NASA's Mars 2020 Rover Mission

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Return of samples from the surface of Mars has long been a high scientific priority, most recenty affirmed by the 2011 Decadal Suvey for Planetary Sciences. An important step towards this goal may be taken by the Mars 2020 mission, a Curiosity-class rover to be launched in 2020 with two years of surface operations. Among the mission objectives are exploration of an astrobiologically relevent geologic environment, and preparation of a cache containing scientifically compelling rock samples for possible future return to Earth.

The rover's instruments have not yet been selected, but the mission's Science Definition Team envisioned capabilities for imaging and mineralogical identification at context and hand-sample (possibly microscopic) scale, as well as the capability to seek signs of ancient life. These instruments will provide critical geologic context and will inform selection of samples to be cached. Previous work suggests caching several suites of rock samples of ~15 g each. Samples would be cored, with emphasis on physical core integrity. After drilling, the individual samples would be sealed in tubes and inserted into the cache. Depending on scientific merit and NASA priorities, the cache may be returned to Earth in the future, culminating in the delivery of the samples to a dedicated curation facility.

The 2020 mission will use a Mars Science Laboratory (MSL)-type landing system, possibly enhanced by new technologies that permit access to more scientifically-diverse terrain. The landing site will be determined through a multi-year community-based process beginning in spring 2014 in which the interests of the retuned sample science community will be important. Potential landing sites will be ranked to maximize the science return for both in-situ exploration and potential returned sample science. Landing sites will likely focus on areas with ancient water deposited or altered rocks, as well as volcanic rocks (preferably in-place).

If returned, the cached samples would provide a coherent context-rich record documenting the early stages of Mars' planetary evolution and early climate and geologic environment, as well as a unique potential record of prebiotic and possibly biotic processes occurring beyond Earth.