GEOLOGIC MAPPING OF ISABELLA QUADRANGLE (V-50) AND HELEN PLANITIA, VENUS.

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Isabella Quadrangle: (25-50°S, 180-210°E) is host to numerous coronae and small volcanic centers (paterae and shield fields), focused (Aditi and Sirona Dorsa) and distributed (penetrative north-south trending wrinkle ridges) contractional deformation, and radial and linear extensional structures, all of which contribute materials to and/or deform the expansive surrounding plains (Nsomeka and Wawalag Planitiae). Regional plains, which are a northern extension of regional plains mapped in the Barrymore Quadrangle V-59 [1], dominate the V-50 quadrangle. Previous mapping divided the regional plains into two members: regional plains, members a and b [2]. A re-evaluation of these members has determined that a continuous and consistent unit contact does not exist; however, the majority of this "radar unit" or "surficial unit" will still be displayed on the final map as a stipple pattern as it is a prevalent feature of the quadrangle.

With minimal tessera or highland material, much of the quadrangle's oldest materials are plains units (the regional plains). Much of these plains are covered with small shield edifices that exhibit a variety of material contributions (or flows). In the northwest, several flows emerge and flow to the southeast from Diana-Dali Chasmata. Local corona- and mons-fed flows superpose the regional plains; however, earlier stages of volcano-tectonic centers marked by arcuate and radial structural elements, including terrain so heavily deformed that it takes on a new appearance, may have developed prior to or concurrently with the region plains. North-trending deformation belts disrupt the central portion of the map area and wrinkle ridges parallel these larger belts.

Isabella crater, in the northeastern quadrant, is highly asymmetric and displays two prominent ejecta blanket morphologies, which generally correlate with distance from the impact structure suggesting that ejecta block size or ejecta blanket thickness may be the cause. The crater floor is very dark and shows no direct connection with the large outflow to the south, which emphasizes the asymmetry observed. Isabella crater ejecta and outflow materials clearly postdate several small craters in the vicinity.

Helen Planitia: In addition to V-50, this project consists of mapping Helen Planitia at 1:10M-scale (0-57°S/180-300°E), which covers over 70 million square kilometers (approximately 1/8th) of the surface of Venus and the southern portion of the Beta-Atla-Themis (BAT) region. The BAT province is of particular interest with respect to evaluating global paradigms regarding Venus' geologic history and thermal evolution, considering it is "ringed" by volcano-tectonic troughs (Parga, Hecate, and Devana Chasmata), has an anomalously high-density of volcanic features with concentrations 2-4 times the global average [3], and is spatially coincident with young terrain as shown by the Average Surface Model Age [4 and 5]. The BAT province is key to better understanding Venus' current volcanic and tectonic modes.

Last year's efforts were focused on mapping the distribution and orientation of structural trends and flow morphologies, and the demarcation of flow unit boundaries. Several hundred radial and circular features (both digitate and lobate flow fields and fracture, fault, and ridge suites) were mapped in this fashion and matched closely the existing coronae and/or volcanic landform databases [6 and 7].

The majority of these radial/circular features lie within a few hundred kilometers of the Parga Chasmata rift system marking a southeast trending line of relatively young volcano-tectonic activity. Although some very localized embayment and crosscutting relationships display clear relative age relations between centers of activity, the majority of Parga Chasmata volcanism and tectonism overlaps in time from Atla Regio in the west to Themis Regio in the east, extending ~10,000 linear kilometers.

Efforts by Martin et al. [8] resulted in a comprehensive categorization of 131 coronae along Parga Chasmata. Their morphologic and spatial analyses concluded that there are no significant correlations between corona type (annulus characteristics or topography) and size with respect to volcanic output or chasma-related tectonics. However, recent geophysical analysis by

Dombard et al., [9] has identified seven sites within the BAT region that may represent contemporary activity. Four of these sites fall within the Helen Planitia region: Maram (600 km), Atete (600 km), Kulimina (170 km), and Shiwanokia (500 km) Coronae. Mapping relations show that each of the four coronae represents some of the youngest local activity [10]. All four coronae also share similar plan form characteristics displaying radiating flows in excess of several hundred kilometers, fractures and faults that trend parallel to Parga Chasmata, and moderately steep concentric bounding scarps. They also fall directly along the main trend of Parga Chasmata rifting, which may suggest that while using strict spatial relations concludes no relationship between coronae and Parga Chasmata [e.g., 5], temporal-spatial relations correlating high-resolution mapping with putative active geophysical centers provides evidence of active rifting and volcanism on the Venusian surface.

The degree to which coronae and chasmata are genetically related remains elusive given the inability to determine, at least with certainty, Venus' surface age. Detailed stratigraphic analyses coupled with geophysical examination may provide the means to understand contemporary processes that may be extrapolated over history – the present is the key to the past.

Mapping of these centers along Parga and within the surrounding plains continues and the generation of quality control maps has begun (see Figure 1 below).

References: [1] Bleamaster III, L.F., (2007) Open-File Report 2007-1233. [2] Johnson, J.R. et al., (1999) USGS Geo. Inv. Sers. I-2610. [3] Head et al., (1992) J. Geophys. Res., 97(E8), 13,153-13,197. [4] Phillips, R.J. and Izenberg, N.R., (1995) Geophys. Res. Lett., 22, 1517-1520. [5] Hansen, V.L. and Young, D.A., (2007) GSA Special Paper. [6] Crumpler L.S. et al., (1997) in Venus II, 697-756. [7] Stofan E.R. et al., (2001) Geophys. Res. Lett., 28, 4267-4270. [8] Martin et al., (2007) J. Geophys. Res., 112,E04S03, doi:10.1029/2006JE002758. [9] Dombard et al., (2007) J. Geophys. Res., 112, E04006, doi:10.1029/2006JE002731. [10] Bleamaster III, L.F., (2007) LPSC XXXVIII, abstract 2434.

Figure 1. Side-by-side comparison of mapping by Ivan Lopez (left) and Les Bleamaster (right), (merged product in the middle) of 10ºx10º region at the cartographic boundaries of V-52, V-53, and V-60 in HPRSA. This exercise (quality control mapping) illustrates the advantage of having multiple sets of eyes on the same "ground" and the importance of compromise for determining unit boundaries. Although unit boundaries were different, relative time relations were mostly consistent.