GEOLOGICAL MAPPING OF FORTUNA TESSERA (V-2): VENUS AND EARTH'S ARCHEAN PROCESS COMPARISONS. J. W. Head[1], D. M. Hurwitz[1], M. A. Ivanov[1,2], A. T. Basilevsky[1,2], and P. Senthil Kumar[1,3], [1]Dept. of Geological Sciences, Brown University, Providence, RI 02912 (james_head@brown.edu), [2]Vernadsky Institute of Geochemistry and Analytical Chemistry, RAS, Moscow, Russia, [3]National Geophysical Research Institute, Hyderabad 500007, India (senthilngri@yahoo.com).

Introduction: The geological features, structures, thermal conditions, interpreted processes, and outstanding questions related to both the Earth's Archean and Venus share many similarities [1-3] and we are using a problem-oriented approach to Venus mapping, guided by insight from the Archean record of the Earth, to gain new insight into the evolution of Venus and Earth's Archean. The Earth's preserved and well-documented Archean record [4] provides important insight into high heat-flux tectonic and magmatic environments and structures [5] and the surface of Venus reveals the current configuration and recent geological record of analogous high-temperature environments unmodified by subsequent several billion years of segmentation and overprinting, as on Earth. Elsewhere we have addressed the nature of the Earth's Archean, the similarities to and differences from Venus, and the specific Venus and Earth-Archean problems on which progress might be made through comparison [6]. Here we present the major goals of the Venus-Archean comparison and show how preliminary mapping of the geology of the V-2 Fortuna Tessera quadrangle is providing insight on these problems. We have identified five key themes and questions common to both the Archean and Venus, the assessment of which could provide important new insights into the history and processes of both planets.

Geological Mapping of the Fortuna Tessera Quadrangle (V-2): The Fortuna Tessera Quadrangle (V-2) (Fig. 1-2) lies just south of the Snegurochka Planitia Quadrangle (V-1) and between two quadrangles that we have previously mapped, Lakshmi Planum (V-7) to the west and Meskhent Tessera (V-3) to the east [7-8]. To the south it is bordered by Bereghinya Planitia (V-8 [9]) and Bell Regio (V-9 [10]). The most prominent topography in the region is the broad Ishtar Terra highland and its associated distinctive mountain belt, Maxwell Montes, representing the highest topography on Venus (Fig. 3). The vast expanse of Fortuna Tessera wraps broadly around the eastern part of Maxwell Montes and is largely separated from Laima Tessera to the southeast by two parallel deformation belts, Sigrun-Manto Fossae and Aušrā Dorsa (Fig. 2, 4), each characterized by different tectonic styles. The broad terrains of the quadrangle extend to the west into the volcanically resurfaced upland Lakshmi Planum, surrounded by the tessera and folded mountain belts of western Ishtar Terra and to the east into Meskhent Tessera [7-8, 11-15].

One of the most distinctive elements of V-2 is the presence of the folded mountain belt Maxwell Montes and the extensive Fortuna Tessera highland, clearly representing large domains of thickened crust [16-19]. Maxwell rises to about 11 km elevation and drops off to the east to about 5-6 km (Fig. 2-3), suggesting a fundamental change in crustal thickening processes. The parallel ridges and troughs of Maxwell are mirrored in the structure of western Fortuna as the tessera fabric wraps broadly around the base of Maxwell (Fig. 2). Maxwell Montes is flanked to the north and south by two basin-like features (Fig. 5) that contain unusual arcuate, overlapping corona-like structures; these regions bear some resemblance to areas of thickened crust that have delaminated and readjusted isostatically and thermally. Further to the east, a broad depression separates western and eastern Fortuna (Fig. 12), suggesting that the eastern domain may be more related to Laima and Meskhent Tesserae than to the Maxwell-dominated western Fortuna (Fig. 5). Laima Tessera is characterized by linear texture not unlike that observed on the Earth's seafloor [20] (although seafloor spreading does not currently occur), and this terrain is undergoing detailed analysis to assess its origin and relation to tessera in Fortuna. Establishing the detailed character of each of these tessera terrains [21], understanding the nature and sequence of deformation [15, 18], and assessing the relationships to crustal thickening processes are among the main goals of the mapping.

