

# Archean unique phosphorous cycle and its relationship to the evolution of biosphere

\*Takeshi Kakegawa<sup>1</sup>

1. Graduate School of Science, Tohoku University

Archean phosphorous cycles have been debated in last decades. Points of the debates are: (1) speciation and (2) concentrations of phosphorous in Archean ocean waters and (3) phosphorous availabilities to biosphere.

In order to approach the above problems, geochemical and mineralogical studies were performed on Archean submarine volcanic rocks and banded iron formations. The examined basalts and rhyolites (3.4 Ga and 2.7 Ga) were suffered from submarine hydrothermal alteration and seafloor CO<sub>2</sub> metasomatism. They contain various secondary phosphate and phosphide minerals as alteration products. The dominant presence of secondary apatite and monazite in those rocks suggest phosphate was the dominant specie in migrating fluids, rather than reduced species. Altered volcanic rocks are in general depleted in phosphorous concentrations. These findings suggest that Archean oceanic crusts behaved as the source of phosphate in the global phosphorous cycle.

Archean BIFs are in general poor in phosphorous concentrations. On the other hand, the examined BIFs (3.2 Ga and 2.7 Ga) are found to be rich in phosphate, accompanied with occurrence of large apatite crystals. Such excess phosphorous concentrations cannot be explained by adsorption effects of Fe-(hydro) oxides. Close association of phosphorous enrichments and occurrence of organic matter in examined BIFs suggest that the biological pump was already established by 3.2 Ga, to sink oceanic phosphate on sea floors through microbial activities. Those results indicate the uniqueness of Archean phosphorous cycle and their strong linkage to early biosphere.

Keywords: phosphorous, Archean, BIF