

**SURFACE VOLATILES CHAPTER UPDATE.** D. M. Hurley<sup>1</sup> and M. A. Siegler<sup>2</sup>, <sup>1</sup>Johns Hopkins University Applied Physics Laboratory (11100 Johns Hopkins Rd., Laurel, MD, 20723 USA; dana.hurley@jhuapl.edu), <sup>2</sup>Planetary Science Institute and Southern Methodist University.

**Introduction:** The *New Views on the Moon 2* “Surface Volatiles” chapter will cover volatile abundance, composition, distribution, and their physical form within the upper ~10m of the lunar surface. This chapter will describe our present state of knowledge about lunar surface volatiles (focusing namely on water and hydrogen), looking at global and polar volatile stability, loss processes, migration (surface and subsurface), and origin. We will briefly discuss evidence from recent missions, outstanding questions and comparisons with other volatile-rich airless bodies (e.g. Mercury, Ceres). The greater community is actively involved in contributing content to the chapter. Content from this chapter overlaps in part with many other chapters including “Summaries of Recent Missions,” “Endogenous Volatiles,” “Lunar Exosphere,” “Space Weathering and Exosphere-Surface Interactions,” “Surface Processes (Regolith),” “Lunar Resources,” and “The Role of Human Exploration.”

**Chapter Outline:** The chapter is divided into 4 sections.

*Introduction.* The introduction defines volatiles, provides the old view of volatiles, discusses the significance of volatiles, introduces the reservoirs of volatiles, and summarizes the data sources since the first book.

*Quantifying present day volatiles.* This section steps through the measureable quantities of the current volatile inventory on the surface of the Moon, both for global volatiles and those concentrated in polar cold traps. We assess the abundance, composition, distribution laterally, with depth, and temporal variability, and the physical/chemical form.

*Processes relevant to surface volatiles as a system.* This section approaches lunar surface volatiles as a system (or set of systems) beginning with sources. Next it includes redistribution processes and stability of volatiles. Finally it examines loss processes

*Outstanding questions and data needed.* The final section of the chapter looks to the future and poses the outstanding issues to be addressed, including the complete quantification of the current volatile contents, the age of the deposits, the replenishing rate, the relative importance of source and loss mechanisms, accessibility as a resource, and the integration of knowledge from other related bodies. Volatiles at Mercury, Vesta, Ceres, and in meteorites provide important insight into the understanding of lunar surface volatiles, and vice versa. Future missions to lunar volatiles will enlighten many processes important throughout the solar system.

**Contributing Authors:** Community involvement in the chapter has been outstanding. The following people are contributing to the chapter at present: Oded Aharonson; Megan Bruck Syal; Joshua Cahill; Anthony Colaprete; Emily Costello; Mona Delitsky; Ariel Deutsch; Richard Elphic; Wenzhe Fa; David Goldstein; Cesare Grava; Ben Greenhagen; Junishi Haruyama; Paul Hayne; Jennifer Heldmann; Amanda Hendrix; Charles Hibbitts; Dana Hurley; Andrew Jordan; Rosemary Killen; Georgiana Kramer; David Lawrence; Shuai Li; Yang (Steve) Liu; Yang Liu; Paul Lucey; Erwan Mazarico; Wes Patterson; Michael Poston; Parvathy Prem; Kurt Retherford; Micah Schaible; Nobert Schorghofer; Matthew Siegler; Paul Spudis; Julie Stopar; Stephen West; Kris Zacny.

**Changes Since Last Meeting:** No real content changes have occurred since the first workshop.

**Potential Overlaps:** We are assuming that the “Recent Mission Summary” chapter will provide brief descriptions of the missions, instrumentation, objectives, and relevant references for the recent missions. Therefore we are not providing descriptions of missions or instrumentation in this chapter. We will start with the observations relevant to surface volatiles and their interpretation.

The systems of surface volatiles and endogenous volatiles may overlap. We consider the “surface” to be within 10 m of the surface of the Moon. The primary focus of this chapter is exogenous sources because we assume that endogenic sources will be included in the “Endogenous Volatiles” chapter.

Each of the chapters “Exosphere,” “Space Weathering” and “Regolith” contain some overlap with this chapter in that the interaction between volatiles and regolith are a key component. Repeated coverage of this topic is appropriate given the critical importance of this to understanding the stability of volatiles, the modulation of the exosphere, the interpretation of spectroscopic observations, and the thermal properties of the regolith.

Volatiles are one of several potential resources that can be used to facilitate exploration and human operations in deep space. Therefore there is overlap with both the “Lunar Resources” and “Human Role” chapters. We assume that the “Resources” chapter will handle the uses, extraction methods, and economic considerations. This chapter will provide the current state of knowledge regarding current contents that can be referred to by the “Resources” chapter.