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Changes in basal dip and frictional properties controlling orogenic wedge propagation and frontal collapse: the External central Betics case

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Orogenic wedges and their key component, thin-skinned fold-and-thrust belts (FTBs), have been extensively studied through both field examples and modelling. The overall dynamics of FTBs are, therefore, well understood. One of the less understood aspects is: what is the combined influence of across-strike changes in the detachment properties and the basement topography on the behaviour of an orogenic wedge, as the deformation progresses towards the foreland? In this study, we use field data combined with reflection seismic interpretation and well data from the External Zones of the Central Betics FTB, S Spain, to identify a basement "threshold" coinciding with a thinning out of a weak substrate (Triassic evaporites) in the wedge basal detachment. The basal changes influenced the tempo-spatial (4D) local wedge dynamics at ∼Early Langhian times, leading to stagnation of FTB propagation, topographic build-up and subsequent collapse of the FTB front, which was enhanced by arc-parallel stretching. This development led to a formation of an important depocentre filled with a thick Langhian mélange unit and later sediments deposited in the NW-migrating foreland basin. This case study illustrates the importance of across-strike changes in wedge basal properties to the stability of the FTB front, especially in terms of the collapse/extensional structures.