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News

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Old trees reveal Late Antique Little Ice Age (LALIA) around 1,500 years ago

Tree-ring measurements have revealed a period of extreme cold in Eurasia between 536 and around 660 CE. It coincides strikingly with the Justinian plague, migrations of peoples and political turmoil in both Europe and Asia, reports an interdisciplinary team, led by the Swiss Federal Research Institute WSL and the Oeschger-Zentrum of the University Bern, in the journal Nature Geoscience.

WSL dendroclimatologist Ulf Büntgen and his fellow researchers were able for the first time to precisely reconstruct the summer temperatures in central Asia for the past 2,000 years. This was made possible by new tree-ring measurements from the Altai mountains in Russia.

The results complement the climatological history of the European Alps, stretching back 2,500 years, that Büntgen and collaborators published in 2011 in the journal Science. "The course temperatures took in the Altai mountains corresponds remarkably well to what we found for the Alps," says Büntgen. The combined findings allow for the first time to infer summer temperatures for large parts of Eurasia over the past two millennia.

Tree-ring widths in old trees reflect the summer climate in any given year in the past. Looking at these, the researchers were particularly struck by a cold phase in the 6th century. It exhibited even lower temperatures, longer duration and larger expanse than the temperature drops in the Little Ice Age (13th to 19th centuries CE). "This was the most dramatic cooling in the Northern Hemisphere in the past 2,000 years," explains Büntgen.

Climate and culture

In light of this, the researchers refer to the period from 536 to around 660 CE for the first time as the "Late Antique Little Ice Age" (LALIA). This was triggered by three major volcanic eruptions in 536, 540 and 547 CE^[1], whose climatic impact was prolonged further by the retardant effect of the oceans and a minimum in solar activity.

According to the team of naturalists, historians and linguists, this period bore witness to a whole series of social upheavals. After famine, the Justinian plague established itself

between 541 and 543 CE, killing millions of people in the centuries that followed and possibly contributing to the decline of the Eastern Roman Empire.

Migrations

Proto-Slavic-speaking people migrated, supposedly from the Carpathian region, into the eastern areas of modern-day Europe that had been abandoned by the Romans, thereby forming the Slavic language area. According to the researchers, this period of cool temperatures may also have fostered the expansion of the Arab Empire in the Middle East. The Arabian Peninsula received more rain, growing more vegetation, which may have sustained larger herds of camels used by the Arab armies for their campaigns.



In cooler areas, various peoples also migrated east towards China, maybe driven away by a lack of pastureland in central Asia. As a result, hostilities broke out in the steppe regions of northern China between nomadic groups and the local ruling powers. Subsequently, an alliance between these steppe populations and the Eastern Romans conquered the Sasanian Empire in Persia, leading to its collapse.

Strategies for modern-day climate change

While the researchers stress, however, that potential links between this period of cool temperatures and socio-political changes always need to be treated with great caution, they write that "the LALIA fits in well with the main transformative events that occurred in Eurasia during that time".

Ulf Büntgen points out that their study serves as an example of how sudden climatological shifts can change existing political systems: "We can learn something from the speed and scale of the transformations that took place at that time," he says. Knowledge about the effects of past climatic fluctuations could maybe contribute to developing strategies how to deal with modern climate change.

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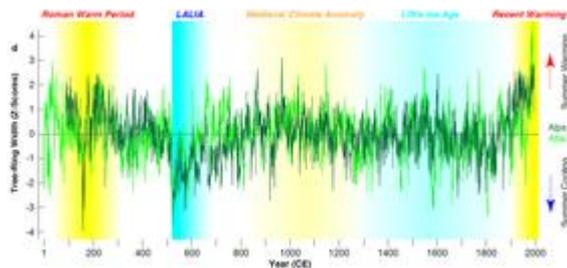
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New tree-ring width measurements from the Russian Altai mountains indicate a drastic cold period 1,500 years ago. (Photo: Vladimir S. Myglan)



Studying old trees in the Altai mountains allowed reconstructing Eurasia summer temperatures over the last 2,000 years. (Photo: Vladimir S. Myglan)



The "Late Antique Little Ice Age" (LALIA) started 536 CE. The temperature drop stands out clearly in the reconstructed summer temperatures (blue shading left). (Graphic: Ulf Büntgen)

