THE SOUTH POLE OF VENUS: GEOLOGY AT 90 DEGREES SOUTH. D. A. Senske[1] and P. G. Ford[2], [1]Jet Propulsion Laboratory, California Institute of Technology Pasadena, CA, Kavli Institute for Astrophysics and Space Research, Massachusetts Institute of Technology,Cambridge, MA.

Introduction: As part of its second cycle of radar mapping, the Magellan spacecraft collected SAR data at 12.6 cm wavelength in a right looking configuration that provided the opportunity to image the Venus South Pole [1]. These data were processed into Basic Image Data Record (BIDR) image strips and archived. Image mosaics that were later produced however, include data extending only as far south as ~82.5° S, resulting in a significant image gap covering over one million km^2 centered on the South Pole. Subsequently, we processed these data into a complete south polar stereographic mosaic at a resolution of 225 meters/pixel. In this paper, we provide an overview of this data set, geologic analysis of this previously unseen part of Venus, and an assessment of mapped units in relation to the broader regional geology.

Geology of the south pole of Venus: The analysis presented here covers the region extending from ~82.5° S to the South Pole (Figure 1). Data acquired over this part of the planet were obtained at incidence angles between ~15.2° and 12.8° where the returned radar echo strength is primarily determined by variations in surface topography with lesser contributions from scattering by sub-wavelength sized surface scattering elements. As such, radar-facing slopes are quite distinct in the resultant images, providing insight into the morphology of mapped surface features. Complementary data for the region northward of 85° S between longitudes 270° and 60° at the 1-km scale is provided by Arecibo observations [2] obtained at a 12.6 wavelength, but at a different viewing geometry.

Volcanic features: The region centered on the south pole of Venus is found to be a volcanic province composed of broad regional plains and shield fields. Seven intermediate scale (10s of km across) volcanoes that range from ~24 to 64 km in diameter are clustered near the South Pole itself (Fig. 1 and Table 1). Associated lava flows extend for distances of 100s of km, forming part of the vast volcanic plains. Two of the volcanoes, area labeled "A" in Figure 1, are the source region for a major flow field that extends between longitudes of approximately 225° and 260° and latitudes 84° S and 87° S. Eruptions have resulted in the emplacement of a broad ridge that has served to control the emplacement of subsequent lava channels on either side of the flow field. It is noted that the lava channels are typically truncated, suggesting that later plains forming events have resulted in infilling of major parts of the channels. As there are no distinct unit boundaries, the radar properties of both the older and younger deposits must be quite similar. The distal part of the flow field and the adjacent plains are cross cut by sets of east-west trending wrinkle ridges indicating that broad, regional compression is the most recent regional-scale activity to occur in this area.

Impact Craters. Located within the mapped region are five previously unobserved impact craters (Fig. 1 and Table 2). These structures range from about 4 to over 17 km in diameter. Superposition relations suggest that the larger craters are relatively young as evidence of recent modification by folding, faulting, and embayment is lacking. Several of the smaller craters are irregular in shape, which may be due to post impact deformation or break up of the impactor before it hit the surface.

Tectonism: Tectonic activity on this part of Venus is relatively limited and is characterized by faulting and fracturing associated with previously identified coronae outside the study region and the widespread formation of wrinkle ridges. Lava flows from some of the larger volcanoes appear to be both modified by and superposed on some of the wrinkle ridges, suggesting contemporaneous formation relations. Within a broad geologic context, the South Pole area is a distinct demarcation between the more northerly complex system of rifting, volcanism, and corona formation associated with Quetzalpetlatl Corona (region between 0° and 90° longitude) and compression forming wrinkle ridges and ridge belts covering longitudes of 180° to 315°.

Interpretation: The center of volcanic activity at the South Pole bears similarities to other areas on Venus interpreted to be hot spot rises such as Western Eistla Regio [3] and Juno Chasma, albeit lacking well developed major rifts. Although neither Magellan nor Pioneer Venus altimetry data were obtained for the South Pole [4], adjacent topography appears to slope to higher elevations toward the south, suggesting that the South Pole area sits higher than its surroundings. The presence of widespread flood volcanism, identified typically as an early stage event at other hot spots (e.g. Juno Chasma), and the lack of a rift system may indicate that the South Pole is the site of a volcanic rise in the early stages of its development.

