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Bioavailable $^{87}\text{Sr}/^{86}\text{Sr}$ in European soils: A baseline for provenancing studies.

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Abstract

We present $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios for ~1200 selected soil samples, collected by the GEMAS consortium from grazing (Gr) and agricultural (Ap) soils in Europe with the aim to better understand the strontium isotope distribution in the bioavailable fraction of the top-soil and its potential for provenancing applications. Spatial analysis shows that there is a clear distinction between coastal (b100 km) and non-coastal (N100 km) samples in their variance and that this variance is mirrored in the sodium concentration, suggesting an important but highly variable contribution from seaspray. We present two $^{87}\text{Sr}/^{86}\text{Sr}$ maps at 25 km × 25 km scale: one based solely on the measured data using a classical kriging approach and one based on a Random Forest model using complementary GEMAS data to predict the strontium isotope composition at the remaining 3000+ GEMAS sampling locations, including appropriate uncertainty assessment. Using a forensic Bayesian likelihood ratio approach, a tool was developed in R to create provenancing likelihood ratio maps. The maps delineate areas of high and low likelihood and allow investigators to direct their resources to areas of interest. For actual forensic case work either the measured or the modelled data can be used as reference data for the overall distribution of $^{87}\text{Sr}/^{86}\text{Sr}$ values in Europe.