VOLCANIC CENTERS IN NORTHERN LAVINIA PLANITIA; S.T. Keddie, J.W. Head, Brown University, Providence, RI 02912, and D.B. Campbell, Cornell University, Ithaca, NY 14853

Three volcanic centers have been located and further mapped on recent Arecibo images: Ushas Mons centered at 25°S, 325°; Innini Mons found at 35°S, 330°; and Hathor Mons located at 40°S, 325° (Fig. 1). The volcanic nature of these structures is inferred from both their topographic expression and the presence of flow-like lobes that appear to emanate from a central radar-distinct region. Bright and dark mottled plains and bright lineated terrains surround these structures.

Topography and Structure: These three edifices occur on a generally north-south oriented topographic high in northwestern Lavinia Planitia. The volcanoes are centered on local highs which rise above the planetary datum to 2 km at Innini and Hathor and 1.5 km at Ushas. Transecting the topographic high and sometimes parallel to its axis are numerous bright lineaments. Where these lineaments form well-defined subparallel arrays, such as south of Ushas and SE of Hathor, they are oriented along local topographic trends. The center of all three constructs is located at the intersection of lineament trends.

Volcanic Deposits: The distribution of volcanic materials at Ushas is controlled by the topography . Bright flow units up to 300 km long and 20 to 80 km wide extend radially away and downslope from the radar-dark 200 km wide central source (Fig 2a). Overlapping flow units to the north indicate that several eruption events have occurred. The elongation of the high topography appears to have limited flow to the south, producing the distinctive triangular shape. The one southward excursion occurs within and parallel to the bright lineament array, suggesting the presence of a local topographic low, possibly a rift.

A similar structural and topographic control of flow unit distribution is observed at Hathor Mons (Fig. 2c). With the exception of a few flow units that follow the proposed local low within the lineament array to the SE, the majority of the flow units occur to the north and west of the bright central region where the topography drops most sharply. Radial, bright and dark flow units of up to 400 km in length and 20 to 100 km in width appear to originate from a small (approximately 20 km diameter) circular structure centered in a diffuse bright region.

Although the pattern of lineaments is not as well-defined at Innini, their presence to the south and NW of the bright central region appears to have controlled or limited flow (Fig. 2b). Bright and dark flows that extend 600 km and reach widths from 20 to 120 km occur predominantly downslope to the west and NE.

South of Innini is a 50 km diameter dark, circular feature with a bright, 40 to 60 km wide bright annulus (Fig. 2b). Bright flow-like units up to 250 km long and 20 to 40 km wide radiate away to the north and NE. The absence of an associated topographic high and the alignment of the flow units with lineaments upslope, towards Hathor, make interpretation of this feature as a fourth independent volcanic edifice uncertain.

Conclusions: The presence of the axis-parallel bright lineaments on the broad topographic high and the similarity of the structures in the region with those of Beta Regio [1] supports the interpretation of this structure as a probable thermal uplift with associated extensional faults. Although the relative ages of the volcanoes cannot be determined, the strong correlation of topographic slope with flow pattern, in addition to the elongation of the local high beyond the volcanic deposits and the coincidence of the volcanic centers with the intersection of probable fault trends, argues for the superposition of the volcanic constructs on this previously formed (or synchronously developing) thermal high. Evidence that flow direction is influenced by structure is seen both NW and SE of Hathor and in south-central and south-east Ushas where bright flow-like features extend parallel to the bright lineaments. This may indicate that flow of material occurred along local lows in zones of faulting and rifting in a manner similar to that seen in Theia Mons [1].

The superposition of volcanic constructs on thermally uplifted and rifted terrain may occur in several places on Venus such as Beta [1], Bell [2], and Atla [4]. Doming and a later thin veneer of volcanism forming Sif and Gula Montes has been proposed for Western Eisila Regio [5]; a similar thin veneer of volcanic material may exist at Ushas, Innini, and Hathor. Although the diameters and altitudes above the planetary datum of these three edifices are similar to those of the Venusian shields tabulated by Schaber and Kozak [6], the true heights of these structures are probably less because of the additional elevation caused by the underlying topographic high. The method used by Schaber [5] to calculate lithospheric thicknesses, therefore, may have to be modified to account for the effect of thermally induced topography. Although not directly related topographically, the Lavinia volcanic centers may be related to adjacent upland structures Phoebe and Themis Regio. High resolution data from Magellan will help to establish the relationship of these volcanoes to Phoebe and Themis, and provide a more precise estimate of the thermal uplift and volcanic constructional aspects of the topography.

