Slab tearing and vertical motions in the Gibraltar Arc: insight from 3D thermo-mechanical modelling.

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The closure of the marine gateways across the Gibraltar Arc during the Late Miocene caused massive salt accumulation in the Mediterranean basin during the Messinian salinity crisis. This major geographic change has been linked to the vertical motions associated with subduction between Iberia and Africa. Tomographic studies of the Gibraltar region suggest an underlying 3D arcuate slab structure, the Rift-Gibraltar-Betic (RGB) slab. The concept of lithospheric slab break off comes from the analysis of seismic tomography data, where positive seismic velocity anomalies are observed beneath collision zones are often interpreted as detached slab segments. Previous slab-breakoff studies involve the evolution of an already subducted slab, and their ‘break off’ term is associated with the symmetrical break off behaviour, i.e. the tears initiate from both sides and propagate towards the centre of the slab. Here, we are interested in the slab breakoff from ‘tearing’ -- initiates on one side and laterally propagate along the slab. We utilise 3D thermomechanical modelling to study the tectonic and rheological settings that lead to the lateral tearing of the lithosphere with lateral propagation of the tearing. Our preliminary results address: (i) the tectonic settings and rheological properties favour slab tearing; (ii) the effect of convergence rate on the tearing behaviour; and (iii) the consequent uplift motions observed on the crustal surface.