

## **Discrimination between long-range transport and local pollution sources and precise delineation of polluted soil layers using integrated geophysical-geochemical methods.**

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The primary goal of this work was to distinguish between soil pollution from long-range and local transport of atmospheric pollutants using soil magnetometry in combination with geochemical analyses and precise delineation of polluted soil layers by using integrated magnetic (surface susceptibility, gradiometric measurement) and other geophysical techniques (conductivity and electrical resistivity tomography). The study area was located in the Izery region of Poland (within the “Black Triangle” region, which is the nickname for one of Europe’s most polluted areas, where Germany, Poland and the Czech Republic meet). The study area was located in the Forest Glade where the historical local pollution source (glass factory) was active since and of 18th until the end of 19th century. The magnetic signal here was the combination of long-range transport of magnetic particles, local deposition and anthropogenic layers containing ashes and slags and partly comprising the subsoil of modern soil. Application of the set of different geophysical techniques enabled the precise location of these layers. The effect of the long-range pollution transport was observed on a neighboring hill (Granicznik) of which the western, northwestern and southwestern parts of the slope were exposed to the transport of atmospheric pollutants from the Czech Republic and Germany and Poland. Using soil magnetometry, it was possible to discriminate between long-range transport of atmospheric pollutants and anthropogenic pollution related to the former glasswork located in the Forest Glade. The magnetic susceptibility values ( $\kappa$ ) as well as the number of "hot-spots" of volume magnetic susceptibility is significantly larger in the Forest Glade than on the Granicznik Hill where the  $\kappa$  is  $< 20 \times 10^{-5}$  SI units. Generally, the western part of the Granicznik Hill is characterized by about two times higher  $\kappa$  values than the southeastern part. This trend is attributed to the fact that the western part was subjected mostly to the long-range pollution originating from lignite power plants along the Polish border, while the southeastern part of the hill was shielded by crag and tail formation. Also the set of chemical elements connected with magnetic particles from long-range transport observed on the western slope and the top of Granicznik Hill (As, Cd, Hg, In, Mo, Sb, Se and U) is different than this observed on the Forest Glade connected with local pollution source (Cu, Nb, Ni, Pb, Sn and Zn).