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The factors controlling formation and intensity of Acid Mine Drainage in the area of Polish part of Muskau Arch

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Exploitation of lignite at the borderland of Poland and Germany caused the formation of numerous post-mining reservoirs impacted by Acid Mine Drainage (AMD). The area under consideration is localized in the eastern part of the Muskau Arch, which is a pushed moraine accompanied by large-scale glaciotectionic disturbances connected with a lobe of Elsterian glaciation. [Fig.1]. It covers about 100 reservoirs, which water chemistry is far from the average composition of natural water bodies in Poland

[1]. It is a consequence of intensive weathering of pyrite (FeS_2), that is present in Miocene lignite-bearing rock forming the banks of the reservoirs. Finally this process leads to Acid Mine Drainage and heavy acidification and increase of sulphates and metals concentration in water. The major processes determining water chemistry are transformation of iron and sulfur, different in the particular depth zones of reservoirs. Isotopic analysis of oxygen and sulfur confirmed that the main importance in forming water composition is the pyrite oxidation [2].

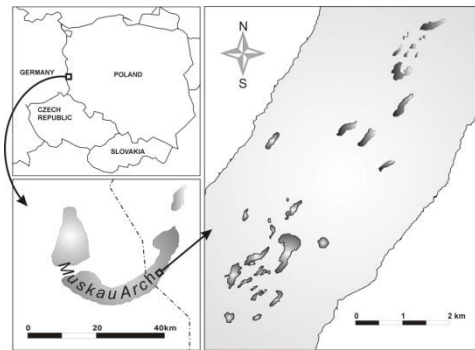


Figure 1: Location of the Muskau Arch

Some of reservoirs are characterized by larger fraction of groundwater of deep circulation, and they are enriched in the heavier isotope of sulfur, and the lighter isotope of oxygen. Waters of shallow circulation, recharging the shallower parts of the lakes, migrate mainly through the vadose zone, in presence of atmospheric oxygen, therefore they are characterized by greater participation of the heavier isotope of oxygen, than the waters of a longer residence in the circulation system. Evaporation in the surficial layers, during which the lighter isotopes preferentially diffuse into the atmosphere, leads to increase of the heavier isotope concentrations of oxygen.

The primary factors important for determining the rate of acid generation within the discussed area were identified and analyzed. Their recognition is the first step towards the prediction, prevention and mitigation of AMD formation in the Muskau Arch area.

References:

- [1] Lutyńska S and Labus K (2015) Arch Environ Prot 41(3): 60-69
- [2] Labus K and Lutyńska S (2014) Geol Q 57 (3): 561-566

