B38 A Novel Approach to the Examination of Soil Evidence: Mineral Identification Using Infrared Microprobe Analysis

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After attending this presentation, attendees will gain an awareness of the application of infrared microspectroscopy for mineral identification, a vital aspect of soil evidence analysis.

This presentation will impact the forensic community and/or humanity by providing an innovative technique for mineral identification which will augment traditional methods of soil analysis.

Soil evidence is commonly encountered at a wide variety of crime scenes, and can be potentially very valuable because of its ability to identify and individualize. Despite this fact, soil analysis is underused and underappreciated in the forensic science community. Advances in the field of infrared microprobe analysis make it possible to perform rapid, reliable, and reviewable identifications of minerals found in soil samples.

The application of infrared microprobe analysis for fiber and paint- evidence analysis is well established and accepted in forensic science laboratories. With new advancements, infrared microprobe analysis can be extended to a wide range of physical evidence; from the identification of minerals and illicit drugs to the differentiation of glass evidence. This paper focuses on the use of the infrared microprobe for the identification of minerals in soil samples.

Infrared microprobe analysis of minerals is made possible through the use of the diamond attenuated total reflection (ATR) microscope objective. The design and use of the diamond ATR microscope objective allows for the selective isolation of individual minerals for simultaneous collection of microscopic, optical, and infrared data, thus enabling the indisputable identification of minerals. Infrared microprobe analysis requires virtually no sample preparation, and enables direct infrared spectroscopic analysis of unknown mineral samples. When coupled with a preliminary examination using traditional methods of polarized light microscopy, complete analysis of an unknown mineral can be performed quickly and easily. Thus a mineralogical profile of a soil sample can be obtained in a short time.

Prior to applying this technique to soil analysis, an infrared spectral library of approximately fifty common minerals was made and tested using the infrared microprobe. Notwithstanding the existence of thousands of diverse minerals, a single soil sample usually contains between three and five mineral varieties, with only twenty minerals being prevalent in all soils. Thus, a library containing the spectra of fifty minerals was deemed sufficient for forensic soil analysis. Next, soil samples were obtained and the mineral fractions separated using traditional methods. The minerals were then isolated, analyzed, and identified using the polarized light microscope and the infrared microprobe. This study shows the great benefits of infrared microprobe analysis for mineral identification and the rapid, reliable, and reviewable creation of a mineralogical profile of a soil sample. The ability to integrate polarized light microscopy with infrared microprobe analysis to minerals in soil samples is unprecedented.

Soil, Mineral, Infrared Microprobe

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