



The Effect of Human Decomposition on Fired Bullets and the Ability to Compare



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ABSTRACT

Full metal copper jacketed bullets were placed in various regions of the body in two donors 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 (in position) during the entire data collection period and one could be repeatedly removed and replaced to assess the effects of decomposition at shorter time intervals. Over time, individual characteristics in the land impressions became dulled and less distinct, and pitting became apparent in the copper jackets due to the process of decomposition and metal oxidation.

INTRODUCTION

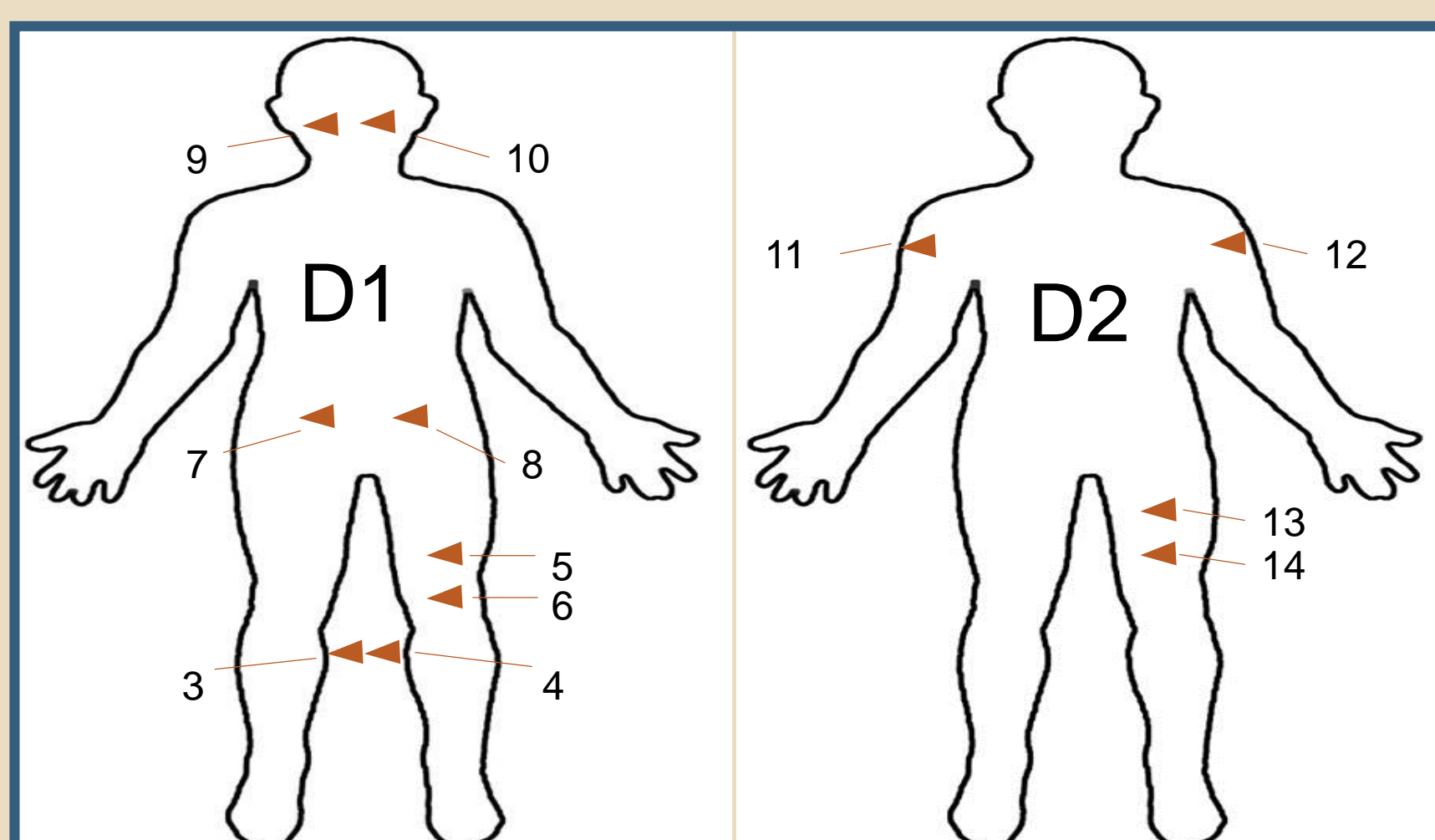
- Past research studied human, pig, dog, and environmental factors on fired bullets
- Copper, nickel, and brass bullets most affected
- Aluminum and nylon least affected
- Fat and muscle have a greater effect
- Aqueous and biological environments degrade bullets more than air and soil

