EGU22-5906
https://doi.org/10.5194/egusphere-egu22-5906
EGU General Assembly 2022

Along strike structural changes in thin-skinned thrusts: 3-D approach to the Leyre thrust (Southern Pyrenees).

Antonio Casas[1], **Francho Gracia-Puzo**[2], and Charles Aubourg[2]
[1]Department of Earth Sciences, Faculty of Sciences, University of Zaragoza
[2]Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, TOTAL, LFCR, Pau, France,

Interpretation at depth of geological structures and cross-section reconstruction of fold and thrust belts requires either (1) constraints derived from geophysical exploration (seismic, gravimetric or, in some cases, magnetic) or borehole data, or, alternatively, (2) assumptions about the geometrical model that help to accept or discard, or, eventually, to evaluate the feasibility of possible solutions. In this sense, 3-D reconstructions can help to correct and modify the reconstruction at depth of the main structural traits of a structure or a set of structures. Factors to take into consideration include the consistency in shortening figures along strike for each thrust sheet and the whole set of thrust sheets, and the deformation associated with thrust fronts, together with the consistency in constraints referred to the relative chronology between the different thrust slices. In this work we present the results of a 3-D high-resolution modelling of the Leyre thrust (Southern Pyrenees), confronting different possible models of its structure at depth, and showing the usefulness of 3-D reconstruction. The interest for its study lies in the strong along-strike changes observed, that must be linked to the particular kinematics of this sector of the Pyrenean chain. The proposed geometrical reconstruction benefits from the outstanding outcrops along the Esca valley transect and the existence of geophysical low quality data that, nevertheless, allow to establish some limits to the maximum depth of particular horizons.

The Leyre thrust is a plurikilometric, E-W striking, shallow-dipping, South-verging thrust located within the Eocene Jaca-Pamplona basin and detached at depth in the Upper Triassic evaporites (the regional décollement for many thrust systems in this area). The overall geometry of the outcropping segment of the Leyre thrust is a low-angle ramp of the Cretaceous-Paleocene competent units (folded and cut with high-angle ramp geometry), onto the Eocene marls that show pervasive slaty cleavage related to the thrust front. A second thrust sheet can be inferred at depth also involving the Cretaceous-Paleocene sequence. Furthermore, a back-thrust linked to a box-fold anticline appears in the hangingwall of the main thrust. This box folds shows a strong eastwards plunge, and disappears laterally towards the East. Finally, a slightly oblique thrust (WNW-ESE) ramps up the box-fold, with increasing displacement from West to East. The connection between this latter thrust and the back-thrust at the rear front of the box-fold is probably related with the warping of the fault surface and (possibly) a clockwise rotation of the uppermost thrust sheet.

All in all, the 3-D reconstruction proposed allows to update and contrast some of the tectonic models classically proposed for the area (see e.g. Labaume et al., 1985), reducing the number of superimposed thrust sheets and relating their geometry with an overall break-back (or hanging-wall-sequence) kinematics triggered by the blocking of movement at particular thrusts and the upward steepening of thrust surfaces. Development of (hardly-to-detect) thrust surfaces in the marls located in the footwall of the frontal thrust would be the manifestation of the last movements of the thrust system.