Can intracellularly accumulated polyphosphate from *Synechococcus* cells trigger apatite formation?

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Phosphorites rocks are a source of phosphorus (P), a critical component of phosphatic fertilizes [1]. The formation of these rocks is enigmatic. Upwelling areas in the ocean are the modern locations, where phosphorites formation, through amorphous apatite as a precursor for fluorapatite, has been observed. However, the mechanism behind is a matter of controversial discussions [2]. Picocyanobacteria are primary producers in marine and freshwater systems. The intracellular polyphosphate (polyP) formation in picocyanobacteria *Synechococcus* strongly responses to P level and contributes significantly to P cycling [3, 4].

However, the fate of picocyanobacterial polyP after the cells reach to the sediment remains unstudied. This study aims to prove that cyanobacterial polyP can trigger apatite formation. The proposed mechanism has been tested in the experiments with *Synechococcus sp*. PCC6312 and cyanobacterial strains isolated from Lake Ontario, Canada. We performed the growing and biomineralization experiments by mimicking conditions at the sediment-water interface, analyzing polyP concentrations over the growing time in continuous cultures; monitoring cell growth, phosphate uptake, total cellular P, alkaline phosphatase activity, and polyP concentrations. Apatite biomineralization experiments with polyP extracted from *Synechococcus* cells were performed under oxic and anoxic conditions. The precipitates have been studied with Scanning and Transmission Electron Microscopy. The elemental composition was analysed by energy-dispersive x-ray spectrometry (EDXS). Our results confirmed that apatite can be formed in the presence of polyP from picocyanobacteria. These findings have strong implications for the biotic pathways of a P sink as apatite minerals and P retention in aquatic systems.

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