

his colleagues remeasured that site, they found the tundra releasing CO<sub>2</sub>.

Temperatures in northern Alaska have risen in recent decades and may have precipitated the change measured by Oechel by drying the tundra and stimulating microbes in the peat. "I personally feel we're seeing the first effects of greenhouse warming," he says. "But even if that's not the case, it gives us indications of how ecosystems will perform when and if that warming occurs."

If tundra across the Arctic were releasing as much CO<sub>2</sub> as Oechel measured in northern Alaska, it would produce roughly 5 percent of the amount that humans emit through burning coal, gas,

and oil. Oechel plans to make measurements this summer in Russia.

Jonathan T. Overpeck of the National Oceanic and Atmospheric Administration in Boulder, Colo., calls the pair of new studies a one-two punch: "Anyone who is going to say you can't believe the modeling stuff because it's so oversimplified better wake up when they see the numbers coming from the tundra."

Yet some tundra scientists remain unconvinced that the tundra has stopped storing CO<sub>2</sub>. "I wouldn't put any significant money of my own down to say that it has changed much," says Donald Schell of the University of Alaska in Fairbanks.

—R. Monastersky

## First direct measure of volcano's blast

Since Japan's Unzen volcano awoke in 1990 from a 200-year repose, lava has oozed from a vent on its eastern slope, forming an unstable dome that looms menacingly over towns below. Periodically, part of the dome shears off or collapses, releasing a cascade of debris with explosive force.

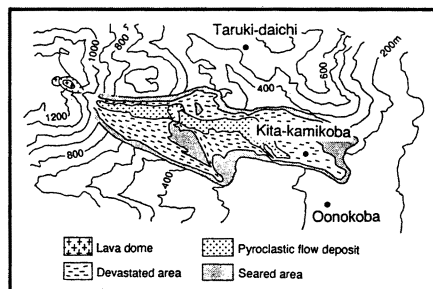
Volcanologists yearn to measure directly the energy released during such volcanic events. But such close-up, detailed observations pose extreme danger, and the fury unleashed by a dome collapse can turn expensive instruments into scorched, shattered hulks.

Now, using a simple, rugged device designed to gauge military munitions and other explosives, Japanese scientists have achieved the first direct measurement of the energy released during a volcanic blowout. Volcanologist Hiroimitsu Taniguchi of the Science Education Institute in Osaka and geologist Keiko Suzuki-Kamata of Kobe University report their findings in the Jan. 22 *GEOLOGICAL RESEARCH LETTERS*.

The researchers measured the shock wave created by a dome collapse on June 8, 1991, and then calculated the pent-up energy required to generate it — the equivalent of about 12,000 tons of TNT. Previously, volcanologists relied on more approximate measurements. In one widely used method, researchers locate a chunk of debris and calculate the energy required to hurl it from the volcano to its landing place.

To make their measurements, Taniguchi and Suzuki-Kamata set up three meters within the volcano's destructive range. The pressure-sensitive part of the meter consists of a hollow chamber about two inches wide, covered with a thin lead plate. The sensor is mounted on a sturdy pole driven into the ground.

The researchers calculated the June 8 shock wave at 75 meters per second at the source on the basis of how severely the wave deformed the lead plate as it passed the meter at Taruki-daichi, a town



Researchers placed meters in three towns near the eastern slope of Unzen to measure directly the energy released by a lava dome collapse.

2,700 meters northeast of the lava dome. That's powerful enough to knock over a person standing in Taruki-daichi, they report.

The new method of measuring may reduce inaccuracies, says Richard B. Waitt, a volcanologist at the U.S. Geological Survey's Cascades Volcano Observatory in Vancouver, Wash. "It's a far more direct means of [making measurements]," he says. "This allows some calculations as to what the volcano is capable of."

Unzen has proved capable of quite a lot. The blast that the Japanese researchers measured came just five days after a massive flow of hot ash and debris from a dome collapse killed 43 people in Kita-kamikoba, a town directly in the firing line of the volcano's east-facing vent.

Direct measurements of volcanic blasts may provide a means of checking the theoretical models some volcanologists have created to explore the physics of crumbling lava domes, says volcanologist Jonathan H. Fink of Arizona State University in Tempe, who helped develop such a mathematical tool.

"It's interesting that the number these [researchers] came up with — 75 meters per second as the maximum velocity — is well within the range that we would calculate based on the model," Fink comments.

—D. Pendick

## Suicide signs loom in pair of surveys

Two new studies provide behavioral clues to the likelihood of attempting or completing suicide among members of two disparate groups: predominantly white, middle-aged nurses and teenagers of both sexes and varied ethnic backgrounds.

Among nurses tracked for 12 years, suicides rose markedly as cigarette smoking increased. And in a large sample of students in public high school, a particularly strong association emerged between thinking about or attempting suicide and committing aggressive acts such as carrying weapons and fighting.

Both studies, and a comment on the findings by psychiatrist David Shaffer of the New York State Psychiatric Institute in New York City, appear in the February *AMERICAN JOURNAL OF PUBLIC HEALTH*.

No decisive explanation exists for the connection between cigarette smoking and suicide, concludes a scientific team headed by David Hemenway, an epidemiologist at the Harvard School of Public Health in Boston. The researchers consider it unlikely that smoking causes suicide in any direct way. However, they note that smokers suffer increased rates of alcoholism and cancer, both of which boost the risk of carrying out a suicide, according to previous studies.

Independent data indicate that common genetic factors may predispose some people to both cigarette smoking and severe depression; the latter poses a major risk of suicide (*SN*: 1/30/93, p.71).

Hemenway and his co-workers studied more than 100,000 female registered nurses, age 30 to 55, living in 11 states. Participants completed questionnaires mailed every two years from 1976 to 1988. The researchers obtained death certificates for volunteers who died during the study; these documents provide a conservative estimate of the number who killed themselves.

Compared with those who had never smoked, women who smoked one to 24 cigarettes daily displayed twice the likelihood of committing suicide, and those smoking 25 or more cigarettes daily exhibited four times the likelihood of committing suicide, Hemenway's team contends.

The analysis did not consider other factors linked to suicide, such as alcoholism and depression, but it stands as a rare long-term study of the relation between a specific behavior and subsequent suicide, Shaffer asserts.

The second study, directed by epidemiologist Carol Z. Garrison of the University of South Carolina in Columbia, relied on questionnaires completed by 3,764 students in grades 9 through 12 regarding their behavior in the year prior to the survey. Youngsters attended public