MARTIAN GEOLOGIC SETTINGS OF INTEREST TO THE SEARCH FOR BIOSIGNATURES, AS SEEN FROM ORBIT.

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Introduction: A sequence of successful orbiters provide a wealth of information about geologic settings on Mars. Typically the highest resolution data available at particular wavelengths are the most useful for considering future landing sites and landed activities (Table 1). This presentation will summarize the datasets and introduce key terrain types of interest for biosignature preservation.

Table 1. Mars Orbiters and High-Resolution Mapping

Orbiter	Investigations
Mars Global Surveyor (MGS)	MOC (1.5 m/pixel visible) [1] LOLA (global topography) [2]
Mars Express (MEX)	HRSC (>10 m/pixel color, stereo) [3] OMEGA (>0.1 km/pixel hyperspectral) [4]
Mars Odyssey (MO)	THEMIS (100 m/pixel thermal IR) [5]
Mars Reconnaissance Orbiter (MRO)	HiRISE (0.3 m/pixel visible) [6] CTX (6 m/pixel visible) [7] CRISM (18 m/pixel hyperspectral vis-NIR) [8] SHARAD (subsurface radar) [9]
Trace Gas Orbiter (TGO)	CaSSIS (4.6 m/pixel, stereo, 4 colors) [10]

Mars Orbital Experiments: Visible imaging is provided by multiple cameras (Table 1), although MGS has ceased operation. HiRISE provides the highest spatial resolution, better than 1 m (~0.3 m/pixel), but has covered only 2.5% of the martian surface in 5 Mars years. CTX has provided nearly global (>85%) coverage at ~6 m/pixel. All of these cameras also acquire stereo data, but HRSC and CaSSIS (beginning in late 2017) are designed to map systematically in stereo, providing more coverage. HiRISE has covered <0.5% of Mars in stereo, but concentrated over candidate landing sites [11].

Mineralogic data is provided by NIR spectrometers such as OMEGA and CRISM. CRISM does so at the highest spatial resolution (~18 m/pixel) but has covered only a few % of Mars at this scale. CRISM has covered >80% of Mars at 200 m/pixel. THEMIS near-global coverage provides additional compositional constraints and maps temperatures, from which thermal inertia is derived [12]. SHARAD can map some subsurface interfaces at depths >10 m.

Superresolution modes: MOC and CRISM have acquired selected observations with along-track oversampling (ATO). ATO does not change the intrinsic resolution of the raw data, but the oversampled data can be processed to improve resolution in one dimension by as much as a factor of two [13]. Superresolution processing of multiple overlapping HiRISE images has produced intriguing results [14], but potential artifacts make the images difficult to evaluate.

Geologic Settings of Interest: This will be the topic of many presentations at this conference, but here is a very quick summary without citations.

Lacustrine and Deltaic Sediments: MSL is exploring probable lacustrine sediments in Gale crater, and some of the highest priority candidate landing sites are deltas in Eberwalde and Jezero craters. A unique sub-lake fan in southwest Melas Chasm is a Mars2020 candidate landing site.

Near-Surface Chemical Sediments: A prime candidate for potential pedogenesis is Mawrth Vallis. Also of great interest are the playa deposits containing what are likely to be chlorides. Chemical sediments being deposited today may be found at the depositional fans of the recurring slope lineae (RSL).

Deep Crustal Rocks (including Hydrothermal): The region northwest of Isidis Basin (including Nili Fossae) includes high-priority candidate landing sites based on exposure of deep crustal rocks. Hydrothermal and lake deposits in Gusev crater are of interest, explored by Spirit rover.

Also of great interest in the search for biosignatures is identification of sites where active erosion is exposing materials that have been shielded from radiation, where complex organics may be preserved. This includes sites with no small impact craters, evidence for scarp retreat, and recent or active abrasion by sand.

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