Geophysical Research Abstracts
Vol. 20, EGU2018-9068, 2018
EGU General Assembly 2018

The crustal evolution of the Eastern Basque-Cantabrian Zone: from the Cretaceous mantle exhumation to the Alpine tectonic inversion

Irene DeFelipe, David Pedreira, and Javier Á. Pulgar
University of Oviedo, Spain (defelipe@geol.uniovi.es)

Tectono-evolutionary models for the Pyrenees must take into account constraints into the Cretaceous hyperextension process with local mantle exhumation and the subsequent Alpine inversion. We present a new crustal transect and its sequential reconstruction since the Jurassic to the present day for the eastern part of the Basque-Cantabrian Zone, in the transition between the Pyrenees and the Cantabrian Mountains. This transect covers the entire orogen in ∼N-S direction, from the Bay of Biscay to the Ebro Basin. At upper crustal levels, the studied transect comprises two major south-vergent structures: the Ollín Fault, uplifting the Paleozoic Cinco Villas Massif, and the South-Pyrenean Frontal Thrust that uplifts the Basque-Cantabrian Basin over the Ebro Basin. The Saldías-Leiza-Aralar thrust system correspond to five thin-skinned North-vergent thrust sheets detached from the Keuper-facies Triassic materials. Published P-wave velocity models allow reconstructing the deeper crustal structure in this transect. It is formed by an Iberian crust of ca. 30 km below the Ebro Basin that subducts below the European crust reaching depths of ca. 60 km. The European crust has a maximum thickness of ca. 35 km. P-wave velocities in the deepest part of the Iberian crust show values of 7.35-7.45 km/s below a layer with middle crust velocities (6.40 km/s) and above the mantle with typical (>8 km/s) velocities. Values around 7.4 km/s, are intermediate between typical velocities for the lower crust and mantle rocks and we interpret them as the result of serpentinization of mantle rocks during the Albian. A sequential reconstruction allows the assessment of the style of convergence through time. During the Mesozoic, hyperextension related to the opening of the Bay of Biscay led to a progressive thinning of the crust that ended in mantle unroofing to the base of the sedimentary basin in the Albian. The unroofing process was favored by the Saldías-Leiza-Aralar detachment system forming a narrow peridotite domain, estimated to be about 10-15 km wide. The change to a convergent setting that governed the Cenozoic evolution gave place to the tectonic inversion of the previous extensional faults of the basins, with progressive closing of the marine environments and generation of relief. Tectonic structures inherited from the Cretaceous period played a major role in mountain building. The Saldías-Leiza-Aralar detachment system was progressively inverted as a thin-skined thrust system with vergence to the North. During this stage, the northernmost of these sub-basins was completely eroded. The Ollín Fault was reactivated as well during the Alpine orogeny uplifting the Cinco Villas Massif over the Mesozoic materials of the Basque-Cantabrian Basin and cutting the Saldías-Leiza-Aralar fault system. The main Alpine tectonic inversion stage ended in the Miocene, when the South-Pyrenean Frontal Thrust was sealed by the subhorizontal sediments of the Ebro Basin. The Alpine orogeny induced an estimated total shortening of ca. 90 km along this transect, whereas the Mesozoic extension, more difficult to assess, was probably close to 50 km.