Searching for biosignatures on Mars: Experimental perspectives

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Upcoming exploration of Mars aims at identifying potential organic biosignatures in the subsurface dating back from the Noachian (~4.1-3.7 Ga). Yet, volcanic events or crater-forming impacts generated hydrothermal systems, altering ancient rocks and their possibly biogenic content. It thus appears crucial to constrain the impact of hydrothermal processes on organic biogeochemical signals, especially in the presence of clay minerals which are targeted by the future rovers. Here, we submitted RNA to hydrothermal conditions in the presence of Mg-smectites. Results show highly heterogeneous organo-mineral residues, with nano-phosphates and nano-carbonates associated to submicrometric amorphous silica particles and Mg-smectites with interlayer spaces saturated by N-rich organic compounds. Even though the chemical structure of RNA did not sustain hydrothermal conditions, the present study demonstrates that clay minerals can efficiently trap organic carbon under hydrothermal conditions typical of Martian subsurface, confirming the relevance of digging for organic carbon on Mars.