

**ANCIENT STRUCTURALLY-CONTROLLED BASINS AS PRIME MARTIAN TARGETS.** J. M. Dohm<sup>1,2</sup>, A. F. Davila<sup>3</sup>, A. G. Fairén<sup>3</sup>, K.J. Kim<sup>4</sup>, William.C. Mahaney<sup>5</sup>, H. Miyamoto<sup>2</sup>, and G. G. Ori<sup>6</sup> <sup>1</sup>Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ85721, USA, ([jmd@hwr.arizona.edu](mailto:jmd@hwr.arizona.edu)), <sup>2</sup>University Museum, University of Tokyo, Tokyo 113-0033 ([miyamoto@geosys.t.u-tokyo.ac.jp](mailto:miyamoto@geosys.t.u-tokyo.ac.jp)), Japan, <sup>3</sup>Space Sciences and Astrobiology Division, NASA Ames Research Center, Moffett Field, CA 94035, USA ([alberto.g.fairen@nasa.gov](mailto:alberto.g.fairen@nasa.gov), [adavila@seti.org](mailto:adavila@seti.org)), <sup>4</sup>Geological & Environmental Hazards Division, Korea Institute of Geosciences & Mineral Resources, Daejeon, South Korea, <sup>5</sup>Geomorphology and Pedology Laboratory, York University, Atkinson College, Ontario, M3J 1P3, Canada; Quaternary Surveys, Thornhill, Ontario L4J 1J4, Canada ([arkose@rogers.com](mailto:arkose@rogers.com)), <sup>6</sup>IRSPS, Università d'Annunzio, Pescara, Italy ([ggori@irsps.unich.it](mailto:ggori@irsps.unich.it)).

**Introduction:** On Earth, biology, hydrology, and geology are interwoven such that certain types of life are linked with specific geologic, hydrologic, and climatic conditions, which include rock type, pressure, temperature, and chemistry. Life has found a niche in diverse environments, and this presents the possibility that Mars, too, may record fossilized and/or extant life in diverse settings. Geologic, paleohydrologic, and climatic conditions through the evolution of Mars are similar in many respects to conditions occurring during the evolution of the Earth, and as such, may point to environments on Mars with potential to have supported living systems. Candidate environments include: long-lived magmatic complexes (including hydrothermal environments [1]), subterranean caverns [2], basins/aquifer systems [3], structurally-controlled conduits and basins [4], evaporite deposits such as salts [5], possible marine and lacustrine sediments [6], Antarctic-like paleosols [7], vent structures such as mud volcanoes [8], and ice bodies such as ice lenses [9].

Of the listed environments, all of which are considered as prime targets for future international exploration of Mars, ancient structurally-controlled conduits and basins will be presented at the workshop.

**Basins/aquifer systems:** Tectonic structures of various relative ages of formation can reveal stress sources [10], strain magnitudes and history [11,12], and pre-existing structural controls that may be related to episodes of local to regional magmatism and tectonism [4,12] on planetary bodies such as the Earth and Mars [13]. In addition, tectonic structures can control the migration of fluids such as magma and water, as well as heat, in the subsurface, influencing volcanic and hydrogeologic activity, as observed for Mars such as within the Thaumasia highlands region [14] and for Earth such as noted for the Atacama Desert [15] and Solfatara Crater, Italy [16]. As energy plus water is often considered a prerequisite of life [17], such environments where magmatism, tectonism, and aqueous activity interact in space and time, as especially highlighted in the Atacama Desert, are considered to be environments of elevated life potential [18]. In the Atacama Desert, such interaction includes: (1) the

formation of elongated basins/valleys through magmatic- and plate tectonic-driven deformation, which are subsequently partly infilled by evaporite and alluvial fan deposits, and (2) fractures, faults, and complex fault systems forming conduits for the migration of subsurface and surface flow of water (e.g., the flow of groundwater, which sources from the Andes, migrates across the Atacama Desert in the subsurface along basement structures having an influence on life, transects the Coastal Range, and eventually debouches into the Pacific Ocean). The Martian deposits such as identified in the structurally-controlled basins of Terra Sirenum [19] bear strong similarities to evaporitic deposits found in the structurally-controlled basins of the Atacama Desert [20], which have been recently recognized as an important niche for life in the extreme arid conditions [21]. Such environments ought to be targeted by international missions to Mars.

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