# Hydrothermalism and molecular preservation of Precambrian Gunflint microfossils

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The 2 Ga old Gunflint cherts (silica-rich rocks) contain among the morphologically best preserved Precambrian microfossils. Yet, the Gunflint formation has experienced intense magmatic-related hydrothermal circulation during the Mesoproterozoic continental rifting (ca. 1.1 Ga).

The present study examines the microstructure and molecular signatures of organic microfossils found in Gunflint cherts sampled in five different localities. By providing *in situ* microstructural information, Raman spectroscopy has allowed to rank these organic microfossils as a function of the maximum temperature they experienced. Synchrotron-based XANES spectroscopy performed on FIB sections has offered submicrometer scale information on the carbon and nitrogen speciation and the nitrogen-to-carbon ratio [2], thereby allowing estimating their degree of molecular preservation.

Organic microfossils from four of the five investigated samples exhibit a degree of molecular preservation which perfectly correlates with their degree of strutural organization, *i.e*. with the maximum temperature each of these samples experienced. In contrast, organic microfossils from the fifth sample do not appear microstructurally homogeneous and their structural and molecular signatures do not match together. The only difference with the four other investigated samples is the presence of carbonates, confirming that the mineral assemblage may constitute a key parameter for the preservation/degradation of biogenic signals [3].

As illustrated here, the structural and molecular evolution of biosignatures of ancient microfossils during hydrothermal alteration may be strongly controlled by the temperature, but also by the nature of their mineral assemblage.

[1] Schopf (2006) *Phil. Trans. R. Soc. B*, **361**:869–885. [2] Alleon et al., (2015), *Carbon*, **84**:290–298 [3] Bernard and Papineau (2014) *Elements* **10**, 435–440.