

# *Evaluation of the Claim of Transmutation of Cesium to Praseodymium with the MHI Structure – Part 2*

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ICCF-15



## Summary of MHI Claims

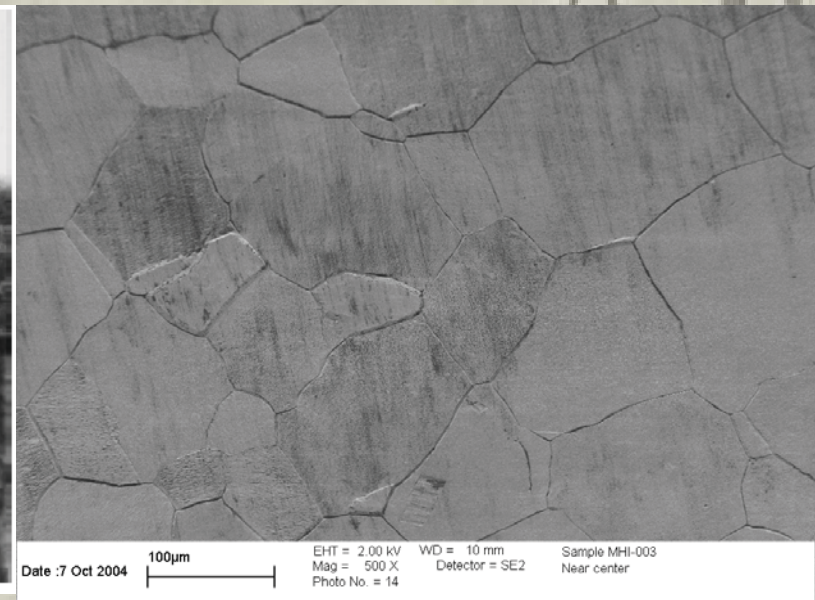
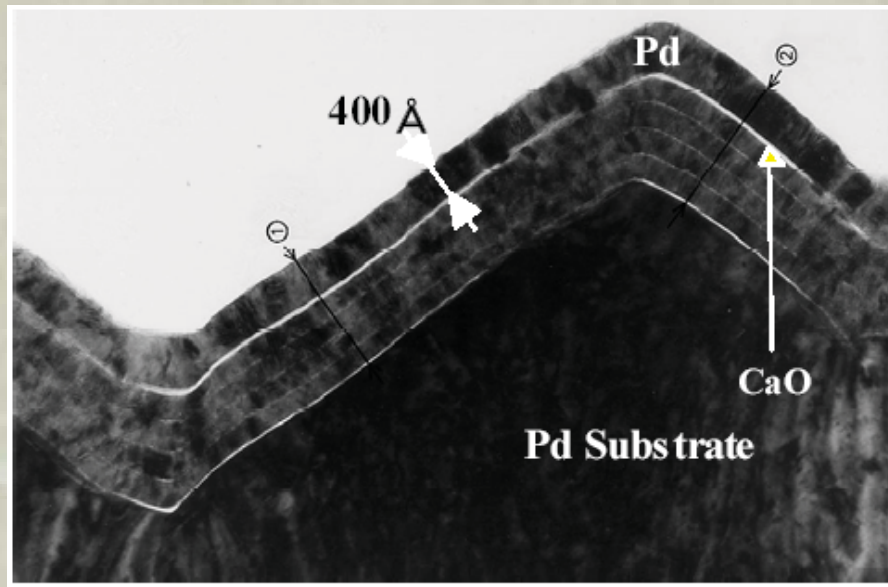
- ❖ By permeating Deuterium through a complicated layer various elemental transmutations can be made to happen

– Reported transmutations:

•  $^{88}\text{Sr} \rightarrow ^{96}\text{Mo}$       Addition of 4D

•  $^{133}\text{Cs} \rightarrow ^{141}\text{Pr}$       Addition of 4D

•  $^{137}\text{Ba} \rightarrow ^{149}\text{Sm}$       Addition of 6D



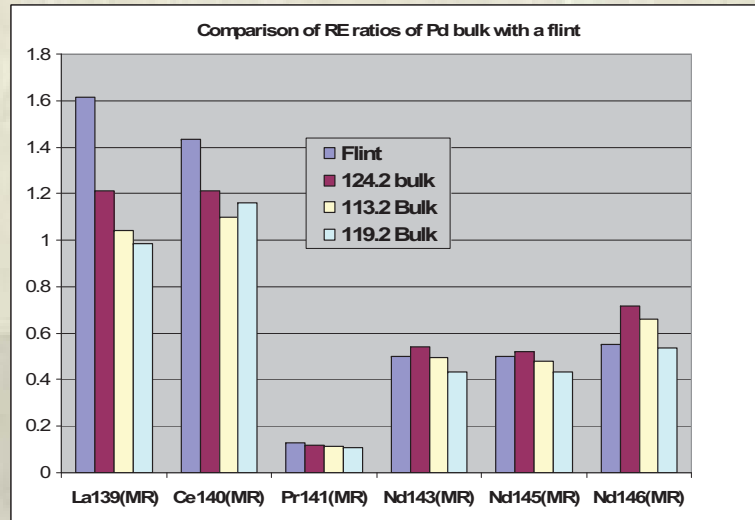
Cross section of Pd complex (Pd/CaO/Pd) observed by TEM.

From: Iwamura, Y., et al. Low Energy Nuclear Transmutation In Condensed Matter Induced By D<sub>2</sub> Gas Permeation Through Pd Complexes: Correlation Between Deuterium Flux And Nuclear Products. in Tenth International Conference on Cold Fusion. 2003.

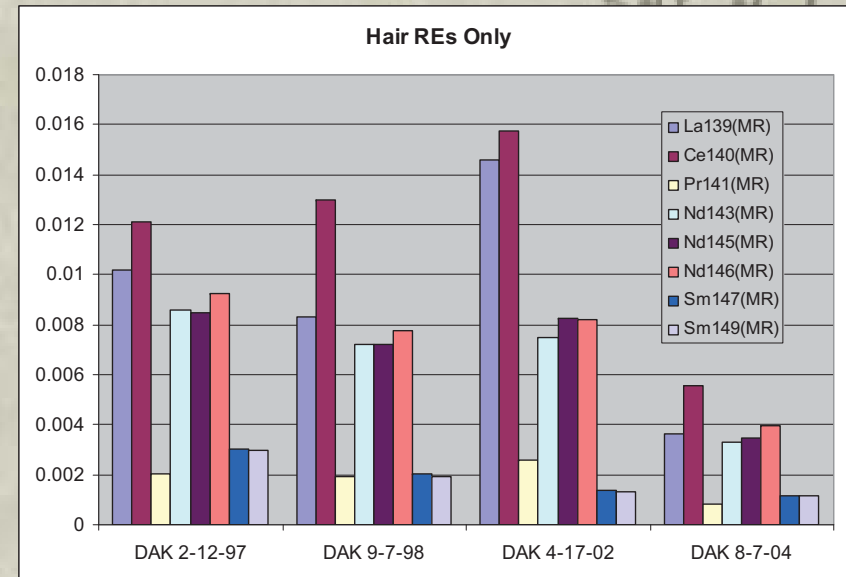
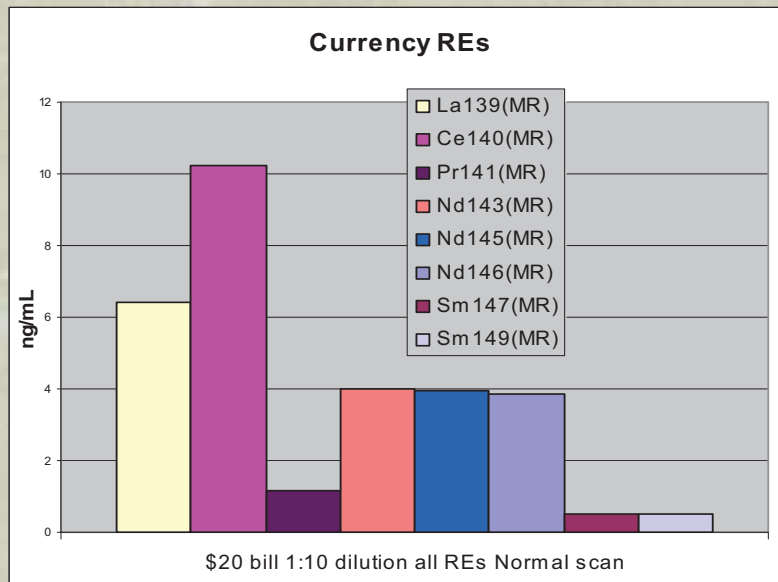
From: C. Carosella - Visual Observations of MHI and NRL Samples

