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Formation models of the multiple coronae of Venus

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We have analyzed the topographic and morphologic characteristics of the 62 multiple coronae [1,2,3] on the surface of Venus in order to assess their possible formation models. We have evaluated the following models: **1)** Movement of the lithosphere over a stationary mantle plume [4, 5]. **2)** Migration of a mantle plume or diapir under the lithosphere [4], perhaps by lithospheric channeling of the diapir [5]. **3)** Emplacement of several spacially close interacting diapirs [6] either more or less synchronously or in succession [4,6]. **4)** A secondary diapir arising from a larger diapir [6]. This may require a thicker lithosphere and/or more pronounced rheological layering of the lithosphere (with perhaps higher heat flow) or crust. Cybele Corona (8˚S, 21˚E; Class D [1]) may be an example of model 4 multiple corona. **5)** Emplacement of an elongated diapir where diapir shape may have been influenced by the crustal/ lithospheric structure, e.g. a zone of weakness (e.g. a rift or a fracture zone) and/or stress field.

Model 1 can be ruled out because Venus appears to be a one-plate planet (at least for the past 500-1000 m.yr.) where surface horizontal movements have been small. For many multiple coronae, and especially for many coronae in morphological Classes A, B, E and F [1], model 3 appears to be most simple and plausible formation mechanism. This applies especially to those multiple coronae where component structures have different topographic morphologies [2]. However, there are multiple coronae where lithospheric channeling [5] could have played a role (Oanuava Corona (32.5˚S, 255.5˚E) [5]; Class E1 [1]), and perhaps also Sandzimari Corona (11˚S, 339.5˚E; Class D [1]). In model 4, the secondary diapir could also be a magmatic diapir rising from the zone of melting on top of the main diapir. This magmatic diapir could then lead to volcanism and deformation of the crust or formation of a large magma chamber and eventually to downsagging and formation of a caldera-like secondary corona part.

This could explain characteristics of some Class D multiple coronae (e.g. Ereshkigal Corona (21˚N, 84.5˚E)). Lithospheric channeling may also explain shapes and some topographic characteristics of Class D [1] multiple coronae. A few multiple coronae of Class C (e.g. Erkir Corona (16.3˚S, 233.7˚E)) may be explained by model 5, but formation by multiple diapirs cannot always be ruled out.

Multiple corona morphological and topographic classes thus do not always directly imply a single formation mechanism and formation of the multiple coronae has to be evaluated case by case from geological and geophysical characteristics and interpretations.

References: [1]] Törmänen T. et al. (2005) *LPS XXXVI*, #1640 [2] Törmänen T. et al. (2006) *LPS XXXVII*, #1725, [3] Törmänen T. et al. (2007) *LPS XXXVIII*, #1338. [4] Stofan E. R. et al. (1992) *JGR, 97*, 13347-13378. [5] Lopez I. (2002) *JGR, 107*, 5116-5127. [6] Törmänen T. and Kauhanen K. (1995) *LPS XXVI*, 1417-1418, abstract.