



**A report on Earthquake activity in Shahapur Taluka, Thane District,  
Maharashtra.**

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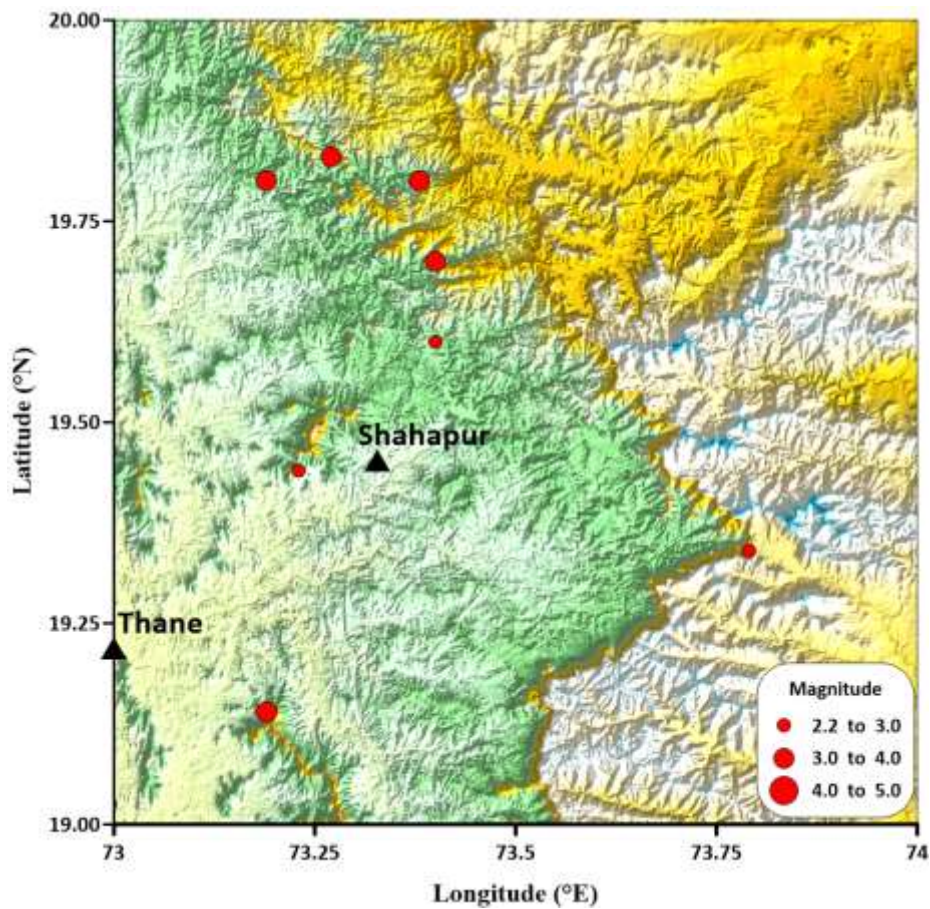
## **1.0 Introduction**

The Thane district of Maharashtra is covered with the Deccan traps, with a few sedimentary sequences of Mesozoic to Quaternary age, which is relatively less vulnerable to moderate to large earthquakes and is tectonically termed as an intra-plate or shield region of Peninsular India. The area, however, has experienced micro- to small-magnitude events in a sporadic manner. The area around the Bhatsa region in the Thane district has been experiencing swarm-type of earthquake activity since May 17, 1983. The Thane district is in the seismic zone-III as per the Bureau of Indian standards map (IS1893 (Part1):2016); seismic zone III categorizes the parts of the region as a moderate damage risk zone with a zone factor of 0.16 and is broadly associated with seismic intensity VII or more on the Modified Mercalli Intensity (MMI) scale. The significant earthquakes reported so far in the area were the Koyna (M6.0) and Killari (M6.3) earthquakes of 1967 and 1993, respectively.

