

# The Mount Vesuvius eruption was so hot, one man's brain turned to glass.

Jennifer Ouellette

Brain tissue found in remains of the volcano's victims typically turned into soap.

When Mount Vesuvius erupted in 79 CE, the heat was so extreme in some places that it vaporized body fluids and exploded the skulls of several inhabitants unable to flee in time. Now, archaeologists have determined that the heat also fused brain tissue into glass in one victim. The discovery is described in a new short paper in the *New England Journal of Medicine*.

The eruption released thermal energy roughly equivalent to 100,000 times the atomic bombs dropped on Hiroshima and Nagasaki at the end of World War II, spewing molten rock, pumice, and hot ash over the the cities of Pompeii and Herculaneum in particular. Pliny the Younger wrote of "broad sheets of flame" and a rain of ash in a letter to the historian Tacitus (the letter is the sole surviving eyewitness account of the disaster).

The vast majority of the victims died of asphyxiation, choking to death on the thick clouds of noxious gas and ash. But a 2001 study in *Nature* estimated a temperature of 300° Celsius (572° Fahrenheit) for the pyroclastic surge that destroyed Pompeii, sufficient to kill inhabitants in fractions of a second. Back in 2018, we reported on the conclusion of University of Naples archaeologist Pierpaolo Petrone (one of the co-authors of the 2001 *Nature* paper) that inhabitants of Herculaneum may have suffered a similar fate.

Petrone and colleagues examined about 100 skeletons excavated from the bathhouses along the shoreline at Herculaneum. It's likely that people unable to evacuate in time tried to take refuge there, only to be killed by the hot, dense pyroclastic flows. They found red and black residue on some of the bones that could not have come from coins or other metal artifacts, since there weren't any near this particular site. Raman microspectroscopy revealed high concentrations of iron, indicative of human bodily fluids, although the researchers couldn't say for certain that the source was human blood.

There was also fracturing in the bones—more evidence of exposure to sudden extreme high heat—as well as "cracking and explosion" of the skullcaps. The latter is consistent with forensic cases where skulls burst from extreme heat, forming the same telltale circular pattern around the skull. They concluded that the pyroclastic flows boiled the soft brain tissue and evaporated the bodily fluids of those victims—so much so that skulls literally exploded.

And now we have additional evidence that extreme heat killed many victims. Petrone and several colleagues have completed an analysis of one victim's skull in particular, first excavated in the 1960s from Herculaneum. The body was found on a wooden bed, buried in volcanic ash, and there was

evidence of brain matter remains in the skull. According to Petrone et al., usually such brain matter would be "saponified" by the extreme heat—that is, it turned to soap (glycerol and fatty acids). But this particular victim's brain matter had been vitrified, i.e., fused into glass.

Co-author Piero Pucci of CEINGE analyzed the glassy material inside the skull and found traces of fatty acids common to the triglycerides in the human brain, along with human hair components. No such substances were found in the surrounding ash or charcoal at the site where the skull was found, indicating that the material was most likely brain matter. Petrone et al. estimate that temperatures could have been as high as 520° Celsius (984° Fahrenheit), based on evidence gleaned from charred wood at the site.

"This suggests that extreme radiant heat was able to ignite body fat and vaporize soft tissue," the authors concluded. "The detection of glassy material from the victim's head, of proteins expressed in human brain, and of fatty acids found in human hair indicates the thermally induced preservation of vitrified human brain tissue."

[Update: 6:36 PM] Not everyone agrees with Petrone et al.'s conclusions. Tim Thompson, a forensic anthropologist at Teesside University in the UK, told bioarchaeologist Kristina Killgrove that he doesn't find the vaporization theory plausible, preferring his own alternate theory that the victims at Herculaneum may have been essentially "baked" by lower-intensity heat. "We don't yet know for sure all of the effects that the 79 AD volcanic eruption had on the human body," Killgrove wrote at Forbes. "But the new research into cause of death and post-mortem activities is opening up an archaeological frontier in understanding what happened in the Bay of Naples that fateful day."

<https://arstechnica.com/science/2020/01/extreme-heat-from-vesuvius-eruption-turned-one-victims-brain-to-glass/>

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Brain tissue fused to a remnant of the volcano's interior, typically formed from lava.

**Photo: Public domain via Wikimedia Commons**

After Mount Vesuvius erupted in 79 AD, the heat was so extreme in some places that it melted bone. And a human skull was found with a glassy material inside the brain. This discovery is described in a new paper in the new journal of Science.

The eruption released thermal energy equivalent to 100 times the amount of energy released by the atomic bomb that destroyed Nagasaki in 1945. The heat was so intense that it melted bone. This discovery is described in a new paper in the new journal of Science.

The new study of the skull led to a discovery that the brain matter was fused into glass. This discovery is described in a new paper in the new journal of Science.

On the left, Piero Pucci of CEINGE analyzed the glassy material inside the skull and found traces of fatty acids common to the triglycerides in the human brain, along with human hair components. No such substances were found in the surrounding ash or charcoal at the site where the skull was found, indicating that the material was most likely brain matter. Petrone et al. estimate that temperatures could have been as high as 520° Celsius (984° Fahrenheit), based on evidence gleaned from charred wood at the site.

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