

**CONTRIBUTION OF RUSSIAN CARTOGRAPHIC AND GEODETIC
SERVICE INTO EXPLORATION AND MAPPING
OF ANTARCTIC CONTINENT**

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Abstract

Main results of extensive program of exploration and mapping Antarctic continent performed by a number of Russian organizations are reviewed. Two large stages are outlined, results of program implementation along the main trends of the performed explorations are analyzed.

Antarctica and Antarctic continent attracts great attention lately. Number of nations participating in exploration of Antarctica is expanding. Mapping the continent, naming features, surveying and mapping support of exploration of Antarctica, perfection of cartographic materials for the continent, international co-operation and exchange by cartographic materials - these are the main directions of the Antarctic program of Russian Cartographic and Geodetic Service, as a National Mapping Centre for Antarctica.

The honour of discovery of Antarctica and first mapping of its coasts belongs to the First Russian Antarctic Expedition on sloops "Vostok" and "Mirny" under the command of F.F. Bellinzhansen and M.P. Lazarev. Russian sailors first reached the Antarctic coast on 27th (15th) January 1820 at the point with co-ordinates $60^{\circ} 21' 28''$ S and $2^{\circ} 14' 50''$ W. Later sailing around the Continent, Russian sailors many times approached its coast, making thorough descriptions and mapping, with co-ordinate positioning. As later explorations proved these operations had been done with very high accuracy. Report charts and descriptions of coasts were published, translated into foreign languages and became widely known in the world as the most trustworthy charts of the region.

Extensive mapping of Antarctica started in 1940-1950s. It should be noted that under conditions of brief Antarctic summer and hazardous meteorological conditions, explorers tried to make surveys without wasting expenditures and covering as much of terrain as possible. Oblique air survey, rarefied survey routes lacking geodetic control decreased accuracy of mapping.

At the same time geographical features were named. In a number of cases, because of low accuracy and disconnection of surveys, there was a confusion in geographical names.

Starting their operations in Antarctica during the International Geophysical Year (IGY), Russian cartographers made a preliminary explorations of geographical features of the Continent and studied available cartographic materials. Air reconnaissance surveys of vast terrains of the dome and of coastal regions of the Eastern Antarctica including mountain massifs, ice shelves and Antarctic oases were done.

Thus methods of survey, map content and accuracy standards, conventional signs and other specifications were elaborated. As a result of these operations reconnaissance maps of low accuracy were refused and surveys according to the specifications and standards used in our country for mapping remote and inaccessible terrains of Arctica were applied with due consideration for peculiar features of the Antarctic Continent. Taking into account peculiarities and dynamic nature of coastal part of the Continent, high accuracy survey data can be used as control for monitoring coastal regions. Review maps for logistics were compiled using available at the time foreign materials of various degree of accuracy.

There are two main stages in Russian mapping activities at Antarctica.

The first stage includes years starting from the IGY (1957-1958) till the end of 1960s. At that stage geodetic control survey and air surveys of vast terrains in mountainous and coastal regions were performed, as well as at places of special scientific interests and regions where Russian scientific stations were erected. Mapping was done by organizations of Ministry of Merchant Fleet, by scientists and professionals of Institute of Geography of Academy of Science, Institute of Arctica and Antarctica and other organizations.

International co-operation and exchange by cartographic materials within framework of Science Committee of Antarctic Research (SCAR) facilitated compilation of review maps of the Continent at 1:3 000 000 and 1:5 000 000 scales, as well as 37 map sheets at 1:1 000 000. They were needed at that time to carry out explorations.

Topographic maps of 1:200 000 scale were compiled and published as a result of airsurvey and field surveying. They covered coastal areas of Princess Elizabeth Land (from 78° E to 111° E), Pravda Coast and Western part of Wilkes Land, as well as coast near Molodezhnaya scientific station.

More detailed maps of 1:1 000 000 were published covering coastal parts of Australian scientific stations Casey, Davis and mountaneous regions to the South of Novolazarevskaya scientific station. Maps of 1:50 000 and 1:100 000 scales were published covering Bunger Hills area; while at Alashev Bay Coast, where Molodezhnaya scientific station is situated, and at Tereshkova Oasis terrain was covered with 1:10 000 scale maps.

