



## **Geochemical distribution of harmful elements in top soils of an Italian National Interest Area (S.I.N.): the Domizio-Flegreo Littoral and Agro Aversano case study**

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The Domizio-Flegreo Littoral and Agro Aversano area has been classified by the Italian Ministry of Environment (Italian Ministero dell'Ambiente e della Tutela del Territorio e del Mare) as a S.I.N. (Sito di Interesse Nazionale, L. 426/98 - Decreto 10 Gennaio 2000 - G.U. 29/5/01). In this category have been included all those contaminated lands that, both for their extension and their historical and present land use, are considered to be particularly harmful for human health. In Italy have been selected a total of 54 S.I.N.; among all of these, the Domizio-Flegreo Littoral and Agro Aversano S.I.N. is one of the widest (1564 Km<sup>2</sup>).

The study area is located in north-western Campania region, from the Avella Mountain to the coastline, and from the Campi Flegrei area to the northern boundaries between Campania and Latium Regions. It includes a total of 77 towns from both Naples and Caserta provinces.

The Domizio-Flegreo Littoral and Agro Aversano S.I.N. is characterized by a strongly urbanization in its internal portions, and by intensive agricultural activities in its northern and coastal portions. During past years this wide area has been the set of an unknown number of illegal activities controlled by the organized crime, including toxic waste disposal of unknown sources from different Regions of Italy, unauthorized building, intensive uncontrolled agricultural practices and so on. Part of these environmental crimes have been and are under investigations by Italian Authorities.

For a geochemical characterization of this contaminated land, between May 2006 and January 2008, a total of 292 (179 in the Litorale Domizio-Flegreo and 113 in the Agro Aversano) top soils (5-15 cm depth) have been collected, with a sampling density of about 1 sample/5 Km<sup>2</sup>. The <100 mesh soil fraction has been analyzed with ICP-MS to determine the concentration of the 39 elements: Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Hg, K, La, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Sc, Se, Sn, Sr, Ta, Te, Th, Ti, U, V, W and Zn.

Chemical data have been organized in a unique database and univariate statistics (histograms, cumulative frequency curves and box-plots) have been performed to describe the distribution of elements all across the investigated area. Using Arc View GIS<sup>TM</sup> and a new Multifractal Inverse Distance Weighted (MIDW) (Cheng 1999 a; b) method available in the software GeoDAS<sup>TM</sup> (Cheng, 2003; Lima et al., 2003) interpolated maps have been obtained. The latter are overlaid by dots, showing the element concentration at each site with the radius of dots as a function of the element concentration classified by a cumulative frequency graph. In order to assess the toxic elements pollution levels and their distribution in the study area, a complete suite of 39 interpolated and dot maps, 39 background maps, 39 anomalies maps and 4 factor-scores maps have been compiled. The final goal is to produce a geochemical environmental atlas which will represent a sound basis for policy makers and legislators, who need to address the public concerns regarding the toxic element pollution threat to ecosystem and human health.

Further studies in the S.I.N. area concern the determination of Pb isotope concentrations in soil profiles, water and most used pesticides. The preliminary results of the latter study are reported by Grezzi et al. (2009).

### **References**

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