Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04430, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04430
EGU General Assembly 2008


# Cryolava Emplacement on Titan and Resulting Morphology: Modelling Strategy

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If volcanic processes are indeed emplacing new cryomagmatic material on the surface of Titan, such activity might be detected by recognizing unique signatures, in particular, a unique morphology that characteristic of the volcanic processes; thermal anomalies on the surface or in the atmosphere; or spectroscopic features that identify likely cryolava compositions. By studying morphology, eruption conditions can be inferred. We are investigating the eruption and emplacement of cryolava on the surface of Titan, an environment that is unique in the Solar System (a very cold, dense atmosphere and low-temperature lava). Under these conditions atmospheric convection plays a dominant role in the heat transfer process [1]. Modelling lava emplacement is an extremely complex process at the best of times, but in the Titan case this effort is hampered by a lack of constraint on possible lava composition, and values of physical and rheological properties that are often temperature-dependent. By studying end-member compositional cases and performing a full parametric search, we produce a range of possible morphological and thermal signatures. In this way, tests can be made to determine the extent and style of volcanic activity which can be detected by instruments on the *Cassini* spacecraft, and spacecraft that will follow *Cassini*. As experimental work continues to constrain lava physical properties and reduce parameter space, comparative geomorphology exercises can further constrain cryolava composition, possibly controlled by the presence (or absence) of a sub-surface Titan ocean. Having evaluated atmospheric heat transfer mechanisms on Titan, we are now modelling the solidification and cooling process, are identifying which thermo-physical variables are most

important in this process, and prioritizing these for laboratory investigation. This work was performed at the Jet Propulsion Laboratory-California Institute of Technology, under contract to NASA. Reference: [1] Davies et al., The role of Titan's atmosphere in removing heat from a cryolava flow, abstract, DPS 39, 2007, 63.05.