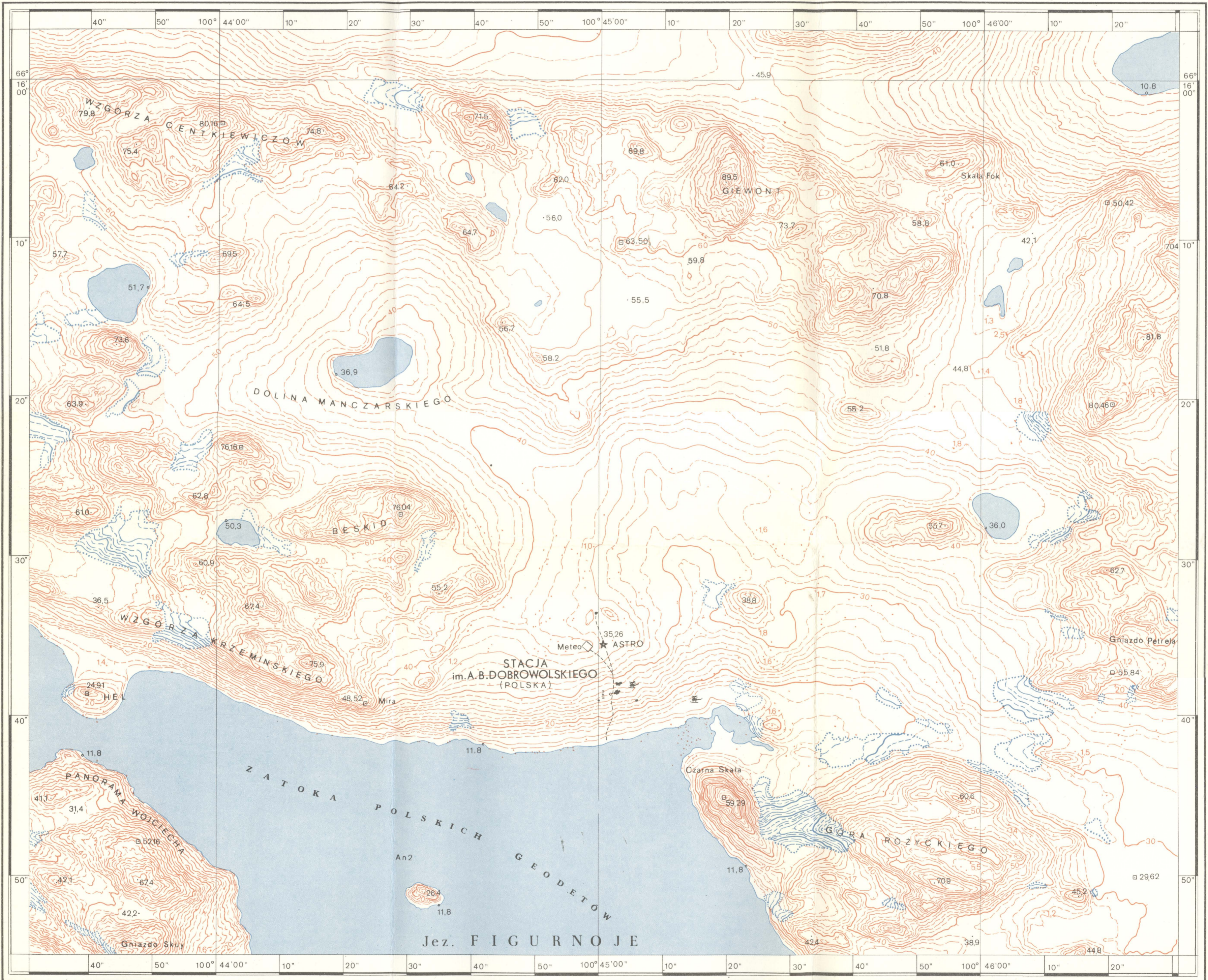
Druk WZKart H-5347, X-30849, nakł. 600 egz.

TERYTORIUM ANTARKTYDY OAZA BUNGERA

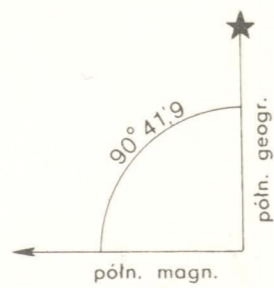
REJON BADAŃ
INSTYTUTU GEOFIZYKI PAN

POLSKA STACJA im. A. B. DOBROWOLSKIEGO

$\varphi = 66^{\circ} 16' S$
 $\lambda = 100^{\circ} 45' W$
Współrzędne geograficzne OAZY



Materiał podstawowy
Zdjęcia lotnicze wykonane w dn. 14.02.1979 r.
Pomiary terenowe wykonane przez
POLSKĄ WYPRAWĘ ANTARKTYCZNĄ 1978—1979
Punkt ASTRO ★
Szerokość geograficzna $\varphi = 66^{\circ} 16' 34",4$
Długość geograficzna $\lambda = 100^{\circ} 45' 00",7$
Wysokość punktu $H = 35,3$ m
Azymut A — MIRA $A = 256^{\circ} 24' 30",0$
Przyspieszenie ziemskie $g = 982438,4$ młg $\pm 0,4$
Deklinacja w okresie lutego 1979 r. $D = -90^{\circ} 41',9$
Mapę wykonał: mgr inż. Zbigniew BATTKE



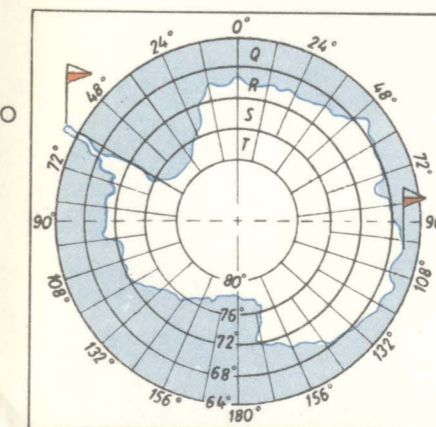
1:5000

1cm = 50m

m 100 50 0 100 200 300 400 m

Warstwicę ciągle prowadzone co 5 m

POLSKIE STACJE ANTARKTYCZNE



im. A. B. DOBROWOLSKIEGO (1959-)

- Legenda
- ★ Budynek stacji
 - Punkt poligonowy
 - Łądowisko
 - 40 m n.p.m. — warstwicą
 - Snieżnik
 - Jezioro