Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18636

Geochemistry and Mineralogy of Ancient Sedimentary Rocks Analyzed by the SuperCam Instrument in the Jezero Delta, Mars

ERWIN DEHOUCK[1], OLIVIER FORNI[2], CATHY QUANTIN-NATAF[3], PIERRE BECK[4], NICOLAS MANGOLD[5], CLÉMENT ROYER[6], ELISE CLAVÉ[7], OLIVIER BEYSSAC[8], JEFFREY R JOHNSON[9], LUCIA MANDON[10], FRANCOIS POULET[11], STÉPHANE LE MOUÉLIC[12], GWÉNAËL CARAVACA[2], HEMANI KALUCHA[10], ERIN GIBBONS[13], GILLES DROMART[3], PATRICK GASDA[14], PIERRE-YVES MESLIN[2], SUSANNE SCHROEDER[15], ARYA UDRY[16], RYAN ANDERSON[17], SAM CLEGG[18], AGNES COUSIN[19], TRAVIS GABRIEL[20], JÉRÉMIE LASUE[2], THIERRY FOUCHET[21], PAOLO PILLERI[2], CÉDRIC PILORGET[22], JOEL HUROWITZ[23], JORGE NÚÑEZ[9], AMY WILLIAMS[24], PATRICK RUSSELL[25], JUSTIN I. SIMON[26], SYLVESTRE MAURICE[27] AND ROGER C. WIENS[6]

[1]LGL-TPE (Univ. Lyon 1 / CNRS)
[2]IRAP
[3]LGL-TPE
[4]Institut de Planétologie et d'Astrophysique de Grenoble – Université Grenoble Alpes - CNRS
[5]LPG UMR 6112 CNRS/Université de Nantes
[6]Purdue University
[7]CELIA, Univ. Bordeaux
[8]IMPMC, Sorbonne Université, CNRS UMR 7590, MNHN
[9]JHU APL
[10]California Institute of Technology
[11]Universite Paris Saclay
[12]LPG
[13]McGill University
[14]Los Alamos National Laboratory
[15]DLR
[16]University of Nevada Las Vegas
[17]USGS (United States Geological Survey)
[18]LANL (Los Alamos National Laboratory)
[19]Institut de Recherche en Astrophysique et Planétologie (IRAP),Université de Toulouse 3 Paul Sabatier, CNRS, CNES
[20]USGS
[21]LESIA
[22]IAS
[23]Stony Brook University
[24]University of Florida
[25]UCLA
[26]NASA Johnson Space Center
[27]IRAP (Institut de Recherche en Astrophysique et Planétologie)

Presenting Author: erwin.dehouck@univ-lyon1.fr

In February 2021, the NASA Perseverance rover landed in Jezero crater, Mars. The first year of the mission was dedicated to the exploration of the crater floor, which was found to be composed of aqueously altered lava flows and cumulate rocks. Then, in April 2022, Perseverance reached the foot of the Jezero western fan, which had been interpreted as a river delta based on both orbital and rover observations. Between April 2022 and February 2023, Perseverance investigated the basal layers of the delta at two locations named Cape Nukshak and Hawksbill Gap, which are ~400 m apart. In this contribution, we present an overview of the geochemistry and mineralogy of the delta rocks as observed by the SuperCam instrument onboard Perseverance.

In terms of major-element geochemistry (measured by LIBS), the lowest exposed strata of the delta front, found at a location named Enchanted Lake (part of the Cape Nukshak section), show mafic compositions broadly in line with those measured on the crater floor. Some LIBS analyzes are consistent with stoichiometric pyroxene and olivine grains. In contrast, most strata exposed above Enchanted Lake show more felsic compositions (i.e., lower Fe and Mg contents, higher Si and Al contents) and lack stoichiometric pyroxene and olivine grains.

In terms of mineralogy, the visible and near-infrared spectra collected by SuperCam reveal the widespread presence of secondary phases throughout the delta front, including phyllosilicates, sulfates and carbonates. Two types of phyllosilicates are identified: Mg-rich serpentine in gray-toned siltstones at the Enchanted Lake location, and Mg-rich vermiculite (likely mixed with smectite) in fine sandstones of the Devils Tanyard member. The sulfates are mainly Fe- and Mg-bearing species, and are found in a distinctly light-toned interval referred to as the Hogwallow Flats member.

Taken together, these observations show that the rocks preserved within the Jezero delta front record a diversity of sediment sources and past aqueous alteration conditions. This diversity implies that the rock samples collected by Perseverance for a future return to Earth likely cover a range of paleoenvironments and organic preservation potentials, which was a primary consideration when selecting Jezero as the landing site.