

The Alboran volcanic arc archipelago isolated the Mediterranean during the Messinian salinity crisis forming the land bridge for biota dispersal across the western Mediterranean

Guillermo Booth-Rea (1), Cesar R. Ranero (2), and Ingo Grevemeyer (3)

(1) University of Granada, Geodinámica, Granada, Spain (gbooth@ugr.es), (2) ICREA at Instituto de Ciencias del Mar, CSIC, Barcelona, Spain, (3) GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany

The Mediterranean Sea desiccation during isolation from the world oceans created the well-known Messinian salinity crisis but also landbridges that permitted the exchange of terrestrial biota between Africa and Iberia contributing to the present biodiversity of the Mediterranean region. The hypotheses for the cause chocking the Mediterranean have typically sought to explain geological features, particularly the giant salt deposits, but the implications of the faunal changes occurring around that time remain inadequately integrated by current geological models. We present wide-angle seismic data that constrain for the first time the 16-18 km thick crust structure of a volcanic arc formed mostly between ~ 10 to ~ 6 Ma across the eastern region of the Alboran basin. The crustal structure supports that the arc created an archipelago forming a land bridge across the basin that largely isolated the Mediterranean. After the cessation of volcanic activity, the archipelago progressively submerged by thermal subsidence and accompanying sediment loading, having emerged islands that persisted into the Pleistocene time and shallow straits forming sills during the early Pliocene. The presence of an archipelago in the eastern region of the basin may explain a number of puzzling observations previously inexplicable by the proposed barriers closing the Gibraltar arc west of Alboran. The progressive volcanic build up of the archipelago together with the closure of the Betic and Rifian marine corridors would explain the initial isolation of the Mediterranean since 7.1 Ma and the exchange of terrestrial biota since 6.2 Ma, i.e. before desiccation, which diversified radiating from SE Iberia and the opposite segment of the eastern Rif. In addition, an eastern barrier agrees with the continuous Messinian-age open marine sediments drilled at ODP site 976 in the western Alboran basin, which may have been the refuge of typical Mediterranean taxa that rapidly repopulated the Mediterranean in the Pliocene. Lastly, the proposed eastern barrier agrees well with the western extension of thick salt deposits. In sum, the new models may be able to integrate for the first time sedimentological, faunal, oceanographical and tectonic patterns, previously not explained by a single geodynamic model.