Change of Stress Field on Venus, Estimated from Surface Geometry of Dike Swarms, Lava Stratigraphy and Crater Density

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We estimate the crustal stress field from the surface geometry of dike swarms. We investigated the age relationships among the volcanoes, using lava stratigraphy and crater densities. Then, the regional stress field has changed over time. This regional change of the stress field can be explained by the addition of an upwelling plume to elevate these region. Some of the mantle upwellings are not necessarily contemporaneous.

Deformational features, such as graben and wrinkle ridges, are abundant on Venus' surface and give information on the surface stress fields. We estimate the orientations of crustal stress from the surface geometry of dike swarms associated with volcanoes. These include novae, arachnoids, coronae, large volcanoes and calderas. The stress field show a uniform pattern in lowland. However, the stress field does not show a uniform pattern in BAT Region, Eista Regio and Thethus Regio. There are two possibilities: either these region had no uniformly oriented crustal stress field or the regional stress field has changed over time. To clarify this, we investigated the age relationships among the volcanoes. Using lava stratigraphy and wrinkle ridges we can classify volcanoes on Venus into 11 groups on the basis of their relative ages. Dike swarms from volcanoes in each group show a similar stress orientation. In this study, crater density is also obtained at each age groups. This result is consistent with the chronological order of stress fields related to volcano groups.

This regional change of the stress field can be explained by the addition of an upwelling plume to elevate these region. Some of the mantle upwellings are not necessarily contemporaneous. The position of each upwelling or at least their relative strength should have changed during recent Venus' history.