A clustering of earthquakes in time and space with no prominent large-magnitude earthquake is termed an earthquake swarm. Numerous studies carried out earlier indicate that the swarm types of earthquakes are triggered either due to a large magnitude earthquake or intrusion of fluids into fracture (weak) zones associated with volcanic activity or rainfall (pore fluid pressure). Generally, swarm earthquakes are small in magnitude, and they may not lead to a large magnitude earthquake. Usually, in this case, the region, instead of being under stress for a long duration and preparing itself for a large magnitude earthquake, releases strain energy instantaneously through such small magnitude earthquakes. A few places in the south Gujarat and Saurashtra region (like Talala, Navsari, Jamnagar, and Haripur) in the past, and presently Palghar (Maharashtra), Vijayapura, and Kalaburagi (Karnataka) have been experiencing swarm-type earthquakes. These events were attributed to triggering due to rainfall during the monsoon season. Further, these earthquakes were observed to be associated with energy in the high-frequency audible range (20-40 Hz), which was later confirmed by the locals, who witnessed subterranean sounds like those generated due to blasting in the epicentral region.

## 2.0 Preliminary Analysis

The 24 hrs day-plot of seismic waveform data of Palghar, Mumbai, Nashik, and Pune seismological observatories have been checked for any event and found that the above stations recorded no tremor from 22 November to 4 December 2022. There might be tremors during the said period, because of its low magnitude, the seismic signal has attenuated and may not be recorded. A sample screenshot of 24 hrs day-plot of seismic waveforms are enclosed for reference (Figure-2).



**Figure 1:** Map showing the past earthquake that occurred within the 50 km radius of Shahapur Tehsil in the past ten years

Date	Time (IST)	Lat (deg.N)	Long (deg.E)	Depth (km)	Magnitude	Location
16-08-2010	19:36:45	19.34	73.79	10	2.5	84 km East of Thane
09-09-2011	14:27:47	19.60	73.40	10	2.2	59 km NE of Thane

25-02-2013	17:21:59	19.80	73.38	10	3.0	75 Km NNE of Thane
25-12-2017	04:14:22	19.80	73.19	10	3.0	66 Km NNE of Thane
01-01-2018	20:51:46	19.83	73.27	10	3.5	72 Km NNE of Thane
13-07-2018	16:01:03	19.14	73.19	17	3.1	22 Km ESE of Thane
06-08-2018	04:31:50	19.44	73.23	10	2.8	34 Km NE of Thane
20-09-2019	11:02:37	19.70	73.40	3	3.5	64 Km NE of Thane

