Geophysical Research Abstracts,
Vol. 11, EGU2009-7122-1, 2009
EGU General Assembly 2009

Dynamics of fluid flow in Martian outflow channels

L. Wilson (1), A.S. Bargery (1,2), and D. Burr (3)

(1) Environmental Science Department, Lancaster University Lancaster LA1 4YQ, U.K., (2) Laboratoire de Planétology et Géodynamique, Université de Nantes, France (alistair.bargery@univ-nantes.fr), (3) Carl Sagan Center for the Study of Life in the Universe 515 N. Whisman Road, Mountain View, CA 94043, U.S.A.

We review the conditions under which large volumes of water may have flowed at high speeds across the surface of Mars. In order to assess the likely ranges of initial water temperature and release rate, we explore possible conditions in subsurface aquifers confined beneath the cryosphere. We then model the transfer of water to the surface in fractures induced by volcanic activity or tectonic events and discuss the physical processes involved in its release into the Martian environment. The motion of the water across the surface is analysed with standard treatments for fluvial systems on Earth, modified for Mars by taking account of the differing environmental conditions and removing what we consider to be the unsafe assumption that most channels involved bank-full flows. The most commonly discussed environmental difference is the smaller acceleration due to gravity. However, an important additional factor may have been the initially vigorous evaporation of water into the low-pressure Martian atmosphere. This process, together with the thermal losses incurred by assimilation of very cold rock and ice eroded from the crustal cryosphere over which the water travels, causes minor changes in the depth and speed of a water flood but, eventually, produces major changes in its rheology as the total ice and sediment loads increase. The roles of these processes in determining the maximum distance to which the water may travel, and the relative importance of erosion and deposition in its bed, are discussed.