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Sedimentology and hydrology of a well-preserved paleoriver systems with a series of dam-breach paleolakes at Moa Valles, Mars

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Moa Valles is a well-preserved paleodrainage system that is nearly 300-km-long and carved into ancient highland terrains west of Idaeus Fossae. The paleofluvial system apparently originated from fluidized ejecta blankets, and it consists of a series of dam-breach paleolakes with associated fan-shaped sedimentary deposits. This paleofluvial system shows a rich morphological record of hydrologic activity in the highlands of Mars. Based on crater counting the latter activity seems to be Amazonian in age (2.43 - 1.41 Ga). This work is based on a digital elevation model (DEM) derived from Context camera (CTX) and High Resolution Imaging Science Experiment (HiRISE) stereo images.

Our goals are to (a) study the complex channel flow paths draining into Idaeus Fossae after forming a series of dam-breach paleolakes and to (b) investigate the origin and evolution of this valley system with its implications for climate and tectonic control.

The first part of the system is characterized by many paleolakes, which are interconnected and drain eastward into Liberta crater, forming a complex and multilobate deltaic deposit exhibiting a well-developed channelized distributary pattern with evidence of switching on the delta plain. A breach area, consisting of three spillover channels, is present in the eastern part of the crater rim. These channels connect the Liberta crater to the eastward portion of the valley system, continuing toward Moa Valles with a complex pattern of anabranching channels that is more than 180-km-long.

Our crater counting results and hydrological calculations of infilling and spillover discharges of the Liberta crater-lake suggest that the system is the result of an Early Amazonian water-rich environment that was likely sustained by relatively short fluvial events (<102 years), thereby supporting the hypotheses that water-related erosion might have been active on Mars (at least locally) during the Amazonian. The most important water source for the system could have been shallow ice melting triggered by impact craters. Indeed, the stratigraphic relationships between channels and crater ejecta show very clearly that the channels cut through the ejecta thus postdating them.

The occurrence of relatively recent (likely Amazonian) hydrological activity supports the hypothesis that hydrological activity could have been possible, at least locally, after the Noachian-Hesperian boundary.