GEOLOGY OF THE GUINEVERE PLANITIA QUADRANGLE OF VENUS; ***David A. Crown,*** *Department of Geology and Planetary Science, University of Pittsburgh, Pittsburgh, PA 15260;* ***Ellen R. Stofan and Jeffrey J. Plaut,*** *Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109*

The Guinevere Planitia quadrangle (V30) of Venus is a low-lying region (0°-25°N, 300°-330°) located between the uplands of Beta Regio and Eistla Regio. Radar bright, dark, and mottled plains units, interpreted to be volcanic in origin, have previously been identified in Pioneer Venus, Goldstone, and Arecibo data of Guinevere Planitia, in addition to the arcuate fracture zones and lineament belt segments defining the Beta-Eistla deformation zone [1-5]. Analysis of Magellan SAR images has confirmed that volcanic landforms compose the majority of the surface of Guinevere Planitia [6]. The resolution of Magellan data allows detailed investigation of the geomorphic characteristics and stratigraphic relationships observed in the region in order to constrain its geologic history. Preliminary geologic mapping indicates that the Guinevere Planitia quadrangle consists of older, tectonically deformed complex ridged terrain, extensive volcanic plains, and volcanic flows. Volcanic materials in Guinevere Planitia have accumulated to form large shield volcanoes, lava flow fields, and small domes, cones, and shields.

Geologic Mapping of Guinevere Planitia

On the basis of geomorphic properties observed in Magellan SAR images, three types of geologic materials have been identified in the Guinevere Planitia quadrangle: complex ridged terrain, plains, and volcanic flows (Figure 1). Complex ridged terrain consists of embayed remnants of materials that have undergone intense deformation. *Lineated materials* contain one dominant orientation of tectonic features, and *complexly lineated materials* exhibit two or more tectonic fabrics. Prominent exposures of complex ridged terrain occur in a zone between 2.5-5.5°N and 315-317°E on the flank of a large volcano and at 12°N, 308°E in the center of a corona. Complex ridged terrain presumably includes the oldest materials preserved in Guinevere Planitia.

Extensive volcanic plains are evident throughout the Guinevere Planitia quadrangle. *Mottled, lineated plains* are generally large expanses containing a variety of small volcanic domes, cones, shields, and flows. Large eruptive centers possessing significant relief are not observed within this unit. Zones of tectonic disruption are common, as are outliers of complex ridged terrain. *Smooth plains* are low-lying regions which exhibit uniform radar brightness over large distances. Volcanic domes, cones, and shields are not abundant, but flow margins can be identified in many areas. Fractures and ridges are common and may extend for large distances (> 100 km). At 3°N, 304° a morphologically distinct network of irregular valleys appears to have formed by collapse of the surface due to the migration of subsurface fluids [7]. Typically, volcanic flows are superposed on the plains; however, locally, plains may embay the flanks of the major volcanoes in the region.

Two types of volcanic flow materials have been mapped in the Guinevere Planitia quadrangle. *Plains-forming flow materials* form extensive, radar bright or dark, relatively flat-lying sheets that can extend for hundreds of kilometers from their apparent source vents. Many exposures of plains-forming flows are associated with coronae or corona-like structures. *Lobate flow materials* form narrow, sinuous, overlapping, radar bright and dark deposits with lobate margins that form radial patterns around their source vents and have accumulated to form three broad, low-relief volcanic edifices in the region (A, B, and C in Figure 1). Numerous small domes, cones, and shields are observed within lobate flow materials on these large volcanoes.

Structures in Guinevere Planitia include numerous wrinkle ridges, fractures, and lineaments found primarily in plains units, coronae and corona-like structures, and the densely spaced ridges and troughs characterizing complex ridged terrain. Structures in plains units display a diversity of orientations, but usually occur in sets of similarly trending features. There does not appear to be a dominant tectonic fabric on the quadrangle scale; however, a large number of structures in the extensive smooth plains unit along the eastern margin of the quadrangle have trends between E-W and SE-NW. A prominent rift zone extends 250 km to the north from the summit of a large volcano (C) where it terminates in a series of arcuate fractures. In the central part of the quadrangle are several coronae and other structures with concentric ridges and/or fractures. The arcuate tectonic zones of these coronae and corona-like structures typically surround interior collapsed regions or clusters of small volcanic edifices. A group of 4 or more corona-like structures, with diameters between ~70 and 250 km, is partially embayed by lobate flow materials from the large volcanoes and also appears to be the source region for plains-forming flows.

Major Eruptive Centers and Regional Geologic History

Three large volcanoes dominate the recent volcanic history of the Guinevere Planitia quadrangle [6]. The northernmost (A in Figure 1) has a field of low shields at its summit and rises ~600 m above its surroundings. Its flanks (~600 x 800 km across) consist of a series of narrow, lobate flows which radiate from the summit region; a large flow field extends north onto the plains and coalesces with a secondary eruptive center consisting of small edifices and flows. Volcano B, ~1000 km across and exhibiting relief of ~1.4 km, consists of a large fan-shaped flow field which covers adjacent plains and lobate flows which embay a large corona and lineated materials. At its

summit radial flows surround a cone with a ~12 km diameter central pit. Volcano C, which rises ~2 km above its surroundings, has a complex summit region consisting of a shield field, a collapsed and embayed steep-sided dome, a large irregular dome, and summit flows that embay its prominent rift zone. The southern flank is composed of lobate flows which extend for ~500 km where they overlie radar dark, smooth plains with wrinkle ridges.