MATERIALS

- Fourteen 9mm Luger caliber (American Eagle Federal 124 grain) full metal jacket cartridges
- 9mm Luger caliber Ruger pistol (model P89)
- Water recovery tank
- Leica FSM comparison microscope
- Plastic coated forceps for recovery
- Envirocide™ and soft bristle brush for decontamination
- Two Donors with protective cage to deter scavengers
 - Donor 1 (D1) – in advanced state of decomposition
 - Donor 2 (D2) – in early state of decomposition

METHODS

- Pistol chosen based on tendency to reproduce individual marks
- Fired and recovered bullets from water recovery tank
- The corresponding land impression (LIMP) on each bullet was identified with same number
 - LIMP 1 was indexed with a coarse mark on the ogive
 - Remaining LIMPs identified with nose pointing to the right and rotating away from examiner
- Compared bullets to control (Item 1) to ensure reproducibility of marks
 - Photographs were taken of each LIMP comparison
- 12 bullets placed – 2 bullets in each selected area
 - One bullet was removed during each sampling (once or twice a week)
 - One bullet remained in donor until conclusion (D1 for 30 days, D2 for 24 days)
- The bullets were cleaned, compared to control, then replaced in location
 - Soaked for ~30 mins, scrubbed with soft bristle brush, soaked ~10 mins
 - Photographs were taken of each comparison
 - A conclusion was reached for each comparison (identification, similarities observed, unsuitable)



RESULTS

Table 1 – Items 3 and 4 – Soil

Days from Placement	Bullet	LIMP 1	LIMP 2	LIMP 3	LIMP 4	LIMP 5	LIMP 6
2	I	I	I	I	I	I	I
4	I	I	I	S	I	S	I
9	I	I	S	S	I	S	I
11	I	I	U	S	I	S	I
16	I	I	U	S	I	U	I
23	I	I	U	U	S	U	I
25	I	I	U	U	S	U	S
30	I	I	U	S	U	U	S
Untouched (Item 3)	U	U	U	U	U	U	U

Table 3 – Items 7 and 8 – Abdomen

Days from Placement	Bullet	LIMP 1	LIMP 2	LIMP 3	LIMP 4	LIMP 5	LIMP 6
2	I	I	I	I	I	I	I
4	I	I	I	I	I	I	I
9	I	I	I	I	S	S	S
11	I	S	I	S	U	U	I
16	I	S	I	S	U	U	S
23	I	S	I	S	U	U	S
25	I	S	I	S	U	U	S
30	I	S	I	U	U	U	U
Untouched (Item 7)	U	U	U	U	U	U	S

Table 5 – Items 11 and 12 – Arm/Bicep

Days from Placement	Bullet	LIMP 1	LIMP 2	LIMP 3	LIMP 4	LIMP 5	LIMP 6
10	I	U	S	U	U	U	I
17	U	U	U	U	U	U	U
19	U	U	S	U	U	U	U
24	U	U	U	U	U	U	U
24	U	U	U	U	U	U	U
Untouched (Item 11)							

Table 2 – Items 5 and 6 – Leg
(Yellow= contact with bullet and bone)

Days from Placement	Bullet	LIMP 1	LIMP 2	LIMP 3	LIMP 4	LIMP 5	LIMP 6
2	I	I	I	I	I	I	I
4	I	I	I	I	I	I	I
9	I	I	I	I	I	I	I
11	I	I	S	I	I	I	I
16	I	S	S	S	I	I	S
23	S	S	U	S	U	S	S
25	S	S	U	U	U	S	U
30	U	U	U	U	U	S	U
30	I	U	U	U	S	I	I
Untouched (Item 5)							

