

Multiple oxygenation events during the Ediacaran Period – Mo isotope evidence from the Nanhua Basin

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The Ediacaran Period (~635Ma to ~540Ma) was a very eventful part of Earth history. Fossil records indicate several important biological and environmental events, including pulses of elevated oxygen levels. To better understand the evolution of ocean redox states and to estimate the extent of seafloor oxygenation during this period, this study analysed the molybdenum (Mo) isotope compositions and redox sensitive element concentrations (RSE) from a continuous, mid-slope section of the Doushantuo Formation (~625--~551 Ma) of the Nanhua Basin on the South China Craton. Here we also present an updated compilation of these new and published Mo isotope and RSE data for the Ediacaran Period.

The Mo isotope compilation shows temporal variations in redox-related Mo sinks, revealing how the oceans experienced multiple, transient ocean oxygenation events (OOEs). Our new Mo isotope and RSE data confirm that three OOEs (~630 Ma, ~580 Ma, and ~560 Ma) occurred within an overall globally anoxic Ediacaran ocean, with the last, particularly extensive event during deposition of Doushantuo Member IV. These oxygenation events correlate well with the first appearance of Ediacaran fossil groups and so may have triggered or stimulated biotic innovations and radiations. Moreover, the spatial distribution of the Mo data supports the episodic expansion of an euxinic wedge on the slope of the Nanhua Basin, which could help to confirm pyrite burial as a potential cause of the oxygenation.