

# A Copper Conundrum

Nearly ten thousand years ago, Native Americans became some of the world's first people to craft tools from copper. New research is offering insight into when this so-called Old Copper Culture flourished, and why these people mysteriously abandoned most copper tools.

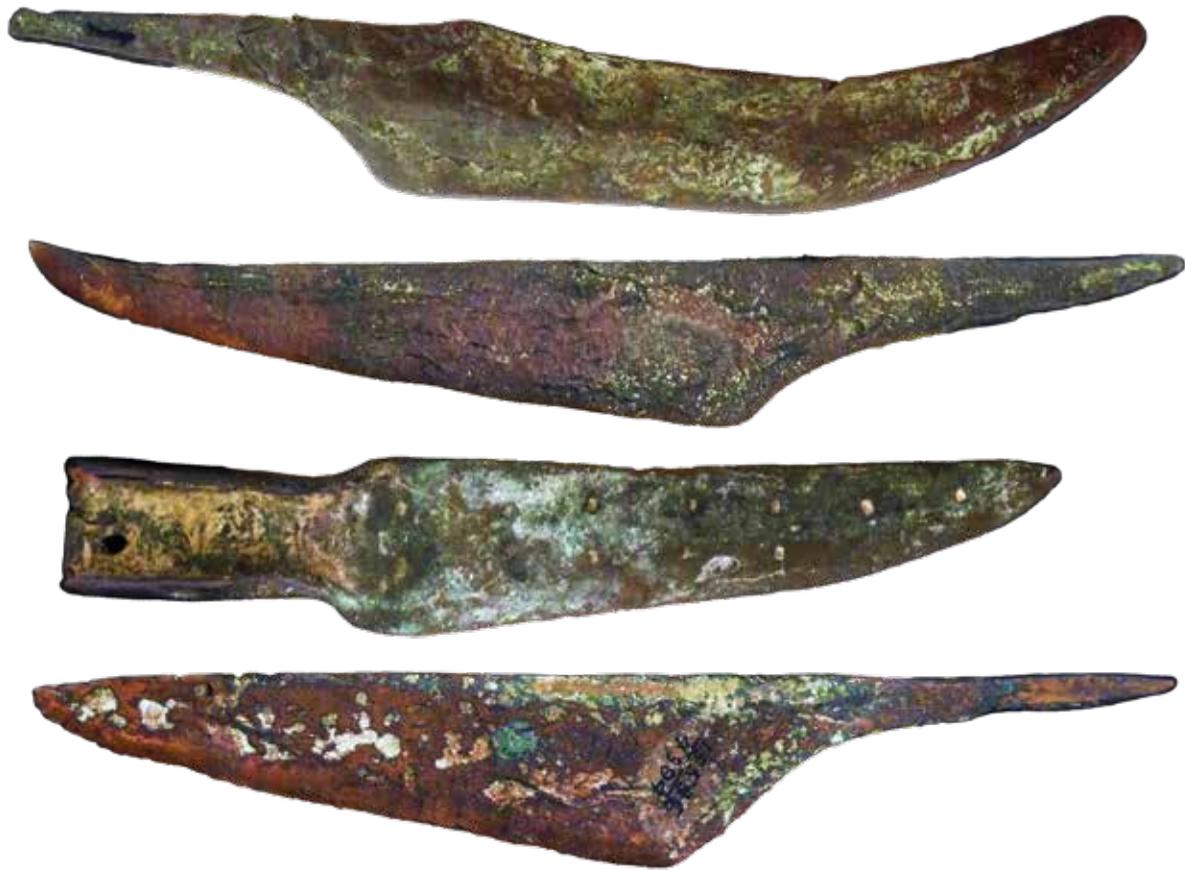
*By David Malakoff*

In the late 1990s, William Reardon, a U.S. Forest Service employee with a keen interest in archaeology, was using a metal detector to scout for artifacts on the shores of Eagle Lake in northern Wisconsin when it sounded an alert. Digging into the dirt, he found the reason: a sharp, conical copper spear point nearly four inches long. Close examination revealed that a chunk of the point's wooden shaft was still attached; researchers later found it had been carved from maple.

