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The Jura Fold-and-Thrust Belt: timing and kinematic of faulting and thrusting

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The Jura Mountains in France and Switzerland are a classical thin-skinned fold-and-thrust belt (FTB), which developed as part of the Alpine orogenic foreland, together with the Western Alpine Molasse Basin. The Molasse Basin initiated as a flexural basin and evolved into a wedge-top Basin following the initiation of the main foreland décollement level. The Jura FTB thus forms the frontal portion of the Alpine foreland, which enjoyed a transport of some 30km towards the foreland along the main décollement in the mechanically weak Triassic salt-rich evaporites.

Overall the Jura FTB behaves as a mechanical wedge in hydrostatic conditions, that is propagating towards the Alpine foreland. Wedge-internal accommodations, due to changes in the surface topography and the basal décollement inclination, as well as in the basal friction, are operated by oscillating forward and backward stepping sequences of thrusting and related fold development. Basement topography associated with inherited faults leads to a kinematic preconditioning of the structures developing in the detached cover. Analogue modelling has helped show that oblique steps in the basement topography lead to the formation of normal and reverse faulting and oblique fold structures in the cover.

Herein we will discuss the link of different types of faults observed in the field, such as normal faults, inverted inherited faults, thrust faults and strike-slip faults, to major tectonic processes such as flexural bending, rifting, faulting due to steps in basement topography, and thrusting inside a mechanical wedge.

Works on relative chronology of faults, combined with new results from kinematic section modelling and data on published and new deformation ages from calcites (using U-Pb) make it possible to assess the timing of deformation. It is thus possible to show that thrust faults and strike-slip faults, as well as, normal and inverted faults were active at different times and witness superposed events. Deformation in the Jura FTB is partitioned and distributed along discrete faults that clearly operate in a forward and backward oscillating manner. We further can identify different structural domains that can be considered as distinct tectonic nappes. These domains are bound by major strike-slip faults (acting as inherited, rigid boundaries), progressive en-echelon relay zones and major thrusts. The present-day deformation involving both the detached cover and the mechanical basement will be discussed.