

## **Spatial pattern analysis of Cu, Zn and Ni and their interpretation in the Campania region (Italy)**

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The uniquely abundant Campanian topsoil dataset enabled us to perform a spatial pattern analysis on 3 potentially toxic elements of Cu, Zn and Ni. This study is focusing on revealing the spatial texture and distribution of these elements by spatial point pattern and image processing analysis such as lineament density and spatial variability index calculation. The application of these methods on geochemical data provides a new and efficient tool to understand the spatial variation of concentrations and their background/baseline values. The determination and quantification of spatial variability is crucial to understand how fast the change in concentration is in a certain area and what processes might govern the variation. The spatial variability index calculation and image processing analysis including lineament density enables us to delineate homogenous areas and analyse them with respect to lithology and land use. Identification of spatial outliers and their patterns were also investigated by local spatial autocorrelation and image processing analysis including the determination of local minima and maxima points and singularity index analysis.

The spatial variability of Cu and Zn reveals the highest zone (Cu: 0.5 MAD, Zn: 0.8-0.9 MAD, Median Deviation Index) along the coast between Campi Flegrei and the Sorrento Peninsula with the vast majority of statistically identified outliers and high-high spatial clustered points. The background/baseline maps of Cu and Zn reveals a moderate to high variability (Cu: 0.3 MAD, Zn: 0.4-0.5 MAD) NW-SE oriented zone including disrupted patches from Bisaccia to Mignano following the alluvial plains of Appenine's rivers. This zone has high abundance of anomaly concentrations identified using singularity analysis and it also has a high density of lineaments.

The spatial variability of Ni shows the highest variability zone (0.6-0.7 MAD) around Campi Flegrei where the majority of low outliers are concentrated. The variability of background/baseline map of Ni reveals a shift to the east in case of highest variability zones coinciding with limestone outcrops.

The high segmented area between Mignano and Bisaccia partially follows the alluvial plains of Appenine's rivers which seem to be playing a crucial role in the distribution and redistribution pattern of Cu, Zn and Ni in Campania. The high spatial variability zones of the later elements are located in topsoils on volcanoclastic rocks and are mostly related to cultivation and urbanised areas.