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Double subduction of continental lithosphere, a key to form wide plateau

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The mechanisms involved in the creation of the high and wide topography, like the Tibetan Plateau, are still controversial. In particular, the behaviour of the indian and asian lower continental lithosphere during the collision is a matter of debate, either thickening, densifying and delaminating, or keeping its rigidity and subducting. But since several decades seismicity, seismic profiles and global tomography highlight the lithospheric structure of the Tibetan Plateau, and make the hypotheses sustaining the models more precise. In particular, in the western syntaxis, it is now clear that the indian lithosphere subducts northward beneath the Hindu Kush down to the transition zone, while the asian one subducts southward beneath Pamir (e.g. Negredo et al., 2007; Kufner et al., 2015). Such double subduction of continental lithospheres with opposite vergence has also been inferred in the early collision time. Cenozoic volcanic rocks between 50 and 30 Ma in the Qiangtang block have been interpreted as related to an asian subduction beneath Qiangtang at that time (De Celles et al., 2011; Guillot and Replumaz, 2013).
We present here analogue experiments silicone/honey to explore the subduction of continental lithosphere, using a piston as analogue of far field forces. We explore the parameters that control the subductions dynamics of the 2 continental lithospheres and the thickening of the plates at the surface, and compare with the Tibetan Plateau evolution.
We show that a continental lithosphere is able to subduct in a collision context, even lighter than the mantle, if the plate is rigid enough. In that case the horizontal force due to the collision context, modelled by the piston push transmitted by the indenter, is the driving force, not the slab pull which is negative. It is not a subduction driving by the weight of the slab, but a subduction induced by the collision, that we could call “collisional subduction”.