Peat deposits as natural uranium filters? - First results from a case study in a dolomitic gold mining area of South Africa.

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Peat in South Africa is a generally scarce resource, especially in the semi-arid interior plateau where the studied peatland is located. The peatland owes its existence to a strong perennial flow of groundwater discharged from the Gerhard Minnebronn (GMB) Eye (spring) mainly used for irrigation and domestic purposes by local farmers and a downstream municipality of some 300.000 people.

The GMB eye is part of an extensive karst system which upstream is severely impacted on by deep level gold mining. Apart from large-scale dewatering of several karst compartments, past and current mining operations pollute not only the Wonderfonteinspruit (WFS) as major drainage line in the area but also dolomitic groundwater. Such pollution arises from a variety of point and non-point sources such as tailings dams and associated seepage, mine effluents and tailings-filled sinkholes to name but a few.

Owing to the well-known ability of peat to remove U and other heavy metals from polluted waters for which it is used in industrial filters, it anticipated that the GMB peatland may potentially serve as a natural buffer between polluting mines and downstream users. Such buffer or filter function would be of particular importance in a possible post-mining scenario where the GMB eye could well be the largest of three karst springs through which large volumes of highly contaminated mine water are expected to decant.

Being located well outside the mining area and the (surface) catchment of the polluted WFS direct impacts of mines on the peatland are unlikely under current conditions. Nevertheless there are indications that indirect impacts e.g. via underground karst networks at least temporarily exist.

This paper outlines the hydrogeological setting and characterises pollution sources as well possible pathways. It also explores different methods to assess in how far, under historic and current conditions, the peatland acts as a filter and sink for miningborne pollutants such as U.

First results suggest that the peatland contributes approximately double the volume of water previously thought, considerably increasing its potential significance as filter. At the same time, however, a significantly deteriorating quality of water flowing through the peatland questions such function. The latter could however also be explained by several areas where polluted water enters the wetland that have been detected, one of which displays a typical mining signature with elevated Au-, U- and SO_4-levels). Quasi-continuous datalogger records furthermore suggest that mining impacts may be triggered or magnified by rainfall events arriving at the eye with a 6-day delay. The exact source, mechanisms and pathways of these impacts are still unknown.

Any filter function of peat will be largely determined by the ability of peat to conduct water through its pores (hydraulic conductivity) and its capacity to adsorb and retain dissolved contaminants in the process (sorption capacity). In order to assess both parameters batch experiments with mine water currently decanting from a flooded mine void in the head water region of the WFS are envisaged.