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Bulk rheology, finite strain development, and multi-particle interaction in shear zones

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We are considering a system composed of clasts embedded in a matrix subjected to pure and simple shear deformation. The clasts may have either a higher or lower viscosity than the matrix. A two dimensional finite element model for incompressible, slowly creeping Stokes flow is used to model the system. The viscosity contrast, the amount of clasts vs. matrix, and the size of clasts are varied systematically to see the effect on bulk viscosity and bulk strain. Bulk strain is calculated using the Fry method. The same model and setup of clasts surrounded by matrix is also used to study strain partitioning in shear zones. Localization in shear zones is often assumed to be an effect of a non-linear material where the actual heterogeneities are approximated by an effective bulk rheology. Here we use a linear (Newtonian) viscous rheology and explicitly model the material heterogeneities and the interactions between them. Our results show that, despite using linear materials, strain localization and partitioning into C-S-fabrics are typical patterns that form in heterogeneous shear zones.