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Chemical weathering response to hydroclimate and soil erosion from Li isotopes in Brazilian speleothems

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Chemical weathering of rocks supplies nutrients to the ocean and draws down atmospheric carbon dioxide, making it a key process in the global carbon cycle. However, the response of chemical weathering to a range of climate variables is not well constrained, either for the past or the future. Obtaining better constraints on the past temporal variability in terrestrial weathering at a catchment scale could therefore help improve this understanding.

Recent studies have used lithium (Li) isotopes to explore the controls on chemical weathering processes over seasonal timescales, with measurements on cave drip-waters indicating an important control of fluid residence times [1], and similar findings being obtained on river waters [2]. These studies open the way for combining Li isotopes in speleothems [3] with multi-proxy reconstructions to assess the climatic controls on past weathering processes over centennial to orbital timescales.

Here, we present Li isotope records from a suite of well-characterised Late Pleistocene and Holocene speleothems from Central Eastern and Northeastern Brazil. These records allow us to assess the effects of millennial-scale precipitation changes during the deglaciation and Meghalayan soil erosion during the Holocene, which were independently reconstructed using other proxies [4,5]. Overall, a comparison of these records indicates a rapid coupling between local hydroclimate and chemical weathering processes in the overlying soils and karst, providing better constraints on the controls on weathering, as well as indicating the potential use of Li isotopes to help constrain the interpretations of other proxy records.

References

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