CORONAE ON VENUS: TOPOGRAPHIC VARIATIONS AND CORRELATIONS BETWEEN MORPHOLOGY AND REGIONAL SETTING;
Ellen R. Stofan, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

Coronae on Venus display a wide range of surface characteristics and topography [1-3]. Previously, a classification scheme for corona morphology based primarily on tectonic features was developed [2]. Here, a classification scheme for corona topography is presented. The variations in morphology of coronae may result from differences in mode of origin, or they may result from variations in lithospheric structure and/or regional tectonic environment. In order to assess the effects of regional tectonic environment, the global population of coronae is classified according to regional geologic setting. Correlations between the previously identified classes of coronae, topography, and geologic setting are then assessed.

Using the Magellan altimetry data, the topography of 360 corona and corona-like features was determined. Topographic groups include: 1) depression; 2) rim surrounding a depression with or without an outer trough; 3) rim surrounding an interior high with or without an outer trough; 4) rim only; 5) outer rise, trough, interior high; 6) outer rise, tough, rim, interior depression; 7) plateau with or without a surrounding trough; 8) dome with or without a surrounding trough; and 9) no discernible topographic signature (Fig. 1). Figure 2 illustrates the percentage abundance of each topographic group. In group 3, most interior topographic highs are surrounded by a moat. Approximately half of coronae are characterized by interior high topography (domes, rims with interior highs, and plateaus), while one-third are characterized by interior depressions. 24% of coronae are surrounded by exterior troughs, with outer rises occurring at 6% of coronae.

Coronae on Venus occur in three distinct geologic environments: at volcanic rises; along chasmata or fracture belts; and as relatively isolated features in the plains. Volcanic rises with clusters of coronae include central and eastern Eistla, Themis, and Mnemosyne Regiones [4]. Most volcanic rises are not characterized by coronae, but instead are dominated by rifts or large volcanoes (*i.e.*, Beta, Atla, Dione Regiones). The presence of coronae at volcanic rises is not interpreted to indicate a specific stage of rise evolution; rather, they are interpreted to indicate small-scale convection in the lithosphere induced by the rising plume or instabilities and break up of the plume head [*e.g.*, 5], creating small-scale diapiric upwellings that form coronae [4]. The majority of coronae (68%) occur along chasmata or fracture belts. Major corona chains include Parga and Hecate Chasmata [6, 7], eastern Aphrodite [8], and the Alpha-Lada fracture zone [9]. Other coronae lie along more subtle fracture belts which are not associated with deep troughs, such as the zone of deformation between Beta and Eistla Regiones. Coronae along Hecate are both cut by and overlie the extensional fractures along the trough system, indicating that the coronae and the fracture system formed concurrently [7]. A similar relationship between corona formation and extension was found along the Alpha-Lada fracture zone [9]. At Parga, the majority of the coronae appear to have formed prior to major extension. Finally, 11% of coronae are classified as plains or isolated coronae, including some very large coronae such as Heng-o Corona. Most of the plains coronae are heavily embayed by plains volcanism. Given the predominance of coronae occurring along fracture belts and the degree to which many of these fracture belts are embayed, it is possible that the plains coronae also formed along fracture belts that have been subsequently covered by volcanic flows.

Is there a relationship between corona morphologic class, topography and geologic setting? The morphologic classes of coronae (concentric, radial, radial/concentric, multiple, asymmetric, and concentric/double-ring [2]) do not correspond well with the topographic groups. An exception to this are Groups 1 and 2, depressions without or with rims, which are almost exclusively concentric features. Some features within this group are interpreted to be large-scale calderas; others may represent very late stage coronae based on previous models of corona evolution [1, 2]. However, all other topographic groups contain concentric coronae, so not all concentric coronae correspond to depressions. No strong correlation exists between most morphologic classes and geologic setting. The exception is the radial/concentric class, which has been interpreted to be coronae in relatively early stages of evolution [2-3, 10]. All of the radial/concentric coronae occur along chasmata. In the case of topography and geologic setting, the only correlation is between the plains setting and topographic groups 4 and 9, features with little or no topographic signature. This supports the interpretation that these features are relatively old, heavily embayed features. In other geologic settings, a wide range of topographic types can be seen. For example, along Parga Chasma, all topographic groups except for group 6 (outer rise, trough, rim, interior depression) can be found.

The observed range in corona surface characteristics and topography are, in general, not correlated, nor do they relate in a clear fashion to regional geologic-setting. These results indicate that the variations seen at coronae are likely to reflect variations in the stage of upwelling, rather than effects of lithospheric structure or regional tectonic environment. Current models of corona origin [10, 11] do not predict the wide range of morphologies and complexities of deformation observed at coronae. More complex models of upwelling that incorporate effects of a chemical residuum (*i.e.*, Smrekar and Parmentier [12]) may better predict the variations observed at coronae on Venus.

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Fig. 1. Corona Topographic Groups

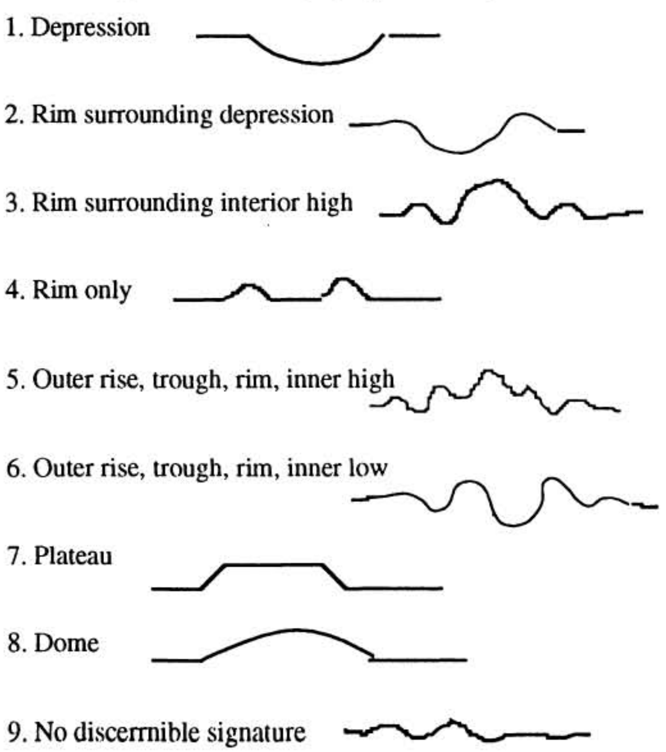

Fig. 2. Corona Topography Groups