

# Forecast of Mexican Quake Accurate, but Ignored

A major earthquake—one of the four or five largest anywhere in a quarter century—struck southern Mexico Nov. 29, within a mile of where University of Texas scientists last year predicted the epicenter would be. The quake's magnitude, 7.9 on the Richter scale, was also very close to the strength expected. The warnings, however, were virtually ignored.

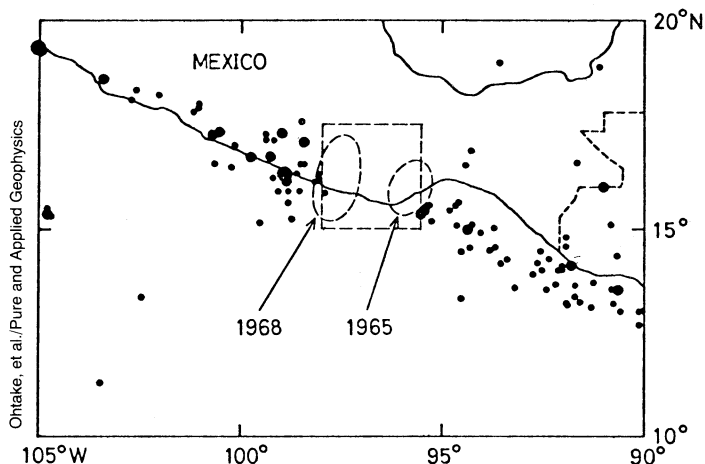
In a paper published in the 1977 *PURE AND APPLIED GEOPHYSICS*, Masakazu Ohtake, Tosimatu Matumoto and Gary V. Latham used seismic history data to forecast an impending quake near the coast of Oaxaca state. At the time, all three were working at the Geophysics Laboratory, Marine Science Institute of the University of Texas at Galveston. Ohtake has now returned to the Japanese National Research Center for Disaster Prevention, where he and others have used similar methods to forecast a major quake in the Tokai region of Honshu Island (SN: 4/29/78, p. 282).

The success of this forecast is likely to give new impetus to efforts aimed at combining various approaches to earthquake prediction. The method used by the University of Texas team involved a search for a "seismicity gap" along an active fault. As giant land masses on either side of a fault slide past one another, tension builds up irregularly along their common boundary. Some regions along the fault may slip rather smoothly in a series of minor tremors; others may "lock" and then release suddenly in a major earthquake.

Where a region becomes locked, two distinct stages of seismic activity may appear prior to a quake. In the "alpha stage," the normal series of small (and usually unnoticed) tremors in a region may cease altogether, even though such activity continues along parts of the fault on either side of the region. A "gap" is then said to exist in the seismicity of the fault, and the region of the gap is considered a prime location for a major quake. If quakes have occurred along neighboring parts of the fault, these can be used to estimate the strength of the impending quake.

But such data are not sufficient to predict *when* an expected quake will occur. Sometimes, just before the quake, a second "beta" stage of activity has been noticed. This stage signals a return of minor tremors to the locked area, just as a piece of wood under pressure will begin to crack before it finally snaps. To detect the beginning of the beta stage, and thus provide a warning of an impending major shock, careful monitoring of activity along a seismic gap becomes extremely important.

The Oaxaca case provided a classic example of a seismicity gap. Along a coastal region near the town of Puerto Angel, two



*A gap (enclosed by square) appears in a plot of seismic activity (tremors shown by dots) in region of Oaxaca, Mexico, where a major quake just occurred. Previous quakes and aftershocks along the same fault line are shown by ellipses.*

major quakes had occurred, separated by a hundred-mile stretch of fault that had recently displayed the suspicious decline of seismic activity characteristic of alpha stage. For both prior quakes, which occurred in 1965 and 1968, the beginning of alpha stage quiescence came about 1.5 to 2.0 years before the major shock. Beta stage activity was less evident because of inadequate local monitoring. The Texas team thus ended their 1977 paper with a call for immediate, detailed measurements around Puerto Angel.

Their plea was virtually ignored. Excitement caused by subsequent amateur predictions that a quake would occur last April soured the Mexican government on further study of the area. The University of Texas team applied for U.S. government funding to monitor seismic activity along the gap and were initially told they could go ahead. Then, only a month before the quake, their request was rejected. With some restraint Latham told *SCIENCE NEWS*, "I think they missed a good bet."

He was more sanguine, however, about the impact this solid success is likely to have on the increasingly fragmented field of quake prediction. At the end of a recent meeting that produced no consensus, he says, "all of us left in despair. What we've done now is give people a new hope that we may one day predict earthquakes." (Although the terminology is not universal, a "prediction" must include place, magnitude *and* time of quake; hence the more restrained claim that the Oaxaca quake was only "forecast.")

Future earthquake prediction scenarios, then, may run something like this: Searches are made to identify seismicity gaps and then instrumentation to detect other precursory phenomena are concentrated in the area of the gap. In areas such as California where background activity is not as great as in southern Mexico, the search for such gaps may require studying

smaller, previously ignored tremors.

And uncertainties about the two stages of quiescence and renewal must also be ironed out. For example, it is not clear that beta stage activity occurs in all cases or whether such activity is confined to just the region close to a potential epicenter. Latham admits that "such a remarkable case as this one may not happen again in my lifetime."

One way or the other, forecasts based on seismicity gaps are likely to be taken much more seriously in the future. Already a team of scientists from Scripps Institute of Geophysics and Planetary Physics have left for Oaxaca to measure after-shock activity in the area. But that such measurements were not made before the recent quake, possibly allowing detection of beta stage activity and prediction of the quake's time of arrival, says Latham, was "a major tragedy." □

## Desegregation: Things get worse first

Social science studies of the effects of school desegregation upon students have been anything but encouraging. The most positive of such studies have shown little improvement in interracial attitudes and contact while the least positive have shown an apparent worsening of attitudes and behaviors. A number of these studies have been criticized, however, for examining just one effect of desegregation or for failing to relate other variables to such effects.

Now, researchers Walter G. Stephan of New Mexico State University and David Rosenfield of Southern Methodist University say they have included such factors in their study of fifth and sixth graders in a "medium sized southwestern city." The methodological improvements, however,