



B36 Global Forensic Provenancing With Geochemical Methods

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After attending this presentation, attendees will learn about the new developments in geographical provenancing and be informed about the possible applicability and limits.

This presentation will impact the forensic community and/or humanity by showing the forensic community that state of the art in forensic provenancing is aiming at a new level of sophistication by combining global information from several disciplines in one expert system. The presentation will provide policy makers with information about the state of present research and case experts in the field with new possibilities to get valuable information in complex cases.

Due to the globalization of legal (and illegal) trade and the limits of paper/electronic mandatory or voluntary traceability systems there is an increasing demand for techniques which can verify and/or validate the geographical origin of commodities. Not only is this relevant for consumer confidence but in almost every case where the origin and/or quality is questioned there is interest to have an independent method able to verify claimed origin.

Provenancing of raw food products like mineral water, vegetables, fruits and shellfish and processed products like honey, wine and olive oil have a high feasibility for geographic profiling as these items have a strong geochemical relation with the host rock and/or soil and precipitation. As certain rock and soil types have a limited spatial distribution on earth, the chemical signature the products inherit from their geochemical and/or bio-climatic environment, may enable geographical sourcing.

The bio-geo-chemical Natural Isotope and Trace Element (NITE) signatures consist of elemental and isotopic profiles related to regional climate (H and O isotopes), bio-environment (C and N isotopes) and geology (elements and S, Sr, Nd, Pb and other isotope systems).

A very important aspect of sourcing is the validation method. The most commonly suggested, but often prohibitively expensive, method is the construction of an analytical database based on authentic samples from specific areas which needs to be maintained indefinitely. More problematic is that any item from an un-authenticated area might lead to false positives. The second method, expensive only in its implementation phase, is to develop an understanding of the relation between the NITE profile in a certain product and its geo-bio-climatic environment. The latter method has the advantage that often knowledge about the geo-bio-climatic environment of un-authenticated area is available, e.g. D/H and ^{18}O isotope precipitation maps, geological and geochemical maps.

However the development and implementation of geo-bio-climatic profiling requires extremely robust analytical methodology and a continued commitment to a very high level of quality assurance.

Against this background the EU has funded a €19M research project TRACE to develop geo-bio-climatic analytical specifications of origin to be combined in a general traceability system. The project will investigate in detail if geo-bio-climatic profiles from a set of food commodities with different grades of complexity: mineral water, wheat, olive oil, honey and lamb meat from 20 different 10x10 km test sites in Europe, can be linked to the geo-bio-climatic environment at these sites. The NITE profiles from soil digests and extracts and local water will be compared with NITE profiles of the selected commodities. On selected commodities additional compound, genetic and pollen analysis will also be performed. The gathered data, combined with full paper/electronic paper traceability data, will be used as initial training set for a Geographical Information System (GIS) based knowledge system. Subsequently the system will be tested on world wide validation sample set. Once the knowledge system is validated it is aimed to be used by the EU to routinely screen food commodities from possible questioned origin before embarking on a full forensic investigation.

The TRACE project also investigates the possibility to include geo-bio-climatic profile data on the product label in a sophisticated bar-code type manner, a chemometric passport for foodstuffs, in the anticipation of the desire for much stronger traceability validation/verification in EU (import) legislation (www.trace.eu.org).

Although at present the focus is on food, the method developed will be applied to other criminal forensic trace material like human remains and drugs.

At present, other TRACE-mirror initiatives are being set-up in Latin America, Australia and New Zealand, China and the USA to enable world wide geographical profiling by NITE and related methods.

Trace Evidence, Provenancing, Biosecurity