Testing crustal plateau formation models for Venus using geological mapping of Ishtar Terra marginal areas

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Problem

Crustal plateaus exposing tessera terrain have been identified on Venus. The origins of plateaus and tessera terrain are poorly understood.

Hypotheses and Predictions

We are testing five proposed models in this study: (Figure 1)

- Downwelling
- Pulsating Continental Regression
- Waning heat pipe to stagnant lid
- Upwelling
- Bolide impact with lava pond

Central differentiations of models are the surface deformation, marginal deformation, and tessera–plain onlapping relationship. (Table 1)

<table>
<thead>
<tr>
<th>Model</th>
<th>Bounding Fault</th>
<th>Surface Deformation</th>
<th>Marginal Deformation</th>
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<td>Downwelling</td>
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<td>Pulsating Continental</td>
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<td>Bolide impact with lava</td>
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Table 1 Prediction of Venusian crustal plateau formation models.

Mapping Methods

- **Tessera** is a complexly deformed surface with at least two overlapping lineaments. [6] [7]

- **Lineament sets of deformation** (Figure 2)

Preliminary Results

We present detailed maps of Ishtar Terra’s marginal areas. (Figure 3-5)

Interpretations

We consider “end-member” interpretations of these areas. (Figure 7-9)

- Thus, the mapping failed to falsify any existing models.

Conclusion and Future Work

- We seek to test models by mapping to see which predictions are robust, but thus far the mapping fails to falsify any existing model.

Future SAR data with 3–4 times higher resolution will be required to test the models. (Figure 11)

References:


Figure 1 The models used to test the formation of the crustal plateau—tessera highland, with both evolution diagrams and predictive maps.

Figure 2 The possible interpretations of mapped V-shape faults: ridged linear fractures and paired general shear zones (a) (b)

Figure 3 (a) Detailed geological and (b) topographic map overlaid by lineament set 3 of northern Ishtar Terra margin. The elevation is above the mean planetary radius, 6053 km.

Figure 4 Detailed geological map of southern Ishtar Terra margin. The black frame outlines Figure 6.

Figure 5 Detailed geological map of western Ishtar Terra margin.

Figure 6 SAR image (a) and mapped image of the V-shape faults.

Figure 7 End-member interpretative maps of the northern Ishtar Terra margin.

Figure 8 End-member interpretative maps of the southern Ishtar Terra margin.

Figure 9 End-member interpretative maps of the western Ishtar Terra margin.