STUDY IN DEVELOPING FINGERPRINTS ON FIREARM EVIDENCE

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OVERVIEW

- Background and Importance
- Previous Research
- Denver Police Dpt. Project
- New Developments and Research
- Summary and Conclusions

BACKGROUND

- **Why is this project important?**
  - The CSI Effect
    - Questioning the absence of evidence
  - Resources
    - Overwhelming requests for evidence processing
  - Limited staff
    - Box full of live ammunition. Time consuming?

PREVIOUS STUDIES

- **California Criminalistics Institute (2005)**
  - Useable fingerprints on unfired cartridges
    - *Bloody prints: 2/8 or 25%*
    - *Sweat prints: 0/8 or 0.0%*
    - *Oily prints: 2/8 or 25%*
  - Useable fingerprints on spent cartridges casings
    - *Bloody prints: 1/8 or 12.5%*
    - *Sweat prints: 0/8 or 0.0%*
    - *Oily prints: 0/8 or 0.0%*
- Concluded that it is **not likely** of obtaining useable fingerprints on cartridge casings
- **No useable prints** were obtained on the cartridge cases that had been fired.

PREVIOUS STUDIES

- **Minneapolis Police Department (Johnson, S.)**
  - Compiled data over 12-month period from 2006-2007.
  - Processed with superglue fuming, R6G dye staining and examination with a Coherent Verdi V-10 diode-pumped laser.

Evidence	Total Processed	Prints Suitable for Comparison	Recovery Percentage
Firearms	289	35	12.11%
Magazines	161	19	11.80%
Unfired Cartridges	2727	0	0.00%
Spent Cartridge Casings	259	1	0.38%

- Fingerprint developed on spent cartridge casing is believed to be touched by someone after being fired.

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- **Methods**
  - Compiled list of all evidence processing requests submitted from May 1st 2008 – May 1st 2010.
  - Requests specifically involving handguns, magazines, unfired cartridges and spent cartridge casings
  - Total of 1,316 items. Approximately 480 items had been processed with magnetic powder.
  - Remaining 836 items processed with superglue and RUVIS (Reflected Ultraviolet Imaging System).

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- **Results**

Evidence	Total Processed	Prints Suitable for Comparison	Recovery Percentage
Semi-Automatics	136	3	2.20%
Magazines	110	11	10.0%
Unfired Cartridges	817	2	0.25%
Spent Cartridge Casings	200	0	0.00%
Revolvers	53	4	7.24%

- **A total of 20 prints were found suitable for comparison:**
  - Only 6 of them were identified to an individual.
  - None of the identifications were from a cartridge casing.

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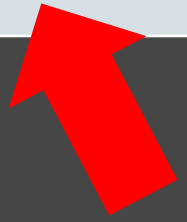
- **Results continued (not published)**
  - Data collected after May 1st, 2010.

Evidence Item	Total Processed	Shown Friction Ridge Detail	Ridge Detail Suitable for Comparison
Semi-automatics	10	6	0
Magazines	8	4	0
Revolvers	2	0	0
Fired cartridge casings	7	0	0
Unfired cartridge casings	23	3	1



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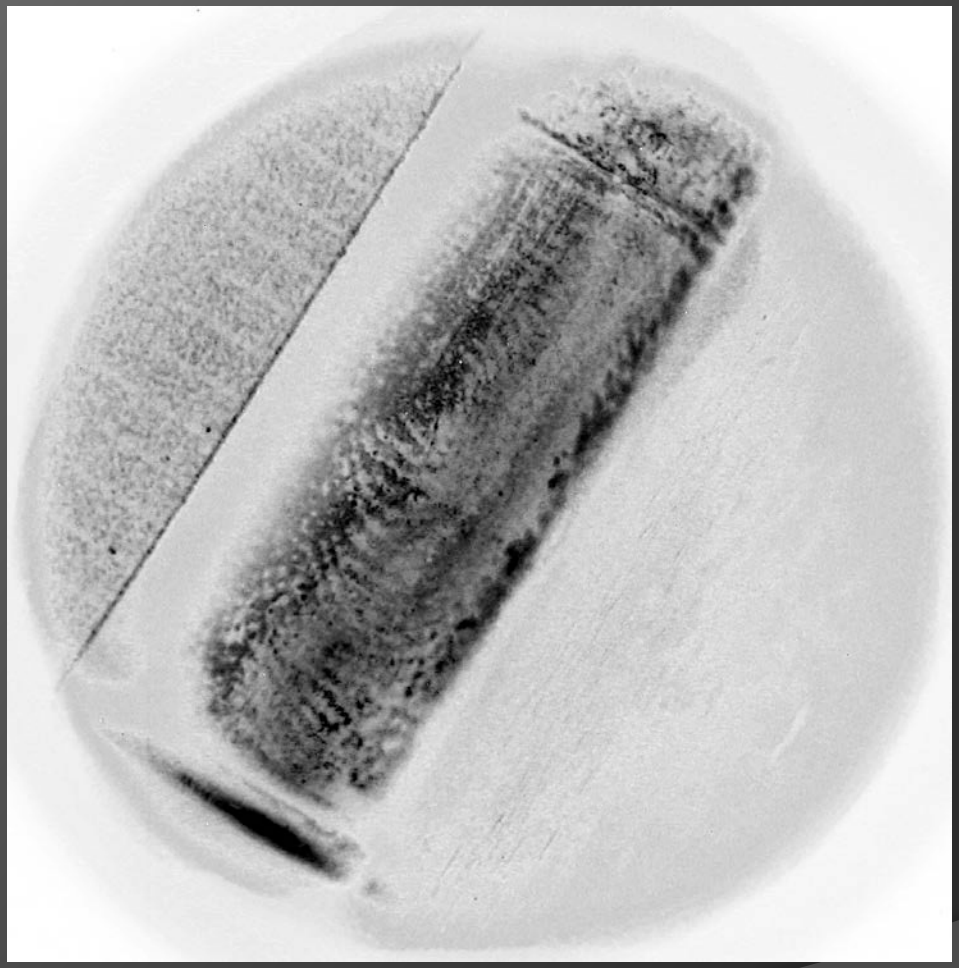
- **Ridge detail suitable for comparison?**



