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Analysis of leachate, VOCs, fatty acids and mineralogy following the discovery of a homicide grave: Potential implications for police led open area ground searches for burials

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Police and law enforcement 'open area ground searches' may take place in a variety of geographical settings and over large tracts of land to locate unmarked graves, drugs, weapons, firearms and other items related to homicide, organised crime and terrorism. Reconnaissance techniques that can reduce substantially the search area bring benefits in terms of time, resources and detectability. Leachate and volatile organic compounds (VOCs) may be potentially generated at a homicide grave. The migration and detectability of the organic compounds and leachate are dependent on several factors, such as the geology, geomorphology and hydrogeology of the burial site, and circumstances of the burial (e.g. was the deceased wrapped in plastic, which could have impeded leachate and flows of organic compounds). A shallow, unmarked, homicide grave was detected, located and recovered with the police at a remote location in Northern Europe. This grave contained the body of a victim who had been buried more than a decade earlier. Following the recovery of the body soil samples were collected using a 30mm diameter soil auger and transferred into 40 ml, glass vials containing a screw cap and a polypropylene septa. The soil samples were taken up to 0.75mbgl at and beneath the floor of the grave, along strike (slope) of the grave, up to 100 m downslope and 75 m upslope. A control sample was also collected at approximately 250 m from the grave, at a higher elevation and in an area of similar geology, but which could not have been influenced by the grave's contents. The geology comprised strong, well-jointed, coarse grained, sandstones of Namurian age, overlain by Periglacial deposits and peat. The leachate, organics and mineralogy were analysed and results compared to the equivalent control sample. Experimental techniques were developed to extract anions and bio-amines from the soil samples. The data showed elevated levels of putrescine, at nearly 150 ppb at the grave, downslope and for several meters upslope at localities where detector dogs had showed an ‘interest’ before the grave was discovered. The mineralogical analysis, using integrated automated mineralogy and petrology (QEMSCAN), detected the presence of calcite (at an abundance of less than 1%) in the soil profile beneath the grave. No calcite was detected using automated analysis in any of the other samples analysed. The texture of the calcite as imaged using scanning electron microscopy indicates that it is likely to be diagenetic in origin, precipitated within the soil profile rather than being detrital in origin. Calcite was not detected by XRD in any of the samples analysed, although this could be due to its low level of abundance. Additionally, the organic analysis detected the presence of elevated stanols at the grave site and downslope. Further, similar research is recommended.