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Global map and spectroscopic analyses of Martian fluvial systems: paleoclimatic implications

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Currently environmental conditions on Mars do not allow the presence of liquid water on its surface for long periods of time. However, there are various evidences for past water flow at its surface. In fact, the ancient terrains of Mars are covered with fluvial and lacustrine features such as valley networks, longitudinal valleys and basin lakes.
There are no doubts about the fact that the Martian valleys were originated by water flow. This led many researchers to think that probably, at the time of their formation, the conditions of atmospheric pressure and surface temperature were different from the present[1].
To infer the climate history of Mars from valley networks, a global approach is necessary. We produced a global map of Martian valleys. We manually mapped all the valleys (longer than 20 km) as vector-based polylines within the QGIS software, using THEMIS daytime IR (100 m/pixel), and where possible CTX images (up to 6 m/pixel), plus topographic MOLA data (∼500 m/pixel). Respect to the previous manual maps[1,2] data of higher image quality (new THEMIS mosaic) and topographic information allow us to identify new structures and more tributaries for a large number of systems.
We also used the geologic map of Mars[3] in order to determine the valleys age distribution. Most valleys are too small for age determination from superposition of impact craters so we have assumed that a valley is as old as the terrain on which it has been carved[1].
Furthermore we are, currently, analyzing spectroscopic data from CRISM instrument (Compact Reconnaissance Imaging Spectrometer for Mars) onboard Mars Reconnaissance Orbiter, concerning the mapped valleys or associated basin lakes with the aim of assessing the mineralogy of these structures. Our attention is especially focused on the possible detection of any hydrated minerals (e.g. phyllosilicates, hydrated silica) or evaporites (e.g. carbonates, sulfates, chlorides). Phyllosilicates- bearing rocks are considered as an ideal place on Mars for prebiotic chemistry and the possible development of life[4]. Using spectral parameters[5], applied to the images to highlight the presence of different aqueous alteration minerals, we have found deposits of possible hydrated minerals in some of these structures.

References
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