

Expedition to Peru captures climate history trapped in ice—before it is gone

November 11 2019, by Laura Arenschiold



Lonnie Thompson climbing Huascarán, the highest peak in the tropics, in Peru in the summer of 2019. Credit: The Ohio State University

From the summit of Huascarán, the highest mountain in Earth's tropics, the valleys of the western Andes look placid and peaceful—calming, even. The signs of climate change—of the melting glaciers throughout the Andes, of the changes to the local villages' water supplies—are not immediately evident.

But the scientific crew on top of the mountain knows those changes are there.

It's part of why they've traveled so far, from the United States, Mexico, Italy, Peru, France and Russia, and tackled this harrowing climb to more than 22,000 feet: to visit the [glaciers](#) at the top and to drill columns of glacier ice to send back to The Ohio State University for analysis. The ice holds many clues to what has happened in Earth's atmosphere and in the climate of the region over the last 20,000 years. And, if Earth keeps warming, the glacier might not be there for much longer.

"I've worked in Peru for 44 years, and have visited some of the ice fields 25 times," said Lonnie Thompson, distinguished university professor in the School of Earth Sciences and senior research scientist at the Byrd Polar and Climate Research Center. "And I've been able to document the increase in temperature and the melting that is taking place on the summits of many of these glaciers."

Huascarán is a peak in the Cordillera Blanca range in northern Peru. Thompson has been here before, in 1980, 1992, 1993, 2016, and in the summer of 2019 he led a group of scientists back to see how the glacier had changed and to collect new ice samples.

Because of its altitude, Huascarán is one of the more challenging and dangerous peaks on which Thompson and his crew have drilled. But that altitude also protects the ice. Currently glaciers at lower altitudes, where it is warmer, are melting rapidly and Huascarán's glacier will eventually melt, too, but for now, it is likely one of the few remaining intact tropical glaciers in the world.

"It is our belief that this mountain is the only one in Peru that still has a largely unaltered ice record, both in the col (the flat glacier area between the North and South Peaks) and on the higher South Peak," Thompson

said. "And this makes it ideal for certain types of gas measurements that have not been made in the low latitudes before—if there's any tropical place on Earth where gases like methane can be measured, this will be it."

Though they ran into some local political tensions during the expedition, the drilling process went smoothly—more smoothly, Thompson said, than any of the past 80-plus similar excursions he has led.

Extracting ice from glaciers in the Tropics can be harrowing. The climbs are often dangerous—in the case of Huascarán, avalanches required the team's mountaineers to create an entirely new route to the summit. (Mountain climbers are known for naming their routes; they christened this one "the Lonnie Thompson route" in Thompson's honor.) The air gets thinner the higher up a person climbs; high-altitude sickness is a real threat. The symptoms, which include shortness of breath, can also go unnoticed or may begin as low as 8,000 feet. At 22,000 feet, the air is so thin that the scientific team traveled with "backup" oxygen tanks and a Gamow bag, a portable hyperbaric chamber that can be pressurized to sea level values. Fortunately, neither had to be used.

"It's that [high elevation](#) that preserves the record in the ice cores—if you didn't have those cold temperatures, you wouldn't have the record," Thompson said. "We've done dozens and dozens of expeditions, and the result of climate change is that we keep having to go higher on the glaciers. And that becomes an issue, because—well, I'm getting older, for one. And we are strict about acclimatizing—we go up four or five thousand meters on hikes and then come back down and sleep at lower altitudes. But it can wear on your body."

And Thompson, who celebrated his 71st birthday in Peru at the start of this summer's expedition, had a heart transplant in 2012.

But the work is necessary, Thompson and the other scientists believe: Because of their ice core work, climate scientists around the world now know that climate change could have devastating effects on vulnerable people in the Andes Mountains and the Tibetan Plateau region. Their research has shown that glaciers in both parts of the world are melting more rapidly than at any point in the past 6,000 years, which could have serious repercussions for the water supply in parts of Peru, Pakistan, China, India and Nepal.

On this most recent trip, they drilled more than 471 meters of glacial ice cores—long columns of ice that had been frozen since the last Ice Age. Work to analyze them is already underway—Thompson calls them "some of the best cores we've ever drilled."

They hope to begin publishing their findings from the cores soon. The cores will be analyzed for mineral dust to detect droughts; isotopes that indicate temperature changes; black carbon and trace elements to determine whether fires like the ones burning in the Amazon this year are part of the historical record; greenhouse gases to see how their concentrations in the atmosphere have changed over time; pollen to track vegetation changes; and microbes to determine how they have evolved over the last 20,000 years.

In the meantime, Thompson and the team are contemplating their next excursion. There are glaciers in Peru and Tibet they would like to revisit, and there are more analyses to be made on ice they've already collected from other parts of the world. He wants to be sure he's helping the next generation of scientists understand how to do this kind of field work.

"These are difficult expeditions—there is the risk of avalanches; there is always the potential for injuries, inflections and various high altitude issues," he said. "But if you overcome these, you realize the potential of which you're capable. Some of our younger members just take to it like

a duck to water. But the only way they are going to get that experience is to go to the field—first on lower elevation glaciers and then to the higher, more challenging glaciers like those on Huascarán."

Provided by The Ohio State University

Citation: Expedition to Peru captures climate history trapped in ice—before it is gone (2019, November 11) retrieved 18 April 2024 from <https://phys.org/news/2019-11-peru-captures-climate-history-icebefore.html>

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