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San Diego Team Strikes Gold in Bronze-Age Copper Factory

History: The 5,000-year-old complex yields trove of artifacts and a map of society's development.

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Working in the arid desert of southern Jordan, UC San Diego archeologists have uncovered a massive 5,000-year-old copper factory--a Silicon Valley of the Early Bronze Age that helped power mankind's leap from the Stone Age to more complex, urbanized societies.

The 70-room complex, on a well-defended mesa about 30 miles south of the Dead Sea, was dedicated to producing copper ingots, axes, hammers and other artifacts that are believed to have spread throughout the Middle and Near East.

Called Khirbat Hamra Ifdan, or KHI, the factory was apparently destroyed by an earthquake about 2700 BC, a disaster for the owners and workers but a spectacular opportunity for the UC San Diego team.

The preservation of artifacts is similar to that at the Roman village of Pompeii, which was destroyed by a volcano in AD 79, said UC San Diego anthropologist Thomas Levy, who led the expedition with archeologist Russell Adams.

"We really hit the jackpot here," he said. "We were extremely lucky to find it as well preserved as it is and not robbed."

The team has already excavated thousands of artifacts from the site, including crucibles, ingots, copper lumps and slag, copper tools and more than 1,000 ceramic molds for casting ingots and tools. By comparison, the largest copper production facility previously unearthed, at Hisarlik, Turkey--site of the legendary Troy--yielded fewer than 70.

The scope of the installation has astounded other scientists.

"This tells us that the folks who were living there were technologically more sophisticated than we had anticipated and engaging in metallurgy on a scale we hadn't appreciated," said archeologist Steven Falconer of Arizona State University, who was not involved in the research. "It shows that the society was more organized than we thought and trading more widely than we thought."

The factory "is related to the time when the first cities emerged, the first walled towns, all over the ancient Near East," Levy said. "Early metallurgy opens a kind of window on how societies evolved."

Archeologists had previously noted a "virtual explosion" in the availability and use of copper objects from the Early Bronze Age and onward, a phenomenon often referred to as *Metallschock*, added Adams.

Such items had previously been associated only with the culturally elite, as markers of social ranking and personal prestige.

Suddenly, however, copper items became objects of mass consumption, available to nearly everyone.

That availability has been viewed--albeit indirectly--as an indicator of the increased complexity of society, the ability to mobilize large numbers of people and resources to produce significant quantities of once rare items--in much the same way Henry Ford's assembly line brought the once rare and exotic automobile to the masses.

"The evidence from KHI is significant largely because it provides, for the first time, detailed evidence of this expansion in the production and use of metals from the perspective of a production center rather than from the consumer or end-users," said Adams, whose findings were reported in the June issue of the journal *Antiquity*.

The site was found by a British road engineer in the early 1970s, but no excavations were carried out and "nobody had any inkling that it was very important," Adams said.

In 1990 and 1992, he did some limited digging there as part of a broader survey of the region for his doctoral thesis.

"We were in the field when Iraq invaded Kuwait, so it was a short field season," he said.

But he found enough to recognize its potential importance, and he and Levy organized a larger expedition that has been working at the site since 1999, in association with researchers from Jordan's Department of Antiquities and the Deutsche Bergbau-Museum in Bochum, Germany.

KHI is on a small mesa in a desert region that gets less than 2 inches of rain a year, Levy said. "It's brutally hot most of the year"--so hot that the team speculates that workers may have occupied the site only during cooler seasons.

The location on the mesa makes the site easily defended: Only one pathway to the top exists, and the site's owners built heavy walls there to block it.

The team has excavated an area of about 1,500 square yards that is dedicated exclusively to copper production. Using a sophisticated surveying system based on satellite mapping, the researchers have been able to plot the progress of copper through the 70 rooms, courtyards and alleyways of the facility.

The bulk of the copper was molded into ingots, indicating that an extensive trade system must have been in place to distribute it throughout the area.

At the 13 smelting facilities at the site, the team discovered about 5,000 tons of slag, indicating that the complex produced several hundred tons of copper over its lifetime.

"This is by far the largest evidence of copper production during this period," Levy said.

Because the team has not found any residential buildings at the site or any monumental architecture, Levy and Russell are not sure who built the installation and owned it.

But there are few signs of external influence in the factory, so it was most likely indigenous people, they said.

"Generally speaking, the basic ethnic stock was loosely associated with the Canaanites of the Old Testament," Falconer said. "But we would have to imagine that these communities would have had lots of different people of

different ethnicities."

Whoever was in charge, "the architecture of the settlement was very well planned, with small alleyways and very well defined storage complexes," Levy said.

Furthermore, many different technologies had to come together for the copper production, including shaft mining, new smelting techniques and charcoal production methods. Charcoal analysis at the site indicates that local fuel had grown scarce, Adams said, and wood had to be imported from long distances.

At the same time, other technologies were being developed in the region, he said. That included large-scale building projects, extensive changes in agriculture patterns, development of an olive oil industry and the planting of vineyards and the production of wine.

"There were lots of things going on that reflect mustering human resources toward a longer-term end," Adams said, added.

"This is a part of the world that provides Western society with a lot of our cultural background," Falconer said. "It's important to know how they developed their ways of life that ultimately influenced ours so thoroughly."

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