Geographic patterns of volcanism: Comparing Venus Coronae to Terrestrial intra-plate volcanism R. K. Kundargi[1] and P. S. Hall[1] (corresponding author: kundargi@bu.edu) [1]Department of Earth & Environment, Boston University

Introduction:

The dominant mechanism for heat transport on Venus has long been suggested to be mantle plumes, resulting in a wide range of physical manifestations on the surface of Venus such as volcanic rises, large shields, as well as smaller coronae features[1,2]. These coronae structures are unique among terrestrial planets and are characterized by circular or near-circular volcano-tectonic features, first identified in images from the Veneras 15 and 16 missions[3]. On the basis of the circular shape of the volcanic and tectonic features, coronae have been interpreted to be manifestations of transient mantle upwellings, or diapirs. In the previously considered models of coronae formation uplift from a thermally buoyant diapir results in an initial dome-like structure with volcanism located at the edges, subsequent cooling of the diapir removes the dynamic support of the central domal feature causing subsidence and compression, leaving behind the coronae structures observed today[4].

Features analogous to coronae can be observed terrestrially at intra-plate hotspots fed by long-lived mantle plumes, resulting in quasi-linear hotspot tracks such as the ones observed at the Hawaii, Samoa, and Louisville hotspots. Recent work of these hotspot tracks have shown that spatial distribution of volcanoes at many oceanic hotspots display a distinct dual-chain pattern as opposed the canonically held belief of a linear hotspot track[5], implying that this feature reflects a bifurcated distribution of melt within the mantle instead of lithospheric processes. Numerical modeling experiments of intra-plate hotspots incorporating the effect of volatiles (in this case water) within the mantle suggest that the dual-chain pattern of volcanism at hotspots results from the creation of a highly viscous plug of buoyant, dehydrated, residuum that extends downwards from the base of the lithosphere, splitting upward flow within the plume conduit at shallow depths[6].

Here we present results from a series of 3D numerical experiments investigating a transient mantle upwelling within Venus, incorporating a depth dependant rheology that is dependant on temperature and water concentration. We propose that volatiles within the Venus mantle may have a similar effect on transient diapirs by facilitating the creation of buoyant and depleted residuum within the mantle upwelling, diverting zones of melting in a circular pattern and manifesting as coronae like features at the surface.

References:

[1] Jurdy, D. M. & Stoddard, P. R. The coronae of Venus: Impact, plume, or other origin? *Geological Society of America Special Papers 430*, 859–878 (2007).

[2] Stofan, E. R. *et al.* Global distribution and characteristics of coronae and related features on Venus: Implications for origin and relation to mantle processes. *Journal of Geophysical Research: Solid Earth (1978–2012) 97*, 13347–13378 (1992).

[3] Barsukov, V. L. *et al.* The geology and geomorphology of the Venus surface as revealed by the radar images obtained by Veneras 15 and 16. *J. Geophys. Res. 91*, 378–398 (1986).

[4] Johnson, C. L. & Richards, M. A. A conceptual model for the relationship between coronae and large-scale mantle dynamics on Venus. *Journal of Geophysical Research: Solid Earth (1978–2012) 108,* (2003).

[5] Kundargi, R. K & Hall, P.S. Geographic patterns of volcanism at intra-plate hotspots. *Geology (in review)*

[6] Kundargi, R. K & Hall, P.S. Untangling the Dual Chain of hotspot Volcanism (in revision)