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Numerical models of the liquid-distribution and attainment of textural equilibrium in a deforming partially-molten rock

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The deformation of partially molten rocks is of great importance of the development of the lower crust and mantle. The distribution of melt in a static environment (e.g. no deformation) is mainly a function of the surface energies of the matrix grains. In a dynamic setting (deforming matrix), the behaviour of melt is not well known. Experimental studies of melt in a deforming matrix, in most cases, show melt oriented perpendicular to the shear plane and this orientation appears to be a function of differential stress rather than of the orientation of the shear plane. Analogue models confirm these observations and indicate that melt seams are oriented at low angles to principal stresses. However, an increasing number of experimental and natural microstructural studies show that melt in deformed partially molten rocks is distributed parallel to grain boundaries which are orientated sub-parallel to the macroscopic foliation

The main problem in natural examples is in almost complete lack of knowledge of rheology of solid and liquid phases during deformation. In contrast, in the experimental and analogue environments, the intensive variables are known (P, T, composition), but the mechanical properties of melt and solids during deformation are poorly constrained.

These problems can be overcome by numerical simulations. All of the above mentioned parameters including the melt fraction can be controlled. However, due to the involved differences in scales and the complexity of deformation mechanisms, simplifications have to be made. Both solid and liquid phases of the simulations are treated as viscous. No grain boundary sliding or cracking of the matrix grains is possible in the simulations. The goal of this work is an understanding of melt behaviour in monomineralic rocks deformed in simple and/or pure shear for variable melt fractions and viscosity ratios using analogue and numerical simulations.