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Exploration and characterization of past Martian paleoenvironments by the *Curiosity* and *Perseverance* rovers

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While the planet Mars is today a dry and cold wasteland dominated by aeolian processes, a large diversity of geomorphologies observed from orbit suggests that aqueous processes took place there. Most of these morphologies implies the presence of developed fluvial networks at the surface of the planet about 3.5 Ga ago. However, the precise conditions behind the formation of these valleys and the climate they evolved in are still being debated, as some of them could be linked to episodic events set in a cold climate. For more than a decade now, the rovers *Curiosity* and *Perseverance* helped to shed light on these questions thanks to a detailed *in situ* analysis of fluvial and lacustrine deposits.

The *Curiosity* rover landed in August 2012 in Gale crater, and since then observed more than 500 meters of a sedimentary succession including lacustrine mudstones and fluvial sandstones and conglomerates. Locally, clay minerals have been observed to make as much as 30 % of the bulk composition, with a substantial degree of chemical alteration, highlighting the role of water in the rock formation processes. The succession, and locally alternation and interfingering of fluvial and lacustrine facies suggest rapid and marked evolutions of the depositional setting, in relation with changing environmental and climatic parameters. However, no (peri-)glacial facies has been found to date, even if glacial processes could have affected those terrains later in their history.

In February 2021, the *Perseverance* rover landed in Jezero crater, which was chosen after the observation from orbit of both a large-scale fan-shaped edifice and the presence of clay and carbonate minerals. Remote observations of the fan and its remnants allowed to identify characteristic sigmoid structures of a deltaic architecture (bottomsets-foresets-topsets), confirming the presence of a perennial lake at the time of the deposition. Observations from both rovers illustrate that liquid water was not ephemeral at the surface of Mars. Nevertheless, the duration and extent of these processes are still yet to be exactly constrained. The detailed analysis of the delta by *Perseverance* and the returned samples on Earth (by a future mission early in the 2030's) would hopefully allow to constrain these chronological questions, as well as to allow to look for potential biosignatures.