Geophysical Research Abstracts,
Vol. 11, EGU2009-11579, 2009
EGU General Assembly 2009

The building of the Betic-Rif orogen and the geodynamic evolution of western Mediterranean

F. Negro (1), B. Goffé (2), L. Jolivet (3), P. Agard (3), I.M. Villa (4), G. Rimmelé (2), J.M. Azañon (5), M.L. Bouybaouène (6), and O. Saddiqi (7)

(1) Institut de Géologie, Université de Neuchâtel, Neuchâtel, Switzerland (francois.negro@unine.ch), (2) Laboratoire de Géologie, Ecole Normale Supérieure, Paris, France, (3) Laboratoire de Tectonique, Université Pierre et Marie Curie, Paris, France, (4) Institut für Geologie, Universität Bern, Bern, Switzerland, (5) Departamento de Geodinamica, Universidad de Granada, Granada, Spain, (6) Département de Géologie, Faculté des Sciences, Rabat, Morocco, (7) Département de Géologie, Faculté des Sciences Ain Chock, Casablanca, Morocco

The building Betic-Rif orogen at the western end of the Mediterranean is still widely debated. We present new tectonic, metamorphic and geochronological data from the Rif together with a synthesis of available data in the whole Betic-Rif orogen, in order to precise its tectonic evolution and the geodynamics of western Mediterranean. The internal zones (Alboran Domain) of the Betic-Rif chain are divided in 3 structural groups: the Nevado-Filabride, the Alpujarride-Sebtide and the Malaguide-Ghomaride complexes, from bottom to top.
The Alpujarride-Sebtide complex units recorded HP-LT metamorphism during the Eocene-Oligocene and were subducted at depth of 30-50 km. In the External Rif, the Temsamane units recorded MP-LT metamorphism (7-9 kbar 330-430°C), similar to the one observed in the Alboran Domain units, during the Oligocene (Ar-Ar ages >23Ma). This event can be related to the same subduction or to an intracontinental suture within the African paleomargin. Both events highlight convergence and N-NW directed subduction in the western Mediterranean during the Eocene-Oligocene.
The contrasted exhumation paths of these units show progressive evolution towards higher geothermal gradient during the Oligocene in the orogenic wedge. HT-LP overprint is recorded in the lower units of the Alpujarride-Sebtide during the Early Miocene. During the Early Miocene, heating is also recorded in the upper plate units of the Malaguide-Ghomaride complex, showing an important uplift of the isotherms and heat advection in the orogenic wedge. All these data indicate strong lithospheric thinning during the Late Oligocene-Early Miocene, associated with asthenospheric uplift. The exhumation of the Alpujarride-Sebtide complex is characterized by N-S to NE-SW ductile stretching and top-to-the-N senses of shear during the Oligocene-Early Miocene. This direction indicates regional ∼N-S extension compatible with progressive southward slab retreat during the Oligocene.
Although they could have a common metamorphic origin with the Alboran Domain, the exhumation of the External Rif Temsamane units took place during the Middle-Late Miocene (Ar-Ar ages in the range 15-6 Ma), and was also associated with different kinematics indicating ENE-WSW stretching and top-to-the-WSW senses. This deformation, with similar timing and kinematics than the Nevado-Filabride complex in the Betics indicates regional ∼E-W extension during the Miocene (until ∼6Ma) recorded on both sides of the Betic-Rif arc. These data rather reflect westward slab retreat during the Middle-late Miocene. This further indicates that the tectonic regime changed at the beginning of the Miocene in the western Mediterranean. This change is contemporaneous with the strong thermal event recorded regionally in the Alboran Domain units, and reflects deep lithospheric processes. Since the Tortonian, the NNW-SSE convergence between Africa and Iberia is recorded by compressive structures in both the Betics and the External Rif.