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Geomolecules in the Late Jurassic Claudia paleo-geothermal field: evidence of a complex geological and biological environment

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Siliceous hot spring deposits (sinters) are dynamic, transient, environments, recording vent-to-marsh facies from >100°C to ambient. Organic matter (OM) in active or recently fossilized sinters (<3 Ma) has revealed complex interplays between environment and life, and the ultimate degree to which OM could be preserved through time has been unclear. Here, we apply gas chromatography-mass spectrometry to samples of quartzose sinter collected from an exceptionally well-preserved Late Jurassic (~150 Ma) sinter complex at Claudia, Deseado Massif, Argentinean Patagonia that, despite its age, has not been deeply buried or deformed [1]. The characteristics of OM from this site are described for the first time. The Patagonian sinter represents a key analogue for the Archean hot spring fossil sites of the 3.5 Ga Pilbara Craton, Western Australia, but time and diagenesis have altered primary paleoenvironmental signatures. Overall, little is known about how and where the best-preserved OM may be distributed within facies of these complex physicochemical systems of Phanerozoic to Precambrian age.

Previous studies demonstrated that OM preservation in hot spring systems is highly variable: microbial mats may become immediately entombed during hot spring discharge; OM may decay and mineralise or degas through weathering and/or hydrothermal alteration; or primary OM may become entrained in hydrothermal fluids and migrate through the system to be redistributed [2-4]. Given this complexity, there is an incomplete understanding of the controls on the variation of OM preservation within specific sinter facies.

Results from Claudia indicate that the distal sinter apron yields exceptional preservation of indigenous OM compared to more proximal facies. In particular, abundant, thermally immature biomarkers are preserved, consistent with the lower overall fluid temperatures of distal hot spring facies. In contrast, homohopane ratios show that the OM of the proximal apron is of mixed thermal maturity and is in low abundance. Biomarkers reveal the presence of terrigenous OM, cyanobacteria, chemotrophic bacteria, methanotrophic bacteria, and algae.

References:

[1] Guido, and Campbell, 2001, Journal of Volcanology and. Geothermal Research, 203, 35-47; [2] Gonsoir et al., 2018. Science Reports 8, 1-13 [3] Reinhardt et al., 2019. Biogeosciences*, 16,* 2443-2465 [4] Teece et al., 2020. Astrobiology 20, 537-551.