



Recent and active shallow extensional faults and basin development in the eastern Rif (Bokoya-Ras Afrou area, Western Mediterranean Sea)

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Westwards motion of the Alboran Domain between the Eurasian and African plate boundaries determined crustal thickening along the southern border of the Gibraltar Arc, forming the Rif Cordillera. This process developed major sinistral NE-SW to ENE-WSW faults (as the Nekor Fault), inactive since the Late Miocene. However, the Neogene-Quaternary Boudinar and Nekor basins underwent very high recent tectonic and seismic activity related to N-S faults. Kinematics of this fault set change with depth. While at ~10 km faults have a sinistral strike-slip, they become normal to normal-oblique at surface (Sfeha, Trougout and Boudinar faults). Their different kinematics could be explained by the existence of crustal detachments separating two deformation domains. Alternatively, shallow transtensive deformations could be a consequence of the sinistral shear associated with deeper major fault zones in addition to the high potential energy related to the relief. Shallow transtensive N-S faults trend orthogonal to the coast line, decreasing their slip southwards until disappearing. Paleostress analysis shows a progressive change from well constrained E-W extension near the coast line up to radial extension in southern areas of major fault terminations. The behavior of each fault block is conditioned by its inherited rheological features. The sequence of horsts (Bokoya, Ras Tarf, Ras Afrou) corresponds mainly to resistant rocks (volcanic or limestones) whereas the grabens (Nekor and Boudinar basins) are generally floored by weak metapelites and flyschs. The presence of liquefaction structures, interpreted as seismites, underlines the continued recent seismic activity of the region. A similar tectonic setting with extension parallel to the coast line occurs in the northern Alboran Sea Coast (Campo de Dalías), but N-S to NW-SE convergence dominated and favors ENE-WSW fold development with respect to horst and graben structures. The recent structures deforming the two Alboran Sea margins support the continuity, at present, of the orogenic processes that the eastern internal regions of the Gibraltar Arc underwent with regional E-W extension in the framework of NW-SE to N-S Eurasian-African convergence.