Wind-Driven Erosion and Exposure Potential at Mars 2020 Rover Candidate Landing Sites

Mars 2020 Rover and Motivation

- Where will the next NASA Mars rover land in 2020?
- 8 candidate sites have been recently considered by NASA for a mission that will explore astrobiologically-relevant ancient environments.

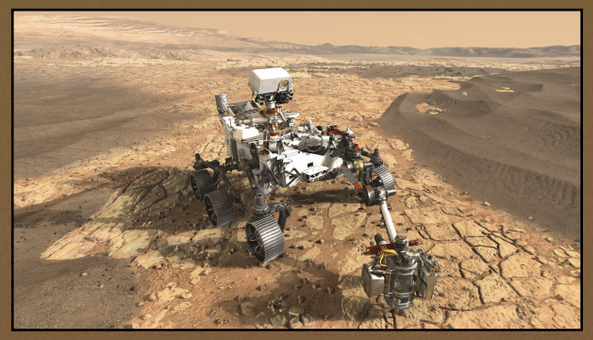

Image Credit: NASA/JPL-Caltech

- One important site criterion will be to identify geologic units that have young exposure ages (due to high erosion rates) and haven't been exposed to prolonged space radiation. These locations would possibly allow any organic materials to remain undegraded.
- Here, we assessed candidate landing-sites for the Mars 2020 Rover mission for potential erosion by active aeolian bedforms.

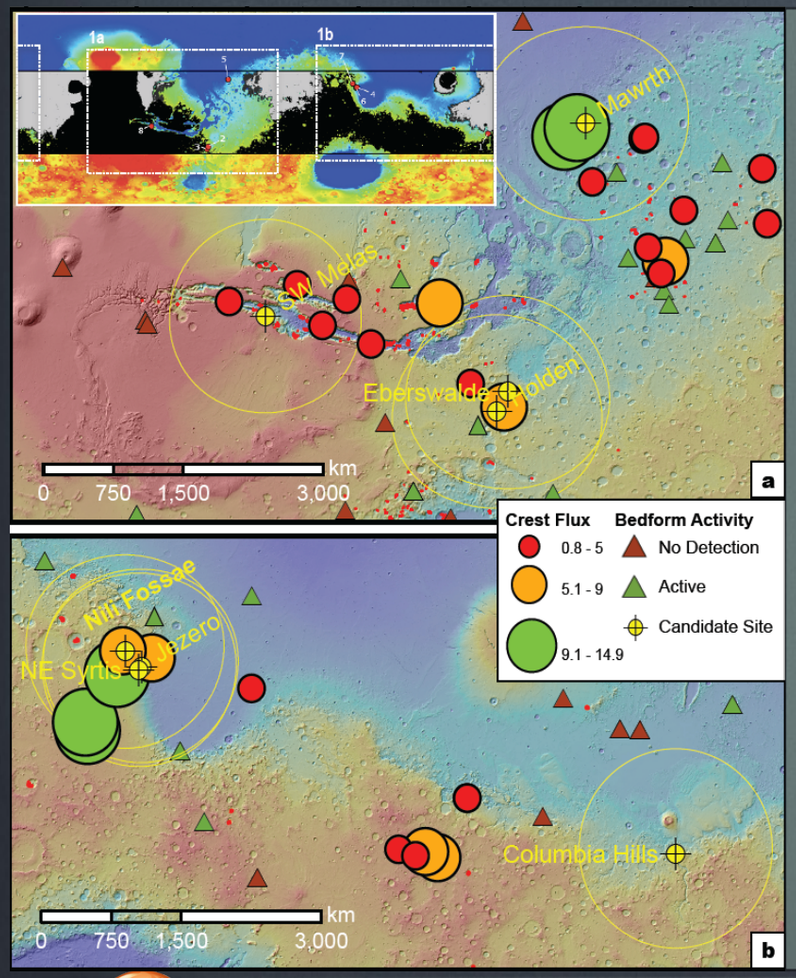

Figure 1. Subarea maps of candidate landing sites with results from global bedform monitoring efforts and regional sand flux measurements for a) western and b) eastern hemispheres. Sand dune crest flux measurements (graduated circles grouped in three classes with units of $m^3m^{-1}yr^{-1}$). 1000-km radius ellipses centered on candidate landing sites provide scale. Base map is MOLA shaded relief with colorized elevation from +4 to -5 km. The distribution of dune fields is shown in red. Fig. 1a inset provides a MOLA map of Mars showing candidate landing sites (red circles) and regions that meet the engineering constraints for landing the 2020 Mars rover (Credit: Golombek et al. (2015, 2016, 2017) *LPSC* and https://marsnext.jpl.nasa.gov/index.cfm).

