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Availability of potentially hazardous elements in soils and their transfer to plants. A case study in polluted soils from the Iberian Pyrite Belt (SW Spain)

Antonio Romero-Baena (1), Maria Manuela Abreu (2), Erika S. Santos (2), Diego Arán (3), and Isabel González (1)

(1) Dpto. Cristalografía, Mineralogía y Química Agrícola. Universidad de Sevilla. C/Prof. García González, s/n. 41012, Sevilla. Spain., (2) Universidade de Lisboa, Instituto Superior de Agronomia, Linking Landscape, Environment, Agriculture and Food Research Centre (LEAF), Tapada da Ajuda, 1349-017 Lisboa, Portugal, (3) Departamento de Edafología y Química Agrícola, Facultad de Biología, Universidad de Santiago de Compostela, Campus Universitario Sur, 15782 Santiago de Compostela, Spain

Protocols for the study of potentially polluted soils by potentially hazardous elements (PHEs) are based on total element concentration. Nevertheless, the hazard depends on their availability and ability to be uptake and translocated to edible part of the plants and consequently to the food chain. Because the bioavailability of elements depends on several factors, as soil properties and plant species, there is not a universal method for its evaluation. The objectives of this work are: to assess the bioavailability of PHEs using different aqueous solutions for chemical elements extraction from different soils and to evaluate its concentrations in edible part of *Lactuca sativa* (lettuce) and *Petroselinum crispum* (parsley). The study has been carried out in four soils polluted by mining activities in Tharsis, Sotiel and Riotinto-Nerva areas (Iberian Pyrite Belt, SW Spain). The soils show high concentration in PHEs (e.g. As 471-1645, Cu 333-1455, Pb 1143-5131, Zn 273-1371 mg/kg). The pH is neutral (7.1-7.9) and the content in organic carbon ranges from 34 to 85 g/kg. For this purpose, experimental work was performed in greenhouse conditions in pots filled with 1.5 kg soil/pot (n=5 per soil). Lettuce and parsley seedlings (11 and 6 cm height, respectively) were transplanted. After six weeks of growth, plants were harvested and soil samples were collected.

The availability of PHEs in soils (beginning and end of the assay) has been assessed by extraction with different aqueous solutions: water (24 hours contact); 1 mol/dm3 ammonium acetate (6 hours contact); DTPA (0.005 mol/dm3 diethylenetriaminepentaacetic acid + 0.1 mol/dm3 triethanolamine + 0.01 mol/dm3 calcium chloride; 6 hours contact); and 10 mmol/dm3 of a mixture of low-molecular weight organic acids (acetic, lactic, citric, malic, formic acids; molar ratio 4:2:1:1:1; 16 hours contact; rhizosphere-based method). The availability of As has been assessed by extraction with 0.05 mol/dm3 ammonium monophosphate (16 hours contact). All the extractions were performed using moist bulk soils (< 2 mm fraction). Plants (roots and shoots) were analysed for the same elements. The uptake and translocation of PHEs by plants was calculated. These results can be useful to study the real hazard for biota posed by PHEs in soils polluted from mining areas.