B82 The Effect of Walking on the Evidentiary Value of Soil Taken From Footwear

Heather T. Moody, 265 N Saint Lucas Street, Apt 1, Allentown, PA 18104; and Lawrence Quarino, PhD, Cedar Crest College, Dept of Chemestry & Physical Science, 100 College Drive, Allentown, PA 18104*

After attending this presentation, attendees will understand how soil analysis from footwear is impacted by distance traveled from the point of origin of the soil.

This presentation will impact the forensic science community by demonstrating the validity of comparisons between soil samples taken at a point of origin and that found on footwear that has been walked on up to 1.5 miles after transfer.

Evidentiary 3D footwear indentations are often casted using a form of dental stone. The cast can then be compared to the exemplar footwear using identifying and individualizing characteristics; however, if the cast does not provide sufficient detail to make it useful in an investigation, scientists may examine adhered soil to the cast in the event that evidentiary footwear is found. Examination of soil from both the cast and the collected footwear may be performed using several methodologies. These analyses include pH, organic loss on ignition, palynology, particle size distribution, mineralogy, and elemental composition. Particle size distribution is particularly probative because it directly relates to the mineral content which in turn directly relates to the elemental composition. In order for a comparison between soil in the footwear and soil adhering to the cast (at least at the point of origin) to be valid, the composition of the soil in the footwear must not be changed as a result of the impact of the footwear with surfaces after transfer. To date, no research has been performed to see if the characteristics of soil in footwear change between transfer and collection. This study examines this question by determining whether the particle size distribution of soil in footwear is altered while walking on an asphalt surface as a function of distance.

Soil was collected along a tree line, mixed, and homogenized. Particle size distribution was performed on five samples of the soil using a previously published method.[1] Cumulative weight graphs were generated from size fractions weighed after sieving with mesh sizes measuring 2,000µm, 500µm, 250µm, 125µm, and 63µm. These results served as the zero-mile trial, representative of the point of origin or site of casting. Soil from the same sample was moistened and applied to the grooves of sneakers (by stepping into the soil) from two volunteers weighing 110 and 130 pounds, respectively, and collected after each of five trials at four walked distances (0.5, 1, 1.5, and 2 miles) on dry asphalt. The same type of sneaker was worn by both volunteers. After each trial, soil remaining on the treads of the sneakers was collected from four regions — right heel, right toe, left heel, and left toe — and approximately 1.2g of the soil was analyzed using the particle size distribution method and compared against the zero-mile trial. Mean cumulative weight graphs were converted to semi-log graphs from soil collected from each region of the sneaker from both volunteers at each distance and compared to mean semi-log graphs generated from the zero-mile trial. The Kolmogorov-Smirnov test, a non-parametric statistical test, was used at the 95% confidence interval to determine differences between the semi-log graphs from the zero-mile samples and the distance trials. This test showed that all (ten out of ten) of the 0.5-mile trials, eight out of ten one-mile trials, and nine out of ten 1.5-mile trials were indistinguishable from the zero-mile samples. Of the two differing one-mile trials, only one region out of eight was found to be indistinguishable from the zero-mile samples. Of the single differing 1.5-mile trial, one-half of the regions were found to be indistinguishable from the zero-mile samples. The two-mile trials did not yield enough soil for analysis.

Although several other parameters need to be examined (different weights of volunteers, running, different surfaces), results of the present study show that false exclusions are not likely to occur when comparing soil from footwear from a point source after walking a distance of up to 1.5 miles.

Reference:

1. Johnson, WH. Soil Particle Size Analysis. UNLV Health Physics Program Laboratory Operating Procedure. 1996:1-16.

False Exclusions in Soil, Footwear, Particle Size Distribution