

Composition and Elastic Properties of Deccan Volcanic Basement: Evidences from Killari borehole, Western India

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Introduction

65 Ma Deccan Volcanic Province forms one of the largest volcanic eruptions on the surface of the earth. It has been experiencing intraplate earthquakes since historical times that includes a number of disastrous earthquakes in recent past like 1967 Koyna (M=6.3), 1993 Killari (M=6.2) and 2001 Bhuj (M=7.6) etc. In spite of a large number of geoscientific investigations, seismo-tectonics of this region is least understood. This led to drilling of boreholes to understand the nature of basement rocks concealed below thick volcanic pile [1, 2]. One of the borehole (KLR-1) was drilled in the epicentral region of the Killari earthquake, which penetrated 280m thick basement.

Significant Results

Our detailed study of the core samples from KLR-1 borehole indicate the basement to be made up of moderately retrogressed halogen rich upper amphibolite to granulite facies transitional rocks, containing Hbl, Cpx, altered Opx, Pl, Bt, Kfs, Qtz and Ep as major constituents and Ap, Ilm, Tnt and opaques as accessories, which is consistent with mid-crustal lithology. As much as 15 to 20 km thick upper crust, appears to have been eroded, before the onset of the Deccan volcanism. Further, the basement rocks are associated with a high mean density of 2.82 g/cm³ (range: 2.67 - 3.11 g/cm³) and average P- and S-wave velocities of 6.17 km/s (range: 5.82 - 6.61 km/s) and 3.61 km/s (range: 3.21 - 4.03 km/s) respectively. Poisson's ratio varies widely from 0.17 to 0.31 with a mean of 0.24. These rocks also contain high amount of FeO_t and CaO, sometimes reaching as high as 18.4 % and 9.4 % respectively, which can be attributed to mantle metasomatic enrichment. Some of the samples are extremely rich in biotites apart from FeO_t, which together resulted into significant drop in measured velocities to the tune of as much as 15%. There are indications that regional metasomatism may have a link with nucleation of large earthquakes.

[1] Pandey *et al* (2009) *J. Asian Earth Sci.* **34**, 781-795. [2] Tripathi *et al* (2012) *Int. J. Earth Sci.* **101**, 1385-1395.