



X-Ray Fluorescence

Lucas Lebin
Caroline Trippel
Miraj Shah
Teacher: Jennifer Pakkala



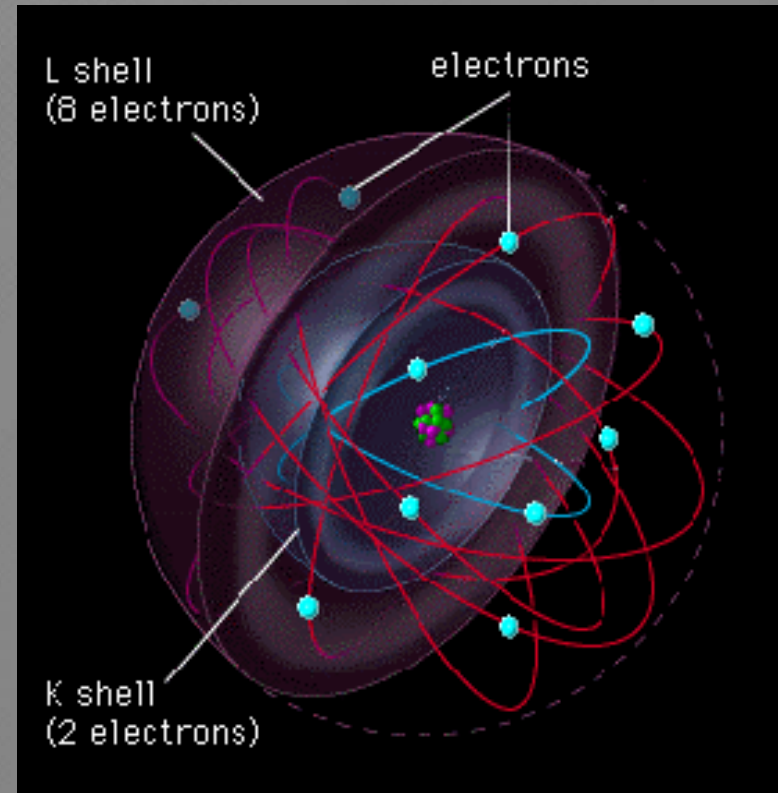
Purpose

- To verify the relationship between x-ray energy and atomic number
- To determine the elemental make-up of various samples



X-Ray Terminology

- Electrons travel in orbits.
- Orbits are designated by the letters K, L, M, etc.

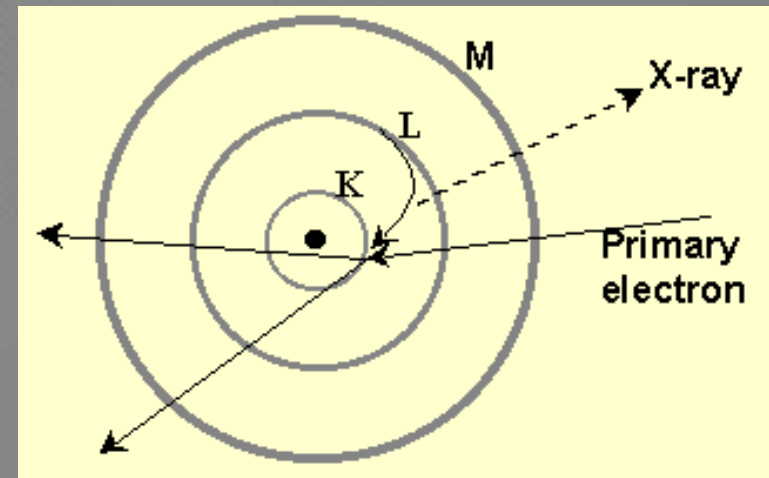


From Forensicscience.net



X-Ray Terminology

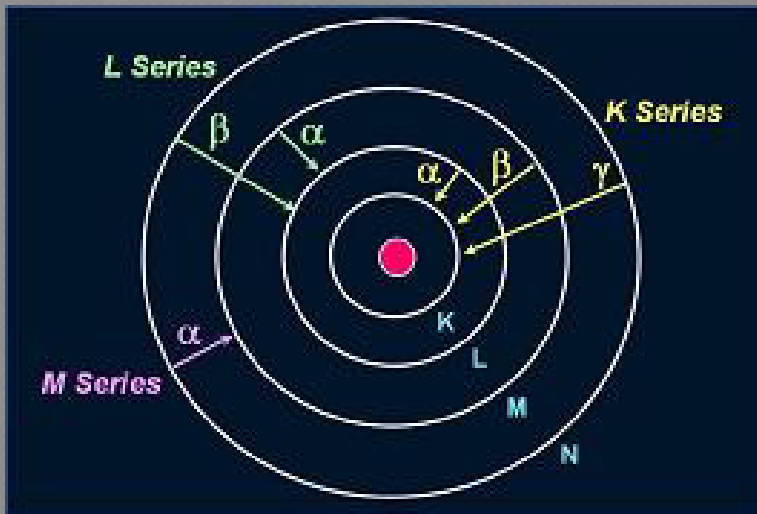
- When electrons become excited they move to a higher orbit (higher energy).
- When excited electrons move back to a lower orbit, they release energy in the form of an x-ray.



