Gunshot Residue Analysis for Law Enforcement

Webinar Series: DAY 2

"Analysis and Testimony Considerations"

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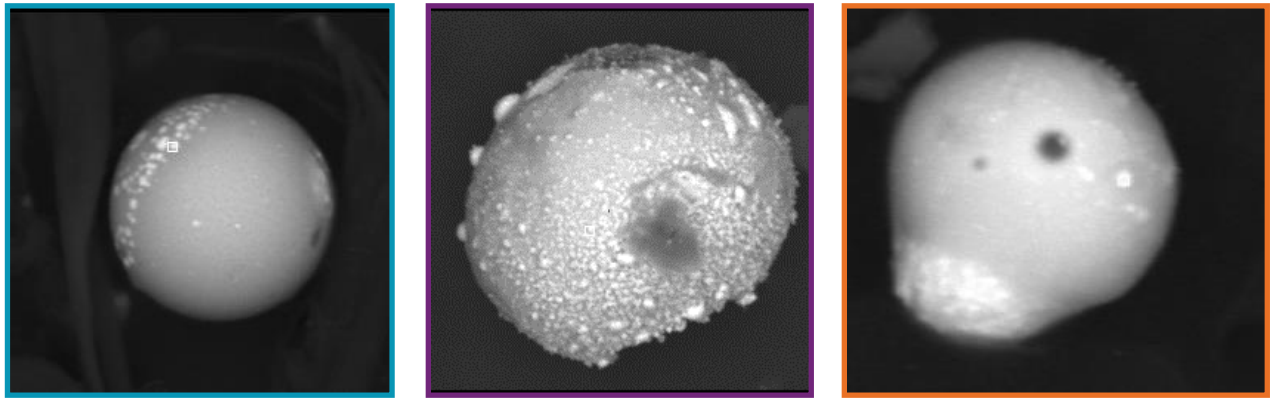
The Forensic Scientists at RJ Lee Group



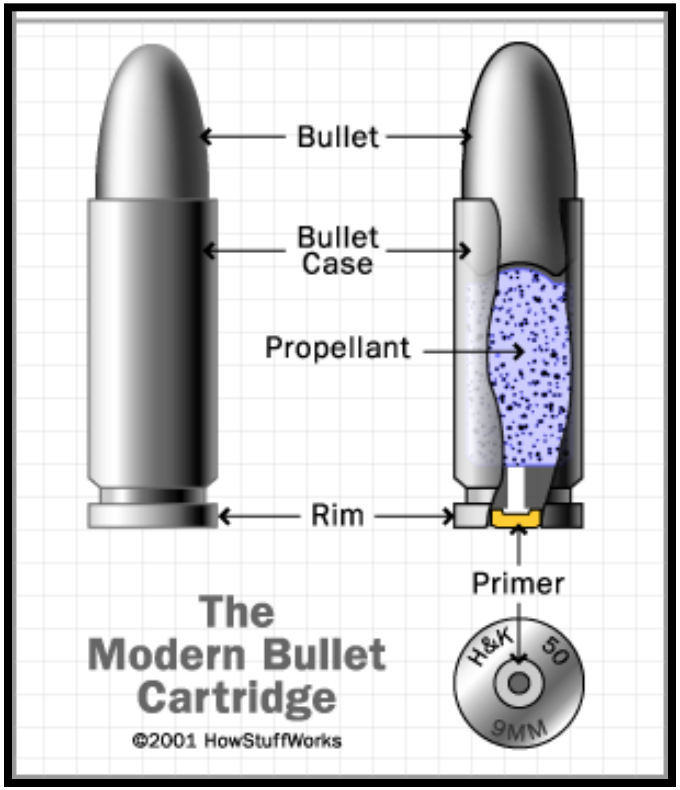
WHAT IS PRIMER GUNSHOT RESIDUE (GSR)?

What's in a Name?

- Gunshot Residue (GSR): The particulate that is expelled from a firearm during the discharge.

What's in a Name?

- Gunshot Residue:
  - **Primer**
    - Lead, Antimony, Barium
  - **Powder or Propellant**:
    - Nitrogen-based Compounds
    - Nitrocellulose, Nitroglycerine, Nitroguanadine
  - **Misc. Metals from Ammo & Firearm**
    - Tin, Aluminum, Copper, Zinc



How is GSR produced?

