SPATIAL AND TEMPORAL RELATIONS BETWEEN CORONAE AND EXTENSIONAL BELTS, NORTHERN LADA TERRA

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Rift zones and hotspots are two of the most dominant tectonic elements on Earth and on Venus. Temporal and spatial associations between rifts and hotspots suggest genetic relations between them as well. The exact nature of interaction between the two tectonic elements on Earth is not yet understood, due to the difficulty of identifying structures that are clearly hotspot-related. Magellan images of Venus, on the other hand, provide a wide variety of both rift-related and hotspot-related structures (coronae and volcanic rises). The topography of hotspots, the geometry of their related rifts and their widespread volcanism are very much alike on the two planets. Thus, understanding rift-hotspot relationships on Venus could significantly improve our understanding of these relations on Earth. In particular, it may be possible to determine whether mantle plumes actively produce the rifting or passively respond to it.

Preliminary studies of the distribution of coronae and volcanic rises on Venus show that many of these features tend to cluster along zones of rifting and intensive extension (1). The plains north of Lada Terra are crossed by two such extensional belts. Each belt is composed of grabens, ridges and faults, along with volcanic flows, coronae and corona-like features. The longer and more prominent belt is the NW trending Alpha-Lada extensional belt (ALEB) which is over 6000 km long and 50-200 km wide, and includes the coronae Eve, Tamfana, Selu, Ammavaru, Otygen, an unnamed corona south of Otygen, and the Carpo nova. The second belt is the NNE trending Ammavaru-Quetzalpetlatl extensional belt (AQEB) which is about 2000 km long and in places over 300 km wide, and includes the coronae Kybele, Eithinoha and Quetzalpetlatl. The two belts intersect west of Ammavaru corona, and it is apparent that deformation along them overlapped in time, though deformation along the ALEB probably continued later than along the AQEB. In certain areas volcanism originated in the grabens within the extensional belts, whereas in other areas, such as in Eve, Selu, Ammavaru and Quetzalpetlatl, volcanism originated in the coronae and flowed into the lower parts of the extensional belts.

Two types of structural relations between the coronae and the extensional belts were examined. (a) Deflection of corona-related structures towards the regional trend of the extensional belts. This type of relation indicates superposition of regional extensional stresses and corona-related stresses. (b) Crosscutting relations between regional structures, such as grabens, fractures and collapse features and corona-related structures. This type of relation indicates the relative age of the actual surface deformation in the coronae and in the

extensional belts. By analyzing the crosscutting relations among the different elements within coronae, the geological histories of individual coronae were also determined (2).

Superposition of regional extensional stresses and corona-related stresses has occurred early in the history of several coronae. In Eve and Selu radial grabens that were formed in the early stages of corona development are deflected towards the regional trends. In Otygen, semi-radial grabens are preferentially oriented to the northwest, and the Quetzalpetlatl dome is elongated to the northeast. Superposition of regional and corona-related stresses has also occurred late in the history of several coronae. In Tamfana, Otygen and Eithinoha concentric structures are deflected towards the regional trends and the concentric structures in Ammavaru are preferentially oriented to the northwest.

Actual deformation along the extensional belts, as evidenced by faults, grabens and collapse features took place before, during and after the development of Eve, Selu and Eithinoha. In other coronae, Otygen, Kybele and Quetzalpetlatl, and in the Carpo nova, regional extensional features were formed only during the late stages of evolution. Ammavaru corona, which is not located right along the extensional belt, was formed after the adjacent rift was fully developed.

The alignment of the coronae along the extensional belts and their mutual relations indicate that the coronae and the Carpo nova are genetically linked to the extensional belts. It is not possible however, to determine at this stage whether the rising mantle plumes that formed the coronae and the nova were originally formed along a linear thermal anomaly that caused the regional extension at the surface, or were passive consequences of extensional regional deformation.

References:
(1) Stofan, E.R. et al., submitted to *Journal of Geophysical Research*, 1991.
(2) Squyres S.W. et al., submitted to *Journal of Geophysical Research*, 1991.