From the Concrete
Durability Group



X-Ray Terminology

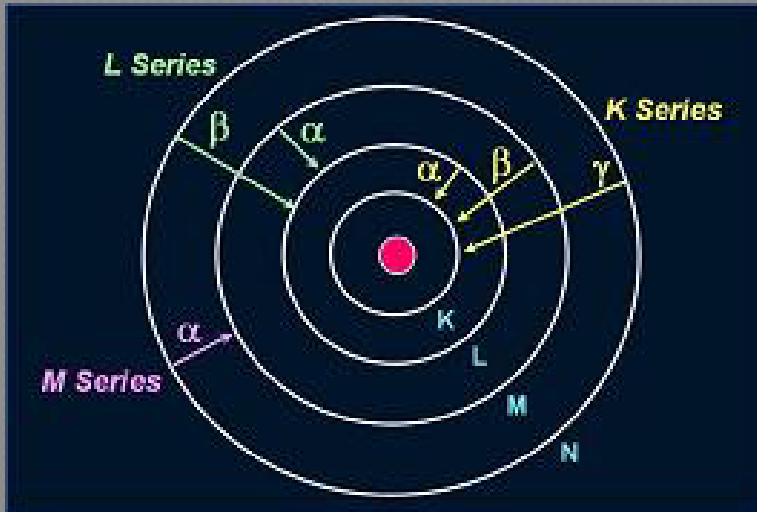


From siliconfareast.com

- The energy of the x-ray released depends on the number of orbits that the electron moved.
- Energies are
 - K_{α}
 - K_{β}



X-Ray Terminology



From siliconfareast.com

- When an electron moves from the second to first orbit it lets off energy A.K.A. K_{α} .
- When an electron moves from the third to the first orbit it also releases energy. This is known as K_{β} .

