MORPHOLOGICAL AND TOPOGRAPHICAL CHARACTERISTICS OF EPONA CORONA: CASE STUDY OF A MULTIPLE CORONA ON VENUS. T. Törmänen[1], V.-P. Kostama[1], M. Aittola[1], and J. Raitala[1], [1]Planetology Group, Div. of Astronomy, Dept. of Physical Sciences, P.O. Box 3000, FIN-90014 University of Oulu, Finland (terhi.tormanen@oulu.fi)

Introduction: Coronae are large volcano-tectonic structures with concentric and/or radial structures and associated volcanic features [e.g. 1-4]. Coronae are proposed to form as a result of buoyant mantle diapirs deforming overlying lithosphere and several competing geophysical models have been proposed [e.g. 3-8]. We have conducted a survey [9] of multiple coronae (coronae with at least 2 linked structures with a common annulus [3,5]) from Magellan data. Currently we include 67 coronae into the multiple coronae population (3 features were left out after closer examination compared to our original survey). Of the multiple coronae 47 are Type 1 and 20 Type 2 coronae (Type 1 and 2 as defined in [10]).

Here we report results from geologic mapping of Epona Corona (28°S, 208.5°E) as part of our mapping of a sample of the multiple coronae. Mapping was based on full-resolution Magellan F-MAPs and topographic data.

Epona Corona (535x225 km; Fig. 1) is a Type 1 two-part structure located on Wawalag Planitia on a regional slope from W and N towards E and S. Epona is a located on a S-N trending chain of 2 coronae and 3 arachnoids [11]. We classify it as Class A multiple corona [9]. The western and eastern parts of Epona Corona are here called Epona West (EpW) and Epona East (EpE), respectively. The shape of EpW is ovoidal with a more linear southern rim, which has the same strike as the linear NW and SE sides of EpE. There is also a circular corona located just NE of EpE (center at 26.6°S, 212°E; CC in Fig. 1a), which we think is not part of Epona. It has a low interior and part of a topographic rim to the east. The rim and associated structures of Epona appear to overlie and deform this corona indicating that it is older than Epona, or that at least major part of its evolution predated formation of Epona.

Topography: Topographically Epona belongs to group 3b [7] (rim surrounding interior dome), and both EpW and EpE have roughly the same characteristics. EpW has a ~150-250 m-high rim along its W/NW annulus (all heights are relative to adjacent plains unless otherwise stated), which continues south around the EpW becoming lower and then rising into a ~400-600 m high rim along the southern edge of EpW. Interior to the rim there is a topographically lower band, which also defines the topography of the N side of EpW. Along the southern rim this lower band becomes a 100 m low trough, which extends into the southern EpE. The interior of EpW is at about the same level as the plains to north of EpW and ~200 m higher than adjacent plains to S. There is also a higher domal rise (DR in Fig. 1a) superposed on the N low, which appears to be a volcanic center. Between the W and E parts of Epona there is 100-400 m high broad ridge, which continues as a 150-400 m high rim around the NW, NE and most of the SE side of EpE. The southerneastern topograhic rim decreases in height from NE to SW. The interior of the EpE is located 200-300 m lower than adjacent plains but has a broad ~200 m central high with superposed volcanic domes.

Structures and Units: EpW has concentric fractures on its rim (a in Fig. 1a) formed probably due to tension of the upwarping crust when rim started to form. There are some radial fractures (b), which cross-cut the W/SW section of the annulus. These fractures seem to result from tensional stretching of surface. There are also some very narrow and long fissures (c), which may be surface expressions of dikes [e.g. 2,8,12,13]. Sub-parallel fractures (d) flank the linear trough paralleling the southern topographic rim of EpW. These fractures are interpreted to be graben formed due to extension. The interior of the EpW is characterized by two types of plain-like surfaces with stratigraphically younger radar-dark smooth inner unit (e) characterized by small volcanic domes and pits.

The stratigraphically oldest unit within EpE is densely fractured terrain (f) located near the base of the rim and as scattered inliers within EpE. The fractures in this terrain are probably surface expressions of dikes [8]. This terrain is covered by at least two material units (g, h), which are interepreted to be volcanic in origin (there are several volcanic cones and domes in the area). Rigdes (i) in the NE side of the EpE are interpreted to be contractional folds formed at the same time as the topographic rim.

