**MARS' RESIDUAL POLAR CAPS: MOC IMAGES SHOW GEOLOGIC DIFFERENCES**. P. C. Thomas[1], M. C. Malin[2], K. S. Edgett[2], M. H. Carr[3], W. K. Hartmann[4], A. P. Ingersoll[5], P. B. James[6], L. A. Soderblom[7], J. Veverka[1], R. Sullivan[1], [1]Center for Radiophysics and Space Research, Cornell Univ., Ithaca NY 14853, [2]Malin Space Science Systems, P.O. Box 910148, San Diego CA 92191, [3]U. S. Geological Survey, Menlo Park, CA, 94025, [4]Planetary Science Institute, Tucson, AZ, 85719, [5]Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena CA, [6]Dept. of Physics and Astronomy, University of Toledo, Toledo OH, 43606, [7]U. S. Geological Survey, Flagstaff AZ 86002.

The Martian poles have distinctive indicators of climate and sedimentologic processes: thick layered deposits, seasonal $CO_2$ frost caps that extend to mid latitudes, and residual frost caps that survive the summer. The northern residual cap, nearly coextensive with the layered deposits, has been observed to consist of water ice, while the southern one, much smaller than the layered deposits in extent, apparently retains $CO_2$ frost[1]. It has not been known from Viking and Mariner 9 data if the residual frost caps were distinct from the underlying layers, or were equivalent to layers, unconformities, or non-conformities within the stack of layers at each pole.

Mars Orbiter Camera (MOC) images from the Mars Global Surveyor (MGS) show both poles at scales as good as 1.5 m/pixel, and cover different seasons at both poles. These images show that the northern residual cap area has complex topography of pits, separate and linked, and knobs, all suggestive of ablational topography. Vertical scales of the relief are less than a few m, horizontal scales of pits are usually much less than 50 m. This topography grades into exposures of the layers in the walls of dark lanes. The northern residual cap thus appears to be closely related to the formation or short term modification of the layers.

By contrast, the southern residual cap displays unique topography suggestive of collapse of a few surficial layers and subsequent removal of much material, possibly by sublimation. The surface of the uppermost layer in the southern residual cap shows polygonal depressions suggestive of thermal contraction. This surface shows sags, and nearby steep-walled depressions of the same general shapes, which indicate an initial subsurface removal of material, followed by sagging of the upper layers, in turn followed by removal of material, probably by sublimation. The resulting pits and troughs, up to a few hundred m across, are all developed in four or five layers, each about 2 m thick. The distinctive topography is present throughout the south residual cap area as imaged by Viking, but is not present on the outlying layered deposits. Some degraded pits and ridges in the layered deposits bear a crude resemblance to those in the residual cap, but are scattered and probably are not the same forms. The layered deposits have other forms of cracks and warped surface layers, that also have no counterparts in the north.

The residual caps thus represent very distinct geologic features, and not simply short-lived variations in summer frost retention. They may suggest long-term differences in polar climates, consistent with differences previously inferred for the layered deposits [2].

**References**: [1] Jakosky, B.A. and Haberle, R.M. (1992), in *Mars* (eds Kieffer, Jakosky, Snyder, and Matthews) 969-1016 (Univ. of Arizona Press, Tucson). [2] Herkenhoff, K.E. and Plaut, J.J. (1999), *Icarus*, in press.