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Lead-Zinc mining and home-grown foodstuffs (Eastern FYR Macedonia)

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Abstract

Mining accompany our civilization since evolution. Since the "Copper (Chalcolithic) Age" and later "Golden Age", mining activities have created great wealth. Unfortunately, beside wealth the exploitation of metal rich ores, have been almost always correlated with a negative impact to the nearby ecosystems. In this study a broad area around the active Pb-Zn Sasa mine (NE FYR Macedonia) was characterized, to evaluate the contents of some Potentially Toxic Elements (PTE). The PTE were determined in the surrounding fresh waters (lake and rivers), soils and the home-grown vegetables. The evaluation of the potential hazardous effects of the PTE, especially on humans, is a key goal. The PTE's were determined by ICP-AES and ICP-MS. Furthermore also detailed questionnaires were applied among the local inhabitants. Sequential extraction analyses of selected soil samples revealed that the majority of PTE was bounded to water soluble and exchangeable fraction, which shows that those elements (Ag, As, Cd, Cu, Mo, Ni, Pb, Sb and Zn) are therefore very easily mobile and consequently available to plants. According to the applied questionnaires, the consumption of home-grown foodstuffs is high, and certain vegetables, such as tomatoes, peppers, salads, etc., are consumed every day or even more than once a day. Chemical evaluation of PTE in home-grown vegetables revealed that the most crucial PTE's (those which heavily exceed upper allowable limits) are Cd, Co, Cu, Pb and Zn, and are closely followed by Cr and As. The calculated Health Risk Index (HRI) shows extremely high estimated values, both for adults and children. As the study area is surrounded by rich metallogenic ore deposits, is expected that the natural background is slightly higher than elsewhere. Nevertheless, the concentrations of PTE's in waters used for irrigation which were increased and the wind-blown (aeorogenic) PTE's pollution from the nearby tailings dam, both increases the PTE contents in the studied foodstuffs. Thus, the health of inhabitants in this area is of high concern.