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Analogue modelling of strike-slip fault propagation across a rheological/morphological crustal anisotropy: implications for the morphotectonic evolution of the Gloria Fault - Tore Madeira Rise area in NE Atlantic.

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The Gloria Fault (GF) marks the E-W dextral transcurrent plate boundary between Eurasia and Africa in NE Atlantic, displaying complying high magnitude (historical and instrumental) seismic activity (e.g. M=7.1 in 1939 and M=8.4 in 1941, Bufforn et al., 1988), and cutting across a NNE-SSW 1000 km long bathymetric ridge: the so called Tore-Madeira Rise – TMR (rising in average 3km above the abyssal plain).

The precise origin and tectono-magmatic evolution of the TMR is still not fully understood, although reported wide-angle refraction data points to a rheological configuration comprising an isostatically compensated thickened oceanic crust, possibly formed during a period of high accretion in the Mid-Atlantic Ridge (Pierce and Barton, 1991). Widespread evidence for volcanic activity has also been recognized, spanning from late Cretaceous to Present (Geldmacher et al. 2006, Merle et al. 2009), noticeably with the most recent volcanism ($\sim$500 Ky) occurring as tectonically aligned volcanic plugs, distributed along the E-W tectonic trend of the GF-related structures.

To better understand the complex interference at play in this key area between the tectonic structures (essentially determined by the Gloria Fault system), the present and past magmatic activity and the resulting seafloor morphology, a series of dynamically scaled analogue modelling experiments have been conceived and carried out. The main focus of this experimental work was to decipher the potential influence of a rheological vs. morphological anisotropy (accounting for the TMR) on the lateral propagation of a major right-lateral strike-slip fault (representing the GF).

The preliminary comparison of the obtained experimental results with the natural morphotectonic pattern in the study area reveals, not only a strong tectonic control of the ongoing volcanism, manifested by the observed preferred directions of aligned volcanic plugs, but also a so far unsuspected deflection/distributed pattern of several faults, and other GF-related structures, here interpreted as resulting from the specific rheological constrains (e.g. crustal soft anomalies) underlying the distributed volcanic activity throughout the TMR.

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