As a result of 10 years of exploration, in 1966 a fundamental scientific-reference complex Atlas of Antarctica was published by General Administration of Geodesy and Cartography in co-operation with Arctica and Antarctica Institute.

The second stage of mapping includes period from 1970s till 1990s. Photo imagery from space carriers was widely used for Antarctic surveys. First they were used to plot a number of features on map of Antarctica at 1:2 500 000 scale including 17 map sheets. In 1975 they were published and handed over to SCAR as the most large-scale maps covering the whole continent.

In 1970s airsurvey with geodetic radio positioning systems continued. Topographic maps covering ice-shelf Amery, Prince Charles Mountains in Eastern Antarctica and Sheckleton Range and Pensacola Mountains in Western Antarctica were compiled as a result of these operations. These areas were covered with 1:200 000 maps, and mountaneous areas with numerous rock outcrops were covered with 1:100 000 maps. Topography of outcrops and ice cover, gletchers, snow cover is very detailed at these maps.

Topographic maps of 1:2 000, 1:5 000 and 1:10 000 were compiled for areas of Russian scientific stations, as well as for ice pier constructions and landing strips for heavy aircrafts at Molodezhnaya and Novolazarevskaya scientific stations.

Accumulation of space remote-sensing photoimagery in 1970-1980s facilitated development of precise

photogrammetric control networks thereby providing control for topographic and photomaps of 1:200 000 scale based on space photoimagery. At present space photoimagery covers actually the whole continent up to 83°S latitude. Space remote-sensing of the continent was completed by 1990 after near the pole survey from Cosmos-2000 space vehicle. At present at Novolazarevskaya and Mirny scientific stations satellite observations are continued throughout the year for orbith parameters monitoring. Space photoimagery coverage for Antarctica is available in Catalogue of State Research and Production Centre "Priroda".

The performed surveys facilitated compilation of topographic maps and photomaps of 1:200 000 scale for a considerable part of Saunders Coast, Ruppert Coast, Wallgreen Coast, Eights Coast in the Western Antarctica, as well as for a number of regions of Dronning Maud Land and Prince Charles Mountains in the Eastern Antarctica. 8 map sheets at 1:500 000 scale covering South-Eastern part of Filchner-Ronne Ice Shelf and near-by mountaineous regions up to 86°S latitude were prepared.

Besides topographic mapping in 1982-1989 radar surveys of ice cover were carried out. Space photoimagery, "Magnavox 4400" receivers, GPS Navstar and airborne radar survey equipment were used therein. Map series displaying surface topography, ice-covered bed-rock topography and thickness of the ice-cover were compiled. They covered Enderby Land at 1:500 000 and 1:1 000 000 scales, Palmer Land at 1:500 000 scale and Ellsworth Land at 1:1 000 000 scale.

At present second edition of fundamental science-reference Atlas of Antarctica is being prepared. General geographic maps of the continent and its separate regions at 1:10 000 000 scale and larger are fully completed, as well as topographic maps of separate terrains.

Preparation to second edition of map of Antarctica at 1:2 500 000 scale has been completed. The map had been revised using space photoimagery and other available up-to-date materials.

During exploration and mapping of the Antarctic Continent geographical names were given to numerous local features. At present Russian explorers have given more then 1200 names, which were used on published maps and in Index of Geographical Names of Antarctica,

elaborated by Central Science-Research Institute of Geodesy, Aersurvey and Cartography.

Aersurveying Enterprise "Aerogeodesia" in S-Petrburg of the Russian Cartographic and Geodetic Service took part in mapping of Antarctica (around the year and seasonal field surveys in Antarctica, topographic, thematic and general geographic atlas maps compilation) as well as Map Production Enterprise "Cartographia" (general geographic maps compilation), State Centre "Priroda" (space remote sensing, photoimagery processing, topographic maps compilation and photomaps production) and Central Science - Research Institute of Geodesy, Aersurvey and Cartography (transcription of geographical names).

Since IGY Russian Cartographic and Geodetic Service actively participates in international co-operation and exchange by cartographic information within framework of Science Committee of Antarctic Research (SCAR) Working Group of Geodesy and Geographical Information along the following programs: Antarctic Data Base; Geographical Names in Antarctica; Index of Antarctic Geographical Information; Atlas of Antarctic Scientific Stations.