



Dating the Pyrenean orogenic wedge – Fault gouge ages and thrust belt evolution in the Spanish Pyrenees

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Constraining the absolute age of brittle faults is one of the major challenges in attempting to understand the kinematics of tectonically recently-active regions. One of the major hypotheses in these structural environments that can be examined with direct dating is the proposal that mountain belts function as doubly-vergent, critically tapered wedges. Whereas the ‘critical wedge’ idea has long been attractive mechanically, field testing of this hypothesis has remained difficult. Field-based temporal relationships on the scale necessary to determine the end of activity on an individual fault are often ambiguous or suitable datable material is absent.

Direct dating of illitic fault gouges using Illite Age Analysis offers a powerful approach to this problem. After discussing our Ar-dating method that is based on clay characterization and quantification of multiple size fractions, we present new ages from 6 fault gouges in the Spanish south-central Pyrenees that document the time of major thrusting on individual structures, from the end of motion on the Boixols thrust at 70 Ma, to the final cessation of motion on the Gavernie thrust at 35 Ma and the Rialp thrust at 25 Ma. These results document the activity of out-of-sequence thrusting and directly record the growth of the southern Pyrenean antiformal stack. These fault ages also demonstrate the efficacy of gouge dating in directly constraining the time of deformation and its regional variation in exhumed mountain belts.