Transient and stepwise ocean oxygenation during the Ediacaran Shuram Excursion

ZHENG LI1*, MENGCHUN CAO2, SEAN J. LOYD3, THOMAS J. ALGEO1, 4, XIANGDONG WANG1*, LAISHI ZHAO1*

1 State Key Laboratory of GPMR, China University of Geosciences
2 School of Geosciences, China University of Petroleum, Qingdao
3 Department of Geological Sciences CSU, Fullerton
4 State Key Laboratory of BEG, China University of Geosciences
5 Department of Geology, University of Cincinnati
*Corresponding authors: zihengli@cug.edu.cn

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 (δ238U) 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 δ238U 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 δ238U record, in combination with published magnetostratigraphic and astrochronological data, reveals a distinct and transient oceanic oxygenation event that lasted ~6.8-Myr. The δ238U signal exhibits a ~0.65-Myr lag relative to the Shuram δ13C_carb excursion owing to a two-step oxygenation event during the onset of the Shuram Excursion.

Fig. 1. δ13C_carb and δ238U profiles of the onset of the SE.