SOUTHERN ISHTAR TERRA AND GUINEVERE/SEDNA PLANITIA: NEW OBSERVATIONS FROM EARTH-BASED RADAR E.R. Stofan[1], D.B. Campbell[2], J.W. Head[1], and A.A. Hine[2] (1)Dept. of Geological Sciences,Brown Univ.,Prov.,R.I. 02912 (2)National Astronomy and Ionosphere Center, Arecibo, PR 00612

The southern Ishtar Terra region is one of the more complex areas on Venus. Significant volcanic and tectonic activity in the region have been identified, including possible calderas and folded or faulted terrain (1-3). High resolution (1-3 km) images of the southern Ishtar region were collected by the 12.6 cm radar at Arecibo in the summer of 1983. The area of study has been divided into four provinces, defined by topographic and radar characteristics (Figure 1). We review these characteristics, and suggest some preliminary inter- and intra-province age relationships.

Province I is a predominantly radar-dark, generally featureless region known as Lakshmi Planum. It is a high plateau, rising over 3 km above the mean planetary radius, with distinct, steeply-sloped boundaries. Two major circular depressions, Colette and Sacajawea, lie in the plateau, and are believed to be volcanic calderas (3). Colette has a dark circular center (2-5 km diameter) surrounded by a quasi-circular bright area (approximately 55 km wide). Sacajawea is less distinct in radar images, appearing as arcuate bright segments defining a quasi-circular area. The other major features of the plateau are small groups of bright lines, occurring near the eastern and western margins. The lines occur in closely spaced groups that appear to be embayed in places by the dark plains material. An exception to this is the set of lines that lie near the easternmost extent of the plateau. This set of lines is more widely spaced and distinct, and does not appear embayed. A few small (<10 km) bright circular features of possible impact origin can be seen in Province I, although distinctive structure cannot be resolved.

Province II is characterized by highly lineated terrain bordering Lakshmi Planum. The brightest areas include the southern Akna Montes and the mountainous region above Vesta Rupes. Vesta and Ut Rupes appear as darker regions bounded by bright linear features. The linear features may be classified as bands (2) and lines (4). Bands are long, very bright, lie in parallel groups, and occur in topographically high terrain. On the border of Lakshmi, the banded region ranges from 2.5-6 km above mpr. The bands first appear in the east as a narrow bright set that defines two oval, depressed areas. The bands widen, then die out, then reappear as a wider group (> 40 km wide) that rim the plateau. To the west, the bands become discontinuous lines that trend to the northwest for over 400 km before dying out. The bands reappear in a northeast-trending coherent group that corresponds to the southern portion of Akna Montes. The majority of Province II is dominated by lines, which are less bright, narrower, and shorter than bands (4). The lines have a dominant trend to the west-northwest, apparently cutting a set in the western region that trend to the northeast. The lines are more widespread than the bands, corresponding to gentler slopes lying between 2.5 km and the mean planetary radius. Several probable impact craters (over 30 km in diameter) can be seen in the zone comprised primarily of lines. A few large circular structures, possibly coronas (3), are also present in the western region, with diameters of over 100 km.

Province III is composed of flow-like units, interpreted as volcanic plains (4). The flows range from low to high backscatter return, and frequently have a lobate appearance. Some flows appear to be over 100 km long. The area is topographically low; its boundaries generally following the topography. A large depression, approximately 140 km across, lies in the western half of the province. The flows appear to originate from two types of vents. Type I is a bright spot surrounded by radar-dark material. Type II has a dark circular center with wide bright surrounds, resembling the feature Colette. One probable impact crater is located near the eastern margin of the province. The boundaries with Province II are quite distinct, while the boundaries with Province IV are transitional.

