**Bioavailability of anthropogenic gadolinium and other anthropogenic rare earth elements in surface waters**

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The rare earth elements (REE) belong to the group of particle-reactive elements and occur at ultratrace levels in natural waters. Recently, these high-tech metals received significant public attention, as they are of great economic importance, and consumption and hence release into the environment have sharply increased.

The most prominent example of a REE (micro)contaminant is anthropogenic Gd which is derived from Gd-based contrast agents used in magnetic resonance imaging. Due to their high stabilities, these compounds are not readily removed by commonly applied waste water treatment technologies and, therefore, are released from treatment plants into surface waters. Hence, this anthropogenic Gd can be used as a tracer for the presence of waste water-derived substances such as pharmaceuticals and other xenobiotics in river, lake, ground and tap waters.

Over the past 20 years, anthropogenic Gd has been identified in numerous surface waters in Europe, North America, Asia and Australia. Recently, it was detected for the first time in South America, in Lake Paranoá in Brazil. Lake Paranoá is an artificial reservoir in the Brazilian capital Brasilia, and is currently considered a potential freshwater resource. The city’s two waste water treatment plants are located on its shore and their effluents are discharged into the lake. To investigate the level of contamination, we took water samples at 11 stations in the lake. All samples show pronounced positive Gd anomalies, revealing the presence of waste water-derived anthropogenic Gd in the lake waters. The presence of anthropogenic Gd indicates that other waste water-derived substances with potential (eco-)toxicity may also be present in the lake water. This needs to be further investigated and monitored before using the lake water as a drinking water resource.

The same microcontamination with anthropogenic Gd was observed in the Rhine River, Germany. In addition, the Rhine River is also microcontaminated with anthropogenic La and Sm, discharged from a local industrial point source. In order to assess the bioavailiability of all these anthropogenic REEs, we analyzed the shells of the freshwater bivalve *Corbicula fluminea*, collected at 10 sites along the Rhine River. The geogenic REEs are incorporated into the shells of *Corbicula fluminea* as they are incorporated into inorganic calcite, indicating that vital effects do not have a crucial impact on their incorporation. There is no discrimination against the incorporation of anthropogenic La and Sm, the aqueous speciation of which are dominated by the same inorganic complexes that dominate the speciation of the geogenic REEs. In contrast, anthropogenic Gd is not incorporated into the shell, probably due to the fact that it still occurs as the very stable organic complex species designed for use as contrast agents. This shows that while the anthropogenic La and Sm are bioavailable, the anthropogenic Gd is not, corroborating the conservative behaviour of anthropogenic Gd which may be used as a pseudo-natural tracer.