THE JEZERO CRATER FLOOR SAMPLE SUITE COLLECTED BY THE MARS 2020 PERSEVERANCE ROVER. Barbara A. Cohen1, Kathleen C. Benison2, Tanja Bosak3, Andrew D. Czaja4, Vinciane Debaille5, Elisabeth M. Hausbrath6, Christopher D.K. Herd7, Keyron Hickman-Lewis8, Lisa E. Mayhew9, Mark A. Sephton10, David L. Shuster11, Sandra Siljeström12, Justin I. Simon13, Benjamin P. Weiss13, Maria-Paz Zorzano14, Meenakshi Wadhwa15, Kevin P. Hand16, Vivian Z. Sun16, Kathryn M. Stack16, Kenneth A. Farley17. 1NASA Goddard Space Flight Center, Greenbelt MD (Barbara.A.Cohen@nasa.gov); 2West Virginia Univ; 3MIT; 4Univ Cincinnati; 5Univ Libre de Bruxelles, Belgium; 6Univ Nevada, Las Vegas; 7Univ Alberta, Canada; 8Natural History Museum, UK; 9UC Boulder; 10Imperial College London, UK; 11UC Berkeley; 12RISE, Sweden; 13NASA JSC; 14CAS, Spain; 15ASU; 16JPL; 17CalTech.

Introduction: The Mars 2020 mission is to investigate regional geology, evaluate past habitability, seek signs of ancient life, and assemble a returnable cache of samples as the Perseverance rover explores Jezero Crater, a Noachian crater on the edge of the Isidis basin that contains a deltaic system. The Perseverance rover recently completed a traverse of the floor of Jezero crater, characterizing and collecting samples from two units informally named the Máaz and Séítah formations (CF-Fr and CF-Fr1 in [1]). The Máaz fm makes up the current Jezero Floor surface, appearing to overlie the Séítah strata. Eight rock samples were collected and stored in the rover, along with proximity science observations using the rover’s onboard payload about the composition, mineralogy, and texture of the sampled rocks.

Séítah samples: The Séítah fm outcrops across the crater floor to the southeast of the delta. Orbital data suggested that Séítah contains olivine- and carbonate-bearing lithologies [2, 3] that may have formed by igneous, volcanoclastic, or sedimentary processes (e.g., [4-7]). Samples were collected from Brac (topographically high, within the Séítah boundaries) and Issole (topographically low, near the contact with the Máaz fm). Natural surfaces of both Brac and Issole exhibited horizontal layering at the cm- to dm-scale. They comprise densely packed, relatively coarse (1-2 mm) dark gray grains variably surrounded by lighter-toned interstitial materials. Their mineralogy is (ultra)mafic, dominated by olivine and pyroxene, with large olivine grains protruding from some natural rock surfaces. Minor (several volume %) secondary phases, including carbonates, silica phases, Mg-sulfates and Na- perchlorates, were present; ongoing work will assess the abundance of organic molecules, potentially associated with secondary mineral phases. The Séítah rocks are interpreted as olivine cumulates, extensively altered by fluids [8, 9].

Máaz samples: The Máaz fm was inferred to be volcanic because of the remote detection of olivine and pyroxene in the unit, its lobate margins, and embayment relationships [5, 10-12]; however, volcanoclastic and/or sedimentary origins were also posited [13, 14]. Three rocks in the area were sampled: Roubion, Rochette, and Sid. Roubion is in a topographically low area of flat-lying, polygonally jointed material. Rochette is located along the feature named Artuby Ridge, a resistant ledge that can be traced from near the Roubion site along the southern edge of the Séítah fm boundary. Sid represents the stratigraphically capping member of the Máaz fm, expressed as massive, blocky rocks that appear to cover much of the Jezero Crater surface. The three Máaz fm rocks are fine-to-medium grained, holocrystalline rocks dominated by pyroxene and feldspar, with an overall alkaline nature in contrast to the basaltic nature of martian meteorites (e.g., [15, 16]), see also Udry et al. this conference). The mafic grain size appeared to be smallest in Roubion and coarsened upward to Sid, where several-mm, euhedral feldspar grains are visible. Roubion was pervasively altered with abundant secondary phases, Rochette and Sid contained only minor secondary phases. Mechanical competence corroborated the degree of weathering. Together, these observations imply that the Máaz fm is an igneous rock package that has experienced variable degrees of fluid interaction.

Future work: The suite of the Séítah and Máaz fm samples represents a powerful outcome of the Perseverance Crater Floor campaign that will address several important objectives of the Mars Sample Return campaign [17], including magmatic history, water-rock interactions, environmental conduciveness to life, and isotopic ages for geologic events. Perseverance is now beginning its exploration of the delta facies and will place one of the returnable sample caches near the delta in the upcoming year for Mars Sample Return in the 2030s (see also Herd et al., this conference).