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Authentication potential of 87Sr/86Sr in water – reference of signatures in natural mineral water to regional geology in Europe

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The study presents the investigation of strontium isotope ratios of about 650 different European natural mineral waters as part of the food traceability project “TRACE” funded by the EU. The 87Sr/86Sr analysis is part of a multi-element approach for authen-ticity which also includes 18O, 2H, 3H, main and trace elements as well as 34S.

The analysed 87Sr/86Sr cover a wide range of values from 0.7035 to 0.7777 indicating that the natural mineral water samples cover the span from young mantle derived basal-tic rocks to very old silicic continental crust.

The results of the large-scale investigation are used to elaborate a novel spatial predic-tion for strontium isotope ratios by combining the measured data with a GIS based geo-logical map of Europe.

The resulting map can be used to predict the strontium isotopic composition of ground-water and as such the composition of bioavailable strontium, which can be taken up by plants and further transferred into the food chain. In this study we show, as an example, that the strontium isotopic composition of honey and wheat from specific sample region within the TRACE project correlates well with that of the natural mineral water as pre-dicted by our map.

The proof of principle shown is highly relevant for geographical food authentication as it will allow an assessment of the origin of food products without the immediate need for geographically authenticated materials which may not always be available in the first instance. As such, our approach provides a cost effective first instance screening tool.

There is an increasing demand for independent analytical methods which can control the geographical origin. The EU project TRACE was started with the aim to develop a gen-eral understanding of the relation between the geo-bio-climatic environment and the isotope and elemental signature in food commodities. As one part of the study detailed isotope maps (e.g. 18O, 87Sr/86Sr) for groundwater will be generated by the isotope re-sults of 650 samples of European natural mineral waters. These isotope groundwater maps provide a multitude of applications not only for authenticity of food, but for groundwater recharge and climate studies, criminal forensics as well as archaeology.