REE patterns along the Moselle River: effect of geology and land use

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Rare Earth Elements (REEs) are naturally found in water systems because of rocks weathering. Depending on the geogenic signature of soil, REEs natural concentrations can differ [1]. Furthermore, REEs have wide and growing applications in high efficiency electronics and energy technologies. These anthropogenic uses have already disrupted the geochemical and biological cycles of REEs and led to enrichments of La, Ce, Sm, and Gd in waters. In the case of anthropogenic La and Sm, enrichments come from a punctual and steady source (catalyst plant) [2]. For anthropogenic Gd, pollution is widespread and derives from conventional wastewater treatment plants (WWTPs) wich are not able to remove the organic complex form of Gd used in MRI analyse [3].

The French part of the Moselle River is 314 km long and flows through different geological units (granite, gneiss, limestone) from its source to the Luxembourg border. The population density and the land use (forestry, agriculture, industry) vary along the river's course which receives the effluents of several WWTPs. River water is also used for drinking water production for the city of Nancy and its area.

Spatial and seasonal changes in REE concentrations were investigated in the French part of the Moselle river and in some of its tributaries to detect the presence of REEs anomalies linked to geological or anthropogenic factors (population density, land use, number of MRI facilities). REEs patterns of water passing through limestone (in the uppermost part of the basin) show light REEs depletion compared to REEs patterns of water passing through granite. Positive Gd anomaly is visible for samples taken downstream of WWTPs discharges.

[1] Sholkovitz (1992), *Earth Planet. Sci. Lett.*, vol. 114, nº 1, p. 77–84. [2] Kulaksız & Bau (1993), *Earth Planet. Sci. Lett.*, vol. 362, p. 43-50. [3] Verplanck *et al* (2015) *Environ. Sci. Technol.*, vol. 39, nº 18, p. 6923-6929.