

X-ray specs for world's oldest letters

Researchers used to smash open clay envelopes encasing ancient texts but looks like those days are now history, says **Katherine Kornei**

Out with the hammer, in with X-rays — researchers have traded brute force for technological finesse when it comes to reading ancient letters.

Cuneiform is the world's oldest written script, and its characteristically wedge-shaped impressions have been found on clay artefacts unearthed in countries such as Iraq, Syria and Turkey. More than 5,000,000 cuneiform artefacts have been discovered but many of them remain unstudied for a very simple reason — they're tightly wrapped in one or more layers of clay, the Mesopotamian version of an envelope.

Researchers used to smash the envelopes open but a team has now developed a portable X-ray scanner that can digitally peel away the layers to reveal the writing inside. The researchers have taken their scanner to several museums, and the 4,000-year-old letters they have analysed have shed light on both trading practices and the role of women in Anatolian society. The results were recently published in the journal *npj Heritage Science*.

Artefacts bearing cuneiform script

tend to be small, rectangular clay tablets roughly the size of a smartphone. Made by pressing a stylus — often reed or wood — into damp clay, these tablets were used to record contracts, legal and administrative matters and personal correspondence. And while the envelopes containing legal and administrative documents are often inscribed with summaries of their contents, a sealed letter is a more private matter.

"You have only the name of the sender and the name of the recipient," said Cécile Michel, who studies ancient Mesopotamia at the National Centre for Scientific Research in France and the University of Hamburg in Germany. "I would love to see what is inside."

To build the device, Michel teamed up with Christian Schroer, an X-ray physicist at the Centre for X-ray and Nano Science at the Deutsches Elektronen-Synchrotron

in Germany. X-ray computed tomography involves firing X-rays at an object and measuring how they're absorbed. By repeating that process from many different angles, it's possible to reconstruct an object's three-dimensional interior structure.

The team spent four years designing and building a portable X-ray scanner. The device can capture more than 1,400 images of an object in under 15 minutes, after which a program creates a three-dimensional view. The technology is good enough to resolve the cuneiform script, differentiate between the handwriting styles and even pinpoint how many layers of clay went into forming each envelope.

The scanner can be disassembled into eight portable pieces, so it can travel from site to site and give more institutions access to the technology, Michel said. It's rare for a

museum to be willing to ship off its tablets for analysis elsewhere. "We have to bring the technology to the objects," Michel said.

Philip Jones, a collections manager at the University of Pennsylvania Museum of Archaeology and Anthropology, US, can attest to the care that cuneiform tablets receive. He was once asked to personally deliver a set of tablets to a different museum, and flew first class.

Michel, Schroer and their colleagues have brought their scanner to museums in France, Germany and Turkey and have analysed more than 100 sealed tablets. The newly revealed texts record "hints about daily life and the relationships between men and women 4,000 years ago", Michel said. They include details, for instance, about a merchant receiving a shipment of textiles and a woman attempting to settle a debt on her absent husband's behalf.

It's exciting to think about getting to analyse more of these objects. Jones said, "The fact that they're coming up with something that you can actually take out to museums is a real breakthrough."

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