Among the most prominent features in the plains in V-2 are two parallel deformation belts, Sigrun-Manto Fossae and Aušrā Dorsa, that trend SW-NE across the central portion (Fig. 2, 4). The presence of these two parallel features provides the opportunity not only to characterize them in detail, but also to assess their temporal relationships and their relationships to crustal extension and shortening processes. For example, Sigrun Fossae (Fig. 4) shows evidence for extension (graben), associated intrusion (radial graben) and volcanism, while Aušrā Dorsa is characterized by folds and some evidence for shear, and partly intersects Sigrun. Is this deformation contemporaneous, or sequential, and how does it relate to the crustal thickening processes associated with the tessera? Could the extension be a response to crustal thickening? Could the shortening be related to the waning stages of tessera formation? These same types of questions are clearly important in Archean terrains [5].

Summary: Geological mapping and processes studies in the V-2 Fortuna Tessera Quadrangle offer key features and relationships (Fig. 2) that will permit us to address many of our important Venus-Archean thematic questions [6] including: 1) crustal thickening environments and processes, 2) the nature of diapirism and possible delamination, and 3) the nature and origin of deformation belts and their relation to crustal thickening processes.

References: 1) E. Nisbet, *The Young Earth*, Allen & Unwin, 1987; 2) K. Condie, *Archean Crustal Evolution*, Elsevier, 1994a; 3) S. Solomon & J. Head, *Science*, 252, 252, 1991; 4) W. Bleeker, *Lithos*, 71, 99, 2003; 5) K. Condie & K. Benn, *AGU Mon.*, 47, 2006; 6) J. Head et al., Venus-Archean, *EPSC* (abs), 2008; 7) M. Ivanov & J. Head, Lakshmi Planum, USGS V-7, in review, 2008; 8) M. Ivanov & J. Head, *USGS I-3018*, 2008; 9) G. McGill, *USGS I-2794*, 2004; 10) B. Campbell & P. Campbell, *USGS I-2743,* 2002; 11) V. Barsukov et al., *JGR*, 91, D399, 1986; 12) J. Head et al., *GRL*, 17, 1337, 1990; 13) A. Pronin, *Venus Geology*, U of A, 68, 1992; 14) W. Kaula et al., *JGR*, 97, 16085, 1992; 15) V. Hansen et al., *JGR*, 105, 4135, 2000; 16) J. Head, *Geology*, 18, 99; *EMP*, 50/51, 391, *EMP*, 50/51, 25, 1990; 17) M. Keep & V. Hansen, *JGR*, 99, 26015, 1994; 18) V. Hansen & J. Willis, *Icarus*, 123, 296, 1996; 19) M. Pritchard et al., *GRL*, 24, 2339, 1997; 20) J. Head, *JGR*, 95, 7119, 1990; 21) M. Ivanov & J. Head, *JGR*, 101, 14861, 1996.

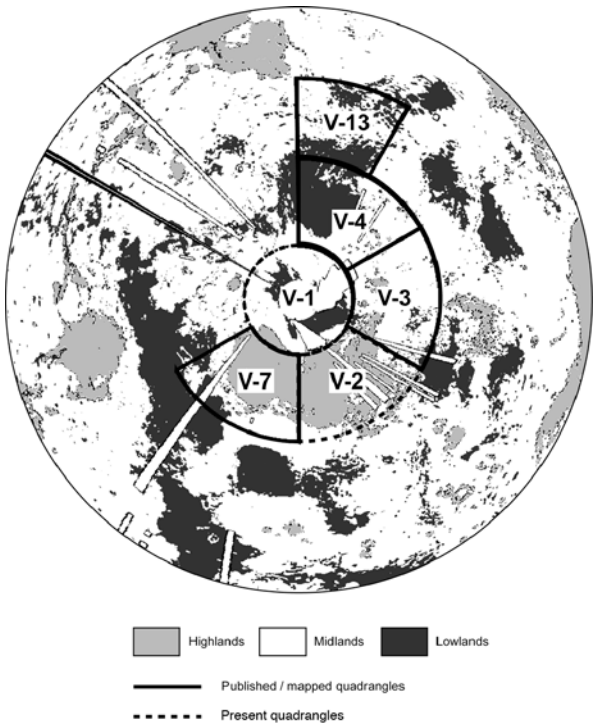

Fig. 1. Northern hemisphere of Venus. Solid lines indicate maps completed (V-4, V-13 published, V-3 in proof, V-7 in review).

