

# Endogenous Volatiles

Co-Leads: Francis McCubbin (francis.m.mccubbin@nasa.gov), Yang Liu (Yang.Liu@jpl.nasa.gov), Still deciding Outline

Introduction:

- Definition: C, H, F, Cl, S, N & noble gas, versus moderately volatiles: K, Rb, Zn (comparable volatility)
- Importance of volatiles in the Newer Views of the Moon: origin of Moon, magma differentiation [point to the overlapping chapters for complementary discussion and evidence], volcanisms, secondary processes in surface and crust interactions (shorter introductory paragraph that sets up all of the volatile processes to be discussed in subsequent chapters)

Results in subject order: Important to incorporate the most recent results not reviewed in 2015 Am Min Paper

- Volcanic glasses as beads or as inclusions or as bulk rocks: direct measurements of volatiles in the magma, but subject to degassing
- Apatite: ubiquitous in diverse rocks and thus a window into different processes, but subject to partition effects (story is also improving), fractionation and degassing
- Nominally anhydrous minerals: more ubiquitous and have been shown on Earth to contain ppm to 100's ppm OH with a correlation to P, but are difficult to analyze and subject to unconstrained partitioning effects (story is also improving)

How to use sample abundances to understand the source region and potential caveats

- Mineral-melt partitioning for NAM-melt and apatite-melt
- Degree of partial melting estimates and relation to the source
- Pitfalls in using sample data, degassing, fractional crystallization effects on apatite, assimilation etc

Implications:

- Synthesis of trends for volatiles, place in context of geochemical affinities and correlations (i.e., chalcophile, siderophile, lithophile)
- Mantle source volatiles: abundances and distribution and processes affecting them,
- Updated Intrinsic volatility scale for the Moon

Future work:

- bona fide mantle rocks for above approaches
- future sample return mission
- improved partitioning models
- Targeted and correlated analyses in samples to link timing of crystallization and composition