THE DATUM POINT

June 2025

Newsletter of the
NORTHERN VIRGINIA CHAPTER (NVC) OF THE
ARCHEOLOGICAL SOCIETY OF VIRGINIA

Chapter Website – www.nvcasv.org

FROM THE CHAPTER PRESIDENT

PATRICK O'NEILL

Hot, Hot, Hot!!!!!! Stay cool, but don't stay inside all the time! I will be sending out information for the Annual Meeting in October in Staunton in the coming days! Please consider coming! It will be a blast!

A crew began clearing brush at the Saint's Hill Mansion in Fauquier County. Hot and muggy, but they made good headway! There is also a 1745 log house foundation next door, and I have permission to work on that site, too. I will send out times and dates when I get them. I want to have the Chapter picnic here in August!!

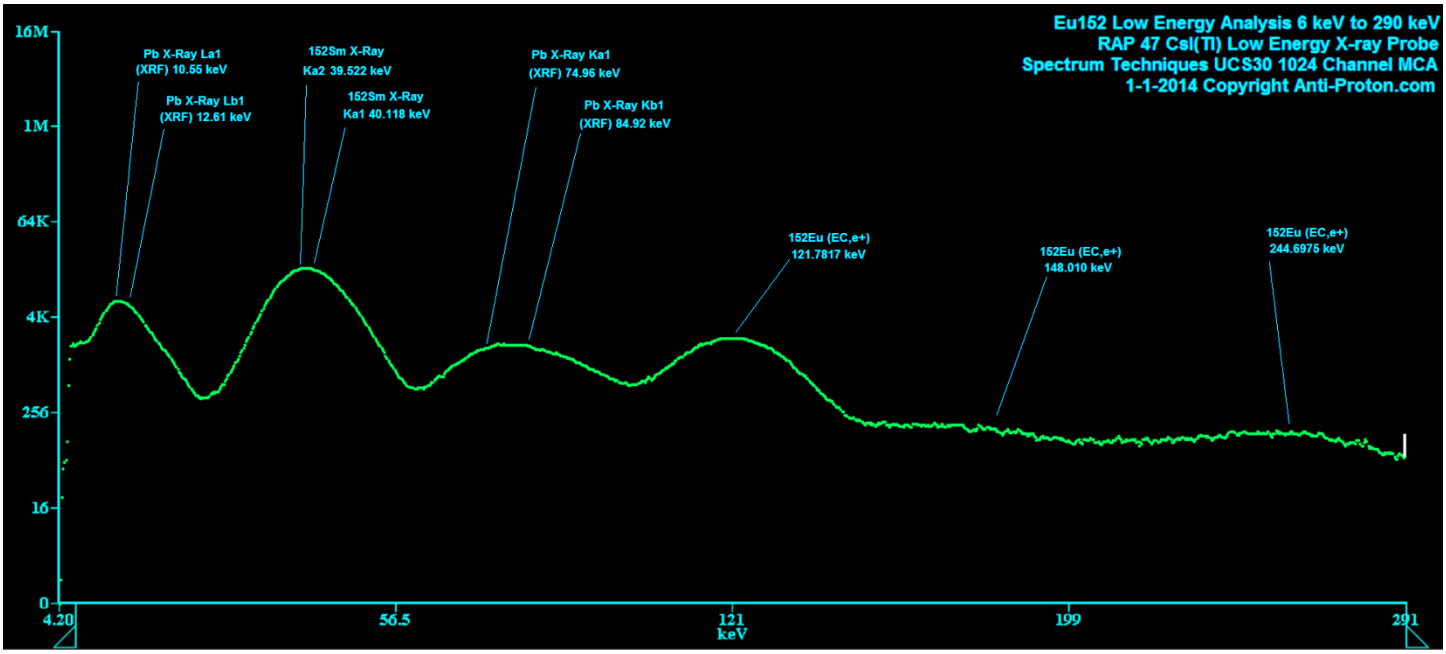
Mike Johnson continues lab work and field work at Jasper Ridge! If you need to be on his email list, let him know at mj44fx1@outlook.com

This month's meeting was at 7:30 PM, Wednesday, June 11th, at the Richard Byrd Library in Springfield, Virginia

Speaker: *Ms. Emma Schlauder, Research Archaeologist at the George Washington Foundation*

Topic: ***Excavating the Unwritten: Archaeology at Washington's Childhood Home***

Emma Schaluder - Emma is the Research Archaeologist for the George Washington Foundation. Primarily based at Ferry Farm, her research covers the lives of the enslaved community and Washington women. Outside research, her work involves community outreach, curation, and artifact conservation plus mending. She has a BA (history & archaeology) from Boston University, a MS (human osteology & funerary archaeology) from the University of Sheffield in the UK, and will be starting a PhD in early American history this fall at GW. She is also a recipient of a Fulbright scholarship and remains active in the Fulbright community as a member of the local chapter's alumni board. A keen traveler, Emma has visited 18 countries so far for travel, study, and archaeological work



Self-excitation XRF of europium 152 taken by Ishtar Watson, 2012.

