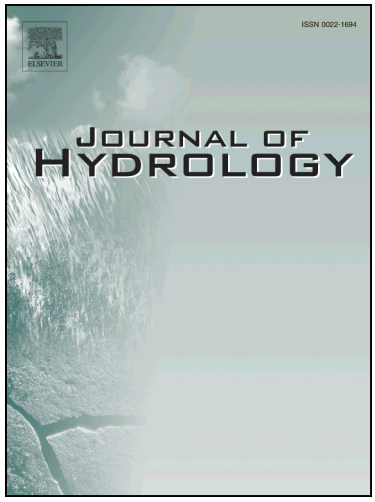

Research papers

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Coupled S and Sr isotope evidences for elevated arsenic concentrations in groundwater from the world's largest antimony mine, central China

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Abstract

The Xikuangshan(XKS) mine, the world's largest antimony mine, was chosen for a detailed arsenic hydrogeochemical study because of the elevated arsenic in bedrock aquifers used by local residents. Hydrochemical data, $\delta^{34}S$ values of dissolved SO_4^{2-} and $^{87}Sr/^{86}Sr$ ratios have been analyzed to identify the predominant geochemical processes that control the arsenic mobilization within the aquifers. Groundwater samples can be divided into three major types: low arsenic groundwater (0-50 μg/L), high arsenic groundwater (50-1000 μg/L) and anomalous high arsenic groundwater (>1000 μg/L). Arsenic occurs under oxidizing conditions at the XKS Sb mine as the $HAsO_4^{2-}$ anion. The Ca/Na ratio correlates significantly with HCO_3^-/Na and Sr/Na ratios, indicating that carbonate dissolution and silicate weathering are the dominant processes controlling groundwater hydrochemistry. The $\delta^{34}S$ values of the groundwater indicate that dissolved SO_4^{2-} in groundwater is mainly sourced from the oxidation of sulfide minerals, and elevated As concentrations in groundwater are influenced by the mixing of mine water and surface water. Furthermore, the $\delta^{34}S$ values are not correlated with dissolved As concentrations and Fe concentrations, suggesting that the reduction dissolution of Fe(Ⅲ) hydroxides is not the dominant process controlling As mobilization. The $^{87}Sr/^{86}Sr$ ratios imply that elevated As concentrations in