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Deformation and sedimentation in constrictional supradetachment basins: the Kvamshesten basin, western Norway

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Basins developed under overall constrictional strain will develop stratigraphic architectures that reflect complex accommodation creation patterns. These will influence distribution and variation of sedimentary facies , thickness variations and other stratigraphic relationships. The Middle Devonian, alluvial-fluvial Kvamshesten basin developed under bulk constrictional strainwith vertical and north-south horizontal shortening combined with large-magnitude horizontal east-west extension. This is consistent with exhumation of the underlying Western Gneiss Region in a regional transtensional strain field, as suggested by other workers. The basin sits in the hanging wall of the extensional Nordfjord-Sogn Detachment, which accommodated > 40 kilometres of displacement during collapse of the Caledonian orogen in western Norway. Our work provide a more detailed understanding of the internal tectono-sedimentary evolution of the hangingwall of the Nordfjord Sogn Detachment. Sedimentary units mapped in the Kvamshesten basin display systematic thickness variations in the vicinity of syn-depositional folds and faults, demonstrating their growth during basin sedimentation. Syn-sedimentary fault growth can be demonstrated for extensional and contractional structures that occur at high angles to each other. These relationships are observed at several stratigraphic levels. N-S shortening of the basin deposits appears to be more important for the geometry of sedimentary units than previously recognized. We present for the first time evidence for syn-sedimentary contraction in detail. Along the northwestern (northern) part of the basin margin, reverse faults are associated with fault-propagation folds. An increase in stratigraphic thickness and complex onlap relationships, facies transitions and thickness variations are associated with a basin-scale fault-propagation fold at high stratigraphic levels as well as with syn-sedimentary extensional faulting and folding. Syn-sedimentary extensional faults at several stratigraphic levels display syndepositional growth wedges and terminate stratigraphically upwards into fault-growth monoclines. Together with the overall retrogradational stacking of sedimentary units in the east-west direction, the syndepositional faults and folds give rise to an intriguingly complex 3D basin architecture.