THEMIS VISIBLE IMAGING OF THE SOUTH POLAR LAYERED DEPOSITS, MARTIAN SOUTHERN SPRING, 2003. J. J. Plaut[1], P. Christensen[2], K. Bender[2], J. Bell[3], L. Cherednik[2], A. Ivanov[1], H. Kieffer[4], T. McConnochie[3], M. Richardson[5], and T. Titus[2], [1]Jet Propulsion Laboratory, California Institute of Technology, Mail Stop 183-501, 4800 Oak Grove Dr., Pasadena, CA 91109, plaut@jpl.nasa.gov, [2]Department of Geological Sciences, Arizona State University, [3]Department of Astronomy, Cornell University, [4]U. S. Geological Survey, Flagstaff, AZ [5]Division of Geological and Planetary Sciences, California Institute of Technology.

Introduction: The polar layered deposits (PLD) of Mars have attracted considerable attention since their identification in Mariner 9 images, largely due to the possibility that these finely layered, volatile-rich deposits hold a record of recent eras in Martian climate history. The PLD have been a target of imaging and other sensors in the last several decades, but only recently has it been possible to obtain a moderately high resolution image map, using the visible sensor on 2001 Mars Odyssey's Thermal Emission Imaging System (THEMIS). We report here on the acquisition of a 36 meter/pixel contiguous single-band visible image data set of the south polar layered deposits (SPLD), obtained during early southern spring in 2003. The data will undoubtedly be applied to many problems in Mars polar studies. We will discuss here, and in more detail at the Conference, the use of these images to further characterize the population of impact craters on the SPLD, and the implications of the observed population for the age and evolution of the SPLD.

Data: An imaging campaign with the goal of obtaining complete coverage of exposures of SPLD during early southern spring began in late April, 2003, just prior to the southern vernal equinox ($L_S = 180$). Most of the SPLD during this time of year is covered with CO_2 frost, giving a uniform albedo, and a view of the landforms that is dominated by local topographic slope. While this remained the case on surfaces close to the pole, higher latitude SPLD exposures showed surprisingly early changes in albedo, particularly in the so-called "cryptic" region [1,2]. The visible camera mode chosen was single band (0.654 microns) at 36 m/pixel resolution, which is twice the minimum pixel size of the visible camera. This allowed collection of a nearly contiguous data set in just two 30-sol Odyssey near-repeat orbital cycles. Each image is approximately 18 km by 260 km. Figure 1 shows the coverage after about 50 sols. The final data set consists of about 1000 images. Images were targeted at all longitudes between –78° and –87° latitude (areas poleward of –87° are inaccessible to THEMIS in the nadir-pointed attitude). The sector containing the Ultimi lobe, between longitudes 130° and 230° E was also targeted up to –70° latitude. At high latitudes, the Odyssey orbit track "walks" ~15 km every two sols, allowing collection of adjacent swaths closely spaced in time. Selected images are retargeted every 30 sols, to monitor changes associated with the retreat of the seasonal CO_2 frost. Simultaneous THEMIS infrared images are also acquired with selected visible images to monitor surface temperatures associated with the visible changes in surface albedo.

Impact Craters: One key objective of the SPLD imaging campaign was to obtain a new inventory of the population of impact craters on the SPLD. Studies using Viking orbiter images [3] and Mars Global Surveyor laser altimeter data [4] determined that the SPLD contained ~10 to 100 impact craters with diameters >800 m. These crater abundances are consistent with a surface age ~10s of My [5]. The THEMIS visible data set at 36 m/pixel allows identification of impact craters as small as about 200 m (~6 pixels). Many such craters have been identified in the THEMIS data. Current models of the size frequency distribution of martian impact craters predict that craters with D>200 m should be at least an order of magnitude more abundant than craters with D>800 m on a surface purely in crater production. Preliminary examination of the new SPLD images suggests that the small craters are not as abundant as expected for a production surface, implying efficient processes of small crater removal, as postulated by [4]. A complete inventory of impact craters on the THEMIS SPLD images will be presented at the Conference.

References: [1] Kieffer, H. et al. (2000) *JGR, 105,* 9653. [2] Titus. et al. (2003) this volume. [3] Plaut, J. J. et al. (1988) *Icarus 75,* 357-377. [4] Koutnik, M. et al. (2002) *JGR 107*, doi:10.1029/2001JE001805, [5] Herkenhoff and Plaut (2000) Icarus 144, 243-253.