# Rare Earths in the Environment

## Rare earths are not so rare



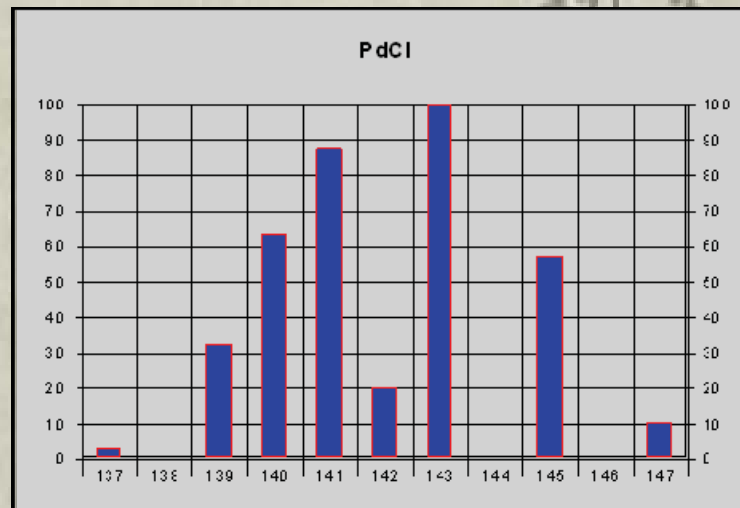
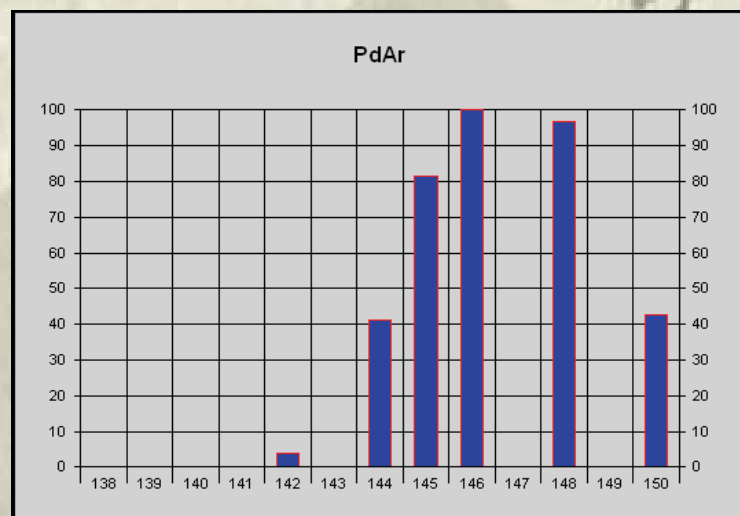
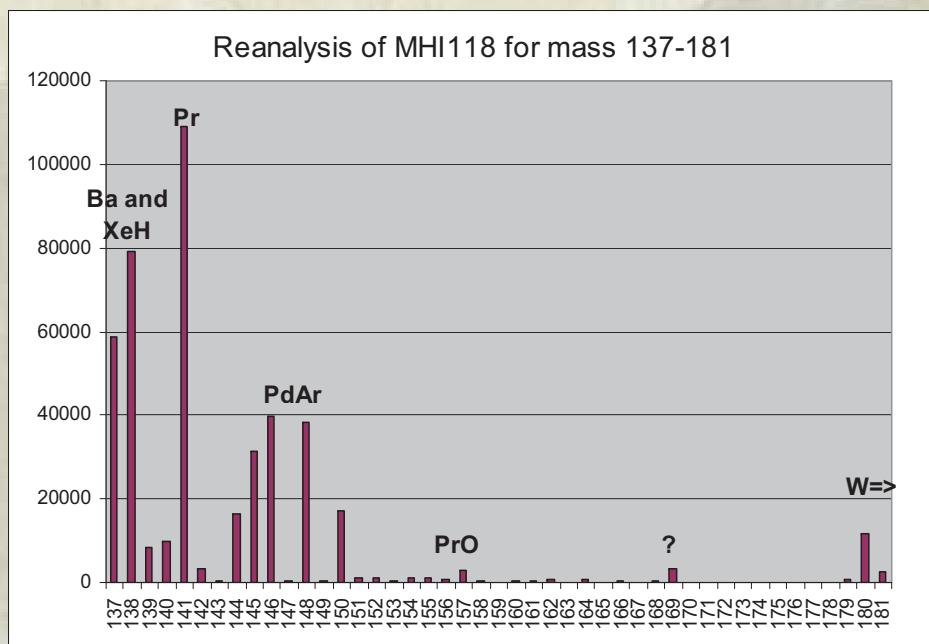
- ❖ Environmental sources of Pr
  - Flints – “Misch Metal”
  - Specialty glazes on ceramics
  - Phosphors in CRTs (tends to be with other REs)



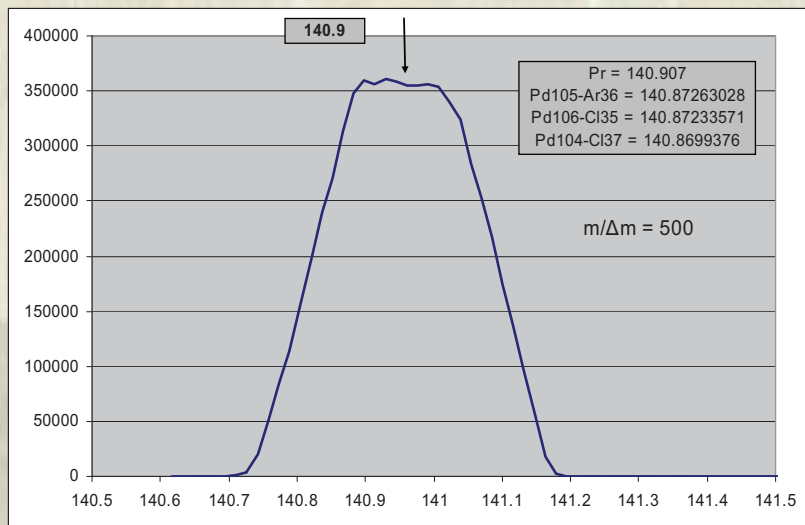
# Molecular Interferences or Misch Metal Contamination?

No!

