

## **Major effect of inherited rheology weakening in the crust and mantle on continental intraplate strain and seismicity rates**

Frédéric Gueydan and Stephane Mazzotti

Géosciences Montpellier, Université de Montpellier, Montpellier, France

Stable Continental Regions (SCR, i.e. intraplate) are commonly viewed as non-deforming and very high resistance lithosphere domains, except in localized regions of higher strain and seismicity rates that often related to fossilized tectonic zones acting as weaker domains (e.g., Rhine Graben, New Madrid). Two main categories of models have been proposed to explain strain concentration in SCR: Local stress concentration (fault intersection, erosion pulse, ...) and local lithosphere weakness (high geotherm, mantle anisotropy, ...). In order to test the respective role of these various parameters of the stress - rheology - strain relationship, we propose a simple 1D model to quantify first-order continental strain rate variations using laboratory and field-based rheology laws for the crust and mantle. In particular, we include new strain-weakening rheologies in order to simulate tectonic heritage.

Within the framework of near-failure equilibrium between tectonic forces and strain rates, we show that inherited rheology weakening plays a fundamental role in allowing for and explaining strain and seismicity concentration in intraplate weak zones. A comparison with empirical strain rate estimations in SCR and intraplate weak zones shows that inherited weakening rheologies can increase local strain rates by as much as three orders of magnitude, about one to two orders higher than that permitted by other processes such as stress concentration, thermal anomaly, etc.