

VENUS MAP

(The series of multilingual maps for terrestrial planets and their moons)

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Abstract

Preliminary version of Venus Map is published. This map was prepared for publication in frames of the international Russian-German project under guidance of Planetary Cartography Commission. It belongs to series of multilingual maps for terrestrial planets and their moons. The idea about compiling of such a series was discussed in Barcelona during ICA-Congress in 1995. After that the preliminary version of Mars map was exhibited in Stockholm at ICC in 1995. During discussion some corrections and improvements were made. The first map of the series was represented at ICA-Congress in Ottawa in August 1999. It was Mars map at scale 1:25 000 000. The Venus map was planned as the next one for this series. Besides of the shaded relief representation each map has to include an information about various parameters of celestial bodies (astrophysical, geodetic and so on), the list of Latin terms for relief features designation and a list of space missions to this planet or to the planet's moon. This information will be placed on the back side of the map in 5 languages, namely in German, in Russian, in English, in French and in Spanish. It is possible to consider this series as the first attempt for creating the multilingual planet maps. The Atlas of terrestrial Planets and their Moons published in Moscow State University for Geodesy and Cartography in 1992 was chosen as a base for the map series. It is important to underline that Venus map in this Atlas had white spots in the south polar regions because of information lack at that time. Today there is enough information about this area thanks Magellan mission. That is why it was necessary at first to recompile the basic Venus map and only then to use it for transforming in the multilingual series map projection. The Venus map at scale 1:50 000 000 (USGS) was used for this purpose. The Venus surface is presented in two hemispheres at scale 1:61 500 000 in one map sheet. The dimensions of map sheet are the same as for the Mars map.

1. Introduction

The space activity in a new millenium will be more and more wide and intensive. The last evidence of this is the manned flight of International Space Station, regular launches of automatic stations to Mars, asteroids etc. Within the last few years it has become quite evident that in the future more planetary lander and surround missions will be carried out. On the other hand, the average knowledge about the atmospheres, shapes and relief of the planets is still rather increased.

In order to supply the interested public as well as experts with information about the "extraterrestrial geography", particular the relief, of planets a new series of relief maps has been prepared with the publication of a Mars map as the first one and the Venus map for continuing of this series now. The Mars map demonstration at the 1999 ICA Conference in Ottawa made it clear that the international interest in such a map series would be sufficient.

We decided to go the same way as by compiling of Mars map, namely to show " Preliminary version" of Venus map at a scale 1: 61 500 000 on this Conference. We hope to produce a map of higher quality after some discussion of the map contents and additional information.

The preprint had a format of cm x cm, the two hemispheres having a diameter ofcm. In addition to the map proper, collateral information in five languages was also printed around the two Mars halves. The color was a bright light brown and green, with all the lettering in black.

2. Production basis

This project was continue to develop on the base of close scientific cooperation between the Moscow Sate University for Geodesy and Cartography (MIIGAIK) and the Institute for Cartography of the Dresden University of Technology (TUD). Since the main goal of the envisaged maps of this series was the high-accuracy depiction of its overall relief, we were looking for an adequate representation. It was chosen a "classical" relief representation which was already used for the Mars map. There was a pencil-made manual hill-shading Venus relief original map prepared in MIIGAIK. It simulated West illumination with an elevation angle equal/smaller 40° . So far, this pencil drawing on film seems to be the most impressive depiction of geomorphologic features of the whole planet: highlands and lowlands, mountains and valleys etc. are perceivable quite clearly. Thus one can obtain a good impression of relief details of the Venus planet and , hence, simultaneously get an idea of its physiognomy as a whole. The overall quality, richness in detail and original size of the shading suggest final map scale of 1: 61 500 000.

However, it was not possible to use the map at once without some additional work because of its smaller scale, $\pm 100^{\circ}$ on longitude and the so called "white spots" in the south polar region. This original map belonged to the "Atlas of Terrestrial Planets and their Moons" published in 1992. It was time when Magellan mission was not ready with Venus surveying. That is why there were white spots on Venus maps. Today some whole Venus maps were produced by USGS and one of them at scale 1: 50 000 000 was used for recompiling the available map. It was necessary to make digitalisation of the polar region contents and transforming it in another projection . This operation was made by special Program "GeoDraw". Then the shaded drawing was done on this base.

2. Map production.

Based on the decision that the final map scale, which resulted in a diameter of the two hemispheres (.....cm), the first general map layout has been made. Soon it became clear that it would be advisable to print all the collateral information not on the front side but rather put it into text blocks in the back. .

For the production process conventional reprographic methods were applied, using a repro screen of 54 points/cm for the relief shading original. A few attempts were made in order to optimise the reproduction of the relief representation, in particular to balance between the bright tones of the highlands and the darker tones of the lowlands.

