



Experimental investigation of gravity effects on sediment sorting on Mars

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Sorting of sedimentary rocks is a proxy for the environmental conditions at the time of deposition, in particular the runoff that moved and deposited the material forming the rocks. Settling of sediment is strongly influenced by the gravity of a planetary body. As a consequence, sorting of a sedimentary rock varies with gravity for a given depth and velocity of surface runoff. Theoretical considerations for spheres indicate that sorting is more uniform on Mars than on Earth for runoff of identical depth. In reality, such considerations have to be applied with great caution because the shape of a particle strongly influences drag. Drag itself can only be calculated directly for an irregularly shaped particle with great computational effort, if at all. Therefore, even for terrestrial applications, sediment settling velocities are often determined directly, e.g. by measurements using settling tubes. In this study the results of settling tube tests conducted under reduced gravity during three experimental flights conducted in November 2012 and 2013 are presented. Nine types of sediment, ranging in size, shape and density were tested in custom-designed settling tubes during parabolas of Martian gravity lasting 20 to 25 seconds. Based on the observed settling velocities, the applicability of empirical relationships developed on Earth to assess particle settling on Mars are discussed. In addition, the potential effects of reduced gravity on the sorting of sedimentary rocks and their use as a proxy for runoff and thus environmental conditions on Mars are examined.