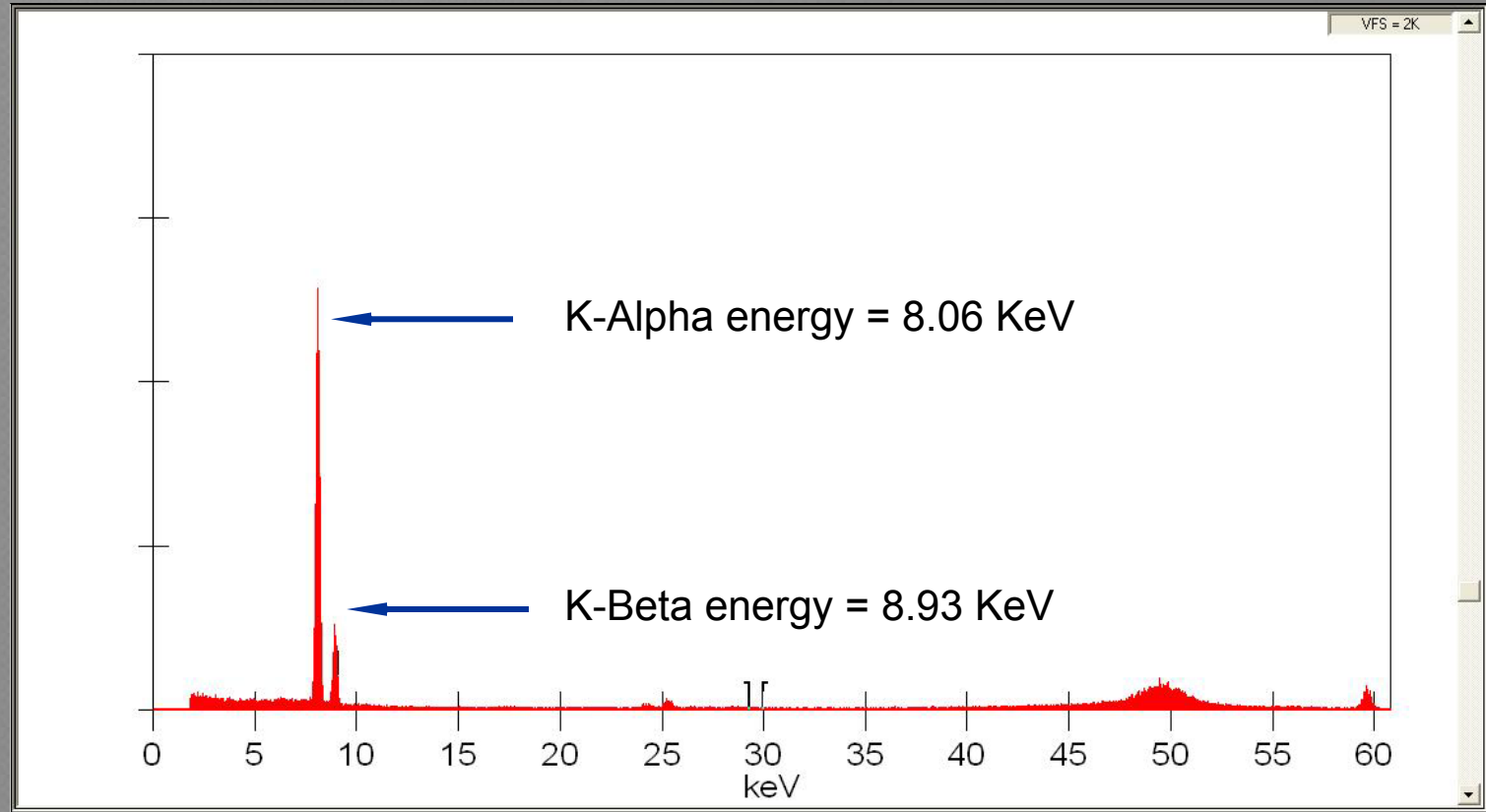


Experiment

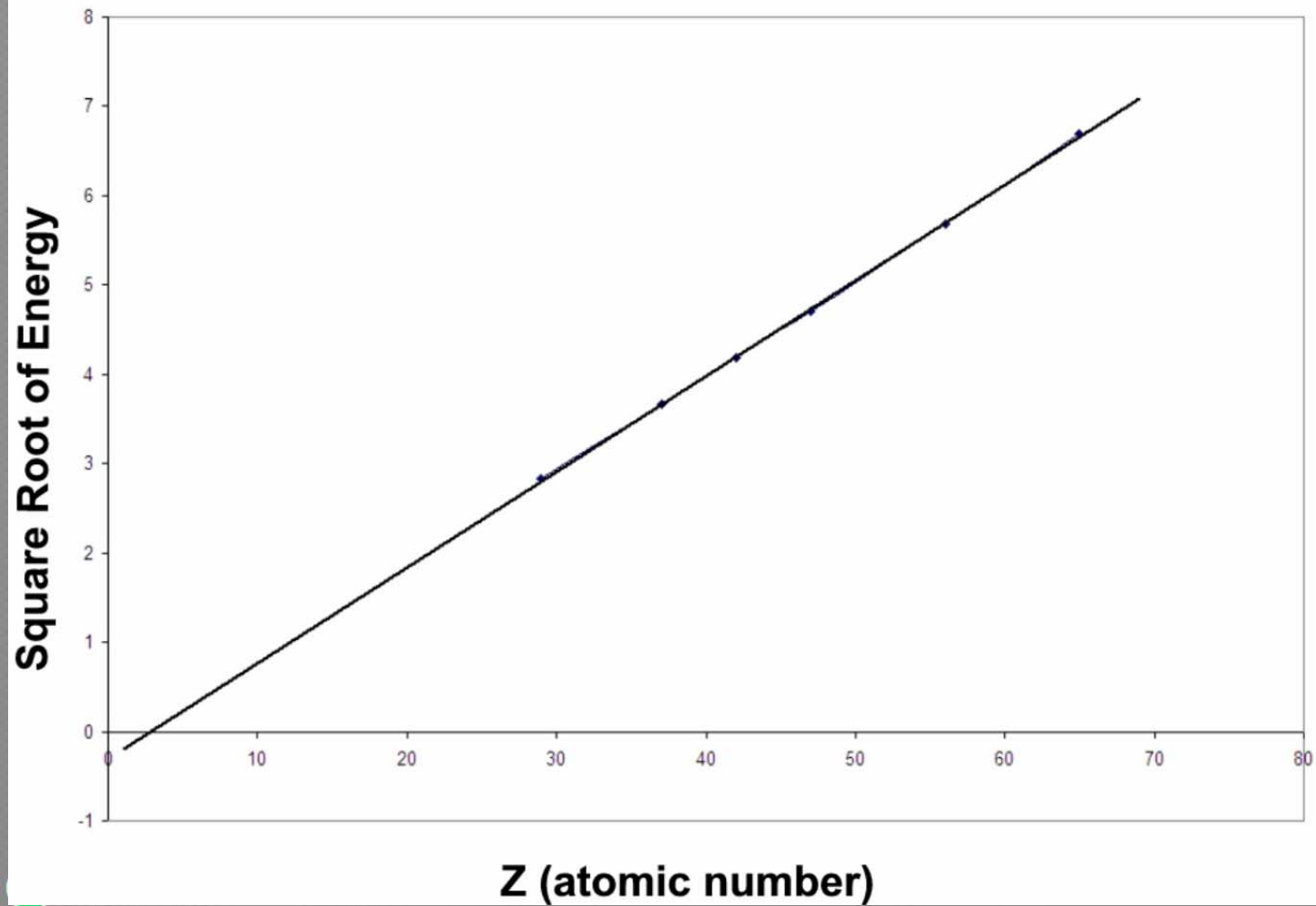
- X-rays produced in the decay of Americium-241 were used to induce x-ray emission in a target material.
- Energies of emitted x-rays were measured.
- Target materials included
 - Copper
 - Rubidium
 - Molybdenum
 - Silver
 - Barium
 - Terbium



