

Pyrotechnic Reaction Products of



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a "*Different Kind*"

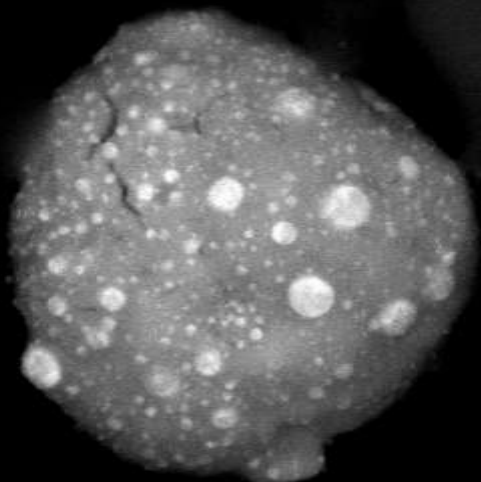
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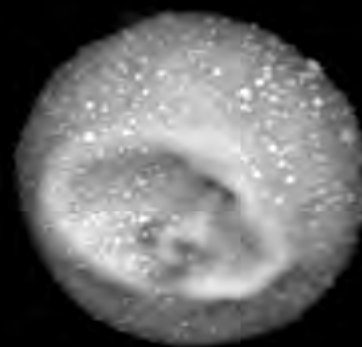


Normally GSR or Fireworks Residues come to mind when we discuss Pyrotechnic Reaction Residues and Automated SEM Particle Analysis of adhesive stub collections from hands

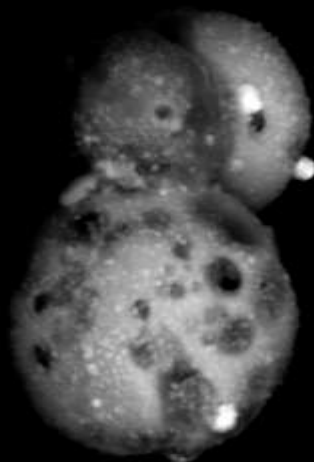




Acc.V Spot Magn Det WD |-----| 5 μ m
25.0 kV 3.0 4000x BSE 10.1 GSR BSE MODE



Acc.V Spot Magn Det WD |-----| 10 μ m
20.0 kV 5.9 2560x BSE 9.8 GSR

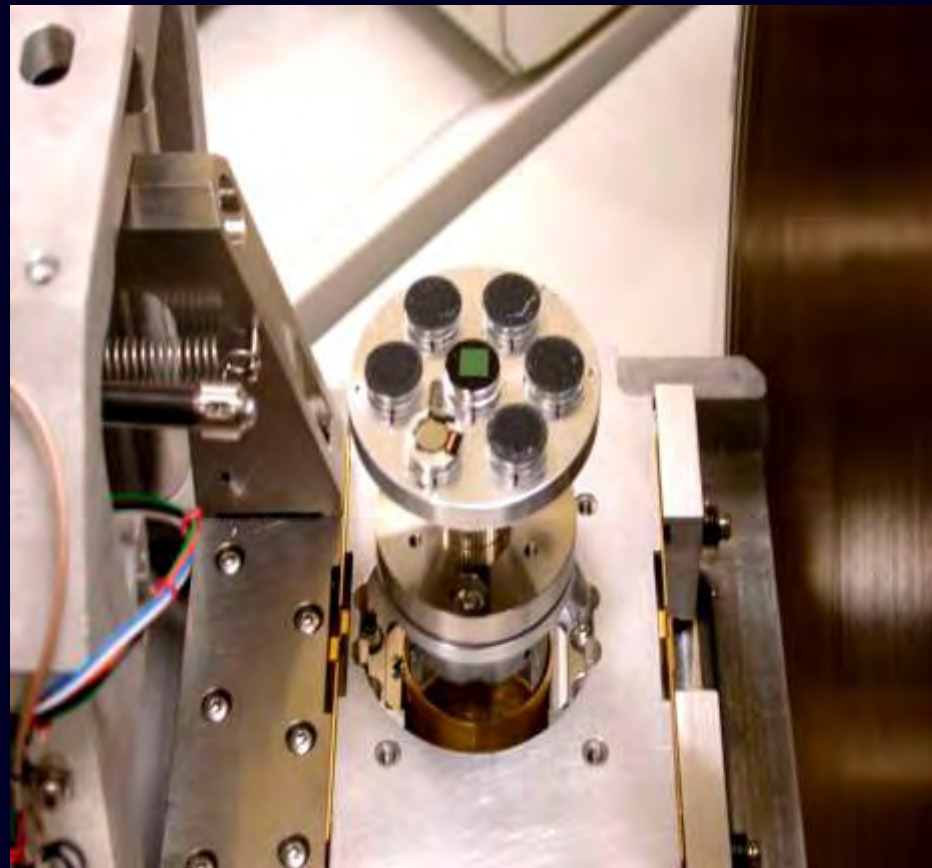


Acc.V Spot Magn Det WD |-----| 10 μ m
25.0 kV 5.6 2456x BSE 10.0 1.0 mBar





**Philips XL30 CP
Oxford's ISIS EDS / WDS**



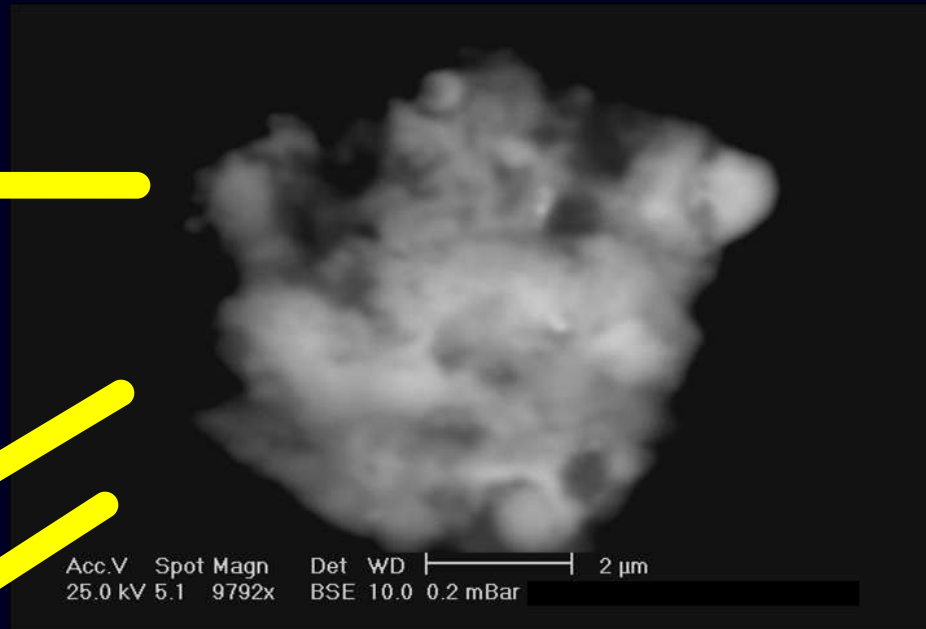
**Sample Sub-Stage shown
with 4 stubs bearing
collected residue and two
stubs bearing reference
standards**

Situation #1

- Subject throws M67 Hand Grenades and Thermite grenades inside tents, shoots fellow soldiers as they exit
- Subject flees the scene, apprehended in remote area



- GSR 4 stub kit - ***Negative for GSR***



- Non-GSR but Ba / Cr rich particles in unclassified particles list for *GSR kit and subjects uniform*



What were those particles?

Could they be used to link the subject to the scene?

M67 Fragmentation Grenade

Anti-personnel
device
designed
to kill, or
incapacitate



Essential Components of M67 Grenade



M213 Fuze
(cast Zinc)

