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