Research reveals evidence of recurring ancient supereruption

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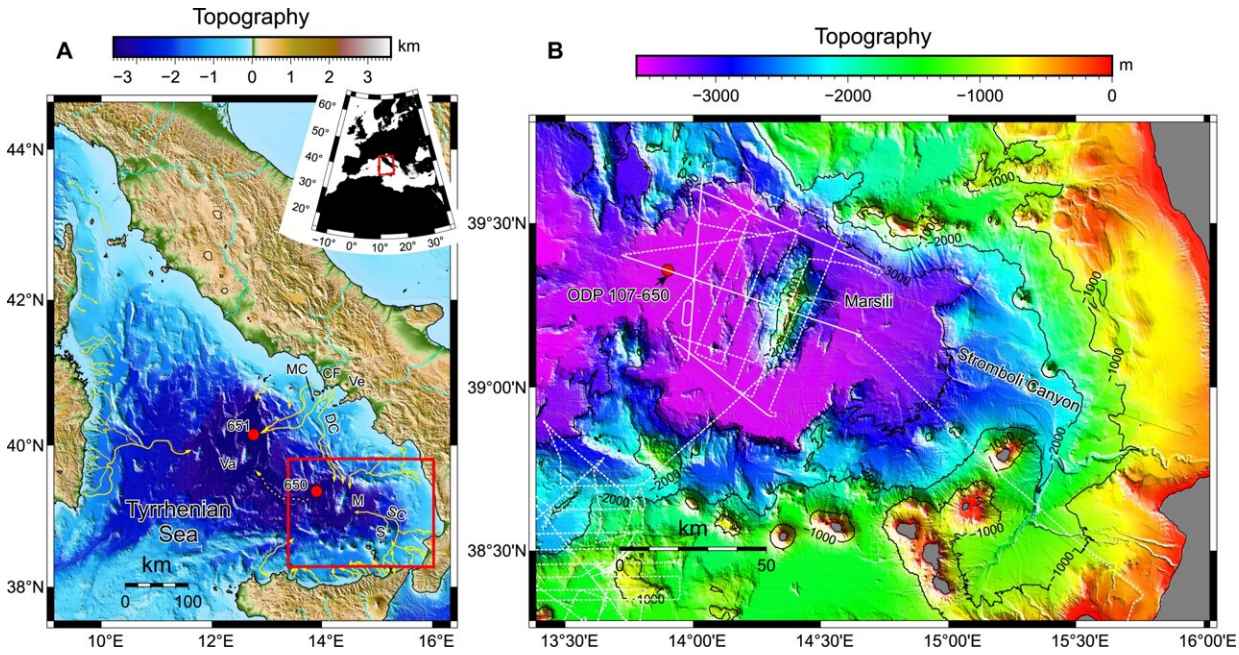

(A) The Marsili Basin lies in ~3000 m water depth in the Tyrrhenian Sea. Ocean Drilling Program Leg 107 Sites 650 and 651 marked as red circles. Red box shows map in (B). Campi Flegrei (CF) fields (source of 39.8 ka Campanian Ignimbrite and 14.9 ka Neapolitan Yellow Tuff) shown with nearby submarine canyons (Dohrm [DC] and Magnaghi [MC]) as yellow lines. Ve—Vesuvius; SC—Stromboli Canyon. (B) CHIRP subbottom profiles shown as white dashed lines. Continuous white lines involved the acquisition of additional airgun seismic data. Bathymetry is a merged dataset of a 40-m grid CHIANTI multibeam bathymetry together with EMODNET bathymetry. Contour interval is 1000 meters. Credit: *Geology* (2023). DOI: 10.1130/G51198.1

Researchers have discovered a series of large undersea sediment deposits in a region near Italy that were likely formed by an ancient volcanic supereruption.

These deposits, known as megabeds, were found in the western Marsili Basin, an area at the bottom of the Tyrrhenian Sea that surrounds the Marsili Seamount, a large undersea volcano.

By combining geophysical data acquired from a Spanish research project and data from sediment cores collected from a nearby Ocean Drilling program site, scientists were able to show that three deposits are made up of alternating beds of volcaniclastic sand and mud, while the fourth is a volcaniclastic debris flow, a more dense mixture of volcanic sediment and water.

The study's findings, published in the journal *Geology*, suggest that these structures were deposited during a volatile time when the Campi Flegrei caldera and the Neapolitan Yellow Tuff supereruption were active.

The new study suggests that these megabeds originated not from nearby volcanoes, but from a volcanic province to the north. That province, researchers think, was an area once near the Campanian Ignimbrite (CI) supereruption of Campi Flegrei, the largest one of its volcanic eruptions since the caldera's formation nearly 50,000 years ago.

This still volcanically active region could pose immense danger in the future, said Derek Sawyer, lead author of the study and an associate professor of earth sciences at The Ohio State University. The discovery of these previously unknown megabeds is pivotal for understanding and measuring the impact of such recurring geohazards over time.

"Megabeds are important components of deep-sea basins and are thought to be the result of major catastrophic events," he said. "So studying them

can serve as an important archive into how these events affected the Earth."

The CI supereruption was so violent an incident that it had a profound effect on the planet and had a hand in shaping Earth's climate and ecosystems, as well as a huge chunk of human migratory and geologic history. Thanks to the huge amounts of dust and ash that were left behind on land and eventually traveled into the ocean, Sawyer and his team were able to discern the age and composition of the four sediment deposits, and determined that their interpretation that the megabeds originated from the Campi Flegrei caldera to the north is likely supported.

More evidence supporting the theory came from the researchers' discovery that tiny marine microbes called benthic foraminifera that reside within these megabeds were found not to have originated from Marsili as previously assumed, but from the Campi Flegrei caldera.

Though scientists can now better predict potential ruptures and other types of seismic hazards, recent volcanic and hydrothermal activity in the Mediterranean has raised scientists' concerns over whether the Marsili Seamount, which rises 3,500 meters from the seafloor to a depth of 489 meters below sea level, will erupt soon.

"This is the part of Italy, the Phlegrean Fields, where Mount Vesuvius is and it's still a very volcanically active area, so it's a known hazard and continuously monitored," said Sawyer. "In doing marine geoscience studies like these, we're working to help understand past eruption events to aid in the effort to build resilient communities that have as much information as they can in order to avoid getting displaced."

If a volcano in this region were to erupt today, the movement of such vast magma deposits beneath the surface could trigger tsunamis

threatening nearby coastal cities and cause a variety of other ecological disasters.

While the study did find that megabeds recur in the Marsili Basin about every 10,000 to 15,000 years, Sawyer said that because not every eruption creates a megabed, scientists should be vigilant in watching for events that don't adhere to these timescales. As the last one is estimated to have happened about 2,100 to 3,000 years ago, there's still some uncertainty regarding when the next one will occur.

"We have to be cautious about these predictions, but in order to be prepared for it, more research is needed," Sawyer said.

More information: Derek E. Sawyer et al, 50,000 yr of recurrent volcaniclastic megabed deposition in the Marsili Basin, Tyrrhenian Sea, *Geology* (2023). DOI: 10.1130/G51198.1

Provided by The Ohio State University