THE POTENTIAL OF IMPACT MELTS AS A LUNAR WATER RESERVOIR. R. S. Harris[1,2] and P. H. Schultz[2], [1]Department of Geosciences, Georgia State University, Atlanta, GA 30302 (rsharris@gsu.edu), [2]Department of Geological Sciences, Brown University, Providence, RI 02912 (peter_schultz@brown.edu).

Summary: The possible role of cometary and/or asteroidal impacts in the delivery of water to the lunar environment has been widely recognized (e.g., [1-3]). However, most water retention models focus on the eventual fate of the vapor phase released from the impactors during hypervelocity collisions. We propose that significant concentrations of water, and perhaps other volatiles, can be trapped more directly as dissolved species in impact melts. The resulting water-rich glasses subsequently can be buried and assimilated into lunar magmas, while surviving fragments in the regolith and fresh ejecta can slowly release OH^- and H_2O to the surface [2]. We provide geologic and experimental evidence supporting the plausibility of this concept, and we suggest that lunar impact glasses should be scrutinized with the same attention presently applied to the reanalysis of volcanic ejecta in order to assess their contribution to the Moon's water budget.

Hydrous Impact Melts in Nature and Experiments: We previously have reported (e.g., [4, 5]) the preservation of hydrous melts in natural glasses produced by impacts into wet loess on the Pampean plain of Argentina (Fig. 1). We have measured water concentrations as high as ~20 wt% using multiple techniques including μT-FTIR, μR-FTIR, and SIMS. Similar experimental melts were produced at the NASA Ames Vertical Gun Range (AVGR) by firing Pyrex® projectiles into water-saturated pumice targets. Both high pressures and rapid quench rates appear to play a role in their formation.

If target volatiles can be entrained in an impact melt, volatiles originating from certain portions of the impactor should be available to trapping, as well. In order to investigate this process experimentally, we fired simulated comets and wet asteroids into dry pumice targets at the AVGR. The "comets" are water-filled hollow aluminum spheres, and the "asteroids" are fashioned from serpentinite. These collisions produce amalgamated melts of target and projectile material. Two interesting observations have been made in our preliminary analyses. The "comet" impacts produce some yellowish, filamentous materials reminiscent of the hydrous inclusions shown in Fig. 1. The melted target materials also appear to contain abundant clay-like phases (either absent or far less concentrated in the pre-impact pumice). We currently are analyzing these experimental melt breccias to determine their compositions and water contents. Phyllosilicate production either during or as an immediate disintegration of wet melts could be an additional way to sequester volatile species in lunar soils and breccias.

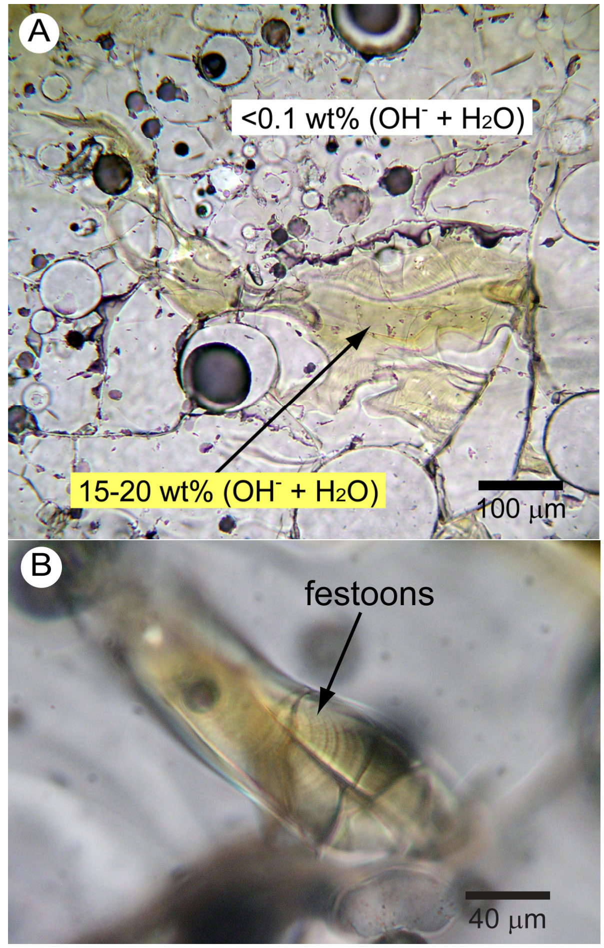

Figure 1. Plane-polarized light (PPL) photomicrographs of terrestrial impact glasses formed by melting water-rich regolith. A) Hydrous yellow glass inclusion in 425 ka impact glass from Centinela del Mar, Argentina. The encasing clear glass is essentially anhydrous. B) Ropy hydrous inclusion in 9.21 Ma impact melt breccia from Chasicó, Argentina.

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