

Mineralogical diversity of Jezero crater, Mars from orbit and rover observations and implications for Mars Sample Return

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The Perseverance rover on the Mars 2020 mission is exploring Jezero crater and terrains beyond in search of potential biosignatures and to collect samples for return to Earth by Mars Sample Return in 2033. Jezero crater was chosen as the landing site for Mars 2020 partially because of its spectacular mineralogical diversity in orbital spectroscopy data, suggesting that diverse lithologies could be sampled by the rover. Here we discuss predictions from orbit for the mineralogy and origin of surface deposits, compare them to observations on the ground by Perseverance, and discuss the implications of current and future collected samples for untangling the geologic history of Mars.

Highlights include: (1) Mafic minerals associated with distinct lava flows on the crater floor; (2) Phyllosilicates, sulfates, and mafic minerals associated with specific sedimentological facies on the delta; (3) Al-rich and possibly felsic lithologies associated with the Jezero crater rim and flood deposits on the delta, including new detections of widespread spinel; (4) Carbonates associated with the margin of the crater, possibly the result of lacustrine precipitation. Already acquired and future samples of these units will create an incredibly diverse sample suite that, upon return to Earth, will provide fundamental new constraints on the planetary evolution, climate, habitability, and astrobiology of terrestrial worlds.