Two-Stage Plate Tectonic Evolution of the Betic-Rif Orogen Recorded by Inclusion Trails with Regionally Coherent Trends in the Nevado-Filabride Complex

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The early orogenic history of the Betic-Rif system has remained poorly known due to the widespread modification and obliteration of corresponding structures during Miocene crustal extension. In an attempt to provide new constraints on the pre-Miocene tectonic evolution we investigated the geometry and orientation of tectonic foliations (i.e. inclusion trails) preserved within garnet porphyroblasts of the Nevado- Filabride Complex (NFC), Betic Cordillera. Thirty oriented samples of garnet bearing schist were collected from different structural levels of this high-pressure unit, along a total strike length of 120 km. Measurements of the strike of inclusion trails on oriented horizontal thin sections define a regionally consistent orientation pattern, which allows these microstructures to be correlated and grouped in two principle age sets. Each set comprises multiple homoaxial foliations. Inclusion trails belonging to the older set have mainly N-S to NE-SW trends, whereas the younger set predominantly has WNW-ESE to NW-SE trends. The relative timing of both sets is indicated by core-rim relationships within idividual garnets.

We also compiled over 4000 orientation data for successive fold generations distinguished and measured by different workers in the NFC. This wealth of field data is shown to independently witnesses a superposition of different crustal shortening directions, whose directions match the strikes of the newly discovered sets of inclusion trails. The two-stage orogenic evolution indicated by this data is tentatively linked to a transition from orogenesis controlled by NW-SE oriented Tethys-Iberia convergence and subduction, prior to 35Ma, followed by NNE-SSW Iberia-Africa convergence from 35Ma to 15Ma. This transition appears to have played a crucial role in triggering the sinking or roll-back of lithospheric slabs and ensuing WNW-ESE crustal extension in the western Mediterranean basin.

Key words: Nevado-Filabride, inclusion trails, porphyroblasts, tectonic evolution, Betic Cordillera