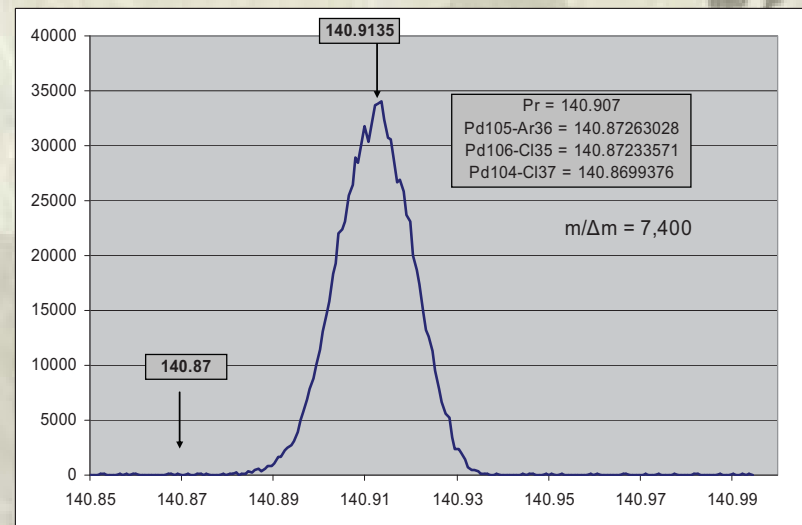
- ❖ Two different ICP-MS instruments



# Raw ICP-MS Curves for MHI-006-box Spectra shown at various resolutions

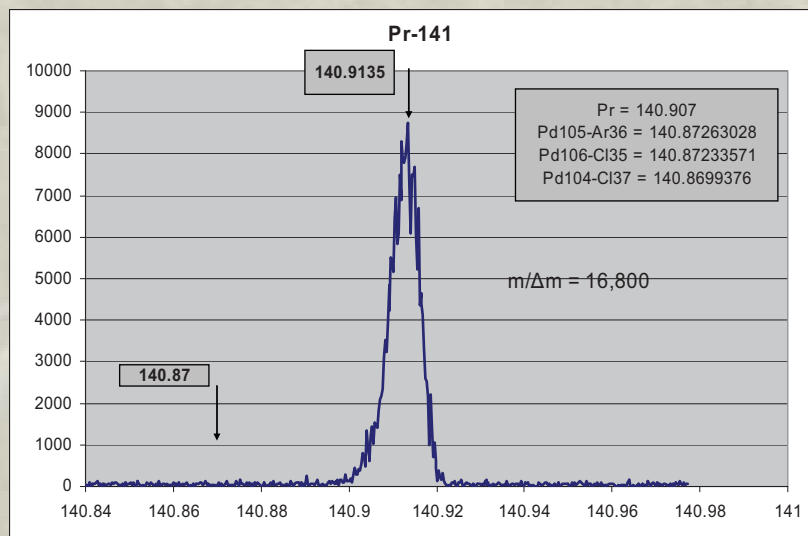


Low - file#Oct20d15LR



Medium - file#Oct20d15MR

High -  
file#Oct20d15HR



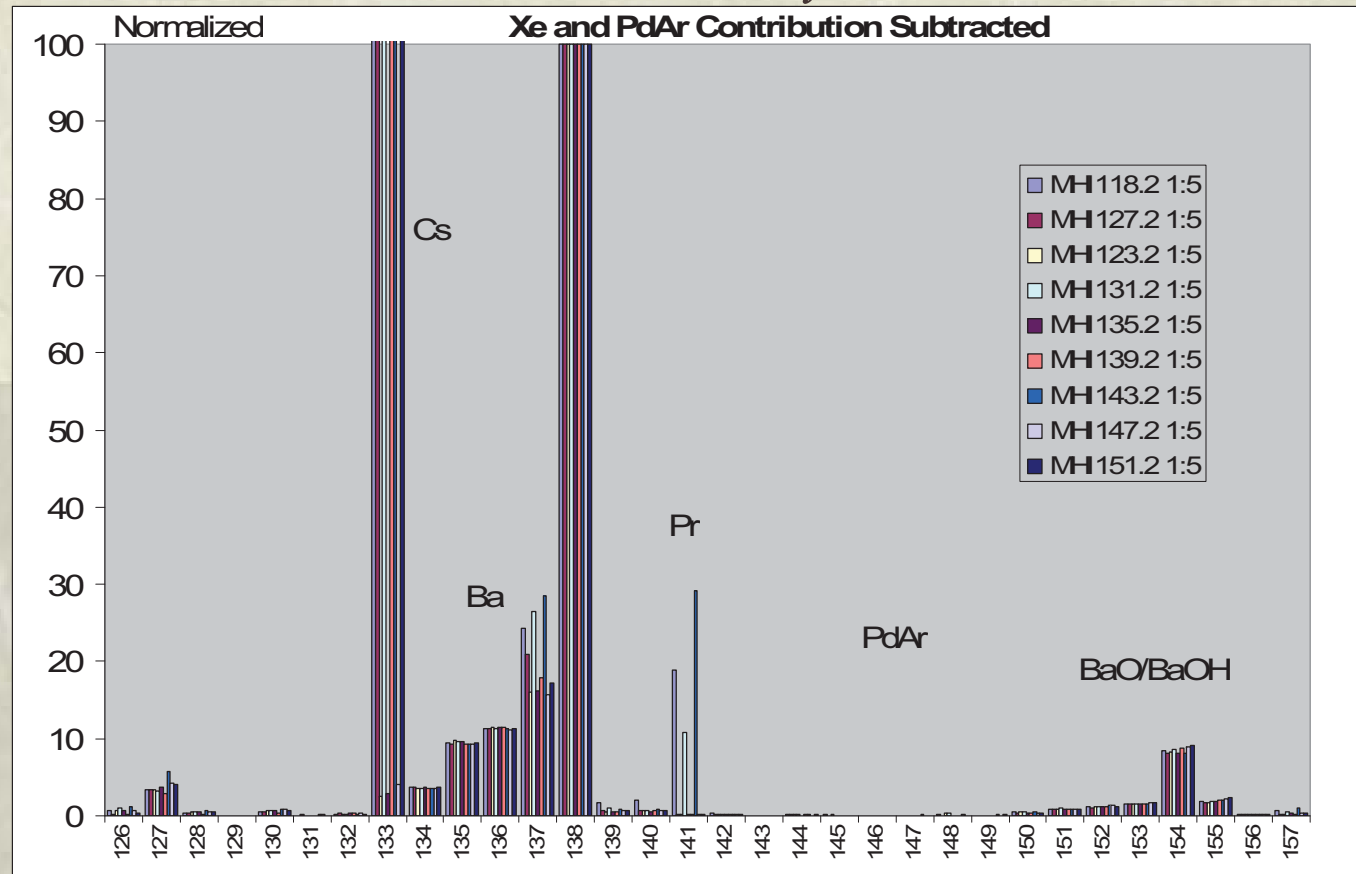
**Masses not  
perfect due to  
magnet drift**

## *Cross Validation of Pr Levels*

- ❖ 15 extracts & 6 blanks were sent from MHI
- ❖ 18 Confirmed negative for Pr – LOD <0.045 ng/cm
  - Includes 6 controls with the three positives (three sets of three)
  - One set from baby chamber – all negative
    - Included a fully permeated sample

<b>Sample</b>	<b>Toray concentration ng/cm<sup>2</sup></b>	<b>NRL concentration ng/cm<sup>2</sup></b>	<b>% Difference</b>
MHI118	20	19	5.00%
MHI131	9.1	9.2	-1.50%
MHI143	25	24	5.54%

