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A new high-resolution kinematic model for the Central Atlantic region during the Oligocene and Early Miocene

Chiara Macchiavelli (1,2) and Antonio Schettino (2)

(1) Institute of Earth Sciences Jaume Almera, ICTJA-CSIC, Lluis Sole i Sabaris s/n, 08028 Barcelona, Spain, (2) University of Camerino, School of Science and Technology – Geology Division, Via Gentile III da Varano, 62032 Camerino (MC), Italy

We present the first high–resolution kinematic model for the northwest Africa – North America plate pair during the Oligocene and early Miocene with the objective to help understanding the processes that occurred in this region during the last 33 Myrs. In particular, we test if the northwest African plate behaved as a single plate, as assumed in the classic models, or alternatively that a separate Moroccan plate existed during the Oligocene – early Miocene as suggested in previous works.
The new plate motions model for the northwest Africa – North America plate pair is accompanied by a high–resolution isochron map for the central Atlantic region, resulting from a re–examination of 423 ship tracks from the NGDC data base for the area between the 15°20' FZ and the Azores triple junction.
Accurate finite reconstruction poles for the North America – northwest Africa conjugate plate pair between the early Miocene (Chron 6) and the early Oligocene (Chron 13) are calculated on the basis of a set of 309 magnetic profiles crossing the Oligocene to recent oceanic crust and of a new digital model of fracture zones.
For times older than Chron 7 (∼25 Ma), the finite reconstruction poles are calculated using a reliable data set coming exclusively from the region south of the Canary Islands FZ (∼32°N), which allowed to test the rigidity of the northwest African oceanic lithosphere during the Oligocene – early Miocene phase of Atlas orogeny.
The magnetic evidence suggests the existence of an independent Moroccan plate, because all the available magnetic profiles north of the Canary Islands FZ (CIFZ) show that anomalously high spreading rates occurred in the area for times older than Anomaly 7 (∼25 Ma), thereby implying that the formation of the Atlas mountain, rather than being a localized intra–continental process, was logically linked to the central Atlantic spreading history.
The model presented here supports the possibility that the CIFZ was temporarily converted into a right–lateral strike–slip plate boundary during the Cenozoic, allowing eastward escape of an independent Moroccan plate, which included both the oceanic lithosphere north of the Canary Islands FZ and the northern Maghrebian areas of Morocco, Algeria, and Tunisia.