Sulphur and heavy metal pollution of the coal-based city soil (labin, croatia)

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The city of Labin has been a major center of former coal mining, coal-fired electricity, and associated industries for more than 100 years. The domestic superhigh-sulphur Raša coal was characterised by S up to 14% [1], and increased radioactivity [2], making the area an environmental hotspot [3]. Soil around a nearby coal-fired power plant is polluted with S (up to 4%), PAHs (up to 13,535 ng/g) [4], and Ra-226 (up to 581 Bq/kg) [5]. The aim of this study is to present for the first time the heavy metal values in soil, surface water (stream and estuary), and vegetables (salad and tomato), whilst S only in soil. Metal analysis was carried out by AAS, and S with Eschka mixture. The basic (mean ± SD) values of Hg, Cd, V, Se, Pb, Sr, Cr, Zn, Cu, U (mg/kg), and S (%) are as follows: 0.52 ± 0.37, 0.42 ± 0.56, 115.12 ± 140.61, 1.99 ± 2.97, 137.40 ± 211.73, 243.40 ± 176.03, 184.75 ± 459.60, 415.70 ± 338.21, 215.65 ± 458.53, 3.98 ± 5.34, and 2.46 ± 2.57, respectively. Compared with Croatian legislative values, at least Hg, Cd, Pb, Cr, Zn, and Cu were increased approximately 2, 2, 9, 23, 6, and 20 times, respectively. With respect to regional control soil data, Hg, Cd, Pb, Cr, Zn, Cu, and S were increased approximately 13, 6, 23, 36, 10, 264, and 63 times, respectively. Statistically significant Kendall Tau correlations ≥0.5 ($P<0.05$) were found for the following variable pairs: Hg-U, Se-U, Zn-Hg, Zn-Pb, and Zn-Cu. Mercury, Cd, and Pb were below detection limits in water, whilst their values (mean ± SD) in vegetables were within acceptable limits as follows (mg/kg): 0.017 ± 0.012, 0.15 ± 0.16, and 1.04 ± 1.25, respectively. Herewith, the analysed soil is severely polluted with S (%), and potentially toxic Hg, Cd, Pb, Cr, Zn, Cu (mg/kg), characterised by following maximum values: 6.9, 1.14, 2.36, 870, 1860, 950, and 1850, respectively. These results call for further detailed research.

[1] Valković et al. (1984) Fuel **63**, 1357-1362. [2] Marović et al. (2004) J. Radioanal. Nucl. Chem. **261**, 451-455. [3] Mohorović (2003) Environ. Health Perspect. **111**, 1902-1905. [4] Medunić et al. (2015) 27th IAGS, 1-17. [5] Ernečić et al. (2014) Acta Mineral. Petrogr. **8**, 28.