Impact of past steel-making activities on lanthanides and Y (REY) fractionation and potential mobility in riverbed sediments

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The increasing use of REY is disrupting their natural biogeochemical cycles and causing toxicity to aquatic organisms(1). Indeed, anthropogenic disturbances have been reported in riverine water, suspended matter and sediments worldwide. The harmful effects of REY are not solely linked to the relatively recent production of technology tools, but also to historical anthropogenic activities, especially those involving steel-making(2). To date, the environmental risk of REY have received little attention because it is perceived as relatively low in comparison to other more abundant metals. Moreover, the forms in which anthropogenic REY are trapped in river sediments and the processes that control their mobility from sediment to the water column need to be further investigated in order to evaluate potential biological and human health threats.

This contribution investigates the REY distribution in sediments of the Orne River, Northeastern France; those sediments were proven to be highly impacted by steel-making wastes, like blast furnace sludge(3). For selected sediment layers of cores that were collected along the Orne river course, we applied complementary geochemical techniques to quantify total REY contents. The results indicate that the industrial processes that had occurred in the blast furnaces generated a REY pattern that contrasts with the natural pattern that is identified in lithogenic sediments.

To determine the potential mobility of REY from sediments to the water column, the desorption capacity was investigated by acid leaching (0.05N acetic acid, 1N HCl, 2N HNO_3). REY stored in anthropogenic sediments appear more refractory to leaching than natural sediments. The preliminary results indicate that these old anthropogenic materials trapped in river sediments do not create any actual REY pollution in this river system.

(1)Gonzalez et al, 2015. Environ. Pollut. 199,139-147.
(2)Hissler et al, 2016. Environ. Sci. Technol. 50, 4624−4631.
(3)Kanbar et al, 2017. Sci. Tot. Environ. 599-600, 540-553.