OAXACA, MEXICO, 1978 PREDICTIONS

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Early in 1975 I was informally contacted by a colleague from the University of Texas who advised me that a seismic gap had been developing since mid-1973 in a 200 km stretch of the coast of Oaxaca, Mexico. The gap was unsually clear, in the sense that no earthquakes at all were being located in this otherwise highly seismic region. The threshold magnitude for worldwide detection in Mexico is about 4.0.

The original definition of a seismic gap was meant to refer to large earthquakes, say magnitude 6 or over. In this sense, the absence of low-level seismicity (M<6) has not been previously suggested as an earthquake precursor. Also, the normal level of earthquake occurrence in this area of Oaxaca was sufficiently high so as to reduce appreciably the "degree of astonishment" in connexion with any earthquake predicted there.

In 1977, the Texas group published their paper on the Oaxaca gap (Ohtake et al., 1977), after checking informally with us and submitting a preprint for our criticism. The paper contained a guarded prediction for an event of magnitude 7.5 to occur at some unspecified time near the centre of the gap. This paper was accepted for publication after the normal process of peer-review.

We informed the Director General of the Mexican Science Research Council of this prediction, and a brief account of it appeared in the official monthly of the Research Council. The press took no notice of this item at the time, and I personally felt that no special action was warranted, as this coastal area is sparsely populated and predominantly rural.

In January 1978, two previously unknown residents of Las Vegas, Nevada, wrote to the President of Mexico announcing a destructive earthquake in the small town of Pinotepa, Oaxaca on 23 April 1978. A copy of this letter was forwarded to the

Mayor of Pinotepa via the office of the Governor of the state of Oaxaca. As the date of 23 April approached there was a developing situation of unrest among the agricultural community and home owners in Pinotepa. This town had suffered a destructive earthquake in 1968 and small earthquakes were almost daily occurrences.

The Governor of Oaxaca consulted with the Office of Urban Emergencies of the Federal Government and it was determined that the authors of the prediction were gamblers, who had evolved an unsuccessful method of winning at roulette and who were now attempting to apply the same method to earthquake prediction. While the prediction itself was not taken seriously by any person in a responsible position, it was agreed, in consultation with the Governor of Oaxaca, that no formal denial or rebuttal be issued as this would inevitably lend weight to the rumours. Instead, the Governor let it be known that he would be in Pinotepa on 23 April, in order to preside over a local fiesta with popular performers and a public dance. This announcement was intended to quell the rumours and shame the population into rejecting panic behaviour; indeed, this policy appears to have been reasonably effective.

Unfortunately, ten days before the date of the prediction made by the two residents of Las Vegas, a press conference was held at the University of Texas in Austin, Texas, for the purpose of announcing a number of research results, among others the prediction of a destructive earthquake in Oaxaca. The announcement was made by an administrative spokesman of the University, who mentioned that the destructiveness of the predicted earthquake would be comparable to that of the 1972 Managua earthquake. The story, circulated by international news telex, made front-page headlines in several Mexico City dailies and was widely interpreted as a confirmation of the earlier non-scientific prediction made in January.

The Office of Urban Emergencies called the University of Texas to protest the announcement but no one assumed responsibility for the statements made to the press. Initially the fact that such statements had ever been made was flatly denied. On the other hand, the Associated Press Agency insisted that his reporter had fairly summarized the information as supplied to him. It seems certain at this point that the scientists directly involved in the prediction were not responsible for this press release. They had recently been made aware of the situation: in fact, they had been asked to refrain from any contacts with the press until after 23 April, at the very least.

On 23 April 1978 several dozens of reporters and a number of television crews assembled in Pinotepa; the town hall was crowded with visitors. The Office of Urban Emergencies had mounted a public exhibit which included a tent for emergency housing and a series of photographs intended to show that an earthquake was not impending or expected to occur in Pinotepa. Governor Eliseo Jimenez arrived at about 5 p.m. and was being shown the exhibit when an earthquake of magnitude 4.2 occured (17:40:02 local time). The epicenter was about 100 km inland and the local intensity in Pinotepa was about IV, with perceptible rattling of doors and windows.

This small event caused considerable commotion among the reporters who were crowding the Town Hall, but the Governor coolly denied that an earthquake had taken place. He proceeded with the programme and the small perturbation was soon forgotten as the fiesta got under way in the town square. At five minutes past midnight the Governor looked at his watch and decided that the prediction had lapsed and that it was time to return to the State Capital.

I knew Pinotepa fairly well from earlier work after the 1968 earthquake. It is my impression that in 1978 about one in five homes were shuttered indicating that up to 20% of the town's inhabitants had decided to be away from Pinotepa on April 23. This was confirmed by the Mayor, who also volunteered the opinion that the economic damage to the town from the 1978 prediction exceeded the 1968 earthquake damage. See also Garza and Lomnitz (1979) for further details.

As for the gap detected by the Texas group, seismic activity resumed in January 1978 on a moderate level. Finally, an earthquake of Magnitude 7.5 occurred on 29 November 1978 close to the location predicted by the Texas group, who subsequently claimed success in their prediction. They proposed that the resumed activity after January 1978 be regarded as the "B-stage" of the seismic gap. These claims were accepted as valid by many colleagues in the scientific community, and strengthened the position of those seismologists who advocated the use of gaps and other seismicity patterns in prediction.

