Assessment of Groundwater Quality and its Suitability for Domestic and Agricultural Purposes in parts of the Central Region, Ghana

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Abstract

Groundwater in parts of the Central Region of Ghana was assessed to determine its suitability for domestic use and irrigation activities. Stiff and Piper diagrams show that the predominant water type in the area is Na-Cl, which is characterized by relatively high salinities. This water type occurs in aquifers underlying six coastal districts, namely; Abura-Asebu-Kwamankese (AA), Mfantseman (MF), Gomoa East (GE), Awutu Senya (AwS), Effutu (EF) and Cape Coast (CC). Other water types are Ca-HCO₃, Ca-SO₄ and Ca-Cl, that occur in districts located further away from the coast. Silicate weathering and ion exchange are identified as the geochemical processes responsible for the various ions in the groundwater. Possible processes that could be responsible for the source of Na⁺ and Cl⁻ are sea water intrusion and dissolution of minerals. The results also show that the groundwater is mainly supersaturated with respect to both calcite and gypsum, indicating high concentrations of both bicarbonate and sulfate ions in solution. This is associated with considerable enrichment of the groundwater with sulfate, bicarbonate, and calcium ions. On a Wilcox diagram, the groundwater samples, mainly from the districts coded as AA, TLD, AS and AN, which are located away from the coast, plot within the “excellent to good” category, suggesting that water from the area is of acceptable quality for irrigation purposes. Similarly, Sodium Adsorption Ratio (SAR) and conductivity values for the groundwater in the AA, TLD, AS and AN districts indicate low SAR and low to medium salinity respectively. Groundwater in aquifers underlying these districts is therefore suitable for irrigation. Generally, groundwater samples from locations along the coast have high salinity and are not suitable for domestic and irrigation purposes. However, about 72% of the water samples predominantly in districts located away from the sea is suitable for the purposes stated.