Black shale weathering in Mackenzie Basin: constraints from barium isotopes

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On the long term, the Earth climate is influenced through two different types of chemical weathering. On the one hand, the dissolution of silicate rocks by carbonic acid removes atmospheric CO_2 and scavenges it into carbonate rock. On the other hand, the dissolution of carbonate rocks by sulfuric acid, deriving from pyrite oxidation, releases CO_2 into the atmosphere [1].

Although global fluxes of chemical weathering by carbonic acid are relatively well constrained, the quantification of carbonate weathering by sulfuric acid remains difficult [2].

In the Mackenzie Basin, river dissolved Ba abundance and isotope composition are controlled by the dissolution of two mineral types: silicate minerals and barite. As barite is strongly enriched in pyrite-hosting black shales, the variations of dissolved Ba concentration and isotope composition are tightly related to the release of sulfuric acid from pyrite oxidation. Using dissolved Ba isotope composition, we estimate the release of cations to rivers through carbonate *vs*. silicate weathering, by carbonic *vs*. sulfuric acid. The inferred CO_2 release from carbonate weathering by sulfuric acid are in agreement with a previous study based on S isotopes [1]. We then discuss the possible controlling factors of the CO_2 release by carbonate weathering by sulfuric acid in the Mackenzie Basin, and compare our findings to previously published data on weathering as a source of atmospheric CO_2 in other contexts.

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