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Geodynamic evolution of the western Mediterranean basin since the Late Cretaceous

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The western Mediterranean basin results from the convergence between Africa and Eurasia and from related interactions between an undetermined number of macroplates and microplates during the Late Cretaceous. Various and very different models proposed during the last thirty years attempted to explain the geodynamic evolution of this area (e.g. Carminati et al., 2012; Schettino and Turco, 2011; Handy et al., 2010; Jolivet et al., 2006). However, none of those models are totally satisfactory, especially when regarding the Gibraltar arc region. The western Mediterranean constitutes a unique laboratory to study interactions between surface deformations and crustal and mantle processes (slab roll-back, slab break-off, delamination, etc.). The goal of this study is to understand how these deep processes are coupled to crustal evolution during the collision between Africa and Eurasia.
In this context, two different approaches will be undertaken. Firstly, using GPlates software (Boyden et al., 2011), kinematic reconstructions will be performed based on stratigraphic, metamorphic, magmatic, structural and paleomagnetic data. These reconstructions will be made from the Present to the Late Cretaceous and using the principle of rigid polygons which enables deformation of areas between polygons. Realizing these reconstructions backward allows to be free from any preconceived geodynamic model. The principle of rigid polygons helps avoiding problems due to rough approximations linked to rigid blocks. Secondly, obtained results will be used to constrain 4D numerical modelling (space and time) of the western Mediterranean subduction zone evolution since the Late Cretaceous. The influence of different primordial parameters (rheological and thermal stratification of the upper and lower plates, convergence rates, presence of weak zones, etc.) will be tested. The results will be compared to natural data (surface velocity field, thermal anomalies, temporal and spatial evolution of the deformation, magmatism distribution, basin geometry) in order to understand the main processes influencing the subduction zone dynamics.
The preliminary results of this study and working perspectives will be presented.