Copper



Summary of K_{α} Data



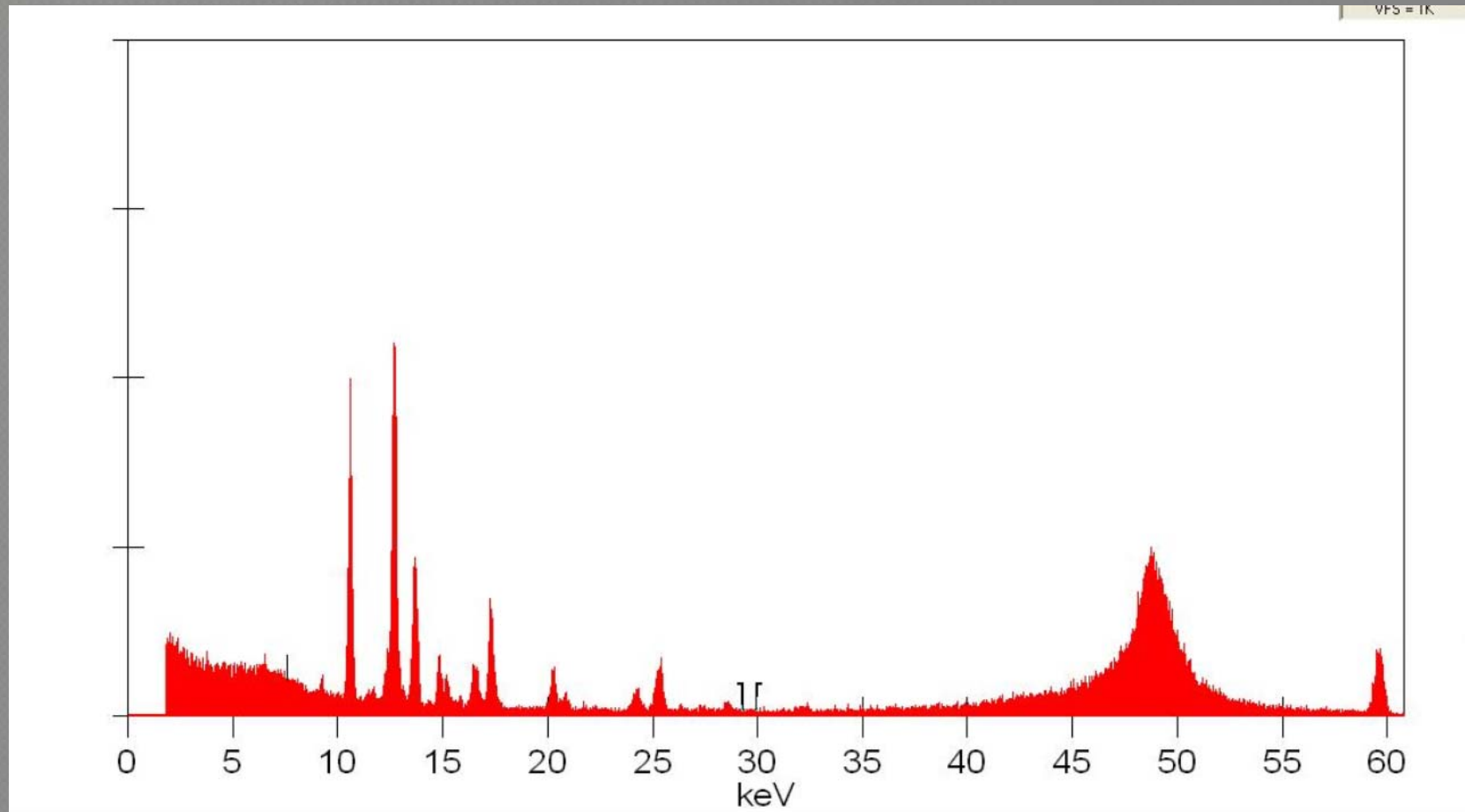
Experiment with Unknowns

- To determine the elements present in the sample:
 - Find the energy represented at the vertex of the peak.
 - Compare this energy with the known energies of elements.