The find wasn't a big surprise to archaeologists. Copper artifacts are relatively common in the region. Scholars know that many were made by Native Americans who were part of the prehistoric Old Copper Culture that once stretched across the Great Lakes region. During the Archaic period these hunter-gatherers became some of the world's first copper miners and metal workers. They learned to identify copper nuggets that had eroded from the bedrock and to extract ore from the region's abundant deposits—the largest and purest copper lodes on Earth. And they pioneered

Archaeologist Michelle Bebber made these copper projectile points that are similar to those produced by the Old Copper Culture. She did this to compare their effectiveness against the white stone points that she also made.





MICHELLE RAE BEBBER / COURTESY MILWAUKEE PUBLIC MUSEUM

***These Old Copper Culture knives were surface-collected by various people over the past 150 years. Most Old Copper Culture artifacts have been recovered this way.***

techniques for shaping the copper into a vast array of tools, including projectile points, knives, axes, awls, and fishing hooks. Still, in 2014 some researchers were surprised to learn just how old the Eagle Lake point is: radiocarbon dating of the maple shaft indicated that the weapon was made about 8,500 years ago.

Now, new research that reexamined every radiocarbon date associated with an Old Copper Culture artifact has concluded that the Eagle Lake point is the oldest reliably-dated copper artifact ever found in North America, making it one of the world's oldest documented copper tools. And Rardon's find is just one piece of evidence that is prompting archaeologists to reassess their views of the Old Copper Culture. Some recent studies suggest that the heyday of Archaic copper working both began and ended much earlier than once believed. And other research is offering fresh perspectives on a longstanding mystery: why did these prehistoric metal workers, after making finely crafted copper tools for thousands of years, abandon the practice and return to seemingly inferior stone and bone implements, relegating their copper production primarily to decorative and ceremonial objects?

That shift "is kind of puzzling, because when humans learn to do something, they usually keep doing it," said David Pompeani, a geologist at Kansas State University who conducted the review of Old Copper radiocarbon dates and has

been studying Archaic copper mines around the Great Lakes. "And this wasn't a casual thing; the Old Copper Culture was one of the world's earliest economically-important metal-working industries. There were lots of mines, miners, and highly-skilled craftspeople."

"It is perplexing... It's not as if these people just experimented with making copper implements for a century or two and then gave up," said Michelle Bebber, an archaeologist at Kent State University who has been making and testing copper tools in an effort to better understand why the Old Copper Culture faded. "They were crafting lots of large, beautiful, and elaborate copper tools for many millennia. Then, for the most part, they stopped. Why?"

**I**n the 1800s, when explorers and settlers reported finding numerous copper artifacts and mining pits in the Great Lakes region that appeared to be very old, many scholars were dismissive. Some argued that Native Americans were too backward to have developed copper-working technologies, and they even suggested that the artifacts had actually been imported from Europe or made by some unknown group of migrants. Eventually, most researchers accepted that Native Americans had made the artifacts. Some researchers even began trying to replicate them, conducting experiments that demonstrated that a few basic techniques—heating, hammering, folding, and grinding—could be used to mine ore



**These Old Copper Culture points have a tang with a socket that was designed to fit over a spear shaft. These points were used for hunting game like white tailed deer.**

and craft objects. (There is no evidence Old Copper people used smelting and casting, which involves melting ore and using molds.) In 1894, the pioneering anthropologist Frank Hamilton Cushing concluded that he could replicate any known copper artifact using just “primitive” techniques.

Still, the ages of Old Copper artifacts was uncertain, and it took the invention of radiocarbon dating to clarify matters. In 1954, chemist Willard Libby, who invented the technique, used it to date charcoal associated with copper artifacts found in human burials at the Oconto site in Wisconsin. Those studies indicated the burials were 8,400 to 6,400 years old, and they were corroborated by subsequent research. But at that time many researchers were skeptical of Libby’s conclusions, and the conventional wisdom held that the Old copper Culture existed from about 6,000 to 3,000 years ago.