# More Detailed Scan of the Nine Samples Extracted at MHI – Analyzed at NRL



❖ Note clean RE levels and high Cs levels

## *Concentration on Surface from Bulk* *No!*

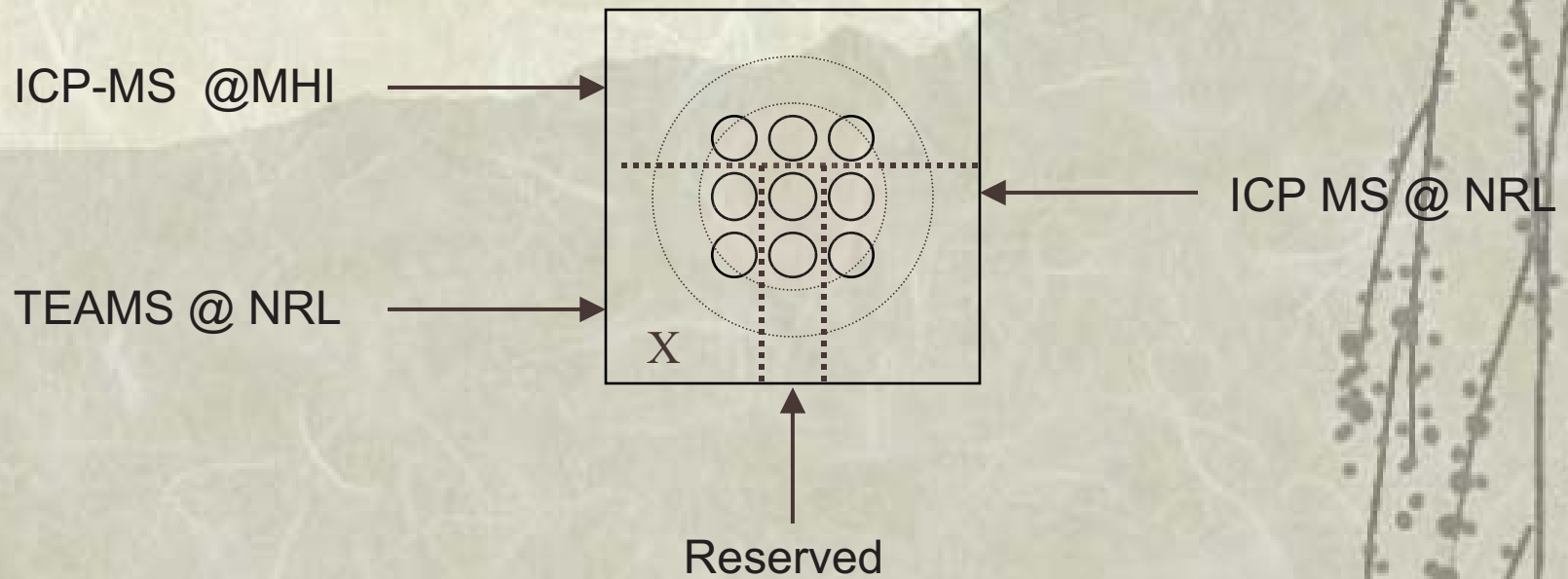
Sample	Pr (ng/cm <sup>2</sup> ) Raw	Pr (ng/cm <sup>2</sup> ) Blank subtracted
MHI119.2	0.108	0.030
MHI113.2	0.114	0.036
MHI124.2	0.121	0.042

From UM 9-25-05

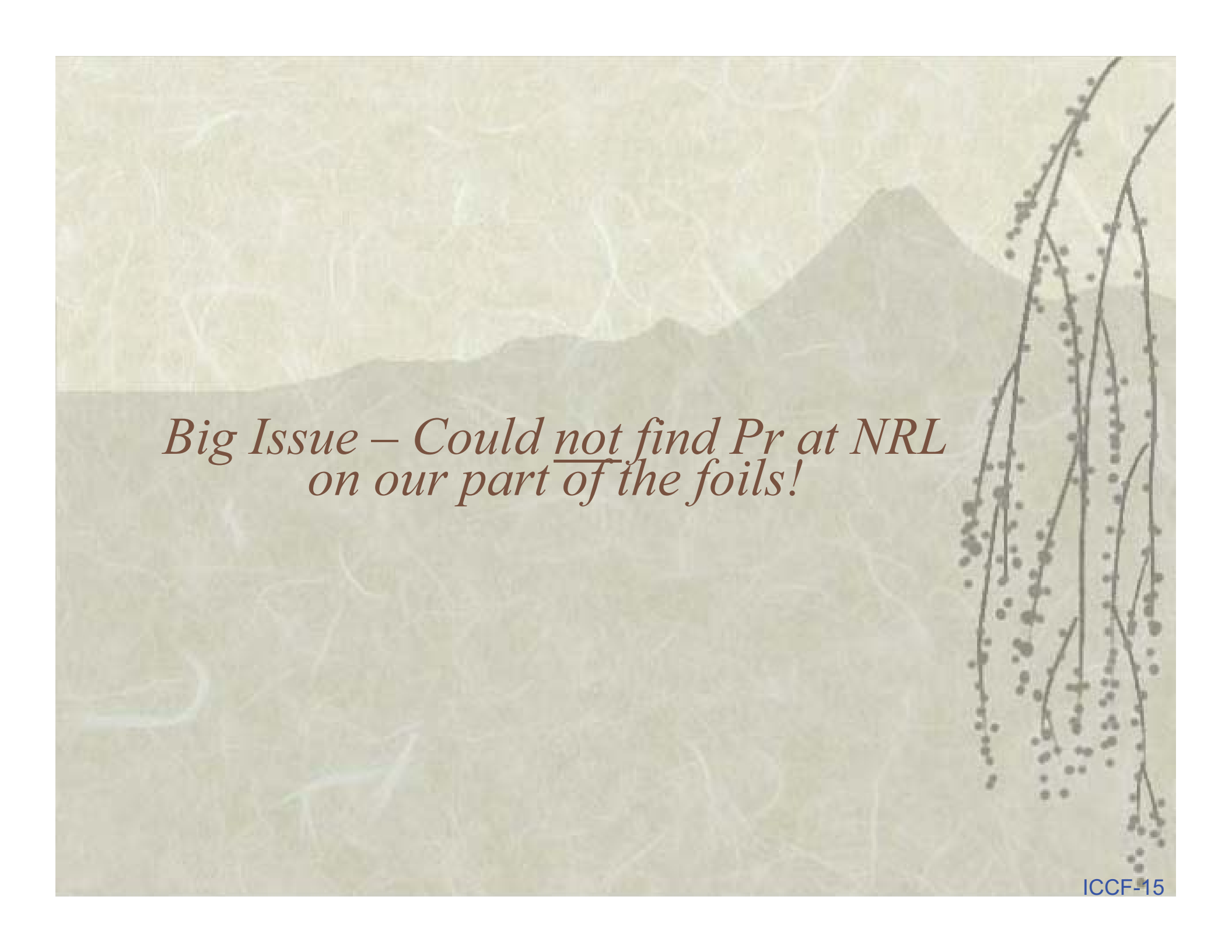
- ❖ Levels too low to account for Pr in permeated samples
  - Methodology discussed at ICCF-14