Orange Fiestaaware



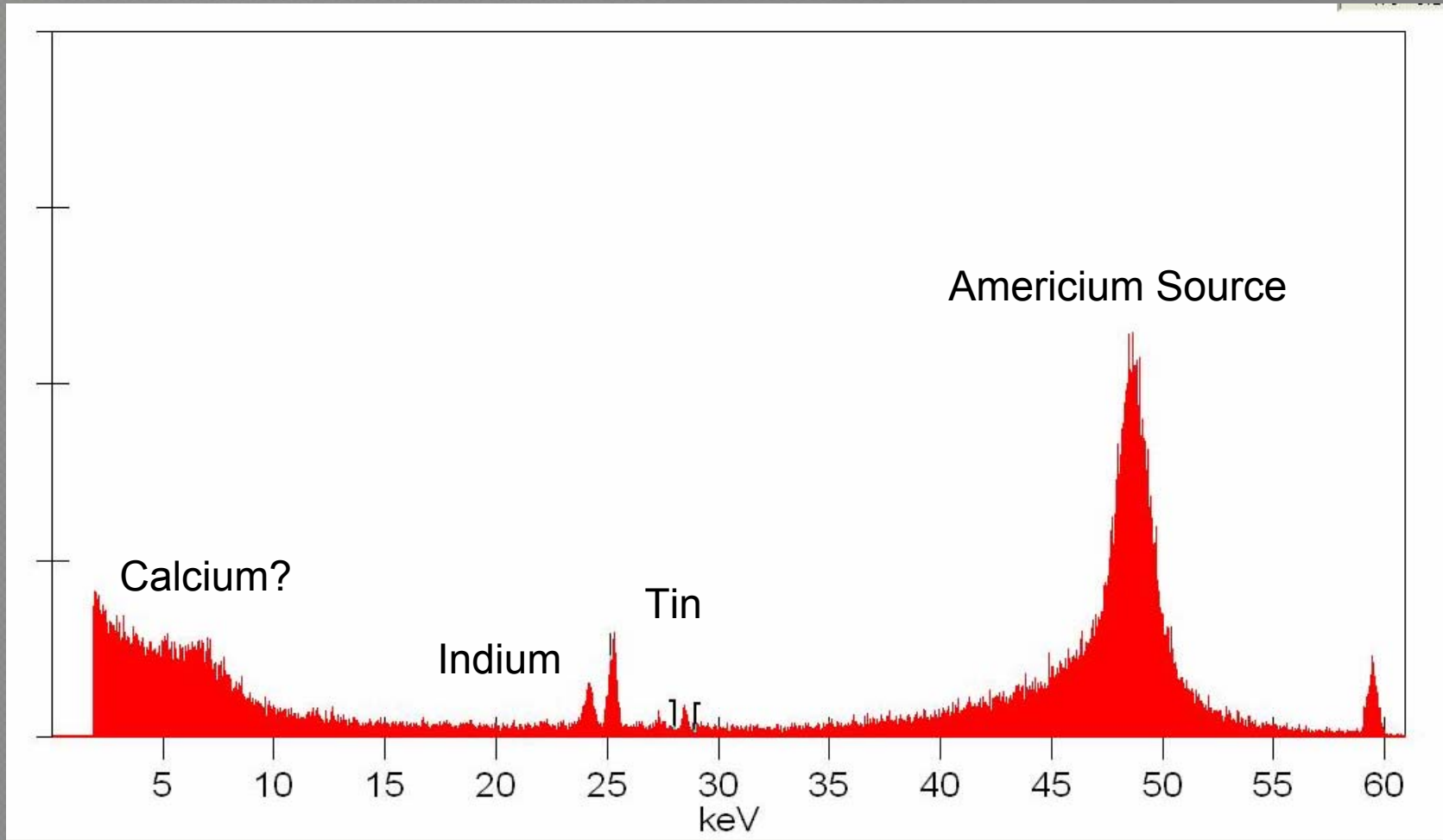
Fiestaware Plate



Contains lead, arsenic, and uranium.

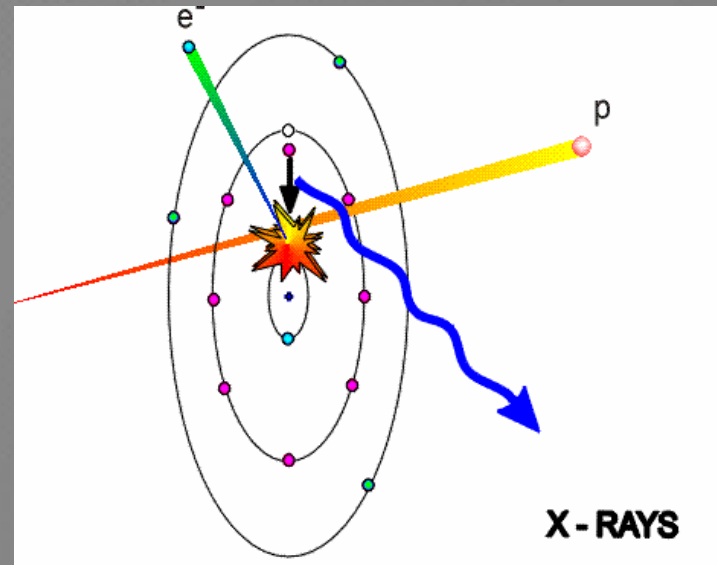


Petoskey Stone



PIXE v. XRF

- Uses the same basic concepts as XRF to determine elemental composition with a different source.
 - In XRF x-rays from Americium 147 were used to excite the target electrons.
 - In PIXE a proton beam is used to excite the target electrons.



