# EVIDENCE FOR VOLCANISM IN NW ISHTAR TERRA, VENUS;

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Venera 15/16 radar data for an area in NW Ishtar Terra, Venus (74°N, 313°E; at the intersection of Akna and Freyja Montes), show an area with moderate radar return and a smooth-textured surface which embays low-lying areas of the surrounding mountainous terrain (figure.1). Although this unit may be an extension of the lava plains of Lakshmi Planum to the southeast, detailed study suggests a separate volcanic center in NW Ishtar Terra. Lakshmi Planum, on the Ishtar Terra highland, exhibits major volcanic[1,2,3,4] and tectonic[5,6] features. It is a smooth-surfaced plateau (3 to 5.5 km in elevation) surrounded by major mountain belts including Akna, Freyja, and Maxwell Montes[5,6,7]. Volcanic features[1,2,3,4] on Lakshmi Planum include calderas of Colette (130x180 km) and Sacajawea (120x200 km) Paterae, lava flows (Colette flows average 15 km in width, 100-300 km in length[3]), and associated smaller vents. These volcanoes may be the surface expression of hot spots, as observed in Hawaii, in which the growing volcanic edifice deformed the surrounding areas[8]; alternatively, compressional deformation may have resulted in crustal thickening and melting, and the formation and deposition of volcanic materials[3].

On the Venera radar image (figure 1) radar brightness is influenced by slope and roughness; radar-facing slopes (east-facing) and rough surfaces (~8 cm average relief) are bright, while west-facing slopes and smooth surfaces are dark. The moderate radar return indicates a smooth unit embaying low-lying areas of the adjacent "ridge-and-trough" terrain; these characteristics are consistent with a volcanic origin for this unit. To the northwest, bright, lobate features extend further northwestward more than 300 km. A geologic sketch map (figure 2) shows smooth terrain for the volcanic units, and the darker units represent adjacent, possibly associated volcanic flows.

A series of semi-circular features, apparently topographic depressions, do not conform in orientation to major structural trends in this region of NW Ishtar Terra. Topography[9] (figure 3) shows elevations from about 5.5 km in the SE (toward Lakshmi Planum) to 2 km (to NW). If the 3.0 km elevation is assumed to be the outer boundary of a complex caldera in the center of the smooth terrain, a feature about 200 x 250 km in size is measured; the smaller depression to the southeast (an associated vent?) is about 50 km in diameter.

The large depression (caldera?) in NW Ishtar Terra is similar to the calderas of Colette and Sacajawea Paterae, as all three structures are large irregular depressions. Although Colette and Sacajawea have been described as shields, their flank slopes are low (<0.5°). All 3 calderas have depths of 1 to 1.5 km, but the caldera in NW Ishtar is both more complex and larger than Colette (130x180 km) and Sacajawea (200x120 km). If a relationship between caldera diameter and magma chamber diameter and depth exists for Venus[10], then the chamber under the NW Ishtar caldera is larger/deeper than those of Colette and Sacajawea. Although the types and volumes of volcanic products from the structures and the presence or absence of rifting and associated volcanism cannot be constrained with Venera data, the large calderas indicate that centralized eruptions were predominant. Age relationships are difficult to establish; although the muted appearance and lower relief of Sacajawea support an older age than for Colette, it is not possible to determine a relative age for the NW Ishtar Terra volcano.

NW Ishtar Terra appears to be the site of a volcanic center with a complex caldera structure, possibly more than one eruptive vent, and associated lobed flows at lower elevations. The morphologic similarity between this volcanic center and those of Colette and Sacajawea suggests that centralized eruptions have been the dominant form of volcanism in Ishtar. The location of this volcanic center at the intersection of two major compressional mountain belts and the large size of the caldera (with an inferred large/deep magma source) support a "crustal thickening/melting" rather than a hot-spot origin for these magmas.

