Some remarks on the cessation of rifting under constant tectonic force

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The simple stretching model proposed by McKenzie (1978) has been successful in explaining a history of basin subsidence with a rapid synrift phase followed by a long-term thermal subsidence. While this simple stretching model satisfactorily accounts for the structure and subsidence of sedimentary basins, it does not provide the dynamics of the sedimentary basin formations, information about the origin and magnitude of the driving force for extension and the rheology of the lithosphere. Degree of the extension is one of the most important parameters controlling the magnitude of subsidence. However, the simple model gives no answers for the questions of these dynamical aspects. The importance of the strain rate (e.g., England, 1983; Sawyer, 1985; Kusznir and Park, 1987; Bassi, 1995) and rheology or initial condition (e.g., Bassi, 1991; Buck, 1991) has been proposed to explain the variability of continental stretching.

In this study, I focus on the strain hardening during lithospheric extension. It is assumed that the strength of rocks is dependent not only on strain rate and temperature but also on the total accumulated strain. Strain hardening is incorporated into a simple one dimensional model through an ad hoc relationship between strain and viscosity. Such strain hardening model does not imply that one particular mechanism for strain hardening is considered, and its purpose is to offer the material behavior associated with the transition from weak to strong rheology. I investigate the following three parameters on the cessation of rifting: (1) the increase in strength associated with strain hardening, (2) the critical strain required for the onset of strain hardening and (3) the rate of strain hardening.