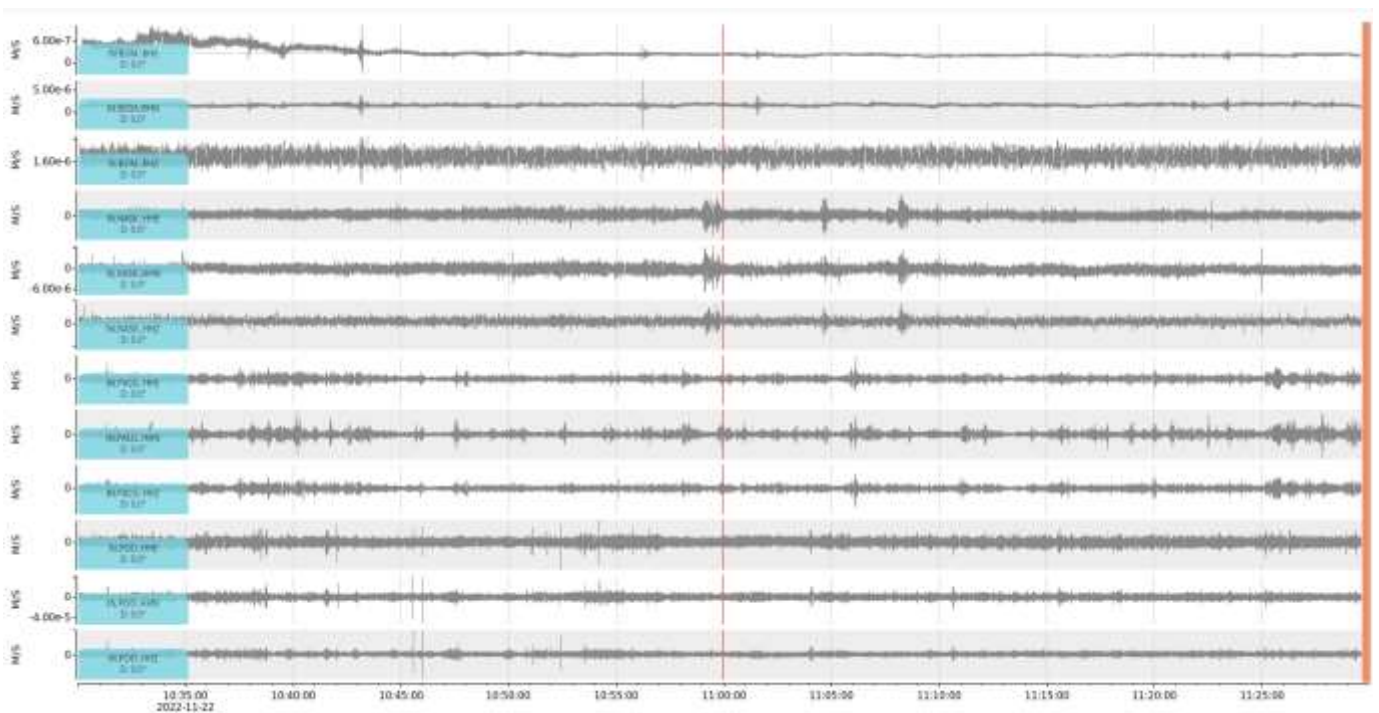
### 3.0 Concluding Remarks

As per reports of the District Administration, there were felt reports on 22 and 29 Nov 2022, however, it could not be detected by the nearby permanent seismological observatories at Mumbai, Pune, Nashik, and Palghar due to low magnitude of earthquakes (Fig. 2). Many of these events were reported to be accompanied by rumbling sounds with or without shaking, which may be due to the shallow focal depths of the events. Further, the acoustic sounds may be associated with the localized mining activity or stone quarry blast which need to investigate by local authority. It is to mention here that the Palghar District, which is about 80 km SE of the affected area, experiencing such micro-earthquakes activity since September 2018, with three earthquakes of maximum magnitude M4.0 on 04.09.2020, 11.09.2020, 01.12.2021, and activity is still continuing and slowly entering into quiescence stage. The region is devoid of any significant earthquakes in the past, and due to the non-presence of potential active/known faults, the probability of occurrence of a large magnitude earthquake appears insignificant. Nevertheless, a precise prediction of an earthquake in space, time, and magnitude is not possible as on date.

The activity appears to be related to the increased pore pressure in the subsurface and subsequent crustal adjustments during monsoon and post-monsoon periods. The fractured rock mass of Deccan basalt may provide a favorable medium for rainwater to infiltrate the subsurface. However, it is emphasized that the Thane district occupies seismic zone III as per

the latest Seismic Zoning map published by the Bureau of Indian Standards (BIS), where the maximum expected MMI scale intensity would correspond to VIII (M~5.5).

The NCS is monitoring the earthquake activity in Maharashtra state on 24 x 7 basis with ten existing permanent seismological observatories at Karad, Pune, Mumbai, Solapur, Palghar, Latur, Hingoli, Akola, Nagpur, and Nashik, in real-time mode, including other permanent observatories in neighbouring states of Gujarat and Madhya Pradesh. In addition to these permanent seismological observatories, NCS is also operating five additional temporary seismic field stations in the Palghar District which is also keeping a close watch on the current activity. As the present activity is sporadic and intermittent, and hence the deployment of temporary field observatories is deferred at this stage and will be considered for deployment in near future based on the analysis of more data from the near-by permanent observatories.



**Figure 2:** Earthquake Waveform plot of BOM, NASK, PALG, and Pune on 22<sup>nd</sup> Nov 2022.

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