Hydrochemical characterization of water resource in the southeastern part of Senegal. Impact of mining in the Kedougou region

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In the Kedougou region, basement of Senegal, the establishment of mining companies has led to a rapid development of some villages through a massive influx of people from all regions of Senegal and neighbouring countries seeking employment in traditional industries or gold mines. In this context, the demand and use of water are increasing due to the large amount of water used by the extractive industry and traditional miners for ore processing. However, the latter could seriously affect the quality of this resource, as mercury is widely used in processing, such as gold washing and leaching of metallic trace elements.

This study aims to assess the chemical quality and geochemical processes of water mineralization as well as the impact of mining activities in surface waters and crystalline rock aquifers in Kedougou.

The methodological approach is based on geochemical investigation and GIS tools in relation to the geological background. Two field campaigns were carried out in May 2017 and June 2018 to measure physicochemical parameters and water sampling. A total of 66 water samples collected at boreholes, dug wells, stream and waste water from mining, were analysed at Graz University of Technology in Vienna to determine major elements and 21 traces elements concentration.

Binary plots between major ions show that the main mechanism of groundwater mineralization is rock/water interactions with: (1) hydrolysis of silicates of higher magnitude in the metasedimentary and granitic reservoir; (2) silicate minerals from the hydrolysis of sodi-potassium to potassium feldspar mainly control the geochemical processes in granitic reservoirs; (3) basic plagioclases, feldspathoids, amphiboles and pyroxenes control mineralization in the basic volcanic domain with more pronounced cationic base exchange. The piper diagram highlights the Ca/Mg-HCO_3 chemical facies that characterizes the majority of the samples. However, pollution is linked to urban waste in the case of nitrates and sulphates; and discharges and leaching from mining areas for iron, mercury, aluminium, cobalt, manganese, nickel, lead and arsenic. Regarding surface waters, silicate alteration appears to be the major geochemical process that controls mineralization with an additional supply of anthropogenic sulphate and/or chloride ions. As a result, the health of local populations is endangered, with risks of congenital, heart, respiratory and dermal diseases as well as a multitude of cancers.

Keywords: Geochemistry, Kedougou, basement aquifer, mining, pollution