THE YOUNG AGE OF THE LAMP-OBSERVED FROST IN LUNAR POLAR CRATERS. W. M. Farrell[1], D. M. Hurley[2], M. J. Poston[3], P. O. Hayne[4], J. R. Szalay[5], and J. L. McLain[6], 1. NASA/Goddard Space Flight Center, Greenbelt MD, 2. Johns Hopkins University/Applied Physics Laboratory, Laurel, MD, 3. Southwest Research Institute, San Antonio, TX, 4. University of Colorado, Boulder, CO, 5. Princeton University, Princeton, NJ 6. University of Maryland, College Park, MD

Introduction: The Lunar Reconnaissance Orbiter/Lyman Alpha Mapping Project (LAMP) UV instrument detected a 0.5-2% icy-regolith mix on the floor of some of the southern pole shadowed craters of the Moon. We present calculations indicating that most or all of this icy-regolith detected by LAMP (sensed to a depth of < 1 micron) has to be relatively young – less than 2000 years old- due to the surface erosional loss by plasma sputtering, meteoric impact vaporization, and meteoric impact ejection.

These processes, especially meteoric impact ejection, will disperse water along the crater floor, even onto warmer regions of the crater where it will then undergo desorption. We have determined that there should be a water exosphere over polar craters (e.g., like Haworth crater) and calculated that a model 40 km diameter crater should emit ~10^{19} waters/s into the exosphere in the form of free molecules and ice-embedded particulates.

Implications. There are a number of implications to this space environmental erosion of a LAMP-observed surface frost:

(1) A 1% wt ice-regolith layer of 500 nm thickness (the layer sensed by LAMP) contains about 4 x 10^{20} water molecules/m^2. For the combined effect of impact vaporization and impact ejecta loss rate at ~ 10^{10} water/m^2-s, the time it would take to remove the water from the top 500 nm is ~1500 yrs - a very short time in a geological context. The space environmental erosion simply does not allow the frost in that top 500 nm to dwell on the surface for long times – even in cold regions below 100K.

(2) The same erosional processes are also occurring in other locations on the crater floor, creating water infall as well as water release along the floor. Thus, in each square meter, impactors and plasma incident in that area act to remove water, but water infall from adjacent regions on the floor acts as a source within that same square meter.

(3) The results also suggest that there should be water molecules and icy grains in the exospheric region above the crater floor related to this space environmental erosion. For a 40 km diameter crater, the water emitted from the crater floor having a 1% ice regolith mix is ~10^{19} released molecules per second in the form of vapor and icy grains.

(4) These erosional processes acting on the crater floor should then also be a source of water that infalls onto terrain outside the polar crater. The space environmental erosion from polar craters as a water source to mid-to-high latitude regions was addressed previously.