Phosphate was rich or poor in the 3.8 Ga ocean?

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It has been unknown as to whether Archean oceans were phosphate-rich or phosphate-poor. This problem may be important because phosphate concentrations in the Archean oceans may have controlled the early biological evolution. Archean pillow lavas and banded iron formation were collected from the Isua district in Greenland (3.8 Ga) and Pilbara district in Australia (3.5 Ga).

It is found that the phosphate were concentrated in carbonatized parts of the pillow lava samples from the both regions. Phosphates were also distributed in banded iron formation from Isua. These indicate that phosphates were precipitated from Archean oceans during pillow lava formation and also during the precipitation of banded iron formation.

These result indicate that the Archean oceans were phosphate-rich since after 3.8 Ga.