Geophysical Research Abstracts
Vol. 21, EGU2019-6600, 2019
EGU General Assembly 2019

Investigations of Artificial Water Reservoir Triggered Seismicity Mechanism at Koyna, India

Harsh K Gupta
National Geophysical Research Institute, Seismology, Hyderabad, India (harshg123@gmail.com)

Located near the west coast of India, Koyna is the most prominent site of artificial water reservoir triggered seismicity (RTS). RTS was observed at Koyna soon after the impoundment of the Koyna Dam in 1962 and it has continued till now. It includes the largest RTS earthquake M 6.3 on December 10, 1967; 22 M$\geq$5.0, and thousands of smaller earthquakes. The entire RTS earthquake is confined to an area of about 30 km x 20 km, with most focal depths being 2 to 9 km. There are no other earthquake sources within 50 km of the Koyna Dam. This makes Koyna a very suitable site to investigate the genesis of reservoir- triggered seismicity (RTS) through deep drilling. On the basis of seismic activity and logistics the location of the first Pilot Borehole was finalized. The drilling started on the 21st December 2016 and the 3000 m deep borehole was completed on 11th June 2017. The basement was touched at 1247 m depth and there were no sediments below basalt. Several zones with immense fluid losses were encountered. Geophysical Logging has been completed. Cores were recovered from 1269, 1892 and 2091 depths. The cores are 9 m long and with 4 inches diameter. The core recovery is almost 100%. In-situ stress measurements have been conducted at depths of 1600 m onwards. Low and variable strength and elastic properties of the basement granitoids in Koyna compared to granitic rocks from other regions indicate that rock strength may have been modified by the recurrent seismic activity. 2-D finite element modeling carried out at Koyna required unusually high permeability values of $\sim$10-14 for granites to induce critical pore pressure changes of 0.1 to 1.0 M Pa up to a depth of 10 km to trigger earthquakes in a critically stressed rock volume. Fractures in granitic basement rocks and also observed in drill holes support the view that water must have percolated to focal depths through fractured basalts and granitic basement rather than due to permeation through granites influencing triggering of earthquakes. A suite of scientific experiments conducted in the Pilot Borehole and other field observations are being analyzed.
(Contributions from the Scientists from the National Geophysical Research Institute, Hyderabad, India and Borehole Geophysics Research Laboratory, Karad, India).