



Natural constraints and the damaged Meli gold mining: forecasting impact on the water resources quality of the Meli area and the surroundings, Tigray

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Abstract: Meli is the only modern gold mining site in the Tigray region, Northern Ethiopia. Water resources of this area and the surroundings are currently very susceptible to pollution by toxic chemicals than ever before, due to both the natural geological setup of the area and anthropogenic impacts, specifically because of the recent war in northern Ethiopia. The war that was started on November 03, 2020, resulted in the complete destruction of the mining company and tailings dam due to bombing. This potentially could lead to the uncontrolled movement of wastewater from the dam to the environment. The area is characterized by quite complex geology and associated geological structures. In addition to the direct flow of contaminant plumes to downstream areas as surface water, the naturally existing geological fractures, as well as faults, could also act as conduits and increase the infiltration rate of the pollutants to the groundwater resource. In this research, integrated geological, structural, and remote sensing methods were applied. Mapping of geology and geological structures was compiled using both Spot and Landsat satellite images and a physical field survey conducted before the war started. Metavolcanics, metasediments, granite, and sandstone are the identified lithologies in the area. The detailed fracture measurement helps determine the possible flow direction of water and the pollutants. Totally, 110 structural measurements were taken, and the area is affected by a series of Neoproterozoic structures. These include WNW-ESE striking compression, NE –SW striking

exfoliation fractures, and variably oriented faults. Moreover, structures such as folds, minor strike-slip faults, and joints were observed. The chemicals used in the gold mining company were evaluated. The Meli area tailing dam contains wastewater with a very high concentration of cyanide, caustic soda, heavy metals, and salts which are very toxic. The possible impact of these pollutants on water resources was forecasted and threat-solving mechanisms were proposed. The result of this research work will serve as a baseline for further pollution impact studies at a larger catchment scale and as an input for groundwater resource pollution modeling works of the Meli area and the surroundings.