

PLANETARY NOMENCLATURE: INFORMATION AND GUIDELINES FOR GEOLOGIC MAPPERS. Tenielle Gaither¹ and Amber Gullikson¹, ¹USGS Astrogeology Science Center, Flagstaff, Arizona (tgaither@usgs.gov).

Introduction: The task of naming planetary surface features, rings, and natural satellites is managed by the International Astronomical Union's (IAU) Working Group for Planetary System Nomenclature (WGPSN). The volunteer members of the WGPSN and its task groups have worked since the early 1970s to provide a clear, unambiguous system of planetary nomenclature that represents cultures and countries from all regions of Earth. WGPSN members include Rita Schulz (chair) and 8 other members representing countries around the globe. Since the 1980s, the USGS Astrogeology Science Center has managed (for the IAU and with the financial support of NASA) the ever-growing database of planetary names, the online Gazetteer of Planetary Nomenclature. This abstract provides a summary of the program status as well as guidelines for geologic mappers.

Status: There are currently 15,718 non-terrestrial surface feature names in use for all planets, satellites, and small bodies. The average number of name approvals per year is 131. Requests for one or two feature names at a time are the most common, but years in which there are active missions to new bodies, or new higher resolution image data become available, can bring name requests containing dozens of features.

Purpose and Rules: Planetary nomenclature is a tool that helps to uniquely identify features on the surfaces of planets and satellites, so that they can be reliably located, described, and accurately discussed and compared across the scientific community. The names are particularly helpful in publication, including peer-reviewed geologic maps. Approved names are listed in the Transactions of the IAU [1] and on the Gazetteer of Planetary Nomenclature website [2]. Any names currently in use that are not listed in References 1 and 2 are not official.

Planetary names must adhere to rules and conventions established by the IAU WGPSN (see <http://planetarynames.wr.usgs.gov/Page/Rules> for the complete list):

- Planetary names should be simple, clear and unambiguous.
- Features should be named only when they are scientifically significant and when the naming

is useful to the scientific and cartographic communities at large.

- Name duplication on two or more bodies is discouraged.
- Solar system nomenclature should be international in its choice of names.
- Names with political, military, or religious significance are not allowed.

Guidelines for Geologic Mappers: Standardized planetary nomenclature is particularly useful in planetary geologic maps. These names provide reliable points of reference for mappers to describe features, units, and histories. As such, planetary mappers are some of the heaviest users of planetary names. To facilitate the correct use of these names, mappers should continuously review the official nomenclature in their map area early in the mapping process, as all names in the map area must be shown on the published map (provided the map scale allows). To facilitate correct application of the nomenclature in GIS mapping, point shapefiles are available for download on each planetary body's homepage. Online PDF maps of all current nomenclature for each body are available in the Gazetteer as well. Authors of geologic maps submitted for technical review are encouraged to use these resources for identifying and placing nomenclature.

Geologic mappers should assess any implications of the nomenclature for the mapping. For example, if there is an approved crater name but no crater unit has been mapped, the mapper should consider whether a crater unit should be mapped. Likewise, feature types should be checked with the geologic units (e.g., if there is a dorsum name on a feature mapped as a fossa, the terminology should be corrected).

Nomenclature fonts are selected according to the feature type (see Table 1), and the correct fonts must be used for each feature name. Feature labels should be scaled appropriately and extend across the associated feature, preferably as feature annotation in GIS (i.e., labeled point files are inadequate for technical review). Using the online nomenclature maps as a guide, the mapper should ensure that names are placed correctly, so that the po-

sitioning of each name shows the location and extent of the feature. USGS will assist with final placement but good faith efforts should be made in the initial placement of names.

Nomenclature Fonts for USGS Geologic Maps	
Arial	Times New Roman Italic
Albedo features	Collis, colles
Arcus, arcūs	Corona, coronae
Crater, crateres	Dorsum, dorsa
Eruptive centers	Facula, faculae
Planitia, planitiae	Macula, maculae
Planum, plana	Mensa, mensae
Terra, terrae	Mons, montes
Tessera, tesserae	Patera, paterae
Vastitas, vastitates	Regio, regiones
	Tholus, tholi
	Corona, coronae
Arial Italic	
Catena, catenae	Linea, lineae
Cavus, cavi	Lingula, lingulae
Chaos, chaoses	Oceanus, oceani
Chasma, chasmata	Palus, paludes
Farrum, farra	Rima, rimae
Flexus, flexūs	Rupes, rupēs
Fluctus, fluctūs	Scopulus, scopuli
Flumen, flumina	Serpens, serpentes
Fossa, fossae	Sinus, sinūs
Fretum, freta	Sulcus, sulci
Labes, labēs	Unda, undae
Labyrinthus, labyrinthi	Vallis, valles
Lacus, lacūs	

Table 1. Fonts used for different feature types in USGS-published geologic maps. Font sizes should be scaled to the size of the feature.

Submitting a Name Request: Only official names may appear on USGS-published maps. An official name should be requested for any unnamed morphological or topographic feature that will be a primary focus of the mapping and/or map text. New name requests should come as early as possible in the mapping phase, so that name proposals do not delay map production. The Gazetteer includes an online Name Request Form (<http://planetarynames.wr.usgs.gov/FeatureNameRequest>) that can be used by members of the professional science community. A specific name may be suggested for a feature, but the name is subject to IAU review and there is no guarantee it will be approved. A published reference is required for each name (reliable web sites and scanned online

books are permitted). Suggested names must also fit the approved theme for each feature type on each body (see <http://planetarynames.wr.usgs.gov/Page/Categories>). Requests to name a crater specifically to honor an individual rather than for scientific needs are not accepted. Before submitting a name request, the online database and maps showing named features should be consulted to confirm that the feature is not already named. If a specific name is included in the request, the database should also be checked to ensure the name has not already been approved for a different feature.

Name Approval Process: Name requests are first reviewed by one of six task groups (Mercury, Venus, Moon, Mars, Outer Solar System, and Small Bodies). After a task group has reviewed a proposal, it is submitted to the WGPSN. Allow four to six weeks for the review and approval process, but more time may be necessary if the proposal is complicated, multiple feature names are being requested, or if questions are raised during the review process. Name requests should be submitted well in advance of publication deadlines. Upon WGPSN approval, names are considered formally approved and it is then appropriate to use them in publications. Approved names are immediately entered into the database and a feature page is viewable on the Gazetteer.

Summary: The USGS Planetary Nomenclature project supports ongoing planetary research and geologic mapping, and the participation of knowledgeable scientists and experts in this process is vital to its success. Questions about the nomenclature database and the naming process can be sent to *Tenielle Gaither*, USGS Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, AZ 86001, or by email to tgaither@usgs.gov.

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References: [1] Transactions of the IAU, Vol. XXIXB, January 2019. http://www.iau.org/science/publications/iau/transactions_b/. [2] Working Group for Planetary System Nomenclature. *Gazetteer of Planetary Nomenclature*. International Astronomical Union. April 4, 2019. <http://planetarynames.wr.usgs.gov/>.