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Numerical modeling of torn boudinage under pure shear: implications for estimating viscosity ratios and finite strain from natural examples

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Numerical experiments of torn boudinage reworking under layer-parallel stretching are reported. The results show that boudin shape depends on both the boudin to matrix viscosity ratio and the initial gap width. In our simulations, we have reproduced the whole spectrum of previously reported boudin shapes due to reworking, and we also report some new structures, including field examples. Central bulges develop within the interior boudin faces for intermediate gap widths. Convex interiors are reported for very narrow initial separations. The initial gap width together with the viscosity ratio control the internal deformation and separation of the boudins. Lowering the viscosity of the gap infill strongly influences boudin shape evolution and it suppresses the bulging of the interior faces. Boudin aspect ratio has only minor influence on the developing boudin shape. The non-linear viscous reworking of boudins is not significantly different to the one observed in linear viscous materials. We show a natural example of how the geometry of the developing bow-tie vein combined with boudin shape and separation can be used to infer strain and rheological properties. Rhomboidal boudins under layer-parallel stretching exhibit rotation and they tend to produce monoclinic structures, which are similar to structures forming due to layer-parallel shear. We caution the use of asymmetric boudins as shear sense indicators.