

In situ Analysis of Organic Compounds on Mars using Chemical Derivatization and Gas Chromatography Mass Spectrometry

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One of the core science objectives of NASA's 2009 Mars Science Laboratory (MSL) mission is to determine the past or present habitability of Mars. The search for key organic compounds relevant to terrestrial life will be an important part of that assessment. We have developed a protocol for the analysis of amino acids and carboxylic acids in Mars analogue materials using gas chromatography mass spectrometry (GCMS). As illustrated in Figure 1, a variety of carboxylic acids were readily identified in soil collected from the Atacama Desert in Chile [1] at part-per-billion levels by GCMS after extraction and chemical derivatization using the reagent *N,N*-*tert*-butyl (dimethylsilyl) trifluoroacetamide (MTBSTFA). Several derivatized amino acids including glycine and alanine were also detected by GCMS in the Atacama soil at lower concentrations (chromatogram not shown). Lacking derivatization capability, the Viking pyrolysis GCMS instruments could not have detected amino acids and carboxylic acids, since these

non-volatile compounds require chemical transformation into volatile species that are stable in a GC column [2].

We are currently optimizing the chemical extraction and derivatization technique for in situ GCMS analysis on Mars. Laboratory results of analyses of Atacama Desert samples and other Mars analogue materials using this protocol will be presented.

References:

[1] Navarro-González, R. et al., "Mars-Like Soils in the Atacama Desert, Chile, and the Dry Limit of Microbial Life", *Science* **7**, 1018-1021 (2003).

[2] Rodier, C. et al., "Detection of Martian Amino Acids by Chemical Derivatization Coupled to Gas Chromatography: In Situ and Laboratory Analysis", *Adv. Space Res.* **27**, 195-199.

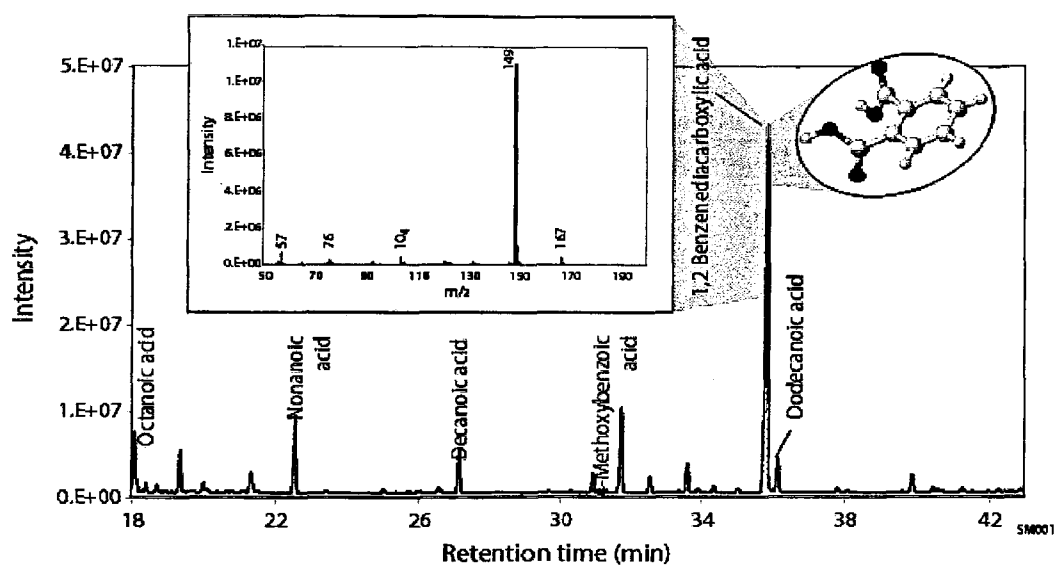


Figure 1. GCMS analysis of carboxylic acids in a propanol extract of an Atacama Desert soil sample after chemical derivatization using MTBSTFA.