Geophysical Research Abstracts
Vol. 13, EGU2011-4058, 2011
EGU General Assembly 2011

Hydrogen, Oxygen and Strontium isoscapes for provenancing in Europe

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The natural environment as defined by geology, climate and ecology provides a wealth of chemical markers that are unevenly distributed on the earth's surface and thus provide a potential for spatial classification of natural materials and derived products. Forensic scientists have used individual markers for ad-hoc comparisons of evidence for specific cases but no forensically essential spatial reference sample-bases have been established, mainly due to financial constraints.

Recently Geographical Information Systems containing geological, geochemical and climatic data have become readily available and they provide new opportunities to predict the spatial distribution of natural chemical markers in a cost effective manner. Our research focusses on evaluating and validating the forensic potential of these and other spatial data in collaboration with colleagues around the world.

In theory, plants and animals are all related to regional soil and climatic conditions through the food (supply) chain and indeed regional foodwebs often show systematic relations between the isotopic profiles at different trophic levels and even humans.

At the basis of every foodweb there is soil and water. On the basis of the isotopic composition of precipitation, combined with high resolution climate models, we have developed new hydrogen and oxygen isotope prediction models, that allow us to discriminate the geographical origin of natural products on a ca 300km scale. To improve the discrimination power in Europe we have used representative soil samples collected by the GEMAS consortium to create the first low resolution measured Sr isotope geochemical map of Europe. The measured data is being used to create a more comprehensive prediction map for the whole of Europe. The water and soil data, combined with systemic knowledge of the foodweb relations and isotopic fractionations, are now being used to make probabilistic predictions of the isotopic composition of regional flora and fauna. In the presentation we will give examples of how we validate and apply our models to support provenancing of food and unidentified human remains and discuss which matters need more immediate research.