Low Carbon Steel
Grenade Body



M67 Grenade

Unique Design

Components

“Jungle” Safety Clip

Pull Ring / Safety Pin

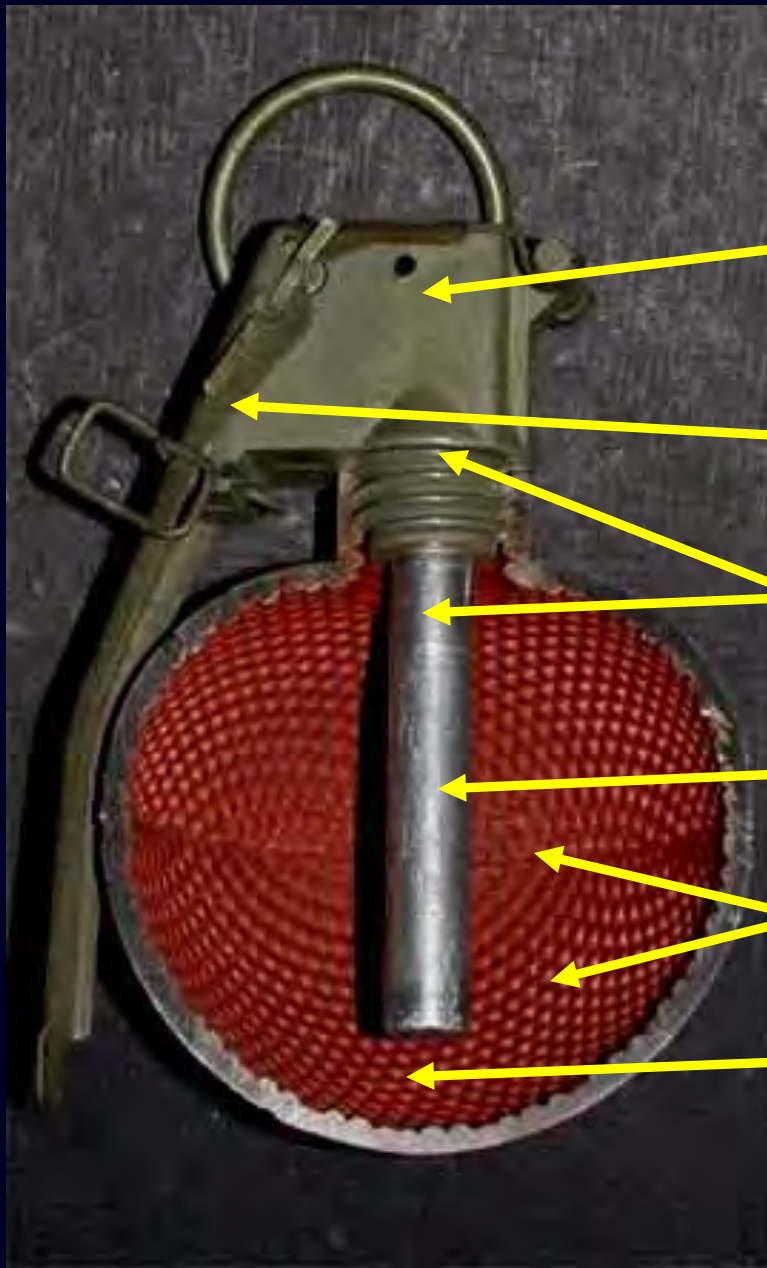
M213 Fuze Lever



Kill radius: ~15 feet
Throw: ~120 feet

Casualty radius: ~50 feet
Fragmentation: ~750 feet

Internal Components



“M42” Shot Gun Primer

Spring Actuated Firing Pin

Gas-less Delay Mixture

Detonator (RDX base)

