Pb isotope ratios in stream sediment around two abandoned mines originating from one ore deposits

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Recently Pb isotope ratios have been successfully used for tracing sources and transports of pollutants from mine sites [2]. In addition, Pb isotope ratio data allowed to estimate relative contributions when there are more than two sources for Pb [3]. We measured Pb isotope ratios of stream sediment and soils around two abandoned mines, DJ and ID mine, originating from one ore deposits. Potential sources existed such as agricultural land, farm house and artificial pool near DJ mine, while no additional sources were found around ID mine. Pb isotope ratios determined in this study provided identification of the sources for Pb in the sediment and assessment of the contributions from those sources to neighboring areas.

The sediment samples collected in the main stream from each mine were commonly characterized by: 1) relatively high concentrations, 2) general decrease in concentrations depending on proximity to mine, 3) constant isotope ratios, and 4) distinguished isotopic compositions from those of tributary stream and downstream areas. This suggests that the Pb in the main stream sediment was affected by Pb pollutants from mines in both sites. The inversed Pb concentrations versus $^{208}Pb/^{206}Pb$ and/or $^{207}Pb/^{206}Pb$ ratios plots showed linear correlation between main stream sediment, tributary sediment and downstream sediment. According to binary mixing equation, the relative contributions of Pb from DJ and ID mines to corresponding downstream area were 35~36 % and 37~42 %, respectively. The relative contributions of each source to downstream area calculated by IsoSource program were 35~67 % for main stream, 17~65 % for tributary stream, 0~3 % for agricultural soil, 0~14 % for farm house and less than 1 % for artificial pool.

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Stable Pb and Cd isotopes in the riverwaters and soils near the Zn-refinery, Korea

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In order to estimate the contribution of refinery borne metals in riverwaters and soils near Zn-refinery and to differentiate them from mining borne metals [1,2], this study collected riverwaters and soils with distance from the refinery to the artificial lake far away 50km. Waste and discharged water, ore and sludge were also collected and analyzed for concentrations of Cu, Zn, Cd and Pb, and isotopes of Cd and Pb using MC ICP/MS.

High concentrations of Cu, Cd, and Pb in riverwaters and soils were observed even in far distance and were correlated with Zn. Based on Pb isotopes, the contribution of refinery borne Pb was identified only in riverwaters and soils within 5 km, which showed the Pb isotopes from imported ores, while samples far away 5 km showed the Pb isotopes from local ores [3] nearby the refinery. $\varepsilon^{114/110}Cd$, isotopic ratio normalized to NIST 3108, showed negative values in soils and positive in riverwaters which indicated the fractionation from ore through the evaporation during refinery. Although the definite decision of the mixing between refinery borne metals and background was not easy, it was evident that refinery borne Cd contributed substantially to samples within 5 km. Size sorting in soils and mixing of enriched heavy isotopes from carbonate deposits with refinery borne metals in riverwaters were responsible for the distribution of $\varepsilon^{114/110}Cd$.

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