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# What are the required conditions to trigger the obduction/subduction initiation?

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The initial stages allowing for the birth of obduction and/or subduction zones still remain enigmatic and highly debated. Although there is no doubt that initiation occurs on a preexisting lithospheric-scale thermal or mechanical discontinuity (e.g., ridge, supra-subduction zone or transform fault), no consensus has yet been reached on this subject. However, more and more data allowing to address this issue are available (coming from field analyses, metamorphic petrology and geochronology). In particular, metamorphic soles located at the base of ophiolitic nappes, which formed during the very first stages of initiation, yield increasingly precise P-T-t constraints. By confronting such data to thermo-mechanical models, it should be possible to identify which initial configuration allows for metamorphic sole formation and for the emplacement (or not) of an ophiolitic nappe of realistic dimensions.
In this study we designed thermo-mechanical models encompassing three initial model configurations, for which P-T-t data from the Semail ophiolite of Oman are then used for the validation of model outputs. The first configuration encompasses an oceanic ridge type initial thermal perturbation (error function). The second configuration mimics the thermal perturbation caused by the arrival of a mantle plume at the base of the lithosphere (gaussian function). The third initial condition corresponds to a case where the obduction/subduction initiates along a transform fault delimitating lithospheres of contrasting thermal ages (step function).
Our results show that obduction never initiates in ridge type models, excepted for particular conditions that are not compatible with the Oman case. They also indicate that the initial thermal anomaly has to be sharp but not necessary of large amplitude and that the strength of the lithosphere has to be high enough to ensure the establishment of thin and long ophiolitic nappe without buckling. Our results also highlight the key role of shear heating in enabling obduction/subduction initiation.