# *Foil - Analysis Layout*

*(typical)*



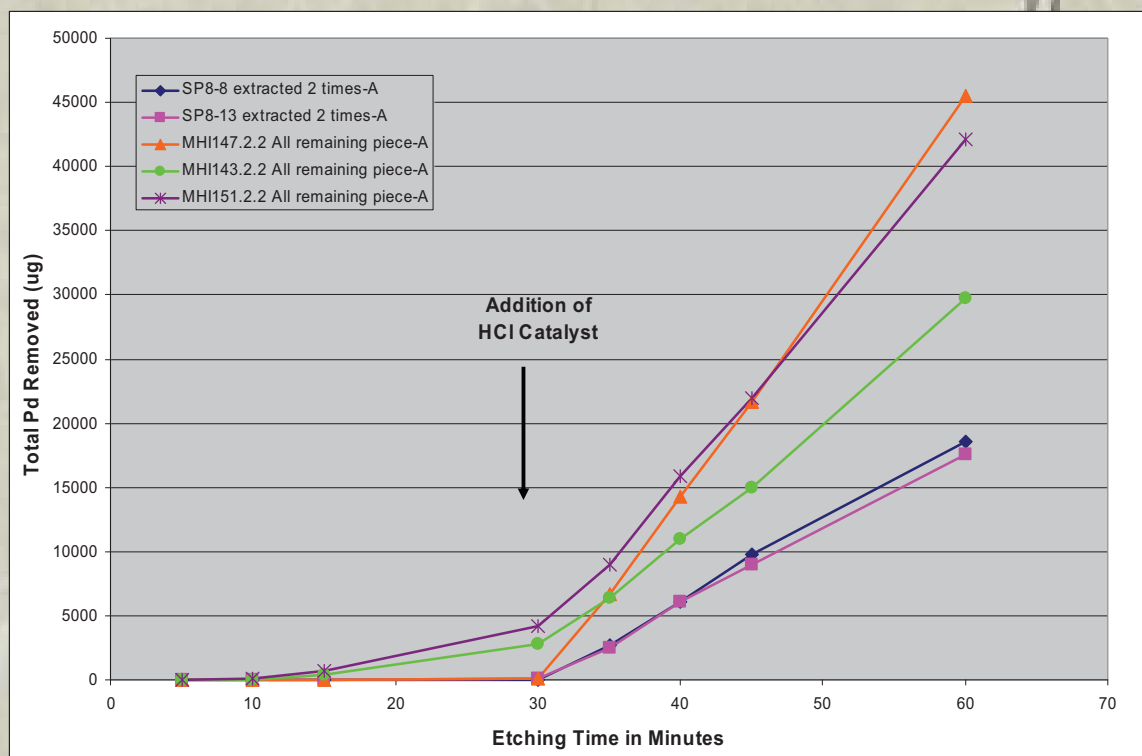
Note: Lower 2/3 Sent to NRL for Analysis



*Big Issue – Could not find Pr at NRL  
on our part of the foils!*

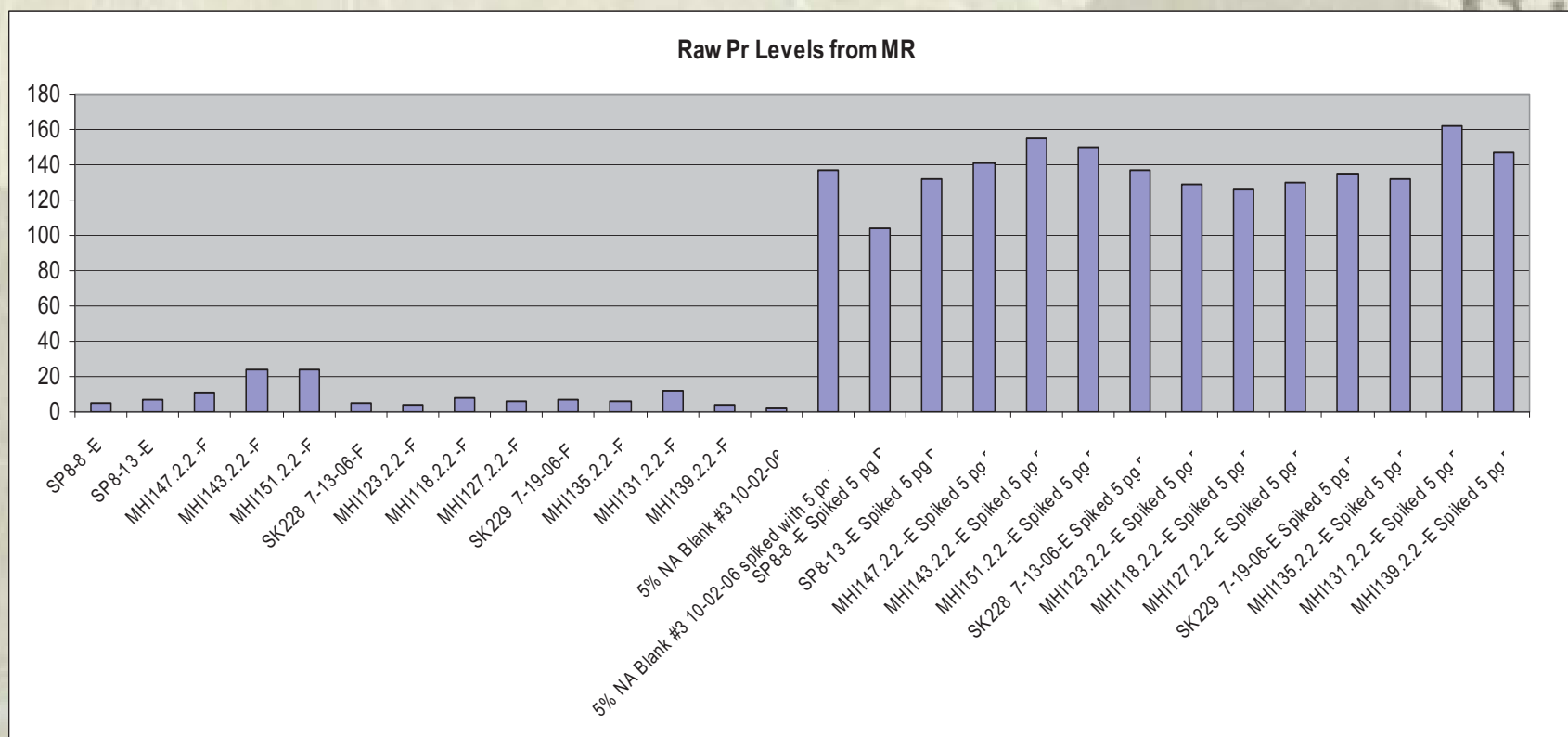
## *Example Showing That NRL Could Have Observed Pr, If Present*

- ❖ Controlled etching done on all samples
  - Discussed at ICCF-14
- ❖ 8 aliquotes taken and bulk analysis done
  - >100 samples + banks + controls
- ❖ No Pr found



## Example Showing That NRL Could Have Observed Pr, If Present

- ❖ One series spiked with equivalent of 170 pg/cm<sup>2</sup> Pr (~100x lower than expected)



