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Introduction to the Exploitation of Microscopic Traces for the Geo-Sourcing of Forensic Soil and Dust Evidence: Method and Examples from Casework

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The physical forensic sciences deal primarily with the comparison of questioned substances (i.e. evidence) to known sources, to determine if a source attribution can be demonstrated and proven by means of facts obtained by observation and analysis. The justification for performing these examinations is Locard's Exchange Principle, which states that "whenever two objects come into contact there is always a transfer of material between them." The results of such examinations are used to prove, usually through sworn testimony in a court of law, an association between people, objects and locations.

Another forensic activity, and one performed far less frequently, is to analyze substances for the purpose of developing information that can assist detectives in an open investigation. Such analyses are typically far more difficult because developing an investigative lead requires more scientific and mental labor than characterizing two materials (e.g. two fibers, pieces of glass, chips of paint, etc.). The results of these efforts are reported, only sporadically, in both the popular press and in the specialized (and often obscure) scientific literature. The value of such information in aiding in the solution of crimes speaks for itself, yet many police and intelligence agencies deride such work as "Sherlockian" or worse. Those who don't believe such results are possible are those who have never had occasion to receive such information from the laboratory during an investigation. Those that have become believers and request this type of analysis, however find that there are few laboratories of individuals that can provide it. If Locard's Exchange Principle is true, then it follows that the dust on a person's clothing, the soil on the undercarriage of their vehicle or the particles on a string used to wrap a dozen sticks of dynamite together, must all carry evidence of the environment from which they originated or spent any length of time. If the theory is of practical use, then it must be possible to analyze this dust and from the identity of the particles discovered, develop a picture of that location.

While there are many types of investigative leads that can be developed by a forensic microscopist with the requisite expertise and experience (and depending, of course on the nature of the case and the open questions to be answered), the subject of this presentation is the type of information that can be obtained from dust and soil. Examples of the types of analyses that can be performed on the small amounts of such sediments available in a typical criminal investigation will be described. The practicality will be illustrated by means of several real-life examples from the author's case-book that reveal how the facts obtained by rigorous analyses were synthesized into investigative leads by means of reference

materials, imagination and creativity to provide investigative leads in cases of several different types. They illustrate Pasteur's adage that "… chance favors the prepared mind."