Rapid response of silicate weathering to climate change: evidence from Li isotopes in the Changjiang delta sediment

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Li isotopes have been proven to be a powerful proxy for indicating silicate weathering over the geologic past. However, sediment provenance change and sedimentary recycling during source-to-sink transport processes can impose serious biases on the recognition of weathering signals registered in the siliciclastic sediments in shale–rich large basins. The Changjiang (Yangtze River) is featured by complex lithologies and monsoon climate regimes in its vast catchment. During the past 14 kyr, the different tempo-spatial variations of Indian Summer Monsoon and East Asia Summer Monsoon might have imprinted the changes of sediment provenance and silicate weathering. These aspects will be investigated using Li isotopes measured in the clay fractions, together with Nd isotopes, mineralogy, major and trace elements, from Core CM97 located in Changjiang Delta.

First results indicate that clay δ^7Li values vary within a restricted range during the last 14 kyr, from –2.7 to –1.1 ‰, with an average value of –1.6 ‰. It is noteworthy that Li isotopes in the core clay fraction responded directly and rapidly to climate changes in cold period, showing obvious co-variations with climate proxy at 14-11 ka. In contrast, δ^7Li values remain constant during the early and mid-Holocene warm period. With the robust constraint of sediment provenance changes by Nd isotopes and clay minerals, we infer that sediments from the upper reaches was further weathered in the mid-lower reaches during the transportation/deposition process in cold peroid, responding to climate fluctuation. However, during the warm period, strong rainfall and higher leachaing rates might explain the smoothing of the Li signals in clays (Bastian et al., 2017), mostly inherited from the upper mountainous catchment. We will refine these interpretations based on additional analyses on river sediments.

Bastian, L., Revel, M., Bayon, G., Dufour, A., Vigier, N. 2017. Abrupt response of chemical weathering to Late Quaternary hydroclimate changes in northeast Africa. Scientific reports, 7, 44231.