Fingerprint processed with Cyanoacrylate Ester and examined with the R.U.V.I.S scope. Photograph was enhanced with A.D.A.M.S.

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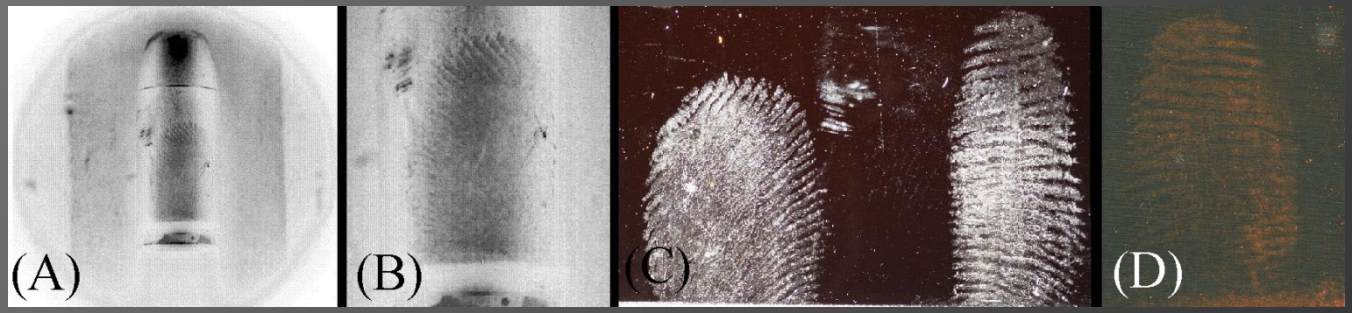
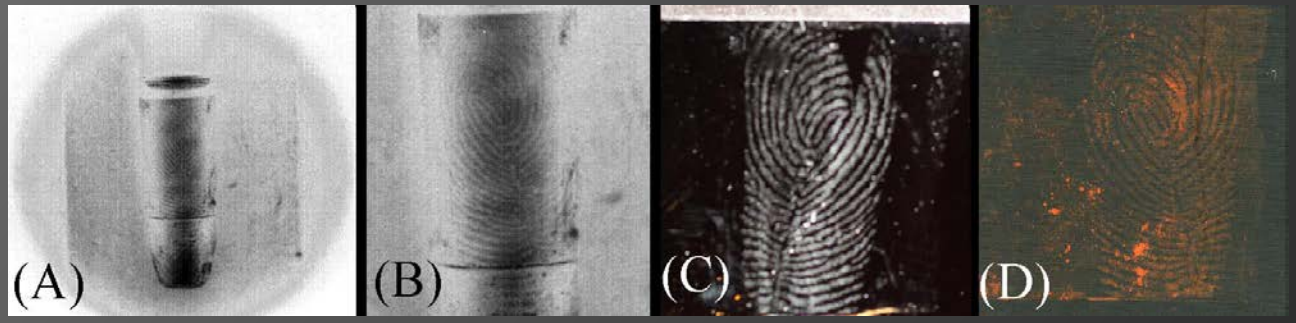
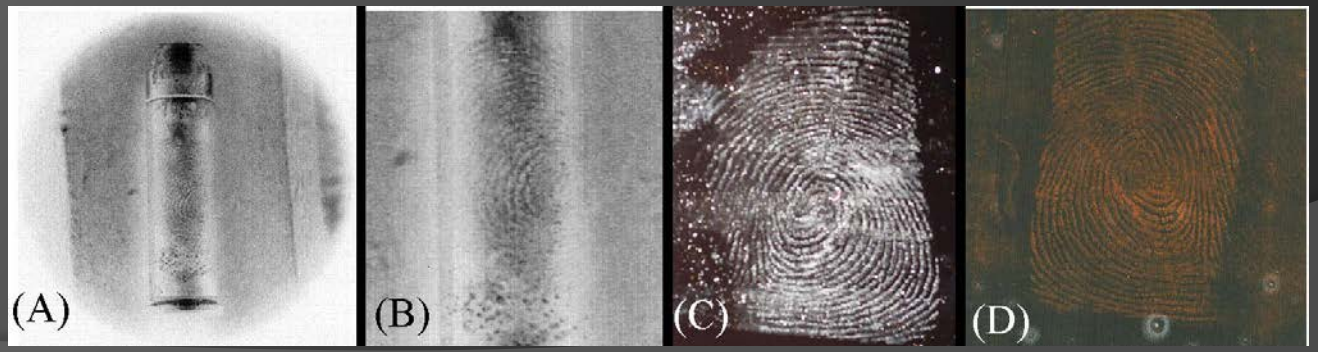
- **Results continued (not published)**



