

Soil Mineralogy and Other Properties in Forensic Investigations

Robert Fitzpatrick^a, Mark Raven^a, ^aCSIRO Land and Water/ Centre for Australian Forensic Soil Science. E-mail: rob.fitzpatrick@csiro.au

Recently there has been an increased usage of soil materials in forensic science. Forensic soil science requires appropriate methods for sampling, separation and analysis. We have developed the following systematic examination sequence. Firstly, soil morphological features are visually examined and then with a stereo binocular microscope. Secondly, infrared spectroscopy and magnetic susceptibility analyses are made on whole samples. These are then sieved and the smallest size fractions used for X-ray diffraction analyses. Further analyses using a petrographic microscope, SEM, TEM, ICP-MS or XRF may be necessary.

The following six criminalistic and environmental forensic case studies demonstrate how soil properties have been used to discriminate between and match soils for critical evidence in: (i) solving a double murder case by identifying the similarities between mineral assemblages (kaolinite crystallinity and presence of mica, talc and rutile) in soils on a shovel and also from a quarry. The soils had a common provenance and revealed the location of two buried bodies, (ii) identifying the locality of stolen ferns from a conservation park, (iii) identifying the provenance of soil removed from a site containing aboriginal artifacts, (iv) a sexual assault case in which a comparison between soil minerals on jeans, shoes and a vehicle, with samples from a road side, (v) identifying the provenance of an industrial dust settling on parked vehicles. The mineralogy of these dusts identified them as coming from a cement works. (vi) identifying the possible overseas provenance of soil on boots belonging to a suspected terrorist.

Keywords: provenance, clays, XRD