Chemical evolution and arsenic occurrences in groundwater of different tectono-morphic provinces of the Himalayan orogenic belt in the Brahmaputra river basin, India

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The present study deciphers the groundwater solute chemistry and arsenic (As) enrichment in the shallow aquifers of three different tectono-morphic settings of the Brahmaputra river basin, India. These regions consist the northwestern part, northern part and southern part of the Brahmaputra basin which shows distinct geology and tectono-morphic provinces in the Himalayas orogenic belt. The northwestern and northern parts are located along the Eastern Himalayas and southern part situated close to Naga-thrust belt in Brahmaputra river basin. Therefore, the sediments provinces are different in these areas. More than 60 % of groundwater samples in northwestern part are enriched with As (maximum concentration 0.13 mg/L), 65 % in northern part (maximum 0.17 mg/L), and 92 % in southern part (maximum 0.45 mg/L) respectively, which draws a distinct difference from the northern part of Brahmaputra basin aquifers. Most groundwater solutes of northwestern and northern parts were derived from both silicate weathering and carbonate dissolution, while silicate weathering process dominates in aquifers of southern part. Groundwater samples from all regions are postoxic with mean pe values between Fe(III) and As(V)-As(III) reductive transition. Positive correlations of As with Fe, Mn and HCO_3 were observed in northwestern and northern parts aquifers. Therefore, reductive dissolution of (Fe-Mn)OOH and combined effect of pH dependent sorption and competitive ion exchange are the dominant mechanisms of As mobilization. While, the lack of a consistent correlation of As with a single component indicate that there is no single factor controlling the concentration of dissolved As in aquifers of southern part.