Tree-Ring Evidence Confirms Alaskan Inuit Saga of Climate Disaster

The oral traditions of the Kauwerak people of extreme northwest Alaska describe a great disaster of cold known as "The Time that Summertime Did Not Come." The resulting famine and hardship decimated their population at this fragile northernmost fringe of human habitation.

The story goes that only about 10 people survived, with two of them - a young woman and her infant son - completing an epic trek to begin the process of rebuilding their culture sometime near the arrival of permanent European settlers.

In an unusual effort of multidisciplinary synthesis, a team led by tree-ring scientist Gordon Jacoby of the Lamont-Doherty Earth Observatory has demonstrated that this mythic disaster did in fact take place in 1783, most likely as the result of a massive volcanic eruption that occurred thousands of miles away in Iceland.

Their work, funded by the National Science Foundation and published recently in Quaternary Science Reviews, combined elements of dendroclimatology with volcanology, history and anthropology to solve the chilling mystery.

"The whole thing is somewhat like a dime novel detective story," Jacoby said. "There are a lot of different clues from various fields of inquiry that weave together into a remarkable story."

Dendroclimatology is the science of deciphering evidence of past climate as recorded by trees in their annual growth rings. In general, the better the growing season the wider the ring and the denser the wood added in late summer. By carefully analyzing tree-ring records,
researchers can not only infer temperature, rainfall and other elements of past climate, but also date backward to determine the exact year, and sometimes the season being studied.

Whether or not the trek of the Kauwerak woman called Napauruhk occurred exactly as chronicled, the eruption of the volcano at Laki, Iceland on June 8, 1783 fits with the oral tradition of a normal spring and early summer that turned suddenly frigid, snowy and barren. The journals of European explorers in the region around that time also speak of deserted villages and a notable decline in the apparent native population.

Independent corroboration comes from tree-ring data, which show 1783 to have been the coldest growing season in that area for over 900 years. While the ring-widths for 1783 were not unusual, the density of the wood from the second half of the growing season was uniquely low, which also suggests an abrupt end to summer. Their analysis indicated that temperatures in July and August hovered at or below freezing, Jacoby said.

That unusual cooling events often follow on the heels of volcanic eruptions is well documented, Jacoby said. The sulfurous gases released into the upper atmosphere combine with water to form crystals of acid that reflect solar radiation back into space. The resulting loss of incoming heat leads to lower temperatures. But the degree and distribution of cooling tends to be uneven.

In fact, there have been three unusually cold summers in North America during the past 400 years of tree-ring history, all of them immediately following major volcanic eruptions and none of them affecting the entire continent. The year 1641 was cold in north central Canada, 1783 was cold in northern Alaska, and 1816 was cold in eastern North America.

The Laki eruption produced the largest lava flow in recorded history and is estimated to have released up to 280 million tons of sulfurous gases into the upper atmosphere. The acid haze from the eruption was noted as far away as China, and is known to have lowered temperatures throughout the Northern Hemisphere. In Japan, 1783 is also known as the "year without a summer."

Just why the effect was so severe in northwest Alaska remains a mystery. Perhaps a temporary oddity of atmospheric circulation concentrated the unseasonably cold air over the region. Whatever the exact mechanism though, the important lesson is that the event was catastrophic for the Kauwerak, but of little consequence elsewhere in North America, Jacoby said.

"This demonstrates that major volcanic eruptions can lead to important, even devastating localized cooling events," he said. "We can't assume that volcanic eruptions always yield globally averaged effects, or even that they're distributed smoothly at the continental scale."

"We need to understand more about these kinds of extreme climatic events - their frequency, ferocity, distribution and causes. This type of multidisciplinary research can really extend our knowledge and expand our awareness of the potential for future events."
"The fact is they're probably far more common than we'd like to think," Jacoby said. "We need to realize that these events can happen, have happened in the past, and will certainly happen again. The world isn't always the consistent, predictable place we might wish it to be."

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