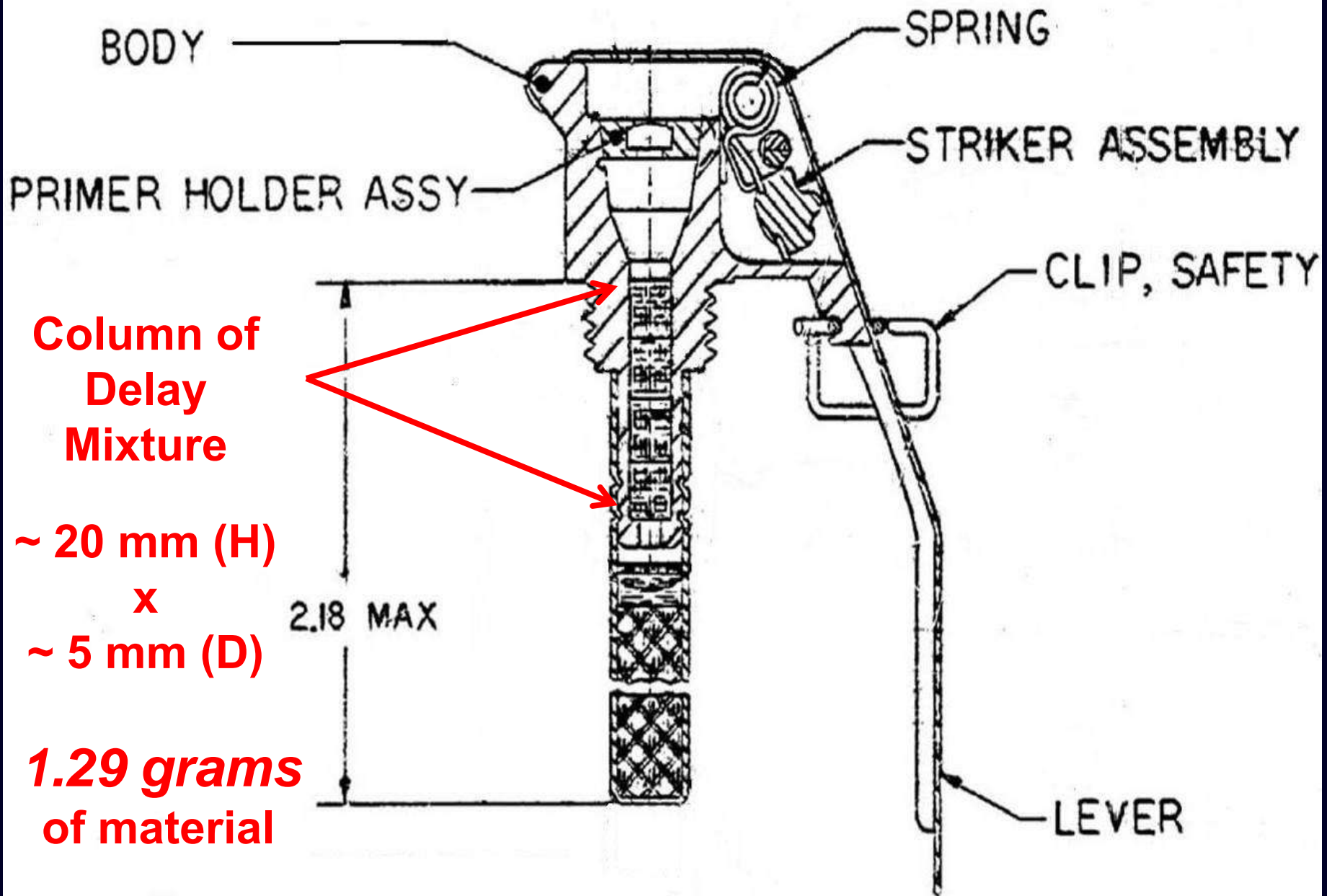
Comp B (RDX/TNT) Filler

Coined Interior Surface for Consistent Fragmentation

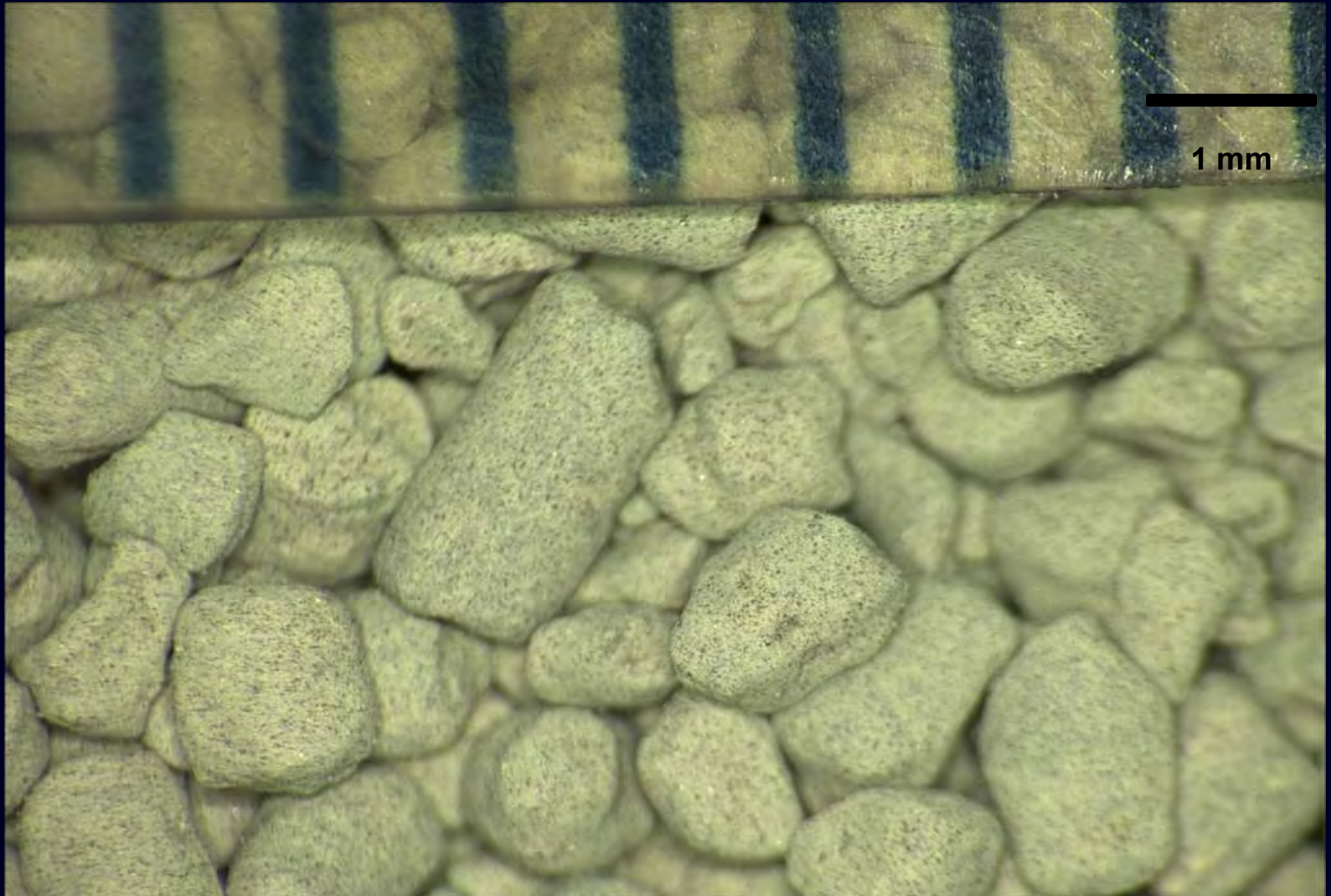
Typical Shrapnel



1 mm



Delay Mixture Type 2

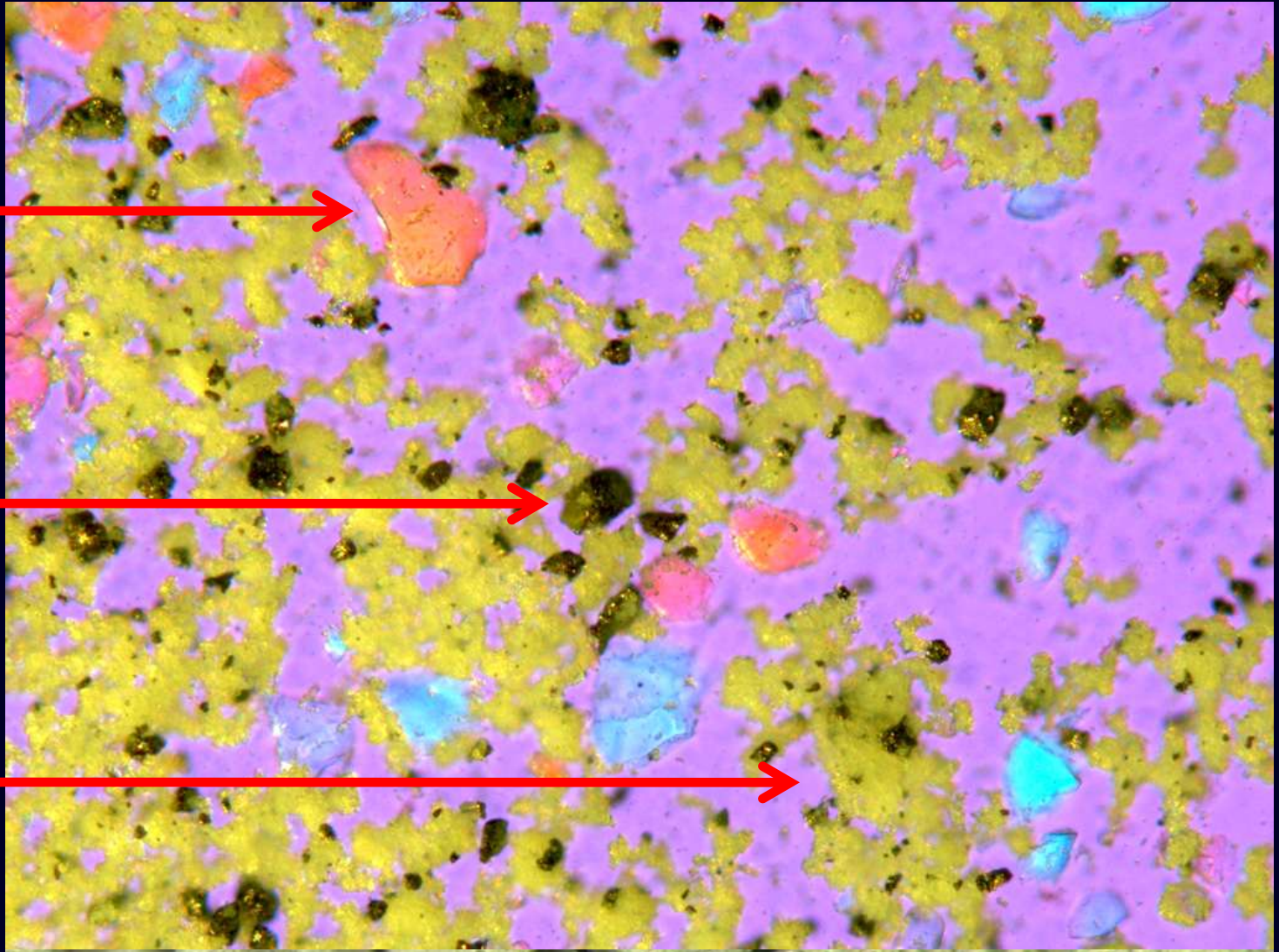


Type II Delay Mixture

KClO_4
30-60 μm

Zr/Ni
15-25 μm

BaCrO_4
1.5 μm
Lumps 10-50 μm



1st Grenade Range Test

4 x 4 ft. box built to “Catch” Residue

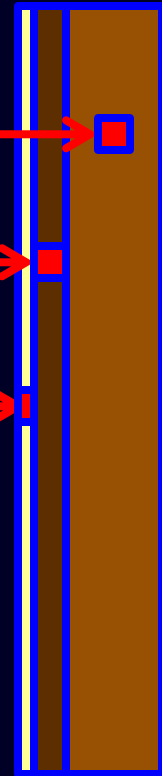
3/4 inch plywood exterior

1/4 inch MDF board inner face/liner

DCU “Catch cloth” inner liner

4 x 4 posts along all edges/corners

6 inch hole in top for insertion of Grenade



1st Grenade Range Test







Delay Mixture Analysis

Philips XL30 CP
Oxford's ISIS EDS /
WDS

Uncoated
Variable Pressure

Residue Collection / Analysis

1/2 inch SEM

Traditional GSR Auto-Search Routine

Element Categories Modification:

Ba / Cr / Ni / Zr / K / Cl (Delay)

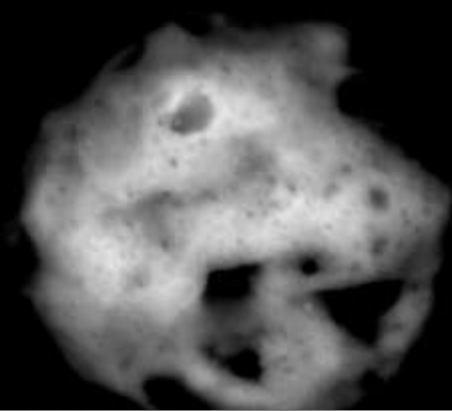
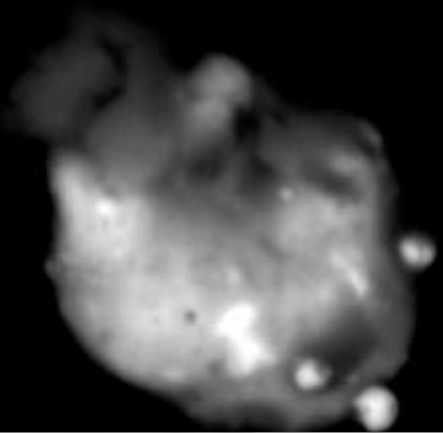
Ba / Cr / Ni / Zr

Ba / Cr

Ni / Zr

Ni

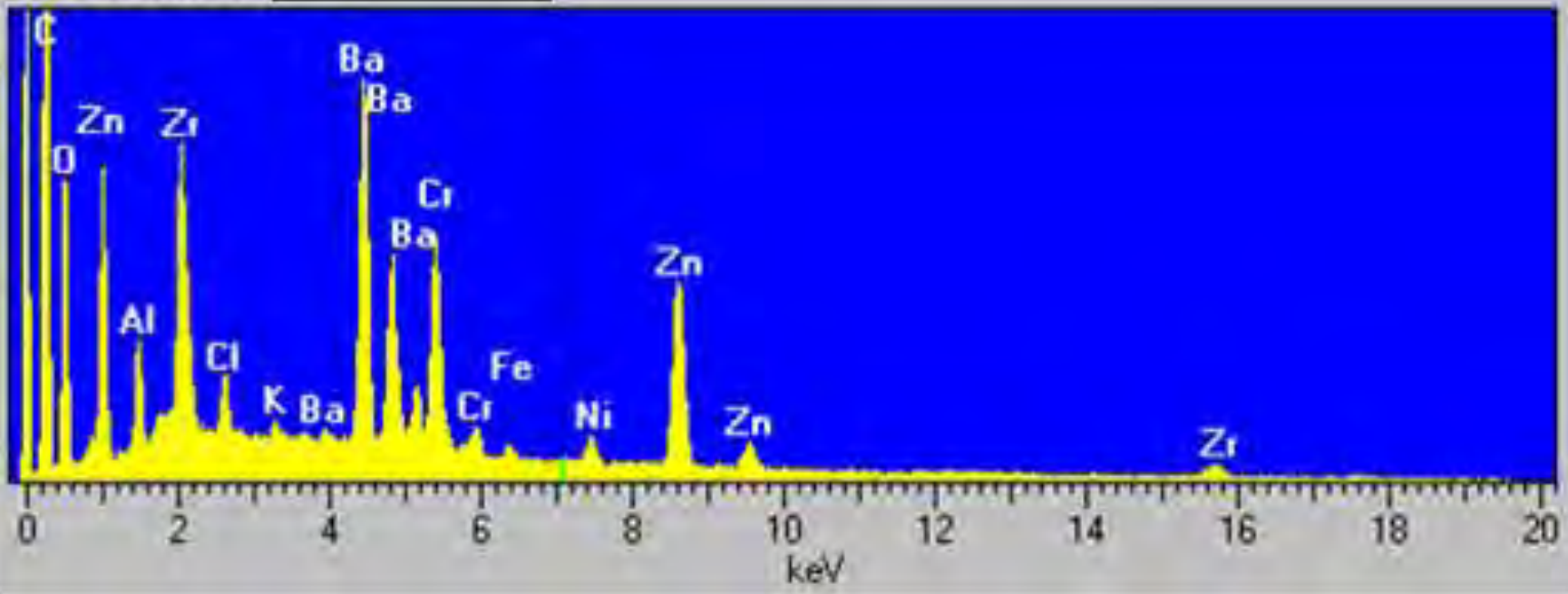
Ba (5%)