**References:** 1) Barsukov *et al.*, 1986, LPSC Proc. 16th, JGR, 91, D378; 2) Magee and Head, 1988, LPSC XIX, 711; 3) Magee and Head, 1988, LPSC XIX, 713; 4) Gaddis, 1989, LPSC XX, 317; 5) Crumpler *et al*, 1986, Geology, 14, 1031; 6) Head, 1988, LPSC XIX, 469; 7) Vorder Bruegge and Head, 1988, LPSC XIX, 1218; 8) Pronin, 1986, Geotektonika, 4, 26 (in Russian); 9) Fotokarta Veneri B4, Lakshmi Planum, 1987; 10) Wood, 1984, JGR, v. 89, 8391.

# VOLCANISM IN NW ISHTAR

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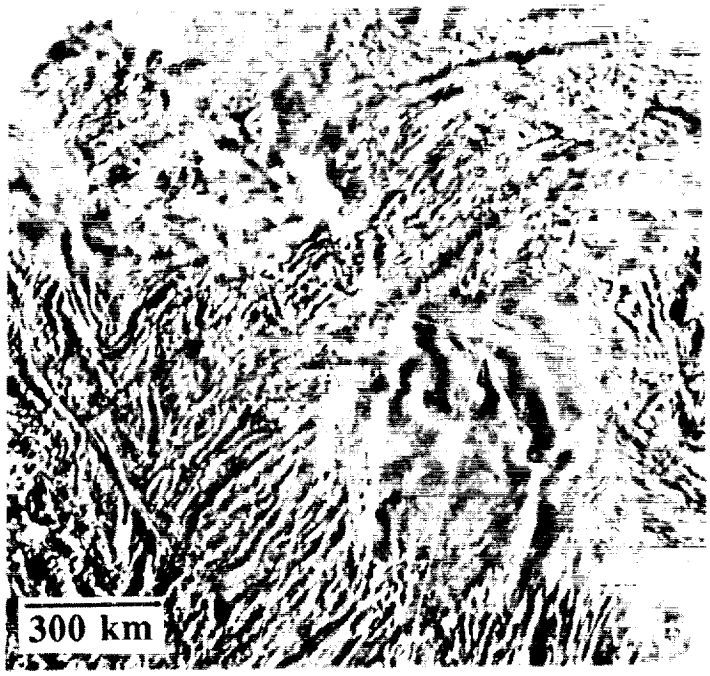


**Figure 1**

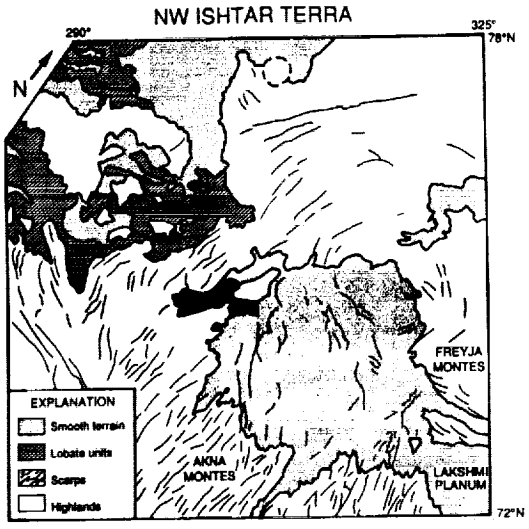


**Figure 2**

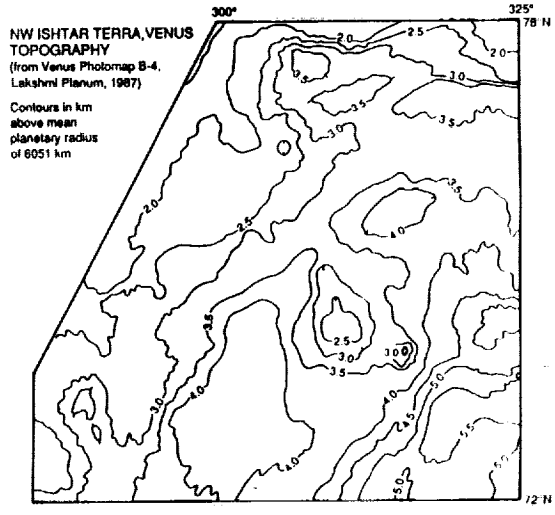


**Figure 3**