This puzzled scholars because, as a rule, ancient cultures that had learned to make metal tools didn’t abandon the technology. Instead, metal tools tended to displace those made of bone, stone, or other materials, because they were sharper, more durable, or more lethal. But that hadn’t happened around the Great Lakes. In 1962, the influential archaeologist Lewis Binford highlighted the conundrum in *American Antiquity*. “It is a common generalization that within the realm of technology more efficient forms tend to replace less efficient forms,” he wrote. But “the Old Copper case seems to be an exception.”

Binford is one of many scholars who have offered explanations for that exception. Generally speaking, those explanations go something like this: During the middle and

late Archaic, a beneficial climate and ample fish and game enabled hunter-gatherers to flourish around the Great Lakes. As social groups grew larger, they became less egalitarian, more complex, and more stratified. People developed various ways of signaling their social role or rank, including by possessing and displaying certain items. Copper became an elite status symbol, likely because of its beguiling shine, and perhaps because the metal required more effort to find and process than stone, bone, and wood. So, over time, copper became more valued for adornment, ritual use, or trade than for making tools. That is why, in the late Archaic archaeological record, most copper tools disappeared while there was an increase in copper beads, jewelry, and ceremonial objects that were often found in human burials.

When Bebber first encountered that explanation years ago, she found it “pretty convincing, and there was evidence to support it,” she recalled. But one issue piqued her curiosity. Scholars generally assumed metal tools were functionally superior to the alternatives. But what if Archaic copper tools actually were not better? Could that be one reason they faded away? “I realized, wow, nobody had rigorously tested this idea,” she said, even though Binford and others had suggested such tests. In 2017, Bebber set out to do just that, designing experiments that would compare the performance of copper, stone, and bone tools.

It was no simple task. Bebber had never made copper objects, and she had no ore to work with. After a search, however, she secured raw nuggets from the Adventure Mining Company in Michigan, which uses a historic mine as an educational site. And she got tool-making guidance from

**Michelle Bebber made this historically-accurate replica of a copper knife hafted into an antler handle.**

MICHELLE RAE BEBBER



a number of sources, including metallurgy enthusiasts. “I wasn’t intimidated by the idea of forging copper,” Bebber said, because she had an art background that included making sculptures. Still, there was plenty of trial and error as she heated the ore with a gas flame and worked it on an anvil. “The first little triangular point I hammered out came out really well,” she recalled. “I was thinking: ‘This is going to be easier than I thought!’” But then came “many, many failed pieces.” She and her colleagues learned that the wrong combination of hammering and heating can cause copper to become brittle, and that some ore contains impurities that cause a tool to crumble. “Sometimes you don’t know how a piece is going to turn out until you’ve already spent a lot of time working on it,” she said. “You get a real appreciation for the difficulties [Archaic] people faced.”

Ultimately, Bebber crafted enough Old Copper-style points, knives, and awls to conduct her experiments, which became the centerpiece of her 2019 doctoral dissertation. In one test, she and her colleagues used a mechanized bow to repeatedly fire ten copper-tipped projectiles and ten stone-tipped projectiles—all of the same design—into blocks of moist clay (a substitute for animal flesh), measuring how deep they penetrated. They also cut plastic tubes (a proxy for meat) with thirty copper and thirty stone knives, observing how quickly they dulled. A third experiment pit five copper awls against five bone awls in a competition that involved punching holes in leather.

