Probable Causes of Intraplate Earthquakes

Probable causes and governing factors related to the manifestation and distribution of intraplate earthquakes are proved to be very much subtle. Different researchers have tried to explain this earthquake in different perception and several model have been proposed till date. On a global context, occurrence of intraplate earthquakes are found to occur along pre-existing zones of weakness within areas affected by the last major orogenesis (Sykes 1978). Some of the models that explain the occurrence of intraplate earthquakes are intersecting faults (Talwani 1988, 1999); local stress concentration around destabilized infringements (Campbell 1978); ductile weak zones in the lower crust (Zoback 1983), fluids presence in the lower crust of ancient rift zones (Vinnik 1989), stress perturbation resulting from buried rift pillows (Zoback and Richardson 1996), a weak zone in the lower crust (Kenner and Segall 2000), rifted crust (Johnston and Kanter 1990; Johnston et al. 1994; Schulte and Mooney 2005), craton edges (Mooney et al. 2012), areas of high heat flow (Liu and Zoback 1997) and lateral density variations (Stein et al. 1989).

In these models, primarily upper crust satisfies seismogenic earthquakes which are governed by the plate generated forces. However, the lower crust being weakened due to higher temperatures the strength of the lithosphere is diminished and this causes moderate magnitude earthquakes. Long (1988) proposed that seismicity due to intraplate earthquakes is a transient phenomenon causing from a perturbation in crustal strength due to the disturbance in the hydraulic or thermal properties of the lower crust. Further models suggest intraplate seismicity is due to the perturbation of the regional stress field by forces associated with lithospheric flexure after deglaciation, gravitational forces at structural boundaries or sediment loading (Stein et al. 1979; Quinlan 1984; Grollimund & Zoback 2001; Goodacre & Hasegawa 1980; Chandrasekhar & Mishra 2002; Talwani & Rajendran 1991).

Zoback (1992) suggested that large intraplate earthquakes occurs due to the compressional stress field within the plate, which is combination of main plate force and local stress field associated with specific tectonic or geological features (such as lateral density contrasts, lateral strength contrasts and lithospheric flexure). Studies of recent data of global stress pattern reveal that the stress field can have broader wavelengths extending from the plate scale to the regional and local scales (Heidbach et al. 2010). Talwani (2014) and Khan et al. (2016) attempted to combine all these various models into an incorporated model for intraplate earthquakes. They proposed that intraplate earthquakes transpire in certain geological areas where local stress concentrates which sustain the gathering of local stresses and this accumulated local stress field interact with the regional tectonic stress field and ultimately lead to an earthquake. Sometimes, strain-acclimatization may also enable buildup of increased

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amount of stress field with transformation of rheology of the constituent rocks, and failure may take place to generate earthquake.

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