

Source of atmospheric lead in Omura City, west Japan, tied to the source of mineral particles

SAITOH, Yu^{1*} ; UMEZAWA, Yu² ; KAWAMOTO, Kazuaki² ; TANIMIZU, Masaharu³ ; ISHIKAWA, Tsuyoshi³

¹Center for Advanced Marine Core Research, Kochi University, ²Graduate School of Fisheries Science and Environmental Studies, Nagasaki University, ³Kochi Institute for Core Sample Research, JAMSTEC

Lead is one of the major environmental pollutants, which seriously harms human body. Atmospheric lead concentration has been suppressed in Japan after the forbiddance of leaded gasoline in 1970s. However, the cross-border air pollution is getting unable to disregard with industrial development in neighboring countries. Identifying the source of aerosol particles is essential in painting a precise picture of the cross-border air pollution. The northern part of the Kyushu Island is the most affected area of the cross-border pollution in Japan due to closeness to the continent. We conducted isotopic analysis of aerosol particle samples corrected with high temporal resolution, once per a few days, from June 2011 to August 2012 in Omura City in the north Kyushu. Pb isotope ratios of 1M-HCl soluble component ("leachate") of the corrected particles indicate the direct source of anthropogenic lead, while Sr-Nd isotope ratios of the residual mineral component digested by concentrated HF-HNO₃ ("silicate") indicate the source area of the mineral particles. High resolution sampling allowed us to distinguish the sources much more sensitively than commonly adopted monthly order sampling.

Sr-Nd isotope ratios of silicates indicate that the main source area of mineral particles changes seasonally. They have local origin in summer, while they are derived from deserts in mid-west China in fall and winter, and those in west China in spring (Figure A). Pb isotope ratios of leachates are distinct when the source of mineral particles is the mid-west China (Figure B). The values suggest the influence of the Chinese lead ore deposits. On the other hand, Pb isotope ratios of leachates are indistinguishable between samples of local origin and those originated from west China. An additional character of samples of west China origin is high amount of Pb in leachate relative to that of mineral component. Anthropogenic lead may be easier to be entrained to wind when the mineral particles comes from mid-west China because the wind trajectory should be much lower in altitude than when particles come from further distant west China. Cross-border atmospheric Pb pollution is suggested more serious in fall and winter when wind trajectory is low than in spring when the westerly transports vast amount of mineral particles known as "Kosa" from the deserts in west China.

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