NOTES

A TRAGEDY TOO DEEP FOR WORDS

Latur Earthquake of 30th September 1993

A National Calamity

What is described as a dance of death took place in the early hours of the morning (3.56 A.M.) of 30th September, 1993 affecting the Latur and Osmanabad districts of Maharashtra and the bordering districts of Gulbarga and Bijapur of Karnataka. Fifty villages within an area of 70 km^2 were razed to the ground. The death toll was about 10,000!

Among the natural hazards to which our planet is subject to, earthquakes are the most fearful, because of their suddenness and the extensive devastation they cause in a matter of a few seconds. India has had its share of disastrous earthquakes in the past. But such quakes had occurred mostly in the north, in the Himalayan foothills region. The Peninsula had been spared such an ordeal. In the only available small-scale maps, Deccan was shown as falling in the aseismic – or the earthquake-free zone where damaging earthquakes are not expected to occur. The shock of 30th September 1993 was a real bolt from the blue causing bewilderment and disbelief in the minds of general public as well as scientists.

Susceptibility of Indian Peninsula for tectonic movements

Forty years ago, impressed by the physiographic youth of the Western Ghats, the predominantly easterly drainage of the peninsula, the antecedent character of the rivers, the occurrence of water falls of great magnitude in the upper reaches of the rivers and flow in deep gorges, and the occurrence of erosion surfaces at different levels, I made bold to project the view that the peninsula of India did not represent a rigid stable mass subject only to subaerial denudation since the Precambrian, but had got rejuvenated in the Tertiary (Radhakrishna, 1952). This idea was again reiterated as recently as in June 1993, in a paper entitled 'Neogene Uplift and Rejuvenation of the Indian Peninsula' (Radhakrishna, 1993). Whoever thought that within months the region would be rocked by an earthquake of magnitude 6.5 and destroy villages wholesale, confirming in no uncertain terms that the Peninsula too was very much subject to tectonic activity.

While it is clear that horizontally directed forces have been responsible for the seismic susceptibility of the Himalayan belt, the movements affecting the peninsula were of a different kind. They were mostly vertical or epeirogenic in character which accounts for the cover rocks over wide areas being left undisturbed giving a false sense of stability.

The peninsula of India is known to have been dissected by a system of criss-crossing lines of fractures and lineaments. It has also been split by rifts. Geological maps show rivers like the Narmada, the Mahanadi and the Godavari as flowing in low-lands bounded by faults. No major earthquake, however, had occurred along these zones of weakness, and it was felt that the shield area had got stabilized.

A greater part of Maharashtra, Madhya Pradesh, Gujarat and north Karnataka is covered by a thick cover of horizontally disposed basaltic flows designated by the term Deccan Trap. This extensive lava cover has effectively hidden from our view, weak structures which may perhaps be present in the underlying basement. There have been speculations from time to time as to the possible existence of subsurface structures beneath the Deccan Trap, mostly based on geophysical considerations. Krishna Brahmam and Negi (1975), for example, based on gravity data had argued for the existence of two rift valleys beneath the Trap which they named as the Koyna and the Kurdwadi rifts. Qureshy (1981) postulated the existence of a number of linear zones of high and low gravity, parallel to the major Precambrian structural grain and suggested the existence of deep-seated faults or lineaments beneath the Trap. Similar high and low gravity signatures have been observed over the granite-greenstone terrain, away from the Deccan Trap region and no significance was attached to such structures connecting them with tectonic activity in the Neogene.

Rivers like the Krishna, Manjira and Bhima, flow in depressions within the Deccan Trap country and their valleys are filled up by deep black soil which may attain thickness of as much as 30 m. These topographic depressions could possibly be the surface expressions of downwarps or rifts below the trap cover and within the gneissic basement. Detailed geological maps with careful recording of dips could possibly confirm or disprove the suggestion. Several waterfalls are known in the upper reaches of the Bhima. Older alluvium and gravels occur in the form of terraces pointing to tectonic rejuvenation during the Neogene (Rajaguru and Badam, 1988).

Possible cause of the earthquake

It is a matter of conjecture whether the weight of the Deccan Trap, nearly 2 km in thickness, could have upset the balance and reactivated some of the weak zones in the basement below. Any such reactivation would send out seismic waves. In that event, it seems likely the effect of such waves would be more marked along the edges where the Trap cover is thin and fragile. Could this be a possible reason for the disastrous earthquake of 30th September 1993? Damage was great because of loose soil and wholesale slumping of houses built of boulders and mud. The quake had a shallow origin and occurred in the night when most people were sleeping soundly. Every thing was so sudden, there was no means of escape.

