AREAL DISTRIBUTION OF DOUBLE-TYPE CORONAE AND CORONA-LIKE FEATURES ON VENUS, AND THEIR RELATION TO TOPOGRAPHY, TESSERAE AND DEFORMATION BELTS; T. Törmänen and K. Kauhanen, Department of Astronomy, University of Oulu, 90570 Oulu, Finland

Introduction. We have analyzed coronae and corona-like features that are characterized by two linked parts. The overall shape of these features ranges from elongated, peanut- or pear-shaped features that have two parts separated by a narrow neck-like part (e.g. Demeter Corona and Gaia Corona) to distinct double features with two parts joined by a common section of a structural annulus (e.g. Neyterkob Corona). We included also features where two corona annuli appear to be partly overlapping, or where the two corona parts are joined by a more complex central structure. Features were identified from Magellan cycle 1, 2 and a few cycle 3 radar images. We recognized 40 double-type coronae and corona-like features. This population includes features in coronae list in [1] and in the Magellan volcanic and magmatic feature catalog [2]. Also included are several features identified as arachnoids in [2]. Some of our double features were not in either of these lists.

The double-type coronae and corona-like features can be divided into 4 morphological classes based on the shape and structural characteristics of the features. The classification with examples is presented in [3]. 40% of the double-type features (16 out of 40) belong to the class A (a distinct double structure with a section of an annulus joining the two parts); 42.5% (17 features) to class B (elongated two-part structure, no joining section between the parts); 12.5% (5) to class C (two overlapping annuli); and 5% (2) to class D (double structure with a complex central part). In this paper we present the first results of our analysis of the areal distribution of the double-type coronae and corona-like features and their relation to global topography and tectonic patterns.

Areal distribution and relations to topography, tesserae and deformation belts. Only about 9% of the total population of coronae and arachnoids exhibits any kind of double structure (40 features out of the total of more than 430 features [1,2]). The areal distribution of this small population follows the general distribution of coronae on Venus [1,4] with over half of all double-type features located within the area of the anomalously high concentration of volcanic centers in the Beta-Atla-Themis regiones (the BAT anomaly [5,6]; Figure 1.). In the southern hemisphere, there is, however, a noticeable paucity of double-type coronae and corona-like features, also in the areas where other types of coronae are present (e.g. the area south of the equator and east and northeast of Alpha Regio; cf. Fig. 6c in [6]). The double-type coronae and corona-like features form seven groups of two or three features that belong to class A or B (Figure 1.). There are groups whose members belong to only one class and groups where both classes are represented. These groups are located within the BAT area or to the north of it. At the present moment it is not clear whether this is result of pure coincidence or whether these groups point to locations favourable for the formation of double-type coronae.

The double-type coronae and corona-like features are located typically on the plains lying slightly lower than the mean planetary radius (MPR) of 6051.84 km (between -1 km and 0 km elevations; Figure 1.). Only a few features are located above the MPR. Features belonging to different morphological classes do not have markedly different base elevations. Thus slight variations in base elevations do not appear to greatly affect the morphology of the double-type coronae and corona-like features. They do not occur in or near large tessera areas such as Fortuna Tessera and Ovda Regio (Figure 2.). Several of them lie on the plains near smaller and more fragmented tesserae but do not appear to be significantly affected by presence of tessera.

Only two double-type features lie on the plains characterized by regional sets of wrinkle ridges (Figure 3.). Also, the majority of these features are not associated with ridge belts. Many of the double-type features are located near fracture belts (Figure 4.). Partly this is due to their concentration within the densely fractured and rifted BAT area. Most of the features, however, are not located directly on the fracture belts or rifts and are preferentially located adjacent to the belts but mostly outside of them. There does not appear to be any correlation between the morphological class of the feature and its location relative to fracture belts. We can conclude that compressional and/or extensional stresses forming deformation belts do not appear to have a dominating effect on formation of the double-type features. Although double-type coronae and corona-like features appear to favor areas near fracture belts they are mostly absent from areas adjacent to the largest and deepest rifts (e.g. troughs of Aphrodite Terra) i.e. areas of largest extensional strain. Coronae on Venus are thought to originate from upwelling mantle plumes or diapirs [7]. We propose that different types of double coronae and corona-like features may form from 1) elongated mantle diapirs, 2) two closely-spaced roughly contemporaneous mantle diapirs, or 3) closely-spaced secondary diapirs rising from larger mantle upwellings. The relationships of the double-type features to fracture belts and rifts suggests that along the deepest rifts and more deformed fracture belts conditions inhibit formation of the double-type coronae and corona-like features or they may have formed at some earlier time but have been subsequently erased by later intense deformation.

Future work: We are now studying structural and volcanic characteristics of these features and their relation to topography in more detail. A thorough analysis of relationships between the fracture belts and the double-type features will give more insight into formation processes of the double-type coronae and coronalike features.

