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Mapping gold pathfinder metal ratios – A methodological approach based on compositional analysis of spatially distributed multivariate data

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The methodology applied in this work is directed at mapping potential targets for Au mineralization using compositional kriging of ratios of Au pathfinder metals [1].

Geochemical exploration in deeply weathered terrains is often hampered by the strong modification of primary geochemical signals at surface making it difficult to locate potential targets using geochemical results of soil samples. This problem is particularly relevant in the Amapari region, Amapá state, Brazil, where 14,623 soil samples were collected in an extensive grid covering an area of approximately 500 km². For the purpose of this work the samples were classified according to three distinct groups: **training**, composed of mineralized samples over a known deposit area (B) and non-mineralized samples from a background area (A); **validation**, composed of another set of mineralized samples over the same known deposit area (B) and non-mineralized samples from the same background area (A) and **prospection**, composed of samples from the rest of the area covered by the grid but where Au mineralization has not yet been recognized.

In the training phase of the model metals associated with the Au mineralization were identified using Compositional Principal Components. Based on these results it has been constructed a Compositional Discriminant Function to identify the origin of each sample (A or B) based on the selected metals. This function was tested in the validation phase when the origin of the samples was omitted and a success index was obtained.

The next phase consisted in obtaining Models of Compositional Crossed Variogram with the metals selected in the previous phase. Based on these Models, Compositional Kriging was performed using the metal ratios previously selected to obtain a map of reinforced geochemical signals. Mapping regions A and B allowed a more clear indication of the areas with and without Au mineralization. Finally, the kriging model was used to build a map with the prospection samples where only geochemical results were available. This map pointed to target areas some of which have proven to be mineralized according to mineral exploration work conducted by companies in the region.

Reference:

[1] Boogaart, K.G Tolosana-Delgado, R. (2013) Analyzing Compositional Data with R: Springer

