

back positive, she was isolated, and David began speaking to her through a window near her bed. He did not develop Ebola.

An Ebola outbreak in Uganda in 2000, which Bausch helped bring under control, yielded some clues about the risks that infected people pose. Bausch and co-workers studied samples from 26 patients. In acute cases, the virus turned up most often in saliva but was also present in stool, tears, nasal blood, and breast milk. Although their sample sizes were small, the team did not find it in sweat or urine, and Bausch says he doesn't think people well enough to walk around the streets secrete the virus in those fluids—which means something like a handshake probably presents little risk. In one recovered patient, the virus turned up in semen 40 days after the onset of his disease.

Bausch says other studies have clearly shown that sicker people have higher viral levels. Corpses have the highest levels of all, and the virus “will seep into other tissues to saliva or sweat,” he says, putting family members and burial teams at risk. Environmental surfaces—unless they're “grossly contaminated with blood”—are unlikely sources of transmission, he says. “It's not jumping off the walls or hanging around when there's not infectious bodily fluid there.”

Rigorous training can bring down the risk of infection. Doctors Without Borders (MSF), which literally has written the book on operating an Ebola treatment unit, has so far had only one worker contract the disease despite taking care of the majority of patients in this epidemic. Last week, the U.S. Centers for Disease Control and Prevention (CDC) held the first of what will be many 3-day training courses in Anniston, Alabama. It took place at an old Army base where working conditions resemble those in the affected countries, including a hot climate with no air conditioning. CDC's Michael Jung, who is leading the program, says nearly every trainee had breaches of protocol, such as skin showing. Bausch attended the session, along with MSF staffers, to share some firsthand stories.

Adequately staffing Ebola treatment units also helps reduce the risk. At the training, Bausch recounted his work as one of two doctors in a 55-bed treatment unit. “You go into that ward and there are probably five or 10 patients who have fallen out of bed or are in delirium and have crawled out, there's blood and vomit and diarrhea everywhere,” he says. “And there's no one with a sprayer behind you cleaning it up.”

Still, when everything is done right, working in an Ebola treatment unit need not be a life-threatening endeavor, Bausch stresses. “Otherwise, I wouldn't do it myself and it wouldn't be ethical for me to counsel other people to do it.” ■



Tsunami waves ravaged Taro, Iwate, Japan; was a massive undersea landslide to blame?

## GEOSCIENCE

# Double-whammy tsunami?

Japan's 2011 quake may have had a hidden accomplice

By Roland Pease

**O**n 11 March 2011, a magnitude-9 earthquake jolted northern Japan and sent a devastating tsunami sweeping down the coast, overwhelming seawalls with a surge more than 10 meters high. Along one 100-kilometer stretch of mountainous coastline called Sanriku, however, the incoming waves reached 40 meters. Those monstrous waves claimed about a quarter of the tsunami's 18,000 victims, yet experts have struggled to explain them.

Now, an international team of researchers says its computer models suggest a previously unsuspected answer: An under-water landslide the size of Paris combined with waves from the quake to deal the coast an extra-deadly blow. But others say they'll need stronger evidence to convince them.

Geoscientists have long known that undersea landslides can trigger tsunamis. But most saw no evidence that one had accompanied the 2011 quake. Instead, seismologist Kenji Satake of the University of Tokyo's Earthquake Research Institute proposed that an undetected second earthquake, involving a thin sliver of crust, had struck north of the main submarine thrust.

But Stephan Grilli, an oceanographer at the University of Rhode Island, Narragansett Bay, says fault movements don't jolt the sea surface in the right way to focus a band of waves as narrowly as at Sanriku. In the new study, he and colleagues worked back from details of the water motion recorded by gauges along the Japanese shore on the day of the earthquake to infer the ocean floor disturbance responsible. They conclude that a slab of sediment measuring 20 by 40 kilometers and up to 2 kilometers thick slid

about 300 meters down the steep slope of the Japan Trench, “acting like a piston.”

Grilli estimates that the slump must have happened near the northern end of the 2011 rupture, 170 kilometers from the Japan shore, and under 4.5 kilometers of water. A co-author, marine geologist David Tappin of the British Geological Survey, compared Japanese seafloor maps from before and after the earthquake and saw signs of just the right kind of slump in the target area. The team's paper is in press at *Marine Geology*.

The authors make a good case but are far from proving it, says Costas Synolakis, a tsunami expert at the University of Southern California in Los Angeles. Synolakis collaborated with Tappin and Grilli on previous studies that showed a similar slump caused a deadly 1998 tsunami off Papua New Guinea. This time, however, he worries the researchers are fixated on details of the tsunami modeling at the expense of the big picture. “Anyone who thinks you can model the behavior of a tsunami to better than a factor of 2 is crazy!” he says. A detailed survey of the sea floor would settle the case, he says. Satake, however, maintains that his two-quake explanation is adequate and that the existing seafloor mapping reveals nothing.

If a submarine landslide was responsible for the Sanriku surge, “then it's a game-changer,” says team member Robert Geller, a seismologist at the University of Tokyo. Geller has long criticized as unscientific the Japanese earthquake-forecasting program and hazard maps based on it. If towering tsunamis can also be produced by collapses along the Japan Trench, he says, there's little hope of anticipating the next one. ■

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