A Speer 45 auto cartridge casing handled as if it were to be loaded in a handgun magazine.



A Luger 9mm cartridge casing fingerprint placed by simply downward and upward motion



A 38 caliber SPL + P cartridge casing with fingerprint placed by rolling finger across the bullet

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- **Discussion on *unfired* cartridge casings:**
  - The common handling of these evidence items creates a barrier for development:
    - Touching and handling leave the least quantity of friction ridge detail.
    - Loading casing into the magazine increases the possibility for pressure distortion.

  - Fingerprints placed on curved surfaces can be challenging:
    - Cyanoacrylate Ester fuming, photography and powdering are not exclusive of one another.
    - Placing superglue residue on a gel lifter is also a nondestructive method to use for these surfaces.

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- **Discussion on *fired* cartridge casings:**
  - John Wallace, a retired U.K. forensic scientist:

"The hot, high-pressure gases from the burning of the propellant (and primer) act initially on the exposed lead at the base of the bullet. The bullet then passes through the barrel and is subjected to strong frictional heating. This causes some of the bullet and bullet jacket material to be melted and vaporized…"

- In other words…
  - Extreme pressure and heating
  - Destroys and melts jacket material
    - Leads to extreme low probability of fingerprint recovery

NEW DEVELOPMENTS

- **John Bond in the United Kingdom:**
  - Focuses on developing fingerprints on metals after being exposed to extreme high temperatures.

- **Underlying Theory:**
  - Association between chloride ions and metals to form metal salts.
  - Formation of metal salts, metal corrosion, can be accelerated by elevated temperatures.
  - Mostly used metal disks, not curved casings, to study natural metal corrosion by perspiration from eccrine glands (sweat).

NEW DEVELOPMENTS

- **John Bond Experiment 1:**
  - 40 unfired brass cartridge casings
  - Loaded casings into a 9 mm pistol and discharged
  - The fired cartridge casings were heated to 400ºC and left to cool.
  - Only 2 displayed any sign of continuous ridges that may be suitable for identification
  - Observed limitations: Physical contact experienced by casings and small surface area.

- **Hypothesized**
  - There must be a way to use this natural phenomenon and further enhance fingerprints.

NEW DEVELOPMENTS

- **John Bond further discovery:**
  - Used metal disks of 50 mm in diameter.
  - After heating and cooling, applied electrical potential to metal (2.5 kV).
  - Introduced black conducting powder.
  - Conducting powder preferentially adhered to areas of corrosion.
  - This method enabled fingerprint to be enhanced!
- **Limitations:**
  - Variation of salt secreted by different individuals.
- Other Applications:
  - Arson investigations.

NEW DEVELOPMENTS

- **Is Bond's method being used?**
  - Successfully used in United Kingdom.
  - Used in Boulder, CO to develop latent fingerprint visualization after 14 years from recovery.
  - Overall, not widely adapted in the U.S.
- **Other considerations:**
  - How does electrostatic charging affect ballistics?
    - Images of the breech face and firing pin marks were captured on 6 nickel and 6 brass casings.
    - None showed any visual difference after the application of potential or conducting powder.

SUMMARY AND CONCLUSIONS

- Several studies have reported the low percent recovery of useable fingerprints from firearm evidence, particularly casings.
  - Limitations: limited surface area and handling of casings.
- Fingerprint residue deposited on cartridge casings *prior* to discharge is subject to extreme heating and pressure.
  - Extremely low probability of developing fingerprints with conventional methods.
  - Metal corrosion with application of electrical potential has shown to enhance visualization of fingerprints on fired casings.
- Until a method that significantly increases the recovery of fingerprints on spent cartridge casings is developed:
  - Limit the processing requests?
  - Communication between examiners and officers is needed to evaluate each situational circumstance.

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Questions?