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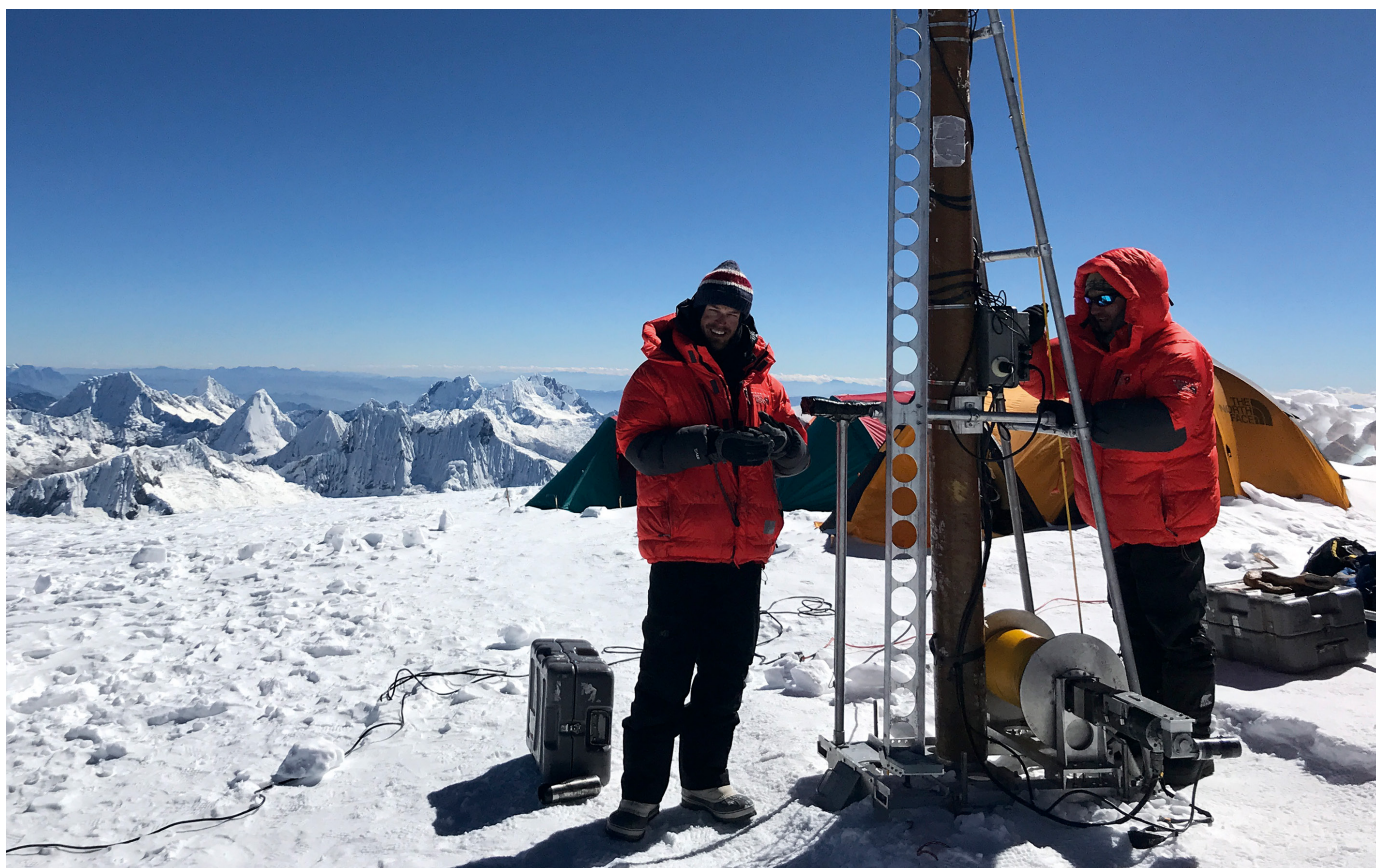
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IVAN LAVRENTIEV



Glaciologists drilled through glacial ice on Mount Huascarán in Peru until they reached bedrock.

## GLACIOLOGY

# Scientists sample Earth's highest tropical glacier

*Researchers race to retrieve ice amid protests by local residents in Peru.*

BY BARBARA FRASER

An expedition to drill ice cores from Earth's highest remaining tropical glacier — on Mount Huascarán in Peru — was cut short last month after a protest by local residents forced researchers to abandon their mountain camp.

The protestors accused the team of being a front for a mining company, a claim that the

scientists, led by glaciologist Lonnie Thompson of Ohio State University in Columbus, deny.

Despite the conflict, the researchers managed to extract four ice cores before being evacuated by helicopter. These samples could reveal new details about changes in atmospheric greenhouse-gas levels, temperature and land use in the Andes Mountains and the adjacent Amazon basin over the past 20,000 years.

The climate record preserved in the cores could also strengthen predictions about the effects of glacial melting, which has put communities downstream at risk of water shortages and catastrophic landslides.

