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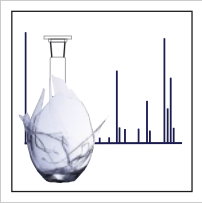

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Forensic Analysis of Glass Fragments

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Broken glass is a common piece of evidence in burglaries, car crashes, and violent crime. When a glass object breaks, fragments are spread in the surrounding area and can be found in the clothes and skin of people who were in the vicinity at the time of the object breaking. If glass fragments found on a suspect are from the same source as the fragments at a crime scene, it can link the suspect to that crime scene.

In order to determine whether two fragments originate from the same source, different glass properties are analyzed and compared. The most successful application so far is the use of Single-Pulse Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) to quantify the concentrations of a set of elements in samples of known and unknown origin and compare them to one another. The court-approved established method makes use of sequential mass analyzers and high-dispersion ablation cells, using long and stable signals for quantification. Six measurements are made using large spot sizes and 500–600 laser pulses for each data point. However, this method requires larger samples of the size of 400 µm x 200 µm x 100 µm (20 µg), while most of the fragments found on suspects are smaller.

Changing to fast-washout low-dispersion ablation cells, individual laser pulses can be resolved and the sample is analyzed layer by layer with each pulse representing an independent measurement. This allows to get more information out of the small samples and to quantify using less material. As sequential mass analyzers are too slow for multi-elemental analysis of the faster transient signals, a (quasi-) simultaneous time-of-flight mass analyzer was used instead. Furthermore, it was possible to significantly increase the amount of data points, allowing for more sophisticated options with the statistical treatment of the measurements.

This approach allowed for a 25-fold reduction in the amount of sample material required to 100 µm x 100 µm x 33 µm (0.8 µg) while offering comparable matching and mismatching capabilities.

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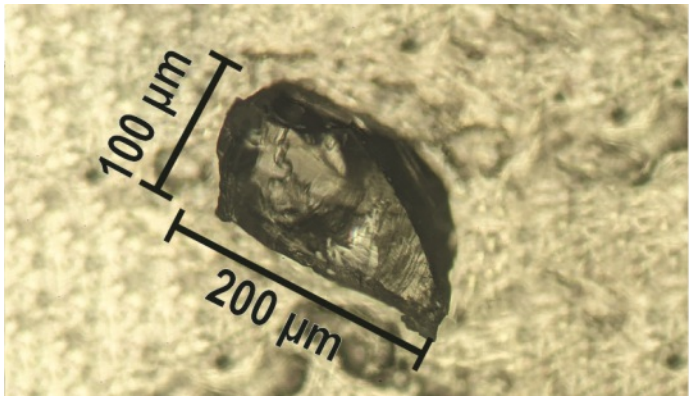
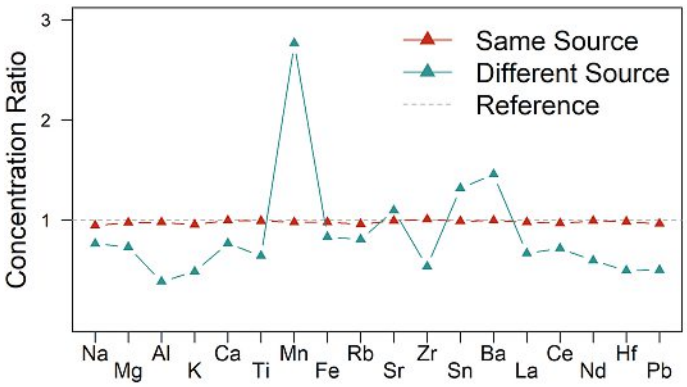


Photograph of a typically sized glass fragment found as evidence on a suspect, placed on tape.



Ratios of concentrations for glass fragments when compared to fragments of the same source or a different source.

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C. Neff, P. Becker, D. Günther, *J. Anal. At. Spectrom.* **2022**, *37,* 677, https://doi.org/10.1039/D1JA00421B.

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