Hydrochemistry and isotope geochemistry of coal mine drainage from the Ibbenbüren coalfield, Germany

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The colliery in the Ibbenbüren coalfield closed in December 2018 and now will be flooded. To facilitate the prediction of the future long-term development, a sampling campaign of the mine drainage and groundwater surrounding the coalfield was conducted in summer 2018. A coupled hydrochemical and isotopic approach is applied to identify the processes which govern the chemical evolution of the mine drainage.

Deep groundwater in the Ibbenbüren coalfield contains high loads in dissolved solids, exceeding several grams per litre. In contrast, the shallow groundwater in the part of the coalfield, which was abandoned already in 1979, is now characterised by high loads of dissolved iron and sulphate.

The coalfield is surrounded by Permian, Triassic and Jurassic sediments. The Sulfur isotopic composition of sulfate in waters, that are relatively close to the surface, points to pyrite oxidation as the main source of sulfate, with $\delta^{34}S$ values between -8,3 and +0,3 ‰. In contrast, the $\delta^{34}S$ values of the brines in the deepest part of the mine resemble the values of Upper Jurassic or Middle Triassic evaporates. In this case the infiltration of groundwater from outside of the coalfield is likely. The intermediate values are rather a result of mixing of the two endmembers, than being influenced by the surrounding Permian evaporites.

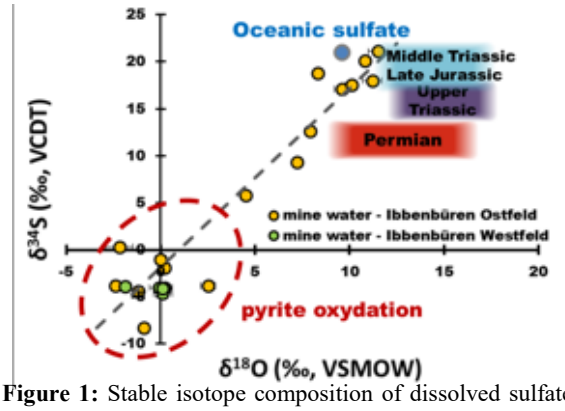

Figure 1: Stable isotope composition of dissolved sulfate in mine drainage from the Ibbenbüren coalfield indicating the source of sulfate