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## **The daguerreotype and the X-ray: A deep look**

### **Argonne, Smithsonian collaboration looks for breakthrough science in earliest photos**

By Ted Gregory, Chicago Tribune reporter

July 15, 2013

Scientists guess that the faded photograph of the young woman was taken in the 1840s. But that is conjecture, and, like everything else about her, the date of the photo is a mystery. They don't know her name, where the image was made or who photographed her.

And yet the woman — her flat expression representative of so many of the earliest photographs known as daguerreotypes — likely will play a crucial role in future scientific breakthroughs. Last week, hers was the first daguerreotype to undergo powerful X-ray analysis in a collaboration between the Smithsonian Institution and Argonne National Laboratory, near Lemont.

The project is the most recent example of an emerging effort that uses cutting-edge science to investigate and preserve cultural history while perhaps illuminating a path toward new scientific applications.

"Cultural heritage, even by itself, is important," said Argonne physicist Volker Rose, who is coordinating the project at the national lab's Advanced Photon Source. "It's something that we have to preserve for our children and the generations that will follow."

The collaborators hope that analysis of the portrait and other daguerreotypes from the Smithsonian will help them understand the images' deterioration and lead to ways to preserve the photographs.

But the analysis also has prospects for future applications that intrigue Rose. Examining about 175 years worth of natural corrosion on the silver-plated copper images may help reveal solutions to an array of issues — from dealing with the significant problem of corrosion on pipelines to making more effective microelectronics, Rose said.

Named for the French artist Louis-Jacques Mande Daguerre, who invented the process in the 1830s, daguerreotypes were created by exposing silver-plated copper slides to natural light in a camera for several minutes before fuming the plate with mercury vapor to develop the image on the plate. The "mirrors with memories" were widely used — the first photograph of Abraham Lincoln is a daguerreotype — and remain the earliest authentic record of how the world looked in the 1830s, '40s and '50s, before other techniques replaced daguerreotypes.

While they were used extensively during the middle 1800s, especially for portraits, it is unclear how many daguerreotypes remain. The Smithsonian's 19 museums and galleries have fewer than 2,000, said Edward Vicenzi, a research scientist at the Smithsonian Institution's Museum Conservation Institute who is collaborating with Argonne's Rose.

The deterioration of those daguerreotypes is minimal, Vicenzi said. But understanding deterioration at the molecular level as a way of preventing it is only one objective of the project. Another is to understand the 19th century better, he added.

"Unraveling the technology from whenever this technology was formed is a story about humans experimenting and manufacturing things," Vicenzi said. "We're interested in ourselves and these are ways to provide human knowledge through the study of objects."

The collaboration was conceived in May 2012 at a New York City conference, Synchrotron Radiation in Art and Archaeology. Rose gave a presentation about Argonne's work in determining that Pablo Picasso was the first artist to use common house paint in his work, a heated issue that had vexed the art world for decades.

Vicenzi attended the discussion, then afterward chatted about his daguerreotypes with Rose.

"His eyes got larger and larger as I told him that the scale of what I was interested in doing was very tiny," Vicenzi said. At Rose's insistence, he and Vicenzi submitted a plan to Argonne in March.

The primary value of Argonne's Advanced Photon Source, the hemisphere's brightest X-ray, is that it can produce beams that allow scientists to see particles at the molecular level. Traditionally, the Advanced Photon Source helps unlock new knowledge about the structure and function of materials and has led to developments in combustion engines, microcircuits, pharmaceuticals and nanotechnology.

But in recent years it also has been used for cultural heritage work. The 2010 X-ray analysis of Picasso's work — which brought together the Art Institute of Chicago, Northwestern University and Argonne — was one of the latest examples of that strengthening bond between cutting-edge science and cultural heritage.

Another, more formal step came in January, when Northwestern and the Art Institute established the Center for Scientific Studies in the Arts. The partnership, funded by \$2.5 million from the Andrew W. Mellon Foundation, serves as a one-of-a-kind "collaborative hub" through which researchers can submit and work on study projects, the Center's website reports.

Argonne had played a critical role in the less formal science-cultural heritage collaborations that began in 2004 between Northwestern and the Art Institute, said Katherine Faber, a Northwestern professor of materials science and engineering who helped create the center. In addition to the work on Picasso's paint, Argonne helped with studies of ancient Chinese bronzes, Faber said.

"The link to Argonne has been extremely important," Faber said in an email, "given that the facilities at the Advanced Photon Source are not available in a university laboratory."

Rose said he is already discussing future projects for the facility and Northwestern. For the next few weeks, though, he and Vicenzi will focus on the Smithsonian daguerreotypes.

After analyzing the photos this month, they will come up with preliminary findings by August, then write a peer-reviewed journal article next year, Rose said. He is optimistic that this cultural heritage work will offer at least some insight into materials and nanoscience.

"As a scientist, I of course spend a lot of long days and nights in the lab," Rose said. "It can be very difficult sometimes to spend so many hours trying to get a result, but if you get it, it's fun to tell people. If I can contribute in that sense, particularly to the cultural heritage community, that's a big blessing to have."

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