

CULTURAL HERITAGE

In 1928, archaeologists unearthed a vast collection of bronze artifacts dating back about 3,300 years at the Yinxu Ruins in Anyang, Henan province, including a massive bronze vessel weighing 832.84 kilograms. The discovery raised a fundamental question: Who produced such a large quantity of bronze, and where did the copper originate? Despite decades of research, no definitive answers emerged, prompting some scholars to speculate that China's bronze culture may have had foreign origins.

A breakthrough finally came in 1973. At a mining site in Daye, Hubei province, archaeologists discovered copper axes, the largest weighing 16.3 kg, revealing an ancient mine that had been buried for more than 2,000 years. The site is now known as the Tonglushan Ancient Copper Mine.

Years of archaeological investigation suggest that mining at the Tonglushan site was most active from the Shang Dynasty (c. 16th century-11th century BC) to the Western Han Dynasty (206 BC-AD 24), spanning over 1,000 years. "This discovery finally provided the long-sought answer to the source of raw materials for bronze artifacts, rewriting the history of China's ancient bronze civilization," says Wu Hongtang, a veteran archaeologist who participated in the site's first excavations in the 1970s.

According to Wu, Tonglushan is an ancient mining and smelting complex distinguished by its long period of operation, large scale, complete production chain, advanced technology, and exceptional state of preservation.

To date, archaeologists have identified more than 100 mining and smelting sites and over 250 ancient tombs, along with a wealth of mining tools and traces of daily life.

Wu notes that among the many ancient copper mining sites discovered in China, Tonglushan is the only one where miners' tombs have been found.

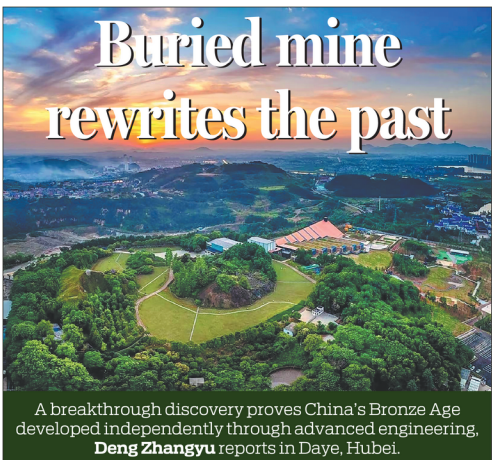
Fewer than 300 artifacts have been unearthed from these tombs. Among them are two high-status burials, believed to belong to a mining engineer and a site supervisor, containing valuable objects such as copper knives, jade artifacts, and small bronze cauldrons.

The limited number of unearthed artifacts suggests that the living conditions for ordinary miners at the time were extremely harsh. The differences among the tombs also reflect the class distinctions of that era," Wu explains.

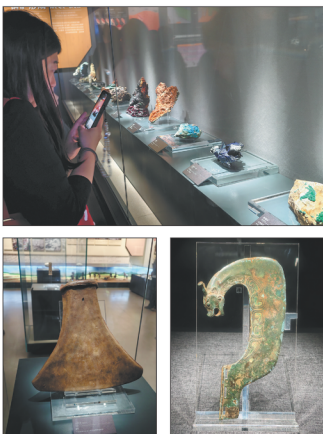
One of the site's most remarkable discoveries is a set of 35 barefoot footprints left by ancient miners. In 2012, Chen Shuxiang, a researcher at the Hubei Provincial Institute of Cultural Relics and Archaeology, and his colleagues uncovered the footprints during an excavation. "The prints vary in condition, with the longest intact footprint measuring 26 centimeters. Based on their characteristics, experts identified them as ancient barefoot impressions. Judging from their depth and surrounding evidence, Chen says he believes the miners were likely carrying heavy loads while crossing wet ground.

Chen notes that some mining shafts reach depths of 60 to 80 meters. Yet, no human remains have been found inside them, suggesting that no major underground accidents occurred during the site's long history of operation.

