Zn-Sr isotope evidence for sea-level falls and constraints on the Frasnian-Famennian mass extinction

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The Frasnian-Famennian (F-F) biotic crisis, ~372 Ma ago, is one of the "Big Five" mass extinctions during the Phanerozoic and also referred to as the two-step "Kellwasser Event". This mass extinction event particularly caused long-term stepwise demise of shallow-water tropical species (e.g. corals, stromatoporoids, brachiopods and ammonoids). The trigger for the catastrophic event is debated and has been typically ascribed to sea level fluctuation, microbial bloom, volcanic/hydrothermal activities, marine anoxia, climate change and/or bolide impact.

Zinc is an essential micronutrient and Zn isotopic composition ($\delta^{66}Zn$) of marine carbonate is markedly higher than those of volcanic rocks and deep seawater[1]. Zn isotope variation of carbonates has been utilized to study environmental changes of the past oceans[2]. Here we present for the first time $\delta^{66}Zn$ and and $^{87}Sr/^{86}Sr$ isotopic data obtained by sequential leaching procedure for carbonate rocks across the F-F boundary from the Fuhe section in South China. Both $\delta^{66}Zn$ and $^{87}Sr/^{86}Sr$ values increase in the Lower and Upper Kellwasser Horizons, and the two lowest values of $\delta^{66}Zn$ occur immediately before the Lower Kellwasser Horizon and after the Upper Kellwasser Horizon, respectively.

The coupling of elevated $\delta^{66}Zn$ and $^{87}Sr/^{86}Sr$ values suggests that the positive shift in seawater $\delta^{66}Zn$ most likely resulted from input of isotopically heavy Zn of the carbonate influx from carbonate platform weathering induced by relative sea-level falls. This interpretation is in accordance with the fact that the F-F mass extinction is almost limited to the shallow-water tropical species, and the deep water species are affected very little.

[1] Pichat *et al.* (2003), *Earth Planet. Sci. Lett.* **210**, 167-178.
[2] Liu *et al.* (2017), *Geology* **45**, 343-346.