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MINERALOGICAL VARIATIONS OF DEPOSITS IN THE UTOPIA PLANITA REGION OF MARS MEASURED BY CRISM: INSIGHTS INTO PAST WATER ACTIVITY AND PERMAFROST DYNAMICS

Abstract

The Utopia Planitia region of Mars, has garnered significant attention due to its potential to preserve records of early Martian history, including evidence of past water activity and permafrost dynamics. This study aims to characterize the mineralogical variations of deposits in Utopia Planitia using data from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), an instrument aboard the Mars Reconnaissance Orbiter. Determine the abundance of hydrated silicates, carbonates, sulfates, and other alteration products that serve as indicators of past aqueous environments. We employed spectral unmixing techniques to quantify the abundance and spatial distribution of these minerals. This approach involves deconvolving the mixed spectra within each pixel to estimate the fractional abundances of end-member minerals, leveraging a library of spectral signatures derived from laboratory measurements and established Martian analogs. Prior to analysis, the CRISM data undergone preprocessing to correct for atmospheric interference and instrumental artifacts, ensuring the accuracy of surface reflectance spectra used in the study. The expected outcomes of this research include the identification of mineral assemblages that suggest past water activity and permafrost dynamics, as well as the mapping of their spatial distribution. These results will contribute to a deeper understanding of Mars' water history and the evolution of its permafrost, which are critical for reconstructing the planet's climatic and geological past.