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Formation and evolution of periglacial landforms in context of global warming: Comparison Earth-Mars

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Abrupt climate-changes in the periglacial environments on Earth such as Central Yakutia (Siberia) deeply modified the landscape. This region is underlined by a continuous permafrost that is ice-rich, ∼40-80% of ice by volume. The permafrost was formed during the last Pleistocene glaciation.
A unique assemblage of landforms is observed: ice-wedge polygons, polygon-junction ponds and thermokarst lakes. The ice-wedges polygons are formed by thermal-contraction of an ice-cemented ground due to rapid drop of air temperature <0°C. The thawing of the network of polygons underlined by ice-wedges produces ponds localized at the junction of polygons. The thermokarst lakes are the result of the subsidence of the ground following the localized thawing of excess-ice. Most of thermokarst lakes were formed during the Holocene climatic optimum where higher temperatures induced the extensive thawing of the permafrost.

Now, the planet Mars is a cold and dry desert, the mean pressure is 6 mbar and mean temperature is -55°C. However, in the last few years, evidences of Mars being an ice-rich planet have become increasingly abundant. The region of Utopia Planitia in the northern mid-latitudes contains relatively young (< 10 Myr) landforms: small-sized polygons (∼100 m in diam.), polygon-junction pits (∼10 m in diam.) and scalloped depressions (∼100-1000 m in diam.). Several authors showed that they are possibly periglacial landforms like on Earth, however their origin is still enigmatic.
We conducted a geomorphologic study of all landforms in Utopia Planitia with high-resolution satellite imagery and topographical data. Then, we compared the Martian morphologies with analogous periglacial landforms of Siberia to understand their processes of formation. In Utopia Planitia, the small-sized polygons have a morphology similar to ice-wedges polygons on Earth and indicate the presence of an ice-cemented ground. The polygon-junction pits are interpreted to be due the sublimation of potential ice-wedges and subsequent subsidence of the ground producing pits. The scalloped depressions are similar in shape and size to thermokarst lakes. They are thought to be due to degradation of ground-ice by melting or sublimation of ground-ice and subsidence of the ground.
Our results show that the assemblage of landforms in Utopia Planitia indicates the presence of an ice-rich permafrost like on Earth. We suggest that this permafrost were formed during cold climatic periods and then were degraded during a relatively recent global warming. Our results show that the permafrost was degraded during a high obliquity periods of Mars.
But the question is how major climate-changes could occur on Mars. Mars is thought to have undergone important variations in the orbital parameters during the last 10 Myr dramatically changing the climate. Therefore, Utopia Planitia is probably a marker of one of the last major climate change that occurred on Mars.