THE SECOND STAGE OF THE CREATING IO MAP: FEATURES AND PROBLEMS

Golodnikova I. Y.

Keywords: Io, relief, volcanoes, relief dynamics, relief dynamics, Io map.

Io is one of the four Jupiter's satellites, opened by Galileo in 1610. It is the third in size and the most internal in the system of Galileo's satellites. In connection with active volcanism Io can be classified as one of the most unusual bodies in the Planetary system.

The first spacecraft to pass by Io were the twin Pioneer 10 and 11 probes on December 3, 1973 and December 2, 1974 respectively. The Quality of those images was better than telescopes could give in those days.

When the twin probes Voyager 1 and Voyager 2 passed by Io in 1979, their more advanced imaging system allowed for far more detailed images. Voyager 1 flew past the satellite on March 5, 1979 at a distance of 20,600 km (12,800 mi). The images returned during the approach revealed a strange, multi-colored landscape devoid of impact craters. The highest resolution images showed a relatively young surface punctuated by oddly shaped pits, mountains taller than Mount Everest, and features resembling volcanic lava flows.

The Galileo spacecraft arrived at Jupiter in 1995 after a six-year journey from Earth to follow up on the discoveries of the two Voyager probes and ground-based observations taken in the intervening years. Out of 35 revolutions of Galileo round Jupiter, 7 were projected for Io research. Io's location within one of Jupiter's most intense radiation belts precluded a prolonged close flyby, but Galileo did pass close by shortly before entering the orbit for its two-year, primary mission studying the Jovian system. Although no images were taken during the close flyby on December 7, 1995 the encounter did yield significant results, such as the discovery of a large iron core, similar to that found on the rocky planets of the inner solar system.

In December, 2000 Cassini passed by Jupiter and received new data about plasmatic torus formed by Io with the aid of sensitive ultraviolet spectrometer.

The New Horizons spacecraft, on its way to Pluto and the Kuiper belt, flew by the Jupiter system and Io on February 28, 2007. During the encounter, numerous remote observations of Io were made. These included images of a large plume at Tvashtar, providing the first detailed observations of the largest class of Ionian volcanic plume since observations of Pele's plume in 1979. New Horizons also took pictures of a volcano near Girru Patera at early stages of its eruption, and several volcanic eruptions that had occurred since Galileo.

Io is a bright celestial body, its surface reflects 60% of incident light. Temperature of Io's surface in equatorial area in the daytime on the average is nearly –50°C. The atmosphere is extremely thin. Io has the most bright colors of all the Galileo's satellites. Its shape is almost a sphere, the size is a little larger than the Moon's (the radius is 1819 km). The orbital period, keeping one face nearly pointed toward Jupiter, is 42.5 hours. The surface of the satellite is variagated in color. Apparently this is the result of the presence of various allotropic forms of sulfur as well as volcanic craters, cracks and others relief features, associated with volcanic processes dominating in surface formation up to now.

When making the draft of a map of Io the key point is rendering relief features. Mapping the satellite requires that some features be taken into account: as a rule, when compiling a map of the Earth group (the Moon, Mercury and Mars), the amount of impact craters covering a given territory helped to determine the whole stratigraphic and sometimes age correlation. On the Io surface, continuous layers of volcanic deposits cover almost all impact craters. Besides, as a rule, when mapping planetary bodies, stereopairs of images are used, but there are not many stereopairs for Io.

The main type of relief on Io is volcanic plains, almost without impact craters exceeding 2 km, but complicated by more than 100 volcanic craters which are more than 25 km in diameter. Most of the craters are at low latitudes, but some are also discovered at circumpolar latitudes (caldera Inti 69°degree S, longitude350°west). In the plains, there also are benches like lava streams, hill-like elevations, depressions of irregular form.

Friable formations on the Io surface are probably light ashes consisting of sulfur coming from underneath through multiple volcanic craters.

It is necessary to remember about relief dynamics as well. For example changes in patera Pilan over 5 months, namely, a new dark spot of 400 km in diameter round patera Pilan.

The relief is rendered by relief shading with computer drawing in the interactive mode, using Adobe Photoshop and data tablet software. Moreover, various areas, formed by volcanic ejection, are shown in color. The color gamut is devised so that to render most exactly the natural colors of Io. For the most exact and detailed rendering of the surface relief, the types of relief encountered, especially volcanoes, are analyzed, and their legend made.

Post-graduate student I. Y. Golodnikova
Moscow State University for Geodesy and Cartography
Moscow, Russia, 105064, Gorohovsky per., 4
mailto:nika_saige@mail.ru