Mars: Periglacial Morphology and Implications for Future Landing Sites

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At the Mars Phoenix landing site and in much of the Martian northern plains, there is ice-cemented ground beneath a layer of dry permafrost. Unlike most permafrost on Earth, though, this ice is not liquid at any time of year. However, in past epochs at higher obliquity the surface conditions during summer may have resulted in warmer conditions and possible melting. This situation indicates that the ice-cemented ground in the north polar plains is likely to be a candidate for the most recently habitable place on Mars as near-surface ice likely provided adequate water activity ~5 Myr ago.

The high elevation Dry Valleys of Antarctica provide the best analog on Earth of Martian ground ice. These locations are the only places on Earth where ice-cemented ground is found beneath dry permafrost. The Dry Valleys are a hyper-arid polar desert environment and in locations above 1500 m elevation, such as University Valley, air temperatures do not exceed 0°C. Thus, similarly to Mars, liquid water is largely absent here and instead the hydrologic cycle is dominated by frozen ice and vapor phase processes such as sublimation. These conditions make the high elevation Dry Valleys a key Mars analog location where periglacial processes and geomorphic features can be studied in situ. This talk will focus on studies of University Valley as a Mars analog for periglacial morphology and ice stability. We will review a landing site selection study encompassing this information gleaned from the Antarctic terrestrial analog studies plus Mars spacecraft data analysis to identify candidate landing sites for a future mission to search for life on Mars.