PLANETARY MAPS IN EDUCATION

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Abstract On the initiation of Moscow State University for Geodesy and Cartography (MIIGAiK) several groups in Europe are working on a Multilingual Planetary Map Series, and, as a next phase of this project, the Cosmic Materials Space Research Group of Eötvös Loránd University, Hungary, is working on a new multilayered map series. At this group we have conducted a survey amongst students and amateur astronomers asking them about our series. We have modified our maps according to the results of the survey. We also gave special mapping tasks to students during regular classes. Most students look for symbols and patterns that are already familiar for them from terrestrial physical geographic maps and school atlases. In this paper we summarize how we produce our series, which thematic layers we use, and what kind of problems we face in producing our *printed* maps. Our goal is to produce maps that not only are attractive ones, and contain the required scientific contents, but maps on which both visual and textual elements are easy-to-understand by the everyday people.

INTRODUCTION

Planetary maps serve several purposes: they are documentation of our discoveries and current knowledge, an everyday tool for the scientific community, and for the non experts - the public, interested students, children - they are attractive representations of strange new worlds. Maps of other planetary bodies - especially with landing sites marked - show that human kind has acquired a new territory in its - our - oikumene. Every new detail in planetary maps adds a new place to this known world. They do not exist until they are displayed on the map even if scientific papers discuss them. Maps are the visual catalogue of the Places Occupied - by our scientific knowledge. They show planets as places instead of dots in the sky. They also show visually and globally how little and how much the other planets are different from the Earth, this way demystifying them and at the same time highlighting Earth's uniqueness in the known Universe.

MAPS ARE TO READ, NOT ONLY TO SEE

The readers find an alien world on the map. Many of the surface forms has no terrestrial parallels, thus we can't have experience to imagine them. Without an existing mental representation, the used symbols and the generalization should help readers properly identify the features. Since many of the landforms don't appear on maps of the Earth, the cartographer has to find a new (system of) symbols for them. A map readable for the „general user" should contain geologic, stratigraphic, albedo, morphologic, topographic and historic (landings) information to make the map better interpretable and understandable. Most planetary maps are very small scale maps. Thus they can only show a limited variety of features, however, most of the interesting features are of relatively small size. Carefully selected cutouts and/or generalization can help to highlight the location of these landforms (in the case of Mars: landslides, layered crater deposits, DDS's, small valleys, calderas etc). Easy interpretation of our symbols is important: the existing geologic symbols can only be used to a limited extent in such a map. A parallel may be the scientific maps of meteorologists versus the weather maps appearing on TV screens or newspapers. The latter contains the same information but with more stress on design elements.

Usually when speaking about a geographic / geologic / climatic etc. phenomena, everyone can visualize its typical area where it can be found on Earth: we all have a cognitive map of landscape types and features, as well as for some place names. This is, however, not true for other planets. We now enter the age, when detailed investigation begin and (photo-) maps of other planetary bodies are available via the internet. News about features and research results appear on a regular basis in newscast and newspapers. We believe that to form a true cognitive image of other planets and better understand their geologic/climatic systems, people should connect the known data (textual information, which sometimes includes place names) with visual spatial information: locations on a map. For this, the visual appearance and the accompanying textual contents of maps (colors, nomenclature, symbols etc.), and also the environments where these maps are available (school walls, World Atlases, textbooks - or in electronic form) are crucial factors – the same way as maps of the Earth have formed the mental picture of our home planet for many centuries since the world map of Agrippa in the 1st century B.C. For the cognitive map, the reader needs "hooks", well recognizable patterns on the map. On the Earth, this is the contour line of sea level (i.e. outlines of continents and islands) and the blue lines of rivers: both related to hydrology. On other planets (except may be from Titan) this system is absent: the cartographer has to find the best basic pattern from which a planet or a part of it can be readily recognized - as a System of Places.

This is essential if we want to avoid the general belief of "one planet - one landscape" (Mars=desert without topography), or, worst, "one planet - one astrological sign".

CONTOUR MAP.

Contour maps are essential for the students' studies. In the case of the Earth, these maps show the hydrologic system and the borders of continents. Mountains are shown as thick black lines. For other planetary bodies, none of the above can be used: no hydrologic system, no continents, no sea-level, no mountain chains. All planetary bodies has their own characteristic features, while craters are the most common landscape types. For Mars, we have included the north-south boundary, volcanoes as black spots and craters as circles, large valleys as lines, carter-rim-mountains as gray areas. For the Moon, it is the maria, crater-rim-mountains, crater rays, large craters. For Venus, continents, volcanoes, coronae, tesserae, chasmae.

MORPHOLOGIC SKETCH MAPS

During Astronomy classes at Eötvös University, one of the tasks of the students was to draw the simplified geomorphologic map of various planetary bodies, using topographic, geologic and photomosaic maps. The task included creating a coherent symbol system for their maps (Fig. 1-2). They had a strong background in geography and geomorphology, but not in planetary science. They - naturally - used those symbols they are used to. The result - even if scientifically not correct - has many useful visual and conceptual elements which can be used in drawing simple planetary maps.

Fig. 1. Students explaining their symbol system for Venus. Photo: P. Lovász.

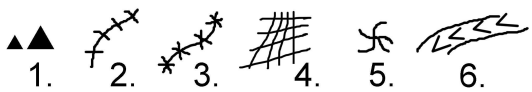

Fig. 2. A few of the symbols the students used: 1. Volcanic cone 2. Mountain 3. Fossa 4. Dorsa (Venus) 5. Arachnoid 6. Valley (outflow and tectonic).

In the overall appearance, for Mars, they used a white background for highlands and striped background for lowlands - because there are more features inside the highland areas than in lowlands, therefore the map will be clearer this way. These are small but important details.

They used the terminology and nomenclature with many errors, since they were not familiar with it. But it was this unfamiliarity which showed exactly the „weak points" of it: they used the word „debris (or ejecta) mountain" for the Lunar circumbasin mountains (Appennines), which exactly describes its nature. They used „Syrtis Major bulge" instead of Planum, "Mariner graben" instead of Valley etc.

DATA SECTION

The World Atlas has a „Geographic Data" section in which the geographic records are shown (longest river etc). We have prepared a dataset of the same structure using planetary records: the largest, highest, longest etc. mountains, valleys, volcanoes, depressions etc. in the Solar System.

CONCLUSIONS

In the case of publishing planetary maps for a non-expert readership, it is proposed to use common (latinized or internationally romanized) specifics (without translation) and separate (translated or transcribed/transliterated) generics for

different languages, as in the case of many undersea features. The specific elements should never be translated, except for those features that has a traditionally translated variant. It is also recommended to show – as available space makes it possible – a bilingual (international and local) nomenclature on planetary maps, especially in the case of names with translated specific elements.

The visual appearance, symbol system and the contents of planetary maps should be closer to terrestrial maps making them easier to interpret correctly. Comments and height data appearing on the map can also help to improve its understandability. Thus the reader can form a more realistic mental map of the particular planetary body.