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Pre-collisional Extension of Microcontinents

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Extension of the continental lithosphere in convergent plate boundaries can be observed in the back-arc region of a subduction zone or in the accreted terranes (microcontinents) due to post-orogenic gravitational collapse. The Aegean Sea and North American Cordillera are of examples of such extensional provinces, respectively. The common element of these extending continental lithospheres is that the deformation occurs on the overriding plate of a subduction system. Here we propose an alternative style of extension for the continental lithosphere which takes place in the pro-plate (subducting plate) prior to a collision event. The interpretation for this new style of plate extension comes from petrological studies and geodynamic numerical modelling results. According to Topuz et al. (2017), rocks from the mid-crustal levels of a microcontinent in Eastern Anatolia were exhumed to the surface in 12 Myr during their drift to a subduction zone within an oceanic plate, long before (∼21 Ma) their accretion. In order to explain this enigmatic pre-collisional extension in the pro-plate, we tested the response of the lithosphere with variably sized microcontinents as well as with different plate convergence rates. Our model results are consistent with the petrological evidence and show that the slab-pull yields appreciable stretching of the subducting lithosphere during its drift to the subduction/collision zone. Furthermore, we find that the amount of extension is inversely proportional with an increase in microcontinent size and convergence rate. While microcontinents undergo extension during their drift to a subduction zone, oceanic lithosphere in which microcontinents are embedded does not show significant extension. This can be accounted for by the higher total lithospheric strength of oceanic lithosphere.