

^{13}C Enrichment of Martian Carbonates An Experimental Analog



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Outline

I. Intro

Water on Mars and Martian atmospheric history

Martian Carbonates

^{13}C Enrichment: Carbon Fractionation Factors

II. Data

Setup and Process

Experimental Results

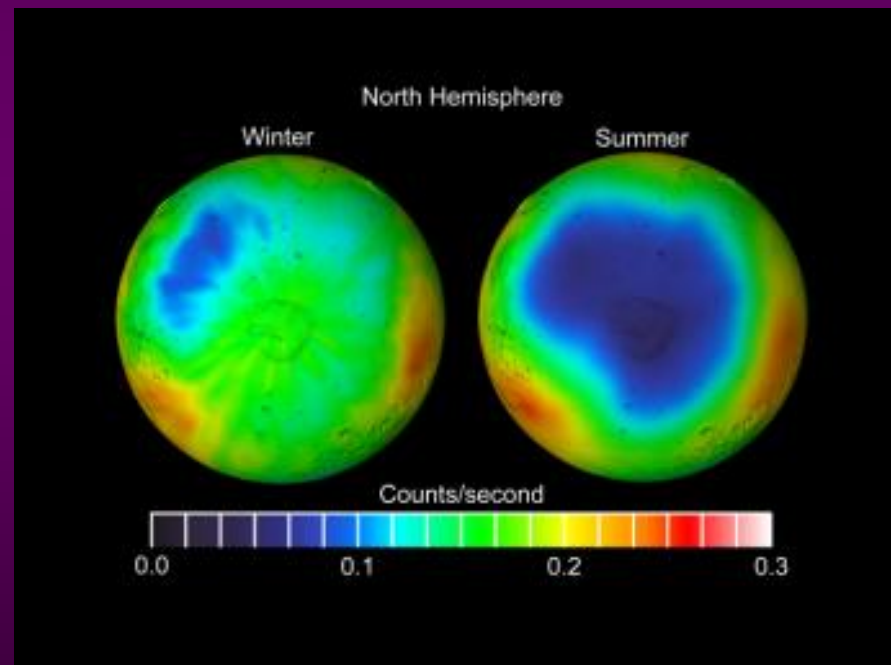
III. Implications and Future Work

History of Water on Mars

- Martian surfaces 4 billion years – 100 million years
- Evidence for ancient surface water – global oceans?
- Dendritic valley networks, outflow channels, slip streaks

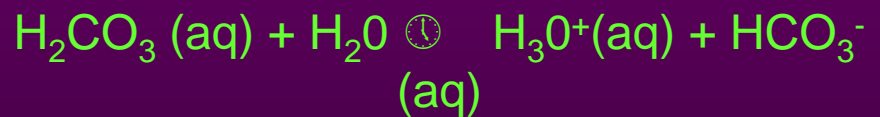
Atmospheric loss:

- Impacts
- Solar wind
- Isotope ratios



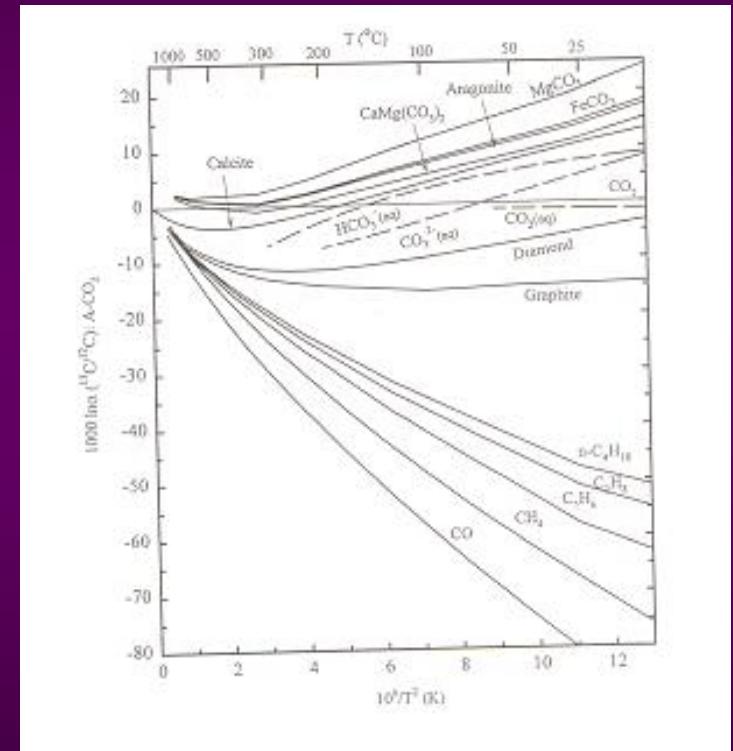
Martian Carbonates

- Interactions with water
- 1970s Viking – no carbonates – why?
- Carbonate searches negative or inconclusive
- SNC meteorites (ALH 84001)



