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Unique formation of organic glass from a human brain in the Vesuvius eruption of 79 CE

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ABSTRACT

Glass forms when a liquid is fast cooled preventing crystallization, across a reversible process known as the glass transition. Organic tissues are commonly preserved as glass by processes of vitrification at very low temperatures, known as cryopreservation, and can return to their original soft state when heated back to ambient temperature. It would therefore be impossible to find organic glass embedded in volcanic deposits that have reached several hundred of Celsius degrees.

Here we demonstrate that material with glassy appearance found within the skull of a seemingly male human body entombed within the hot pyroclastic flow deposits of the 79 CE Vesuvius eruption formed by a unique process of vitrification of his brain at very high temperature, and is the only such occurrence on Earth.

Calorimetric analyses show that the temperature at which the brain transformed into glass was well above 510 °C, implying that the body was exposed to the passage and vanishing of a short-lived, dilute and much hotter pyroclastic flow, explaining its early fast heating and the following very fast cooling. The glass that formed as a result of such a unique process attained a perfect state of preservation of the brain and its microstructures.