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Sedimentary architecture of the delta front at Jezero crater, Mars

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The Perseverance rover landed on the floor of Jezero crater in February 2021, a site selected thanks to the presence of fluvial valleys, sedimentary fans and astrobiologically-relevant minerals (phyllosilicates, carbonates). Images obtained along the rover traverse by the Mastcam-Z camera and the SuperCam instrument provide in-situ observations of scarps along the western fan and the residual butte Kodiak. These images display a variety of facies consistent with a deltaic architecture: Close to the base of scarps of the butte Kodiak, subhorizontal, fine-grained layers are interpreted as bottomsets transitioning progressively into steeply inclined (up to 35°) planar beds interpreted as foresets. Above foresets, sandstones and pebbly sandstones display cross-bedding and local channelization as observed in fluvial deposits, interpreted as topsets on the deltaic plain. The transition from foresets to topsets display varying elevations (from -2510 to -2580 m below datum) suggestive of fluctuating lake levels in a closed lake system. Boulder-rich conglomerates are observed toward the top of scarps. They display a clast-supported texture with imbricated, rounded cobbles and ~1 m thick beds with fining upward sequence consistent with accretion of fluvial bars from high-energy floods of still undetermined origin (e.g., glacial dam break, rapid snowmelt). The persistence of a lake during these flood events is currently unknown. The overall architecture and presence of flood deposits suggest a building of the fan in relatively short period at geological scale in agreement with estimations made in the past (hundreds to thousands of years).