From: University of Leipzig



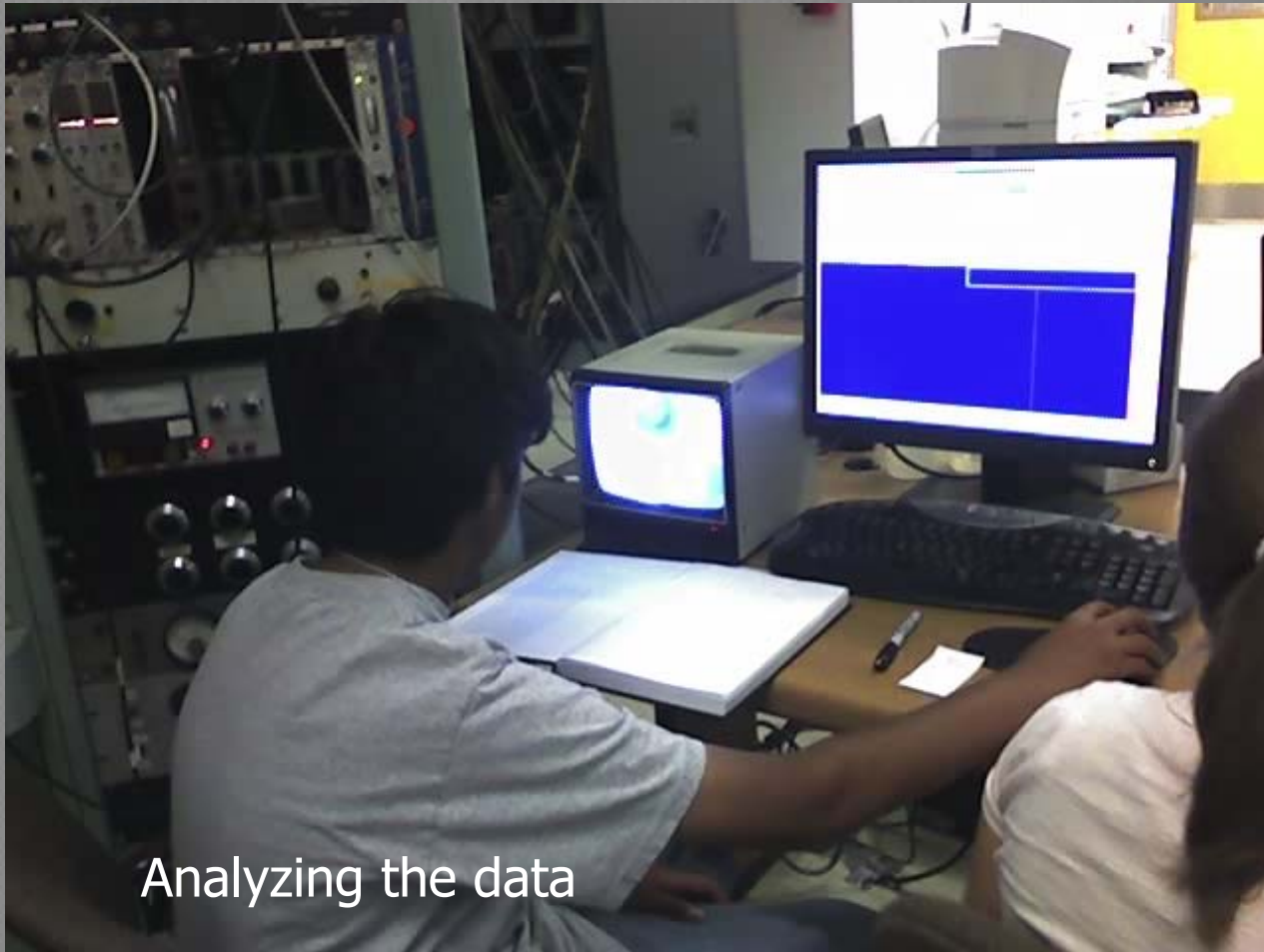
PIXE



Placing a target



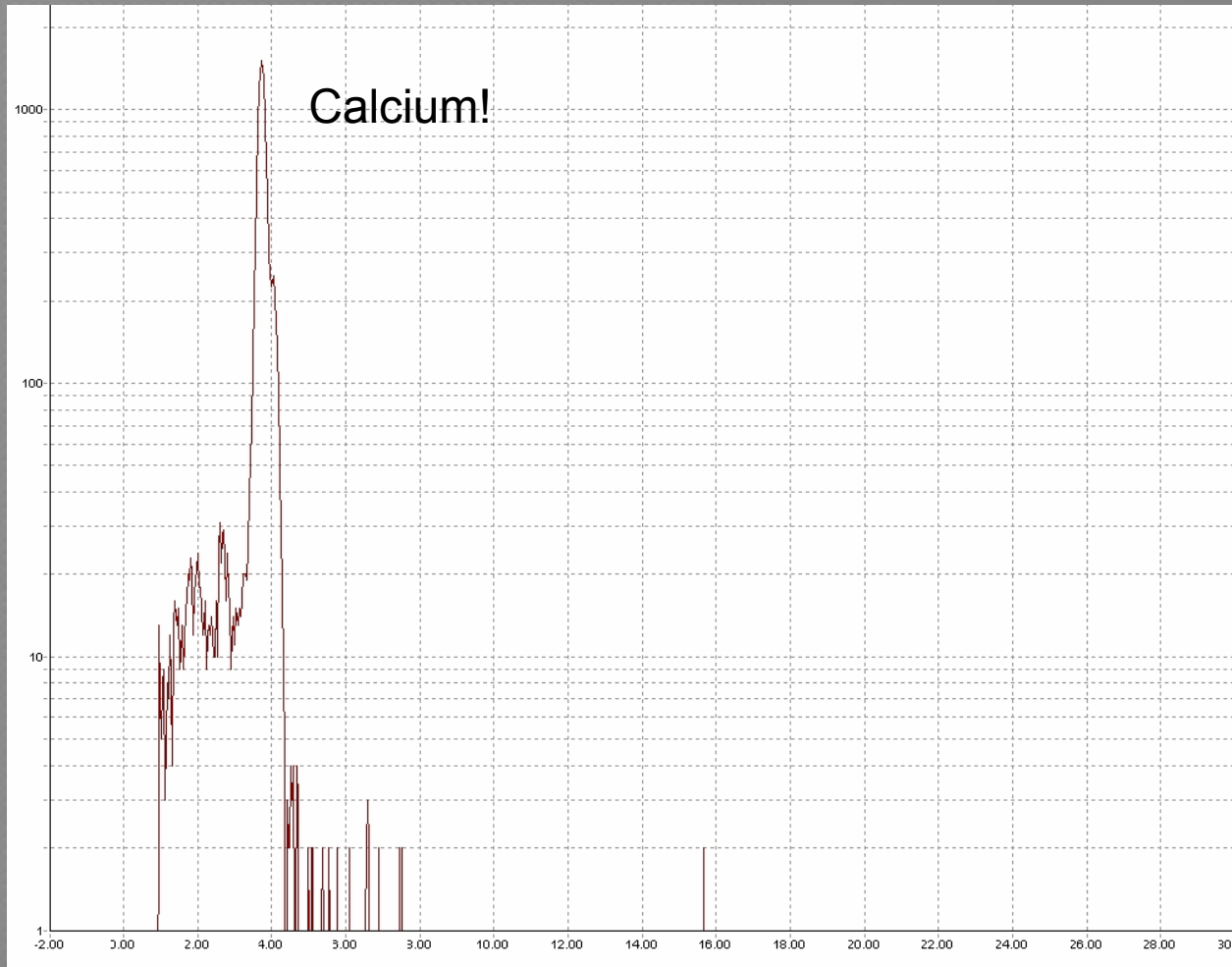
PIXE



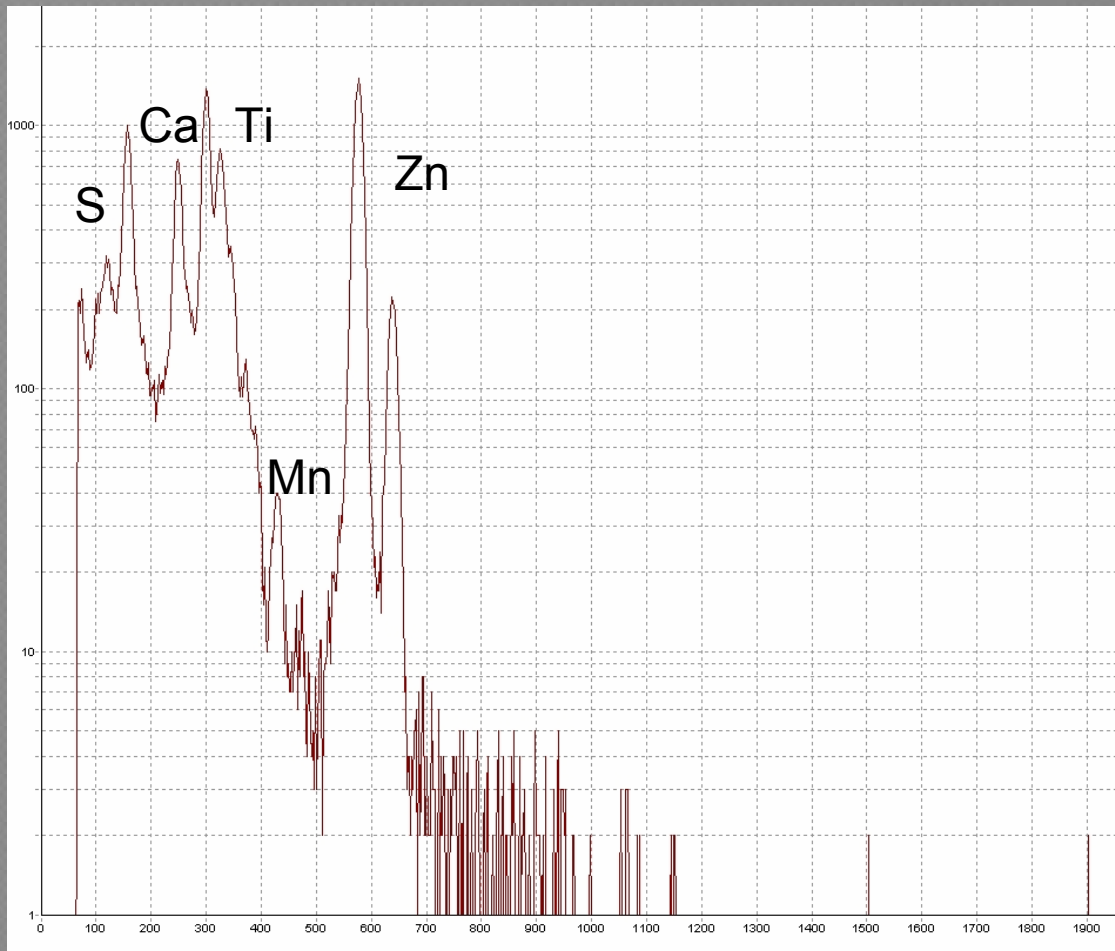
Analyzing the data



Petoskey Stone