Relative age relationships both within and between the major eruptive centers in southern Guinevere Planitia are difficult to determine due to the complex nature in which volcanic flows interfinger and overlap. Each of the three large volcanoes appears to have had an extensive period of eruptive activity with several major phases emplacing large flow fields and more localized activity occuring both at vents on the flanks of the volcanoes and at their summits. Further geomorphic analyses and geologic mapping, including investigation of the radar properties of the flow units associated with the large volcanoes, will assist in documenting the types of volcanic activity which have occurred and the evolution of eruptive centers in the Guinevere Planitia quadrangle.

References: [1] Campbell, D.B., et al. (1989) *Science, 246*, 373-377. [2] Arvidson, R.E., et al. (1990) in *Proc. Lunar Planet. Sci. Conf., 20th*, 557-572, LPI, Houston. [3] Senske, D.A. (1990) *Earth, Moon, and Planets, 50/51*, 305-327. [4] Senske, D.A., et al. (1991) *Earth, Moon, and Planets, 55*, 163-214. [5] Stofan, E.R., et al. (1990) in *Lunar Planet. Sci. Conf., XXI*, 1208-1209, LPI, Houston. [6] Crown, D.A., et al. (1993) in *Lunar Planet. Sci. Conf., XXIV*, 355-356, LPI, Houston. [7] Baker, V.R., et al. (1992) *J. Geophys. Res., 97*, 13421-13444.

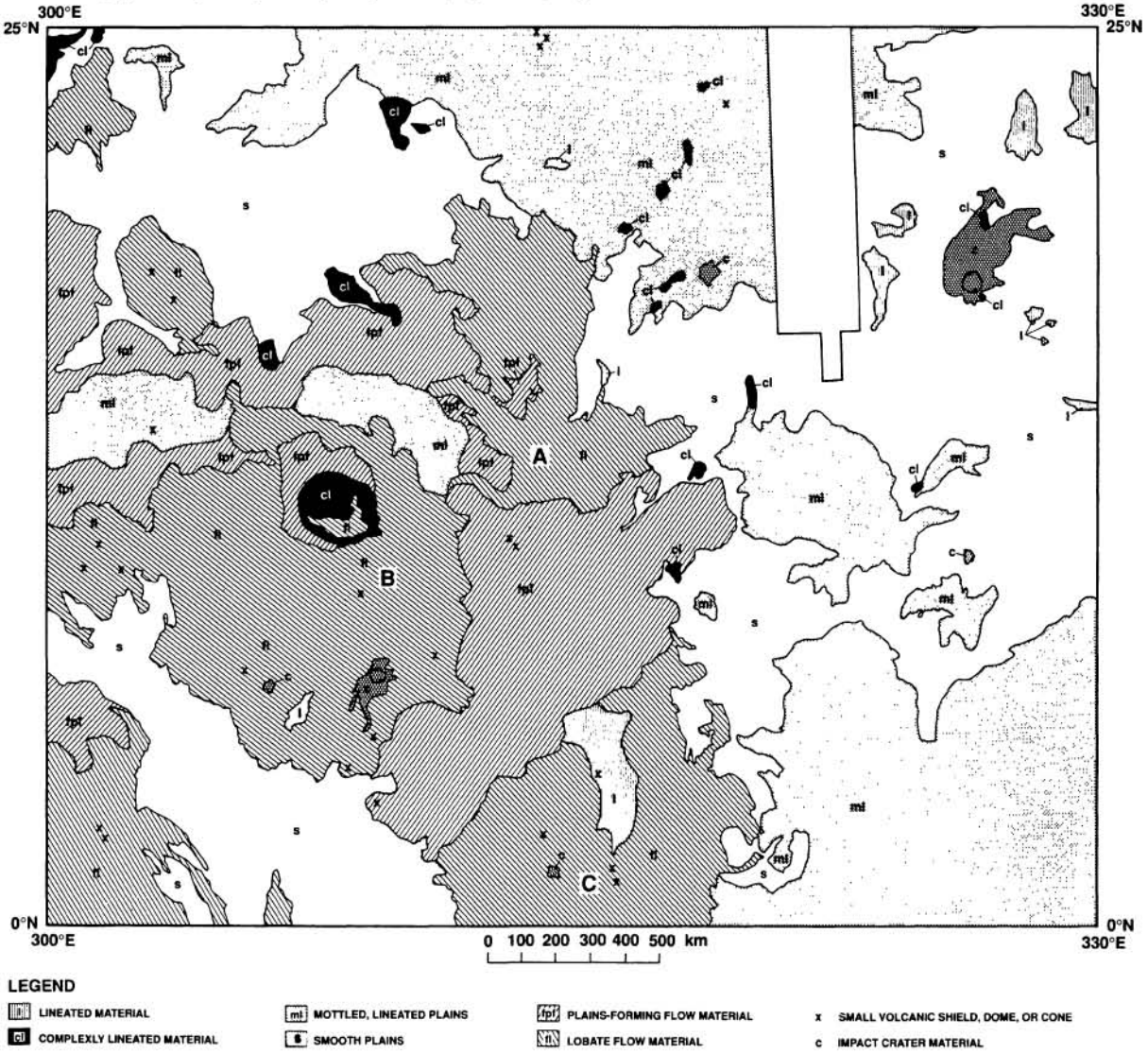

Figure 1. Simplified geologic map of the Guinevere Planitia quadrangle of Venus showing major geologic units (see text), impact crater materials, and small volcanic constructs. The summits of three large volcanoes are indicated by A, B, and C. Structures are not shown due to scale.