TOPOGRAPHY AND MORPHOLOGY OF DOUBLE-TYPE CORONAE ON VENUS FROM MAGELLAN DATA; T. Törmänen and K. Kauhanen, Department of Geosciences and Astronomy, Astronomy Division, University of Oulu, 90570 Oulu, Finland

We have studied the topography of 40 double-type coronae and corona-like features, which were first identified on the basis of their planform and morphology and which can be divided into 4 morphological classes [1,2]. A typical corona has a raised annular rim and interior lower than the rim but higher than surrounding plains. Some features have a low annular moat exterior to the structural annulus [3-5]. We examined the topographic characteristics of the annulus and the corona interior, and the presence of the outer annular moat in the double coronae. The double coronae can be divided into 3 classes based on the presence and characteristics of an annular topographic feature. The topography of the interior and the presence of an outer moat also show some systematic characteristics relative to morphology. The ongoing work focuses on the quantitative examination of the topography.

Comparison of topographic characteristics and morphology. **Topographic annulus.** The double coronae and corona-like features can be classified based on the presence and type of a topographic ring structure. We established 3 classes: In class I, double coronae have a raised topographic annulus (e.g., corona at 66.5N, 206.5E, Fig. 1). Structural annulus or annuli of concentric ridges or sometimes fractures are usually located on the slopes or at the base of this topographic high. The topographic ring itself may have a relatively smooth surface morphology with few structures (e.g. Neyterkob Corona or Demeter Corona). 75% of the double-type coronae and corona-like features (30 out of 40) fall into this class so it is by far the most typical topographic characteristic of these coronae. Class II double coronae have an annular topographic trough, which typically coincides with an annular band of less deformed, smooth-looking surface located between two rings of concentric fractures (e.g., corona at 16S, 234E, Fig. 2). This class can be divided into two subclasses based on the topography of the structural annuli (which typically consist of concentric fractures). In class IIA features, the outer structural annulus is located on the outer edge or slope of the topographic trough and does not have a distinct topography (high or low). The outer structural annulus of class IIB features is superposed on an annular topographic high located outboard of the annular trough. 20% (8) of the features belong to the class II, 7.5% to class IIA and 12.5% to IIB (3 and 5 features respectively). There are also double-type coronae which do not have recognizable topographic ring although a structural annulus is observed. Only 2 features belong to this class III. We conclude that the majority of the double-type coronae have a topographic annulus that correlates with morphological annuli and that the most typical feature is an annular topographic high. Within the four morphological classes of the double-type coronae [1,2] most of the features fall into the class I. Only type A double coronae (a distinct double structure with a section of an annulus joining the two parts) have more frequently an annular trough of class II features (6 out of 16).

Topography of the interior relative to the surrounding plains. The interiors of the coronae may 1) be mostly higher than or on the level of the surrounding plains, 2) lower than or on same level as the plains, or 3) have both areas that are lower and parts that are higher than the plains. Half of the double-type features have interiors that are mostly lower than the surrounding plains, and 9 features are higher than the plains. Interiors of 11 coronae show varied topography relative to the plains. Higher interiors are typical to double coronae with annular troughs (class II). The deepest parts of the interiors of the double coronae are usually located adjacent to an annular topographic high and are sometimes located symmetrically relative to a shorter axis of a corona (e.g., corona at 66.5N, 206.5E). The higher areas of the interiors are often mounds of volcanic flows and constructs (e.g., Gaia Corona) or areas of concentrated radial or through-going fractures (e.g. corona at 31S, 276E).

Outer annular depression (moat). We observed that 40% (16) of the double-type coronae have a topographic outer moat exterior to at least part of the annulus. All but one of these moats are adjacent to class I annular topographic highs. Half of these coronae with outer moats belong to the morphological class B (elongated two-part structure with no joining section of the annulus between the parts [1,2]).

Discussion and some preliminary results. Coronae on Venus are thought to originate from upwelling mantle plumes or diapirs [5-8]. Although the models predict the stresses and structures of the coronae relatively well (e.g., [7,8]) the modelling of the corona topography is a bit more problematic [8]. The most popular model of gravitational relaxation of the originally raised topography works reasonably well [5,6] although it has some problems [8]. Within the framework model of rising mantle diapirs and gravitational relaxation of the raised topography, we propose that double coronae and corona-like features may form from 1) elongated or deflected mantle diapirs, 2) two closely-spaced and roughly contemporaneous mantle diapirs or secondary diapirs rising from a larger mantle upwelling or 3) secondary pulses following the main diapir [9]. The topographic characteristics of the double coronae do not markedly differ from the topography of the coronae population as a whole. The class II features with an annular trough appear to be difficult to explain by the gravitational relaxation model [5]. There must be a mechanism that produces the low topographic annuli. Many of these features are located on or near fracture belts produced by extensional stresses (e.g. 16S, 234E). Therefore we propose that the extensional stresses within these belts affect the formation of the topographic annulus, perhaps by causing more subsidence in the outer region of the

