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Subduction initiation in the western Mediterranean: preliminary results of numerical modeling

M. Baes, R. Govers, and M.J.R. Wortel

Department of Earth Sciences, Utrecht University, The Netherlands (baes@geo.uu.nl)

This study aims to shed light on the geodynamical context of Oligocene-Early Miocene initiation of subduction in the western Mediterranean. Here we investigate one hypothesis, that Late Oligocene-Early Miocene continental collision in the Alps triggered initiation of a northwest-dipping subduction zone along a STEP (Subduction-Transform Edge Propagator) fault which was located along the former Iberian passive margin (which included Corsica and Sardinia), similar to what appears to be currently happening north of Sicily and Algeria. We use published plate tectonic reconstructions for the Early Miocene to constrain the main aspects of the regional geometry and plate tectonic forces. Using two-dimensional finite element models, we investigate the extent to which Alpine subduction and collision primed the western Mediterranean for subsequent initiation of subduction.

Mechanical properties of the finite element models are found to be particularly relevant in our study; we use elastic, (power law) viscous, and plastic rheologies to represent temperature and pressure dependent rock behavior. One particular important assumption is that rollback of the Alpine slab created a STEP deformation zone that subsequently was the locus of subduction initiation. In the numerical models, this deformation zone is an initially assumed channel of 6 km wide. Published models of subduction initiation emphasize the relevance of including the upper mantle into our models. Our first results show how convergence of Africa with respect to Europe developed from induced to self-sustained subduction, paving the way towards subsequent rollback and development of the Current western Mediterranean basin.