



A New Paradigm for Large Earthquakes in Stable Continental Plate Interiors

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Large earthquakes within stable continental regions (SCR) show that significant amounts of elastic strain can be released on geological structures far from plate boundary faults, where the vast majority of the Earth's seismic activity takes place. SCR earthquakes show spatial and temporal patterns that differ from those at plate boundaries and occur in regions where tectonic loading rates are negligible. However, in the absence of a more appropriate model, they are traditionally viewed as analogous to their plate boundary counterparts, occurring when the accrual of tectonic stress localized at long-lived active faults reaches failure threshold. Here we argue that SCR earthquakes are better explained by transient perturbations of local stress or fault strength that release elastic energy from a pre-stressed lithosphere. As a result, SCR earthquakes can occur in regions with no previous seismicity and no surface evidence for strain accumulation. They need not repeat, since the tectonic loading rate is close to zero. Therefore, concepts of recurrence time or fault slip rate do not apply. As a consequence, seismic hazard in SCRs is likely more spatially distributed than indicated by paleoearthquakes, current seismicity, or geodetic strain rates.