Mechanism of Action

- Trigger pulled
- Firing pin strikes primer cap setting off a gaseous reaction within the cartridge
- Particulate expelled from firearm
- Particulate lands on surrounding area
- Particulate collected

The Plume

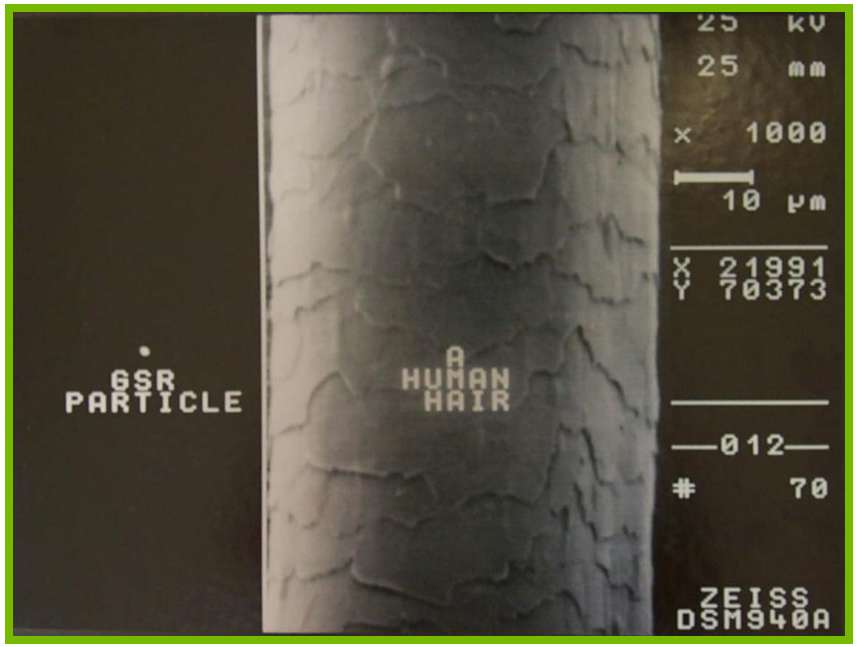
What is Primer GSR comprised of?

- Primer residue contains
  - Lead
  - Antimony
  - Barium
- These elements can combine to form 3 different particle types:
  - Characteristic of GSR (3 component particles)
  - Consistent with GSR (2 component particles)
  - Commonly associated with GSR (1 component particles)
- Typically, these elements are found in primer residue.

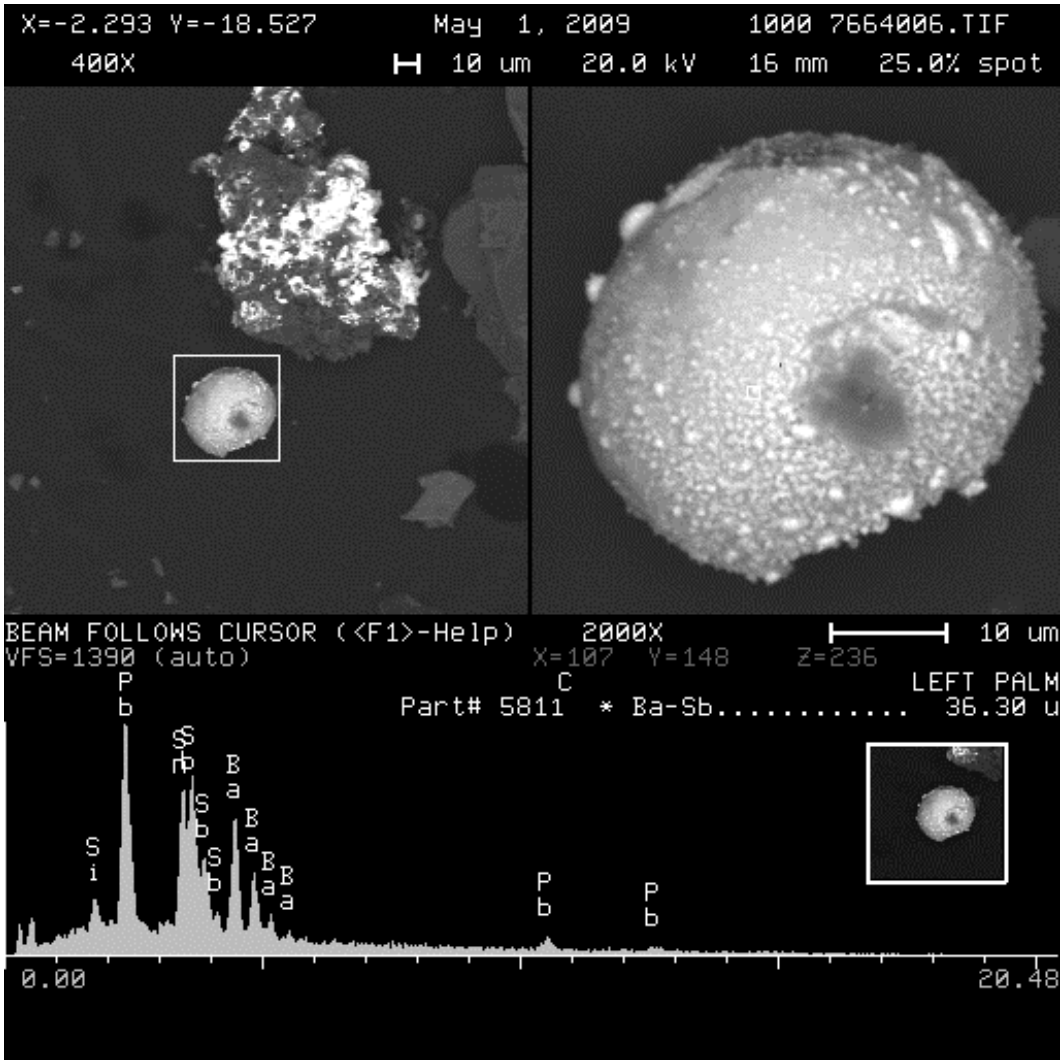
How Big is Primer GSR?

