

NOTES

PREDICTION OF AN M~4 EARTHQUAKE IN THE KOYNA REGION COMES TRUE!

(A somewhat excited Dr.H.K. Gupta phoned me on the morning of 16th May and said that he has been observing intense seismic activity in the Koyna region and felt that an earthquake of intensity 4 would occur in the Koyna region within the next four days and I should keep a watch. True to his prediction an earthquake of magnitude 4.2 occurred in the Koyna region. Obviously Dr. Gupta was on the right track in this extremely vital topic of earthquake prediction and we expect to hear more on this work of Dr. Gupta and his colleagues in NGR-I – BPR.)

Koyna, located near the west coast of India, is known to be one of the most significant site of artificial water reservoir triggered earthquakes (Gupta, 1992). Over the past 44 years triggered earthquakes have been occurring in the region (Gupta et al. 2002), and the largest triggered earthquake, any where in the world of M 6.3, occurred on 10 Dec. 1967. It has been shown that the maximum credible earthquake for the region is M 6.8, that about one half of the energy of an M 6.8 earthquake has been already released, that there is no large enough fault segment left intact to cause an M 6 earthquake (Gupta et al. 2002). However, smaller earthquakes will continue to occur, and the occurrence of M ~5 will be governed by Kaiser effect and other factors.

In August 2005, it appeared that all the criteria that govern the occurrence of an M~5 earthquake in the Koyna region were present. On 25th August, 2005 a short communication was sent to *Current Science* entitled "An earthquake of M~5 may occur in the Koyna region" by Gupta et al. (2005). Keeping in mind several considerations, it was also postulated that this M~5 earthquake should occur in the next few weeks time, and should this not occur till the end of 2005, this forecast should be considered as a false alarm. An earthquake of M 4.8 did occur on 30 August, 2005, in the Koyna region making the forecast come true. As a matter of fact, seismic activity in the Koyna region during the period August through December 2005 has been much higher than the previous four years.

Earthquake forecast is the most cherished goal of the seismologist for over 100 years now. During the 1970's there was a considerable amount of optimism that the goal may be around the corner with the development of the dilatancy model of earthquakes and successful prediction of the Blue Mountain earthquake of 1973 in the USA and the Heicheng earthquake of 1975 in China. However, non-occurrence of the Park Field earthquake on the San Andreas Fault within the predicted parameters, and failure of the Tokai region forecast in Japan, led to pessimism. Around the turn of the century, there were global debates and the opinion varied from being optimistic to very pessimistic. Gupta (2001) was

of the view that under suitable geological situations, it may be possible to forecast medium size earthquakes in the foreseeable future. He pointed out that Koyna is probably the best site anywhere in the world to advance the science of earthquake forecast. He discussed in detail the precursors observed at the Koyna region. One of the most potential precursors is the nucleation that precedes M 4 to 5 earthquakes in the Koyna region. Nucleation is the occurrence of small earthquakes that nucleate into an M 4 to 5 earthquake. The crucial issue being the identification of the nucleation in the real time.

We have been monitoring seismic activity at the Koyna region very carefully with the deployment of a seven station closely spaced network, as shown in Fig.1. Several other

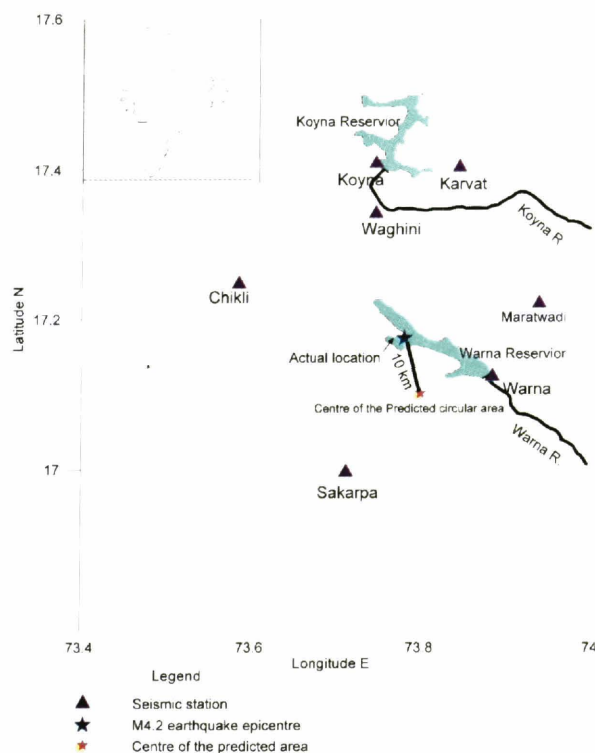


Fig.1. Seismic stations and predicted epicentre of earthquake in the Koyna region (earthquake of M 4.2 occurred on 21 May 2006).

observations, such as gravity, radon emission, crustal deformation, water level changes in the bore-wells, changes in magnetic field etc are also being made. In middle of May, 2006 we identified a nucleation centered around 17°1'N latitude and 73°8'E longitude within a radius of 10 km. Taking into account of all other parameters, the following forecast was made at 19:05 hrs IST on May 16, 2006, and communicated to Dr. K. R. Rao, Editor, *Current Science* and Dr. B. P. Radhakrishna, President Geological Society of India.

"On the basis of the data available from 7 seismic stations operating in the Koyna region, we identified a nucleation, which started on 12th May, 2006. It was inferred that this could lead to the occurrence of an M~4 earthquake in the next 15 days within a radius of 10 km centered at 17°1'N, 73°8'E. On the basis of our previous experience of studying nucleation preceding earthquakes in the Koyna region, we expected this earthquake to occur over the next 15

days time (till 31st May, 2006), with a 50% probability."

Information about this forecast was also given to Dr. Hari Narain, Dr. P. S. Goel, and Mr. V. C. Shelke and to Shri Bijesh Bansal on May 17, 2006.

An earthquake of M 4.2 occurred in the region on 21 May, 2006 at 20:29:01.2 (UTC). The epicenter of this earthquake (17°17'N latitude, 73°77'E longitude), lies within 10 km of the predicted epicenter. The depth is 4.7 km. Figure 1 shows the predicted area of the epicenter and the 21st May earthquake location. So the forecast has come true.

More detailed analysis is being carried out.

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GLACIERS AND DIAMONDS

A recent note in the Quarterly News Bulletin of the Geological Society of South Africa (March 2006) directs attention to a new source of alluvial diamonds which are different from the processes familiar to us.

Glacial erosion and till deposition over an enormous area is claimed to be an important source of alluvial diamonds in the gravels as well as in the coastal sediments of South Africa. The note refers to the work of Moore and Moore (Moore, J. M. and Moore, A. E., 2004, The roles of primary kimberlite and secondary Dwyka glacial sources in the development

of alluvial and marine diamond deposits in Southern Africa *Jour African Earth Sci*, v 38, pp 115-134). This paper is said to contain a detailed discussion on Dwyka glaciation and the important role it has played in the distribution of diamonds off the Atlantic coast, Southern Africa and alluvials in South Africa.

Those who are engaged in exploration for diamonds in the gravels and coastal sediments of India should take note of this new major source of diamonds and be on the look out for evidences of glaciation in the accumulation of gravel beds – *BPR*