# Conditions for the Generation of the Rifts Based on the Two-dimensional Dynamical Model

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A critical strain rate leading to the formation of the continental rifts exists, and its value is in the range 10-17 to 10-16 (1/s). If the lithospheric extension starts with larger strain rate than the critical value, the acceleration of thinning always occurs. On the other hands, if the extensional rate is lower than the critical value, the hardening due to crustal thinning makes it impossible to rift, resulting in failed rift. In order to create the continental rift under currently believed magnitude of tectonic forces (~ 5 or 6 TN/m), the initial crustal thicknesses are required to be more than 30 km for lithospheric thickness L = 80 km, 40 km for L = 120 km and 50 km for L = 200 km.

I present a two-dimensional thermo-mechanical finite element model of the continental lithosphere to study the dynamics of continental extension and to estimate the conditions of lithospheric structure leading to the initiation of the continental rifting due to horizontal tectonic forces. The continental lithosphere is represented as a visco-elasto-plastic rheology including the brittle failure at low temperature and pressure conditions and creep at temperature and pressure conditions. I use the Von Mises associated elasto-perfectly plastic rheology to model the brittle deformation, and adopt the viscoelastic rheology for ductile deformation. A stratified lithosphere with three layers, i.e., wet quartzite upper crust, Adirondack granulites lower crust and wet dunite mantle, is adopted here. In this model, applied tectonic forces are assumed to be constant with time.

Rift flank uplift is an intrinsic consequence of the necking process and is supported by the flexural strength. The larger amplitude of this uplift was obtained for the numerical model with harder lithosphere. The parameters controlling the amplitude of the rift flank uplifts were, however, clarified in this study. In order to create the continental rift under currently believed magnitude of tectonic forces (~ 5 or 6 TN/m), the initial crustal thicknesses are required to be more than 30 km for lithospheric thickness (a) = 80 km, 40 km for a = 120 km and 50 km for a = 200 km. A critical strain rate leading to the formation of the continental rifts exists, and its value is in the range 10-17 to 10-16 (1/s). If the lithospheric extension starts with larger strain rate than the critical value, the acceleration of thinning always occurs. On the other hands, if the extensional rate is lower than the critical value, the hardening due to crustal thinning makes it impossible to rift, resulting in failed rift.