The coordinate grid of the map whose geometry is based on the Transversal Equivalent Azimuth Projection of Lambert shows every twentieth parallel and meridian.

The lettering is kept in black and displays different fonts: for craters 7 point Arial, capital letters; for mountain ranges 7 point Arial, italic, capital letters; for plains 7 point Arial, wide spacing, capital letters; for landing sites 7 point, Arial. Thus it gives explanations on all known and named geographic features. The type of lettering allows to deduce the geomorphologic categories.

Below the title "Venus", between the two hemispheres, one finds the astronomical/astrological symbol for this planet.

For the printing three colors have been used. All letterings have been printed in black. The background of the whole is kept in "night-blue", representing the darkness of the outer space and using special printing ink.

The paper format of the map is 55 cm x 84 cm, the format of the printed area being 47 cm x 78 cm which corresponds to the hemisphere diameter. The printed area in the back amounts to 43 cm x 81.5 cm. This is the size of a frame which contains explanatory texts about the map and the planet.

The front side comprehends collateral information about map designer, printer, editor, cartographers and consultants.

The back displays geophysical information about the Venus like density, radius, volume, albedo, orbit inclination, rotation period, and many more (Figure 1).

Data on Venus:

Mass: 4.869×10^{27} g

Density: 5.248 g cm^{-3}

Reference Datum: sphere.

Equatorial Radius:

A: 6.051.9km; **B:** 6051.9km; **polar C:** 6051.9km.

Surface: $46.011 \times 10^7 \text{ km}^2$

Volume: $92.805 \times 10^{10} \text{ km}^3$

Gravitational Acceleration:
at the Equator: 8.87 m s^{-2}

Axial Inclination: 177.3° .

Orbit Inclination: 3.395° .

Average orbital speed: .35.03 km s⁻¹
Orbital Period: 224.701 days.
Synodic Orbital Period: 583.92 days.
Rotation Period: .243.01 days

Average Surface Temperature: 480°C.
Average Clouds Covering Temperature: -33°C

Albedo: 0.76.
Maximum Brightness: -4.4 mag.

Figure 1. Geophysical background information about Venus.

Besides a list of imaging Venus sondes (Figure 2), a complete glossary of "Venus-morphologic" terms like tessera, corona etc. completes the backside information.

Venus Sondes:
(having imaged Venus)
1975 Venus 9, 10: 1.5x2 surface panoramas (USSR).
1978 Pioneer-Venus 1: surface profiles for 90% of surface(USA).
1981 Venus 13, 14: 4 surface panoramas (USSR)
1983 Venus 15,16: radar images for 113 million km in 2 (USSR)
1991- 94 Magellan: radar images for the whole surface (USA)

Figure 2. Imaging Venus sondes.

Relief Forms of Venus:

Chasma: very big linear fracture.
Colles: hills
Corona: large, not of crater origin circus-shaped formation with complex structure
Crater: round depression.
Dorsum (Plural Dorsa): elongate hill, mountain ridge.
Fluctus: wavelike relief formation
Fossa: graben, long, flat and narrow depression.
Linea: filamentlike formation
Mons: mountain, volcano.
Montes: mountain range or mountain massif.
Patera: volcanic formation whose shape reminds on an upside-down saucer and which has very characteristic edges.
Planitia: gentle low plain.
Planum: plateau, not very rough high-altitude plain.
Regio: vast lowlands
Rupes: cliffs, escarpments; steep slopes.
Terrae: mainland, frequently term for a region of equal albedo (degree of reflexion), mainly dating from the time of terrestrial observation.
Tesserae: regio with complex relief looking like parquet

Tholus: separate, not very high domeshaped mountain or hills
Vallis: valley or canyon, frequently bent.

Figure 3. Glossery of morphological terms occuring in the Venus map.

All this information is (from left to the right) given in English, German, French, Spanish and Russian (in cyrillic letters), each text block being printed in a light-grey, screened, elongate box of 14.6 cm x 39.8 cm.

The first edition of the multilingual Venus map amounts to 300 copies. Depending on the demand further print series will be produced.

4. Concluding Remarks

With all its features like easy-to-perceive relief representation , complete landing sites, gossary of morphological terms, and its five-language multilingualism the described Venus map is unique world-wide. The next in the envisaged series of planetary map will be a Moon map, which will also be produced in close cooperation between TUD and MIIGAIK.

The international sales and distribution are carried out by the Institute for Cartography of the Dresden University of Technology.

5. References

1. Atlas of terrestrial Planets and their Moons, Moscow, MIIGAIK, 1992.
2. Atlas of Venus, 1: 50 000 000 series, NASA, USGS, 1997.