Full scale = 47 cps

Cursor: 7.0875 keV

M67TestStub2- [REDACTED]



spot	HV	WD	mag	mode	5 μm
4.5	25.00 kV	9.9 mm	15 000 x	Z Cont	

Situation #2

- Subject initiates claymore mine which kills 2 Officers in his command
- Subject throws three M67 Grenades to simulate a mortar attack as a diversionary tactic
- Subject arrested 7 days after incident



Aerial Photo Crime Scene



DELAY ELEMENT classified particles found



3 Suspect



Attac



Gloves (5 particles)

2nd Range Study Performed to
Answer A Singular Question:

***What is the Distribution
Pattern for the Delay Element
Residue?***

Metal
Fence
Stake



Center ~ 4 ft
from ground

Wood
with Cloth

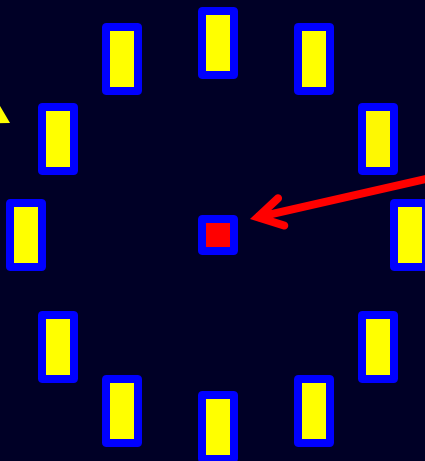
Range Soil

45 foot Radius



North

Plywood
Witness
Panel



M67 Grenade



Test #3

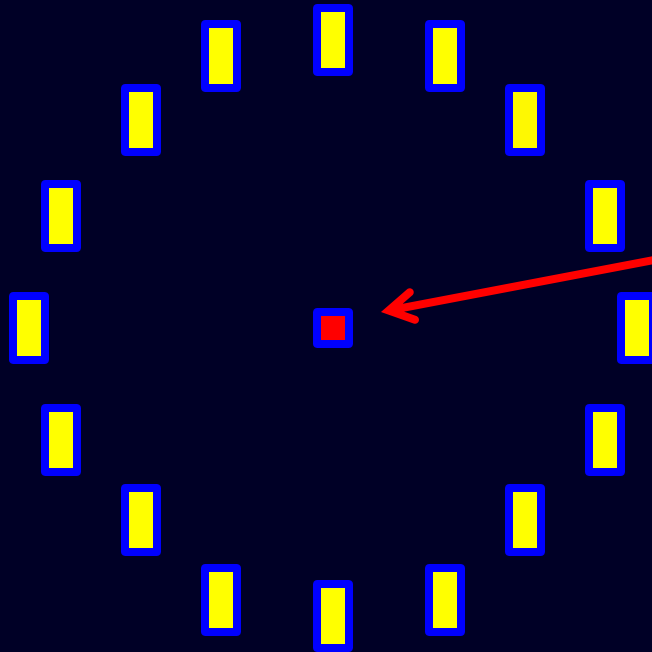
12 Witness Panels

30 Degrees Apart

67.5 foot Radius



North



M67 Grenade

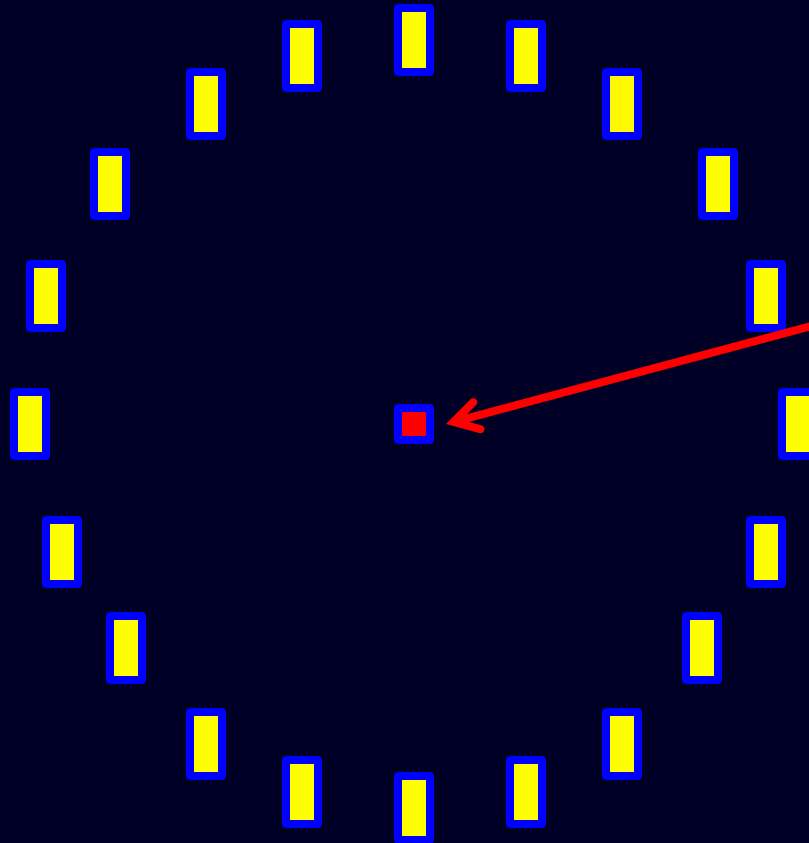
Test #2

16 Witness Panels
22.5 Degrees Apart

90 foot Radius



North



M67 Grenade

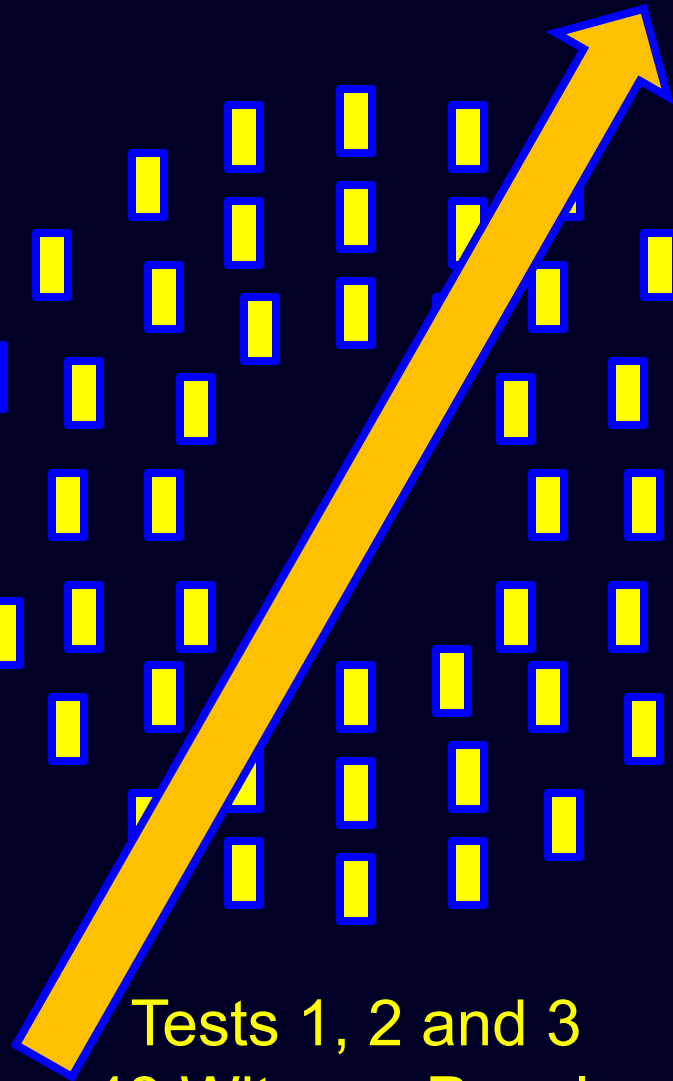
Test #1

20 Witness Panels

18 Degrees Apart



North



*Prevailing Wind
Direction*

Tests 1, 2 and 3
48 Witness Panels
45, 67.5 and 90 ft. radius





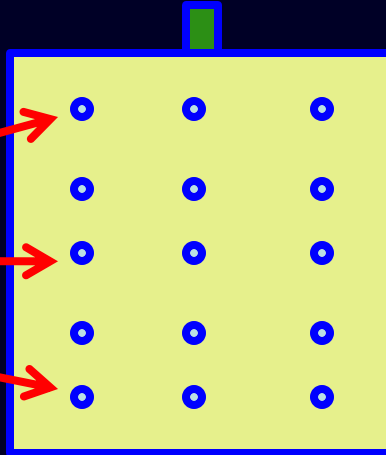


Post Detonation Collection

15 "sticks" per panel

1/2 inch SEM stubs

5 left / 5 center / 5 right



Range Soil



Batch details:

