

Exploring the cause of Fluoride concentration in groundwater of a granitic aquifer: Geogenic or Anthropogenic?

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Fluoride (F⁻) concentration is an important aspect of hydrogeochemistry, because it is an essential ion in drinking water for all living beings from the health point of view. The chief source of fluoride in groundwater is fluoride bearing minerals and in some cases anthropogenic activities.

In India, about 62 million people, including 6 million children, suffer from fluorosis due to the high content of F⁻ in water. Most parts of Andhra Pradesh in India have highly endemic fluorosis zones. It is well known that groundwaters in granite aquifer are vulnerable to F⁻ contamination and most part of south India is covered by granites rocks and the main aquifers are in the granitic formation. A study was conducted in Maheshwaram watershed, Andhra Pradesh, India during 1999-2002 to analyse the influence of hydrogeological factors on fluoride concentration in pre and post monsoon seasons. The study area is mainly underlain by Granites of Archaean age. The water samples collected from 32 representative wells in the granitic aquifer during pre and post monsoon season were analysed for F⁻ and other ions and a detailed correlation analysis was performed. The presence of excess fluoride than the permissible limits as well as its high variability both in space and time is attributed mostly to geogenic processes. It is therefore imperative to study the water-rock interaction. CHESS, a computer program has been used to calculate ionic activities of aqueous species and the mineral saturation index (SI) for calcite and fluorite and also GARDENIA, another computer program was used to calculate the recharge values in the study area. The influences of dissolution kinetics of fluoride minerals in the host rocks and recharge from rainfall on fluoride concentration were compared. The results clearly indicated that fluoride content in groundwater depends on the interaction period of groundwater with host rock. The variation in Fluoride concentrations between pre and post monsoon seasons could be because the ionic concentrations in the groundwater during the post monsoon period were generally less than their counterparts during the pre monsoon period, because of dilution by rainwater. By contrast, the fluoride concentration in many places was relatively high during the post-monsoon period. This indicates contamination of groundwater from anthropogenic activities in addition to geogenic process due to greater contact zone. These findings are helpful in designing suitable remedial measures as well as demarcating various zones of F⁻ contamination.

Key words: Groundwater¹; Fluoride²; Hydrogeological parameters³