



# NASA/USGS Planetary Geologic Mapping Program



## Guidelines and Recommendations from a Meeting of the Venus Geological Mapping Steering Group Washington, DC, October 24, 1995.

Mappers are referred to the guidelines distributed after the meeting in Flagstaff during July, 1995. Those guidelines are not repeated here.

### I. Mapping standards.

#### A. Volcanic features.

##### 1. Pits and calderas.

- a. If  $D > 20$  km, use the closed hachured line shown on the USGS list of symbols distributed to all mappers.
- b. Use a circle with a central dot for  $10\text{km} < D < 20\text{km}$ .
- c. In general, we recommend not showing pits and calderas with  $D < 10\text{km}$ , but if there is a good reason to do so, smaller pits and caldera can be shown simply with a dot.

##### 2. Domes and shields.

- a. use a plus (+) sign for  $10\text{km} < D < 20\text{km}$  (or  $5\text{km} < D < 20\text{km}$  if justified).
- b. For domes and shields between  $D = 20$  km and  $D = 40$  or  $50$  km:
  - i. If the feature has a cone- or shield-shaped profile, use a plus (+) enclosed in a circle or oval.
  - ii. If the feature is pancake-shaped (steep-sided dome), use a circle or oval with outward pointing barbs in each of the four cardinal directions (like a plus sign with its center covered by a circle or oval).
- c. Domes and shields larger than  $D = 40$  or  $50$  km should be mapped as separate stratigraphic units.

3. A graphics file illustrating these volcanic map symbols is available in .gif format as map\_sym.gif, and can be obtained via anonymous ftp from: 128.119.45.20, /pub/mcgill.

#### B. Impact craters

##### 1. It is OK to map just two impact-crater units:

- a. Outflow deposits (the direction of flow can be indicated with an arrow, if desired). Do not use scarp symbol to show outflow deposits.
- b. All other deposits (ejecta, rim, floor, central peak), undifferentiated.

##### 2. If desired, peak, floor, rim, and ejecta may be mapped separately for very large craters.

However, the central peak should never be delineated with a special symbol (to avoid possible confusion with volcanic features).

##### 3. The stratigraphic position (or range of possible positions) for each crater should be indicated in one or more of 3 possible ways:

- a. as separate range boxes on the correlation chart; craters with identical age ranges should

be lumped within a single box.

- b. as a text table.
- c. in a text paragraph.

### C. Structures

1. Be sure that lines used to represent faults, lineaments, etc. are drafted with a heavier line than contacts.
2. The presence of coronae should be indicated by increasing the density of the lines used to represent fractures or ridges; a specific line completely encircling the feature should not be used. Coronae as structures should not be mapped as material units. However, it is common for portions of coronae to consist of mappable units distinct from surrounding plains.
3. Map only those structures that are distinct on the SAR base. Vague structures and topography should not be mapped.

### D. Stratigraphy

1. Local vs. regional vs. global units.
  - a. Widespread plains units.
    - i. We must avoid any naming scheme that implies a common age or origin for widely separated plains of similar appearance. Plains units may prove to be correlatable globally, but this has yet to be demonstrated by anyone.
    - ii. The most workable scheme is probably to correlate regionally; that is, all quadrangles including parts of a given planitia should logically have correlatable regional plains units. Thus mappers will attempt to define common units on a regional basis.
    - iii. The names used for these regional plains units should convey geographical information; thus vph might stand for Vinmara homogeneous plains, tph for Tinatin homogeneous plains. These units should have similar SAR properties, but correlation will be left open to explicit interpretation.
    - iv. Mappable members of these regional plains units may be identified with names or letters, but not numbers (numbers carry undesirable cryptic implications for global chronology). Members can be local to a single quadrangle, or of more regional import.
    - v. The mapping meeting next summer will include a large block of time during which mappers will meet in regional groups to settle on common regional plains units, and suggest names for these units. **HOWEVER**, authors should submit their maps to the USGS for review whenever they are ready; that is, do **NOT** wait until after the meeting next summer. There will be plenty of time to change unit names before the revised maps go to press.
  - b. Names of local units should include the source feature wherever this can be clearly defined. Thus hf might represent flows emanating from Heng-O. For such units, members may (and commonly should) be numbered. Thus gf1 and gf2 would represent two flow units from Gula Mons that are of demonstrably different age. It also is permissible to create generic local units, such as sf for flows emanating from shield fields, or cf for flows emanating from coronae. The choice will depend on a balance between added information on one hand, and an excess of basically similar units on the other hand.
  - c. If no source is obvious for a local unit, it should be given a simple descriptive name.
  - d. Please note that all letters in the symbolic names are lower case; use of upper case for the first letter is reserved for formal time-stratigraphic terms, and these do not exist for Venus at this time.
2. "Basement"
  - a. Great care should be exercised with respect to the age of old units.
    - i. Even if the materials within tessera terrain appear to be the oldest unit in a quadrangle, this in no way implies that they are the same age as materials of tessera terrain found elsewhere on the planet (remember the 19th century error in assuming that metamorphic "basement" on Earth was everywhere the same age!).
    - ii. Many quadrangles have more than one type of material occurring as inliers in regional plains. It is a natural tendency to assume that the most deformed of these are older than the less deformed (e.g., tessera vs. densely fracture plains of some mappers). Unless the two units are actually in contact so that this age relationship is demonstrable, the correlation chart should convey the possibility of age overlap.
  - b. In summary, the correlation chart and the text should indicate relative ages based only on

explicit evidence in the quadrangle or in neighboring quadrangles.

