Geophysical Research Abstracts
Vol. 17, EGU2015-1718, 2015
EGU General Assembly 2015

Origin of circular collapsed features in the Chryse region of Mars

Manuel Roda (1), Maarten G. Kleinhans (2), Tanja E. Zegers (2), and Rob Govers (2)
(1) Università degli Studi di Milano, Italy (manuel.roda@unimi.it), (2) Universiteit Utrecht, The Netherlands

The quasi-circular collapsed features occurring in the Chryse region of Mars share similar morphological characteristics, such as deeply collapsed quasi-circular areas with intensively fractured floor characterized by polygonal tilted blocks of highly variable size. We analyze statistical relations between diameter, maximum and minimum depth, and amount of collapse of several of these features. Based on their morphometric characteristics, we find that these features have a common origin. Different scenarios have been proposed to explain quasi-circular collapsed features. We find that the maximum depth and minimum amount of collapse are strongly correlated to diameter. Impact craters show the same relations, strongly suggesting that collapsed features originated as impact craters. Furthermore, the morphometric characteristics of the infill agree with melting and subsequent collapse of an ice layer below a sediment layer. This interpretation agrees with a buried sub-ice lake scenario. After the formation of an impact crater the increase in temperature resulting from the release of impact energy would induce melting of the surrounding cryosphere. The generated groundwater flows towards the crater, which represents a topographically depressed area with low hydraulic head and produces a crater-lake. The volume of molten cryosphere and the amount of water flow is strictly related to the size of the impact crater: larger craters result in more melting and deeper lake. Due to low surface temperatures, the water lake freezes and sediments can be depositated at the top of the ice layer. The buried ice unit melts as result of the thermal insulation by the overburden in combination with the planetary heat loss, creating a subsurface lake. The system is no longer stable and the overburden collapses, resulting in massive expulsion of liquid water to the surface. Taking into account a uniformly distributed heat loss, the amount of melting is strictly affected by the crater size. This is a non-climatic mechanism for producing and storing abundant liquid water under martian conditions.