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Chemistry meets art: Instrumental analysis at the LCVA

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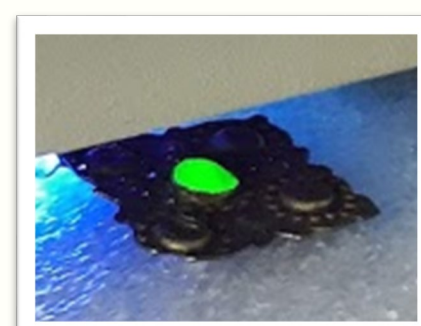
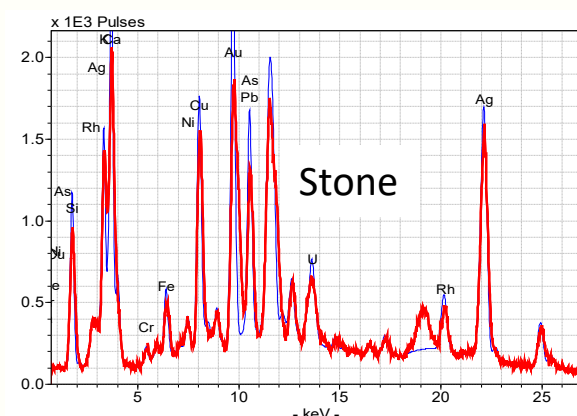
Chemistry meets art: Instrumental analysis at the LCVA

CHEM 351: Mia Arrieta, Kaleigh Beale, Adonel Grubb, Adam Gyori, Kimia Jahangiri, Keana Jones, Marcia Lanasa, James Rakes, and Dr. Sarah Porter
LCVA: Emily Grabiec and Mack Lenhart

The LONGWOOD CENTER for the VISUAL ARTS

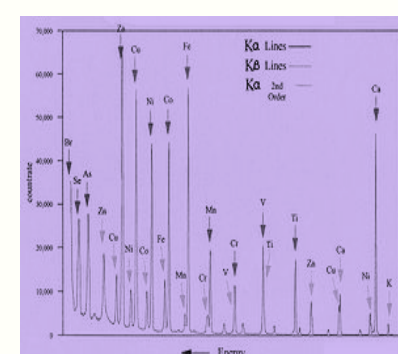
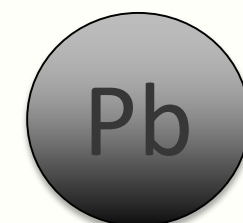
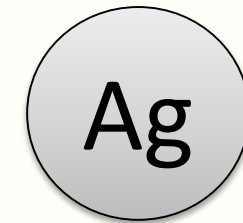
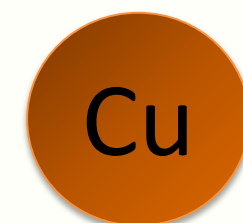
Abstract: This project is an ongoing collaboration between the Longwood chemistry program and the Longwood Center for the Visual Arts. The demonstration shows the capabilities of the X-ray fluorescence spectrophotometer as a non-destructive elemental analysis technique. Our class visited the LCVA to analyze several pieces in their art collections. We were able to utilize the XRF instrument to analyze the elemental composition of glass and metal, painted pottery and porcelain, oil paintings, and metals. This project lays the groundwork for further research using X-ray fluorescence for non-destructive chemical analysis.

GLASS & METAL

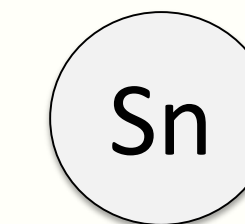
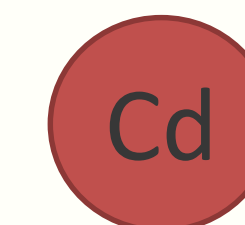
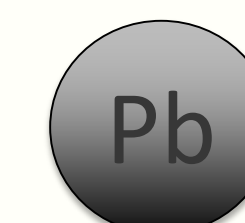


Museum mystery solved!

