A159   Analysis of Predictive Source Attribution Methods That are Based on Small Particle Traces

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After attending this presentation, attendees will understand, and be able to recognize applications of the major classifications of methods that have been used for predictive source attribution, along with the requirements for, and corresponding limitations of, their application.

This presentation will impact the forensic science community by organizing and specifying different classes of source attribution methods and providing an analysis of both their scope and limitations. The overall implication of this analysis is that specific applications can be addressed in alternative ways, but that general application requires a diversity of expertise and tools, along with a process that enables the facile choice among these in response to the particular investigative problem and the specifics of the samples that are available.

As part of ongoing research, a review and analysis was conducted of predictive source attribution efforts that are based on small particle traces. The goal of predictive source attribution is to use the results of analyses to make accurate inferential estimates of exposures to geographical areas, environments, activities, and processes. The discipline of predicative source attribution is distinguished from that of comparative source attribution, where the focus is on the degree of correspondence between two sources in relation to other possible sources.

Source attribution efforts in the forensic and broader scientific literature are conveniently grouped based on the type of material being analyzed. Major groupings are: foodstuffs, minerals (including soil and gemstones), illicit drugs, insects, plants (including pollen), bacteria (including viruses), and animal products. There are also some multidisciplinary case reports.

The review covered a large number of publications and studies relating to past and current source attribution efforts. A critical analysis showed, however, that nearly all of these were narrow in scope. Therewere four principle ways in which the scope was narrowed (with many of the efforts being limited in more than one of these ways). These categories for limitations in scope are: (1) those based on comparison; (2) those discriminating among members of a closed set of options; (3) those that employ only one method; and, (4) those that require a large sample size.

In contrast to these narrowed approaches, there were a set of individual source attribution case reports that had a microscopical, multidisciplinary perspective. Collectively, these cases are an excellent illustration of the potential of laboratory methods to provide information that either leads directly to source attribution or that does so when the results are integrated with other investigative information. Each of these cases used a multidisciplinary approach, but the particular methods that were used were determined by case parameters and the available expertise. Disciplines that have been applied repeatedly in these cases are geology, botany, pollen analysis, zoology, and forensic particle analysis. Three types of samples are also commonly represented: those from a particular location (as in a residence or business), those on clothing, and those on a motor vehicle.

The implications of the analysis of these cases are: (1) that a diversity of laboratory expertise and methodology is required in order for source attribution to be successful; (2) that different tools need to be applied in different cases; and, (3) that a process must be in place that allows a facile choice among this diversity of tools, in response to the particular investigative problem and the specifics of the samples that are available.

Source Attribution, Trace Evidence, Small Particles