Table 4 – Items 9 and 10 – Eye Sockets

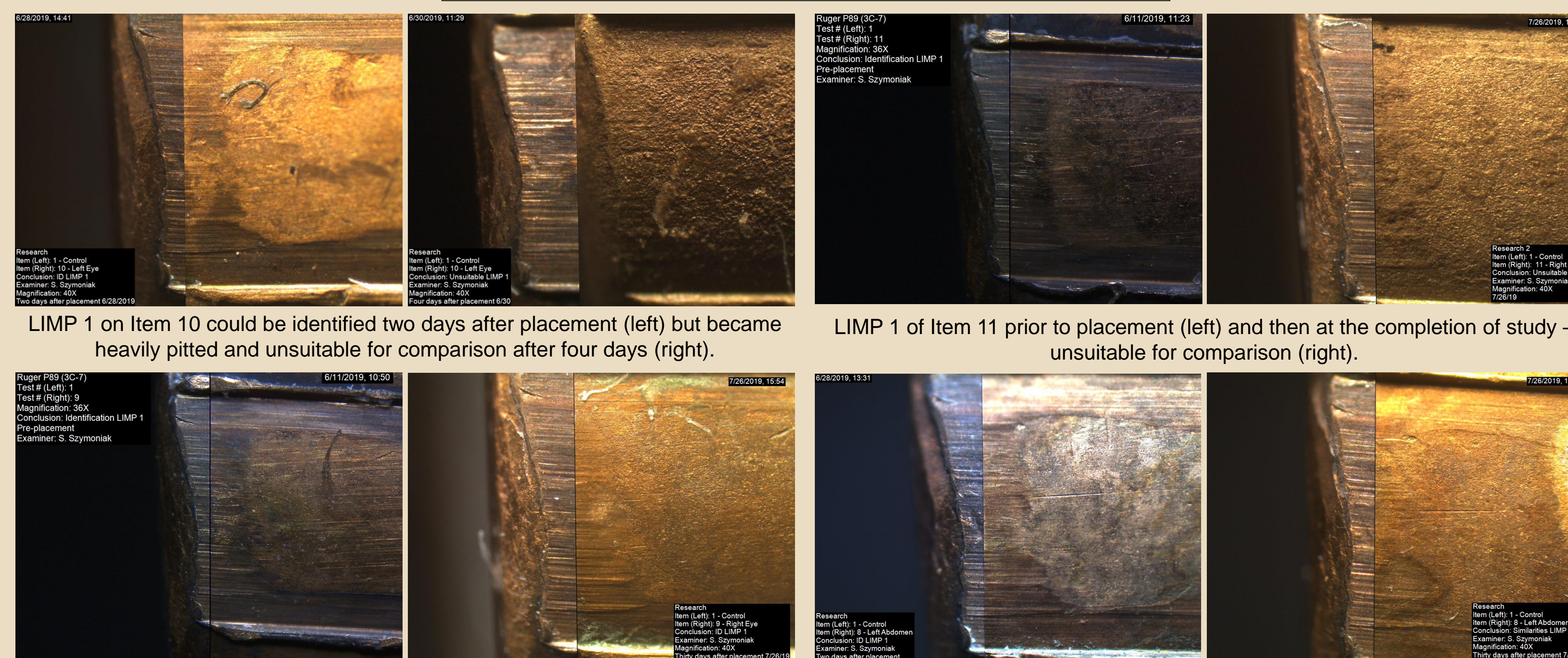
Days from Placement	Bullet	LIMP 1	LIMP 2	LIMP 3	LIMP 4	LIMP 5	LIMP 6
2	I	I	S	S	S	S	I
4	I	U	S	S	S	S	I
9	S	U	U	S	U	S	S
11	S	U	U	S	U	S	S
16	S	U	U	U	U	S	S
23	S	U	U	U	U	S	S
25	S	U	U	U	U	S	S
30	U	U	U	U	U	S	U
30	I	I	S	U	U	U	U
Untouched (Item 9)							

Table 6 – Items 13 and 14 – Femur

Days from Placement	Bullet	LIMP 1	LIMP 2	LIMP 3	LIMP 4	LIMP 5	LIMP 6
10	I	I	S	U	U	U	U
17	U	U	U	U	U	U	U
19	U	U	U	U	U	U	U
24	U	U	U	U	U	U	U
24	-	-	-	-	-	-	-
Untouched (Item 14)							

(Yellow = supposed to be in contact with bone;
Brown = discoloration observed)

I = Identification; S = Similarities; U = Unsuitable



LIMP 1 on Item 10 could be identified two days after placement (left) but became heavily pitted and unsuitable for comparison after four days (right).

