

# Ancient cave reveals Syria may suffer further from severe droughts

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Credit: University of Reading

A stalagmite collected from a remote cave in the Middle East has revealed climate models may be underestimating the severity of droughts likely to hit the region in future years.

A research team led by the University of Reading travelled to Iraq to collect the stalagmite and used it to present the first ever detailed [climate](#) reconstruction for the eastern part of Middle East's most important region for agriculture – the Fertile Crescent – extending back 2,400 years.

The new and detailed rainfall record, published in *Geophysical Research Letters* journal, reveals that the catastrophic [droughts](#) in 1998-2000 and 2007-2010 were the most severe in around 1,100 years. Many scientists

believe they were an important contributing factor to the turmoil witnessed in Syria in recent years.

The researchers also found the effects of these droughts were made worse by the climate having become steadily drier since the 10th century, something [climate models](#) failed to identify when simulating rainfall over the last 800 years.

Project leader Professor Dominik Fleitmann, from the University of Reading's Archaeology department, said: "Using stalagmites formed below the Earth's surface to study the climate above appears to be strange, but stalagmites are formed from precipitation above the cave.

"By taking measurements from the layers of minerals that form the stalagmite, changes in the amount of rainfall can be reconstructed from year to year back to several hundred thousand years.

"We found the recent droughts, in combination with the increasing demand for water in Syria and Iraq by a fast-growing population, created the perfect storm for societal turmoil. Our new and unique stalagmite record has also exposed flaws in the complex climate models currently used to predict droughts in the Middle East."

## **Window into the past**

The Middle East now has the largest water deficit in the world due to population increase, added water demands and climate change. The devastating droughts between 2007 and 2010 caused the displacement of more than a million people and have been argued to be a contributing factor to the ongoing Syrian civil war.

Understanding the nature of droughts in this region is therefore vital to prepare for ongoing and future climate change, and to convince

governments to prepare more effectively for future droughts. However, current knowledge about the frequency and duration of droughts is very limited, as meteorological records go only 50 to 100 years back in time.

An international team, including paleoclimatologists and archaeologists from the University of Reading, carried out nearly 25,000 tests on the 38cm-long stalagmite collected from Gejkar Cave in northern Iraq to reconstruct fluctuations in rainfall within the eastern Fertile Crescent (Iraq and Syria). The area, covering parts of Iraq, Syria, Lebanon, Jordan, Israel and Palestine, is where farming started and the first civilizations emerged several thousand years ago.

The team used state-of-the-art chemical analysis, including critical isotope measurements in Reading, to learn more about the timing, duration and severity of droughts in the recent past in unprecedented detail. Studying this data will allow them to learn how to better predict future climate in the region.

They discovered that the Middle East has experienced a long-term trend towards drier conditions, unseen by climate models and tree ring records, which began at the latest around 940AD. Comparing the data from the stalagmite with that produced by simulations showed they did not match, suggesting the climate models currently used to predict droughts may be producing inaccurate results.

The continuous decrease in rainfall coincides with a general decline in settlement density since the Medieval times, indicating that societies in the Fertile Crescent endured a long strife against climate.

Corresponding Reading author Dr Pascal Flohr said: "Unlike tree rings and current simulations, this stalagmite shows us the bigger and more complete picture about climate trends in the Fertile Crescent. It reveals droughts lasting several decades, which can have a cumulative and

devastating effect on vulnerable societies.

"We hope that our results will help to improve our predictions and lead to a more responsible water management policy in the region to mitigate the effects of future mega-droughts."

**More information:** Pascal Flohr et al. Late Holocene droughts in the Fertile Crescent recorded in a speleothem from northern Iraq, *Geophysical Research Letters* (2017). [DOI: 10.1002/2016GL071786](https://doi.org/10.1002/2016GL071786)

Provided by University of Reading

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