The construction of high gravity dams over structurally weak zones, unplanned growth of congested urban agglomerations and the poor quality of building construction are probably the causes of such unprecedented havoc. The houses and not the earthquake directly caused the death of so many people. A rethinking on the part of our planners is necessary regarding construction activity in earthquake prone regions. While prevention of earthquakes is not in our hands, the mitigation of the evils is certainly within our reach and every effort should be made to reduce the hazard.

Role of fluids in earthquakes

One aspect which requires to be emphasized in this connection is the role fluids play in earthquakes. This in our opinion, has not received adequate attention. It is said that 'if there was no water in the rocks, there would be no tectonic earthquakes' (Bolt, 1993). Water seeping into fractures could cause sudden slippage. That water stored in reservoirs can induce earthquake is well documented and is popularly known as Reservoir Induced Seismicity (RIS). Sudden influx of water either due to heavy rain or through sudden build-up of water column in reservoirs may cause shallow earthquakes. Sudden withdrawal of large quantities of groundwater from shallow aquifers could also possibly trigger an earthquake, because of voids created and uneven settlement of the heavy load above. The injection of wastewater under pressure into deep wells is known to have triggered earthquake activity. It is, therefore, desirable to initiate special study of ground water levels, changes in pore pressure and resultant seismic activity by deploying an array of sensitive instruments in earthquake-prone regions.

Earthquake Prediction

Geologists are being criticized for not declaring the region as seismic. Merely declaring any region as seismic is not going to be of much help. What is necessary is a warning, even if it be a few seconds earlier, before the onset of the main shock, so that people may run into the open. Animals seem to sense the onset of earthquakes earlier than men. The ground that is likely to be affected by an earthquake is believed to get arched up because of dilation. Groundwater levels may also change in advance of the shock. Sensitive instruments can be expected to measure such changes and issue a timely warning. The ionosphere above seismically active zones is stated to get disturbed days before the actual quake. Prediction and forewarning are still a remote goal. There is as yet no way of predicting the time, place and intensity of earthquakes.

An analysis of earthquake activity extended over long periods has shown that there is a broad pattern of gaps in seismicity. Since 1951, there has been no major earthquake, leaving aside the reservoir-induced quake at Koyna in 1967. Forty years of quiet is a long enough period to allow for stresses to be built. The Uttar Kashi quake of 1991, followed by one at Latur is a pointer that a major earthquake may be in the offing. If may occur suddenly in any part of the country.

Need for educating public – Natural hazard maps

The disaster which has struck the country emphasizes the need for a wider dissemination of knowledge about earthquakes. Organisations charged with the task of conducting surveys should give up their secretive ways and consider it as their primary responsibility to inform and educate the public. Drafting cyclostyled reports and stacking them, and remaining content with publishing maps on a scale where a thin line may represent several km in width is a practice which has nothing to recommend. It should give place to a more liberalised policy of publishing detailed geological maps. Apart from publication of regional geological maps which is the primary function of the Survey, a new generation of National Hazard Maps of vulnerable areas on larger scales should be planned, executed and widely circulated. The example of the U.S. Geological Survey in educating the public about natural hazards is worth emulating.

Till now we have failed to inform our people on what causes earthquakes and what precautions they have to take before, during and after the quake. Garbled versions appearing in papers are out to create sensation rather than inform and educate the public. The help of the many advances in communication should be fully utilised. The need of the hour is to educate our people and make them be prepared to face disasters which are in store, which cannot be prevented and which may strike any part of the country without notice. Our responsibility will not cease by merely declaring a region as seismic. Much more is expected of us. Progress achieved in forecasting cyclones is a pointer as to what is possible in predicting impending disasters.

A gratifying part of this sad event is the speed and efficiency with which the people of Latur, without any training is disaster management, have rushed the injured to nearby hospitals. The Maharashtra Government has acted almost immediately and set an excellent example. Greater administrative ability and social justice is needed in making the aid pouring from all parts of the world reach the people in dire need and not frittered away by a host of middlemen, officials and contractors.

What is to be done

I can do no better than conclude this note with the words of Donald Peck of the United States Geological Survey: 'Natural hazards are sobering reminders that we will never conquer nature. By understanding better the mechanisms of these hazards, we can mitigate the severity of their impact: . . Through scientific research, social planning and preparedness and proper emergency response, we can as a nation and global community, work to lessen the effects of natural hazards and reduce the economic and social losses from natural hazards'.

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