MORPHOLOGY AND MODELS FOR THE EVOLUTION OF EASTERN HECATE CHASMA, VENUS, Victoria E. Hamilton, Department of Geology, Occidental College, Los Angeles, CA 90041; Ellen R. Stofan, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109.

Introduction: Hecate Chasma is a deep trough characterized by a chain-like concentration of coronae and corona-like features trending approximately southwest-northeast between approximately 200 and 260 degrees east longitude (terminating at Beta Regio). The section of Hecate in which we have concentrated our study is centered at 15N, 249, where the trough is especially well-defined. Nearby, a smaller chain of eight coronae lies along a minor trough parallel to the general trend of the greater chain. The trough itself is unusual in this area because it has a highly asymmetric profile. Using Magellan radar and topography data, we have examined the morphology of this area in order to assess the tectonic and volcanic history of the area. After examining the most important types of features (linear, arcuate and circular) in eastern Hecate, we present two possible models of origin. A companion abstract [1] presents an overview of the Hecate and Parga linear deformation zones.

Linear Features: Hecate Chasma is primarily characterized by linear features. For the most part, these features trend east-west and are generally located within 300 km of the main trough. Approximately 70% are typically characterized by long, straight, paired lineaments which are interpreted to be graben. The remaining lineaments generally trend east-west as well, but are usually more irregular and are interpreted to be wrinkle ridges. The graben are chiefly concentrated on the topographically lower southern side of the main trough and are associated with digitate flows extending to the north and south. It is difficult to distinguish the extreme variation in the topography of this area as the lineaments to not display any appreciable displacement or curvature consistent with the topography. The few ridges associated with the small chain follow topographic highs, as they are concentrated at the rims and outer rises of the coronae.

Arcuate Ridges: Broad arcuate ridges are visible around the large corona located at 16N, 252. These are 15 km across axis, and of probable compressional origin. These ridges are unusual in this area and require more in depth examination. More prominent are the slightly less arcuate ridges which typically define the coronae of the smaller eight-corona chain. These ridges maintain the generally east-west trend of the linear features, and may even run through the center of a corona and continue past to the next corona. While the arcuate ridges all partially define the rims of coronae, they only make up a small portion of the annulus and tend to extend beyond the corona.

Circular Features: Coronae are the dominant type of circular structure studied in this region, with average diameters of about 225 km, and circular to highly angular shapes. The 10-12 coronae in this area display morphologies typical of others on Venus, and are in a range of developmental stages [2-4].

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However, only the 525 km diameter corona at 16N, 252 is bounded by the extremely asymmetric west-southwest to east-northeast trending main trough. To the west of this large corona, the north side of the chasm is considerably higher than the south side, but to the east of the corona, the higher topography is on the southern side of the trough. The relationship between the coronae and the linear features varies with location; the above described corona superposes nearby linear features while in the smaller chain, corona formation and compressional deformation overlapped in time.

Models of Formation: Based on the types and relationships between the features in this region, two possible models of evolution are assessed. A hotspot-type origin is not considered here as there is little evidence for a time progression of the features [1]. A model like that of Sandwell and Schubert [5] proposes limited retrograde subduction and/or delamination along the arcuate troughs around large coronae. One large corona does exist along the trace of the main trough, and it is ringed by many concentric fractures. The extreme asymmetry of the chasm is also very similar to profiles of terrestrial trenches [5]. Nonetheless, there is substantial evidence which opposes this model for this area. The evidence includes: the abundance of extensional features and the general lack of compressional features along a dominantly linear trough, and the lack of coronae along the trace of the main chasm which presents a problem for the initiation of subduction-like activity. In addition, in places, the deformation is not restricted to the trough. Lastly, this model cannot account for the radical switch in topography across the chasm as described above. The final model proposes an extensional rift system with coronae related to diapiric upwellings [3]. Some terrestrial rifts are known to have deep troughs with asymmetrical profiles due to uneven normal faulting. The switch in profile topography may be accounted for by a change in the pattern of normal faulting, also encountered terrestrially. At this time, we feel that the structural, volcanic and topographic characteristics are best explained by a rift zone and diapiric upwellings. This is consistent with the observed abundant graben, associated flows, and sequence of events in the eastern Hecate region. Future research will be directed at examining the rest of the Hecate and Parga regions, their relationship to each other, and comparisons to similar regions such as the Dali and Diana Chasmata.

REFERENCES [1] E.R. Stofan et al., LPSC XXIV, this volume.; [2] E.R. Stofan and J.W. Head, Icarus, 83, 216, 1990.; [3] E.R. Stofan et al., JGR, 97, 13, 347, 1992.; [4] S.W. Squyres et al., JGR, 97, 13, 611, 1992.; [5] D.T. Sandwell and G. Schubert, JGR, 97, 16,069, 1992.