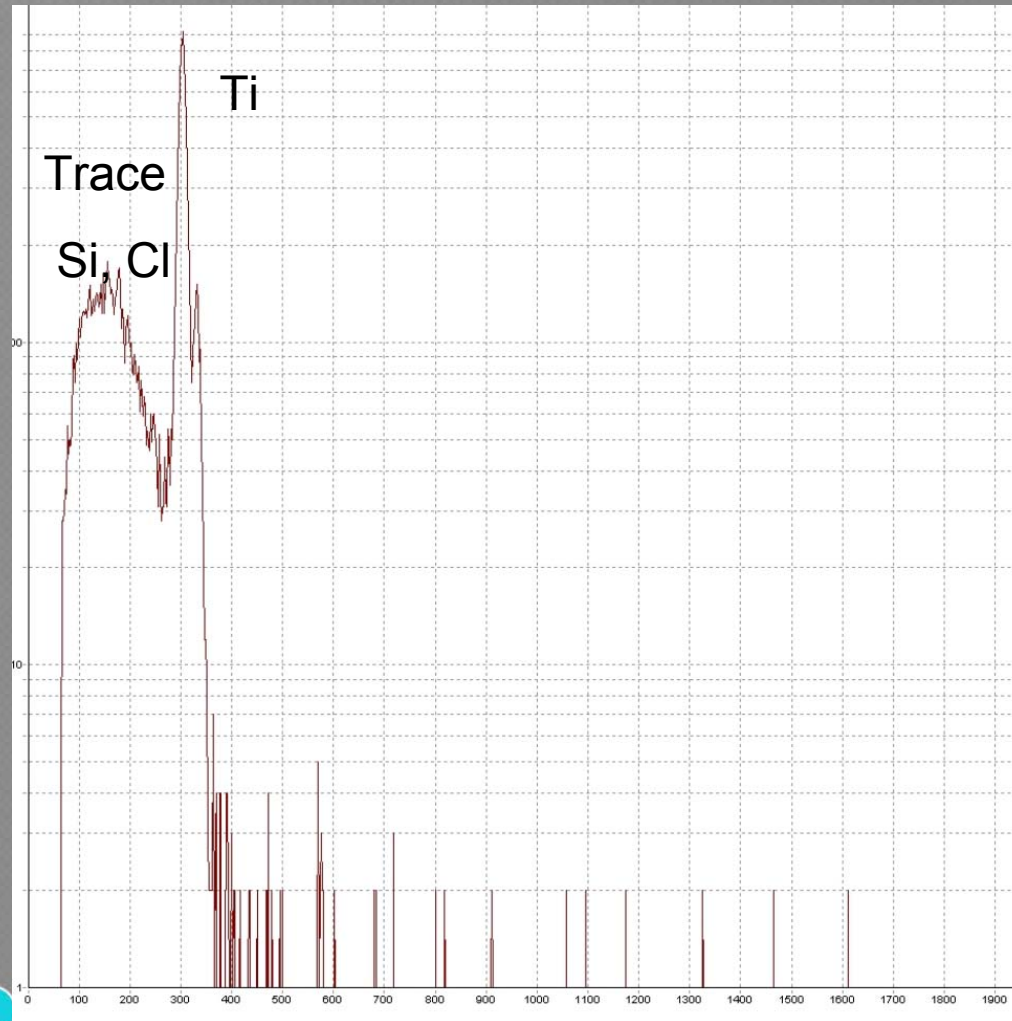
Golf Ball



The inside of a
golf ball.

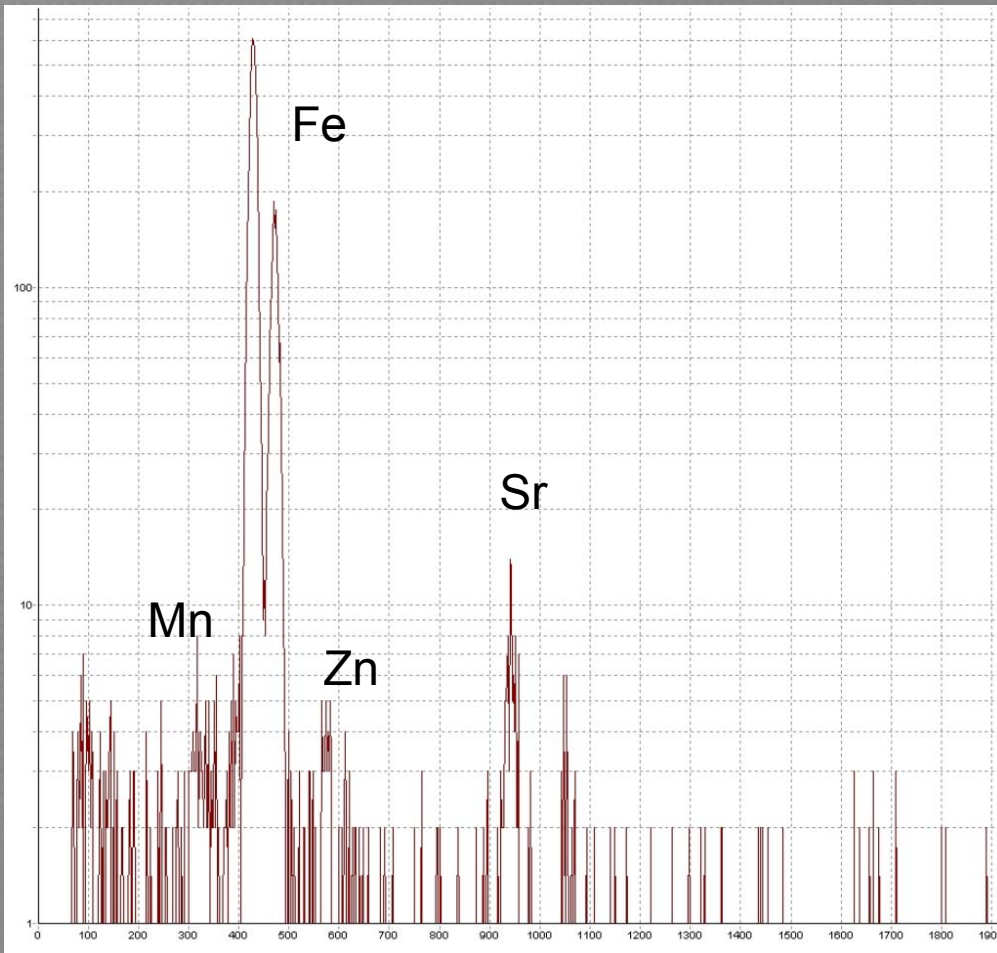


Golf Ball



The outside of
a golf ball.

Igneous Rock



Found on a glacier in Alaska.



Conclusion



- Both XRF and PIXE use X-rays to measure energy.
- The different methods allow one to see different elements present in samples.
- A good time was had by all!



Special Thanks

- Shawn & Graham



Special Thanks

- Ed Stech