Since any large earthquake must be preceded either by a gap or a "B stage" I personally feel that forecasts based on such unspecific and trivial precursors are of little practical use. My main reservation is due to the

fact that large shocks are regularly followed by after-shock sequences which decay for years; thus, as time goes by since the previous earthquake a low level of seismicity will naturally develop. Then the next earthquake will appear to be preceded by a seismic gap; and there seems to be no practical way of distinguishing such a gap from the kind of gap which should be interpreted as an earthquake precursor.

Also the kind of quiescence which occurred in 1973-1977 on the Oaxaca coast is unprecedented; it is certainly a much rarer occurrence than major earthquakes in this region. Thus, the gap hypothesis, at least in this case, appears to be an instance of attempting to predict a fairly common occurrence by means of a very rare precursor. Whether or not gaps occur, large earthquakes are a regular feature along the Oaxacan coast.

REFERENCES

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DISCUSSION

In response to a question, Prof. Lomnitz remarked that figures on the economic losses of the November 1978 event may be available, but that he had not seen them. He stated that the false prediction of 23 April 1978 caused economic losses through the reduction of tourism.

Replying to Prof. Nersesov, Prof. Lomnitz said that the focal depth of the November 1978 earthquake was between 30 and 40 kms.

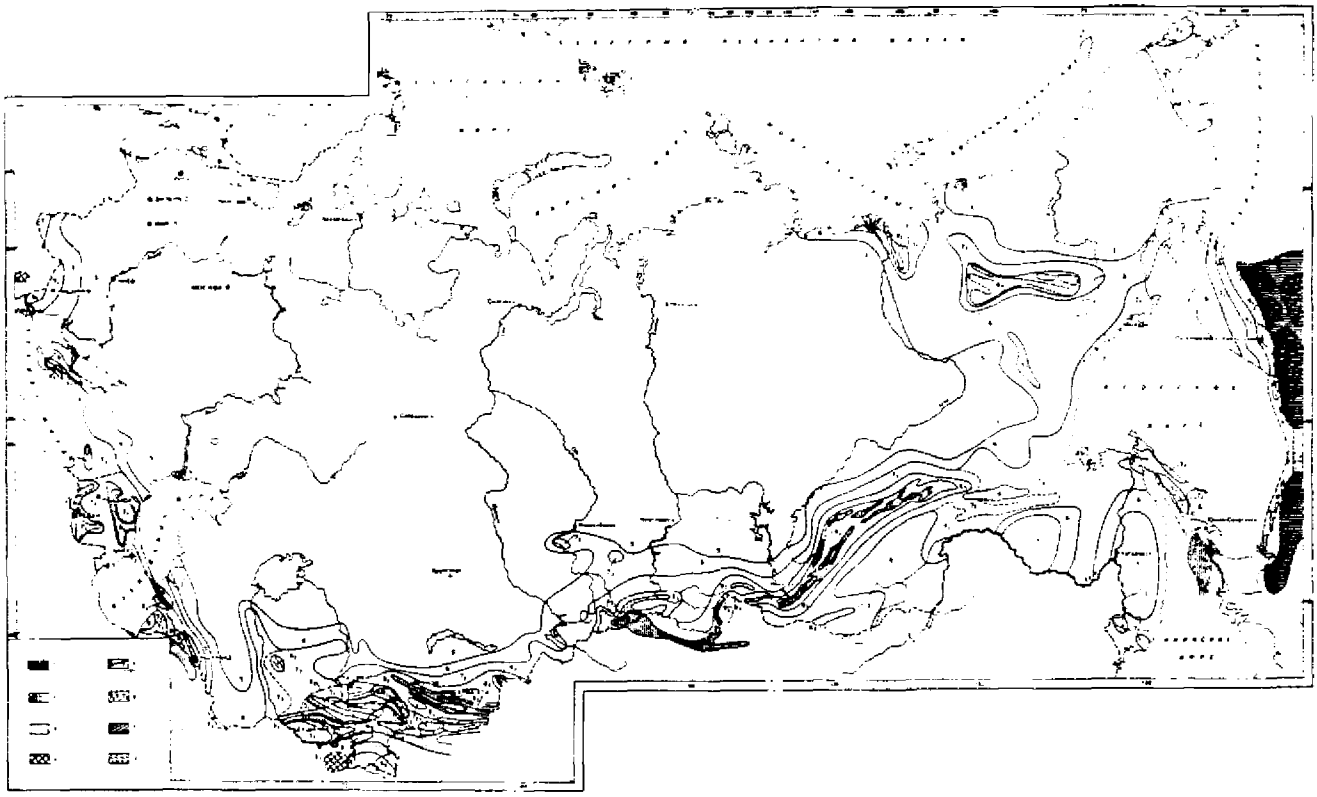

Fig.1. Seismic zoning map of the USSR.

1-4: areas of possible occurrence of earthquakes.

1. M = 8.1; h = 20-40 km. 2. 8.1 = M = 7.1; h = 15-30 km.

3. 7.1 = M = 6.1; h = 10-20 km. 4. M = 7.1; h = 100-200 km.

5. Areas of different intensity: 7_1, 7_2, 7_3 - one earthquake per 100, 1,000, 10,000 years.

7. Areas with probability p = 0.8 for the next 70 years.

8. Areas with probability p = 0.1(1).