Taiwan quake floods scientists with data

As residents of Taiwan try to piece together their lives in the aftermath of last week's catastrophic temblor, scientists are starting to sift through mountains of seismic recordings that promise to make this event the most closely documented earthquake in history.

"It is probably the best data set ever collected for an earthquake," says Lucile M. Jones, a seismologist with the U.S. Geological Survey in Pasadena, Calif.

"It's almost like a gold mine in terms of instrumental recordings," agrees Ta-Liang Teng, a seismologist at the University of Southern California in Los Angeles.

In 1990, Teng helped persuade Taiwan to spend $40 million in setting up a nationwide network of more than 1,000 seismic recording instruments, a system unparalleled elsewhere in the world. The Taiwanese Central Weather Bureau completed the network in 1996, with some critics saying that decades would pass before it recorded a direct hit from a major tremor.

At 1:47 a.m. on Sept. 21, the magnitude 7.6 earthquake struck the heart of the network, near the city of Chi-Chi at the center of the island. Within 102 seconds, the seismic system determined the quake's location, size, and basic characteristics, according to data from the Central Weather Bureau. The information was published on the Internet by William H.K. Lee of the USGS in Menlo Park, Calif., who formerly managed a seismic network for USGS and also played a role in setting up the Taiwanese system.

The web of instruments on the island follows a strategy different from that of traditional networks in the United States. Designed largely by seismological researchers, the U.S. networks in California and other parts of the country were built to capture all earthquakes, powerful and puny. To record distant tremors, seismologists must install their instruments in quiet sites far from traffic, waves, and other sources of vibrations unrelated to earthquakes.

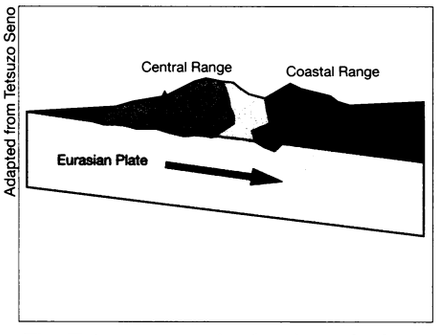
The Taiwanese system, in contrast, puts most of the instruments in urban areas to record how different parts of cities shake during quakes. The network consists mainly of so-called strong-motion instruments that don't stop recording even in the most violent shaking, unlike traditional ultrasensitive seismometers. The Taiwanese network also has 50 sets of recorders placed in buildings and on bridges to determine how these structures fare during earthquakes.

The result is that Taiwan has the densest coverage of strong-motion instruments in the world. Although only about one-tenth the size of California, the island has more strong-motion recorders.

If these instruments worked as planned, they will enable Taiwan to build a more earthquake-resistant country. "The really important thing if you're going to have to rebuild your society—the most crucial information to have—is how hard did the ground shake in those areas that were heavily damaged and how did those buildings respond," says Roger D. Borcherdt of the USGS in Menlo Park, who oversees the U.S. network of strong-motion instruments.

"Unfortunately, we missed a lot of important opportunities" in recent U.S. quakes, says Borcherdt. Ten years ago this month, the Loma Prieta earthquake struck the San Francisco region and destroyed part of the Bay Bridge, as well as highway overpasses in Oakland. Much of the most spectacular damage occurred in areas underlain by soft sediments, but there were no sensors in these settings to record how they amplified the shaking, says Borcherdt.

In the Los Angeles area, scientists have recently developed a network of instruments designed to correct some of the deficiencies of past systems (SN: 3/14/98, p.169), although it lacks the density of the Taiwanese network. The Clinton administration is currently considering a $170 million proposal to set up a network of 6,000 strong-motion instruments across the country. —*R. Monastersky*



The Taiwanese quake (star) resulted from a collision between two patches of Earth's outer shell. The plate carrying Europe and Asia scrapes beneath the Philippine Sea plate.

Cave finds revive Neandertal cannibalism

The butchered skeletal remains of six individuals, unearthed at a 100,000-to-120,000-year-old cave site in southeastern France, offer compelling evidence of Neandertal cannibalism, according to a new report.

Neandertal and animal bones found in Moula-Guercy Cave, which overlooks the Rhone River, exhibit identical signs of meat and marrow removal, says a team headed by anthropologist Alban Defleur of the CNRS Anthropology Laboratory in Marseille, France.

Neandertals were the only members of the human evolutionary family known to have inhabited southwestern Europe at the time. Defleur and his coworkers thus propose that Neandertals killed and ate their own at Moula-Guercy—for as yet undetermined reasons.

"This is conclusive evidence that at least some Neandertals practiced cannibalism," holds anthropologist Tim White of the University of California, Berkeley, a member of Defleur's group. "Moula-Guercy was a temporary occupation, and we can't say what the reasons were for cannibalism occurring there."

Reports of prehistoric cannibalism go back more than a century. Researchers have identified butchery marks on human bones at a 6,000-year-old French cave and at U.S. Southwest Anasazi Indian sites that are 800 to 1,600 years old (SN: 1/2/93, p. 12).

Controversy still surrounds claims that ancient groups pursued anything other than starvation-induced cannibalism in emergencies.

Defleur began excavating Moula-Guercy in 1991. After finding Neandertal bones with stone-tool incisions suggestive of cannibalism, he invited White to help analyze the remains.

Their report, published in the Oct. 1 SCIENCE, focuses on 78 pieces of bone from at least six smashed Neandertal skeletons found among animal bones and stone tools. The Neandertal remains come from two adults, two adolescents, and two children.

The braincases had been broken into fragments and the limb bones shattered. The tongue of one child had been cut out. Microscopic scrutiny of incisions on the bones indicates that the skeletons were cut apart to obtain meat, the researchers contend.

A reassembled leg bone also displayed dents made by a stone hammer, fracture marks produced when the bone was smashed, and striations from a stone anvil against which it was held. Bones of red deer and other animals that lay among the Neandertal remains showed the same types of marks.

Neandertals often faced food shortages in the ice age environments of western Europe, suggesting that they turned to cannibalism at Moula-Guercy and elsewhere to stave off starvation, remarks anthropologist Erik Trinkaus of Washington University in St. Louis.

White suspects that cannibalism had deeper meaning for Neandertals and other prehistoric groups. He plans to compare evidence at Moula-Guercy with that from other ancient cannibalism sites—including a cave containing 800,000-year-old butchered *Homo* bones, which Spanish scientists will soon describe in a scientific journal. —*B. Bower*