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Role of Fe(II)-saponite on organic matter evolution during chondritic aqueous alteration.

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The parent bodies of meteorites play a crucial role in the formation and final chemical composition of organic matter of carbonaceous chondrites and asteroids, particularly through secondary processes such as aqueous alteration [1]. Among the secondary minerals identified in asteroids (Ryugu and Bennu) and carbonaceous chondrites, ferrous saponite presents catalytic properties and crystallographic structure that might facilitate the polymerisation of prebiotic molecules such as amino acids [2], [3].

To assess its catalytic role in prebiotic chemistry and formation of insoluble organic matter, we designed experiments to mimic the evolution of organo-mineral mixtures under hydrothermal conditions relevant to chondritic evolution. We used synthetic mixtures of Fe(II)-saponite incorporating formaldehyde and glycolaldehyde, and ammonium-bearing fluids [4], [5] and put them in pressurized vessels at 150°C for 1 to10 days. These experiments are novel in that they explore the effect of the variation of proportions of the compounds (i.e. mineral, organic, ammonia) on their co-evolution in hydrothermal conditions.

Afterward, the minerals are characterised using XRD-synchrotron beam, AFM-IR and UV spectroscopy, from the interlayer nanoscale to the microscopic scale. Additionally, both soluble and insoluble organic residues are analysed using Ion Chromatography, LCMS, and FT-ICR MS to establish their chemical evolution from elemental bulk composition to molecular scale.

We will discuss the presence and nature of organic molecules trapped within the saponite interlayers, and its potential role in catalysing prebiotic molecules during the evolution of carbonaceous chondrites and their parent body.

[1] Suttle et al., (2021), *Geochemica Cosmochemica Acta* 299, 219-256;

[2] Viennet et al., (2023), *Geochemical Perspectives Letters* 25;

[3] Viennet et al., (2022), *Geochemica Cosmochemica Acta 318,* 352-365;

[4] Noda et al., (2021), *Minerals* 11, 1244;

[5] Kebukawa et al., (2020), Icarus 347, 13827.