Geochemical speciation of phosphorus minerals in early earth spherule beds from the Barberton Greenstone Belt

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Phosphorus is one of the important element in essential life molecule. It is incorporated in the energy system such as ATP and NADH, phospholipid which maintain cellular structure, and genetic information system based on the nucleic acids such as DNA and RNA. As phosphate minerals are relatively insoluble and unreactive under early earth’ s surface conditions, it is considered that more reactive phosphide minerals derived from meteorite could be plausible source of phosphorylated biomolecules of early life. On the other hand, it has not been verified from meteorite records in early Earth. In this study, we focused on one of the middle Archean impact layers (S3 layer) in the Barberton Greenstone belt because it is considered to formed by the oldest meteorite impact. A variety of spherule textural types has been distinguished (e.g., Krull-Davatzes et al., 2012). Most of spherules are mainly composed of quartz, sericite, chrolite, titanite and opaque minerals like chromium spinel, pyrite, and magnetite. In addition, some of spherules are mainly composed of phosphate mineral like apatite. Small grains of phosphorus minerals are also observed in and around dendritic structure of Ni rich chromium spinel. An important trace component is formed by chromium spinel, which may preserve primary geochemical information.
To understand the origin of these phosphorous minerals in spherules, we used X-ray absorption fine structure (μ-XAFS) techniques. For comparison, we analyzed schreibersite (P0) in imilac parasite and a phosphide reagent (PIII). In this presentation, we will discuss preliminary results.

Keywords: Barberton Greenstone belt, Phosphorus, Origin of life, X-ray absorption fine structure (μ-XAFS)

