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A New Model for the Development of the Asymmetry of Conjugate Margins During Continental Rifting.

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The rifting processes that lead to the commonly observed asymmetry in structure of conjugate non-volcanic rifted margins are still poorly understood. One of the margins displays gradual crustal thinning and pervasive faulting. Perplexing is the abrupter crustal thinning but little faulting of the conjugate side. Some models attempting to explain this asymmetry have invoked simple shear extension along crustal-scale - or even lithospheric - detachment zones. However, clear candidates for detachment faults have only been seismically imaged at the edge of thinned continental crust, near the continent-ocean transition where the crust is $< \sim$8 km km thick. This observation suggests that those potential detachments did not exist for most of the rifting history, and cannot explain the general large-scale asymmetry. In addition, it has been inferred, for both conjugate margins, that there is an apparent discrepancy between the extension caused by faulting (measured as horizontal stretching) and observed crustal thinning (measured thinning factor). To study faulting during the formation of non-volcanic margins, we pre-stacked depth migrated seismic lines from the West-Iberia/Newfoundland conjugate system. The depth images have been used to accurately calculate extension and compare it to measured crustal thinning on coincident wide-angle seismic profiles. The new data shows that crustal thinning is larger than extension by faulting only at scantly faulted margins. In contrast, crustal thinning can be explained only by faulting at pervasively faulted margins. We propose a model that accounts for the new observations and explains the development of the asymmetry at non-volcanic margins.