Hydrogelogical and hydrochemical characterization of shallow high arsenic and deep low arsenic aquifers in Yinchuan Plain: A case study of deep aquifer development for domestic water supply

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Groundwater has been a strategic resource for the Yinchuan plain area where arsenicosis patients have been found in large number. An investigation is carried out to illuminate the different hydrochemical environment between high and low arsenic groundwater, and to address sustainable utilization of low arsenic groundwater resources by numerical modelling. The concentration of arsenic increases from the front of proluvial plain at higher elevation to the center of alluvial lacustrine plain. High arsenic groundwater show point distribution on local scale but display a regional pattern as a stripe in lacustrine plain areas. High arsenic groundwater is found between 10 and 40m depths of the aquifer in the unconfined and first confined aquifer. The arsenic concentration is generally less than 10μg/L between 60-250m, the second confined aquifer in the stratum deposit sample.

A three dimensional non-isotropic isotropy unstable groundwater model is established in Visual Modflow for the northern part of Yinchuan plain. Developmental scenarios were tested before demonstration production wells targeting the low arsenic phreatic water and second confined aquifer were installed. Yield of a single well is 1000-2000m^3/d with good water quality. Our research demonstrates that supply wells can be drilled in these areas. Piped water systems are needed to supply water to arsenic affected areas in Yinchuan plain.

The geochemical evolution of deep Ordovician limestone groundwater in the coalfield of North China

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The coalfield of North China whose coal output accounts for about 60 percent of China's total production is a very important energy base in China [1]. The groundwater in Ordovician limestone overlain by the Carboniferous strata and Permian strata is not only vital water resources, but a serious threat to mining safety [2]. So, the study on its geochemistry evolution is of great significance for safety of water supply and mining. Taking Yanzhou coalfield as a study case, the purpose of this research is to qualitatively analyze the possible geochemical evolution through major ion relations and quantitatively analyze it by PHREEQC program.

Twenty-nine groundwater samples were collected from the coalfield in Yanzhou. The main hydrochemical type was SO_4-CaMg, pH varied between 7 and 7.9, and total dissolved solids ranged from 1.54 to 2.05 g/L. The concentration of sulphate, chloride, bicarbonate ion, calcium, magnesium and the TDS increased along the groundwater flow path. We selected two reaction-paths to perform the geochemical inverse modelling by PHREEQC. The results of the modelling quantitatively explained the water-rock interactions which occurred between groundwater and major minerals (dolomite, calcite and gypsum). Along the flow path, gypsum and halite dissolved; dolomite and calcite dissolved or precipitated; ion exchange and sorption occurred. Because the water-bearing media of karst water was of high inhomogeneity, the geochemical evolution of groundwater along different reaction-paths was different.

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