Experimental fossilization of Archaea encrusted by Fe-phosphates

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Reconstructing the original biogeochemistry of organic fossils requires quantifying the extent of the chemical transformations that they underwent during burial-induced diagenesis. Organic maturation processes in natural settings may be strongly affected by the presence of mineral phases[1,2] the influence of which still needs to be precisely investigated.

Here, we report results of experimental diagenesis performed in closed systems at 150 °C for a few days (up to 5) on a hyperthermophilic archaeon (*Sulfolobus acidocaldarius)* encrusted beforehand on proteinaceous surface layers (S-layers) by amorphous Fe-phosphates[3]. The mineralogical nature of the residues was investigated using focused ion beam and electron microscopies while the speciation of organic remains was explored using X-ray absorption near edge structure (XANES) spectroscopy at the C K-edge. Lipscombite ($Fe^{II}_xFe^{III}_{3-x}(PO_4)_2(OH)_{3-x}$) crystallized during all experiments and trapped organic matter (only a small part escaped entombment). Lipscombite textures were function of the encrustation stage, whatever the duration of experiments. Results also demonstrated that encrustation by Fe-phosphates is detrimental to the chemical preservation of microbial organic matter.

Although extrapolating laboratory results to natural settings remains difficult, the present results evidence the influence of mineral phases on biogenic organic matter degradation processes during fossilization.

[1] Li et al. (2014) *EPSL* **400**, 113-122.

[2] Alleon et al. (2016) *Chem. Geol*. **437**, 98-108.

[3] Kish et al. (2016) *Sci. Rep.* **6**, 26152.