RESULTS OF GEOLOGICAL AND MORPHOLOGICAL ANALYSIS OF STRUCTURES OF VENUS' CORONAE. E.N. Guseva, M.A. Ivanov. Vernadsky Institute of Geochemistry and Analytical Chemistry of Russian Academy of Sciences, Moscow, Russia, guseva-evgeniya@ya.ru

Introduction: Coronae are volcano-tectonic structures that probably existed throughout the observable geological history of Venus [1-3]. These are large (up to 2500 km in diameter) concentric and often asymmetric structures with an annulus that usually consists of densely packed grooves [4-7]. The circular shape of the coronae, their volcanic and tectonic activity, and non-random spatial distribution [8] indicate that they represent the surface manifestations of mantle diapirs [9-11]. Because of the virtual lack of erosion on Venus, the topographic configuration of coronae can correspond to different stages of evolution of their parental diapirs, and expressed as specific topographic profiles that mark different phases of the evolution of coronae [12].

We examined all cataloged coronae on Venus [7; 13] and classified them according to their characteristic topographic profiles in order to identify the stages of the coronae evolution.

Observations and results: We investigated 550 coronae and coronae-like structures (their list is available at http://www.planetology.ru/coronalist.php?language=english). Using the geological map of Venus [14], we divided the entire population of coronae into three stratigraphic groups according to the type of relationship between their annulus and the surrounding area.

Group 1: structures, the annulus of which is either made up by groove belts or morphologically indistinct and in all cases is flooded by regional plains and/or deformed by wrinkled ridges. This is the most numerous group, including 444 structures (81% of the total population).

Group 2: structures, the annulus of which consists of both fractures of the older groove belts and younger rift zones. This group includes 25 structures (5%).

Group 3: structures, the annulus of which consists of rift fractures. These fractures deform regional plains, but sometimes are embayed by lobate plains. This group includes 81 coronae (15%).

The topographic profiles of the studied coronae belong to five classes: (1) D-shaped (99 structures or ~ 18% of the total number of coronae); (2) W-shaped (188 or ~ 34%); (3) W-W-shaped (18 or ~ 3%); (4) W-V-shaped (59 or ~ 11%) and (5) U-shaped (186 or ~ 34%) (fig. 1).

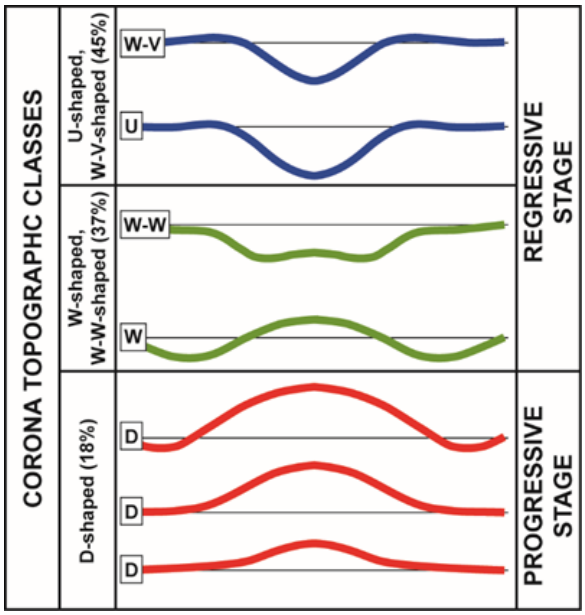

Figure 1. Topographic profiles of coronae that likely correspond to different stages of evolution of their parent diapirs (modified from [12]).

Coronae from Group 1 are characterized primarily by the U- (171 structures or 38.5% of the total number of the structures of group-1) and W-shaped (158 or 35.5%) topographic classes. The D-, W-V- and W-W-shaped classes also characterize coronae from Group 1 (56 or 13%, 49 or 11% and 10 or 2% respectively). The Group 2 coronae more often have the W-shaped (13 or 52%) and less to have D-, U-, WW- and WV-shaped classes of structures (6 or 24%, 3 or 12%, 2 or 8% and 1 or 4% respectively). The Group 3 coronae are represented mainly by the D-shaped class (37 or 46%) and less by the W-, U-, WV- and WW-shaped (17 or 21%, 12 or 15%, 9 or 11% and 6 or 7% respectively) (tab.1).

