Cases of uranium accumulation and mobilization in the German Triassic

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The occurrence of elevated U concentrations in groundwater and drinking water is of growing scientific and societal concern worldwide mainly due to the carcinogenic and nephrotoxic character of the heavy metal [1]. Uranium is an incompatible element in the course of magmatic differentiation, and therefore accumulates in late cooling lithologies and sediments derived from their erosion.

In Germany, sedimentary basins were successively filled with eroded material from Variscan ranges during Triassic times. Especially the southern parts (Moldanubian Variscides) show highly differentiated provenance, and hence, associated Triassic sediment basins yield a high U potential. This is the case for the Keuper basin in northern Bavaria where U was synsedimentarily accumulated in apatite [2] or dolomite [3]. Remobilization in the course of water-rock-interaction processes resulted in regional groundwater U concentrations above drinking water guideline values.

But also farther north, outcropping Triassic sediments derived from erosion of lesser differentiated provenance (Rhenohercynian Variscides) account for elevated U, albeit anthropogenic action contributes to its mobilization. Close to the Dutch border, Buntsandstein aquifers yield U whose mobility appears to be driven by agricultural nitrate reduction and associated U(IV) oxidation in the subsurface. On the German island of Heligoland in the North Sea, managed aquifer recharge remobilizes concretionary U from a mainly carbonatic pool in Buntsandstein sediments [4].

This work summarizes and compares these different cases of geogenic U occurrences in used Triassic aquifer systems to improve the understanding of the dynamics of a trace element which increasingly finds itself in the focus of environmental and toxicological research.

[1] Bjørklund *et al.* (2017) *Environ. Res.* **156**, 526-533. [2] Banning & Rüde (2015) *Appl. Geochem.* **59**, 139-146. [3] Steffanowski & Banning (2017) *Environ. Earth Sci.* **76**, 508-518. [4] Meurer & Banning (2019) *Grundwasser* **24**, 43-50.