



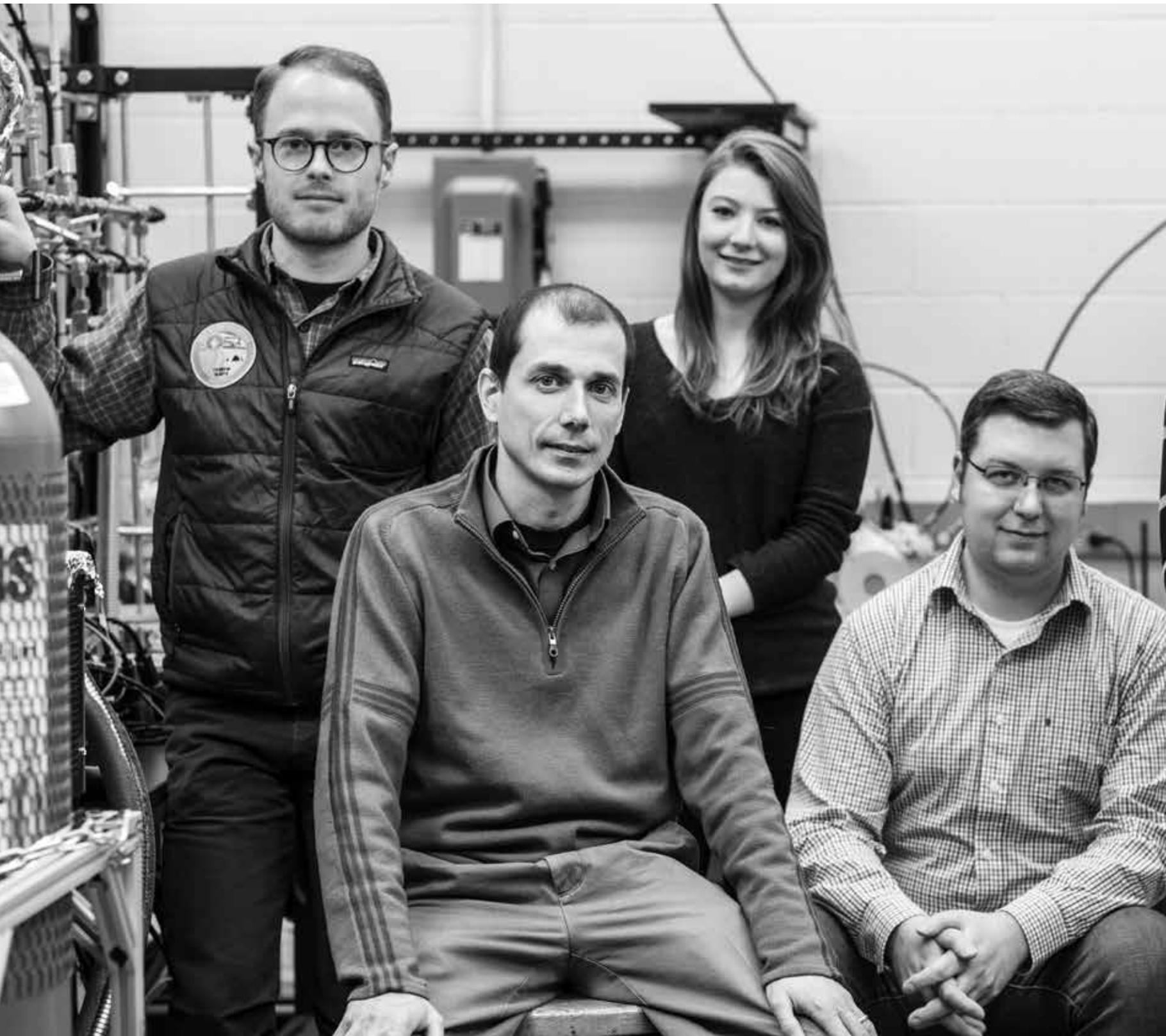
A N C I E N T



By Carlie Fishgold

ICE

A group of University of Rochester scientists is studying ice up to 800,000 years old to track ways global warming is affecting the Earth.



The Ice Core Team (left to right): Peter Neff, Vasilii Petrenko, Emily Mesiti, Philip Place, Benjamin Hmiel and Michael Dyonisius (not pictured).



In a modest office jutting off the brutalist brick building of Hutchison Hall at the University of Rochester, geologist Vasilii Petrenko sits behind a desk looking out at the Genesee River.

“It’s really different than the ice you’d see in the river, in the sense that it’s full of air bubbles,” he says, referring to glacial ice in Greenland and Antarctica.

Year after year (800,000 years if we’re talking Antarctica), snow compacts under its own weight forming strata that encapsulate the space—the air—between flake structures. “And these [ice cores] are perfect samples of past atmospheres.”

Petrenko, an assistant professor in the U of R’s department of Earth and environmental sciences, studies the dynamics of Earth’s natural climate system and how it works from the perspective of climate pasts. As a scientist, he says, the object of study is ideally examined in a well-controlled lab where one variable can be tweaked at a time. But with the Earth, he says, “We can’t do that.” The drilling and examination of glacial ice core samples from Greenland and now Taylor Glacier, Antarctica, allow scientists like Petrenko to hypothesize the continuity of spikes in global temperatures as anthropogenic (human-caused) and natural ecological shifts occur.

Per molecule, the greenhouse gas methane (CH₄) is about 25 times more potent than carbon

dioxide (CO₂). Considering contributions from different anthropogenic emittants today, methane is the second-largest contributor to the warming of the planet after CO₂.

