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# Modelling the Deformation Front of a Fold-Thrust Belt: The Effect of an Upper Detachment Horizon (ABSTRACT)

Caroline M. Burberry
*University of Nebraska - Lincoln*, cburberry2@unl.edu

H. Koyi
*Imperial College, London*

F. Nilfouroushan
*Imperial College, London*

John W. Cosgrove
*Imperial College, London*

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# Modelling the Deformation Front of a Fold-Thrust Belt: The Effect of an Upper Detachment Horizon (ABSTRACT)

Caroline M. Burberry, H. Koyi, F. Nilfouroushan, John W. Cosgrove
Imperial College London

Structures found at the deformation fronts of fold-thrust belts are variable in type, geometry and spatial organisation, as can be demonstrated from comparisons between structures in the Zagros Fold-Thrust Belt, Iran and the Sawtooth Range, Montana. A range of influencing factors has been suggested to account for this variation, including the mechanical properties and distribution of any detachment horizons within the cover rock succession. A series of analogue models was designed to test this hypothesis, under conditions scaled to represent the Sawtooth Range, Montana. A brittle sand pack, containing an upper ductile layer with variable geometry, was shortened above a ductile base and the evolution of the deformation front was monitored throughout the deformation using a high-accuracy laser scanner. In none of the experiments did the upper detachment horizon cover the entire model. In experiments where it pinched out perpendicular to the shortening direction, a triangle zone was formed when the deformation front reached the pinch out. This situation is analogous to the Teton Canyon region structures in the Sawtooth Range, Montana, where the Cretaceous Colorado Shale unit pinches out at the deformation front, favouring the development of a triangle zone in this region. When the pinch out was oblique to the shortening direction, a more complex series of structures was formed. However, when shortening stopped before the detachment pinch out was reached, the deformation front structures were foreland-propagating and no triangle zone was observed. This situation is analogous to foreland-propagating thrust structures developed at the deformation front in the Swift Dam region of the Sawtooth Range, Montana and to the development of fault-bend folds at the deformation front of the Zagros Fold-Thrust Belt, Iran. We suggest that the presence of a suitable intermediate detachment horizon within a sediment pile can be invoked as a valid explanation for the development of varied deformation front structures in fold-thrust belts. Specifically, the spatial extent of the upper detachment horizon with respect to the spatial extent of the deformed region is a key influence on the development of deformation front structures. However, we acknowledge that factors such as basement structure and variable sedimentation within the foreland basin may also be key influences on deformation front structures in other fold-thrust belts.