(See next page for Figure 1)

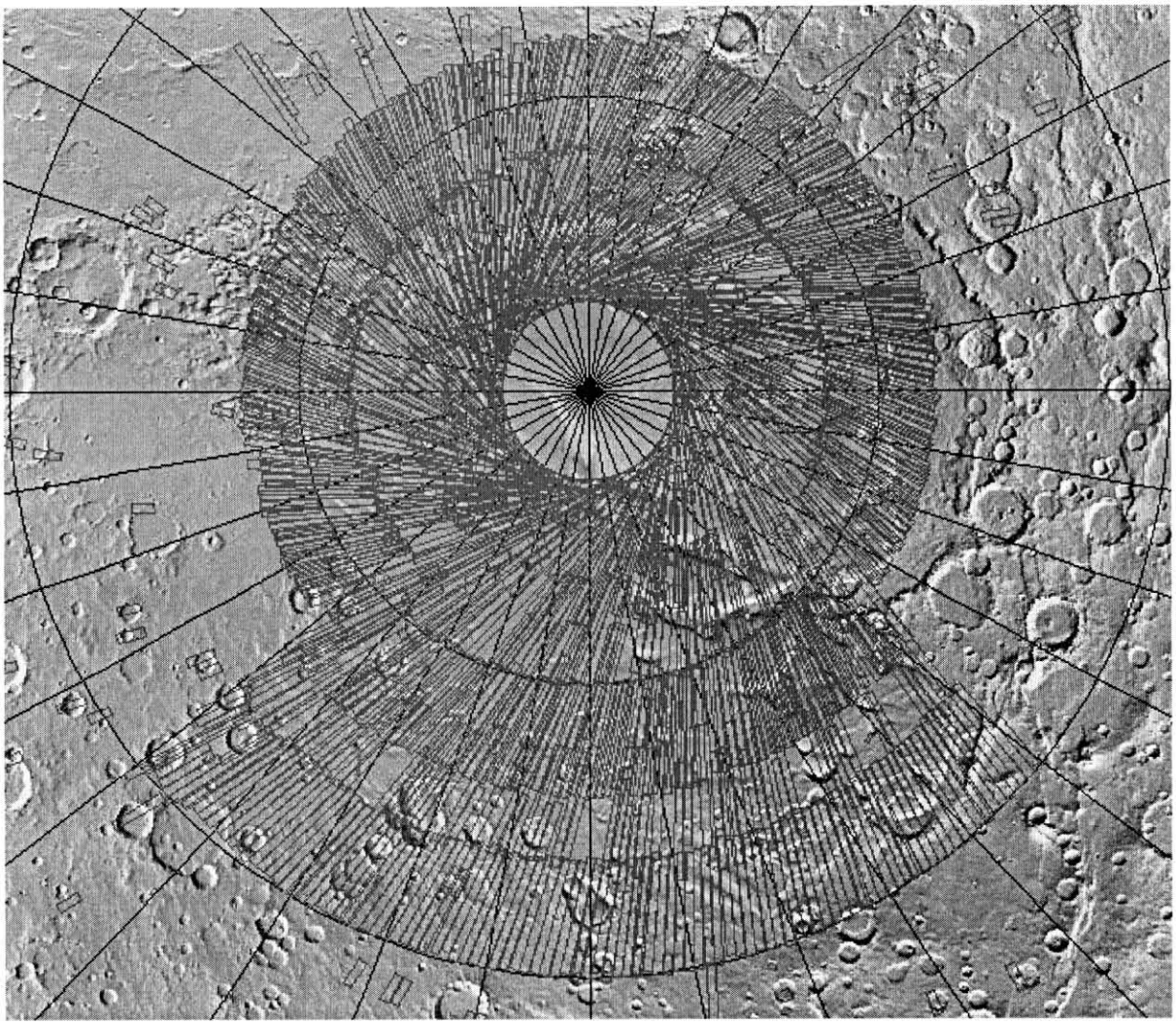

Figure 1. The south polar region of Mars, showing coverage of THEMIS visible images (blue outlines) after ~50 sols of the springtime imaging campaign. Background image is MGS MOLA topography. Latitude rings are 10 degrees. The area poleward of –87° is not accessible to THEMIS.