THEMIS REGIO, VENUS: ANALYSIS FROM HIGH RESOLUTION ARECIBO IMAGES; E.R. Stofan[1], J.W. Head[2] and D.B. Campbell[3], [1]Jet Propulsion Laboratory, Pasadena, CA 91109; [2]Dept. Geol. Sci., Brown Univ., Providence, RI 02912; [3]Natl. Astronomy and Ionosphere Center, Cornell Univ., Ithaca, NY 14853

High resolution (1-3 km) Arecibo images were obtained of Themis Regio in the southern hemisphere of Venus in 1983 and 1988 (1, 2). Themis is a highland region elevated over 3 km above the surrounding region, part of a NW-trending linear zone extending for over 14,000 km through Atla Regio (3). Two types of multiple ring features in Themis Regio were originally described; merged rings (diameters >300 km) and beaded rings (diameters approx. 200 km) (1). Both types of multiple ring features are cut by radar-bright lineaments, frequently in pairs spaced approximately 60 km apart. The multiple ring features were interpreted to be endogenic in origin, possibly similar to coronae (1). Nikishin (4) interpreted the structures as coronae, formed over a hot spot.

Recent Arecibo images reveal that central Themis is characterized by at least seven large (250-412 km across) quasi-circular structures, with center-to center distances averaging 406 km (Fig. 1). The features are characterized by a discontinous ring or rings, sometimes quite polygonal, made up of numerous radar-bright lineaments similar to the multiple concentric ridges surrounding coronae. The interiors of the features are composed of some combination of radar-dark and mottled radar-bright regions and radar-bright lineaments oriented obliquely or radially to the ring features. Two of the features have interior radar-bright circular features interpreted as volcanic constructs (A, B, Fig. 1); a third volcanic construct lies just to the north of the ring features (C, Fig. 1). The central ring features are connected to the smaller (20-250 km) bead ring structures to the northwest by radar-bright lineaments, which both cut and terminate at the ring structures.

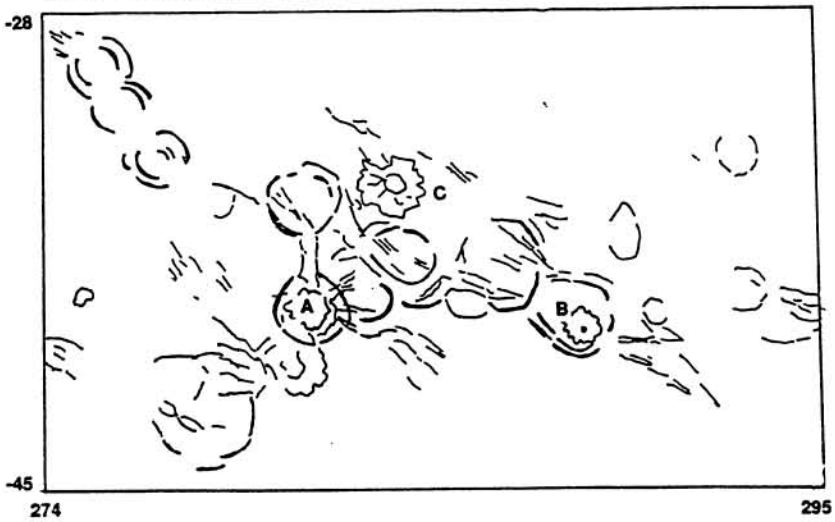
The Themis ring structures are similar to coronae in size, association with relatively raised topography and annulae of concentric ridges. However, they are dissimilar in the extreme polygonality of some of the features in Themis, the strong association with tectonic lineaments, and their chain-like nature. Coronae in the northern hemisphere of Venus tend to occur as isolated features in the plains or in clusters spaced hundreds of kilometers apart (5, 6). The Themis features do resemble a group of corona-like structures southeast of Ishtar Terra (7) interpreted by Raitala and Tormanen (8) as a possible hot spot chain; however, these features have little or no tectonic relief. The Themis Regio structures are also similar to features within the Beta-Eisila Deformation Zone, which is characterized by smaller ring structures (80-240 km across) connected by radar-bright lineaments (9).

The similarities of the Themis features with coronae suggest that they may be formed by similar processes (hotspot or rising thermal anomaly, (10)), but their chain-like appearance and close association with tectonic lineaments indicate a more complex origin. We suggest three possible models of formation for the ring features in Themis (Fig. 2). **Hotspot chain** Active crustal

formation and spreading has been suggested to be taking place in Aphrodite Terra (11). Hot spots forming beneath moving plates should produce a linear group of features associated with uplift, volcanism and possibly extension. **Zone of crustal spreading** Segmentation of terrestrial spreading centers is thought to be caused by periodic spacing of rising magma bodies (12, 13). Themis may be part of a zone of extension or crustal spreading, characterized by upwellings of mantle material along the axis of extension. **Sinking diapirs in zone of compression** Crustal thickening caused by compression may cause instabilities to form and drop off the base of the crust. Sinking mantle anomalies first result in a basin, followed by uplift and possibly extension (10). These models are being assessed for the origin of Themis, as well as the Beta-Eisila Deformation zone (9).

**References** 1) E.R. Stofan et al., LPSC XVI, 825, 1985. 2) D.B. Campbell et al., LPSC XX, 141, 1989. 3) G.G. Schaber et al., GRL, 9, 499, 1982. 4) A.M. Nikishin, LPSC XVII, 615, 1986. 5) E.R. Stofan and J.W. Head, in press, Icarus, 1989. 6) A.A. Pronin and E.R. Stofan, submitted, Icarus, 1989. 7) E.R. Stofan et al., Earth, Moon and Planets, 38, 183, 1987. 8) J. Raitala and T. Tormanen, LPSC XX, 882, 1989. 9) E.R. Stofan et al., LPSC XXI, this volume. 10) E.R. Stofan et al., submitted, JGR, 1990. 11) J.W. Head and L.S. Crumpler, Science, 238, 1380, 1987. 12) J.A. Whitehead et al., Nature, 312, 146, 1984. 13) H. Schouten et al., Nature, 317, 225, 1985.

**Figure 1. Sketchmap of Themis Regio from Arecibo data**



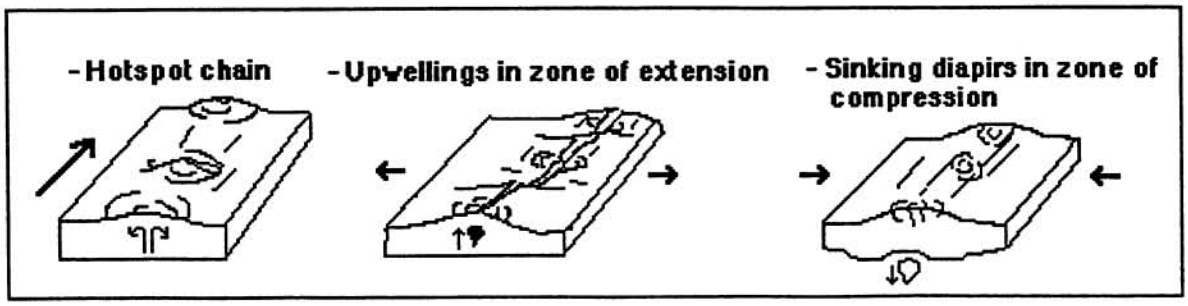




**Figure 2**