Carbon Isotope Fractionation

- formation temperature
- evaporation of brines
- cryogenically
- freezing/evaporation of alkalai-rich oceans)
- Terrestrial analogs



The Experiment

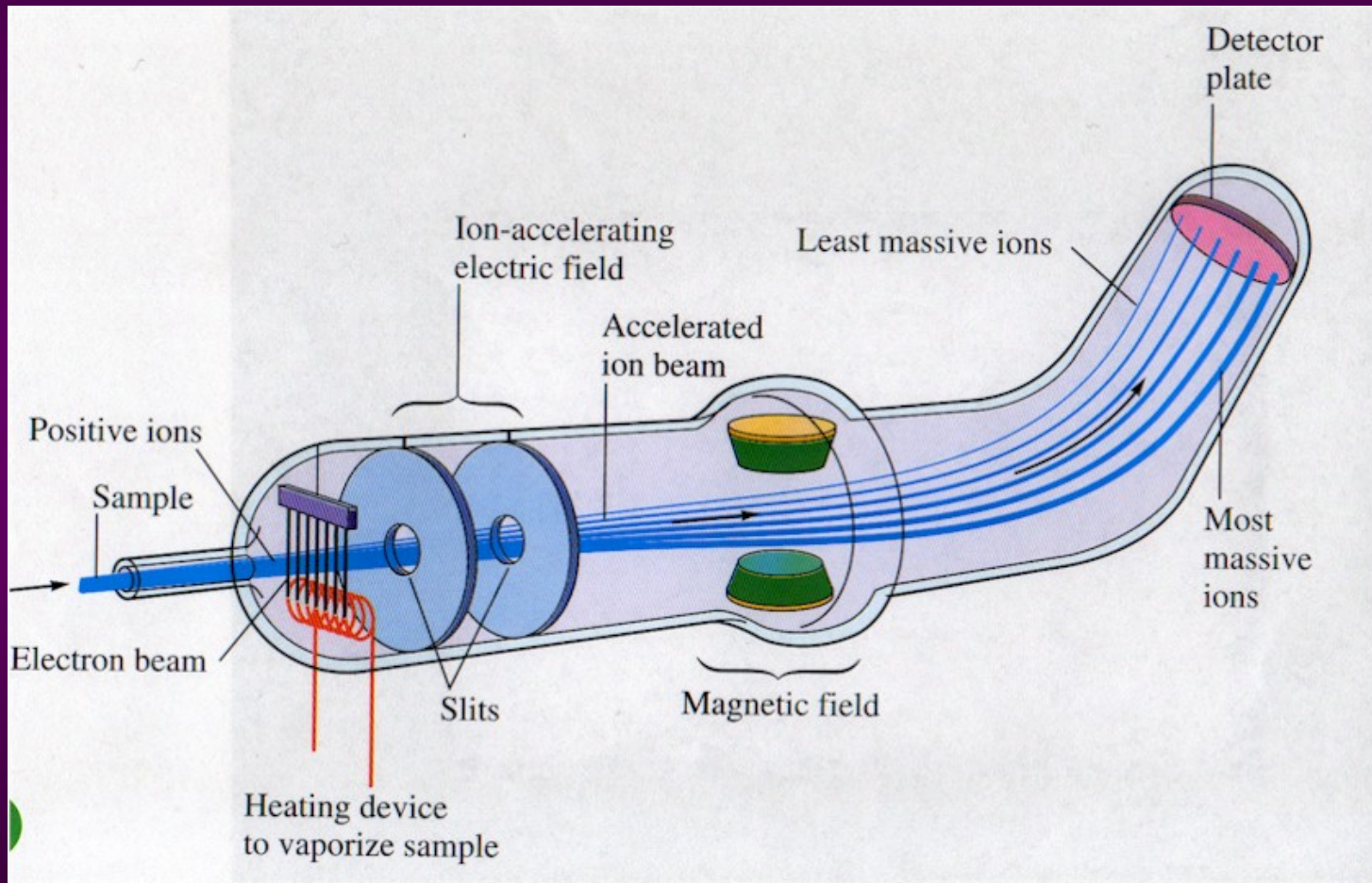
- 24 250mL separatory funnels
- three temperature conditions
- carbonated v. distilled water
- 1 month duration
- 6 control funnels



