EFFECT OF LOW pH OF GROUNDWATER IN RATHUPASWALA AREA, SRI LANKA: A CASE STUDY

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Abstract

Groundwater occurs in different type of aquifers under various geological conditions. Sri Lanka has a centrifugal pattern of groundwater movements which effectively controlled by the geomorphological characteristics of the terrain. This study is focus to Rathupaswala area in the western province which was highly controversial during the past due to low pH groundwater. The area is covered within Attanagalla basin which has dendritic drainage pattern. The lateritic aquifer system is common in the study area consisting of hard and soft laterite soil which is usually considered as a very good filter media for groundwater. The research is mainly aim to identify the mobility of selected trace elements (Fe, Mn, Cr, Zn, Cs, Sr, Rb, and Li) into the groundwater under prevailing low pH condition and to identify the water type of the area using selected major cations (Na^+, K^+, Ca^{2+}, Mg^{2+}) and anions (SO_4^{2-}, Cl^-, CO_3^{2-} and HCO_3^-) to investigate possible geochemical processes that can be take place under natural low pH.

Thirty (30) selected groundwater samples were collected from the shallow and deep wells and in-situ measurements of pH, Oxidation Reduction Potential (ORP), conductivity and turbidity were done just after collecting of the samples. Selected cations were analyzed using Atomic Absorption Spectrometer (AAS). In addition, sulfate analysis were done using nephelometer. Conversely element chloride, carbonate and bicarbonate were analyzed using respective titration methods. Multivariate statistical analyses were used to determine the correlations between the elements and the physiochemical properties by means of minitab14 software.

Average values of cations and anions and the physiochemical parameters indicate that lower effects on groundwater in the area. Results further show that strong positive relationship between Mg-Mn, Li-Rb and Na-K. Significant strong positive relationship between K-Mn. Positive relationships between Na-Mn and Na-Mg. Correlations between those elements may reflect the weathering evidences of ferromagnesian minerals available in the basement.

However, pH show negative relationship with Na, K, and Mg. This may reflect lack of sulfide bearing minerals with ferromagnesian minerals which usually help to create acidic pH for soil and water. This concluded that the lower pH is not due to mineral weathering in the basement in the area. Other elements such as Ca, Mn, Fe, Cu, Zn,

Li, Sr, Cs, Rb, chloride, sulphate and bicarbonate show very poor trends with pH. This further reflect possible evidences for lower impacts of mineral weathering on low pH groundwater. Conductivity shows positive relationships with Na, K, Mg and Mn which reflect salinity of groundwater is controlled from those elements and they considered as basic cations which help to buffer the lower pH. Only calcium shows stronger positive relationship with turbidity may be due to calcium carbonate sources. In general, it can be concluded that lower pH groundwater in the area is not directly associate with mineral weathering phases in the basement rocks.

Piper classification is used to determine the available water type. The classification indicate that the Na-bicarbonate water (51.6%) as the major water type present in the area and Ca-Na-bicarbonate (35.5%) type water is also dominantly present. In addition, few samples from the area reflect high concentration of Mn.

Key words – Groundwater, Low pH, Trace element, Piper plot, Correlations