Deadly Eruption Yields Prediction Clues

José Arlez Zapata and Fernando Gil Cruz/ Observatorio Volcanológico del Sur

Gases escaping from the Galeras volcano.

When volcanologist Stanley N. Williams visited Colombia's Galeras Volcano last year, he had no idea that burning chunks of rock would soon shoot from the crater, severely injuring him and killing nine people standing nearby. But from this tragedy, Williams and several colleagues have discovered geological clues that can help scientists foretell when pressures inside a volcano are reaching a critical level, according to research results they report this week.

"If we could have recognized this pattern, there might have been a chance [last January] to say it was too dangerous to go into the volcano. But we hadn't seen this pattern before," says Tobias P. Fischer, a graduate student studying with Williams at Arizona State University in Tempe. Fischer, Williams, and their colleagues discuss their work in the March 10 NATURE.

The volcanologists made their discovery by comparing earthquake behavior with the amount of sulfur dioxide gas that Galeras emitted prior to last year's Jan. 14 and March 23 eruptions. The researchers noticed a relationship between the gas releases and a particular type of tremor that has long-period seismic waves.

According to theory, volcanoes produce these long-period quakes when pressurized gases flow through underground fractures, setting up vibrations much like the clanging in water pipes. Over the last decade, researchers have gradually come to realize that swarms of long-period tremors often herald an eruption.

Indeed, such jolts shook Galeras before the fatal field trip last year, but the number of quakes was much lower than it had been, providing a false sense of security. "Basically, we were not worried at all about the volcano," Williams told SCIENCE NEWS.

When Fischer examined data for last year, however, he observed that three distinct phases preceded the eruptions. In the first period, roughly 6 weeks before the blasts, Galeras began releasing more sulfur dioxide than usual, indicating that gases were flowing unimpeded to the surface. Researchers can measure such gases remotely with a spectrometer because sulfur dioxide blocks ultraviolet rays from the sun.

In the second stage, a few weeks after the initial gas surge, emissions fell, while the energy of long-period quakes increased. These two trends suggest that fractures had started to close, reducing the gas leakage and increasing the pressure within the volcano.

During the final phase, the energy of long-period tremors dropped, signaling that the fractures had sealed completely and that gas could no longer escape. The internal pressure increased until it blew out the rocks that plugged the inner crater.

Volcanologists have monitored earthquakes and gas emissions at dangerous volcanoes for over a decade, but this study was the first to compare the two and decipher a distinct pattern, says Fischer. He suggests that researchers can better monitor the pressure within a volcano by tracking gases and seismicity.

Scientists studying other eruptions are finding similar, although not identical, patterns. At Mt. Pinatubo in the Philippines, for example, sulfur dioxide emissions did drop before the June 1991 eruption, even as the energy of long-period quakes increased, according to Christopher Newhall of the U.S. Geological Survey (USGS) in Seattle.

But Alaska's Mt. Redoubt showed no gas changes prior to erupting in 1989, says Bernard A. Chouet of the USGS in Menlo Park, Calif. Although volcanologists may identify precursors of some eruptions, Chouet warns that they cannot bank on seeing the same changes before all blasts. "Every volcano is going to have its own personal behavior," he says.

At Galeras, Williams and others intend to watch closely for any repeats of the past pattern. Although the recent eruptions there were minor, Williams worries that a much larger blast could occur. Almost 400,000 people live within 7 kilometers of the active crater, and their houses sit atop old volcanic flows. It was this danger that spurred researchers to gather there last year to discuss Galeras.

— R. Monastersky

Asteroid 243 Ida: A moon of its own?

Ida appears to have a friend.

An image of the asteroid 243 Ida, being radioed piecemeal to Earth by the Galileo spacecraft, indicates that the rocky body has a tiny moon orbiting it. If confirmed when Galileo finishes transmitting the image late this month, this would be the first moon of an asteroid ever detected.

During a brief photo session with Galileo last August, Ida became the second asteroid ever to be imaged from space (SN: 11/6/93, p.300). But because the craft's main antenna never fully opened, Galileo couldn't radio the pictures immediately. Instead, it stored them on a tape recorder for transmission later at a much slower rate by a less powerful antenna.

One complete image, a high-resolution portrait of the 56-kilometer-long asteroid received in September, gave no hint of a moon. But parts of a second, lower-resolution image reveal an intriguing feature.

Galileo began sending this image 3 weeks ago. The trickle of data received so far — thin, widely spaced strips of the full picture — shows a bright area distinct from the asteroid. This bright patch appears to be sunlight reflecting off a neighboring body, probably a moon of the asteroid, says Galileo project manager William O'Neil of NASA's Jet Propulsion Laboratory in Pasadena, Calif.

He says it's less likely, though possible, that the body, instead of orbiting Ida, simply happened to pass near the asteroid during Galileo's flyby. The size and proximity of the body to Ida remain unknown.

O'Neil notes that researchers think the patch is real because two instruments aboard Galileo, the solid-state imaging camera and the near-infrared mapping spectrometer, both indicate the same feature. "It's not a surprise," he says, to find that an asteroid has a moon. But until the Galileo encounter, O'Neil adds, astronomers had no way of detecting a moon in the asteroid belt, the doughnut-shaped region between the orbits of Jupiter and Mars in which Ida resides. Ida lies at the outskirts of the belt, near Jupiter.

— R. Cowen