Geophysical Research Abstracts
Vol. 18, EGU2016-5532, 2016
EGU General Assembly 2016

Large-scale block rotations from Late Tortonian to Present in the Gibraltar Arc System: input into the Messinian salinity crisis

Ana Crespo-Blanc (1,2), Menchu Comas (2,1), and Juan Carlos Balanyá (3)

(1) Departamento de Geodinámica, Universidad de Granada, Granada, Spain (acrespo@ugr.es), (2) Instituto Andaluz Ciencias de la Tierra, Consejo Superior de Investigación Científica, Armilla (Granada), Spain (mcomas@ugr.es), (3) Departamento de Sistemas Físicos, Químicos y Naturales, Universidad Pablo de Olavide, Sevilla, Spain (jcbalrou@upo.es)

We propose a reconstruction of one of the tightest orogenic arcs on Earth: the Gibraltar Arc System (GAS), which closes the Alpine-Mediterranean orogenic system to the west. This reconstruction, which includes onshore and offshore data, is completed for approximately 9 Ma, a few Ma before the Messinian Salinity Crisis (MSC). By that time a change in the direction of the Africa-Iberia convergence took place, the main shortening in the external wedge was accomplished, most of the low-angle normal fault systems that contribute to crustal-scale extension in the GAS ceased, and a significant emersion along the Africa and Iberia continental margins occurred, due to an overall contractive reorganization in the GAS.
Our paleotectonic reconstruction is based on a review in terms of structures and age of the superposed deformational events that took place during the Miocene within the GAS, with special attention to the external zones of its northern branch. Our review and new structural data permit to constrain the timing of vertical axis-rotations evidenced by previously published paleomagnetic data, and to identify homogeneous domains in terms of relationships between timing of deformation events and block rotations.
Block-rotations as high as 53º took place from 9 Ma to Present, which represents around 6º/Ma. The size of the rotated blocks reach 150 to 200 km long (measured along-strike). It implies that the rotations were accommodated by relatively rigid large-scale domains instead of smaller segments rotated progressively, which favors a model of vertical-axis block-rotations on top of crustal-scale decoupling levels. These rotations accommodated tightening and lengthening of the GAS and drastically altered its onshore and offshore geometry from 9 Ma onwards. In the back-arc Alboran Basin, this post-Miocene tightening produced inversion on Middle Miocene normal faults, wrench tectonics, the reactivation of shale diapirism and volcanism, and the uplift of the margins. The arc-lengthening and the concomitant N-S shortening may have played an important role for both the closure of marine gateways between the Atlantic Ocean and the Mediterranean Sea at 5.96 Ma and the subsequent opening of the Atlantic-Mediterranean connection through the Gibraltar Straight denoted by the Zanclean flood at 5.33 Ma. Accordingly, to fully understand the processes driving the MSC, these post-9 Ma tectonic, large-scale rotations should be taken into account.

Keywords: Gibraltar Arc orogenic system, 9Ma paleotectonic restoration, block-rotations, Messinian Salinity Crisis

Acknowledgements: This study was supported by grants RNM-215 and 451 (“Junta de Andalucía”, Spain) and CGL2013-46368-P (“Ministerio de Economía y Competitividad”, Spain).