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Spitsbergen, Polish Polar Station in Hornsund Maps in the scale of 1:5000 and 1:500

ABSTRACT: Works connected with execution of geodesic and photogrammetric surveys and with setting up maps in the scale of 1:5000 of environs of the Polish Polar Station on the Isbjørnhamna Bay and in the scale of 1:500 of the area covered with buildings of the Station are discussed.

KEY WORDS: Arctica, setting up the topographic map, Hornsund, Spitsbergen.

1. Introduction

The Polish geodesists began to participate in the Polish polar expeditions to Spitsbergen in 1934, when geodesis and photogrammetric works on a part of the Torell's Land were carried out. Then the triangulation network was established and the map of the area not recognized earlier was set up. A visible trace of this activity constitute, among other things, Polish names of mountains and glaciers on all the maps of this region. Since that time many Polish geodesists, topographers and photogrammetrists took often part in the polar expeditions, carrying out surveys for both setting up the maps and studying the dynamics of the glaciers as well as performing other measurements connected with geophysical, geological, glaciological and ecological investigations.

The studies aiming at publication of maps, which recently appeared in print, began in 1979 during the polar summer. Then the geodesic network referred to the points of the existing Norwegian triangulation network and the astronomic point between the Hansa Glacier and Revdalen walley from Ariekammen-Fugleberget slopes to the sea coast was established by Witold Mizerski, geodesist-photogrammetrist, who carried out also photogrammetric surveys of a fragment of this area. On the basis of these surveys the working variant of the map of the Ariekammen-Fugleberget

catchment area in the scale of 1:2500 was worked out. This scale of the map was assumed on the basis of consultation with the specialists carrying out ecological investigations on the area in question. The area around the main base of the Polish Polar Station was comprised with the research carried out by specialists in various fields, and therefore the need arose to work out a uniform map for this whole area, and consequently to perform suitable measurements on this area in the subsequent periods.

In summer 1980 by Seweryn Mroczek and Stanisław Dąbrowski, among other things, photogrammetric surveys of 13 bases as well as measurements for their orientation, against the background of the network of points established in 1979 and points of the Norwegian triangulation were carried out. These measurements constituted a main information source for setting up the present map in the scale of 1:5000.

The elaborations were continued in the working version in the scale of 1:2500 while extending the area over 5 sheets of the map. By the chamber works the need of supplementation of some fragments of the area with field measurements and photogrammetric survey was revealed. This supplementation was done in 1982 and 1983 by W. Mizerski and Z. Warchoń.

Eventually the scale of 1:5000 was assumed as most suitable for the whole area, what enabled to set up the map in the form of one sheet.

2. Position and characteristics of the area presented on the map in the scale of 1:5000

The sheet of this map covers the area situated between 15°31' and 15°38' of eastern geographical longitude and between 76°30' and 77°01' of the northern geographical latitude. This area expands over the northern shore of the northern part of the Hornsund fiord on the Isbjørhamna Bay situated between the Wilczekoden promontory and the Hansa (Hansbreen) glacier front. From the northern side the area adjoins the mountain ridge with the Arikammen and Fugleberget peaks. The area relief is strongly differentiated. Steep slopes of the mountain ridge lowering southwards pass into small-gradient terraces, on which rather numerous rocky uplands with relative altitudes varying from several to dozen or so metres are to be found. In the eastern part of the area, from the Fugleberget foot towards sea, moraines of stony forms, with distinctly formed meridionally directed terminal moraine rampart of the Hansa Glacier, retreated at present, expand. This rampart built of rocky rubble and ice, with the

besset at the western side, constitutes a variable form and will settle along with melting ice. Similar changes depending on climatic conditions, will undergo all forms of the active moraine. In the eastern part of the area under study the tip disclosed in consequence of the glacier's retreat, situated in the vicinity of a fragment of the Hansa glacier, is presented on the map. This is the first cartometric presentation of the reach and configuration of a fragment of this area, which was named Baranowski promontory by the participants of the Polish polar expeditions. In the central part of the area buildings of the Polar Station of the Polish Academy of Sciences constituting a main base of the Polish polar expeditions to Spitsbergen are shown on the map. In the close vicinity of the Station an astronomic point established upon a solid rock in the form of a concrete pillar in 1958 by Jerzy Jasnorzewski, geodesists, who measured for the first time its geographical coordinates on the basis of observations of stars, is to be found. This point is also included into the triangulation network serving for geodesic measurements.

