D35 Odor Analysis of Decomposition

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The goal of this presentation is to present research on the identification of molecular odorants (volatile compounds) released during decomposition of buried human remains. Attendees will become aware that human decomposition is significantly more complex than previously thought, which has implications in the training of cadaver dogs and in the detection of human remains

This presentation will impact the forensic community and/or humanity by demonstrating research which furthers our understanding of human decomposition and has profound ramifications in cadaver dog training procedures and in the development of field portable analytical instruments which can be used to locate buried human remains.

The detection of buried human remains is often aided through the use of ground-penetrating radar (GPR), manual probing techniques or trained 'cadaver dogs.' Of these methods, the means by which cadaver dogs locate human remains is least understood as the compounds the dogs are actually alerting to are unknown.

Because of the success of canines, the science of odorology expanded to deal with the forensic applications of scent discriminating dogs. These dogs have proved invaluable in such vital areas as explosive and accelerant detection, narcotics detection, cadaver location and searching for criminals as well as lost or missing persons. Canines have the ability to find historic human remains and the ability to discriminate human remains from those of other mammals. Additionally, dog trainers have recognized from observation of canine behavior that odor emitted by a live person differs from a cadaver and the odor from a recently deceased individual differs from one in advanced decomposition. As such, the smell associated with the stages of decomposition consists of multiple signatures. While dogs are trained to locate bodies and differentiate between human and animal remains there are limits to their abilities, in part due to environmental factors.

The current study seeks to find the basis for the canine's scent acuity by identifying the volatile compounds released from soft tissue decomposition in a burial environment and was conducted at the University of Tennessee's Anthropological Research Facility. Air samples were collected from directly below and above buried subjects (at a depth of 2.5 ft.) and also at the surface of the graves using triple sorbent traps which concentrated the volatile compounds released from the decompositional process. These samples were then thermally desorbed and analyzed using gas chromatography – mass spectrometry (GC-MS).

A total of four individuals, ranging from freshly buried to having been buried for over a decade, were monitored twice monthly for over a year. Results show that volatile compound releases from buried subjects are more complex than previously realized, with over 300 specific compounds identified to date. Additionally, the compounds released are dependent upon the stage of decomposition and the length of interment. Below-ground video capture imagery shows decomposition under conditions of shallow burial in a temperate climate to be roughly eight times slower than surface decomposition and dependant upon the season of burial. Temperature measurements of burials using belowand aboveground thermocouples showed seasonal fluctuations in temperature and indicate an approximate 12 hour lag between equilibration of grave temperature with the surface air. In addition, a 35^{o}F disparity between summer and winter grave temperature extremes was observed.

Odor Analysis, Cadaver Dog, Burials

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