

Probing the past with X-rays

Innovative 21st century technology recently transported two brothers back to the 16th century in a quest for truth.

At issue was the authenticity of two astrolabes, astronomical instruments that predate the invention of the telescope. Both—one owned by the Adler Planetarium, one by Harvard University—were allegedly finished and dated by the same worker on the same date, an unlikely coincidence given the time and care Renaissance craftsmen required to handcraft an astrolabe.

Argonne's 21st century tool, the Advanced Photon Source (APS), produces the nation's most brilliant X-rays for materials, biological and environmental research. The APS can reveal a material's composition, crystal structure and thickness without damaging the material itself.

"Museum curators need to know which astrolabes are genuine, so they aren't deceived by reproductions," says Bruce Stephenson of Chicago's Adler Planetarium.

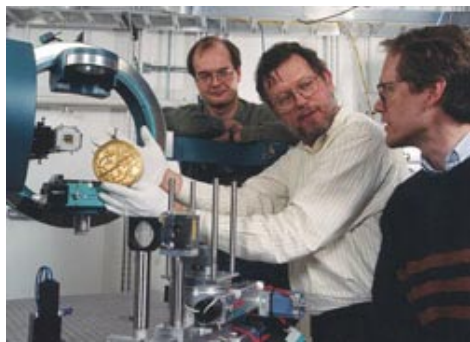
Stephenson's brother Brian works in Argonne's Materials Science Division and suggested they use the laboratory's APS to solve the mystery scientifically.

The APS's brilliant X-rays would reveal each astrolabe's material composition, crystal structure and thickness profile. The process would not damage the astrolabes, but would allow researchers to determine which was genuine. The Stephenson brothers were joined by Dean Haeffner of the APS. "In this experiment, we were able to merge history with our knowledge of materials science," Haeffner explains.

X-ray fluorescence revealed the Adler astrolabe to be made of a copper-zinc alloy; it is "old brass." The Harvard astrolabe, however, has no zinc and is gold-plated copper rather than brass.

The researchers concluded that the composition and microstructure of the Adler astrolabe is consistent with the metallurgical technology of 1597, the date inscribed on the astrolabe, suggesting that it is the real McCoy—um, make that the real Bos.

Submitted by DOE's Argonne National Laboratory



Dean Haffner (left), Bruce Stephenson and Brian Stephenson discuss their experiments.

SANDIA BRINGS ELECTRICITY TO AREAS OF NAVAJO RESERVATION

DOE's Sandia National Laboratories is providing technical support for a new solar power initiative of the Navajo Tribal Utility Authority (NTUA) to bring electricity to the homes of people living in remote areas of the vast reservation.

In a program that is the largest of its type in the country, the NTUA is providing 200 photovoltaic systems for \$2 million and installing individual units at private residences to furnish electrical power. Sandia engineers ensure the units are properly installed and working as intended.

Each system serves a single home. All 200 systems are to be installed by the end of summer.

Photovoltaics technology converts energy from the sun into electricity, which is stored in batteries for future use in the home.

Jimmie Daniels, NTUA solar program manager, says the utility decided to offer this alternative power source to its customers because the cost of stringing wire over parts of the reservation's rural terrain is prohibitive.

"The only way for many of these people to have electricity is to provide each household its own photovoltaic unit," he says.

Between 10,000 and 30,000 Navajos are estimated to live without electricity throughout the reservation that covers parts of New Mexico, Arizona, and Utah. The systems give some of these people their first opportunity to live in an illuminated world—having access to electric light so children can do homework at night, and to radio, television, and computers to help reduce rural isolation.

The systems have about 600 watts of photovoltaic collectors, which will be able to convert about 3 kilowatt hours per day, on average, in the winter.

That's enough electricity to power a single household for a day, if the family members are conservative in their use of electricity.

Submitted by DOE's Sandia National Laboratories



Navaho families use photovoltaic cells like these to power their homes.