MAWRTH VALLIS AS A LANDING SITE FOR THE NASA MARS2020 MISSION. D. Loizeau[1], B. Horgan[2], F. Poulet[3], J. L. Bishop[4]. [1]Observatoire de Lyon, France (damien.loizeau@univ-lyon1.fr). [2] Purdue University, USA. [3] Observatoire Paris Sud, France. [4]SETI Institute, Mountain View, CA, USA.

Introduction: The Mars2020 rover will be launched in 2020 to the surface of Mars. The landing site selection is ongoing, to choose the best landing site for the surface mission. The selection involves evaluating a safe place for landing and driving, and the best place to fullfil the science objectives of the mission, which include exploring an astrobiologically relevant ancient environment, searching for the signs of past life, and preparing for Mars Sample Return.

The landing ellipse is 12 km x 10 km, and the surface mission will imply driving few km on the surface during the nominal mission to access a diversity of rock units and samples. Having all these regions of interest (ROIs) inside the landig ellipse is important to achieve the mission goals within the nominal mission and to prepare the return of the samples.

Mawrth Vallis offers large clay-rich outcrops with a variety of ancient environments, offering in particular past environments with reducing conditions, and a long history of aqueous conditions.

Revealing ancient wet environments: the region comprises a large clay-rich unit, extending over hundreds of km laterally, and more than 200 m in depth in the central part, where the landing ellipse is located. Rocks are finely layered with strata thickness of 1 m or less [1, 2]. Two main subunits are present in the clay unit: at the top of the section, rocks comprise Al-smectites, kaolins and hydrated silica; underneath, Fe-smectites dominate [3-6]. Local sulfate deposits are also observed, with jarosite present at the very top of the sequence [7], and basanite identified in deeper layers [8]. The clay-unit may be formed by a sequence of paleosols [9].

Within the landing ellipse, the two main sub-units are accessible at several locations across the ellipse (figure 1). Driving only a few km will enable the rover to traverse a few tens of meters in depth, accessing several strata of the two sub-units, and hence several past environments with different oxidation conditions.

Accessing a long history of fluid interaction: The thickness of the clay unit and its formation requires a long period of wet environments during the Noachian period [10]. But in addition to the large clay unit, several halo-bounded fractures reveal another or several other episodes of interaction between the rocks and fluids flowing through the fractures, after the formation of the main part of the clay unit.

At the landing ellipse, halo-bounded fractures and veins are present at several locations. Sampling and analyzing rocks from the fracture and the halo will enable access to an additional environment that could have been favorable for the development of past life.

In addition, a long series of elongated buttes, that splits and merges again over few km likely reveal an eroded inverted valley that formed through fluvial erosion at the very top of the clay unit. It shows that water flowed at the surface as well.

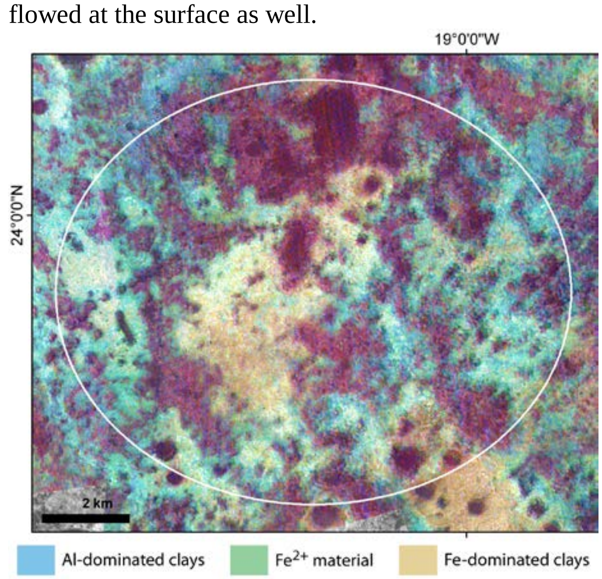

Figure 1: CRISM parameter map at the Mawrth Vallis landing site.

Preserving potential signs of past life:

Capturing organic molecules. Phyllosilicate particles are efficient sites for organic molecules accumulation and preservation. In addition, they can serve as reaction center for organic molecules [11], and could have played a role in the origin of life [12]. There are very good candidate rocks for finding signs of past life, in particular in the framework of returned samples.

Protection from atmosphere and space. A large aeolian or pyroclastic unit, the dark cap, covered the whole area, and is today under erosion [6], revealing progressively the clay-rich unit below. This dark cap protected the rocks underneath during a long period from the atmosphere, UV radiation and cosmic rays. In addition, the clay-rich rocks are easily eroded (very few craters are present), resulting in rocks that are permanently fresh [10], and hence where biomolecules would have been preserved.

Avoiding diagenetic transformation. On the other side, morphologic and mineralogic observations show that the clay unit has never been deeply buried, and has not been entirely leached, maximizing the chance of biosignatures preservation.

Access to an unaltered igneous unit: Within the landing ellipse, most of the dark cap has been eroded away, but some outcrops are still present at several locations, and may offer access to an unaltered igneous unit.

Offering well distributed targets within the landing ellipse: The landing ellipse has been placed to avoid hazards and to maximize the distribution of ROIs: each ROI is present at several locations distributed over the landing ellipse (figure 2). Wherever the rover will land, it has more than 90% of chances to land directly on the clay unit (figure 1), and all ROIs will be accessible with a few km long drive only, optimizing the time for science operations. In particular, exploration zones of less than 1 km can offer all variety of alteration environments that occurred at the site.

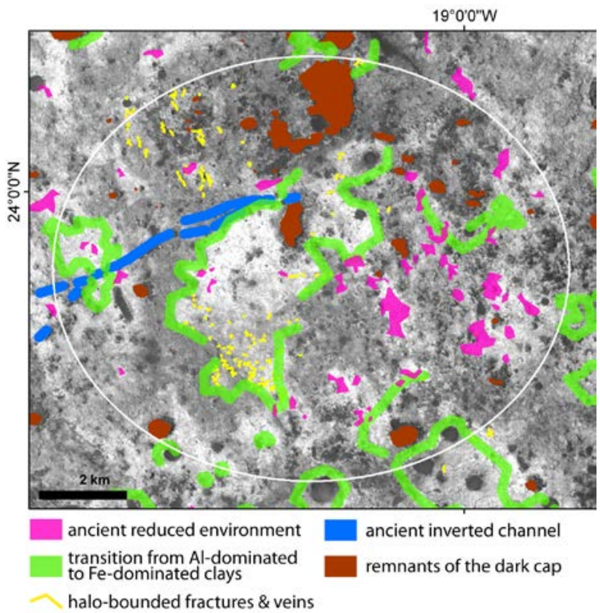

Figure 2: map of the ROIs for Mars2020 at the Mawrth Landing site.

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