STRUCTURAL MAPPING AROUND IRNINI MONS, VENUS. M.A. Matiella Novak and D.L. Buczkowski, Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, Debra.Buczkowski@jhuapl.edu.

Introduction: Irnini Mons, a volcano in central Eistla Regio at 14ºN, 16ºE, is roughly centered on the V-20 quadrangle of Venus [1]. While Eistla Regio as a whole is known to have the highest degree of polyphase deformation on Venus [2], the area immediately around Irnini Mons is particularly complex, even at the 1:5,000,000 scale of the quadrangle map. The arrangement of cross-cutting tectonic structures indicates a detailed and multipart stress history, which suggests Irnini Mons is an ideal location to identify distinct patterns of changes in stress orientation over time, as well as to ascertain the deformation associated with the volcano relative to the deformation of the local regional plains. A thorough investigation of the distribution and orientation of the numerous structures around Irnini Mons at the highest possible resolution (75 m/pixel) is likely to reveal the relative timing of the structures and thus shed light on the deformation history of this region of Venus.

Geology of Irnini Mons: *McGill* [1] mapped flows and other deposits from Irnini Mons that are superimposed on an older, regional plains material. These superposed materials include: 1) a shield plains unit (fs) younger than the regional plains (prb), 2) flows from Irnini Mons (fI and fhI) that are also younger than the plains (prb), and 3) a smooth plains unit (ps) that is younger than the flows (fI and fhI). The regional plains material (prb) has abundant wrinkle ridges in at least two sets: one trending generally east-west and another concentric to Irnini Mons.

The shield plains unit (fs) is abundantly covered with small domes. Although the shield plains are crossed by wrinkle ridges, they are not necessarily oriented in the same manner as the wrinkle ridges on the background regional plains (prb). Graben associated with Badb Linea cut through the shield material, which overlies a lineated plains material (pl), interpreted as being a relatively old plain of deformed volcanic rocks [1].

The Irnini flows are described by *McGill* [2000] as two units. The first is interpreted as basaltic lava flows (fI), while the second is basaltic lava overlain by a thin pyroclastic veneer (fhI). Both units are free of wrinkle ridges, but do show fabrics of lineations and graben. They seem to overlie every unit save the smooth plains (ps). Radial features on top of the Irnini flows (fI and fhI) were mapped by [1] as lineations or graben, as resolution allowed.

The smooth plains unit (ps) is superposed on the Irnini flows and most of the structures [1]. There are no wrinkle ridges, but small domes and some lineations are visible, though apparently covered.

Structural Features around Irnini Mons: Previous work has determined the nature of large-scale structural features proximal to Irnini Mons. The volcanic edifice is about 475 km wide and 1.75 km high [1] and the volcano is capped by Sappho Patera, a 225 km diameter depression rimmed by both concentric graben and a large circumferential ridge. Sappho Patera has been characterized by [3] as a corona or corona-like feature; simply, a corona is a circular to elongate feature surrounded by multiple concentric ridges thought to be formed by hot spots. Irnini Mons is crossed by two rift systems, the north-south trending Badb Linea and an older rift that incorporates Guor Linea to the northwest and Virtus Linea to the southeast. Large surrounding structural complexities include four coronae and Anala Mons, a 550 km diameter, 2.25 km high volcano almost directly to the south of Irnini Mons.

High-resolution structural mapping was completed by [4] in a 1° x 1° region from 15º-16º N, 17º-18º E, north-east of Irnini Mons. The difference in radar backscatter in high resolution images (75 m/pixel) indicates that some of the radial features are topographic highs [*Buczkowski*, 2006] although they are too narrow to be resolved in altimetry data sets. These features are similar to the "horst-like lineaments" identified by [5]. Unlike the textured plains material (pt) unit of arcuate ridges mapped by [1], which is directly south, these ridges are on top of the Irnini flows and cannot be an older feature. To the north the radial features appear to be graben, also located on top of the Irnini flows. Due north, the radial graben become indistinguishable from the graben associated with the Badb Linea rift.

New Structural Mapping around Irnini Mons: The V-20 quadrangle [1] also included a tectonic elements map of the region. However, the quadrangle was mapped at a scale of 1:5,000,000 and thus many small-scale structures could not be included. Also, there were some small-scale linear features mapped by [1] as “radar-bright lineations” because they could not be resolved as either graben or ridges.

As with solar illumination, radar illumination of a planetary structure highlights the surface that faces the source [6]. If a topographic low, such as a graben, were being imaged, the surface away from the radar look direction would be the surface facing the radar system and would be illuminated. The graben surface closer to the look direction would be facing away from the radar system and would appear relatively dark. Thus a linear feature in a radar image that is composed of a dark band then a bright band from left to right is some type of linear topographic low, such as a graben,

trough or fracture. A topographic high, such as a ridge, would have the opposite appearance. The surface closer to the look direction would be facing the radar source and would be illuminated, while the farther surface would be facing away and thus dark. The image resolution used for quadrangle mapping commonly does not allow the discernment of both a bright and dark part of a linear feature. Without knowing whether these features are extensional or contractional in nature it is impossible to determine the stress history of the region.

