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Low level of phosphorous concentration at the late Paleoproterozoic shallow seawater: Evidence from the BIF rocks of the Chilpi Group, Bastar Craton, Central India

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Phosphorus (P) is one of the key bio-limiting nutrient elements in the modern ocean, which modulates primary marine productivity over geological time. Precambrian, especially the late Paleoproterozoic (2.0–1.8 Ga), phosphorous concentrations in seawater have been poorly constrained. Seawater P concentration can be reconstructed by the ratio of phosphorus to iron [expressed as (P/Fe)100] in BIFs and iron oxide-rich sedimentary rocks. Here we measured the P/Fe ratios of banded iron formation from the Chilpi Group, Bastar Craton, Central India. The bulk rock P/Fe molar ratios of the Chilpi BIF vary between 0.001 and 0.012 (average 0.005±0.003) and EPMA spot analysis P/Fe molar ratio is 0.003 ± 0.004, considerably lower than the values of coeval BIF deposited in other parts of the world. The low P/Fe molar ratio cannot be attributed to contamination from terrestrial input, diagenetic alterations or high temperature hydrothermal fluids. Instead, the very low P/Fe molar ratio may indicate that deposition of the Chilpi BIF probably in a P-lean seawater. Combining with the P/Fe data from other localities, extremely low P/Fe molar ratio of the Chilpi Group is indicative of very low shallow marine P concentration below 0.001 μM. This study bolsters the idea that the low level of phosphorous concentration may have arrested eukaryotes evolution and one of the possible reasons for the low primary production, therefore, the low level of atmospheric oxygen towards the late Paleoproterozoic Era.