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Field studies on Pb poisoning in animals and humans
to contribute to the settlement of Pb pollution
in a mining area, Kabwe, Zambia

(ザンビア・カブウェ鉱床地域の鉛汚染被害解決に向けた
動物及びヒトの鉛中毒に関するフィールド研究)

Lead (Pb) poisoning poses a serious public health concern in the world. Kabwe, Zambia is a Pb mining area, which was operational for over 90 years with no pollution laws regulating emissions from the mine. The mine has left the city with poisons and hazardous concentrations of Pb in biota, soil and water. Pb exposure in humans and animals in Kabwe, Zambia is necessary to be controlled and prevented.

The aim of my thesis is to contribute to the settlement of Pb pollution in a lead mining area, Kabwe, Zambia. Firstly, this thesis was conducted to understand the current scale of Pb exposure on animals and humans in Kabwe, Zambia. Moreover, the determination of the sources and routes of Pb exposure on humans and animals using Pb isotope analysis were carried out. The effects of Pb exposure on humans and animals were evaluated to determine the health impact.

In chapter 1, I focused on the current circumstance of Pb exposure on dogs as a sentinel animal. High Pb exposure on dogs in Kabwe were revealed as the first report. The locations of the dogs and their ages were significantly related to their Pb. The trends of the exposures of dogs were shown to be largely similar to those previously reported for humans. Dogs could be useful as sentinel animals for Pb exposure of human residing in Kabwe.

In chapter 2, the Pb exposure in infants and the contribution of lactation as one of the exposure pathways to infants were assessed. High Pb concentrations in breastmilk, which were above the WHO acceptable level for breastfeeding, were found and could be one of the sources of

Pb exposure in infants. However, the results of Pb isotope analysis suggest that the main source of Pb exposure in infants is Pb from environment, such as from soil. High Pb concentrations in mothers' blood were found in the study, suggest the possibility of Pb exposure in fetus via placenta as well as Pb exposure in infants via breastfeeding. Thus, mothers in Kabwe should be treated with chelation therapy to reduce the Pb exposure in their fetus and infants.

My research revealed high Pb exposure in dogs and humans in a Pb mining area, Kabwe, Zambia and could briefly grasp the scale that high Pb exposure occur only in a part of Kabwe, especially near the mine. The results of Pb isotope analysis suggests that one of the sources of Pb exposure in dogs and humans could be environmental origin, such as soils. Therefore, environmental remediation is urgently necessary to reduce the Pb exposure.

The health impacts of Pb exposure in dogs and humans were not clearly determined in my research. The results strongly suggest the difference of health impacts between acute and chronic Pb exposure, and the possibility that animals and humans in Kabwe have some biological defense mechanism for Pb exposure. Further study should focus on the detailed survey on the health impact and the biological defense mechanism to mitigate the Pb toxicity.