The team's expedition began in early July, with the goal of sampling ice from two sites on Mount Huascarán, Peru's tallest mountain. Even before Thompson's team was forced to leave the mountain, he saw the trip as a ▶



► “salvage mission”. That’s because Mount Huascarán’s ice is thawing rapidly, a process that is releasing trapped air bubbles that glaciologists use to reconstruct the past climate.

The project is personal for 71-year-old Thompson, who began studying glaciers in Peru in 1974 and has seen them shrink steadily since then. He compares his trips to dwindling glaciers to visiting a loved one with terminal cancer. “I can monitor and document the rate of retreat,” he says, “but unfortunately cannot stop its demise.”

The researchers plan to use analytical techniques that were not available in 1993, when Thompson last extracted a full-length ice core from the glacier. These include examining embedded pollen, sooty black-carbon particles and bacteria for clues to how the Amazon’s extreme biodiversity has evolved since the last ice age.

### ICY RECEPTION

On previous trips to the area, Thompson extracted cores at lower altitudes than those he targeted during the latest trip. But the surface area of Peru’s glaciers has shrunk by about 40% since the 1970s, and the tops of many glaciers no longer stay frozen year-round. Meltwater trickling down through the thawing ice is blurring the boundaries between layers. Thompson hopes to get a clearer climate record from the Huascarán cores.

His team is also studying the topography and thickness of glaciers across the Cordillera Blanca, the section of the Andes that includes Mount Huascarán, seeking ways to calculate how much water they store and to predict their risk of collapse. As the climate warms, ice blocks could break off and plunge into meltwater lakes, sending water, mud and rock

cascading through towns along the Santa River in the valley.

The scientists started drilling on Mount Huascarán in mid-July. It took them a week to extract two cores in a col — a saddle between two peaks — at about 6,000 metres above sea level. One sample measured 165 metres long; the other, 168 metres. The team then spent three days drilling a pair of shorter cores on the mountain’s south peak, at 6,768 metres above sea level.

Rumours that the scientists were actually a front for a foreign mining company began circulating on about 1 August. Social-media posts urged local leaders to demand that the researchers leave the mountain. The non-Peruvian members of the team were evacuated by helicopter on 5 August, leaving behind most of their ice cores.

On 11 August, Thompson’s team and representatives of Peru’s National Institute for Research on Glaciers and Mountain Ecosystems (INAIGEM), based in Huaraz, met with protestors from the town of Musho, who gave them three days to move the ice cores and equipment down from the mountain.

That task fell to Wilmer Sánchez Rodríguez, a project member from Peru and an intern at the American Climber Science Program in Eldora, Colorado, along with local climbers whom the researchers had hired as porters. On 13 August, they returned to the project’s staging area, an alpine hut, to begin retrieving 471 metres of cored ice from the col in

one-metre chunks. A government helicopter carried the last shipment of ice off the mountain on 18 August.

“Glaciers are political,” says Mark Carey, an environmental historian at the University of Oregon in Eugene who has studied the relationship between people and ice in the Cordillera Blanca.

### LINGERING SUSPICIONS

The Huascarán expedition was not the first in the region to be caught up in conflicts related to water scarcity, political manoeuvring and residents’ reverence for the mountains.

In 2016, people living near Carhuaz, Peru, destroyed an early-warning system for glacier outburst floods. The system had been installed in 2012, after an outburst flood from a lake in 2010 stopped just short of the town. But a subsequent drought exacerbated tensions over water rights. The people who attacked the network of microphones and cameras designed to detect ice falling into the lake blamed the equipment for keeping clouds at bay.

Local residents’ concerns about the expedition to Mount Huascarán are probably rooted in a number of factors. These include a desire to protect the mountain and reinforce territorial and water rights, fears about the effects of mining, and discontent over the distribution of revenue from the Huascarán National Park and tourism, says Benjamin Orlove, an anthropologist at Columbia University in New York City who studies Andean communities in Peru.

### BUILDING TRUST

He says that the people who destroyed the early-warning system near Carhuaz and those who protested against the ice-core drilling might also have felt that they did not benefit from the projects, even though both were designed to provide data that could help local people deal with the effects of melting glaciers.

To head off future conflicts, Gisella Orjeda Fernández, executive president of INAIGEM, is developing an outreach programme for communities in the Cordillera Blanca. Its goal will be to explain what scientists are studying in the mountains — and how such analyses could contribute to policies that benefit communities that depend on glacial meltwater.

The recent conflict was not the first time Thompson has faced sceptical local residents. Tribal leaders forced him to descend Jaya Peak in New Guinea in 2010, and in 1997 residents of Sajama, Bolivia, required that he donate to their library, hire local porters and participate in a ritual that involved sacrificing an alpaca before he could drill on Mount Sajama.

Thompson sees a positive side to communities’ protectiveness towards their peaks.

“Glaciers are sacred places,” he says. “If every mountain had a village that was trying to protect it, we wouldn’t have the environmental problems we have today.” ■

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Police officers escort scientists to a meeting with residents of the town of Musho in Peru.

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