

Habitable aqueous environment on Early Mars inferred from reconstructed water chemistry at Gale

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There is a wealth of geomorphological and mineralogical evidence indicating the presence of liquid water on early Mars. However, the chemical properties of the water such as pH and salinity, which are crucial to habitability on early Mars, have not been clarified so far. The NASA rover Curiosity has conducted a geological survey of Gale crater, a former lake on Mars, and provided mineralogical and geochemical data on the lacustrine sediment. The present study quantitatively estimates the water chemistry of the pore water based on exchangeable cation compositions in the smectite and the salt mineralogy in the sediment. Results show that the liquid water was of Na-Cl type with moderate salinity (0.1-0.5 mol/kg) and circumneutral pH. The estimated Na-Cl concentrations reflect hyposaline lakes developed in 10^4 -- 10^6 -year-long semiarid climates. The mild aqueous conditions and redox disequilibria in secondary minerals under this estimated water chemistry suggests that there was a habitable aqueous environment on early Mars.

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