**GEOLOGIC MAPPING OF THE MEDUSAE FOSSAE FORMATION, MARS, AND THE NORTHERN LOWLAND PLAINS, VENUS.** J. R. Zimbelman, CEPS/NASM MRC 315, Smithsonian Institution, Washington, D.C., 20013-7012; zimbelmanj@si.edu.

**Introduction:** This report summarizes the status of mapping projects supported by NASA grant NNX07AP42G, through the Planetary Geology and Geophysics (PGG) program. The PGG grant is focused on 1:2M-scale mapping of portions of the Medusae Fossae Formation (MFF) on Mars. Also described below is the current status of two Venus geologic maps, generated under an earlier PGG mapping grant.

**Medusae Fossae Formation, Mars:** Work on mapping of the heavily eroded western portions of MFF continues to progress, only hampered by the PI's learning about ArcGIS. Attributes of MFF as documented in Mars Orbiter Camera images were used in a reevaluation of the numerous hypotheses about the origin of MFF, with the conclusion that an ignimbrite origin is most consistent with observations [1]. Yardangs are abundant within an intensely eroded component of the lower member of MFF (which we label as unit $Aml_2$), and they provide insights into the friable nature of $Aml_2$ [2], as evidenced by differences in competency resulting from erosion and mass wasting, a result that appears to be most consistent with variable degrees of welding often present within volcanic (ignimbrite) deposits [1]. A preliminary geologic map of the MC-23 NW quadrangle (Fig. 1) covers the southwestern margin of the globally mapped large

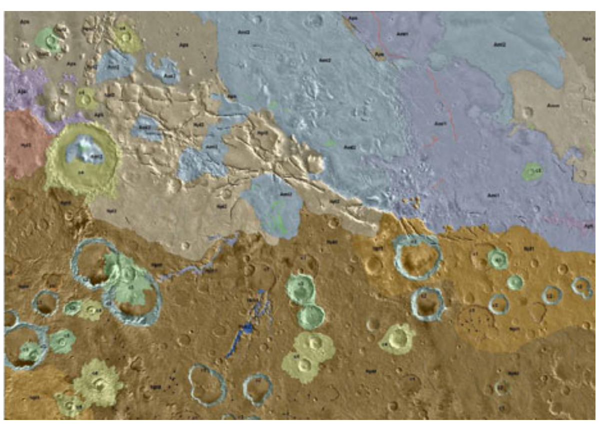

Figure 1. 2009 version of the MC-23 NW geologic map (MFF are the blue, violet, and light tan units).

exposures of MFF [3]. Mapping has revealed several outliers interpreted to be isolated remnants of $Aml_2$ (Fig. 2), suggesting that the previous extent of MFF materials may have been much larger than what is expressed by the present-day MFF exposures [4].

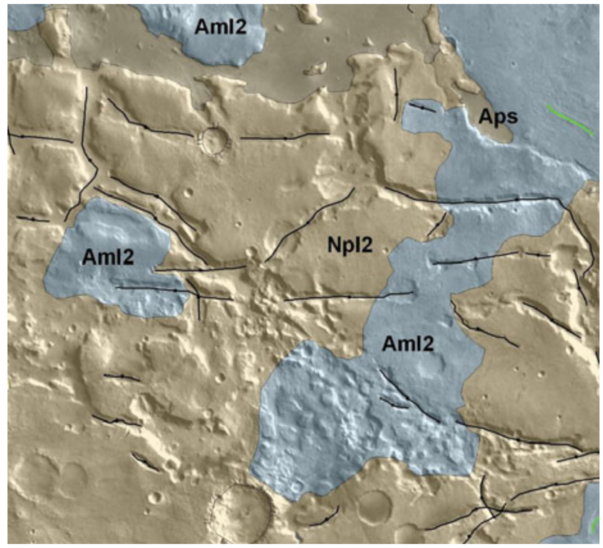


Figure 2. Detail of MC-23 NW map (center-left of Fig. 1) showing outliers of $Aml_2$ materials, located south and west of broad $Aml_2$ exposures.

A distinctive feature thus far restricted to the westernmost MFF exposures is the occurrence of sinuous positive-relief ridges [5], which in MC-23 NW are restricted to the topographically lowest portions of $Aml_1$, what we interpret to be the lowest stratigraphic component of global unit Aml [2; Aml is described in 3]. These sinuous ridges are interpreted to be inverted paleochannels [5, 6] which may represent prolonged flow of a liquid coincident with the emplacement of the stratigraphically lowest component of MFF [2, 5, 6].

Since early 2009, the PI has been learning to use ArcGIS software, obtained through a licensing agreement with the Smithsonian Institution. The learning curve for ArcGIS continues to be very steep, and after a full year the PI is still getting familiar with the intricacies of the software. Unfortunately, at the 2009 mappers meeting, the PI learned that all ArcGIS mapping he had done to date was incorrect, and he is still in the process of trying to get polygons and line attributes all sorted out. The map of MC-23 NW is the first geologic map that will be produced by the PI using ArcGIS, and thus it remains a work in progress at present. The unit contact locations are likely to not change by much, but the symbology and the contact attributes for this map are not yet in USGS format, as of the time of this writing.

