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Traces of sun storms locked in tree rings could confirm ancient historical dates

A new science, astrochronology, could finally fix precise dates for key events in prehistory using traces of violent solar storms preserved by trees

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Archaeologists believe they have identified a new way of putting accurate dates to great events of prehistory. Rare and spectacular storms on the sun appear to have left their mark in forests and fields around the planet over the past 5,000 years.

Michael Dee, of Oxford University's research laboratory for archaeology and the history of art, thinks evidence of such solar storms could help put precise years to some of the great uncertainties of history: the construction of Egypt's Great Pyramid of Giza, the collapse of the ancient Mayan civilisation in Central America, and perhaps even the arrival of the Vikings in the Americas.

Every tree maintains its own almanac in the form of annual growth rings. For decades dendrochronologists have been using tree-ring evidence and radiocarbon dating to build a timetable of events that confirm historical accounts, even those predating the first written chronicles.

Carbon dating works by comparing the ratio between two isotopes of the element carbon, C-14 and C-12, present in old samples of organic material. Because of constant bombardment by cosmic rays, ratios of C-14 in the upper atmosphere are more or less constant, and since radioisotopes decay with time, at a predictable rate, the ratio of C-14 to the stable form C-12 is a guide to the age of any timber in a cathedral roof or a stone age burial site, for example.

The technique is imprecise, with an error range of 50-100 years, and also expensive. However, the discovery of unusually high levels of C-14 - up to 20 times the normal level - laid down in during especially violent solar storms may enable scientists to date material much more accurately. Every tree growing at the time of such a sun storm, anywhere in the world, would have preserved a record of it.

In 2012, the Japanese scientist Fusa Miyake identified a dramatically raised level of C-14 in one set of growth rings that is known to date from 775AD. Since then, what the Oxford team call a second Miyake event - a consequence of a catastrophic extraterrestrial discharge of energy - has been identified from the year 994AD.

Dee and his co-author Benjamin Pope propose a new science, astrochronology, to harness this solar storm evidence, in an article in the journal Proceedings of the Royal Society A . The technique could very precisely tie so-called “floating chronologies” of ancient Egypt , Mayan civilisation or the bronze age to fixed dates in the universal calendar. The Mayan day numbering system spans a thousand years and is well established - but researchers have so far been unable to tie any event in that to any date in the Gregorian calendar of Europe.

“In fact, the earliest truly fixable date in the Americas is still taken to be the arrival of Columbus in 1492,” the authors write.

Where checks have been made on tree rings, these have been on a decadal basis - which is why no-one noticed the rare single-year anomalies of the past. Such celestial violence may also have been witnessed: the Anglo-Saxon Chronicle records an eerie “red crucifix” in the sky in 774AD. Another spectacular solar storm in 1859 led to aurorae visible in Hawaii and the Caribbean.

The scientists propose cutting-edge mathematical techniques to re-examine all the existing data and identify hints of more possible solar storm spikes.

“What we have is a decadal record going back more than 10,000 years,” Dee said. “There must be more of these events and we will try and find where we should look for them. You can’t just measure every single tree ring because it would cost tens of millions of pounds, because each tree ring has to be measured in triplicate essentially and there are a lot of years between now and 5,000 BC.”

If the researchers do identify another spike, they expect it to be duplicated in surviving plant tissue everywhere in the world from that year: in the reeds that became papyrus, in the flax that was preserved as linen, in the timbers that shore up ancient graves. Spikes in tree rings from 775AD have been found in Germany, Russia, the US and New Zealand. The astrochronologists have a potential record far more accurate than a human scribe.

“The key here is that we have long connected chronologies. In the Old Kingdom of Egypt, we have all the sequence of kings, and the order of kings is pretty well established. We have a reasonable handle on how long they were in power,” Dee said.

“If we found two or three spikes in the third millennium BC not only would we be able to pin down the Old Kingdom’s 400-500 year sequence, we’d be able to check that the years between the kingdoms add up; there’s no missing years, because the tree ring record is absolutely established.”

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