SURVEY OF HIGH ALBEDO EVENTS IN MARS POLAR CRATERS. J. C. Armstrong, S. K. Nielson, S. Gatrell, *Department of Physics, Weber State University, Ogden, UT, USA*, T. N. Titus, *United States Geological Survey, Flagstaff, AZ, USA*.

Mars polar features are a sensitive record of the planet's climate history. Layered terrains and circumpolar dunes record short-term changes in Mars' current climate [1] and changes of polar features over the long-term provide a record of Mars' past climate [2]. In particular, near-polar craters (defined as craters covered with seasonal CO_2 ice but located away from the permanent ice cap) provide an opportunity to examine the polar processes in detail. Near-polar craters have unique morphologies, due in large part to their interaction with the seasonal polar caps [3]. The first step in understanding these interactions is gathering information on the nature of the crater floor deposits.

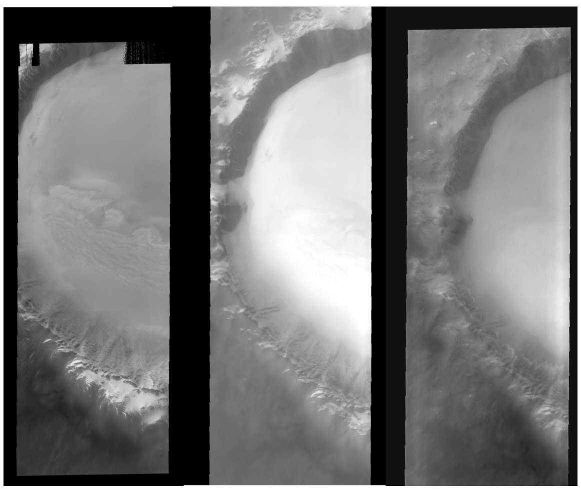

Figure 1: THEMIS visible images (left to right) showing crater 145W_77N at L_s = 79, 149, and 163 degrees (images V11976077, V13823008, and V14135009). The HAEs for this crater begin at L_s = 85 degrees.

While circumpolar winds can deposit dust and sand visible in crater dune formations [4] and CO_2 ice is seasonally deposited in the polar regions, including polar craters, the interaction these craters have with water ice deposits is largely unexplored. Observations of transient patches of water frost in the Northern polar cap [5] and exposures of water ice near the south pole [6] suggest that water ice deposits may play an important role in polar geological processes. TES temperature measurements of Korolev crater in the northern polar region show evidence of seasonal water ice and CO_2 ice deposition within the crater [7]. Additional craters near the pole also show evidence of persistent interior water ice [8].

In previous work [9], deposits identified within Korolev crater from THEMIS and TES observations indicate the presence of water ice. Further inspection of the TES data revealed that Korolev exhibited mid summer brightening in the crater's interior albedo, when the temperature was far too high for CO_2 frost. The authors suggested that these deposits are formed when the thermal wave propagates to the depth of the ice table, releasing H_2O vapor that later condenses on the surface. This thermal wave propagates to the depth of the ice table within the crater as well as in the surrounding regions, but it is the 20 K temperature difference between the surrounding plains and the crater interiors that allow the frost to form and persist within the crater.

This work was extended to explore northern polar craters greater than 10 km that exhibit signs of interior deposits [10]. Many of the craters show evidence of mid summer high albedo events (HAEs) similar to those witnessed in Korolev. We found evidence for surface frost in visible images (Figure 1) and albedo measurements from the Thermal Emission Spectrometer aboard Mars Global Surveyor indicate that the HAEs correlate well with the distribution of subsurface hydrogen (Figure 2).

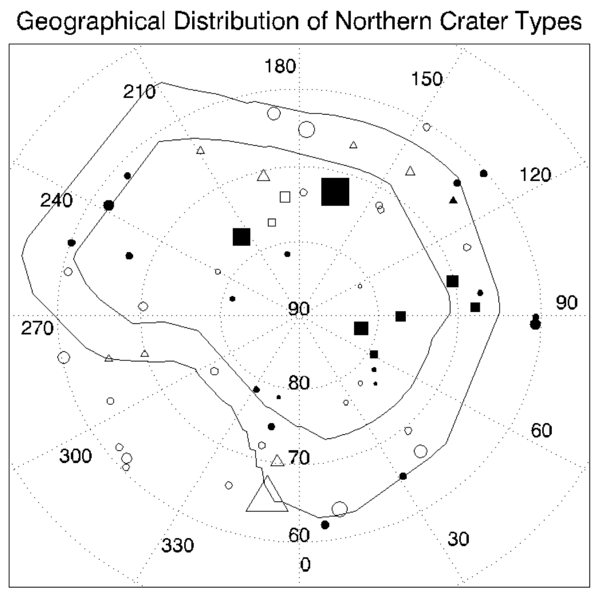

Figure 2: The geographical distribution of craters types for northern polar craters. The square symbols represent craters with am and pm high albedo events, the triangles represent craters with high albedo events in the am data only, and the circles are craters that exhibit no mid-summer high albedo events. The filled symbols are craters that have distinct, complex fill deposits in their interiors, as evidenced by MOLA topography and THEMIS imagery. The size of the symbols is proportional to the crater diameter. The two contours are the 15% and 25% water equivalent hydrogen abundance from [11].

One way to probe the nature of these deposits is to model the near-surface thermal evolution of the diurnal and seasonal temperature waves and match those to the TES temperature measurements. With Korolev, the timing of the HAE may indicate the depth of the ice table (comparable to the time it takes the thermal wave to penetrate to that depth and vaporize the water ice in the regolith), which may vary at different regions within the crater. This method was applied to Korolev [9], yielding an average surface thermal inertia of 800 $m^{-2}\ K^{-1}\ s^{-1/2}$ and a depth to the ice table of 0.7 m.

We are now extending the modeling of subsurface ice deposits to other northern craters to infer the thermal inertia of the crater interiors. In addition, we are exploring craters in the southern hemisphere for similar phenomenon. A detailed comparison of differences between the northern polar crater deposits and southern crater deposits will shed light on the physical processes at work in these regions.

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