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Pre-lithification tectonic foliation development in a clastic sedimentary sequence

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The current view regarding the timing of regionally developed penetrative tectonic fabrics in sedimentary rocks is that their development postdates lithification of those rocks. In this case fabric development is achieved by a number of deformation mechanisms including grain rigid body rotation, crystal-plastic deformation and pressure solution (wet diffusion). The latter is believed to be the primary mechanism responsible for shortening and the domainal structure of cleavage development commonly observed in low grade metamorphic rocks. In this study we combine field observations with strain analysis and modelling to fully characterise considerable (>50%) mid-Devonian Acadian crustal shortening in a Devonian clastic sedimentary sequence from south west Ireland. Despite these high levels of shortening and associated penetrative tectonic fabric there is a marked absence of the expected domainal cleavage structure and intra-clast deformation, which are expected with this level of deformation. In contrast to the expected deformation processes associated with conventional cleavage development, fabrics in these rocks are a product of translation, rigid body rotation and repacking of extra-formational clasts during deformation of an un-lithified clastic sedimentary sequence.