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Enhanced continental weathering as a trigger for the Hangenberg Crisis: Role of land plants in regulating Late Devonian climate

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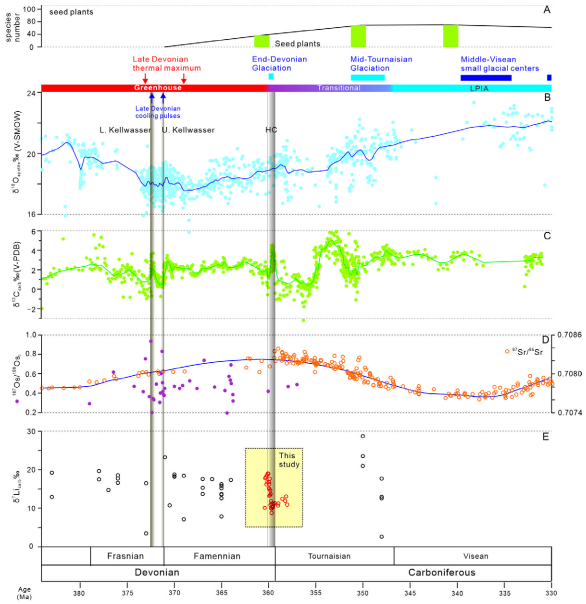

The Hangenberg Crisis (HC) coincided with a large decline of marine biodiversity and widespread expansion of anoxia in the end-Devonian ocean. Previous research linked marine anoxia to increased nutrient fluxes caused by the spread of deeply rooted plants [1] and/or increased volcanic activity on the continents [2], although the internal links have not been fully explored. Here, we propose enhanced weathering as a fundamental trigger, as evidenced by a negative shift of ~8‰ in lithium isotopes (δ^7Li) and a coupled response in the carbon isotopic composition of marine carbonates in the Longmenshan section of South China. Our findings imply that rapid weathering of crustal rocks increased nutrient delivery to the ocean, as indicated by an increase in the abundance of carbonate-associated phosphate (CAP), contributing to oceanic eutrophication and anoxia. Relationships among weathering, productivity, and redox proxies demonstrate that the HC was a "weathering-driven" event, in contrast to most other Phanerozoic crises, in which weathering served to stabilize climate change ("weathering thermostat") [3]. In the absence of massive carbon inputs and intense orogeny during the HC, the cause of enhanced continental weathering is likely to have been expansion of the terrestrial rhizosphere, highlighting the potential for land plant evolution to initiate weathering changes of sufficient severity to trigger a major bio/environmental crisis in the Earth system.

References:

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