MAGELLAN EMISSIVITY MEASUREMENTS AND THEIR RELATIONSHIP TO GEOLOGIC FEATURES ON THE SURFACE OF VENUS; D.B. Campbell and N.J. Stacy, Dept. of Astronomy, Cornell University, Ithaca, New York 14853; P.G. Ford and G.H. Pettengill, Center for Space Research, MIT, Cambridge, MA 02139; R.E. Arvidson and J.J. Plaut, Dept. of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130.

Measurements of the thermal emission from Venus utilizing the 3.8 m Synthetic Aperture Radar (SAR) antenna of the Magellan Orbiter have provided a map at a wavelength of 12.6 cm of the emissivity of the planet's surface in the direction of the spacecraft [1,2]. The surface resolution cell size is approximately 14 km by 20 km near the orbit periapsis latitude of 10°N increasing to about 75 km square near the north pole and 80°S. Local differences in the emissivity as small as 0.01 can be distinguished although the absolute accuracy is approximately three times this value depending on both the calibration of the receiver and the accuracy with which the effects of the atmosphere can be modeled [1,2].

Surface emissivity is primarily a function of the ratio of the (possibly complex) indices of refraction at the boundary between the surface and the atmosphere, but it is also influenced by the degree of wavelength scale surface roughness and the angle of emission [3]. Small differences in the measured emissivity may be due to differences in surface roughness and/or the electrical properties of the surface material.

A preliminary map of the surface emissivity of Venus has been obtained which covers the region from longitude 330°E to 30°E in the latitude range 80°S to 90°N, approximately 15% of the planet's surface. This region is dominated in area by the lowland plains, Guinevere, Sedna and Lavinia but it also contains several major elevated regions, Western Ishtar Terra, including Maxwell Montes, in the north, Eistla and Alpha Regiones near the equator and Lada Terra at high southern latitudes.

Typical values of emissivity are near 0.85 consistent with rock or highly consolidated soil. However, there is considerable variability some of which is associated with surface geologic features while some is not. Very low emissivity values were measured for Maxwell Montes (~0.4) and the summit region of Gula Mons in Eistla Regio (~0.55) indicating dielectric constants of approximately 80 and 25, respectively. There is some indication that the low emissivity regions associated with these edifices may be altitude dependent. Several areas such as Alpha Regio and a region of high radar backscatter south of Ishtar Terra have emissivity values near 0.90, somewhat higher than the typical value. However, the high radar backscatter cross sections observed for both these regions indicate a high degree of wavelength scale surface roughness which may account for the elevated emissivity. Not all areas of high emissivity are correlated with 'bright' features in the SAR images. An area NE of Gula Mons has emissivity values up to 0.95 but its outline is not associated with any feature in the SAR image, possibly indicating changes in surface composition uncorrelated with surface structure.

Perhaps the most unusual features in the emissivity map are horn or parabolic-shaped areas of low emissivity associated with a small percentage of impact craters. These areas normally have an open parabolic shape oriented with the principal axis lying EW and the apex to the east. The crater is normally located just to the west of the apex (Figure 1). The EW and NS extents of these features are, typically, 500 to 600 km. Emissivity values are approximately 0.80 compared with values for the surrounding terrains of 0.82

to 0.85. This may be explained by differences in surface roughness but compositional differences cannot be ruled out. Current explanations center on the emplacement by the prevailing westerly winds of fine material produced during the impact event but many of the details need to be worked out.

References:

[1] Saunders, R.S., et al., *J. Geophys. Res.*, **95**, B6, 8339, 1990; [2] Tyler, G.L., et al., "Electrical and Physical Properties of Venus' Surface from Magellan Radar and Radiometer Observations", submitted to *Science*, January 1991; [3] Pettengill, G.H., P.G. Ford and B.D. Chapman, *J. Geophys. Res.*, **93**, B12, 14,881, 1988.

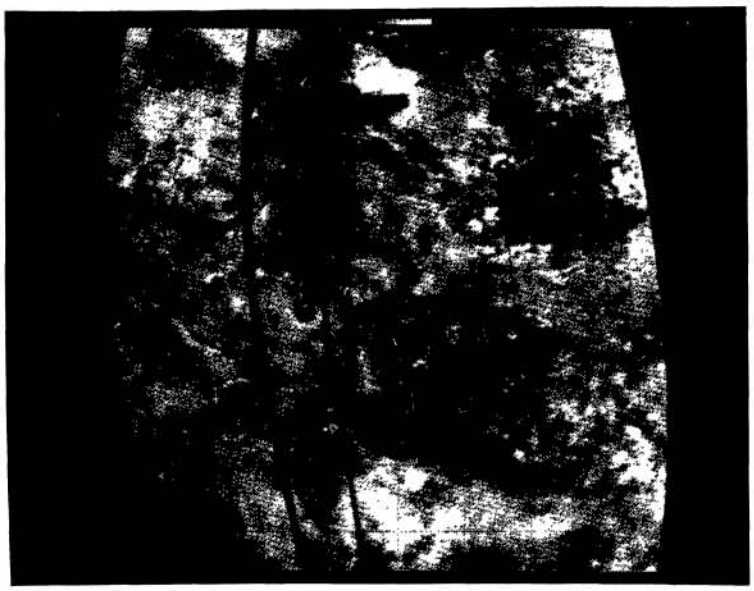

Figure 1. An emissivity image of Venus covering approximately 60 deg. of latitude and longitude. At least seven dark (lower emissivity) parabolic-shaped features are apparent, most of them 500 to 600 km in extent. The small patches of high emissivity just to the west of the apexes corresponds to the location of the impact craters.