The Red Planet and The Blue Planet: Past, Present and Future Symposium Speakers

Search for The Signs of Past Life on Mars: Understanding The Formation of Jezero Crater and Chemical Alteration of Foundational Rocks by Past Aqueous Environments

Presented by:
Dr. Lawrence Wade and the PIXL Team
California Institute of Technology, Jet Propulsion Laboratory

Dr. Lawrence A. Wade received his Physics B.A. in 1980 from California State University, Fullerton and his Molecular Biology and Biochemistry Ph.D. in 2011 from the California Institute of Technology. He spent 13 years in working in aerospace companies before joining JPL in 1991. Currently, Dr. Wade serves as Chief Engineer of the PIXL instrument on the Perseverance Mars Rover. His past spaceflight work includes the design and development of instruments (e.g., PIXL) and devices (e.g., 16 K Sorption Cryocoolers for the Planck Mission), architecture of space missions (including Planck, Herschel, and the James Webb Space Telescope), and science team participation in both the Planck High and Low Frequency Instruments. Much of his career has been spent doing research and development of various instruments and components. These include Stirling and sorption cryocoolers operating at temperatures as low as 10 K, and a near-field optical microscope that resolved single-molecules with <10 nm spacing. Lawrence has authored over 200 papers and has had seven U.S. patents issued. He has also won numerous awards including the 2022 NASA Exceptional Engineering Achievement Medal (for PIXL), the 2018 Gruber Cosmology Prize (awarded to the Planck Team), and the 2010 NASA Exceptional Technical Achievement Medal (for Planck).

Abstract:

The Perseverance rover landed in Jezero crater on Mars with three scientific objectives: to explore the geologic setting, to identify ancient habitable environments and assess the possibility of past Martian life, and to collect samples for potential transport to Earth for further analysis. Jezero crater was an open-system lake containing a well-preserved delta. It was identified as being suitable for astrobiological investigation because on Earth similar environments of a similar age contain evidence of microbial life. Perseverance uses five instruments for characterizing the geology of Mars: Mastcam-Z (panoramic and stereoscopic imaging), SuperCam (imaging and LIBS IR and Raman spectroscopy), RIMFAX (ground penetrating radar), SHERLOC/WATSON (high resolution imagery and UV Raman spectroscopy), and the subject of this discussion, PIXL.

PIXL, Planetary Instrument for X-ray Lithochemistry, characterizes targeted rocks using multi-spectral imaging and X-ray spectroscopy to correlate rock textures with chemical composition. PIXL high-resolution data measures the elemental chemistry of tiny features observed in rocks such as individual sand grains, veinlets, cements, concretions, and crystals. PIXL has sufficient sensitivity to enable geologists to determine the processes that formed targeted rocks, identify their mineralization, and illuminate processes that subsequently altered them.

This talk will focus on the evaluation of the Olivine-rich Bastide and Brac rock outcrops on the floor of Jezero crater. We find that these outcrops are composed of igneous rock, moderately altered by aqueous fluid. We interpret them as an olivine cumulate, formed by settling and enrichment of olivine through multi-stage cooling of a thick magma body.