

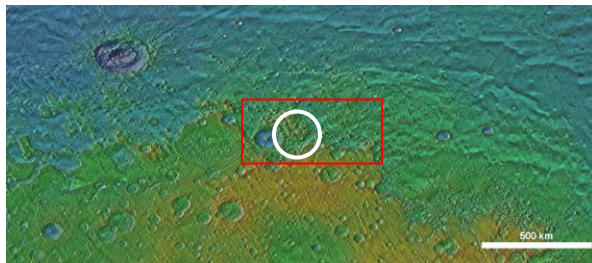
**THE SEARCH FOR EXTANT LIFE AT THE CANDIDATE HUMAN EXPLORATION ZONE: PROTONILUS MENSAE.** Z. E. Gallegos<sup>1</sup>, H. E. Newsom<sup>1</sup>, L. A. Scuderi<sup>1</sup>. <sup>1</sup>Earth and Planetary Science Dept., Institute of Meteoritics, Univ. of New Mexico, Albuquerque, NM, U.S.A. ([zeg@unm.edu](mailto:zeg@unm.edu))

**Introduction:** The search for extant life on Mars will be significantly improved with the presence of human explorers. It is therefore important to choose a suitable exploration zone with evidence for potential habitable environments, both past and present.

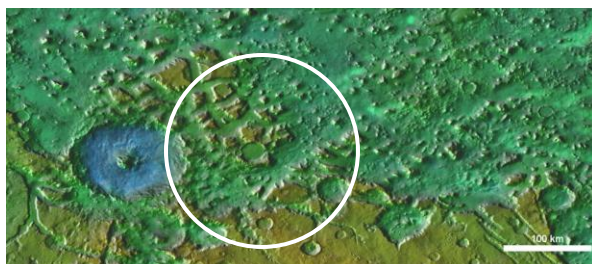
**Human Exploration Zones:** In 2015 NASA issued a call for proposals of candidate sites for future human exploration zones on Mars. These exploration zones comprise a 200 km diameter area between 50° north and south latitude with multiple regions of interest for both science and resource requirements.

*Life related science requirements.* The science requirements for an exploration zones include astrobiological components. The threshold criteria is potential for past habitability as well as potential for present habitability/refugia, which are evident from orbital investigation. The qualifying criteria is potential for organic matter with surface exposure, which may need to be answered with precursory rover missions.

**Protonilus Mensae:** Along the planetary dichotomy boundary in the northern hemisphere, Protonilus Mensae is a uniquely fretted terrain of mesas and valleys (Figure 1a). This network represents fluviially and glacially modified remnants of Middle Noachian highlands crust on the potential shoreline of an ancient Mars ocean.



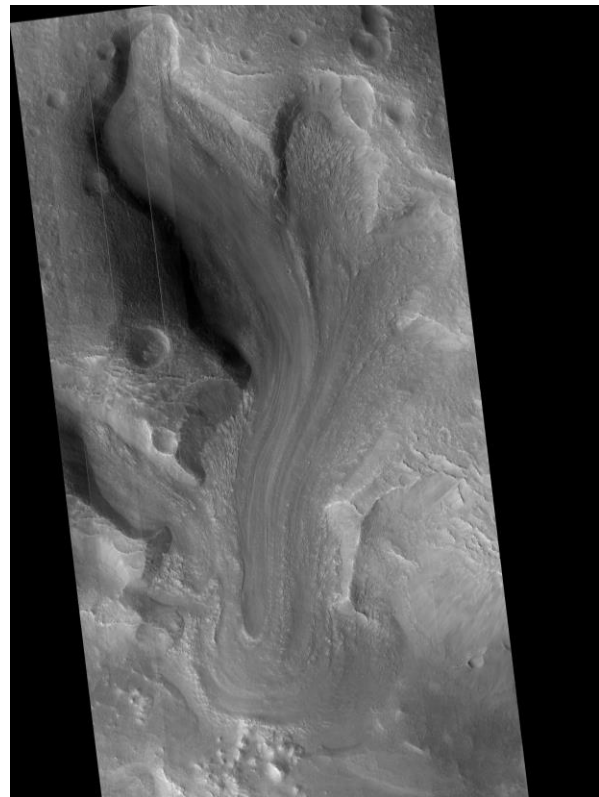
**Figure 1a.** Regional context of Protonilus Mensae. The white circle represents the 200 km diameter EZ and the red box represents the extent of Figure 1b. Scale bar represents 500 km.



**Figure 1b.** Close up of the 200 km diameter EZ. Scale bar represents 100 km.

**Exploration Zone:** The Protonilus Mensae exploration zone is centered at 48.062E, 42.187N, just to the east of Moreux crater (Figure 1b). It contains many compelling regions of interest for investigation of extinct and possible extant life, including: large craters with a potential for hydrothermal deposits, large outflow channels which carried groundwater sourced materials through the exploration zone, and significant glacial deposits carved into the mesas.

*New Protonilus Mensae observations.* Several HiRISE images have been acquired in the area as a result of the human exploration zone process. ESP\_055924\_2210 (40.699° N x 48.342° E) represents a small groundwater sapping tributary located at the mouth of a one of the two unnamed large outflow channels within the exploration zone. The tributary is currently occupied by distinct glacial deposits and represents a potential refugia for extant life.



**Figure 2.** Glacial deposit in a groundwater outflow channel within the Protonilus Mensae exploration zone. Image width is ~6 km.

**References:** [1] Gallegos Z. E. and Newsom H. E. (2015) HLS2 Workshop, Abstract #1053. [2] Gallegos Z. E. and Newsom H. E. (2017) *LPSC XLVIII*, Abstract #2983.