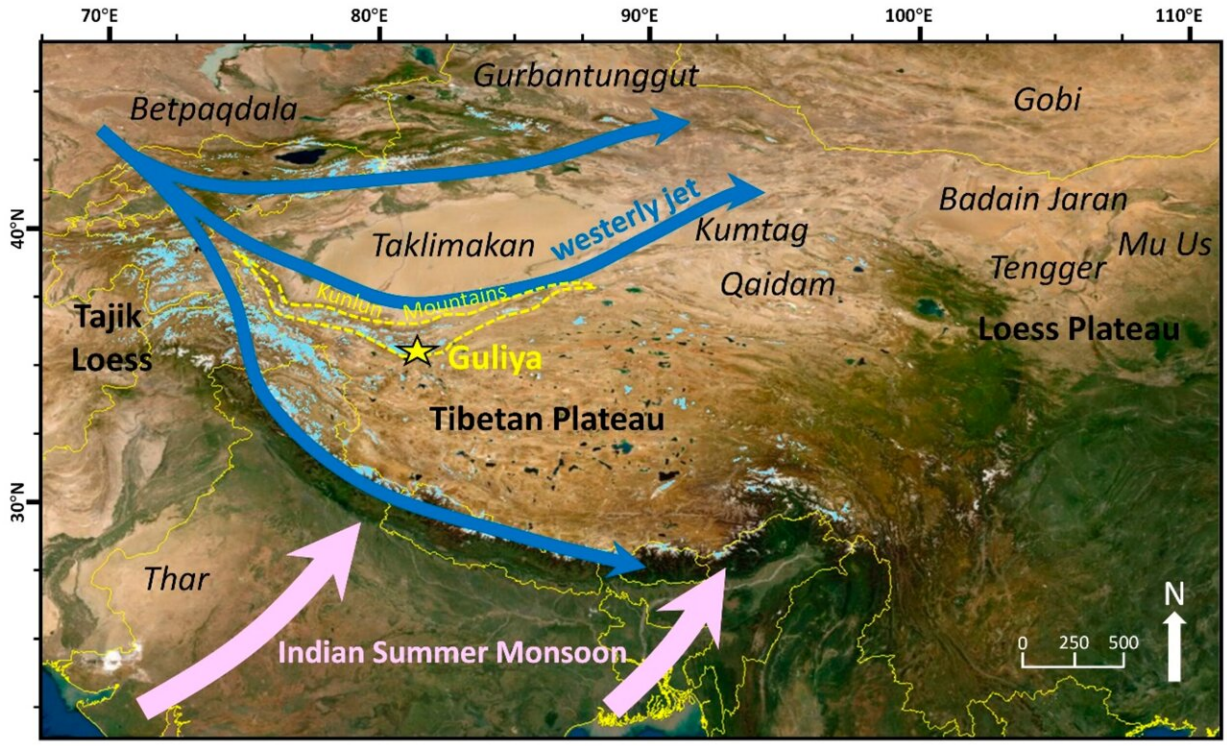
# Desert dust collected from glacier ice helps document climate change

November 14 2022, by Tatyana Woodall




Third Pole region with the location of the Guliya ice cap (yellow star) in the Kunlun Mountains (yellow dashed line), the main deserts and loess sub-regions. The arrows depict the trajectories of the main seasonal air masses that influence NW Tibet climate. (Source background image: ESRI, world imagery). Credit: *Geosciences* (2022). DOI: 10.3390/geosciences12100366

Researchers from The Ohio State University are using dust trapped in

glacier ice in Tibet to document past changes in Earth's intricate climate system—and maybe one day help predict future changes.

Their findings suggest that the dust composition in samples collected from different areas and depths of the same glacier can vary greatly, a discovery that hints that a complete dust record could offer up more secrets than scientists realize.

Dust stirred up by strong winds can cause a host of chain reactions in the atmosphere, affecting everything from human health and marine biochemistry to the balance of carbon dioxide in the atmosphere. How these microparticles affect the surrounding atmosphere is largely dependent on their size, shape and chemical makeup.

In a new study, recently published in *Geosciences*, researchers worked to help understand how dust affects climate—and is affected by it—through examining dust particles locked inside ancient ice, or what Emilie Beaudon, co-author of the study and a senior research associate at the Byrd Polar and Climate Research Center, calls "cryo-dust."

"By looking at dust composition through the ice, we can extract information about Earth's environmental condition at the time the snow was deposited and the ice was formed," she said. "We might be able to learn if it was a relatively dry or wet period or try to infer where the dust originally came from, and thereby obtain information on past atmospheric influences."

But researchers need a lot of ice to be able to collect that data.

Ice cores, cylinders of ice drilled from glaciers and ice caps, have long been used as comprehensive archives of Earth's climate system because of how well-preserved they are.

As layers of ice accumulate over seasons and years, aerosols accumulate within each new coating, eventually providing researchers with very detailed records of the planet's tumultuous climate history. With the help of these natural time capsules, scientists can learn about what the world looked like at the time, including aspects like greenhouse gas concentrations, as well as volcanic, solar and biological activity.

The ice researchers used in this study was collected from the Guliya Ice Cap in Northwestern Tibet, an area home to one of the largest atmospheric dust source regions in the Northern Hemisphere, second only to the Sahara Desert. Because the region is under the influence of westerly winds, much of the dust that it picks up gets blown toward big cities in East Asia, Beaudon said.

For instance, in 2021, China experienced its largest dust storm in a decade as the storm forced entire cities to take shelter, eventually raising concerns from the scientific community about the effects climate change is having on the frequency and intensity of such events.

But scientists don't have enough data to help identify how Central Asian desert dust is transported over long distances, nor how it changes over time. Studying a dust record from a Tibetan ice core is one of the only ways to provide a long-term perspective on the Central Asian dust cycle, Beaudon said.

In 2015, a team of researchers from the United States and China helped drill for ice cores from different locations at the Guliya ice cap, before shipping these cores back to the lab at Ohio State. Beaudon's team analyzed two of the ice cores, investigating the area's dust record by studying microparticles collected on filters from melted ice, as well as those trapped in typical ice subsamples. Beaudon noticed that the encased dust wasn't uniform; instead, each deposit was an unlikely array of different colors, sizes and layers.

"That's how the idea of trying to determine where the dust was coming from emerged because there were already so many visual cues that highlighted their differences," Beaudon said.

Beaudon's team also sought to discern whether most of the particles present in the ice came from the Taklimakan desert near the Guliya ice cap, or if it was carried there from other far-away locations.

"What we wanted to prove with these preliminary samples is that there is actual variability in their geochemistry and mineralogy," she said. "We found that it's not all the same dust coming from the same desert, and even in the same glacier, you don't always have the same material."

Overall, the study notes that the particularly old Guliya glacial dust archive is a prime candidate for deeper exploration, suggesting that in using additional ice core samples to develop higher-resolution dust records, Beaudon's work opens up many research avenues, including studying the microbial populations that exist inside the ice and feed on the nutrients cryo-dust carries within it.

Eventually, Beaudon envisions her work helping to investigate the glacial records of planets beyond Earth. "My goal is to acquire a lot of expertise in cryo-dust," she said. "If there are ever ice cores drilled or samples taken from Mars or any other planet, I hope to study them."

**More information:** Emilie Beaudon et al, Aeolian Dust Preserved in the Guliya Ice Cap (Northwestern Tibet): A Promising Paleo-Environmental Messenger, *Geosciences* (2022). DOI: 10.3390/geosciences12100366

Provided by The Ohio State University