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# Numerical modelling of the effect of composite rocksalt rheology on (progressive) internal deformation in down-built diapirs

Lukas Fuchs (1), Hemin Koyi (1), and Harro Schmeling (2)

(1) Uppsala University, Earth Sciences, Uppsala, Sweden (lukas.fuchs@geo.uu.se), (2) Goethe-University, Institute of Geosciences, Frankfurt am Main, Germany

Salt diapirs are driven by differential loading of sediments which drive the salt from high to low pressure areas, e.g. a down-built diapir. Rocksalt behaves in a non-Newtonian way under certain natural conditions (e.g. grain size and temperature). The non-Newtonian component of rocksalt has a significant impact on the general dynamics of down-built diapirs and thus their internal deformation patterns.

A two-dimensional finite difference code (FDCON) was used to investigate the effect of a composite rocksalt rheology on finite deformation patterns within a down-built diapir. Down-building was simulated by fixing the initial geometry of the diapir using two rigid rectangular overburden units which sank into a source layer of a certain rheology. Systematic models were run where different "salt" rheologies were tested.

Model results show three different deformation regimes within the "salt": (I) a squeezing channel-flow deformation regime within the source layer beneath the sinking overburden blocks, (II) a corner-flow/pure shear deformation regime within the source layer beneath the diapir stem, and (III) a pure channel flow deformation regime within the diapir stem. We analysed the evolution of the individual finite deformation in each regime, the progressive deformation for a particle passing all three regimes, and the total 2D finite deformation within the source layer for Newtonian and non-Newtonian rocksalt rheologies.

Progressive deformation within the salt illustrates the significance of inherited strain regarding the deformation analyses in the stem. Thus, one might obtain different strain patterns as expected by the individual regimes within the salt and, moreover, even an undeforming for some particles while rising through the stem.

Within the non-Newtonian models strain distribution is more complex. Two main features could be attributed to the non-Newtonian rheology: (1) The strain rate weakening of the rock salt creates a strong localization of deformation at the edges of the source layer and the stem. (2) Due to the plug flow character within the salt layer, the finite deformation decreases strongly within the centre of the source layer and within each half of the stem. Thus, the deformation within the non-Newtonian models increases along the boundary and material interface in comparison to the Newtonian one. Within the centre of the layer, though, the strain decreases strongly due to the non-Newtonian rheology.