At the Tonglushan Site Museum, visitors can view a archaeological excavation resembling an "underground labyrinth." The original mining site, a dense network of shafts and tunnels, has been preserved in situ beneath a protective exhibition hall measuring 36 meters long and 30 meters wide, built in 1984.



A breakthrough discovery proves China's Bronze Age developed independently through advanced engineering, Deng Zhangyu reports in Daye, Hubei.



Top: An aerial view of the Tonglushan Ancient Copper Mine site. **Center:** Different types of copper ore are on show at the Tonglushan Site Museum. **Above:** A bronze axe (left) dated about 3,300 years ago and a bronze biao (right) from the Western Zhou Dynasty (c. 11th century-771 BC). **Below:** Malachite unearthed from the Tonglushan site was used by ancient miners to locate copper deposits. PHOTOS PROVIDED TO CHINA DAILY AND BY DENG ZHANGYU AND SUN MENG / CHINA DAILY.



An archaeological site at the Tonglushan Site Museum shows an "underground labyrinth" of cross-corrugated shafts and tunnels.

Viewed from above, visitors see a "maze" of vertical shafts, inclined passageways, horizontal tunnels, and blind shafts supported by wooden structures.

Drainage channels and wooden troughs weaved through the complex, offering a vivid picture of how ancient miners excavated ore and maintained underground operation.

The museum's new building, opened in June 2023, features five themed exhibition halls that explore how ancient people located copper deposits, developed mining techniques, mastered smelting technology, and transported bronze materials across the region.

Wu says that in ancient times, people often located copper deposits by looking for a plant called *Ehretia splendens*, which has red stems and green leaves. It resembles a toothbrush and produces purple flowers.

Every November, when the flowers are in full bloom, Tonglushan Mountain is covered in a sea of purple.

The site's copper-smelting technology was remarkably advanced. Ancient metallurgists developed a stone-built shaft furnace into which alternating layers of ore and charcoal were loaded. Unlike contemporary furnaces in Mesopotamia, which were typically used only once, these furnaces could be reused repeatedly.

It is estimated that the mining area produced about 400,000 metric tons of ancient slag, yielding between 80,000 and 120,000 tons of crude copper. The copper ingots smelted had a copper content of over 93 percent, while the slag contained only 0.7 percent copper — evidence of highly efficient purification techniques.

"This level is remarkably close to modern standards," Wu says.

Scientific testing has since confirmed that the elemental composition of copper used in bronze artifacts from the Panlongcheng site in Wuhan, Hubei province, and the bronzes found in Fu Hao's tomb at Yinxu matches that of copper from Tonglushan.

The findings provide strong evidence that Tonglushan served as a major source of copper for China's bronze industry in the early Bronze Age, "proving that China's bronze civilization developed independently and formed its own system," Wu says.

Daye, where the Tonglushan site is located, is adjacent to the Yangtze River. At that time, the transportation route likely involved moving goods via the Yangtze River to an ancient dock in Nanyang, Henan, and finally reaching the ancient capital Luoyang, then a major political and cultural center.

"The abundant copper resources in the middle reaches of the Yangtze River, combined with bronze smelting and casting techniques that spread southward from the Central Plains dynasties in northern China, together created the bronze civilization of the Yangtze River basin," says Zhang Changting, a history professor from Wuhan University.

Contact the writer at dengzhangyu@chindaily.com.cn

Ancient capital opens its hidden doors to visitors

By DENG ZHANGYU and LIU KUN in Tianmen, Hubei

Around 5,900 to 8,900 years ago, a thriving civilization flourished along the middle reaches of the Yangtze River. Its people built a vast city, engineered sophisticated waterworks, mastered jade carving, developed a highly organized pottery industry, and conducted elaborate religious rituals. Today, archaeologists know it as the Shijiahe Culture.

At the Shijiahe Site Museum in Tianmen, Hubei province, visitors can now explore this civilization.

The museum, roughly the size of a football field, opened on May 18 and features six exhibition halls. Its focus spans ancient urban planning, religious practices and jade craftsmanship, displaying over 800 valuable artifacts — including pottery, jade and stone tools — that shed light on the archaeological discoveries and historical significance of the Shijiahe site.

