The Salt Astrobiology, Geochemistry And Nanoclimate (S.A.G.A.N.) mission to Mars

ALFONSO DAVILA[1*], ANTHONY COLAPRETE[1], ARWEN DAVE[1], PABLO SOBRON[2], KRIS ZACNY[3]

[1]NASA Ames Research Center, CA, USA (*correspondence: alfonso.davila@nasa.gov);
[2]The SETI Institute, CA, USA
[3]Honeybee Robotics, CA, USA

Are we alone in the Universe? Humanity has wondered for centuries about the possibility of life beyond Earth. The Salt Astrobiology, Geochemistry And Nanoclimate (S.A.G.A.N) mission seeks to answer this question by investigating one of the largest salt evaporitic deposits on Mars, a site with great potential for habitability and expression of biosignatures.

Hundres of Cl-bearing deposits appear scattered in the southern highlands of Mars [1]. These deposits have been interpreted as salt pans formed approximately 3.5 billion years ago, after the evaporation of surface waters. The composition and morphology of the salt deposits is analogous to continental NaCl evaporites (aka *salares*) found in the hyperarid core of the Atacama Desert, which contain a biogeochemical record of past, habitable, lacustrine environments. Atacama salares are also one of the few locations in the desert where extant microbial communities can still be found [2], and whose survival depends on meager amounts of liquid water formed via deliquescence [3], a source of liquid water that has also been speculated on Mars.

S.A.G.A.N would be the first mission ever to land in the southern hemisphere of Mars. Using a carefully selected payload, S.A.G.A.N. surveys the salt substrate searching for organic "hotspots" in morphologic units of interest. In addition, S.A.G.A.N. performs comprehensive geochemical and mineralogical analyses near the lander workspace. When an organic "hotspot" is identified, S.A.G.A.N. collects a sample and performs sensitive organic analyses in search for molecular signatures of life. In addition, S.A.G.A.N. measures the nano-climate inside the salt pore-space, and determines whether liquid water can form via deliquescence under the current martian climate. We will discuss the science scope of S.A.G.A.N. as well as some of the important technology challenges that need to be addressed before it can be succesfully implemented, including the requirement to land at higher elevation than any previous Mars mission.

[1] Osterloo et al. (2008) *Science* 319:1651-4. [3] Wierzchos et al. (2006) *Astrobiology* 6(3):415-22. Davila et al. (2008) *JGR* 113, G1.