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Soil and plant contamination by lead mining in Bellmunt (Western Mediterranean Area)

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Galena has been mined in Bellmunt (Priorat, Western Mediterranean Area) since ancient times until 1972. While sediment pollution originated by the mining activity in the Ebro river passing the region has been investigated (Ferré, 2007), the local impact on soils and plants has received little attention. Here we report the first results on the concentrations of major metal contaminants and antimony in soils and representative plants from 5 selected sites with different pollutant burdens around the mining area. Both total (HNO3, HF, HClO4 digest) and extractable (EDTA) soil concentrations were studied. The range of total and extractable soil values in mgkg−1 is as follows: Sb 9.7-31 and 2.4-7.2; Cu: 89-823 and 20-62; Pb: 19-39 and 18-33; Zn: 318-989 and 79-287 mg•kg-1, respectively). Soils had alkaline pH (7.7-8.2), organic matter contents ranging from 0.8 to 2.4%, and a sandy-loam or a loamy-sand texture. All analysed plant species showed enhanced root and shoot concentrations of Pb, Cu, Zn and Sb when growing on the more polluted soils, and all but one restricted the translocation of metals from roots to shoots exhibiting shoot/root concentration ratios lower than unity. A notably exception was Moricandia moricandioides. This species of the Brassicaceae family exhibited higher Zn concentrations in the shoots than in the roots at all sampling sites yielding shoot/root concentration ratios up to 5.5. This metal accumulation pattern was only observed for Zn and not for other analysed metal contaminants. The concentrations of other, poorly mobile metals, like Pb or Cu were always higher in roots than in shoots (e.g. Pb shoot/root ratios ranged from 0.12 to 0.41). Taking into account the high Pb burden of the soil samples and these low shoot/root Pb ratios, it can be excluded that the particular Zn accumulation pattern of Moricandia moricandioides was biased by soil contamination of shoot samples. To the best of our knowledge, this is the first report of a Zn accumulation behaviour in a Moricandia species. The soil-to-shoot transfer factors (shoot Zn conc/total soil conc.) for this species were, however, relatively low ranging from 0.3 to 1.3. Two main reasons for this could be 1) the fact that real total Zn soil concentrations after HF attack and not pseudototal metal concentrations were analysed in the present study and 2) the relatively high pH of the soils which could considerably hamper Zn bioavailability. Further studies are required to confirm the possible Zn (hyper)accumulator character of Moricandia moricandioides (Boiss.) Heyw. [M. ramburii Webb].

Reference: Ferré, N. 2007 Nivells de metals pesants a la conca Catalana del riu Ebre. Avaluació del risc per la población i l'ecosistema. Universitat Rovira Virgili. ISBN 978-84-691-0371-5. Acknowledgement: Supported by BFU2007-60332/BFI