RHEOLOGICAL INVESTIGATION OF CRYOVOLCANIC SLURRIES. Aaron A. Morrison[1], Alan G. Whittington[1], Fang Zhong[2], Karl L. Mitchell[2], and Elizabeth M. Carey[2], [1]Department of Geological Sciences, University of Missouri, [2]National Aeronautics and Space Administration, Jet Propulsion Laboratory. (aamgz8@mail.missouri.edu)

Abstract: Cryovolcanic processes have been considered theoretically for decades but with few experimental studies providing supporting data over a narrow compositional range. The rheology of these materials is fundamental in determining how cryovolcanic features are emplaced and the morphologies that result. We will attempt to address this knowledge gap by conducting a rheological investigation of briny crystal-liquid suspensions likely to be erupted on icy bodies. The few previous studies measuring subliquidus viscosity are plotted in Figure 1. Brine compositions can form due to either fractionation or melt segregation (enhanced by a very low viscosity carrier fluid) from an ammonia-water/ice source which could then be erupted creating a dome or flow feature. Potential cryogenic compositions span a similar viscosity range to that of silicate lavas. Many bodies exhibit flow features/constructs and a defined rheology will allow inferences about possible compositions based on observed morphology. This would be particularly useful on bodies, like Titan, Triton, or Pluto, that have atmospheres or geysers that can cover other features in (methane) frost or ejecta complicating spectral analysis of the feature itself. Understanding how these materials move, deform, and evolve upon crystallizing will help constrain what morphological features can form by various compositions. The rheological data will allow comparisons to terrestrial silicates and determinations of how similar the two materials behave. If they are, in fact, analogous to silicate systems (in terms of viscosity, flow index, yield strength, etc.), are they formed and emplaced by the same mechanisms and processes further strengthening their link? And if not, what factors are contributing to the difference? Determining rheologies of these cryogenic materials should allow us to answer these questions. Understanding these flows will also provide insight into how various bodies have evolved (or are evolving) and may suggest what the body may have looked like in the past.

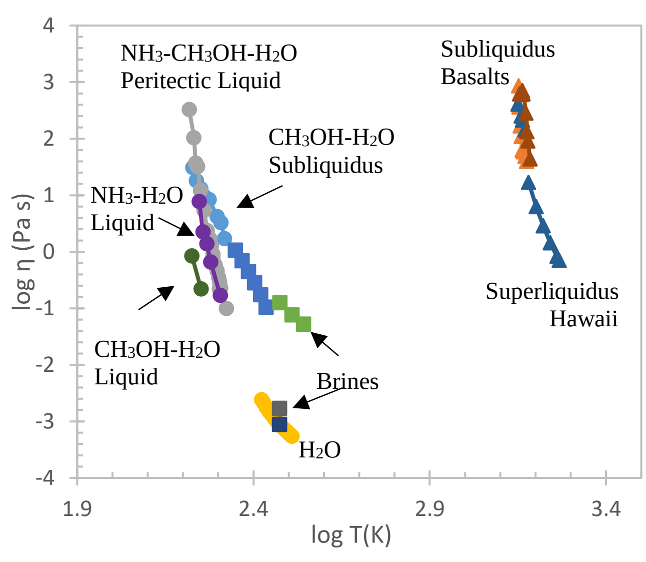

Figure 1. Viscosity data for water [1], brines [2,3], ammonia-water [4], methanol-water [4,5], ammonia-methanol-water [4], East African Rift basalts [6], Hawaiian basalt [7].

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