Volatile Traps in a Lunar Landslide. An Example From the Unopened Apollo 17 Double Drive Tube

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Identifying lunar volatile reservoirs and undertsanding the lunar volatile cycle is key to understanding the origin and evolution of airless bodies and for planning future missions and human activities on the Moon. With foresight, mission planners and sample scientists devised sample containment and preservation approaches to capture delicate and transitory characteristics of lunar samples that would be disturbed or lost during standard sample collection and handling. A portion of these special samples will be examined by an international consortium. Particularly important is an Apollo 17 double drive tube (73001/02; 1.24 kg) which sampled landside deposits in the Taurus-Littrow Valley. A portion of this core was sealed in a Core Sample Vacuum Container by the Apollo astronuats and has remained both sealed in a vacuum container and unstudied. The recent landslide deposit is approximately 75-100 Myrs old and contains material from the South Massif that may contain pre-mare lithoclastic eruptive material. The landslide(s) may have been triggered by movement along the underlying Lee-Lincoln scarp or ejecta from the Tycho impact event [2]. Prior to collection of the core, the surface reached a maximum temperature of 384°K [1] at local noon, whereas the lower portion of the core tube was possibly “frozen” (<250°K) at the time it was sealed [1] and provides a sampling of the volatile cold trap with a large mean temperature gradient. This core sample that penetrated a lunar cold trap provides an oppoortunity to examine volatile species derived from numerous lunar volatile reservoirs. These include primordial volatiles released along the Lee-Lincoln scarp and during pre-mare and mare degassing events. Exogenous and surface reservoirs trapped in this deposit include solar wind, meteorites, and mobile surface volatiles.

[1] Keihm and Langseth (1973) *Proc. 4th Lunar Sci. Conf.* 2503-2513. [2] Schmitt et al. (2017) *Icarus 298, 17-21*.