2 October 1981, Volume 214, Number 4516 **SCIENCE**

Tectonic Hazards

Officials at the Department of Interior have been considering a sharp cut in the department's budget for studying volcanism and the elimination of funds for earthquake prediction. Funding for the earthquake program is $16 million a year. In contrast, the probable costs of a major earthquake are tens of billions of dollars and tens of thousands of lives.

Top officials at the Office of Management and Budget should refresh their memories of the eruptions at Mount St. Helens. The destruction near the mountain is awesome—large areas of forest blown down and ash flows more than 100 meters thick. Had there not been seismic monitoring and restrictions on travel into the area, as many as 1000 lives might have been lost. And Mount St. Helens was a small event in comparison with other eruptions. At one time, Mount Mazama in southern Oregon was comparable in size to the largest mountains of the Cascade Range. Where that mountain once stood there is now Crater Lake, which is about 600 meters deep.

Before the eruptions at Mount St. Helens, such destruction seemed to be something that happened in other places. But having experienced a small sample of nature's violence should make us prudent and vigilant. We should have a monitoring program including the use of seismometers, tiltmeters, and distance-measuring facilities on the more active peaks, as well as geologic studies to determine the frequency of earlier events.

The destruction at Mount St. Helens led President Carter to order a study of the likelihood of a major earthquake in California and the potential damage from such an event.* The study identified seven fault systems capable of generating major earthquakes that could severely damage population centers. The aggregate probability of a catastrophic quake in California during the next 30 years is greater than 0.5. The prime candidate is the Southern San Andreas fault near Los Angeles. Geologic evidence indicates that at least eight major earthquakes have occurred there during the last 1200 years with an average interval of 140 years. The last episode was in 1857.

California is only one of many states where earthquakes may occur. Perhaps the most violent quakes of record in the United States occurred at New Madrid, Missouri, in 1811 and 1812. Another event of large magnitude took place near Charleston, South Carolina, in 1886. Geologists believe that earthquakes are likely in more than 30 states, although the probability in any one spot is much less than that in the Pacific states.

Present knowledge and experience do not permit dependable and accurate forecasting of the time of an earthquake. Some of them are attended by obvious premonitory phenomena, others are not. Through observing and heeding such phenomena, the Chinese were successful in avoiding great loss of life in one instance. On another occasion, precursors were not evident and several hundred thousand lives were lost. Ultimately, there will be a better understanding of the events culminating in a major quake.

For now, the most practical approach is to identify the likely locations and magnitudes of earthquakes and to design structures to withstand the disturbances. Around the world most of the lives lost in earthquakes have resulted from collapse of buildings. In view of the potential damage and loss of life, it hardly seems wise policy to contemplate abandoning a program designed to improve predictive capabilities. Substantial efforts and funds have gone into emplacing instrumentation along major fault systems. The program should be continued. In addition, the United States should seek to expand its cooperation with other countries where earthquakes occur frequently. Some of them, especially Japan and China, have extensive programs. The Japanese have widespread monitoring networks and are making notable progress in engineering research on building design. We have much to learn from them.—PHILIP H. ABELSON

*Federal Emergency Management Agency, *An Assessment of the Consequences and Preparations for a Catastrophic California Earthquake: Findings and Actions Taken*, Washington, D.C., November 1980.