Earth System Science Organisation
Ministry of Earth Sciences

Scientific Deep Drilling Investigation in Koyna-Warna region of Maharashtra

The Koyna region located close to the west coast of India is the most outstanding example of Reservoir Triggered Seismicity (RTS). The largest ever reservoir-triggered earthquake (M 6.3) occurred in the area in December 1967, a few years after the impoundment of the Sivaji Sagar reservoir. Small and micro - earthquakes have continued to occur in the area since then. The isolation of the epicentral zone from significant tectonic forces, with most of the events occurring within a depth of ~ 7 km, makes it the most suitable site for deep drilling and setting up of on observatory at depth to enable earthquake related near field observations. A major national project, "Scientific Deep Drilling in the Koyna Intra-plate Seismic zone of Maharashtra", has been undertaken for directly measuring the in-situ physical properties of rocks, pore-fluid pressure, hydrological parameters, temperature and other parameters of an intra-plate, active fault zone in the near-field of earthquakes – before, during and after their occurrence.

As a part of the 'Preparatory Phase', various studies/investigations were taken up which include Broadband Seismology, Magneto-Tellurics (MT), Land-based Gravity-Magnetics, Airborne Gravity and LIDAR surveys, etc. These studies were supplemented by the exploratory boreholes at a depth of ~ 1.5 km surrounding the seismic zone. Out of the 10 planned boreholes, 6 have been drilled so far (to depths of 1522.5m (Rasati), 1196m (Udgiri), 1134m (Kundi), 1211.6 (Nayari), ~1500m (Panchgani) and ~1500m (Ukhalu)) with logging and heat flow measurements. Also, borehole seismometers have been deployed in two holes. The studies helped to delineate the sub-surface structure around the seismic zone most prospective for scientific deep drilling and fault zone investigations.

Significant results inferred from the above investigations/studies include absence of sediments below the basalt cover; the thickness of the basalt column and its relation with the surface elevation; and almost a flat topography of the basement. The temperature at the depth of 5 km has been estimated to be around 130 to 150^{0} C.

The issues related to the design of the deep borehole, instrumentation to be deployed, the drilling and the operational plans for drilling, and international collaboration are being addressed.

It is planned to drill and instrument the two 3 km pilot boreholes at identified locations in the Koyna-Warna region in the next one and half years, to be followed by detailed design and drilling of the deep borehole(s).

As a part of the project, it is planned to set up a Research Laboratory (RL) at Karad, Maharashtra, which will serve as the operational centre for carrying out the research activities related to the scientific deep drilling. The laboratory will mainly focus on the borehole geophysics investigations and related research, including core analysis and associated field/research studies.