



Young Forensic Scientists Forum—2020

Y3 The Effect of Human Decomposition on Fired Bullets and the Implications for Identification

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Learning Overview: After attending this presentation, attendees will understand the effects of human decomposition on individual characteristics in land impressions on bullets and how the deterioration over time affects an examiner's ability to analyze the bullets.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a novel analysis of an examiner's ability to identify the source weapon in cases involving bullets found in decomposed human remains.

For the purpose of this study, copper full metal jacketed bullets were placed in various regions of the body in two donors (Donor 1 and Donor 2) at the Northern Michigan University Forensic Research Outdoor Station (FROST) during the summer of 2019. Two bullets were placed in each of the selected regions so one could be left *in situ* during the entire data collection period and one could be repeatedly removed and replaced to assess the effects of decomposing soft tissue at shorter time intervals. All bullets were test fired from the same firearm into a standard tank at the Michigan State Police Detroit Laboratory and one control bullet was retained for comparison against the study bullets.

The condition of the donors and the other research in which they were participating affected the researchers' decisions regarding bullet placement. Prior to bullet placement, Donor 1 was in an advanced state of decomposition, meaning decomposition in some areas of the body was too far advanced for them to be viable placement locations. Donor 1 bullets were placed in the eye sockets, abdominal cavity, resting on the left femur, and in the soil near the body. Prior to bullet placement, Donor 2 was in an early stage of decomposition, but was part of an ongoing study focusing on gut bacteria, which precluded placement of bullets in the abdomen. Donor 2 bullets were placed in the right and left arms and resting on the left femur.

When the study bullets were removed for examination, they were analyzed for physical changes, cleaned, and compared to a control bullet using a comparison microscope according to standard agency protocols. After the examination, the bullets were replaced in the same locations. Three possible conclusions could be reached during the examination: identification, similarities (inconclusive), or unsuitable. The examination of the bullets involved examining each land impression independently and reaching a conclusion, then analyzing the bullet as a whole to determine if could be identified, despite damage to some land impressions.

Analysis showed that within only a few days of exposure to decomposing tissue, the copper displayed areas of discoloration, which appeared as a marbling effect. The areas of the bullets that were in direct contact with the bone (femur) were consistently lighter in color than the rest of the bullet(s). The copper also underwent oxidation, and patina formed around the exterior of the bullet. During the examinations, the patina was removed to observe the individual marks. The bullets that remained untouched until the conclusion of the study displayed a thicker layer of patina.

Results demonstrate that the number and quality of land impressions still visible after exposure to decomposing human tissue differed according to location, length of exposure time, and contact with bone. The bullets left *in situ* until the end of the data collection period were more heavily corroded than those that were removed and cleaned over time. Over time, the individual characteristics in the land impressions became dulled and less distinct, and pitting became apparent in the copper jackets. Additionally, maggot activity appears to have accelerated the rate of change observed on the bullets, as the bullets placed in Donor 1 (after most of the maggots had left the body to pupate) were identifiable longer than those placed in Donor 2, which progressed through all stages of entomological activity following bullet placement.

This research demonstrates the need to be aware of the potential effects of decomposing tissue on the ability to identify the source weapon that may have fired bullets related to the cause and manner of death of decedents. Additional research is needed to ascertain the effects of different time intervals and possibly those related to the seasons and other climatic factors.

Decomposition, Bullet, Comparison