Arsenic Occurrence and Its Origin in Sulfides Deposits of the Hokusetsu Area, Osaka, Japan

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Arsenic contamination in the river and ground waters of the Hokusetsu area, Osaka Prefecture, Japan, have been chronically reported since 1994. The dissolution of pyrite contained in the host rocks is thought to be responsible for the As contamination. Our geochemical investigation of the As origin and the sulfur isotopic data suggested that two kinds of sulfide ore deposits would be responsible for the As contamination: one from the Late Paleozoic intensive submarine volcanisms that lead to the formation of stratiform Cu and bedded Mn deposits, and the other from the Late Cretaceous igneous activities that lead to the formation of the myriad ore deposits that constitute the W-Cu-Sn Province of Southwest Japan.
In order to confirm the origin of As, sedimentary rocks collected in highly contaminated areas and sulfides ores from in several mines were chemically analyzed. The sulfides minerals assemblages were optically observed under reflected light. As and associated trace elements were analyzed with Laser Ablation-Inducted Coupled Plasma-Mass Spectrometry (LA-ICP-MS) to document the genetic relationships among host rocks and ore deposits to the As origins.
Weathered sulfides along calcite veins, related to the Paleozoic volcanogenic ore deposits contained important levels of As, together with Pb, Cu and Zn, implying that the sulfides were the cause of the As contamination of hydrosphere of the study area. Others sulfides found in the contact-metamorphosed sedimentary rocks by the granitic intrusion, were mostly pyrite with some minor chalcopyrite and sphalerite. These sulfides contained As plausibly substituting sulfur as arsenopyrite. Heavy metals such as Ni, Co were found in the sulfides from hydrothermal ore deposits and in contact-metamorphosed rocks related to granitic activities, suggesting the As-enrichment in these rocks was induced by the igneous intrusion during Late Cretaceous.
Level of As in rivers and ground waters were generally higher in areas hosting sedimentary rocks rather than in area hosting metamorphosed rocks or closed to deposits related to granitic magma. This implies that the diffuse distribution of As-bearing sulfides and its dissolving rate, likely controlled by the crystalinity and/or the size of crystals, are important to factors contributing to the As contamination of the studied hydrosphere.

Keywords: Arsenic, Igneous Intrusion, Ore Deposit, Sulfide