Treatment Process



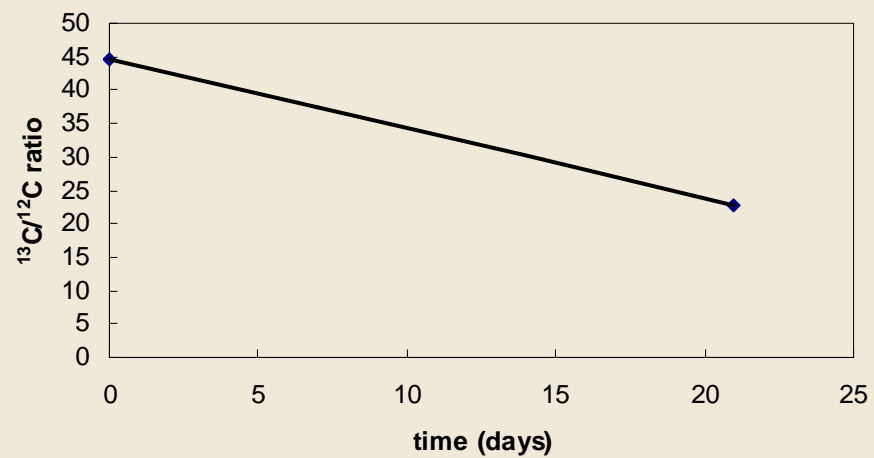
Mass Spectrometry



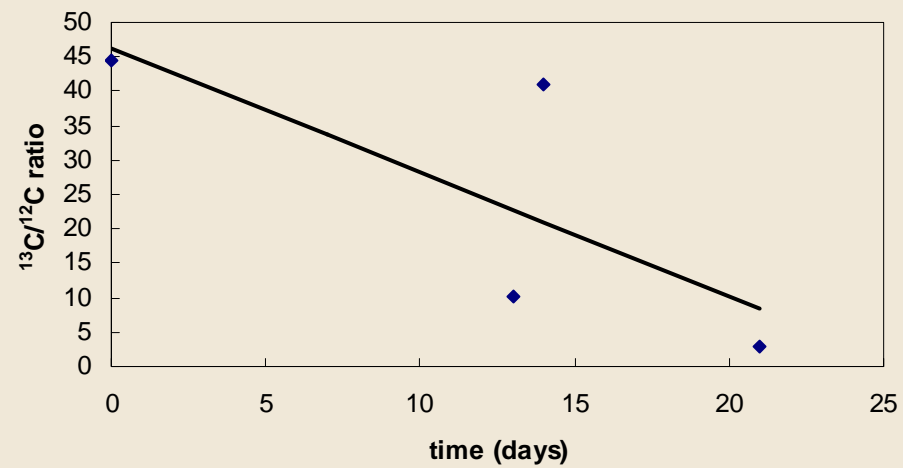
Results

- Precision: ≤ 0.01
- Average slope = -1.72
- Sources of error: leaks in the gas treatment line, removal errors, dropped tubes
- Carbonated v. Non-carbonated inconclusive
- General trend = decrease in ^{13}C

