

Transient and stepwise ocean oxygenation during the Ediacaran Shuram Excursion

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The Ediacaran Shuram Excursion (SE) was a key episode in the history of atmospheric and oceanic oxygenation that has also been linked to contemporaneous bio-evolutionary events. However, key aspects of the redox state of Ediacaran oceans during the SE remain unknown. Here, marine-carbonate-associated uranium isotope compositions ($\delta^{238}\text{U}$) were used to investigate shallow-water oxygenation during the SE. We found that the onset of the SE was characterized by a shift toward higher $\delta^{238}\text{U}$ values, which is present in widely separated coeval sections, including in South China (from -0.8‰ to -0.3‰), Siberia (from -0.75‰ to -0.3‰), California (from -0.75‰ to -0.3‰), and Mexico (from -0.7‰ to -0.3‰). Our $\delta^{238}\text{U}$ record, in combination with published magnetostratigraphic and astrochronological data, reveals a distinct and transient oceanic oxygenation event that lasted $\sim 6.8\text{-Myr}$. The $\delta^{238}\text{U}$ signal exhibits a $\sim 0.65\text{-Myr}$ lag relative to the Shuram $\delta^{13}\text{C}_{\text{carb}}$ excursion owing to a two-step oxygenation event during the onset of the Shuram Excursion.

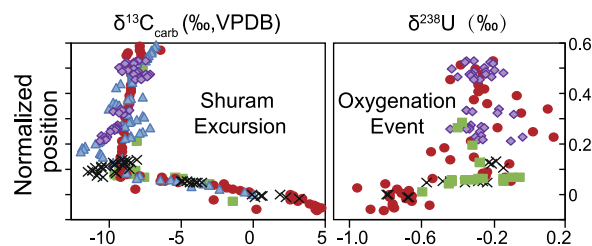


Fig. 1. $\delta^{13}\text{C}_{\text{carb}}$ and $\delta^{238}\text{U}$ profiles of the onset of the SE.