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Uprising of the Iranien plateau: Inferences from thermomechanical modelling.

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The Iranian plateau is a vast region with smooth, average elevation of c. 1.5 km located at the rear of the Zagros mountain. Its formation results from the collision between the Arabian and Eurasian lithospheres (30-35 Ma ago). A number of recent studies have suggested an implication of a recent (10-5 Ma) slab break-off below Central Iran to explain the formation of the Iranian plateau. This collision zone is of particular interest due to its disputed resemblance to the faster Himalayan collision between the Indian craton and Eurasia, which gave birth to the vast Tibetan plateau. To test this hypothesis, we have designed large-scale (3082*590 km), high-resolution (3*3 km) numerical models of oceanic-continental subduction followed by continental collision. Our models have free upper surface boundary, surface erosion, rheological stratification (upper crust, lower crust, lithospheric mantle and asthenosphere), brittle-elastic-ductile rheology, metamorphic phase changes (density and physical properties) and account for the specific crustal and thermal structure of the Arabian and Iranian continental lithospheres.
The initial model geometry corresponds to the pre-continental collision phase, with an oceanic, Neotethyan subducting lithosphere still separating the two continents. We tested the response of the transition from oceanic subduction to continental subduction and the impact of progressive continental subduction on the topography.
The models show the importance of the positive buoyancy of the lower plate mantle lithosphere rheology for slab breakoff. Our experiments show that the transition from oceanic subduction to continental subduction very rapidly (< 1Ma) results in significant topography ($\sim$3 km) and horizontal shortening. The topographic high is located directly above the zone of coupling between the two plates. This uplift is accompanied by a progressive disappearance of the trench topography.
The results indicate a significant influence of mantle flow on topography during continental subduction and break-off processes. In fact, after the decrease of the convergence rate in response to the continental subduction and slab break-off, the mantle lithosphere of the overriding plate delaminates from the overlying crust. With local isostatic adjustment, subduction and delamination driven crustal processes plateau-like uplift occurs.