3. Methods of measurement and working out map

The principal basis for the measurements constituted points of the Norwegian triangulation network: Fannytoppen, Fugleberget, Ariekammen, Rotjesfiellet, and the astronomic point of the Hornsund-Settlement. The condensing network was measured by W. Mizerski, who performed angular measurements with the use of theodolite and the distance measurements using the paralactic method and stabilizing points with steel pipes. On the basis of points of the basic and condensed network, the position of stands of photogrammetric surveys and of photopoints necessary for orientation of these surveys was measured. These measurements were carried out by the angular-linear method. Also lengths of bases for all stereograms were determined. A main element of detailed measurements of the area constituted ground stereophotogrammetric surveys made with the use of the Phototheo 1318 theodolite on glass plates. A detailed measurement of this area on the basis of ground photogrammetric surveys required special approach to the question of choice of the phototheodolite stands. This was connected with configuration of the area, which caused the formation of extensive so-called "dead fields" invisible on surveys, situated beyond elevations, little rocks, remparts, etc. A part of the surveys were performed from stands situated at a rather considerable height on the Ariekammen slopes. These works were carried out mainly in 1980 by S. Dąbrowski and S. Mroczek. Despite attempts, some fragments of the area, like e.g. eastern bank of the Wilczek promontory or a part of the bank of the Baranowski promontory,

must be supplemented later by the tachymetric measurement or plane table method (Z. Warchoł).

Construction of the map was developed while using the transverse cylindrical project of Gauss-Krüger with the axial meridian of 15° eastwards Greenwich. The initial elaboration carried out in the scale of 1:2500 comprised several sheets. The principal method of the elaboration was mapping of the situation and relief of the area on the basis of ground photogrammetric surveys. The Stereoautograph Zeiss was used for mapping. While plotting in the first place on the panel points of the basic and condensing network as well photopoints determined by calculated coordinates, every model of the area fragment projected from the stereoscope pair of surveys was then adapted subsequently and the course of situation and contour lines and the position of characteristic points were mapped. In such a way the initial original sketches of the map were made. These works were carried out by the Institute of Geodesy and Cartography, their main executor being Mrs. J. Federowska.

Upon finishing the drawing works and supplementations, realing of particular sheets of 1:2500 to the scale of 1:5000 was performed and all of them were mounted into one working sheet. In the further part of the elaboration the final substantial and technical version of the map has been accomplished (B. Sakławska, Institute of Geodesy and Cartography) and prepared to print (J. Sakowska, State Cartographic Publishers). The print was made in Warsaw in 1984 by the State Cartographic Publishers).

4. Remarks and conclusions concerning the set up map

The presented map constitutes a preliminary, and consequently unfull version. Nevertheless, it can constitute a good cartometric material for various thematical elaborations on the respective area. A considerable limitation constitutes a lack of data concerning depth and configuration of the sea bottom and location of underwater rocks. However, while disposing of only these unfull data, the authors were of the opinion that presentation of sea as an uniform blue spot would be the safest solution for the further users of the map. It seems that in further works on this area one should try to collect measuring material rendering possible filling up the whole sheet of the map, both by liquidation of white spots of the fragments of continent and quotation of possibly fullest bathymetric data.

After printing the map, some inaccuracies and errors in the situation presented were found, among other things, as the following: 1. The name of Ariekammen placed on the map concerns the triangulation point and not geographical name of the peak, which is situated north-eastwards from this

point. 2. The fragment of surface water flowing into the sea (situated on the map in the vicinity of crossing the network line of 115000 and 51500) was printed in the same colour as the sea and not in the shade assumed for surface waters.

Those knowing well this area or penetrating it, can surely find still other errors committed by performers. I think that even if they were hardly excusable, the performers would have the satisfaction that they could be shown at all.

