

Science Made Possible

Subatomic Particles Get Philosophical

PIXE helps researchers decipher ancient scrolls

Researchers are putting a new twist on an elemental analysis capability, using proton-induced X-ray emission (PIXE) to help decipher text on ancient scrolls. The scrolls, believed to be written in Greek and contain Epicurean philosophy, were part of the library of Julius Caesar's father-in-law in the city of Herculaneum. Carbonized as a result of the Mt. Vesuvius eruption in 79 AD, they were recovered 250 years ago. The scrolls reside at the Sorbonne in Paris, France, and paid a visit to EMSL for analysis along with physician and EMSL user Ed Iuliano, Director of MRI and Radiology at Kadlec Medical Center in Richland, Washington, as well as one of his University of Kentucky collaborators, computer science graduate student Matt Field.

PIXE analysis is the first step in a new, nondestructive method under development to read papyrus scrolls. Previous attempts to read similar scrolls involved unrolling them; however, this approach can be very damaging. Newer methods use X-ray and computer tomography (CT) scans, but these techniques have limitations; for example, they only work for scrolls inscribed with metal-containing inks. The Herculaneum scrolls use carbon-based ink, adding difficulty in distinguishing inscriptions from the papyrus.

Using PIXE, a proton beam is directed at a sample surface, and the sample in turn emits X-rays. The energy of the subsequent X-rays relates to the elemental composition of the sample. Armed with elemental knowledge, scientists may be able to identify a volumetric imaging technique to detect the distinct chemical signature of the ink on the papyrus in the many layers of the Herculaneum scrolls. An integrated approach will then combine the imaging data with computational tools to virtually unroll the scrolls and read the Greek text.

Scientific impact: Broadening applications for PIXE, which at EMSL is traditionally used for analysis of biological and environmental samples, opens the door to novel, previously unexplored research directions, enabling forward motion and new discoveries in several areas of environmental molecular sciences.

Societal impact: Deciphering ancient texts holds immeasurable cultural value. The new, nondestructive technique under development has the potential to be broadly applicable and will lead to new discoveries in many different areas of environmental molecular sciences.

For more information, contact EMSL Communications Manager Mary Ann Showalter (509-371-6017).

Acknowledgments: This work is supported by the EDUCE (Enhanced Digital Unwrapping for Conservation and Exploration) project, which is funded by the National Science Foundation and led by Brent Seales at the University of Kentucky.



Herculaneum scrolls hide messages inside many layers of carbonized papyrus. Photo credit: Stephen Bailey, University of Kentucky.