3. Descriptive names for material units.
  - a. In general, use English rather than Latin words. Thus "plains materials" rather than "planitia materials", "flow materials" rather than "fluctus materials". "Corona materials" is OK. There still is no consensus concerning tessera vs. complex ridged terrain. The problem is that the materials within tessera are not everywhere ridged, nor are they necessarily complex. We need a new, strictly descriptive English name for the materials of tessera terrain. For now, "tessera materials" will be accepted as an exception to the "use English" rule, but this may change.
  - b. Descriptive terms such as rough and smooth are preferable to bright and dark, because the relative brightnesses of surfaces with different roughnesses change with SAR incidence angle.
  - c. Pattern (or "textural") terms such as mottled, homogeneous, grainy, etc. should be used if appropriate. Beware of using "smooth" where homogeneous is meant; a uniform SAR backscatter could derive from a uniformly rough surface as well as a uniformly smooth surface.
  - d.
  - e. If possible, avoid using topographic or structural characteristics in the name of a unit because these are secondary and thus not necessarily related to the materials of the unit (Normanskill Formation is Normanskill Formation whether exposed on a mountain or in a valley, whether horizontal or folded). Use geomorphic rather than genetic terms (e.g., "lineated" instead of "fractured"). We realize that it may well be necessary to violate this guideline in specific and very difficult cases, but these should be rare.
4. Radar properties
  - a. The radar properties of all regionally important units (such as widespread plains) should be included in a table, and the backscatter values shown on a graph.
  - b. Local units may be illustrated with selected examples. For example, if flow units of similar appearance are mapped around several volcanoes, include only a representative sample that illustrates the range of backscatter values.
  - c. The logic behind the sizes of the sampling boxes should be stated, either in the table caption or in the text.

## II. Text and Figures

- A. Standard text: members of the Steering Group are writing brief paragraphs covering two important topics:
  1. a description of the Magellan spacecraft and mission, and
  2. the basic methodology of mapping using SAR images and ancillary data. These paragraphs will be printed as part of the marginal information on all Venus geological maps. Authors must still discuss the specifics relevant to their quadrangles in their text (what data cycles, the range of incidence angles, how units are defined, etc.), but it will not be necessary to discuss these issues generically. When these paragraphs are completed, copies will be circulated to all mappers.
- B. Authors should consult planetary geological maps recently published by the USGS for examples of how to organize the text. There is no rigid format, but most text organizations should not deviate in a major way from the following model outline:
  1. INTRODUCTION: covers such topics as the location and size of the area, topographic features, and the data products used.
  2. MAPPING TECHNIQUES: includes problems encountered in mapping.
  3. GENERAL GEOLOGY: includes regional setting.
  4. STRATIGRAPHY
  5. STRUCTURE
  6. IMPACT CRATERS
  7. SURFICIAL MATERIALS
  8. DISCUSSION; GEOLOGICAL HISTORY
  9. Acknowledgements

## III. Reviews

- A. When maps are submitted, the USGS conducts a "pre-review" to verify if the author has submitted all of the materials required for the scientific reviews. An incomplete submission can lead to a delayed review.

- B. Reviewers receive a USGS "flow sheet". If a reviewer signs this sheet, she/he is stating that the map and text require only minor revision, and thus do not need to be subjected to any additional scientific review (similar to when a reviewer of a journal article indicates that author responses to the review can be evaluated by the editor only). If the map or text requires more extensive revision, reviewers should initial rather than sign the flow sheet.
- C. The author check list provided by the USGS is quite explicit about what should be submitted. However, some additional guidelines are needed to be sure that the reviewers can do a thorough job without unnecessary extra effort.
  - 1. The 1:5M base mosaic should be submitted with the map because the primary reviewer must check every contact against the base. This mosaic will be returned to the author.
  - 2. The colored and uncolored copies of the geological map should be at the same scale as the 1:5M base mosaic.
  - 3. Depending on who the reviewers are, it may be necessary for the author to submit the F\_MAPS covering the quadrangle as well. This should be negotiated with the USGS mapping coordinator (currently Ken Tanaka). These will be returned to the author.

---

*Last Update: January 13, 1999*

---

