**Biosignature Preservation In Acidic And Circumneutral Icelandic Hot Spring Deposits**

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**Introduction:** One way to look for biosignatures on Mars is to study terrestrial analog systems. This research aims to investigate the preservation and detection of organic biosignatures in relevant Martian analog mineralogies. One such mineralogy is iron rich silica sinter from Icelandic hydrothermal systems. On Mars, siliceous sinter deposits with hydrothermal origins have been identified in Nili Patera as well as deposits of opal-A in Columbia Hills, Gusev crater (Sun and Milliken 2018, Tarnas 2019, Williams et al., 2021). These systems produce silica sinter, which is known to preserve physical biosignatures on Earth (Kaur et al., 2011, and Campbell et al., 2015). The goal of this work is to characterize fatty acids, straight chain hydrocarbons, and other organics using current Martian spaceflight technology pyrolysis ramps coupled to GC-MS.

The goal of this work is to compare GC-MS *in situ* techniques to characterize the organics preserved in siliceous sinter hydrothermal environments. We hypothesize that the neutral silica sinter hydrothermal system will have more diversity and abundance of biosignature preservation than the acidic system. To test this hypothesis, we will characterize fatty acids, straight chain hydrocarbons, and other organics within acidic and circumneutral hydrothermal silica sinter deposits using SAM and MOMA-like pyrolysis ramps coupled to GC-MS.

**Field Location:** Samples were collected from two active silica sinter hot springs in the Kerlingarfjöll volcano region which is located west of the Hosfjökull glacier in central Iceland (Moreras-Marti et al., 2021). The first site is acidic and is located west of the volcano (N64°38.728' W19°17.344') and a second circumneutral site is located much further north of the volcano system (GPS: N 64°50.651' W23°13.281').

**Methods:** Ten samples from the Kerlingarfjöll volcano region, seven samples from the acidic site and 3 samples from the circumneutral site, were analyzed. Different thermochemolysis reagents, pyrolysis temperatures, and ramp rates were utilized. The thermochemolysis reagents TMAH and TMSH were utilized. Samples with TMSH were pyrolyzed at up to 400˚C and those with TMAH were pyrolyzed at up to 500˚C (Kivrak and Williams 2022). Neat pyrolysis was performed at 600˚C and 850˚C. Testing multiple temperatures allows for a more complete profile of the organics present in the sample. Another round of analyses was performed using TMAH as a reagent, but with a pyrolysis temperature ramp of 35˚C/min to simulate the SAM-like ramp and 200˚C/min to simulate the MOMA-like ramp. The samples were analyzed on an Agilent 7890B-5977 GC-MS coupled to a Frontier 3030D pyrolysis oven, using a 30m Restek MXT-5 capillary column with a 0.25 mm internal diameter and He as the carrier gas. The samples underwent flash pyrolysis followed by a chromatographic separation with the GC oven starting at 50˚C then ramping at 15˚C/min to 300˚C with a 5 minute hold. The samples were prepared by combining 1 mg of powdered sample with 1 µL of TMSH in methanol or 1 µL of TMAH in methanol.

**Results:** Figure 1 shows a chromatogram of a representative sample. Both samples underwent neat pyrolysis at 600˚C. The top panel shows the acidic sample, and the bottom panel shows the neutral sample. The acidic sample does not yield the same diversity of organics as the neutral sample does. In Figure 1, there is a strong presence of alkanes detected in the circumneutral sample that the acidic sample does not show.

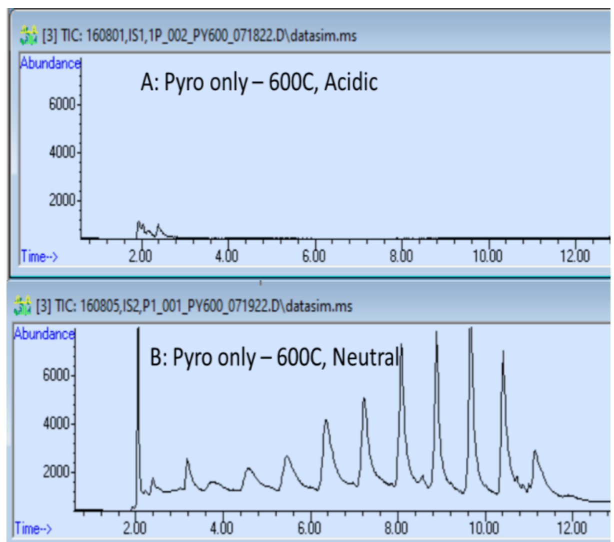


*Figure 1. Chromatogram of iron-rich silica sinter from acidic and circumneutral environments.*

**Discussion:** The results will identify hydrothermal systems with the best preservation of biosignatures to influence future Mars missions target locations.

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