Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.4400

Perseverance rover notional caches for Mars Sample Return

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The NASA Mars 2020 Perseverance rover plans to collect a suite of scientifically compelling samples for return to Earth [1–3]. Strategic planning by the Mars 2020 Science Team has identified notional sample caches within the framework of the geology of Jezero crater and its surroundings [2]. Locations of interest were identified by considering remotely sensed data and traversability constraints [1]. Notional sample caches have been defined for the *prime mission* within Jezero crater, and an *extended mission* outside Jezero crater.

Prime mission notional cache. Samples of interest include: deltaic, crater floor, crater rim, and regolith materials. Lithologies with high habitability and biosignature preservation potential, such as carbonates and/or chemical deposits, will also be targeted. Such samples would address several questions:

1. What habitable niches were present at Jezero? Are biosignatures and/or prebiotic organics preserved?
2. What was the timing of fluviolacustrine activity?
3. How can Jezero lithologies facilitate absolute crater chronology calibration?
4. What insights do these lithologies provide into Mars climate evolution?
5. What is the origin and alteration history of regional Noachian crust?

Extended mission notional cache. Nili Planum is geologically distinct from Jezero, containing diverse Early or Pre-Noachian rocks [4]. Samples of interest include: basement rocks; megabreccias; fractures cross-cutting basement; olivine- and carbonate-bearing rocks; and mafic cap rock. These samples could answer questions 1, 4 and 5 above, together with:

6. What characteristics defined the early planetary evolution and habitability of Mars?
7. How long did the Martian dynamo persist?
8. How do outside-Jezero surfaces, including bedrock and ejecta enable crater chronology calibration?
9. What were the local and regional effects of the Isidis impact?

The samples to be collected by Perseverance align with community priorities for Mars exploration [3,5], addressing geological diversity and potential biological activity (iMOST Objectives 1 and 2), long-term planetary evolution, e.g., magnetic field, atmosphere and climate (Objective 3), volatiles (Objective 4) and hazards to human exploration (Objective 6).

[1] Farley et al. (2021), *LII LPSC* #1317. [2] Stack et al. (2020) *SpaceSci.Rev. 216,* 127. [3] Beaty et al. (2019) *Meteorit.Planet.Sci. 54,* S3-S152. [4] Simon et al. (2021) *LII LPSC* #1515. [5] Mustard et al. (2013) MEPAG Report.

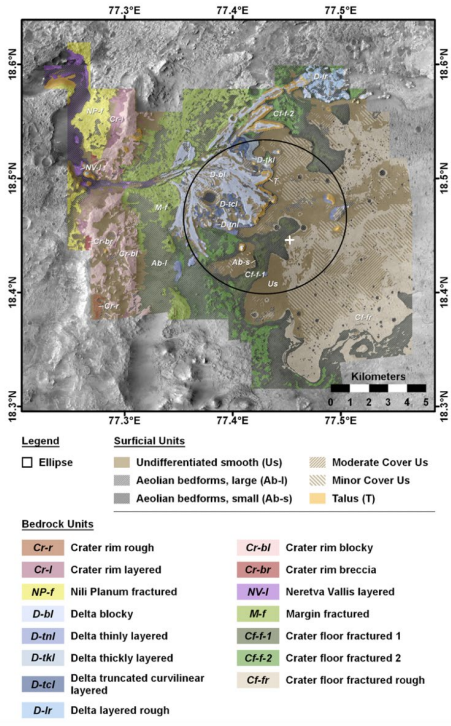

Fig. 1. Photogeological map of bedrock exposure and surficial units around the Perseverance landing site at Jezero crater. White cross = landing site. (adapted from Stack et al. (2020).