“It has also been a factor in the past,” Petrenko says. “When temperatures are high, methane concentrations are high. When temperatures are low, methane concentrations are low. It reinforces the warming, and what we see is that there are these really rapid warming events, particularly in the northern hemisphere, that happen periodically, and a couple of these happened during the last deglaciation when the Earth was transitioning from the last glacial maximum, when Rochester was buried under a mile or more of ice.”

Measuring and mapping up to 800,000 years of past atmospheres on Earth provide researchers with a schematic view of what a balanced climate system looks like, how it acts, and how the planet reacts out of balance.

“The ultimate goal is to better understand the Earth’s climate system, and get a more predictive power for the future,” Petrenko says.

THE BLUES

Looking north from camp over the gorgeous blue ice surface towards the Asgard Range and Catspaw Glacier in Antarctica. The surface is not smooth and slick like an ice-skating rink. Instead, it is uneven and covered by thousands of mini-mountains called “sun cups,” formed primarily by sun and wind.







GETTING THERE

Researchers start out by flying commercial air from their home location to Christchurch, New Zealand, but the main mode of transportation for scientists and logistical support personnel to Antarctica is the C17 U.S. Air Force cargo jet. From Christchurch, where the U.S. Antarctic Program maintains a base of several airplanes, scientists such as Petrenko fly in the C17 to McMurdo Station. “McMurdo is kind of like a small town that has a lot of science going on, but it has a mechanical shop, a carpenter shop to support the science constructions, and a few other things. I’ve never seen tourists in McMurdo; it’s rare.” The U.S. Antarctic Program issues climate-specific clothing, like the red parkas required by the Air Force, for the flight to McMurdo.

HOME BASE

“This is the so-called ‘Big House,’” says Petrenko. “This is the main building at Greenland Summit station (summitcamp.org.) It’s a year-round research and atmospheric observation station at the top of the Greenland ice sheet. Some of our recent fieldwork was conducted near this station.”





BIRD'S-EYE VIEW

An aerial photo taken by kite at Taylor Glacier looks up-glacier (in the direction from which the glacier flows), featuring the living camp of Petrenko's research team. Like gumdrops, single-person sleeping tents dot the midground. "These are the kind of tents you take with you on a backpacking trip, maybe a little sturdier. You make sure you have really good sleeping bags, good padding to insulate from the glacier [beneath you]; you make sure you're eating well, staying hydrated ... We've never had anyone suffer from hypothermia or frostbite, but they're issues we need to make sure people are aware of to protect themselves." The largest tent in the foreground is the kitchen tent, and to the right is the yellow Taylor Glacier Scott tent toilet and the 55-gallon UG (urine-grey water) barrels. According to U of R's ice core expedition blog, liquid waste is disposed in the UG barrel. Solid waste is deposited directly into a 5-gallon bucket and sealed. Tightly. Waste is flown by helicopter to McMurdo Station and is then processed back in the U.S. Waste removal is not only environmentally kind but scientifically necessary.



GATHERING

Group meals at the table are a rare occurrence, but Christmas dinner is an exception. Petrenko says the main distinguishing characteristic of the food in Antarctica is there is a lot of it. “You need to eat to adjust because you’re burning more calories in the cold, so I eat about time-and-a-half of what I eat [at home].” A larger group of researchers requires a camp coordinator. “She was also the camp cook, and she was wonderful, making a lot of really nice meals ranging from meat, fish, and Indian curries. She lives in India for part of the year, so for these particular expeditions, the food was fantastic.” Smaller groups are responsible for their own meals. Fruit and vegetables are scarce because there is no space for storage, nor is fresh produce logical. “At the end of the day, we pour boiling water over dehydrated meals, like you buy at EMS, and wait 10 minutes: There’s your dinner. Frozen vegetables we have!” Petrenko says.



CAMP

Petrenko says adjusting to the bright Antarctic summer nights is easy with a blindfold and an oversized hat pulled over the face for warmth. “I generally sleep pretty well and enjoy camping. At this location, it can be difficult because it’s windy a lot, so if there’s a 30-mile-per-hour wind outside, it rattles the tent and it’s noisy. For that, I just use earplugs. The first night in a bed for me is at McMurdo Station and it’s great. You have a bed, a room that keeps temperature steady rather than fluctuating 20 degrees, there’s no wind. I sleep like a log. You could probably fire a cannon in the room.”



SELFIE

Photos are sometimes taken by kite or helium balloon for analysis of glacial folding, giving perspective on the age structure and surface of the landscape. UR Ph.D. student Michael Dyonisius, Sarah Shackleton of Scripps Institution of Oceanography in San Diego, and Swiss collaborator Bernard Bereiter take a selfie as they launch the balloon.



UNDERGROUND

Taking core samples of 241 millimeters in diameter (about 9.5 inches), the Blue Ice Drill can bore down about 100 meters (328 feet). Taylor Glacier is located in the Dry Valleys of Antarctica, where old ice remains on the surface, bare, with little to no melting, even during the summer season. Wind sweeps any snowfall, and the action of sun and wind keep the ice sublimating away over time. “We’re drilling into the surface of the glacier and identifying where ice of the correct age of interest is located, and we’ve identified how deep we want to go to get the ice,” says Petrenko.



DOWNTIME

Dr. Peter Neff, a UR postdoctoral researcher. “Near the end of the season, everyone is exhausted, and we typically just lay low on our days off—sleep in, cook a big breakfast, read books, watch a movie, take a nap,” Petrenko says. “We have to melt ice to get all our water. It’s a pretty Spartan camp, and we do not have the option of bathing or showering. The only somewhat heated place in camp is the kitchen tent, where this photo was taken. No laundry either. We are a tired, dirty, smelly bunch by the end of the field season, but usually with a good sense of accomplishment.”