



Intraplate Seismicity of the northwestern Indian shield: Implication for the reactivation of palaeo-tectonic elements

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High intensity intraplate (or stable continental region, SCR) earthquakes are recorded recently in the northwestern shield. The explanation for the intraplate seismicity necessitates understanding of the structures and processes of the shield area. In this context, it has been shown that the epicenter distribution is highly correlative with the lineaments related to the palaeoaccretionary corridors, rift margins, fault zones etc. These pre-existing weak zones are vulnerable and show episodic remobilization.

The northwestern Indian shield has a unique evolutionary history since beginning. The banded gneissic complex of Aravalli craton exhibits oldest 3.3 billion year isochron in the region. The northwestern shield evolved through several orogenic, anorogenic, magmatic, granulite exhumation and tectonism. The Aravalli, Delhi and Sirohi orogeny show the compressional tectonic regime in the craton. The Rodinia fragmentation initiated extensional lithospheric tectonism and resulted wide spread large silicic Malani magmatism (~750 Ma) through linear crustal fractures in the northwestern India, Pakistan, and Seychelles during Neoproterozoic time. The assembly of Gondwana continent marks with the deposition of Marwar Supergroup platformal deposits in the region.

The Gondwanaland fragmentation during the Mesozoic era caused extensional tectonics in the northwestern Indian shield. This led to the development of rift basins in Kutch (Gujarat) and Barmer (western Rajasthan). The Deccan volcanism, separation of the Seychelles microcontinent from India, sedimentary basin development in western Rajasthan and the alkaline magmatism of Mundwara, Sarnu-Dandali and elsewhere are considered to be the products of Reunion plume activity in western India.

However, a bolide impact hypothesis is also proposed for the K-T magmatism and other tectonism.

The continual extensional tectonic regime caused deep fractures in the continental and oceanic lithosphere. The Cambay-Sanchor-Barmer rift developed in continental lithosphere, which accumulated tertiary sediments. The northward movement of Indian plate accelerated during the late Tertiary time initiated the realignment of stress pattern and reactivation of palaeo tectonic elements in the region.

The northwestern Indian shield evidenced several geomorphologic changes in the Quaternary time. The western Rajasthan and Gujarat experienced rapid tectonic upheaval since the Vedic period (~5000-10000 year BC). The Vedic rivers Drishadvati and Saraswati, became extinct around 1500 BC. The Arabian Sea gradually receded and resulted development of the Rann (marshy land) in the region. The region is surrounded and transacted by various weak zones, which in the geological past suffered repeated reactivation of the tectonic elements. The reason for perpetual reactivation throughout the geological history in the region might be the consequence of the weakened and criss-crossed base. The area is virtually at the crossroads of several active and silent lineaments, which made the northwestern Indian shield a highly vulnerable earthquake zone