



Pb isotopic study on soils from Domizio-Flegreo Littoral area, Napoli, Italy

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The Domizio – Flegreo Littoral area, together with the Agro Aversano area, are part of a Site of National Interest for pollution assessment. This area is located along the north coastal zone of the Campania region (Italy) and has an extension of about 855 Km². We analyzed soils for heavy metal content in order to study and discriminate the impact of natural and anthropogenic sources. We collected 292 soil surface samples (5-15 cm depth) and produced maps showing the distribution of heavy metals in the soils. On the basis of the geographic distribution of heavy metals, 9 soil profiles were also collected for detailed examination (1 meter from surface). From each soil profile, we collected 10 soil samples (1/10 cm) in the urban and suburban areas of the littoral area. Also, we collected 8 groundwater samples likely associated with the soils. Pb isotope compositions of these soils and waters help to constrain the impact of anthropogenic and natural components on the soil profiles.

Possible anthropogenic end-members include pesticides used in the area. Lead isotope compositions of soils known to contain anomalously high values of heavy metals were measured in order to determine the sources of the Pb and, by inference, sources of other metals that are likely to share similar geochemical behaviour in the surface environment (e.g., As). Acid-leach compositions of the soils represent Pb that is adsorbed to mineral surfaces, whereas residue compositions may reflect bedrock. Labile Pb (acid-leach fractions) from the soils shows a range in compositions of $^{207}\text{Pb}/^{206}\text{Pb} = 0.8275$ to 0.8486 , and $^{208}\text{Pb}/^{206}\text{Pb} = 2.0488$ to 2.0873 . The isotope values vary and decrease with depth. The Pb isotope ratios obtained on groundwater samples range from about $^{207}\text{Pb}/^{206}\text{Pb} = 0.8516$ to 0.8636 , $^{208}\text{Pb}/^{206}\text{Pb} = 2.0706$ to 2.1064 . The Pb isotope ratios in the soil profiles and groundwater are generally consistent with multiple sources that include anthropogenic Pb. Surface soil samples from Giugliano (representative of an urban area) have Pb isotope values closer to the composition of gasoline and industrial Pb used in Italy. Surface samples from Mondragone and Cannello Arnone (sub-rural area) have the lowest Pb isotopic ratios and suggest that the geogenic or natural component characterizes the Pb isotopic trend in these areas—the isotope values argue against a major contribution of Pb from human activities. The Pb isotope compositions of groundwater point to an anthropogenic component. In particular, the impact of the pesticides and aerosol (atmospheric deposition) is evident for 6 groundwater samples which have Pb isotope ratios very different from natural sources. Soil metal contents and Pb isotope ratios of the soil profiles and groundwaters from the Domizio – Flegreo Littoral area (Giugliano, Villa Literno, Castelvolturno and Cannello Arnone urban areas) indicate a significant contribution of Pb from human activity.