## *Possible Explanations for failure to find Pr*

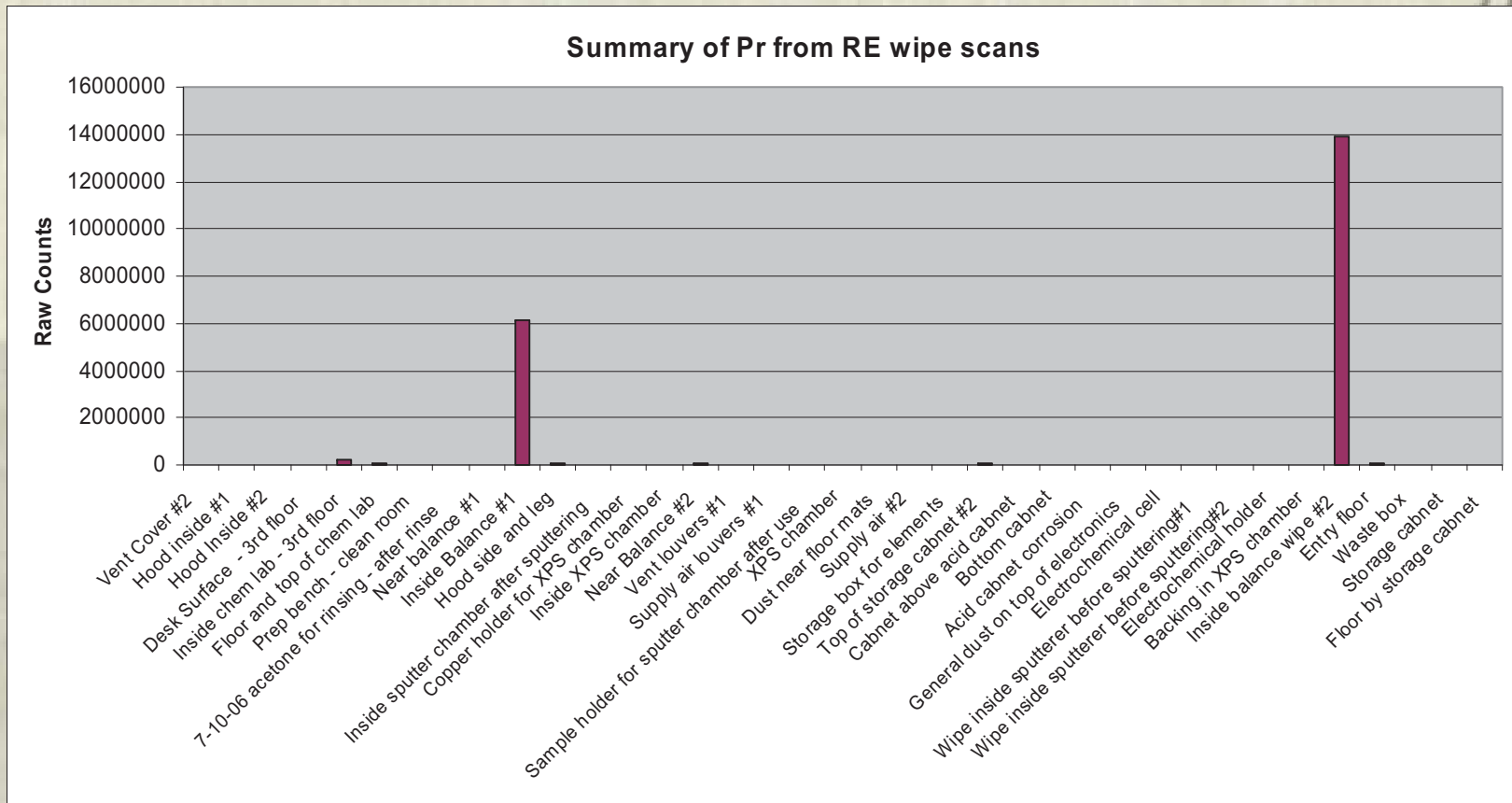
- ❖ Wrong part of foil
  - Systematic issues – statistically improbable
- ❖ Pr migrates into the interior – bulk analysis should find it!
  - Have done bulk analysis on MHI118 and essentially negative
- ❖ Pr lost in transit or handling
  - Film unstable – Pr should be in boxes – checked and no
- ❖ Pd catalyzes reverse nuclear reaction with time?
  - Real stretch of science
- ❖ Pr not there – we clearly have the required sensitivity and specificity

## *Months worth of work (frustration) later...*

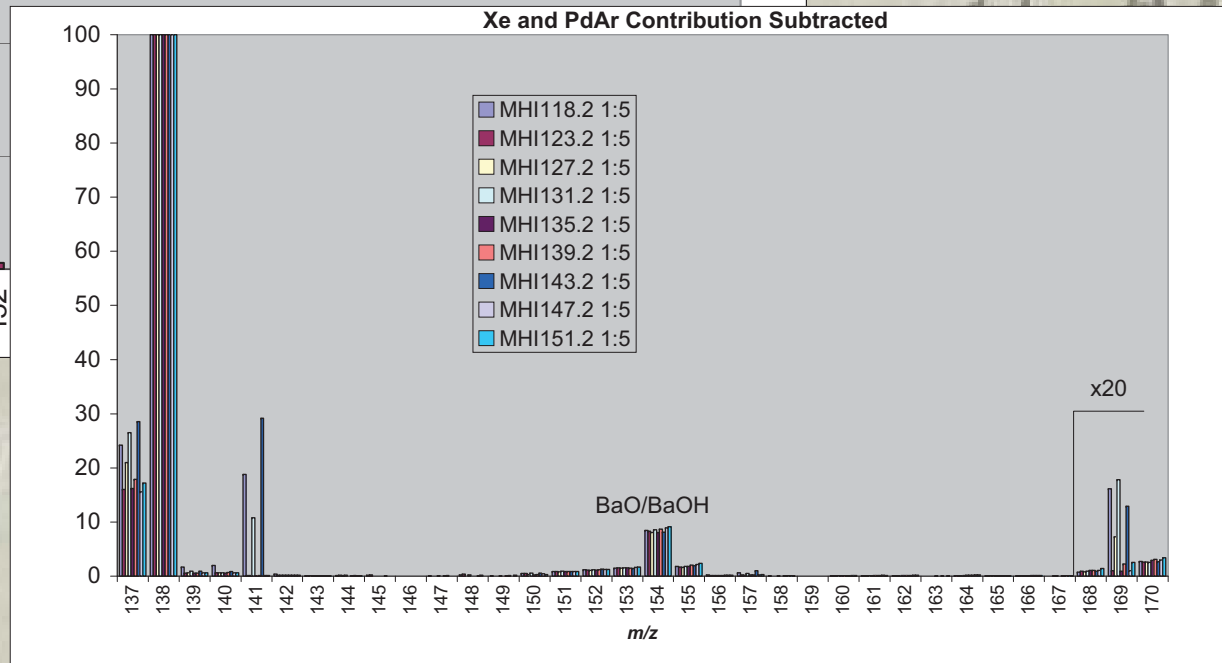
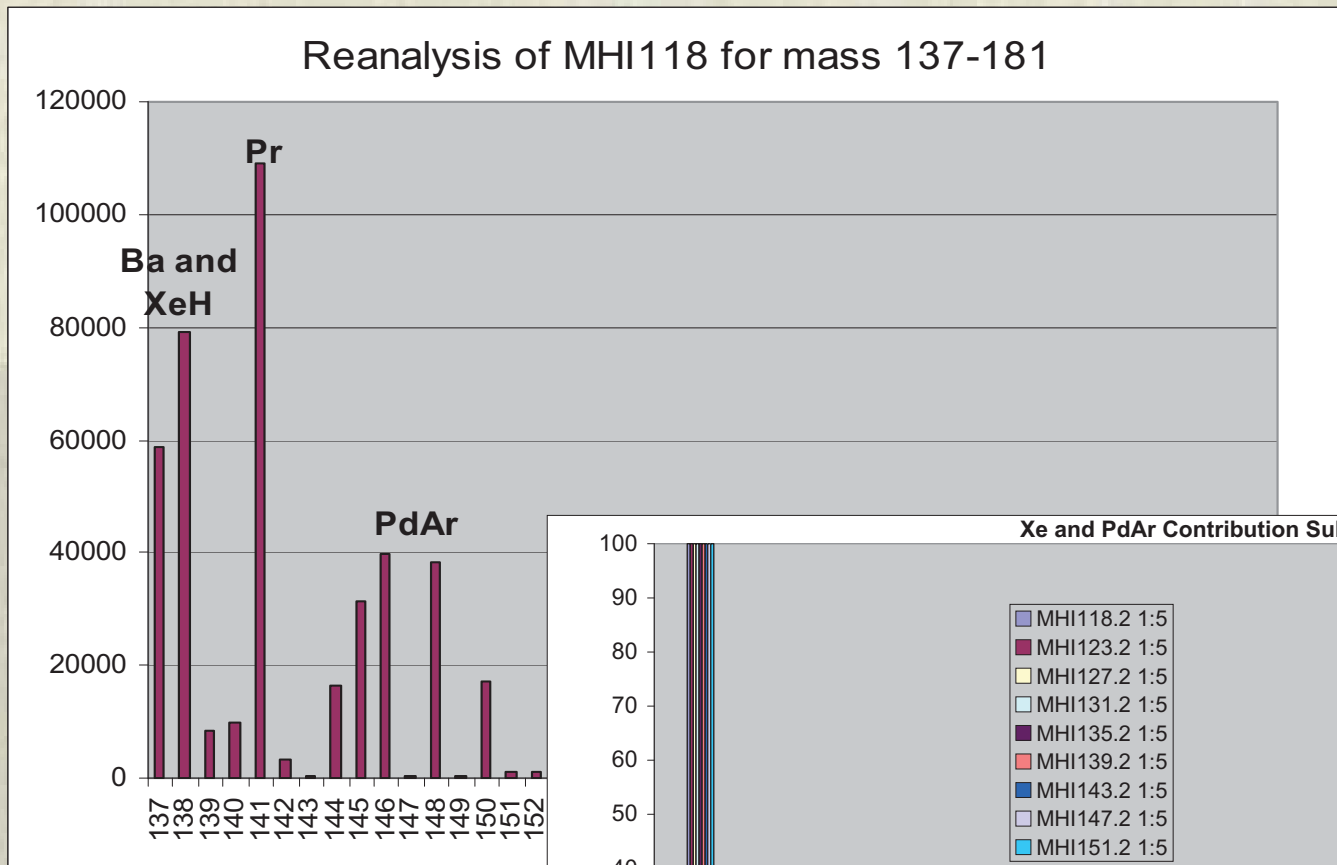
- ❖ Not etching enough Pd foil
  - Loss of deuterium with time causes lower Pd etching
- ❖ Traveled to MHI to observe process and extract a freshly prepared sample
  - Participated in extraction using their equipment on a fresh sample
  - Take split sample extracts
- ❖ Samples extracted at MHI in the presence of NRL personnel were negative at NRL and negative with a commercial laboratory in Japan