- Primer residue from the discharge of a firearm is unable to be seen by the unaided, naked eye.

- YOU NEED A HIGH RESOLUTION MICROSCOPE (SEM)



Primer GSR Particle



Lead (Pb), Barium (Ba), Antimony (Sb) and Tin (Sn)

SEM ANALYSIS

Primer GSR Analysis

- All samples are analyzed using a scanning electron microscope (SEM).

- Allows scientists to:
  - Determine the chemical make up of potential GSR particles
  - Visualize their shape/morphology.

Average analysis time is 4-8 hours per sample.

Historical Tests

- Paraffin or Dermal Nitrate Test
- ISID & RIFF
  - Instant Shooter Identification
  - Rapid Identification/Friend or Foe
- Atomic Absorption(AA)
  - Bulk Analysis

Scanning Electron Microscopy Kits
THE BEST

- SEM kits are the best and most effective collection technique
  - SEM is a confirmatory technique
  - Kits are cost effective
  - Fast and easy collection
  - Non-destructive
  - Reproducible

TESTIMONY

Hypothetical Situations

IDEAL SCENARIOS

- Static environment
- No airflow
- Functioning firearm
- Immediate, efficient collection
- No activity after discharge
- No debris on hands
- Clean test area
- Room, surface, material untouched

POTENTIAL RESULTS

- 100s – 1000s of GSR and GSR-related particles *produced*

Hypothetical Situations

REALISTIC SCENARIOS

- Rain, wind, snow, sleet
- Airflow
- Firearm is not a good producer of particles
- Collection long after incident
- Lots of activity
  - Hand washing, hand shaking, running, wiping, etc.
- Biological material
  - Blood, sweat, dirt, debris, etc.

POTENTIAL RESULTS

- 100s – 1000s of GSR and GSR-related particles (unlikely)
- Some GSR and GSR-related particles
- No GSR and GSR-related particles

WHY…

Should you collect GSR samples?

- Sample retention
- Thorough case examination
  - Testimony
  - Jury benefit
- Probative evidence
- Investigative leads

Primer GSR Population

SWG-GSR Terminology

Characteristic of GSR

- Lead-Barium-Antimony

Consistent with GSR

* Two-component particles

- Lead-Barium
- Lead-Antimony
- Barium-Antimony

Commonly Associated with GSR

* One-component particles

- Lead
- Barium
- Antimony

Results

- **WHEN GSR IS PRESENT, IT MEANS:**
  - Subject discharged a firearm
  - Subject was in close proximity to the discharge of a firearm
  - Subject came into contact with a surface that has GSR on it

- **WHEN GSR IS NOT PRESENT:**
  - Does not eliminate the possibility of a discharge
  - Inconclusive

Qualifiers

- Reasons GSR could be present
- Other sources of one and two component particles
- The meaning of inconclusive results

Testimonial Considerations

- The FBI Laboratory
  - www.swggsr.org
  - Guide for Primer Gunshot Residue Analysis
  - Page 64
- Sources of Particles Similar to GSR
- Subject Occupations
- Contamination

Testimony Considerations

- How long has GSR been on there?
- What type of firearm was used?
- Who was the shooter?

THANK YOU!

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