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Mars Rover proposed for 2018 to seek signs of life and to cache samples for potential return to Earth

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Mars Rover proposed for 2018 to seek signs of life and to cache samples for potential return to Earth
Lisa Pratt, David Beatty, Frances Westall, John Parnell, François Poulet, and the MRR-SAG team
The search for preserved evidence of life is the keystone concept for a new generation of Mars rover capable of exploring, sampling, and caching diverse suites of rocks from outcrops. The proposed mission is conceived to address two general objectives: conduct high-priority in situ science and make concrete steps towards the possible future return of samples to Earth. We propose the name Mars Astrobiology Explorer-Cacher (MAX-C) to best reflect the dual purpose of the proposed mission. The scientific objective of the proposed MAX-C would require rover access to a site with high preservation potential for physical and chemical biosignatures in order to evaluate paleo-environmental conditions, characterize the potential for preservation of biosignatures, and access multiple sequences of geological units in a search for evidence of past life and/or prebiotic chemistry. Samples addressing a variety of high-priority scientific objectives should be collected, documented, and packaged in a manner suitable for possible return to Earth by a future mission.
Relevant experience from study of ancient terrestrial strata, martian meteorites, and from the Mars exploration Rovers indicates that the proposed MAX-C's interpretive capability should include: meter to submillimeter texture (optical imaging), mineral identification, major element content, and organic molecular composition. Analytical data should be obtained by direct investigation of outcrops and should not entail acquisition of rock chips or powders. We propose, therefore, a set of arm-mounted instruments that would be capable of interrogating a relatively smooth, abraded surface by creating co-registered 2-D maps of visual texture, mineralogy and geochemical properties. This approach is judged to have particularly high value for evaluating potential signs of ancient microbial life likely to be manifested at relatively small scale. Scientists could use the 2-D micro-mapping data to select an outstanding set of samples for sample acquisition, encapsulation, and caching. This cache would be left either on the ground or on the rover where it could be recovered by a possible future sample return mission. The proposed MAX-C mission would launch from Earth in May of 2018 and arrive at Mars in January of 2019 during late northern winter.
Data from the Mars Exploration Rovers and from orbiting instruments, such as CRISM and HiRISE, continue to reveal sites with phyllosilicates, sulfates, silica, and carbonates which are indicators of aqueous activity and habitability as well as good materials for preservation of physical and chemical biosignatures. Additional information on the seasonality and footprint of methane emissions on Mars is anticipated from the Mars Science Laboratory and proposed future orbiters. In order for the Mars Program to remain highly responsive to these types of discoveries, engineering of MAX-C must integrate micro-mapping and caching functionalities in a flexible design that would minimally encumber landing site competition.