Geophysical Research Abstracts, Vol. 8, 01299, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01299

Present-day stress field pattern in the Gibraltar Arc (Western Mediterranean)

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A multidisciplinary approach to estimate the stress field pattern in the Betic-Rif Alpine Chain and the Alboran Basin, which configures the Gibraltar Arc System (Western Mediterranean), has been performed gathering stress information from four different categories of indicators: breakouts analysis, focal mechanisms, fault slip data, and hydraulic fracturing. Whereas fan-shaped patterns of maximum horizontal stress, perpendicular to the orogen trend, commonly typify the stress-field in orogenic arcs; the Gibraltar Arc System shows a complex sigmoid stress-field pattern. Major rotations, in cases greater than 40 degrees, are inferred with respect to the stress field imposed by the ongoing Africa-Eurasia oblique convergence. Differential stress rotations in the Arc are deeply controlled by the structure of the crust, in particular by the high gradients of crustal thinning occurring across the present margin, and by differential loading imposed from the high sediment thickness in basin depocenters parallel to the shoreline. Other sources of stress perturbation are related to active strike-slip faulting in the eastern region of the Arc depicting a large left-lateral deformation zone formed of fault segments in relay.

With these results we expect to add valuable data for establishing the nature and partitioning of the recent deformation in the Gibraltar Arc. In particular, we discuss if post-orogenic collapse or some other postulated geodynamic models (e.g. active subduction or lithosphere delamination) can explain the present-day stress-field pattern and consequently if they may still operate in the Western Mediterranean.