



## **Geochemistry of topsoil in kindergarten playgrounds in Zagreb, Croatia**

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Geochemical mapping based on analysis of urban topsoil (0–5 cm) and deeper soil horizons (40–50 cm) in kindergarten playgrounds has been carried out in Zagreb. In two geochemical studies performed by sampling on a regular grids (1x1 km<sup>2</sup>) it was determined that the soils in the Old Town and industrial area have elevated concentrations of heavy metals (Pb, Hg, Zn). The high soil heavy metal concentrations are decreasing toward the outer parts of the city, similar to patterns observed in many other cities in Europe. Since the youngest children are exposed to topsoil in playgrounds, an evaluation of heavy metal pollution for 150 kindergarten and 50 public playground topsoil was made. During the study aqua regia (ISO 11464) soil extracts were analyzed for 42 major and trace elements. Urban soil pollution in each city is specific depending on pollution sources and the geochemical signature of the local lithology. Based on the calculated enrichment factors for heavy metals and the regional geochemical baseline values for northwestern Croatia the following elements were found in concentrations that can be attributed to pollution: Pb, Hg, Zn, Cu. Also elevated concentrations Sb, Ag, Zn and Cd at some of the locations indicate anthropogenic influences. Other elements considered as potentially toxic (As, Cr, Ni, Co, Mo, Tl) have concentrations within the established regional soil baselines and can be considered as lithogenic. Guidance values for heavy metals in soils for kindergarten playground soils have not been established in Croatia so the quality criteria for soils in playgrounds of Norwegian Institute of Public Health were used as well as calculated enrichment factors were used to evaluate the degree of soil pollution. It was determined that based on the composite soil data 21 locations should be assessed with follow up studies to determine the need for remediation. In Zagreb, only 5 of the 64 kindergartens sampled had an elevated dust lead level. Paint chips taken from metal playing equipment in the playgrounds had paint lead levels that exceeded the standard for lead in paint of 5.000 mg/kg in 80% of the analyzed samples. This is probably due the presence of undercoats of lead paint applied in previous decades (most of the equipment contains numerous paint layers) and a study using lead isotopes, sequential extractions of playground soil is been conducted to determine possible sources and bioavailability of potentially toxic elements.