

Scientists prove gold purifying process used in medieval West Africa works

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Clay thumbprint molds were used to cast replica blank coins in bronze. Credit: Northwestern University

Humble fragments of clay crucibles and coin molds flecked with gold excavated by a joint team of British and Malian archaeologists in 2005 led archaeologist Sam Nixon, in consultation with Thilo Rehren, a specialist on ancient materials and technologies, to theorize how West Africans used them to purify gold and cast unmarked coins during the

10th and 11th centuries in Tadmekka, Mali. The theory was supported by writings from that time—largely thought in recent times to be exaggerated—that praised Tadmekka's pure gold "blank dinar" [coins].

Now a team of Northwestern University materials scientists have experimentally replicated the medieval gold purification method [outlined by Nixon and Rehren in a 2014 paper](#) using the same material resources and found the process works incredibly well. The unusual method involves heating a mixture of gold, sand and glass to high temperatures and separating out the gold.

"We proved this innovative process of purifying gold works," said Marc Walton, who led the analytical team. "These medieval Africans, at a confluence of trade routes in the Sahara, were sophisticated in their use of available materials. Their technique of percolating raw materials through molten glass had not been seen before. It is unique to the archaeological record."

The team used sand from nearby Lake Michigan, gold dust and recycled glass to conduct a reduced version of the original process. The gold dust was melted and filtered through crushed glass to purify it. Copies of the original clay thumbprint molds were then used to cast replica blank coins in bronze instead of gold, due to gold's high cost.

Walton is co-director of the Center for Scientific Studies in the Arts, a collaboration between Northwestern and the Art Institute of Chicago. He and former postdoctoral fellow Gianluca Pastorelli conducted the replication experiments after Kathleen Bickford Berzock, the curator of the "Caravans of Gold" exhibition and associate director of curatorial affairs at Northwestern's Block Museum of Art, put them in touch with Nixon about the excavation.

"It's exciting to connect esteemed colleagues across fields and

particularly gratifying to learn that this unique casting process is indeed possible," Berzock said. "Experiments like these allow us to envision life in medieval Saharan Africa with new detail and depth."

Two of the molds used to produce gold coins in Tadmekka and three replica coins made of wax are included in Berzock's groundbreaking exhibition, "[Caravans of Gold, Fragments in Time: Art, Culture and Exchange Across Medieval Saharan Africa](#)," currently at The Block Museum through July 21. The show on the movement of things, people and ideas across the Sahara Desert in the medieval period aims to change public perception of Africa's role in the global economy in the 8th to 16th centuries.

"Archaeologists are bound by what they find," said Walton, a research professor of materials science and engineering at Northwestern's McCormick School of Engineering. "These fragments speak loudly about ancient civilizations and human history. Now we have proved the process used to refine gold in Tadmekka is real."

Walton, Pastorelli and Nixon, curator of Africa in the department of Africa, Oceania and the Americas at the British Museum, are authors of a chapter in the exhibition catalog about the preliminary results from the [gold](#) processing replication.

Provided by Northwestern University

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