ADMITTANCE SURVEY OF TYPE 1 CORONAE ON VENUS: IMPLICATIONS FOR ELASTIC THICKNESS.

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Introduction: Coronae are volcano-tectonic features on Venus which range from 60km to 2600km and are defined by their nearly circular patterns of fractures. Type 1 (regular) coronae are classified as having >50% complete fracture annuli. Previous work has examined the factors controlling the morphology, size, and fracture pattern of coronae, using lithospheric properties, loading signature and geologic characteristics [1,2,3]. However, these studies have been limited to Type 2 (topographic) coronae (e.g. coronaes with <50% fracture annuli), and the factors controlling the formation of Type 1 coronae remain poorly understood. In this study, we apply the methodology of [1,2] to survey the admittance signature for Type 1 coronae to determine the controlling parameters which govern Type 1 coronae formation.

Methods: We use a wavelet approach [4] to calculate admittance spectra for 105 different Type 1 coronae that were adequately resolved relative to the local error in the gravity data. The wavelet admittance spectrum is derived directly from the spherical harmonic gravity and topography fields, averaging wavelength power beginning at a central point and moving outward in annuli of variable width [4]. From a global wavelet admittance map [5] we extract the region which encompasses the corona of interest using a commercial spectral analysis package ENVI [6]. The mean spectrum for the area covered by the corona is then fit with compensation models using the wavelet method.

For each corona of Type 1, we have determined values of crustal thickness (*Zc*), elastic thickness (*Te*) and apparent depth of compensation (*Zl*) using the admittance signature. The admittance spectrum consists of the ratio of the gravity/topography as a function of wavelength, and is sensitive to bending of the elastic lithosphere in response to a load. Both top and bottom loading models are used to fit the spectra. Additionally, some coronae exhibit a signature consistent with isostatic compensation at the short wavelengths associated with corona-scale processes. Here we interpret these loading signatures in the context of corona formation models.

Results and Discussion: The majority of Type 1 coronae (approximately 65%) are found to have a top loading signature which is best explained by a mass near the upper surface (such as a volcano) that is depressing the original topographic surface as the elastic plate flexes. Of these, approximately 50% have an elastic thickness of < 25km. For these coronae, an elastic thickness of 0 km provides an equally good fit to the data. These coronae are probably isostatically compensated, which may imply that they are no longer active. The remaining 35% display a bottom loading signature which implies that a low density region, such as a plume is pushing up from below.

For both Type 1 & 2 coronae, interpretation of loading signatures is not straightforward. There is often no obvious load on the surface. Although this suggests that this type of signature is better interpreted as an isostatic signature, coronae exist for which only a top loading signature will fit the admittance spectra. A bottom loading signature is typically due to a low density regoin pushing up the lithosphere, and is this expected over a topographic high, not a depression. Top and bottom loading signatures can also be produced by dynamic processes [eg. 8].

Conclusions: This survey provides a quantitative assessment of lithospheric properties associated with Type 1 coronae which are consistent with previous coronae studies [7,8].

While the range of elastic thickness estimates for both Type 1 and Type 2 coronae are similar (indicating general similarity in both the lithospheric structure of the regions in which they occur) they are not identical. We also find differences in elastic thickness estimates between topographic forms which have previously been subdivided into 9 groups [9]. These variations are interpreted to indicate that different processes are active over the course of the corona lifetime. The implications of these results for the processes forming coronae will be discussed.

In agreement with the results found for Type 2 corona [1], we find that for Type 1 corona, the elastic thickness has no correlation with diameter and thus does not limit the location of coronae. Nor is there a relationship between crustal thickness and diameter. Overall, Zl and Zc have large ranges. For crustal thickness variations, this may imply that density variations are present as well. Alternatively, the variations may be actual crustal thickness variations. For elastic thickness and apparent depth of compensation, some variations may be due to dynamic processes still active in forming the coronae.

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