Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.8467

The pursuit of elusive extraterrestrial liquid water in astromaterials

PETER A.B. KRIZAN[1], QUEENIE HOI SHAN CHAN[1], AMY GOUGH[1] AND DOMINIC PAPINEAU[2,3,4]

[1]Royal Holloway, University of London
[2]The Centre for Planetary Sciences
[3]University College London
[4]London Centre for Nanotechnology
Presenting Author: peter.krizan.2017@live.rhul.ac.uk

Since the breakthrough discovery of the first samples of liquid extraterrestrial water in the Zag and Monahans (1998) ordinary chondrites [1], there has been great speculation as to whether any additional direct water samples exist in other astromaterials. We now understand that transient water is present and significantly abundant throughout the Solar System - predominantly in the form of solid ice - an observation which lies consistent with the extensive evidence of aqueous alteration seen in primitive meteorites [2]. Nonetheless, it still remains unknown if any more of these extraterrestrial liquid water samples exist (in the form of fluid inclusions), but also why they continue to evade detection, despite the apparent wide-spread influence of hydrothermal alteration in the Solar System.

Here, we present our findings from our assessment of previous unsubstantiated claims of fluid inclusions within a wide range of meteorites and their likelihood of containing true liquid water. We analysed one achondrite meteorite (Allan Hills A77256) and eight chondrite meteorites (Allan Hills 84029, Bjurböle, Holbrook, Jilin, Lonewolf Nunataks 94101 & 94102, Mighei, and Orgueil) from a set of freshly produced thin sections, using a specifically designed anhydrous preparation technique for the study of fluid inclusions. We show that both petrographically primary and secondary fluid inclusions are observed within a range of host minerals, as well as the compositional analyses of the trapped fluids in suitable inclusions (diameter >1μm) using a combination of Raman spectroscopy and SEM-EDS.

[1] Zolensky, M. E., Bodnar, R. J., Yurimoto, H., Itoh, S., Fries, M., Steele, A., ... & Ito, M. (2017). The search for and analysis of direct samples of early Solar System aqueous fluids. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2094).

[2] Tsuchiyama, A., Miyake, A., Okuzumi, S., Kitayama, A., Kawano, J., Uesugi, K., ... & Zolensky, M. (2021). Discovery of primitive CO2-bearing fluid in an aqueously altered carbonaceous chondrite. *Science Advances*, *7*(17).