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Conference Abstract

Emergence of the 2.1 Ga Francevillian biota was preceded by unprecedented hydrothermally driven seawater eutrophication

Ernest Chi Fru[‡], Jérémie Aubineau[§], Olabode Bankole[|], Mohamed Ghnahalla[|], Landry Soh Tamehe[¶], Abderrazak El Albani[|]

‡ Cardiff University, Cardiff, Wales
§ Montpellier University, Montpellier, France
| Poitiers University, Poitiers, France
¶ China Nonferrous Metals (Guilin) Geology and Mining Co. Ltd, Guilin, China

Corresponding author: Ernest Chi Fru (chifrue@cardiff.ac.uk)

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Abstract

Recently, two independent studies suggest that the emergence of putative fossilized macro-eukaryotes in the Paleoproterozoic Francevillian Basin, ~2.1 billion years ago, may be related to a rise in seawater Zn bioavailability. This explanation is reliant on their extraordinary high Zn content and association with light Zn isotopes characteristic of eukaryotic enrichment. However, the trigger and origin of rising seawater Zn supply to the basin remains unknown. This study unravels a transient episode of intense submarine hydrothermal activity that triggered the weathering of a nutrient-rich oceanic crust reservoir, related to the collision of the Congo-São Francisco cratons during the Eburnean-Transamazonian orogeny, as the source of abundant seawater dissolved Zn, together with a suite of essential trace metals and phosphate to the continental margin waters. Surprisingly, the initiation of hydrothermal weathering coincided with the rapid onset of a rare Paleoproterozoic seawater eutrophication event. This transition is marked by basin-wide redox stratification, high sediment loading with organic carbon (C_{org}) and nitrogen, elevated C/N ratios, a steep negative C_{org} and positive bulk N isotope excursion, positive Ce anomalies, and low Mn/Fe ratios. Importantly, the transient eutrophication event ended

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with a reversal to lower seawater phosphate levels that coincided with rapid seawater ventilation and the appearance of macrofossil bearing sediments in Franceville. We suggest that these unexpected, localized conditions, set the stage for the emergence of the Francevillian biota.

Keywords

Francevillian biota, Nutrient enrichment, Dissolved seawater phosphate, Trace metals, Biological evolution

Presenting author

Ernest Chi Fru

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Conflicts of interest

The authors have declared that no competing interests exist.