
Distributed extensional deformation at the continent-ocean transition stage

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Abstract

The evolution from stable continental lithosphere to oceanic seafloor spreading is traditionally studied from structural analysis deduced from geophysical measurement campaigns both across and along passive margins. Early on, the Afar Depression was recognized to be the above water location of active spreading axes of incipient oceanic ridges. Many studies have focused on the dynamics of the rift segments and their related rifting/dyking cycles. The recent densification of both permanent and temporary geodetic and seismic networks, together with the development of remote sensing dedicated to surface deformation estimate, shed light on the active deformation occurring far from the active axes. By revisiting some of these data sets, we show that both tectonic and tectonic extensional deformation can be in evidence along the margins bordering the whole Afar Depression. Because they are associated with the early stage of continental rifting, these detected episodic events together with structural observations augment our understanding of the transition from continental to oceanic lithosphere. At this early stage of the continental breakup, the concentration of the extensional deformation along the active rift segments can potentially compete with distributed deformation affecting a broad area, depending on the availability of magma within the recent axes.

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