The results were not what some might have expected. The copper points, for example, showed no appreciable advantage over stone points. The copper points were thinner than the stone, making it easier for them to slice into their targets. But that advantage was minimal because the copper points were also heavier, so they hit their targets at slower speeds, which diminished penetration. And the metal

knives weren’t superior to their stone counterparts. New stone knives were actually sharper, though after repeated use the two materials were equally sharp. (The unusual purity of North American copper might be one reason, Bebber noted; the ore is often more than ninety percent pure, producing a relatively soft metal, whereas copper ore elsewhere is often laced with other metals, producing a harder alloy.) The metal awls, meanwhile, showed a distinct advantage over the bone equivalents, requiring less force to punch a hole.

These conclusions, which were published in peer-reviewed journals in 2018 and ’19, add another facet to the explanations of Old Copper’s fade, Bebber believes. Copper points and knives “don’t appear to have had a real functional advantage,” she said, and they were likely “inferior” to stone versions once the time and effort required to produce them is factored in. Copper awls were a different story. Their functional superiority likely explains why archaeologists have found that Native Americans continued to use them long after the end of the Old Copper Culture. “It’s easier to see why awls would persist,” she said; they not only worked better, but making them also required relatively little copper.

Bebber’s work “offers an interesting way of thinking about the various mechanisms—social [and] technological—that might have been in play in the decline of the Old Copper Culture,” said archaeologist Mark Seaman, an emeritus professor at Kent State who has studied copper use by Native American cultures after the Archaic. But he, Bebber, and others said it leaves plenty of questions. Why, for example, were some relatively large copper axes and adzes—which required ample ore—produced after the Archaic? Is it because they were more functional than their stone alternatives, or because possessing one was a status symbol, or some combination of both? A related question is just how many Old Copper tools were actually used in daily



activities, said Kathy Ehrhardt of the Illinois State Museum, an archaeometallurgist who has extensively studied ancient copper technologies. “Their form might be utilitarian, but their function in life may not have been entirely utilitarian,” she said. Such questions, Seeman said, support the idea that Old Copper’s fade “was the result of a fairly complex set of factors, playing out over a long time and a large area.”

Other recent research by Pompeani is highlighting another possible factor in Old Copper’s decline—a regional climate shift during the Archaic—and remaking the culture’s timeline. Nearly a decade ago, while a graduate student in geology, Pompeani realized that emerging techniques for measuring the pollution left behind by ancient mining operations might reveal new information about the thousands of copper mining pits that Native Americans dug around the Great Lakes. Some of these prehistoric mines are up to sixty feet deep, and they once held the remains of ladders, scaffolding, and thousands of heavy rocks known as hammer stones that Old Copper workers had hauled to the sites from miles away and used to break up ore. The techniques that Pompeani was eyeing involved measuring metallic elements—including lead—that are released by ore processing and then wash into nearby lakes, where they become locked into bottom sediments that can



DAVID POMPEANI

David Pompeani (center) holds a sediment core that was taken on Michigan’s Isle Royale, a copper mining area, in 2017.

## Other Prehistoric Copper Production

**T**he Old Copper Culture wasn't the only Native American group to master copper working. Thousands of years after it faded, the metal also came to play a prominent role in the Hopewell culture, which flourished in Eastern North America 2,000 to 1,500 years ago, and in the Mississippian communities of the Southeast some 1,200 to 400 years ago. And while Old Copper crafters are known for their utilitarian tools, Hopewell and Mississippian artisans used copper to create "visually striking and technologically complex" ceremonial objects, said archaeometallurgist Kathy Ehrhardt of the Illinois State Museum.

Copper was "by far the most important metal" for many Hopewell communities, said archaeologist Mark Seeman of Kent State University. Hopewell sites have yielded numerous copper artifacts, including costume elements, coverings for musical instruments such as panpipes, embossed animal cutouts, and earspools that men and women wore in their earlobes. Hefty copper axe heads, known as celts, that were wrapped in textiles or leather, have been found in burials. "They aren't using the celts to cut wood, these are symbolic objects materializing relationships among people, communities, and links to their creator," said Seeman. Archaeologists are reconstructing where Hopewell people got their copper, which carries a distinctive chemical signature that allows them to trace the metal to its source. In a 2019 study of fifty-two copper artifacts from six Hopewell sites in Ohio's Scioto Valley, Seeman and his colleagues concluded that, not surprisingly, most of the copper came from the huge deposits around the Great Lakes. But, for the first time, they showed that about one-fifth of the finished objects were made from copper from the southern Appalachian Mountains. That confirms Hopewell trade networks "stretched far and wide," Seeman said.