Mapping of MC-16 NW (Fig. 3) has barely begun, but it is already clear that this map will provide some

Figure 3. MDIM base map for MC-16 NW.

important new insights into both the lower and middle members of MFF [3]. To illustrate some of the stratigraphic relationships evident here, it is apparent that the global units will be able to be divided into multiple subunits, based on distinctive levels expressed in the erosion of the MFF materials (Fig. 4). Results from

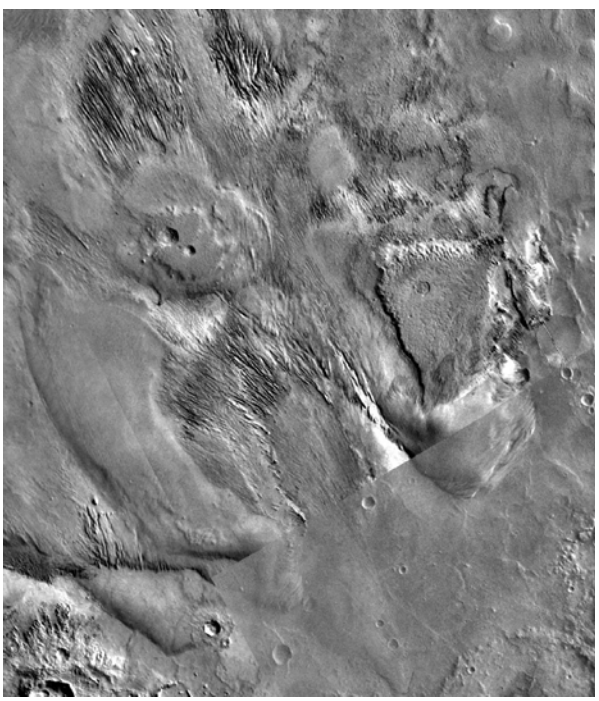

Figure 4. Detail of cliff-forming subunits within MFF (from center-left of Fig. 3).

MC-16 NW are expected to provide valuable new insights into both the emplacement and the erosional characteristics of all three of the globally mapped members of MFF. When mapping of both MC-23 NW and MC-16 NW is successfully completed using ArcGIS, the PI will work on producing an ArcGIS version of a geologic map for MC-8 SE, using an earlier (Illustrator 9) mapping product [7] as a guide to the newly mapped geology.

**Northern Lowland Plains, Venus:** The map and text for the Kawelu Planitia quadrangle (V-16) have been in review with the USGS for many years [8]. A revised version, addressing all reviewer comments, was submitted to the USGS in 2008, at which time it became apparent that the linework (which dated from mapping carried out on unstable hardcopy base materials) was not uniformly registered to the digital photobase that is the current standard for production of published maps. Careful review of all of the linework revealed that no single shift or warp could correct the situation, due to map revisions that were made at different times to various sections of the map. During 2009, all of the V-16 linework was manually adjusted to register with the digital photobase, through the helpful assistance of NASM volunteers. We have not yet regenerated the unit polygons in Adobe Illustrator 9, the software used to make the current version of the map, but we hope to do so later this year. Once the adjusted linework is reconstituted into a map registered to the digital base, V-16 should be able to continue through the revision process. The Bellona Fossae quadrangle (V-15) was mapped preliminarily several years ago [9] under a previous PGG grant, also initiated on hardcopy base materials like V-16. When the V-16 map is finally through review, we will redo the V-15 geology in ArcGIS, using the prior map as a guide while generating the new linework in ArcGIS.

**Future Plans:** Plans for a no-cost extension of funding include submission of the MC-23 NW map to the USGS and preparation of a preliminary map for MC-16 NW, followed by production of revised versions of the geologic maps for MC-8 SE and V-15 using ArcGIS.

**References:** [1] Mandt, K.E., et al. (2008) JGR-Planets, 113, E12011, doi: 10.1029/2008JE003076. [2] Zimbelman, J.R., and Griffin, L.J. (2010) Icarus, doi: 10.1016/j.icarus.2009.04.003. [3] Greeley, R., and Guest, J.E. (1987) USGS Misc. Invest. Series Map I-1802-B. [4] Zimbelman, J.R., et al. (2009) Geol. Soc. Am. Abs. Prog. 95-1. [5] Burr, D.M., et al. (2009) Icarus 200, 52-76, doi: 10.1016/ j.icarus.2008.10.014. [6] Williams, R.M.E., et al. (2009) Geomorphology, doi: 10.1016/j.geomorph.2008.12.015. [7] Zimbelman, J.R. (2007) NASA Mappers mtg, ZIMBELMANa2007 PGM.PDF. [8] Zimbelman, J.R. (2007) NASA Mappers mtg, ZIMBELMANb2007PGM.PDF. [9] Zimbelman, J.R. (2004) NASA Mappers mtg, ZIMBELMAN2004PGM.PDF.