On whim, do environmental survey

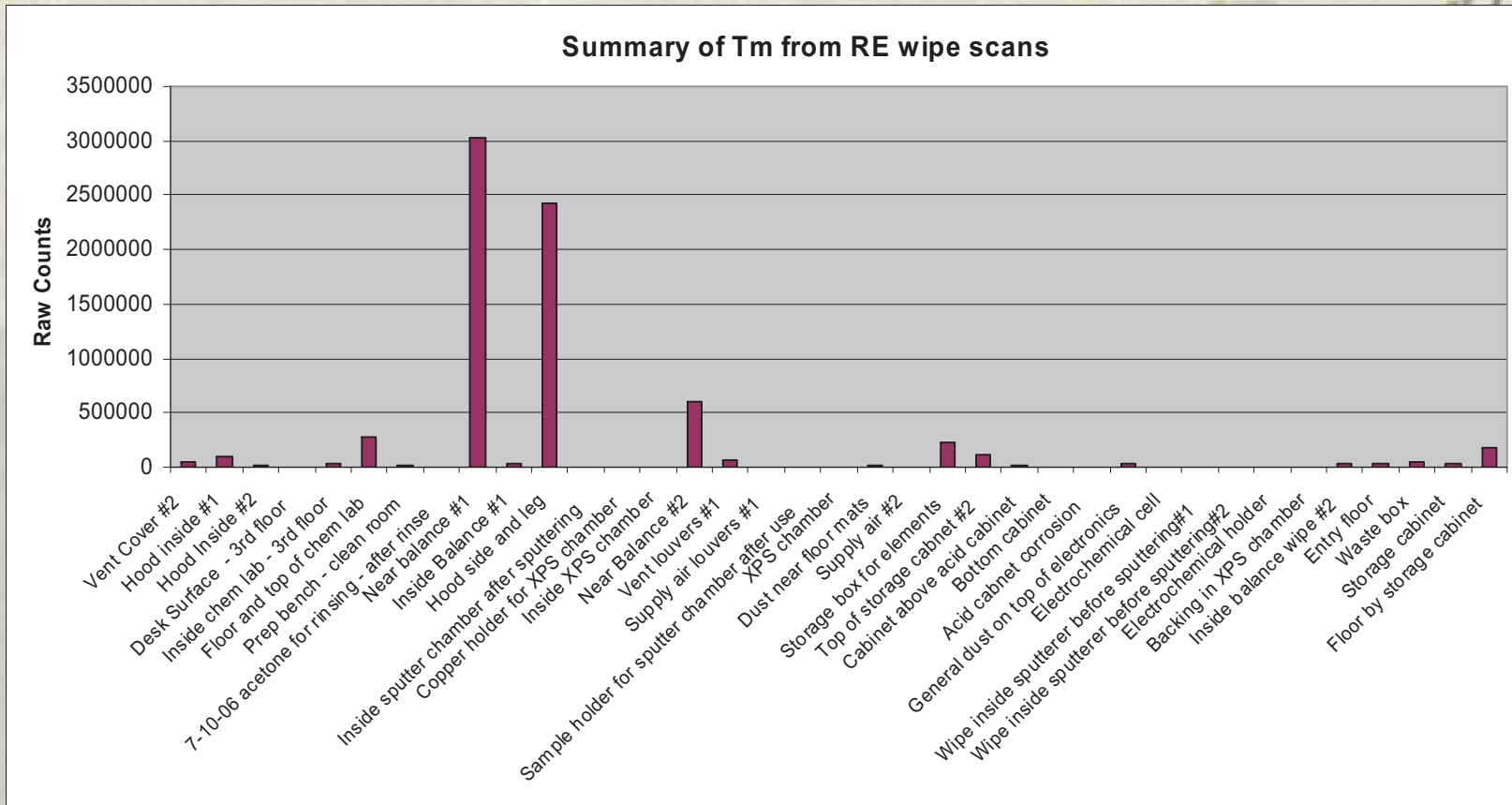
# Results from Environmental Survey



# Excess $^{137}\text{Ba}$ and Thulium Found in Samples Origin??



# Results from Environmental Survey



# Trace Elements in Samples

Sample	Excess Ba137 present	Total amount of Tm found (LR mode)
SP8-8 -E	No	0.005
SP8-13 -E	No	0.002
MHI147.2.2 -E	No	0.004
<b>MHI143.2.2 -E</b>	<b>Substantial</b>	<b>0.150</b>
MHI151.2.2 -E	Slight	0.016
SK228 7-13-06-E	No	0.004
MHI123.2.2 -E	No	0.006
<b>MHI118.2.2 -E</b>	<b>Substantial</b>	<b>0.082</b>
MHI127.2.2 -E	Substantial	0.029
SK229 7-19-06-E	No	0.003
MHI135.2.2 -E	No	0.006
<b>MHI131.2.2 -E</b>	<b>Substantial</b>	<b>0.199</b>
MHI139.2.2 -E	Substantial	0.008
Blank		0.001

Highlighted lines are the positive samples

# *Speculation*

## *Explanations of Results*

- ❖ Two types of contamination occur:
- ❖ ICP-MS
  - Extraction at MHI – contaminates the solutions
    - MHI extracts show Pr but NRL extracts do not
    - Individual doing extraction left MHI
      - “Lucky” tweezers??
    - Last samples prepared and extracted in presence of NRL personnel are blank
- ❖ *in situ* measurements - XRF/XPS – increase with permeation in a highly localized area
  - Contamination from dust in balance – contaminates the interior of the multi-layer structure with small particles of Pr
    - Blank runs not sensitive enough to see buried Pr
      - Under surface and localized
    - Pr migrates to surface under influence of the Deuterium flux
      - Spreads as migrates
    - Looks like production of Pr!

