Large variations of lithium isotopic compositions in the Congo river system trace two contrasted weathering regimes on a flat continental setting

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Lithium and its isotopes (^{7}Li and ^{6}Li) are a promising and robust tracer of chemical weathering of continental silicate rocks. Secondary minerals formation during chemical weathering is accompanied by the preferential incorporation of ^{6}Li, what drives the dissolved lithium isotopic composition (δ^7Li) of waters toward values much higher that the source rocks in general. Here, we investigate the dissolved δ^7Li of the Congo river, the second largest watershed in the world.

Dissolved δ^7Li at Kinshasa over the year 2010 vary from 14‰ to 22‰ and is negatively correlated with the discharge. On the basis of the relationship between dissolved δ^7Li and both ^{87}Sr/^{86}Sr (a source tracer) and Li/Na, we suggest that this large variation can be explained by the mixture between waters inherited from two extreme continental weathering regimes: one end-member with high δ^7Li (≈ 25‰) representing waters washing out from lateritic soils covering the periphery of the basin and in which Li is highly sequestered (≈ 75%) into secondary minerals products and another one represented by black rivers with low δ^7Li (average of 5.7 ± 0.11‰, N = 2) coming from the swampy central depression in where secondary mineral products initially formed in lateritic soils are redissolved in the organic-rich upper layers of the soils.

Our results show that δ^7Li is a conservative tracer in the Congo river system and that rivers draining flat continental areas, although typical of « transport-limited » regime can exhibit very contrasted dissolved δ^7Li and not only low values as it is usually thought.