EQ '89 - Geological

Quake offers scientists new information

By RICHARD EMANUEL
Sentinel staff writer

SANTA CRUZ — Sleep has been a rare commodity for UC Santa Cruz seismologist Karen McNally since the quake that convulsed the Santa Cruz Mountains 12 days ago.

With students and colleagues, she has spent most of her time at her computer terminal, poring over charts and maps or talking on the telephone.

Friday, with UCSC geologic hazards expert Gary Griggs, McNally slid behind a battery of microphones, cameras and reporters to talk about what scientists have learned about the temblor that ripped up Northern California.

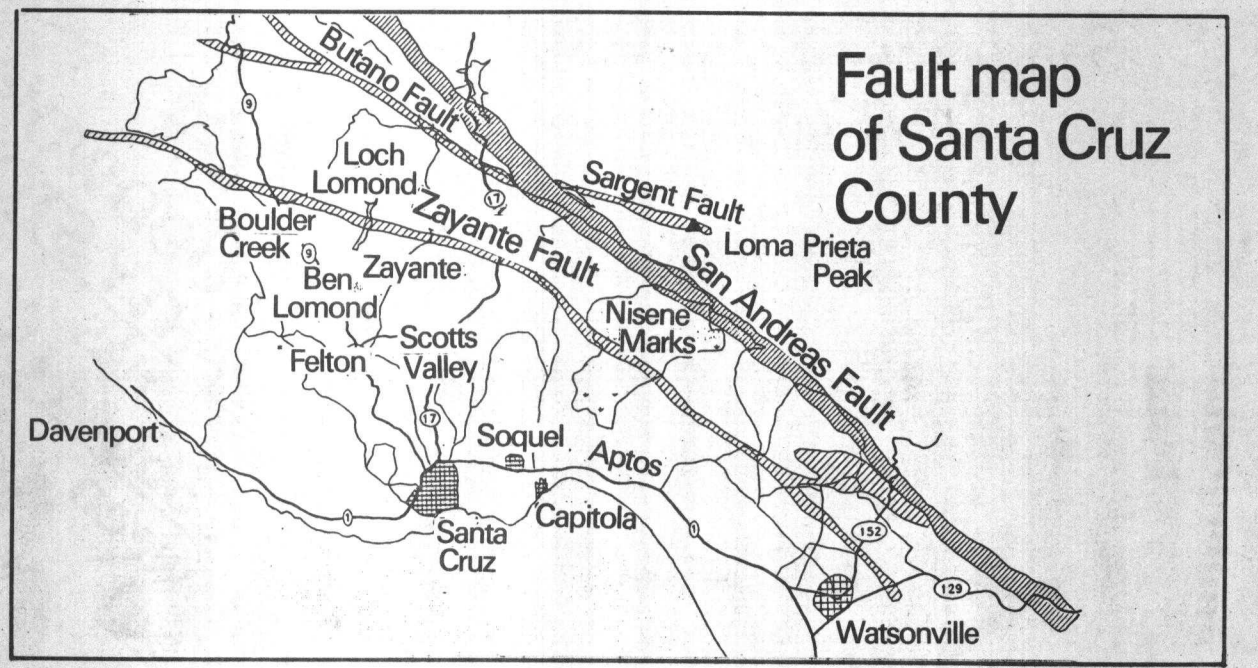
The facts about the earthquake have been refined as more seismic stations have pooled their data. By Friday, 18 stations around the world had contribued their records.

The 7.1-magnitude quake broke loose on the San Andreas fault at 5:04 p.m. PDT Oct. 17. The quake's center was 11⅓ miles underground, four miles north and a mile east of Aptos Village, near China Ridge in the Nisene Marks State Park.

A 30-mile length of the fault, known as the Santa Cruz Mountains segment, ruptured. The seaward side of the fault, including most of Santa Cruz County, slipped about 5½ feet to the northwest; vertical movement along the fault was about 4¼ feet.

By 9 a.m. Friday, the U.S. Geological Survey had recorded more than 4,000 aftershocks, most of them too small to feel. Aftershocks were still occuring at a rate of 5 to 7 an hour on Friday.

The quake had spawned 79 aftershocks magnitude 3.0 or greater, including 20 quakes 4.0 or greater. Two aftershocks registered 5.0 or more. Quakes will continue for the next few weeks or months, but not as often as during the first week after the main shock, and will abate with time.



Courtesy of Fred Hochstaedter

The rupture on the San Andreas Fault started near China Ridge in Nisene Marks State Park.

On Friday, McNally announced that two previously undetected magnitude 5 quakes had hit within five minutes after the primary quake. The strong aftershocks had been "pulled out from the tail of the main shock" by analyzing data from special recorders deployed by her UCSC lab.

A surprise from the quake was the number of aftershocks on the Zayante fault, which runs southwest of and roughly parallel to the San Andreas fault in the Santa Cruz Mountains. Graduate student Dan Orange has been monitoring those.

"The state didn't feel the Zayante fault was active" when it drew up a fault map in 1975, Orange said. "The county does, based on Kevin Coppersmith's thesis" for the UCSC Earth Sciences Board.

But the location of numerous aftershocks on the Zayante fault has "allowed us to say for sure that it's not a 'dead fault,' " Orange concluded.

Earthquakes are generally caused by the jostling of huge chunks of the Earth's crust, called plates, as they grind past each other. The San Andreas fault system lies along the boundary between the plate bearing the Pacific Ocean, and the North American plate. The Pacific plate is moving toward Alaska at a rate of less than two inches a year.

"It's hard for all of the Pacific Ocean to slide by all of California smoothly and gently," Griggs said.

"Stress builds up, and as the stress builds up, weaker fault segments break," McNally said.

"Each segment has its own characteristic or typical earthquake," added Griggs. The 30-mile long Santa Cruz Mountain segment typically ruptures to produce a quake in the 7.0 range — just as it did 12 days ago.

The Oct. 17 quake, McNally and Griggs agreed, is about as strong as any likely to hit the Santa Cruz area. The local segment of the San Andreas fault is now "relaxed," they said, and is not likely to rupture again for a number of decades.

There are other active faults in the Santa Cruz area, including the San Gregorio fault, which runs offshore from Monterey Bay.

"Historically, that has produced magnitude 6, 6.5 events," McNally said. "But there could be some shaking here" because the fault is so near.

Ruptures along San Andreas egments outside the Santa Cruz Mountains can also shake the Santa Cruz area. During the 1906 San Francisco quake, which ruptured 270 miles of fault and measured 8.0 to 8.3, Griggs said, "the shaking in Santa Cruz appears to have been about the same intensity" as during the recent quake.

Damage in the county was similar after both quakes, he added, and was most severe in two general areas: "Low-lying alluvial areas, where you have sediments with high water tables," Griggs said. Downtown Santa Cruz and Watsonville are built on such sediments.

There was also "intense groundshaking" and "intense fracturing and fissuring" mountain ridgetops near the ruptured fault zone.

Griggs also warned that ancient landslides may be reactivated in mountainous areas, especially if heavy winter rains seep into newly opened fissures. The collapse of jolted beach-cliffs is also a danger that may persist after the quake subsides.

Despite these hazards and the extent of damage in the wake of the recent temblor, Griggs and McNally found some reasons for optimism.

"I think it's encouraging that nobody died in this earthquake in a single-family residence," Griggs said.