# Li isotopes : The ideal weathering tracer?

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The development of MC-ICPMS techniques has led to a considerable increase of Li isotopic data availability. Lithium has two isotopes, $^{6}$Li and $^{7}$Li which are particularly fractionated during low temperature water-rock interactions. The residence time of Li in the ocean is about 3 Myr which makes it a very good tracer of global surface geodynamics over geological time. Records of Li isotopes in the ocean are now available [1]

We have investigated the behavior of Li isotopes through the continental water cycle, by analyzing Li in large river materials, both solid and dissolved, as well as Li in smaller catchments.

Compared to other non-traditionnal isotopes, Li isotopes are highly discrimated during water rock interaction at the surface of the Earth, with a systematic enrichment of $^{6}$Li in the solid residue of weathering and a complementary $^{7}$Li enrichment in the dissolved load. Li is well partitioned between the solids and the dissolved phase, allowing us to measure isotopic differences between the weathering residue and the parent rocks and to establish and use mass budgets.

From our new data set, we infer that:

Li isotopes in the dissolved load are controlled by the precipitation of secondary minerals, occuring eiher in soils or in weathering “hot spots” in large watersheds (e.g. floodplains). Although shown in the data, the involvment of Li in the biological cycle is very weak.

Li in the river sediments traces the mixing between present-day weathering products and weathering products inherited from the geological past. Therefore, Li isotopes open the *pandora box* of the importance of geological legacy and continental reclycing on chemical weathering fluxes at the the global scale.

According to these conclusions, Li and its isotopes hence constitute an extremely powerful tracer of chemical weathering integrated over geological time.

[1] Misra and Froelich, 2012, *Science*. **335** **(6070)**: 818-824

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# Evidence for elevated Iron flux to the Early Phanerozoic Ocean

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The Great Unconformity marks the end of a protracted episode of continental denudation that affected most of Laurentia and other continents worldwide. The processes that ultimately led to the formation of this geomorphic surface exposed crystalline basement rocks to atmospheric weathering over an area that is unprecedented in the rock record. An elevated flux of continental weathering products, immediately prior to and during the Sauk Marine Transgression, is suggested to have resulted in unique seawater chemistry during the terminal Ediacaran and Cambrian. In this study, we used whole rock geochemical data to quantify the patterns of alteration of basement rocks underlying the Great Unconformity to better constrain the chemical weathering flux to the oceans during this critical transition in the history of life. We analysed samples from seven weathering profiles developed into both felsic and mafic basement rocks at three localities in Colorado and Arizona. Our results are similar to those of Driese *et al* (2007) who also studied Cambrian weathering profiles below the Great Unconformity. Observed cation losses are similar to those found in modern weathering profiles, with the exception of Fe, which was depleted in these profiles. Thus, under Cambrian weathering conditions, Fe was preferentially leached, rather than accumulated. These results imply an elevated weathering flux of $Fe^{3+}$ to the oceans from an exceptionally large area of exposed crystalline basement. This flux may have had several important consequences, including stimulation of primary productivity and enhanced burial efficiency of C-org, and thereby may have contributed to a rise in $pO_2$ during the Terminal Neoproterozoic-Early Ordovician.

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