The search of ancient life through the use of geologic samples

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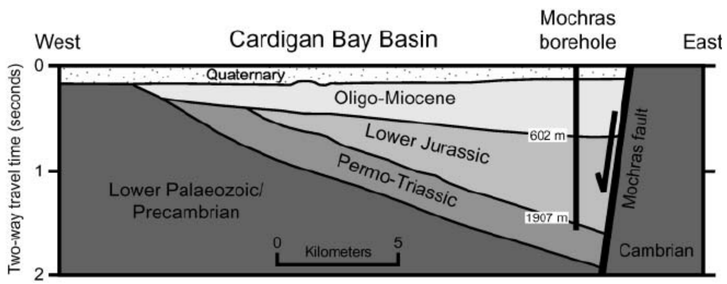
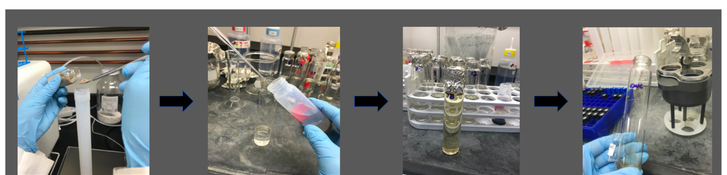
Background

Astrobiogeochemistry Laboratory is interested in exploring molecular and mineralogical biosignatures in ancient and recent Earth samples to provide evidence of early signs of life. Through a lipid biomarker extraction and analysis, scientists are able to remove organic material in preparation for the Mars 2020 Mission.



Method

1. Measure crushed sample into large Teflon tube
2. Use dichloromethane as solvent
3. Transfer DCM and sample into small Teflon tube
4. Centrifuge Teflon tubes for 14 minutes at 3000rpm
5. Extract supernatant and place into labeled glass tubes
6. Add DCM to Teflon tubes
7. Sonicate Teflon tubes for 3 minutes
8. Shake Teflon tubes to separate lipids from sediment
9. Centrifuge Teflon tubes for 14 minutes at 3000rpm
10. Extract supernatant and place into labeled glass tubes
11. Repeat steps 6-10
12. Evaporate liquid from glass tubes
13. Suspend organic material in glass tubes using DCM
14. Transfer to gas chromatography vial and dry down sample
15. Resuspend in hexane and dry down again
16. Use GC/MS for chromatogram



Results

Mochras Samples

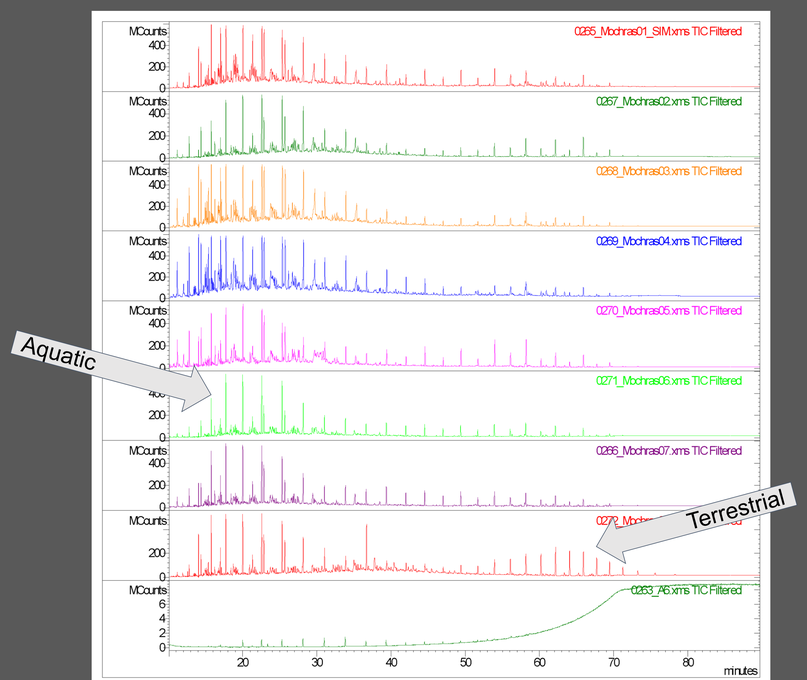
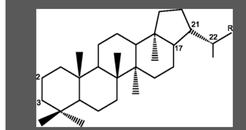


Figure 1: This chromatogram depicts molecules in the Mochras samples. As the compounds in the samples move from the GC column to the detector, they are zapped with a large volume of electrons, breaking the compounds into fragments. The mass to charge ratio is detected along with the abundance for each fragment.

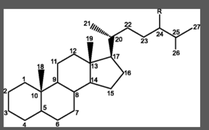
Data

C#	Time	MO1	MO2	MO3	MO4	MO5	MO6	MO7	MO8
C15	17.719	6.83E+09	4.24E+09	5.80E+09	6.31E+09	3.95E+09	4.91E+09	4.69E+09	4.42E+09
C17	22.537	6.72E+09	6.22E+09	6.84E+09	6.80E+09	4.64E+09	5.50E+09	5.39E+09	4.97E+09
C19	28.111	4.14E+09	3.89E+09	4.69E+09	4.80E+09	2.04E+09	2.70E+09	2.46E+09	2.83E+09
C27	49.358	1.82E+09	8.28E+09	6.36E+09	1.04E+09	1.80E+09	1.23E+09	1.51E+09	7.96E+08
C29	53.889	1.97E+09	1.78E+09	1.49E+09	1.03E+09	3.12E+09	1.29E+09	1.49E+09	1.58E+09
C31	58.181	1.29E+09	1.97E+09	1.37E+09	1.24E+09	3.05E+09	1.66E+09	1.24E+09	1.99E+09
TAR		3.49	1.19	1.88	5.41	1.34	3.13	2.96	2.8

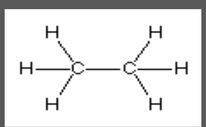
Hopanes



Steranes



Alkanes



Terrestrial Aquatic Ratio

(C15 + C17 + C19) / (C27 + C29 + C31)

- High number more aquatic
- Lower number more terrestrial

Future Plans

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