# *Speculation*

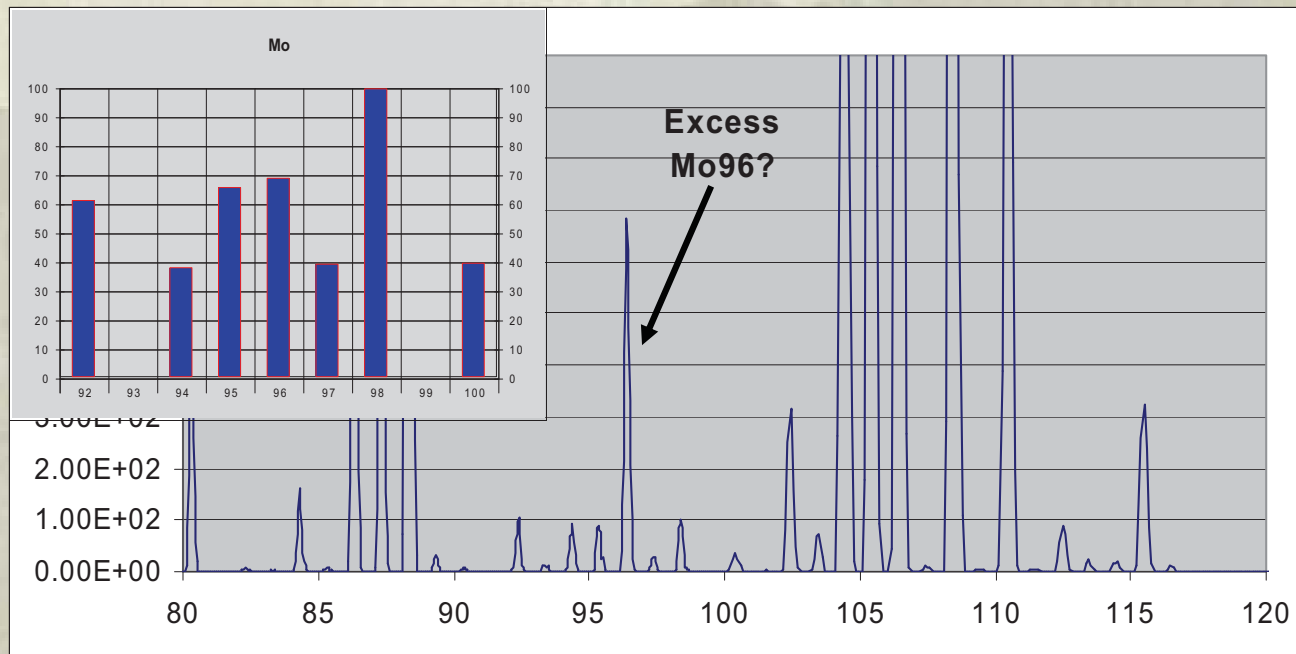
## *Scenario for how this contamination could have occurred*

- MHI tried other elements, believed to see  $^{133}\text{Cs} \rightarrow ^{141}\text{Pr}$  by *in situ* XPS
  - Cu can be confused for Pr
  - Needed standard of Pr – made one up in the laboratory to confirm XPS or ICP-MS analysis
  - From that time forward, actually was looking at Pr but from what source?
- In initial XPS results, believed to see Sr  $\rightarrow$  Mo.
  - Secondary Ion Mass Spectrometry appeared to confirm  $^{88}\text{Sr} \rightarrow ^{96}\text{Mo}$
  - Observing other transmutations appears to strengthen each observation
    - How strong was the evidence?

# *Be Wary of Cluster Ions*

## *Secondary Ion Mass Spectrometry (SIMS)*

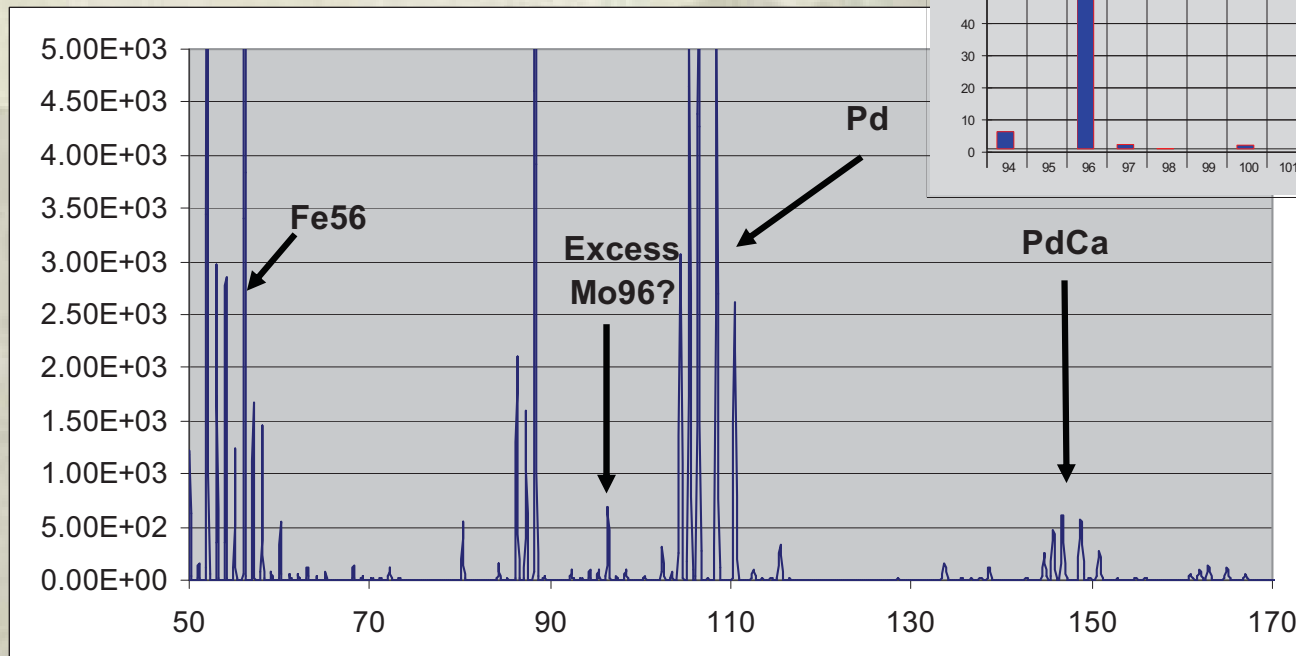
- ❖ Example: was  $^{96}\text{Mo}$  due to a cluster ion?



# *Be Wary of Cluster Ions*

## *Secondary Ion Mass Spectrometry (SIMS)*

- ❖ Example: was  $^{96}\text{Mo}$  due to a cluster ion?



- ❖ Observe Pd+40 (likely Ca), why not  $^{56}\text{Fe}+^{40}\text{Ca}$  → mass 96

## *Conclusions*

- ❖ The complex, multi-layer MHI structure was claimed to transmute elements
- ❖ Praseodymium is in the samples extracted by MHI at MHI
  - Analyzed by ICP-MS by NRL and a commercial laboratory with good agreement in results
  - Praseodymium in positive samples but not in controls
  - Praseodymium not in bulk palladium
  - Praseodymium signature not consistent with typical contamination from misch metal from the environment

## *Conclusions*

- ❖ Praseodymium could NOT be extracted at NRL by NRL from split portions of the samples
- ❖ Environmental surveys at MHI by NRL and MHI found Praseodymium in key areas of laboratory
- ❖  $^{137}\text{Ba}$  and Thulium also found on positive samples and in laboratory at MHI
  - Not on historic samples prior to this study
  - Both handled previously to this study
  - Found in key areas of laboratory
- ❖ Presence of Praseodymium may have other explanations than transmutation of Cs

“We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.”

- Isaac Newton

## *Acknowledgements*

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