Detecting a Novel Biosignature Using Modern Spaceflight Technology

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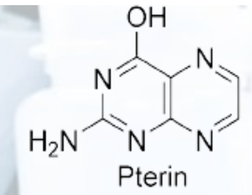
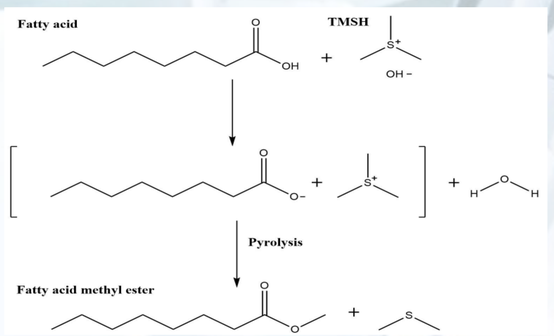
Background

- When searching for life on other planets, an organic biological signature is a key finding because it gives evidence to activity that is only possible by a living organism.



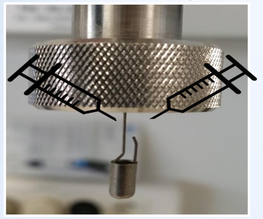
Marin et al., 2015



Gries et al., 2021

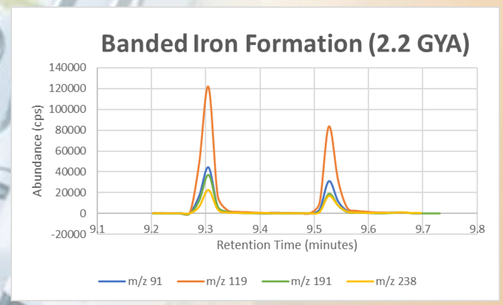
- Here, we discuss the potential for a new class of metabolic biosignatures: pterins (above). Pterins are a part of the pteridines family, containing a nitrogen heterocycle with an amino group at position 2 and a keto group at position 4. Pterins are found in all domains of life, are widely conserved, and play an important part in metabolism.

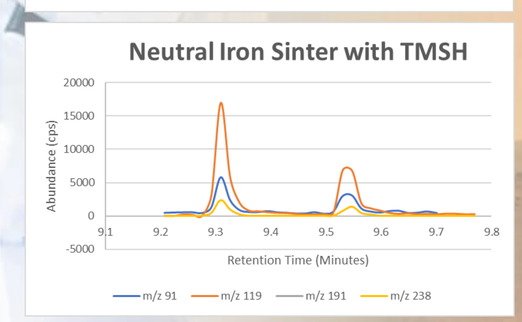
(1) Add powdered rock sample and reagent

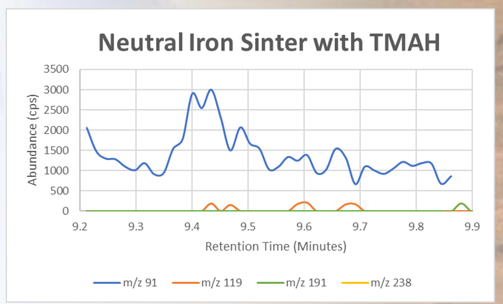


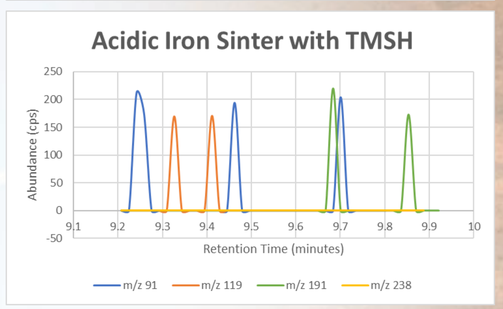
(2) Pyrolyze sample

Results



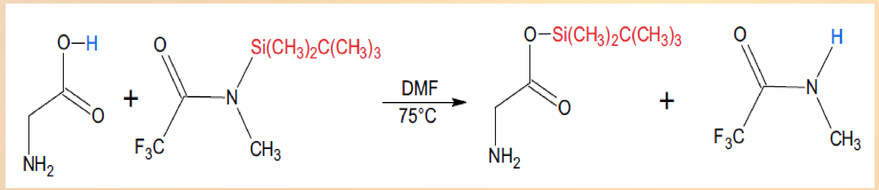






Methods

- This work seeks to determine the limits of detection and limits of quantification of the biomarker with TMSH thermochemolysis and the detectability of the biomarker with MTBSTFA derivatization



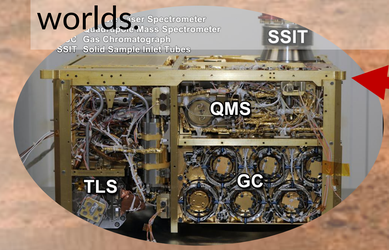
Millan et al., 2016

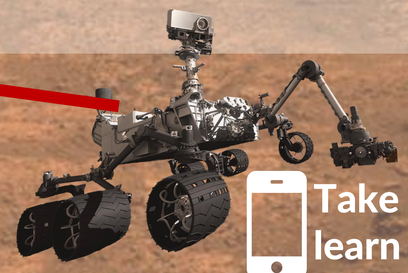
- Once samples are collected, the limit of blank (LOB), limit of detection (LOD), and limit of quantification (LOQ) will be calculated using the following equations

1.LOB = mean blank + 1.645(Std Dev blank)
2.LOD = LOB + 1.645(Std Dev low concentration sample)
3.LOQ ≥ LOD, where the critical value = 20%

Future Implications

Current spaceflight technologies are equipped with an GC-MS instrument that uses both TMAH and MTBSTFA. Neither the SAM instrument aboard the Mars Curiosity Rover nor the MOMA instrument aboard the ExoMars Rover are equipped with TMSH. Designing future missions with TMSH will open a new class of biosignatures to search for in the hunt to find microbial life on other worlds.





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