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Fold and thrust belt kinematics from growth strata in the Spanish Pyrenees



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Abstract:

Foreland basin growth strata are ideal recorders of deformation rates and kinematics in fold and thrust belts. Cyclostratigraphy can recover 10^{4-5} yr resolution from either marine or terrestrial growth strata and rock magnetic analyses can provide additional kinematic constraints on fold and thrust belt development. Examples from the Spanish Pyrenees thrust front illustrate these points at high temporal resolution. At Sant Llorenç de Morunys, northeastern Spain, the growth strata record fixed hinge, flexural folding kinematics with an onset of deformation at 33.85 Ma and the end of deformation younger than 31.06 Ma. Deformation and sediment accumulation rates were both unsteady at 20 kyr time scales but appear artificially steady at a magnetic polarity chron time scale. Further west, deformation at Pico del Aguila anticline allowed incremental tilting rates to be calculated between selected horizons over the ~ 6 myr of fold growth. The results show significant variability in folding rates over time with calculated rates varying between $0^\circ \pm 5.5^\circ$ and $90^\circ \pm 19^\circ/\text{myr}$ over 100s kyr time increments. The acceleration phase of fold growth was variable, punctuated by a prolonged period of tectonic quiescence, and correlated to sedimentation changes in the wedge-top basin. Low-dipping bedding intrinsically modulated the initial rates of folding for the first 25° of limb tilt, until ~ 38.86 Ma. Then, differential loading halotectonics in the Paleogene Jaca Basin extrinsically modulated accelerating folding rates for the next 45° of limb tilting until ~ 37.42 Ma. Finally, forelimb-steepening leading to geometric strain hardening and blunting of folding rates for the last 17° of fold tightening, preceded a thrust fault cutting the anticline's core. Folding ended at Pico del Aguila at ~ 35.10 Ma. Along the southwestern thrust front at the Peña flexure, development of a thrust-related anticlinorium at the mountain front allowed the exploration of the coupling of synorogenic sedimentation and the structural formation of adjacent accommodation space. Synorogenic sediments dating from 33.2 Ma to 23.4 Ma record the deformation here. Deformation all along the Pyrenean mountain-front was unsteady as recorded by growth strata throughout the Paleogene.

Tuesday 9 May Room F Department of Physics and Geology
14.30 – 15.30 Piazza dell'Università 1, Perugia



[Link for remote access on Teams](#)

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