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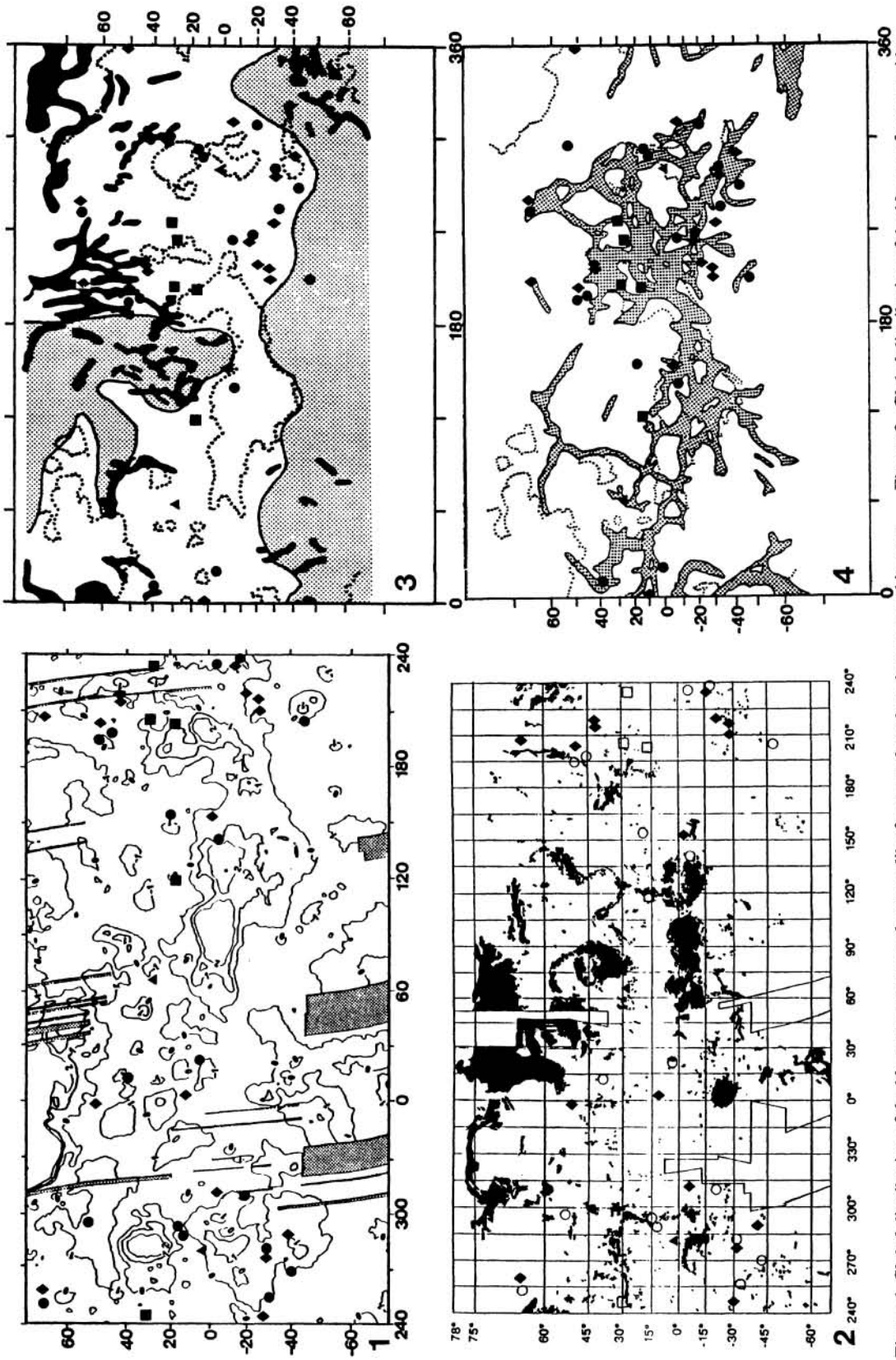

Figure 1. Global distribution of double-type coronae and corona-like features plotted on the topographic map of Venus. Diamonds indicate class A features, dots class B features, squares class C and triangles class D. Contour interval is 1 km, 0-elevation corresponds to the MPR. Shaded areas are altimetry data gaps.
Figure 2. Global distribution of double-type coronae and corona-like features and tesserae. Base map modified from [8]. Open circles indicate class B features and open squares class C. Other symbols as in the Fig. 1.

Figure 3. Global distribution of double-type features, ridge belts and ridged plains. Symbols as in Fig. 1. Distribution map of ridge belts and ridged plains modified from [9].
Figure 4. Global distribution of double-type features and fracture belts. Distribution map of fracture belts is from [9].