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An integrated geochemical, geophysical and mineralogical study of river sediments in alpine area and soil samples near steel plant, in Austria

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Concentration of nickel and chromium in any part of the ecosystem is important for environmental concerns in particular human health due to the reason that some species of them can cause health problem e.g. dermatitis and cancer. Sediment samples collected form a river Vordernberger Bach (Leoben, Austria) in an alpine region and soil samples collected in an area adjacent to steel production unit in same narrow valley were investigated. In previous studies a correlation between magnetic susceptibility values and concentration of nickel and chromium showed that a magnetic susceptibility meter can be used to point out the contaminated areas as in-situ device. The purpose of the whole study is to understand the real (point or diffuse, anthropogenic or geogenic) sources of contamination of soils, water and river sediments through heavy metal deposition. Unseparated, magnetic and non-magnetic fractions of soil samples were investigated for geochemical and mineralogical aspects with XRF, ICP-MS, EMPA, Multi-Functional Kappabridge (MFK1) and laser ablation coupled with ICP-MS.
Mineralogical study of sediment samples for several sampling points with higher Ni and Cr content was performed. Sediment samples were sieved below 1.4 mm and then a concentrate of heavy minerals was prepared in the field through panning. Concentrated heavy minerals were then subjected for heavy liquid separation in the laboratory. Separated magnetic and non-magnetic fractions below 0.71/0.1 mm and density greater than 2.9 g/cm3 were selected for mineralogical investigation. The abundance of typical anthropogenic particles, e.g., spherical, tinder, roasted ores, iron and steel mill slag was observed under the microscope. Magnetite (mostly anthropogenic), maghemite, chromspinel, chromite (type I & II), (Ca,Al)-ferrite, wustite, apatite (anthropogenic), olivine mixed crystals, calcium silicate and spinel (anthropogenic) are found in magnetic fraction. Non-magnetic fractions contain hematite, siderite, ankerite, corundum (anthropogenic), garnet, chlorite, titanium oxide minerals (ilmenite, rutile, titanite) and amphibole etc. The observed significant increase in heavy metal content from the source region of the Vordernberger Bach at 1500 m above sea level to the confluence of the Vordernberger Bach with the Mur River at 540 m AMSL can be attributed to anthropogenic influence. As expected, the anthropogenic input is more pronounced in the vicinity of historic and current iron and steel production.