

Intra oceanic subduction initiation

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Subduction is key for driving for plate tectonics. Yet it is still unclear where and how subduction initiates in the oceanic domain. It is widely accepted that it critically depends on the rheology of the oceanic lithosphere (Nikolaeva et al., 2010) and can occur upon failure of the load-bearing crustal and mantle layers. When oceanic lithosphere is too strong, high shear strength of the oceanic lithosphere does not permit failure, and subduction may occur by deforming a passive margin at ocean-continent transition. However, weakening processes such as zones of serpentized mantle may affect the strain localization (Maffione et al., 2015; Stern, 2004). Therefore, a series of experiments conducted to determine the favourable rheological and kinematic conditions that lead to the development of subduction zones in the intra-oceanic domain. These experiments involving both oceanic and continental domains which incorporate weak zones of realistic dimensions in the oceanic crust. Model results show that the key factor for the strain localisation is the difference in strength between the continental and oceanic upper crust. Analysis of deformation is used to define a boundary of rheological conditions enabling subduction in oceanic or in continental domain. Additionally, addition of a weak zones in a thick and strong oceanic lithosphere doesn't affect the deformation pattern. However, presence of a weak zone in a relatively younger oceanic lithosphere (60 ± 10 My) may induce strain localization in the oceanic crust rather than at passive margin. This shows the importance of geological inheritance and thermo-mechanical feed-backs for the locus and evolution of subduction zone.

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