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Multivariate statistic treatments of LA-ICP-MS chemical mapping

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The last two decades, LA-ICP-MS emerges as a cost effective and time-efficient technique for quantitative elements distribution on wide range of geological material [1]. Those type of micro-scale mapping may also be considered as a big dataset (often>100ko) able to be statistically analysed and provide insight on numerous geological issue [2].

Although software for concentration maps building are more and more powerful (e.g. Iolite 4), statistical treatment are generally done manually with Excel spreadsheets and are very time consuming.

In this context, BRGM has developed an exploratory and predictive multivariate statistical tool able to:

- open a multichannel concentration map from LA-ICP-MS or EPMA analysis and filtered the low (<LOD) or high (inclusion?) concentrations in different ways;
- implement different types of conventional statistical treatment like discriminants diagrams, error ellipse plotting, Agglomerative Hierarchical Clustering (AHC), Principal Component Analysis (PCA), Multidimensional Scaling (MDS) and Linear Discriminant Analysis (LDA)

The complete method has been tested and validated on an already treated dataset of sulphur LA-ICP-MS maps of Algoma-Type BIF gold system [3], the results are in perfect agreement with those obtained through manual Excel Spreadsheet treatment. This approach has also been performed on isolated quartz grains and quartz in thin section, and provide statistical evidences of different mineralising events [2].

In addition to the BRGM capacities to performed LA-ICP-MS mapping on different minerals, this rapid and efficient integrative tool for multivariate statistical treatment(s) leads to raise the level of prospective exploration of elemental coupling/decoupling on geological sample.

[1]Woodhead et al. (2007), *Geostand. Goanalytical Res.*, **31**, 331-343.

[2]Monnier et al. (2018), *Lithos*, 355-377

[3]Gourcerol et al. (2018), *Miner. Depos.*, 53, 871-894.