# Perseverance rover uncovers the role of water in Mars's mineral past

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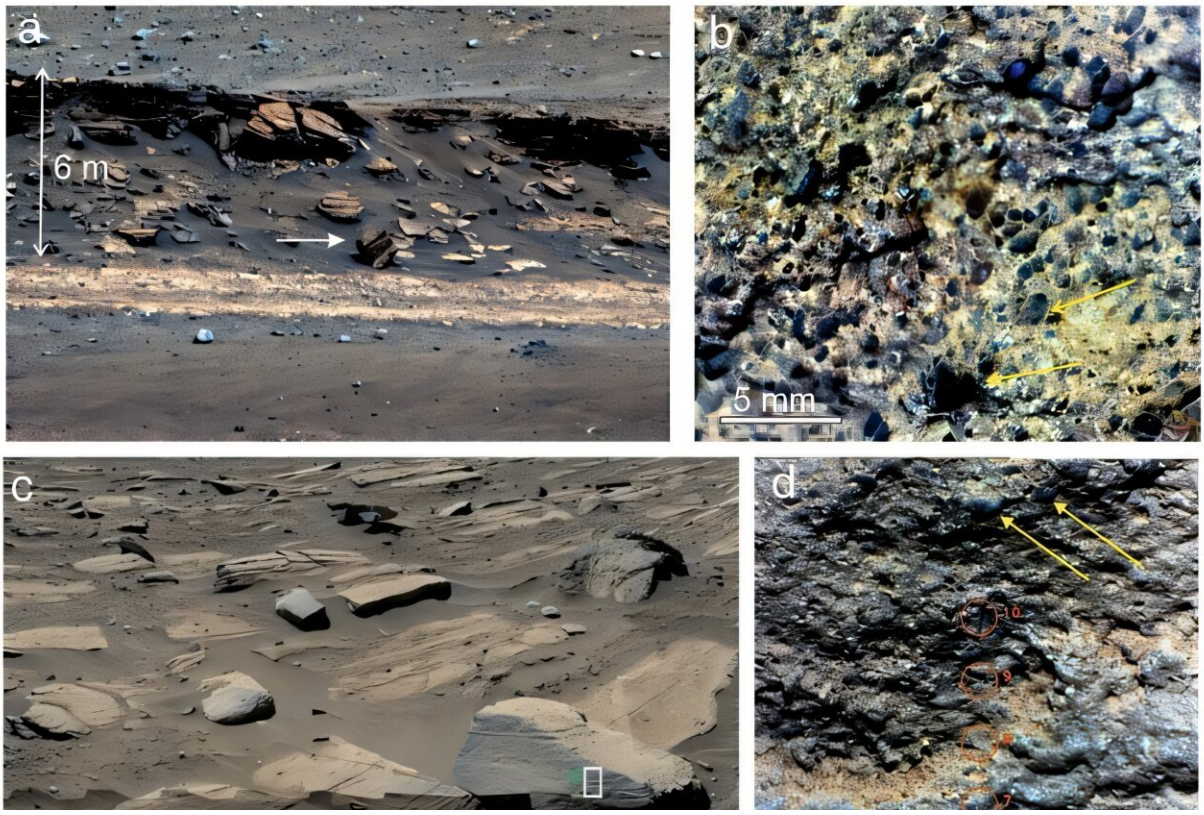


Rock samples examined by Perseverance on its journey across the Jezero Crater. Credit: Elise Clavé et al.

NASA's Perseverance rover has spent more than three and a half years exploring Mars's Jezero Crater, building up a remarkable catalog of

mineral discoveries.

In a new study published in the Journal of Geophysical Research: Planets , an international team of planetary scientists led by Elise Clavé at the Institute of Space Research in Berlin has used Perseverance's data to show that three chemically distinct rock formations in the crater share a surprisingly similar mineral fingerprint—whose origins appear to be closely tied to the presence of liquid water on ancient Mars.

## A shared formation story?

During its time on the Martian surface, Perseverance has now identified three key mineral formations, spanning a range of geological origins. While igneous rocks formed from solidified magma sit both on the floor of the Jezero Crater and at its boundary, sedimentary forms in its western reaches were likely transported and deposited by flowing water in Mars's distant past.

Despite these contrasting backgrounds, all three of these formations share a strikingly consistent set of minerals: including iron- and magnesium-rich carbonates, hydrated silica, and phyllosilicates. As far as geologists understand, the formation mechanisms of all these minerals typically require water.

## Delving into SuperCam data

To probe these formations in detail, Clavé's team drew on data from Perseverance's SuperCam instrument, a sophisticated remote-sensing tool that analyzes rocks from several meters away using multiple laser-based techniques.

By firing laser pulses at individual rock targets, SuperCam can determine

both the elemental composition of a surface and identify the specific minerals present, all without the rover needing to make physical contact. This multi-technique approach allowed the researchers to build up a detailed and consistent picture of the mineralogy across all three of the formations examined by Perseverance.

## Reconstructing formation history

The team's central finding concerns minerals containing carbon and oxygen. Present in all three formations, these carbonates make up as much as 16% of the rock by weight in some cases. The researchers argue that these carbonates formed through a chemical reaction between the rocks and carbon dioxide.

This process would have been driven and enhanced by the presence of liquid water, possibly including hot water circulating through the crust, as well as the lake that once filled Jezero Crater.

The implications reach well beyond Jezero. If rocks across the Martian surface really underwent a similar carbonation process, they may collectively have locked away a substantial amount of carbon over time—effectively drawing carbon dioxide out of the atmosphere.

In turn, Clavé's team suggest that this could have contributed to the dramatic cooling of Mars that transformed it from a potentially habitable, water-rich world into the cold, arid planet we observe today.

**More information:** E. Clavé et al, In Situ Carbonation of Sedimentary and Igneous Rocks of Ultramafic Composition in Jezero Crater, Mars, *Journal of Geophysical Research: Planets* (2026). DOI: 10.1029/2025je009107