NORTH TIBETAN PLATEAU AS AN ANALOGUE FOR MARTIAN ENVIRONMENTS

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The surface of Mars preserves a variety of geomorphological structures formed by episodic hydrodynamic processes. The transition stage between the wetter and warmer early Mars and the hyper-arid environment that is today may have been characterized by strong chemical weathering by the long-term water rock interactions and the deposition of various salts. However, understanding the planetary images and geomorphology, dynamic evolution and chemical geodynamics of Mars in terms of properties and processes of the host rocks continues to be a challenge.

Western Qaidam Basin, located in North-western Tibetan Plateau, contains many geomorphological structures that combine fluvial and glacial attributes and relic clues comparable in their dimensions to the features associated with Martian landforms. The area is characterized by its high altitude (>2700m), dramatic change of diurnal and annual temperatures and extremely low annual precipitation (~14mm). The weak hydrodynamic erosion of the compacted detrital sediments of the mountain area during the latest glaciations developed a unique geomorphology and geology. The dry lakes are mainly formed of siliciclastic deposits covered by salts, which were encrusted by the evaporation of water, forming a surface of mostly sulphates and carbonates. The geomorphology of the mountain area is characterized by its high density of small gullies and large surrounding fluvial fans, cyclic structures and catastrophic debris flow structures. Small gullies filled with white mirabilite salt strongly suggest their young age and the sapping of brine fluid confirms the interaction between the thawed ice and salts in the upper alcove in a strong evaporite environment. The geomicrobiology and adaptive mechanisms of the only observable microbial life (hypolithic cyanobacteria) to survive the environmental extremes provides a rare chance to study the living strategies of life on Mars during its habitable time window.
Given the level of information that western Qaidam Basin contain about its unique dynamic evolution and microorganisms preservation potential, this site is a great terrestrial analogue to study the Martian processes and potential habitability, and likewise can be treated as an important site for future Mars sample return missions.