Spatial distribution approach to evaluate soil contamination in the surrounding area of Panasqueira mine

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Mining activity generates large volumes of wastes, left in piles or tailings dam. In the case of the Panasqueira mine the beneficiation process have given rise, during a long period, to a large amount of sulphide-rich waste, contained in Rio (~731034m^3) and Barroca Grande (two dams ~1193885m^3) tailing ponds - and in Rio (~1200000m^3), Barroca Grande (~7000000m^3), Vale da Ermida (100000m^3) and Panasqueira (1000000m^3) impoundments. The presence of these sulphide-rich wastes compromises soil quality.

In this area around 6000 inhabitants are living distributed by seven villages. The economy of the area is based mainly in the mining activity and agriculture. According to the information available the population consumes vegetables and meat from local production

A soil sample campaign was conducted in the area surrounding the Panasqueira mine tailings and facilities in order to evaluate the extent of the contamination. Throughout a selected area of approximately 32km^2 a total of 238 samples were collected (122 superficial soil samples and 116 soil samples at 15cm depth).

A three-step approach based on Multivariate Data Analysis and Geostatistics was been applied in this study. In a first step, Principal Component Analysis (PCA) was applied to chemical analysis results with the aim of identifying the cluster of elements with anthropogenic origin.

In a second step Correspondence Analysis (CA) was applied to the sub-set of elements considered as contaminants, through the complete disjunctive matrix built using the guidelines values established in the literature. The combined use of several guidelines allows covering all the identified contaminant elements as well as creating a hierarchy of scale of contamination. Since CA has the advantage of interpreting jointly variables and samples, is then possible to identify samples according to their degree of contamination.

Finally, the third step consists in the spatial estimation of the results obtained in the second step. For this propose Ordinary Kriging and Direct Sequential Simulation techniques were applied, to define the distribution of pernicious elements in the area.

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