The Investigation of Geologically Relevant Metal Phosphites as a Plausible Source of Phosphorus in Prebiotic Chemistry

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To understand the origin of life, the abiotic incorporation of phosphorus in energy-promoting molecules like adenosine triphosphate (ATP) need to be identified. However, a consensus has not been reached on the source of phosphorus for prebiotic chemistry on Archaean Earth. One hypothesis is that metal phosphites were an important source of phosphorus for prebiotic chemistry. The primary issue with this hypothesis is the lack of phosphites in the geological rock record, where different phosphorus compounds (mostly inorganic phosphates) are observed instead. Two geologically relevant metal phosphites with varying waters of hydration, $CaHPO_3$ and $MgHPO_3$, were synthesized, structurally characterized, and thermally processed to determine if the conditions on early Earth could explain the lack of phosphite in the geological record. The phosphites were characterized using Thermogravimetic Analysis, X-Ray Diffraction, and phosphorus Nuclear Magnetic Resonance. From these experiments, interstitial waters associated with the metal phosphites are dehydrated from the compounds, which influences their reactivity. From Thermogravimetric Analysis, and phosphorus Nuclear Magentic Resonance data, simultaneous polymerization and oxidation is observed defining reactivity. Also, X-Ray Diffraction data validated the synthesis of metal phosphites in the lab. Since they are subject to polymerize and oxidize at higher temperatures in different environments, metal phopshites may not easily preserved in the geological rock record. Preliminary data to support this investigation will be presented here.