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The ephemeral development of C' shear bands

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C' shear bands are common structures in ductile shear zones but their development is poorly understood. They occur in rocks with a high mechanical strength contrast so we used numerical models of viscoplastic deformation to study the effect of the proportion of weak phase and the phase strength contrast on C' shear band development. We employed simple shear to a finite strain of 18 in 900 steps and recorded the microstructure, stress and strain distribution at each step. We found that C' shear bands form in models with ≥5% weak phase when there is a moderate or high phase strength contrast, and they occur in all models with weak phase proportions ≥15%. Contrary to previous research, we find that C' shear bands form when layers of weak phase parallel to the shear zone boundary rotate forwards. This occurs due to mechanical instabilities that are a result of heterogeneous distributions of stress and strain rate. C' shear bands form on planes of low strain rate and stress, not in sites of maximum strain rate as has previously been suggested. C' shear bands are ephemeral and they either rotate backwards to the C plane once they are inactive or rotate into the field of shortening and thicken to form X- and triangle- shaped structures.