Province IV, characterized by plains, is generally radar-dark like the plateau, but has more abundant bright lines. Bright lines occur in a variety of orientations and types. 1) Single, often arcuate lines- occur predominantly in the western region. Near the

southwestern margin, the arcuate lines are associated with extension at the northern end of Beta and Devana Chasma. 2) Paired lines- occur in both IVa and IVb. Paired lines are generally closely spaced and range from straight to arcuate. 3)Arcuate groups- majority in IVb. Two or more parallel arcuate segments occur in groups that usually approximately define a circular area. We interpret the lines to be of tectonic origin, most likely representing faults. The province is also characterized by coronas that range in diameter from 60-300 km. They occur in IVa as isolated, generally circular features, elongate structures as in the center of the plains, and in clusters. In general, they are relatively high topographically. The rims of coronas in IVa range from distinct, bright and continuous to discontinuous and faint, probably representing varying states of degradation and/or flooding. The arcuate segment groups in IVb are interpreted as portions of coronas that have been more thoroughly flooded. Most of the coronas have multiple, concentric rings. In addition, IVa and IVb have areas of anomalous brightness. This corresponds to high, probably rough topography in IVb. In the western region, no topographic correlation is seen, indicating isolated areas of high roughness. Both IVa and IVb have scattered probable impact craters, with a somewhat higher density in IVb. The majority of the craters are <10 km in diameter.

Analysis suggests that volcanism and tectonism are significant in the geological evolution of the region. On the basis of cross-cutting, superposition, and embayment relationships, multiple volcanic and tectonic events have occurred in each province. The style and proportion of volcanic and tectonic activity (e.g. coronas, bands, flows) is significant in defining each province. We do not feel that these provinces represent distinctly sequentially formed geologic units, but rather we suggest that different styles of tectonic and volcanic activity have occurred in different provinces. However, some relative age relationships can be determined. Stratigraphic relationships suggest that the deformation associated with the west-northwest trending lines in Province II postdates the deformation associated with Akna Montes, and that the volcanic plains in Province III postdate the major deformation surrounding Ishtar Terra (Province II). Volcanic flooding has locally postdated corona formation, particularly in IVb. Some of the lines of Province II are superposed over a corona in IVa. The relatively small number of impact craters seen throughout the area (3,5) suggest that most of the observed geologic activity has taken place in the last one-third of solar system history.

References 1)Masursky,H. *et al.* (1980) *JGR, 85,* 8232-8260. 2)Campbell,D.B. *et al.* (1983) *Science,221,* 644-647. 3)Barsukov,V.L. *et al.* (1984) *Geochimia,12.* 4)Head,J.W. *et al.* (1985)Lunar Planet. Sci. Conf. XVI,this volume. 5)Campbell,D.B. and Burns,B.A.(1980) *JGR,85,* 8271-8281.

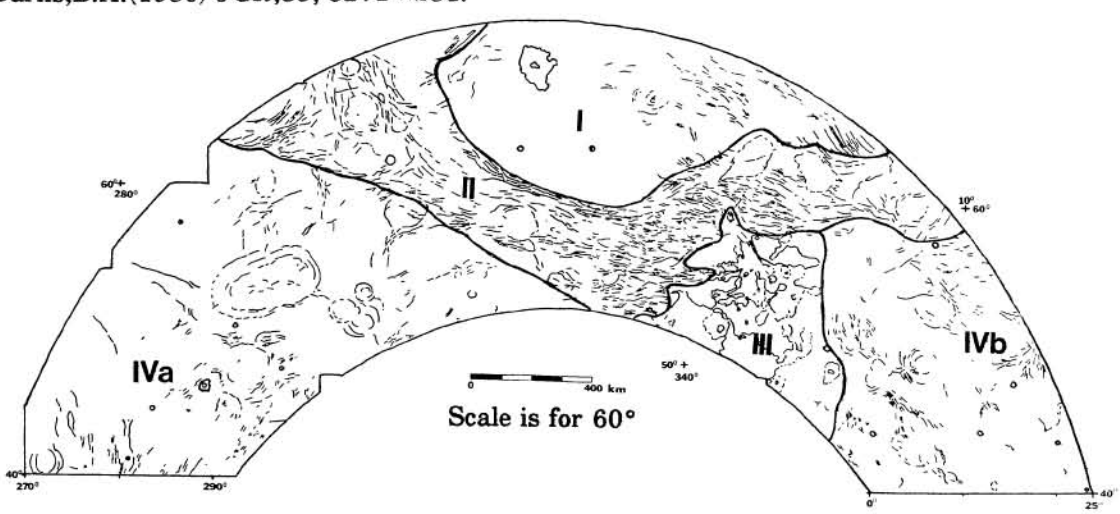

Figure 1. Sketch map of the southern Ishtar region from high resolution Arecibo images.