PRESERVATION OF ORGANIC MOLECULES AT MARS' NEAR-SURFACE.

C. Freissinet[1,2] D. P. Glavin[1], A. Buch[3], C. Szopa[4], P. D. Archer Jr[5], W. B. Brinckerhoff[1], A. E. Brunner[1], J. L. Eigenbrode[1], H. B. Franz[1], S. Kashyap[7], C. A. Malespin[1], M. Millan[4], K. E. Miller[8], R. Navarro-González[9], B. D. Prats[1], R. E. Summons[8], S. Teinturier[1], P. R. Mahaffy[1]
[1]NASA Goddard Space Flight Center, Greenbelt, MD caroline.freissinet@nasa.gov, [2]CRESST, Baltimore MD, [3]Ecole Centrale Paris, Chatenay-Malabry, France, [4]LATMOS, Guyancourt, France, [5]Jacobs, NASA Johnson Space Center, Houston, [6]University of Massachusetts Amherst, Amherst MA 01003, [7]Massachusetts Institute of Technology, Cambridge, MA.

Introduction: One of the biggest concerns for the *in situ* detection of organics on extraterrestrial environment is the preservation potential of the molecules at the surface and subsurface given the harsh radiation conditions and oxidants they are exposed to. The Mars Science Laboratory (MSL) search for hydrocarbons is designed to understand taphonomic windows of organic preservation in the Mars' near-surface. The Sample Analysis at Mars (SAM) instrument on the MSL Curiosity rover discovered chlorohydrocarbon indigenous to a mudstone drilled sample, Cumberland (CB) [1]. The discovery of chlorohydrocarbons in the martian surface means that reduced material with covalent bonds has survived despite the severe degrading conditions.

Results and Discussion: The precursors of the chlorohydrocarbons detected by pyrolysis at CB remain unknown. Organic compounds in this ancient sedimentary rock on Mars could include polycyclic aromatic hydrocarbons and refractory organic material, either formed on Mars from igneous, hydrothermal, atmospheric, or biological processes [2] or, alternatively, delivered directly to Mars via meteorites, comets, or interplanetary dust particles [3]. It has been postulated that organic compounds in near-surface rocks may undergo successive oxidation reactions that eventually form metastable benzenecarboxylates, including phthalic and mellitic acids [4]. These benzenecarboxylates are good candidates as the precursors of the chlorohydrocarbons detected in SAM pyrolysis at CB. Indeed, recently, SAM performed a derivatization experiments on a CB sample, using the residual vapor of N-methyl-N-*tert*butylsilyltrifluoroacetamide (MTBSTFA) leaking into the system. The preliminary interpretations are compatible with the presence of benzocarboxylates, coincidently with long chain carboxylic acids and alcohols. The analysis of this interesting data set to identify these derivatization products, as well as future SAM measurements on Mt Sharp, should shed additional light on the chemical nature and the origin of the organic matter in near-surface materials in Gale Crater.

The future Mars Organic Molecule Organizer (MOMA) instrument onboard ExoMars 2018 should improve the detection of organic molecules in Mars subsurface in two ways. Firstly, by drilling a sample down to 2 meters, it will access more preserved area against deleterious radiations. Secondly, MOMA derivatization using dimethylformamide dimethylacetal (DMF-DMA) as a reagent is designed to assess the potential enantiomeric excess of complex chiral molecules of interest, such as amino acids, sugars or carboxylic acids, to aid at the determination of their biotic or abiotic origin.

Gale crater had recently been defined as an ancient habitable environment, due to the simultaneous presence of liquid water, energy source and a mild range of temperature, pH, pressure and salinity. The presence of organic molecules opens up habitability to another level, where the building blocks of life were available for more complex system to evolve. This view into ancient Mars begins to provide a context for habitable environments and is a first step toward understanding the presence and diversity of possible prebiotic or biotic molecular signatures. Moreover, it helps mapping out potential windows of preservation for chemically reduced organic compounds, which will help on sample and site selection on all bodies of the solar system for future missions, including MSL2020.

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