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Closing to open – Small, subducting oceanic basins and their effects on the deformation of the overriding plate

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While there has been a lot of work focusing on improving our understanding of divergent and convergent plate boundaries, the intricate nature of back-arc extension, where subduction and large-scale extension occur and interact in close proximity, is yet to be explored properly. The absolute and relative velocities of the plates, the age of the subducting oceanic plate, the mantle flow pattern of the subduction zone and the inherited rheological properties of the backarc lithosphere are all thought to be key players, shaping the dynamics of the fore-arc back-arc systems.

We use lithospheric scale plane-strain thermo-mechanical model experiments to investigate the factors controlling the formation of active back-arc extension and its interaction with subduction-rollback and potential slab breakoff throughout the closure of a small oceanic basin.

Our first results suggest that a weakened continental mantle-lithosphere is required in the back-arc for significant thinning/rifting to occur. The location of the rheological contrast between the weakened zone and the normal back-arc lithosphere is a key parameter setting the location of back-arc rifting. Moreover, a slow convergence is of paramount importance for the initiation of back-arc rifting as it allows for the slab-pull to become a dominant force in the system causing subduction-rollback. Additionally, the width of the subducting oceanic basin sets the amount of space available for subduction-rollback and through that the amount of extension in the back-arc zone.