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"Rosetta Stone" of supervolcanoes discovered in Italian Alps

Scientists have found the "Rosetta Stone" of supervolcanoes, those giant pockmarks in the Earth's surface produced by rare and massive explosive eruptions that rank among nature's most violent events. The eruptions produce devastation on a regional scale — and possibly trigger climatic and environmental effects at a global scale.

The fossil supervolcano was discovered in the Italian Alps' Sesia Valley by a team led by James E. Quick, a geology professor at Southern Methodist University in Dallas. The discovery will advance scientific understanding of active supervolcanoes, like Yellowstone, which is the second-largest supervolcano in the world and which last erupted about 630,000 years ago.

A rare uplift of the Earth's crust in the Sesia Valley reveals for the first time the actual "plumbing" of a supervolcano from the surface to the source of the magma deep within the Earth. The uplift reveals to an unprecedented depth of 25 kilometers the tracks and trails of the magma as it moved through the Earth's crust.

Supervolcanoes, historically called calderas, are enormous craters tens of kilometers in diameter. Their eruptions are sparked by the explosive release of gas from molten rock or "magma" as it pushes its way to the Earth's surface.

Calderas erupt hundreds to thousands of cubic kilometers of volcanic ash. Explosive events occur every few hundred thousand years. Supervolcanoes have spread lava and ash vast distances and scientists believe some eruptions may have set off catastrophic global cooling events at different periods in the Earth's past.

Sesia Valley's caldera erupted during the "Permian" geologic time period, say the discovery scientists. It is more than 13 kilometers in diameter.

"What's new is to see the magmatic plumbing system all the way through the

Earth's crust," says Quick, who previously served as program coordinator for the Volcano Hazards Program of the U.S. Geological Survey. "Now we want to start to use this discovery. We want to understand the fundamental processes that influence eruptions: Where are magmas stored prior to these giant eruptions? From what depth do the eruptions emanate?"

Sesia Valley's unprecedented exposure of magmatic plumbing provides a model for interpreting geophysical profiles and magmatic processes beneath active calderas. The exposure also serves as direct confirmation of the cause-and-effect link between molten rock moving through the Earth's crust and explosive volcanism.

"It might lead to a better interpretation of monitoring data and improved prediction of eruptions," says Quick.

Calderas, which typically exhibit high levels of seismic and hydrothermal activity, often swell, suggesting movement of fluids beneath the surface.
"We want to better understand the tell-tale signs that a caldera is advancing to eruption so that we can improve warnings and avoid false alerts," he says.

To date, scientists have been able to study exposed caldera "plumbing" from the surface of the Earth to a depth of only 5 kilometers. Because of that, scientific understanding has been limited to geophysical data and analysis of erupted volcanic rocks. Quick likens the relevance of Sesia Valley to seeing bones and muscle inside the human body for the first time after previously envisioning human anatomy on the basis of a sonogram only.

"We think of the Sesia Valley find as the 'Rosetta Stone' for supervolcanoes because the depth to which rocks are exposed will help us to link the geologic and geophysical data," Quick says. "This is a very rare spot. The base of the Earth's crust is turned up on edge. It was created when Africa and Europe began colliding about 30 million years ago and the crust of Italy was turned on end."

Scientists have documented fewer than two dozen caldera eruptions in the last 1 million years.

Besides Yellowstone, other monumental explosions have included Lake Toba on Indonesia's Sumatra island 74,000 years ago, which is believed to be the largest volcanic eruption on Earth in the past 25 million years.

Described as a massive climate-changing event, the Lake Toba eruption is thought to have killed an estimated 60% of humans alive at the time.

Another caldera, and one that remains active, Long Valley in California erupted about 760,000 years ago and spread volcanic ash for 600 cubic kilometers. The ash blanketed the southwestern United States, extending from California to

Nebraska.

"There will be another supervolcano explosion," Quick says. "We don't know where. Sesia Valley could help us to predict the next event."

Quick will present the research in a topical session at the Oct. 18-21 annual meeting of the Geological Society of America. Co-researchers include Silvano Sinigoi, Gabriella Peressini and Gabriella Demarchi, all from Universita di Trieste; John L. Wooden, Stanford University; and Andrea Sbisa, Universita di Trieste.

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When & Where
Topic: 165489: Quick, James E. presenter
“Magmatic Plumbing of a “Supervolcano” Exposed to a Depth of 25 KM.”