PRELIMINARY GEOLOGICAL MAP OF THE FORTUNA TESSERA (V-2) QUADRANGLE, VENUS.

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Introduction: The Fortuna Tessera quadrangle (50-75°N, 0-60°E) is a large region of tessera [1] that includes the major portion of Fortuna and Laima Tesserae [2]. Near the western edge of the map area, Fortuna Tessera is in contact with the highest mountain belt on Venus, Maxwell Montes. Deformational belts of Sigrun-Manto Fossae (extensional structures) and Aušrā Dorsa (contractional structures) separate the tessera regions. Highly deformed terrains correspond to elevated regions and mildly deformed units are with low-lying areas. The sets of features within the V-2 quadrangle permit us to address the following important questions: (1) the timing and processes of crustal thickening/thinning, (2) the nature and origin of tesserae and deformation belts and their relation to crustal thickening processes, (3) the existence or absence of major evolutionary trends of volcanism and tectonics. The key feature in all of these problems is the regional sequence of events. Here we present description of units that occur in the V-2 quadrangle, their regional correlation chart (Fig. 1), and preliminary geological map of the region (Fig. 2).

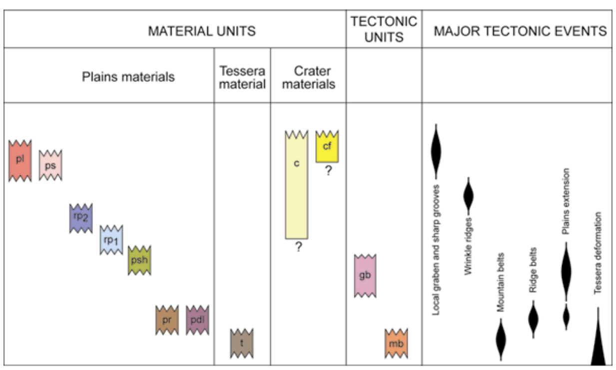

Fig. 1. Correlation chart of units mapped within the Fortuna quadrangle.

Topographic characteristics: The topographic variations within the quadrangle appear to reflect changes in crustal thickness [3]. The highest regions in the quadrangle are the tesserae and the mountain belt of Maxwell Montes. These topographic features represent large domains of thickened crust [4-7]. The western part of Fortuna Tessera is ~2 km higher than its eastern part and a broad depression separates western and eastern Fortuna. This may suggest that the eastern domain is more related to the lower Laima and Meskhent Tesserae than to the Maxwell-dominated western domain. Belts of contractional structures (dorsa) are preferentially associated with elevated flanks of the tesserae, and belts of extensional structures (fossae) occur between major tessera regions within low-lying areas where they form local highs. Moderately deformed plains are in topographic lows between heavily deformed terrains. Tectonically undeformed plains occur on the slopes of large volcanoes.

Units and structures: During preliminary mapping of the V-2 quadrangle we have defined ten material units (including two units related to impact craters) and two structural units (Figs. 1,2) and placed them in stratigraphic sequence using embayment and cross-cutting relationships. From older to younger, these units are as follows. <u>Tessera material (t):</u> represents one of the most tectonically deformed types of terrain on Venus [8,9,1]. Both the material and tectonic structures play a key role in the definition of the unit. Tessera occupies the majority of the quadrangle (~50%, Fig. 2) and occurs in two major regions: Fortuna and Laima Tesserae. Type locality: 63.4°N, 19.5°E. <u>Densely lineated plains material (pdl):</u> heavily dissected by numerous densely packed narrow (<100s m), short (10s km), parallel and subparallel lineaments (fractures). Type locality: 52.4°N, 9.7°E. <u>Mountain belts (mb):</u> represent a structural unit that surrounds Lakshmi Planum and forms the highest mountain ranges on Venus [10,11,8,4,12,13]. Densely packed ridges that are 5-15 km wide and tens to a few hundreds of kilometers long characterize all mountain belts. Within the quadrangle, only the eastern portion of Maxwell Montes is represented. Type locality: 65.5°N, 0.9°E. <u>Ridged plains material (pr):</u> characterized by the morphology of lava plains and are deformed by broad (5-10 km) and long (10s km) linear and curvilinear ridges. In places, the ridges are concentrated into prominent belts (Aušrā Dorsa). Type locality: 53.2°N, 27.8°E. <u>Groove belts (gb):</u> represent a structural unit, which consists of dense swarms of linear and curvilinear subparallel lineaments (fractures or graben). Occurrences of the unit have a distinct belt-like shape. Between the structures within the belts, small fragments of preexisting units are seen in places. These fragments are usually too small to be mapped at the scale of the mapping (1:5M). Type locality: 56.4°N, 25.3°E.

<u>Shield plains material (psh):</u> characterized by abundant small (<10 km) shield- and cone-like features that are interpreted as volcanic edifices [14-17]. In places, the shields form clusters of structures. In contrast to the above units, the material of shield plains occurs at lower elevations and is mildly deformed by

tectonic structures (wrinkle ridges and sparse fractures/graben). Type locality: 61.4°N, 33.9°E. Material of the lower unit of regional plains (rp_1): is characterized by a morphologically smooth surface with a homogeneous and relatively low radar backscatter. The surface of the unit is mildly deformed by wrinkle ridges. The lower unit of regional plains occurs within low-lying areas and embays the heavily tectonized units and shield plains material. Type locality: 51.5°N, 25.6°E. Material of the upper unit of regional plains (rp_2): has a morphologically smooth surface that is moderately deformed by wrinkle ridges that belong to the same family of structures that deform the unit rp_1. The unit (in contrast to the unit rp_1) shows higher radar albedo and often forms flow-like occurrences that are superposed on the surface of the lower unit of regional plains. Type locality: 52.9°N, 7.2°E.

Smooth plains material (ps): has a morphologically smooth, usually dark and featureless surface, which is tectonically undisturbed. The unit makes small equidimensional and elongated patches a few tens of km across. Type locality: 54.8°N, 2.4°E. Lobate plains material (pl): is characterized by a morphologically smooth surface with an albedo pattern consisting of numerous bright and dark flow-like features. Material of lobate plains is tectonically undisturbed and fields of the unit are associated with several medium-sized (a few hundreds km across) volcanic centers near the northern and southern edges of the quadrangle. Type locality: 50.5°N, 22.0°E.

Impact crater materials, undivided (c): includes materials of the central peak, floor, walls, rim, and continuous ejecta. Type locality: 59.7°N, 26.8°E (crater Goeppert-Mayer). Impact crater outflow material (cf), type locality: 61.6°N, 36.2°E (outflow from crater Baker).

Evolutionary trends: Consistent relationships of cross-cutting and embayment among the mapped units/structures (Fig. 1) suggest progressive decline of the amount of tectonic deformation from heavily tectonized units such as tessera, densely lineated plains, ridged plains, and deformational belts through mildly deformed plains units (psh, rp_1, rp_2) to tectonically undeformed smooth and lobate plains. The elevated regions within the quadrangle correspond to the occurrences of the older and heavily tectonized units and mildly tectonized plains occur in topographic lows. This correlation suggests that the regional topographic patterns within the quadrangle were established during the earlier stages of the geologic history and that the processes of crustal thickening/thinning mostly operated at this time.

Clear morphological differences of the broad and mildly deformed plains units as well as their consistent age relationships (Fig. 1) suggest that there were significant changes in the volcanic style from shield plains (distributed small sources) through regional plains (volcanic flooding) to lobate plains (several major volcanic centers).

Fig. 2. Preliminary geological map of the Fortuna Tessera quadrangle.

References

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