Batch name: Ex 89, 91, 92 dust

Reference:

Laboratory: USACIL

Operator: David

Batch Notes:

Partially-completed batch

Started: 17:15 20-Jul-05, Finished: 11:46 21-Jul-05

Total analysis time: 14:36:11

Stub name:	Gp:	Area done:	No. particles:
			Class'd Unclass'd
1: Ex 89	-	2%	253 131
2: Ex 91	-	57%	2847 3122
↔ 3: Ex 92	-	13%	284 254
4: <none installed>			
5: <none installed>			
6: <none installed>			
7: <none installed>			
8: <none installed>			
Total:		24%	3384 3507

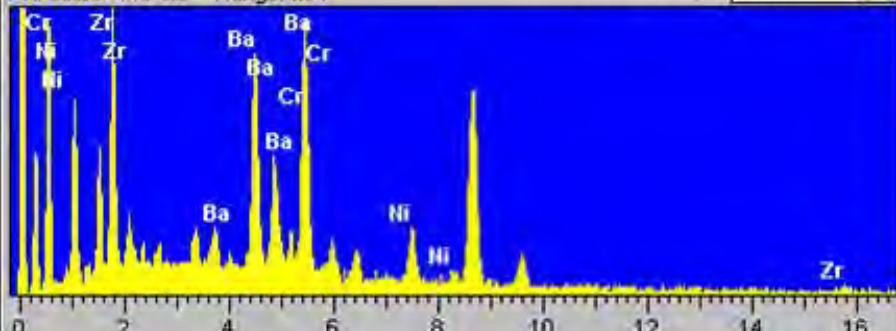
Detected particles:

View: All types Stub 3: Ex 92

Stub - ID	Class	Size (µm)	Shape
3 - 55	delay	0.4	0.57
3 - 63	delay	1.4	1.25
3 - 135	delay	1.5	1.12
3 - 136	delay	1.5	1.12
3 - 142	delay	1.2	1.05
3 - 245	delay	1.7	1.02
3 - 303	delay	0.4	0.57
3 - 324	delay	3.5	1.53
3 - 352	delay	1.3	1.22
3 - 446	delay	2.1	1.04
3 - 481	delay	1.2	0.94
3 - 2	Ni	0.4	0.57
3 - 3	Ni	1.2	1.10
3 - 4	Ni	0.6	0.83
3 - 9	Ni	0.6	0.83
3 - 11	Ni	0.8	0.83
3 - 13	Ni	0.6	0.83
3 - 15	Ni	0.4	0.57

Particle details:

Full scale: 445 cts Range: keV Classification: Auto

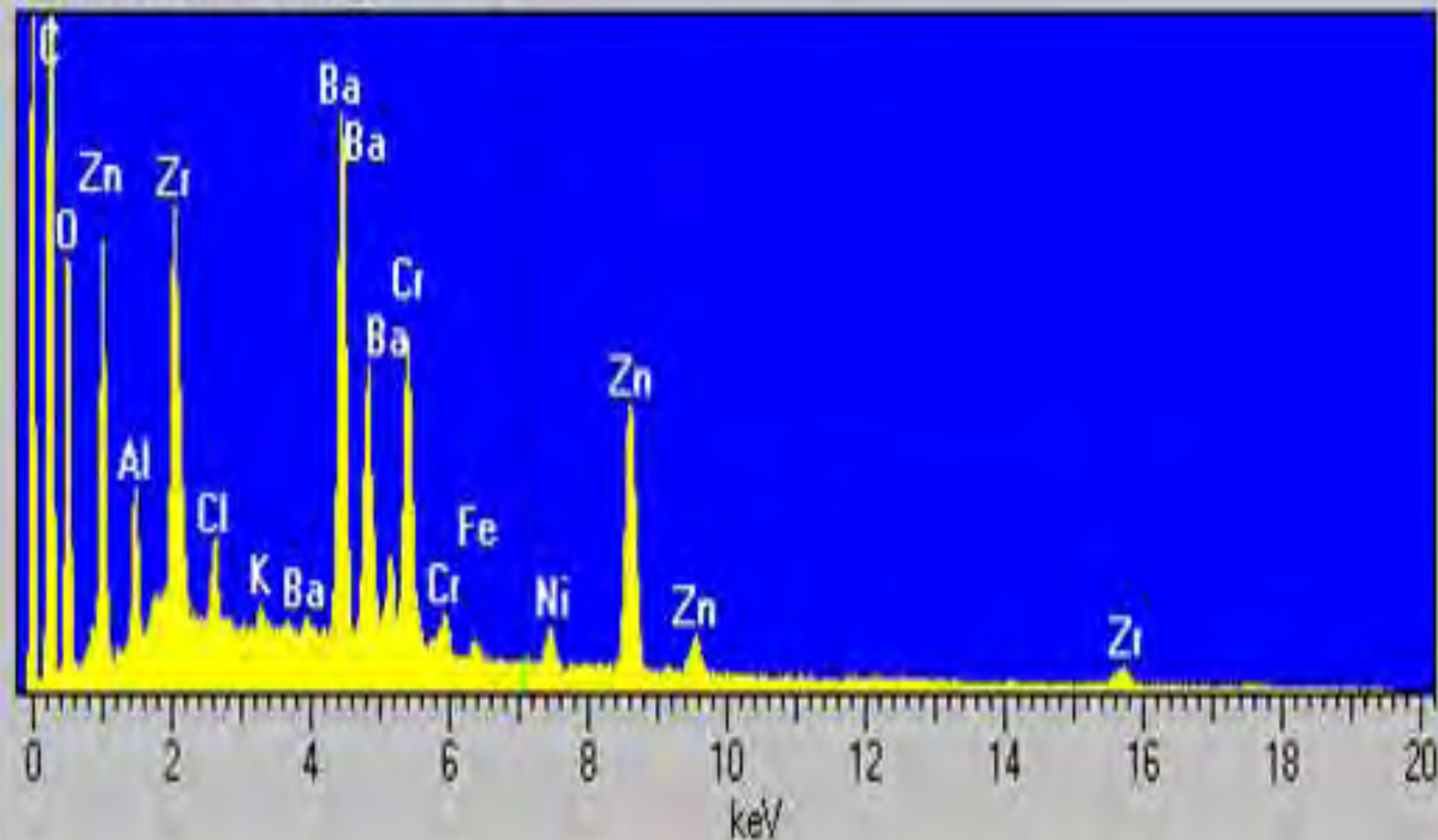


Auto classification:
 Class: delay (Type:Unique)
 Signature element(s):
 Ba: 10.0 - 100.0% Cr: 10.0 - 100.0% Zr: 1.0 - 100.0%
 Ni: 1.0 - 100.0%

