EGU22-2092
https://doi.org/10.5194/egusphere-egu22-2092
EGU General Assembly 2022

Rapid large-amplitude vertical motions generated by 3D subduction slab roll-back in the Valencia Trough, Western Mediterranean

Penggao Fang[1,2], **Julie Tugend**[3,4], Geoffroy Mohn[4], Nick Kusznir[5], and WeiWei Ding[1,2]
[1]Key Laboratory of Submarine Geosciences & Second Institute of Oceanography, Ministry of Natural Resources, Hangzhou, 310012, China
[2]Southern Marine Science and Engineering Guangdong Laboratory (Zhuhai), Zhuhai, 519080, China
[3]Sorbonne Université, CNRS-INSU, Institut des Sciences de la Terre de Paris, ISTeP UMR 7193, F-75005 Paris, France
[4]Department of Geosciences and Environmental Sciences, CY Cergy Paris Unversité, Cergy-Pontoise, 95000, France
[5]Department of Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool L693GP, UK

The Cenozoic geodynamic evolution of the Western Mediterranean is complex comprising subduction, slab roll-back, back-arc extension, collision, and lithosphere delamination. We investigate the subsidence of a regionally observed unconformity in the Valencia Trough of the Western Mediterranean, here referred to as the Miocene Unconformity, which separates Mesozoic from latest Palaeogene to Neogene sediments. The mechanisms controlling its subsidence are poorly understood.

We show, using a dense grid of seismic reflection data, well data and 3D flexural backstripping, that the Miocene Unconformity in the SW Valencia Trough subsided by more than 1.5 km to the present day at an average rate of 90 m/Myr. The absence of Cenozoic extensional faults affecting the basement shown by seismic data indicates that this rapid subsidence is not caused by Cenozoic rifting or remaining Mesozoic post-rift thermal subsidence. Neither can this subsidence be explained by subduction dynamic subsidence or flexural loading related to the thin-skin Betic fold and thrust belt which only affects subsidence observed near the deformation front.

We interpret the 1.5 km subsidence of the Miocene Unconformity as the collapse of a back-arc transient uplift event. Erosion during this uplift, resulting in the formation of the Miocene Unconformity, is estimated to exceed 4 km. Transient uplift was likely caused by heating of back-arc lithosphere and asthenosphere, combined with mantle dynamic uplift, both caused by segmentation of Tethyan subduction resulting in slab tear. Subsidence resulted from thermal equilibration and the removal of mantle flow dynamic support Tethyan subduction slab roll-back. We propose that our observations and interpretation of rapid back-arc km-scale uplift and collapse have global applicability for other back-arc regions experiencing subduction segmentation and slab tear during subduction slab roll-back.