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SOME HYDROCHEMICAL ASPECTS OF FLUORIDE-RICH GROUNDWATER IN FRACTURED ROCK AQUIFERS AND THEIR IMPLICATIONS – A CASE STUDY FROM TAMILNADU, INDIA

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Abstract

Fluoride contamination of groundwater is one of the major constraints in ensuring safe drinking water supplies to many habitations in several states in India. Fluoride is endemic in the hard rock aquifers in Salem, Dharmapuri and Erode districts of Tamil Nadu. Ensuring supply of safe drinking water to the affected populace in both rural and urban habitations continues to pose a serious challenge to the Government agencies dealing with drinking water supply in the state. The hydrochemical characteristics of fluoride-rich (F >=1.0mg/L) groundwater from fractured rock aquifers in the depth range of 50 to 150m below ground level in parts of Dharmapuri district, Tamil Nadu have been studied. Analysis of data indicates rock weathering as the dominant factor controlling the hydrochemistry of groundwater in fractured rock aquifers. Groundwater in these aquifers is found to be predominantly Ca-Mg-HCO_3 type. Fluoride does not show significant correlation with any major cation or anion. Strong positive correlations are observed between Ca and Mg and between Na + K and Cl. The weak negative correlation between F and PO_4 seems to indicate that application of phosphatic fertilizers does not contribute significantly to the increase in fluoride in the deeper aquifers. R-mode factor analysis of the standardized analytical data indicates that five factors account for about 81 percent of the spatial variability observed in the groundwater quality. The analysis also indicates that anthropogenic contamination is yet to pose any serious threat to the quality of groundwater in fractured rock aquifers in the area. The quality variations in the deeper aquifers are more likely due to the dissolution of minerals during weathering of silicate rocks in the area. The analysis also supports the theory about geogenic origin of fluoride in the groundwater. Findings of the study have implications on the source-finding for drinking water supplies and also on the selection of technologies for groundwater recharge augmentation measures.

Keywords: Groundwater quality, Fractured rock aquifers, Fluoride, Factor analysis, Anthropogenic contamination.