An important problem for some investigations on the area considered can constitute the reference level in altitudinal measurements. For altitude the regular and most appropriate reference level is the mean sea level. Such mean reference level should be determined, as known, on the basis of measurements of the water line level in the possibly calm zone of the sea in the many-year period at continuous or high-frequency recordings. This requires developing of a special instrument—mareograph lacking in the Station. The measurement of the momentary or short-period mean sea level with the use of usual methods of geodesic measurements was not performed in view of the fact that their low accuracy can be foreseen in advance. It is connected with the influence of great changes of the sea level in tide cycles, both short- and long-term ones, and also with local impoundments of water under the effect of strong winds and maritime currents. Thus at elaboration of the map it has been assumed the conventional zero level of the sea as the reference level, while subtracting the altitudes given for points of the Norwegian triangulation network.

5. Map in the scale of 1:500

For purposes of an efficient utilization of area of the main base of the Polish Station, its equipment and outfit, and for a correct planning of supplementing structure or installations as well as for prevention of the natural environment degradation in the close surroundings of the base, direct geodesic measurements (tachymetry) were carried out in 1982 by W. Mizerski, on the basis of which the map of the Polish Polar Station in Hornsund in the scale of 1:500 was worked out. The map shows buildings and outer structures of the Station, vertical configuration of the area and the space covered with tundra. The area relief is presented by contour lines and points with the quoted altitudes as well as by marks representing steep slopes of disclosed rock forms. The position of the astronomic point and the points of the geodesic network are presented as well on the map.

The map was printed at the printing office of the State Cartographic Publishers in Warsaw in 1983.

ENCLOSURES

1. Spitsbergen, the Polish Polar Station in Hornsund — map in the scale of 1:5000, 1 sheet.
2. Map of the Polish Polar Station in Hornsund in the scale of 1:500, 1 sheet. Warsaw, in May 1985.

6. Резюме

В настоящей статье рассматриваются геодезические и фотограмметрические работы проведенные на Шпицбергене и в камерных условиях в Польше, связанные с составлением карты в масштабе 1—500 необходимой для правильного использования базы польской полярной станции, а также карты в масштабе 1:5000 охватывающей площадь в ближайшем соседстве станции.

В описании измерительных работ проводится привязка к традиционным геодезическим и фотограмметрическим измерениям выполненным раньше на Шпицбергене начиная с 1934 г., а также рассматриваются методы измерений и ход составления карты с приведением фамилий авторов.

Измерения для составления карты польской полярной станции проводились в нескольких периодах, а составление рабочей версии состоялось в масштабе 1—2500 охватывающем 5 листов. Окончательно был принят как наиболее соответствующий для данной площади масштаб 1:5000 на одном листе. Карта облегчает проведение исследований специалистами разных научных отраслей, а в геодезическом отношении она привязана к норвежской геодезической сети.

7. Streszczenie

W artykule przedstawiono prace geodezyjne i fotogrametryczne wykonane na Spitsbergenie oraz w warunkach kameralnych w kraju przy opracowaniu mapy w skali 1:500 potrzebnej dla celów sprawnego użytkowania bazy Polskiej Stacji Polarnej, oraz mapy w skali 1:5000 obejmującej najbliższy obszar przyległy do Stacji.

W opisie pracy pomiarowej nawiązano do tradycji pomiarów geodezyjnych i fotogrametrycznych wykonanych uprzednio na Spitsbergenie począwszy od 1934 roku, przedstawiono metody pomiaru i opracowania mapy podając nazwiska autorów wykonawstwa.

Pomiary do mapy okolicy Polskiej Stacji Polarnej prowadzono w kilku okresach, a opracowanie wersji roboczej kontynuowano w skali 1:2500 obejmującej 5 arkuszy. Ostatecznie przyjęto jako najwłaściwszą dla całego obszaru skalę 1:5000 w postaci jednego arkusza. Mapa umożliwia prowadzenie badań przez specjalistów różnych dziedzin naukowych, geodezyjnie nawiązana jest do norweskiej sieci geodezyjnej.