ENDOGENOUS LUNAR VOLATILES *Co-leads*: F. M. McCubbin[1] & Y. Liu[2]; *Contributors*: J. J. Barnes[1], J. W. Boyce[1], J. M. D. Day[3], S. M. Elardo[4], H. Hui[5], T. Magna[6], P. Ni[7], R. Tartèse[8], and K. E. Vander Kaaden[9], [1]NASA Johnson Space Center, Mailcode XI2, 2101 NASA Parkway, Houston, Texas 77058, USA [2]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109, USA. [3]Geosciences Research Division, Scripps Institution of Oceanography, La Jolla, CA 92093-0244, USA [4]Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Rd. NW Washington DC 20015 [5]State Key Laboratory for Ore Deposit Research, School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, China [6]Czech Geological Survey, Kla´rov 3, CZ-118 21 Prague 1, Czech Republic [7]Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, MI 48109 [8]School of Earth and Environmental Sciences, University of Manchester, Manchester, UK [9]Jacobs, NASA Johnson Space Center, Mailcode XI, 2101 NASA Parkway, Houston TX 77058, USA (email: francis.m.mccubbin@nasa.gov).

Introduction: At the time of publication of New Views of the Moon [1], it was thought that the Moon was bone dry with less than about 1 ppb H_2O. However in 2007, initial reports at the 38th Lunar and Planetary Science Conference speculated that H-species were present in both apatites [2] and pyroclastic volcanic lunar glass beads [3]. These early reports were later confirmed through peer-review [4-8], which has motivated many subsequent studies on magmatic volatiles in and on the Moon within the last decade. Some of these studies have cast into question the post-Apollo view of lunar formation, the distribution and sources of volatiles in the Earth-Moon system, and the thermal and magmatic evolution of the Moon. Consequently, this chapter will synthesize and summarize all of the work on endogenous lunar volatiles that has occurred since 2007. Although we acknowledge that there have been a considerable number of studies on volatiles prior to 2007, these studies have been summarized previously in a recent review article in American Mineralogist [9] and in The Lunar Source Book prior to that [10].

Chapter Summary: The chapter will begin with an introduction that defines magmatic volatiles (e.g., H, F, Cl, S) versus geochemical volatiles (e.g., K, Rb, Zn). We will discuss our approach of understanding both types of volatiles in lunar samples and lay the ground work for how we will determine the overall volatile budget of the Moon. We will then discuss the importance of endogenous volatiles in shaping the "Newer Views of the Moon", specifically how endogenous volatiles feed forward into processes such as the origin of the Moon, magmatic differentiation, volcanism, and secondary processes during surface and crustal interactions.

After the introduction, we will include a review/synthesis on the current state of 1) apatite compositions (volatile abundances and isotopic compositions); 2) nominally anhydrous mineral phases (moderately to highly volatile); 3) volatile (moderately to highly volatile) abundances in and isotopic compositions of lunar pyroclastic glass beads; 4) volatile (moderately to highly volatile) abundances in and isotopic compositions of lunar basalts; 5) volatile (moderately to highly volatile) abundances in and isotopic compositions of melt inclusions; and finally 6) experimental constraints on mineral-melt partitioning of moderately to highly volatile elements under lunar conditions. We anticipate that each section will summarize results since 2007 and focus on new results published since the 2015 Am Min review paper on lunar volatiles [9].

The next section will discuss how to use sample abundances of volatiles to understand the source region and potential caveats in estimating source abundances of volatiles. The following section will include our best estimates of volatile abundances and isotopic compositions (where permitted by available data) for each volatile element of interest in a number of important lunar reservoirs, including the crust, mantle, KREEP, and bulk Moon. The final section of the chapter will focus upon future work, outstanding questions, and any insights on the types of samples or experimental studies that will be needed to answer these questions.

Chapter changes since the NVM II 2016 Workshop: In the months following the 2016 NVM II workshop, we were informed by the steering committee that the request to have a stand alone chapter on stable isotopes was denied. Consequently, we have decided to cover the topic of volatile stable isotopes in our chapter and include a synthesis/review of new stable isotope data where relevant. There were no additional major changes to report on the contents of this chapter.

References: [1] Jolliff et al (2006) *RiMG* 60 721 pp **[2]** McCubbin et al (2007) *37th LPSC* #1354 **[3]** Saal et al (2007) *37th LPSC* #2148 **[4]** Saal et al (2008) *Nature* 454, 192-195 **[5]** McCubbin et al (2010) *PNAS* 27, 11223-11228 **[6]** Boyce et al (2010) *Nature* 466, 466-469 **[7]** Greenwood et al (2011) *Nat. Geosci.* 4, 79-82 **[8]** Tartèse et al (2013) *GCA* 122, 58-74 **[9]** McCubbin et al (2015) *Am. Min.* 100, 1668-1707 **[10]** Taylor et al (1991) *The Lunar Source Book*, p. 183–284. Cambridge University Press, U.K.