Table 1. Proportion of coronae with specific topographic profile in each stratigraphic group.

Stratigraphic group	Topographic class				
	W-V	U	W-W	W	D
1	11	38.5	2	35.8	13
2	4	12	8	52	24
3	11	15	7	21	46

We studied the size-frequency distribution of coronae of various topographic classes (fig. 2). Coronae belonging to the final phases of diapir evolution (classes U and W-V) have a bimodal size distribution. U-shaped coronae are systematically smaller and mostly have diameters in the range of 100-150 km (48% of the total number of coronae of this class). The W-V coronae are systematically larger and their diameters are more evenly distributed, mainly in the interval of 100-250 km (56% of coronae). Such differences in size may indicate either different diameters of the parent diapirs, or different degrees of their thermal degradation, or both. For example, class W-V coronae may represent more advanced phases of subsidence of the diapir heads.

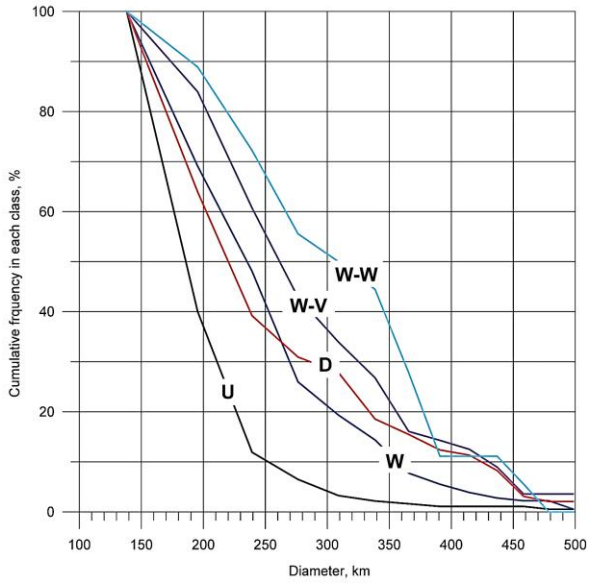

Figure 2. Size-frequency distributions of coronae of different topographic classes.

The size-frequency distributions of D and W class of coronae are close to each other (their diameters are distributed evenly in the range of 100-200 km, 44 and 48% of the coronae, respectively) and, probably, characterize transitional forms from the progressive to regressive stages of evolution of diapirs.

The largest coronae are usually belong to the W-W class (their diameters are mainly distributed in the range 300-350 km, 28% of coronae), which may reflect the mature phases of the diapir evolution. However, such coronae are rare (3% of the total number of studied coronae) and they can characterize the mature stages of evolution of unusually large parental diapirs.

Conclusions: (1) Coronae that belong to the stratigraphic Group 1 are most common features and usually have the U-shaped topographic profile that probably correspond to the regressive stage of evolution of the parental diapirs (fig. 1).

(2) Structures of the stratigraphically transitional Group 2, are rare, which suggests time lag between the formation of the older (Group 1) and younger (Group 3) coronae. The Group 2 coronae most often have the W-shaped topographic profile.

(3) Coronae of Group 3 compose ~ 20% of the total number of the studied coronae. More often, these coronae show the D-shaped topographic profile that likely correspond to the progressive stage of the evolution of the parental diapirs.

(4) The quantitative distribution of the structures of different stratigraphic Groups indicates that coronae (Groups 1 and 2) were predominantly formed during an earlier tectonic regime of surface renewal [15] and only about 20% of coronae (Groups 3) with framing, consisting of rift fractures, were probably formed during the later, volcano-tectonic regime.

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