

Aveiro, Portugal | July 26 > August 1 2015



MEDGEO'15

6th International Conference
on Medical Geology
Aveiro - Portugal



6th International Conference on Medical Geology – MEDGEO'15

organization	University of Aveiro, Instituto Superior Técnico, the GeoBioTec Research Centre and the Cerena Research Centre
support	IMGA - International Medical Geology Association
copyright 2015	6 th International Conference on Medical Geology (MedGeo'15) Aveiro, Portugal, July 27-31, 2015
title	MedGeo2015: Book of Abstracts of the 6 th International Conference on Medical Geology
editors	Eduardo Ferreira da Silva, Amélia Paula Reis, Carla Patinha, Ana Cláudia Dias, Nuno Durães, Carla Candeias, José Manuel Marques, Orquidia Neves
publisher	UA Editora, Universidade de Aveiro
address	Universidade de Aveiro. Campus de Santiago. 3810-193 Aveiro. Portugal
ISBN	978-972-789-449-9
prepared by	Organizing Committee of MedGeo'15

MedGeo2015 [Recurso electrónico]: Book of Abstracts of the 6th International Conference on Medical Geology / eds. Eduardo Ferreira da Silva...[et al.]. – Aveiro: UA Editora, 2015. – XXIII, 156 p. : color.

ISBN - 978-972-789-449-9

Medical geology // Environmental risk assessment // Environmental toxicology // Epidemiology // Contaminants // Environmental monitoring

CDU 502.17

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

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Abstract Type Oral Presentation

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.