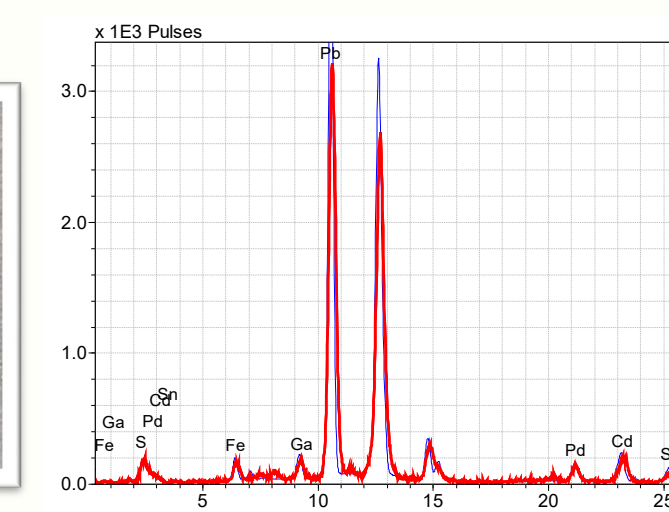
- A Moroccan pendant was listed in museum records as "metal with green stone."
- Analysis of the stone revealed uranium, silicon, lead and arsenic, confirming that the stone was made of "uranium glass."
- Uranium also glows under UV light, which was used to confirm the presence of uranium in the glass.
- Analysis of the metal indicated a unique alloy of copper, gold, and silver.



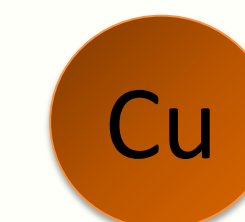
POTTERY



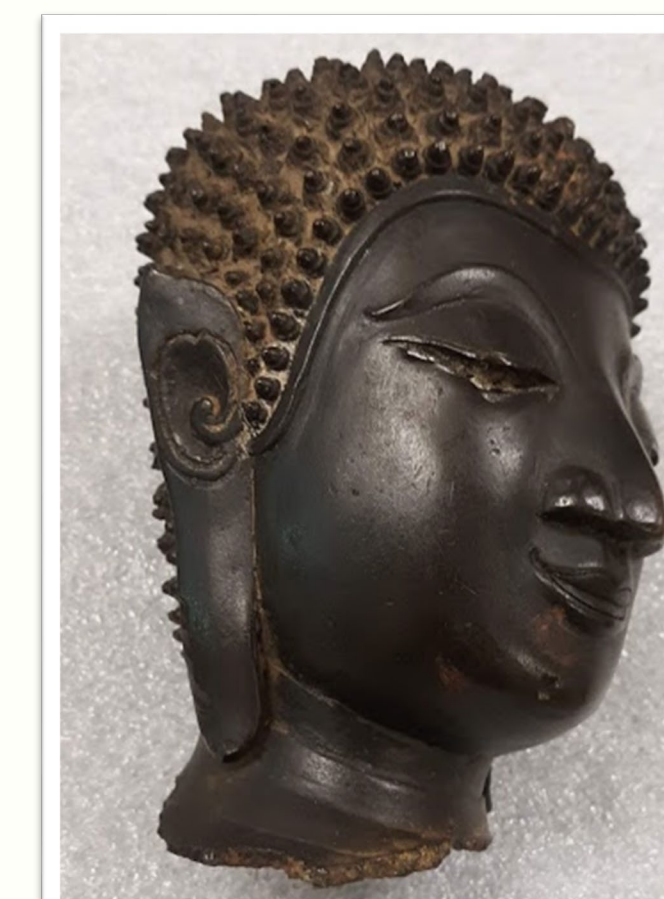
- Yellow pigment on Chinese pottery (no date noted) and green porcelain snuff bottle (Qing dynasty) were analyzed.
- Lead along with traces of cadmium and tin were detected.
- Barium was not detected, which could help to eliminate a time period in which lead-barium-silicate glazes were common¹.



METALS



- Buddha head from Chinese collection had no date range indicated.
- The presence of copper and zinc may indicate that the statue might be brass rather than bronze.
- Literature suggests that the provenance of bronze can be characterized using a combination of non-destructive analytical techniques that includes X-ray fluorescence³.



PAINTING



- Analysis of different colors on this painting dated to the late 19th century indicated lead and other trace elements.
- "White lead" was a common base during this time period and the spectroscopic analysis can help confirm the museum's information on this piece².

References

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3. Kotlar, Marta, et al. "Studying a 2 millennia old bronze kettle using easily accessible characterization techniques." *Heritage Science* 9.1 (2021): 1-13.