References: [1] Saunders, R. S. et al. (1992) *JGR*, 97, 13067-13090. [2] Kratter, K. M. et al. (2007), JGR, 112, E04008, doi:10.1029/2006JE002722. [3] Senske et al. (1992) JGR, 97, 13395-13420. [4] Ford, P. G. et al. (1992) JGR, 97, 13103-13114.

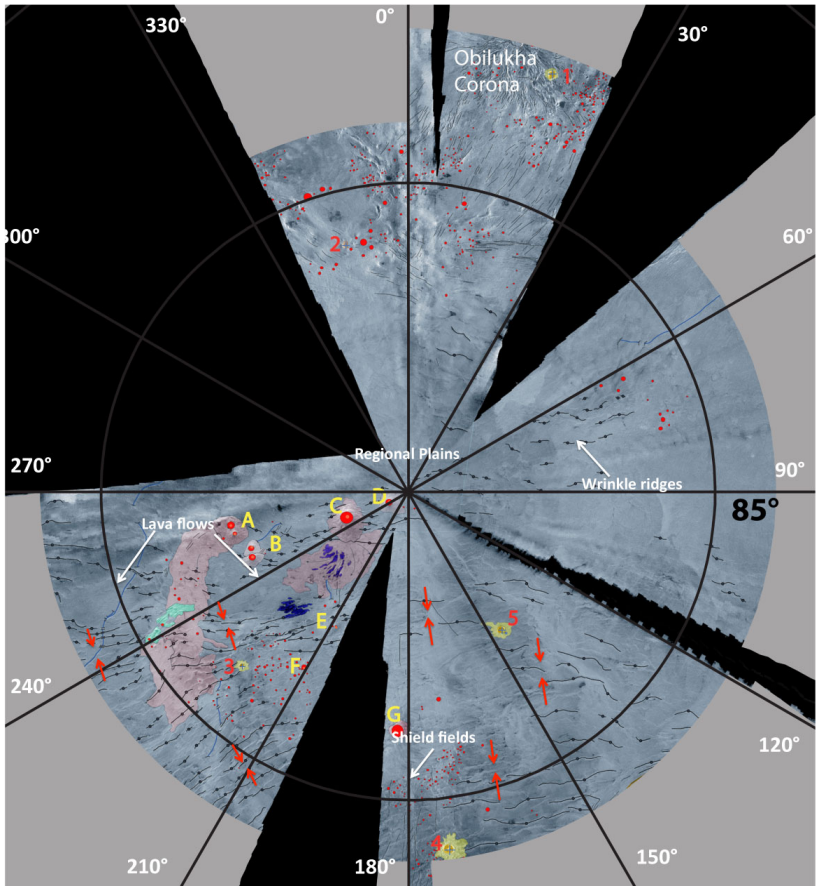

Figure 1. Generalized geologic map of the Venus South Pole. Located at the pole itself are a number of intermediate scale (10's of km in diameter) volcanoes and their associated lava flows. The region between 150° and 255° is dominated by compression (red arrows) forming wrinkle ridges.

Table 1. Venus South Pole Volcanoes

Volcano	Latitude	Longitude	Diameter
A	-87.05°	257.0°	55
B	-87.25°	247.5°	42
C	-89.00°	248.0°	64
D	-89.75°	240.0°	26
E	-87.55°	209.0°	40
F	-86.70°	210.0°	24
G	-86.05°	183.0°	31

Table 2. Venus South Pole Impact Craters

Crater #	Lat.	Long.	Dia. (km)	Description	Geologic Relation
1	-82.81°	18.80°	13.4	Simple irregular	Superposes fractures from corona
2	-85.87°	345.50°	12.3	Simple irregular	Superposes NW/SE trending ridges and part of a volcanic shield field
3	-86.10°	224.10°	8.4	Simple sub-circular	Superposes wrinkle ridges & plains
4	-84.15°	173.20°	17.3	Circular; central peak; radar dark floor	Superposes wrinkle ridges & shield field
5a	-87.30°	145.50°	11.7	Simple sub-circular	Superposes wrinkle ridges & plains
5b	-87.25°	145.00°	3.9	Simple sub-circular	Superposes wrinkle ridges & plains