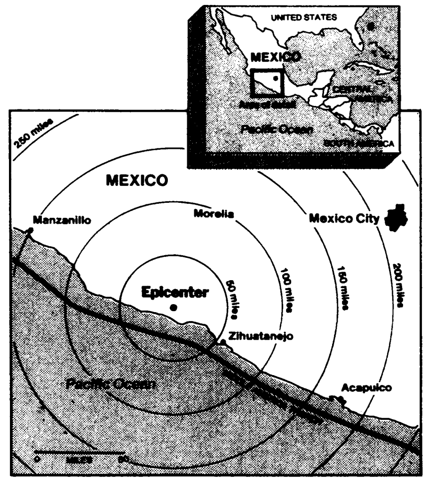
A Large and Late Quake

The magnitude 7.8 earthquake that jolted southwestern Mexico last week, devastating sections of Mexico City and three states on the coast and killing thousands of people, was unexpected only in the sense that it waited so long to happen, seismologists say.

Earthquakes along Mexico's western coast generally result from the movement of oceanic plates as they are subducted, or dragged down, under the North American plate upon which Mexico sits. In the region where the Cocos oceanic plate is being subducted, earthquakes typically recur every 30 to 60 years, says Christopher Scholz at the Lamont-Doherty Geological Observatory in Palisades, N.Y. But the last quake to shake this particular 140-kilometer-long segment of the plate boundary occurred 78 years ago. Since scientists are not certain that this 1907 earthquake was large enough to rupture the segment, it may well be that an even earlier earthquake, in 1811, was the last to rupture the fault.

Seismologists first pointed to the suspicious dearth of large earthquakes along this section of the plate margin in the late 1970s. In addition to its long recurrence time, the segment is unusual in that it is longer than the rupture lengths of other earthquakes in the region. Since longer lengths have been empirically correlated with larger earthquakes, this segment should create larger-magnitude quakes. Indeed, Scholz estimates that the energy released by last week's quake was three to four times greater than that released by the magnitude 7.5 to 7.6 earthquakes typical of the region.

The main theory explaining the unusual behavior of this segment is that seamounts, or undersea mountains, on the Cocos plate "jam up the works so that the stress builds up for a longer time, and then when an earthquake occurs it's bigger," says Scholz. One thing seismologists will be looking at when more data come in is how the earthquake's energy was distributed over the fault. Energy concentrated in a small part of the segment would support the idea that the fault had been locked in place by the seamounts.



According to the National Earthquake Information Center in Golden, Colo., preliminary data place the quake about 360 kilometers southwest of Mexico City. Although Acapulco is even closer to the epicenter, the resort city, which is built on relatively solid ground, is reported to have suffered little damage. The central part of Mexico City, on the other hand, sits atop a drained lake bed consisting of 46 meters of soft clay, which vibrates "like a bowl of jelly when seismic waves come through the ground beneath it," says earthquake engineer George Housner of Caltech in Pasadena.

During a 1960 earthquake, the natural period of this vibration was found to be 2.5 seconds, according to Housner. Because 10- to 20-story buildings have natural periods much closer to this value than do one- and two-story buildings, Housner believes that tall (as well as weak) buildings were the most likely to succumb to the shaking of the earthquake and collapse. Of the approximately 1 million buildings in Mexico City, fewer than 1 percent have been reported damaged. The main quake is thought to have completely destroyed 250 buildings. A magnitude 7.3 aftershock the day after the main quake crumbled more structures that had been damaged by the initial jolt.

Scientists will have to wait until data from many more seismic stations arrive before they can pin down the precise epicenter, depth, magnitude and rupture mechanism. According to one geophysicist at the National Earthquake Information Center, initial estimates had been made using only three stations in Alaska, Colorado and Canada; because they were

Collisions in the Fermilab Tevatron

Fermilab

Protons and antiprotons can now collide in the Fermilab Tevatron accelerator in Batavia, Ill., at total energies of up to 2 trillion volts (see p. 202). The Collider Detector Facility (CDF), shown here, will record the outcome of such collisions. In the center of the blue circle appears the pipe through which protons and antiprotons will run. Assembled in a hall at the edge of the accelerator, the CDF was recently moved with rollers and hydraulic pushers through the opening at right to the accelerator itself.