Full scale = 47 cps

Cursor: 7.0875 keV

M67TestStub2-90away

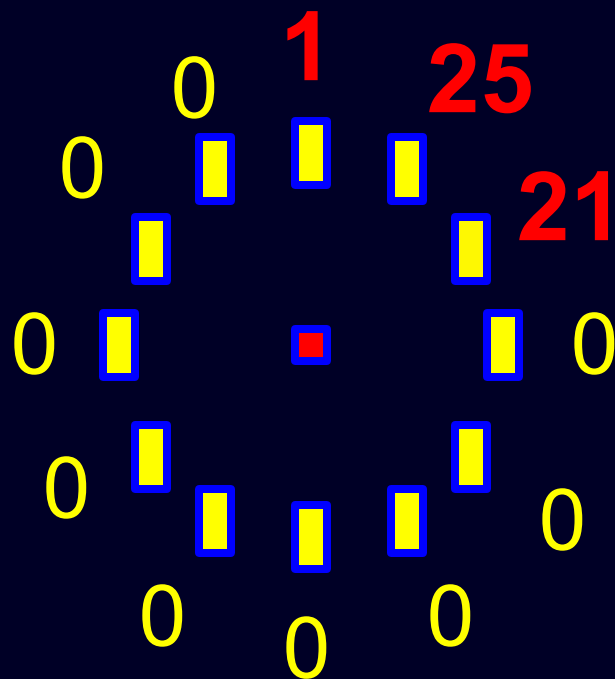


Test #3

45 foot radius

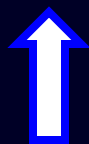


North

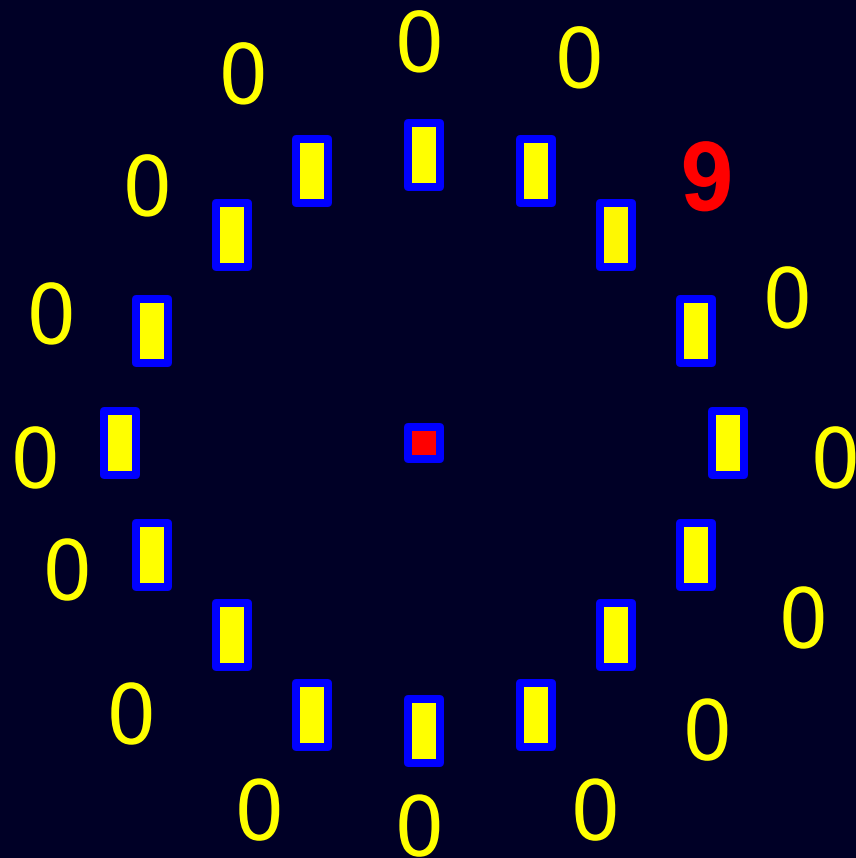


Test #2

67.5 foot radius



North

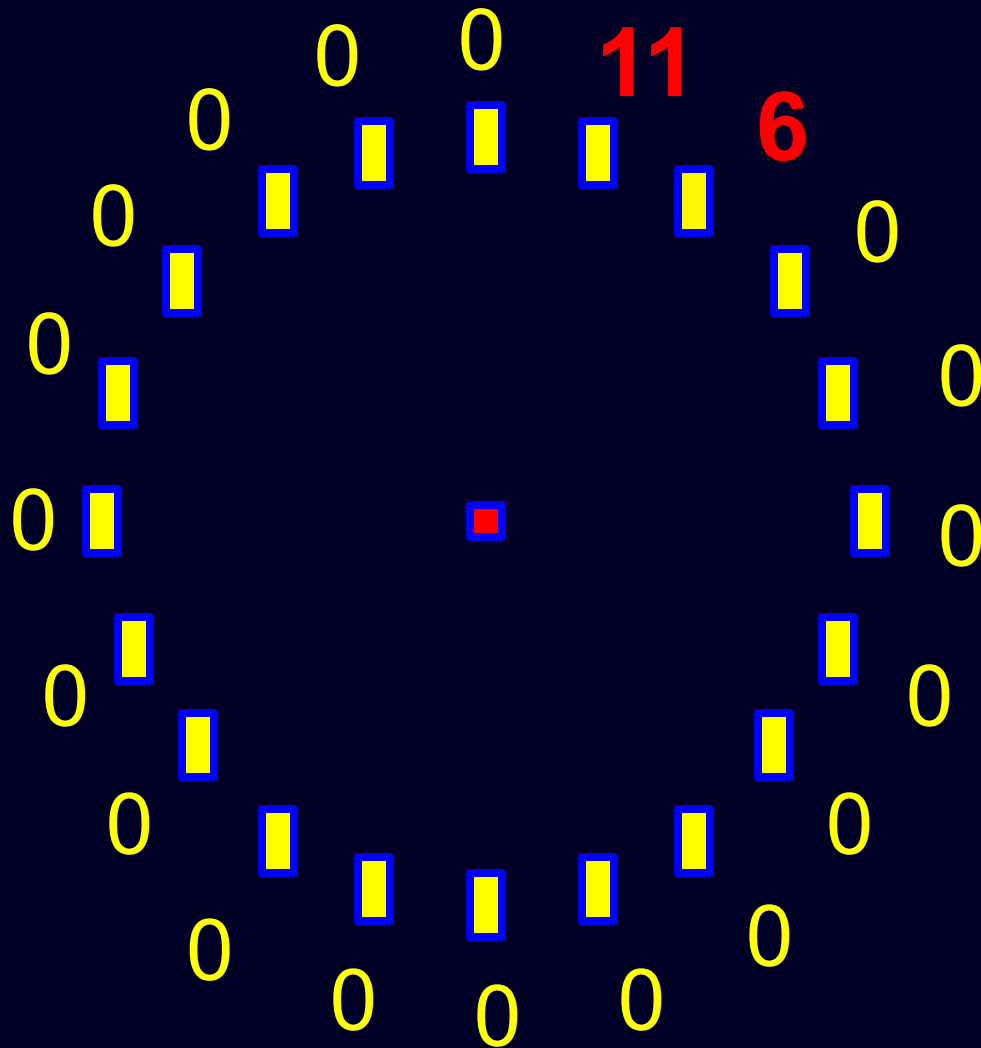


Test #1

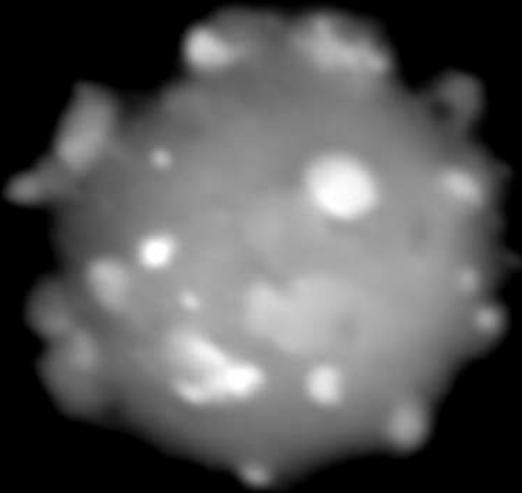
90 foot radius



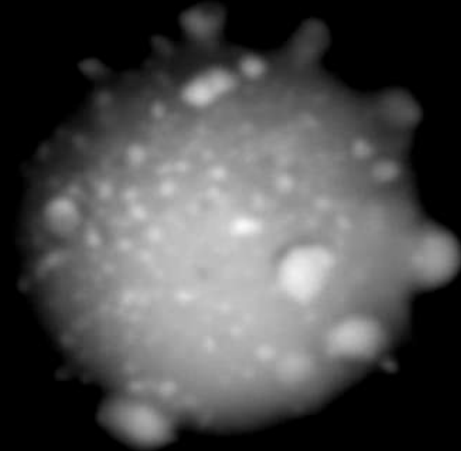
North



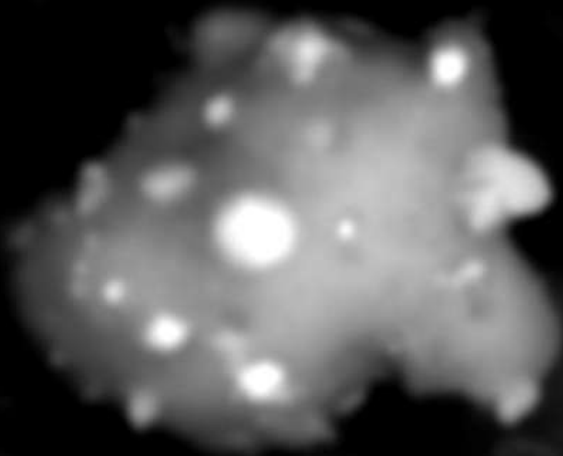
Nodular Rounds



Acc.V Spot Magn Det WD |-----| 2 μ m
25.0 kV 5.3 9792x BSE 10.0 2.5 mBar 137-3 3-266



Acc.V Spot Magn Det WD |-----| 2 μ m
25.0 kV 5.1 9792x BSE 10.0 0.3 mBar Ex139-3 T1 3-286



Acc.V Spot Magn Det WD |-----| 2 μ m
25.0 kV 5.2 9792x BSE 10.0 0.5 mBar Ex137(2) 2-872

Massive Irregulars



Acc.V Spot Magn Det WD |-----| 5 μ m
25.0 kV 5.2 4896x BSE 10.1 0.5 mBar Ex137(2) 2-405

