

Seismic Risk: When Less Means More

Anyone who has lost a battle with a slippery bathtub or an errant kitchen knife knows all too well that most accidents occur at home. Seismologists may now have to apply that maxim to earthquake hazards in Seattle, Portland, Vancouver, and surrounding areas.

Researchers in the Pacific Northwest spent the last decade focusing on the potential for huge quakes occurring off the coast, some distance from the major urban centers. These megaquakes remain a concern, but smaller shocks closer to the population centers may present an equal, if not greater threat, suggest studies reported last week at a meeting of the Seismological Society of America in El Paso, Texas.

For major northwest cities, "the strongest ground shaking will probably come from [a] nearby earthquake occurring on a crustal fault," says seismologist Ivan G. Wong of Woodward-Clyde Federal Services, a consulting firm in Oakland, Calif. Wong reached this conclusion after estimating how severely different types of quakes would shake Seattle.

Quakes in the Pacific Northwest fall into three categories, all driven by a sub-surface plate tectonic collision that stretches from northern California to southern British Columbia. Known as the Cascadia subduction zone, this region marks where a patch of ocean floor is diving beneath the western edge of North America, an act called subduction.

Until the mid-1980s, seismologists believed that the bending of the ocean plate accounted for most of the region's quake hazard because the two major Washington State jolts this century came from 60 kilometers below the surface. Although such shocks in 1949 and 1965 caused major damage, their depth limited the strength of shaking.

In the last decade, researchers discovered that great tremors of magnitude 8 to 9 also have walloped the region repeatedly, although not since the advent of written records there. These so-called subduction quakes originate offshore where the ocean plate scrapes beneath the edge of North America.

A third type of quake attracted attention in 1992 after geologists found a fault running right through Seattle that caused a major jolt 1,100 years ago.

Wong studied the triple threat by modeling the peak shaking in Seattle from three quakes: an offshore subduction quake of magnitude 8.5, a magnitude 7.5 shock 60 km beneath the city, and a magnitude 7.0 shock only 3 km under Seattle. The smallest quake produced the greatest shaking because of its proximity, a

conclusion bolstered by the destructive magnitude 6.8 quake directly under Kobe, Japan, in January.

While shallow, nearby shocks can cripple a city, seismologists in the Pacific Northwest remain unsure where such tremors might strike or how often. At the meeting, Garry Rogers of the Geological Survey of Canada in Sidney, British Columbia, noted that three major crustal quakes have occurred on either side of the border in last 150 years, a rate of one every half-century.

But measurements of small earthquakes in the region suggest that major shocks should come far less frequently. "These quakes are the biggest unknown in trying to get a handle on seismic hazard here," Rogers says.

In contrast, researchers have a better sense of the threat from subduction quakes but nevertheless debated at the meeting whether a giant one will hit anytime soon. Dieter H. Weichert of Canada's Geological Survey has analyzed the regularity of megaquakes by studying deposits of offshore debris flows. Such slides occurred when giant quakes destabilized sediments that had built up



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over the centuries in ocean canyons. The thickness of each debris layer reflects the time between successive quakes, he contends.

The technique suggests that massive shocks hit much more regularly than previously thought. For the last 13 quakes, the interval between jolts averaged 590 years, with the shortest span measuring roughly 435 years. Since the last quake occurred around A.D. 1700, Weichert concludes the risk of another giant one anytime soon is low, perhaps only 10 percent in the next 2 centuries.

Thomas H. Heaton of the U.S. Geological Survey in Pasadena disagrees. "In other parts of the world, it's hard to make a case for regularity. There are enough really amazing exceptions." — R. Monastersky

Baby's AIDS virus infection vanishes

Why do some 75 percent of infants born to women with the AIDS virus fail to acquire their mother's infection during her pregnancy? A provocative new report suggests one possible answer: Many of the children may have hosted the virus briefly, only to eventually clear it from their systems.

There have been sporadic reports of infants who showed signs of HIV, the AIDS-causing virus, at birth but failed to exhibit the virus when tested again, months later. However, many AIDS researchers dismissed such accounts, arguing that the initial positive report likely resulted from laboratory error.

Now researchers at the University of California, Los Angeles, School of Medicine report unambiguous evidence of a boy who tested positive for HIV twice — at 19 days of age and 1 month later. Yet by every measure, this kindergartner appears to have been HIV-free for at least 4 years, report Yvonne J. Bryson and her colleagues in the March 30 *NEW ENGLAND JOURNAL OF MEDICINE*.

To rule out the possibility of lab errors, her team analyzed DNA sequences from the protein envelope around the HIV that researchers had cultured from the infant's blood during both the early

tests. For all practical purposes, the two samples of virus appeared identical, the UCLA team notes.

Because the hospital never kept samples of the mother's blood from the time of her son's delivery, the researchers attempted to match the infant's HIV to the virus circulating in his mother 1 year later. And even though the virus can mutate quickly inside its host, the boy's HIV matched one of the forms that his mother carried.

Overall, Bryson's team concludes, when the DNA sequencing and genetic typing of the HIV samples are taken together, "it is highly likely that [the virus] found in the infant originated from his mother." Moreover, they add, the fact that the child carried the virus for almost 2 months suggests his infection had been active.

In an accompanying editorial, Kenneth McIntosh and Sandra K. Burchett of Children's Hospital in Boston argue that the current report suggests that at least some previous reports of HIV clearance in infants were correct. If so, they add, it may prove possible to design an immunology-based approach to thwart HIV's transmission from mother to baby.

— J. Raloff