

Updated symbol catalogue for geologic and geomorphologic mapping in Planetary Sciences

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Maps are one of the most powerful communication tools for spatial data. This is true for terrestrial data, as well as the many types of planetary data. Geologic and/or geomorphologic maps of planetary surfaces, in particular those of the Moon, Mars, and Venus, are standardized products and often prepared as a part of hypothesis-driven science investigations. The NASA-funded Planetary Geologic Mapping program, coordinated by the USGS Astrogeology Science Center (ASC), produces high-quality, standardized, and refereed geologic maps and digital databases of planetary bodies. In this context, 242 geologic, geomorphologic, and thematic map sheets and map series have been published since the 1962. However, outside of this program, numerous non-USGS published maps are created as result of scientific investigations and published, e.g. as figures or supplemental materials within a peer-reviewed journal article.

Due to the complexity of planetary surfaces, diversity between different planet surfaces, and the varied resolution of the data, geomorphologic and geologic mapping is a challenging task. Because of these limiting conditions, the mapping process is a highly interpretative work and is mostly limited to remotely sensed satellite data – with a few exceptions from rover data. Uniform and unambiguous data are fundamental to make quality observations that lead to unbiased and supported interpretations, especially when there is no current groundtruthing.

To allow for correlation between different map products (digital or analog), the most commonly used spatial objects are predefined cartographic symbols. The Federal Geographic Data Committee (FGDC) Digital Cartographic Standard for Geologic Map Symbolization (DCSGMS) defines the most commonly used symbols, colors, and hatch patterns in one comprehensive document. Chapter 25 of the DCSGMS defines the Planetary Geology Features based on the symbols defined in the Venus Mapper's Handbook. After reviewing the 242 planetary geological maps, we propose to 1) review standardized symbols for planetary maps, and 2) recommend an updated symbol collection for adoption by the planetary mapping community. Within these points, the focus is on the changing of symbology with respect to time and how it effects communication within and between the maps. Two key questions to address are 1) does chapter 25 provides enough variability within the subcategories (e.g., faults) to represent the data within the maps? 2) How recommendations to the mapping community and their steering committees could be delivered to enhance a map's communicability, and convey information succinctly but thoroughly.

For determining the most representative symbol collection of existing maps to support future map results (within or outside of USGS mapping program) we defined a stepwise task list: 1) Statistical review of existing symbol sets and collections, 2) Establish a representative symbol set for planetary mapping, 3) Update cartographic symbols, 4) Implementation into GIS-based mapping software (this implementation will mimic the 2010 application of the planetary symbol set into ArcGIS (more information <https://planetarymapping.wr.usgs.gov/Project>). 6) Platform to provide the symbol set to the mapping community.

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