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Isotopic fingerprints of «non-traditional» elements for authenticity and geographical assessments of food and beverages

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Authenticity and traceability of food are an area of high priority since they link directly the quality. However, more and more food and beverage are subject now to misdescription or adulteration and thus poses an increased risk for customers and producers. The new advanced analytical approaches, notably, stable isotope analysis of non-traditional elements such as strontium (Sr), lead (Pb), and boron (B) combined to trace element profiles make a decisive contribution to geographical provenance assessment. These isotopic signatures are indeed influenced by geological scene, anthropogenic, agricultural and environmental impact or even production processes. Constantly evolving modelled maps of spatial isotopic distribution, called isoscapes of bioavailable Sr, are becoming a dynamic tendency for interpreting the provenance of food.

Sample preparation methods are developed and optimized regarding matrix specification of each sample, notably, appropriate ion exchanging resin needs to be applied for a reliable analyte purification (satisfactory yield >80%) prior to MC-ICP-MS analysis. Isotope measurement performed by MC-ICP-MS with a precision down to 0.003% (2RSD, Sr), and 0.02% (2RSD, Pb) in the conditions of wet or dry plasma respectively. Boron isotopes in wine were determined using quadrupole ICP-MS with a precision down to 0.5% (2RSD).

An integral review of these isotopic and elemental markers shows a great potential in reliable authenticity assessment of foods and beverages, especially for those within a limited geographical area of production and standardized processes. The efficiency of geographical provenance determination using this approach was confirmed by its successful application to different food and beverages such as red wines and champagnes, products labeled PGI from France (rice from Camargue and dry-cured ham from Bayonne), French mineral bottled waters, and tea samples from wide-worlds origins.

The presented results obtained on food matrices are correlated to available isoscapes on Sr and Pb. At the same time, they build on and extend the previously developed database of authentic samples and aimed to investigate and develop a conceptual and practical framework that promotes a valid indication approach to dealing with fraudulent practices in the food sector.