Earthquake Forecast Endorsed

The U.S. Geological Survey announced on 5 April that federal and state of California panels have endorsed studies that indicate a moderate earthquake is likely to strike near Parkfield in central California within several years of 1988. The actions are the first such endorsements of any earthquake prediction.

The endorsements by the National Earthquake Prediction Evaluation Council (NEPEC) and the California Earthquake Prediction Council enhance the credibility of a long-term prediction that already had widespread support in the scientific community (*Science,* 6 January 1984, p. 36). William Bakun and Allan Lindh of the U.S. Geological Survey (USGS) in Menlo Park and Thomas McEvilly of the University of California at Berkeley had for some years been pointing out the likelihood of the next in a series of moderate earthquakes that have struck Parkfield about every 22 years since 1857. The most recent was in 1966, so the next seemed most likely to occur in 1988. Each of the recent Parkfield earthquakes was magnitude 5.5 to 6, so an event of similar size, capable of modest damage to some structures, would be expected. And each had ruptured the same 20 kilometers of the San Andreas fault, so the location in sparsely populated cattle country near Parkfield (population 34) is well defined. Such tight constraints on time, magnitude, and location are the heretofore missing essential ingredients of an earthquake prediction.

It is the unusual nature of the San Andreas fault near Parkfield that has allowed such a relatively specific prediction. A bend in the fault to the north sets off the Parkfield section from a section that slips continually without generating significant earthquakes, and an offset to the south sets it apart from the fault length that last slipped during the great southern California earthquake of 1857. Given such a precise location and length of fault, the greatest uncertainty is the timing of the next event.

The most likely date according to the model of the fault's behavior developed by Bakun and his colleagues is January 1988. Other researchers find that date generally acceptable as a working hypothesis, but even its originators seem uncertain as to how they should express their confidence in that prediction. In informal presentations over the past few years, they have cited a confidence interval of 1 standard deviation or ±2 years. The version of their work reviewed by NEPEC cited 2 standard deviations, extending the predicted interval to the present. In his letter to William Medigovich, director of the California Office of Emergency Services, summarizing the results of the scientific review, USGS director Dallas Peck cites the group's latest range, a 95 percent confidence interval of ±5 years.

There is also some uncertainty about the size of the next Parkfield earthquake. It could be much larger than any events there during the past hundred years. As Peck noted in his letter, Kerry Sieh of the California Institute of Technology and the late Richard Jahns have pointed out the possible extension of the next Parkfield fault rupture as much as 40 kilometers to the south. Estimates of the size of such an earthquake range from magnitude 6.5 to a hefty 7.5. Sieh and Jahns expected that this section would probably break before the end of the century, but whether the Parkfield earthquake would trigger this larger, although still moderate, event remains a matter of speculation.

NEPEC's endorsement of the Parkfield forecast is its second foray into actual prediction evaluation. In 1981 it was asked to evaluate an extremely precise prediction of huge earthquakes off Peru. The council found the prediction to be scientifically groundless. Under its new chairman Lynn Sykes of Lamont-Doherty Geological Observatory, it is now pursuing a more active role than it has since its inception. The council initiated the Parkfield review, urged Peck to make a public statement about the prospects there, and is undertaking a systematic review of long-term forecasts in areas of high risk. The first area under consideration is southern California, for which the USGS must soon decide whether or not to drop an earthquake hazard watch it instituted when the Palmdale bulge first reared up.

The reconsideration of the southern California situation was prompted by the USGS's dropping of its three-tier geologic hazard warning system of notices, watches, and warnings. It was replaced by a single warning of a "significant threat to the public . . . for which some timely response [by the public] would be expected." Situations not meeting that criterion—so far meaning 19 of the 23 previously covered—will merit informal communications from the USGS director, as in the case of Parkfield.

The Parkfield section of the San Andreas is one of the most closely watched faults in the world.

The three-tier warning system had been based on a scheme used by weather forecasters, but, as John Filson of the USGS's Office of Earthquakes, Volcanoes, and Engineering explains, "It turned out that the weather people were much farther ahead in the prediction business than we were. We didn't have the precision." In addition, the furor kicked up by businessmen and landowners when the notice of potential volcanic hazard was issued for the Mammoth Lakes area of California probably prompted the USGS to review its policy in order to avoid "unwarranted public concern over potential hazards that present low risk to the public," as Peck put it. Mount St. Helens and Kilauea have been retained under the new system, and southern California and the Yakataga region in Alaska are still being reconsidered.

Even before its formal recognition, the Parkfield prediction had drawn enough attention to make that section of the San Andreas one of the most closely watched faults in the world. It is nearly the ideal prediction experiment—a modest-size earthquake expected in the near future in an almost empty part of the country. Even if its small size prevents detection of clear precursors and the issuance of a short-term prediction, the record of the rupture itself would be the most valued acquisition in a field much in need of such a watershed.—**RICHARD A. KERR**