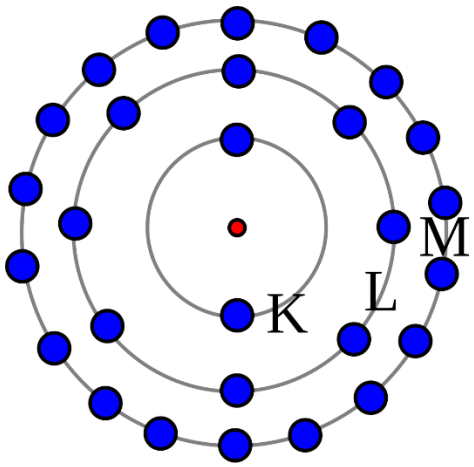
What is EDXRF?
A brief overview

By Ishtar Watson

XRF, P-XRF, EDXRF, and many other related acronyms appear regularly within various sciences, including archaeology. But what does XRF mean, and how does it work? XRF stands for X-ray Fluoroscopy, sometimes called X-Ray Emissions Fluoroscopy. The ED prefix refers to the method used to excite atoms in a sample for XRF, in this case, energy dispersion.

The basic concept: energy within atoms can only exist within discrete quantities and is thus said to be "quantized." Yes, this is where the term "quantum" originates. The nucleus of an atom, having at least one or more protons and typically one or more neutrons, is surrounded by tiny electrons. They don't orbit, but for simplicity, we can think of them that way.

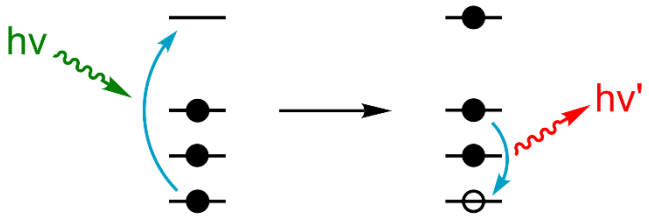
There are discrete orbits of electrons, sometimes called shells. The closest shell to the nucleus is the K shell. For an electron within the K shell to transition to the next shell up, the L shell, it would require more energy, similar to a satellite being boosted into a higher orbit. Likewise, for an electron in the L shell to "drop" to the lower K shell, energy would need to be lost.



Bohr Model of Atom, Cdang, via Wikipedia, CCBY-SA 3.0

The law of conservation of energy tells us that energy can neither be created nor destroyed. Thus, when energy is lost in a transition from a higher energy shell to a lower energy shell, that energy must go someplace else and is emitted as a photon, called "fluorescence."

The amount of energy needed to transition between shells is largely determined by the number of protons in the nucleus. Since every element has a different number of protons, and since the energy is always the same for any specific transition, such as L to K shell, for a specific element, we can detect these energies and use them to determine which element was involved in producing them.



Schematic of XRF, by Calvero, via Wikipedia, Public Domain

But how does one convince an electron to transition from one shell to another? **Radiation!** Using x-rays or gamma rays, we can provide enough energy to one of the lower-energy shell electrons, such as those in the K shell, to eject one of its electrons from the atom. This leaves a hole for another, higher-energy electron to enter. Our universe favors lower energy configurations of matter, so a higher energy electron from the M or L shells will quickly transition down to the K shell, filling the hole that was created. The released excess energy can be detected and measured.

When you point a handheld XRF "gun" at a sample and pull the trigger, a tiny X-ray machine within the gun is activated. The X-rays are directed at the sample, causing them to fluoresce. Some of the resulting fluorescence is captured by a detector in the nose of the gun. These signals are measured using a multi-channel analyzer (MCA). Within the gun is a memory with a series of counters, or "bins," each corresponding to a specific energy. When a photon from an electron transition is captured, the bin associated with its energy is incremented by one. Over time, a statistical pattern begins to emerge within the MCA. These patterns may be used to determine the elemental makeup of a sample.

For more information on this process, Mr. Wizard's 1960's explanation of gamma spectroscopy, a very similar technique, remains one of the best and easiest to understand explanations, https://www.youtube.com/watch?v=h0dF2FUo5WU

When an XRF machine scans a sample, typically, the first few millimeters are scanned, as the X-rays from the XRF machine are not powerful enough to penetrate deeply. The sample reabsorbs the XRF fluorescence produced before it can escape to the detector. The intensity of the X-ray beam, also referred to as "beam quantity,"

and the average energy of the X-rays, known as "beam quality," can be increased, allowing for deeper penetration of the sample. However, these enhancements come with significant tradeoffs.

