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Review of Arsenic Geochemical Characteristics and Its Significance on Arsenic Pollution Studies in Karst Groundwater, Southwest China

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Abstract: As a metalloid element, Arsenic (As) is widely distributed in the natural environment. Its ingestion can cause cancer, deformities, and mutations. Therefore, it has become an important environmental problem in recent years. There are large amounts of arsenic ore and coal with high arsenic content in Southwest China, a karst area. There, arsenic accours in wastewater from mines contaminate soil, vegetation, and surface water. Karst underground aquifers are also contaminated through pipes, cracks, scuttles, and sinkholes, leading to a more serious arsenic pollution problem than in non-karst areas due to the unique karst hydrogeological conditions. To prevent and curb karst underground water contamination and guarantee water resource security and public health, a review on the arsenic contamination in the karst area is necessary. This paper discusses the progress of geochemical studies on arsenic. Through an analysis of the hydrogeology of karst areas, this paper proposes that studies on arsenic pollution in karst regions should be combined with the spatial distribution and redox characteristics of groundwater. More attention should be paid to chemical compositions of water, soil, and rocks as well as adsorption–desorption processes between water and sediment when conducting arsenic geochemical research in karst groundwater.

Keywords: arsenic pollution; geochemistry; karst; underground water

1. Introduction

Arsenic (As) is a metalloid element that is widely distributed in the natural environment and is known to be carcinogenic, causing deformities and mutations (Norra, et al. 2006). Arsenic and its compounds accumulate in animals and plants and spread via food chains, harming the ecological environment and humanity (Cullen and Reimer 1989). There two ways of arsenic pollution, i.e. the natural release of arsenic from high-arsenic underground water (Smedley, et al. 2003) and human emissions (Zhang, et al. 2014), including mine exploiting and concentrating (Wei and Zhou 1992), irragation (Norra, et al. 2005) and pesticide usage (Alam, et al. 2015), etc.. In southwest China, arsenic ore deposit distributes a large area (Xiao, et al. 2008). Therefore aquifers in southwestern China are contaminated by arsenic-containing wasterwater that with unresonable treatment. Arsenic from mine can be released and desorbed from minerals when the environmental conditions change, causing a regional arsenic pollution. Arsenic containing wastewater enters underground rivers through pipes, cracks, scuttles, and sinkholes directly, which leads to serious arsenic pollution (Zhang, et al. 2014). With population growth and industrial development, this problem is becoming increasingly serious. A number of large aquifers in various parts of the world are identified as problematic, with As concentrations above 50 μg/L (Fig. 1) (Smedley and Kinniburgh 2002). Also underground rivers, which are widely distributed in karst areas in Southwest China, are reported to be repeatedly contaminated with arsenic. This poses a significant threat to the