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FÜR ARCHÄOLOGIE

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Press release

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Cold without consequences?

Short-term climate fluctuations appear to have had less impact on the subsistence practices of early farmers than previously thought

Mainz, Germany. Cold conditions may not have been responsible for the centuries-long pause in the spread of farming across south-eastern Europe during prehistory, according to a new study by the Leibniz-Zentrum für Archäologie (LEIZA) in Germany, published in the journal PNAS. Researchers found no evidence of extreme cold at the Greek archaeological site of Franchthi, nor any statistically significant link between local temperature fluctuations and changes in how people obtained their food.

The spread of farming into Europe was one of the major transformations of prehistory. From its origins in the Near East, agriculture reached Europe from around 7,000 BC. At first, farming communities expanded only slowly. Then, between about 6,600 and 6,000 BC, their movement beyond Greece almost stopped for around 600 years. When expansion resumed, it happened remarkably quickly: within roughly 500 years, farming communities had spread along the Mediterranean coast as far as Portugal.

Did climate bring the expansion to a halt?

One possible explanation has been a period of sudden and unpredictable cooling, including the abrupt climate change known as the 8.2-kiloyear event, around 8,200 years ago. "This period coincided with rapid climate change, when particularly cold winters may have occurred," says Dr Niklas Hausmann of LEIZA, who led the study. "Extreme cold could have reduced agricultural yields and made it harder for people to establish new settlements." But did these cold conditions actually occur where people were living - and did they affect their subsistence practices? To find out, the researchers reconstructed local temperatures at Franchthi, a key

archaeological site in the Peloponnese (Greece), and compared the results with archaeological evidence for the subsistence practices of the people who lived there.

Limpet shells reveal past temperatures

The team turned to an unusual source of climate information: the shells of 121 limpets (*Patella* sp.) recovered from Franchthi. The limpets had been eaten by the site's inhabitants, leaving their shells behind as food waste. As the shells grow, they record information about the environmental conditions in which the animals lived. Using a specially developed laser-based technique, the researchers were able to identify the shells' seasonal growth phases precisely. They then analysed oxygen isotopes in the shells to reconstruct seasonal temperature extremes during these growth phases. The result is the largest high-resolution dataset of its kind so far obtained from a single archaeological site.

No sign that cold changed people's diet

The researchers then compared the reconstructed temperatures with animal bones from the same archaeological layers. These remains provide evidence of which animals people used and how important they were to their diet. This allowed the team to test directly at the site whether changes in temperature coincided with changes in people's subsistence practices. "Our results show that there is no direct evidence of extreme cold and no strong and statistically significant relationship between local climate fluctuations and the subsistence practices of the people," says Dr Danai Theodoraki, co-author of the study at LEIZA. "For Franchthi, there is therefore no evidence that cold conditions affected food supplies severely enough to prevent the spread of farming."

Climate was not the only possible factor

"The results of our study do not mean that climate played no role for people," says Hausmann. "They show instead that, at this coastal site, short-term cold does not provide the explanation previously assumed for the delay in the spread of farming. Other possible factors - including social, economic and cultural developments - therefore deserve greater attention."

The researchers now plan to apply their method to other archaeological sites. This will help establish whether Franchthi was unusual, or whether evidence from other locations points to a broader pattern in the role of short-term climate events in human decision-making during prehistory.

The research forms part of the Emmy Noether Junior Research Group SEAFRONT at LEIZA, funded by the German Research Foundation (DFG) and led by Hausmann. The project investigates the relationship between seasonal climate fluctuations

and human behaviour during the Neolithic period in the Mediterranean region, addressing a key challenge in the study of human-environment interactions.

Publication

N. Hausmann & D. Theodoraki (2026), On-site, subannual climate records decouple Neolithic expansion from climate instability, Proc. Natl. Acad. Sci. U.S.A. 123 (45) e2607859123
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Leibniz-Zentrum für Archäologie (LEIZA)

As a Leibniz Research Institute and Museum for Archaeology, LEIZA studies humans and their development based on material remains that span three million years across time and space. The fundamental insights we gain improve our understanding of human behaviour, actions and the development of societies. In this way, LEIZA enriches our knowledge of humans from an archaeological perspective and creates essential foundations for reflecting on the present and shaping the future. With archaeology, LEIZA views human beings in context and shares the knowledge gained in international dialogue. LEIZA is active worldwide and has successfully and comprehensively conducted research in various regions of Africa, Asia and Europe. The unique concentration of archaeological, scientific, restoration and information technology expertise, combined with important workshops, laboratories and archives, makes it possible to conduct object-oriented research into the archaeology of the ancient world (Asia, Africa, Europe) from the beginnings of human history to modern times. As one of eight research museums in the Leibniz Association, LEIZA combines excellent science with exhibitions and, with its educational mission, is also a place for dialogue with the public.

Until its renaming on 1 January 2023, LEIZA was known internationally as the Römisch-Germanisches Zentralmuseum (RGZM), which was founded in Mainz in 1852 by resolution of the German Historical and Antiquities Societies. Since 2024, LEIZA is represented at four locations in Germany: Mainz, Neuwied, Mayen, and Schleswig. www.leiza.de

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