The work of [4] showed that the nature of at least some of these lineations can be determined in the highest resolution (75 m/pixel) images. However ,[4] only evaluated a small portion of the region surrounding Irnini Mons. High resolution mapping, like that done by [4], of the entire Irnini Mons area is needed to fully determine the nature of the surrounding structures and thus the region's stress history.

We are building on the work of [4], extending the published structural map of the region from 15º-16º N, 17º-18º E to the entire Irnini Mons region from 12°-20°N, 13°-20°E, which includes structures related to both Irnini Mons and the surrounding regional plains. While the V-20 quadrangle [1] included a tectonic elements map the quadrangle was mapped at a 1:5,000,000 scale, and the nature of many of the small-scale structures could not be resolved. At the highest FMAP resolution of 75 m/pixel many of the features that [1] had to map as "radar bright lineations" could be resolvable as either topographic highs or lows. The structural features in this region include graben, corona structures, wrinkle ridges and fracture and ridge belts.

As an example of how this high-resolution structural mapping may differ from the V-20 map, we present our analysis of the area from 14°-15°N, 16°-18°E (Fig. 1). Previous mapping [1] in this area included two features that were marked as "radar-bright lineations." One is a north-west trending lineation and the other is a concentric lineation in the north-east quadrant of Irnini Mons. The concentric lineation is now suspected to be part of a complex graben system, or a horst and graben structure, based on the high-resolution radar data. Additionally, a feature that was previously mapped by [1] as a graben is now mapped as a wrinkle ridge structure (Fig.1).

The "radar-bright lineations" identified by [1] are still unresolved at this resolution and are therefore still marked as radar-bright lineations. Although it is difficult to identify these structures as either topographic highs or lows, their appearance does seem to distinguish itself from the features known as wrinkle ridges, and therefore it is unlikely that these structures are wrinkle ridges.

Two large concentric graben mapped by [1] are still resolved as graben with very little north-south trending structures in between, instead being dominated by a few east-west trending graben that cut through the north-south trending graben and two east-west "radar-bright lineations" (Fig. 1). However, it is difficult to assign an order of events for these crosscutting structures.

References: [1] McGill (2000) USGS map I-2637. [2] Billoti and Suppe (1999) Icarus **139**, 137-157. [3] Stofan et al. (1992) JGR **97**, 13,347-13,378. [4] Buczkowski (2006) JSG 2**8**, 2156-2168. [5] Ernst et al. (2003) Icarus, **163**, 282-316. [6] Campbell (2002) Radar Remote Sensing of Planetary Surfaces, Cambridge University Press.

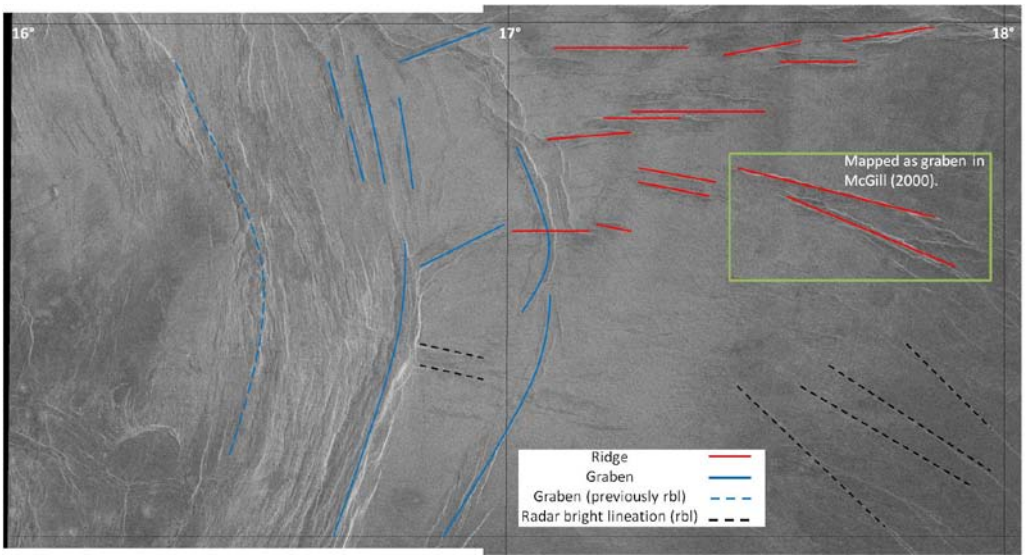

Figure 1. FMAP image of the region from 14°-15°N, 16°-18°E. Structures that radar reflectance show are topographic highs are mapped in red. Topographic lows are mapped in blue.