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Identifying groundwater contamination sources in the Anayari Catchment using isotopes and hydrochemistry

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Groundwater offers the most practical and safe source of water for most rural areas around the world. In the Anayari Catchment of the Upper East Region, it serves as a major source of reliable water for domestic and agricultural use. Application of fertilizer and manure to farmlands has the potential of leaching of nitrates, potassium and other nutrients into the groundwater which may cause water related health problems. Nitrate concentrations above the maximum contaminant level have been reported in parts of the Anayari Catchment. The hydrochemistry and environmental isotopes of 15N-NO_3- and 18O-NO_3- of the catchment is therefore being studied to identify the main sources of nitrate contamination in the groundwater and the chemical composition of the water types.

Hydrogeochemical assessment of the water samples using piper diagram, Wilcox saturation index and correlation analysis was done to detect the hydrochemical characteristics the groundwater from the area and its suitability for drinking and irrigation. From the statistical summary, the major ions are in decreasing order of Na+>Ca2+>Mg2+>K+ for cations and $HCO_3$2->Cl->SO42->NO_3->PO42-for anions. The dominant hydrochemical facies of the groundwater is Ca-HCO_3, mixed and Na-Cl type. Carbonate dissolution is likely to be the source of major ions in groundwater. Nitrate concentration ranges between 1.91mg/L to 30.5mg/L and about 51% of the samples exceed the maximum contaminant level of 10mg/L. Environmental isotopes of 15N-NO_3- and 18O-NO_3- of the samples would also be analysed to identify the main sources of nitrate contamination in the groundwater. The Wilcox diagram indicates that about 95% of the sampled groundwater is suitable for irrigation from the drinking water standard of the World Health Organisation (WHO) and the Ghana Standards Authority (GSA) most of the groundwater in the area is suitable for drinking.