Petrography and geochronology of the Xianshi uranium deposit in Xiazhuang ore field of South China

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South China is rich in numerous U deposits that provided the dominantly U source for the country in the past several decades. Xianshi U deposit is one of very particular deposit in Xiazhuang ore field, situated in southeast Guidong composite granite pluton, Guangdong province is directly associated with hosted-granite and diabase dike and the intersection part between trend and silicification zone. Additionally, the netlike diabase dikes seemingly intrude the main U mineralization of massive uraninite, based on the relatively close contacts between diabase dikes and the high-grade U mineralization. We present detailed petrography, mineral paragenesis and geochronology characteristics of the Xianshi U deposit. Four distinct types of U mineralization have been identified by cross cutting relationships and textures observed in thin sections and BSE images. Alteration is well developed, mainly including pyritization, silicification, carbonation and hematitization. The latter two types are closely related to the high-grade U mineralization. *In-situ* SIMS U-Pb dating of the different type uraninites firstly yield three group ages of 134.6 ± 4.4, 113.4 ± 2.1 and 103.7 ± 1.8 Ma, respectively. The major U mineralization event occurred at ~135 Ma, closely related to the emplacement of diabase dykes and the crust extensional tectonic regime. It appears to represent the oldest U mineralization event observed in Xiazhuang ore field. Stage 2 and stage 3 of U reconcentration generated at 113.4 ± 2.1 and 103.7 ± 1.8 Ma, respectively and appeared as veined uraninite associated with calcite vein. Two ages are consistent with hydrothermal fluid events correlated well with that of diagenetic age of diabase dykes, likely representing the age of two resetting events. Therefore, there are indications that uraninite from Xianshi U deposit has experienced at least three episodes of U concentration associated with the intrusion of local mantle-derived diabase dykes, and is likely to be interpreted to be the hydrothermal origin during Cretaceous crustal extension in South China.

Behaviors of Pb, As and Cd in the Mining Impacted Farmlands

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Behaviour and correlations of Pb, As, Cd, Cr, Cu, Zn and other trace elements in farmlands near a Pb-Zn mine were investigated and evaluated. Some of the water and soil quality in the farmlands exceeded permitted standards. The highest concentration of Pb in irrigation water system was over 10 times that of the standards. The minimum, average and maximum, concentrations of Pb in farmland soils were 3.3, 14 and 35 times higher, respectively, than the environmental quality evaluation standards for farmland of edible agricultural products. The minimum concentrations of As and Cd were beyond the standards, while the average and maximum concentrations of As were 4.5 and 11 times higher than the environmental quality evaluation standards. For Cd they were 9 and 34 times higher than the standards. The concentrations of Pb, As and Cd in aerosols and dusts were extremely high and the maximum concentrations of Pb, As and Cd were 10296, 114, and 76 mg/kg, respectively.

The Pb isotope data reveals that the sources of lead in the soils around the Pb-Zn mine were a mixture of lead minerals and ores, current vehicle exhaust particles and deposits of vehicle exhaust particles before unleaded gasoline became available, and even some coal ash.

Correlations between element concentrations in water and soils in the farmlands were very strong. For example, the correlation coefficient of Pb and Cd concentrations in water was 0.944, and in vegetable farmland soils, the correlation coefficients between Pb and As, Pb and Cu, Cd and Mn and Zn concentrations, as well as between Mn and Zn exceeded 0.9. The correlation coefficients between Pb concentrations in soil and water were 0.679, and for As and Cd, they were 0.717 and 0.611, respectively. The element correlations between water and soils were rather strong and may indicate direct impacts on each other. The element concentrations in the aerosols were correlated strongly. For example, the correlation coefficients of Pb and Cd, as well as with Mn, Cu and Zn, were over 0.9 in aerosol samples.

The investigation reveals that the major sources of the pollution in the irrigation water systems and farmland soils were mining activity and vehicle exhaust particles. The contaminants from mining activities have impacts on surrounding environments and may be transported to wide ranges.

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