CARTOGRAPHIC SUPPORT TO *VENGLOBGEK* INTERNATIONAL PROJECT ON THE GENERAL GEOLOGIC MAPPING OF VENUS: THE MAIN OUTLINES

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Introduction. The planet Venus is the second largest (after the Earth) body among the terrestrial-type planets. The surface of Venus is 460×10^6 km^2, which is three times larger than the area of the dry land (continents + islands) on the Earth. The general geologic mapping of the planet Venus is under development as the joint *VENGLOBGEK* project of Vernadsky Institute, Moscow, Russia and Brown University, Providence, Rhode Island, USA since 1995. *VENGLOBGEK* is the abbreviation from the Russian transcription of 'Venus: Global geologic map' – **Ven**era: **Glob**al'naya **ge**ologicheskaya **k**arta). The project is aimed to produce the geologic map covering the whole planet Venus at 1:10,000,000 scale. The project coordinators are A. T. Basilevsky (Vernadsky Institute) and J. W. Head (Brown University). The map editors are A. T. Basilevsky (geology) and G. A. Burba (cartography).

Unified legend. The geologic structure of the surface should be portrayed on the map in the unified legend. Twelve geologic units in the map's legend represent a stratigraphic series from older to younger units. The base for the legend is the stratigraphic model of Basilevsky and Head [1]. The global geologic map of Venus will portray the largest area ever mapped in the uniform legend and after the uniform-type survey materials.

Cartographic base. The whole set of the necessary cartographic tasks have been developed to provide a support to the global geologic map. It includes the design of the multisheet configuration; the selection, development and computation of the map projectio; the determination of the technique for transformation of the images into seamless map of another projection; the cartographic drawing and coloring of the original paper map sheets.

Data sources – the survey materials. The compilation of the geologic map of Venus is based on the side-looking radar images, obtained from the American *Magellan* and Russian *Venera 15* and *Venera 16* orbiters. The radar image resolution is from 1.8 km up to 75 m per pixel. To fill the gaps in the coverage we use the Earth-based Arecibo Radar Observatory image data with resolution ~ 2 km/pixel, as well as the coarser radar altimetry data from the *Pioneer Venus* orbiter.

Multisheet configuration. The map at the 1:10,000,000 consists of 28 sheets. There are 6 sheets in each of the two polar areas (latitudes 35 to 90°) and 8 sheets in each of the two equatorial bands (40°N to 40°S). The area of each sheet is 16.35×10^6 km^2 or ~ 3.55% of the surface of Venus. It could be compared with the area of Russia – 17.1×10^6 km^2, or the area of the USA – 9.4×10^6 km^2. The boundary longitudes of the map sheets in the polar areas are 20, 80, 140, 200, 260 and 320° E. Within the equatorial bands the sheet boundary latitudes are 45 degrees apart, beginning from the 320° E meridian. Such 'prime' meridian have been established by us due to the astronomical meaning of the longitude 320° E as this is the central longitude during the lower conjunction of Venus, when the planet is between the Sun and the Earth. The version of 6 sheets at 1:20,000,000 scale is anticipated as well.

Map projection. The polar areas (latitudes 35 to 90°) are presentewd in polar azimuthal projection. Equatorial areas will be in normal cylindrical projection. Both projections are with the equal intervals along meridian. The overlapping zones between the polar and equatorial sheets of the map (35 to 40° of latitude) have the same scale. The nominal scale is saved along the meridians and along the equator. The figure of Venus used for the computation of the projections is a sphere with a radius of 6050 km. The diameter of the polar area map (6 sheets joined together) is 116.2 cm.

Using the base for geologic mapping. The detailed description of the mapping procedure and the geologic analyses of the map of the North Venus (35 to 90°N) is published with numerous illustrations, including radar images and small maps of each stratigraphic unit [2]. By this time there are 6 sheets of the geologic map at 1:10,000,000 scale for the whole area of the North Venus – 98.1×10^6 km^2 or 21% of the surface of Venus. Such area is equal to the areas of Asia, Africa, and North America taken together (or it is slightly more than the area of the Atlantic Ocean).

Also the geologic interpretation is made for 5 sheets, which cover 83% of the South Venus (see table). These 11 sheets (6 in North and 5 in South Venus) cover ~39% of the surface of Venus, or 180×10^6 km^2. It is equal to 120% of the area of dry land on the Earth.

Coverage of Venus with the map sheets

(The current status of the Global geologic map at 1:10,000,000 scale – VENGLOBGEK Project)

Region of Venus	Limits		Sheets	Area	
	Lat.	Long.		10^6 km^2	% **
North	35–90°N	0–360°E	6	**98.1**	21
South	35–84°S *	320–0–260°E	5	**81.8**	18
Total			11	**179.9**	39

* *The area southward of 84°S is not imaged.*
** *Of the whole surface of Venus.*

Electronic version. Software have been developed to transform the drawings of the geologic boundaries from the C1-MIDRP format into the seamless map sheet at the appropriate cartographic projection. The original hand-drawn and colored paper maps of the six sectors of North Venus (drawn at 1:8,750,000 scale) were connected together with the computer technique into the electronic version of the single map of the whole area [3]. The electronic version includes geologic boundaries, color coding of the stratigraphic units, letter indexes of the units, and the cartographic grid with 10°-intervals both in latitude and longitude.

References. [1] Basilevsky A. T. and Head J. W. (1995) *Earth, Moon & Planets*, *66,* 285-336. [2] Basilevsky A. T. et al. (2000) *Solar System Res*., *34*, No 5, 349-378. [3] Basilevsky A. T. et al. (2001) *Vernadsky – Brown Microsympos. Compar. Planetol., 34,* Suppl. (CD-ROM).