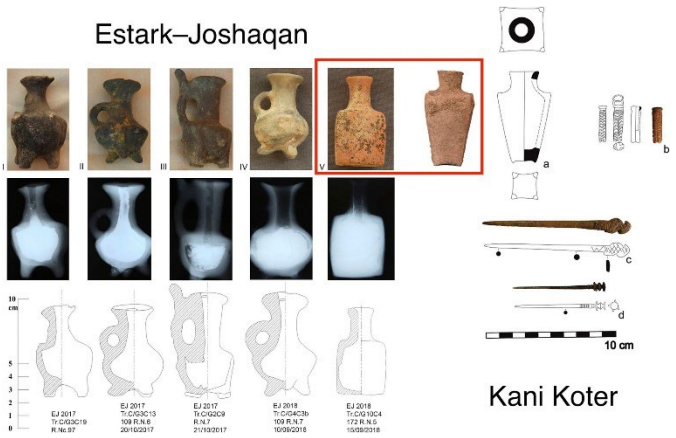
Thus, XRF can provide a list of elements present within the surface layers of a sample, doing so non-destructively. Importantly, the depth that a scan can penetrate is limited and based upon the intensity and power of the x-ray or gamma-ray source used to excite the sample's electrons. This is a critical fact, as there is often a misconception that a scan of a sample provides the elemental makeup of the sample when, in fact, the scan may only be representative of the top few millimeters of material, and anything in between, including the air.

XRF machines are often limited by several factors, including power consumption, the energy and intensity of their radiation sources, their resolution (how well they can resolve a single band of energy), and the lightness or heaviness of the elements they can scan. The characteristic XRF x-rays from lead are roughly 75-85 keV, while the characteristic XRF x-rays from aluminum are roughly 1.5 keV. This is a rather wide energy range for a low-energy detector, and it is a serious consideration when determining which unit to use for a test.

Despite its complexities and limitations, EDXRF remains an extremely useful tool for various branches of science, including archaeology. The reader is encouraged to learn more about XRF. Bruker, a major supplier of XRF equipment, has released an on-demand webinar for use of XRF within the context of cultural heritage.

Authors Note: Ishtar Watson has nearly fifteen years of hands-on experience with EDXRF, including building units from scratch and manual analysis without the aid of software. While she considers herself a hobbyist, she has an extensive background in the topic, including some academic study and professional experience.

Eyeliner From the Past



Cosmetic containers found at the site, Creative Common License, John Wiley & Sons Ltd on behalf of University of Oxford.

Ancient Egyptian and Middle Eastern artwork is often filled with imagery of people wearing dark eyeliner and mascara, also known as kohl. In the Bronze Age, Kohl was usually made from silicon, lead, or manganese-based materials. But archaeologists working in Iran have uncovered a new recipe for kohl.

Within the Kurdistan province lies Kani Koter, an Iron Age cemetery located beside the village of Dere Pemeyan in western Iran, and it likely holds the remains of those who inhabited a fortified settlement not far to the North.

One of the graves was destroyed by the landowner, but the contents of the grave were recovered. The extensive and high-quality grave goods likely indicate a high-status burial, and were tested using a variety of methods, including micro XRF, x-ray powder diffraction, and field emission gun scanning electron microscopy. These tests indicated the presence of carbon from natural graphite and manganese oxides, used as a colorant.

The reader is urged to view the full article at https://doi.org/10.1111/arcm.13097

Call for Content

- Working on a project?
- Found a fascinating article?
- Visited someplace interesting?
- Reviewed a book you have read?
- Have an artifact you want to discuss?

The Datum Point newsletter could use your content. Please contact Ishtar Watson with your ideas and content suggestions and submission. The deadline is the first of each month. Each submission will be evaluated on a case-by-case basis.

CONFERENCE ON PUBLIC ARCHAEOLOGY
AUGUST 8-9, 2025 WASHINGTON, DC

The 2025 Conference on Public Archaeology will be held in Washington, D.C., from August 8 to 9, 2025. Archaeology in the Community is hosting this event for public-minded archaeologists and cultural heritage

professionals. Don't miss out on a chance to join workshops, panels, and special events tackling key topics like:

- Public archaeology & Section 106
- Community science & site stewardship
- Climate impacts on heritage
- Digital outreach & education
- Engaging with schools & educators

This unique conference will skip traditional paper presentations in favor of discussions, hands-on activities, and networking opportunities. Let's shape the future of archaeology together! https://zurl.co/rz4yg

2025 NVC/ASV CHAPTER OFFICERS

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Dues:

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Please make check payable to NVC/ASV.

Return to:
Barbara Leven, Treasurer, NVC/ASV
9518 Liberty Tree Lane
Vienna VA 22182

The Chapter meets at 7:30p.m. on the 2nd Wed. of each month. *Meetings may take place in-person and/or on Zoom. Details with start time and on-line/in-person information will be provided in the *Datum Point* or email prior to each meeting.

EVERYONE IS WELCOME!!!!