



Hydrochemical study of an arsenic-contaminated plain in Guandu, north Taiwan

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Arsenic pollution in Guandu Plain, north Taiwan is a critical issue due to highly developed anthropogenic activities. It was considered that arsenic was carried in by surface water system. Two major rivers, Huanggang Creek and South Huang Creek, flow through Guandu Plain. Both creeks originate from Tatung Volcano Group, which is extensively active in post-volcanic activities. In this study, the hydrochemistry along the two major rivers was studied for tracing the source of arsenic pollution in Guandu Plain.

The pH values in the upstream water are in the range from 6 to 8 but dramatically decrease down to 2-4.5 in the downstream area. It can be concluded that the creeks are recharged with very low pH geothermal water. In addition, arsenic shows a different spatial distribution. In Huanggang Creek, arsenic concentration is much higher, about 200 ppb to 500 ppb, in the downstream than in the upstream while arsenic concentration is extremely low, below 1 ppb, in the downstream of South Huang Creek. The geochemical results show that rare earth elements (REEs) are depleted in the upstream both in Huanggang creek and South Huang creek, and the NASC-normalized ratios of heavy to light REE (Lu/La) in the upstream are very close to 1. This demonstrates that the upstream water is geochemically dominated by the interaction between water and sedimentary rock. In the downstream, the NASC-normalized REE pattern shows a quite different type which is depleted in light REEs (much higher Lu/La ratio). It is well known that igneous rock is depleted in light REEs; therefore, arsenic is possibly volcanic origin. In this study, PHREEQC, a thermodynamic modeling program, was also utilized to calculate the saturation index (SI) of hydrous ferric oxide (HFO), which can effectively scavenge arsenic in water. The results demonstrate that SI of HFO is mainly controlled by pH in this study. When pH is greater than 3.5, HFO start to precipitate and remove arsenic from water. Therefore, it is believed that the arsenic pollution in Guandu Plain could result from HFO co-precipitation due to the increase of pH when Huanggang creek and South Huang creek flow through the land.