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Isoscapes for Provenancing; Forensic Requirements and Inference.

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In recent years there have been interesting developments in using isotope maps to study the origin and migration of natural materials and organisms. The potential of using this information not only for scientific pursuits but also to aid forensic investigations was realized early on. However when porting scientific results to real world applications with potential serious consequences for those investigated, the scientific models need to be properly validated. Essential for use in law enforcement is that any outcome should be presented in such a manner that jurors, lawyers and law enforcement officers can make proper use of the statements made.

Scientifically it has become evident that the hydrogen and oxygen isotopic composition of rainwater is related to a limited number of well-understood spatial parameters like latitude and altitude. Models of the isotopic composition of the precipitation have been validated globally and now the regional composition of groundwater and food products can be predicted with a useful level of accuracy, enabling discrimination of latitudinal distances in the 200 mile range. As the precipitation models roughly provide latitudinal bands of distinction other parameters are sought to give more longitudinal discrimination and/or a higher scale of spatial resolution. Any parameter that can be linked to existing information already captured in maps is desirable and therefore existing geochemical stream-sediment and soil maps and the associated samples, provide a useful starting point. Recent research has shown that especially the radiogenic isotopic composition of elements like strontium and lead in soil can be linked to the isotopic composition of a local foodweb. The often relatively well-understood behavior of these isotope systems allows researchers to make spatial predictions of the isotopic profiles in target tissues and objects.

The presentation will use results of recent human provenancing investigations performed with light and heavy isotope maps to discuss strategies how to combine different isotopic parameters and other relevant information to construct a spatial likelihood model that is scientifically correct, provides a tool for investigators and suits the legal process.