



Eco-monitoring of highly contaminated areas: historic heavy metal contamination in tree ring records

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This study examines and compares tree rings of trees grown in a mining area highly contaminated with heavy metals. Tree rings offer an excellent opportunity for eco-monitoring polluted areas. Contamination dispersion from the source to the receptors can be studied in time and space. The sampled area is located in the eastern part of the Matra Mts. of the Inner-Carpathian calc-alkaline Volcanic Arc (Hungary) with abundant historical ore (Pb, Zn, Cu, etc.) mining in the area. Dense forests are composed of the most typical association of the Turkey oak (*Quercus cerris*), Scots pine (*Pinus sylvestris*), European black pine (*Pinus nigra*), oak (*Quercus robur*), beech (*Fagus sylvatica*), and hornbeam (*Carpinus betulus*) also occurs in the landscape. Sampled trees are located within a 1km radius of the abandoned historic ore mines. Sample sites were located above the old mines and waste rock heaps, under the waste rock heaps and on the floodplain of the Ilona Creek. The sampled trees were selected by the following criteria: the tree should be healthy, showing no signs of thunderbolt or diseases and having a minimum diameter of 50 cm. Samples were taken with a tree borer at the height of 150 cm. At the same time, soil samples were also taken near the trees in a 25 cm depth. Prior to laboratory analysis, the samples measured and air dried. Every fifth years tree ring was taken from the samples under microscope, working backwards from the most recent outer ring (2012, the year of the sampling). Samples were digested with a mixture of H₂SO₄ and H₂O₂ in Teflon vessels in a microwave unit. The samples were analyzed by ICP-OES instrument. The results were evaluated with statistical method. Results revealed a consistent picture showing distinct locations and years of the contamination history in the former mining area. Some elements are built into the trees more efficiently than other elements depending on mobility in the soil solution that is influenced by soil chemical properties, in turn. The majority of the metals become more mobile in acidic soil and heavy rain climatic conditions giving rise to availability of metal uptake by the studied trees.