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Shaking down deep

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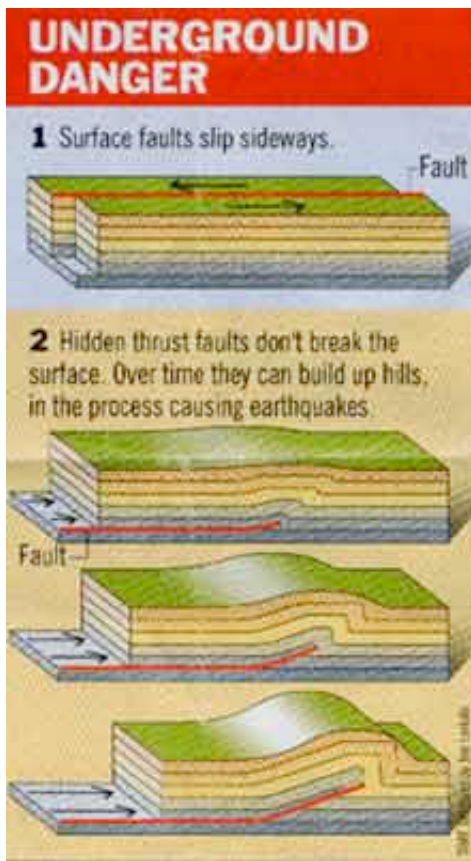
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Shaking Down Deep

Tremors from hidden faults alarm seismologists

by J. Madeleine Nash / San Francisco



Ever since an earthquake nearly destroyed San Francisco in 1906, Californians have dreaded the next Big One. The anxiety has been greatest for those who live near the San Andreas Fault, a dramatic 800-mile-long gash in the earth's surface that comes within one mile of San Francisco and 30 miles of Los Angeles. However, evidence is mounting that this huge fault is only the most visible evidence of a threat that is much broader and more dangerous than once thought. Deep under the Los Angeles basin, the state's most populous region, is a hidden group of faults, cracks in the earth's crust. Discovered only two years ago, this underground network belongs to a new class of earthquake hazards that seismologists are just beginning to study. They believe similar undetected danger zones exist all over the world.

Suspicious were first aroused in 1983, when the small, central-California town of Coalinga was surprised by an earthquake--measuring a hefty 6.5 in magnitude. The culprit turned out to be a fault that no one had realized existed. Reason: it was buried four to ten miles beneath the surface. In 1987 another hidden fault ominously creaked, this time directly under the city of Whittier, a scant twelve miles from downtown Los Angeles. It caused eight deaths and some \$350 million in property damage. Together, observes geologist Clarence Allen of the California Institute of Technology, "Coalinga and Whittier forced us to broaden our perspective."

The only surface sign of a hidden fault is a fold, or buckling in the earth's crust. The hills and mountains

created by these folds were long considered products of slow, progressive deformation, not violent change. But that theory apparently needs revision. Sometimes fold growth takes place gradually, but not always. Declares geophysicist Ross Stein of the U.S. Geological Survey in Menlo Park, Calif.: "It can be demonstrated that folds grow by repeated earthquakes."

Stein, with geologist Robert Yeats of Oregon State University, has published that provocative hypothesis in *Scientific American*. During the 1983 earthquake, the two note, Coalinga's fold grew more than 2 ft. taller. More spectacular was the 5-ft. uplift that occurred when an earthquake hit El Asnam, Algeria, in 1980. The sudden growth of the El Asnam fold blocked the flow of the Cheliff River, creating an instant lake. Similar fold belts have been found in India, New Zealand, Argentina, Canada, Japan, Iran, Pakistan, Greece and Chile. Many of these have spawned sizeable earthquakes. The tremors that devastated Spitak, Armenia, last year, the two scientists speculate, may have been fold related.

Nowhere is the notion of unseen danger taken more seriously than in the Los Angeles basin. A major hidden fault system lurks below the communities of Palos Verdes Estates and Torrance and clips the shoreline of Newport Beach. Another, the Elysian Park system, slinks under Whit tier and sashays beneath downtown Los Angeles. The route taken by the Elysian Park system might have been laid out by a tour guide. "It cuts right under the big HOLLYWOOD sign," exclaims independent geologist Thom Davis, one of the scientists who first identified the fault.

There is no doubt that hidden faults generate earthquakes. What remains controversial is how large such quakes might be. For the residents of Los Angeles, this is no academic argument. A quake under the center of the city would do far more damage than a tremor of the same size on the San Andreas Fault. Until more is known about the destructive potential of hidden faults, the people living over them will have to remain constantly alert.