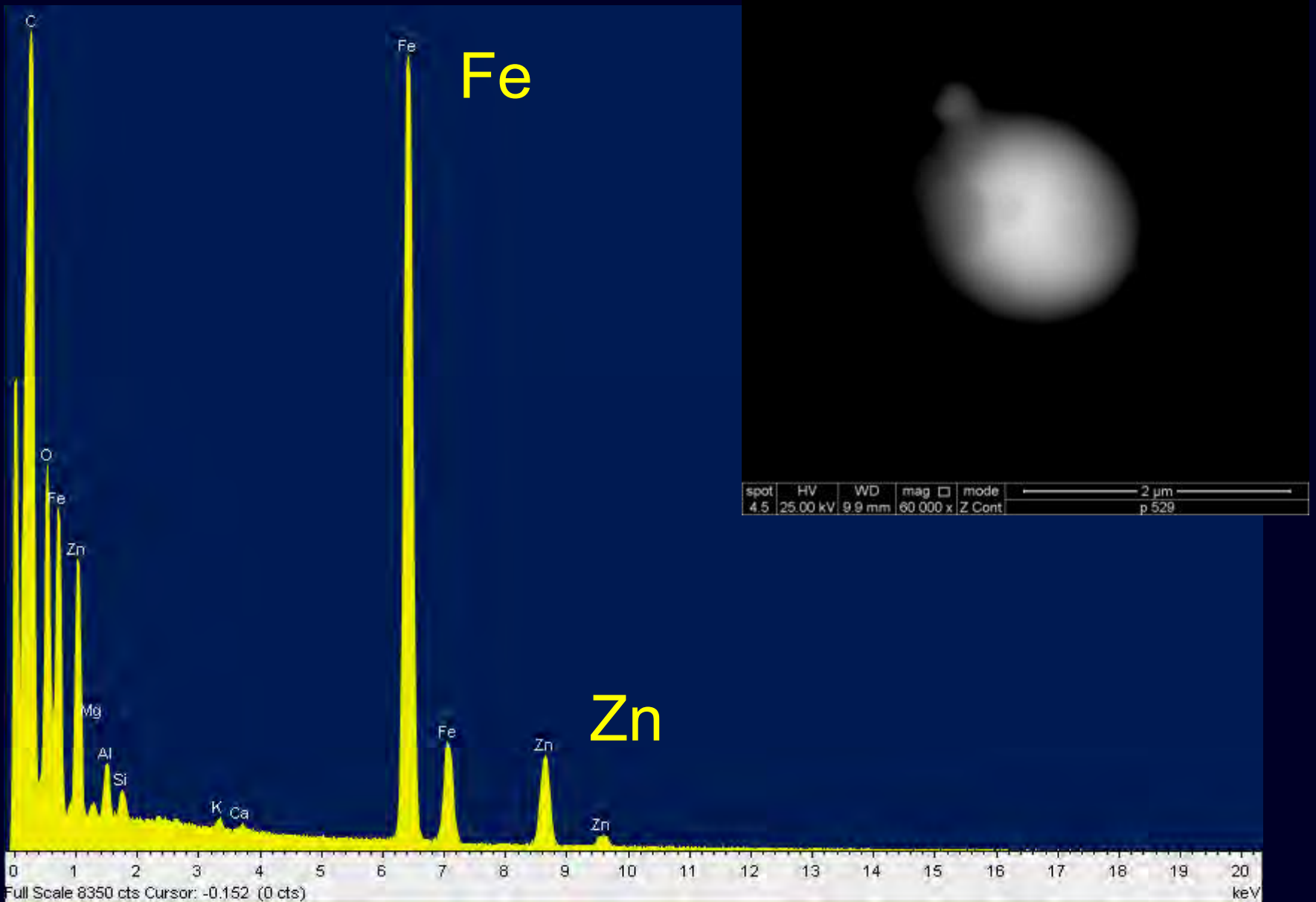


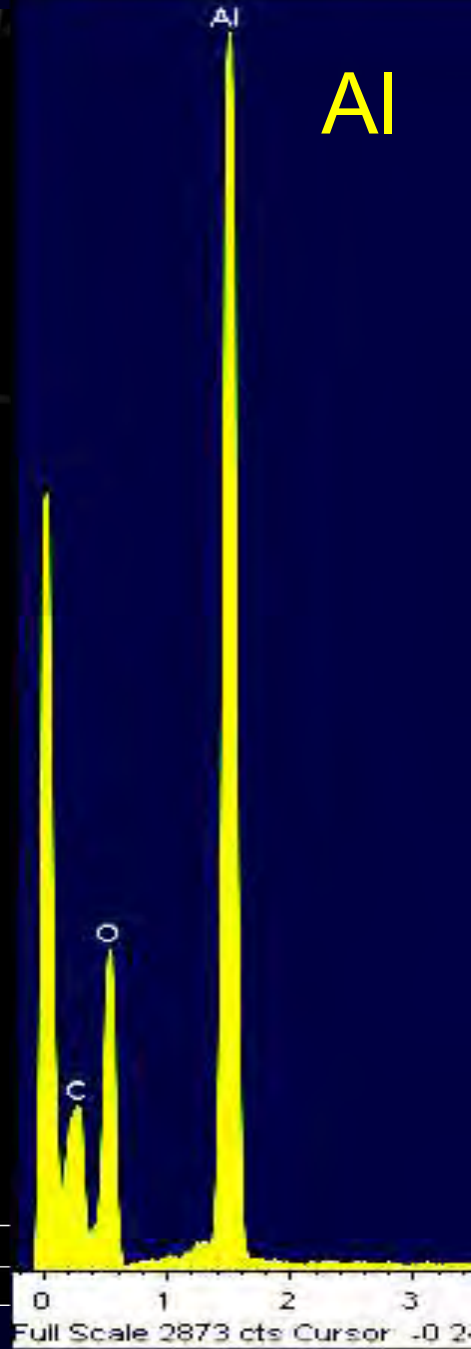
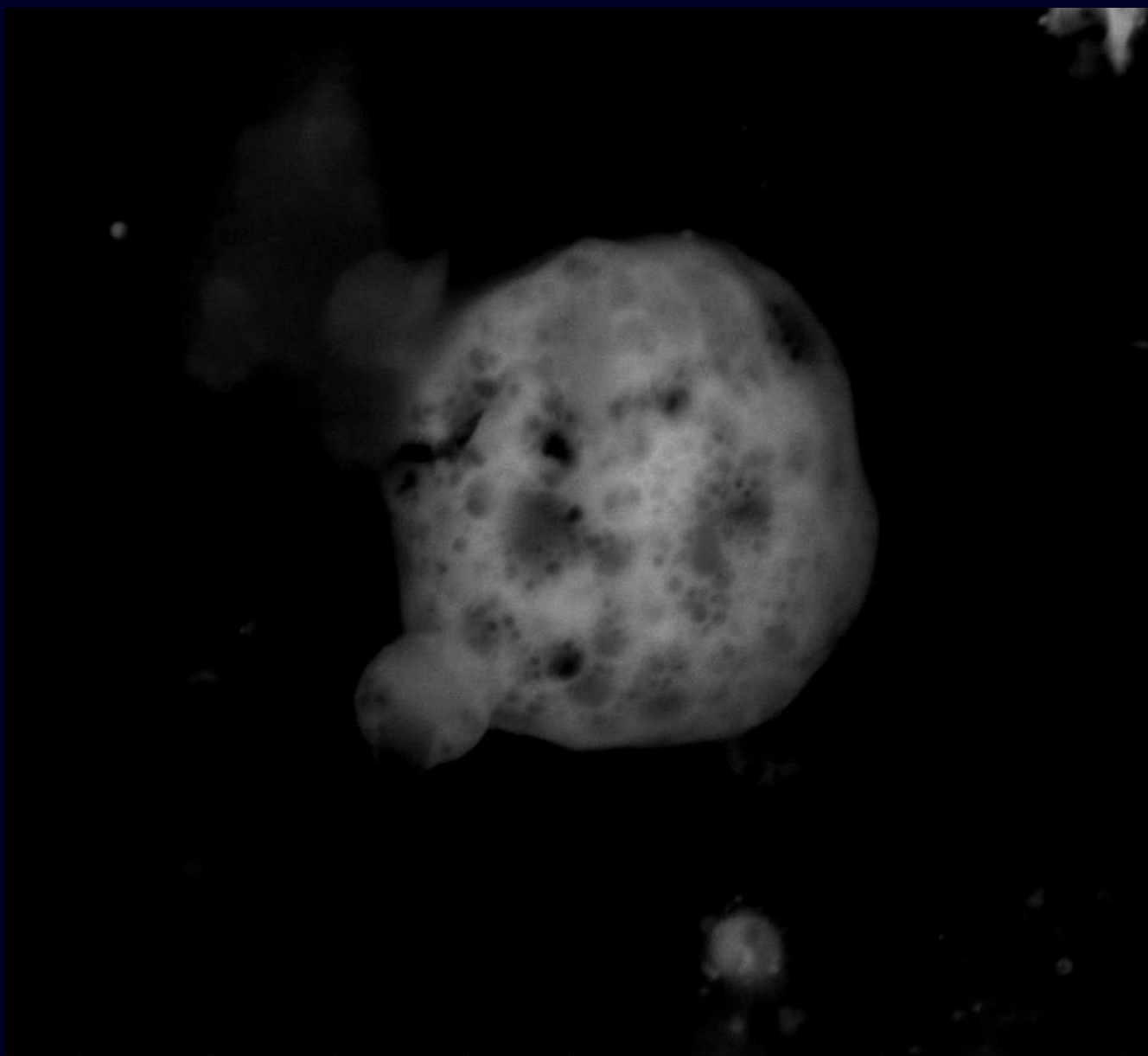
Acc.V Spot Magn Det WD |-----| 10 μ m
25.0 kV 5.2 2448x BSE 10.0 0.5 mBar Ex137(2) 2-2967

