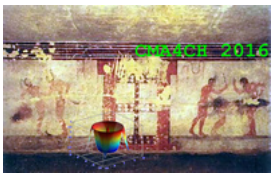
CMA4CH 2016, Mediterraneum Meeting
Straightforward approach in Cultural Heritage and Environment studies - Multivariate Analysis and Chemometry
6th ed., Rome, Italy, Europe, 18-20 December 2016



Distribution of Metals in Salento (South Italy) Agricultural Soils

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Abstract

During the month of December 2008 a sampling campaign was performed in Salento agricultural soils whit the aim of an explorative investigation of crustal elements and metals spatial distribution. The results have highlighted that crustal elements concentrations reflect the typical geo - lithological characteristics of the area, while some metal concentrations and distribution reflect the land use.

Introduction

The increasing demands on land use and continuum developments in soil management require new and revised assessment of soil resources.

Chemometric methods have been widely used for soil analysis in geochemical and environmental applications. These methods provide powerful tools to obtain and analyze significant information about large and complex multivariate datasets. For example these methods are often used for assessing spatial and temporal distribution of soil parameters (Islabao et al., 2012; Ielpo et al., 2016).

In this work, we have investigated the spatial distribution of 15 elements and metals, both from crustal and anthropogenic origins, in a circular (radius 25 km) area of Salento (South Italy) by using multivariate statistical techniques.

Materials & Methods

The sampling area, centred on the location of the Università del Salento Campus (Lecce), has been divided in four quarters corresponding to the cardinal points: the first quarter between North and East, the second quarter between East and South, the third sector between South and West and the fourth between West and North. In the first sector 10 samples were collected: 3 from olive groves, 7 from arable lands. In this quarter the vineyards were absent. In the second quarter 9 samples: 7 from olive groves, 2 from arable lands. In the third quarter 9 samples were collected: 3 from olive groves, 3 from vineyards and 3 from arable lands. Finally, in the fourth sector 8 samples were collected: 4 from olive groves, 1 from vineyards areas, 3 from arable lands. In each one site 24 sub-samples were taken using a rectangular grid with 24 points of collection covering the entire area chosen. The collection of samples is performed at a depth of 2-3 cm in each point of the grid. The 24 sub-samples obtained in each site have been mixed in order to have a sample representative of the entire area chosen.

Soil samples were pre-treated by applying dehydration process, followed by crushing of aggregates and then filtration with a nylon sieve with light net mesh of 2 mm. On soil samples the content of Fe, Al, Ti, Ca, Mg, K, Mn and Na was determined via Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES); while the elements Cd, Cu, Cr, Sb, V, Ni, Pb were analysed via Graphite Furnace Atomic Absorption Spectroscopy (GF-AAS). In both cases it has been used an acid digestion, using microwave (Milestone MLS 1200 MEGA), to prepare the solutions for chemical analysis. Digestion of soil samples has been performed using a mixture of nitric acid 70%,

hydrochloric acid 40%, and 60% hydrofluoric acid in volume proportions of 4:2:2. After, 0.7 g of boric acid and 5 ml of deionized water were added to each sample and repeated heat treatment using the same program of mineralization.

Results

As example of multivariate statistical techniques applied on soil data set, Principal Component Analysis results are shown. In figure 1 the score plot in the plane of the first and second components has shown.

In the figure the squares represent soils for which the main type of land use is vineyard; plus indicates soils which main type of land use is arable land and stars represent soils which crops are the olives. Roman numerals indicate the quarters of the sampling area. Observing figure 1 it is possible to note that vineyard soils samples scattered from the main cluster composed mostly by olive soil samples and some arable soil samples.

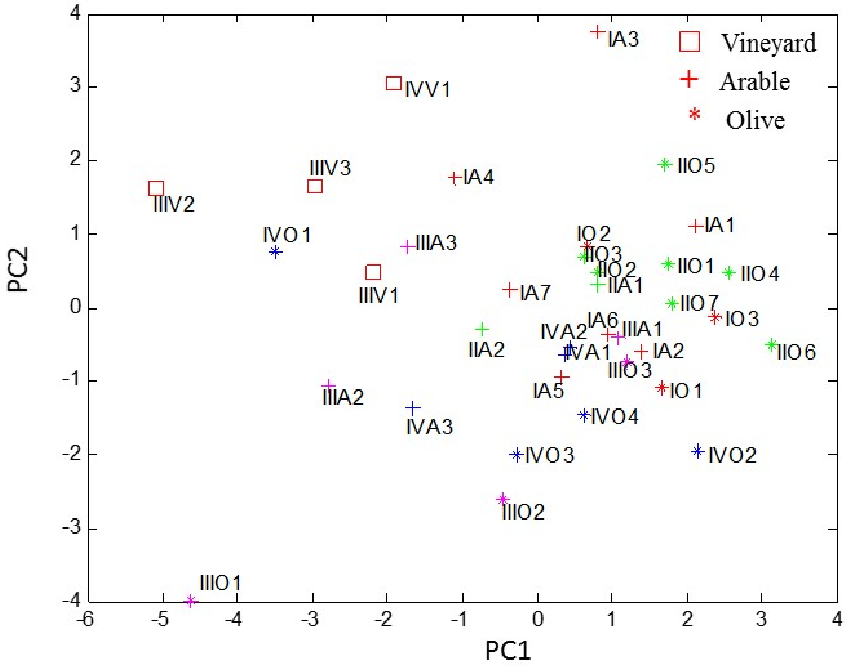

Fig.1; Soil data set score plot in the plane of the first and second Principal Component

Conclusions

The explorative investigation of element and metal concentrations in Salento agricultural sites has highlighted that more abundant element found was Calcium, due to the typical lithological characteristics of the area. Copper showed the biggest variability among sites and its maximum concentrations have been found in vineyard soils: this probably reflects the use of Cu based plant health compounds.

Moreover, enrichment factor has highlighted anthropogenic origin for Pb, Sb, Cd, while Ni and Cr showed a mixed origin (natural and anthropogenic).

References

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2) P. Ielpo, R. Leardi, G. Pappagallo, V.F. Uricchio, Tools based on multivariate statistical analysis for classification of soil and groundwater in Apulian agricultural sites, *Environ Sci Pollut Res*, DOI 10.1007/s11356-016-7944-y