In the Shadow of a Volcano

Around the world, volcanoes threaten nearly half a billion people. Scientists are working to better forecast when eruptions will occur.

In 2017, a volcanologist, a photographer, and a cartographer traveled to Guatemala on a National Geographic-funded expedition.

Their goal was threefold: to conduct innovative research that could help shape volcanic eruption warning systems; to create educational materials that explain the risks of living in the vicinity of a volcano; and to better understand what is appealing enough about these locations for communities to remain, despite the risks.

There's nothing quite like the thrill of going into the field for research. It's a kind of nervous excitement that just keeps building—through grant writing, planning, meticulously taking stock of the necessary gear, packing, hustling through the airport, and watching the ground race by below the plane. Then, finally, the arrival. I'm here—I've made it to Quetzaltenango, and the Santiaguito complex is waiting.

During this expedition, we planned to summit Santa María Volcano and investigate the hazards from an active Guatemalan volcano, monitor those hazards using photogrammetry techniques, and educate the local public about those hazards through a multifaceted media campaign.

Santiaguito is a complex of four lava domes that sit at the base of the Santa María volcano. Santa María is best known for its massive eruption in 1902; the event was devastating, decimating the surrounding area and killing thousands. It ended up being one of the largest eruptions of the century.

Since then, the magma below the surface has started to emerge in lava flows at the base of the volcano. Over time, these flows have accumulated into the four different lava domes present today: Caliente, El Brujo, El Monje, and La Mitad.

The domes have been erupting regularly over the past 100 years. Thankfully, these eruptions have been relatively minor. But the near-constant activity makes the complex an ideal place for research.

This expedition has the potential for some groundbreaking research. My team and I planned to explore the possibility of remote cameras and time-lapse photography to identify indicators of imminent volcanic activity.

Hundreds of thousands of people live near the domes. Another major eruption could be devastating to the communities living in this region. But, if our camera experiment worked, it could provide powerful, reliable tools for warning nearby communities when they need to evacuate ahead of an especially large eruption.

Why do people live so close to active volcanoes? Each time I travel to Quetzaltenango, I imagine what it's like to grow up so close to an active volcano. Santiaguito has small

eruptions each day, so it isn't a surprise when a huge cloud of water vapor and gas appears in the sky. For people who grew up in these communities, it's a part of life. Families have been living here for generations, and people depend on the land surrounding the volcano for their livelihoods.

Like all good expeditions, this one started with a hike. To collect scientific data on the volcanoes, we needed to get in the right position. I wanted to set up three cameras overlooking the lava dome complex—to do that, the team needed to get above them.

At first light on November 12, we laced up our boots, shouldered our packs, and began our ascent of Santa María.

The scenery was incredible, complete with tranquil, foggy woods that opened onto sweeping views of the world stretched out below. We climbed over 5,000 feet to the summit. Throughout the hike, we ascended through variable microclimates, terrain, and weather. It was a long, intense trek, but, as I sat perched at the top, I knew it was completely worth it.

With camp set up, our next task was to get the cameras into position. Each one needed to collect a different view of the same portion of the lava domes, and they had to be close enough together that the remote trigger fired them simultaneously.

The clouds would be our biggest challenge, though. This high up, they can completely obscure the view of the domes for days at a time. With limited food and water supplies, time was of the essence. The clouds made for beautiful photos, but they were not so great for data collection.

A break in the clouds. After a turbulent night of wind and rain, I woke up and peeked my head out of my tent to check the conditions. In the predawn light, I could see the valley below our basecamp—the clouds had lifted. To my excitement, the domes that were once obscured were now visible. I quickly sprang into action to sync the cameras so they would start recording photos in case there was an eruption.

To ensure we collected the proper scientific data, I had to check the cameras every few hours to make sure they had enough power and space to keep taking continuous images of the dome. With a radio coordinator synced to three cameras, they could simultaneously take a photo at the same time every 5 seconds. That created synchronous image sequences for use to monitor the eruptive behavior of the dome explosions. The photogrammetry was working without a hitch.

After setting up all the cameras, it was time to wait for an eruption to occur. During one of my camera checks, I realized I was being watched by a blue and green lizard. It was basking in the sun on a nearby rock. It didn't seem bothered by my presence, and I watched until it ran off into the brush. Volcanoes may seem lifeless, but, in actuality, they're home to many species that have adapted to this ecosystem.

The first eruption of the active Caliente dome was impressive—it rose nearly 3,000 feet into the air. The excitement of our team was palpable as we photographed it and stood in awe of the power and might of the volcano below us.

The next three days at the summit were full of documenting the volcano and managing the photogrammetry equipment. By day three, our food and water supplies were beginning to run low; it was time to return to Quetzaltenango. We journeyed down the volcano with over 20,000 photos of the volcano to be used for scientific research.

Back in Quetzaltenango, it was time to start the next phase of our expedition. I wanted to share our research with the communities that live in the shadow of the volcano.

We set to processing the images from our journey up Santa María and crafting a photo exhibit to share the research and risks of living so close to active volcanoes.

We found a local printer to create print enlargements that would communicate the work of the project. After a week of processing images and finalizing a venue for the exhibit, we were ready to print the images.

The monthlong journey was a success. Our results indicated that local volcanologists in Guatemala could employ this photogrammetry method to monitor changes of the lava dome, as it is a relatively inexpensive method. The data could be used to monitor surface changes of the dome and explosions, as well as slope stability, which will help reveal the volcano’s behavior and therefore inform forecasting eruptive activity.

Through this research, we introduced a new method of monitoring active volcanoes to the science community and made meaningful connections with the local Guatemalan communities.