Scientists use rare mineral to correlate past climate events in Europe, Antarctica

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The first day of spring brought record high temperatures across the northern part of the United States, while much of the Southwest was digging out from a record-breaking spring snowstorm. The weather, it seems, has gone topsy-turvy. Are the phenomena related? Are climate changes in one part of the world felt half a world away?

To understand the present, scientists look for ways to unlock information about past climate hidden in the fossil record. A team of scientists led by Syracuse University geochemist Zunli Lu has found a new key in the form of ikaite, a rare mineral that forms in cold waters. Composed of calcium carbonate and water, ikaite crystals can be found off the coasts of Antarctica and Greenland.

"Ikaite is an icy version of limestone," say Lu, assistant professor of earth sciences in SU's College of Arts and Sciences. "The crystals are only stable under cold conditions and actually melt at room temperature."

It turns out the water that holds the crystal structure together (called the hydration water) traps information about temperatures present when the crystals formed. This finding by Lu's research team establishes, for the first time, ikaite as a reliable proxy for studying past climate conditions. The research was recently published online in the journal Earth and Planetary Science Letters and will appear in print on April 1. Lu conducted most of the experimental work for the study while a post-doctoral researcher at Oxford University. Data interpretation was done

after he arrived at SU.

The scientists studied ikaite crystals from sediment cores drilled off the coast of Antarctica. The sediment layers were deposited over 2,000 years. The scientists were particularly interested in crystals found in layers deposited during the "Little Ice Age," approximately 300 to 500 years ago, and during the "Medieval Warm Period," approximately 500 to 1,000 years ago. Both climate events have been documented in Northern Europe, but studies have been inconclusive as to whether the conditions in Northern Europe extended to Antarctica.

Ikaite crystals incorporate ocean bottom water into their structure as they form. During cooling periods, when ice sheets are expanding, ocean bottom water accumulates heavy oxygen isotopes (oxygen 18). When glaciers melt, fresh water, enriched in light oxygen isotopes (oxygen 16), mixes with the bottom water. The scientists analyzed the ratio of the oxygen isotopes in the hydration water and in the calcium carbonate. They compared the results with climate conditions established in Northern Europe across a 2,000-year time frame. They found a direct correlation between the rise and fall of oxygen 18 in the crystals and the documented warming and cooling periods.

"We showed that the Northern European climate events influenced climate conditions in Antarctica," Lu says. "More importantly, we are extremely happy to figure out how to get a climate signal out of this peculiar mineral. A new proxy is always welcome when studying past climate changes."

Provided by Syracuse University

climate-events.html