

Natural purification of arsenic and antimony in river water by iron hydroxide: Case study of Ichinokawa mine area

Sakae Sano[1]; Masayuki Sakakibara[2]; Etsuko Chiba[3]

[1] Earth Sci. Lab., Fac. Educ., Ehime Univ.; [2] Earth Sci., Ehime Univ.; [3] Biology and Earth Science, Ehime Univ.

Ichinokawa historic mine is an one of the famous stibnite mine in world. Considerable amount of antimony from the country rock is dissolved to adjacent river water ($\sim 200\text{ng/mL}$ Sb) by the chemical weathering near the surface condition. Acid mine drainage (AMD) from the underground and precipitation of yellowish iron hydroxide are observed at the downstream of the mine. We report a case study of natural purification of arsenic and antimony from river water by the iron hydroxide.

Arsenic and antimony contents in the river water at the upstream of the appearance of AMD are ca. 4 and 280 ng/mL, respectively. On the other hand, the contents change to 39 and 5 ng/mL, respectively, at the AMD point. Arsenic content increases once with appearance of iron hydroxide on the river-bed, and decreases gradually at the downstream (39 to 11 ng/mL As). Antimony content decreases drastically at AMD point (200 to 5 ng/mL), and increases gradually at the downstream (5 to 52 ng/mL). The pH value and water temperature decrease once at the AMD point (pH=6.9, T=16C), and increase again (pH=7.7, T=20C) at the downstream. It has been considered that chemical behavior of arsenic and antimony during common environmental condition is similar each other, and that they are absorbed effectively into iron hydroxide. This means that existence of the iron hydroxide precipitation introduces natural purification of the toxic elements from the water. However, based on our results, it is not necessarily the case of the Ichinokawa river environment that the chemical behavior of arsenic is similar to that of antimony. Elemental distributions between iron hydroxide and water (D iron hydroxide/water) on arsenic and antimony change systematically with the position of the sampling site. The distribution coefficients from up- to downstream samples change from 200,000 to 530,000 for arsenic and from 140,000 to 14,000 for antimony. This suggests that chemical behavior of antimony is different from that of arsenic depending on a certain environmental condition.

Natural purification of antimony in river water around the Ichinokawa historic mine may perform effectively by formation of iron hydroxide. According with change of the water condition such as pH, temperature or composition of iron hydroxide, antimony absorbed once in the precipitate may liquate gradually out again in the river water.