REFERENCES: [1] Campbell, D.B. et al., 1989, Styles of volcanism on Venus: New Arecibo high resolution radar data. *Science*, 246, pp. 373-377. [2] Janle, P. et al., 1987, Morphologic and gravimetric investigations of Bell and Eisila Regiones on Venus. *Earth, Moon and Planets*, 39, pp. 251-273. [3] Schaber, G.G., 1988, Elevation of Venusian shields as indicators of lithospheric thickness. *LPSC XIX*, pp. 1023-1024. [4] Senske, D.A. and Head, J.W., 1989a, Venus Equatorial Geologic Units. *LPSC XX*, pp. 986-987. [5] Senske, D.A. and Head, J.W., 1989b, Western Eisila Regio, Venus: Geology and Origin of Equatorial Highland. *28th IGC* abstracts, pp. 3-80--3-81. [6] Schaber, G. and Kozak, 1989, Morphologies of ten Venusian shields between lat. 30° and 90° N. *LPSC XX*, pp. 954-955.

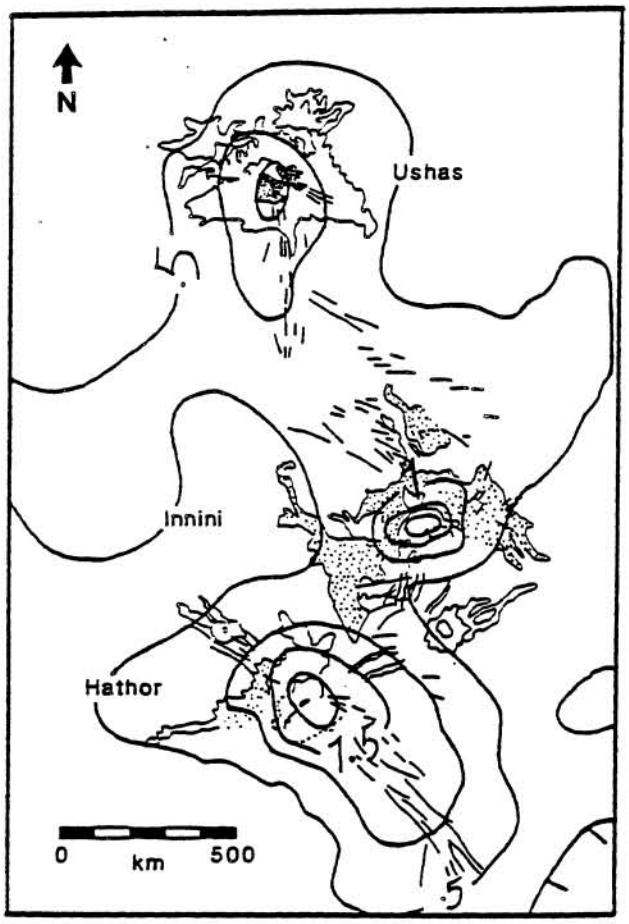

Figure 1: Sketch map of flow units of Ushas, Innini and Hathor Montes and the associated structural features. Increase in the density of stippling corresponds to an increase in radar-darkness of a flow unit. Narrow lines indicate bright lineaments. Contour interval = 0.5 km.

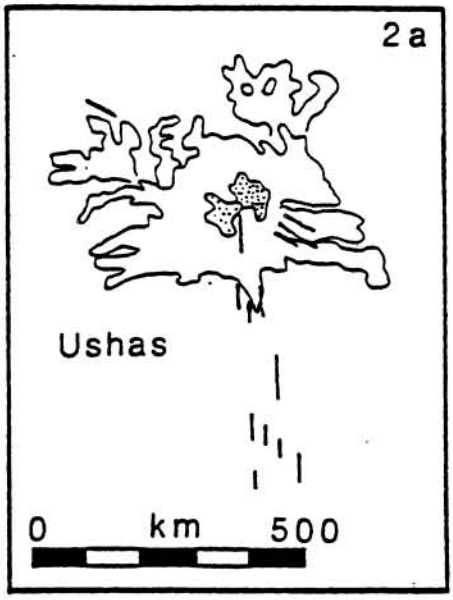

Figure 2: Geologic sketch maps of volcanic features from Figure 1. (a) Ushas Mons; (b) Innini Mons and small circular feature to the south; (c) Hathor Mons. Note intersection of bright lineament trends at volcanic centers and flow features parallel to lineaments. Full descriptions in text.