At the southern slope of the southeastern rim of EpE there are narrow fractures (j) arranged in a left-stepping *en echelon* formation. The fractures form a belt that fans out into a wider area of more parallel structures around 28.62°S, 210.6°E (k). These fractures, at least the *en echelon* ones, may be tension gashes formed in a right-lateral shear zone.

There is a set of regional N-S trending wrinkle ridges (l), which deform the plains S of Epona Corona and continue through Epona to N. They wrap

around the SE topographic rim of EpE but do not seem to be disturbed by the topographic rim or trough of the EpW, although they appear to be cut by the widest and apparently youngest fractures at the sides of the southern trough. This indicates that when the wrinkle ridges started forming due to roughly E-W oriented compressional stress, the SE rim of EpE existed (as evidenced by the interaction with topography [14]), but the southern rim and trough of EpW may have been less pronounced than now or that their topography has formed after the formation of the wrinkle ridges (or partly at the same time).

Sequence of Events: The inferred sequence of events from observable units and structures at Epona appear to have been: 1) formation of the oldest radial fractures of EpW, 2) formation of densely fractured terrain in EpE, 3) formation of W/NW rim and its fractures and the southern topographic rim of EpW, 4) material covering interior of EpW and possibly concurrent formation of the volcanic unit embaying fractured terrain within EpE, 5) continued formation of radial to sub-parallel fractures cutting part of the W rim of EpW, 6) formation of the topographic rim of EpE and ridges at the eastern end of EpE, 7) formation of the wrinkle ridges, 8) fracturing along outer edge of the SE rim of EpE producing also the *en echelon* fractures perhaps due to extension and shear linked to 9) formation of the S trough of the EpW with faulting along its northern wall and on the crest of the S rim (due also to perhaps further uplift of the rim), and fracturing along the northern side of the NW topographic rim of EpE (m), 10) flow units on the lowest parts of the EpE interior and volcanism in the EpW. Phases 7) to 9) may have partly overlapped in time, because changes in the strike of some wrinkle ridges appear to be controlled by pre-existing fractures within EpW and N of central Epona Corona.

Conclusions and Future Work: The sequence of events does in general agree with the diapir model of corona formation [e.g. 2-6]. Whether the interior dome and trough/rim formation require delamination [7] is not certain in this case. Dome topography may be produced by accumulation of volcanic materials and edifice building rather than as a consequence of delamination [7]. The two parts of Epona Corona appear to be produced by two close diapirs, which may have started deforming the crust at about the same time or the eastern one slightly later. It appears that the EpW has either relaxed further or did not produce as pronounced topography as the EpE. The formation of the S trough and associated faulting appears to be a late stage event due to changes of stress field either regionally or more locally (i.e. principally related to corona evolution).

We are continuing mapping multiple coronae of different morphologic and topographic types to constrain the relative timing of formation of the multiple corona parts and models for their formation.

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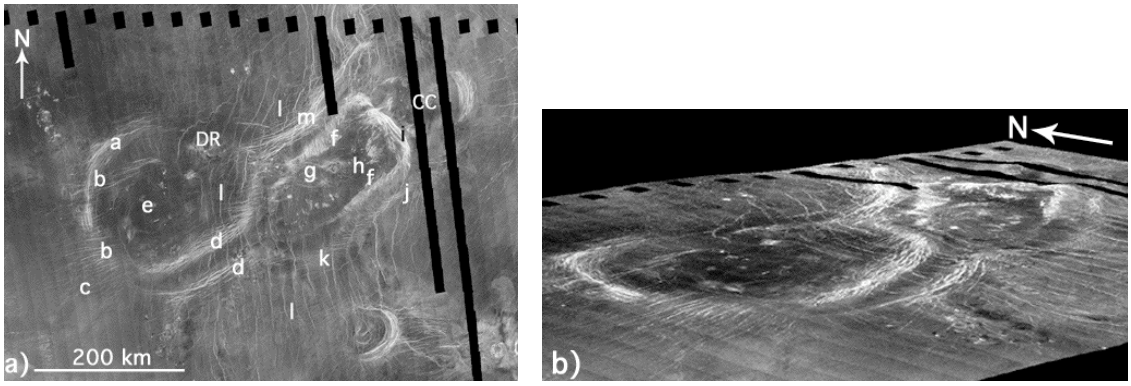

Figure 1. a) Left-looking Magellan image of Epona Corona (from C1-MIDR 30S207;1). Letters refer to structures and features discussed in text. b) Perspective view of Epona from SW. Vertical exaggeration is 25.