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A new high-resolution kinematic model for the southern North Atlantic region: the Iberian plate kinematics since the Late Cretaceous

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We present the first high–resolution kinematic model for the southern North Atlantic since the late Cretaceous, in order to constrain the Iberian kinematics during the last ∼83 Myr. Assessing the detailed movements of the Iberian plate is crucial to constrain the kinematics of the Western Mediterranean region and to better understand the Pyrenees and Betic – Rif orogenic systems evolution.
The new plate motions model for the Iberia – North America plate pair is accompanied by a high–resolution isochron map for the southern North Atlantic region, resulting from a re–examination of ∼400 ship tracks and 3 aeromagnetic tracks in the NGDC data base for the area between the Azores triple junction and 46° N. We derive a well-constrained kinematic solution for the relative motion between an independent Iberia and North America from seafloor spreading data despite the short length of the magnetic lineations and the scarcity of large-offset transform faults and fracture zones.
Accurate finite reconstruction poles for the Iberia – North America conjugate plate pair between the Late Cretaceous (Chron 34, 83.5 Ma) and the present day (Chron 2A, 2.58 Ma) are calculated on the basis of a set of ∼100 magnetic profiles through an iterative method. Euler poles and associated angles of rotation are computed as follow. An initial rotation pole is calculated using only magnetic anomaly crossings. The initial large uncertainty associated with the first determination is reduced by generating a set of synthetic fracture zones associated with the initial pole and using points sampled along these structures in conjunction with magnetic anomaly crossings to calculate a new Euler pole and associated confidence ellipse. This procedure is repeated n times, generating a sequence of improving approximate solutions and stopped when the solution become stable excluding solutions that were inconsistent with geological constraints.
We used these results to build a comprehensive kinematic model for the North America – Iberia – Europe – Africa – Morocco plate system. A set of plate reconstructions illustrates the Iberian plate kinematics and show plate boundaries and velocity fields since the Late Cretaceous attempting to reconcile the geology of Pyrenees and Betic – Rif chain and the kinematic of the southern North Atlantic Ocean.

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