"The Shijiahe site is remarkable for its vast urban scale, long period of continuous occupation, rich cultural remains and distinctive regional character," says Wang Wei, a veteran archaeologist at the Chinese Academy of Social Sciences.

"Particularly striking is the abundance of remains linked to spiritual beliefs, something rarely seen at contemporary sites elsewhere," Wang says.

According to Fan Qin, director of the Hubei Provincial Institute of Cultural Relics and Archaeology, Shijiahe was the largest prehistoric urban center and the most densely populated settlement cluster in the middle reaches of the Yangtze River during the late Neolithic period.

Listed among China's Top 100 Archaeological Discoveries of the Past Century, the site has undergone more than 20 excavations since its discovery in 1954. Its culture developed continuously for about 2,000 years, making it the longest-occupied settlement among China's major prehistoric urban sites.

Fang, who has spent decades studying the culture, says the ancient city covered nearly 3.5 million square meters — more than four times the size of the Forbidden City in Beijing.

Distinct functional zones included residential quarters, ceremonial spaces, pottery workshops and cemeteries. An advanced water-management network served irrigation, flood control and defensive purposes.

Among the site's most celebrated finds are its jade artifacts, considered a pinnacle of prehistoric Chinese craftsmanship. More than 400 jade pieces have been unearthed, depicting deities, phoenixes, eagles, tigers and cicadas with extraordinary artistry and refinement.

Phoenix imagery was especially prominent.

A star jade phoenix, now housed in the National Museum of China in Beijing, is renowned as "China's first phoenix" for its highly stylized circular design.

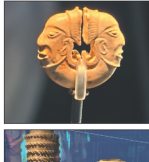
Equally intriguing are depictions of deities believed to represent ancestral figures, ancient gods and ancient history," he says.

"In doing so, we hope visitors gain a deeper understanding of Shijiahe culture and its enduring legacy."

Xu Lin contributed to this story.

its lively clay sculptures of birds, chickens, pigs, and dogs, as well as a contemplative figure that recalls Auguste Rodin's *The Thinker*.

Nearby, at the Sanfangguan site, archaeologists uncovered an 8,000-square-meter workshop dedicated to the production of red pottery cups. According to Hu Yongming, deputy director of the Shijiahe Site Museum, it is the largest Neolithic pottery workshop ever discovered.



From top: Two jade deities' faces connect to each other. Pottery jars and pots are widely found in the sacrificial area at the Shijiahe site. Shijiahe Site Museum in Tianmen, Hubei province, opens to the public. PHOTOS BY DENG ZHANGYU / CHINA DAILY.

He says that the large number of red pottery cup remnants indicates possible trade with other regions.

Near the kiln site, a large ritual area with numerous pottery jars and pots was uncovered, which archaeologists believe were used to hold ritual offerings.

"The sophistication of both the jade and pottery industries points to a highly specialized division of labor," Hu says.

To help visitors visualize the ancient world, the museum offers an immersive digital production titled *Seeing Shijiahe*. Combining holographic projections, moving mechanical displays and environmental effects such as wind, mist and vibration, the experience recreates dramatic scenes ranging from floodwaters breaching city defenses to grand rituals and phenomena soaring across the sky. All props are produced using high-precision 3D-printing technology.

With no fixed seats or traditional stage, the audience becomes "discoverers of civilization," traveling 5,000 years back to "touch" ancient culture, according to director Yan Yungang.

Fan says that since there are no visual or written records to draw from, the production was built on archaeological evidence and expert interpretation, balancing imagination with academic rigor.

"By recreating archaeological scenes through immersive performance, we can bridge the distance between modern audiences and ancient history," he says.

"In doing so, we hope visitors gain a deeper understanding of Shijiahe culture and its enduring legacy."

Xu Lin contributed to this story.



A star jade phoenix, now housed in the National Museum of China in Beijing, is renowned as "China's first phoenix" for its highly stylized circular design.