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The Martian Geomorphology as mapped by the Mars Express High Resolution Stereo Camera (HRSC): Implications for Geological Processes and Climate Conditions.

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One major reason for exploring Mars is the similarity of surface features to those present on Earth. Among the most important are morphological and mineralogical indicators that liquid water has existed on Mars at various locations over the entire history of the planet, albeit in decreasing abundance with time. Due to the strong evidence for aqueous processes at or near the surface, Mars is the most Earth-like body in the Solar System. The HRSC instrument is designed to simultaneously map the morphology, topography, structure and geologic context of the surface as well as atmospheric phenomena [1]. After 10 years of ESA's Mars Express orbiting the planet its High Resolution Stereo Camera (HRSC) has covered about 90 % of the surface in stereo and color with resolutions up to 10 m/pixel. Digital elevation models of up to 30-50 m grid spacing [1], generated from all suitable datasets of the stereo coverage, currently cover about 40% of the surface [1,2]. The geomorphological analyses of surface features, observed by the HRSC indicate major surface modifications by endogenic and exogenic processes at all scales. Endogenic landforms (e.g., tectonic rifts, small basaltic shield volcanoes) were found to be very similar to their equivalents on Earth [1,3,4,5,6,7]. Volcanism may have been active up to the very recent past or even to the present, putting important constraints on thermal evolution models [6,7]. The analysis of diverse landforms produced by aqueous processes revealed that surface water activity was likely episodic, but ranged in age from very ancient to very recent [1,8-16]. Particularly important are prominent glacial and periglacial features at several latitudes, including mountain glaciers and a frozen sea [17-21]. The identification of aqueous alteration minerals and their geological context has enabled a better understanding of paleoenvironmental conditions and pedogenetic processes [23-25]. Dark dunes contain volcanic material and are evidence for the very dynamic surface environment, characterized by widespread erosion, transport, and redeposition [26].

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