Searching for Traces of Life with the ExoMars Rover: The What, When, and Where of Landing Sites

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The second ExoMars mission is scheduled to launch on 24 July 2020. It will deliver to the martian surface a rover and an instrumented landed platform. The rover will explore the landing site's geological environment and conduct a search for signs of life. A drill will allow to collect samples from outcrops and at depth, reaching down to 2 m below the surface. Such depth range has never been probed on Mars before and provides the best chance yet to gain access to well preserved molecular biosignatures.

This presentation will discuss the ExoMars rover and the strategy to search for biosignatures with a focus on addressing the desireable properties of candidate landing sites. Our thesis is that martian life —if it ever existed— was likely to be chemotrophic in nature, obtaining its nutrients from volcanic material, salts, and from hydrothermal sources. Morphological and/or organic remains could be preserved in volcanic and chemical sediments, and organic molecules could be traped in clay minerals (Vago et al., 2017; Westall et al., 2015). While investigating the general geological context of the landing site, we will study microscopic features that might indicate microbial presence (clotted fabric, carbonaceous layering) and analyse organic matter to determine molecular composition and chirality.

The two candidate landing sites offer a variety of environments showing evidence for the presence of water on a variety of time scales. Some of this settings may have been active long enough to have witnessed the appearance of life (especially in the case of long-term hydrothermal activity), others could have hosted already flourishing life forms. These environments include long-lived water basins and fluvial environments. A prime target, unfortunately difficult to detect from orbit, that we hope to encounter and investigate are hydrothermal sites.

Vago, J. L. et al., 2017. *Astrobiology* (accepted)
Westall, F. et al., 2015. *Astrobiology*, 15(11):998-1029