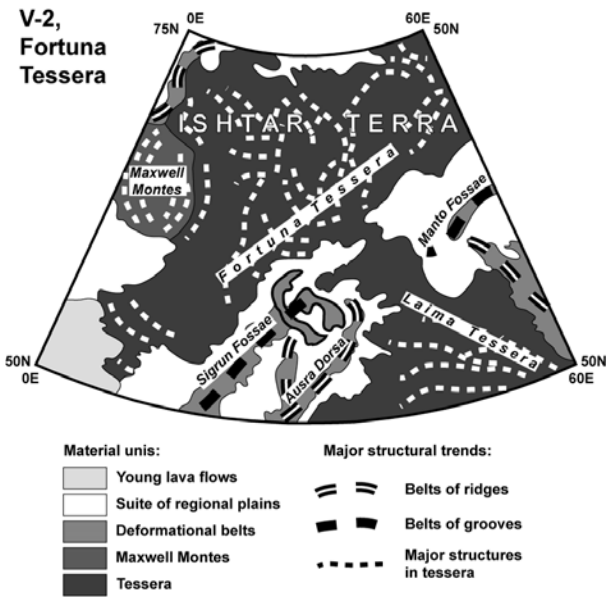

Fig. 2. Geologic sketch map of the Fortuna Tessera (V-2) quadrangle.

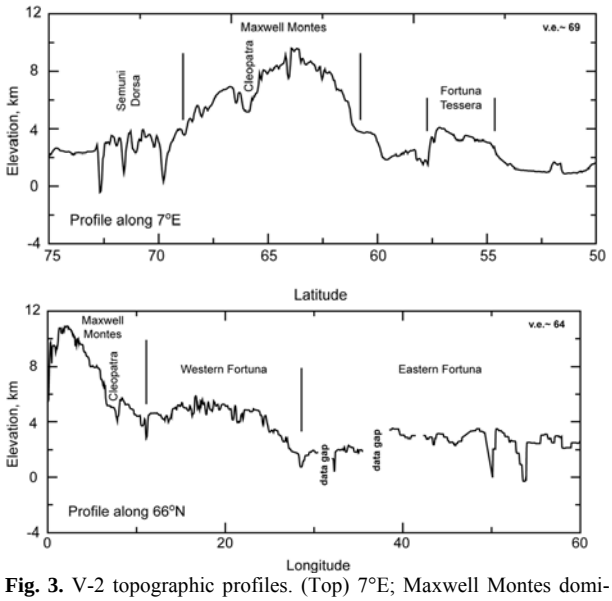

Fig. 3. V-2 topographic profiles. (Top) 7°E; Maxwell Montes dominates central portion, bordered to south by large depression (Fig. 5). (Bottom) 66°N; Maxwell Montes, elevated W., lower E. Fortuna Tessera.

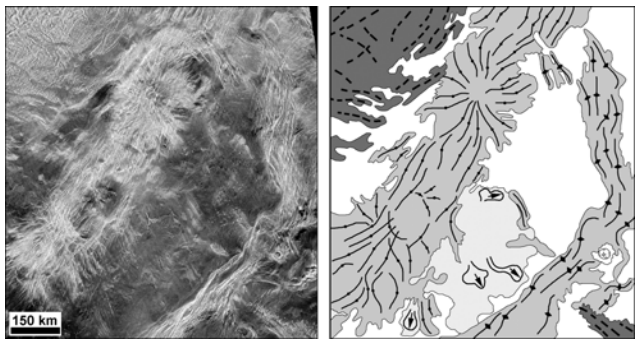

Fig. 4. Image and sketch map of two deformational belts (V-2). Sigrun Fossae (middle portion of image) consists of densely packed graben and Aušrā Dorsa (lower right) is a belt of broad curvilinear ridges. Center ~52°N, 20°E.

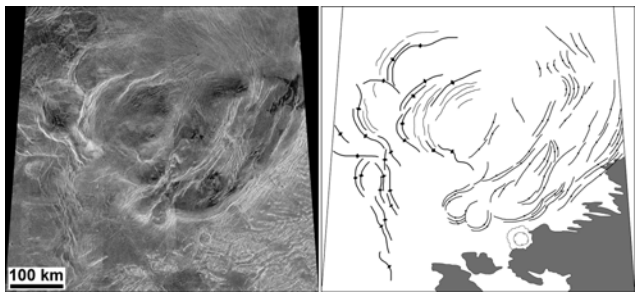

Fig. 5. Image and sketch map of a depression in the plains S. of Maxwell Montes (V-2). The depression is within regional plains and outlined by arcuate ridges in the west and arcuate graben in the east. Center ~59°N, 5°E.