



The Urey Instrument: Ultra-sensitive Chiral Biomarker Detection with Soil Oxidant Profiling

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The Urey Instrument is an integrated suite of in situ instruments, formerly termed MOD/MOI, which is designed to search the Martian regolith for chiral biomarkers at terrestrial laboratory state-of-the-art detection levels while profiling the presence and chemical reactivity of surface and atmospheric oxidants that might have reactively degraded organic compounds. We will describe the component instruments including the Mars Organic Detector (MOD), the microchip Capillary Electrophoresis System (μ CE), the Mars Oxidant Instrument (MOI) and our sub-critical water extractor (SCWE) which have been developed to TRL 5-6 using field campaigns to refine our prototypes. We will emphasize the experimental results of our Atacama Desert campaigns through which we have demonstrated the sensitivity (pp trillion) of our Amino Acid biomarker detection system to be several orders of magnitude greater than the pyrolytic GCMS systems utilized by Viking and the SAM instrument that is part of the upcoming MSL mission; established direct measurements of unique acid-derived oxidation systems triggered by molecular films of water that are consistent with Viking observations of Martian soils; and showed the extreme variation of detectable organics over lateral distances of decimeters and over depths from the surface of centimeters. The successes of this effort have raised several tantalizing research issues including critical sampling extraction methods related to the unique arid chemistry of this high gypsum/anhydrite/halite desert analog of the Martian surface, possible accretion or concentration of residual organics in the near surface region (less than 10 cm depth)

and the preliminary observation that careful study of the local geomorphology of the surface can direct the search for organic rich sub-surface regions.

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