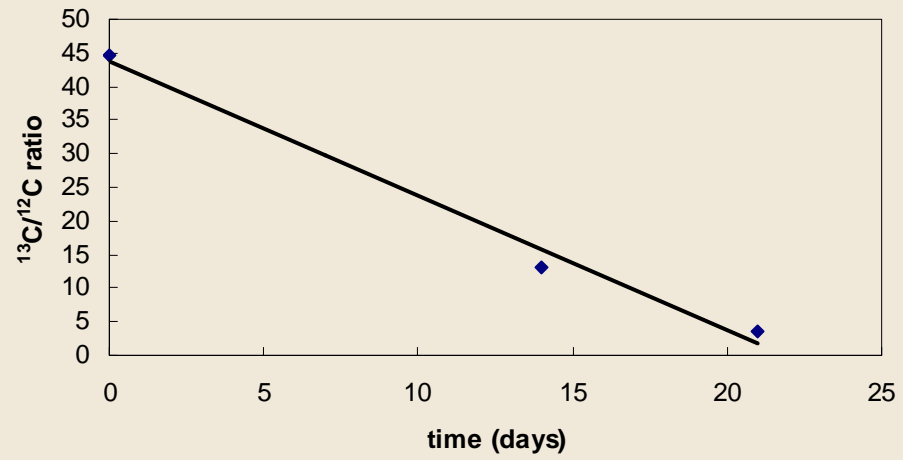
-20C Carbonated



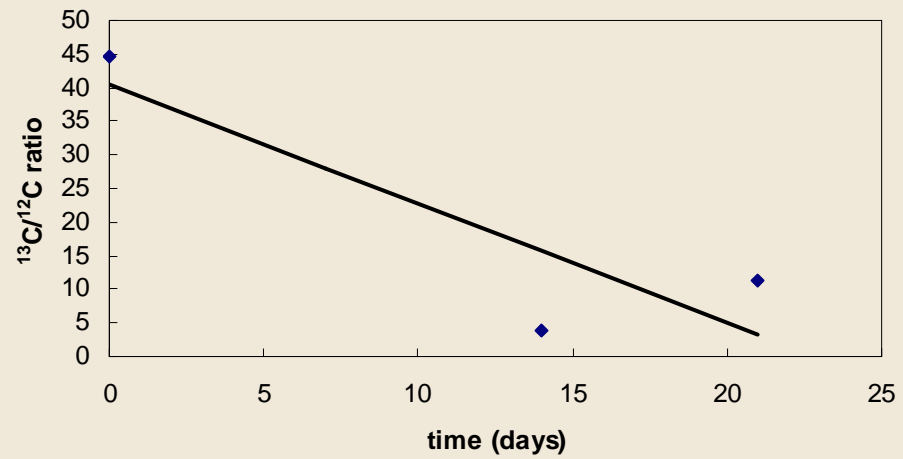
-20C Non-Carbonated



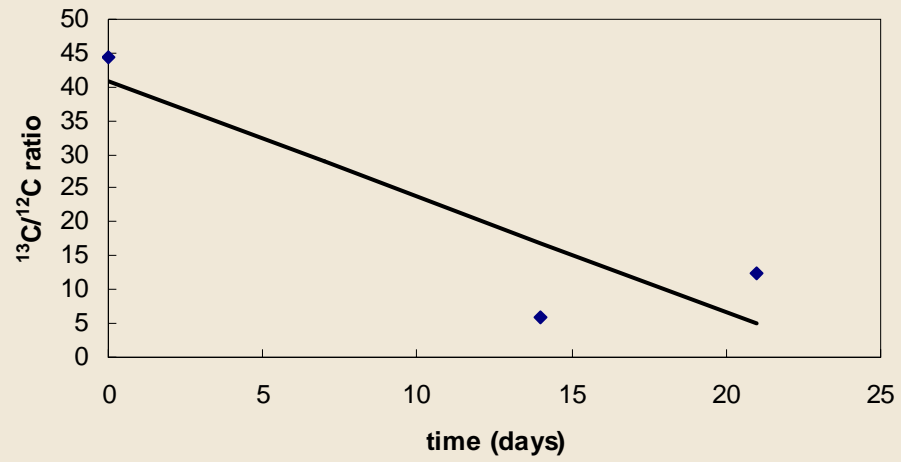
23C Carbonated



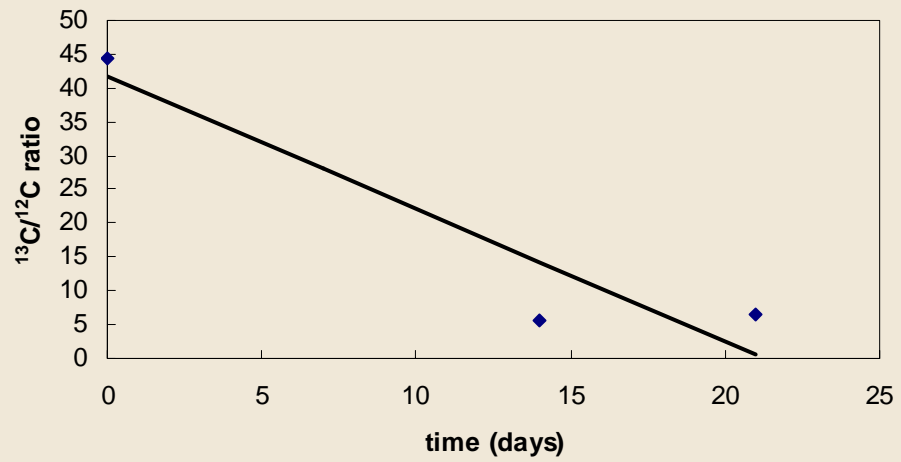
23C Non-Carbonated



60C Carbonated



60C Non-Carbonated



Future Work

- Andromeda Chamber
- Soil v. CO₂
- X-ray Diffraction Analysis
- Repeatability

References and Acknowledgements

- Thanks to Mikhail Kareev and Glenn Piercey of the Stable Isotope Lab
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