LIMP 1 of Item 11 prior to placement (left) and then at the completion of study – unsuitable for comparison (right).

LIMP 1 on Item 9 prior to placement (left) and then at completion of the study – identifiable (right).

LIMP 1 on Item 8 two days after placement (left) and then at completion of the study – similarities observed (right).



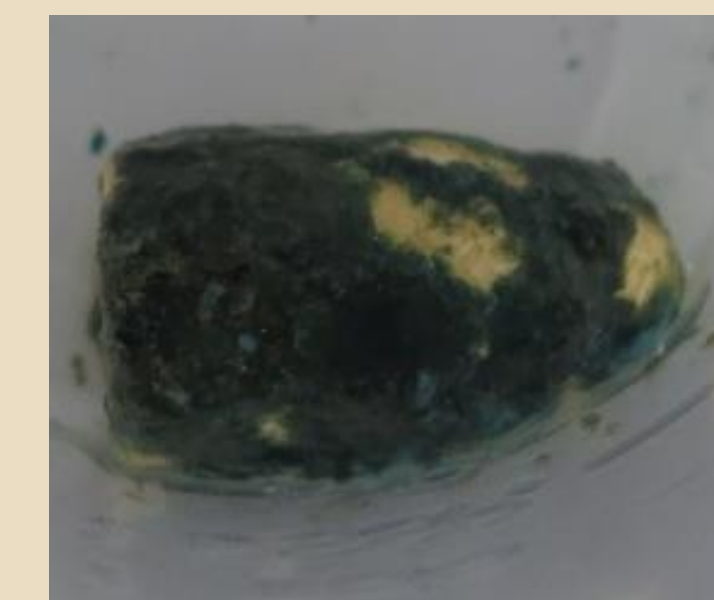
Dulling of jacket and patina on bullet recovered from donor.



Discoloration on jacket from bullet resting on bone.



Discoloration on bullet (in soil) from possible oxidation.



Patina from oxidation on bullet left in situ.

DISCUSSION

- D1 sampled 8 times over 5 weekends; D2 sampled 4 times over 3 weekends
- Sampling method chosen to limit the amount of incisions created to minimize rate of decomposition
- Bullets from D2 could not be sampled until 10 days after placement
 - Donor was bloated and had heavy maggot activity
- Thick oxidation layer (patina) developed on bullets left in situ
 - Not easily cleaned from the surface
 - Patina not observed on D2 bullets until weeks 2 and 3, possibly due to maggot activity
- Bullet finish became dulled and pitted
- Couldn't make a correlation if contact with bone had direct effect
 - LIMPs resting on the bone were similarly affected as the other LIMPs
- Bullets placed on bone same orientation each time – scribe right side up on base
 - Light discoloration where the bullet was placed on the femur (D1)
 - Discoloration observed adjacent to where bullet was placed (D2); bullet could have been slightly turned when placed
- D1 bullets that could be identified each week they were sampled had a corresponding bullet (left in situ) in the same location that could not be identified (and vice versa)
- Bullets from D2 – one LIMP only identified the first time sampled
- Distal bullet in D2 femur was not recovered – possible scavenger
- Harder to identify the longer exposed, eventually became unsuitable

CONCLUSIONS

- In the beginning, all LIMPs had distinct striations that could be identified
 - Became duller/less distinct as time progressed
- Bullets progressively deteriorated the longer they were exposed to decomposition
 - Bullets from D2 became deteriorated sooner – Donor was in earlier stages of decomposition
- No specific location had a greater effect on bullets
- When exposed to environmental factors, individual characteristics in LIMPs can become deteriorated and affect the examiner's ability to analyze bullets

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