Small Rounded



Other "Indicative" Particle



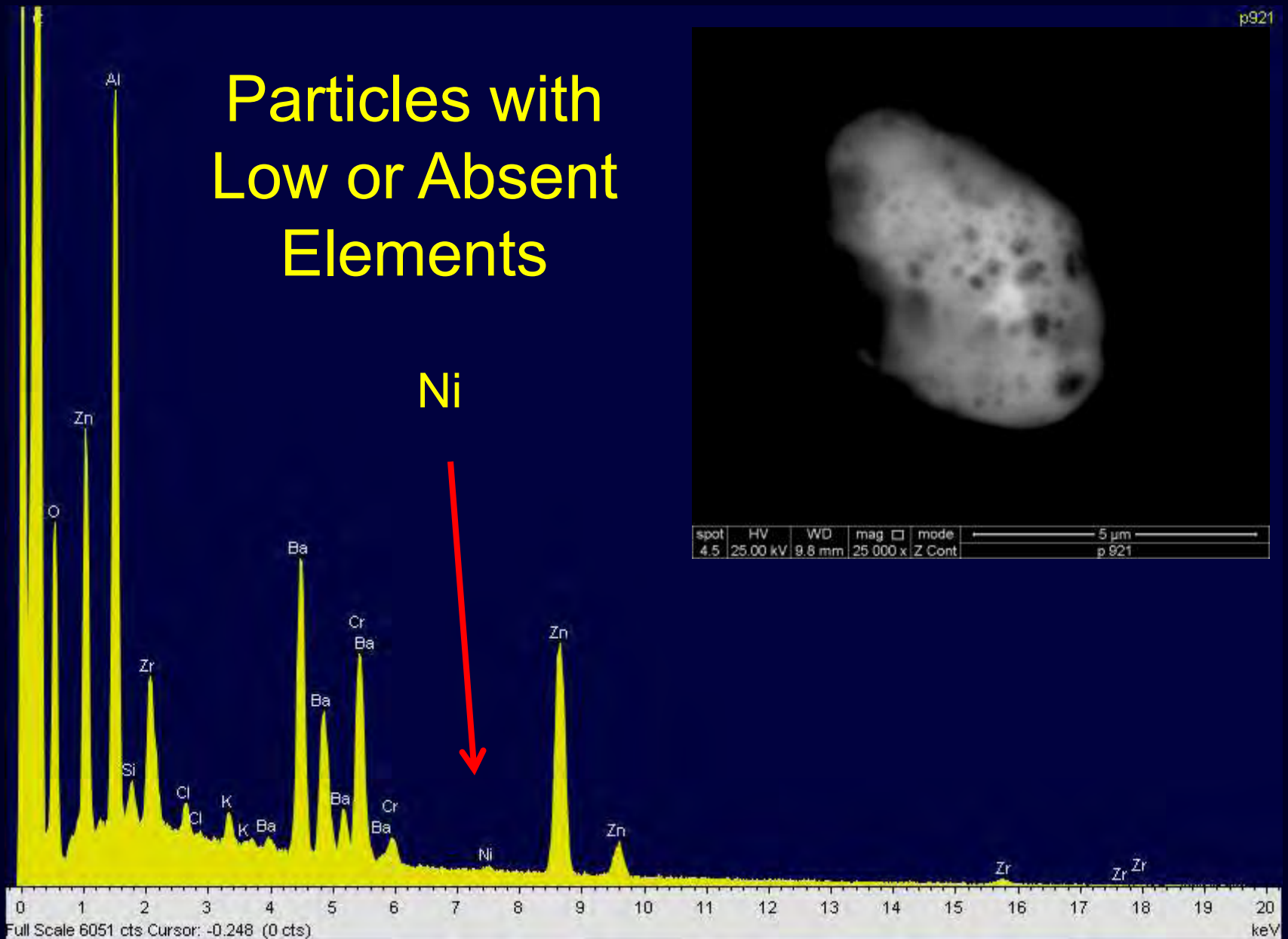
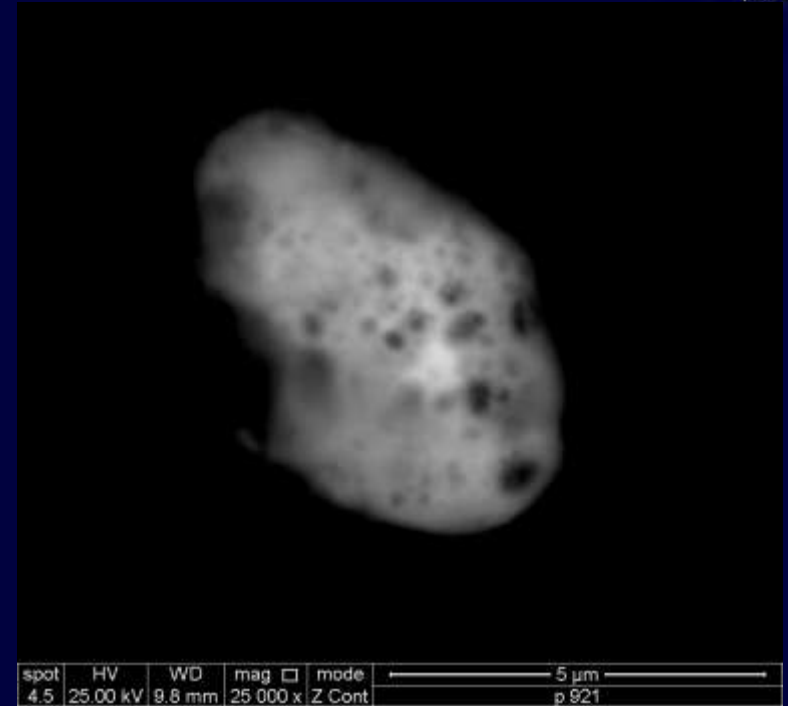


spot	HV	WD	mag	mode
4.5	25.00 kV	9.8 mm	10 000 x	Z Cont

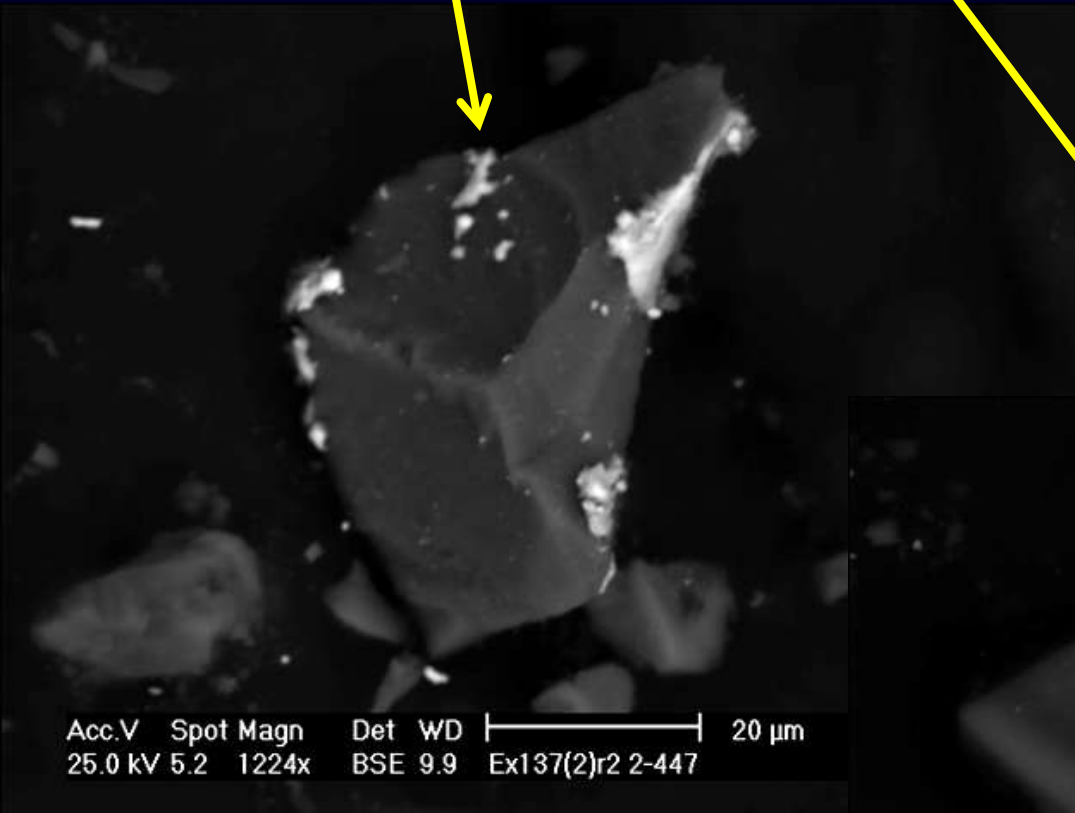
10 μ m
Spherical Aluminum

Full Scale 2873 cts Cursor: -0.2

Particles with Low or Absent Elements



Quartz Grains with Zinc Splattered on Surface



Questioning the Forensic
Use and Utility of this
Information ?

June 24, 2011

Seattle Terrorism Plot Foiled as Abu Khalid Abdul-Latif & Walli Mujahidh are arrested

SEATTLE—KDVR:

Foiling a deadly terrorism plot, federal authorities Wednesday night arrested and charged two men with planning to attack a military processing office in Seattle with guns

and grenades!!!!