*An artisan fashioned a copper plate into a raptor nearly 2,000 years ago.*



*A copper plate designed in scroll depicts a stylized raptor. It's also nearly 2,000 years old.*

NPS PHOTO / TOM ENGBERG

During the Mississippian period, copper working "reached an expressive high point," Ehrhardt wrote in 2009. Researchers have uncovered elaborate copper artifacts, which were often found in elite mortuary contexts and ritual spaces at many major Mississippian sites. But Cahokia's lack of major copper artifacts has posed a puzzle. However, excavations that began in 2007 confirmed that a copper workshop, first found in the 1950s, existed at Cahokia's Mound 34 some 800 years ago. It's the best documented Mississippian copper workshop. Archaeologist John Kelly of Washington University, who helped lead the digs, said that bits of copper sheeting found in the workshop suggest "it at least helped prepare the copper." But he suspects the sheets were handed off to other artisans, who may have been located elsewhere, "who were the specialists responsible for crafting items of great cultural significance." —David Malakoff



**This copper antler headdress on a mannequin with copper pendant and jewelry (top) and copper object (bottom) were recovered from Mound 25 of the Hopewell Mound Group in southern Ohio.**

be dated using radiocarbon and other methods.

One of Pompeani's projects analyzed sediments from five lakes on the Keweenaw Peninsula, the northernmost part of Michigan's Upper Peninsula, which was a hotspot for prehistoric copper mining. They held trace metal levels which indicated that mining began near some lakes as early as 9,500 years ago, and ended about 5,000 years ago. He found a similar pattern in a study of sediments collected near Minong Ridge on Michigan's Isle Royale, another prehistoric mining center located north of the Upper Peninsula. There, miners appear to have started work around 6,500 years ago and then stopped about 5,400 years ago.

Curious about how his sediment data lined up with timelines developed from other evidence, Pompeani compiled a list of every available radiocarbon date from Old Copper sites and artifacts. He then assessed and recalibrated the dates using the most recent methods. The list consisted of more than fifty dates, including the one from Reardon's Eagle Lake spear point, which Pompeani concluded is the oldest accurately dated copper artifact from North America. Taken together, the most reliable dates from the two data sets also indicate that, around the Great Lakes, the Old Copper Culture began and ended several thousand years earlier than once believed.

In addition, Pompeani believes it is no coincidence that Old Copper's decline appears to roughly coincide with a millennia-long dry period in the region that began about 5,400 years ago. Paleoclimate studies from Minnesota indicate "lakes are drying up, and you can imagine how that could create some stress," he said. Communities might have decided that mining copper was a waste of time when they needed people to gather food or defend their territory, for example. Such upheaval also could have disrupted the trade in copper ore, making it difficult to acquire raw material.

Bebber, too, sees climate stress as possibly creating a tipping point for an Old Copper Culture that was already experiencing cultural change caused by population growth and social stratification. "The social, environmental, and technological factors are likely intertwined," she said. And while some scholars have found it odd that North America's ancient copper masters never went on to develop even more sophisticated metal tools, Bebber believes that, viewed from an evolutionary perspective, it likely made sense for Old Copper people dealing with an array of pressures to have discarded copper tools that didn't deliver an obvious practical benefit and were more labor-intensive to make. "Essentially... the copper tools that performed poorly went extinct; while the copper tool that performed well, the humble awl, persisted into modern times," she wrote in a recent paper published in the *Journal of Archaeological Method and Theory*. And that should be not be viewed as some kind of technological failure, she said, but as a notable example of people doing the best they could to adapt to changing circumstances.

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