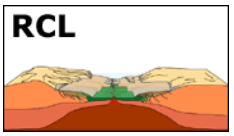
How Sediment Promotes Narrow Rifting: Applications to the Gulf of California



Award: MARGINS-Related

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Sediments are one of the main recorders of tectonic events, but they may also affect the way compression or extension proceeds. It is now accepted that the unloading effect of erosion can change the pattern of compressional deformation in areas of continental convergence (e.g. Willett et al., 1993; Beaumont et al., 2004). In a similar way, we suggest that the load of sediments may promote localized deformation in areas of continental extension. Recently collected data from the Gulf of California (Lizzaralde et al, 2007) indicates that higher rates of sedimentation are associated with a switch from distributed, or wide rift style, extension to more focused, narrow rift style, extension. We examined the effect of deposition of large amounts of non-locally derived sediment on extensional style using two-dimensional, regional-scale numerical experiments of extending thick continental crust. Depending on initial model conditions, the onset of rifting in thick continental crust occurs in either the narrow rifting, wide rifting, or core complex mode. For a system in wide rift mode, sedimentation shortens the time needed to transition to a narrow rift. It appears that the weight of sediments reduces the crustal buoyancy force caused by local crustal thinning, allowing a rift to extend more easily in a narrow rift mode. In the Gulf of California, changes in extensional style correlate with sediment thickness, with an earlier transition to narrow rifting in the north versus the south.

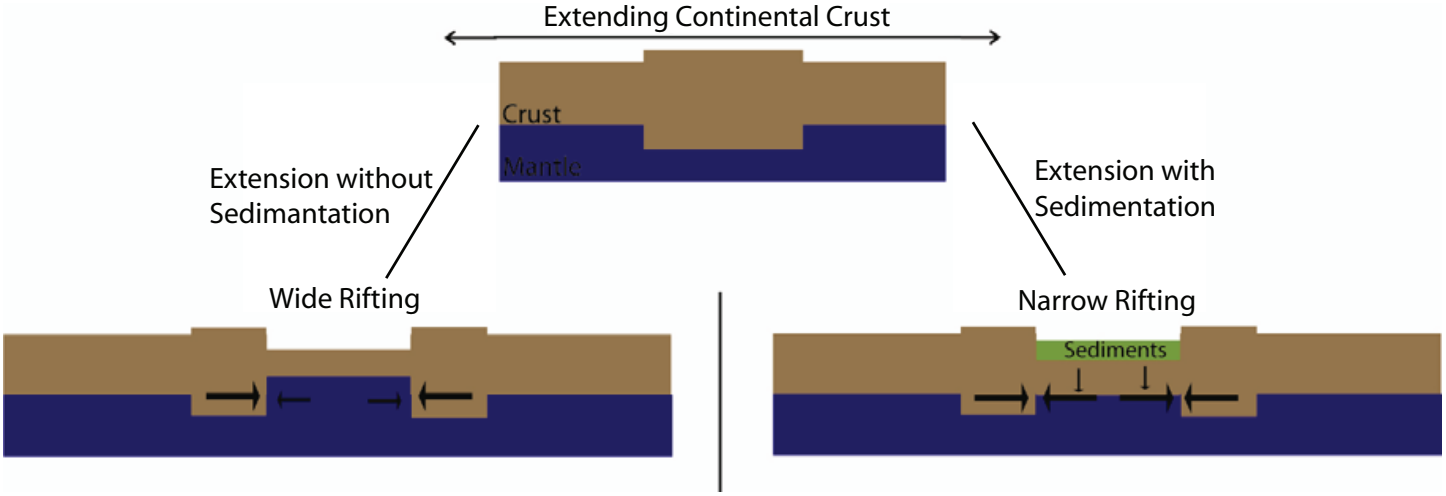

Figure: Illustration of the effect of sediments on the style of rifting as seen in numerical models. The load of the sediments make narrow rifting occur when lithospheric conditions and no sedimentation would lead to wide rifting.