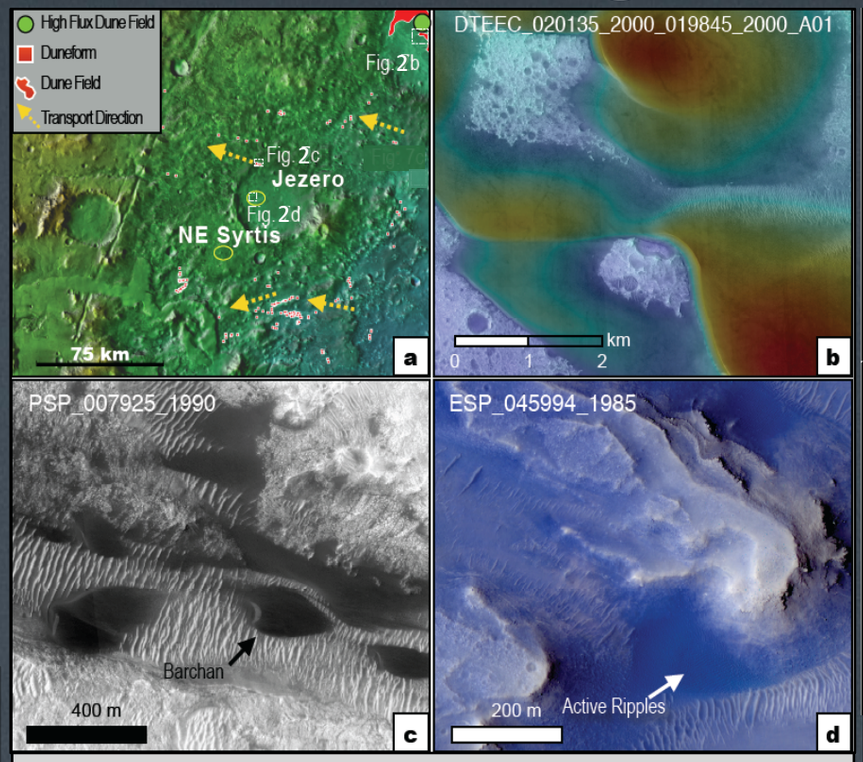

Figure 2. a) Map showing candidate landing sites at Jezero and NE Syrtis with landing ellipses (yellow), dune fields (red), and derived wind directions arrows. b) High sand flux sand dunes a few hundred kilometers to the NE of the landing ellipses. c) A dry river inlet channel entering the north rim of Jezero with active dunes migrating west. d) Small patches of active, dark wind ripples located along the delta toe and within the Jezero ellipse where they likely erode local surfaces.

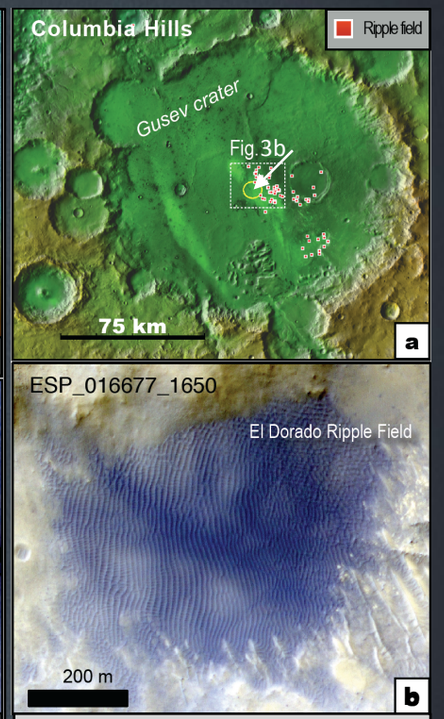

Figure 3. a) Map showing candidate landing site (yellow ellipse) at Columbia Hills. No dune fields were found in the broader region (~1500 km). b) A typical coarse-grained ripple field, visited by the Spirit rover in 2007, which was not detected to be active.

Highlights

- Candidate landing-sites for the Mars 2020 Rover mission were assessed using repeat HiRISE images for potential erosion by active aeolian bedforms of ripples and dunes.
- Of the three down-selected sites NE Syrtis then Jezero crater showed the most evidence for ongoing sand transport and erosion potential with active aeolian bedforms on and around the sites.
- The Columbia Hills site lacked evidence for sand movement from local bedforms based on HiRISE data and in situ investigation by the Spirit rover, suggesting current abrasion there rates are low.

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