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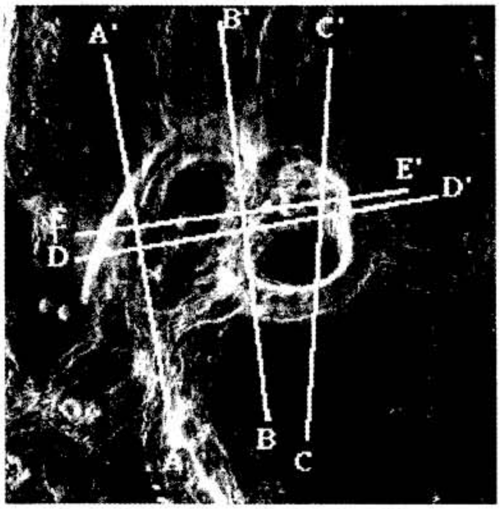
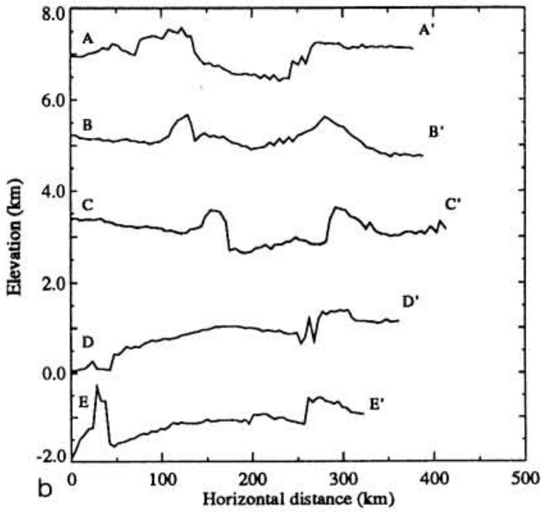
corona during the relaxation process. Also the low interiors of many double coronae are enigmatic. In a few cases, the topographic profiles over the interior and annular high are very similar to topographic profiles produced by lithospheric flexure. The load of the high topographic annulus may cause flexure of the lithosphere. Implications of the topographic characteristics of the double coronae will be studied and discussed further.

References. [1] Kauhanen K. and Törmänen T. (1994) *LPSC XXV*, 673. [2] Törmänen T. and Kauhanen K. (1994) *ibid.*, 1411. [3] Stofan E.R. and Head J.W. (1990) *Icarus, 83*, 216. [4] Stofan E.R. et al. (1992) *JGR, 97*, 13347. [5] Janes D.M. et al. (1992) *ibid.*, 16055. [6] Stofan E.R. et al. (1991) *ibid.*, 20933. [7] Squyres S.W. et al. (1992) *ibid.*, 13611. [8] Koch D. (1994) *JGR, 99*, 2035. [9] Kauhanen K. and Törmänen T. (1995) *Venus II Conference*, abstract, *in press.*



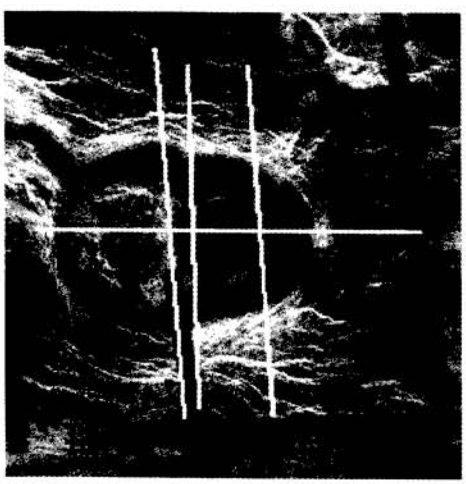
1a



b

1c

2c



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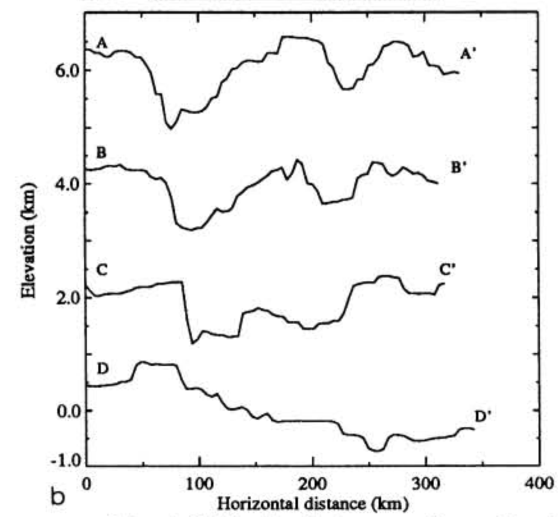

b

Figure 1. a) Corona at 66.5N, 206.5E, example of a double type corona (class A [1,2]) with a high topographic annulus, deep interior and a shallow outer moat. Part of C1-MIDR 60N208;1. b) Topographic profiles over the corona in a). Vertical exaggeration in all profiles is 50:1. c) Topography. Polar projection; not in the same scale as SAR image in a). **Figure 2.** a) Corona at 16S, 234E, example of a double type corona (class A [1,2]) with a low topographic annulus (class IIB), a high interior and no outer moat. Part of C1-MIDR 15S232;1. b) Topographic profiles over the corona in a). c) Topography. Mercator projection; not in the same scale as SAR image in a).