Dating Changes in Relative Plate Motion in the Betic-Rif Cordillera Using Sm-Nd Garnet Geochronology

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In this study Sm-Nd geochronology was conducted on garnet porphyroblasts from the Betic-Rif Cordillera containing inclusion trails, the orientations of which are hypothesized to record relative plate motions. These microstructures are interpreted to develop by overgrowth of alternating subvertical and subhorizontal crenulation cleavages, such that the intersection axes of the included foliations or 'FIA' (foliation intersection axis) lies normal to the compression direction [1]. The Betic-Rif Cordillera is an arcuate orogen with a core of polydeformed, metamorphic complexes. Structural research in this region has found evidence for an extensive deformational history that produced five FIA generations, each with a regionally consistent trend [2]. The directions of these five FIA and their relative timing appear to correlate with successive plate motion vectors from the Late-Eocene to Mid-Miocene. Structurally characterized garnets were selected for chronological study to test whether this apparent FIA vs. plate motion correlation is temporal as well as spatial. Preliminary Sm-Nd garnet ages of 35.5 ± 2.1 and 25.4 ± 2.0 Ma are linked to the two principle FIA sets whose trends are broadly WNW-ESE and E-W. These trends and our new ages are consistent with a change from NNE- to N-directed motion (normal to the dated FIA) of the African plate relative to Iberia at 33Ma according to recent plate kinematic reconstructions [3, 4].

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