

Brain tissue more than 2,000 years old was found preserved near Mount Vesuvius

The catastrophic eruption of Mount Vesuvius almost 2,000 years ago is famous for having preserved its many victims in volcanic ash. New research suggests that this preservation extends to the cellular level, due to the apparent discovery of neurons in a victim whose brain was turned into glass during the eruption.

A new survey published Friday (2) in PLOS One describes the discovery of neuronal tissue in the vitrified brain and spinal cord of a victim of the Mount Vesuvius eruption, which exploded in 79 AD

“The discovery of brain tissue in ancient human remains is an unusual event,” said Pier Paolo Petrone, a forensic anthropologist at Federico II University in Italy and the lead author of the new study. “But what is extremely rare is the integral preservation of the neuronal structures of a 2,000-year-old central nervous system, in our case in an unprecedented resolution.”

The eruption of Mount Vesuvius devastated several ancient Roman cities, including Herculaneum, Pompeii, Stabia and Oplontis. After a series of earthquakes, the volcano launched a huge column of molten rock, hot ash and pumice into the sky. Inhabitants of nearby settlements quickly succumbed to pyroclastic flows – avalanches of superheated material in rapid motion. It is estimated that 2,000 people died during the eruption.

The fall of volcanic ash has resulted in quick burials and the preservation of many victims, the most famous of which in Pompeii. In some cases, however, the intense heat caused the victims’ skulls to explode, as temperatures suddenly rose to 500 ° C. In Herculano, some inhabitants sought shelter in the chambers of nearby boats, where they were cooked alive.

Research published earlier this year in New England Journal of Medicine showed that the extreme conditions on that fateful day also turned a victim’s brain into glass, described in an article led by Petrone.

Vitrification is the process in which intense heat transforms the fabric into a glassy substance – a reasonably good way to preserve the structure on a macro and micro scale. The male victim was found in Herculaneum, lying on a wooden bed and buried in volcanic ash.

Petrone, along with an interdisciplinary team of experts, examined this same vitrified brain more deeply, finding evidence of neuronal structures in it. The researchers say this is evidence of the rapid cooling of a volcanic ash cloud that hit Herculaneum during the early stages of the eruption. The resulting vitrification solidified man’s neuronal structures, keeping them preserved and in place for almost 2,000 years, according to the scientists.

Using a scanning electron microscope and an image processing tool designed for neural networks, the team discovered traces of a central nervous system, including the remains of brain cells, axons, myelin and cellular microtubules. The structures seen in these microscopic images seem highly organized, suggesting a remarkable degree of preservation in this vitrified brain.

For a second line of evidence, the researchers analyzed the proteins they found earlier this year, finding that the genes within these proteins are associated with the expression of various structures

in the human brain. These proteins “combine even more with the neuronal origin of the unusual archaeological finding,” wrote the authors in their study.

Not all experts are convinced

Zachary Throckmorton, a researcher at the University of Witwatersrand in Johannesburg and an associate professor of anatomy at the Arkansas School of Osteopathic Medicine, appreciated the authors’ use of two different lines of evidence to support his discovery, but he is not entirely convinced.

“The analysis of protein residues provides the basis for the statement [do estudo], but the complexity of how the gene’s expression varies throughout the body’s tissues makes its findings suggestive, but not definitive,” Throckmorton said by email.

On the other hand, the microscopic images shown in the article “suggest more strongly that they actually found [células nervosas] preserved in this victim of Vesuvius,” he said.

Still, Throckmorton believes that the authors’ claims could have been reinforced by comparative experimental images. To be completely convinced, he “would like to see their images compared to tissue from the central nervous system of mammals experimentally vitrified under known and controlled conditions.”

Tim Thompson, professor of applied biological anthropology at Teesside University in the United Kingdom, felt that the new article, like some of Petrone’s previous works, did not contain enough information for “an external person to make an appropriate assessment,” he said during a call video.

Brains, according to Thompson, tend not to preserve themselves very well and are often the first thing to decompose after death. Thus, the new study “highlights the complexity of preservation in Herculaneum”.

Thompson said he did not know whether the authors actually found preserved neurological structures, but the new article shows that not everyone affected by the superheated gas wave, known as heat wave clouds, was vaporized instantly.

As a forensic expert, Thomas would like to know how a preservation like this is possible, saying that the new article “doesn’t really answer that”.

During the same video call, Matthew Collins agreed with Thompson. Collins is a professor of paleoproteomics (the study of ancient proteins) at the University of Copenhagen. He said he found it “frustrating” that the authors did not disclose all of their raw data, claiming that Petrone makes it a habit. The microscopic images shown in the article appear to “have structures”, but he says he wanted to see more.

Collins added: “There is clearly something going on in the preservation of the brain, and this is very exciting.” That such preservation is possible makes sense, he said, since the human body is a “liquid-rich medium” in which the pieces on the outside do not cook as fast as the parts on the inside.

The opening sentence of the new article states that the detection of microscopic brain tissue “in human archaeological remains is a rare event that can offer a unique insight into the structure of the ancient central nervous system”.

Thompson, Collins and Alexandra Morton-Hayward, an archaeologist at University College London who also participated in the video conversation, respectfully disagree.

A recent article that has the trio as co-author and was published in NEJM argues that brain tissue is very common in the archaeological record. In their study, scientists provide a large number of examples, including organic material found in well-preserved mummified corpses of ancient Egypt and skulls found buried in drenched mud pits.

“Your readers need to be aware that when it comes to finding ancient brain tissue, this latest discovery is not so special,” said Morton-Hayward, who led the study published in NEJM. “More than 1,300 brains have been reported in various contexts in archaeological records since the middle of the 17th century. It is impressive here, and not unique, and not even exciting in some ways.” The problem, she said, is that these brains are not being studied enough, which may explain the underreporting.

Morton-Hayward, in fact, was excited by the potential discovery of brain tissue in the vitrified remains. Preserved brains found in heat-based contexts “are not so common,” she noted, but they do happen. She added that she “would not be surprised” if Petrone and her colleagues actually found “well-preserved microstructure” in the sample.

“Herculaneum is an exceptional place with an exciting context,” said Morton-Hayward. “We are finding preserved brains around the world and I hope this is the beginning of much more work in this area.”

<https://www.time24.news/2020/10/brain-tissue-more-than-2000-years-old-was-found-preserved-near-mount-vesuvius.html>

The screenshot shows a news article on the Time24 News website. The article title is "Brain tissue more than 2,000 years old was found preserved near Mount Vesuvius". The article text includes: "The eruption of Mount Vesuvius devastated several ancient Roman cities, including Herculaneum, Pompeii, Stabia and Oplontis. After a series of earthquakes, the volcano launched a huge column of molten rock, hot ash and pumice into the sky. Inhabitants of nearby settlements quickly succumbed to pyroclastic flows – avalanches of superheated material in rapid motion. It is estimated that 2,000 people died during the eruption." and "The fall of volcanic ash has resulted in quick burials and the preservation of many victims, the most famous of which in Pompeii. In some cases, however, the intense heat caused the victims' skulls to explode, as temperatures suddenly rose to 500 ° C. In Herculano, some inhabitants sought shelter in the chambers of nearby boats, where they were cooked alive." Below the text is a microscopic image of a brain fragment with technical details: "300 µm, EHT = 4.00 kV, Signal A = SE2, WD = 8.4 mm, Mag = 73X".