

## CARTOGRAPHIC SUPPORT OF EXTRATERRESTRIAL GEOGRAPHY

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**Abstract.** At the beginning of the nineties it was begun to discuss and later to develop a conception of extraterrestrial geography. Planetary maps and globes should play very important role in it. Today there are a lot of Mars, Moon, Venus maps in various small and large scales (on one sheet and on many sheets using different classes of projections), maps of some giant-planet moons and asteroids, maps of comet. Unfortunately this information is concentrated in special laboratories and scientific institutes in very limited number of countries. But this knowledge must be accessible for the whole mankind, especially for the young generation. The printing of a multilingual map series belongs to the first steps on this way.

Extraterrestrial geography based on planetary cartography can play an important role in space explorations. The main idea is that it is necessary to prepare the mankind in the whole to the next steps on space explorations in future, viz. to manned mission to Mars, to permanent base on the Moon and to make right cardinal decisions in this field.

That is why it is a good time to begin with such education at school. On the threshold of the new Millenium the educated people must hear about chaoces on Mars, tesseras on Venus, catenas on the Moon and so on. Special program on extraterrestrial geography is created. It is considered as a base for the course of extraterrestrial geography for school. This program includes parallel to students testing, special materials for teachers, writing text-books on extraterrestrial geography for 8-9 grades, on comparative planetology and planetary cartography for 10-11 grades (as profile subjects), also compiling various help material for exercises, viz. contour and thematic planetary maps, globes etc. Today it is possible to tell children about atmosphere and climate on the planets, about relief and morphology of their surface, about inner structure using various thematic maps, topographic plans and diagrams.

Concerning the relief forms discovering on other celestial bodies, the International Astronomical Union authorizes more than 40 terms for their designations, and a lot of these forms has not the Earth analogs. As to communication with mankind culture, a certain interest is represented here by an adopted system of proper names for the separate relief forms. For example, the craters on a Mercury are named in honor of the persons of art, on the Moon and Mars in honor of the astronomers, physicists, mathematicians, and Venus is peculiar collection for the famous women of all epoch and peoples.

To imagine capabilities of planetary cartography we shall stay briefly on cartographic studying of celestial bodies.

Today the greatest volume of cartographic products is created for a surface of the Moon. Some tens (one-sheeted and many-sheeted) maps, issued in Russia, USA, England, Switzerland, Germany Poland, Czechoslovakia etc. are existed. They are divided on small-, middle- and large-scales. The small-scale maps represent general maps on scale 1:5 000 000 and less. Such maps exist both for the whole Moon and for its visible and far hemispheres. The maps of middle scales are general-topographical maps of some areas on scales from 1: 1 000 000 up to 1: 250 000. And, at last, maps of large scales are maps on local regions and separate sites on scales from 1:100 000 up to 1: 5 000. There are also topographical plans and schemes on scales from 1: 1 000 up to 1:20.

A lot of small-scale maps of Mars is published in USA, Russia, Switzerland, Germany. Besides there are two maps, namely scale 1: 5 000 000 (30 sheets) and 1: 2 000 000 (138 sheets) on the whole surface of the planet. It was possible to create maps of larger scales (1:1 000 000 and 1: 500 000 ) on some regions of Mars. The topographical plans were compiled on the Viking landing sites.

The first topographic Venus map on scale 1: 50 000 000 based on altimetry measuring from space vehicle Pioneer - Venus was created for the Venus surface with the exception of polar regions. Besides a map of scale 1: 5 000 000 on northern hemisphere (27 sheets of mosaics with horizontals conducted through 100 m) was compiled by using the radar survey data of stations Venera -15 and -16 . The large-scale plans are made for landing sites of automatic stations Venera 9, 10, 13, 14 . The radar survey of all the surface of the planet conducted by Magellan mission has allowed considerably expand a scale number of Venus maps. In particular, the compiling a map on scale 1: 2 000 000 is made for the whole surface of the planet on these materials.

The Mercury maps are covered only 40 % of the planet surface. The materials of surveying on remaining territory are not available yet. The map on scale 1: 15 000 000 is the most accomplished one. The map on scale 1: 5 000 000 is issued on 15 sheets according to adopted sheet division though majority of sheets have not full covering with images.

The first maps of Mars satellites Phobos and Deimos are also composed. A triaxial ellipsoid was applied for the first time for approximation of Phobos figure.

The maps of Galilean satellites of Jupiter (Io, Europa, Ganimed, Callisto) are one-sheeted, have scale 1: 25 000 000 and represent the celestial body surface with some gaps. Some maps are compiled for several asteroids, viz. Gaspra, Ida, Eros.

Here it is necessary to underline, that the materials of surveying listed above and corresponding cartographic products are basic concentrated in research laboratories of USA and partly of Russia. In this connection the only very limited circle of persons even in the indicated countries can use them.

It is possible to consider printing a series of multilingual maps for planets and their moons as the first attempt to change this situation. Today Mars and Venus maps are printed under support of ICA Commission on Planetary Cartography (Fig. 1 and 2). These maps have information on five languages namely English, German, French, Spanish and Russian. The Moon Map is prepared as uncorrected version for discussion. Then it will be printed too. It is planned to issue Mercury and Phobos maps in the next future.

