CROSSCUTTING, PERIODICALLY SPACED WRINKLE RIDGES OF HESPERIA PLANUM;

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Wrinkle ridges are the long, sinuous anticlinal features which occur on the volcanic plains units of the terrestrial planets and the Moon. Most of these ridges form single, parallel trending groups or concentric patterns within circular basins. The wrinkle ridges of Hesperia Planum on Mars, however, show a much more complex spatial relationship. Two distinct sets of ridges have formed here, crosscutting one another at nearly orthogonal angles, implying a more complex structural history for the region. Termed reticulate ridge patterns (1), these crosscutting ridges are found elsewhere on Mars, but at Hesperia Planum they dominate a very large area to the east and southeast of Tyrrhena Patera.

In this study, the two directional components of the reticulate pattern were separated and ridge spacing was determined using a series of sampling traverses spaced about 20 km apart and oriented perpendicular to the mean ridge trend of both sets. In addition, the two sets of ridges maintain a constant trend over a limited area. Therefore, a large area of Hesperia Planum containing the reticulate pattern was divided into three domains based on the mean trend of the ridges. In each of the domains, the ridge spacings of the two sets were found to be very similar and passed the statistical t-test for equivalency. This test compares two sets of sampled numerical data to determine if they appear to be derived from the same population. The mean spacing for the two ridge sets in each domain are as follows: 34.0 km and 35.1 km for domain one, 37.9 km and 38.9 km for domain two, and 28.7 km and 29.4 km for domain three. The equivalent spacing of both sets of ridges can be explained by two superimposed episodes of buckling at a critical wavelength, governed by the rheological properties and thickness of the plains material in which the ridges formed (2).

The origin(s) of the compressive stresses which formed the reticulate pattern is not readily apparent. The compressional stresses that resulted in the formation of the wrinkle ridges of the Tharsis Plateau may have been in part due to isostatic uplift (3,4,5,6). In the absence of a "Tharsis-like" uplift or load in Hesperia Planum, other mechanisms for the generation of compressional stresses must be found. Compression may have resulted from subsidence due to loading of the volcanic plains material (see 1), but this mechanism may produce only a single ridge trend related to the shape of the basin. A superimposed regional tectonic event may account for the second ridge set in the reticulate pattern, with local influences accounting for the variable trends of the ridges.

References Cited

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Figure 1. Crosscutting wrinkle ridges in the ridged plains of Hesperia Planum.