animals. Analysis of radioactive isotopes in the lava suggests the eruptions occurred between March 26 and April 6.

The discovery of recent lava flows now gives researchers the opportunity to track post-eruptive changes, says Jean-Christophe Sempere of the University of Washington in Seattle. "People are very excited, and there is a big push from investigators from various disciplines to work together to study the evolution of this piece of midocean ridge," he says. For instance, some scientists will check to see how long it takes organisms to establish colonies on newly formed lava.

This region of the Pacific midocean ridge draws considerable scientific traffic. In January, the international Ocean Drilling Program will attempt to bore into a ridge section just 25 kilometers north of the part that erupted. Scientists are also planning to dive at the eruption site in March.

Although Haymon and her colleagues didn't expect to find an eruption in progress, she says previous work by others had hinted that the site was active. In the 1970s, sonar surveys suggested that magma had risen close to the seafloor there, causing this section of the ridge to bulge upward.

"We're wising up to ways that can pinpoint the regions most likely to be active," she says. *– R. Monastersky*

Bikes: The helmet's value

Though head injuries are the leading cause of bicycle-related deaths, fewer than 10 percent of U.S. bike riders wear helmets. In the Dec. 4 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, the Centers for Disease Control (CDC) offers the first estimate of the U.S. toll taken by this failure to don head protectors: one death daily and another head injury every 4 minutes.

In reviewing five years' worth of data from two national registries of health statistics, CDC researchers identified 2,985 bicycle-crash fatalities involving head injuries and 905,752 nonfatal, bicycle-related head injuries. Based on the reduced risk of head injury documented among bicycle-accident victims wearing helmets, Jeffrey J. Sacks and his CDC co-workers conclude that between 1984 and 1988, helmet use by all U.S. bicyclists "could have prevented as many as 2,500 deaths and 757,000 head injuries" – primarily in children.

Childhood deaths from bicycling roughly match the death rate once associated with a bacterial meningitis known as "H. flu," notes Barry D. Weiss of the University of Arizona in Tucson. "While we now immunize all [U.S.] children against *H. influenzae*, we do little or nothing on a national level about bicycle-related deaths," he writes in an editorial accompanying the report. □

Uranium displays rare type of radioactivity

The rarest of all observed radioactive events involves the simultaneous decay of two neutrons within an unstable atomic nucleus to form two protons, accompanied by the emission of two beta particles (electrons) and two neutrinos. Now researchers have added the isotope uranium-238 to the handful of nuclei known to display "double-beta" decay.

Measurements of uranium-238's double-beta decay rate, however, indicate that this unusual process occurs about 100 times faster than predicted by calculations based on conventional theory. These results, if correct, suggest two possibilities: Either neutrinos, normally assumed to have no mass, actually have a certain mass, or theoretical calculations of the decay rates of heavy nuclei are somehow flawed.

"It's a very difficult calculation," acknowledges George A. Cowan of the Santa Fe (N.M.) Institute, a member of the team that made the uranium-238 measurements. The explanation of the results depends largely on "what error you should attribute to the theoretical calculations," he says. "If you take the error to be small, then the [experimental] results are surprising, and the theory permits you to account for a [faster rate] by giving the neutrino a mass."

Cowan and co-workers Anthony L. Turkevich and Thanasis Economou of the University of Chicago report their findings in the Dec. 2 PHYSICAL REVIEW LETTERS.

Like many unstable nuclei, uranium-238 normally decays by ejecting an alpha particle, thereby transforming itself into thorium-234, which has two fewer neutrons and two fewer protons. When double-beta decay occurs, uranium-238 turns into plutonium-238, leaving the total number of neutrons and protons in the nucleus unchanged.

To detect this extremely rare type of radioactivity, the researchers first had to find a uranium sample uncontaminated by human-made sources of plutonium-238, such as fallout from atmospheric nuclear explosions and residues from processing plutonium-238 for use in power generators on spacecraft.

"It's easy to find extraneous sources of plutonium-238," Cowan says. "You have only to go out and process a certain amount of soil in your backyard, and there's enough there to give you a signal."

Indeed, excessive contamination halted the original experiment to detect double-beta decay in uranium at the Los Alamos (N.M.) National Laboratory. The researchers then turned to a long-forgotten, pure supply of a uranium compound known as uranyl nitrate that had been stored undisturbed and protected from contamination for 33 years at the University of Chicago.

In 1956, "we had some money left over in one of our contracts, and we bought some uranyl nitrate, then forgot about it," Turkevich says. After abandoning the Los Alamos effort, "we remembered this sample."

Working with 8.47 kilograms of the pure uranium salt, the researchers extracted and purified the plutonium present in the sample. By counting the number of alpha particles of a certain energy emitted by the purified plutonium, they could determine the number of plutonium-238 atoms present in the sample. Assuming that those nuclei represented the products of double-beta decay, the team could estimate the rate at which double-beta decay occurs in uranium.

Turkevich and his colleagues found a decay rate of about 0.1 count per day, which corresponds to a half-life for double-beta decay in uranium-238 of 2×10^{21} years. That rate is roughly 100 times greater than the best theoretical estimate to date, Turkevich says.

"If this is true, it's a very interesting result," says Michael K. Moe of the University of California, Irvine, whose group in 1987 became the first to observe double-beta decay in the laboratory. Their experiments involved the isotope selenium-82.

However, Moe adds, theoretical calculations usually predict faster double-beta decay rates than those actually observed. Because the newly observed rate is considerably faster than the predicted rate, Moe suggests that Turkevich and his co-workers may have overlooked some background sources of plutonium-238 that would contribute to the observed decay rate.

"We took great pains," Cowan says. "We did the most careful background measurements we could. We tried to eliminate all extraneous sources of plutonium-238."

If both theory and experiment are correct, the observation of a faster decay rate implies that the neutrino has a mass, expressed in terms of energy, of about 14 electron-volts. This mass, however, is nearly 10 times larger than the value obtained from recent observations of double-beta decay in germanium-76.

Turkevich and his colleagues are now considering repeating their experiment. They recently learned of a supply of uranium left over from Germany's effort to develop nuclear weapons during World War II. Sealed up and stored for decades in Vienna, this uranium would likely be free of contamination from radioactive fallout.

"If we can find the resources to repeat the experiment, they've offered to let us have the uranium," Turkevich says. "We can't think of anything we've done wrong, but it would be good to try to repeat the experiment." *– I. Peterson*