Increased organic carbon burial during the Ordovician–Silurian glaciation recorded by Zn isotopes

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In modern oceans, burial of organic/sulfide-rich sediments could increase zinc isotope ratios of seawater, which is mass-balanced by sinks of oxic sediments enriched in isotopically heavy Zn. Zinc isotopes may thus be utilized to trace changes of redox condition and organic carbon burial in the past oceans. The Hirnantian glaciation is coeval and causally linked with the Late Ordovician biocrisis, the second most devastating extinction of the 'Big Five' Phanerozoic mass extinction. The mechanism or change in the carbon cycle that promoted this glaciation is still debated. Here we reported black shales and carbonates spanning Ordovician–Silurian (O-S) transition in South China to provide new constraints on the Hirnantian glaciation and the Late Ordovician mass extinction. A $\delta^{66}Zn$ elevation of ~ 0.2‰ in the Hirnantian glaciation could be generated by removal of Zn in organic phase, which indicates the increased organic matter burial. The larger organic matter reservoir during the Hirnantian glaciation could draw down the atmosphere CO_2, and leads to climate cooling. The positive shift in sedimentary Zn isotope compositions in this study supports the assumption of the high burial rate of organic carbon across the Hirnantian glaciation which is also indicated by a global positive carbon isotope excursion, and demonstrates the proxy potential for Zn isotope compositions in the black shales in the study of sulphur and carbon cycling in the past oceans.